June 20, 2014

SOUTHWEST COOK INLET OIL AND GAS EXPLORATION LICENSE

Written Finding of the Director

Prepared by:
Alaska Department of Natural Resources
Division of Oil and Gas

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Table of Contents

Page

Executive Summary

The director of the Division of Oil and Gas (DO&G), with consent of the State of Alaska Department of Natural Resources (DNR) commissioner, determines whether issuing an oil and gas exploration license serves the state's best interests (AS 38.05.133(f)). This document presents the director's written finding for the disposal of an oil and gas exploration license in the Southwest Cook Inlet license area, located on the west side of lower Cook Inlet, encompassing the Iniskin Peninsula and surrounding areas. All relevant facts and issues within the scope of review that were known or made known to the director were reviewed. The director limited the scope of the finding to the disposal and exploration phases of oil and gas activities and the reasonably foreseeable significant effects of issuing an exploration license (AS 38.05.133(f); AS 38.05.035(e)(1)(A); and AS 38.05.035(e)(1)(C)(ii) and (iii)). The content of the best interest findings is specified in AS 38.05.035(e), and matters that must be considered and discussed are found in AS 38.05.035(g) and AS 38.05.133(f).

A. Director's Decisions

After weighing the facts and issues known at this time, considering applicable laws and regulations, and balancing the potential positive and negative effects given the mitigation measures and other regulatory protections, the director finds the potential benefits of issuing an exploration license, and approving the exploration phase, outweigh the possible negative effects. The director finds that issuing an oil and gas exploration license to the winner of the competitive bid process for the license is in the best interests of the State of Alaska. The full director's decision can be found in Chapter One.

B. Exploration Licensing

The intent of oil and gas licensing is to encourage exploration in areas far from existing infrastructure, with relatively low or unknown hydrocarbon potential, and where there is a higher investment risk to the operator. An exploration license will give the successful licensee the exclusive right to explore for oil and gas without the initial expense of leasing bonuses. Through exploration licensing, the state receives valuable subsurface geologic information and, should development occur, revenue through royalties and taxes. Additionally, any reserves discovered could provide a source of energy for local consumption. Exploration licensing is discussed in further detail in Chapter Two.

Oil and gas activities proceed in phases, with the activities of each subsequent phase dependent on the completion or initiation of the preceding phase. While the state holds oil and gas lease sales in established petroleum provinces, like areas of Upper Cook Inlet and the North Slope, an exploration license is the method to initiate oil and gas exploration in other areas of the state. The exploration license disposal phase is a first step in the process of developing the state's oil and gas resources, subsequent to the director's affirmative written finding. An exploration license (Appendix B) grants the licensee the exclusive right to explore for oil and gas and, provided the licensee meets certain conditions, to then convert all or a portion of the license to a lease (Appendix C). An oil and gas lease grants to the lessee the exclusive right to drill for, extract, remove, clean, process, and dispose of oil and gas. However, a plan of operations, subject to all applicable regulatory authorities and permits, must be approved before any operations may be undertaken on or in the licensed or leased area.

With an exploration license, the successful licensee may gather information about the area's petroleum potential. This process may include examining surface geology, performing environmental assessments, conducting geophysical surveys, and drilling exploratory wells. If converted to an oil and gas lease, further exploration may occur. During the development and production phase, operators evaluate the results of exploratory drilling, develop plans to bring the discovery into production, and bring oil or gas to

the surface and prepare it for transport. Additional information regarding exploration licensing can be found in Chapter Six.

C. Description of the Exploration License Area

The exploration license area is approximately 169,000 acres in size, approximately 120 miles south of Tyonek. The exploration license area consists of state-owned, unencumbered lands within T. 3 S., R. 20-22 W., T. 4 S., R. 20-23 W., T. 5 S., R. 21-24 W., T. 6 S., R. 22-25 W., T. 7 S., R. 23-25 W., Seward Meridian. Only free and unencumbered state-owned subsurface mineral estates are included in the oil and gas license. Lands whose subsurface mineral estates are owned by other entities are within the license boundary, but are excluded from the licensed exploration lands.

The southern boundary of the license area is the south edge of Ursus Cove. The license area is bounded by the Saddle Mountain on the north, the Kenai Peninsula Borough boundary on the west, and state owned Cook Inlet marine waters on the south and east. The license area is located on the western side of Cook Inlet across from the City of Homer, and the communities of Anchor Point and Seldovia. Additional information about the area and these communities is found in Chapter Three.

D. Habitat, Fish, and Wildlife

The license area includes terrestrial, freshwater, and marine habitats. Freshwater and anadromous fishes may be found in the area's waters. The license area is seasonally inhabited by migratory birds. Terrestrial habitats support moose, brown and black bears, and furbearers. Marine mammals include beluga, fin, humpback, minke, blue, North Pacific right, sei, and sperm whales, harbor and Dall's porpoises, harbor seals, Stellar sea lions, and northern sea otters. Additional information on species and habitats of the license area is found in Chapter Four.

E. Current and Projected Uses

Commercial guiding, sport fishing and hunting, trapping, and recreation are the major land uses in the license area. Oil and gas exploration and production activities are currently conducted in Cook Inlet within and adjacent to the license area. Additionally the license area is adjacent to Lake Clark National Park, and a proposed overland transportation corridor that would connect Cook Inlet to Bristol Bay. As of 2013, the Alaska Department of Transportation and Public Facilities' Cook Inlet to Bristol Bay corridor project is being reevaluated because of changing levels of state and federal funding for transportation projects. Traditional subsistence hunting, trapping, and fishing occur within the license area. These uses are discussed in more detail in Chapter Five.

F. Oil and Gas in the License Area

The several proven and potential petroleum systems of Cook Inlet provide important insights into the oil and gas resource potential in the Southwest Cook Inlet exploration license area. Commercial production in Cook Inlet comes from two main plays: 1) biogenic natural gas, sourced from Tertiary coals and reservoired in sandstones of the middle and upper Kenai Group (upper Tyonek, Beluga, and Sterling Formations), and 2) thermogenic oil with minor associated gas, sourced from the Middle Jurassic Tuxedni Group and reservoired in sandstones of the lower and middle Kenai Group (West Foreland, Hemlock, and lower Tyonek Formations). The most likely method of transportation is by pipeline. Petroleum potential, phases of exploration, conversion of the license to a lease, development, production, and transportation are discussed in Chapter Six.

G. Governmental Powers to Regulate Oil and Gas

All oil and gas activities, including exploration, are subject to numerous federal, state, and local laws and regulations with which the licensee is obligated to comply. These government agencies have broad authority to regulate and condition activities related to oil and gas. Agencies include the Alaska Departments of Natural Resources, Environmental Conservation, and Fish and Game; the Alaska Oil and Gas Conservation Commission; the U.S. Environmental Protection Agency; the U.S. Army Corp of Engineers; the National Marine Fisheries Service; and the U.S. Fish and Wildlife Service. Many of the regulatory and statutory authorities are discussed in Chapter Seven.

H. Reasonably Foreseeable Cumulative Effects of Licensing and Subsequent Activity

Most potentially negative effects on fish and wildlife species, habitats, subsistence, and their uses; on local uses, residents, and property owners; and on local communities may be mitigated through mitigation measures imposed on the exploration license. These measures are listed in Chapter Nine. These provisions, along with other laws and regulations, apply to the license, and to a subsequent lease, if the license is converted to a lease.

Potential oil and gas activities that could have cumulative effects on the area's habitats and fish and wildlife populations include seismic surveys, construction of support facilities, and drilling, production, and transportation activities. Some potential cumulative effects of these activities include physical disturbances that could alter the landscape, lakes, rivers, coastal zone, and wetlands; habitat change; behavior changes of fish, wildlife and birds; drawdowns and contamination of groundwater; and contamination of terrestrial, freshwater, or marine habitats from discharges from well drilling and production, gas blowouts, or spills of hazardous substances.

Oil and gas development could result in increased access to recreation, mining, hunting, and fishing areas due to construction of new access routes, coastline infrastructure, and roads. This could also increase competition among user groups. Exploration and development could decrease the area's visual quality and attraction to tourists and could restrict local access to the area. However, increased access could benefit recreational and visitor uses by increasing the area available for those uses. Other potential benefits from oil and gas development include a potential increase in wage earning opportunities to supplement subsistence activities.

If unregulated, oil and gas activities subsequent to licensing could potentially affect local landowners and surface users, habitats, fish and wildlife, air quality, subsistence, viewshed, recreational, sport, and commercial uses. Local residents' use of the area requires access to it. Activities, facilities, or structures that restrict access could have an adverse impact on local residents, especially if private property is involved. However, access to the area may not be restricted, except immediately around facilities. Mitigation measures included in this written finding, along with laws and regulations imposed by state and federal agencies, are expected to mitigate these potential effects.

Oil and gas activities may also have effects, including fiscal, on communities. Positive potential effects are job creation, a small initial contribution to state revenues, and the potential to use oil and gas to lower energy costs. If the licensee employs local and Alaska residents and contractors for work performed on the licensed area, to the extent they are available and qualified, the multiplier effect may benefit local and state economies. More information about potential effects is found in Chapter Eight.

I. Mitigation Measures

Mitigation measures address protection of private property; water quality and aquifers; air quality; facilities and operations; habitat, fish, and wildlife; subsistence, commercial, and sport harvest activities; management of fuels, hazardous substances, and wastes; potential spills of hazardous substances; access; prehistoric, historic, and archaeological sites; and local hire, and communication and training. Mitigation measures are found in Chapter Nine.

Chapter One: Director's Finding and Decisions

Table of Contents

Chapter One: Director's Finding and Decisions

This is the director's decision under AS 38.05.133(f) that, after considering the matters required by AS 38.05.035(e) and (g), disposing of a state interest by issuing the Southwest Cook Inlet Exploration License (exploration license) is in the best interests of the state. All relevant facts and issues within the scope of review that were known or made known to the director were reviewed. The director limited the scope of the finding to the disposal phase and the exploration phase and the reasonably foreseeable significant effects of the disposal and exploration (AS 38.05.035(e)(1)(A)). Conditions for phasing are met under AS 38.05.035(e)(1)(C).

A. Director's Written Finding

In making this finding, the director considered and discussed facts and public comments received during review that address the matters required by AS 38.05.035(g). The discussion of these matters is set out in the accompanying chapters of this written finding. Based on consideration and discussion of the information contained herein, the director finds:

- The Alaska constitution directs the state "to encourage ... the development of its resources by making them available for maximum use consistent with the public interest" (Alaska Constitution, art. VIII §§1, 2).
- The people of Alaska have an interest in developing the state's oil and gas resources and maximizing the economic and physical recovery of those resources…(AS 38.05.180(a)).
- The intent of the oil and gas licensing program (AS 38.05.131 —.134) is to encourage exploration in areas far from existing infrastructure, with relatively low or unknown hydrocarbon potential, and where there is a higher investment risk to the operator.
- On April 30, 2013, DO&G received a timely Exploration License Application.
- On May 30, 2013, DO&G published a notice of intent to evaluate the proposal, request for comments on exploration licenses in the area, and request for competing proposals. Responses were due by July 1, 2013.
- DO&G received one competing proposal on July 26, 2013.
- One comment was received from the public during the comment period. United Utilities Incorporated expressed concern about the safety and integrity of a fiber optic cable that is buried in the seafloor and transects the license area.
- AS 38.05.133(f) requires a written finding addressing all matters set out in AS 38.05.035(e) and (g) after considering proposals and public comment on the proposals.
- AS 38.05.035(e)(1)(A) allows the director to establish the scope of the administrative review and the scope of the written finding supporting that determination.
- AS 38.05.035(e)(1)(B) allows the director to limit the scope to a review of applicable statutes and regulation, facts, and issues material to the determination, and known or available to the director during the administrative review.

- AS 38.05.035(e)(1)(C) allows the director to limit a written finding to the disposal phase, which is the issuance of an exploration license, and oil and gas leases if the license is converted.
- Under AS 38.05.035(e)(1)(C)(ii) and (iii), before the next phase - the exploration phase – of the project may proceed, public notice and the opportunity to comment must be provided. These were provided through the May 30, 2013, public notice.
- AS 38.05.035(h) states the director may not be required to speculate about possible future effects that cannot reasonably be determined until the project or proposed use for which a written finding is required is more specifically defined.
- All oil and gas activities conducted under an exploration license or oil and gas lease are subject to numerous federal, state, and local laws and regulations with which a licensee or lessee must comply.
- Potential effects of activities subsequent to licensing can be both positive and negative.
- Fish and wildlife species in Southwest Cook Inlet that could be affected by the license are salmon, belugas, trumpeter swans, waterfowl, migratory birds, black bear, brown bear, and moose. Seabird nesting sites, resting locations, and pelagic feeding areas are extremely sensitive to oil pollution. Mitigation measures addressing free passage and movement protect fish and wildlife.
- Several important subsistence, sport, personal use, and commercial uses of fish and wildlife could be affected by the license as well. Tyonek residents harvest subsistence resources that are present within, or migrate through the license area. Mitigation measures addressing harvest interference avoidance, public access, road construction, and oil spill prevention can mitigate impacts.
- Discharges of oil, gas, and hazardous substances into the land, water, and air can harm habitats and fish and wildlife populations. Improved design, construction, operating techniques, proper handling, storage, spill prevention measures, and disposal of such substances can mitigate impacts. The fixed locations of marine terminals on the eastern shore of Cook Inlet improve contingency planning and spill response capabilities.
- Increased use of the area for oil and gas activities could affect subsistence uses. However, potential negative effects may be outweighed by potential positive effects such as higher incomes that offset costs of equipment and other subsistence activities. Roads and transportation corridors may also lead to increased access for hunting, fishing, and trapping.
- Communities near the exploration license area such as Tyonek, Homer, Nikiski, and Anchor Point could benefit through economic opportunity and lower fuel prices if oil or gas is discovered in paying quantities.
- Most potentially negative effects of oil and gas activities on fish and wildlife species, habitats, and their uses; on local uses, residents, and property owners; and on local communities, if not adequately addressed by federal or state law, may be mitigated through mitigation measures imposed on the exploration license and subsequent lease activities.
- The director has enough information to decide whether to approve the exploration phase because the applications included specifics about the types of activities that will

likely occur during exploration. DNR possesses a body of knowledge covering nearly 100 years of oil and gas activities in Alaska and around the world which demonstrate the potential cumulative effects that could occur in the license area as a result of subsequent activity.

B. Disposal Phase Decision

After weighing the facts and issues known at this time, considering applicable laws and regulations and public comments, and balancing the potential positive and negative effects given the mitigation measures and other regulatory protections, the director finds the potential benefits of disposing of a state interest through the exploration license outweigh the possible negative effects. The director has determined that issuing an oil and gas exploration license for a term of four years covering approximately 169,000 acres to the winner of the competitive bid process for the license is in the best interests of the state of Alaska. The minimum work commitment bid for this exploration license is $1,000,000.

The licensee must comply with all applicable state and federal codes, statutes, and regulations; and additional project-specific and site-specific mitigation measures will be applied as appropriate to future authorizations. These laws and mitigation measures will ensure the oil and gas activities can be conducted without jeopardizing habitats and fish and wildlife populations of the area, and current and projected uses of the area.

The state is sufficiently empowered through constitutional, statutory, and regulatory regimes, the exploration license, and plans of operation to ensure that the licensee protects the integrity of the environment and maintains opportunities for existing and anticipated uses.

An eligible person affected by this decision may request reconsideration of it, in accordance with 11 AAC 02. Any request for reconsideration must be received within 20 calendar days after the date of issuance of this decision, as defined in 11 AAC 02.040(c) and (d), and may be mailed or delivered to Joseph Balash, Commissioner, Department of Natural Resources, 550 W. 7th Avenue, Suite 1400, Anchorage, Alaska 99501; faxed to 1-907-269-8918; or sent by electronic mail to dnr.appeals@alaska.gov.

An eligible person must first request reconsideration of this decision in accordance with 11 AAC 02 before appealing this decision to Superior Court. If the commissioner does not act on a request for reconsideration within 30 days after issuance of this finding, the request for reconsideration is considered denied and this finding becomes a final administrative order and decision on the 31st day after issuance for the purposes of an appeal to Superior Court. A copy of 11 AAC 02 is available from any regional information office of the Alaska Department of Natural Resources.

W. C. Barron, Director

6/20/2014
Date

C. Exploration Phase Decision

To provide clarity to the public and the exploration license applicants, the director is also explicitly stating his decision regarding the exploration phase. The director has weighed the facts and issues known at this time and has set out his findings regarding exploration. After considering applicable laws and regulations and public comments, and balancing the potential positive and negative effects of oil and gas exploration given the mitigation measures and other regulatory protections, the director finds that the potential benefits of approving the exploration phase outweigh the possible negative effects and hereby approves the exploration phase.

The successful licensee must obtain all required approvals before beginning on-the-ground exploration activities and must comply with all applicable local, state, and federal codes, statutes, and regulations; and additional project-specific and site-specific mitigation measures will be applied as appropriate to future authorizations. These laws and mitigation measures will ensure the oil and gas activities can be conducted without jeopardizing habitats and fish and wildlife populations of the area, and current and projected uses of the area.

The state is sufficiently empowered through constitutional, statutory, and regulatory regimes, the exploration license, and plans of operation to ensure that the successful licensee protects the integrity of the environment and maintains opportunities for existing and anticipated uses.

An eligible person affected by this decision may request reconsideration of it, in accordance with 11 AAC 02. Any request for reconsideration must be received within 20 calendar days after the date of issuance of this decision, as defined in 11 AAC 02.040(c) and (d), and may be mailed or delivered to Commissioner, Department of Natural Resources, 550 W. 7th Avenue, Suite 1400, Anchorage, Alaska 99501; faxed to 1-907-269-8918; or sent by electronic mail to dnr.appeals@alaska.gov.

An eligible person must first request reconsideration of this decision in accordance with 11 AAC 02 before appealing this decision to Superior Court. If the commissioner does not act on a request for reconsideration within 30 days after issuance of this finding, the request for reconsideration is considered denied and this finding becomes a final administrative order and decision on the 31st day after issuance for the purposes of an appeal to Superior Court. A copy of 11 AAC 02 is available from any regional information office of the Alaska Department of Natural Resources.

W. C. Barron, Director

6/20/2014
Date

D. Invitation to Bid

Competing proposals were received and the commissioner has concluded that it is in the best interest of the state to issue an exploration license for Southwest Cook Inlet. AS 38.05.133(h) states that if competing proposals are submitted and the commissioner's finding under AS 38.05.133(f) concludes that an exploration license should be issued, the commissioner shall issue a request for competitive sealed bids to determine which prospective licensee should be issued the exploration license. The successful bidder is the prospective licensee who submits the highest bid in terms of the minimum work commitment dollar amount. 11 AAC 82.921 states that the commissioner will issue each applicant an invitation to submit a sealed bid form supplied by the department. The invitation to bid will:

- be issued concurrent with this written finding;
- describe the area to be offered for licensing;
- designate the date a sealed bid must be received by the commissioner;
- include the finding under AS 38.05.133(f), the exploration license and lease forms that will be used, and a bid form; and
- disclose additional information and set out additional requirements as the commissioner determines to be necessary.

Submission of a sealed bid to the commissioner on a form supplied by the department constitutes notice of a prospective licensee's intent to participate in the bidding as required by AS 38.05.133(h). The invitation to bid is being sent to the applicants concurrently with the issuing of the Director's written finding including a bid form to complete and return within 20 days of the invitation's receipt.

Chapter Two: Introduction

Table of Contents

Page

List of Tables

Table **Page**

Chapter Two: Introduction

The Alaska Department of Natural Resources (DNR), Division of Oil and Gas (DO&G) is offering an oil and gas exploration license, upon completion of the evaluation of the exploration proposals and a competitive bid process, to the successful licensee.

The exploration license area is approximately 169,000 acres, on and around the Iniskin Peninsula, Iniskin Bay, Chinitna Bay, Oil Bay, and the adjacent state-owned waters. The license area consists of state-owned, unencumbered land within T. 3 S., R. 20-22 W., T. 4 S., R. 20-23 W., T. 5 S., R. 21-24 W., T. 6 S., R. 22-25 W., T. 7 S., R. 23-25 W., Seward Meridian. Only free and unencumbered state-owned subsurface mineral estates are included in the oil and gas license. The exploration license grants the exploration licensee the exclusive right to explore for oil and gas, and could subsequently be converted to a lease. A more detailed description of the license area is found in Chapter Three.

A. Authority

The Alaska Constitution provides that the state's policy is "to encourage…the development of its resources by making them available for maximum use consistent with the public interest" and that the "legislature shall provide for the utilization, development, and conservation of all natural resources belonging to the State…for the maximum benefit of its people" (Alaska Constitution, article VIII, §1 and 2). To comply with this provision, the legislature enacted Title 38 of the Alaska statutes and directed DNR to implement the statutes.

The legislature found that the people of Alaska have an interest in the development of the state's oil and gas resources to maximize the economic and physical recovery of those resources; maximize competition among parties seeking to explore and develop the resources; and maximize use of Alaska's human resources in the development of the resources (AS 38.05.180(a)(1)).

AS 38.05.180(a)(2) further states it is in the state's best interest to encourage an assessment of its oil and gas resources, allow the maximum flexibility in the methods of issuing leases, and to offer acreage for oil and gas leases or for gas only leases.

B. Exploration Licensing

Exploration licensing supplements the state's conventional oil and gas leasing program by targeting areas outside known oil and gas provinces (the North Slope, North Slope Foothills, Beaufort Sea, upper Cook Inlet, and Alaska Peninsula).[1] The licensing program encourages exploration in areas far from existing infrastructure, with relatively low or unknown hydrocarbon potential, and where there is a higher investment risk to the operator. Lease sales held in some of these higher-risk areas have attracted little participation because of the bonus money one has to pay to win the lease. Exploration licensing gives the licensee the exclusive right to explore for oil and gas without this initial expense. Through exploration licensing, the state will receive subsurface geologic information about these regions and, should development occur, additional revenue through royalties and taxes.

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[1] However, there are lands where the exploration licensing program does not apply. AS 38.05.131 states oil and gas exploration licenses statutes (AS 38.05.132 –.134) do not apply to land:

1) north of the Umiat baseline, and
2) in the vicinity of Cook Inlet that is within the area bounded by
   A) the north boundary of Township 17 North, Seward Meridian;
   B) the Seward Meridian;
   C) the south boundary of Township 7 South, Seward Meridian; and
   D) the west boundary of Range 19 West, Seward Meridian.

The licensing process begins in one of two ways:

1. Annually each April applicants may submit to the commissioner a proposal for exploratory activity within an area they have specified; or
2. The commissioner may, at any time, request proposals to explore an area he has determined may be subject to the provisions of AS 38.05.132.

Any proposal received by the commissioner must designate how much money the applicant will spend on exploration (the work commitment), the amount of acreage desired, and the term (duration) of the license. An exploration license may range from 10,000 to 500,000 acres, and may have a term of up to 10 years. The proposal need not describe the type of exploration activity although direct exploration expenditures must meet the requirements of AS 38.05.132(f)(1) . However, before any exploration activity may occur, the proposed activity must first go through the required authorization processes.

Within 30 days of receiving a proposal for an exploration license, the commissioner must either reject it in a written decision or give public notice of DNR's intent to evaluate the acceptability of the proposal. The commissioner must also solicit comments and request competing proposals (AS 38.05.133(d)). If the commissioner decides to evaluate the acceptability of a proposal, DO&G develops a written finding determining whether issuing a license is in the state's best interests. DO&G must consider all comments received during the comment period (AS 38.05.133(f)).

Among other requirements set out in AS 38.05.035(e) and (g), the written finding sets the term of the license (both of which may be different than what the applicants proposed). If there are no competing proposals, the finding must also identify the prospective licensee. If competing proposals are submitted and the finding concludes that issuing an exploration license is in the state’s best interests, the successful licensee will be determined by a sealed bid process. The successful bidder is the prospective licensee who submits the highest bid in terms of the minimum work commitment dollar amount (AS 38.05.133(h)).

The licensee must pay a one-time $1.00 per acre license fee, and must annually post a bond equal to the work commitment, less the cumulative expenditures, divided by the years of the remaining license term. There are no additional charges during the term of the license. Upon fulfilling the work commitment, the bond is released; if the work commitment is not fulfilled, the bond is forfeited to the state.

By the fourth anniversary of the exploration license, if the licensee has not completed at least 25% of the total work commitment, the license will be terminated, and the remainder of the security will be forfeited to the state. If the licensee has completed less than 50% of the total work commitment, 25% of the licensed area would be relinquished, with an additional 10% relinquished each successive year until half of the original acreage has been relinquished.

Once the work commitment has been met, and if the licensee requests, the commissioner will convert all or a portion of the remaining license area to an oil and gas lease. Therefore, this written finding contemplates that the exploration license may be converted to a lease.

C. Process

In April 2013, DO&G received a request for an oil and gas exploration license in the Southwest Cook Inlet area, in and around Iniskin Peninsula. On May 30, 2013, the division issued a "Notice of Intent to Evaluate" this proposal (AS 38.05.133(d)), and requested comments and competing proposals. To ensure confidentiality under AS 38.05.035(a)(8), DO&G did not identify the name of the applicant, and identified a solicitation area that was larger than the area sought in the proposal. One set of public comments was received about a communications project involving buried and submerged fiber optic

cable in the southern portion of the exploration license area. The comment and map received, and DNR's response, are in Appendix A.

At the same time, additional proposals were solicited (AS 38.05.133(d)). DO&G received an additional competing exploration license proposal. The prospective licensees are not identified at the time of this written finding, and a planned competitive bidding process will determine the successful licensee (AS 38.05.133(f) & (h)).

Following an evaluation of the exploration proposals, DO&G began developing its written finding. On May 30, 2013, DO&G issued a Request for Agency Information to state and federal agencies, local governments, and parties requesting correspondence for this project. The request asked for publicly available substantial information and data about the area's property ownership, people, economy, current uses, subsistence, historic and cultural resources, fish and wildlife, habitats, other natural resource values, and reasonably foreseeable effects of exploration on the area (AS 38.05.035(g)). Recipients were given until July 29, 2013 to respond. No agency comments were received about the proposed exploration project or license area. The exploration license statutes (AS 38.05.131—.134) and regulations (11 AAC 82.903—.990) do not require a preliminary written finding.

After issuing the written finding, an eligible individual or organization may request the commissioner to reconsider in accordance with AS 38.05.035(i). The request must be filed within 20 days after publication of the written finding. To file a request for reconsideration, an eligible person must have "meaningfully participated" in the administrative review process and must be affected[2] in some way by the finding. "Meaningfully participated" means that the person (1) timely submitted written comment during a public comment period; or (2) presented oral testimony at a public hearing if one was held (AS 38.05.035(i)). The request for reconsideration must specify the basis on which the finding is challenged.

An eligible person may appeal to the superior court only if the person had already requested reconsideration by the agency, and only those points raised in that request for reconsideration may be appealed (AS 38.05.035(l)). By requiring a party to exhaust the administrative review and reconsideration process before appealing to the superior court, the agency has full opportunity to review, analyze, and respond to the appealed concerns before litigation. For the purposes of review, the eligible person appealing must state and prove the defect alleged to exist within the written finding (AS 38.05.035(m)).

D. Written Finding

AS 38.05.035 and AS 38.05.131—.134 govern the issuance of exploration licenses and address public notice requirements. Under AS 38.05.035(e), DNR may not dispose of state land, resources, property, or interests, unless the director first determines in a written finding that a disposal will serve the state's best interests. Because it is understood that the proposed exploration license is a disposal and for ease of reading, the proposed exploration license disposal area will be called the "license area" throughout the director's written finding.

1. Requirements

AS 38.05.133(f) describes what the written finding must address, including all matters set out in AS 38.05.035(e) and (g) (except for 38.05.035(g)(1)(B)(xi)). For ease of reading, this document does not necessarily follow the order as found in AS 38.05.035(g)(1)(B) (Table 2.1).

[2] Alaska case law defines "a person affected by a decision" as someone who has a personal stake in the results of the decision. *Sisters of Providence v. Dept. of Health & Social Services*, 648 P. 2d 970, 974 (Alaska 1982).

Table 2.1 Locations of topics required by AS 38.05.035(g)(1)(B)

AS 38.05.035(g)(1)(B) subsection number	Description	Location in this document
i	Property descriptions and locations	Chapter Three
ii	Petroleum potential	Chapter Six
iii	Fish, wildlife, and habitat	Chapter Four
iv	Current and projected uses; uses and value of fish and wildlife	Chapter Five
v	Governmental powers	Chapter Seven
vi	Reasonably foreseeable effects on subsistence; fish, wildlife, and habitat and their uses; and historic and cultural resources	Chapter Eight
vii	Mitigation measures	Chapter Nine
viii	Oil or gas transportation	Chapter Six
ix	Reasonably foreseeable fiscal effects	Chapter Eight
x	Reasonably foreseeable effects on municipalities and communities	Chapter Eight

2. Scope of Review

The scope of this administrative review and finding addresses only reasonably foreseeable, significant effects of the uses proposed to be authorized by the disposal (AS 38.05.035(e)(1)(A)). The director does not speculate about possible future effects that are subject to AS 38.05.035(h).

The director interprets “reasonably foreseeable” to mean there must be:

- some cause/result connection between the lease sales and the effect to be evaluated;
- a reasonable probability that the effect will occur as a result of the lease sale; and
- the effect will occur within a predictable time after the lease sale.

A reasonably foreseeable effect must also be "significant." The director interprets “significant” to mean a known and noticeable impact on or within a reasonable proximity to the license area.

Public input assists in providing an inclusive body of information for a finding. Information provided by agencies and the public assists the director in:

- determining which facts and issues are material to the decision of whether to issue an exploration license;
- determining the reasonably foreseeable, significant effects of licensing and subsequent leasing that arise from those material facts and issues; and
- determining if issuing an exploration license for the area will serve the state’s best interests.

3. Phased Review

Phased review is appropriate for exploration licensing. Although the licensee proposed specific exploration activities in its application it is unknown when, where, how, or what kind of development or production might ultimately occur as the result of an exploration license. Whether development would be consistent with public and state interests is unknown at this time. Therefore, the legislature

provided for phased review "to allow for consideration of those issues when sufficient data are available upon which to make reasoned decisions." Ch. 38, § 1(11), SLA 1994.

The director may, if the project for which the proposed disposal is sought is a multi-phased development, limit the scope of an administrative review and finding for the proposed disposal to the applicable statutes and regulations, facts, and issues that pertain solely to the disposal phase of the project (AS 38.05.035(e)(1)(C)) under the following conditions:

(i) the only uses to be authorized by the disposal are part of that phase;

(ii) the disposal is a disposal of oil and gas, or of gas only, and, before the next phase of the project may proceed, public notice and the opportunity to comment are provided under regulations adopted by the department;

(iii) the department's approval is required before the next phase may proceed; and

(iv) the department describes its reasons for a decision to phase.

The exploration license satisfies these requirements for phased review.

Condition (i) is met because this written finding authorizes the issuance of an exploration license, which is the full extent of the disposal phase. The license gives the successful licensee, subject to the provisions of the license, the exclusive right to conduct geological and geophysical exploration for oil and gas within the licensed area. If the license terms are met, and the licensee requests conversion the license be converted to a lease, the licensee will have the exclusive right to drill for, extract, remove, clean, process, and dispose of any oil, gas, or associated substances they may find on those lands converted to a lease. The license itself does not, however, give the licensee authority to proceed with any of those activities. The licensee must first obtain the necessary approvals.

Condition (ii) is met because the license is for oil and gas, and DNR provided public notice and the opportunity to comment when it issued a "Notice of Intent to Evaluate" this proposal (AS 38.05.133(d)), and requested comments on May 30, 2013.

Condition (iii) is met because DNR's approval is required before the next phase may proceed.

Condition (iv) is met by this discussion of the reasons to phase.

4. Exploration Phase Approval

This written finding also provides DNR's explicit approval of the exploration phase, as required by AS 38.05.035(e)(1)(C)(ii)(iii) as well as the disposal phase.

DNR possesses a body of knowledge, covering nearly 100 years of oil and gas activities in Alaska, and around the world that is sufficient to approve the exploration phase. The exploration license applications and this written finding satisfy the conditions for phased review because the applications included specifics about the types of activities that will likely occur during exploration. The director, in making this finding, has limited the scope of the finding to the applicable statutes and regulations, facts, and issues that pertain to the exploration licensing disposal phase and exploration phase.

DNR did provide public notice and the opportunity to comment on exploration in the solicitation area as required by AS 38.05.035(e)(1)(C)(ii), the director considers herein the exploration phase and exploration activities and approves the exploration phase as required by AS 38.05.035(e)(1)(C)(iii), and thus the exploration phase may proceed.

Chapter Three: Description of the License Area

Table of Contents

Page

List of Tables

Table **Page**

List of Figures

Figure **Page**

Chapter Three: Description of the License Area

AS 38.05.035(g)(1)(B)(i) requires that the Director consider and discuss the property descriptions and locations of the license area. The following overview includes information material to the determination of whether the exploration license will be in the state's best interest (AS 38.05.035(e)(1)(B)(iii)). It is not intended to be all inclusive.

A. Property Description

The Southwest Cook Inlet license area consists of approximately 169,000 acres on and around the Iniskin Peninsula, Iniskin Bay, Oil Bay, Chinitna Bay and the adjacent state-owned waters seaward to three nautical miles from the coastline. The exploration license area consists of state-owned, unencumbered lands within T. 3 S., R. 20-22 W., T. 4 S., R. 20-23 W., T. 5 S., R. 21-24 W., T. 6 S., R. 22-25 W., T. 7 S., R. 23-25 W., Seward Meridian (Figure 3.1). The solicitation area contains not only State, but also federal, and privately owned land, and State owned waters of Cook Inlet. It is located within the Kenai Peninsula Borough. The exploration license area is located within the solicitation area that was identified in the May 30, 2013 Notice of Intent to Evaluate the Oil and Gas License Proposal soliciting public comment and competing proposals.

The exploration license area includes state-selected but unconveyed acreage, which cannot be included in an exploration license until the state receives title. It is possible, during the term of the license, that some of the acreage on which the state has topfiled or the mineral estate of the Native selected land or Native allotments may be conveyed to the state. The successful licensee may request to have the selected acreage identified in its application included or excluded in the issued license.

The majority of the on-shore land within the license area is Cook Inlet Regional Inc. (CIRI) property. CIRI owns the subsurface estate and the surface estate is owned by several village corporations including Chickaloon, Knik, Ninilchik, Salamatof, Seldovia, and Tyonek (CIRI 2014b). The northeast portion of the license area is adjacent to Lake Clark National Park and the Alaska Maritime National Wildlife Refuge along the north shore of Chinitna Bay. The tidelands in and adjacent to Lake Clark National Park and the Alaska Maritime National Wildlife Refuge have been designated as Special Use Lands (ADL 227835) (DNR 2001). The federal and privately owned land is outside the state's jurisdiction with regards to access and management of the subsurface mineral estate.

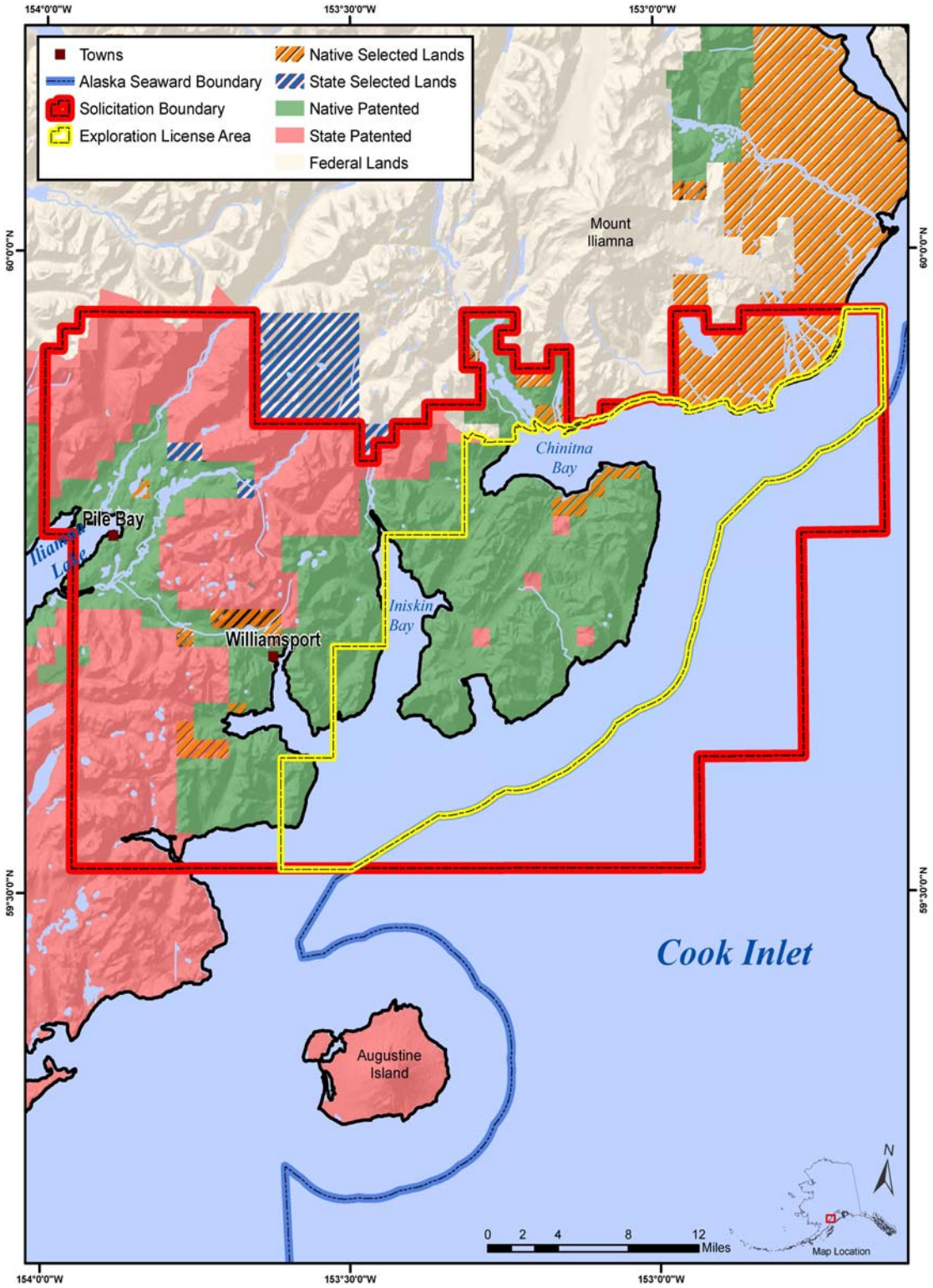

Figure 3.1. Location and boundaries of the Southwest Cook Inlet exploration solicitation and license area.

B. Access

The primary access routes within the license area are by marine transport, helicopter, and ancillary roads and trails on state and private property. Marine facilities in Cook Inlet would provide ports of call for vessel traffic to, from, and through the license area. The closest port facilities are shallow-draft navigation ports, Williamsport and Port Graham, and deep-draft navigation at Port of Homer, City of Seldovia, with other deep-draft facilities available in middle and upper Cook Inlet (Cape International 2012).

Cook Inlet waters host high volume vessel traffic. Approximately 480 vessel trips for self-propelled vessels greater than 300 gross tons entered Cook Inlet in 2010. Levels of activity varied, with Kachemak Bay in lower Cook Inlet experiencing the highest levels of traffic in Cook Inlet. Vessel traffic is forecasted to remain flat or show moderate increases due to population growth and post-recession improvements in the economy (Cape International 2012).

Williamsport is the closest permanent port facility and is just outside of the license area to the west. It is privately owned, and is the connection port with the state road that connects Iliamna Bay to Lake Iliamna, and the Village of Pile Bay. The road shortens the 1,100-mile marine route from Cook Inlet to Bristol Bay. Cargo, fishing boats, and vehicle traffic are transported to and from Cook Inlet to the Lake Iliamna area, with high volume use reported in summer months (Cape International 2012). Lake Iliamna drains west to Bristol Bay, and cargo can be transported from Cook Inlet Basin to Bristol Bay and into the Bering Sea ocean waters beyond by way of the road. Vessel traffic into and from Williamsport is planned based upon the 14.5 foot daily tidal range, and high tides of 20 feet are preferred for barge traffic (USDC 2006). There are no additional small-boat harbor facilities in the area (Waring 2010).

The road from Williamsport northwest to Pile Bay Village on Lake Iliamna, is a single lane unpaved state owned and maintained road that supports local and commercial traffic. It is known as Pile Bay-Williamsport Road, or Portage Road, is 15.5 miles long, and has was constructed the 1930s. This route has been in use by residents and travelers for hundreds of years (USACE 1995). It occupies a 100 foot wide right of way (ROW), and provides a portage connection across the Chigmit Mountains (USACE 2007). It is usually open from June through November, weather permitting, and is not maintained in winter (Waring 2010).

Approximately half the Pile Bay-Williamsport Road is in the Kenai Peninsula Borough, with the remainder in the Lake and Peninsula Borough (USACE 2007). A six-mile segment was repaired in 2009 for improved safety (Klouda 2010). The current terminus of the Pile Bay-Williamsport Road is on private property at Lake Iliamna (Waring 2010).

Several historic Revised Statute (RS) 2477 ROW trails are located on the Iniskin Peninsula. RS 2477 is found in section 8 of the Mining Law of 1866. RS 2477 was enacted by the US Congress in 1866 to encourage the settlement of the Western United States by the development of a system of highways. The term RS 2477 is used to describe a public ROW across unreserved federal land to guarantee access across federal land, and is transferred with the lands to subsequent State or private ownership. The revised statute trail (RST) 496, Iniskin Peninsula Road, runs from Camp Point near Seal Spit on Chinitna Bay along Fritz Creek Valley for about eight miles. The RST 529, the Iniskin Bay-Oil Bay Trail, runs approximately 2.5 miles from Oil Bay to an historic oil drilling site abandoned over a century ago. The RST 1873, Dry Bay Trail, is a trail that extends from Dry Bay inland for approximately 2.5 miles. Another 5 mile trail, RST 311, traverses over Portage Pass from Chinitna Bay to Iniskin Bay (Waring 2010). These roads and trails are shown on Figure 6.1.

C. Subsurface Property and the Public Interest

The Statehood Act allowed Alaska to select 104 million acres of federal land as its economic base. The land grants included the subsurface mineral rights underlying these selections. The Act requires the state to retain these mineral interests when conveying interests in the surface estate stating "mineral deposits in such lands shall be subject to lease by the State as the State legislature may direct" (P.L. 85-508, § 6(i)).[1] Additionally, the Act states that if Alaska disposes of its mineral estate contrary to the Act, it will have to forfeit that mineral estate to the federal government.

Complying with the intent of the Act, the Alaska Constitution directs the state's policy: "to encourage ... the development of its resources by making them available for maximum use consistent with the public interest" and the "legislature shall provide for the utilization, development and conservation of all natural resources belonging to the state, ... for the maximum benefit of its people" (Alaska Constitution, art. VIII, §§ 1, 2.)

To meet this mandate, the legislature enacted Title 38 of the Alaska statutes and directed DNR to implement these laws. The legislature found the people of Alaska have an interest in developing the state's oil and gas resources and maximizing the economic and physical recovery of those resources (AS 38.05.180(a)). When state surface land is conveyed to an individual citizen, state law requires that the deed reserve mineral rights for the state (AS 38.05.125).

A large portion of the state owned lands within the license area are designated Alaska's School Trust. DNR Department Order 143 states that if School Trust Lands are involved, the following criteria must be met prior to the disposal of the land or resources:

- The action approved must be for full, fair market value at the highest and best use of the parcel, or
- The action must be a result of an existing contractual obligation (i.e., land sale contract, reappraisal of an existing lease, or a land settlement with a municipality).

D. Historical Background

At the time of first European contact, Dena'ina Athabaskans occupied all of Cook Inlet north of Kamishak Bay. Na-Dene speaking Athabaskans were well established in the region by 1000 AD, replacing an earlier Kachemak Tradition culture. The Kachemak were Yu'piq speaking marine specialists descendent of Aluutiq or Yupik cultures of the Kodiak Archipeligo and/or Southwest Alaska. The earliest Kachemak Tradition sites date to ca. 3000 BC and are found in Kachemak Bay and coastal margins of Cook Inlet (Boraas 2007). Evidence of earlier Northern Archaic and American Paleoarctic cultures have also been identified, however most occur at inland locations such as Round Mountain, Long Lake, Trapper Creek (Reger 2004; Wygal 2009).

The Dena'ina have a long history of fishing, hunting, and gathering in the license area. Traditional subsistence resources include anadromous and pelagic fish, beluga whales, waterfowl, seals, moose, sheep, fur bearers, and plants (Fall 1981).The Dena'ina were salmon fishing specialists and employed weirs, nets, and complex storage pits (caches) to preserve their harvests (Boraas 2007). Winter homes were of permanent semi-subterranean design and were common throughout Cook Inlet (Reger 2004).

Euroamerican activity in the region began in the late eighteenth century with the arrival of Russian fur traders and other European explorers. Russian trading posts were established at over a dozen locations

[1] There are two types of interests or ownership in land: the surface estate and the subsurface or mineral estate. The interests may become separated when an original owner keeps only the surface estate and sells the subsurface, or when an owner sells only the surface and keeps the subsurface to sell or use later. Therefore, the surface and subsurface interests may be separate, and a property or homebuyer could buy land but acquire only the surface estate.

from Cook Inlet to Prince William Sound. The first known trading post at Illiamna Lake was established by the Lebedef-Lastochkin Company in the 1790s (Townsend 1961). The fur trade generally continued unimpeded after the Alaska Purchase of 1867.

Rapid change occurred in the ensuing decades with discovery of gold at Turnagain Arm (1896), commercial fishing and canneries, oil and gas exploration, missionization, schools, and establishment of a cash economy and permanent towns and cities. Throughout this period the Dena'ina experienced epidemic disease, hunting, fishing, and land inequities, and major culture change (Boraas 2007).

E. Local Communities

There are no communities within the license area, though it is entirely within the boundary of the Kenai Peninsula Borough. In 2012, the United States Census Bureau estimated that the population of the Kenai Peninsula Borough was 56,900 people (USCB 2014). The larger communities in the borough include Homer, Kenai, Soldotna, and Nikiski.

In 2010, the estimated unemployed adults living in the Kenai Peninsula Borough was 8.4%. The 2010 estimated population living below the poverty line in the Kenai Peninsula Borough was 9.12% (ADCRA 2014). Table 3.1 provides additional information on the region's employment and income statistics.

Table 3.1. Socioeconomic indicators for communities near the license area.

Community	Population	Estimated Median Household Income ($)	Estimated in Labor Force (#)	Estimated Unemployed (%)	Estimated Population Living Below Poverty Level (%)
Kenai Peninsula Borough	55,400	59,421	24,089	8.4	9.12
Tyonek	171	38,125	88	14.04	30.24
Anchor Point	1,930	49,712	823	7.72	10.21
Homer	5,003	52,535	2,136	3.23	10.59

Notes: Values are from 2010 census.

Source: ADCRA 2014; USCB 2014

The nearest development to the license area is Williamsport, which is not a population center, but a shallow draft port and the end of the portage road between Cook Inlet and Lake Iliamna. The closest community to the license area is Pile Bay which is at the other end of the Portage road that begins in Williamsport. The closest population center and community in the Cook Inlet basin is Anchor Point which is located approximately 60 miles east of the license area, on the east side of Cook Inlet on the road system. Anchor Point has a population of 1,930 people (USCB 2014). Tyonek, which is located approximately 120 miles north of the license area's northern boundary, is the closest community on the western shore of Cook Inlet with a population of 171 (USCB 2014). There are several other communities that are located on Lake Iliamna, close to the license area, including Pile Bay, Pedro Bay, Iliamna, Newhalen, and Nondalton. These communities are on the opposite side of the Chigmit Mountains in the Aleutian Range and are part of the Bristol Bay watershed and not likely impacted by activity in this license area.

No population information is available from the U.S. Census Bureau regarding the populations of Pile Bay or Williamsport. Both of these settlements have important infrastructure supporting the transportation of boats, fuel, and other supplies into the Lake and Peninsula Borough and the Bristol Bay region (USACE 2007).

1. Pedro Bay

The village is located on the northeast shore of Iliamna Lake, about 175 miles southwest of Anchorage. Iliamna Lake is the largest lake in Alaska, measuring about 80 miles long and 20 miles wide. The subsistence fishing and hunting culture is the predominant lifestyle. The Pedro Bay Village Tribal Council is active throughout the year, and the population is 42 year round residents, with 67% of Dena'ina (Tanaina) descent (DCCED 2014). It covers about 18 mi^2 of land and 9 mi^2 of water. An overland trail connects the communities of Pile Bay and Pedro Bay.

2. Tyonek

The village is located on the west shore of Cook Inlet approximately 70 miles southwest of Anchorage and approximately 120 miles north of the license area. The subsistence fishing and hunting culture is the predominant lifestyle (DCCED 2014). The population is 171 year round residents made up of approximately 95% Alaska Native of Dena'ina Athabascan descent. The Native Village of Tyonek is a federally recognized tribe that governs the village (DCCED 2014). Eighty-eight of the residents were employed in 2012, 45 of which were employed by local government and the other 43 were employed in the private sector, predominantly in construction (DOLWD 2014).

3. Anchor Point

The town of Anchor Point is located on the Kenai Peninsula within the Kenai Peninsula Borough at the junction of the Anchor River and its north fork at mile 156 of the Sterling Highway. Anchor Point has a visitor's center and a chamber of commerce. The year round population is 2,041 people (DCCED 2014). The economy is relatively diverse with approximately 21% of the working population employed in trade, transportation, and utilities and nearly 18% of the working population employed by local governmental organizations (DOLWD 2014).

4. Homer

Homer is a First Class City within the Kenai Peninsula Borough. It is located on the north shore of Kachemak Bay on the southwestern edge of the Kenai Peninsula. It includes the Homer Spit which is a 4.5 mile glacial moraine gravel bar. The City of Homer comprises 10.6 mi^2 of land and 14.9 mi^2 of water. There are 5,136 year round residents. The Homer area has been home to the Kenaitze for thousands of years (DCCED 2104).

Various coal mining operations have been conducted in and around the area. Commercial and sport fishing are important to the local economy and tourism has been gaining importance in the economy. Homer is the gateway to destinations in Kachemak Bay and also a terminus for the Alaska Marine Highway System to embark to Kodiak or out to the Aleutian Chain (DCCED 2104). Homer has a diverse economy with 2,136 people employed with 23.2% in the trade, transportation and utilities sector; 17.9% employed by local government; 15.9% in leisure and hospitality; and 12.2% in education and health services (DOLWD 2014). Homer is the nearest deep-water port to the project area.

5. Seldovia

Seldovia is a First Class City within the Kenai Peninsula Borough. It is located on the south shore of Kachemak Bay. The city comprises 0.4 mi^2 of land and 0.2 mi^2 of water. Seldovia is an Alutiiq village, and commercial fishing and subsistence are the basis for the local economy and culture. There are 245 year round residents (DCCED 2014.). Seldovia is the second closest deep water port to the license area. The economy of Seldovia consists of 103 employed residents with approximately 15% of the working population employed in trade, transportation and utilities and nearly 49% of the working population employed by local governmental organizations (DOLWD 2014).

6. Kenai

Kenai is a first class city in the Kenai Peninsula Borough. It is located on the western coast of the Kenai Peninsula at the mouth of the Kenai River and on Cook Inlet. It is situated on the western boundary of the Kenai National Wildlife Refuge on the Kenai Spur Highway. Kenai's population is 7,247 year round residents (DCCED 2014). The Kenai River is a major sport fishing location for Anchorage residents and tourists, as the river is world-renowned for trophy Chinook and silver salmon (DCCED 2014). Kenai's economy consists of 3,532 employed residents with 20.2% of the working population in trade, transportation and utilities; 15.4% in education and health services; 14.3% in natural resources and mining; 11.7% of the working population employed by local governmental organizations; and 10.9% in leisure and hospitality (DOLWD 2014).

7. Nikiski

Nikiski is an unincorporated town in the Kenai Peninsula Borough. It is located on the Kenai Peninsula, nine miles north of the City of Kenai, and also known as Port Nikiski. Nikiski's population is 4,593 year round residents. Nikiski grew with the discovery of oil in 1957 on the Kenai Peninsula and has served as an oil field services base supporting oil production and exploration in Cook Inlet (DCCED 2014). The economy of Nikiski consists of 1,980 employed residents with 19.2% of the working population in natural resources and mining; 16.5% of the working population in trade, transportation and utilities; 13% of the working population employed by local governmental organizations; 12.7% in education and health services; and 9.2% in leisure and hospitality (DOLWD 2014).

F. Historical and Cultural Resources

The National Historic Preservation Act of 1966 created the State Historic Preservation Office (SHPO). The Alaska Office of History and Archaeology (OHA) carries out the responsibilities of SHPO. SHPO responsibilities include (DNR 2013):

- Review and consultation under Section 106 of the National Historic Preservation Act (NHPA)and the Alaska Historic Preservation Act;
- Statewide historic preservation planning (Alaska's Historic Preservation Plan);
- Statewide historic property survey and inventory (Alaska Heritage Resources Survey);
- National Register of Historic Places property nomination;
- Federal historic preservation grants-in-aid program administration;
- Historic preservation program development assistance and national program participation certification for local governments (Alaska's Certified Local Government Program); and,
- Federal, state, and local historic preservation project advisement and assistance

Historic and cultural resources can include a range of sites, deposits, structures, ruins, buildings, graves, artifacts, fossils, and objects of antiquity. The lead agency, determined to be the federal agency with the most authority over a project, is required to review the project and consult with the appropriate parties under either Section 106 of the NHPA (for Federal undertakings) or the Alaska Historic Preservation Act (for State undertakings) to assess the potential for effects to significant cultural resources.

The first comprehensive archaeological survey of Cook Inlet was conducted in 1930 by Frederica de Laguna (1975). Seminal ethnographic and linguistic studies were conducted by Osgood (1937),

Townsend (1965), Kari and Fall (2003), and Kari (2007). A summary of over 20 years of ethnographic studies in Lake Clark National Park and Preserve was recently compiled by Gaul (2007).

Large-scale excavations by Townsend (1961) at Pedro Bay provided evidence of Eskimo, Athabaskan, Russian-American, and Euroamerican use of Illiamna Lake. Work at the Chinitna Bay pictograph site (SEL-006) located at Ocean Bay (Kachemak) component was similar to the Pedro Bay site (Townsend 1969).

Most archaeological surveys of the past decades were conducted to meet requirements of Sections 106 and 110 of the National Historic Preservation Act (NHPA), Section 14(h)(1) of the Alaska Native Claims Settlement Act , and the Alaska Historic Preservation Act (AS 41.35). In 1975 CIRI completed a regional inventory of Section 14(h)(1) sites (Brelsford 1975). Major oil and gas-related surveys were conducted by Mobley and Carlson (1982), Mobley and Mobley (2012), and HDR (2013). Lands associated with the Chuitna coal deposits were inspected by Gerlach and Lobdell (1984), Lobdell (1988), and most recently SRBA (2006, 2009). Studies of the Cook Inlet side of Lake Clark National Park and Preserve (LACL) include a coastal survey between Chinitna and Tuxedni Bay (Klingler and Reger 1993), the Chinitna Bay coastline (Tennessen 2006), and Kamishak Bay (Reger 1980). The Williamsport-Pile Bay Road was surveyed by DePew (2001). Substantial surveys are currently underway in association with the copper and gold Pebble project. Field surveys were conducted within the license area in 2005 and 2007. There are 11 Alaska Heritage Resource Survey sites in the license area near Knoll Head, Oil Bay, Chinitna Point, and the northern shore of Chinitna Bay. None of these have been evaluated for the National Register of Historic Places (Braund 2011).

Artifacts recovered on state land belong to the state and are curated in state facilities. These artifacts can be loaned to groups who have appropriate curation and exhibit facilities (AS 41.35.020(b)).

G. Climate

The Cook Inlet area is characterized by three climate zones: the maritime zone, continental zone, and transition zone. In the maritime zone areas, which encompass the coast and islands, annual precipitation averages about 60 inches. Mean maximum temperatures in the summer are in the upper 50s, and low means during winter are in the low 20s. Offshore winds average 12-18 knots, with winter extremes of 50-75 knots. Areas further from the coast may have continental zone characteristics, with annual precipitation from 20 inches, with January temperatures ranging from 4-22°F and July temperatures ranging from 46-65°F (DCCED 2014). Surface winds tend to be lighter compared to coastal maritime areas (BLM 2008).

Temperature and precipitation records from the last half of the twentieth century show annual and seasonal mean temperature increases throughout Alaska (Stafford et al. 2000). The average temperature increase in Alaska from 1949 to 2009 was 3.0°F, although the temperature changes varied greatly across the state. Most of the change occurred in winter and spring months. The fall months showed the least amount of change (ACRC 2014). Global surface temperatures have increased about 0.9°F since the late 19th century. Since 1900 the increase was 0.09°F per decade, and was about 0.29°F per decade during the past 30 years (Folland et al. 2006).

At northern latitudes, potential effects of climate change may include rising temperatures, melting glaciers, and a reduction in seasonal sea ice cover. These changes could result in increased storm effects and higher coastal erosion rates, increased permafrost melting, shifting vegetation zones, increased fires, insect outbreaks, changing animal migration paths, and changing subsistence patterns. Climate changes and associated geologic hazards may threaten and negatively impact Alaskans and other users of the Arctic (DGGS 2014).

In 2006, the Alaska Climate Impact Assessment Commission (ACIAC) was formed to assess the effects of climate change on citizens, resources, economy, and assets of the State of Alaska (ACIAC 2008). In September 2007, Administrative Order 238 was signed, creating the Climate Sub-Cabinet. Members of the sub-cabinet represent the Alaska DEC, DF&G, DNR, Department of Transportation (DOT), Department of Commerce, Community, and Economic Development (DCCED), University of Alaska, and the Office of the Governor. The sub-cabinet was tasked with developing an Alaska Climate Change Strategy, providing assessments and recommendations for adaptation, mitigation, and for defining research needs to assist Alaskans with the impacts of climate change. The strategy serves as a guide for responding to climate change, identifying immediate priorities, long-term strategies, and including recommendations for saving energy and reducing greenhouse gas emissions. Dillingham, Clark's Point, and Port Heiden are three of the 31 Alaskan villages threatened by coastline impacts (Alaska Climate Sub-Cabinet 2009).

In April 2008, the Governor's sub-cabinet released its report of recommended actions including emergency planning and training, erosion control, and village relocation planning (IAW 2008). In 2009-2010, the ACIAC released two draft and two final reports written by the Climate Change Advisory Groups. The Adaptation Advisory Group's report discussed how to address present and future impacts on infrastructure, human health, and ecosystems. Current impacts are those associated with village relocation in Western Alaska, though climate change affects all of the state. The Mitigation Advisory Group focused on preparing recommendations to be included in a strategy to mitigate greenhouse gas emissions in Alaska. One section of the report looks at the oil and gas industry. The Mitigation Advisory Group's recommendations may be beneficial to possible future development (ACIAC 2012).

H. Geologic Hazards

The natural environments in the license area include estuarine, mountain, forest, marsh, and riverine (Fall 1981). The primary geologic hazards within the license area include earthquakes and faulting, volcanoes and associated hazards, and tsunamis. These geologic hazards could impose constraints to exploration, development, production, and transportation activities.

1. Earthquakes and Faulting

The license area is vulnerable to naturally occurring subduction zone earthquakes that are caused by one geologic crustal plate moving beneath another. In Southcentral Alaska, the oceanic Pacific plate is slowly subducting, or moving beneath, the North American continental plate. Earthquakes can occur along the subduction interface, within the shallow crustal region of the upper plate, and within the Benioff Zone at great depth. Volcanoes, such as Augustine Island and those located on the Aleutian Islands, are a direct result of the subduction process. In addition to surface fault rupture and strong ground shaking, earthquakes can cause other events such as landslides, avalanches, tsunamis, uplift, subsidence, infrastructure failures, and soil liquefaction (DHSEM 2013).

Two significant earthquakes have been observed in the license area in in the last 100 years. The first was recorded on November 10, 1938 with an estimated magnitude of 8.3. Its epicenter was located in the Gulf of Alaska near the Shumigan Islands (Caldwell et al. 2012). The second major earthquake occurred on March 27, 1964, also known as the Good Friday Earthquake.

The 1964 earthquake occurred along the Aleutian Arc, which is the northern rim of the circum-Pacific Ring of Fire zone of seismic and volcanic activity where the Pacific Plate subducts into the mantle beneath North America (USGS 2014e). The majority of the seismicity in the arc area comes from coupling along the thrust fault interface, or the megathrust zone. The 1964 earthquake rupture began at 35 kilometers depth in the northern part of Prince William Sound, and it traveled southwest across the

Kenai Peninsula to the western part of Kodiak Island (Ichinose et al. 2007). The epicenter was 120 kilometers southeast of Anchorage (USGS 2014d).

The earthquake was the largest recorded in North America during the past century (Doser & Brown 2001). With a moment magnitude of 9.2, it was also the second-largest earthquake recorded in the world since 1900 (USGS 2014e). The event caused significant tectonic deformation. Upper Cook Inlet land subsided, and that around Prince William Sound was uplifted (Hamilton et al. 2005). Vertical land displacement, over 520,000 square kilometers, ranged from 11.5-meter uplift to 2.3-meter subsidence relative to sea level (USGS 2014d).

Shaking during the earthquake is believed to have lasted for three minutes (USGS 2014d). Thousands of aftershocks followed the main shock, and they occurred over a belt 250 kilometers wide and 800 kilometers long. Eleven of the aftershocks that occurred within 24 hours of the main shock had magnitudes of 6.0 or greater (AEIC 2014). The earthquake caused 128 deaths and $311 million in property damage. Various communities, ranging geographically from Chitina to Kodiak, felt strong effects. Much of the loss of life came not from the ground shaking but from the tsunamis that the earthquake generated. Tsunamis inundated multiple towns around the Gulf of Alaska and in Canada, Hawaii, and the western coast of the United States. The largest wave amplitude recorded was 67 meters in Valdez Inlet (USGS 2014d). In some towns, landslides triggered local tsunamis (AEIC 2014).

Damages reported from the license area and surrounding communities were relatively minor. The community of Tyonek and the southwest shore of Cook Inlet reported no casualties and minor damages. One waterline buried eight feet below ground surface was broken by ground fissures. South of Tuxedni Bay the roof of a small sawmill collapsed forcing it out of operation. This was the most significant damage in the vicinity of the license area (Plafker 1969b).

2. Volcanoes

There are four historically active volcanoes in the Cook Inlet region that may pose hazards to the license area: Spurr, Redoubt, Iliamna, and Augustine. Redoubt and Spurr are to the north of the license area and ash fall from these volcanoes has potential to impact this region, depending on wind direction. Redoubt Volcano has produced significant ash eruptions in recent years including 1966-68, 1989-90, and 2009. Mount Spurr, located in the Tordrillo Mountains, last erupted explosively in 1992. Iliamna Volcano is also located north of the license area, although large ash eruptions have not been recorded in historical time. Hazards associated with Iliamna such as debris flows, pyroclastic flows, and volcanic mudflows (lahars) are mostly confined to the flanks of the volcano and major drainages that extend from the summit. In the license area, the hazard zones for lahars and pyroclastic flows include West Glacier Creek (flows into Chinitna Bay), and Red River and Johnson River (flowing into Cook Inlet) (Waythomas and Miller 1999).

Augustine Volcano is the most active volcano in Cook Inlet and presents several potential geologic hazards to the license area and surrounding waters (Power et al. 2010; Waythomas and Waitt 1998). It is located about 10 miles south of the license area's southern boundary. Hazardous phenomena recorded at Augustine Island include volcanic ash clouds, ash fallout, volcanic bombs, pyroclastic flows, debris avalanches, lahars, floods, lava flows, volcanic gases, and tsunamis (Waythomas and Waitt 1998). Augustine Volcano has experienced several major eruptions in historical time, such as eruptions in 1883, 1935, 1963-64, 1976, 1986, and December 2005 through 2006 (Waitt and Begét 2009). The most recent explosive eruption occurred in 2006, after approximately 6 months of precursory activity (Coombs et al. 2010).

3. Volcanic Ash Clouds, Ash Fallout and Volcanic Bombs

Ashfall occurs when clouds of ash accumulate and fall to the earth as they drift away from the volcano. Depending on the extent or thickness of the ashfall, infrastructure may collapse under the added weight of ash. Public health is a concern during periods of ashfall as inhaling volcanic ash can cause respiratory issues and may significantly decrease visibility (Waythomas and Waitt 1998). Ash is extremely abrasive, mildly corrosive, and electrically conductive, especially when wet (USGS 2014c).

Historically, Augustine Volcano has erupted explosively, sometimes ejecting fragments of tephra into the atmosphere. Larger-sized volcanic debris, called blocks or bombs, typically strike near the vent of the volcano. Tephra ejected from the volcano form ash clouds which may drift in the wind for several weeks or days, and pose potential threats to air travel. The Alaska Volcano Observatory (AVO) reported that ash clouds from the 1976 and 1986 Augustine eruptions reached altitudes higher than 40,000 feet in height. In 1976, five jet liners experienced severe abrasion on exterior parts of the aircraft, but no crashes resulted from the ash cloud encounters. In March 1986, a DC-10 aircraft encountered an Augustine Volcano ash cloud during descent into Anchorage airport, but landed safely, and air traffic was routed around the ash cloud for several days (Waythomas and Waitt 1998).

The 2006 Augustine eruption included pyroclastic flows, lava flows, block- and ash-flows, lava domes, and ash fall deposits (Coombs et al. 2010). The bulk of the ash from this eruption fell into Cook Inlet, with minor amounts of ash (≤1mm) falling on villages and towns in the lower Cook Inlet (Power et al. 2010).

4. Pyroclastic Flows and Debris Avalanches

A pyroclastic flow is a fast-moving mixture of hot ash, pumice, rock fragments, and volcanic gas that flows downslope during eruptive events. Pyroclastic flows may result from explosive eruptions or the collapse of a lava dome; as the lava dome cools, it may collapse and fall apart, moving debris downslope several miles beyond the vent (Waythomas and Waitt 1998; USGS 2014a). A debris avalanche is the rapid downslope movement of rock, volcanic debris, snow, or ice. Debris avalanches are not always associated with eruptive events. Heavy rainfall, the intrusion of magma, and earthquakes can cause catastrophic avalanches (USGS 2014b). The cone of Augustine Volcano has been built up vertically over the last two thousand years, causing about a dozen major avalanches and creating areas of hummocky topography on Augustine Island and irregular bathymetry in near shore waters (Waythomas and Waitt 1998; Waitt and Begét 2009).

Pyroclastic flows and debris avalanches can move at speeds of three to six miles per second, creating a serious hazard to life and property on the island (Waythomas and Waitt 1998). An eruption in 1976 caused a pyroclastic flow that damaged AVO infrastructure and equipment on the north shore of the island (Neal et al. 2009). Pyroclastic flows and debris avalanches moving rapidly down the volcano flank can extend beyond tidelands, potentially generating tsunamis (Waythomas and Waitt 1998; Neal et al. 2009). The topography of Augustine Island would cause a pyroclastic flow to spread out laterally from the vent, although it is unlikely that a flow would reach more than three miles off the island's shore (Waythomas and Waitt 1998).

5. Lahars and Floods

Various types of flow phenomena can occur on Augustine Island as a result of pyroclastic flows and eruptive events. When in contact with hot, volcanic material, snow and ice on the flanks of the volcanic cone will melt and move rapidly downslope in the form of lahars (mudflows) and floods. Lahars may contain large boulders, sand, or silt, and travel quite quickly, or they may subside into smaller flooding events. Both lahars and floods pose a serious risk to the entire island, although it is unlikely either would reach much further than near shore areas (Waythomas and Waitt 1998).

6. Lava Flows

Lava flows at Augustine Volcano generally move slowly down slope and, as was the case in 2006, can produce steep fronts that shed debris, forming fast-moving block- and ash flows (Neal et al. 2009).

7. Volcanic Gases

Gases may be emitted by active volcanoes during periods of unrest or eruptive events. Common gases emitted by Augustine Volcano are water vapor, carbon dioxide, carbon monoxide, sulfur dioxide, and hydrogen sulfide. When dispersed by the wind, gases can displace oxygen, cause acid precipitation, and may cause skin and respiratory irritation. The hazards from volcanic gases at Augustine Island are minor and would likely only pose a threat to those in the vicinity of the cone (Waythomas and Waitt 1998).

8. Tsunamis

Tsunamis can be generated by large displacements of the seafloor during subduction zone earthquakes. The majority of the damage to local communities from the March 27, 1964 earthquake resulted from the associated tsunamis that followed the land displacement and seismic shaking. The powerful and sustained ground shaking during the 1964 earthquake triggered many under water slides along the coast, which resulted in tsunami activity. The waves were responsible for 31 of the 114 casualties in the various communities. The seismic sea waves that struck the coast of the Gulf of Alaska damaged property as far south as northern California. Extensive damage was observed to the coast including scoured shorelines, smashed trees, displaced driftwood, and shoreline deposits. Violent local waves generated by under water slides caused major damage to adjacent shorelines and casualties in the city of Seward, Valdez, and Whittier (Plafker 1969b). Tsunamis from the 1964 earthquake are responsible for 16 casualties in Oregon and California (AEIC 2014).

A tsunami can also be generated if large amounts of volcanic debris rapidly enter the surrounding waters during a large eruption of Augustine Volcano. Several historical eruptions have resulted in small-volume pyroclastic flows that reached the surrounding waters. However, only the 1883 eruption appears to have generated a debris avalanche that initiated a tsunami, as observed in English Bay at the location of modern day Nanwalek and Port Graham (Waythomas and Waitt 1998). The 1883 tsunami resulted in flooding of coastal homes and kayaks being washed away, although no fatalities were reported (Begét and Kowalik 2006). There is potential for a larger avalanche of debris to flow into lower Cook Inlet and create a larger-scale, radiating tsunami (Power et al. 2010).

The size of a volcanic tsunami is based on several factors: the volume and velocity of debris entering the sea, water depth in the run out zone, and the position of tides during the eruption. Low-lying areas along the coastline of lower Cook Inlet would be the most susceptible to a tsunami, especially if an eruptive event occurred during high tide. However it is difficult to assess the tsunami hazard at Augustine Island because of the lack of geologic evidence and eyewitness accounts (Waythomas and Waitt 1998).

9. Mitigation Measures

Although issuing an exploration license is not expected to have any effects on the license area other than to generate revenue for the state, several geologic hazards exist in the license area that could pose risks to subsequent exploration activities. As discussed above, these potential hazards include earthquakes, volcanoes, and tsunamis. The risks from earthquake damage can be minimized by siting facilities away from potentially active faults and unstable areas, and by designing them to meet or exceed national standards and International Building Code seismic specifications particular to Alaska. Preparedness and response to volcano activities can prevent injuries and loss.

National industry standards sometimes referred to as "technical standards," establish standard practices, methods, or procedures that have been evaluated, tested, and proven by analysis and application. These standards are intended to ensure the safe design, construction, operation, maintenance, and repair of infrastructure.

Because geologic hazards could affect and damage oil and gas infrastructure, State, federal, and local regulations, design and construction standards, and measures in this finding should mitigate those hazards. A complete list of mitigation measures is found in Chapter Nine.

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Chapter Four: Habitats, Fish, and Wildlife

Table of Contents

Page

List of Tables

Table **Page**

List of Figures

Figure **Page**

Chapter Four: Habitats, Fish, and Wildlife

This chapter considers and discusses the license area's habitats, fish, and wildlife populations, as required by AS 38.05.035(g)(iii). This chapter is not intended to be an exhaustive examination of all habitats and fish and wildlife species of the area, but rather, the director has limited the scope of the administrative review and finding to considering and discussing those that have important subsistence, recreational, or commercial value, and that are material to the determination of whether the proposed exploration license will best serve the interests of the state (AS 38.05.035(e)(1)(B)).

A. Habitats

According to the Environmental Protection Agency (EPA) the license area lies within the Alaska Range Level III ecoregion (EPA 2013). This ecoregion had extensive glaciation during the Pleistocene epoch that carved U-shaped valleys into the mountains (Gallant et al. 1995). Volcanic activity and ocean storms have shaped the landscape. Deeply cut fjords along the Gulf of Alaska coast are composed of intertidal and sub-tidal algal forests, with kelp attached to rocky substrates. The interior lowlands contain mixed forests of black or white spruce, balsam poplar, black cottonwood, paper birch, and quaking aspen. The semiarid alpine tundra habitat supports low shrubs, lichens, mosses, and grasses (ADF&G 1985; ADF&G 2006). The landforms, vegetation types, streams and wetlands, and marine waters of the license area provide habitat for fish, birds, and wildlife. Streams and rivers feed into Cook Inlet.

Iniskin and Chinitna bays contain sheltered tidal flats habitat. This unvegetated habitat is sheltered from strong tidal currents and dominated by a soft, muddy substrate. This habitat also supports large populations of benthic organisms, which are an important food source for birds and fish. Chinitna Bay's exposed tidal flats are also unvegetated, but the substrate is dominated by sand. Large populations of shellfish occur in this habitat and it is an important resting and feeding area for birds, fish, seals, and sea lions. Iniskin, Oil, and Chinitna bays all have marsh habitats lining their inner coasts, colonized by perennial vascular plants that can tolerate the waterlogged soils. Many species of fish and wildlife use these areas to feed (NOAA 2002). Coastal wetlands, lagoons, and bays provide staging areas for large seasonal aggregations of waterfowl and shorebirds (ADF&G 2006).

The license area includes a number of freshwater habitats such as small ponds and wetlands (USFWS 2014b). Streams draining into the Gulf of Alaska are short with steep gradients and carry heavy glacial sediment loads (CEC 2011). They are fed by the glaciers on top of the surrounding mountains and volcanoes (Gallant et al. 1995).

The license area's higher elevations support dwarf scrub communities, and lower elevations have low scrub communities. Tall scrub communities are found at low elevations along hill-slope drainages (Gallant et al. 1995). The lower slopes and valley bottoms support shrub communities of willow, birch, and alder (CEC 2011).

The northeast portion of the license area is adjacent to Lake Clark National Park and Preserve. Boreal forests dominate the southern portion of the park and preserve which are dominated by white spruce mixed with black spruce and birch (NPS 2014). Oil and gas exploration and development are not allowed in U.S. national parks and preserves.

1. Designated Habitat Areas

Several designated habitat areas are located near and within the license area.

a. Lake Clark National Park and Preserve

The license area borders the federal Lake Clark National Park and Preserve. This park contains mountains, volcanoes, rivers, lakes, and many fish and wildlife resources. Research has shown that people have been living in this region since the last ice age, approximately 12,000 years ago (NPS 2014). The park is managed under the National Park Service, with authorities from 36 CFR parts 1-199 (national parks); 36 CFR part 13 (Alaska national parks), and the Superintendent's compendium.

b. Alaska Maritime National Wildlife Refuge

The license area coincides with the marine waters refuge in Cook Inlet. The national refuge was created to conserve marine mammals, seabirds, migratory birds, and the resources in these marine habitats. The refuge also provides continued opportunities for subsistence uses by local residents. The refuge is managed under the Alaska National Interest Lands Conservation Act of 1980 (ANILCA) (USFWS 2013). Exploration for resources is regulated under federal laws and regulations.

2. Critical Habitats and Special Status Species

The State of Alaska, Department of Fish and Game (ADF&G) is responsible for maintaining and determining a list of endangered species in Alaska. The state considers a species endangered when the Commissioner of ADF&G determines the species population has decreased to such an extent as to indicate its continued existence is threatened (ADF&G 2014e).

On the federal level, under the Endangered Species Act, a species is listed as endangered if it is in danger of extinction throughout all or a significant portion of its range. It is listed as threatened if it is likely to become an endangered species within the foreseeable future. Listing a species makes it illegal to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect that species (NOAA 2013b).

Ten species inhabiting the license area are listed as endangered or threatened on one or both of these lists (Table 4.1). The federally designated critical habitat of the Cook Inlet beluga whale and the the Southwest Alaska Distinct Population Segment (DPS) of the northern sea otter overlap the license area. See the marine mammals section, below, for maps of the critical habitat areas.

Table 4.1. Special status species found in the license area.

Species	Special Status	Critical Habitat in License Area
Blue Whale	Endangered	No
Cook Inlet Beluga Whale	Endangered	Yes
Fin Whale	Endangered	No
Humpback Whale	Endangered	No
North Pacific Right Whale	Endangered	No
Northern Sea Otter	Threatened	Yes
Sei Whale	Endangered	No
Sperm Whale	Endangered	No
Steller Sea Lion	Endangered	No
Steller's Eider	Threatened	No

Sources: ADF&G 2014e, NOAA 2013b

B. Fish and Wildlife Populations

The diverse landforms, vegetation types and abundance of streams and wetlands of the license area provide habitat for a wide variety of Alaska's game and non-game mammals, fish, and birds. Fish and wildlife of particular importance are salmon, various marine and freshwater fish, moose, black and brown bears, several furbearer species, and several species of whales and other marine mammals. Many species of seabirds, shorebirds, waterfowl, and land birds inhabit the area as year-round residents, summer residents, or spring-fall migrants. ADF&G manages wildlife resources by Game Management Units (GMU). The license area is located in ADFG's game management subunit 9A (Figure 4.1).

All Alaskans are eligible to participate in subsistence hunts and fisheries. The primary subsistence wildlife species include moose, black and brown bear, Pacific harbor seals, shorebirds, seabirds, and land birds. Common subsistence fish are salmon, halibut, rainbow and steelhead trout, burbot, Dolly Varden, groundfish, Pacific herring, bottom fish, and shellfish. Tyonek is the only population center on the western shore of Cook Inlet that participates in subsistence fishing (Fall 1991; ADF&G 2006; ADF&G 2013).

1. Fish and Shellfish

a. Pacific Salmon

All five salmon species (Chinook, sockeye, coho, pink, and chum) inhabit the license area and surrounding streams. They migrate from the marine waters of Cook Inlet into license area streams to spawn each year (ADF&G 2014b). There are several anadromous streams in the license area, including: Brown Creek, Bowser Creek, Right Arm Creek, Portage Creek, Wrong Branch Trail Creek, Fitz Creek, Shelter Creek, East Glacier Creek, West Glacier Creek, Silver Salmon Creek, Marsh Creek, Chinitna River, Red River, Clearwater Creek, and Y-Valley Creek (Johnson and Blanche 2012) (Figure 4.2).

The license area is in ADF&G's Kamishak Bay fishery management district of the Lower Cook Inlet fishery management area. This district includes coastal waters and inland drainages on the western shore of Cook Inlet, south of the latitude of Anchor Point. Two hatcheries supply salmon to the Lower Cook Inlet area. The Trail Lakes Hatchery contributes sockeye and coho salmon and the Fort Richardson Hatchery supplies Chinook and coho salmon (Hollowell et al. 2013).

Only three areas in or near the license area (Ursus Cove, Cottonwood Creek, and Iniskin Bay) are considered major spawning systems in the Kamishak Bay district, and only for chum salmon (Hollowell et al. 2013) (Table 4.2).

Table 4.2. Estimated chum salmon escapements in thousands of fish for major spawning systems in Kamishak Bay District of the Lower Cook Inlet Area, 2008-2012.

Spawning System	2008	2009	2010	2011	2012	10-Year Average
Ursus Cove	6.5	12.9	11.8	10.6	2.8	15.4
Cottonwood Creek	11.6	19.4	15.8	4.7	2.8	22.7
Iniskin Bay	20	30.8	19.3	16.5	3	19.3

Source: Hollowell et al. 2013

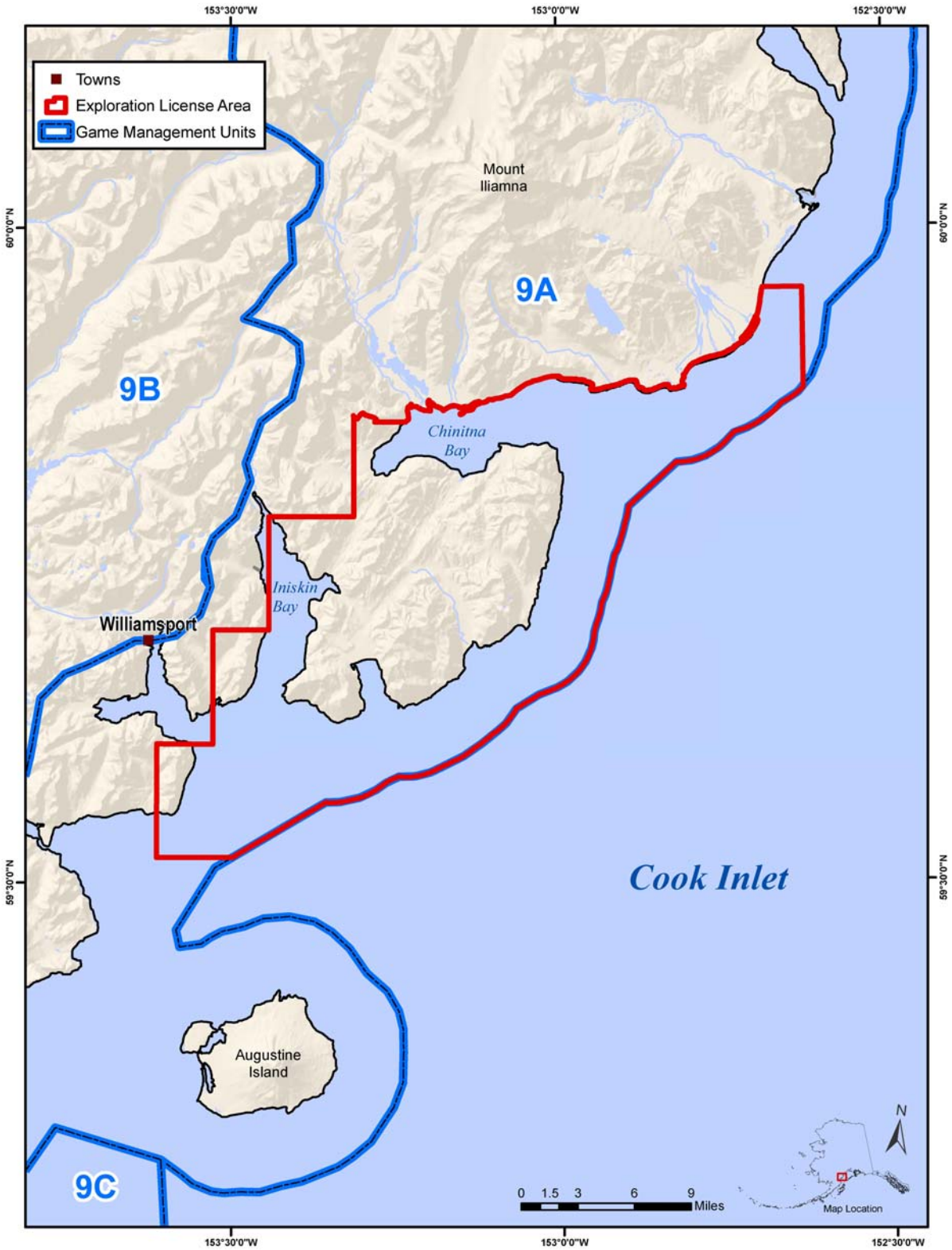

Figure 4.1. Northern region of ADF&G's game management unit 9.

Source: ADF&G 2014c

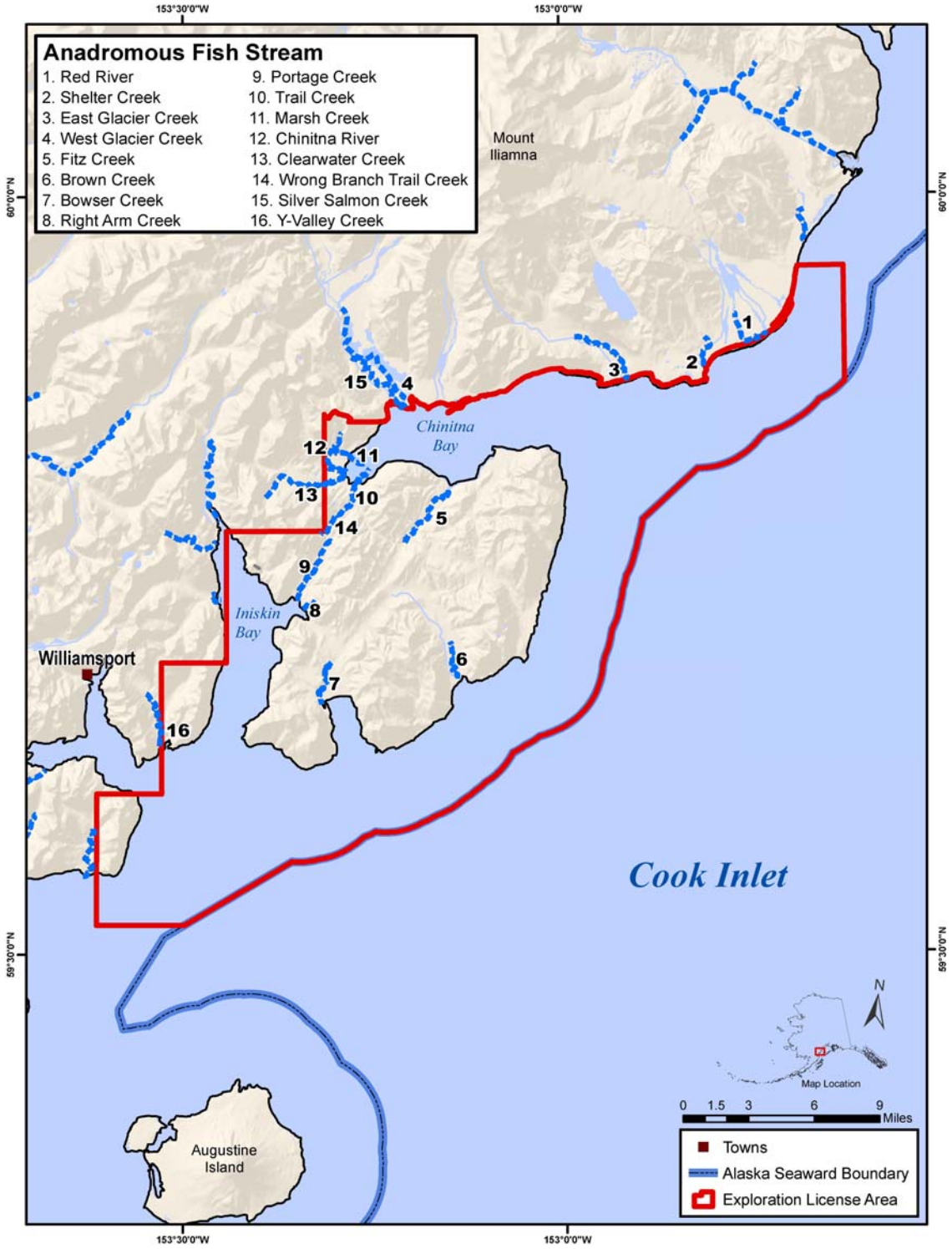

Figure 4.2. Southwest Cook Inlet exploration license area highlighting surrounding anadromous streams.

Source: Johnson and Blanche 2012

i. Chum Salmon

Chum salmon spawn in several other freshwater streams in and around the license area, including Brown Creek, Bowser Creek, Right Arm Creek, Portage Creek, Wrong Branch Trail Creek, Fitz Creek, and Shelter Creek and are present in West Glacier Creek, Silver Salmon Creek, Marsh Creek, the Chinitna River, and Clearwater Creek (ADF&G 2014b). The 2012 total chum salmon escapement in Kamishak Bay District index streams was 79,112 fish, which is within the sustainable escapement goal range of 65,550 - 141,600 fish, but below the previous 10-year average of 131,000 fish (Hollowell et al. 2013).Chum salmon return to fresh water to spawn between June and September. Eggs hatch between December and February, and alevin remain in the gravel for two to three months before migrating downstream to the sea. Juveniles remain near shore for several months and then move to the open ocean, where they spend three to four years before returning to their natal streams. Chum salmon feed on insects, diatoms, crustaceans, and fish (ADF&G 1985; ADF&G 2014a).

ii. Pink Salmon

Pink salmon spawn in Brown Creek, Bowser Creek, Right Arm Creek, Portage Creek, and Shelter Creek (ADF&G 2014b). There were 35,948 pink salmon counted in Kamishak Bay District index streams in 2012, which is within the sustainable escapement goal range of 25,950 - 203,400 fish, but below the previous 10-year average return of 597,000 fish (Hollowell et al. 2013). Pink salmon return to fresh water to spawn between June and late September. Eggs hatch between late December and February, and alevin remain in the gravel until migrating toward the sea in April or May. Juveniles remain close to estuaries until they are 6-8 cm long, when they move farther offshore to spend 18 months before returning to their natal streams. Pink salmon feed on crustaceans, insects, fish, and squid (ADF&G 1985; ADF&G 2014a).

iii. Sockeye Salmon

Sockeye salmon are present in two freshwater streams in and around the license area. They are West Glacier Creek and the Chinitna River (ADF&G 2014b). No hatchery data was available for the sockeye salmon spawning systems within and near the license area, although, the 2012 estimated sockeye salmon escapement for the species' major spawning systems (outside the license area) in the Kamishak Bay District was 21,500 fish, which is below the previous 10-year average of 29,900 fish (Hollowell et al. 2013). Hatchery returns of sockeye salmon in the Lower Cook Inlet management area were below forecast in 2012. Sockeye salmon return to fresh water to spawn between June and July. Eggs hatch during the winter months, and alevin remain in the gravel until the spring when they emerge as fry and move to rearing areas. In systems with lakes, juveniles usually spend one to three years in fresh water before migrating to the ocean in the spring; however, in systems without lakes, many juveniles migrate to the ocean soon after emerging from the gravel. Sockeye salmon feed on zooplankton, small crustaceans, and small fish (ADF&G 2014a).

iv. Chinook Salmon

Chinook salmon are present in one freshwater stream (Y-Valley Creek) in and around the license area and migrate through the area. (ADF&G 2014b). No hatchery data was available for the Chinook salmon spawning systems within and near the license area, although, the 2012 estimated Chinook salmon escapement for the species' major spawning systems in Cook Inlet was 5,461 fish (Hollowell et al. 2013). Hatchery returns of Chinook salmon are the largest of all Pacific salmon. They return to fresh water to spawn between May and July. Eggs hatch during the winter months, and alevin remain in main –channel river areas for one year. They spend anywhere from 1-5 years feeding in the ocean and return to their native streams to spawn Juvenile Chinook salmon initially feed on plankton and later feed on insects. In the ocean they eat a variety of organisms including herring, pilchard, sandlance, squid, and crustaceans (ADF&G 2014a).

v. Coho Salmon

Coho salmon are present in eight freshwater streams in and around the license area. They are the Red River, Shelter Creek, East Glacier Creek, Silver Salmon Creek, Brown Creek, Bowser Creek, Iniskin River, and Y-Valley Creek (ADF&G 2014b). No hatchery data was available for the Coho salmon spawning systems within and near the license area.

Coho salmon return to fresh water to spawn from July to November, usually during periods of high runoff. Eggs hatch in early spring, and alevin remain in the gravel until May or June when they emerge as fry and move to rearing areas. They spend 1-3 winters in streams before migrating to the ocean as smolt. Most fish spend 18 months in the ocean before returning as full size adults to spawn. In freshwater Coho fry feed on a variety of insects, plankton, and eggs deposited by adult salmon. In the ocean their diet mainly consists of fish and squid (ADF&G 2014a).

b. Other Freshwater Species

Freshwater habitats found throughout the license area support many populations of freshwater fish. These include rainbow and steelhead trout, Dolly Varden, and burbot. Freshwater species may be resident or may migrate to the ocean for part of their lifecycle.

i. Rainbow and Steelhead Trout

Rainbow and steelhead trout are the same species with differing lifestyles. Rainbow trout remain in fresh water. They spawn in the spring and may reside in lakes or streams. Steelhead trout spend one to four years in fresh water before migrating to the ocean and later return to their home streams to spawn (Morrow 1980). Rainbow trout occur naturally throughout the freshwaters of the Kenai Peninsula and the Upper Cook Inlet. Rainbow trout and steelhead trout, during their time spent in freshwater, feed on aquatic insects, plant material, salmon carcasses, eggs, and even small mammals. After steelheads smolt and migrate to the ocean, their diet consists of squid, amphipods, and other fish (ADF&G 2014a).

ii. Dolly Varden

Dolly Varden spawn in many streams draining into the western side of Cook Inlet (ADF&G 2014b). They may be resident or anadromous. They reside in near shore marine waters and return to deep river pools in their natal streams between late July and November to overwinter. When Dolly Varden mature, between four and six years of age, they spawn between the end of July and the beginning of December. Eggs hatch in March and April, and alevin remain in the gravel for three weeks until emerging as fry. Juveniles remain in the streams for two to four years and then may begin to migrate to the sea to feed along the coasts in the summers. Dolly Varden feed on insects, salmon eggs, small fish, and invertebrates (ADF&G 1985; ADF&G 2014a).

iii. Burbot

Burbot are a relatively long-lived species, maturing in six to seven years and often living more than 20 years. They broadcast spawn under the ice in February through March. Burbot are found in clear lakes and glacial rivers within the license area. They feed on insects and other invertebrates but mainly eat fish (ADF&G 2014a).

c. Other Marine Fish Species

Marine fish in or near the license area include Pacific herring, eulachon, Pacific sand lance halibut, walleye pollock, Pacific cod, sablefish, and rockfish. Several species of shellfish are found in the area such as crab, shrimp, and clams.

Pacific herring spawning biomass in the Kamishak Bay District has been below the 6,000-ton regulatory commercial fishing threshold since 2001 (Hollowell et al. 2013). Pacific herring live in

coastal waters on the inner continental shelf in the summer and spawn in shallow, vegetated intertidal areas in the spring. They are found from the surface down to 1,300 feet and travel in large schools. Young rear in sheltered bays and inlets and then join adults migrating to deeper waters in the fall to overwinter. Pacific herring feed on crustaceans, phyto- and zooplankton, and small fish (ADF&G 1985; ADF&G 2014a).

Eulachon are an anadromous species that returns to spawn in drainages throughout Cook Inlet in early May. They feed on krill (ADF&G 2014a). Eulachon are important food for marine birds and eagles, fish (including salmon), and marine mammals (including beluga whales) (Armstrong 1996).

Pacific sand lance live in the sandy substrates of the intertidal zone (ADF&G 2014a). They spawn in August through October (ADF&G 2014a, citing to Robards et al. 1999) and feed on phyto- and zooplankton. Pacific sand lance are a key prey species because of their high protein content (ADF&G 2014a, citing to Mabry 2000).

Pacific halibut feed in shallow coastal areas in the summer and move to deep water between November and March, where the mature ones (8-12 years old) spawn. Eggs hatch in about two weeks, and larvae drift with currents until settling in shallow nearshore waters, where they spend 1-3 years. Pacific halibut are generally found between 20 and 1,000 feet deep. They move on and off the continental shelf and feed on plankton, crustaceans, fish, octopus, and clams (ADF&G 1985; ADF&G 2014a).

Walleye pollock occur in large schools, inhabiting waters between 350 and 1,000 feet deep. Spawning occurs in late February through mid-June, when they move high in the water column in shallow waters. They migrate toward the sea bottom in deeper areas in December through February. Walleye pollock feed on planktonic crustaceans, shellfish, and fish, moving near the water surface at night to feed (ADF&G 2014a).

Pacific cod, or gray cod, are important prey for a wide range of fish and marine mammals, including Steller sea lions. They occur in large schools, inhabiting waters between 350 and 1,000 feet deep. They generally reach maturity in 3-5 years and have lifespans of up to 17-18 years. Spawning usually occurs in late winter to early spring (NMFS 2008d; Armstrong 1996).

Sablefish, or black cod, spawn in winter in waters 1,000 to 1,600 feet deep. The larvae live at the surface and drift inshore as they grow. At about two years old, the fish move into deeper waters to sandy or muddy ocean floors (Armstrong 1996). They feed on fish, cephalopods, and crustaceans (ADF&G 2014a).

Black rockfish are found from the surface to 1,000 feet deep but usually stay shallower than 500 feet. They live in large pelagic schools but may rest on the sea floor. Black rockfish give birth to larvae from January to May. They feed on zooplankton, crustaceans, and small fish (ADF&G 2014a).

Shellfish are found in the intertidal, nearshore, and offshore waters of Cook Inlet. Crab (Dungeness, tanner, and golden and red king) are reported to occur in the license area (ADF&G 2014a). Razor clams are found in commercial quantities on the western side of Cook Inlet (ADF&G 1985). Clams are found in fine, soft, muddy areas near river sources and in protected areas of the coastline (ADF&G 2014a). Northern pink shrimp live in lower Cook Inlet in large concentrations (ADF&G 1985). They are found over soft mud bottoms at about 150 to 350 feet. Spot shrimp are bottom feeders. They are usually found at depths of about 360 feet but have a habitat range of 12 to 1,500 feet (ADF&G 2014a). Other shellfish in Cook Inlet include octopus, green urchin, sea cucumber, and scallops (Trowbridge and Goldman 2006).

2. Birds

Approximately 450 species of birds are found in Alaska, many of which may be found in the license area. Birds may live in the license area year round, or migrate for breeding or seasonal uses (ADF&G 2006). The tidal flats within Iniskin and Chinitna Bays are excellent resting and feeding grounds for

shorebirds and seabirds (NOAA 2002). The coastal wetlands, lagoons, and bays are staging areas for large seasonal populations of waterfowl and shorebirds (ADF&G 2006). The Cook Inlet area is important for many species of shorebirds as a stopover site during migrations or as a wintering area; as many as 28 species have been identified in the area (Gill and Tibbitts 1999) (Table 4.3). These migrating shorebirds appear suddenly in the Cook Inlet area in early May, their numbers increase rapidly, and then they depart abruptly by late May. During this period, over 150,000 birds were counted per day (Gill and Tibbitts 1999).

Table 4.3. List of shorebirds surveyed in the Cook Inlet area.

Common Name	Scientific Name
Black-bellied Plover	*Pluvialis squatarola*
American Golden-Plover	*P. dominica*
Pacific Golden-Plover	*P. fulva*
Semipalmated Plover	*Charadrius semipalmatus*
Greater Yellowlegs	*Tringa melanoleuca*
Lesser Yellowlegs	*T. flavipes*
Solitary Sandpiper	*T. solitaria*
Whimbrel	*Numenius phaeopus*
Hudsonian Godwit	*Limosa haemastica*
Bar-tailed Godwit	*L. lapponica*
Marbled Godwit	*L. fedoa*
Ruddy Turnstone	*Arenaria interpres*
Black Turnstone	*A. melanocephala*
Surfbird	*Aphriza virgata*
Red Knot	*Calidris canutus*
Sanderling	*C. alba*
Semipalmated Sandpiper	*C. pusilla*
Western Sandpiper	*C. mauri*
Least Sandpiper	*C. minutilla*
Baird's Sandpiper	*C. bairdii*
Pectoral Sandpiper	*C. melanotos*
Rock Sandpiper	*C. ptilocnemis*
Dunlin	*C. alpina*
Ruff	*Philomachus pugnax*
Short-billed Dowitcher	*Limnodromus griseus*
Long-billed Dowitcher	*L. scolopaceus*
Common Snipe	*Gallinago gallinago*
Red-necked Phalarope	*Phalaropus lobatus*

Source: Gill and Tibbitts 1999

a. Waterfowl

i. Steller's Eiders

Steller's eiders, a species of sea duck, winter from the eastern Aleutian Islands to lower Cook Inlet. They make an annual migration from the Alaska Peninsula and Aleutian Islands, their wintering grounds, to the arctic coastal plain of northern Alaska and Russia, where they breed in the spring. They first breed at 2-3 years of age. They build nests on islands or peninsulas in tundra lakes and ponds near the coast. Steller's eiders feed by diving or dabbling in shallow water. Their primary food source is insect larvae from freshwater wetlands, but they will also eat aquatic plants. In marine habitats, they eat small fish and saltwater invertebrates. The USFWS listed the Steller's eider as threatened on June 11, 1997 because of apparent declines in abundance of nesting birds. Its population along the Alaska Peninsula has drastically declined since the 1960s for unknown reasons (ADF&G 2014a).

ii. Trumpeter Swans

Trumpeter swans are the largest waterfowl in North America. They are found in river wetlands, lakes, ponds, marshes, and open wooded areas (USFWS 2014a). Swans build nest sites in undisturbed marshes adjacent to small lakes in late March through early May. Young swans are unable to fly until 13 to 15 weeks of age (ADF&G 1985). After leaving the breeding areas in late summer and early fall, the swans congregate on ponds and marshes. They migrate south when temperatures start to drop in October and November (ADF&G 2014a). Trumpeter swans feed on wild celery and other freshwater plants, insects, snails, and invertebrates (ADF&G 1985). Censuses of Alaskan nesting habitats show that trumpeter swans have nested in the license area beginning in 1990, and their observed numbers there have increased with each subsequent census (up to the year 2005) even though researchers believed the Cook Inlet area swan habitat was saturated in 2000 (Conant et al. 2007).

b. Raptors

i. Bald Eagles

Bald eagles live and winter in Southcentral and Southeast Alaska, residing around coasts, offshore islands, and interior lakes and rivers. They tend to congregate along salmon-spawning streams and shorelines. Bald eagles nest in large trees or on rocky cliffs in April and May and fledge by the end of August. They usually use and rebuild the same nest each year. Their main food source is fish, including salmon, herring, flounder, and pollock, but they will also prey on waterfowl, small mammals, sea urchins, and crabs. Bald eagles are protected by the Bald Eagle Protection Act of 1940, which makes possession of an eagle, dead or alive, illegal (ADF&G 2014a). Bald eagles were removed from the federal list of threatened and endangered species on August 9, 2007 (USFWS 2014c).

c. Landbirds

i. Olive-sided Flycatcher

The olive-sided flycatcher breeds throughout Alaska in boreal forests, including those in the license area. An estimated 23% of the global population breeds in Alaska. Breeding season begins in late May to early June, with nests typically being built in spruce trees. Hatching occurs in mid-June and fledging in July. The birds begin their migration to their wintering grounds in South America in early August through early September. The olive-sided flycatcher feeds by aerial hawking large insects, including bees, wasps, and flying ants. Its Alaskan population had a 1% annual decline from 1982-2007, thought to be caused by rapid loss of forested habitats on their wintering grounds. It is listed by the BLM as a Sensitive Species because of its declining population (USFWS 2008).

ii. Rusty Blackbird

The rusty blackbird is a summer breeding resident of much of Alaska including the license area. They breed in boreal forests and prefer wet areas, including marshes and edges of ponds. Their primary food

source is insects. They migrate to the eastern U.S. for the winter months (Cornell Lab of Ornithology 2014). The rusty blackbird has experienced one of the steepest declines of any North American bird species. Over the last 15 years since 1995, the range-wide population has declined by 87-98%. There has been a 5% population decline per year in Alaska. Causes of the decrease in abundance are unknown (DOD 2010).

d. Seabirds and Shorebirds

The Cook Inlet region is also an important wintering area for many other bird species, including rock sandpipers, migrating western sandpipers and dunlin, and for breeding and migrating Hudsonian godwits, greater yellowlegs, solitary sandpipers, and short-billed dowitchers. Tidal flats are important to shorebirds, providing their bivalve food supply (Gill and Tibbitts 1999). Sandpipers overwinter and forage in winter on mudflats that are ice-free, generally occurring in lower Cook Inlet below Redoubt, Tuxedni, and Kachemak bays, and Homer Spit. There are many species of seabirds in the Cook Inlet area, including murres, gulls, kittiwakes, cormorants, murrelets, and puffins. Lower Cook Inlet is one of the most productive areas for seabirds in Alaska, with 2.2 million seabirds foraging in the area in July 1992 (Piatt 1994). Shallow coastal habitats are particularly important for seabirds at sea, as these areas have high densities of forage fish (Piatt and Roseneau 1997). Important food items include small fish, squid, and crustaceans such as krill and crabs (USGS 2014).

3. Mammals

a. Terrestrial Mammals

Numerous terrestrial mammals inhabit the license area. Important species include moose, black and brown bears, and furbearers include wolf, beaver, red fox, coyote, wolverine, mink, muskrat, marten, and river otter. ADF&G manages and monitors wildlife in the license area, which is in game management subunit 9A.

i. Moose

Moose are found in lowland and upland shrub communities and in winter, may concentrate along river drainages with shallow snow depths. They feed on willow, birch, shrub leaves, and pond vegetation. Moose calve from mid-May through early June. The males rut in late September and early October. Most moose move seasonally, from a few miles to 60 miles, among calving, rutting, and wintering areas (ADF&G 2014a). Moose density in game management subunit 9A is low. Surveys conducted from 2007 through 2009 estimate a population of 300 in the subunit (Butler 2010a).

ii. Brown and Black Bears

Brown and black bears are solitary until mating season (ADF&G 2008). They hibernate in winter and emerge in spring when food is available. Dens may be found from alpine areas down to sea level (ADF&G 2014a).

Brown bears may congregate at salmon spawning streams in summer and fall (ADF&G 2008). They eat a wide variety of foods, including: berries, grasses, sedges, horsetails, cow parsnip, fish, squirrels, and roots. They also prey on moose, caribou, and carrion. Young cubs are born in January through February and emerge in June. Families may remain together for a few years. The mating season extends from May to July (ADF&G 2014a). Based on data gathered from 2008 through 2010, the Unit 9 brown bear population is stable, with a high density of one bear per 3.5 mi^2 (Riley and Butler 2011).

Black bears also have a varied diet, composed of green vegetation, small mammals, newborn moose and caribou, salmon, berries, ants, grubs, and insects (ADF&G 2008). Black bears may occur in higher densities along coastlines, which may be related to salmon runs and lower numbers of brown bears (ADF&G 2014a). Documented trends in black bear abundance in the license area are not available.

iii. Furbearers

Wolves are common across the state. They live in packs throughout a variety of habitats in exclusive, defended territories. Packs usually have 6-7 animals in them and include parents and the year's pups, but they can also fluctuate to include yearlings and other adults, up to 20-30 animals. Wolves generally have litters of seven pups per year (ADF&G 2014a). Based on data collected from 2005 through 2008, wolf density in Unit 9 is low to moderate; the unit population has increased since the 1990s and is estimated at 350 wolves. Due to the low moose population, wolves in the area feed upon salmon and marine mammal carcasses as alternative food sources (Butler 2009).

Numerous other furbearers can be found throughout the license area. For example, beaver are found in forested areas and live near and within fresh waters. They construct dams to secure dens used for food storage, rearing and shelter (ADF&G 2014a).

Red fox are present in the license area and can adapt to a wide range of habitats. They are omnivores and prey on voles, small mammals, birds, eggs, insects, vegetation, and carrion. Red fox build underground dens and bury and cache foods. They mate in February through March. A fox will normally birth a litter each year, and the family unit remains together until fall, when the animals live on their own (ADF&G 2014a).

Coyote are found throughout the Unit 9 mainland (Butler 2010b). They are opportunistic hunters and feed on snowshoe hares, voles, and carrion as well as on other small mammals, fish, birds, and insects. Coyote mate in January through March, and pups are born in spring. The male and female may remain in a territory. Coyote populations are reported to be fairly stable across their habitat range (ADF&G 2014a).

Wolverines are found on the Unit 9 mainland, but in lower densities than other furbearers (Butler 2010b). They have wide habitat ranges (up to 260 square miles). They are generally solitary and exhibit endurance in travel and foraging. Some have been found in higher elevations in summer and lower elevations in winter due to food availability. Mating occurs about February, and denning continues through July (ADF&G 2014a).

Mink live in burrows close to the water, such as saltwater beaches, lakeshores, and stream banks. They are omnivores and feed on fish, birds, eggs, insects, shellfish, and small mammals. They mate in March through April, and young kits are born in June (ADF&G 2014a).

Other small furbearers found in the license area include muskrat, marten, and river otter (ADF&G 2014a).

b. Marine Mammals

Several marine mammals may be found in the license area, including beluga whales, fin whales, humpback whales, minke whales, blue whales, North Pacific right whales, sei whales, sperm whales, harbor and Dall's porpoises, harbor seals, Steller sea lions, and northern sea otters.

i. Cook Inlet Beluga Whales

Cook Inlet beluga whales are a federally-listed endangered species, and the critical habitat designation area for the Cook Inlet beluga whale overlaps the license area (Figure 4.4) (NOAA 2013a). Estimates of the Cook Inlet beluga whale population from 2009 to 2011 were 321, 340, and 284 animals, respectively. The population trend from 2001 to 2011 shows an average estimated decline of 1.1 percent per year (Allen and Angliss 2012b).

Beluga whales are a medium-sized cetacean found in the Northern Hemisphere throughout Arctic and subarctic waters (NMFS 2008a). Cook Inlet belugas occur primarily in upper Cook Inlet, particularly in shallow, relatively warm, low-salinity water near river mouths (Moore et al. 2000; Hobbs et al. 2006; Hobbs et al. 2005; Goetz et al. 2007). In winter they are more dispersed but remain in the general

area (Moore et al. 2000). Breeding is believed to occur in late spring and early summer, and calves are born about fourteen months after mating. Mating periods and calving areas are poorly documented (ADF&G 2008; Hobbs et al. 2006). Belugas molt each summer, rubbing their bodies against the bottom in shallow areas to remove old skin. They travel in pods, surfacing simultaneously to breathe. These whales have well-developed echolocation, which they use to communicate, navigate, and hunt (ADF&G 2014a). Belugas are predators and consume a wide range of prey. Species found in stomachs of belugas in Cook Inlet include eulachon, salmon, walleye pollock, cod, flatfish, sculpin, crab, and shrimp (Hobbs et al. 2006).

ii. Other Whales

Several other whale species may be found near the license area. Of these, six are on the federal endangered species list: fin, humpback, blue, north Pacific right, sei, and sperm. The minke whale population is considered healthy and stable (NOAA 2013b). Other than the beluga whale, only the North Pacific right whales have designated critical habitat, outside the license area. North Pacific right whales are the most endangered of all large whales (ADF&G 2014a).

Minke whales feed in bays and shallow coastal waters in summer. Besides minke, fin and humpback whales are present in the waters surrounding the license area during the summer (ADF&G 2006). Baleen whales (fin, humpback, minke, blue, North Pacific right, and sei) feed primarily on krill, zooplankton, and small schooling fish. The sperm whale is a toothed whale and feeds mainly on squid but also fish, skates, and sharks (ADF&G 2014a). In the winter months, the fin, humpback, minke, blue, North Pacific right, sei, and sperm whales migrate to subtropical and temperate waters to mate and calve (NOAA 2013b).

iii. Porpoises, Seals, Sea Lions, and Sea Otters

Harbor porpoises are generally found in harbors, bays, and river mouths (MMS 2003; NMFS 2008c). Those found in Cook Inlet belong to the Gulf of Alaska stock, one of three stocks found in Alaska (Angliss and Outlaw 2008). Densities of harbor porpoises in Cook Inlet have been reported at 1.86 animals per square mile (MMS 2003, citing to Dahlheim et al. 2000). In 1991, an aerial survey estimated that 422 harbor porpoises inhabited Cook Inlet (Small and DeMaster 1995). Harbor porpoises make inshore-offshore seasonal movements that may be related to prey or ice conditions (NMFS 2008c). They feed on a wide variety of fish and cephalopods, particularly schooling fish such as herring, mackerel, and pollock (MMS 2003, citing to Leatherwood and Reeves 1987). Harbor porpoises can be found singly, in pairs, or in groups up to 10. Mating occurs in summer and births occur between May and July (NMFS 2008c).

Dall's porpoises are found in the North Pacific Ocean including Cook Inlet, usually in groups of between two and 20 individuals. They feed on schooling fish, cephalopods, and occasionally crabs and shrimp. They occur in offshore, inshore, and nearshore waters but are found in highest abundance near the shelf break. Dall's porpoises migrate as far north as the Bering Sea. The Alaskan stock is estimated to include 77,000-83,500 individuals and is considered reasonably robust (NOAA 2013a).

Harbor seals are found in the marine and estuarine waters of the Cook Inlet area but may be found seasonally in freshwater rivers and lakes (Angliss and Outlaw 2008; ADF&G 2008). They generally stay less than 15 miles from shore and usually do not migrate (Angliss and Outlaw 2008; ADF&G 2014a). They use haulouts to rest, give birth, nurse their pups, regulate body temperature, interact socially, and avoid predators (ADF&G 2008; NMFS 2008b). Harbor seals have a strong tendency to return to the same haulout sites in June and July, when pups are born (Angliss and Outlaw 2008). Their haulout areas include rocks, reefs, beaches, and drifting glacial ice (Angliss and Outlaw 2008). Within the license area, the mouths of Clearwater and Chinitna Creek, near Pomeroy and Iniskin Islands, and areas in Oil Bay are known harbor seal haulouts (DNR 2001). They molt between June and October and are especially vulnerable to disturbance during this time (ADF&G 1985). Harbor seals feed on

walleye pollock, Pacific cod, capelin, eulachon, Pacific herring, salmon, octopus, and squid (ADF&G 2008).

Steller sea lions found in the Cook Inlet area belong to the western stock (NMFS 2008e). The Western DPS is a federally-listed endangered species, but its critical habitat does not include the license area (NMFS 2007). Based on surveys between 2008 and 2011, the minimum population estimate for the western US stock of Steller sea lions is 45,916. Rookeries, used for breeding and giving birth in June, are usually found on remote island beaches and vary from expanses across low-lying reefs and islands to narrow strips of beach by steep cliffs. Haulouts, used by adults during the non-breeding season, include rookery areas as well as rocks, reefs, beaches, jetties, breakwaters, navigational aids, floating docks, and sea ice (NMFS 1992). Steller sea lions feed from the intertidal zone to the continental shelf and eat a wide variety of fish, including: pollock, flounder, herring, capelin, Pacific cod, salmon, rockfish, sculpin, and invertebrates such as squid and octopus (ADF&G 2008).

Northern sea otters (Southwest Alaska DPS) are listed as threatened under the Endangered Species Act and critical habitat has been designated in the license area (Figure 4.4) (USFWS 2010). They occur in Southcentral Alaska and are found in low densities in lower Cook Inlet habitats (Angliss and Outlaw 2008). In 2002, the abundance of sea otters in lower Cook Inlet and the Kenai Fjords was estimated to be 2,673 animals. The overall trend for the Southcentral stock (Southwest Alaska DPS), which includes Cook Inlet, appears to be stable or slightly increasing, and the population in lower Cook Inlet and the Kenai Fjords also appears to be increasing slightly (Angliss and Outlaw 2008). Sea otters are generally not migratory. They breed throughout the year, but in Alaska most pups are born in late spring. The pup is weaned at 3-6 months when it weighs approximately 30 pounds, almost the same size as its mother (ADF&G 2014a). Northern sea otters feed on sea urchins, crabs, clams, mussels, octopus, other marine invertebrates, and fish (ADF&G 2008).

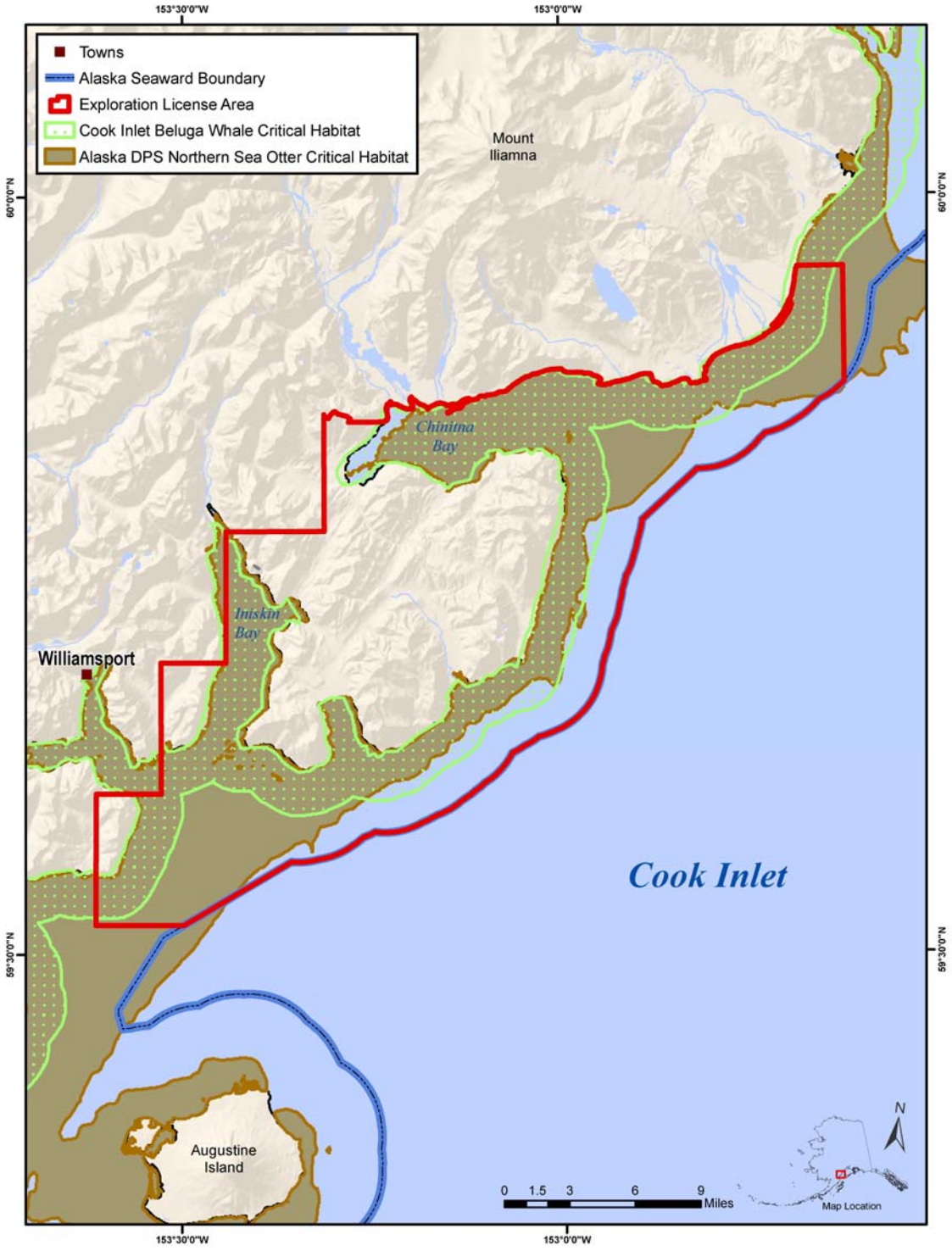

Figure 4.3. Portions of federal critical habitat designations of the Cook Inlet beluga whale and Southwest Alaska DPS of the northern sea otter that overlap the license area.

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Chapter Five: Current and Projected Uses

Table of Contents

Page

List of Tables

Table **Page**

List of Figures

Figure **Page**

Chapter Five: Current and Projected Uses of the License Area

AS 38.05.035(g)(iv) requires the director to consider and discuss the current and projected uses in the license area, including uses and value of fish and wildlife. The land and waters included in and near the license area provide habitat for a variety of fish and wildlife as described in Chapter Four. The license area also provides a variety of uses such as subsistence, sport, and commercial harvest activities. The area is used for forestry and oil and gas exploration. The primary industries in the area are commercial fishing and marine transportation. The US federal oil and gas lease Cook Inlet planning area is directly east of the marine waters of the license area. Increased marine traffic and resources development of the region may increase traffic volumes and duration periods of uses in the license area.

The license area is within the vessel traffic corridor for marine traffic to Williamsport from the various Cook Inlet ports, e.g. Homer, Kenai, and Anchorage. These and other current and projected uses are considered and discussed below. The projected uses of the license area are expected to remain consistent with current uses. The following information is not intended to be all inclusive, but to provide an overview of the current and projected uses (Cape International Inc. 2012).

A. Kenai Area Plan

Area plans are developed by DNR's Resource Assessment and Development Section within the Division of Mining, Land, and Water. AS 38.04.065 requires that state land be classified through a planning process prior to a sale or lease (excluding oil and gas lease sales), and incorporates the public's meaningful participation in the planning process.

The state owned lands and waters in the license area are within the boundaries of the current Kenai Area Plan (KAP) (ADNR 2001). This plan provides guidance to DNR to manage state land and waters in the Cook Inlet region in the vicinity of the Kenai Peninsula, the inlet's marine waters, and western Cook Inlet. The Kenai Area Plan defers any decision regarding leasing for oil and gas to DNR's existing leasing process. Oil and gas lease sales are not subject to this Kenai Area planning process but rather under processes established under AS 38.05.180

The plan sets out land disposal locations, land use classifications, administrative designations, and land selections, relinquishments and exchanges. The recommended land use designations within and around the license area include forestry for the School Trust Lands on the Iniskin Peninsula uplands, with other land use designations in the license area that include resource development, habitat, high value resource management, waterfront development (Williamsport area), and general uses (ADNR 2001: KAP Region 12 map).

Because more than one use is allowed on most state lands, the plan establishes guidelines that allow various uses to occur without serious conflicts. For instance, oil and gas and mineral exploration activities are allowed, and surface leasing that support oil and gas activities may be allowed (ADNR 2001).

B. Uses and Value of Wildlife, Fish and Plants

Alaska Game Management Units are managed by ADF&G. They compile and analyze harvest and biological information, enabling the establishment of ecologically sound population-based fishing, hunting, and trapping regulations. This information may also be used to promote conservation strategies and recovery actions (ADF&G 2013e). The license area is located within game management unit 9A.

1. Subsistence

The state, through the Boards of Fisheries and Game, manages subsistence resources on all state-owned lands and waters in Alaska. State law defines subsistence use as the noncommercial, customary and traditional uses of wild, renewable resources for a variety of purposes (AS 16.05.940(33)). AS 16.05.258 requires that subsistence uses be consistent with sustained yield.

The ADF&G, Division of Commercial Fisheries manages subsistence fishing in state managed fisheries. The USFWS, Office of Subsistence Management manages subsistence hunting, trapping and fishing on Alaska's federal public lands and non-navigable waters. Since 1999, federal subsistence management has expanded to include fisheries on all federal public lands and waters (ADF&G 2013f).

From 2005-2006, 96% of Tyonek households used wild resources and 94% successfully harvested at least one type of fish, wildlife, or wild plant resource (Stanek et al. 2007). Common subsistence resources in the license area are listed in Table 5.1 below.

Table 5.1. Common subsistence use resources in the license area.

Fish	Birds	Small Mammals	Large Mammals
King (chinook) salmon	Waterfowl	Beaver	Moose
Red (sockeye) salmon	Trumpeter swans	Red Fox	Brown bear
Silver (coho) salmon	Tule white-fronted geese	Coyote	Black bear
Pink (pink) salmon	Seabirds	Wolverine	Dall sheep
Dog (chum) salmon	Murres	Lynx	Wolf
Pacific herring	Gulls	Mink	
Eulachon (hooligan)	Kittiwakes	Marten	
Pacific sand lance	Cormorants	River otter	
Groundfish	Murrelets		
Halibut	Puffins		
Bottom fish	Shorebirds		
Shellfish	Land birds		
Whitefish	Spruce grouse		
Northern pike	Ruffed grouse		
Rainbow trout	Willow ptarmigan		
Steelhead trout	Common loon		
Dolly Varden			
Burbot			

Source: Stanek et al. 2007

a. Fish and Shellfish

There are several subsistence salmon fisheries in Cook Inlet, one of which is on state land and managed and reported by ADF&G, however not within the license area. Most subsistence fisheries are located where there are few roads, and they require boat access (ADF&G 2014c). There is one ADF&G subdistrict area of west Cook Inlet open for subsistence fishing near Tyonek (ADF&G 2013a). The area designated for subsistence use is centered around Tyonek and stretches south to Trading Bay which is approximately 100 miles north of the northern boundary of the license area.

Salmon setnet fishing for subsistence is conducted in May and targets Chinook salmon within the Tyonek subdistrict (Stanek et al. 2007). In 2009, 89 permits were issued for the Tyonek subdistrict subsistence salmon fishery. Sixty-two permits were issued to Tyonek residents and 27 permits issued to other Alaska residents. Residents of Tyonek accounted for 86% of the reported harvest total which was 927 salmon (Holen and Fall 2011).

Halibut may be caught under the federal subsistence halibut program. The subsistence halibut fishery is managed by the National Oceanic and Atmospheric Administration (NOAA), and fishers must obtain a Subsistence Halibut Registration Certificate (NOAA 2014). The United States and Canada participate in the International Pacific Halibut Commission, which publishes regulations governing the Pacific halibut fishery under the authority of the Northern Pacific Halibut Act of 1982. The regulations that govern the subsistence halibut fishery can be found in 50 CFR Part 300 (NOAA 2014b). Approximately 312,650 pounds of halibut were harvested for subsistence in 2010 which is 39% of the total for Alaska subsistence harvest (Fall and Koster 2012).

Additional subsistence fisheries occur for Pacific herring, eulachon, bottomfish, and shellfish (ADF&G 2014c). Subsistence fishers harvested an estimated 12,851 rockfish and 2,864 lingcod in 2010 (Fall and Koster 2012). Pacific herring subsistence fisheries predate recorded history and have occurred for centuries by indigenous coastal peoples. Eulachon is one of the first fish resources available in the spring in Cook Inlet waters. Tyonek residents begin set gillnet fishing for eulachon on beaches close to the village in April (Stanek et al. 2007). In the early summer months, Tyonek residents harvest razor clams and cockles on sand bars during low tidal cycles. They target the shellfish south of the Tyonek subdistrict on beaches in Redoubt Bay, which is outside of the license area approximately 60 miles to the north (Stanek et al. 2007).

b. Wildlife

i. Marine Mammals

Subsistence hunting of marine mammals is federally regulated under the federal Marine Mammal Protection Act, and is limited to Alaska Natives who reside on the coast of the North Pacific Ocean or the Arctic Ocean (ADF&G 2013b). The USFW manages subsistence hunting of sea otters in the region. The National Marine Fisheries Service (NMFS) manages subsistence hunting for seals, sea lions, and whales (ADF&G 2013b). In the Cook Inlet area, Alaska Natives hunted beluga whales prior to and subsequent to the Marine Mammal Protection Act in 1972 (Hobbs et al. 2006). NMFS implemented regulations on subsistence hunting of belugas in Cook Inlet beginning in 2001. In 2001 and 2002, subsistence harvest was 1 beluga each year, no belugas were harvested in 2003 and 2004, 2 were harvested in 2005, and none were harvested in 2006 and 2007 (Angliss and Outlaw 2008; Hobbs et al. 2006; Hobbs et al. 2008).

The one harvested beluga taken in the study year 2005-2006 provided 700 pounds of food to the community of Tyonek, averaging 11 pounds per household. Based on regulation in 73 FR 60976 from October 2008, no harvest of Cook Inlet belugas is allowed if the 5-year average abundance drops below 350 belugas. Because the 5-year average abundance was below 350 whales for the 2003-2007 time period, the allowable harvest during 2008-2012 was set at zero (Allen and Angliss 2012).

Additionally, harbor seals inhabit the waters of the license area and those around Tyonek as well. Two Tyonek hunters harvested 4 seals during the 2005-2006 study (Stanek et al. 2007).

ii. Terrestrial Mammals

In ADF&G GMU 9, (Figure 4.1) hunting permits are required for brown and grizzly bear, caribou, Dall sheep, moose, and wolf (ADF&G 2013d). Many of the subsistence hunting permits are restricted to residents of the area. Three large land mammals are readily available in the Tyonek area: moose, brown bear, and black bear. All three species are harvested by Tyonek residents for subsistence.

Moose usually provide a large amount of food for Tyonek residents, though moose populations have declined in the area during recent years (Stanek et al. 2007).

Tyonek residents do utilize small mammals for subsistence; however a minor percentage of the total subsistence harvest in the area consists of small land mammals as the predominant harvests are from fish and large mammals (Stanek et al. 2007).

iii. Birds

Federal subsistence regulations apply to subsistence hunting for migratory birds in Alaska (ADF&G 2013b). There is a spring and fall waterfowl hunting season for Tyonek residents. Migrating ducks, geese and cranes are hunted as they congregate on the Trading Bay Flats near the Beluga River as they move through the area (Stanek et al. 2007).

c. Plants

Berries begin to ripen at the end of July and Tyonek households pick blueberries, currants, highbush cranberries, and several other varieties of berries and greens (Stanek et al. 2007).In 2005-2006, 92% of Tyonek households used wild plants and berries with 70% of all households participating in berry harvests. An estimated 241 gallons of berries were harvested yielding 963 total pounds equaling 15 pounds per household. In the spring, fresh greens including fireweed, cow parsnip, and bluebells are harvested (Stanek et al. 2007).

2. Commercial Fishing

Alaska's commercial fishing industry is the most productive and valuable in the nation with a wholesale value of over $3 billion (McDowell Group 2013). The State of Alaska has primary jurisdiction for managing fish in Alaska; this includes commercial, sport, personal use, and educational fisheries. State jurisdiction includes freshwaters, and marine waters within 3 miles of shore (Clark et al. 2006b). Article 8 of the Alaska Constitution mandates that state fish resources be managed under the sustained yield principle. The Alaska Board of Fisheries sets fishing regulations and management guidelines. Advisory committees are local groups that make recommendations to the Board; there are 81 advisory committees statewide, and nine in the Cook Inlet area. ADF&G implements regulations passed by the Board, manages the state's fisheries according to management guidelines, and provides information and recommendations on fish populations and harvest through research (ADF&G 2013c).

There are a few exceptions to state fisheries management. NMFS manages fisheries in federal waters, from 3 miles to 200 miles off shore, as well as most groundfish fisheries. Similar to the Alaska Board of Fisheries, the North Pacific Fishery Management Council sets regulations and management guidelines for federal marine fisheries (Clark et al. 2006b). The USFWS, with the Federal Subsistence Board, manages subsistence fisheries on waters in which the federal government has reserved water rights (USFWS 2012).

Cook Inlet is divided into two main state management areas: Upper Cook Inlet and Lower Cook Inlet. The Upper Cook Inlet area includes waters north of Anchor Point; the Lower Cook Inlet area includes the remainder of Cook Inlet waters, Kachemak and Kamishak bays south to Cape Douglas, and the Barren Islands. The license area occurs in the Kamishak Bay district in the Lower Cook Inlet Management Area and in the Chitina District within the Upper Cook Inlet Management Area. Cook Inlet districts are further divided into sub-districts (ADFG 2013c). The license area is near the boundary between the management areas but is considered a part of the Lower Cook Inlet management area (Hollowell et al. 2013).

All five species of Pacific salmon are harvested commercially in Cook Inlet. Commercial fisheries for halibut, groundfish, herring, and razor clams also occur in Lower Cook Inlet and Kamishak Bay. Fish are delivered to docks at Anchorage, Nikiski, Ninilchik, Kenai, Kasilof and Homer for processing.

Salmon fisheries are the most significant commercial fisheries in the Cook Inlet area. Sockeye salmon are the most important economically, followed by coho, Chinook, chum, and pink (Shields and Dupuis 2013). Three types of commercial fishing gear are allowed for salmon in Cook Inlet: set gillnets, drift gillnets, and seines. However, all types of gear are not allowed in all districts. The locations, times, and other details of fishery prosecution are tightly controlled through fishing regulations and in-season emergency orders guided by management plans (ADF&G 2013c).

In 2012, Lower Cook Inlet management area commercial salmon harvest was 499,080 fish comprised of 256,590 pink, 186,644 sockeye, 55,466 chum, 243 coho, and 137 Chinook salmon (Hollowell et al. 2013). The total 2012 Kamishak Bay District commercial harvest was 55,255 sockeye, 2,425 chum, and 61 pink salmon harvested by 6 seine permit holders (Hollowell et al. 2013).

Pacific halibut have been commercially harvested in Cook Inlet for many years. Halibut are managed by several different state, federal, and international agencies (Clark and Hare 2006; Meyer 2006; NMFS 2014; PFMC 2014). The International Pacific Halibut Commission (IPHC), created in 1923 by a convention between the U.S. and Canada, sets harvest strategies and total allowable harvest levels for the U.S. and Canada, and conducts studies on halibut population dynamics. The North Pacific Fishery Management Council (NPFMC), a federal agency, deals with allocation issues within Alaska. The National Marine Fisheries Service (NMFS), another federal agency, manages individual fishing quotas for the commercial fishery. Although it does not have management jurisdiction over halibut, the Alaska Board of Fisheries has adopted sport fishing regulations that do not conflict with IPHC regulations to facilitate enforcement of regulations, and ADF&G monitors and conducts research on the sport fishery (IPHC 2013, ADF&G 2014c).

In 1995, an individual fishing quota (IFQ) system was implemented in Alaska for the commercial halibut fishery. Under this system, individual fishers are given a percentage share of the total commercial harvest that will be allowed each year. After implementation of IFQs, the commercial fishery was quickly transformed from a "derby fishery" in which the entire annual harvest was taken in a few days in chaos and danger, to a fishery that now extends through most of the year. In addition, the value of the harvest has increased, bycatch of other species has decreased, and the fishery is much less dangerous (Clark and Hare 2006; Meyer 2006; NMFS 2014; PFMC 2014).

From 1997-2006, statewide commercial harvest of halibut ranged from about 700,000 pounds in 2000 to over one million pounds in 1997, 1998, 2004 and 2005. In 2012, the commercial harvest for halibut was highest in Area 3A with 4.4 million pounds of halibut off loaded in Homer. Area 3A includes the license area within the Gulf of Alaska waters off Southcentral Alaska between Cape Spencer and the southernmost tip of Kodiak Island. This equaled 18% of the Alaskan commercial catch and was higher than any other regulatory area (IPHC 2013).

Pacific herring were harvested at varying levels in the Cook Inlet area from the early 1900s through the 1990s, primarily in Kamishak Bay on the west side of Lower Cook Inlet. Declines in abundance, as well as market conditions, resulted in decreased harvests. This led to closure of herring fisheries in Lower Cook Inlet from 1980-1984 and 1999 through the present (Hammarstrom et al. 2007). The commercial herring fishery in Upper Cook Inlet dates from 1973, but decreases in abundance and a shift in age structure were observed in 1988, leading to closures and additional restrictive seasons (Shields and Dupuis 2013). Harvest, abundance and closures have fluctuated widely. Although there is a herring management plan and commercial fisheries in several subdistricts were reopened in 2002, participation has been low (35.6 tons and 14 permit holders in 2013) (Shields and Dupuis 2013). For example, the Kamishak Bay sac roe fishery remained closed in 2012 because the spawning biomass did not reach the regulatory threshold of 6,000 tons. Information collected in 2012 suggested that the 2013 biomass would be less than the regulatory threshold as well (Hollowell et al. 2013).

Several species of **clams** are harvested commercially in the Cook Inlet area (Figure 5.1). DEC is required to certify beaches for commercial clam harvest to ensure that clams are safe for human

consumption (Trowbridge and Goldman 2006). In Lower Cook Inlet, littleneck clams, butter clams, and cockles are harvested commercially, but all commercial harvest occurs in Kachemak Bay (Trowbridge and Goldman 2006) which is not included in the license area. Kachemak Bay beaches are opened for commercial clam harvests on an alternating schedule, with half the certified beaches open in even years and the other half in odd years.

King, Tanner and Dungeness crab stocks have been harvested in the Cook Inlet area since the early 1900s. Crab fisheries in the Cook Inlet area are managed as part of ADF&G shellfish Area H which is divided into Central, Southern (includes Kachemak Bay), Kamishak Bay, Barren Islands, Outer, and Eastern districts. Commercial fisheries for king crab in Cook Inlet began in 1937, peaking at 8.0 million pounds per year in the 1960s and ranging from 2.5-4.8 million pounds annually during the late 1960s and early 1970s (ADF&G 2002). Red king crab was the primary king crab species harvested commercially, and most of the harvest came from the Southern District and Kamishak/Barren Islands districts. After 1976, harvests declined and the commercial fishery was closed during the 1981-1982 season in the Southern District and during the 1983-1984 season in the Kamishak/Barren Islands fishery districts because of low abundance, and the fisheries have remained closed. Causes for the decline in abundance and subsequent failure of the population to recover, even after the fishery has been closed for many years, are poorly understood, but overfishing and environmental conditions are considered likely explanations (ADF&G 2002). The commercial king crab fishery will remain closed until stocks recover sufficiently for a harvest strategy to be developed by the department and adopted by the Alaska Board of Fisheries (5 AAC 34.310).

Commercial fisheries for Tanner crab developed during the mid-1960s in Kachemak Bay as they were harvested incidentally to red king crab (ADF&G 2002). However, the fishery soon expanded to other areas of Cook Inlet and harvests increased rapidly, peaking at 8.0 million pounds in 1973-1974. The Tanner crab commercial fishery was closed in 1989, and has remained closed since 1995 in the Southern District and since 1992 in the Kamishak Bay/Barren Islands districts. Due to low abundance, non-commercial fisheries have been closed since 2002 (Kerkvliet et al. 2013). After the stock collapsed, it continued to remain depressed despite many years of the fishery remaining closed. Possible causes include overfishing of legal crabs, high incidence of death due to handling of illegal crabs, and death from lost and derelict crab fishing pots. Another possible cause may be ocean conditions that favor production of predators and suboptimal environment conditions for crab larvae survival (ADF&G 2002). The Alaska Board of Fisheries adopted conditions under which the commercial Tanner crab fishery could be reopened, in particular, setting specific abundance levels (5 AAC 35.408).

During the late 1970s, a commercial fishery for Dungeness crab developed in the Cook Inlet area, primarily in the Southern District, with harvests averaging 1.0 million pounds from 1978-1991 (Trowbridge and Goldman 2006). As with other crab fisheries in the Cook Inlet area, abundance decreased sharply, and in 1991 the commercial fishery was closed and has remained closed since. In addition to natural fluctuations, the sharp decrease in abundance is due to three primary factors: “1) depression of the stock due to handling and trapping mortality that was the result of fishing during and immediately after the molting period; 2) extremely high effort over long seasons with the resultant high annual fishing mortality due to ease of access by both commercial and recreational fishermen; 3) violation of the 150 pot limit by a portion of the fleet” (ADF&G 2002).

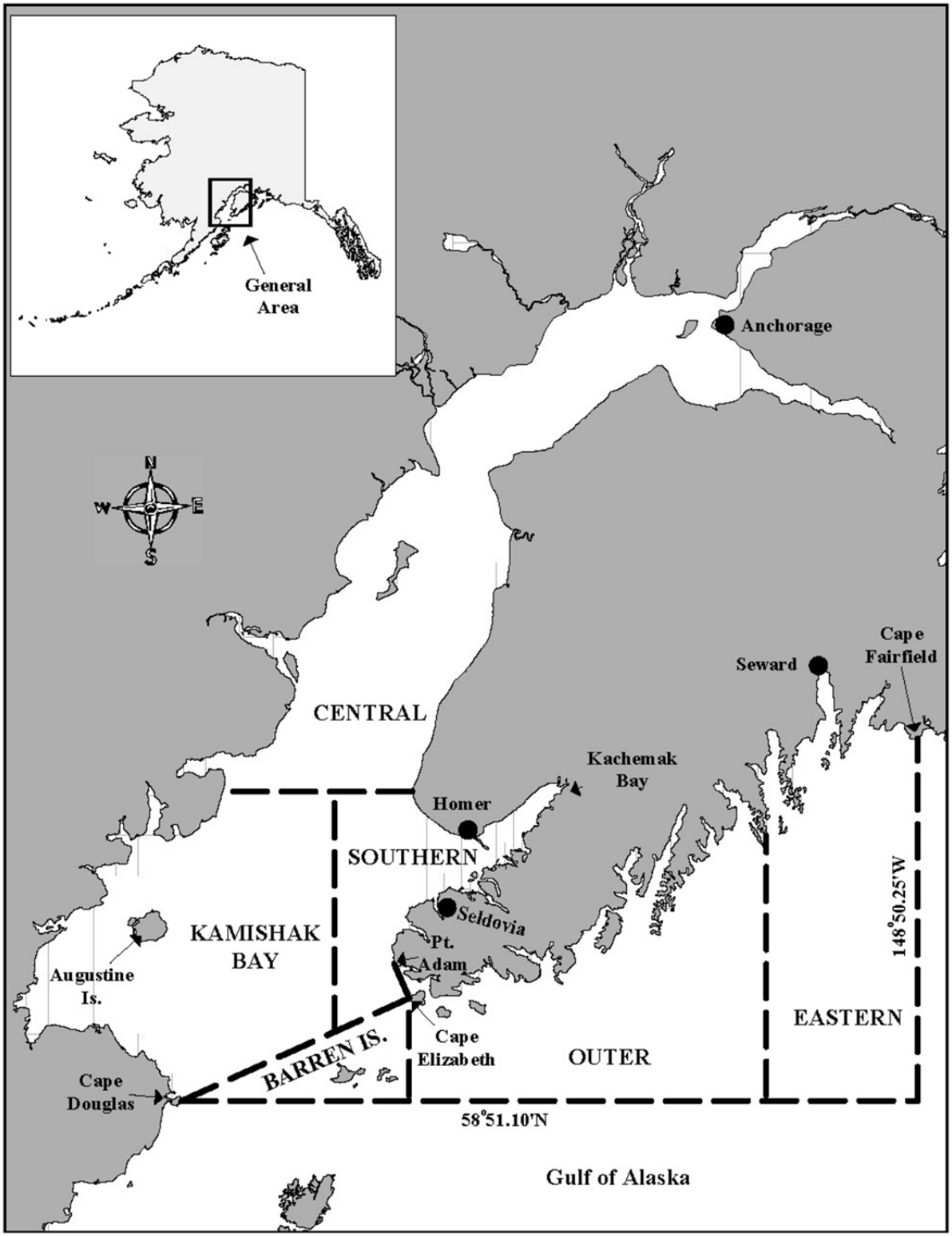

Figure 5.1. Six districts of ADF&G shellfish management

Source: ADF&G 2013c

The Cook Inlet Area Dungeness Crab Fisheries Management Plan specifies that fisheries will not be reopened until crab stocks recover and the Alaska Board of Fisheries adopts a further management plan that addresses 14 factors such as allowable exploitation rates, biological composition of the stock, reporting requirements, and ecosystem functions (5 AAC 32.390). Despite the long-term, continued fishery closure, Cook Inlet Dungeness crab stocks remain depressed and increases in abundance are considered unlikely in the near future (Trowbridge and Goldman 2006). This fishery remains closed due to the reduced crab stocks.

Shrimp were harvested commercially with trawls and pots in the Cook Inlet area from 1970 through the mid-1980s, primarily in Kachemak Bay (Trowbridge and Goldman 2006) which is not included in the license area. Annual harvests averaged over 5 million pounds, but abundance declined and the fishery was closed in 1987 and has remained closed since (Trowbridge and Goldman 2006). Causes for the collapse of shrimp stocks and subsequent continued lack of recovery are unknown. It is suspected that stocks were overfished during the 1970s and 1980s. Failure of the stocks to recover despite long-term fishery closures may be due to changing environmental conditions which could result in greater mortality of shrimp larvae, greater mortality of the forage base, and increased production of shrimp predators (ADF&G 2002). Shrimp stocks remain at low levels but show signs of recovery in some locations (Trowbridge and Goldman 2006).

Other shellfish species that are harvested commercially in the Cook Inlet area include weathervane scallops, octopus, green sea urchins, and sea cucumbers. Development of the fishery began in 1983, harvest and participation in the fishery has been variable, and regulations and management of the fishery have become increasingly restrictive and complex (Trowbridge and Goldman 2006).

Although fisheries for octopus are closed, they are harvested incidentally to other commercial fisheries, particularly the Pacific cod pot fishery, and harvests are highly variable, ranging from 435 to 48,067 pounds (Trowbridge and Goldman 2006). Small commercial fisheries for green sea urchins and sea cucumbers have also occurred in the Cook Inlet area. From 1987-1996, harvest ranged from 80 pounds to 195,403 pounds; in some years there was no participation in the fishery (Trowbridge and Goldman 2006). From 1990-1997, sea cucumbers were harvested in four years, and harvest ranged from 1,528-30,940 pounds. Divers did not find commercial quantities of sea cucumbers in 1991, 1992, or 1995-1996 (Trowbridge and Goldman 2006).

3. Sport Fishing

Sport fishing is an important part of the culture and economy of the Cook Inlet area. It provides recreation, food, and jobs to both residents and visitors. In the summer, sport fishing opportunities range from bank fishing in small streams, to saltwater trolling and jigging for salmon and bottomfish, and clam digging. Charter flights are offered from the Kenai Peninsula and Anchorage to the west side of Cook Inlet to access more remote salmon fishing. The license area is outside of the areas where sport fishing usually takes place because of the distance from the license area to population centers (ADF&G 2014b).

Salmon species and Dolly Varden provide sport fishing opportunities in western Cook Inlet fresh waters. The main sport fishing window is between July and August, but opportunities extend from June through October (ADF&G 2014d) (Table 5.2).

The only notable fishing restriction within the license area is at the head of Chinitna Bay. The Clearwater Creek drainage, including Roscoe Creek, is closed year round to all fishing approximately ½ mile upstream of the confluence with the Chinitna River (ADF&G 2014c). An estimated 10,682 angler-days were fished in West Cook Inlet drainages in 2012, a reduction of angler-days over the past 10 years which averaged 14,686 angler-days per year (ADF&G 2014d).

Table 5.2. Peak run timing of sport fish in western Cook Inlet fresh waters.

	June	July	August	September	October
Chinook salmon	X	X			
sockeye salmon		X	X		
coho salmon			X		
pink salmon		X			
chum salmon		X	X		
Dolly Varden			X	X	X

Source: ADF&G 2014d

State sport fishing licenses are generally required, which brings in revenue of $24 per annual license for residents and $145 for non-residents. In addition to a fishing license, anglers fishing for Chinook salmon must also purchase a Chinook salmon stamp at an additional cost of $10 for residents and $100 for non-residents (ADF&G 2014e). The revenue from sport fishing licenses, tags and permits directly supports ADF&G research and management of sport fisheries (ADF&G 2013g).

Current economic estimates for sport fishing specific to the license area are unavailable. However, in 2011, statewide fishing in Alaska generated approximately $718 million in retail sales, $359 million in wages and salaries, 9,992 jobs, and over $1 billion moved through the statewide economy as a result of sport fishing in Alaska (USFWS 2012; Southwick Associates 2012). All categories increased since 2006, except jobs (Table 5.3). It should be noted that these estimates, which use data from the U.S. Fish and Wildlife Service's National Survey of Fishing, Hunting and Wildlife-Associated Recreation, may underestimate the total economic impact of sport fishing in Alaska because it does not include expenditures made outside Alaska. For example, fishing equipment purchased in another state used for fishing in Alaska (Southwick Associates et al. 2008).

Table 5.3. Economic impact of sport fishing in Alaska in 2006 and 2011.

Year	Retail Sales	Output	Wages and Salaries	Jobs
2006	$530,165,682	$800,921,744	$252,957,398	8,465
2011	$718,452,401	$1,073,716,980	$358,679,292	9,992

Sources: Southwick Associates 2007, 2012.

4. Hunting and Trapping

It is estimated that moose population within Game Management Unit (GMU) 9A is 300. Since 2000, about 154 moose were harvested per year throughout GMU 9 (Butler 2010). The number of moose hunters in Unit 9 reached its highest number in 1987 with 694 hunters. Participation has dropped to an average of 561 hunters in the 1990s. In 2008, only 363 people hunted for moose in Unit 9 (Butler 2010). Compared to other areas of the state, moose harvests in Unit 9 have remained relatively stable since 1990. The recent decline in the number of harvested moose is associated with the decrease in the number of people attempting to hunt in GMU 9. This is not attributed to a reduction in moose population (Butler 2010).

The majority of the Northern Alaska Peninsula Caribou herd are present within GMU 9C and 9E, and typically do not enter the license area which is within GMU 9A (Butler 2009). The herd has declined since 2000 (Butler 2010). Tension between user groups has increased as a result of the decline in caribou populations throughout GMU 9 (Butler 2010). Biologists have evaluated intensive management options for this population and concluded that no viable solutions exist to alter the status of this herd (Butler 2009).

Some of the small mammals in and around the license area are harvested for their fur or pelts. During 2005-2006 three species were reported as harvested including 14 beavers, 11 porcupines, and 3 snowshoe hares. These small game species contributed a combined 206 pounds to the community harvest and revenue from the pelts (Stanek et al. 2007) (Table 5.4).

Table 5.4. Average statewide prices paid for raw furs.

Species	2008-09	2009-10	2010-11	2011-12	2012-13	Top Price 2012-13
Lynx	$ 94.53	$ 127.50	$ 149.64	$ 179.78	$ 205.11	$ 1050.00
Muskrat	$ 3.19	$ 7.73	$ 7.72	$ 9.97	$ 12.53	$ 54.00
Fox (all species)	$ 21.42	$ 26.22	$ 33.55	$ 52.82	$ 59.97	$ 340.00
Coyote	$ 24.33	$ 36.13	$ 52.90	$ 65.99	$ 76.27	$ 1400.00
River Otter	$ 33.11	$ 43.65	$ 58.84	$ 86.76	$ 100.75	$ 330.00
Beaver	$ 20.11	$ 12.83	$ 17.82	$ 32.56	$ 32.56	$ 200.00

Source: ADF&G 2013

5. Recreation and Tourism

Alaska's Cook Inlet region offers a wide range of year-round outdoor recreational activities and opportunities that are valuable and important to local residents and visitors to the area. Ocean environments, rivers, streams, lakes, valleys, mountains, and numerous trails can be used for hiking, dog mushing, fishing, hunting, sightseeing, cross-country skiing, snowmachining, rafting, boating, camping, and other private and commercial recreational activities (ADNR 2001). The majority of the recreation and tourism activity within the license area likely occurs during the summer (ADF&G 2014f; ADF&G 2014g). However, the license area's remote distance from population areas makes access challenging and limits the amount of recreational use.

6. Marine Vessel Traffic

Cook Inlet is a wide, long inlet with moderate to low levels of marine vessel traffic when compared to other large North American ports. Traffic is complicated by sudden and severe weather, strong tides, and seasonal sea ice. Eighty percent of large ship operations were made by only 15 vessels that regularly called at Homer, Nikiski, or Anchorage. Commercial fishermen and suppliers use this cross-Inlet traffic route to reduce the travel distance from Cook Inlet locales to the Bristol Bay region (Cape International Inc. 2012).

The closest port to the license area is Williamsport. Williamsport is a shallow draft port at the head of Iliamna Bay. There is a gravel portage road that connects Williamsport on Cook Inlet to Pile Bay on Lake Iliamna. The portage provides shorter transport of goods and supplies between Cook Inlet and the Lake and Peninsula borough communities. Access to Williamsport is reliant on tides, and larger vessels must utilize the highest tides of the month to navigate into Williamsport (Cape International Inc. 2012).

7. Fiber Optic Cable Communication

In 2011, United Utilities Inc., a subsidiary of GCI, installed a fiber optic cable within Cook Inlet, Iliamna Bay, and other areas of southwest Alaska that runs through the license area (Figure 5.2). The hybrid fiber-microwave system utilizes a combination of the fiber optic cable and a series of microwave repeater towers to provide broadband service to the Bristol Bay and Yukon-Kuskokwim

Delta regions of southwest Alaska. The cable is buried on the seafloor within the license area. Damage to the cable must be avoided as it would interrupt or eliminate broadband service to rural communities in Southwest Alaska including schools and hospitals (TERRA GCI 2014). The UUI cable's location within the license area is shown on NOAA navigation charts 16640 and 16648. Technical manuals are available from the International Cable Protection Committee to help the licensee avoid impacting the cable during subsequent activities (ICPC 2008a, 2008b, and 2008c).

8. Energy

The license area and surrounding region have a long history of oil and gas exploration. See Chapter 6 for a full description of the geology and exploration history.

U.S. Department of Energy has released reports stating that waves and tidal currents off Alaska's coastline could generate more than 850 terrawatt-hours of electrical energy annually, if fully developed (Spence 2012). Ocean Renewable Power Company is currently conducting a study on the effects of tidal turbines on beluga whales partially funded by the U.S. Department of Energy (USDOE 2013; ORPC 2014). Two companies are engaged in monitoring the inlet environment and characterizing a potential turbine site off Nikiski in the East Forelands area of the inlet, northeast of the license area (Spence 2012).

Cook Inlet Regional Incorporated owns and operates a 17.6 megawatt wind turbine project on Fire Island in Cook Inlet northeast of the license area. The project came on-line in 2012 with 11 wind turbines and has the capacity to deliver power to 6,500 homes in the region. The project is projected to supply more than 50,000 megawatt-hours to Chugach Electric Association annually (Fire Island Wind 2014).

The Augustine Island geothermal resource disposal area is located approximately 20 miles south of the southern boundary of the license area. In January 2013 DNR issued the Augustine Island Geothermal Resources Disposal Written Finding of the Director which approved the offering of approximately 65,992 acres of land on and surrounding Augustine Island for geothermal resources disposal (ADNR 2013). Currently there is an active lease in tract number 13 of the area exploring the geothermal energy resources (ADNR 2014).

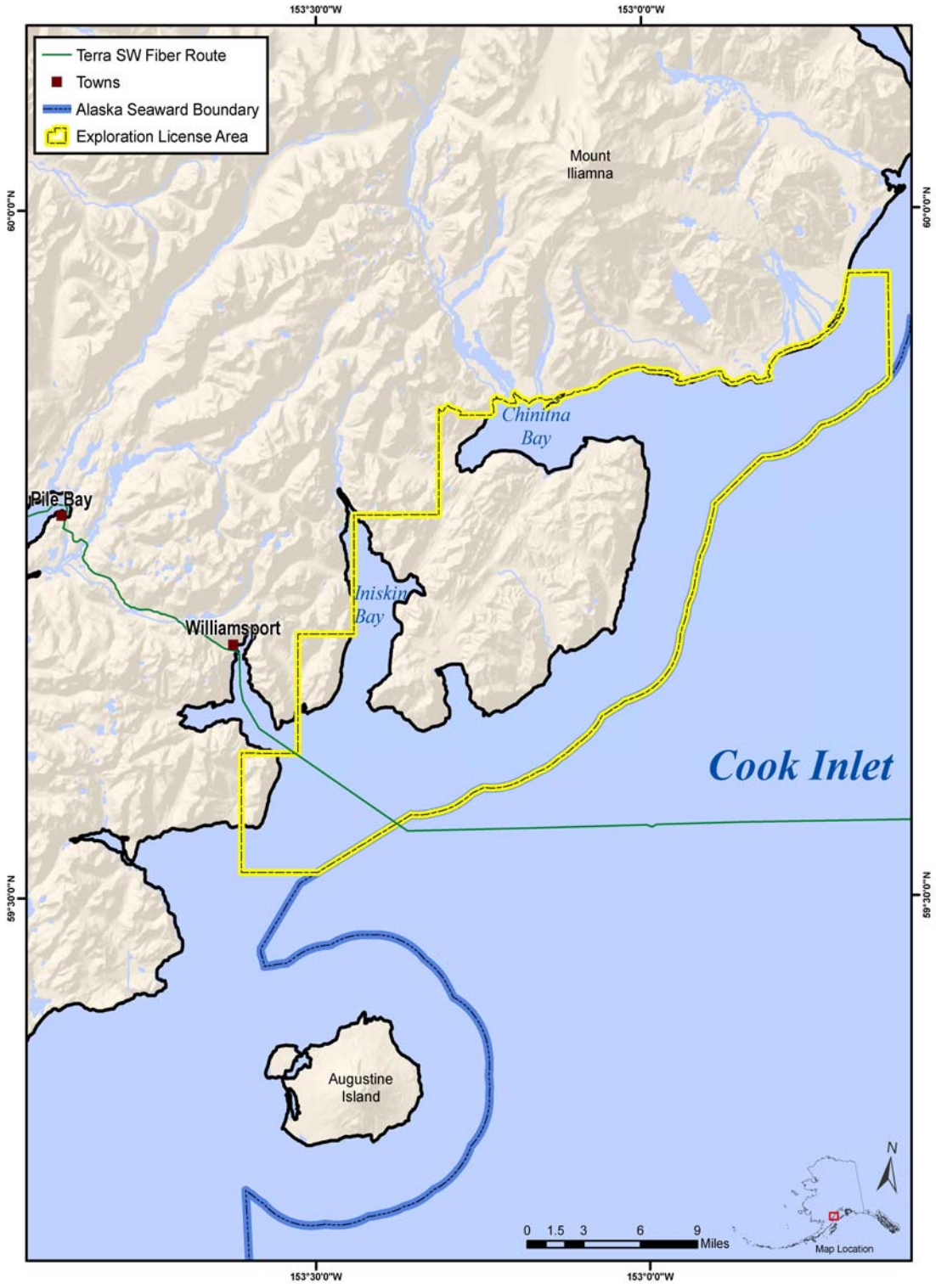

Figure 5.2. Route of UUI buried fiber optic cable in southern portion of the license area.

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Chapter Six: Oil and Gas Exploration, Development, Production, and Transportation

Table of Contents

Page

List of Figures

Figure **Page**

Chapter Six: Oil and Gas Exploration, Development, Production, and Transportation

A. Geology

1. Tectonic Setting

The Cook Inlet basin occupies the forearc setting between the Aleutian-Alaska Range magmatic arc on the west and the Chugach terrane accretionary prism on the east. The basin-fill succession is floored by Permian and Triassic volcanic agglomerate and limestone, the oldest units of the Peninsular terrane, exposed only locally on the northeastern Alaska Peninsula at Puale Bay. Lower Jurassic through Upper Cretaceous volcanic and sedimentary Peninsular terrane rocks are known from outcrop and wells to be widespread beneath Cook Inlet, providing a stratigraphic record of its early, dominantly marine stage of basin evolution. Paleocene and younger formations of the entirely nonmarine Kenai Group overlie the Mesozoic succession with a significant angular unconformity that records compressional uplift above sea level, erosion, and a gap in deposition during latest Cretaceous to Paleocene time. Strata of the lower Kenai Group are present locally in the Southwest Cook Inlet exploration license area north of Chinitna Bay and are present in the shallow section of some offshore wells outside the license area in Lower Cook Inlet, but Tertiary units are entirely absent on the Iniskin Peninsula.

2. Mesozoic History and Rock Units

The Alaska-Aleutian Range batholith, dominantly diorite, quartz monzonite, and granodiorite (Detterman and Hartsock 1966), form the deep roots of the magmatic arc on the west side of Cook Inlet. Together, Middle Jurassic plutons and the overlying Lower Jurassic volcanic edifice that they intrude constitute much of the Talkeetna arc (Nokleberg et al.1994), a volcanic oceanic island arc within the Peninsular terrane, believed to have formed above a northward-dipping subduction zone before the Peninsular terrane accreted to the southern Alaska margin in mid-Cretaceous time. The Lower Jurassic Talkeetna Formation, mainly submarine volcanic flows and breccias, reaches a total thickness on the order of 2,600-2,750 m on the west side of Cook Inlet (Magoon and Claypool 1981; Detterman and Hartsock 1966) and at least 5,270 m east of Cook Inlet near Seldovia (Bradley et al.1999).

By mid-Jurassic time, parts of the Talkeetna Formation were subject to erosion at or above sea level, generating large volumes of volcanic-rich clastic sediment that were re-deposited in the nearby shallow marine forearc setting to form the siltstones, fossiliferous graywacke sandstones, and conglomerates of the Middle to Upper Jurassic Tuxedni and Chinitna Groups. These units reach a combined thickness of up to 1,150 m on the west side of lower Cook Inlet (Detterman and Hartsock 1966). Geochemical evidence identifies Tuxedni Group siltstones and shales as the source rock for commercial oil produced from Tertiary reservoirs in upper Cook Inlet (Magoon and Claypool 1981; Magoon and Anders 1992; Magoon 1994a, 1994b; Stanley et al. 2011; Stanley, Herriott, et al. 2013).

Deposition of the Upper Jurassic Naknek Formation marked a significant change in sediment composition, from volcanic-rich graywackes of the underlying Tuxedni and Chinitna Groups to plutonic-rich arkosic sandstones, siltstone, and conglomerate (e.g., Detterman and Hartsock 1966). This indicates erosional unroofing of the intrusive roots of the magmatic arc on the basin's western

margin in response to uplift on the Bruin Bay fault system while the marine forearc basin continued accumulating sediment during Late Jurassic time. Syntectonic deposition is further reflected by eastward thinning and grain size decrease, particularly in the lower Naknek. Reported thicknesses of the Naknek Formation range from a minimum of 1,663 m in the Lower Cook Inlet COST No. 1 well (Magoon 1986) to more than 2,185 m elsewhere in Cook Inlet (Magoon and Claypool 1981).

The Cretaceous stratigraphic record is incomplete in the Cook Inlet region, with significant time represented only by unconformities. Within the onshore parts of the Southwest Cook Inlet exploration license area, Cretaceous strata are entirely absent, due to non-deposition or erosion, or both. Outside the license area at the offshore Lower Cook Inlet COST No. 1 well, the Lower Cretaceous Herendeen Formation unconformably overlies the Naknek Formation with a gap in deposition of nearly 20 million years (Magoon and Claypool 1981). The Herendeen comprises fossiliferous sandstone and sandy limestone totaling approximately 570 m thick (Magoon 1986). The Lower to Upper Cretaceous Matanuska Formation and the Upper Cretaceous Kaguyak Formation overlie the Herendeen Formation unconformably with a gap in the stratigraphic record that varies from approximately 25 to 55 million years in different areas of the basin. These units are in part laterally equivalent to each other, and reach reported thicknesses of 744 to 2,600 m, respectively (Magoon 1986; Magoon and Claypool 1981). They are dominated by deep water turbidites, but the Matanuska is punctuated by internal unconformities, and both locally include or are partially time-equivalent to shelfal, shallow marine and non-marine facies (Nokleberg et al. 1994; Lepain et al. 2012; Wartes et al. 2013). The Cretaceous unconformities in Cook Inlet attest to tectonic instability of the forearc setting, though the uplift and subsidence mechanisms that created them are not well understood.

3. Cenozoic History and Rock Units

As noted above, Mesozoic and Cenozoic strata in Cook Inlet are separated by a regional angular unconformity corresponding to uplift that elevated the basin above sea level, creating nonmarine conditions that persisted throughout Tertiary time. Calderwood and Fackler (1972) assigned most Tertiary strata in the basin to the redefined Kenai Group, made up of five formations, in stratigraphic order, the West Foreland Formation, Hemlock Conglomerate, Tyonek Formation, Beluga Formation, and Sterling Formation. They estimated the maximum thickness of Tertiary strata in excess of 7.9 km based on drilling data; seismic mapping by Shellenbaum and others (2012) places the basal Tertiary unconformity at a depth of greater than 7.6 km in the area north of East Foreland, the basin's deepest part. The Kenai Group thins dramatically toward the south in the Cook Inlet offshore, due in large part to uplift and erosion on the Seldovia Arch, a major structural high that trends nearly east-west across the basin between the southernmost Kenai Peninsula and Augustine Island. Tertiary strata also thin from offshore to onshore, again largely due to uplift and erosion, although depositional thinning also plays a role. The result is that Kenai Group strata are absent entirely from the onshore parts of the exploration license area south of Chinitna Bay and probably too thin to host significant hydrocarbon accumulations where they are present locally in Lake Clark National Park onshore north of Chinitna Bay.

4. Structure

The structural framework of Cook Inlet is dominated by transpression (Haeussler et al. 2000), faulting and folding combining strike-slip and compressional movements. The Bruin Bay and Lake Clark – Castle Mountain fault systems are steeply-dipping structures with a significant component of up-to-northwest vertical displacement bounding the basin on the west and north. Most of the major fault systems in central and southern Alaska have a right-lateral sense of horizontal displacement, but there is some evidence for left lateral movement on the Bruin Bay fault (Detterman and Hartsock 1966; Detterman and Reed 1980; Decker et al. 2008). The transpressional regime has created en echelon folds, anticlines and synclines arrayed in overlapping steps. Anticlinal geometries vary

widely throughout Cook Inlet, from long, narrow highs with steeply dipping limbs, to broad, elliptical closures with gently dipping limbs (Haeussler et al. 2000). Offset of anticlines by cross faults is common, creating separated compartments with oil and gas trapping potential. Major folds within the Southwest Cook Inlet exploration license area include a narrow, dominantly south-plunging, internally faulted anticline with moderate to very steeply dipping limbs (Fitz Creek anticline) and a broader, south-plunging, slightly asymmetric syncline with more moderately dipping limbs (Tonnie syncline). The Bruin Bay fault system transects the license area, northeast-southwest across the neck of the Iniskin Peninsula; interpretations vary as to whether it is best viewed as a discrete fault zone or as overlapping en echelon strands (Detterman and Hartsock 1966; Hartsock 1954).

B. Exploration History

1. Oil Seeps and Initial Prospecting

Natural seepages of oil at the surface have been known on the Iniskin Peninsula since at least 1853, and were reportedly first sampled in 1882 (Martin 1905; Detterman and Hartsock 1966), leading to the staking of oil prospecting claims in 1892 and 1896. Detterman and Hartsock (1966) mapped live oil seeps in three areas: Well Creek, one-half mile north of the head of Oil Bay near the south end of the peninsula; Brown Creek, two miles north of the head of Dry Bay on the southeast side of the peninsula; and Fitz Creek, in the interior of the peninsula. All of these seeps are located along mapped faults, which are presumed to be more favorable as flow conduits than the relatively low permeability Jurassic sandstones found in the area (Detterman and Hartsock 1966).

The earliest petroleum exploration wells in Cook Inlet were drilled by the Alaska Petroleum Company, beginning in 1902 on a claim staked in 1896 near Oil Bay and the Well Creek oil seep(s). Drilling of the first well was concluded in 1903, and although no official records are known, it is reported to have reached a total depth of 305 m, with continuous gas encountered below 58 m, as well as "considerable" oil flow at 213 m. Upon further drilling, strong water influx shut off the flow of oil, though the gas flow continued even after drilling was concluded (Martin 1905). The company drilled a second well about a quarter of a mile northwest of the first in 1903, encountering oil shows while drilling in badly caving shale (presumably faulted or fractured) at a depth of 98 m. This well was abandoned at a total depth of 137 m, unable to produce oil due to the collapsing shale (Martin 1905). A third well, located 76 m south of the previous well, reached a total depth of 274 m, encountering oil and gas in three thin sandstones at approximately 236 m, as well as gas shows at various other depths, some sufficient to blow the water out of the hole to a height of 6 m (Martin 1905). The fourth and final well drilled by Alaska Petroleum Company was located on top of a low hill approximately 260 m north of the second hole. There is no information available regarding the depth drilled or shows encountered in this well.

A well drilled by the Alaska Oil Company in 1902 near the seep on Brown Creek north of Dry Bay reached a total depth of just 98 m, abandoned without oil shows when drilling tools were lost in the hole. A second attempt nearby in 1903 apparently met with even less success, and was abandoned at shallow depth after a mishap with the equipment (Martin 1905). Subsurface exploration shut down in 1903, and no additional wells have been drilled at either Oil Bay or Dry Bay since this initial prospecting phase.

Initially, oil and gas activities were subject to mining claims under the General Mining Act of 1872. Federal lands were closed off to mineral entry in 1910. The Mineral Leasing Act of 1920 authorized leasing of public lands for developing deposits of coal, petroleum, natural gas, and other hydrocarbons. In 1959, following Alaska statehood and the creation of state natural resource agencies, oil companies bought exploration leases from the state.

2. Iniskin Bay Association No. 1 Well

Between 1903 and 1934, exploration activity in the license area was limited to geologic field studies by USGS geologists (Moffit 1922a; 1922b; 1927), which described the potential structural trap now known as the Fitz Creek anticline. The Iniskin Bay Association (IBA) obtained exploration rights on 51,000 acres on the anticline near the Fitz Creek oil seep, built a road into the interior of the Iniskin Peninsula up the Fitz Creek drainage from Chinitna Bay, and began drilling the Iniskin Bay phase Association No. 1 well in late 1936 (Detterman and Hartsock 1966). Working over four summer seasons, drilling was suspended in 1939 at a total depth of 2.7 km after penetrating Middle Jurassic sedimentary rocks, apparently only the lower formations of the Tuxedni Group. It encountered trace oil and gas shows at a depth of 1.5 km upon penetrating the nearly vertical Fitz Creek fault zone that cores the tight anticline. The well penetrated high-pressure gas in thick sandstones between 1.5 and 2 km, and a thin oil-bearing sandstone at 2.1 km just before the end of the 1938 drilling season. When the well was reentered in May 1939, the crew recovered 12 barrels of high gravity oil before drilling the deepest section of the hole, comprising mostly hard dark gray to black shales with occasional thin sandstones characterized by strong oil and gas shows accompanied by strong salt water influx. When the well was abandoned in 1939, it was flowing 240 barrels of water per day with minor oil and gas. Oil sampled from the well in 1946 yielded a highly favorable analysis of 47.6 degree API gravity (Detterman and Hartsock 1966).

3. Beal No. 1 and Zappa No. 1 Wells

Oil and gas exploration in the license area came to a halt during World War II, and resumed under a new group of investors called Iniskin Unit Operators formed by IBA president Russell Havenstrite in 1953. Preparations for drilling began the same year, and the group drilled the Beal No. 1 well between August 1954 and October 1955 (Detterman and Hartsock 1966). The well is located 213 m east of the Fitz Creek fault in the downthrown block, approximately one mile southeast of the structurally highest point on the Fitz Creek anticline, where structural closure cannot be demonstrated. Beal No. 1 encountered sedimentary strata of the lower Tuxedni Group before entering Lower Jurassic Talkeetna Formation volcanic and volcaniclastic rocks at 2.8 km, and penetrated to a total depth of 2.97 km (Detterman and Hartsock 1966). Gas shows were noted in sandstones of the lower Gaikema Formation between 748 and 788 m and in a thin Red Glacier Formation sandstone at 1.15 km. Core samples taken near a zone of steep dips and fractures just below 1.95 km yielded oil shows with good cut fluorescence. Further oil shows appeared below 2.35 km and the well yielded 14 barrels of oil-rich fluid at 2.38 km. The operator reentered Beal No. 1 in 1956 and 1957, perforating selected intervals and recovering a small but unspecified quantity of oil and gas; casing head pressures were used to obtain a computed gas flow rate of 4,000 cubic feet per day. The operator transferred the lease to Alaska Consolidated Oil Company in 1958, but further efforts to achieve commercial flow rates, including hydraulic fracture stimulation, were unsuccessful.

Alaska Consolidated Oil Co. drilled one additional well in 1958-1959. The Antonio Zappa No. 1 is located some 732 m west of the Beal No. 1, immediately west of the Fitz Creek fault in the upthrown block near the structural crest of the Fitz Creek anticline. The well bottomed at 3.42 km total measured depth, having encountered numerous minor to fair oil shows beginning at a depth of approximately 213 m and becoming abundant below 1.83 km. Nearly all oil indications were restricted to the surfaces of faults, fractures, and associated calcite vein fills, well described from cuttings samples and the 30 cores attempted in the well (AOGCC 2014). Drilling records identify the top of the Talkeetna Formation volcanics at a depth of 2.97 km, nearly 183 m deeper than in the nearby Beal No. 1 (despite the fact that the well was spudded in the upthrown block), suggesting that the well may have penetrated the fault and passed into the downthrown block (Detterman and Hartsock 1966). The presence of oil shows in fractured volcaniclastic strata nearly 457 m below the top of the Lower

Jurassic Talkeetna Formation at the bottom of the well strongly suggests oil migration into the Fitz Creek anticline from Middle Jurassic Tuxedni Group source rocks deeper in the basin offshore to the east. Figure 6.1 depicts the location and type of oil and gas wells that have been drilled in the license area.

4. Recent Activity and Interest

The most recent exploration activity in the license area has been two-dimensional seismic acquisition conducted mostly onshore during summer 2013. At the time of this writing, little additional public data was available regarding the project.

One application was received in April 2013 indicating interest in oil and gas exploration in the area. Following DNR's issuing of a Notice of Intent to Evaluate Oil and Gas Exploration License Proposal a competing proposal was received leading to a potential competitive bidding situation to obtain the exploration license.

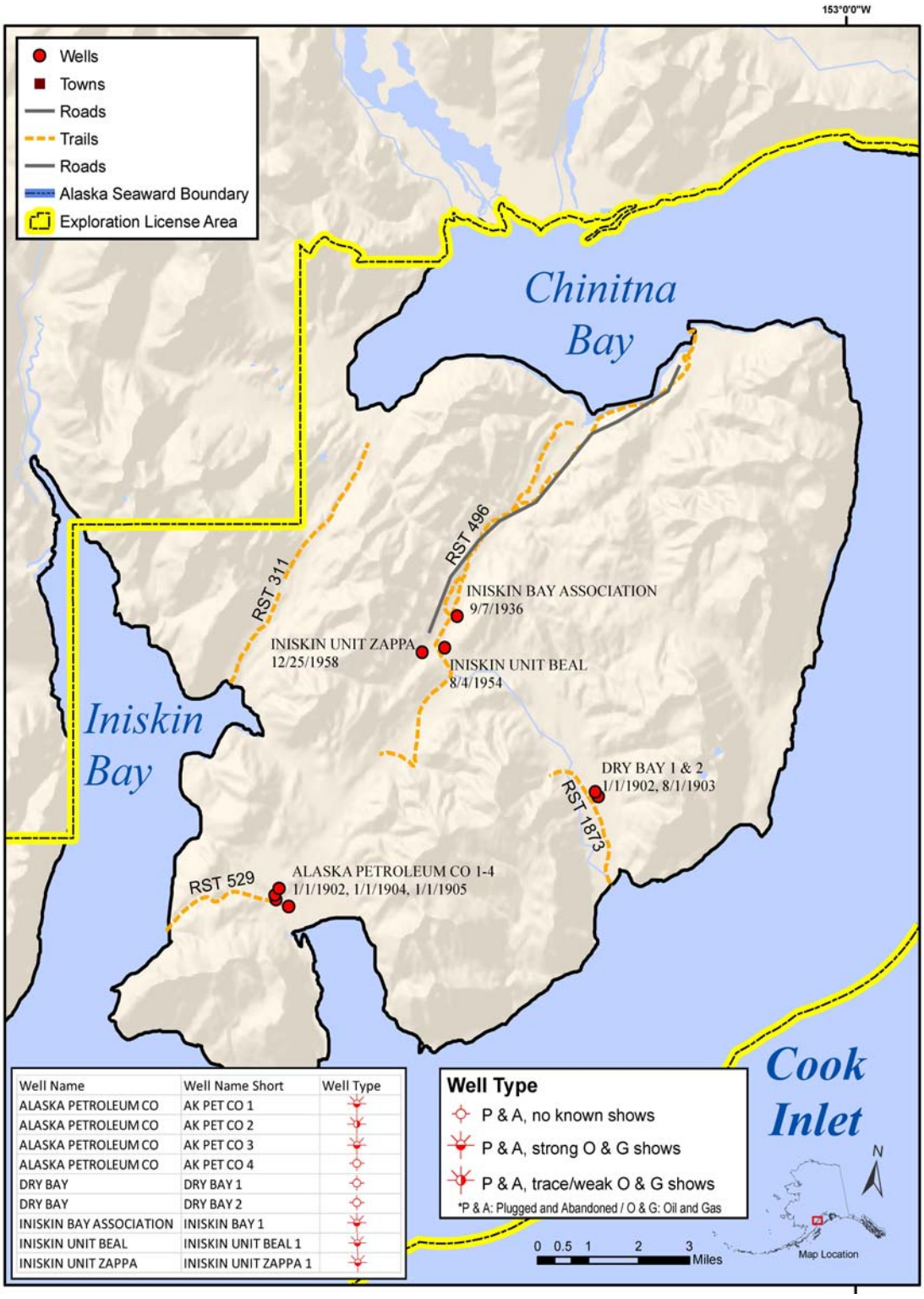

Figure 6.1. Oil and gas wells in the license area

C. Oil and Gas Potential

The several proven and potential petroleum systems of Cook Inlet provide important insights into the oil and gas resource potential of the license area. Commercial production in Cook Inlet comes from two main plays: 1) biogenic natural gas, sourced from Tertiary coals and reservoired in sandstones of the middle and upper Kenai Group (upper Tyonek, Beluga, and Sterling Formations), and 2) thermogenic oil with minor associated gas, sourced from the Middle Jurassic Tuxedni Group and reservoired in sandstones of the lower and middle Kenai Group (West Foreland, Hemlock, and lower Tyonek Formations).

Contiguous to the license area in the waters of Cook Inlet is the federal Bureau of Ocean and Energy Management (BOEM) Outer Continental Shelf (OCS) oil and gas leasing area. The offshore acreage that can be offered in a federal oil and gas lease sale is reported to be approximately 5.36 million acres. The BOEM special interest oil and gas lease sale is tentatively scheduled in Cook Inlet for 2016, pending additional resource and environmental information (BOEM 2013). There are no current active federal oil and gas leases in the direct vicinity of the license area.

1. Biogenic Gas

Biogenically sourced methane in Cook Inlet originated from the bacterial decay of Tertiary Kenai Group coals and carbonaceous mudstones during the early stages of burial in the relatively shallow subsurface, where bacteria flourish at temperatures less than approximately 80°C. As pressure increased with deeper burial, the bacterial methane dissolved in pore waters and adsorbed onto the carbon-rich micro-fabric of the coals, where it was effectively trapped until late Tertiary to Quaternary tectonics uplifted much of the basin. This uplift lowered the confining pressure on the coals, causing the gas to bubble out of solution to form a free gas phase, and allowing the cleats (coal fractures) to open and serve as conduits for gas to flow. At that point, the gas migrated by buoyancy out of the coals and into nearby sandstones, forming dry gas accumulations in numerous structural traps.

2. Thermogenic Oil and Gas

Geochemical "fingerprinting" techniques have been applied to both oil samples and rock samples from the license area, and clearly demonstrate that the commercial oil accumulations were sourced from the Tuxedni Group. Even so, there are remarkably few published analyses characterizing the Tuxedni Group in terms of organic richness and kerogen type, the key attributes of source rock type and quality. Four thermally immature samples from the Soldotna 33-33 well exhibit only marginal or fair oil source quality, averaging 1.7% TOC represented by mixed Type II/III kerogens. Three thermally mature samples from the Beal 1 well on the Iniskin Peninsula and 19 overmature outcrop samples from the Red Glacier area north of Chinitna Bay yield lower TOC values and low levels of remaining pyrolyzable hydrocarbon, consistent with partially to completely spent source (Magoon and Claypool 1981; Magoon and Anders 1992; Magoon 1994a; Stanley, Herriott, et al. 2013; LePain et al. 2014).

3. Resource Potential

Together, Cook Inlet's Tertiary-reservoired oil and gas plays are assessed by the USGS (Stanley et al. 2011) as having mean undiscovered, technically recoverable resources of 394 million barrels of oil plus natural gas liquids and 12.2 trillion cubic feet of natural gas. However, Tertiary Kenai Group strata are absent over nearly all of the license area. Where strata of the Kenai Group are locally present onshore north of Chinitna Bay, they are devoid of structural trapping potential, of limited stratigraphic thickness, and within Lake Clark National Park, all of which makes them unattractive as petroleum targets.

The greatest prospectivity in the license area is thus for Jurassic-sourced thermogenic oil and gas in Jurassic sandstones of the Tuxedni Group, Chinitna Group, and the Naknek Formation. Natural oil seepages and the small quantities of oil and gas recovered in wells drilled on the Iniskin Peninsula provide clear evidence that hydrocarbons have been generated and migrated into onshore portions of the license area. These occurrences are believed to be controlled by the network of faults and natural fractures (Detterman and Hartsock 1966). The chief uncertainty is whether the chemically and mechanically unstable, igneous-rich Jurassic sandstones have retained sufficient porosity and permeability to host economically viable reservoirs; it is unknown at present whether oil and gas is present in the rock matrix or only in the fractures. A secondary risk is that the integrity of anticlinal structural traps in the license area may have been compromised by faulting, causing leakage of potentially trapped hydrocarbons.

Throughout the Cook Inlet basin, Stanley and others (2011) estimate the Mesozoic sandstones to have mean undiscovered, technically recoverable resources of 241 million barrels of oil and more than 1.5 trillion cubic feet of gas in conventional, buoyancy-driven accumulations, plus about 0.6 trillion cubic feet of gas in unconventional, continuous (tight) accumulations where the Middle Jurassic Tuxedni Group source rocks are modeled to be at gas-window thermal maturity below about 6 km depth in the deepest part of the basin near East Foreland. Although there is proof of oil in the license area, the 2011 study includes no estimates of potential in-place volumes or the likelihood that oil can be commercially recovered (Stanley et al. 2011).

D. Phases of Oil and Gas Resource Development

License and lease-related activities may proceed in phases: disposal (licensing and leasing), exploration, development and production, and transportation. Subsurface storage may be an additional phase. Only exploration may occur under an exploration license. Various activities may occur at each of these phases, depending on the specifics of a project, and although each subsequent phase's activities may depend on the initiation or completion of the preceding phase, phases may overlap in time and may occur simultaneously.

Until discoveries are made, the level of associated activities and their specific effects may be unknown. Generally, the process for evaluating a prospect is lengthy. It may involve shallow geophysical surveys, core hole test wells, pilot projects, water disposal plans, field development, and gas transportation.

1. Disposal Phase

The exploration license will grant the licensee the exclusive right to explore for oil and gas within the license area (AS 38.05.132). The license will have a term of four years. There is a non-refundable fee of $1 per acre.

The exploration license is conditioned on a specific work commitment over the 5 year term of the license. The licensee must complete at least 25% of that commitment by the fourth anniversary of the license, and must post a bond and annually renew it. Allowable expenditures for the work commitment are cash expenses such as labor costs, equipment, materials, supplies, and contractors, with the goal of gathering exploration data or drilling one or more exploration wells.

2. Exploration Phase

Exploration activities may include the following: examination of the surface geology, geophysical surveys, performing environmental assessments, and drilling one or more exploratory wells. Surface analysis includes the study of surface topography or the natural surface features of the area, near-surface structures revealed by examining and mapping exposed rock layers, and geographic features such as hills, mountains, and valleys.

a. Geophysical Exploration

Geophysical surveys help reveal the characteristics of the subsurface geology. Seismic surveys are the most common type of geophysical exploration. To gather seismic data, an energy source is emitted into the subsurface and reflected energy waves are recorded by vibration-sensitive receivers called geophones. Impulses are recorded, processed on high-speed computers, and displayed in the form of a seismic reflection profile. Different densities of rock layers beneath the surface result in a unique seismic profile that can be analyzed by geophysicists to determine subsurface structures and petroleum potential. Both two-dimensional (2D) and three-dimensional (3D) data are gathered from seismic surveys.

b. Exploratory Well Drilling

Exploratory drilling may occur under a license and under a lease. It often occurs after seismic surveys are conducted and the interpretation of the seismic data incorporated with all available geologic data indicates gas prospects. Exploration drilling is the only way to learn whether a prospect contains commercial quantities of oil and gas, and helps determine whether to proceed to the development phase.

Drilling operations collect well logs, core samples, cuttings, and a variety of other data. A well log is a record of one or more physical measurements as a function of depth in a borehole and is achieved by lowering measuring instruments into the well bore and taking measurements at various depths. Well logs can also be recorded while drilling. Cores may be cut at various intervals so that geologists and engineers can examine the sequences of rock that are being drilled. Rock fragments (drill cuttings) are produced during the drilling of the borehole. Drilling fluids (muds) are used to circulate the cuttings out of the hole. During drilling operations, the cuttings are separated from the drilling muds and disposed of. The muds may be re-circulated or disposed.

The drill site is selected to provide access to the prospect and is located to minimize the surface area that may have to be cleared. Sometimes temporary roads must be built to the area. If oil or gas is discovered at the exploratory well, it is likely that the gravel pad used for the exploratory well will also be used for development and production operations. Gravel pads are semi-permanent structures and can be rehabilitated following field depletion.

If the exploratory well is successful, the operator may drill additional wells to delineate the extent of the discovery and gather more information about the field. The licensee needs to know the quantity of gas, and the quality of the rocks or coal in which it is found, to determine whether to proceed to convert to a lease, and whether to proceed with further exploration and/or development.

3. Development and Production Phase

Development and production are interrelated and may overlap in time; therefore, this section discusses them together.

a. Conversion to Leases

If the licensee meets the work commitment, it may request conversion of the license to leases of up to 5,760 acres each. The leases are subject to a production royalty of 12.5% and an annual rental of $3 per acre until the state's royalty income exceeds rental income. A lease is for a maximum period of 10 years and is automatically extended if, and for so long as, oil or gas is produced in paying quantities from the lease or the lease is committed to a unit.

If the license is converted to leases, further exploration may occur, with either or both geophysical exploration or drilling one or more wells.

b. Development

Development and production phases begin after exploration has been completed and tests show that a discovery is economically viable. During the development phase, operators evaluate the results of exploratory drilling and develop plans to bring the discovery into production. Production operations bring well fluids to the surface and prepare them for transport to the processing plant or refinery. The fluids undergo operations to purify, measure, test, and transport. Pumping, storage, handling, and processing are typical production processes (Van Dyke 1997).

After designing the facilities and obtaining the necessary permits, the operator constructs permanent structures that will last the life of the field and drills production wells. New facilities may have to be designed and added for enhanced recovery operations as production proceeds. After exploration wells have been drilled, a process called extended reach drilling (ERD) may be used during production. ERD can be used for both onshore and offshore reservoirs. ERD is already being used in Prudhoe Bay, Alaska to access offshore reservoirs using drilling rigs from land (New Developments in Upstream Oil and Gas Technologies 2011). ERD may not only reduce wellsite footprint and minimize environmental effects, but may also improve reservoir drainage at the least cost (Schlumberger 2013). A single production pad and several directionally drilled wells can develop larger subsurface areas, as compared to drilling multiple vertical wells to reach the same subsurface areas.

c. Production

Production facilities on the well site may include oil and gas processing facilities to remove some of the water produced with the petroleum, water and sewage treatment equipment, power generators, a drilling rig, and support buildings and housing for workers. Support facilities may include a production facility to receive and treat or transport the oil and gas to markets, refineries, or for shipment to other processing facilities in the lower 48 states and elsewhere. Other support facilities may include a supply base and a transportation system for cement, mud, water, food, and other necessary items.

Production operations for natural gas generally follow these steps:

- Natural gas flows through a high-pressure separator system where any liquids (water, condensate, etc.) are removed. Produced oil goes through a separator to remove the natural gas from the oil.
- Gas is compressed if necessary.
- Gas is dehydrated to lower its water content.
- Impurities are removed, if necessary.
- Gas is then metered, i.e. the amount of gas produced is measured.
- Gas is transported to a facility where it passes through a water precipitator to remove any liquid.
- Gas may be conditioned or treated prior to transportation. An example is the conversion of gas to liquefied natural gas.

Production operations steps for oil are:

- Produced crude oil goes through a separator to remove water and gas from the oil stream.
- Oil moves to a processing facility via a pipeline.
- Gas removed from the oil may be used to power production facilities or compressed and reinjected to keep the pressure up in the producing formation to assist in oil production.

4. Oil and Gas Storage Phase

Under AS 38.05.180(u), the Commissioner of DNR may authorize the subsurface storage of oil or gas to avoid waste or to promote conservation of natural resources. In Alaska, depleted reservoirs with established well control data are preferred storage zones. Subsurface storage must comply with all applicable local, state, and federal statutes and regulations, and with any terms imposed in the authorization or in any subsequent plan of operation approvals, or in the Alaska Oil and Gas Conservation Commission (AOGCC) Storage Injection Order.

A subsurface storage authorization allows the storage of gas and associated substances in the portions of the gas storage formation, subject to the terms and applicable statutes and regulations, including mitigation measures incorporated by reference into the authorization. It does not matter whether the gas is produced from state land, so long as storage occurs in land leased or subject to lease under AS 38.05.180. A gas lease on which storage is authorized shall be extended at least for the period of storage and so long thereafter as oil or gas not previously produced is produced in paying quantities. The feasibility of subsurface storage depends on favorable geological and engineering properties of the storage reservoir, including its size and its gas cushion (or base gas requirements). It also depends on access to transportation, pipeline infrastructure, existing production infrastructure, gas production sources, and delivery points.

DNR may amend a subsurface storage authorization if stored gas migrates from the gas storage formation to other formations or if stored gas expands beyond the limits of the authorized area. DO&G must be notified of any anticipated changes in the project resulting in alteration of conditions that were originally approved and further approval must be obtained before those changes are implemented.

The availability of subsurface storage horizons and gas storage facilities affect the technologies and preferred routes of transportation used for natural gas distribution.

Facilities for gas storage may be integral components of the natural gas transportation system. Cryogenic tanks are used to store liquefied natural gas. Gas condensate is stored between production and shipping in condensate storage tanks. Distances to market and the need to allocate supply at prescribed times of demand may justify the construction and operation of storage facilities along the distribution system route.

5. Transportation

Transportation is also a phase of oil and gas resource development. See the next section for further discussion.

E. Likely Methods of Transportation

AS 38.05.035(g)(1)(B)(iii) requires the director to consider and discuss the method or methods most likely to be used to transport oil or gas from an area, and the advantages, disadvantages, and relative risks of each. Transportation of oil or gas from the area would probably involve the construction of a pipeline transmission system.

Strategies used to transport potential oil and gas resources depend on many factors, most of which are unique to an individual discovery. The location and nature of oil and gas deposits determine the type and extent of facilities necessary to develop and transport the resource. DNR and other state, federal, and local agencies will review the specific transportation system when it is actually proposed. Modern oil and gas transportation systems may consist of pipelines, marine terminals with offshore loading platforms, trucks, and tank vessels. The location and nature of oil or gas deposits determine the type and extent of facilities needed to develop and transport the resource. Due to the limited road

system in the license area, the most likely method of transportation will include pipelines, marine terminals and tanker vessels.

If the license is eventually converted to leases, no oil or gas will be transported from the area until the lessee has obtained the necessary permits and authorizations from federal, state, and local governments. The state has broad authority to withhold, restrict, and condition its approval of transportation facilities. In addition, the federal and local governments may have jurisdiction over various aspects of any transportation alternative.

The mode of transport from a discovery will be an important factor in determining whether future discoveries can be economically produced – the more expensive a given transportation option is, the larger a discovery will have to be for economic viability.

1. Pipelines

One method of transporting oil is by pipeline. Pipelines may be onshore or offshore. Onshore pipelines may be buried or unburied. Buried pipelines, over which the ground is normally reseeded, are advantageous because they do not pose an obstacle to wildlife or result in scenic degradation. However, buried pipelines are more expensive to install and to maintain than unburied pipelines. This is especially true in regards to inspection, repair and maintenance (SPCO 2011). Spills may result from pipeline leaks in either buried or unburied pipelines, and leak detection systems play a primary role in reducing discharges of oil from either system. Elevated pipelines offer more ways to monitor the pipeline such as ground inspection, visual air inspections, ground-based infrared (IR) and airborne forward-looking infrared (FLIR) surveys. In-Line Inspection (ILI) can be used for both aboveground and belowground crossings, but is the only practical method for belowground installations. Mitigation measures in this finding are designed to mitigate potential releases from a pipeline. Pipelines must be buried where conditions allow and must be designed and constructed to assure integrity against climatic and geophysical hazards (SPCO 2011).

Offshore pipelines usually do not hinder water circulation and minimally affect fish and wildlife habitat. Weighted pipelines are used in areas where tidal currents are exceptionally strong. Marine arctic pipelines are usually trenched and buried (C-CORE 2008). This technique is advantageous because it may offer a way to avoid creating a navigational hazard, being damaged by ship anchors, by sea ice, or trapping fishing nets. In deeper water, weighted pipelines may be disadvantageous because they may become silted-in or self-buried. A disadvantage of sub-sea pipelines is that they are expensive to build and maintain. They can be difficult to monitor for leaks, defects, and corrosion problems, however significant advances have been made in recent years.

Sophisticated monitoring methods now available can overcome many disadvantages of subsea pipelines. Some of these include:

- volumetric flow measurement;
- pressure monitoring;
- pressure measurement with computational analysis;
- external oil detection;
- remote sensing;
- geophysical sensing techniques;
- pressure or proof testing;
- pipe integrity checking (i.e., smart pigging);
- visual inspection; and
- through-ice borehole sampling.

Many of these methods are considered to be proven technology while others are still under development (C-CORE 2008).

2. Marine Terminals

If oil or gas must be transported across marine waters by tanker, a marine terminal is necessary. Crude oil terminal facilities generally store quantities of oil equivalent to several large tanker loads. Therefore, a disadvantage of transporting oil or gas by tanker is the possibility for a very large spill at these facilities. A strong earthquake or other natural disaster could damage the facilities and initiate a large spill. The risk of explosion or sabotage at the facilities also exists. Accidental ballast discharge or loading or unloading accidents could also cause a spill. However, environmental risks can be minimized through improved design, construction, operating techniques and spill prevention measures.

The fixed location of loading facilities at marine terminals improves spill response and contingency planning. With constant staffing, leaks are easier to detect than with some pipelines. For example, the Valdez Marine Terminal is staffed 24 hours a day and its oil response crews are trained to conduct land and water response operations. Even though a spill from a tanker is the responsibility of the tanker owner, Alyeska Pipeline Service Company provides initial response. Spill prevention measures include (APSC 2011):

- training;
- extensive inspection programs;
- monitoring of transfer operations;
- facility security programs;
- use of proper valves and overfill alarms;
- secondary and tertiary containment systems around the tanks; and
- drug and alcohol testing of personnel.

3. Tank Vessels

Deep water ports are required for tanker operations; it is therefore anticipated that any future tanker operations associated with the license area would be located on the northeast side of the Iniskin Peninsula. A disadvantage for tankers is the potential for a large oil spill, although in recent years spills from pipelines outnumber those from tankers (Etkin 2009). Data also indicate that tanker spillage continues to decline despite an overall increase in oil trading (ITOPF 2012; Anderson et al. 2012).

Tankers are also used to transport natural gas. Liquefied natural gas (LNG) is methane that has been cooled to an extremely cold temperature (-260° F), where it becomes liquid. At standard atmospheric conditions, methane is a vapor. LNG is stored and transported exclusively at cryogenic temperatures, so it is maintained in a liquid state, facilitating storage and transportation. LNG should not be confused with NGL (Natural Gas liquid) or LPG (liquefied petroleum gas), which are transported at near ambient temperature.

4. Summary

The mode of transportation from a discovery will be an important factor in determining whether or not a discovery can be economically produced. The more expensive a given transportation option, the larger a discovery will have to be for economic viability. Oil and gas produced from the license area would likely be transported by a system of gathering lines, processing facilities, marine terminal, and tankers. If resources are discovered and developed, more detailed transportation options, such as exact routes, locations, and size of facilities, would need to be evaluated.

F. Regulating Pipelines

Jurisdictional authority over pipelines depends on many factors such as design, pipe diameter, product transported, whether it meets state or federal designation (e.g., transmission line, gathering

line, or distribution line), and other attributes as specified in regulations. Generally, the design, maintenance, and preservation of transmission pipelines transporting gas are under the authority and jurisdiction of the Pipeline and Hazardous Materials Safety Administration (PHMSA) and specific regulations for natural gas (49 CFR 192). Both regulations prescribe the minimum requirements that all operators must follow to ensure the safety of their pipelines and piping systems. The regulations not only set requirements, but also provide guidance on preventive and mitigation measures, establish time frames for upgrades and repairs, and incorporate other relevant information such as standards incorporated by reference developed by various industry consensus organizations.

Both state and federal agencies have oversight of pipelines in Alaska. State agencies include the Petroleum Systems Integrity Office (PSIO) and DO&G within DNR; the State Pipeline Coordinator's Office; and DEC. Federal agencies include the Pipeline and Hazardous Materials Safety Administration (PHMSA) within the U.S. Department of Transportation.

G. Oil Spill Risk, Prevention, and Response

1. Risk

DEC administers and enforces laws and regulations related to oil spill prevention and cleanup contingency plans. To ensure that a contingency plan is not required for a well, DEC requires AOGCC to make a determination that the exploration wells will not penetrate a formation capable of flowing oil to the ground surface (AS 46.04.050; AS 31.05.030(l)). If that determination cannot be made, the licensee is required to have an approved oil discharge prevention and contingency plan (C-Plan) and determination of financial responsibility prior to commencing operations.

Whenever hazardous substances are handled, there is a risk of a spill. Consequently, measures are imposed to mitigate the possibility of a spill.

2. Prevention

A well blowout can take place when high pressure gas is encountered in the well and sufficient precautions, such as increasing the weight of the drilling mud, are not effective. The result is that oil, gas or mud is suddenly and violently expelled from the well bore, followed by uncontrolled flow from the well. Blowout preventers, which immediately close off the open well to prevent or minimize any discharges, are required for all drilling and work-over rigs and are routinely inspected by AOGCC (AS 46.04.030). Blowout preventers greatly reduce the risk of a release. If a release occurs, however, the released gas will dissipate unless it is ignited by a spark. Ignition could result in a violent explosion. Released oil would likely precipitate in the vicinity of the well head.

Each well has a blowout prevention program developed before the well is drilled. Operators review bottom-hole pressure data from existing wells in the area and seismic data to learn what pressures might be expected in the well to be drilled. Engineers use this information to design a drilling mud program with sufficient hydrostatic head to overbalance the formation pressures from surface to the total depth of the well. They also design the casing strings to prevent various formation conditions from affecting well control performance.

Effective monitoring of pipelines is crucial and the technology for monitoring is continually improving. To ensure the efficient and safe operation of pipelines, operators are required to routinely inspect pipelines for corrosion and defects. This is done through the use of robotic devices known as "pigs" which are propelled down pipelines to evaluate the interior of the pipe. Pigs can test pipe thickness, roundness, check for signs of corrosion, detect minute leaks, and any other defect along the interior of the pipeline that may either impede the flow of oil or gas, or pose a potential safety risk for the operation of the pipeline. Pigs can be sent through the pipeline on a regular schedule to detect changes over time and give advance warning of any potential problems. The Trans-Alaska Pipeline

System operation has pioneered this effort for Arctic pipelines. The technique is now available for use worldwide and represents a major tool for use in preventing pipeline failures.

If pipelines are used in the development of the license area, operators would follow the appropriate American Petroleum Institute recommended practices. They would inspect the pipelines regularly to determine if any damage was occurring and would perform regular maintenance. Preventive maintenance includes installing improved cathodic protection, using corrosion inhibitors, and continuing regular visual inspections.

An integrity management plan is a documented and systematic approach to ensure the long-term integrity of an asset and a process for assessing and mitigating risks in an effort to reduce the likelihood and consequences of incidents. Basic requirements for an integrity management plan include:

- Periodic integrity assessment of pipelines that could affect high consequence areas. Integrity assessments are performed by in-line inspection (also referred to as "smart pigging"), hydrostatic pressure testing, or direct assessment. Through these assessment methods, potentially injurious pipeline defects that could eventually weaken the pipe, or even cause it to fail, are identified early and can be repaired. This significantly improves the pipe's integrity.
- Development and implementation of a set of safety management and analytical processes collectively referred to as an integrity management program. The purpose of the program is to assure pipeline operators have systematic, rigorous, and documented processes in place to protect high consequence areas.

3. Response

Response plans in relation to the sale area are included in the Alaska Federal/State Preparedness Plan for Response to Oil and Hazardous Substance Discharges/Releases (Unified Plan) and the Cook Inlet Subarea Contingency Plan (DEC 2010a, 2010b).

A Unified Command structure of the Incident Command System (ICS) is the basis for government response and organization in the State of Alaska. The Unified Command brings together the Federal On-Scene Coordinator (FOSC), the State On-Scene Coordinator (SOSC), and the Responsible Party's Incident Commander into one governing unit. If an immediate threat still exists to the health and safety of the local populace the Local On-Scene Coordinator (LOSC) will also be brought in (DEC 2010a, 2010b).

Response objectives include (DEC 2010a, 2010b):

- ensure safety of responders and the public;
- stop the source of the spill;
- deploy equipment to contain and recover the spilled product;
- protect sensitive areas (environmental, cultural, and human use);
- track the extent of the spill and identify impacted areas;
- cleanup contaminated areas and properly dispose of wastes;
- notify and update the public; and
- provide avenues for community involvement where appropriate.

Federal response action priorities/strategies general guidelines include (DEC 2010a, 2010b):

- safety of life;
- safety of vessel, facility and cargo;
- control sources of discharge;
- limit spread of pollution; and
- mitigate effects of pollution.

DEC, Division of Spill Prevention and Response is responsible for ensuring facilities prevent spills and take proper response actions when spills occur. One of their programs is the Prevention and Emergency Response Program (PERP). Its mission statement is as follows (DEC 2011):

> Protect public safety, public health and the environment by preventing and mitigating the effects of oil and hazardous substance releases and ensuring their cleanup through government planning and rapid response.

Because of statutory requirements, the State of Alaska implemented the following Response Objectives (DEC 2010a, 2010b, 2011):

- safety—ensure the safety of all persons involved in a response or exposed to the immediate effects of the incident;
- public health—ensure the protection of public health from the direct or indirect effects of contaminated drinking water, air or food;
- environment—ensure the protection of the environment, including natural and cultural resources, from the direct or indirect effects of contamination;
- cleanup—ensure adequate containment, control, cleanup and disposal by the responsible party, or take over the response when cleanup is judged inadequate;
- restoration—ensure the assessment of damages from contamination and the restoration of property, natural resources and the environment; and
- cost recovery—ensure the recovery of costs and penalties for reimbursement to the Oil and Hazardous Substance Release Prevention and Response Fund for use in Future emergency response actions.

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Chapter Seven: Governmental Powers to Regulate Oil and Gas

Table of Contents

Page

Chapter Seven: Governmental Powers to Regulate Oil and Gas

AS 38.05.035(g)(1)(B)(v) requires the director to consider and discuss the governmental powers to regulate the exploration, development, production, and transportation of oil and gas or gas only. All exploration license and subsequent lease activities — exploration, development and production, and transportation — are subject to federal, state, and local laws, regulations, ordinances, and policies with which the licensee must comply. An exploration license grants the licensee the right to explore, but does not allow it to do any physical work on the land itself. Should exploration proceed and prove successful, subsequent activities could include building new facilities and infrastructure, and extracting, removing, cleaning, processing and disposing of oil, gas and associated substances.

This chapter is not a comprehensive description of all of the laws and regulations that may apply to activities associated with exploration, development, production, and transportation. Rather, it provides a broad overview of the laws and regulations that pertain to oil and gas activities. Actual requirements and processes, terms, and conditions may vary. Regulatory agencies may have different roles in the oversight and regulation of oil and gas activities; although some agencies may have overlapping authorities. The licensee is responsible for knowing and complying with all applicable state, federal, and local laws, regulations, ordinances, and policies.

In addition to existing laws and regulations applicable to oil and gas activities, DO&G requires, under its standard license and lease contracts, that licenses and leases are subject to all applicable state and federal statutes and regulations in effect on the effective date of the license or lease. Licenses and leases are subject to all future laws and regulations in effect after the effective date of the license or lease to the full extent constitutionally permissible and are subject to any changes to the responsibilities of oversight agencies.

State of Alaska

A. Department of Natural Resources (DNR)

DNR has several agencies that approve, oversee, or coordinate activities related to oil and gas.

1. Plan of Operations Approval (DO&G)

Land use activities under the oil and gas exploration license are regulated under 11 AAC 83.158, 11 AAC 83.346, and the lease. They require the licensee to prepare plans of operations that must be approved by DO&G before the licensee begins work. Each plan of operations is site-specific and is tailored to the activity requiring the permit. DO&G may make field inspections to monitor and assess compliance.

When it considers a plan of operations, DO&G may require stipulations in addition to the mitigation measures developed through the written finding (11 AAC 83.158(e), 11 AAC 83.346(e)). These additional stipulations address site-specific concerns directly associated with the proposed project. The license stipulations are attached to the plan of operations approval and are binding on the licensee. The license also requires the licensee keep the license area open for inspection by authorized state officials. DNR, DEC, ADF&G, and AOGCC may monitor field activities for compliance with each agency's terms. In addition, each permittee must post a bond before beginning operations (11 AAC 83.160).

2. Geophysical Exploration Permit (DO&G)

A geophysical exploration permit is a land use permit issued by DO&G under 11 AAC 96.010. Seismic surveys related to oil and gas development are the most common activity authorized by this permit. Submission of seismic exploration and stratigraphic test data to the state is a permit condition (11 AAC 96.210). Under AS 38.05.035(a)(8)(C), geological and geophysical data are held confidential. If the seismic survey is part of an exploration well program, the permit will be reviewed as part of the exploration well permit package. The application must contain the following information in sufficient detail to allow evaluation of the planned activities' effects on the land:

(1) … a map at a sufficient scale showing the general location of all activities and routes of travel of all equipment for which a permit is required;

(2) a description of the proposed activity, any associated structures, and the type of equipment that will be used (11 AAC 96.030(a)).

DO&G may require security depending on the applicant's history of compliance and potential risk to the state (11 AAC 96.060).

A geophysical exploration permit is usually issued for a single survey season, but may be extended. If the permit is extended, the director may modify existing terms or add new ones. A permit remains in effect for the term issued, unless revoked sooner. A permit is revocable effective immediately for cause for (1) a violation of a permit provision or (2) a violation of 11 AAC 96. A permit is revocable at will if DO&G determines that revocation is in the state's interest. DO&G will give 30 days' notice before revoking a permit at will (11 AAC 96.040(a)).

3. Pipeline Rights-of-way

The State Pipeline Coordinator's Office (SPCO) administers the Alaska Right-of-Way Leasing Act process (AS 38.35.010). Most oil and gas transportation facilities within the license area or beyond its boundaries must be authorized by SPCO. As prescribed by AS 38.35.010, SPCO issues leases on state land for pipeline rights-of-way (SPCO 2014).

4. Alaska Petroleum Systems Integrity Office (PSIO)

PSIO is the lead state agency for oversight of facilities, equipment, and infrastructure for the sustained production and transportation of oil and natural gas resources in the state. PSIO was established in 2007 by executive order of the governor to:

(1) ensure that oil and gas infrastructure is designed and maintained in a safe and environmentally sound manner in compliance with state law;

(2) minimize economic impacts of unplanned interruptions in oil and gas production to the ongoing functions of state government;

(3) avoid premature abandonment of oil and gas infrastructure and waste of state resources; and

(4) ensure efficient and effective oversight of oil and gas industry practices by utilizing existing state government structures and processes to the maximum extent possible.

Through designated agency liaisons, PSIO leads interagency efforts to evaluate industry system integrity performance. Designated agencies, to the extent authorized by state regulations, require oil and gas producers and operators to provide comprehensive descriptions of current practices of quality control, quality assurance, monitoring, and inspection used to ensure the integrity and reliability of oil and natural gas facilities, equipment, infrastructure and activities.

The goal of PSIO is to provide a comprehensive and cost-effective approach to statewide oil and gas oversight activities, and to address any gaps in oversight. PSIO is tasked with ensuring that

overarching quality management programs are in place and followed, both within industry and involved state agencies. PSIO makes recommendations to the commissioner of DNR regarding gaps, findings, and issues that address the reliability and system integrity of oil and gas infrastructure (PSIO 2014).

Additionally, the PSIO Coordinator makes recommendations to the DNR commissioner regarding enforcement actions by DNR and cases to be referred to other state, local, or federal agencies for appropriate civil or criminal penalties available under the law (PSIO 2007).

5. Temporary Water Use Authorization (DMLW)

Exploration activities may require a temporary water use authorization. DMLW administers temporary water use authorizations as required under 11 AAC 93.035 before (1) the temporary use of a significant amount of water, (2) if the use continues for less than five consecutive years, and (3) the water applied for is not otherwise appropriated (DMLW 2014). The volume of water to be used and permitted depends upon whether it is for consumption or non-consumptive uses, and the duration of use. The authorization may be extended one time for good cause for a period of time not to exceed five years.

The authorization is subject to conditions including suspension or termination, considered necessary to protect the water rights of other persons or the public interest. Information on lake bathymetry, fish presence, and fish species may be required when winter water withdrawal is proposed to calculate the appropriate withdrawal limits.

6. Permit and Certificate to Appropriate Water (DMLW)

Industrial or commercial water use requires a Permit to Appropriate Water under 11 AAC 93.120. The permit is issued for a period of time consistent with the public interest and adequate to finish construction and establish full use of water. The maximum time period for this permit is five years, unless the applicant proves or the commissioner independently determines that a longer period is required. The commissioner may issue a permit subject to terms, conditions, restrictions, and limitations necessary to protect the rights of others, and the public interest. Under 11 AAC 93.120(e), permits are subject to conditions to protect fish and wildlife habitat, recreation, navigation, sanitation or water quality, prior appropriators, or any other purpose the department determines is in the public interest.

A Certificate of Appropriation will be issued under 11 AAC 93.130 if the permit holder:

(1) submits a statement of beneficial use stating that the means necessary for the taking of water have been developed and the permit holder is beneficially using the quantity of water to be certified, along with the required fee; and

(2) has substantially complied with all permit conditions.

7. Land Use Permits (DMLW)

DMLW issues land use permits and may require them for oil and gas activities unless the activities are approved under a plan of operations. Land use permits can be issued for periods up to five years depending on the activity.

In accordance with 11 AAC 96.025, a generally allowed use listed in 11 AAC 96.020 is subject to the following conditions:

(1) activities employing wheeled or tracked vehicles must be conducted in a manner that minimizes surface damage;

(2) vehicles must use existing roads and trails whenever possible;

(3) activities must be conducted in a manner that minimizes

(a) disturbance of vegetation, soil stability, or drainage systems;

(b) changing the character of, polluting, or introducing silt and sediment into streams, lakes, ponds, water holes, seeps, and marshes; and

(c) disturbance of fish and wildlife resources;

(4) cuts, fills, and other activities causing a disturbance listed in (3)(a) - (c) of this section must be repaired immediately, and corrective action must be undertaken as may be required by the department;

(5) trails and campsites must be kept clean; garbage and foreign debris must be removed; combustibles may be burned on site unless the department has closed the area to fires during the fire season;

(6) survey monuments, witness corners, reference monuments, mining location posts, homestead entry corner posts, and bearing trees must be protected against destruction, obliteration, and damage; any damaged or obliterated markers must be reestablished as required by the department under AS 34.65.020 and AS 34.65.040;

(7) every reasonable effort must be made to prevent, control, and suppress any fire in the operating area; uncontrolled fires must be immediately reported;

(8) holes, pits, and excavations must be repaired as soon as possible; holes, pits, and excavations necessary to verify discovery on prospecting sites, mining claims, or mining leasehold locations may be left open but must be maintained in a manner that protects public safety; and

(9) on lands subject to a mineral or land estate property interest, entry by a person other than the holder of a property interest, or the holder's authorized representative, must be made in a manner that prevents unnecessary or unreasonable interference with the rights of the holder of the property interest.

8. Material Sale Contract (DMLW)

If the operator proposes to use state-owned gravel or other materials for construction of pads and roads, DMLW requires a material sale contract (11 AAC 71). The contract must include, at a minimum, a description of the sale area; the volume of material to be removed from the sale area; the method of removal of the material; the bonds and deposits required of the purchaser; and the purchaser's liability under the contract. The material sale contract must also include the purchaser's site-specific operating requirements.

The contract must state the date upon which the severance or extraction of material under the contract is to be completed. A contract may be extended before its expiration if the DMLW director determines the delay in completing the contract is due to unforeseen events beyond the purchaser's control, or the extension is in the state's best interests.

In connection with a material sale, the DMLW director may require the purchaser to provide a performance bond that guarantees performance of the terms of the contract. If required, the bond amount will be based on the total value of the sale. The performance bond must remain in effect for the duration of the contract unless released in writing by the DMLW director.

9. Office of History and Archaeology (OHA)

OHA does the work of the State Historic Preservation Office (SHPO) (OHA 2014a). OHA follows the state's Historic Preservation Plan in maintaining the Alaska Heritage Resources Survey (AHRS), an inventory of all reported historic and prehistoric sites within the state. This inventory includes objects,

structures, buildings, sites, districts, and travel ways, with a general provision that they are over 50 years old. The fundamental use of the AHRS is to protect cultural resource sites from unwanted destruction (OHA 2014b). Before beginning a project, information regarding important cultural and historic sites should be obtained by contacting the OHA. The AHRS data sets are "restricted access documents" and specific site location data should not appear in final reports or distributed to others.

AS 41.35.010 states that it is the policy of the state to preserve and protect the historic, prehistoric, and archeological resources of Alaska from loss, desecration, and destruction so that the scientific, historic, and cultural heritage embodied in these resources may pass undiminished to future generations. Further, the historic, prehistoric, and archeological resources of the state are properly the subject of concerted and coordinated efforts exercised on behalf of the general welfare of the public in order that these resources may be located, preserved, studied, exhibited, and evaluated.

It is unlawful for a person to appropriate, excavate, remove, injure, or destroy, without a permit from the DNR commissioner, any historic, prehistoric, or archaeological resources of the state (AS 41.35.200(a)).

A person may be charged with criminal mischief in the third degree if a person knowingly:

(A) defaces, damages, or desecrates a cemetery or the contents of a cemetery or a tomb, grave or memorial regardless of whether the tomb, grave, or memorial is in a cemetery or whether the cemetery, tomb, grave, or memorial appears to be abandoned, lost, or neglected; and

(B) removes human remains or associated burial artifacts from a cemetery, tomb, grave, or memorial regardless of whether the cemetery, tomb, grave, or memorial appears to be abandoned, lost, or neglected (AS 11.46.482(a)(3)).

A person who is convicted of violating a provision of AS 41.35.010 –.240 is guilty of a class A misdemeanor. In addition to other penalties and remedies provided by law, a person who violates these provisions is subject to a maximum civil penalty of $100,000 for each violation.

B. Department of Environmental Conservation (DEC)

DEC has statutory responsibility to conserve, improve, and protect Alaska's natural resources and environment, by controlling air, land, and water pollution, and oil spill prevention and response. DEC implements and coordinates several federal regulatory programs in addition to state laws (DEC 2014a).

1. Interference with Salmon Spawning Permits

DEC is responsible for granting or denying permits for activities that interfere with salmon spawning streams and waters. If a person plans to obstruct, divert, or pollute waters of the state utilized by salmon in the propagation of the species, they must first apply for and obtain a permit before beginning any activities (AS 16.10.010).

Permits may be granted if DEC finds the purpose of the permit is to develop power, or obtain water for civic, domestic, irrigation, manufacturing, mining, or other purposes tending to develop the state's natural resources. The applicant may also be required to construct and maintain adequate fish ladders, fishways, or other means by which fish may pass over, around, or through the dam, obstruction, or diversion in the pursuit of spawning.

2. Air Quality Permits

DEC administers the federal Clean Air Act (42 USC 85 §§7401-7761q) and the state's air quality program under a federally-approved State Implementation Plan (AS 46.14; 18 AAC 50). Through this plan, federal requirements of the Clean Air Act are met including National Ambient Air Quality Standards (NAAQS), New Source Review (NSR), New Source Performance Standards (NSPS),

National Emission Standards for Hazardous Air Pollutants (NESHAP), and Prevention of Significant Deterioration (PSD). Additionally, DEC monitors air quality and compliance.

The NAAQS set limits on pollutants considered harmful to public health and the environment. Limits have been defined for principal pollutants, or criteria pollutants: carbon monoxide, lead, nitrogen dioxide, particulate matter (PM10), particulate matter (PM2.5), ozone, and sulfur dioxide. NSR, a permitting program required for new construction projects, ensures that air quality is not degraded by the new project, and that large new or modified industrial sources will be as clean as possible (EPA 2014a). NSPS are intended to promote use of the best air pollution control technologies available, and account for the cost of technology and any other non-air quality, health, and environmental impact and energy requirements (EPA 2014b). NESHAPs are set for air pollutants that are not covered by NAAQS, but that may be harmful (EPA 2014c). The standards are categorized by type of source, and require the maximum degree of reduction in emissions that is achievable, as determined by the EPA.

The two primary types of permits issued to meet these requirements are Title I Construction Permits and Title V Operation Permits (DEC 2014b). Permits specify what activities are allowed, what emission limits must be met, and may specify how the facility must be operated. Permits may contain monitoring, recordkeeping, and reporting requirements to ensure that the applicant meets the permit requirements (DEC 2014b).

a. Title I (NSR) Construction Permits

Title I permits incorporate air quality requirements for the PSD as well as other requirements of the Clean Air Act. This permit must be obtained before onsite construction can begin. Title I permits are required for projects that are new major sources for pollutants, or major modifications at existing sources. PSD requires installation of the "Best Available Control Technology (BACT)"; an air quality analysis; an additional impacts analysis; and public involvement (EPA 2014d).

The permitting process includes a pre-application meeting between the applicant and DEC, several DEC reviews, a Technical Analysis Report, and a 30-day public comment period, after which DEC may issue a final permit. The final permit includes a final Technical Analysis Report and response to comments. The process for a Title I process can take up to 3 years, depending on the amount of meteorological data collection required.

b. Title V Operations Permits

The federal Clean Air Act gives EPA authority to limit emissions from point sources (EPA 2014e). EPA regulations require facilities that emit certain pollutants or hazardous substances to obtain a permit to operate the facility, known as a Title V permit. In Alaska, DEC is responsible for issuing Title V permits and making compliance inspections (AS 46.14; 18 AAC 50; DEC 2012a). The permit establishes limits on the type and amount of emissions allowed, requirements for pollution control devices and prevention activities, and monitoring and record keeping requirements (DEC 2014b).

Operators have one year after beginning operations to submit their completed Title V permit application. Operations can continue while DEC processes the application. However, significant revisions to an existing permitted facility cannot be made until DEC approves the permit revision. Processing time for permit revisions can take up to six months. Title V permits and revisions can be processed concurrently with Title I permits.

c. Other Requirements

DEC also operates ambient air quality monitoring networks under the provisions of the Prevention of Significant Deterioration Program to assess compliance with the NAAQS for carbon monoxide, particulates, nitrogen dioxide, sulfur oxide, and lead; assesses ambient air quality for ambient air toxics level; provides technical assistance in developing monitoring plans for air monitoring projects; and issues air advisories to inform the public of hazardous air conditions (DEC 2014b).

Operators in Alaska are required to minimize the volume of gas released, burned, or permitted to escape into the air (20 AAC 25.235(c)). Operators must report monthly to AOGCC any flaring event lasting over an hour. AOGCC investigates these incidents to determine if there was unnecessary waste (AOGCC 2004).

3. Solid Waste Disposal Permit

DEC regulates solid waste storage, treatment, transportation, and disposal under 18 AAC 60. EPA administers the Resource Conservation and Recovery Act (RCRA) relating to hazardous wastes and Underground Injection Control (UIC) Class I injection wells. A different state agency, the AOGCC, regulates UIC Class II oil and gas waste management wells.

DEC requires a comprehensive disposal plan for all solid waste disposal facilities it regulates. Solid waste disposal permit applications are reviewed for compliance with air and water quality standards, wastewater disposal, and drinking water standards, and their consistency with the Alaska Historic Preservation Act before approval.

Non-drilling related solid waste must be disposed of in an approved municipal solid waste landfill (MSWLF). MSWLFs are regulated under 18 AAC 60.300 – .398. All other solid waste (except for hazardous materials) must be disposed of in an approved monofill (18 AAC 60.400 – .495).

Drilling waste disposal is specifically regulated under 18 AAC 60.430. Design and monitoring requirements for drilling waste disposal facilities are identified in 18 AAC 60.430(c) and (d).

All produced waters must be reinjected down well or treated to meet Alaska Water Quality Standards before discharge.

Hazardous substances to be disposed of have a separate permitting and review process by both DEC under 18 AAC 62 and 63 and the EPA.

4. Wastewater Disposal Permit

Domestic graywater must be disposed of properly at the surface, which requires a wastewater disposal permit (18 AAC 72). Monitoring records must be available for inspection, and a written report may be required upon completion of operations.

5. APDES Discharge Permits and Certification

DEC administers the Alaska Pollution Discharge Elimination System (APDES) program. This program regulates discharges of pollutants into U.S. waters by point sources, such as industrial and municipal facilities. Permits are designed to maximize treatment and minimize harmful effects of discharges.

APDES covers a broad range of pollutants, which are defined as “any type of industrial, municipal, and agricultural waste discharged into water” (18 AAC 83.990).

There are two basic types of APDES permits: general permits and individual permits. General permits cover multiple facilities that are similar. Individual permits are issued for a defined time period, not exceeding five years, and the facility must reapply for the permit before it expires.

6. Industry Oil Discharge Prevention and Contingency Plans

DEC regulates spill prevention and response under AS 46.04.030 (DEC 2014c). ADF&G and ADNR support DEC in these efforts by providing expertise and information. Contingency plans (C-plans) must be filed with DEC before beginning operations. DNR reviews and comments to DEC regarding the adequacy of these C-plans (DEC 2014d).

C-plans for exploration facilities must include a description of methods for responding to and controlling blowouts, the location and identification of oil spill cleanup equipment, the location and availability of suitable drilling equipment, and an operations plan to mobilize and drill a relief well. Holders of approved plans are required to have sufficient oil discharge containment, storage, transfer, cleanup equipment, personnel, and resources to meet the response planning standards for the particular type of facility, pipeline, tank vessel, or oil barge (AS 46.04.030(k)). If development and production follow, additional contingency plans must be filed for each facility before activity commences.

Discharges of oil or hazardous substances must be reported to DEC recording the volume released, whether the release is to land or to water, and whether the release has been contained by a secondary containment or structure. The discharge must be cleaned up to DEC's satisfaction. DEC will modify proposed cleanup techniques or require additional cleanup techniques for the site as DEC determines to be necessary to protect human health, safety, and welfare, and the environment (18 AAC 75.335(d)).

C-plans must describe existing and proposed means of oil discharge detection, including surveillance schedules, leak detection, observation wells, monitoring systems, and spill-detection instrumentation (AS 46.04.030; 18 AAC 75.425(e)(2)(E)). C-plans must include a Response Action Plan, a Prevention Plan, and Supplemental Information to support the response plan including a Best Available Technology Section (18 AAC 75.425). Operators must also provide proof of financial ability to respond in damages (AS 46.04.040).

C. Alaska Department of Fish and Game (ADF&G)

1. Fish Habitat Permit

Under AS 16.05.871(b) a fish habitat permit is required before performing any work that would affect an anadromous fish stream, including operating vehicles or equipment in the stream bed, or using, diverting, obstructing, polluting or changing the natural flow or bed of an anadromous river, lake or stream. Under AS 16.05.841, a permit is required to ensure that any stream frequented by any fish is not obstructed in any way that would block fish passage.

2. Hazing Permit

Under AS 16.05.920, a permit to haze that may include the actual taking of some species may be issued for public safety or spill response.

3. Special Area Permit

Any land or water use activities in a special area that may impact fish, wildlife, habitats, or existing public use may require a permit (5 AAC 95.420) (ADF&G 2013). Special areas are described as refuges, sanctuaries, or critical habitat areas.

D. Alaska Oil and Gas Conservation Commission (AOGCC)

The Alaska Oil and Gas Conservation Commission (AOGCC) was established by the Alaska Oil and Gas Conservation Act (AS 31.05) to prevent waste, protect correlative rights, improve ultimate recovery, and protect underground freshwater.

Among its other duties, AOGCC issues permits and orders, and administers the UIC Program for the State of Alaska as the delegated authority of the federal Safe Drinking Water Act.

1. Permit to Drill

A permit to drill a well from AOGCC is often the last step in the overall approval process, and usually occurs after all of the other concerned agencies have given their approval. The application must be accompanied by the items set out in 20 AAC 25.005(c).

AOGCC will notify the applicant if there are any deficiencies in the application. The operator will either supplement the original application with revised or additional information, or, in the event that substantive changes are needed, resubmit the entire application (AOGCC 2014).

2. Underground Injection Control Program (UIC)

AOGCC regulates Class II wells in Alaska through a Memorandum of Understanding with the EPA. The goal of the UIC program is to protect underground sources of drinking water from contamination by oil and gas (Class II) injection activities. The three types of Class II wells include oilfield waste disposal wells, enhanced oil recovery (EOR) wells, and hydrocarbon storage wells. AOGCC reviews and takes appropriate action on proposals for the underground disposal of Class II oil field wastes (20 AAC 25.252). Before receiving an approval, an operator must demonstrate that injected fluids will not move into freshwater sources. Disposal or storage wells must be cased and the casing cemented in a manner that will isolate the disposal or storage zone and protect oil, gas, and freshwater sources (AOGCC 2014).

Once approved, liquid waste from drilling operations may be injected through a dedicated tubing string into the approved subsurface zone. The pumping of drilling wastes through the annular space of a well is an operation incidental to drilling of the well, and is not a disposal operation subject to regulation as a Class II well.

3. Annular Disposal of Drilling Waste

An AOGCC permit is required if waste fluid is to be injected into a well annulus. The material must be muds and cuttings incidental to the drilling of a well. AOGCC considers the volume, depth, and other physical and chemical characteristics of the formation designated to receive the waste. Annular disposal is not permitted into water bearing zones where dissolved solids or salinity concentrations fall below predetermined threshold limits. Waste not generated from a hydrocarbon reservoir cannot be injected into a reservoir (AOGCC 2014)

4. Disposal Injection Orders

Operators may apply for disposal injection orders to dispose of waste in individual wells. After the public review process and AOGCC analysis, an order may be issued that approves the proposed disposal project (AOGCC 2014).

5. Area Injection Orders

Injection orders may be issued on an area basis rather than for individual wells in areas where greater activity is anticipated. Area injection orders describe, evaluate, and approve subsurface injection on an area wide basis for enhanced oil recovery and disposal purposes (AOGCC 2014).

E. Department of Labor and Workforce Development (DOLWD)

The Alaska Department of Labor and Workforce Development (DOLWD) administers the Alaska Employment Security Act under AS 23.30 and 8 AAC 85.

DOLWD also administers some delegated authorities of the Occupational Safety and Health Administration (OSHA), PL-91-596, 1970. Section 18 of the law, State Jurisdiction and State Plans, allows states to obtain approval to assume responsibility for development and enforcement of federal occupational safety and health standards. DOLWD has obtained approval from OSHA for administration of some of the federal OSHA standards (OSHA 2014; DOLWD 2014).

Federal

F. Environmental Protection Agency (EPA)

The U.S. Environmental Protection Agency (EPA) implements, administers, or oversees programs and federal environmental regulations. These programs, some of which are delegated to the states, safeguard the air, land, and water.

1. Air Quality Permits

DEC administers the federal Clean Air Act and the air quality program for the State of Alaska under a federally-approved State Implementation Plan (see Section B2) (EPA 2014f).

2. Hazardous Waste (RCRA) Permits

The federal Resource Conservation and Recovery Act (RCRA) regulates the management of solid waste, hazardous waste, and underground storage tanks holding petroleum products or certain chemicals. Regulations set the parameters for transporting, storing, and disposing of hazardous wastes and for designing and operating treatment, storage, and disposal facilities safely. Regulations are enforced through inspections, monitoring of waste handlers, taking legal action for noncompliance, and providing compliance incentives and assistance (EPA 2014g).

Some states may receive authorization to administer parts of the program, which requires the state standards be at least as strict as federal standards. EPA administers the RCRA program in Alaska.

3. NPDES Discharge Permit

DEC administers this EPA program, now titled APDES (see Section B(5)). Permits specify the type and amount of pollutant, and include monitoring and reporting requirements, so that discharges do not harm water quality and human health.

4. Underground Injection Control (UIC) Class I and II Injection Well Permits

EPA regulates injection wells used to dispose of fluid pumped into the well. Authorized as part of the federal Safe Drinking Water Act of 1974, EPA's UIC program protects underground sources of drinking water from being contaminated by the waste injected in the wells. Injection wells are categorized into five classes; Classes I and II are most common in the oil and gas industry. EPA administers the program for Class I wells in Alaska, and authority for Class II oil and gas wells has been delegated to AOGCC (see Section D(2)).

All injections falling into Class I must be authorized through EPA's UIC Class I program. Class I wells must operate under a permit that is valid for up to 10 years. Permits stipulate requirements such as siting, construction, operation, monitoring and testing, reporting and record keeping, and closure. Requirements differ for wells depending on whether they accept hazardous or non-hazardous wastes.

G. U.S. Army Corps of Engineers (COE)

The COE has regulatory authority over construction, excavation, or deposition of materials in, over, or under navigable waters of the United States, or any work which would affect the course, location, condition, or capacity of those waters (Rivers and Harbors Acts of 1890 [superseded] and 1899 [33 USC 401, et seq.; Section 10 [33 USC 403; COE 2014). Section 10 permits cover oil and gas activities, including exploration drilling from jack-up drill rigs and installation of production platforms.

Section 404 of the Clean Water Act regulates discharge of dredged and fill material into United States waters and wetlands. This program is administered by COE, which is authorized to issue Section 404 permits for discharging dredge and fill materials.

Permits issued for specific projects are the basic type of permit issued. General permits (including programmatic, nationwide, and regional general permits) authorize activities that are minor and will result in minimal individual and cumulative adverse effects. General permits carry a standard set of stipulations and mitigation measures. Letters of permission, another type of project authorization, are used when the proposed project will not have significant individual or cumulative environmental impact, and appreciable opposition is not expected (COE 2014).

Section 404 and Section 10 permits follow a similar three-step review process: pre-application consultation (for major projects), formal project review, and decision making.

In making a final decision on whether to issue a permit, COE considers conservation, economics, aesthetics, wetlands, cultural values, navigation, fish and wildlife values, water supply, water quality, and other factors judged important to the needs and welfare of the people (COE 2014).

The process for letters of permission is shorter. In this situation, the proposal is coordinated with fish and wildlife agencies and adjacent property owners who might be affected by the project, but the public is not notified (COE 2014).

DEC reviews Section 404 and 10 permit applications for compliance with Alaska water quality standards. If the applications comply, DEC approves the permit.

Permits may also be reviewed by other agencies, such as USFWS and NMFS, to ensure compliance with the Endangered Species Act, the National Environmental Policy Act, and Essential Fish Habitat Provisions of the Magnuson-Stevens Act.

H. Pipeline and Hazardous Materials Safety Administration (PHMSA)

The Federal Office of Pipeline Safety (OPS) in the Pipeline and Hazardous Materials Safety Administration (PHMSA), an agency of the U.S. Department of Transportation regulates movement of hazardous materials by pipeline (PHMSA 2014a). Federal PHMSA inspectors review technical issues on hazardous liquid pipelines in Alaska (PHMSA 2014b). The Pipeline Inspection, Protection, Enforcement, and Safety Act of 2006 requires hazardous liquid pipeline operators to develop integrity management programs for transmission pipelines.

I. Fish and Wildlife Service (USFWS)

USFWS is a part of the Department of the Interior and dedicated to the conservation of natural resources. It has management authority for migratory birds, some threatened and endangered species, the national wildlife refuge system, and on lands under their jurisdiction, landscape conservation and aquatic resources (USFWS 2014a). USFWS issues permits related to migratory birds and endangered species, with the goal of managing risks and benefits of projects by using best available science and expertise. Permits may authorize activities consistent with conservation, protection and enhancement of wildlife, plants, and their habitats (USFWS 2014b).

J. National Marine Fisheries Service

The National Marine Fisheries Service (NMFS) is a division of the National Oceanic and Atmospheric Administration within the Department of Commerce. It is the federal agency responsible for the management, conservation, and protection of living marine resources within the United States' Exclusive Economic Zone (3-200 miles offshore). Under the Marine Mammals Protection Act and the

Endangered Species Act, NMFS works to help protected marine species stocks recover. Under the Magnuson-Sevens Act NMFS assesses and predicts the status of fish stocks, and ensures compliance with fisheries regulations (NMFS 2014).

K. U.S. Coast Guard

The U.S. Coast Guard has authority to regulate offshore oil pollution under 33 CFR §§153-157 and to make a determination of a hazard to navigation under 33 CFR §64.31.

L. Regulations of Oil Spill Prevention and Response

Section 105 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (42 USC §9605), and §311(c)(2) of the Clean Water Act, as amended (33 USC §1321(c)(2)) require environmental protection from oil spills. CERCLA and the Clean Water Act require a National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR §300; 33 USC §1321(d)). Under these regulations, the violator must plan to prevent and immediately respond to oil and hazardous substance spills and be financially liable for any spill cleanup. If the pre-designated Federal On-Scene Coordinator (FOSC) determines that the response is neither timely nor adequate, the federal government will respond to the spill, and then seek to recover cleanup costs from the responsible party.

The Oil Pollution Act of 1990 (OPA 1990) requires the development of facility and tank vessel response plans and an area-level planning and coordination structure to coordinate federal, regional, and local government planning efforts with the industry. OPA 1990 amended the Clean Water Act (§311(j)(4); 33 USC §1231(j)) and established regional citizen advisory councils (RCACs) and area contingency plans as the main parts of the national response planning structure.

The Alaska Regional Response Team (ARRT) is an advisory board to the FOSC. It provides processes for participation by federal, state and local governmental agencies to participate in response to pollution incidents (DEC 2010). The Unified Plan is the area contingency plan for Alaska. Since Alaska is so large and geographically diverse, the federal agencies have found it necessary to prepare subarea contingency plans.

M. Alaska National Interest Lands Conservation Act (ANILCA) Title VIII. Section 811

ANILCA ensures that rural residents engaged in subsistence uses shall have reasonable access to subsistence resources on public land.

N. Native Allotments

Licensees must comply with applicable federal law concerning Native allotments. Activities proposed in a plan of operations must not unreasonably diminish the use and enjoyment of lands within a Native allotment. Before entering lands subject to a pending or approved Native allotment, licensees must contact the Bureau of Indian Affairs (BIA) and the Bureau of Land Management (BLM) and obtain approval to enter.

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Chapter Eight: Reasonably Foreseeable, Cumulative Effects of Licensing and Exploration

Table of Contents

Chapter Eight: Reasonably Foreseeable, Cumulative Effects of Licensing and Exploration

A. Introduction

This chapter considers and discusses reasonably foreseeable effects that the license and subsequent activities could have on habitats, fish and wildlife populations, and their uses of the license area, and potential effects on historic and cultural resources, fiscal effects, and effects on local communities as required by AS 38.05.035(g).

The director has limited the scope to considering and discussing those effects on the important subsistence, sport, commercial species, and uses of the license area described in Chapters Four and Five (AS 38.05.035(e)(1)(B)). As explained in Chapter Two, the director has limited the administrative review for this exploration license to the disposal and exploration phases, and has limited the scope of review to significant effects, meaning known or noticeable impact on or within a reasonable proximity to the license area. Although the license issuance itself is not expected to have any effects other than to provide initial revenue to the state, nearly 100 years of science and research demonstrate the potential cumulative effects that could occur in the license area as a result of subsequent activity. As a result these effects are considered and discussed below, as required by AS 38.05.035(g). Also included in the scope of review are concerns raised in public comments on the license application (AS 38.05.035(g)(1)(A)). In addition to being addressed in this chapter, specific responses to the comments are provided in Appendix A.

AS 38.05.035(h) specifies that speculation about possible future effects is not required. However, a large body of research on the effects of oil and gas exploration, development, and transportation is available to the director, much of which is applicable to the license area. In particular, many studies are available on the effects of oil and gas development for arctic and northern marine habitats, fish, and wildlife, as well as concerning industrial development in boreal forests of Canada. Although the license area may differ from these areas in some respects, the license area shares much in common with these environments, thus much of this body of knowledge is applicable to the license area.

To facilitate a discussion of the potential cumulative nature of effects, this chapter is organized around terrestrial ecosystems, freshwater ecosystems, and the marine environment. Within these broad ecosystems, effects are considered and discussed within general categories of potential oil and gas activities because a certain activity could result in effects across multiple habitats, species, and uses. The protections offered by mitigation measures are discussed as well (AS 38.05.035(g)(vii)).

B. Terrestrial Habitats, Wildlife and Birds

This section considers and discusses potential cumulative effects on terrestrial habitats, wildlife, and birds.

1. Potential Activities and Cumulative Effects

a. Construction and Other General Activities

In arctic environments, the largest effects of oil and gas activities are from physical disturbances (Huntington 2007). During the initial exploration phases, disturbances caused by cross-country travel and construction are the most significant (Hanley et al. 1983). Other activities that may induce impacts include installation of pile foundations, construction of gravel roads, and general terrain

disturbance (Hanley et al. 1981). Most impacts are likely to occur during development and production. Oil field development and pipeline construction disturbances may be the most significant (Hanley et al. 1983).

Habitat fragmentation may occur, which may impact biological diversity (Spellerberg and Morrison 1998). Direct loss of habitat, degradation of habitat quality, degradation of water quality, habitat fragmentation, and reduced access to vital wildlife habitats may result with the building and maintenance of roads, trails, highways, and railways. Fish and wildlife may avoid these areas. Fish and wildlife may experience increased exploitation by humans, the splitting and isolation of populations, and disruption in their social structure and the processes that maintain regional populations (ADF&G 2006 citing Jackson 2000). Invasive species may also displace native species as roads can act as travel conduits (ADF&G 2006).

Land surface disturbances may change and destroy vegetation, and alter soil characteristics. Types of land surface disturbances may include vegetation clearing, slash disposal, altered soil characteristics, hydraulic erosion, altered surface hydrology, above ground obstructions and filled areas (Hanley et al. 1983). Construction activities relating to petroleum extraction can cause impacts from the following: off-road transportation; road, pad and airstrip construction; pile foundations; below-ground pipelines; and terrain disturbance (Hanley et al. 1981).

Some effects of constructing production pads, roads, and pipelines may include direct loss of habitat acreage due to gravel infilling, and loss of dry tundra habitat due to entrainment and diversion of water. Construction of roads and gravel pads can interrupt surface water sheet flow and stream flows (NRC 2003). Prior identification of sensitive areas can support the construction of infrastructure away from sensitive habitats. A study of the impacts to habitats from the construction of the Trans-Alaska Pipeline System found that the greatest percentage loss of habitat was from gravel material sites used for construction materials, with the work pad areas and road construction causing the next greatest habitat loss percentages (Pamplin 1979). A secondary effect of construction activities includes dust deposition, which may reduce photosynthesis and plant growth (McKendrick 2000).

The effects upon the ecosystems impacted by roads include potential chemical input from roads to water bodies and to the airshed, and bioaccumulation in soils. Roads can impact fluvial dynamics, sediment transport and floodplain ecology. When roads alter habitats, plant species can be changed or removed, and nonnative plants can be introduced. Additional wildlife habitat impacts from roads can change the density, composition of animal species and populations (NRC 2003).

Road construction, vehicular passage, and oil spills can alter surface albedo (reflectivity of sunlight off the earth's surface) or water drainage patterns, resulting in thaw and subsidence or inundation. Such changes can affect regeneration and revegetation of certain plant species, and species composition may also change after disturbance from construction activities (Linkins et al. 1984).

The effects of roads can also include physical disturbance, habitat loss or fragmentation, and threatening of populations and species near the road edge, mortality of wildlife on roads, the use of road edges as habitat, and dispersal of wildlife along road networks (Spellerberg and Morrison 1998). Human use of land with denning sites can force animals to move (Eberhardt 1977). A study of the effects of roads on brown bears in British Columbia and Montana found that bears used areas within 100 m of roads significantly less than areas farther from the roads, but this behavior change did not translate into a demonstrable effect on the population (McLellan and Shackleton 1988). A study of the frequency and distribution of highway crossings by brown bears on the Kenai Peninsula found that highways affected brown bear travel patterns (Graves et al. 2006).

The presence of linear pipelines may affect moose habitats, causing disruption in migration movements. A study of the effect of the Trans-Alaska pipeline on moose habitats suggested that moose are physically prevented from crossing under pipe structures that are less than 4 ft above ground

level (Van Ballenberghe 1978). During shallow snow conditions about 60% of all moose crossings occurred when distances were 6 to 8 ft high. Three-quarters of all crossings occurred where the pipe was 8 ft or less above ground, and more than 90% used crossing locations that were less than 10 ft high. Open ditches of 10 ft or more in depth deflected moose migration (Van Ballenberghe 1978).

b. Aircraft Activity

Effects of aircraft traffic on birds have been studied for several species, locations, and types of aircraft with varying results. Studies regarding the impact of low altitude overflights by helicopter or other aircraft traffic can adversely affect birds by causing stress and the flushing of habitats and nests (Rojek et al. 2007). Research relating to aircraft disturbances of common murres along the California coast showed that aircraft noise and the presence of aircraft flying below 1,000 ft altitude caused head-bobbing behavior or flushing of part or all of a bird colony (Rojek et al. 2007). Helicopters can cause more disturbances due to their low altitude capabilities (Rojek et al. 2007). Flushing and displacing adults and/or broods from preferred habitats during prenesting, nesting, and brood rearing and migration can cause disruption of courtship, chick loss, egg breakage, and predation by predators (Rojek et al. 2007).

An older study evaluated the impacts of helicopters to moulting sea ducks on Herschel Island, Canada. This study found that helicopter disturbances at 100 m height had an immediate impact, but that bird behavior showed no lasting effects. Helicopter disturbances did not drive birds from the habitat, and helicopter overflights at 300 m did not affect bird behavior (Ward and Sharp 1974).

In a four-tear study, Ward et al. (1999) observed the effects of aircraft overflights on Pacific brant and Canada geese in Izembek Lagoon, located just west of the license area on the west side of the Alaska Peninsula. The findings showed that 75% of the Pacific brant and 9% of the Canada geese flew in response to overflights. The Pacific brant were more reactive to helicopter rotary wing aircraft (51%) and louder aircraft (49%), as compared to fixed-wing (33%) and low-noise aircraft (40%). The Canada geese were more reactive to helicopter rotary wing aircraft (41%) and louder aircraft (43%), as compared to fixed-wing (20%) and low-noise aircraft (31%) (Ward et al. 1999). The greatest response was to flights at intermediate altitudes of about 1,000 to 2,300 ft. Lateral distance from the birds was also a critical factor in determining the amount of disturbance to the birds (Ward et al. 1999). Although this study provides a great deal of behavioral detail, it shows that because responses to aircraft are influenced by many variables, it is difficult to generalize responses to noise disturbance across species (Wyle 2008).

Larned et al. (1997) found contrasting results about bird impacts from helicopters compared to fixed wing aircraft. They found that eiders tolerated close passes by helicopters at 150 m with mild alarm responses, while fixed wing aircraft caused the entire flock to leave with approaches within 150 to 200 m (Larned et al. 1997).

c. Wildlife and Human Interaction

Also of concern to wildlife managers is the potential for increased interactions of animals with humans. Of particular concern is bear-human interactions and potential subsequent high non-hunting mortality of bears resulting from those interactions (Suring and Del Frate 2002). The proper management of wastes and landfills may reduce availability of anthropogenic foods to the bear population (Shideler and Hechtel 2000). If food is present, human activity serves as an attractive nuisance, attracting foraging bears, especially to refuse disposal areas. This may pose a threat to human safety and the potential need to remove animals that pose a risk to humans (NRC 2003). Foxes readily habituate to human activity, and this can lead to human-animal encounters, the foxes' use of human structures, and attraction to human food sources. Foxes are especially attracted to human activity because of potential scavenging sources (Burgess 2000, citing to Wrigley and Hatch 1976; Eberhardt 1977).

Tundra swan habitats in or near oil fields have experienced some human impacts and habitat loss due to the construction of gravel roads, pads, material sites and other permanent infrastructure (Ritchie and King 2000). The selection of nesting habitat has been more important than oil field facility avoidance (Ritchie and King 2000). Road noise and human presence, including pedestrians, on roads have caused some swans to nest farther from the road than they had previously (>100 to 200 m) (Ritchie and King 2000, citing to Murphy and Anderson 1993). Although these studies only addressed tundra swans, the studies may be applicable to trumpeter swans, which inhabit the license area.

d. Land-Based Seismic Surveys

Clearing operations to prepare seismic lines, and explosions that occur during seismic surveys may disturb wildlife. Birds and wildlife are particularly sensitive during nesting and calving periods (Schneider 2002). Repeated disturbances can result in increased movement rates of wildlife and subsequent significant energy losses, which can be particularly problematic during winter when food supplies may be scarce (Schneider 2002). However, one study found that, with the exception of ovenbirds, abundance of 41 species of songbirds, and location and size of their territories, were unaffected by seismic lines in boreal forests of the Northwest Territories (Machtans 2006). Seismic activity that occurs in winter may disturb denning bears. Studies have found that radio-collared bears in their dens were affected by seismic activities within 1.2 mi of their dens, demonstrated by an increased heart rate and greater movement within the den. However, no negative effect, such as den abandonment, was documented (Reynolds et al. 1986).

Winter seismic surveys can affect tundra vegetation, depending on snow depth, vehicle type, traffic pattern, and vegetation type. Soil-water content, and the freezing and thawing cycles impact soil strength. Water that freezes in the soils impedes the movement of soil particles. In contrast, low soil-water content does not increase soil strength (Lilly et al. 2008).

Effects from seismic surveys during any season could be substantial if operations are conducted improperly. Vehicles can leave visible tracks in the tundra, but they should disappear with the recovery of the vegetation within a few years, especially in moist or wet vegetation areas. Damage was observed to shrubs, forbs and tussocks. More significant impacts were observed on higher, drier sites, with little to no evidence of damage observed in wetlands (Guyer and Keating 2005).

Traditional seismic lines may leave a long-lasting footprint in boreal forests. However, surveys now use global satellite positioning instruments, making the past practice of long clear-cuts through forests for line-of-sight measurements unnecessary. Plant communities on seismic lines have been found to be significantly different from adjoining forests, and seismic lines showed little change for up to 30 years (MacFarlane 2003). The slow recovery rate may be due to factors such as damage to root systems by bulldozers and competition from grass species. Heavy equipment may result in soil compaction and erosion, and cratering may occur from improperly filled shot holes. Increased access for all-terrain vehicles, snow machines, and off-road trucks, and continued use of the lines by these vehicles may also contribute to extended recovery times (Schneider 2002). Studies have shown that low impact lines do not recover any faster, and the length of time for natural plant communities to be restored on low impact lines is unknown (MacFarlane 2003). Bog habitats that have been disturbed may take many years to return to their pre-disturbance state naturally (ADF&G 2006).

Loss of forest habitat that occurs when seismic lines are cleared is magnified by fragmentation. This reduces the usefulness of the habitat, and may lead to avoidance of intact habitat in the area of the seismic lines by some species (Schneider 2002). Habitat fragmentation, which could create “island populations”, displacement, reduction of habitat quality, and potential increased frequency of high energy-cost flight responses have been identified as a concern for some brown bear populations (ADF&G 2000).

Seismic lines may alter predator-prey interactions. In boreal forests, radio-collared wolves were observed significantly closer to linear corridors, and they traveled faster along linear seismic corridors than in the forest. Travel speed was unrelated to whether the seismic line was packed or unpacked, so it is suspected that the visual stimulus of a long distance influences wolves to stay and follow the corridor when they intersect it (James 1999).

e. Discharges from Exploration, Development, and Production

Discharges from exploration, development, and production may be intentional, such as permitted discharges regulated by the NPDES, or unintentional, such as gas blowouts, leakages, and spills. Excluding oil spills, activities related to oil and gas exploration, development, and production are minor contributors of petroleum hydrocarbons to the environment (Huntington 2007).

i. Gas Blowouts

During drilling, shallow gas pockets of natural gas may be encountered. Gas can get trapped in soils, water, and ice in permafrost environments. Sediments in which gas has accumulated are potential hazards for drilling that penetrates them (Hyndman and Dallimore 2001).

Explosions and resultant fires may occur during a natural gas blowout. Gas vapors from an explosion are lighter than air and may migrate downwind where they are readily dispersed. Blowouts occur only if hydrogen sulfide is present and can also cause a toxic cloud to accumulate at shallow depths. Condensates, a low-density mixture of hydrocarbon liquids present in raw natural gas, which did not burn in the blowout would be hazardous to any organisms exposed to high concentrations (Kraus 2011).

ii. Hazardous Spills

Hazardous spills can have toxic effects on vegetation, soils, wildlife, birds and fish. Effects of spills depend on time of year, vegetation, and terrain. Oil spilled on the tundra would migrate both horizontally and vertically. The characteristics of the soil, such as porosity, permeability, texture, degree of water saturation and organic matter content, would affect substance movement (Jorgenson and Cater 1996).

If oil penetrates the soil layers and remains in the plant root zone, longer-term effects, such as mortality or reduced regeneration, would occur in following seasons (Linkins et al. 1984). Hydrogen degrading bacteria and fungi can act as decomposers of organic material, and under the right conditions can assist in the breakdown of hydrocarbons in soils. Natural or induced bioremediation using microorganisms can also occur (Linkins et al. 1984; Jorgenson and Cater 1996). Natural recovery in wet habitats may occur in time durations of 10 years or less, if aided by cleanup activities and additions of fertilizer (McKendrick 2000).

The long term effects of oil may persist in the sediments for many years. Shifting population structure, species abundance, diversity and distribution can be long term effects, especially in areas that are sheltered from weathering processes (USFWS 2004).

Oil leaks or spills in boreal forests can have a range of potential effects, including killing plants directly, slowing growth of plants, inhibiting seed germination, and creating conditions in which plants cannot receive adequate nutrition. Although a single addition of petroleum hydrocarbons does not appear to limit microbial communities in the long term, species richness often decreases (Robertson et al. 2007).

At low concentrations, petroleum hydrocarbons can stimulate plant growth (Robertson et al. 2007). Heterotrophic bacteria and fungi in most natural microbial communities apparently have an inherent ability to degrade organic pollutants, and usually, biological processes eventually degrade or transform

most organic compounds. Although mycorrhizal ecosystems may be harmed by oil spills or leaks, they are also used for bioremediation (Robertson et al. 2007).

Oil may cause harm to wildlife through physical contact, ingestion, inhalation and absorption. As food sources are impacted by oil, larger animals, fish, mammals and humans can in turn be affected (USFWS 2004). Impacts to birds from oil releases may foul plumage and destroy insulation value, and resultant loss of buoyancy or hypothermia can kill birds (Burger and Fry 1993). While cleaning plumage, birds can ingest or inhale the oil, causing damage to lungs, liver, kidneys and death. Non-lethal effects to birds can include impaired reproduction or suppression of the immune system (USFWS 2004). Individual animals in the immediate vicinity and the associated nearby habitat and food sources may be impacted. Wildlife species may be disturbed or displaced. Additional efforts may need to divert wildlife from access to the impacted area.

Oil weathers over time, and organisms may be able to tolerate the presence of oil while it is naturally degrading (Jorgenson and Cater 1996).

iii. Releases of Drilling Muds and Produced Water

Common drilling fluids contain water, clay, and chemical foam polymers. Drilling additives may include petroleum or other organic compounds to modify fluid characteristics during drilling. The down-hole injection of drilling muds and cuttings are unimportant if they are not placed into a subsurface drinking water aquifer (NRC 2003). Waters and drilling muds produced and discharged during oil and gas production activities may contain toxic levels of heavy metals, radioactive particles, and brine and persist for longer periods of time.

When these production waters are discharged to land they can be more devastating to plants and animals than crude oil. Where they are discharged into marine waters, the toxic components are distributed differently than oil which floats to the surface (LaRoche and Associates 2011). They may have acute effects on the sea floor flora and fauna, reducing both their abundance and diversity in the immediate area of discharge (Arctic Council 2009). The technique of injecting mud and cutting disposal has greatly reduced the potential adverse impacts caused by releases of drilling muds and reserve pit materials (NRC 2003).

2. Mitigation Measures and Other Regulatory Protections

Although oil and gas activities subsequent to licensing and exploration could potentially have cumulative effects on terrestrial habitats, wildlife and birds, measures in this best interest finding, along with regulations imposed by other state, federal, and local agencies, are expected to mitigate those potential effects.

For example, administration of the federal Clean Water Act (32 USC § § 1251-1376) and state water quality statutes (18AAC75, AS 46.03, AS 46.15) are expected to mitigate potential effects. Therefore, additional DO&G mitigation measures are not included in the finding because water quality regulations are under DEC's jurisdiction. U.S. Army Corps of Engineers has regulatory authority over wetlands (33 USC 401, 33 USC 403).

Further, standard DNR land use permit conditions serve to protect habitat and water quality from potential negative effects of facility construction and operation. Work areas must be kept clean. Trash, survey markers, and other debris that may accumulate in camps or along seismic lines and travel routes that are not recovered during the initial cleanup must be picked up and properly disposed of. All solid wastes, including incinerator residue, must be backhauled to a solid waste disposal site approved by DEC.

Mitigation measures included in this best interest finding address habitat loss avoidance, and protection of wetland, riparian, and aquatic habitats. A complete listing of mitigation measures is found in Chapter Nine.

C. Marine and Freshwater Habitats, Fish, and Marine Mammals

This section considers and discusses potential cumulative effects on marine and freshwater habitats, fish, and marine mammals.

1. Potential Activities and Cumulative Effects

Potential activities that could have cumulative effects on marine habitats, fish, and wildlife of the license area include seismic surveys, discharges from well drilling and production, construction of support facilities, and ongoing disturbances from production activities such as boat and aircraft traffic. In addition, gas blowouts and oil spills could potentially occur during development and production.

If unregulated, general construction activities could affect marine and freshwater habitats, fish, and marine mammals. The blockage of passage, siltation of streams, and destruction of spawning habitat were the main problems associated with construction of fish passage crossings along the Trans-Alaska Pipeline System (Gustafson 1977). Excavation of gravel construction materials can disturb floodplains and habitats. Construction activities can also cause erosion of river banks, siltation, bottom substrate disturbance, reduced water volumes, altered water quality, barriers to fish passage, and elimination of habitat (Hanley et al. 1983).

Erosion is a potential impact of all phases of exploration and development. If activities associated with oil and gas exploration and development, such as gravel removal, heavy equipment operations, and siting of support facilities are unregulated, they could increase stream sedimentation and erosion, impede fish passage, alter drainage patterns, and have other negative effects on freshwater habitats, fish, and other aquatic organisms (Schneider 2002). Erosion can increase sedimentation and turbidity of aquatic habitats, which can cause decreased primary production, resulting in depleted food for zooplankton, insects, freshwater mollusks, and fish. This can lead to direct mortality, reduced physiological function, and depressed growth rates and reproduction in aquatic organisms (Henley et al. 2000).

Removal of water from lakes, ponds and rivers where fish overwinter may affect the viability of overwintering fish, and longer-term effects of lake drawdown may impede the ability of fish to return to the lake in subsequent years. Removal of snow from lakes may increase the freeze depth of the ice, kill overwintering and resident fish, and adversely affect the ability of fish to utilize the lake in future years. Water depths of 7 ft or more are considered the minimum for supporting overwintering freshwater fish (ConocoPhillips Alaska Inc. 2010). Oxygen depletion, caused by overcrowding or over-demand by biological and chemical processes, can result in fish mortality (Schmidt et al. 1989; Reynolds 1997).

a. Freshwater Environments

The principle impacts to freshwater habitats attributed to seismic surveys involve the acoustic energy pulses emitted by airguns. Seismic surveys typically cover a relatively small area and only stay in a particular area for hours. The airgun firing overpressures the water, and the fish react to the airgun, and immediately swim in an intense effort to flee from the sound. Adverse effects from seismic activities to the migration, spawning, and hatchling survival of fish most likely would be temporary and localized (MMS 2007).

In a study conducted in the Sagavanirktok River, broad whitefish were first observed in their natural state and were sedentary and showed minimal movement. When an airgun was fired in close proximity, the broad whitefish fled the immediate area, and after 2 minutes slowed their swimming speed, and were observed to school as a group back at the original water location. Repeated firing of the airgun revealed that this pattern was consistent, and fish returned to a sedentary posture at the

original water location each time. The authors concluded that there was little evidence that energy from the airguns harmed the fish observed (Morris and Winters 2005).

Popper et al. (2005) measured the effects of seismic airgun firing on broad whitefish and found that the firing of airguns had no apparent effect on hearing. The results also showed that the lake chub species experienced only temporary hearing loss, and hearing of northern pike returned after 18 hours.

Similarly, in a 2005 study, airguns were fired in close proximity to Arctic char within a flooded gravel pit at Duck Island mine site on the North Slope. Results showed that no fish deaths occurred as a direct result of airgun noise, no bleeding of the gills was noted, but internal injuries were observed in some fish. No swim bladder damage was observed. Eye injuries were noted at rates ranging from 0.1 to 7%, and body tissue injuries were noted at rates ranging from 6 to 12% in the fish. Fish eye injury was the injury with the highest frequency occurrence (Morris and Winters 2005).

b. Marine Environments

One of the primary concerns about oil and gas development in marine waters is the potential effects that noise from seismic surveys, construction activities, and ongoing boat, drilling, and aircraft activities could have on marine mammals and other marine animals (Hofman 2003). Attempts have been made by scientists, the oil and gas industry, and by environmental groups to compile and draw conclusions about the effects of these activities from existing research, but these reports draw on few experimental studies, relying rather on anecdotal observations, unpublished reports, and non-peer reviewed research (OGP/IAGC 2004; Gordon et al. 2004; WDCS 2004). The lack of experimental research on the effects on marine animals of noise from oil and gas development, and the lack of conclusive results, particularly at the population level, is frequently highlighted by scientific, industry, and environmental organizations alike (Jasny et al. 2005; Gordon et al. 2004; OGP/IAGC 2004; WDCS 2004).

Hofman (2003) reviewed available studies of the effects of industrial noise on whales, finding that some effects on activity patterns of some whales were documented, but that research was insufficient for understanding which species are affected, how many animals are affected, distances at which various species are affected, and the biological significance of the effects. Although some studies found distribution and behavior changes for some whales, the changes were negligible and no harmful effects were documented. Research is also lacking on whether or not some species may become habituated to, and stop being affected by, certain kinds of sounds, or on whether certain species may become more sensitive to sounds with increased exposure (Hofman 2003).

Researching these effects on marine mammals and other marine animals is a difficult undertaking. Hofman (2003) explained the many variables that influence the effects of noise on animals in the marine environment:

> The nature and significance of acoustic effects are dependent on a number of variables. They include the intensity, frequency, and duration of the sound; the location of the sound source relative to the potentially affected animals; water depth, bottom reflectivity and other features of the environment; the distance between the animal and the sound source; whether the sound source is stationary or moving; the species, age, sex, reproductive status, activity and hearing ability of the animals exposed to the sound; whether the animals use similar sounds for communicating, locating and capturing prey, etc.; and whether and how frequently the animals in question are exposed to the sound.

In one of the few controlled experiments on the response of whales to noise, a four-year study examined responses of whales to airguns used in seismic surveys in the Gulf of Mexico. This study found no horizontal avoidance to seismic airgun sounds by sperm whales (Jochens et al. 2008).

In Cook Inlet, beluga whales appear to exhibit site fidelity, returning to estuary areas even after a disturbance, including adults with calves (Moore et al. 2000). They continue to occupy upper Cook Inlet despite oil and gas development, vessel and aircraft traffic, and dredging operations. One study, based on a review of available information, concluded that belugas appear to have become habituated to offshore oil and gas activities in central Cook Inlet (Moore et al. 2000).

A study of interactions between beluga whales and boats in Knik Arm, in Cook Inlet suggested that an increase in boat traffic from recreation or industrial activity and construction in or near areas where the whales congregate and feed might disrupt these important activities in Cook Inlet (Stewart 2012).

An assessment of human and environmental stressors on Cook Inlet beluga whales concluded that threats to quantity and quality of beluga prey species may occur due to continued development. The study determined that Cook Inlet beluga whales may be at risk for chronic, serious sublethal effects if contaminant concentrations in the environment have a similar effect as seen in other marine mammal species (Norman 2011). However, an assessment of the winter prey availability and oil-related contaminants for Cook Inlet beluga whales stated that analyses of hydrocarbon in selected prey tissues showed non-detectable levels, though these results are counter to earlier analysis of their summer prey (Saupe et al. 2014).

A study in the Beaufort Sea found that ringed seals were not affected by noise from pipe-driving and construction sounds, except for helicopters, concluding that seals were likely habituated to the industrial sounds and visual activity (Blackwell et al. 2004). Additionally, a 2003 study in the Beaufort Sea found that the proportion of long-tailed ducks detected in areas with seismic surveys was not significantly different from control areas without the surveys; the study also found that there was no difference in diving behavior of ducks in the seismic and non-seismic areas (Lacroix et al. 2003).

Additionally, there is no evidence that routine oil and gas development and transport activities have a direct impact on the sea otter stock of Southcentral Alaska (Angliss and Outlaw 2008).

An experimental study of the effects of seismic surveys on cod and haddock in the Barents Sea, located north of Norway and Russia, found that fish distribution, abundance, and catch rates were significantly affected, decreasing by up to 50% during and after seismic shooting, compared to rates just previous to commencement of the seismic survey (Engas et al. 1996).

In a study of a rocky reef off Scotland, fish response from seismic airguns showed minor behavioral responses to airgun emissions. The researchers found there were no permanent changes in behavior, and no fish appeared to leave the reef habitat. There were no indications of observed damage to the reef animals (Popper and Hastings 2009, citing to Wardle et al. 2001).

The ocean substrate may be physically disturbed from activities such as anchoring or from sedimentation from discharges, potentially resulting in effects on the organisms living there (Lissner et al. 1991). However, research is lacking on the specifics of these potential effects, especially specific to the license area. Recovery time for substrate disturbances can vary from a few days or months to decades, depending on the type and frequency of the disturbance, and the type of organisms inhabiting the substrate (Lissner et al. 1991). Eelgrass beds are vulnerable to increased turbidity, sediment disturbances, and eutrophication that could occur as a result of development activities; these could, in turn, promote growth of epiphytic algae on eelgrass, decrease eelgrass photosynthesis and growth, and smother or uproot eelgrass (ADF&G 2006).

Human intrusions into seabird colonies can result in reduced reproductive success. Eggs, hatchlings, and fledglings are particularly vulnerable to activities that may result in loss of eggs or young, dispersion from the nesting site or rookery, and disruption of vital parent-offspring bonds (Boesch et al. 1987).

c. Discharges from Exploration, Development, and Production

i. Gas Blowouts

In addition to noise and physical disturbances, discharges into the water may result from oil and gas activities (Huntington 2007). If a natural gas blowout occurs the initial explosion and possibility of fire are possible hazards, and vapors may migrate downwind. Blowouts can also cause a toxic cloud of hydrogen sulfide that accumulates close to the ground (Van Dyke 1997). Natural gas and condensates that did not burn in the blowout would be hazardous to any organisms exposed to high concentrations.

ii. Oil Spills

Oil spills could range from small chronic leaks from equipment or facilities to catastrophic pipeline failures or, a blowout. The effects of oil spills on fish habitats would depend on many factors, including the time of year, size of the spill, and water body affected. Type and extent of effects depends on a myriad of factors including habitat involved, species, life history stage, migration patterns, nursery areas, season, type of chemical, amount and rate of release, time of release, duration of exposure, measures used for retaining the chemical, and use of counteracting or dispersing agents (Davis et al. 1984).

Whales and other marine mammals can suffer impacts from exposure to oil. For example, the ingestion of oil leads to both lethal and sublethal effects. Before the *Exxon Valdez* oil spill, little was known about the effects of oil on marine mammals. In the early 1980s researchers observed gray whales swimming through oil seeps off the coast of California and captive bottlenose dolphins initially avoiding but eventually swimming through oiled areas in their tanks (Matkin et al. 2008).

Any mammals using haulout areas are susceptible to effects from oil spilled in the marine environment. If adults are contaminated during a time that pups are being nursed, the young may ingest the oil while nursing. The females may also have trouble recognizing their young which could lead to abandonment and starvation (LaRoche and Associates 2011).

The toxins in oil could affect invertebrates and fish (Jorgenson and Cater 1996). Potential adverse effects include direct uptake of oil by the gills, ingestion of oil, ingestion of oiled plankton or prey, decreased survival of eggs and larvae, and ecosystem changes in freshwater habitats. Adult fish may be affected by reduced growth, enlarged livers, heart and respiration rate changes and effects to reproduction. Toxic compounds in oil could reduce spawning success, and increase mortality of eggs and larvae in spawning or nursery areas. Floating oil can also affect plankton, such as algae, fish eggs and invertebrate larvae (USFWS 2004). Sublethal effects may also reduce fitness and impair an organism's ability to endure environmental stress. The long term effects to ecosystems impacted by oil spills due to persistence of toxic substances and chronic exposures may continue to affect wildlife (Peterson et al. 2003).

Oil spills can have short- and long-term negative effects on aquatic life, including fish and benthic organisms (Olsgard and Gray 1995). Lethal or sub-lethal effects may subtly reduce or impair physiological and reproductive fitness (Davis et al. 1984). Sedentary animals, such as oysters, clams, and mussels, are more susceptible to releases of petroleum products than fish and shellfish such as crabs and shrimp, which are capable of active avoidance (Davis et al. 1984).

Several studies of the 1989 *Exxon Valdez* oil spill and its effects on pink salmon provided compelling evidence that growth was not reduced by the exposure to the levels of oil in marine waters in 1989. Record returns of adult pink salmon in 1990 and 1991 support the conclusion that pink salmon populations were not damaged at any detectable level by the *Exxon Valdez* oil spill as those two brood years were exposed as embryo or fry to the greatest risk from the oil in 1989 (Brannon et al. 2013).

iii. Releases of Drilling Muds and Produced Water

Unregulated releases of drilling muds, cuttings, produced waters, and other effluents from oil and gas exploration, development, and production can have short- and long-term negative effects on aquatic life, including fish and benthic organisms similar to a release of crude oil (Olsgard and Gray 1995).

Produced water contains naturally occurring substances such as clay, sand, oil, water, metals, and gas. These substances are found in the subterranean strata. Produced waters are usually saline with some level of hydrocarbons and naturally occurring solids and bacteria. They may also contain chemicals added to inhibit corrosion, as well as emulsifiers, coagulants, flocculants, clarifiers and solvents. Produced waters from gas production also can include condensed water, dehydration chemicals, hydrogen sulfide removal agents and chemicals that inhibit formation of hydrates (Veil et al. 2004).

Produced waters may contain hydrocarbon and chemical constituents in volumes that may be toxic to microorganisms and mysid shrimp (*Mysidopsis bahia*) (Brown et al. 1992). Significant accumulation of drilling mud in wetlands can potentially impact benthic habitats and can blanket fish spawning grounds (Schmidt et al. 1999, citing to Falk and Lawrence 1973; and citing to Friedheim; Sprague and Logan 1979). Suspended solids in aquatic habitats can have adverse effects on egg and larval development of amphibians (Schmidt et al. 1999, citing to Richter 1995).

Technological advances in drilling mud systems have developed mud systems less toxic to the environment. Newer synthetic-based muds are formulated from synthetic organics base fluids. They produce even less waste, improve drilling efficiency, are reusable, and have advantages in environmental protection over oil or water-based muds. Synthetic muds can be reconditioned instead of discharged as waste (Wojtanowicz 2008).

d. Groundwater

Oil and gas activities may have effects on groundwater in the license area. Water use from groundwater wells may be required for the construction and maintenance of ice roads and pads, for blending drilling muds in drilling activities, and for potable and domestic water uses at drilling camps (NRC 2003; Van Dyke 1997). Industrial use of groundwater could draw down the elevation of the water table in the vicinity of the industrial well or wells, and could affect nearby domestic well water depths. These effects are usually insignificant and temporary as other hydraulically connected groundwater sources replace pumped volume.

Improper disposal or accidental releases of drilling muds, cuttings, produced waters, and other effluents from oil and gas activites could have short- and long-term negative effects on water resources. Re-injection is the preferred method for disposal of drilling fluids. Disposal of drilling muds and cuttings requires permit approval.

Most oil field wastes are considered non-hazardous and waste fluids are recycled, filtered, and treated before reinjection or disposal. Cuttings and waste fluids must be made non-hazardous before injection. Produced water is treated using heat, gravity settling, and gas flotation devices to remove hydrocarbons. After treatment, produced water is reinjected into either the oil-bearing formation to maintain pressure and enhance recovery or into an approved disposal well. Cuttings disposal is done through grinding and injecting on-site, or cuttings are transported to an approved disposal site. Cuttings disposal can cost more than the total cost to drill a well. Wastewater, including sanitary and domestic graywater, is also treated to meet effluent guidelines before discharge. All disposal wells inject fluids deep beneath any drinking water aquifers.

USGS monitors water quality at eight fixed sites in the Cook Inlet area (Brabets and Whitman 2004). Sites studied included the Ninilchik River, two sites on the Kenai River, South Fork of Campbell Creek, Chester Creek, the Deshka River, Moose Creek near Palmer, and Johnson River near Tuxedni Bay. Of the sites that had human activities, only urbanization affected water quality. The Chester

Creek basin was found to have volatile organic compounds, pesticides, an increased number of tolerant species, and changes in physical habitat, all related to urbanization (Brabets and Whitman 2004). Some sites near leaking fuel-storage tanks, fuel-storage facilities, and petroleum refineries have been documented to contain organic-compound contaminants (Glass 1999).

2. Mitigation Measures and Other Regulatory Protections

Although oil and gas activities subsequent to licensing and exploration could potentially have cumulative effects on marine and freshwater habitats, fish, and marine wildlife, measures in this best interest finding, along with regulations imposed by other state, federal and local agencies, are expected to mitigate those potential effects.

For example, because of the potential effects discussed above, effluents discharged by the oil and gas industry into marine and fresh surface waters within the license area and within state boundaries, are regulated through the state's APDES program (see Chapter Seven). This program ensures that state and federal clean water quality standards are maintained by requiring a permit to discharge wastes into the state's waters (DEC 2014d).

Steller's eiders, Steller sea lions, Northern sea otters, and fin, beluga, and humpback whales are provided additional protection under the Endangered Species Act. Designation of critical habitat for Cook Inlet beluga whales (50 CFR Part 226) administered by NOAA and the Southwest Alaska DPS Northern Sea Otter (73 FR 76454) administered by USFWS that overlap the license area's waters are expected to mitigate any effects on the marine habitat. A complete listing of mitigation measures is found in Chapter 9.

D. Air Quality

1. Potential Activities and Cumulative Effects

Oil and gas activities may produce emissions that have the potential to affect air quality. Gases may be emitted to the air from power generation, flaring, venting, well testing, leakage of volatile petroleum components, supply activities, shuttle transportation boilers, diesel engines, drilling equipment, flares, glycol dehydrators, natural gas engines and turbines, and fugitive emissions, which are leaks from sealed surfaces associated with process equipment (BOEMRE 2011; Arctic Council 2009).

On-road and off-road vehicles, heavy construction equipment, and earth-moving equipment could produce emissions from engine exhaust and dust. Sources of air emissions during drilling operations include rig engines, camp generator engines, steam generators, waste oil burners, hot-air heaters, incinerators, and well test flaring equipment. Emissions could be generated during installation of pipelines and utility lines, excavation and transportation of gravel, mobilization and demobilization of drill rigs, and during construction of gravel pads, roads, and support facilities. Emissions could also be produced by engines, turbines, and heaters used for oil/gas production, processing, and transport. In addition, aircraft, supply boats, personnel carriers, mobile support modules, as well as intermittent operations such as mud degassing and well testing, could produce emissions (BOEMERE 2011).

Other sources of air pollution include evaporative losses of volatile organic compounds from oil/water separators, tanks, pump, compressor seals, and valves. Venting and flaring could be an intermittent source of volatile organic compounds and sulfur dioxide (MMS 2008). Gas blowouts, evaporation of spilled oil, and burning of spilled oil may also affect air quality. Should a gas or oil blowout ignite, a light, short-term coating of particulates could be deposited over a localized area. (DEC et al. 2008).

There are significant uncertainties associated with estimates of Alaska's greenhouse gas emissions from the oil and gas sector as there are no regulatory requirements to track carbon dioxide or methane emissions. Alaska's emissions account for 0.7% of all U.S. emissions. Of the 52 million metric tons of

carbon dioxide equivalent emissions generated in Alaska, 15 million metric tons of carbon dioxide equivalent are related to the oil and gas industry, approximately 29% (AMAG 2009).

The Alaskan overall oil and natural gas industry historical trend projection for emissions was an estimated 3.0 million metric tons of greenhouse gases statewide in 2005, contributing about 6% of the state's total greenhouse gas emissions (Roe et al. 2007). This is a projected decrease from 1990 and 2000, and continued decreases are expected through 2020. These estimates are for fugitive emissions, including methane and carbon dioxide released from leakage and venting at oil and gas fields, processing facilities, and pipelines. Estimates of emissions resulting from fuel combustion are only available for residential, commercial, and all industries combined, and are not available for the oil and gas industry separately (Roe et al. 2007).

In 2008, improvements were made to the Alaska Greenhouse Gas Emission Inventory. DEC broke down 2005 GHG emissions data by source category and refined it. By applying these refinements with the 2007 Center for Climate Strategies (CCS) updates, it was estimated that Title V oil and gas sources contributed to 29% of GHG emissions in Alaska. In 2008, using the same data, DEC estimated oil and gas development sources were responsible for 73% GHG emissions of all Title V sources (see Table 8.1). In other words, industries in Alaska combusting, refining, storing, and transporting fuel had the highest GHG emission estimates (DEC 2008).

However, in 2005, according to the EPA's Energy CO2 Emissions by state, emissions from the combustion of fuel in Alaska were about the same as Connecticut, Nevada, and North Dakota. And Alaska's fuel combustion emissions were about half of Washington's emissions even though Washington had 10 times the population of Alaska (DEC 2008).

2. Mitigation Measures and Other Regulatory Protections

Administration of the Clean Air Act (42 USC §§ 7401-7671) and state air quality statutes (18 AAC 50, AS 46.03, AS 46.14) are expected to mitigate potential effects to air quality. Therefore, additional mitigation measures are not included in this finding; air quality regulations are under DEC's jurisdiction.

In-situ burning of spilled oil must be pre-approved by DEC and EPA and/or the U.S. Coast Guard (DEC et al. 2008). Controlled in-situ burning of spilled oil is only allowed if it is located a safe distance from populated areas. Approved burn plans require removal of particulates.

Additional information about air quality regulations and permits is found in Chapter Seven and a complete listing of mitigation measures is found in Chapter Nine.

E. Subsistence Use

1. Potential Activities and Cumulative Effects

Subsistence uses of the license area depend on the area's fish, wildlife, and habitats. Therefore, potential cumulative effects from oil and gas activities on the area's fish, wildlife, and habitats could also affect subsistence uses. Potential cumulative effects to fish, wildlife, and habitats are discussed in the preceding sections. Other potential effects on subsistence uses are discussed below.

Oil and gas exploration, development, and production could result in increased access to hunting and fishing areas. For example, roads built by oil companies during exploration and development recently and over the last 50 years are important for access to subsistence resources for Tyonek and Beluga residents in the Cook Inlet area, who travel to subsistence areas primarily by truck. However, increased public access to hunting, fishing, and trapping areas due to construction of new roads could also increase competition between user groups for fish and wildlife resources. Roads can also raise concerns among subsistence users that increased traffic is affecting distribution of wildlife (Braund 2007).

Oil and gas activities can raise other concerns among subsistence users. For example, Tyonek and Beluga residents have expressed concerns that disturbance from oil rigs has contributed to decline in beluga and seals; that pollution from oil rigs has resulted in fish diseases and declines in clam abundance; and that oil development has changed bear distribution and waterfowl habitat (Braund 2007). However, independent research corroborating these concerns is not always available.

A major oil spill could decrease resource availability and accessibility, and create or increase concerns about food safety which could result in effects on subsistence users, effects which could linger for many years. For example, subsistence harvests of fish and wildlife by residents of fifteen predominately Alaska Native communities, as well as by residents in larger rural communities, declined by as much as 70% after the 1989 *Exxon Valdez* oil spill (Fall 1999).

Within two years of the spill, subsistence harvests and participation had returned to pre-spill levels, although communities closest to the spill lagged behind. However, concerns remained about food safety, availability of many species was reduced, efficiency was reduced, and opportunities to teach subsistence skills to young people were lost (Fall 1999). By 2003, harvest levels were higher than pre-spill levels, or were within the range of other rural communities. However, harvest composition remained different from the pre-spill composition, and concerns about the safety of some shellfish species remained (Fall 2006). There is limited information available on whether, after an oil spill, spatial redistribution of a species affects harvest and the time required for a successful hunt (NRC 2003).

Additional complex factors may confound effects of an oil spill, including demographic changes in communities, increased competition for fish and wildlife resources by other user groups, predators, and increased awareness about other contaminants (Fall 2006). Because many subsistence resources affected by the spill had not fully recovered, subsistence in areas affected by the *Exxon Valdez* oil spill was still not considered to have fully recovered in 2010 (EVOSTC 2010).

Although the oil and gas industry has the potential to provide jobs and income to subsistence users, work in the oil and gas industry may reduce the time available for subsistence activities (Stanek et al. 2007; EDAW/AECOM 2007). Some studies have found that "higher levels of household cash income were directly correlated with peoples' commitment to, and their returns from, natural resource harvesting" (EDAW/AECOM 2007, citing to Kruse 1986). Other studies have shown that young men in Inupiaq communities balance wage employment with seasonal subsistence activities, even when there are large numbers of high paying job opportunities (EDAW/AECOM 2007, citing to Kleinfeld et al. 1983). The availability of time-saving technologies, such as ATVs, snow machines, and outboard motors, has counter-balanced decreased availability of time, and "cash derived from wage employment did not replace subsistence but underwrote it" (EDAW/AECOM 2007, citing to Lonner 1986).

2. Mitigation Measures and Other Regulatory Protections

Oil and gas activities could potentially affect subsistence uses, mostly as secondary effects from effects on habitat, fish, or wildlife. Mitigation measures in this written finding, along with regulations imposed by other state, federal and local agencies, are expected to mitigate those potential effects. A complete listing of mitigation measures is found in Chapter Nine.

F. Sport and Commercial Fishing and Sport Hunting

1. Potential Activities and Cumulative Effects

In addition to subsistence, other important uses of fish and wildlife populations in and around the license area include sport and commercial fishing; and sport hunting. Potential activities that could have effects include seismic surveys, discharges from well drilling and production, construction of

road and support facilities, and ongoing disturbances from production activities such as pipeline activities, vehicle, boat, and aircraft traffic. In addition, gas blowouts and oil spills could potentially occur during development and production.

Potential effects from oil and gas activities on the area's terrestrial and freshwater habitats and fish and wildlife populations could affect these uses. Potential effects to the area's habitats and fish and wildlife populations are discussed in the preceding sections.

2. Mitigation Measures and Other Regulatory Protections

Oil and gas activities could potentially affect sport and commercial fishing, and sport hunting, primarily from effects on habitat, fish, and wildlife. Mitigation measures in this best interest finding, along with regulations imposed by other state, federal and local agencies, are expected to mitigate those potential effects. A complete listing of mitigation measures is found in Chapter Nine.

G. Recreation and Tourism

1. Potential Activities and Cumulative Effects

Effects from oil and gas development on fish, wildlife, and their habitats could affect recreation and tourism. Possible effects from oil and gas activities on fish and wildlife populations and habitats are discussed in the preceding sections. Other potential effects on recreation and tourism are discussed below.

Oil and gas activities could decrease an area's visual quality and attraction to tourists. Excess turbidity and sedimentation in an area's waters can decrease recreation value (USGS 2014). It could likewise restrict local access to an area. For example, after the *Exxon Valdez* oil spill, access to visibly oiled areas was limited to recreational users such as kayakers. Some unoiled areas were used more heavily because activities were displaced from the oiled areas. Because some species had not completely recovered from the spill and oil remained in some localized areas, recreation and tourism were considered to be recovering, but not yet recovered as of 2010 (EVOSTC 2010). Alternatively, oil and gas activities could result in increased access to recreational areas due to the construction of new roads.

2. Mitigation Measures and Other Regulatory Protections

Oil and gas activities subsequent to leasing could potentially affect recreation and tourism, mainly as secondary effects from effects on habitat, fish, and wildlife. Measures in this best interest finding, along with regulations imposed by other state, federal and local agencies, are expected to mitigate those potential effects. A complete listing of mitigation measures is found in Chapter Nine.

H. Historic and Cultural Resources

1. Potential Activities and Cumulative Effects

The license area has documented occurrences of historical and cultural resources. The potential impacts to these resources may be from accidental oil spills, erosion and vandalism (Dekin et al. 1993).

Impacts and disturbances to historic and cultural resources could be associated with installation and operation of oil and gas facilities, including drill pads, roads, airstrips, pipelines, processing facilities, and any other ground disturbing activities. Damage to archaeological sites may include: direct breakage of cultural objects; damage to vegetation and the thermal regime, leading to erosion and deterioration of organic sites; shifting or mixing of components in sites resulting in loss of association between objects' and damage or destruction of archeological or historic sites by oil spill cleanup crews collecting artifacts (BLM 2007; USFWS 1986).

Spills can have an indirect effect on archaeological sites by contaminating organic material, which would eliminate the possibility of using carbon C-14 dating methods (USFWS 1986). The detrimental effects of cleanup activity on these resources are minor because the work plan for cleanup is constantly reviewed, and cleanup techniques are changed as needed to protect archaeological and cultural resources (Bittner 1996).

For example, historic and cultural resources may be encountered during field-based activities, and these resources could be affected by accidents such as an oil spill. Following the *Exxon Valdez* oil spill, 24 archaeological sites experienced adverse effects including oiling of the sites, disturbance by clean-up activities, and looting and vandalism. Monitoring of the sites over a seven-year period indicated that vandalism continued to be a minor problem, and that although some sites were initially badly damaged by oiling, residual oil does not appear to be contaminating known sites, and sites are now considered to be recovered (EVOSTC 2010).

2. Mitigation Measures and Other Regulatory Protections

Various mitigation measures used to protect archaeological sites during oil spill cleanups include avoidance (preferred), site consultation and inspection, onsite monitoring, site mapping, artifact collection, and cultural resource awareness programs (Bittner 1996). Measures in this best interest finding, along with regulations imposed by other state, federal, and local agencies, are expected to mitigate those potential effects.

Because historic and cultural resources are irreplaceable, caution is necessary in order to not disturb or impact them. AS 41.35.200 addresses unlawful acts concerning cultural and historical resources. It prohibits the appropriation, excavation, removal, injury or destruction of any state owned cultural site. In addition, all field based response workers are required to adhere to historic properties protection policies that reinforce these statutory requirements, and to immediately report any historic property that they see or encounter (AHRS 2014). A complete listing of mitigation measures is found in Chapter Nine.

I. Fiscal Effects

This section considers and discusses the fiscal effects, both statewide and local, of licensing activities, as required by AS 38.05.035(g)(1)(B)(ix). Licensing and subsequent activity may generate income for state government, with some possible fiscal benefits including increased revenue sharing, creation of new jobs, and indirect income multiplier effects. Fiscal effects may be statewide and local.

1. Statewide Effects

Alaska's economy depends heavily on revenues related to oil and gas production and government spending resulting from those revenues. Oil and gas revenues fund education and the state's operating and capital budgets.

The primary source of state revenues is North Slope oil production, although oil and gas are also produced from Cook Inlet. In FY 2013, oil and gas revenues totaled $6.4 billion and comprised approximately 92% of the state's general fund unrestricted revenue. The Alaska Department of Revenue (DOR) forecasts FY 2014 oil revenue at $4.4 billion and the forecast for FY 2015 is $3.9 billion (DOR 2013). However, North Slope and Cook Inlet production are declining. Alaska North Slope production peaked at 2.006 million barrels per day in FY 1988, declining to 0.532 million bbls per day in FY 2013 (DOR 2013). DOR anticipates volumes will decline by 4.5% in FY 2014 to about 0.508 million bbls per day, declining further to 0.498 million bbls per day in FY 2015. Cook Inlet oil fields produced 0.012 million bbls per day in FY 2013 and have an FY 2014 projection of producing 0.014 million bbls per day (DOR 2013).

If a discovery is made, this project will contribute to state revenues. The level of that contribution is unknown, dynamic, and will depend on many factors. In comparison to the state's total revenue from oil and gas activities, revenue from this exploration license is expected to be small. However, even relatively small discoveries can contribute to the energy needs of a village or community, and could relieve the state of providing energy subsidies to some extent.

The exploration license may provide other long-term contributions to the state's fiscal wellbeing. Exploration licensing supplements the state's long-standing conventional oil and gas leasing program for areas such as the North Slope and Cook Inlet, by targeting areas outside known oil and gas provinces. The intent of licensing is to encourage exploration in areas far from existing infrastructure, with relatively low or unknown hydrocarbon potential, where there is a higher investment risk to the operator. Through exploration licensing, the state receives valuable subsurface geologic information on these regions regardless of whether revenue is ever generated. Further, because the upfront capital for obtaining an exploration license is generally less than for obtaining leases, new, smaller companies may be encouraged to begin operating in Alaska. And, even relatively small successes can spur additional activity and investment in exploring and developing Alaska's oil and gas resources.

2. Local Effects

Most of the communities discussed in Chapter Three are in an unincorporated area of the state, and none are individually incorporated as municipalities under state law. Unlike incorporated municipalities such as the North Slope and Cook Inlet, royalties, rents, license fees, and other revenues generated by licensing or oil or gas production in the unincorporated portion of the license area will not directly return to the area unless a municipal government entity is established in the unincorporated area. If incorporated, the revenues from oil or gas production could fund education, health, and public safety programs, and transportation system improvements throughout the license area. Additionally, local incorporated municipalities may generate significant revenue through property taxes on infrastructure required for oil and gas development and production.

Relative to other fiscal effects, economic activity associated with oil and oil or gas exploration, development, and production may increase other economic activity in the license area, but benefits to the economies of the local communities may be smaller than for the larger state economy. In rural Alaska communities, where there are typically smaller economies, the multiplier is 1.3. The economic multiplier associated with dollars injected into a community depends upon the size of the local market. A small market means the multiplier is small and most of the money that comes into the community leaves almost immediately in the purchase of goods and services somewhere outside the community (Colt et al. 2003). Population and employment changes in any of the communities might occur depending on the amount of exploration activity and the size of an oil or gas discovery.

J. Effects on Communities

The following sections describe the potential effects of activities associated with oil and gas exploration, development, production, and transportation on employment, population, income, utilities, and other resources in the communities of the area.

1. Employment

Oil and gas jobs already in the area include maintenance, inspection, and other activities related to oil and gas exploration and production in Cook Inlet. Residents of the license area would likely benefit from the development of oil or gas resources in the area through increased job opportunities in the oil and gas industry. Other employment directly related to the oil and gas industry could include environmental and wildlife studies, planning and design activities, materials acquisition, facility construction, seismic surveys, drilling, transportation, and logistics.

The exploration license may create additional employment opportunities in the service, transportation, utilities, and retail sectors of the local economy. Short-term job opportunities could arise during the exploration phase. The long-term employment benefits in the vicinity of the license area will depend on the subsequent production of commercial quantities of oil or gas.

The local labor force may not be able to meet demands for some technical positions. As a result, these jobs may be filled by workers from the service support industry that is active in other regions of the state, or outside Alaska. However, the licensee and its contractors are encouraged to hire local and Alaska residents to the extent they are qualified and available.

2. Access and Land Use

Communities and surface estate owners in the area adjacent to exploration activities could be affected. For example, use of transportation systems could increase, such as air charter services, airstrips, or roads, for transportation of personnel or construction equipment. Roads could be constructed to provide access to more remote areas. Other effects include disturbance due to increased air traffic, machinery noise, and loss of privacy due to the presence of project workers. The extent of these effects depends on the size of exploration projects and the proximity of facilities, and utility, pipeline, and transportation corridors to the affected community.

Some portions of the area could be developed from existing roads or access routes; however, much of the acreage is remote from existing infrastructure. Some use of existing roads and trails may occur during exploration license activities. It is likely that an increase in vessel traffic and mooring activity as a result of any exploration work in the license area could have an effect on the economy and dock availability in Homer or Nikiski as they are the closest deep water ports that provide harbor and service to the oil and gas industry (Klouda 2012; Armstrong 2013; Homer 2013).

3. Mitigation Measures and Other Regulatory Protections

Although oil and gas activities could potentially have effects on local communities, mitigation measures in this written finding, along with regulations imposed by other state, federal and local agencies, are expected to mitigate those potentially negative effects. Positive effects are expected on local governments and economies, employment, personal income, reasonable energy costs, and opportunities for industrial development. A complete listing of mitigation measures is found in Chapter Nine.

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Chapter Nine: Mitigation Measures

Table of Contents

Page

Chapter Nine: Mitigation Measures

To ensure that this disposal is in the state's best interest (AS 38.05.035(e)), and in approving the exploration phase, operations will be conditioned by mitigation measures which will be attached to the license and any future leases issued and are binding on the licensee. These measures were developed to mitigate potential effects of license-related or lease-related activities, considering all information made known to the director. Additional measures may be imposed when the licensee submits a proposed plan of operations (11 AAC 83.158(e) and 83.346(e)). The director may consult with local government organizations and other agencies in implementing the mitigation measures below. Licensees must also comply with all applicable local, state, and federal laws and regulations, as amended.

The director may grant exceptions to these mitigation measures. Exceptions will only be granted upon a showing by the licensee that compliance with the mitigation measure is not practicable and that the licensee will undertake an equal or better alternative to satisfy the intent of the mitigation measure. Requests and justifications for exceptions must be included in the plan of operations application as specified by the application instructions, and decisions of whether to grant exceptions will be made during the plan of operations review.

A. Facilities and Operations

1. To ensure system integrity, oil and gas facilities, including pipelines, must be designed using industry-accepted engineering codes and standards. Technical submittals to the Division that reflect the "practice of engineering", as defined by AS 08.48.341, must be sealed by a professional engineer registered in the state of Alaska.
2. The siting of facilities, other than docks, roads, utility or pipeline corridors, or terminal facilities is prohibited within one-half mile of the coast and 500 feet of all fish bearing water bodies. Facilities may be sited, on a case-by-case basis, within the one-half mile buffer if the lessee demonstrates that siting of such facilities outside this buffer zone is not feasible or prudent, or that a location within the buffer is environmentally preferable, but in no instance will a facility be located within one-quarter mile of the river bank. ADF&G consultation is required for siting within the one-half mile buffer. Road and pipeline crossings must be aligned perpendicular or near perpendicular to watercourses.
3. Exploration roads, pads, and airstrips must be temporary unless the Director approves a proposed alternative. Use of gravel roads, pads, and airstrips may be permitted on a case-by-case basis by the director, in consultation with DMLW and ADF&G. Approval for use of existing structures will depend on the extent and method of restoration needed to return these structures to a usable condition.
4. Pipelines must use existing transportation corridors where conditions permit. In areas with above ground placement, pipelines must be designed, sited, and constructed to allow for the free movement of wildlife. Oil and gas infrastructure must be designed to facilitate the containment and cleanup of spilled fluids.
5. Pipelines that must cross marine waters will be constructed beneath the marine waters using directional drilling techniques. Offshore pipelines must be located and constructed to prevent obstruction to marine navigation and fishing operations.
6. Gravel mining within an active floodplain is prohibited, unless DMLW, after consultation with DO&G and ADF&G, approves a proposed alternative

7. Exploration activities must utilize existing road systems, where practicable, or vehicles that do not cause significant damage to the ground surface or vegetation. Construction of temporary roads may be allowed on a case-by-case basis.

B. Fish and Wildlife Habitat

1. The Director, in consultation with ADF&G, will impose seasonal restrictions on activities located in, or requiring travel through or overflight of, important moose calving and wintering areas during approval of a plan of operations.

C. Subsistence, Commercial and Sport Harvest Activities

1. License-related or lease-related use will be restricted if necessary to prevent unreasonable conflicts with fish and wildlife harvest activities.

D. Fuel and Hazardous Substances

1. During fuel or hazardous substance transfer, secondary containment or a surface liner must be placed under all container or vehicle fuel tank inlet and outlet points, hose connections, and hose ends. Appropriate spill response equipment, sufficient to respond to a spill of up to five gallons, must be on hand during any transfer or handling of fuel or hazardous substances.
2. Vehicle refueling will not occur within the annual floodplain, except as addressed and approved in the plan of operations. This measure does not apply to water-borne vessels.
3. New solid waste disposal sites, other than for drilling waste, will not be approved or located on state property for exploration.

E. Access

1. Public access to, or use of, the license area may not be restricted except within the immediate vicinity of drill sites, buildings, and other related facilities. Areas of restricted access must be identified in the plan of operations. Facilities and operations will not be located so as to block access to or along navigable or public waters as defined in AS 38.05.965.

F. Definitions

Facilities - Any structure, equipment, or improvement to the surface, whether temporary or permanent, including, but not limited to, roads, pads, pits, pipelines, power lines, generators, utilities, airstrips, wells, compressors, drill rigs, camps and buildings.

Hazardous substance – As defined under 42 USC 9601-9675 (Comprehensive Environmental Response, Compensation, and Liability Act of 1980)**.**

Plan of operation- A lease plan of operations under 11 AAC 83.158 and a unit plan of operations under 11 AAC 83.346.

Practicable- Feasible in light of overall project purposes after considering cost, existing technology, and logistics of compliance with the standard.

Appendix A: Summary of Comments and Responses

AS 38.05.035(e)(7)(B) requires that final written findings include a summary of agency and public comments received and the department's responses to those comments. This appendix summarizes agency and public comments timely received in response to DO&G's request for comments on the proposed Southwest Cook Inlet exploration license.

1. Commenter name: United Utilities, Inc. (UUI) Terra-SW Office

Comment Summary: In 2011, UUI installed fiber optic cable within Cook Inlet that provides broadband service to the Bristol Bay and Yukon-Kuskokwim Delta regions of Southwest Alaska. Portions of the cable are buried on the sea floor within the license area. The cable emerges from Cook Inlet in Iliamna Bay at Williamsport. UUI installed the cable under Land Use Permit ADL No. 230875 issued by ADRN-DMLW and utility permits issued by ADOT&PF. UUI is concerned that equipment may contact the cable during exploration work. Consequences of damaging or severing the existing cable would be severe for Southwest Alaska's infrastructure (hospitals and schools) and UUI financially.

UUI requests that any license issued contain a special stipulation prohibiting license holders and their agents, employees, contractors, subcontractors, invitees, assigns, or licensees from contacting or interfering with the operation of the cable, and requiring license holders to maintain a one km buffer on each side (two km buffer total) of the charted submarine cable. UUI also requests that notice of the cable route and location be provided to all such persons.

ADNR Response: It is the best interest of the state of Alaska to protect the UUI fiber optic cable that provides broadband internet service to communities in southwest Alaska. Information regarding the presence and location of the cable has been included in Chapter Five (Current and Projected Uses of the License Area) of this Best Interest Finding. The licensee is advised of the implications of damage to the cable, to limit the potential of any activity that could damage the cable or interrupt the service. However, Stipulation Nine (Reservation of Rights) of the Land Use Permit (Early Entry Authorization) ADL # 230875 states that the Division reserves the right to grant additional authorizations to third parties for compatible uses on or adjacent to the land covered under this authorization. Authorized concurrent users of state land, their agents, employees, contractors, subcontractors and licensees shall not interfere with the operation or maintenance activities of authorized users, and therefore, the one km buffer on either side of the cable will not be mandated in this Best Interest Finding.

Appendix B: Sample Exploration License

Oil and Gas Exploration License
Form #DOG 2013-09

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES

_____ Exploration License
ADL _____

THIS OIL AND GAS EXPLORATION LICENSE is issued by the State of Alaska, Department of Natural Resources ("the state" or "the department") to

("the licensee") whether one or more, whose address for purposes of notification is set out in Paragraph 18.

In consideration of the nonrefundable Oil and Gas exploration license fee, work commitment, and performance bond, and subject to the provisions of this exploration license ("license"), including the attached schedules, and by reference, incorporated into this license, the state and the licensee agree as follows.

1. GRANT. (a) Subject to the provisions contained in this license, the state grants to the licensee the exclusive right to explore for Oil and Gas on the state lands described in Schedule 1 ("licensed land"), unless this license is terminated in whole or part under the provisions of this license or applicable statutes and regulations.

(b) This license may be converted to one or more Oil and Gas Leases under the provisions of AS 38.05.134 and 11 AAC 82.978.

(c) If the state's ownership interest in the Oil and Gas in the licensed land is less than an entire and undivided interest, the grant under this license is effective only as to the state's interest in that Oil and Gas.

(d) The state makes no representations or warranties, express or implied, as to title, or access to, or quiet enjoyment of, the licensed land. The state is not liable to the licensee for any deficiency in title to the licensed land, nor is the licensee or any successor in interest to the licensee entitled to any refund due to deficiency in title for work commitments or other expenditures made under this license.

2. RESERVED RIGHTS. (a) The state, for itself and others, reserves all rights not expressly granted to the licensee. These reserved rights include, but are not limited to:

(1) the right to dispose of to others the surface of the licensed land subject to the license, and the right to authorize others by grant, lease, or permit, subject to the license;

(2) the right to explore for Oil or Gas by geological or geophysical means including the drilling of shallow core holes or stratigraphic tests to a depth of not more than 1,000 feet;

(3) the right to explore for, develop, and remove natural resources other than Oil or Gas on or from the licensed land;

(4) the right to non-exclusive easements and rights-of-way for any lawful purpose, including shafts and tunnels necessary or appropriate for working of the licensed land or other land for natural resources other than Oil or Gas;

(5) the right to well sites and well bores of wells drilled from or through the licensed land to explore for or produce Oil, Gas, and Associated Substances in and from other land; and

(6) the right to undertake any other purpose authorized by law and not inconsistent with the rights under the license.

(b) Reserved rights may be exercised by the state, or by any person or entity acting under authority of the state, in any manner that does not unreasonably interfere with or endanger the licensee's operations under this license.

3. TERM. This license is issued for a term of ___ years from the Effective Date.

4. WORK COMMITMENT. This license is conditioned upon the performance of a work commitment, as required under AS 38.05.132, of $_____. Failure of the licensee to timely meet this work commitment will result in the relinquishment, removal, or deletion of the licensed land, termination of this license, and forfeiture of the bond under the provisions of AS 38.05.132 and 11 AAC 82.903—11AAC82.990.

5. GEOLOGIC AND GEOPHYSICAL DATA. (a) On or before each Anniversary Date of the Effective Date of this license, the licensee shall submit to the department all geologic and geophysical data, as defined in 11 AAC 82.990, in accordance with 11 AAC 82.981 and 11 AAC 82.984.

6. DATA SUBMITTAL. (a) The lessee shall submit to the state, at the Department of Natural Resources, Division of Oil & Gas (Division), all geological, geophysical, and engineering data obtained from the lease within 30 days following completion, abandonment, or suspension of each well, pilot hole, and plugged back well bore. The lessee shall also submit to the Division, on behalf of the state, data acquired subsequent to completion, abandonment, or suspension of each well, pilot hole, and plugged back well bore within 30 days following acquisition of those data. The Division, on behalf of the state, may waive receipt of operational data from some development, service, or injection wells, and will inform the operator of the waiver in writing prior to data submittal. Data shall be submitted according to the instructions set out in Attachment 1. Submission of data under this paragraph does not affect any statutory or regulatory obligation to submit data or other information to the state or any of its agencies.

(b) Any data submitted to the state, at the Department of Natural Resources, Division of Oil & Gas will be available at all times for use by the state and its agents, and will be held confidential as provided in AS 38.05.035(a)(8) and its applicable regulations. In accordance with AS 38.05.035(a)(8)(C), in order for geological, geophysical, and engineering data to be held confidential, the lessee must request confidentiality at the time of submission and mark the data “CONFIDENTIAL” in compliance with applicable regulations.

7. BONDING. (a) On or before the Effective Date of this license the licensee shall post, and during the term of this license the licensee shall maintain, a performance bond or other security in accordance with AS 38.05.132 and 11 AAC 82.945. The form to be used for bond calculations is incorporated as Schedule 2 to this license.

8. FORCE MAJEURE. (a) If by the fourth anniversary of this license the state determines that the licensee has been prevented by Force Majeure from performing an act that would maintain this license, the Effective Date of this license will be extended by adding the time lost as result of the Force Majeure.

(b) If Force Majeure occurs after the fourth anniversary and before the expiration of the term of this license, the term of this license will be extended by adding the period of time lost as a result of the Force Majeure.

9. AUDIT. The commissioner will, in the commissioner’s discretion, audit expenditures as set out in 11 AAC 82.960. The licensee shall keep and have in its possession books and records showing all expenditures regarding the licensee’s direct exploration expenditures, reports, data, or other information relevant to the drilling of an Oil and Gas exploration well or the gathering of geologic or geophysical data, whether or not that information is confidential. The licensee shall permit the state or its agents to examine these books and records at all reasonable times. Upon request by the state, the licensee's books and records must be made available to the state at the state office designated by the state. These books and records must employ methods and techniques that will ensure the most accurate figures reasonably available. The licensee shall use generally accepted accounting procedures consistently applied.

10. PLAN OF OPERATIONS. Before operations may be undertaken on the licensed land, the licensee shall comply with the applicable statutes and regulations in effect on the date the proposed activity is scheduled to commence, including the provisions of AS 38.05.130 and 11 AAC 82.951.

11. INSPECTION. The licensee shall keep open at all reasonable times, for inspection by any duly authorized representative of the State of Alaska, the licensed land, all wells, improvements, machinery, and fixtures on the licensed land, and all reports and records relative to operations and surveys or investigations on or with regard to the licensed land or under this license. Upon request, the licensee shall furnish the State of Alaska with copies of and extracts from any such reports and records.

12. ASSIGNMENT. This license, or an interest in this license, may be assigned or otherwise transferred in accordance with 11 AAC 82.966, 11 AAC 82.969, and 11 AAC 82.972.

13. SURRENDER. The licensee may, at any time, file with the state a written surrender of rights under the provisions of 11 AAC 82.957.

14. TERMINATION. The commissioner will, in the commissioner's discretion, terminate this license under the provisions of 11 AAC 82.975 for the licensee's failure to comply with any of its provisions, applicable statutes, regulations, or stipulations.

15. RIGHTS UPON SURRENDER OR TERMINATION. Upon the surrender or termination as to all or any portion of the licensed land, the state will direct the licensee in writing and the licensee will have the right at any time within a period of one year after the surrender or termination, or any extension of that period as the state may grant, to remove from the licensed land or portion of the licensed land all machinery, equipment, tools, and materials. Upon the expiration of that period or extension of that period and at the option of the state, any machinery, equipment, tools, and materials that the licensee has not removed from the licensed land or portion of the licensed land become the property of the state or may be removed by the state at the licensee's expense. At the option of the state, all improvements such as roads, pads, and wells must either be abandoned and the sites rehabilitated by the licensee to the satisfaction of the state, or be left intact and the licensee absolved of all further responsibility as to their maintenance, repair, and eventual abandonment and rehabilitation. Subject to the above conditions, the licensee shall deliver the licensed land or those portions of the licensed land in good condition.

16. DAMAGES AND INDEMNIFICATION. (a) The licensee shall indemnify the state for, and hold it harmless from, any claim, including claims for loss or damage to property or injury to any person caused by or resulting from any act or omission committed under this license by or on behalf of the licensee. The licensee is not responsible to the state under this subparagraph for any loss, damage, or injury caused by or resulting from the sole negligence of the state.

(b) The licensee expressly waives any defense to an action for breach of a provision of this license or for damages resulting from an oil spill, well blow-out, or other harm to the environment that is based on an act or omission committed by an independent contractor in the licensee's employ. The licensee expressly agrees to assume responsibility for all actions of its independent contractors.

17. AUTHORIZED REPRESENTATIVES. The Director of the Division of Oil and Gas, Department of Natural Resources, State of Alaska, and the person executing this license on behalf of the licensee will be authorized representatives for their respective principals for the purposes of administering this license. The state or the licensee may change the designation of its authorized representative or the address to which notices to that representative are to be sent by a notice given in accordance with Paragraph 18 below. When activities under a plan of operations are underway, the licensee shall also designate, by notice under Paragraph 18 below, by name, job title, and address, an agent who will be present in the state during all license activities.

18. NOTICES; PROTEST. (a) Any notices required or permitted under this license must be by electronic media producing a permanent record or in writing and must be given personally or by registered or certified mail, return receipt requested, addressed as follows:

TO THE STATE:

DIRECTOR, DIVISION OF OIL AND GAS
DEPARTMENT OF NATURAL RESOURCES
550 WEST 7TH AVENUE, SUITE 1100
ANCHORAGE, ALASKA 99501-3563

TO THE LICENSEE:

(b) Any notice given under this paragraph will be effective when delivered to the above authorized representative.

19. APPEALS. The licensee shall appeal decisions of the commissioner related to this license in accordance with 11 AAC 82.963.

20. STATUTES AND REGULATIONS. This license is subject to all applicable state and federal statutes and regulations in effect on the Effective Date of this license, and to all statutes and regulations placed in effect after the

Effective Date of this license. A reference to a statute or regulation in this license includes any future change in that statute or regulation whether by amendment, repeal and replacement, or other means. This license does not limit the power of the State of Alaska or the United States of America to enact and enforce legislation or to promulgate and enforce regulations affecting, directly or indirectly, the activities of the licensee or its agents in connection with this license or the value of the interest held under this license. In case of conflicting provisions, statutes and regulations take precedence over this license.

21. INTERPRETATION. This license is to be interpreted in accordance with the rules applicable to the interpretation of contracts made in the State of Alaska. The paragraph headings are not part of this license and are inserted only for convenience. The state and the licensee expressly agree that the law of the State of Alaska will apply in any judicial proceeding affecting this license.

22. WAIVER OF CONDITIONS. The state reserves the right to waive any breach of a provision of this license, but any waiver extends only to the particular breach waived and does not limit the rights of the state with respect to any future breach; nor will the waiver of a particular breach prevent cancellation of this license for any other cause or for the same cause occurring at another time. Notwithstanding the foregoing, the state will not be deemed to have waived a provision of this license unless it does so in writing.

23. SEVERABILITY. If it is finally determined in any judicial proceeding that any provision of this license is invalid, the state and the licensee may jointly agree by a written amendment to this license that, in consideration of the provisions in that written amendment, the invalid portion will be treated as severed from this license and that the remainder of this license, as amended, will remain in effect.

24. NONDISCRIMINATION. The licensee and the licensee's contractors and subcontractors may not discriminate against any employee or applicant because of race, religion, marital status, change in marital status, pregnancy, parenthood, physical handicap, color, sex, age, or national origin as set out in AS 18.80.220. The licensee and its contractors and subcontractors shall, on beginning any operations under this license, post in a conspicuous place notices setting out this nondiscrimination provision.

25. DEFINITIONS. To the extent that the words and phrases used in this license are defined in 11 AAC 82.990, those definitions will apply to this license. With respect to all other words and phrases used in this license, they will be interpreted in accordance with AS. 01.10.040. However, the following words have the following meanings unless the context unavoidably requires otherwise.

(1) "Anniversary Date" means the date in each successive calendar year following the Effective Date that is the same as the Effective Date.

(2) "Associated Substances" means all substances except helium produced as an incident of production of Oil or Gas by ordinary production methods and not defined in this license as Oil or Gas;

(3) "Effective Date" means the first day of the month following the date on which the exploration license or, if an extension is granted, the extension was signed on behalf of the state or, upon written request, on the first day of the month in which it was signed on behalf of the state.

(4) "Force Majeure" means war, riots, acts of God, unusually severe weather, or any other cause beyond the licensee's reasonable ability to foresee or control and includes operational failure of existing transportation facilities and delays caused by judicial decisions or lack of them.

(5) "Gas" means all natural gas (except helium gas) and all other hydrocarbons produced that are not defined in this license as Oil;

(6) "Oil" means crude petroleum oil and other hydrocarbons, regardless of gravity, that are produced in liquid form by ordinary production methods, including liquid hydrocarbons known as distillate or condensate recovered by separation from Gas other than at a Gas processing plant.

26. EFFECTIVE DATE. This license takes effect on

BY SIGNING THIS LICENSE, the state and the licensee agree to be bound by its provisions.

STATE OF ALASKA

By: _____
W. C. Barron
Director, Division of Oil and Gas

STATE OF ALASKA)
) ss.
Third Judicial District)

On , before me appeared W. C. Barron of the Division of Oil and Gas of the State of Alaska, Department of Natural Resources, and who executed this license and acknowledged voluntarily signing it on behalf of the State of Alaska as lessor.

_____
Notary public in and for the State of Alaska
My commission expires _____

LICENSEE: _____

Signature: _____

Printed Name/Title: _____

INSERT NOTARY ACKNOWLEDGMENT OF LICENSEE'S SIGNATURE HERE

SCHEDULE 1

Legal Description

Southwest Cook Inlet Exploration License

ADL 392536

Tract 1
T. 3 S., R. 20 W., Seward Meridian, Alaska.

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 133.00 acres;
Section 10, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 275.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 532.00 acres;
Section 16, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 46.00 acres;

This Tract (1) contains 4,826.00 acres, more or less.

Note: The licensee is cautioned that the mean high water line of Lake Clark National Park and Preserve, PL 96-487, abutting the Southwest Cook Inlet Exploration License area is unsurveyed. The data used for acreage computations is the DNR GIS Administrative Large Parcel depiction of Lake Clark National Park and Preserve, current as of May 12, 2014, and does not necessarily depict the current location of the line of mean high water.

Tract 2
T. 3 S., R. 20 W., Seward Meridian, Alaska.

Section 19, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 99.00 acres;
Section 20, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 292.00 acres;
Section 21, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 566.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 623.00 acres;
Section 31, Protracted, All, 629.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres;

This Tract (2) contains 4,769.00 acres, more or less.

Note: The licensee is cautioned that the mean high water line of Lake Clark National Park and Preserve, PL 96-487, abutting the Southwest Cook Inlet Exploration License area is unsurveyed. The data used for acreage computations is the DNR GIS Administrative Large Parcel depiction of Lake Clark National Park and Preserve, current as of May 12, 2014, and does not necessarily depict the current location of the line of mean high water.

Tract 3
T. 3 S., R. 20 W., Seward Meridian, Alaska.

Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres;
Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34 Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, within the computed Alaska Seaward Boundary, 450.27 acres;

This Tract (3) contains 5,570.27 acres, more or less.

Note: Alaska Seaward Boundary Diagrams based on the currently approved Submerged Lands Act Boundary have not been approved by the State of Alaska and the Bureau of Ocean Energy Management for this region of Cook Inlet. Acreage computations are based on the coordinates published by BOEM for Outer Continental Shelf Official Protraction Diagrams Iliamna NO 05-01 and Seldovia NO 05-02.

Tract 4
T. 3 S., R. 21 W., Seward Meridian, Alaska.

Section 25, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 161.00 acres;
Section 27, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 10.00 acres;
Section 34, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 458.00 acres;
Section 35, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 507.00 acres;
Section 36, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 539.00 acres;

This Tract (4) contains 1,675.00 acres, more or less.

Note: The licensee is cautioned that the mean high water line of Lake Clark National Park and Preserve, PL 96-487, abutting the Southwest Cook Inlet Exploration License area is unsurveyed. The data used for acreage computations is the DNR GIS Administrative Large Parcel depiction of Lake Clark National Park and Preserve, current as of May 12, 2014, and does not necessarily depict the current location of the line of mean high water.

Tract 5
T. 3 S., R. 21 W., Seward Meridian, Alaska.

Section 28, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 40.00 acres;
Section 30, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 50.00 acres;
Section 31, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 574.00 acres;
Section 32, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 495.00 acres;
Section 33, Protracted, All, 627.00 acres;

This Tract (5) contains 1,786.00 acres, more or less.

Note: The licensee is cautioned that the mean high water line of Lake Clark National Park and Preserve, PL 96-487, abutting the Southwest Cook Inlet Exploration License area is unsurveyed. The data used for acreage computations is the DNR GIS Administrative Large Parcel depiction of Lake Clark National Park and Preserve, current as of May 12, 2014, and does not necessarily depict the current location of the line of mean high water.

Tract 6
T. 3 S., R. 22 W., Seward Meridian, Alaska.

Section 25, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 146.00 acres;
Section 26, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 215.00 acres;
Section 27, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 56.00 acres;
Section 31, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 6.00 acres;
Section 32, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 112.00 acres;
Section 33, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 323.00 acres;
Section 34, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 625.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres;

This Tract (6) contains 2,763.00 acres, more or less.

Note: The licensee is cautioned that the mean high water line of Lake Clark National Park and Preserve, PL 96-487, abutting the Southwest Cook Inlet Exploration License area is unsurveyed. The data used for acreage computations is the DNR GIS Administrative Large Parcel depiction of Lake Clark National Park and Preserve, current as of May 12, 2014, and does not necessarily depict the current location of the line of mean high water.

Tract 7
T. 4 S., R. 20 W., Seward Meridian, Alaska.

Section 1, Protracted, All, within the computed Alaska Seaward Boundary, 0.58 acres;
Section 2, Protracted, All, within the computed Alaska Seaward Boundary, 288.99 acres;
Section 3, Protracted, All, within the computed Alaska Seaward Boundary, 630.18 acres;
Section 10, Protracted, All, within the computed Alaska Seaward Boundary, 114.36 acres;

This Tract (7) contains 1,034.11 acres, more or less.

Note: Alaska Seaward Boundary Diagrams based on the currently approved Submerged Lands Act Boundary have not been approved by the State of Alaska and the Bureau of Ocean Energy Management for this region of Cook Inlet. Acreage computations are based on the coordinates published by BOEM for Outer Continental Shelf Official Protraction Diagrams Iliamna NO 05-01 and Seldovia NO 05-02.

Tract 8
T. 4 S., R. 20 W., Seward Meridian, Alaska.

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 631.00 acres;
Section 7, Protracted, All, 633.00 acres;
Section 8, Protracted, All, within the computed Alaska Seaward Boundary, 639.63 acres;
Section 9, Protracted, All, within the computed Alaska Seaward Boundary, 394.24 acres;
Section 17, Protracted, All, within the computed Alaska Seaward Boundary, 266.27 acres;
Section 18, Protracted, All, within the computed Alaska Seaward Boundary, 599.55 acres;
Section 19, Protracted, All, within the computed Alaska Seaward Boundary, 23.60 acres;

This Tract (8) contains 4,467.29 acres, more or less.

Note: Alaska Seaward Boundary Diagrams based on the currently approved Submerged Lands Act Boundary have not been approved by the State of Alaska and the Bureau of Ocean Energy Management for this region of Cook Inlet. Acreage computations are based on the coordinates published by BOEM for Outer Continental Shelf Official Protraction Diagrams Iliamna NO 05-01 and Seldovia NO 05-02.

Tract 9
T. 4 S., R. 21 W., Seward Meridian, Alaska.

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres;

This Tract (9) contains 5,760.00 acres, more or less.

Tract 10
T. 4 S., R. 21 W., Seward Meridian, Alaska.

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 631.00 acres;
Section 7, Protracted, All, 633.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 634.00 acres;

This Tract (10) contains 5,738.00 acres, more or less.

Tract 11
T. 4 S., R. 21 W., Seward Meridian, Alaska.

Section 19, Protracted, All, 636.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 638.00 acres;
Section 31, Protracted, All, 639.00 acres;
Section 32, Protracted, All, 640.00 acres;

Section 33, Protracted, All, within the computed Alaska Seaward Boundary, 477.91 acres;

This Tract (11) contains 5,590.91 acres, more or less.

Note: Alaska Seaward Boundary Diagrams based on the currently approved Submerged Lands Act Boundary have not been approved by the State of Alaska and the Bureau of Ocean Energy Management for this region of Cook Inlet. Acreage computations are based on the coordinates published by BOEM for Outer Continental Shelf Official Protraction Diagrams Iliamna NO 05-01 and Seldovia NO 05-02.

Tract 12
T. 4 S., R. 21 W., Seward Meridian, Alaska.

Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, within the computed Alaska Seaward Boundary, 505.37 acres;
Section 24, Protracted, All, within the computed Alaska Seaward Boundary, 134.11 acres;
Section 26, Protracted, All, within the computed Alaska Seaward Boundary, 29.26 acres;
Section 27, Protracted, All, within the computed Alaska Seaward Boundary, 460.56 acres;
Section 34, Protracted, All, within the computed Alaska Seaward Boundary, 13.11 acres;

This Tract (12) contains 1,782.41 acres, more or less.

Note: Alaska Seaward Boundary Diagrams based on the currently approved Submerged Lands Act Boundary have not been approved by the State of Alaska and the Bureau of Ocean Energy Management for this region of Cook Inlet. Acreage computations are based on the coordinates published by BOEM for Outer Continental Shelf Official Protraction Diagrams Iliamna NO 05-01 and Seldovia NO 05-02.

Tract 13
T. 4 S., R. 22 W., Seward Meridian, Alaska.

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All tide and submerged lands excluding Alaska Maritime National Wildlife Refuge, 624.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Unsurveyed, All tide and submerged lands, 298.00 acres;
Section 15, Unsurveyed, All tide and submerged lands, 190.00 acres;

This Tract (13) contains 4,952.00 acres, more or less.

Note: The licensee is cautioned that public lands on islands, islets, rocks, reefs, spires and designated capes and headlands in the coastal areas and adjacent seas of Alaska are included in the Alaska Maritime National Wildlife Refuge, Gulf of Alaska Unit, PL 96-487. Due to lack of survey data, the data used for acreage computations is the DNR GIS Hydrography data current as of May 21, 2014, is based on USGS topographic maps and 1978 – 1985 aerial high altitude photography, and may not depict the current line of mean high water.

Tract 14
T. 4 S., R. 22 W., Seward Meridian, Alaska.

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 548.00 acres;
Section 7, Protracted, All, 633.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 16, Unsurveyed, All tide and submerged lands, 217.00 acres;
Section 17, Unsurveyed, All tide and submerged lands, 501.00 acres;
Section 18, Unsurveyed, All tide and submerged lands, 634.00 acres;
Section 19, Unsurveyed, All tide and submerged lands, 506.00 acres;
Section 20, Unsurveyed, All tide and submerged lands, 88.00 acres;

This Tract (14) contains 5,687.00 acres, more or less.

Note: The licensee is cautioned that the mean high water line of Lake Clark National Park and Preserve, PL 96-487, abutting the Southwest Cook Inlet Exploration License area is unsurveyed. The data used for acreage computations is the DNR GIS Administrative

Large Parcel depiction of Lake Clark National Park and Preserve, current as of May 12, 2014, and does not necessarily depict the current location of the line of mean high water.

Tract 15
T. 4 S., R. 22 W., Seward Meridian, Alaska.

Section 23, Unsurveyed, All tide and submerged lands, 4.00 acres;
Section 24, Unsurveyed, All tide and submerged lands, 582.00 acres;
Section 25, Unsurveyed, All tide and submerged lands, 546.00 acres;
Section 35, Unsurveyed, All tide and submerged lands, 10.00 acres;
Section 36, Unsurveyed, All tide and submerged lands, 611.00 acres;

This Tract (15) contains 1,753.00 acres, more or less.

Tract 16
T. 4 S., R. 23 W., Seward Meridian, Alaska.

Section 1, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 498.00 acres;
Section 2, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 502.00 acres;
Section 3, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 463.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Unsurveyed, All tide and submerged lands, 626.00 acres;
Section 15, Unsurveyed, All tide and submerged lands, 547.00 acres;

This Tract (16) contains 5,196.00 acres, more or less.

Note: The licensee is cautioned that the mean high water line of Lake Clark National Park and Preserve, PL 96-487, abutting the Southwest Cook Inlet Exploration License area is unsurveyed. The data used for acreage computations is the DNR GIS Administrative Large Parcel depiction of Lake Clark National Park and Preserve, current as of May 12, 2014, and does not necessarily depict the current location of the line of mean high water.

Tract 17
T. 4 S., R. 23 W., Seward Meridian, Alaska.

Section 4, Unsurveyed, All tide and submerged lands excluding Lake Clark National Park and Preserve, 47.00 acres;
Section 5, Unsurveyed, All excluding Lake Clark National Park and Preserve, 29.00 acres;
Section 6, Unsurveyed, All excluding Lake Clark National Park and Preserve, 211.00 acres;
Section 8, Unsurveyed, All tide and submerged lands, 6.00 acres;
Section 9, Unsurveyed, All tide and submerged lands, 439.00 acres;
Section 16, Unsurveyed, All tide and submerged lands, 626.00 acres;
Section 17, Unsurveyed, All tide and submerged lands, 452.00 acres;
Section 18, Unsurveyed, All tide and submerged lands, 2.00 acres;
Section 19, Unsurveyed, All tide and submerged lands, 45.00 acres;
Section 20, Unsurveyed, All tide and submerged lands, 508.00 acres;
Section 21, Unsurveyed, All tide and submerged lands, 144.00 acres;

This Tract (17) contains 2,509.00 acres, more or less.

Note: The licensee is cautioned that the mean high water line of Lake Clark National Park and Preserve, PL 96-487, abutting the Southwest Cook Inlet Exploration License area is unsurveyed. The data used for acreage computations is the DNR GIS Administrative Large Parcel depiction of Lake Clark National Park and Preserve, current as of May 12, 2014, and does not necessarily depict the current location of the line of mean high water.

Tract 18
T. 4 S., R. 23 W., Seward Meridian, Alaska.

Section 23, Unsurveyed, All tide and submerged lands, 77.00 acres;
Section 24, Unsurveyed, All tide and submerged lands, 453.00 acres;
Section 25, Unsurveyed, All tide and submerged lands, 8.00 acres;
Section 36, Surveyed, All, 640.00 acres;

This Tract (18) contains 1,178.00 acres, more or less.

According to the survey plat accepted by the United States Department of the Interior, General Land Office in Washington, D.C. on March 2, 1927.

Tract 19
T. 5 S., R. 21 W., Seward Meridian, Alaska.

Section 5, Protracted, All, within the computed Alaska Seaward Boundary, 119.17 acres;
Section 6, Protracted, All, within the computed Alaska Seaward Boundary, 601.00 acres;
Section 7, Protracted, All, within the computed Alaska Seaward Boundary, 528.37 acres;
Section 8, Protracted, All, within the computed Alaska Seaward Boundary, 2.36 acres;
Section 18, Protracted, All, within the computed Alaska Seaward Boundary, 304.13 acres;
Section 19, Protracted, All, within the computed Alaska Seaward Boundary, 165.40 acres;
Section 30, Protracted, All, within the computed Alaska Seaward Boundary, 16.02 acres;

This Tract (19) contains 1,736.45 acres, more or less.

Note: Alaska Seaward Boundary Diagrams based on the currently approved Submerged Lands Act Boundary have not been approved by the State of Alaska and the Bureau of Ocean Energy Management for this region of Cook Inlet. Acreage computations are based on the coordinates published by BOEM for Outer Continental Shelf Official Protraction Diagrams Iliamna NO 05-01 and Seldovia NO 05-02.

Tract 20
T. 5 S., R. 22 W., Seward Meridian, Alaska.

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Unsurveyed, All tide and submerged lands, 370.00 acres;
Section 10, Unsurveyed, All tide and submerged lands, 564.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres;

This Tract (20) contains 5,414.00 acres, more or less.

Tract 21
T. 5 S., R. 22 W., Seward Meridian, Alaska.

Section 9, Unsurveyed, All tide and submerged lands, 1.00 acres;
Section 16, Unsurveyed, All tide and submerged lands, 93.00 acres;
Section 21, Unsurveyed, All tide and submerged lands, 296.00 acres;
Section 28, Unsurveyed, All tide and submerged lands, 449.00 acres;
Section 32, Unsurveyed, All tide and submerged lands, 75.00 acres;
Section 33, Unsurveyed, All tide and submerged lands, 634.00 acres;

This Tract (21) contains 1,548.00 acres, more or less.

Tract 22
T. 5 S., R. 22 W., Seward Meridian, Alaska.

Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres;
Section 25, Protracted, All, within the computed Alaska Seaward Boundary, 592.44 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, within the computed Alaska Seaward Boundary, 427.25 acres;

This Tract (22) contains 5,499.69 acres, more or less.

Note: Alaska Seaward Boundary Diagrams based on the currently approved Submerged Lands Act Boundary have not been approved by the State of Alaska and the Bureau of Ocean Energy Management for this region of Cook Inlet. Acreage computations are based on

the coordinates published by BOEM for Outer Continental Shelf Official Protraction Diagrams Iliamna NO 05-01 and Seldovia NO 05-02.

Tract 23
T. 5 S., R. 23 W., Seward Meridian, Alaska.

Section 16, Surveyed, All, 640.00 acres;

This Tract (23) contains 640.00 acres, more or less.

According to the survey plat accepted by the United States Department of the Interior, General Land Office in Washington, D.C. on March 2, 1927.

Tract 24
T. 5 S., R. 23 W., Seward Meridian, Alaska.

Section 36, Surveyed, All, 640.00 acres;

This Tract (24) contains 640.00 acres, more or less.

According to the survey plat accepted by the United States Department of the Interior, General Land Office in Washington, D.C. on March 2, 1927.

Tract 25
T. 5 S., R. 24 W., Seward Meridian, Alaska.

Section 6, Unsurveyed, All tide and submerged lands, 338.00 acres;
Section 7, Unsurveyed, All tide and submerged lands, 550.00 acres;
Section 8, Unsurveyed, All tide and submerged lands, 4.00 acres;
Section 16, Unsurveyed, All tide and submerged lands, 8.00 acres;
Section 17, Unsurveyed, All tide and submerged lands, 486.00 acres;
Section 18, Unsurveyed, All tide and submerged lands, 605.00 acres;

This Tract (25) contains 1,991.00 acres, more or less.

Tract 26
T. 5 S., R. 24 W., Seward Meridian, Alaska.

Section 15, Unsurveyed, All tide and submerged lands, 1.00 acres;
Section 19, Protracted, All, 606.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Unsurveyed, All tide and submerged lands, 484.00 acres;
Section 22, Unsurveyed, All tide and submerged lands, 265.00 acres;
Section 27, Unsurveyed, All tide and submerged lands, 10.00 acres;
Section 28, Unsurveyed, All tide and submerged lands, 310.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 608.00 acres;
Section 31, Protracted, All, 610.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Unsurveyed, All tide and submerged lands, 247.00 acres;

This Tract (26) contains 5,061.00 acres, more or less.

Tract 27
T. 5 S., R. 24 W., Seward Meridian, Alaska.

Section 36, Surveyed, All, 640.00 acres;

This Tract (27) contains 640.00 acres, more or less.

According to the survey plat accepted by the United States Department of the Interior, General Land Office in Washington, D.C. on March 2, 1927.

Tract 28
T. 6 S., R. 22 W., Seward Meridian, Alaska.

Section 1, Protracted, All within the computed Alaska Seaward Boundary, 266.12 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All within the computed Alaska Seaward Boundary, 618.68 acres;
Section 12, Protracted, All within the computed Alaska Seaward Boundary, 72.21 acres;
Section 14, Protracted, All within the computed Alaska Seaward Boundary, 211.48 acres;
Section 15, Protracted, All within the computed Alaska Seaward Boundary, 611.21 acres;

This Tract (28) contains 3,699.70 acres, more or less.

Note: Alaska Seaward Boundary Diagrams based on the currently approved Submerged Lands Act Boundary have not been approved by the State of Alaska and the Bureau of Ocean Energy Management for this region of Cook Inlet. Acreage computations are based on the coordinates published by BOEM for Outer Continental Shelf Official Protraction Diagrams Iliamna NO 05-01 and Seldovia NO 05-02.

Tract 29
T. 6 S., R. 22 W., Seward Meridian, Alaska.

Section 4, Protracted, All, 640.00 acres;
Section 5, Unsurveyed, All tide and submerged lands, 633.00 acres;
Section 6, Unsurveyed, All tide and submerged lands, 321.00 acres;
Section 7, Protracted, All, 613.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 615.00 acres;

This Tract (29) contains 5,382.00 acres, more or less.

Tract 30
T. 6 S., R. 22 W., Seward Meridian, Alaska.

Section 19, Protracted, All, 616.00 acres;
Section 20, Protracted, All within the computed Alaska Seaward Boundary, 604.74 acres;
Section 21, Protracted, All within the computed Alaska Seaward Boundary, 304.49 acres;
Section 22, Protracted, All within the computed Alaska Seaward Boundary, 52.48 acres;
Section 29, Protracted, All within the computed Alaska Seaward Boundary, 88.21 acres;
Section 30, Protracted, All within the computed Alaska Seaward Boundary, 578.42 acres;
Section 31, Protracted, All within the computed Alaska Seaward Boundary, 109.48 acres;

This Tract (30) contains 2,353.82 acres, more or less.

Note: Alaska Seaward Boundary Diagrams based on the currently approved Submerged Lands Act Boundary have not been approved by the State of Alaska and the Bureau of Ocean Energy Management for this region of Cook Inlet. Acreage computations are based on the coordinates published by BOEM for Outer Continental Shelf Official Protraction Diagrams Iliamna NO 05-01 and Seldovia NO 05-02.

Tract 31
T. 6 S., R. 23 W., Seward Meridian, Alaska.

Section 1, Unsurveyed, All tide and submerged lands, 73.00 acres;
Section 2, Unsurveyed, All tide and submerged lands, 47.00 acres;
Section 11, Unsurveyed, All tide and submerged lands, 322.00 acres;
Section 12, Unsurveyed, All tide and submerged lands, 639.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Unsurveyed, All tide and submerged lands, 497.00 acres;
Section 15, Unsurveyed, All tide and submerged lands, 72.00 acres;

This Tract (31) contains 2,290.00 acres, more or less.

Tract 32
T. 6 S., R. 23 W., Seward Meridian, Alaska.

Section 18, Unsurveyed, All tide and submerged lands, 28.00 acres;
Section 19, Unsurveyed, All tide and submerged lands, 250.00 acres;
Section 20, Unsurveyed, All tide and submerged lands, 13.00 acres;
Section 21, Unsurveyed, All tide and submerged lands, 214.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 29, Unsurveyed, All tide and submerged lands, 620.00 acres;
Section 30, Unsurveyed, All tide and submerged lands, 612.00 acres;
Section 31, Protracted, All, 620.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres;

This Tract (32) contains 4,277.00 acres, more or less.

Tract 33
T. 6 S., R. 23 W., Seward Meridian, Alaska.

Section 22, Unsurveyed, All tide and submerged lands, 601.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres;
Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, within the computed Alaska Seaward Boundary, 642.30 acres;

This Tract (33) contains 5,723.30 acres, more or less.

Note: Alaska Seaward Boundary Diagrams based on the currently approved Submerged Lands Act Boundary have not been approved by the State of Alaska and the Bureau of Ocean Energy Management for this region of Cook Inlet. Acreage computations are based on the coordinates published by BOEM for Outer Continental Shelf Official Protraction Diagrams Iliamna NO 05-01 and Seldovia NO 05-02.

Tract 34
T. 6 S., R. 24 W., Seward Meridian, Alaska.

Section 11, Unsurveyed, All tide and submerged lands, 117.00 acres;
Section 12, Unsurveyed, All tide and submerged lands, 225.00 acres;
Section 13, Unsurveyed, All tide and submerged lands, 628.00 acres;
Section 14, Unsurveyed, All tide and submerged lands, 208.00 acres;
Section 23, Unsurveyed, All tide and submerged lands, 93.00 acres;
Section 24, Protracted, All, 640.00 acres;
Section 25, Unsurveyed, All tide and submerged lands excluding Alaska Maritime National Wildlife Refuge, 639.00 acres;
Section 26, Unsurveyed, All tide and submerged lands, 282.00 acres;
Section 27, Unsurveyed, All tide and submerged lands, 124.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres;

This Tract (34) contains 4,876.00 acres, more or less.

Note: The licensee is cautioned that public lands on islands, islets, rocks, reefs, spires and designated capes and headlands in the coastal areas and adjacent seas of Alaska are included in the Alaska Maritime National Wildlife Refuge, Gulf of Alaska Unit, PL 96-487. Due to lack of survey data, the data used for acreage computations is the DNR GIS Hydrography data current as of May 21, 2014, is based on USGS topographic maps and 1978 – 1985 aerial high altitude photography, and may not depict the current line of mean high water.

Tract 35
T. 6 S., R. 24 W., Seward Meridian, Alaska.

Section 4, Unsurveyed, All tide and submerged lands, 88.00 acres;
Section 5, Unsurveyed, All tide and submerged lands, 638.00 acres;
Section 6, Protracted, All, 611.00 acres;
Section 7, Protracted, All, 613.00 acres;

Section 8, Unsurveyed, All tide and submerged lands, 594.00 acres;
Section 17, Unsurveyed, All tide and submerged lands excluding Alaska Maritime National Wildlife Refuge, 255.00 acres;
Section 18, Unsurveyed, All tide and submerged lands, 596.00 acres;

This Tract (35) contains 3,395.00 acres, more or less.

Note: The licensee is cautioned that public lands on islands, islets, rocks, reefs, spires and designated capes and headlands in the coastal areas and adjacent seas of Alaska are included in the Alaska Maritime National Wildlife Refuge, Gulf of Alaska Unit, PL 96-487. Due to lack of survey data, the data used for acreage computations is the DNR GIS Hydrography data current as of May 21, 2014, is based on USGS topographic maps and 1978 – 1985 aerial high altitude photography, and may not depict the current line of mean high water.

Tract 36
T. 6 S., R. 24 W., Seward Meridian, Alaska.

Section 19, Unsurveyed, All tide and submerged lands excluding Alaska Maritime National Wildlife Refuge, 486.00 acres;
Section 20, Unsurveyed, All tide and submerged lands, 132.00 acres;
Section 21, Unsurveyed, All tide and submerged lands, 23.00 acres;
Section 28, Unsurveyed, All tide and submerged lands, 529.00 acres;
Section 29, Unsurveyed, All tide and submerged lands excluding Alaska Maritime National Wildlife Refuge, 639.00 acres;
Section 30, Unsurveyed, All tide and submerged lands excluding Alaska Maritime National Wildlife Refuge, 600.00 acres;
Section 31, Protracted, All, 620.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Unsurveyed, All tide and submerged lands excluding Alaska Maritime National Wildlife Refuge, 620.00 acres;

This Tract (36) contains 4,289.00 acres, more or less.

Note: The licensee is cautioned that public lands on islands, islets, rocks, reefs, spires and designated capes and headlands in the coastal areas and adjacent seas of Alaska are included in the Alaska Maritime National Wildlife Refuge, Gulf of Alaska Unit, PL 96-487. Due to lack of survey data, the data used for acreage computations is the DNR GIS Hydrography data current as of May 21, 2014, is based on USGS topographic maps and 1978 – 1985 aerial high altitude photography, and may not depict the current line of mean high water.

Tract 37
T. 6 S., R. 25 W., Seward Meridian, Alaska.

Section 1, Unsurveyed, All tide and submerged lands excluding Alaska Maritime National Wildlife Refuge, 245.00 acres;
Section 12, Unsurveyed, All tide and submerged lands, 439.00 acres;
Section 13, Unsurveyed, All tide and submerged lands excluding Alaska Maritime National Wildlife Refuge, 512.00 acres;

This Tract (37) contains 1,196.00 acres, more or less.

Note: The licensee is cautioned that public lands on islands, islets, rocks, reefs, spires and designated capes and headlands in the coastal areas and adjacent seas of Alaska are included in the Alaska Maritime National Wildlife Refuge, Gulf of Alaska Unit, PL 96-487. Due to lack of survey data, the data used for acreage computations is the DNR GIS Hydrography data current as of May 21, 2014, is based on USGS topographic maps and 1978 – 1985 aerial high altitude photography, and may not depict the current line of mean high water.

Tract 38
T. 6 S., R. 25 W., Seward Meridian, Alaska.

Section 22, Unsurveyed, All tide and submerged lands excluding Alaska Maritime National Wildlife Refuge, 72.00 acres;
Section 23, Unsurveyed, All tide and submerged lands excluding Alaska Maritime National Wildlife Refuge, 272.00 acres;
Section 24, Unsurveyed, All tide and submerged lands excluding Alaska Maritime National Wildlife Refuge, 639.00 acres;
Section 25, Unsurveyed, All tide and submerged lands excluding Alaska Maritime National Wildlife Refuge, 638.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Unsurveyed, All tide and submerged lands excluding Alaska Maritime National Wildlife Refuge, 628.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres;

This Tract (38) contains 4,809.00 acres, more or less.

Note: The licensee is cautioned that public lands on islands, islets, rocks, reefs, spires and designated capes and headlands in the coastal areas and adjacent seas of Alaska are included in the Alaska Maritime National Wildlife Refuge, Gulf of Alaska Unit, PL 96-487. Due to lack of survey data, the data used for acreage computations is the DNR GIS Hydrography data current as of May 21, 2014,

is based on USGS topographic maps and 1978 – 1985 aerial high altitude photography, and may not depict the current line of mean high water.

Tract 39
T. 7 S., R. 23 W., Seward Meridian, Alaska.

Section 1, Protracted, All, within the computed Alaska Seaward Boundary, 33.11 acres;
Section 2, Protracted, All, within the computed Alaska Seaward Boundary, 390.29 acres;
Section 3, Protracted, All, within the computed Alaska Seaward Boundary, 630.40 acres;
Section 10, Protracted, All, within the computed Alaska Seaward Boundary, 87.54 acres;

This Tract (39) contains 1,141.34 acres, more or less.

Note: Alaska Seaward Boundary Diagrams based on the currently approved Submerged Lands Act Boundary have not been approved by the State of Alaska and the Bureau of Ocean Energy Management for this region of Cook Inlet. Acreage computations are based on the coordinates published by BOEM for Outer Continental Shelf Official Protraction Diagrams Iliamna NO 05-01 and Seldovia NO 05-02.

Tract 40
T. 7 S., R. 23 W., Seward Meridian, Alaska.

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 621.00 acres;
Section 7, Protracted, All, within the computed Alaska Seaward Boundary, 561.41 acres;
Section 8, Protracted, All, within the computed Alaska Seaward Boundary, 482.56 acres;
Section 9, Protracted, All, within the computed Alaska Seaward Boundary, 361.80 acres;
Section 18, Protracted, All, within the computed Alaska Seaward Boundary, 28.99 acres;

This Tract (40) contains 3,335.76 acres, more or less.

Note: Alaska Seaward Boundary Diagrams based on the currently approved Submerged Lands Act Boundary have not been approved by the State of Alaska and the Bureau of Ocean Energy Management for this region of Cook Inlet. Acreage computations are based on the coordinates published by BOEM for Outer Continental Shelf Official Protraction Diagrams Iliamna NO 05-01 and Seldovia NO 05-02.

Tract 41
T. 7 S., R. 24 W., Seward Meridian, Alaska.

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, within the computed Alaska Seaward Boundary, 360.38 acres;
Section 14, Protracted, All, within the computed Alaska Seaward Boundary, 597.63 acres;
Section 15, Protracted, All, 640.00 acres;

This Tract (41) contains 5,438.01 acres, more or less.

Note: Alaska Seaward Boundary Diagrams based on the currently approved Submerged Lands Act Boundary have not been approved by the State of Alaska and the Bureau of Ocean Energy Management for this region of Cook Inlet. Acreage computations are based on the coordinates published by BOEM for Outer Continental Shelf Official Protraction Diagrams Iliamna NO 05-01 and Seldovia NO 05-02.

Tract 42
T. 7 S., R. 24 W., Seward Meridian, Alaska.

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 621.00 acres;
Section 7, Protracted, All, 623.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;

Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 624.00 acres;

This Tract (42) contains 5,708.00 acres, more or less.

Tract 43
T. 7 S., R. 24 W., Seward Meridian, Alaska.

Section 19, Protracted, All, 626.00 acres;
Section 20, Protracted, All, within the computed Alaska Seaward Boundary, 594.10 acres;
Section 21, Protracted, All, within the computed Alaska Seaward Boundary, 268.07 acres;
Section 22, Protracted, All, within the computed Alaska Seaward Boundary, 64.12 acres;
Section 23, Protracted, All, within the computed Alaska Seaward Boundary, 4.17 acres;
Section 29, Protracted, All, within the computed Alaska Seaward Boundary, 47.06 acres;
Section 30, Protracted, All, within the computed Alaska Seaward Boundary, 363.34 acres;

This Tract (43) contains 1,966.86 acres, more or less.

Note: Alaska Seaward Boundary Diagrams based on the currently approved Submerged Lands Act Boundary have not been approved by the State of Alaska and the Bureau of Ocean Energy Management for this region of Cook Inlet. Acreage computations are based on the coordinates published by BOEM for Outer Continental Shelf Official Protraction Diagrams Iliamna NO 05-01 and Seldovia NO 05-02.

Tract 44
T. 7 S., R. 25 W., Seward Meridian, Alaska.

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres;

This Tract (44) contains 5,760.00 acres, more or less.
Tract 45
T. 7 S., R. 25 W., Seward Meridian, Alaska.

Section 4, Unsurveyed, All tide and submerged lands excluding Alaska Maritime National Wildlife Refuge, 631.00 acres;
Section 5, Unsurveyed, All tide and submerged lands excluding Alaska Maritime National Wildlife Refuge, 37.00 acres;
Section 8, Unsurveyed, All tide and submerged lands excluding Alaska Maritime National Wildlife Refuge, 133.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 17, Unsurveyed, All tide and submerged lands, 389.00 acres;

This Tract (45) contains 2,470.00 acres, more or less.

Note: The licensee is cautioned that public lands on islands, islets, rocks, reefs, spires and designated capes and headlands in the coastal areas and adjacent seas of Alaska are included in the Alaska Maritime National Wildlife Refuge, Gulf of Alaska Unit, PL 96-487. Due to lack of survey data, the data used for acreage computations is the DNR GIS Hydrography data current as of May 21, 2014, is based on USGS topographic maps and 1978 – 1985 aerial high altitude photography, and may not depict the current line of mean high water.

Tract 46
T. 7 S., R. 25 W., Seward Meridian, Alaska.

Section 19, Unsurveyed, All tide and submerged lands, 161.00 acres;
Section 20, Unsurveyed, All tide and submerged lands, 590.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 628.00 acres;
Section 31, Protracted, All, 629.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres;

This Tract (46) contains 5,208.00 acres, more or less.

Tract 47
T. 7 S., R. 25 W., Seward Meridian, Alaska.

Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres;
Section 25, Protracted, All, within the computed Alaska Seaward Boundary, 630.37 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, within the computed Alaska Seaward Boundary, 474.45 acres;
Section 36, Protracted, All, within the computed Alaska Seaward Boundary, 110.75 acres;

This Tract (47) contains 5,055.57 acres, more or less.

Note: Alaska Seaward Boundary Diagrams based on the currently approved Submerged Lands Act Boundary have not been approved by the State of Alaska and the Bureau of Ocean Energy Management for this region of Cook Inlet. Acreage computations are based on the coordinates published by BOEM for Outer Continental Shelf Official Protraction Diagrams Iliamna NO 05-01 and Seldovia NO 05-02.

Aggregating 168,581.49 acres, more or less.

SCHEDULE 2

Annual Bonding Calculation

(This schedule must be updated and submitted annually to the Division of Oil & Gas)

1.	Enter	Beginning Work Commitment	$ _____
2.	Enter	Cumulative Direct Exploration Expenditures	$ _____
3.	Line 1 Minus Line 2	Balance of Remaining Work Commitment	$ _____
4	Enter	# of Years Remaining in Term of License	_____
5	Line 3 Divided by Line 4	Annual Bond Due	$ _____

Attachment 1. Alaska Department of Natural Resources, Division of Oil & Gas
Submittal of Well Data Required by DNR License

Data shall be submitted to the Division in a digital format, generally in PDF. For spreadsheets, include the original Excel document. For images such as maps or charts, include a high-resolution TIFF or JPEG. For logs, see formats specified below, but include a graphical image file of the logs as a PDF or TIFF in addition to the final merged data file of the log curves. Data may be submitted on CD, DVD or USB mass storage device (include any necessary cables). Required data shall include any and all of the following:

1. A copy of the well completion report (AOGCC Form 10-407) for each well bore.
2. Daily drilling reports or a summary report of daily drilling.
3. Latitudinal and longitudinal coordinates for each well, pilot hole, and plugged back well bore with completed surface and bottom hole locations. Coordinates can be based upon either the NAD 83 or NAD 27 geodetic datum as long as the datum used is clearly specified.
4. Directional survey for each well, pilot hole, and plugged back well bore.
5. A list of all logs run and the depth interval covered for each well, pilot hole, and plugged back well bore.
6. A list of formations and other geologic markers encountered and the measured depths (MD) and true vertical depths (TVD) of each, for each well, pilot hole, and plugged back well bore.
7. Summary of cored intervals (conventional and sidewall), including depth, formation name, lithology, presence of oil, gas, gas hydrates, and water, porosity, fractures and apparent dips; indicate "**none**" on completion report or in an attachment if no cores were taken.
8. Core reports including lab analyses of lithology, porosity, permeability (vertical and horizontal, air and liquid), density, capillary pressure, and fluid saturation, if available.
9. Conventional and sidewall core photos (plain light and ultraviolet), if applicable.
10. Identified formation names and corresponding depths for oil, gas, and gas hydrate shows. Indicate "**none**" on the completion report or in an attachment if no shows were observed.
11. Identified depth zones of abnormal pressure. Indicate "**none**" on the completion report or in an attachment if none were observed.
12. A synopsis or summary of testing and all fluid recovery efforts, including production tests (IP), drill stem tests (DST), wireline formation tests (i.e. repeat formation tests (RFT) and modular dynamics tests (MDT)), and any other production and formation testing data; the summary should include test date, time, depth, formation name, method of operation, recovered fluid type(s) and amount(s), fluid rate, gas-oil ratio (GOR), oil gravity, pressure, and choke size, when available. If no tests were undertaken, indicate "**none**" where appropriate on the completion report or in an attachment, if tests were undertaken but failed to recover fluids indicate "**no recovery**".
13. Pressure build-up and fluid PVT analyses, if applicable.
14. Open flow potential test reports and report attachments to AOGCC Forms 10-421.
15. Well test procedures, field chronologies, and field data; including details necessary for evaluation (intervals open to test; volumes of oil, gas, water, mud, and other borehole substances; API gravity; gas density; wellhead and down hole pressure; and formation and wellhead temperature).
16. Geochemical and formation fluid analyses and reports, if applicable.
17. Down hole and surface fluid sampling procedures, field chronologies, raw data, and laboratory test results for all water and hydrocarbon-bearing zones (oil, gas, gas hydrates) sampled; including details sufficient to fully evaluate quality of sample data.
18. Permit to drill (AOGCC form 10-401) and the survey as-built of the well location.
19. LAS Version 2, TAP, TIF, LIS and DLIS (if available) files of final merged open-and cased-hole log data, including specialty logs (such as Schlumberger's cyberlook, formation microscanners and dipmeter logs), measured-while-drilling (MWD) and logged-while-drilling (LWD) logs. Include a graphical image file of the 2-inch MD & TVD logs as a PDF or TIFF in addition to the log data file.
20. LAS Version 2 of final composite mudlog or lithology log curves. Include a graphical image file of the final 2-inch MD & TVD logs, with lithology display, oil, gas, and gas hydrate show indicators, mud properties, and cuttings descriptions and report as a PDF or TIFF in addition to the log data file.
21. Clear, legible files of all well data and reports including, but not limited to, paleontology, palynology, petrography (including point-count analyses), X-ray diffraction analyses, SEM micrographs, thermal maturity, vitrinite reflectance, total organic carbon, RockEval pyrolysis, geochronology, fission track analyses, fluid inclusion analyses, Mercury injection capillary pressure analyses, chemical analyses (EPMA, XRF, ICP, etc.), isotope analyses, water chemistry, burial and temperature history analyses, strain analyses, acoustic analyses, gas hydrate analyses and well pressure and temperature survey analyses.

22. Final reports of velocity, checkshot or VSP surveys (an ASCII format digital version of the above data shall also be submitted), including seismic profile data in SEG-Y format. Indicate “none” in your response to this request if no velocity, checkshot or VSP surveys were undertaken. Submission of velocity, checkshot, and VSP surveys is always required by DNR under the operator surface-use permit obligations.
23. All coalbed core, gas, and water quality reports including lab analyses of core lithology, coal rank, vitrinite reflectance, maceral composition, total organic carbon, ash, sulfur and BTU content, moisture content, cleating, adsorption/desorption data, residual gas measurements, porosity and permeability analyses, core photos, if available.
24. Any other geoscience- and engineering-related data sets from the well(s).

Please note: Physical samples of well cuttings or cores specified in 20 AAC 25.071(b)(2) and 20 AAC 25.071(b)(4) should be sent to AOGCC, not to the Division.

All material should be either hand-carried by bonded courier or mailed by registered mail to:

Resource Evaluation Section
Alaska Department of Natural Resources, Division of Oil & Gas
550 West 7th Avenue, Suite 1100
Anchorage, AK 99501-3510
Email: DOG.REdata@alaska.gov

Appendix C: Sample Lease

Oil and Gas Conversion Lease
Form #DOG 201309 CL

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES

Southwest Cook Inlet Oil and Gas Exploration License Conversion Lease
ADL No.

THIS LEASE is entered into , between the State of Alaska, "the state," and

"the lessee," whether one or more, whose sole address for purposes of notification is under Paragraph 25.

In consideration of the cash payment made by the lessee to the state, which payment includes the first year's rental and any required cash bonus, and subject to the provisions of this lease, including applicable stipulation(s) and mitigating measures attached to this lease and by this reference incorporated in this lease, the state and the lessee agree as follows:

1. GRANT. (a) Subject to the provisions in this lease, the state grants and leases to the lessee, without warranty, the exclusive right to drill for, extract, remove, clean, process, and dispose of oil, gas, and associated substances in or under the following described tract of land:

containing approximately acres, more or less (referred to in this lease as the "leased area"); the nonexclusive right to conduct within the leased area geological and geophysical exploration for oil, gas, and associated substances; and the nonexclusive right to install pipelines and build structures on the leased area to find, produce, save, store, treat, process, transport, take care of, and market all oil, gas, and associated substances and to house and board employees in its operations on the leased area. The rights granted by this lease are to be exercised in a manner which will not unreasonably interfere with the rights of any permittee, lessee or grantee of the state consistent with the principle of reasonable concurrent uses as set out in Article VIII, Section 8 of the Alaska Constitution.

(b) For the purposes of this lease, the leased area contains the legal subdivisions as shown on the attached plat marked Exhibit A.

(c) If the leased area is described by protracted legal subdivisions and, after the effective date of this lease, the leased area is surveyed under the public land rectangular system, the boundaries of the leased area are those established by that survey, when approved, subject, however, to the provisions of applicable regulations relating to those surveys. If for any reason the leased area includes more acreage than the maximum permitted under applicable law (including the "rule of approximation" authorized in AS 38.05.145 and defined in AS 38.05.965 (18)), this lease is not void and the acreage included in the leased area must be reduced to the permitted maximum. If the state determines that the leased area exceeds the permitted acreage and notifies the lessee in writing of the amount of acreage that must be eliminated, the lessee has 60 days after that notice to surrender one or more legal subdivisions included in the leased area comprising at least the amount of acreage that must be eliminated. Any subdivision surrendered must be located on the perimeter of the leased area as originally described. If a surrender is not filed within 60 days, the state may terminate this lease as to the acreage that must be eliminated by mailing notice of the termination to the lessee describing the subdivision eliminated.

(d) If the State of Alaska's ownership interest in the oil, gas, and associated substances in the leased area is less than an entire and undivided interest, the grant under this lease is effective only as to the state's interest in that oil, gas, and associated substances, and the royalties and rentals provided in this lease must be paid to the state in the proportion that the state's interest bears to the entire undivided fee.

(e) The state makes no representations or warranties, express or implied, as to title, or access to, or quiet enjoyment of, the leased area. The state is not liable to the lessee for any deficiency in title to the leased area, nor is the lessee or any successor in interest to the lessee entitled to any refund due to deficiency in title for any rentals, bonuses, or royalties paid under this lease.

2. RESERVED RIGHTS. (a) The state, for itself and others, reserves all rights not expressly granted to the lessee by this lease. These reserved rights include, but are not limited to:

(1) the right to explore for oil, gas, and associated substances by geological and geophysical means;

(2) the right to explore for, develop, and remove natural resources other than oil, gas, and associated substances on or from the leased area;

(3) the right to establish or grant easements and rights-of-way for any lawful purpose, including without limitation for shafts and tunnels necessary or appropriate for the working of the leased area or other lands for natural resources other than oil, gas, and associated substances;

(4) the right to dispose of land within the leased area for well sites and well bores of wells drilled from or through the leased area to explore for or produce oil, gas, and associated substances in and from lands not within the leased area; and

(5) the right otherwise to manage and dispose of the surface of the leased area or interests in that land by grant, lease, permit, or otherwise to third parties.

(b) The rights reserved may be exercised by the state, or by any other person or entity acting under authority of the state, in any manner that does not unreasonably interfere with or endanger the lessee's operations under this lease.

3. TERM. This lease is issued for an initial primary term of years from the effective date of this lease. The term may be extended as provided in Paragraph 4 below.

4. EXTENSION. (a) This lease will be extended automatically if and for so long as oil or gas is produced in paying quantities from the leased area.

(b) This lease will be extended automatically if it is committed to a unit agreement approved or prescribed by the state, and will remain in effect for so long as it remains committed to that unit agreement.

(c) (1) If the drilling of a well whose bottom hole location is in the leased area has commenced as of the date on which the lease otherwise would expire and is continued with reasonable diligence, this lease will continue in effect until 90 days after cessation of that drilling and for so long as oil or gas is produced in paying quantities from the leased area.

(2) If oil or gas in paying quantities is produced from the leased area, and if that production ceases at any time, this lease will not terminate if drilling or reworking operations are commenced on the leased area within sixty days after cessation of production and are prosecuted with reasonable diligence; if those drilling or reworking operations result in the production of oil or gas, this lease will remain in effect for so long as oil or gas is produced in paying quantities from the leased area.

(d) If the lease is not automatically extended under subsections (a) – (c) above, the state may approve a one-time extension of the primary term of the lease upon written application by the lessee if the state finds that the extension is in the best interest of the state. A lessee requesting a one-time extension must send the request to the state

at least 180 days before the expiration date of the primary term of the lease. The length of the primary term of the lease combined with the term of the one-time extension may not exceed a total of 10 years. The state shall consider the funds expended by the lessee to explore and develop the lease, the types of work completed by or on behalf of the lessee, and any other relevant information in deciding whether to extend the lease. The state may condition a lease extension on posting of a performance bond by the lessee, meeting a minimum work commitment, or both. The work commitment, if required, must be expressed in terms of money to be spent or type and amount of work to be performed.

(e) If there is a well capable of producing oil or gas in paying quantities on the leased area, this lease will not expire because the lessee fails to produce that oil or gas unless the state gives notice to the lessee, allowing a reasonable time, which will not be less than six months after notice, to place the well into production, and the lessee fails to do so. If production is established within the time allowed, this lease is extended only for so long as oil or gas is produced in paying quantities from the leased area.

(f) If the state directs or approves in writing a suspension of all operations on or production from the leased area (except for a suspension necessitated by the lessee's negligence), or if a suspension of all operations on or production from the leased area has been ordered under federal, state, or local law, the lessee's obligation to comply with any express or implied provision of this lease requiring operations or production will be suspended, but not voided, and the lessee shall not be liable for damages for failure to comply with that provision. If the suspension occurs before the expiration of the primary term, the primary term will be extended at the end of the period of the suspension by adding the period of time lost under the primary term because of the suspension. If the suspension occurs during an extension of the primary term under this paragraph, upon removal of that suspension, the lessee will have a reasonable time, which will not be less than six months after notice that the suspension has been removed, to resume operations or production. For the purposes of this subparagraph, any suspension of operations or production specifically required or imposed as a term of sale or by any stipulation made a part of this lease will not be considered a suspension ordered by law.

(g) If the state determines that the lessee has been prevented by force majeure, after efforts made in good faith, from performing any act that would extend the lease beyond the primary term, this lease will not expire during the period of force majeure. If the force majeure occurs before the expiration of the primary term, the primary term will be extended at the end of the period of force majeure by adding the period of time lost under the primary term because of the force majeure. If the force majeure occurs during an extension of the primary term under this paragraph, this lease will not expire during the period of force majeure plus a reasonable time after that period, which will not be less than 60 days, for the lessee to resume operations or production.

(h) Nothing in subparagraphs (f) or (g) suspends the obligation to pay royalties or other production or profit-based payments to the state from operations on the leased area that are not affected by any suspension or force majeure, or suspends the obligation to pay rentals.

5. RENTALS. (a) The lessee shall pay annual rental to the state of $3.00 per acre or fraction of an acre, provided that the state may increase the annual rental rate as provided by law upon extension of this lease beyond the primary term.

(b) Annual rental paid in advance is a credit on the royalty or net profit share due under this lease for that year.

(c) The lessee shall pay the annual rental to the State of Alaska (or any depository designated by the state with at least 60 days' notice to the lessee) in advance, on or before the annual anniversary date of this lease. The state is not required to give notice that rentals are due by billing the lessee. If the state's (or depository's) office is not open for business on the annual anniversary date of this lease, the time for payment is extended to include the next day on which that office is open for business. If the annual rental is not paid timely, this lease automatically terminates as to both parties at 11:59 p.m., Alaska Standard Time, on the date by which the rental payment was to have been made.

6. RECORDS. The lessee shall keep and have in its possession books and records showing the development and production (including records of development and production expenses) and disposition (including records of sale prices, volumes, and purchasers) of all oil, gas, and associated substances produced from the leased area. The lessee shall permit the State of Alaska or its agents to examine these books and records at all reasonable times. Upon request by the state, the lessee's books and records shall be made available to the state at the state office designated by the state. These books and records of development, production, and disposition must employ methods and techniques that will ensure the most accurate figures reasonably available without requiring the lessee to provide separate tankage or meters for each well. The lessee shall use generally accepted accounting procedures consistently applied.

7. APPORTIONMENT OF ROYALTY FROM APPROVED UNIT. The landowners' royalty share of the unit production allocated to each separately owned tract shall be regarded as royalty to be distributed to and among, or the proceeds of it paid to, the landowners, free and clear of all unit expense and free of any lien for it. Under this provision, the state's royalty share of any unit production allocated to the leased area will be regarded as royalty to be distributed to, or the proceeds of it paid to, the state, free and clear of all unit expenses (and any portion of those expenses incurred

away from the unit area), including, but not limited to, expenses for separating, cleaning, dehydration, gathering, saltwater disposal, and preparing oil, gas, or associated substances for transportation off the unit area, and free of any lien for them.

8. PAYMENTS. All payments to the State of Alaska under this lease must be made payable to the state in the manner directed by the state, and unless otherwise specified, must be tendered to the state at:

DEPARTMENT OF NATURAL RESOURCES
550 WEST 7TH AVENUE, SUITE 1410
ANCHORAGE, ALASKA 99501-3561
ATTENTION: FINANCIAL SERVICES SECTION

or in person at either of the Department's Public Information Centers located at

550 W. 7th Ave., Suite 1260
Anchorage, Alaska

3700 Airport Way
Fairbanks, Alaska

or to any depository designated by the state with at least 60 days' notice to the lessee.

9. PLAN OF OPERATIONS. (a) Except as provided in (b) of this section, a plan of operations for all or part of the leased area must be approved by the commissioner before any operations may be undertaken on or in the leased area.

(b) A plan of operations is not required for:

(1) activities that would not require a land use permit; or

(2) operations undertaken under an approved unit plan of operations.

(c) Before undertaking operations on or in the leased area, the lessee shall provide for full payment of all damages sustained by the owner of the surface estate as well as by the surface owner's lessees and permittees, by reason of entering the land.

(d) An application for approval of a plan of operations must contain sufficient information, based on data reasonably available at the time the plan is submitted for approval, for the commissioner to determine the surface use requirements and impacts directly associated with the proposed operations. An application must include statements and maps or drawings setting out the following:

(1) the sequence and schedule of the operations to be conducted on or in the leased area, including the date operations are proposed to begin and their proposed duration;

(2) projected use requirements directly associated with the proposed operations, including the location and design of well sites, material sites, water supplies, solid waste sites, buildings, roads, utilities, airstrips, and all other facilities and equipment necessary to conduct the proposed operations;

(3) plans for rehabilitation of the affected leased area after completion of operations or phases of those operations; and

(4) a description of operating procedures designed to prevent or minimize adverse effects on other natural resources and other uses of the leased area and adjacent areas, including fish and wildlife habitats, historic and archeological sites, and public use areas.

(e) In approving a lease plan of operations or an amendment of a plan, the commissioner will require amendments that the commissioner determines necessary to protect the state's interest. The commissioner will not require an amendment that would be inconsistent with the terms of sale under which the lease was obtained, or with the terms of the lease itself, or which would deprive the lessee of reasonable use of the leasehold interest.

(f) The lessee may, with the approval of the commissioner, amend an approved plan of operations.

(g) Upon completion of operations, the lessee shall inspect the area of operations and submit a report indicating the completion date of operations and stating any noncompliance of which the lessee knows, or should reasonably know, with requirements imposed as a condition of approval of the plan.

10. PLAN OF DEVELOPMENT. (a) Except as provided in subparagraph (d) below, within 12 months after completion of a well capable of producing oil, gas, or associated substances in paying quantities, the lessee shall file two copies of an application for approval by the state of an initial plan of development that must describe the lessee's plans for developing the leased area. No development of the leased area may occur until a plan of development has been approved by the state.

(b) The plan of development must be revised, updated, and submitted to the state for approval annually before or on the anniversary date of the previously approved plan. If no changes from an approved plan are

contemplated for the following year, a statement to that effect must be filed for approval in lieu of the required revision and update.

(c) The lessee may, with the approval of the state, subsequently modify an approved plan of development.

(d) If the leased area is included in an approved unit, the lessee will not be required to submit a separate lease plan of development for unit activities.

11. DATA SUBMITTAL. (a) The lessee shall submit to the state, at the Department of Natural Resources, Division of Oil & Gas (Division), all geological, geophysical, and engineering data obtained from the lease within 30 days following completion, abandonment, or suspension of each well, pilot hole, and plugged back well bore. The lessee shall also submit to the Division, on behalf of the state, data acquired subsequent to completion, abandonment, or suspension of each well, pilot hole, and plugged back well bore within 30 days following acquisition of those data. The Division, on behalf of the state, may waive receipt of operational data from some development, service, or injection wells, and will inform the operator of the waiver in writing prior to data submittal. Data shall be submitted according to the instructions set out in Attachment 1. Submission of data under this paragraph does not affect any statutory or regulatory obligation to submit data or other information to the state or any of its agencies.

(b) Any data submitted to the state, at the Department of Natural Resources, Division of Oil & Gas will be available at all times for use by the state and its agents, and will be held confidential as provided in AS 38.05.035(a)(8) and its applicable regulations. In accordance with AS 38.05.035(a)(8)(C), in order for geological, geophysical, and engineering data to be held confidential, the lessee must request confidentiality at the time of submission and mark the data “CONFIDENTIAL” in compliance with applicable regulations.

12. DIRECTIONAL DRILLING. This lease may be maintained in effect by directional wells whose bottom hole location is on the leased area but that are drilled from locations on other lands not covered by this lease. In those circumstances, drilling will be considered to have commenced on the leased area when actual drilling is commenced on those other lands for the purpose of directionally drilling into the leased area. Production of oil or gas from the leased area through any directional well surfaced on those other lands, or drilling or reworking of that directional well, will be considered production or drilling or reworking operations on the leased area for all purposes of this lease. Nothing contained in this paragraph is intended or will be construed as granting to the lessee any interest, license, easement, or other right in or with respect to those lands in addition to any interest, license, easement, or other right that the lessee may have lawfully acquired from the state or from others.

13. DILIGENCE AND PREVENTION OF WASTE. (a) The lessee shall exercise reasonable diligence in drilling, producing, and operating wells on the leased area unless consent to suspend operations temporarily is granted by the state.

(b) Upon discovery of oil or gas on the leased area in quantities that would appear to a reasonable and prudent operator to be sufficient to recover ordinary costs of drilling, completing, and producing an additional well in the same geologic structure at another location with a reasonable profit to the operator, the lessee must drill those wells as a reasonable and prudent operator would drill, having due regard for the interest of the state as well as the interest of the lessee.

(c) The lessee shall perform all operations under this lease in a good and workmanlike manner in accordance with the methods and practices set out in the approved plan of operations and plan of development, with due regard for the prevention of waste of oil, gas, and associated substances and the entrance of water to the oil and gas-bearing sands or strata to the destruction or injury of those sands or strata, and to the preservation and conservation of the property for future productive operations. The lessee shall carry out at the lessee's expense all orders and requirements of the State of Alaska relative to the prevention of waste and to the preservation of the leased area. If the lessee fails to carry out these orders, the state will have the right, together with any other available legal recourse, to enter the leased area to repair damage or prevent waste at the lessee's expense.

(d) The lessee shall securely plug in an approved manner any well before abandoning it.

14. OFFSET WELLS. The lessee shall drill such wells as a reasonable and prudent operator would drill to protect the state from loss by reason of drainage resulting from production on other land. Without limiting the generality of the foregoing sentence, if oil or gas is produced in a well on other land not owned by the State of Alaska or on which the State of Alaska receives a lower rate of royalty than under this lease, and that well is within 500 feet in the case of an oil well or 1,500 feet in the case of a gas well of lands then subject to this lease, and that well produces oil or gas for a period of 30 consecutive days in quantities that would appear to a reasonable and prudent operator to be sufficient to recover ordinary costs of drilling, completing, and producing an additional well in the same geological structure at an offset location with a reasonable profit to the operator, and if, after notice to the lessee and an opportunity to be heard,

the state finds that production from that well is draining lands then subject to this lease, the lessee shall within 30 days after written demand by the state begin in good faith and diligently prosecute drilling operations for an offset well on the leased area. In lieu of drilling any well required by this paragraph, the lessee may, with the state's consent, compensate the state in full each month for the estimated loss of royalty through drainage in the amount determined by the state.

15. UNITIZATION. (a) The lessee may unite with others, jointly or separately, in collectively adopting and operating under a cooperative or unit agreement for the exploration, development, or operation of the pool, field, or like area or part of the pool, field, or like area that includes or underlies the leased area or any part of the leased area whenever the state determines and certifies that the cooperative or unit agreement is in the public interest.

(b) The lessee agrees, within six months after demand by the state, to subscribe to a reasonable cooperative or unit agreement that will adequately protect all parties in interest, including the state. The state reserves the right to prescribe such an agreement.

(c) With the consent of the lessee, and if the leased area is committed to a unit agreement approved by the state, the state may establish, alter, change, or revoke drilling, producing, and royalty requirements of this lease as the state determines necessary or proper to secure the proper protection of the public interest.

(d) Except as otherwise provided in this subparagraph, where only a portion of the leased area is committed to a unit agreement approved or prescribed by the state, that commitment constitutes a severance of this lease as to the unitized and nonunitized portions of the leased area. The portion of the leased area not committed to the unit will be treated as a separate and distinct lease having the same effective date and term as this lease and may be maintained only in accordance with the terms and conditions of this lease, statutes, and regulations. Any portion of the leased area not committed to the unit agreement will not be affected by the unitization or pooling of any other portion of the leased area, by operations in the unit, or by suspension approved or ordered for the unit. If the leased area has a well certified, under 11 AAC 83.361, as capable of production in paying quantities as defined in 11 AAC 83.395(4) on it before commitment to a unit agreement, this lease will not be severed. If any portion of this lease is included in a participating area formed under a unit agreement, the entire leased area will remain committed to the unit and this lease will not be severed.

16. INSPECTION. The lessee shall keep open at all reasonable times, for inspection by any duly authorized representative of the State of Alaska, the leased area, all wells, improvements, machinery, and fixtures on the leased area, and all reports and records relative to operations and surveys or investigations on or with regard to the leased area or under this lease. Upon request, the lessee shall furnish the State of Alaska with copies of and extracts from any such reports and records.

17. SUSPENSION. The state may from time to time direct or approve in writing suspension of production or other operations under this lease.

18. ASSIGNMENT, PARTITION, AND CONVERSION. This lease, or an interest in this lease, may, with the approval of the state, be assigned, subleased, or otherwise transferred to any person or persons qualified to hold a lease. No assignment, sublease, or other transfer of an interest in this lease, including assignments of working or royalty interests and operating agreements and subleases, will be binding upon the state unless approved by the state. The lessee shall remain liable for all obligations under this lease accruing prior to the approval by the state of any assignment, sublease, or other transfer of an interest in this lease. All provisions of this lease will extend to and be binding upon the heirs, administrators, successors, and assigns of the state and the lessee. Applications for approval of an assignment, sublease, or other transfer must comply with all applicable regulations and must be filed within 90 days after the date of final execution of the instrument of transfer. The state will approve a transfer of an undivided interest in this lease unless the transfer would adversely affect the interests of Alaska or the application does not comply with applicable regulations. The state will disapprove a transfer of a divided interest in this lease if the transfer covers only a portion of the lease or a separate and distinct zone or geological horizon unless the lessee demonstrates that the proposed transfer of a divided interest is reasonably necessary to accomplish exploration or development of the lease, the lease is committed to an approved unit agreement, the lease is allocated production within an approved participating area, or the lease has a well capable of production in paying quantities. The state will make a written finding stating the reasons for disapproval of a transfer of a divided interest. Where an assignment, sublease, or other transfer is made of all or a part of the lessee's interest in a portion of the leased area, this lease may, at the option of the state or upon request of the transferee and with the approval of the state, be severed, and a separate and distinct lease will be issued to the transferee having the same effective date and terms as this lease.

19. SURRENDER. The lessee at any time may file with the state a written surrender of all rights under this lease or any portion of the leased area comprising one or more legal subdivisions or, with the consent of the state, any

separate and distinct zone or geological horizon underlying the leased area or one or more legal subdivisions of the leased area. That surrender will be effective as of the date of filing, subject to the continued obligations of the lessee and its surety to make payment of all accrued royalties and to place all wells and surface facilities on the surrendered land or in the surrendered zones or horizons in condition satisfactory to the state for suspension or abandonment. After that, the lessee will be released from all obligations under this lease with respect to the surrendered lands, zones, or horizons.

20. DEFAULT AND TERMINATION; CANCELLATION. (a) The failure of the lessee to perform timely its obligations under this lease, or the failure of the lessee otherwise to abide by all express and implied provisions of this lease, is a default of the lessee's obligations under this lease. Whenever the lessee fails to comply with any of the provisions of this lease (other than a provision which, by its terms, provides for automatic termination), and fails within 60 days after written notice of that default to begin and diligently prosecute operations to remedy that default, the state may terminate this lease if at the time of termination there is no well on the leased area capable of producing oil or gas in paying quantities. If there is a well on the leased area capable of producing oil or gas in paying quantities, this lease may be terminated by an appropriate judicial proceeding. In the event of any termination under this subparagraph, the lessee shall have the right to retain under this lease any and all drilling or producing wells for which no default exists, together with a parcel of land surrounding each well or wells and rights-of-way through the leased area that are reasonably necessary to enable the lessee to drill, operate, and transport oil or gas from the retained well or wells.

(b) The state may cancel this lease at any time if the state determines, after the lessee has been given notice and a reasonable opportunity to be heard, that:

(1) continued operations pursuant to this lease probably will cause serious harm or damage to biological resources, to property, to mineral resources, or to the environment (including the human environment);

(2) the threat of harm or damage will not disappear or decrease to an acceptable extent within a reasonable period of time; and

(3) the advantages of cancellation outweigh the advantages of continuing this lease in effect. Any cancellation under this subparagraph will not occur unless and until operations under this lease have been under suspension or temporary prohibition by the state, with due extension of the term of this lease, continuously for a period of five years or for a lesser period upon request of the lessee.

(c) Any cancellation under subparagraph (b) will entitle the lessee to receive compensation as the lessee demonstrates to the state is equal to the lesser of:

(1) the value of the cancelled rights as of the date of cancellation, with due consideration being given to both anticipated revenues from this lease and anticipated costs, including costs of compliance with all applicable regulations and stipulations, liability for clean-up costs or damages, or both, in the case of an oil spill, and all other costs reasonably anticipated under this lease; or

(2) the excess, if any, over the lessee's revenues from this lease (plus interest on the excess from the date of receipt to date of reimbursement) of all consideration paid for this lease and all direct expenditures made by the lessee after the effective date of this lease and in connection with exploration or development, or both, under this lease, plus interest on that consideration and those expenditures from the date of payment to the date of reimbursement.

21. RIGHTS UPON TERMINATION. Upon the expiration or earlier termination of this lease as to all or any portion of the leased area, the lessee will be directed in writing by the state and will have the right at any time within a period of one year after the termination, or any extension of that period as may be granted by the state, to remove from the leased area or portion of the leased area all machinery, equipment, tools, and materials. Upon the expiration of that period or extension of that period and at the option of the state, any machinery, equipment, tools, and materials that the lessee has not removed from the leased area or portion of the leased area become the property of the state or may be removed by the state at the lessee's expense. At the option of the state, all improvements such as roads, pads, and wells must either be abandoned and the sites rehabilitated by the lessee to the satisfaction of the state, or be left intact and the lessee absolved of all further responsibility as to their maintenance, repair, and eventual abandonment and rehabilitation. Subject to the above conditions, the lessee shall deliver up the leased area or those portions of the leased area in good condition.

22. DAMAGES AND INDEMNIFICATION. (a) No rights under the AS 38.05.125 reservation may be exercised by the lessee until the lessee has provided to pay the owner of the land, his lessees and permittees, upon which the AS 38.05.125 reserved rights are sought to be exercised, full payment for all damage sustained by the owner by reason of entering the land. If the owner for any reason does not settle the damages, the lessee may enter the land after posting a surety bond determined by the state, after notice and an opportunity to be heard, to be sufficient as to form, amount, and security to secure to the owner, his lessees and permittees, payment for damages, and may institute legal proceedings in a court of competent jurisdiction where the land is located to determine the damages which the

owner of the land may suffer. The lessee agrees to pay for any damages that may become payable under AS 38.05.130 and to indemnify the state and hold it harmless from and against any claims, demands, liabilities, and expenses arising from or in connection with such damages. The furnishing of a bond in compliance with this paragraph will be regarded by the state as sufficient provision for the payment of all damages that may become payable under AS 38.05.130 by virtue of this lease.

(b) The lessee shall indemnify the state for, and hold it harmless from, any claim, including claims for loss or damage to property or injury to any person caused by or resulting from any act or omission committed under this lease by or on behalf of the lessee. The lessee is not responsible to the state under this subparagraph for any loss, damage, or injury caused by or resulting from the sole negligence of the state.

(c) The lessee expressly waives any defense to an action for breach of a provision of this lease or for damages resulting from an oil spill or other harm to the environment that is based on an act or omission committed by an independent contractor in the lessee's employ. The lessee expressly agrees to assume responsibility for all actions of its independent contractors.

23. BONDS. (a) If required by the state, the lessee shall furnish a bond prior to the issuance of this lease in an amount equal to at least $5 per acre or fraction of an acre contained in the leased area, but no less than $10,000, and must maintain that bond as long as required by the state.

(b) The lessee may, in lieu of the bond required under (a) above, furnish and maintain a statewide bond in accordance with applicable regulations.

(c) The state may, after notice to the lessee and a reasonable opportunity to be heard, require a bond in a reasonable amount greater than the amount specified in (a) above where a greater amount is justified by the nature of the surface and its uses and the degree of risk involved in the types of operations being or to be carried out under this lease. A statewide bond will not satisfy any requirement of a bond imposed under this subparagraph, but will be considered by the state in determining the need for and the amount of any additional bond under this subparagraph.

(d) If the leased area is committed in whole or in part to a cooperative or unit agreement approved or prescribed by the state, and the unit operator furnishes a statewide bond, the lessee need not maintain any bond with respect to the portion of the leased area committed to the cooperative or unit agreement.

24. AUTHORIZED REPRESENTATIVES. The Director of the Division of Oil and Gas, Department of Natural Resources, State of Alaska, and the person executing this lease on behalf of the lessee shall be authorized representatives for their respective principals for the purposes of administering this lease. The state or the lessee may change the designation of its authorized representative or the address to which notices to that representative are to be sent by a notice given in accordance with Paragraph 25 below. Where activities pursuant to a plan of operations are underway, the lessee shall also designate, pursuant to a notice under Paragraph 25 below, by name, job title, and address, an agent who will be present in the state during all lease activities.

25. NOTICES; PROTEST. (a) Any notices required or permitted under this lease must be by electronic media producing a permanent record or in writing and must be given personally or by registered or certified mail, return receipt requested, addressed as follows:

TO THE STATE:

DIRECTOR, DIVISION OF OIL AND GAS
DEPARTMENT OF NATURAL RESOURCES
550 WEST 7TH AVENUE, SUITE 1100
ANCHORAGE, ALASKA 99501-3563

TO THE LESSEE:

(b) Any notice given under this paragraph will be effective when delivered to the above authorized representative.

(c) A lessee who wishes to protest the amount of money due the state under the lease or any action of the state regarding a provision of this lease must file a written protest with the Division of Oil and Gas within 30 days after the mailing date of the state's notice or bill. A lessee who fails to file a protest within the required time waives any further right to protest. The state will establish the administrative appeal procedure to be followed and will inform the lessee of the procedure no later than 30 days after the filing of the written protest.

26. STATUTES AND REGULATIONS. This lease is subject to all applicable state and federal statutes and regulations in effect on the effective date of this lease, and insofar as is constitutionally permissible, to all statutes and regulations placed in effect after the effective date of this lease. A reference to a statute or regulation in this lease includes any change in that statute or regulation whether by amendment, repeal and replacement, or other means. This lease does not limit the power of the State of Alaska or the United States of America to enact and enforce legislation or to promulgate and enforce regulations affecting, directly or indirectly, the activities of the lessee or its agents in connection with this lease or the value of the interest held under this lease. In case of conflicting provisions, statutes and regulations take precedence over this lease.

27. INTERPRETATION. This lease is to be interpreted in accordance with the rules applicable to the interpretation of contracts made in the State of Alaska. The paragraph headings are not part of this lease and are inserted only for convenience. The state and the lessee expressly agree that the law of the State of Alaska will apply in any judicial proceeding affecting this lease.

28. INTEREST IN REAL PROPERTY. It is the intention of the parties that the rights granted to the lessee by this lease constitute an interest in real property in the leased area.

29. WAIVER OF CONDITIONS. The state reserves the right to waive any breach of a provision of this lease, but any such waiver extends only to the particular breach so waived and does not limit the rights of the state with respect to any future breach; nor will the waiver of a particular breach prevent cancellation of this lease for any other cause or for the same cause occurring at another time. Notwithstanding the foregoing, the state will not be deemed to have waived a provision of this lease unless it does so in writing.

30. SEVERABILITY. If it is finally determined in any judicial proceeding that any provision of this lease is invalid, the state and the lessee may jointly agree by a written amendment to this lease that, in consideration of the provisions in that written amendment, the invalid portion will be treated as severed from this lease and that the remainder of this lease, as amended, will remain in effect.

31. LOCAL HIRE. The lessee is encouraged to hire and employ local and Alaska residents and companies, to the extent they are available and qualified, for work performed on the leased area. Lessees shall submit, with the plans of operations, a proposal detailing the means by which the lessee will comply with this measure. The lessee is encouraged, in formulating this proposal, to coordinate with employment services offered by the State of Alaska and local communities and to recruit employees from local communities.

32. CONDITIONAL LEASE. If all or a part of the leased area is land that has been selected by the state under laws of the United States granting lands to the state, but the land has not been patented to the state by the United States, then this lease is a conditional lease as provided by law until the patent becomes effective. If for any reason the selection is not finally approved, or the patent does not become effective, any rental, royalty, or other production or profit-based payments made to the state under this lease will not be refunded.

33. NONDISCRIMINATION. The lessee and the lessee's contractors and subcontractors may not discriminate against any employee or applicant because of race, religion, marital status, change in marital status, pregnancy, parenthood, physical handicap, color, sex, age, or national origin as set out in AS 18.80.220. The lessee and its contractors and subcontractors must, on beginning any operations under this lease, post in a conspicuous place notices setting out this nondiscrimination provision.

34. DEFINITIONS. All words and phrases used in this lease are to be interpreted where possible in the manner required in respect to the interpretation of statutes by AS 01.10.040. However, the following words have the following meanings unless the context unavoidably requires otherwise:

(1) "oil" means crude petroleum oil and other hydrocarbons, regardless of gravity, that are produced in liquid form by ordinary production methods, including liquid hydrocarbons known as distillate or condensate recovered by separation from gas other than at a gas processing plant;

(2) "gas" means all natural gas (except helium gas) and all other hydrocarbons produced that are not defined in this lease as oil;

(3) "associated substances" means all substances except helium produced as an incident of production of oil or gas by ordinary production methods and not defined in this lease as oil or gas;

(4) "drilling" means the act of boring a hole to reach a proposed bottom hole location through which oil or gas may be produced if encountered in paying quantities, and includes redrilling, sidetracking, deepening, or other means necessary to reach the proposed bottom hole location, testing, logging, plugging, and other operations necessary and incidental to the actual boring of the hole;

(5) "reworking operations" means all operations designed to secure, restore, or improve production through some use of a hole previously drilled, including, but not limited to, mechanical or chemical treatment of any horizon, plugging back to test higher strata, etc.;

(6) "paying quantities" means production in quantities sufficient to yield a return in excess of operating costs, even though drilling and equipment costs may never be repaid and the undertaking considered as a whole may ultimately result in a loss; and

(7) "force majeure" means war, riots, acts of God, unusually severe weather, or any other cause beyond the lessee's reasonable ability to foresee or control and includes operational failure of existing transportation facilities and delays caused by judicial decisions or lack of them.

35. ROYALTY ON PRODUCTION. Except for oil, gas, and associated substances used on the leased area for development and production or unavoidably lost, the lessee shall pay to the state as a royalty percent in amount or value of the oil, gas, and associated substances saved, removed, or sold from the leased area and of the gas from the leased area used on the leased area for extraction of natural gasoline or other products.

36. VALUE. (a) For the purposes of computing royalties due under this lease, the value of royalty oil, gas, or associated substances shall not be less than the highest of:

(1) the field price received by the lessee for the oil, gas, or associated substances;

(2) the volume-weighted average of the three highest field prices received by other producers in the same field or area for oil of like grade and gravity, gas of like kind and quality, or associated substances of like kind and quality at the time the oil, gas, or associated substances are sold or removed from the leased or unit area or the gas is delivered to an extraction plant if that plant is located on the leased or unit area; if there are less than three prices reported by other producers, the volume-weighted average will be calculated using the lesser number of prices received by other producers in the field or area;

(3) the lessee's posted price in the field or area for the oil, gas, or associated substances; or

(4) the volume-weighted average of the three highest posted prices in the same field or area of the other producers in the same field or area for oil of like grade and gravity, gas of like kind and quality, or associated substances of like kind and quality at the time the oil, gas, or associated substances are sold or removed from the leased or unit area or the gas is delivered to an extraction plant if that plant is located on the leased or unit area; if there are less than three prices posted by other producers, the volume-weighted average will be calculated using the lesser number of prices posted by other producers in the field or area.

(b) If oil, gas, or associated substances are sold away from the leased or unit area, the term "field price" in subparagraph (a) above will be the cash value of all consideration received by the lessee or other producer from the purchaser of the oil, gas, or associated substances, less the lessee's actual and reasonable costs of transportation away from the leased or unit area to the point of sale. The "actual and reasonable costs of transportation" for marine transportation are as defined in 11 AAC 83.229(a), (b)(2), and (c) – (l).

(c) In the event the lessee does not sell in an arm's-length transaction the oil, gas, or associated substances, the term "field price" in subparagraphs (a) and (b) above will mean the price the lessee would expect to receive for the oil, gas, or associated substances if the lessee did sell the oil, gas, or associated substances in an arm's-length transaction, minus reasonable costs of transportation away from the leased or unit area to the point of sale or other disposition. The lessee must determine this price in a consistent and logical manner using information available to the lessee and report that price to the state.

(d) The state may establish minimum values for the purposes of computing royalties on oil, gas, or associated substances obtained from this lease, with consideration being given to the price actually received by the lessee, to the price or prices paid in the same field or area for production of like quality, to posted prices, to prices received by the lessee and/or other producers from sales occurring away from the leased area, and/or to other relevant matters. In establishing minimum values, the state may use, but is not limited to, the methodology for determining "prevailing value" as defined in 11 AAC 83.227. Each minimum value determination will be made only after the lessee has been given notice and a reasonable opportunity to be heard. Under this provision, it is expressly agreed that the

minimum value of royalty oil, gas, or associated substances under this lease may not necessarily equal, and may exceed, the price of the oil, gas, or associated substances.

37. ROYALTY IN VALUE. Except to the extent that the state elects to receive all or a portion of its royalty in kind as provided in Paragraph 38 below, the lessee shall pay to the state that value of all royalty oil, gas, and associated substances as determined under Paragraph 36 above. Royalty paid in value will be free and clear of all lease expenses (and any portion of those expenses that is incurred away from the leased area), including, but not limited to, expenses for separating, cleaning, dehydration, gathering, saltwater disposal, and preparing the oil, gas, or associated substances for transportation off the leased area. All royalty that may become payable in money to the State of Alaska must be paid on or before the last federal banking day of the calendar month following the month in which the oil, gas, or associated substances are produced. The amount of all royalty in value payments which are not paid when due under this lease or the amount which is subsequently determined to be due to the state or the lessee as the result of a redetermination will bear interest from the last federal banking day of the calendar month following the month in which the oil, gas, or associated substances were produced, until the obligation is paid in full. Interest shall accrue at the rate provided in AS 38.05.135(d) or as may later be amended. Royalty payments must be accompanied by such information relating to valuation of royalty as the state may require which may include, but is not limited to, run tickets, evidence of sales, shipments, and amounts of gross oil, gas, and associated substances produced.

38. ROYALTY IN KIND. (a) At the state's option, which may be exercised from time to time upon not less than 50 days' notice to the lessee, the lessee shall deliver all or a portion of the state's royalty oil, gas, or associated substances produced from the leased area in kind. Delivery will be on the leased area, unit area, or at a place mutually agreed to by the state and the lessee, and must be delivered to the State of Alaska or to any individual, firm, or corporation designated by the state.

(b) Royalty oil, gas, or associated substances delivered in kind must be delivered in good and merchantable condition, of pipeline quality, and free and clear of all lease expenses (and any portion of those expenses incurred away from the leased area), including, but not limited to, expenses for separating, cleaning, dehydration, gathering, saltwater disposal, and preparing the oil, gas, or associated substances for transportation off the leased area.

(c) After having given notice of its intention to take, or after having taken its royalty oil, gas, or associated substances in kind, the state, at its option, may elect to receive a different portion or none of its royalty in kind. If, under federal regulations, the taking of royalty oil, gas, or associated substances in value by the state creates a supplier-purchaser relationship, the lessee hereby waives its right to continue to receive royalty oil, gas, or associated substances under that relationship, and further agrees that it will require any purchasers of the royalty oil, gas, or associated substances likewise to waive any supplier-purchaser rights.

(d) The lessee shall furnish storage for royalty oil, gas, and associated substances produced from the leased or unit area to the same extent that the lessee provides storage for the lessee's share of oil, gas, and associated substances. The lessee shall not be liable for the loss or destruction of stored royalty oil, gas and associated substances from causes beyond the lessee's ability to control.

(e) If a state royalty purchaser refuses or for any reason fails to take delivery of oil, gas, or associated substances, or in an emergency, and with as much notice to the lessee as is practical or reasonable under the circumstances, the state may elect without penalty to underlift for up to six months all or a portion of the state's royalty on oil, gas, or associated substances produced from the leased or unit area and taken in kind. The state's right to underlift is limited to the portion of royalty oil, gas, or associated substances that the royalty purchaser refused or failed to take delivery of, or the portion necessary to meet the emergency condition. Underlifted oil, gas, or associated substances may be recovered by the state at a daily rate not to exceed 100 percent of its royalty interest share of daily production at the time of the underlift recovery.

39. REDUCTION OF ROYALTY. Lessee may request a reduction of royalty in accordance with the applicable statutes and regulations in effect on the date of application for the reduction.

40. EFFECTIVE DATE. This lease takes effect on .

BY SIGNING THIS LEASE, the state as lessor and the lessee agree to be bound by its provisions.

STATE OF ALASKA

By: _____
W. C. Barron
Director, Division of Oil and Gas

STATE OF ALASKA)
) ss.
Third Judicial District)

On , before me appeared _____ of the Division of Oil and Gas of the State of Alaska, Department of Natural Resources, and who executed this lease and acknowledged voluntarily signing it on behalf of the State of Alaska as lessor.

_____
Notary public in and for the State of Alaska
My commission expires _____

LESSEE: _____

Signature: _____

Printed Name/Title: _____

INSERT NOTARY ACKNOWLEDGMENT OF LESSEE'S SIGNATURE HERE.

LESSEE: _____

Signature: _____

Printed Name/Title: _____

INSERT NOTARY ACKNOWLEDGMENT OF LESSEE'S SIGNATURE HERE.

Attachment 1. Alaska Department of Natural Resources, Division of Oil & Gas
Submittal of Well Data Required by DNR Lease

Data shall be submitted to the Division in a digital format, generally in PDF. For spreadsheets, include the original Excel document. For images such as maps or charts, include a high-resolution TIFF or JPEG. For logs, see formats specified below, but include a graphical image file of the logs as a PDF or TIFF in addition to the final merged data file of the log curves. Data may be submitted on CD, DVD or USB mass storage device (include any necessary cables). Required data shall include any and all of the following:

1. A copy of the well completion report (AOGCC Form 10-407) for each well bore.
2. Daily drilling reports or a summary report of daily drilling.
3. Latitudinal and longitudinal coordinates for each well, pilot hole, and plugged back well bore with completed surface and bottom hole locations. Coordinates can be based upon either the NAD 83 or NAD 27 geodetic datum as long as the datum used is clearly specified.
4. Directional survey for each well, pilot hole, and plugged back well bore.
5. A list of all logs run and the depth interval covered for each well, pilot hole, and plugged back well bore.
6. A list of formations and other geologic markers encountered and the measured depths (MD) and true vertical depths (TVD) of each, for each well, pilot hole, and plugged back well bore.
7. Summary of cored intervals (conventional and sidewall), including depth, formation name, lithology, presence of oil, gas, gas hydrates, and water, porosity, fractures and apparent dips; indicate "**none**" on completion report or in an attachment if no cores were taken.
8. Core reports including lab analyses of lithology, porosity, permeability (vertical and horizontal, air and liquid), density, capillary pressure, and fluid saturation, if available.
9. Conventional and sidewall core photos (plain light and ultraviolet), if applicable.
10. Identified formation names and corresponding depths for oil, gas, and gas hydrate shows. Indicate "**none**" on the completion report or in an attachment if no shows were observed.
11. Identified depth zones of abnormal pressure. Indicate "**none**" on the completion report or in an attachment if none were observed.
12. A synopsis or summary of testing and all fluid recovery efforts, including production tests (IP), drill stem tests (DST), wireline formation tests (i.e. repeat formation tests (RFT) and modular dynamics tests (MDT)), and any other production and formation testing data; the summary should include test date, time, depth, formation name, method of operation, recovered fluid type(s) and amount(s), fluid rate, gas-oil ratio (GOR), oil gravity, pressure, and choke size, when available. If no tests were undertaken, indicate "**none**" where appropriate on the completion report or in an attachment, if tests were undertaken but failed to recover fluids indicate "**no recovery**".
13. Pressure build-up and fluid PVT analyses, if applicable.
14. Open flow potential test reports and report attachments to AOGCC Forms 10-421.
15. Well test procedures, field chronologies, and field data; including details necessary for evaluation (intervals open to test; volumes of oil, gas, water, mud, and other borehole substances; API gravity; gas density; wellhead and down hole pressure; and formation and wellhead temperature).
16. Geochemical and formation fluid analyses and reports, if applicable.
17. Down hole and surface fluid sampling procedures, field chronologies, raw data, and laboratory test results for all water and hydrocarbon-bearing zones (oil, gas, gas hydrates) sampled; including details sufficient to fully evaluate quality of sample data.
18. Permit to drill (AOGCC form 10-401) and the survey as-built of the well location.
19. LAS Version 2, TAP, TIF, LIS and DLIS (if available) files of final merged open-and cased-hole log data, including specialty logs (such as Schlumberger's cyberlook, formation microscanners and dipmeter logs), measured-while-drilling (MWD) and logged-while-drilling (LWD) logs. Include a graphical image file of the 2-inch MD & TVD logs as a PDF or TIFF in addition to the log data file.
20. LAS Version 2 of final composite mudlog or lithology log curves. Include a graphical image file of the final 2-inch MD & TVD logs, with lithology display, oil, gas, and gas hydrate show indicators, mud properties, and cuttings descriptions and report as a PDF or TIFF in addition to the log data file.
21. Clear, legible files of all well data and reports including, but not limited to, paleontology, palynology, petrography (including point-count analyses), X-ray diffraction analyses, SEM micrographs, thermal maturity, vitrinite reflectance, total organic carbon, RockEval pyrolysis, geochronology, fission track analyses, fluid inclusion analyses, Mercury injection capillary pressure analyses, chemical analyses (EPMA, XRF, ICP, etc.), isotope

analyses, water chemistry, burial and temperature history analyses, strain analyses, acoustic analyses, gas hydrate analyses and well pressure and temperature survey analyses.

22. Final reports of velocity, checkshot or VSP surveys (an ASCII format digital version of the above data shall also be submitted), including seismic profile data in SEG-Y format. Indicate “none” in your response to this request if no velocity, checkshot or VSP surveys were undertaken. Submission of velocity, checkshot, and VSP surveys is always required by DNR under the operator surface-use permit obligations.
23. All coalbed core, gas, and water quality reports including lab analyses of core lithology, coal rank, vitrinite reflectance, maceral composition, total organic carbon, ash, sulfur and BTU content, moisture content, cleating, adsorption/desorption data, residual gas measurements, porosity and permeability analyses, core photos, if available.
24. Any other geoscience- and engineering-related data sets from the well(s).

Please note: Physical samples of well cuttings or cores specified in 20 AAC 25.071(b)(2) and 20 AAC 25.071(b)(4) should be sent to AOGCC, not to the Division.

All material should be either hand-carried by bonded courier or mailed by registered mail to:

Resource Evaluation Section
Alaska Department of Natural Resources, Division of Oil & Gas
550 West 7th Avenue, Suite 1100
Anchorage, AK 99501-3510
Email: DOG.REdata@alaska.gov