Application for the Incidental Harassment Authorization for the Taking of Non-listed Marine Mammals in Conjunction with the BlueCrest Alaska Operating LLC Activities at Cosmopolitan State Unit, Alaska, 2014

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1. DETAILED DESCRIPTION OF SPECIFIC ACTIVITIES EXPECTED TO RESULT IN THE INCIDENTAL TAKING OF MARINE MAMMALS

BlueCrest Alaska Operating LLC (BlueCrest) plans to conduct an exploratory drilling program in lower Cook Inlet at Cosmopolitan State well site #B-1 during September and October 2014 (well site #A-1 was drilled in 2013). Both the A-1 and B-1 well locations are shown in Figure 1. Drilling would occur from either the *Endeavour – Spirit of Independence* jack-up rig (previously called the *Adriatic XI*) or the *Spartan 151* jack-up rig, depending on availability. If a rig is not available fall 2014, drilling would be delayed until April 2015. Cosmopolitan #B-1 lies within the State of Alaska Division of Land (ADL) oil and gas lease 384403 (Cosmopolitan State).

Because this operation could acoustically harass local marine mammals, a form of take as defined under the Marine Mammal Protection Act (MMPA), it is subject to governance under MMPA. Incidental and unintentional harassment takes are permitted with the issuance of an Incidental Harassment Authorization (IHA) from the National Marine Fisheries Service (NMFS). MMPA identifies 14 specific items that must be addressed when applying for an IHA, which allow NMFS to fully evaluate whether the proposed actions remain incidental and unintentional. The 14 items are addressed below in this application, which addresses the 2014 exploratory drilling program.

There are five proposed phases of the Cosmopolitan exploratory drilling program of most relevance to lower Cook Inlet marine mammals:

1. Mobilization of the *Endeavour* drill rig from Port Graham (winter moorage site) to the Cosmopolitan State #B-1 location (or the *Spartan 151* from active drilling in upper Cook Inlet).
2. Driving of the conductor pipe.
3. Exploratory drilling.
4. Vertical Seismic Profiling (VSP).
5. Mobilization of the drill rig to another location (at the owner's discretion) at the completion of drilling.

In addition, the rig will remain active with generators, pumps, and other standard equipment operating during and outside the above phases.

This IHA application addresses non-listed marine mammals under the jurisdiction of NMFS only. Listed marine mammals (i.e., beluga whales [*Delphinapterus leucas*], humpback whales [*Megaptera novaeangliae]*, and Steller sea lions [*Eumetopias jubatus*]) have already been addressed under a separate ESA consultation governed by a Letter of Concurrence (LOC) from James Balsiger dated April 25, 2013. Sea otters (*Enhydra lutris*) are under the jurisdiction of the U.S. Fish and Wildlife Service and are addressed under a separate IHA application.

1.1 Overview of Activity

BlueCrest conducted oil and gas exploratory drilling at the Cosmopolitan State #A-1 well site in summer 2013. Beginning in fall 2014, BlueCrest intends to conduct an oil drilling operation at Cosmopolitan

State #B-1 (originally Cosmopolitan #2). The exact well location is latitude N 59°52'13.887", longitude W 151°52'17.225", and the water depth is 61 feet. Depending on the results, BlueCrest will evaluate future (2016-2018) potential oil and/or gas activities at both the Cosmopolitan #A-1 and Cosmopolitan #B-1 locations. Specific locations of the two well sites are shown in Figure 1.

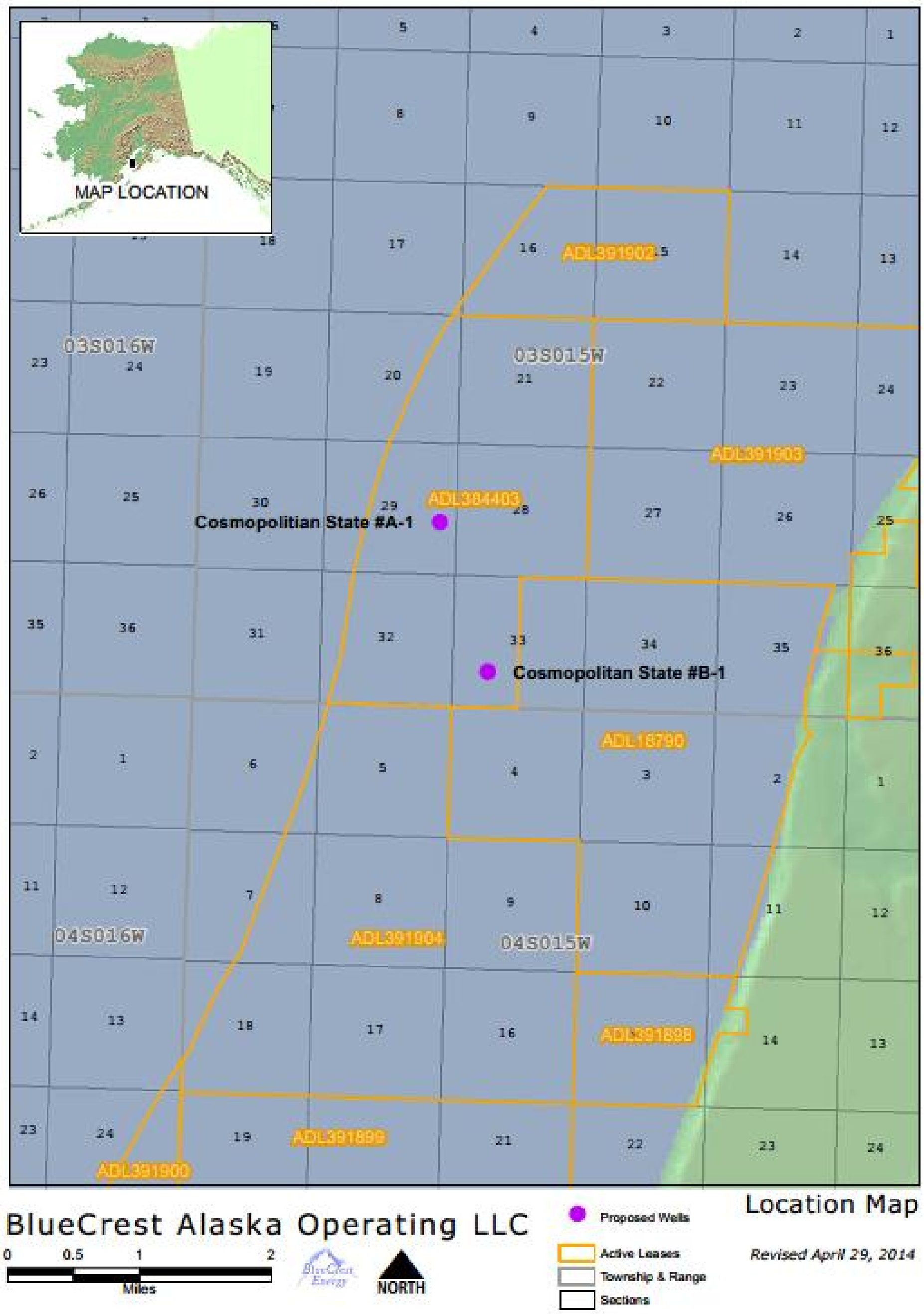


Figure 1. Locations of the Proposed Cosmopolitan Unit Well Sites.

BlueCrest will use existing infrastructure and resources found on the Kenai Peninsula and south-central Alaska area whenever possible during the project. These resources include barge landings, private staging areas, airstrips, landfills, water supplies, heavy equipment, and personnel. Most on-shore activity will base from either Kenai or Homer. The phases of the operation and specifications of the equipment to be used are addressed individually below.

1.2 Project Details

1.2.1 Drilling Operations

BlueCrest proposes to conduct exploratory oil drilling operations at the Cosmopolitan State well site #B-1 from September 1 through October 31, 2014. If a full 60-day drilling period cannot be completed during the fall, then the drilling operations will be delayed until spring 2015.

1.2.2 Drilling Rig

BlueCrest proposes to conduct its exploratory drilling using the *Endeavour - Spirit of Independence* (a modified and improved *Adriatic XI*; Figure 1-2). Specifications, plans, and drawings of the rig are presented in Appendix 1. The *Endeavour* is an independent leg, cantilevered jack-up drill rig of the *Marathon LeTourneau* Class 116-C and is capable of drilling to 7,620 meters (25,000 feet) in water depths from 4.6 to 91 meters (15 to 300 feet). There is a small chance that if the *Endeavour* is unavailable during fall 2014, BlueCrest may use the *Spartan 151* drill rig.

Figure 1-2. *Endeavour* arriving at Port of Homer.

The *Spartan 151* is a 150 H class independent leg, cantilevered jack-up drill rig. Like the Endeavour, it has a drilling depth capability of 7,620 meters (25,000 feet), but can operate in maximum water depths up to only 46 meters (150 feet).

To maintain safety and work efficiency, both jack-up rigs will be equipped with the following:

- Either a 5,000, 10,000, or 15,000 pounds per square inch (psi) blow out preventer (BOP) stack, for drilling in higher pressure formations found at greater depths in Cook Inlet;
- Sufficient variable deck load to accommodate the increased drilling loads and tubular for deeper drilling;
- Reduced draft characteristics to enable the rig to easily access shallow water locations;
- Riser tensioning system to adequately deal with the extreme tides/currents in up to 91-meter (300-foot) water depth;
- Steel hull designed to withstand -10 degrees Celsius (°C) to eliminate the risk of steel failure during operations in Cook Inlet (*i.e.*, built for North Sea arctic conditions); and
- Ability to cantilever over existing platforms for working on development wells or during plug and abandonment (P&A).

1.2.3 Rig Mobilization

The *Endeavour* is currently (July 2014) moored at Port Graham where it is undergoing maintenance and winterization. The intention is to move the drill rig to the Cosmopolitan State #B-1 well site in September 2014, a distance of about 50 kilometers (31 miles). If the *Spartan 151* is used it will likely come from a well site location in upper Cook Inlet approximately 100 kilometers (62 miles) north of Cosmopolitan State #B-1. Tows from either location would likely be accomplished within a 24-hour period. Any subsequent move will be controlled by the owner of the drilling rig. Either rig will be towed between locations by ocean-going tugs that are licensed to operate in Cook Inlet by the Southwest Pilots Association. All tow vessels will be United States Coast Guard (USCG) certified. Move plans will receive close scrutiny from the rig owner's tow master as well as the owner's insurers, and will be conducted in accordance with state and federal regulations. Rig moves will be conducted in a manner to minimize any potential risk regarding safety as well as cultural or environmental impact.

While under tow, the rig operations will be monitored by BlueCrest and the drilling contractor management, both aboard the rig and onshore. Very High Frequency (VHF) radio, satellite, and cellular phone communication systems will be used while the rig is under tow. Helicopter transport will also be available. A description of helicopter operations is presented below. A certified marine surveyor will also be onboard during all rig moves to ensure cadastral documentation of the rig and well locations and the final rig position at set-down.

1.2.4 Logistics Support and Oil Field Support Services

BlueCrest operations will be directed from the Anchorage BlueCrest office, and an onsite field office on the rig. Contractor and vendor facilities are located at Nikiski, Kenai, Homer, and Anchorage.

1.2.4.1 Oil Field Support Services

Table 1-1 presents a list of services, activities, equipment, and supplies that will be mobilized to the exploration drill site during drilling operations. The rig will be stocked with most of the drilling supplies required to complete a full summer program. Deliveries of remaining items will be performed by support vessels and helicopters. The majority of the oilfield support services contractors have offices, shops, and additional equipment located in Kenai and Nikiski that will support their remote field operations. The tugs used to mobilize the rig will be staged nearby at the OSK Dock in Kenai or at the Homer Dock in Homer for additional rig support and anchor-handling.

Table 1-1: Identified Exploration Project Support Services, Service Activities, Equipment, and Supplies

Drill Site Management Drilling	Drill Cuttings & Drill	Well Control BOP
Engineering / Technical Support	Fluids Disposal	Medical
Well Testing / Drill Stem Testing	Rig Camp Operations Catering	Onsite EMT
Well Drilling	Housekeeping	1st Aid & General Medical
Casing	Drilling & Completion Operations	Equipment & Supplies
Plugging & Abandonment	Cementing Services, Directional /	Advanced Cardiac Life Support /
Drill Rig Crew	MWD / LWD	Trauma Life Support Equipment &
Rig Mobilization	Mud Logging, Service Packers	Supplies
Marine Surveyor	Completion Equipment, Casing	Marine Mammal Monitoring
Heavy Lift Vessel	Accessories	Certified Biologist / Marine
Oceangoing Tug Boats	Tubing and Perforating	Mammal Observers
Waste Management	Wireline and Slickline	Oil Spill Response Action
Dumpsters	Liner Hanging	Contractors (ODPCP)
Landfill	Drill Pipe Rental, Drilling Jars	Spill Technicians and Spill
Recycling	Fishing Services and Tubular	Prevention
Wastewater Treatment	Inspections	Fuel-Fluid Transfers

1.2.4.2 Helicopter Support

Helicopter logistics for project operations will include transportation for personnel, groceries, and supplies. Helicopter support will consist of a twin turbine Bell 212 (or equivalent) helicopter certified for instrument flight rules land and over water operations. Helicopter crews and support personnel will be housed in existing Kenai area facilities. The helicopter will be based at the Kenai Airport to support rig crew changes and cargo handling. Fueling will take place at these facilities. No helicopter refueling will take place on the rig.

Helicopter flights to and from the rig are expected to average two per day. Flight routes will follow a direct route to and from the rig location, and flight heights will be maintained 300 to 450 meters (1,000 to 1,500 feet) above ground level to avoid acoustical harassment of marine mammals (Richardson et al. 1995). The aircraft will be dedicated to the drilling operation and will be available for service 24 hours per day. A replacement aircraft will be available when major maintenance items are scheduled.

Rig crews, operator personnel, and third party personnel not already on the rig or in the Cook Inlet area will be flown to the Kenai Airport from Anchorage by scheduled commercial or chartered aircraft. Personnel will then be transported by helicopter to the rig. Personnel will be housed in an appropriate facility in the Homer or Kenai area in the event of inclement weather.

Alternate landing zones will be identified and available for diverted flights if weather prevents a helicopter landing at the Kenai Airport, such as the Nikiski OSK facility, Homer Airport, or the Hanson drill site helipad. Sufficient fuel will be carried on all flights under inclement weather conditions to return to the rig as an additional alternate destination. The rig will be provided with adequate instrumentation, communications, a helipad, and navigational aids to ensure all flight operations are conducted safely at all times.

1.2.4.3 Supply Vessel Support

Major supplies will be staged on-shore at the Kenai OSK Dock. Required supplies and equipment will be moved from the staging area by contracted supply vessels and loaded aboard the rig when the rig is established on a drilling location. Major supplies will include fuel, drilling water, mud materials, cement, casing, and well service equipment. Supply vessels also will be outfitted with fire-fighting systems as part of fire prevention and control as required by Cook Inlet Spill Prevention and Response, Inc. (CISPRI).

The specific supply vessels have not been identified; however, typical offshore drilling support work vessels are of steel construction with strengthened hulls to give the capability of working in extreme conditions.

1.2.4.4 Fuel

Rig equipment will use diesel fuel or electricity. Personnel associated with fuel delivery, transfer, and handling will be knowledgeable of Industry Best Management Practices related to fuel transfer and handing, drum labeling, secondary containment guidelines, and the use of liners/drip trays.

The jack-up rig will take on a maximum fuel load prior to operations to reduce fuel transfers during drilling. Commercial tank farms in the Nikiski or Kenai area will supply fuel transported by barge as needed. The rig barge master will be in charge of re-fueling and fluid transfers between the rig and fuel barge, and subsequent transfers between tanks on the rig.

1.2.5 Drilling Program and Well Operations

The drilling program for the well has been described in detail in the Plan of Operations filed with the Alaska Division of Oil and Gas. The APD presents information on the drilling mud program; casing design, formation evaluation program; cementing programs; and other engineering information.

After rig up/rig acceptance by BlueCrest, the well will be spudded and drilled to the bottom-hole depths of approximately 2,100 to 4,900 meters (7,000 to 16,000 feet). The fall 2014 drilling season is constrained by the requirement that the drill rig be off location by October 31, 2014, leaving a maximum 60-day drilling season that would include 7 to 15 days of well testing post-drilling. If the drilling is postponed until spring/summer 2015, then the drilling period could extend to 90 days, including up to 15 days of well testing.

1.2.5.1 Blowout Prevention Program and Equipment

All operating procedures on the rig, whether automated or controlled by company or contractor personnel, are specifically designed to prevent a loss of well control. The primary method of well control utilizes the hydrostatic pressure exerted by a column of drilling mud of sufficient density to prevent an undesired flow of formation fluid into the well bore. In the unlikely event that primary control is lost, surface blowout prevention (BOP) equipment would be used for secondary control. BlueCrest will use a 10,000 or 15,000 psi BOP stack due to the higher pressure formations known to exist in Cook Inlet.

1.2.5.2 Well Plugging and Abandonment (P&A)

When planned and permitted operations are completed, the well will be suspended or P&A'd according to AOGCC regulations. The well string is sealed and cemented with mechanical plugging devices to prevent the movement of any reservoir fluids between various strata. P&A includes cutting the casing below the sea floor and retrieving the stub. A P&A procedure will be presented to the AOGCC for approval prior to beginning the operation.

1.2.5.3 Waste Management Program

The onsite Health, Safety, and Environmental (HSE) Advisor will supervise drilling waste, solid waste, and wastewater, and will be responsible for authorized discharge and proper manifesting for transport and off-site disposal.

1.2.5.4 Drilling Fluids and Cuttings

Drilling wastes include drilling fluids, known as mud, rock cuttings, and formation waters. Drilling wastes (non-hydrocarbon) will be discharged to the Cook Inlet under the approved Alaska Pollution Discharge Elimination System (APDES) general permit. Drilling wastes (hydrocarbon) will be delivered to an onshore permitted location for disposal. During drilling, the onsite tool pusher/driller and qualified mud engineers will direct and maintain desired mud properties, and maintain the quantities of basic mud materials on site as dictated by good oilfield practice. BlueCrest will follow best management practices to ensure that a sufficient inventory of barite and lost circulation materials are maintained on the drilling vessel to minimize the possibility of a well upset and the likelihood of a release of pollutants to Cook Inlet waters. These materials can be re-supplied, if required, using the supply vessel. Because adverse weather could prevent immediate re-supply, sufficient materials will be available on board to completely rebuild the total circulating volume. BlueCrest will conduct an Environmental Monitoring Study of relevant hydrographic, sediment hydrocarbon, and heavy metal data from surveys conducted before and during drilling mud disposal and up to a least one year after drilling operations cease in accordance with the APDES general permit for discharges of drilling muds and cuttings.

Non-drilling wastewater includes deck drainage, sanitary waste, domestic waste, blowout preventer fluid, boiler blowdown, fire control test water, bilge water, non-contact cooling water, and uncontaminated ballast water. Non-drilling wastewater will be discharged into Cook Inlet under the approved APDES general permit or delivered to an onshore permitted location for disposal.

Solid waste (*e.g.*, packaging, domestic trash) will be classified, segregated, and labeled as general, universal, and Resource Conservation and Recovery Act exempt or non-exempt waste. It will be stored in containers at designated accumulation areas. Then, it will be packaged and palletized for transport to an approved on-shore disposal facility. No hazardous wastes should be generated as a result of this project. However, if any hazardous wastes were generated, it would be temporarily stored in an on-board satellite accumulation area and then transported offsite for disposal at an approved facility.

1.3 Project Components of Relevance to Acoustical Harassment of Marine Mammals

The project components with a potential for harassment of marine mammals include:

1) Towing of the jack-up drill rig to the Cosmopolitan State #B-1 well site,
2) Driving the conductor pipe at the well prior to drilling,
3) Active exploratory drilling at the well site with associated generator and pump noise, and
4) VSP operations that may occur at the completion of drilling.

For these activities the primary impact of concern is the effect the noise generated by these operations could have on local marine mammals. Helicopters will be used to transport personnel on and off the drill rig, but any noise related impacts to marine mammals will be avoided by maintaining 300- to 450-meter (1,000- to 1,500-foot) flight altitudes. Towing, drilling, generators, and submersible pumps generate continuous noises; therefore, continuous noise criteria developed by NMFS apply (*i.e*., Level B disturbance harassment with exposure to sound levels >120 dB re 1 µPa-m (rms)). Potential impacts from these noise sources are addressed relative to exceeding the 120 dB noise "take" threshold. The conductor pipe driving and VSP are impulsive noise activities. Here the Level B disturbance exposure to sound levels >160 dB re 1 µPa-m (rms) applies, and "take" is addressed relative to noise levels exceeding 160 dB.

1.3.1 Rig Tow

The jack-up rig would be towed twice during the fall of 2014 (or spring/summer 2015 if fall operations are delayed). It is estimated that the tows will take less than 24 hours to complete.

The rig will be wet-towed by two or three ocean-going tugs licensed to operate in the Cook Inlet. Tugs generate their loudest sounds while towing due to the propeller cavitations. While these continuous sounds have been measured at up to 171 dB re 1 µPa-m (rms) at 1-meter source, they are generally emitted at dominant frequencies of less than 5 kHz (Miles et al. 1987, Richardson et al. 1995, Simmonds et al. 2004). Thus, the dominant noise frequencies from propeller cavitation are significantly less than the dominant hearing frequencies for pinnipeds and odontocetes. Still, because it is currently unknown which tugs will be used to tow the rig on each tow (to and from the well site), and there are few sound signatures for tugs in general, it is assumed that noise exceeding 120 dB dB re 1 µPa-m (rms) extends 600 meters (2,000 feet) from the operating tugs (based on a 171 dB re 1 µPa-m (rms) source). The tug's cavitating propellers do not exceed 180 dB re 1 µPa-m (rms) at 1-meter source, thus they do not represent a Level A injury take concern.

1.3.2 Conductor/Drive Pipe Placement

A drive pipe is a relatively short, large-diameter pipe driven into the sediment prior to the drilling of oil wells. The drive pipe also serves to support the initial sedimentary part of the well, preventing the looser surface layer from collapsing and obstructing the wellbore. Drive pipes are usually installed using pile driving techniques. (Drive pipe is often synonymous to the term conductor pipe, although a 50.8-centimeter (20-inch) conductor pipe will be drilled (not hammered) inside the drive pipe, and is used to transport or "conduct" drillhead cuttings to the surface. There are no noise concerns associated with the conductor pipe drilling.) BlueCrest proposes to drive the drive pipe approximately 60 meters (200 feet below mudline) of 76.2-centimeter (30-inch) pipe at Cosmopolitan State #B-1 prior to drilling using a Delmar D62-22 impact hammer. This hammer has impact weight of 6,200 kg (13,640 pounds) and reaches a maximum impact energy of 224 kilonewton-meters (165,215 foot-pounds) at a drop height of 3.6 meters (12 feet). Illingworth & Rodkin (2014) measured the hammer noise operating from the *Endeavour* in 2013 and found noise levels exceeding 160 dB re 1µPa (rms) out to 1.63 kilometers (1 mile; disturbance zone), 180 dB re 1µPa (rms) to 170 meters (560 feet; cetacean injury zone), and 190 dB re 1µPa (rms) to 180 feet (55 meters; pinniped injury zone).

Blackwell (2005) measured the noise produced by a Delmar D62-22 driving 91.4-centimeter (36-inch) steel pipe in upper Cook Inlet and found sound pressure levels to exceed 190 dB re 1µPa-m (rms) at about 60 meters (200 feet), 180 dB re 1µPa-m (rms) at about 250 meters (820 feet), and 160 dB re 1µPa-m (rms) at just less than 1.9 kilometers (1.2 miles). The conductor pipe driving event is expected to last one to three days, although actual noise generation (pounding) would occur only intermittently during this period.

1.3.3 Exploratory Drilling and Standard Operation

BlueCrest proposes to use the jack-up drilling rig *Endeavour* for the Cosmopolitan State program, although the *Spartan 151* will be considered if the *Endeavour* became unavailable. Because the drilling platform and other noise-generating equipment is located above the sea's surface, and there is very little surface contact with the water compared to drill ships and semi-submersible drill rigs, lattice-legged jack-up drill rigs are relatively quiet (Richardson et al. 1995, Spence et al. 2007).

The *Spartan 151*, the only other jack-up drilling rig operating in the Cook Inlet, was hydroacoustically measured by Marine Acoustics, Inc. (2011) while operating in 2011. The survey results showed that continuous noise levels exceeding 120 dB re 1µPa extended out only 164 feet (50 meters), and that this noise was largely associated with the diesel engines used as hotel power generators.

The *Endeavour* was hydroacoustically tested during drilling activities by Illingworth & Rodkin (2014) in May 2013 while the rig was operating at a Cosmopolitan #A-1. The results from the sound source verification indicated that noise generated from drilling or generators were below ambient. The generators used on the *Endeavour* are mounted on pedestals specifically to reduce noise transfer through the infrastructure, and they are enclosed in an insulated engine room, which may further have reduced underwater noise transmission to levels below those generated by the *Spartan 151.* Also, as mentioned above, the lattice legs limit transfer of noise generated from the drilling table to the water.

However, the sound source verification revealed that the submersed deep-well pumps that charges the fire-suppression system and cools the generators (in a closed water system) does generate noise levels exceeding 120 dB re 1µPa out a distance of approximately 300 meters (984 feet). It was not clear at the time of measurements whether the noise was direct result of the pumps or was from the systems discharge water falling approximately 12 meters (40 feet) from the deck. Thus, after the falling water was enclosed in pipe extending below the water surface in an effort to reduce the noise levels, the pump noise levels were re-measured in June 2013 (I&R 2014) with results indicating that piping the falling water had a modicum of effect on reducing underwater noise levels; nevertheless, the 120-dB radius still extended out to 260 meters (853 feet) in certain directions, and noise exceeding the 160-dB radius to 3 meters (10 feet).

Thus, neither drilling operations nor running generators on the *Endeavour* drill rig generates underwater noise levels exceeding 120 dB re 1µPa. However, the *Endeavour*'s submersed deep-well pumps generate continuous noise exceeding 120 dB re 1µPa to a maximum distance of 260 meters (853 feet). Deep-well pumps were not identified as a noise source by Marine Acoustics, Inc. (2011) during their acoustical testing of the *Spartan 151*.

1.3.4 Vertical Seismic Profiling

Data on geological strata depth collected during initial seismic surveys at the surface can only be inferred. However, once a well is drilled, accurate follow-up seismic data can be collected by placing a receiver at known depths in the borehole and shooting a seismic airgun at the surface near the borehole. This gathered data provides not only high resolution images of the geological layers penetrated by the borehole, but can be used to accurately correlate (or correct) the original surface seismic data. The procedure is known as vertical seismic profiling, or VSP.

BlueCrest intends to conduct VSP operations at the end of drilling the well using an array of airguns with total volumes of between 9.83 and 14.42 liters (600 and 880 cubic inches). The actual size of the airgun array will not be determined until the final well depth is known. The VSP operation is expected to last less than one or two days. Illingworth & Rodkin (2014) measured noise levels associated with VSP (using a 750 cubic inch airgun array) conducted at Cosmopolitan State #A-1 in 2013. The results indicated that the 190 dB radius (Level A take threshold) from source was 120 meters (394 feet), the 180 dB radius was 240 meters (787 feet), and the 160 dB radius (Level B disturbance take threshold) at 2.47 kilometers (1.54 miles).

1.4 Maintaining Safe Radii

Acoustical injury to marine mammals can occur if received noise levels exceed 180 dB re 1 µPa (rms) for whales or 190 dB re 1 µPa (rms) for pinnipeds. This application is not requesting authorization of these takes, termed Level A injury takes, but instead will implement mitigation measures to avoid these takes. However, the drilling and rig towing procedures to be used during BlueCrest's operation do not have the potential to acoustically injure marine mammals (see Section 6). Therefore, no shutdown safety zones will be established for these activities (but see Section 13 regarding monitoring of harassment zones). The conductor pipe driving and VSP operations do generate impulsive noises exceeding 180 dB re 1 µPa (rms). Based on the estimated distances to the 180 dB isopleth addressed above, a 170-meter (560-foot) shutdown safety zone will be established and monitored during conductor pipe driving (at least until the noise levels are empirically verified), while a 240-meter (787-foot) shutdown safety zone will be monitored during VSP operations.

2. DATES AND DURATION OF PROPOSED ACTIVITY AND SPECIFIC GEOGRAPHICAL REGION

The request for incidental harassment authorization is for both the 2014 and 2015 drilling seasons at BlueCrest's Cosmopolitan State unit in lower Cook Inlet. Exploratory drilling at Cosmopolitan well site

#B-1 is expected to commence in September 2014, and be completed by October 2014. However, depending on the availability of a drill rig, and the completion of various permitting processes, drilling for oil at Cosmopolitan State #B-1 may be delayed until spring 2015. This application assumes the possibility of drilling occurring in the Cosmopolitan State unit in the fall of 2014, or the spring and summer of 2015.

3. THE SPECIES AND NUMBERS OF MARINE MAMMALS LIKELY TO BE FOUND WITHIN THE ACTIVITY AREA

Non-listed cetaceans and pinnipeds most likely to be found in the vicinity of the Cosmopolitan activity area is best reflected in the data collected during marine mammal monitoring at Cosmopolitan #A-1 during the summer of 2013. Between May and August (112 days), 104 harbor porpoise (*Phocoena phocoena*), 72 harbor seals (*Phoca vitulina*), 32 minke whales (*Balaenoptera acutorostra*), 19 Dall's porpoise (*Phocoenoides dalli*), 12 gray whales (*Eschrichtius robustus*), and 2 killer whales (*Orcinus orca*) were recorded. Based on their seasonal patterns, gray whales are not likely to be encountered during spring. Minke whales have been considered migratory in Alaska (Allen and Angliss 2012) but have recently been observed off Cape Starichkof and Anchor Point year-round. The remaining species could be encountered year-round. The stock populations for non-listed marine mammals found in Cook Inlet are shown in Table 3.

Table 3. Non-listed Cetaceans and Pinnipeds in the Cook Inlet Action Area.

Species	Stock Estimate	Comment
Minke Whale (*Balaenoptera acutorostra*)	1,233	Central Alaska Stock?
Gray Whale (*Eschrichtius robustus*)	19,126	Eastern North Pacific Stock
Killer Whale (*Orcinus orca*)	2,084	Alaska Resident Stock
Killer Whale (*Orcinus orca*)	552	Alaska Transient Stock
Harbor Porpoise (*Phocoena phocoena*)	31,046	Gulf of Alaska Stock
Dall's Porpoise *(Phocoenoides dalli*)	83,400	Alaska Stock
Harbor Seal (*Phoca vitulina*)	22,900	Cook Inlet/Shelikof Stock

Source: Allen and Angliss (2012, 2013), Zerbini et al. (2006)

4. A DESCRIPTION OF THE STATUS, DISTRIBUTION, AND SEASONAL DISTRIBUTION (WHEN APPLICABLE) OF THE AFFECTED SPECIES OR STOCKS OF MARINE MAMMALS LIKELY TO BE AFFECTED BY SUCH ACTIVITIES

4.1 Minke Whale (Balaenoptera acutorostra)

Minke whales are the smallest of the rorqual group of baleen whales reaching lengths of up to 11 meters (35 feet). They are also the most common of the baleen whales, although there are no population estimates for the North Pacific. However, Zerbini et al. (2006) did estimate the coastal population between Kenai Fjords and the Aleutian Islands at 1,233 animals.

During Cook Inlet-wide aerial surveys conducted from 1993 to 2004, minke whales were encountered only twice (1998, 1999), both times off Anchor Point approximately 30 kilometers (19 miles) northwest of Homer. A minke whale was also reported off Cape Starichkof in late fall 2011 (A. Holmes, pers. comm.) and January 2013 (E. Fernandez and C. Hesselbach, pers. comm.), suggesting this location is regularly used by minke whales, including during the winter. More importantly, minke whales were recorded 32 times at Cosmopolitan #A-1 between May and August 2013 in patterns suggesting the presence of a small, yet conspicuous summer population (at least) within the Cosmopolitan State unit, although only three minke whales were recorded within 300 meters of the active drill rig. There are no records north of Cape Starichkof.

4.2 Gray Whale (Eschrichtius robustus)

Each spring, the Eastern North Pacific stock of gray whale migrates 8,000 kilometers (5,000 miles) northward from breeding lagoons in Baja California to feeding grounds in the Bering and Chukchi seas, reversing their travel again in the fall (Rice and Wolman 1971). Their migration route is for the most part coastal until they reach the feeding grounds. A small portion of whales do not annually complete the full circuit, as small numbers can be found in the summer feeding along the Oregon, Washington, British Columbia, and Alaskan coasts (Rice et al. 1984, Moore et al. 2007).

Human exploitation reduced this stock down to an estimated “few thousand” animals (Jones and Swartz 2002). However, by the late 1980s the stock was appearing to reach carrying capacity and estimated to be at 26,600 animals (Jones and Swartz 2002). By 2002 that stock had been reduced to about 16,000 animals, especially following unusually high mortality events in 1999 and 2000 (Allen and Angliss 2012). The stock has continued to grow since then and is currently estimated at 19,126 animals with a minimum estimate of 18,017 (Allen and Angliss 2012).

Most gray whales migrate past the mouth of Cook Inlet to and from northern feeding grounds. However, small numbers of summering gray whales have been noted by fisherman near Kachemak Bay and north of Anchor Point. Further, summer gray whales were recorded a dozen times offshore of Cape Starichkof by marine mammal observers monitoring BlueCrest’s Cosmopolitan #A-1 drilling program between May and August 2013; however, none of this animals closely approached the drilling operations and most were observed well south of the well site.

4.3 Harbor Porpoise (*Phocoena phocoena*)

Harbor porpoise are small (1.5 meters length), relatively inconspicuous toothed whales. The Gulf of Alaska Stock is distributed from Cape Suckling to Unimak Pass and was most recently estimated at 31,046 animals (Allen and Angliss 2013). They are found primarily in coastal waters less than 100 meters (328 feet) deep (Hobbs and Waite 2010) where they feed on Pacific herring (*Clupea pallasii*), other schooling fishes, and cephalopods.

Although they have been frequently observed during aerial surveys in Cook Inlet, most sightings were of single animals, and were concentrated at Chinitna and Tuxedni bays on the west side of lower Cook Inlet (Rugh et al. 2005). Dahlheim et al. (2000) estimated the 1991 Cook Inlet-wide population at only 136 animals. However, harbor porpoise were the most commonly observed marine mammal (excluding sea otters) recorded at Cosmopolitan #A-1 during monitoring of marine mammal activities between May and August 2013. At least 104 harbor porpoise were recorded, but only 12 were recorded inside 260 meters of the drill rig.

4.4 Dall's Porpoise (*Phocoenoides dalli*)

Dall's porpoise are widely distributed throughout the North Pacific Ocean including Alaska, although they are not found in upper Cook Inlet and the shallower waters of the Bering, Chukchi, and Beaufort Seas (Allen and Angliss 2013). Compared to harbor porpoise, Dall's porpoise prefer the deep offshore and shelf slope waters. The Alaskan population has been estimated at 83,400 animals (Allen and Angliss 2013), making it one of the more common cetaceans in the state. Dall's porpoise have been observed in lower Cook Inlet, including Kachemak Bay and near Anchor Point, but sightings there are rare. During 112 days of monitoring during the Cosmopolitan #1 drilling operation between May and August 2013, 19 Dall's porpoise were recorded, but none in close proximity (less than 260 meters) of the drill rig.

4.5 Killer Whale (*Orcinus orca*)

Two different stocks of killer whales inhabit the Cook Inlet region of Alaska: the Alaska Resident Stock and the Gulf of Alaska, Aleutian Islands, Bering Sea Transient Stock (Allen and Angliss 2013). The resident stock is estimated at 2,084 animals and occurs from Southeast Alaska to the Bering Sea (Allen and Angliss 2013). Resident whales feed exclusively on fish and are genetically distinct from transient whales (Saulitis et al. 2000). The transient whales feed primarily on marine mammals (Saulitis et al. 2000). The transient population inhabiting the Gulf of Alaska shares mitochondrial DNA haplotypes with whales found along the Aleutian Islands and the Bering Sea suggesting a common stock, although there appears to be some subpopulation genetic structuring occurring to suggest the gene flow between groups is limited (see Allen and Angliss 2013). For the three regions combined, the transient population has been estimated at 552 animals (Allen and Angliss 2013).

Killer whales are occasionally observed in lower Cook Inlet, especially near Homer and Port Graham (Shelden et al. 2003, Rugh et al. 2005a). A concentration of sightings near Homer and inside Kachemak Bay may represent high use, or high observer-effort given most records are from a whale-watching venture based in Homer. The few whales that have been photographically identified in lower Cook Inlet belong to resident groups more commonly found in nearby Kenai Fjords and Prince William Sound (Shelden et al. 2003). Prior to the 1980s, killer whale sightings in upper Cook Inlet were very rare. During aerial surveys conducted between 1993 and 2004, killer whales were observed on only three flights, all in the Kachemak and English Bay area (Rugh et al. 2005). However, anecdotal reports of killer whales feeding on belugas in upper Cook Inlet began increasing in the 1990s, possibly in response to declines in sea lion and harbor seal prey elsewhere (Shelden et al. 2003). These sporadic ventures of transient whales into beluga summering grounds have been implicated as a possible contributor to decline of Cook Inlet belugas in the 1990s, although the number of confirmed mortalities from killer whales is small (Shelden et al. 2003). Two killer whales were recorded during the May to August 2013 marine mammal monitoring activities at Cosmopolitan #A-1.

4.6 Harbor Seal (*Phoca vitulina*)

At over 150,000 animals state-wide (Allen and Angliss 2013), harbor seals are one of the more common marine mammal species in Alaskan waters. They are most commonly seen hauled out at tidal flats and rocky areas. Harbor seals feed largely on schooling fish such a walleye pollock (*Theragra chalcogramma*), Pacific cod (*Gadus macrocephalus*), salmon (*Onchorhynchus* spp.), Pacific herring, eulachon (*Thaleichthys pacificus*), and squid. Although harbor seals may make seasonal movements in response to prey, they are resident to Alaska and do not migrate.

The Cook Inlet/Shelikof Stock, ranging from approximately Anchorage down along the south side of the Alaska Peninsula to Unimak Pass, has been recently estimated at a stable 22,900 (Allen and Angliss 2013). Large numbers concentrate at the river mouths and embayments of lower Cook Inlet, including the Fox River mouth in Kachemak Bay (Rugh et al. 2005). Montgomery et al. (2007) recorded over 200 haulout sites in lower Cook Inlet alone. However, only a few dozens to a couple hundred seals seasonally occur in upper Cook Inlet (Rugh et al. 2005), mostly at the mouth of the Susitna River where their numbers vary in concert with the spring eulachon and summer salmon runs (Nemeth et al. 2007, Boveng et al. 2012). In 2012, up to 100 harbor seals were observed hauled out at the mouths of the Theodore and Lewis rivers during monitoring activity associated with SAE's (with Apache) 2012 Cook Inlet seismic program. Montgomery et al. (2007) also found seals elsewhere in Cook Inlet to move in response to local steelhead (*Onchorhynchus mykiss*) and salmon runs. During the marine mammal monitoring associated with 2013 drilling activities at Cosmopolitan, 72 harbor seals were recorded. Their inquisitive nature probably accounts for the observation that 18 of these seals were observed within 260 meters of the active drill rig.

5. TYPE OF INCIDENTAL TAKING AUTHORIZATION BEING REQUESTED AND METHOD OF INCIDENTAL TAKING

The incidental take authorization requested is for Level B noise harassment associated with the exploratory oil and gas drilling activity. Actual Level B "takes" will depend upon numbers of marine mammals occurring within the 160 dB ZOI at the time of impulsive noise activity (conductor pipe driving and VSP) and within the 120 dB ZOI during the time of continuous noise activity (deep-well pump operation). No Level A injury "takes" (noise exceeding 180 dB re 1 µPa [rms] for cetaceans and 190 dB re 1 µPa [rms] for pinnipeds) are expected with the proposed mitigation measures (see Section 1.3 and Appendix 2) in place.

6. BY AGE, SEX, AND REPRODUCTIVE CONDITION (IF POSSIBLE) THE NUMBER OF MARINE MAMMALS (BY SPECIES) THAT MAY BE TAKEN

6.1 Basis for Estimating Numbers of Marine Mammals That Might Be "Taken by Harassment"

Exposure to continuous sound levels greater than 120 dB re 1 µPa (rms) and impulsive sounds greater than 160 dB re 1 µPa (rms) can elicit behavioral changes in marine mammals that might be detrimental to health and long-term survival where it disrupts normal behavioral routines, and is the Level B harassment criteria for acoustical disturbance under MMPA (NMFS 2005). Exposure to sound levels greater than 180 dB re 1 µPa (rms) for cetaceans and 190 dB re 1 µPa (rms) for pinnipeds can lead to acoustical injury including temporary loss in hearing sensitivity and permanent hearing damage. These values are the MMPA Level A injury criterion. However, only the impulsive noise sources (pipe driving and VSP) are likely to exceed 180 dB (see below). Shutdown safety zones will be established to avoid Level A injury take.

The estimate of the numbers of each species of marine mammals that could be "taken" by exposure to exploratory drilling and drill rig towing noise levels is determined by multiplying the maximum seasonal density of each species by the area that will be ensonified by greater than 120 dB re 1 µPa (rms) for towing and drilling and greater than 160 dB re 1 µPa (rms) for pipe driving and VSP operations.

6.1.1 Ensonified Area - Rig Tow

The jack-up rig would be towed twice in association with Cosmopolitan operations: once to the well site and once away from the site. If the *Endeavour* drill rig is used in fall 2014 or spring/summer 2015 it will be coming from Port Graham, approximately 50 kilometers (31 miles). If drilling is completed in October 2014, the *Endeavour* would then travel to a winter moorage location as the owner's discretion (likely Port Graham or Homer). If the drilling is completed in summer 2015, the *Endeavour* may be returned to moorage or moved to a non-BlueCrest drilling project. If the *Spartan 151* is used in fall 2015, it is likely to come from an existing drilling project in upper Cook Inlet approximately 100 kilometers (62 miles) north of Cosmopolitan, and then moved to winter moorage at the end of October 2015 (likely Port Graham). If the *Spartan 151* is used in spring or summer 2015, whether it is coming from or going to other drilling projects or mooring locations is dependent on the rig owner's accommodation schedule for BlueCrest. Regardless, the tow distances are likely to be between 50 and 100 kilometers.

All rig tows within Cook Inlet are expected to last less than 24 hours. The rig will be wet-towed by two or three ocean-going tugs licensed to operate in Cook Inlet. Tugs generate their loudest sounds while towing due to propeller cavitation. While these continuous sounds have been measured at up to 171 dB re 1 µPa-m (rms) at source (broadband), they are generally emitted at dominant frequencies of less than 5 kHz (Miles et al. 1987, Richardson et al. 1995, Simmonds et al. 2004).

For the most part, the dominant noise frequencies from propeller cavitation are significantly less than the dominant hearing frequencies for pinnipeds (10 to 30 kHz) and toothed whales (12 to >100 kHz) (Wartzok and Ketten 1999). Still, because it is currently unknown which tug or tugs will be used to tow the rig, and there are few sound signatures for tugs in general, the potential area that could be ensonified by disturbance-level noise is calculated based on an assumed 171 dB re 1 µPa-m source. Using Collins et al.'s (2007) 171 - 18.4 Log(R) – 0.00188 spreading model determine from hydroacoustic surveys in Cook Inlet, the distance to the 120 dB isopleth would be at 523 meters (1,715 feet). The associated ZOI (area ensonified by noise greater than 120 dB) is, therefore, 0.86 square kilometers (212 acres).

6.1.2 Ensonified Area – Conductor Pipe Driving

The Delmar D62-22 diesel impact hammer proposed to be used by BlueCrest to drive the 76.2-centimeter (30-inch) conductor pipe was previously acoustically measured by Blackwell (2005) in upper Cook Inlet. She found that sound exceeding Level A noise limits for pinnipeds to extend to about 60 meters (200 feet), and Level A impacts to cetaceans to about 250 meters (820 feet). Level B disturbance levels extended to just less than 1.63 kilometers (1.0 miles). The associated ZOI (area ensonified by noise greater than 160 dB) is 8.3 square kilometers (3.1 square miles).

6.1.3 Ensonified Area – Deep-well Pumps

BlueCrest proposes to use the jack-up drilling rig *Endeavour* for the Cook Inlet program. Because the drilling platform and other noise-generating equipment on a jack-up rig are located above the sea's surface, and there is very little surface contact with the water compared to drill ships and semi-submersible drill rigs, lattice-legged jack-up drill rigs are relatively quiet (Richardson et al. 1995, Spence et al. 2007).

The *Spartan 151*, the only other jack-up drill rig currently operating in the Cook Inlet, was hydroacoustically measured by Marine Acoustics, Inc. (2011) in 2011. The survey results showed that continuous noise levels exceeding 120 dB re 1 µPa extended out only 164 feet (50 meters), and that this noise was largely associated with the diesel engines used as hotel power generators, rather than the drilling table. Similar, or lesser, noise levels were expected to be generated by the *Endeavour* because generators are mounted on pedestals specifically to reduce noise transfer through the infrastructure, and enclosed in an insulated engine room, with the intent of reducing underwater noise transmission to levels even lower than the *Spartan 151.* This was confirmed during a sound source verification test on the *Endeavour* by Illingworth & Rodkin (2014) in May 2013 where it was determined that the noise levels associated with drilling and operating generators are below ambient.

However the sound source verification identified another sound source, the submersed deep-well pumps, which were emitting underwater noise exceeding 120 dB. In the initial testing (I&R 2014), the noise from the pump and the associated falling (from deck level) water discharge was found to exceed 120 dB re 1 µPa out a distance just beyond 300 meters (984 feet). After the falling water was piped as a mitigation measure to reduce noise levels, the pump noise was retested (I&R 2014) with the results indicating that the primary deep-well pump, operating inside the bow leg, still exceeded 120 dB re 1 µPa at a maximum of 260 meters (853 feet). For calculating potential incidental harassment take, the 260-meter (853-foot) distance to the 120 dB isopleth will be used giving a ZOI of 0.21 square kilometers (52.5 acres).

6.1.4 Vertical Seismic Profiling

Illingworth and Rodkin (2014) measured noise levels during VSP operations associated with post-drilling operations at the Cosmopolitan #A-1 site in lower Cook Inlet during July 2013. The results indicated that the 11.8-liter (720-cubic-inch) airgun array used during the operation produced noise levels exceeding 160 dB re 1 µPa out to a distance of approximately 2,470 meters (8,100 feet). Based on these results, the associated ZOI would be 19.2 square kilometers (7.4 square miles).

6.1.5 Marine Mammal Densities

Density estimates were derived for harbor porpoises and harbor seals as described below and shown in Table 6-1. Because of their low numbers, there are no available Cook Inlet density estimates for the other marine mammals that occasionally inhabit Cook Inlet north of Anchor Point.

Table 6-1. Estimated Summer Marine Mammal Densities (number per square kilometer) in Cook Inlet.

Species	Summer Density
Harbor Porpoise	0.013
Harbor Seal	0.278

6.1.5.1 Harbor Porpoise

Hobbs and Waite (2010) calculated a Cook Inlet harbor porpoise density estimate of 0.013 per square kilometer based on sightings recorded during a 1998 aerial survey targeting beluga whales. They derived the value by dividing estimated number of harbor porpoise inhabiting Cook Inlet (249) by the area of the entire inlet (18,948 square kilometers). As all of Cook Inlet would remain ice-free during the drilling period, this density value would apply from April to October.

6.1.5.2 Harbor Seal

Boveng et al. (2003) estimated the harbor seal population that inhabits Cook Inlet at 5,268 seals. Dividing that value by the area of the inlet (18,948 square kilometers) provides a Cook Inlet-wide density of 0.278 seals per square kilometer. It is presumed that densities in lower Cook Inlet will remain the same until November when winter ice conditions begin moving animals out of upper Cook Inlet.

6.2 Exposure Calculations

The estimated potential harassment take of local marine mammals by BlueCrest's proposed drilling and rig towing activities was determined by multiplying the animal densities in Table 6-1 with the area ensonified by continuous noise greater than 120 dB re 1 µPa (rms) (0.86 square kilometers for rig towing and 0.21 square kilometers for the deep-well pumps), and by impulsive noise greater than 160 dB re 1 µPa (rms) (8.3 square kilometers for driving conductor pipe and 19.2 square kilometers for the VSP). The resulting exposure calculations are found in Table 6-2.

Table 6-2. Number of Harbor Porpoise and Harbor Seals Potentially Exposed to Harassment Noise Levels

Species	Rig Tow	Deep-well Pump	Pipe Driving	VSP	Total
Harbor Porpoise	0.01	0.02	0.11	0.25	**0.39**
Harbor Seal	0.24	0.06	2.30	5.34	**7.94**

Based on the density estimates of the most common marine mammals potentially inhabiting the activity area and the area expected to ensonified by continuous noise levels exceeding 120 dB re 1 µPa (rms), neither of BlueCrest's proposed continuous noise activities (rig towing or deep-well pumps) is expected to result in the take of a single animal. The impulsive noise sources (conductor pipe driving and VSP) do generate louder noises, and could collectively harass eight harbor seals (but well less than one harbor porpoise). These estimates are probably low given that 18 harbor seals and 12 harbor porpoises were recorded inside similar harassment ZOIs during the 2013 drilling program (112 days) at Cosmopolitan #A-1, but which may be due to repeated sightings of the same animals. These estimates are the basis for the requested take authorizations in Table 6-3, and are probably conservative given the 2014 (or 2015) drilling program is expected to last only 60 days, compared to the 112-day 2013 program.

Table 6-3. The Estimated and Requested Take of Marine Mammals.

Species	Estimated Take	Take Authorization Request
Gray Whale	<1	2
Minke Whale	<1	2
Killer Whale	<1	5
Harbor Porpoise	12	12
Dall's Porpoise	<1	5
Harbor Seal	18	18

For the less common marine mammals such as gray whales, minke whales, killer whales, and Dall's porpoise population estimates within central and upper Cook Inlet are too small to calculate density estimates. Still, at even very low densities, it is possible to encounter these marine mammals during BlueCrest operations, especially since all were recorded in the vicinity of Cosmopolitan #A-1 during the 2013 drilling operations (although only three animals, all minke whales, approached to within a harassment ZOI). Marine mammals may approach the drilling rig out of curiosity, and animals may approach in a group. Thus, requested take authorizations (Table 6-3) are based on density estimates where available, with the added combination of group size and the potential for attraction.

7. ANTICIPATED IMPACT OF THE ACTIVITY ON THE SPECIES OR STOCK

7.1 Introduction

The primary potential impact of the proposed BlueCrest drilling operations to local marine mammals is acoustical harassment from the short-term conductor pipe driving and VSP operations, both impulsive noise sources. The operating drill rig (drilling table, generators, etc.) and the rig tow (propeller cavitation from towing tug boats) are expected to have much less impact potential because the activities are short in duration and received levels are well below injurious levels. Noise generated from these continuous noise sources could, however, disrupt normal behaviors of marine mammals where received levels exceed 120 dB re 1 µPa (rms). A summary of what is known about behavioral responses to noise stimuli by the marine mammals that inhabit the Cook Inlet project area follows. Both the estimated and requested incidental harassment take as a percentage of the marine mammal stock is very small or negligible in all cases (Table 7-1). Thus, the population level impacts of BlueCrest's proposed lower Cook Inlet activities on non-listed marine mammals is extremely small to discountable.

Table 7-1. Requested "Take" as Percentage of the Stock.

Species	Abundance	Requested Take	Percent Population
Gray Whale	19,126	2	0.01%
Minke Whale	1,233	2	0.16%
Killer Whale Alaska Resident	2,084	5	0.24%
Killer Whale Alaska Transient	552	5	0.91%
Dall's Porpoise	83,400	5	0.01%
Harbor Porpoise	31,046	12	0.04%
Harbor Seal	22,900	18	0.08%

Abundance sources: Allen and Angliss (2012, 2013), Zerbini (2006)

Acoustical injury is possible where received sound levels exceed 180 dB re 1 µPa (cetaceans) or 190 dB re 1 µPa (pinnipeds), but this potential impact will not occur given that the continuous noise sources do not exceed these values, and shutdown safety zones will be established during impulsive noise activities.

Other direct impacts to species could occur from an oil spill or pollution discharge event. The consequences and likelihood of these impacts are also addressed in the following subsections.

7.2 Behavioral Response

Gray Whales - Gray whales, and other large baleen whales such as humpback and bowhead whales (Eubalaena mysticetus), have shown strong overt reactions to impulsive noises, such as seismic operations, at received levels between 160 and 173 dB re 1 µPa (rms) (Richardson et al. 1986, 1999; Ljungblad et al. 1988; Miller et al. 1999, 2005; McCauley et al. 2000). Baleen whales also seem to be sensitive to continuous noise (Richardson and Malme 1993), often detouring around drilling activity when received levels are as low as 119 dB re 1 µPa (rms) (Malme et al. 1983, Richardson et al. 1985, 1990). Based on the previously cited studies, NMFS developed the 120 dB re 1 µPa (rms) harassment criteria for continuous noise sources.

Ship strike is not an issue. Most strikes of marine mammals occur when vessels are traveling at speeds of between 24 and 44 kilometers per hour (13 and 24 knots) (http://www.nmfs.noaa.gov/pr/pdfs/shipstrike/ss_speed.pdf), well above the 1.9- to 7.4-kilometer per hour (1- to 4-knot) drill rig tow speed expected. However, ship cavitation noise, or mere presence, can result in behavioral changes by baleen whales. Humpback whales in particular have been studied relative to reactions to cruise ships and tankers with results showing a general avoidance reaction at distances from 2 to 4 kilometers (1.2 to 2.5 miles; Baker et al. 1982, 1983), and no reaction at distances to 800 meters (2,625 feet) when the whales were feeding (Watkins et al. 1981, Krieger and Wing 1986). Also, humpback whales have been especially responsive to fast moving vessels (Richardson et al. 1995), and often react by with aerial behaviors such as breaching or tail/flipper slapping (Jurasz and Jurasz 1979). However, temporarily disturbed whales often remain in the area despite the presence of vessels (Baker et al. 1988, 1992). Between 1999 and 2003, the California stranding network reported only four serious injuries or mortalities of gray whales caused by ship strikes, and only one reported in Alaska (Allen and Angliss 2012). The estimated annual mortality to gray whales in the U.S. from ship strikes is 1.5 (Allen and Angliss 2012)

Minke Whales – Other than observations that minke whales are often seen at visual ranges from drilling vessels off Greenland (Kapel 1979), there is little information for this species specific to drilling and drilling related activities. Information on minke reactions to boats is varied. These whales have been observed to avoid boats when approached and approach boats when the boats are stationary (see Richardson et al. 1995). Relative to bigger ships, information is lacking.

Harbor Porpoise – Harbor porpoise are naturally shy and tend to move away from boats and ships. Reaction to boats can be strong when within 400 meters (Polacheck and Thorpe 1990) out to 1.5 kilometers (Barlow 1988, Palka 1993). There is little information on harbor porpoise reaction to drilling activities, but they probably show tolerance to noise levels similar to other odontocetes given their effective hearing is above frequencies characterizing drilling sounds. However, Lucke et al. (2009) recently exposed harbor porpoise and found that a TTS was induced at sound pressure levels of about 200 dB re 1 µPa (peak-peak) and harbor porpoises showed behavioral aversion to impulsive sounds as low as 174 dB re 1 µPa (peak-peak), indicating a greater sensitivity to impulsive noise than beluga whales. Acoustical harassment devices with full spectrum impulsive source levels of 180 dB re 1 µPa effectively deterred harbor porpoise from salmon pens (Johnston 2002).

Killer Whale – There is very little information on killer whale reactions to drilling activity or ships other than studies on tour boat impacts to inland stocks of Washington and British Columbia. Presumably, the frequencies of noise generated by drilling and rig tow are largely below the effective hearing range of this odontocete. Killer whales are sensitive to impulsive noises as evidenced by the effective use of acoustical harassment devices to protect salmon pen fisheries (Morton and Symonds 2002).

Harbor Seal – Pinnipeds in general appear somewhat tolerant of underwater industrial noises, partially because they can escape underwater pressure levels by exposing their head above the water surface, and they are less sensitive to lower frequency noises. In her review of the known effects of noise on marine mammals, Weilgart (2007) largely confined her discussion on cetaceans and only once mentioned a possible negative effect on pinnipeds. What few studies have been conducted have shown that seals and sea lions do not avoid drilling ships and platforms (*e.g.*, Gales 1982, McCarty 1982, Brueggeman et al. 1991). Richardson et al. (1990, 1991) found ringed and bearded seals to approach within at least 50 meters (164 feet) of played back drilling rig sounds.

Most information on the reaction of seals and sea lions to boats relate to disturbance of hauled out animals. There is little information on the reaction of these pinnipeds to ships while in the water other than some anecdotal information that sea lions are often attracted to boats (Richardson et al. 1995).

7.3 Temporary Threshold Shift and Permanent Threshold Shift

Noise has the potential to induce temporary (temporary threshold shift [TTS]) or permanent (permanent threshold shift [PTS]) hearing loss (Weilgart 2007). The level of loss is dependent on sound frequency, intensity, and duration. Similar to masking, hearing loss reduces the ability for marine mammals to forage efficiently, maintain social cohesion, and avoid predators (Weilgart 2007). For example, Todd et al. (1996) found an unusual increase in fatal fishing gear entanglement of humpback whales to coincide with blasting activities, suggesting hearing damage from the blasting may have compromised the ability of the whales to use sound to passively detect the nets. Experiments with captive bottlenose dolphins (*Tursiops truncatus*) and beluga whales found that short duration impulsive sounds can cause TTS (Finneran et al. 2002). The impulsive noises associated with conductor pipe driving and VSP operations could cause TTS if the animals were close enough to the activity. However, the monitoring of shutdown safety zones by qualified marine mammal observers is designed to ensure operations cease at the approach of a marine mammal to noise levels of TTS concern.

PTS occurs when continuous noise exposure causes hairs within the inner ear system to die. This can occur due to moderate durations of very loud noise levels, or long-term continuous exposure of moderate noise levels. However, PTS is not an issue with BlueCrest's drilling and towing operations. Deep-well pump noise levels are far below intensities of concern, and local marine mammals can easily move away from the drilling rig. Cavitation noise from the tugs during the wet tow is louder, but exposure would be of short duration as the tugs are continually moving.

7.4 Masking

Masking occurs when louder noises interfere with marine mammal vocalizations or ability to hear natural sounds in their environment (Richardson et al. 1995), which limit their ability to communicate or avoid predation or other natural hazards. Masking is of special concern for mysticetes that vocalize at low frequencies over long distances, as their communication frequencies overlap with anthropomorphic noises such as shipping traffic. Some baleen whales have adjusted their communication frequencies, intensity, and call rate to limit masking effects. For example, McDonald et al. (2009) found that California blue whales (*Balaenoptera musculus*) have shifted their call frequencies downward by 31 percent since the 1960s, possibly in an attempt to communicate at frequencies below masking shipping noise frequencies. Melcon et al. (2012) found blue whales to increase their call rates in the presence of shipping noise, but to significantly decrease call rates when exposed to mid-frequency sonar. Also, Di Iorio and Clark (2010) found blue whales to communicate more often in the presence of seismic surveys, which they attributed to compensating for an increase in ambient noise levels. Fin whales (*Balaenoptera physalus*) have reduced their calling rate in response to boat noise (Watkins 1986), and were thought to stop singing altogether for weeks in response to seismic surveys (IWC 2007).

Low frequency noise associated with underwater pumps and rig towing is unlikely to create masking issues for odontocetes and pinnipeds as these animals effectively hear and communicate at much higher frequencies. The impulsive noises associated with conductor pipe driving and VSP are both sporadic and short-term, limiting masking effects to a few hours at a time at most. Masking from low frequency noise sources is more a concern for baleen whales. However, both species of baleen whales of concern – gray whale and minke whale – are found in lower Cook Inlet in relatively low numbers, and when present rarely approached the Cosmopolitan drilling operations.

7.5 Oil Spills and Pollution Discharges

Oil spills are an inherent risk in oil drilling operations. To limit this risk and to mitigate any impacts in the unlikely event of a spill, BlueCrest has prepared an Oil Discharge Prevention and Contingency Plan (ODPCP) and submitted it for approval by the Alaska's Department of Environmental Conservation (ADEC) prior to commencing offshore drilling operations by BlueCrest (approval is expected prior to September 1, 2014), which covers operations in Cook Inlet during the April 15 to October 31 open water period. NMFS reviewed the previous ODPCP covering the Cosmopolitan project (prepared by Buccaneer Alaska Operations LLC) during the ESA consultation process for Cosmopolitan leases and resolved that with the implementation of the plan, the potential impacts to beluga whales, and by extension other marine mammals, were discountable. Relevant detail from the plan modified from the Biological Assessment (BA) prepared for this drilling activities at Cosmopolitan State is found in Appendix 3. Copies of both the previous ODPCP and BA have been provided to NMFS for review in association with this application. The new ODPCP will also be provided to NMFS upon receipt.

The drill rig *Endeavour* is currently operating under the Alaska Pollutant Discharge Elimination System (APDES) general permit AKG-31-5021 for wastewater discharges (ADEC 2012). This permit authorizes discharges from oil and gas extraction facilities engaged in exploration under the Offshore and Coastal Subcategories of the Oil and Gas Extraction Point Source Category (40 CFR Part 435). Twelve effluents are authorized for discharge into Cook Inlet once ADEC discharge limits have been met. The authorized discharges include: drilling fluids and drill cuttings, deck drainage, sanitary waste, domestic waste, blowout preventer fluid, boiler blow down, fire control system test water, uncontaminated ballast water, bilge water, excess cement slurry, mud cuttings cement at sea floor, and completion fluids. Areas prohibited from discharge in the Cook Inlet are 10-meter (33-foot) isobaths, 5-meter (16-foot) isobaths, and other geographic area restrictions (AKG-31-5021.I.C.).

NMFS reviewed the Revised Biological Evaluation, prepared by the Environmental Protection Agency (EPA), for the Cook Inlet National Pollutant Discharge Elimination System (NPDES). In a letter dated October 13, 2006, NMFS concurred with EPA's determination that the reissuance of the NPDES permit is not likely to adversely affect Steller sea lions. NMFS did not agree or disagree with the same determination for Cook Inlet beluga whales, but requested future analysis on potential bioaccumulation effects. However, NMFS' concerns were directed towards waters in Critical Habitat Area 1 approximately 160 kilometers (100 miles) north of the Cosmopolitan well. During the ESA consultation process for the BlueCrest leases, NMFS concluded that significant adverse effects from discharge are unlikely and that any harm, injury, or harassment to beluga whales, and by extension other marine mammals, is unlikely to occur, and is therefore, discountable.

8. THE ANTICIPATED IMPACT OF ACTIVITY ON AVAILABILITY OF SPECIES OR STOCKS OF MARINE MAMMALS FOR SUBSISTENCE USES

The proposed drilling activities will occur near the marine subsistence area used by the villages of Homer, Ninilchik, and Kenai. The only non-listed marine mammal available for subsistence harvest in Cook Inlet is the harbor seal (Wolfe et al. 2009). There are no harvest quotas for other non-listed marine mammals found there. The Alaska Department of Fish and Game (Wolfe et al. 2009) has regularly conducted surveys of harbor seal subsistence harvest in Alaska. Since 1992, Alaskan natives from the Cook Inlet villages of Homer and Kenai have annually taken (harvested plus struck and lost) an average of 14 to 15 harbor seals (there is no subsistence data for Ninilchik). The impact of drilling operations at Cosmopolitan is unlikely to affect harbor seal populations sufficient to render them unavailable for subsistence harvest in the future, especially given that the villages are located approximately 22 kilometers (14 miles; Ninilchik) to 81 kilometers (50 miles; Kenai) from the Cosmopolitan well sites.

Oil spill trajectory scenarios developed in preparation of the ODPCP indicate that potential spills would travel south through the central channel of the inlet away from shoreline subsistence harvest areas. Further information can be found in the approved ODPCP provided to NMFS.

9. THE ANTICIPATED IMPACT OF THE ACTIVITY UPON THE HABITAT OF THE MARINE MAMMAL POPULATIONS AND THE LIKELIHOOD OF RESTORATION OF THE AFFECTED HABITAT

The Cosmopolitan State #B-1 well site is located in lower Cook Inlet. Cook Inlet is a large subarctic estuary roughly 300 kilometers (186 miles) in length and averaging 96 kilometers (60 miles) in width. It extends from the city of Anchorage at its northern end and flows into the Gulf of Alaska at its southernmost. For descriptive purposes, Cook Inlet is separated into unique upper and lower sections, divided at the East and West Forelands, where the opposing peninsulas create a natural waistline in the length of the waterway, measuring approximately 16 kilometers (10 miles) across (Mulherin et al. 2001).

Lower Cook Inlet extends from the Forelands southwest to the inlet mouth demarked by an approximate line between Cape Douglas and English Bay. Water circulation in lower Cook Inlet is dominated by the Alaska Coastal Current (ACC) that flows northward along the shores of the Kenai Peninsula until it is turned westward and mixed by the combined influences of freshwater input from upper Cook Inlet, wind, topography, tidal surges, and the coriolis effect (Field and Walker 2003, MMS

1996). Upwelling by the ACC brings nutrient-rich waters to lower Cook Inlet and contributes to a biologically rich and productive ecology (Sambrotto and Lorenzen 1986). Tidal currents average 1.0 to 1.5 meters per second (2 to 3 knots) and are rotary in that they do not completely go slack before rotating around into an opposite direction (Gatto 1976, Mulherin et al. 2001). Depths in the central portion of lower Cook Inlet are 60 to 80 meters (197 to 262 feet) and decrease steadily toward the shores (Muench 1981). Bottom sediments in the lower inlet are coarse gravel and sand that grade to finer sand and mud toward the south (Bouma 1978).

Coarser substrate support a wide variety of invertebrates and fish including Pacific halibut, Dungeness crab (*Metacarcinus magister*), tanner crab (*Chionoecetes bairdi*), pandalid shrimp (*Pandalus* spp.), Pacific cod, and rock sole (*Lepidopsetta bilineata*), while the soft-bottom sand and silt communities are dominated by polychaetes, bivalves and other flatfish (Field and Walker 2003). Sea urchins (*Strongylocentrotus* spp.) and sea cucumbers are important otter prey and are found in shell debris communities. Razor clams (*Siliqua patula*) are found all along the beaches of the Kenai Peninsula. In general, the lower Cook Inlet marine invertebrate community is of low abundance, dominated by polychaetes, until reaching the mouth of the inlet (Saupe et al. 2005). Overall, the lower Cook Inlet marine ecosystem is fed by midwater communities of phytoplankton and zooplankton, with the latter composed mostly of copepods, and barnacle and crab larvae (Damkaer 1977, English 1980).

The potential direct habitat impact by the BlueCrest drilling operation is limited to the actual drill-rig footprint defined as the area occupied and enclosed by the drill-rig legs. This area was calculated as 0.22 hectares (0.54 acres) during the land use permitting process. The collective 0.8-hectare (2-acre) footprint of the well represents a very small fraction of the 18,950 -square-kilometer (7,300-square-mile) Cook Inlet surface area. Potential damage to the Cook Inlet benthic community will be limited, however, to the actual surface area of the three spud cans (collective total of 442 square meters [4,755 square feet]) that form the “foot” of each leg. Given the high tidal energy at the well site locations, drilling footprints are not expected to support benthic communities equivalent to shallow lower energy sites found in nearshore waters where harbor seals mostly feed.

Acoustical affects to prey resources are also limited. Christian et al. (2004) studied seismic energy impacts on male snow crabs (*Chionoecetes* sp.) and found no significant increases in physiological stress due to exposure. No acoustical impact studies have been conducted to date on the above fish species, but studies have been conducted on Atlantic cod (*Gadus morhua*) and sardine (*Clupea* sp). Davis et al. (1998) cited various studies found no effects to Atlantic cod eggs, larvae, and fry when received levels were 222 dB. What effects were found were to larval fish within about 5 meters, and from air guns with volumes between 49.2 and 65.5 liters (3,000 and 4,000 cubic inches). Similarly, effects to sardine were greatest on eggs and 2-day larvae, but these effects were greatest at 0.5 meters, and again confined to 5 meters. Further, Greenlaw et al. (1988) found no evidence of gross histological damage to eggs and larvae of northern anchovy (*Engraulis mordax*) exposed to seismic air guns, and concluded that noticeable effects would result only from multiple, close exposures. Based on these results, impulsive conductor pipe driving and VSP could acoustically impact local marine communities, but only out to about 2 or 3 meters at most. From an ecological community standpoint, these impacts are considered minor.

Overall, rig placement and acoustical effects on prey resources will have a minor effect at most on the marine mammal habitat within the seismic survey area. Some prey resources might be temporarily displaced, but no long-term effects are unexpected.

10. THE ANTICIPATED IMPACT OF THE LOSS OR MODIFICATION OF THE HABITAT ON THE MARINE MAMMAL POPULATIONS INVOLVED

Based on the conclusions of Section 9 above, no loss or modification of marine mammal habitat is expected. Any impacts to prey resources is considered minor or negligible, and no long-term effects would occur. However, potential damage to local benthic resources from the drill rig legs and anchors will be assessed with side-scan sonar (at a high resolution 500 kilohertz, or beyond marine mammal hearing ranges) after the drill rig leaves the well site to confirm the extent, if any, of the damage.

Oil spill risks are reduced and mitigated with the implementation of the Oil Discharge Prevention and Contingency Plan (ODPCP) that will be used in the unlikely event of a spill. Alaska's Department of Environmental Conservation (ADEC) previously approved an ODPCP for the Cosmopolitan Project. Based on their review during ESA consultation process, NMFS concluded that oil spill risks to local marine mammals were negligible (see Appendix 3).

With oil and gas platforms presently operating in Cook Inlet, there is concern for continuous exposure to potentially toxic heavy metals and metalloids (*i.e.*, mercury, lead, cadmium, copper, zinc, and arsenic) that are associated with oil and gas development and production. These elements occur naturally in the earth's crust and the oceans, but many also have anthropogenic origins from local sources of pollution or from contamination from atmospheric distribution. North American beluga whales, for example, were analyzed for heavy metals and other elements. Cadmium, mercury, selenium, vanadium, and silver were generally lower in the livers of Cook Inlet animals than in the other beluga whale stocks, while copper was higher (Becker et al. 2001). Hepatic methyl mercury levels were similar to those reported for other beluga whales (Becker et al. 2001). Similar work on heavy metals has not been done for Cook Inlet harbor seals, but because discharge by BlueCrest of drilling muds, cuttings, or sanitary wastes from their rig will meet the conditions of the Cook Inlet pollution discharge permit, no impacts to water quality are expected, and any effects to harbor seal habitat are therefore insignificant (see Appendix 3). Studies have been conducted on persistent organochlorine concentrations in Alaskan harbor seals (Papa and Becker 1998), which showed that Prince William Sound harbor seals had much lower loads of PCBs, DDT/DDE, and chlordane compared to seals inhabiting the Oregon and Washington coasts, reflective of differences in human development between the areas.

11. AVAILABILITY AND FEASIBILITY OF EQUIPMENT, METHODS, AND MANNER OF CONDUCTING ACTIVITY OR OTHER MEANS OF EFFECTING THE LEAST PRACTICABLE ADVERSE IMPACT UPON THE AFFECTED SPECIES OR STOCKS, THEIR HABITAT, AND ON AVAILABILITY FOR SUBSISTENCE USES

Compared to other drill rigs or platforms used in Cook Inlet, the use of the jack-up drilling rig *Endeavour* will mitigate potential noise impacts. With their lattice leg structure, jack-up rigs have less surface contact with the water and, therefore, convey less noise from the drilling table and generators into the underwater environment. Sound source verifications conducted by Illingworth & Rodkin (2014) confirmed that underwater drilling and generator noises produced by the *Endeavour* are below ambient.

The initial sound source verification (I&R 2013a) did identify noise levels exceeding 120 dB re 1 µPa (rms) produced by the submersed deep-well pumps and associated falling water. This was partially mitigated by piping the falling water, resulting in a reduction of noise and a smaller radius to the 120 dB isopleth (I&R 2014).

Reducing and mitigating potential acoustical impacts to local marine mammals while on site is further addressed in the Marine Mammal Monitoring and Mitigation Plan found in Appendix 2.

In the unlikely event of an oil spill, BlueCrest will be working with Cook Inlet Spill Prevention and Response, Inc. (CISPRI), which is certified as a U.S. Coast Guard oil spill removal organization and State of Alaska Primary Response Action Contractor serving the Cook Inlet region of Alaska. BlueCrest will follow the procedures as outlined in CISPRI's Technical Manual, Wildlife Tactics. Most procedures discussed in the CISPRI Technical Manual are associated with responses for either waterfowl or marine mammals. CISPRI will dedicate personnel and equipment as appropriate in support of wildlife during a spill. The Planning Chief will work to implement a Wildlife Plan addressing those species anticipated to be at risk and needing protection. The protocols are described in further detail in the ODPCP.

12. LOCATION OF PROPOSED ACTIVITY – IN OR NEAR A TRADITIONAL ARCTIC SUBSISTENCE HUNTING AREA AND IMPACT ON AVAILABILITY OF SPECIES OR STOCK OF MARINE MAMMALS FOR ARCTIC SUBSISTENCE USES

The proposed activity does not occur in or near a traditional Arctic subsistence hunting area, and the Cosmopolitan State #B-1 well site is located south of 60°N, the latitude NMFS regulations consider Arctic waters. Thus, a Plan of Cooperation is not required. However, potential impacts to local Cook Inlet subsistence harvest are addressed in Section 8, and coordination with local subsistence users is addressed in Section 14.

13. SUGGESTED MEANS OF ACCOMPLISHING THE NECESSARY MONITORING AND REPORTING THAT WILL RESULT IN INCREASED KNOWLEDGE OF THE SPECIES, THE LEVEL OF TAKING OR IMPACTS ON POPULATIONS OF MARINE MAMMALS THAT ARE EXPECTED TO BE PRESENT WHILE CONDUCTING ACTIVITIES AND SUGGESTED MEANS OF MINIMIZING BURDENS BY COORDINATING SUCH REPORTING REQUIREMENTS WITH OTHER SCHEMES ALREADY APPLICABLE TO PERSONS CONDUCTING SUCH ACTIVITY

Monitoring and reporting potential acoustical impacts to local marine mammals are fully addressed in the Marine Mammal Monitoring and Mitigation Plan attached as Appendix 2.

14. LEARNING, ENCOURAGING, AND COORDINATING RESEARCH OPPORTUNITIES, PLANS, AND ACTIVITIES RELATING TO REDUCE AND EVALUATE INCIDENTAL "TAKE"

Potential impacts of seismic noise on marine mammals have been studied, with the results used to establish the noise criteria for evaluating "take" and to support shutting down seismic operations to avoid Level A injury "take". However, all observations of marine mammals, including any observed reactions to the seismic operations will be recorded and reported to NMFS.

Further, to ensure that there will be no adverse effects resulting from the planned drilling activities, BlueCrest is currently coordinating with NMFS, USFWS, Bureau of Safety and Environmental Enforcement (BSEE), the Army Corps of Engineers, the State of Alaska, and other state and federal agencies in the assessment of all measures that can be taken to eliminate or minimize any impacts from planned activities. In 2013, BlueCrest, through its Buccaneer partner at the time, reached out to and coordinated with numerous communities including the cities and villages of Homer, Port Graham, Kenai, Seldovia, Soldotna, and Ninilchik, as well as Kenai Peninsula Borough, Cook Inlet Region, Inc., Cook Inlet Keeper, United Cook Inlet Drift Association, and the Chugach Alaska Services. BlueCrest is currently in the process of a follow-up coordination with the same entities.

Any observed marine mammal interactions with the BlueCrest operations deemed potentially harmful will be immediately reported to the Anchorage Office of NMFS (Ms. Barbara Mahoney). Given the very low likelihood of observing cetaceans and pinnipeds during the Cook Inlet operations, especially considering the actions (such as timing) to be taken to avoid encounters, developing a research program would be impractical.

15. REFERENCES

Allen, B.M. and R.P. Angliss. 2012. Alaska Marine Mammal Stock Assessments, 2011. NOAA Technical Memorandum NMFS-AFSC-234. Seattle, Washington, National Marine Fisheries Service. 297 pp.

Allen, B.M. and R.P. Angliss. 2013. Alaska Marine Mammal Stock Assessments, 2012. NOAA Technical Memorandum NMFS-AFSC-245. Seattle, Washington, National Marine Fisheries Service**.** 291 pp.

Blackwell, S.B. 2005. Underwater measurements of pile-driving sounds during the Port MacKenzie dock modifications, 13-16 August 2004. Rep. from Greeneridge Sciences, Inc., Goleta, CA, and LGL Alaska Research Associates, Inc., Anchorage, AK, in association with HDR Alaska, Inc., Anchorage, AK, for Knik Arm Bridge and Toll Authority, Anchorage, AK, Department of Transportation and Public Facilities, Anchorage, AK, and Federal Highway Administration, Juneau, AK. 33 pp.

Baker, C.S., L.M. Herman, B.G. Bays and W.F. Stifel. 1982. The impact of vessel traffic on the behavior of humpback whales in Southeast Alaska Contract 81-ABE00114, NMFS, National Marine Mammal Laboratory, Seattle. 78 pp.

Baker, C.S., L.M. Herman, B.G. Bays and G.B. Bauer. 1983. The impact of vessel traffic on the behavior of humpback whales in Southeast Alaska: 1982 season. Report submitted to the NMFS, National Marine Mammal Laboratory, Seattle. May 17, 1983.

Baker, C.S., A. Perry and G. Vequist. 1988. Humpback whales of Glacier Bay, Alaska. Whalewatcher, Fall 1988:13-17.

Baker, C.S., J.M. Straley and A. Perry. 1992. Population characteristics of individually identified humpback whales in southeastern Alaska: summer and fall 1986. Fishery Bulletin 90:429-437.

Bouma, A.H., M.A. Hampton, J.W. Whitney and W.G. Noonan. 1978. Physiography of Lower Cook Inlet, Alaska. U.S. Geological Survey Open-File Report 78-728.

Brabets, T.P., G.L. Nelson, J.M. Dorava, and A.M. Milner. 1999. Water-Quality Assessment of the Cook Inlet Basin, Alaska – Environmental Setting. U.S. Geological Survey Water-Resources Investigations Report 99-4025.

Christian, J.R., A. Mathieu, and R.A. Buchanan. 2004. Chronic effects of seismic energy on snow crab (*Chionoecetes opilio*). Environmental Studies Research Funds Report No. 158, Calgary, AB.

Collins, K. A. MacGillivray, and S. Turner. 2007. Underwater source level measurements of airgun sources from ConocoPhillips' 2007 Beluga 3D seismic survey, Cook Inlet, Alaska. Unpublished report prepared by JASCO Research Ltd., for Veritas DGC. 27 pp.

Dahlheim, M., A. York, R. Towell, J. Waite, and J. Breiwick. 2000. Harbor porpoise (*Phocoena phocoena*) abundance in Alaska: Bristol Bay to Southeast Alaska, 1991-1993. Mar. Mammal Sci. 16:28-45.

Damkaer, D. 1977. Initial zooplankton investigations in Prince William Sound, Gulf of Alaska and Lower Cook Inlet. In Outer Continental Shelf Environmental Assessment Program. Boulder, CO. pp. 137-274.

Davis, R.A., D. Thomson, and C.I. Malme. 1998. Environmental assessment of seismic exploration of the Scotian Shelf. Unpublished Report by LGL Ltd., environmental research associates, King City, ON and

Charles I. Malme, Engineering and Science Services, Hingham, MA for Mobil Oil Canada Properties Ltd, Shell Canada Ltd., and Imperial Oil Ltd.

Di Iorio, L. and C.W. Clark. 2010. Exposure to seismic survey alters blue whale acoustic communication. Biology Letters 6:51-54.

English, S.T. 1980. Lower Cook Inlet meroplankton. University of Washington. Seattle, WA. 57 pp.

Field, C. and C. Walker. 2003. A Site Profile of the Kachemak Bay Research Reserve: A Unit of the National Estuarine Research Reserve System. Kachemak Bay Research Reserve publication. 135 pp.

Finneran, J.J., C.E. Schlundt, R. Dear, D.A. Carder and S.H. Ridgway. 2002. Temporary shift in masked hearing thresholds in odontocetes after exposure to single underwater impulses from a seismic watergun. Journal of the Acoustical Society of America 111:2929-2940.

Gatto, L.W. 1976. Baseline data on the oceanography of Cook Inlet, Alaska. Cold Regions Research and Engineering Laboratory, U.S. Army Corps of Engineers, Hanover, NH. CAREL Report 76-2E, 92 pp.

Greenlaw, C.F., D.V. Holliday, R.E. Pieper and M.E. Clark. 1988. Effects of air gun energy releases on the northern anchovy. Journal of the Acoustical Society of America 84:S165.

Hobbs, R.C. and J.M. Waite. 2010. Abundance of harbor porpoise (*Phocoena phocoena*) in three Alaskan regions, corrected for observer errors due to perception bias and species misidentification, and corrected for animals submerged from view. Fisheries Bulletin 108(3):251-267.

Illingworth & Rodkin, Inc. 2014. 2013 Cook Inlet Exploratory Drilling Program – Underwater Sound Source Verification Assessment. Report prepared for BlueCrest Energy, Inc. Illingworth & Rodkin, Inc., Petaluma, CA. 20 pp.

International Whaling Commission (IWC). 2007. Report of the scientific committee. Annex K. Report of the Standing Working Group on environmental concerns. Journal of Cetacean Research and Management 9 (Suppl.):227–296.

Johnston, D.W. 2002, "The effect of acoustic harassment devices on harbour porpoise (*Phocoena phocoenna*) in the Bay of Fundy, Canada." Biological Conservation. 108:113-118.

Jones, M.L., and S.L. Swartz. 2002. Gray whale *Eschrichtius robustus*. In: Perrin WF, Würsig B, Thewissen JGM (eds) Encyclopedia of marine mammals. Academic Press, Massachusetts, pp 525–536.

Jurasz, C.M., and V.P. Jurasz. 1979. Feeding modes of the humpback whale, *Megaptera novaeangliae*, in southeast Alaska. Scientific Reports of the Whales Research Institute, 31:69-83.

Kapel, F.O. 1979. Exploitation of Large Whales in West Greenland in the twentieth Century. Report of the International Whaling Commission 29: 197–214.

Krieger K.J. and B.L. Wing. 1986. Hydroacoustic monitoring of prey to determine humpback whale movements. NOAA Tech Memo NMFS/NWC-98. 62 pp.

Ljungblad, D.K., B. Würsig, S.L. Swartz, and J.M. Keene. 1988. Observations on the behavioral responses of bowhead whales (*Balaena mysticetus*) to active geophysical vessels in the Alaskan Beaufort Sea. Arctic 41(3):183-194.

Lucke, K., U. Siebert, P. Lepper, and M.A. Blanchet. 2009. Temporary shift in masked hearing thresholds in a harbor porpoise (*Phocoena phocoena*) after exposure to seismic airgun stimuli. J Acoust Soc Am 125:4060–4070.

Malme, C.I., P.R. Miles, C.W. Clark, P. Tyack, and J.E. Bird. 1983. Investigations on the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior. Report No. 5366 submitted to the Minerals Management Service, U.S. Department of the Interior, NTIS PB86-174174, Bolt, Beranek, and Newman, Washington, DC.

McCauley, R.D., J. Fewtrell, A.J. Duncan, C. Jenner, M-N. Jenner, J.D. Penrose, R.I.T. Prince, A. Adhitya, J. Murdoch and K. McCabe. 2000. Marine Seismic Surveys-A study of Environmental Implications. Australian Petroleum Production and Exploration Association (APPEA) Journal. p. 692-705.

McDonald M.A., Hildebrand J.A., Mesnick S. 2009. Worldwide decline in tonal frequencies of blue whale songs. Endangered Species Research 9:13-21.

Melcon, M.L., Cummins A.J., Kerosky S.M., Roche L.K., Wiggins S.M., et al. 2012. Blue whales respond to anthropogenic noise. PLoS ONE 7(2):e32681. doi:10.1371/journal.pone.0032681

Miller, G.W., R.E. Elliott, W.R. Koski, V.D. Moulton and W.J. Richardson. 1999. Whales. Pp. 5-1 to 5-109 In: W.J. Richardson (ed.), Marine mammal and acoustical monitoring of Western Geophysical's open-water seismic program in the Alaskan Beaufort Sea, 1998. LGL Rep. TA2230-3. Rep. from LGL Ltd., King City, Ont., and Greeneridge Sciences Inc., Santa Barbara, CA, for Western Geophysical, Houston, TX and U.S. Nat. Mar. Fish. Serv., Anchorage, AK, and Silver Spring, MD. 390 pp.

Mineral Management Service (MMS). 1996. Cook Inlet Planning Area Oil and Gas Lease Sale 149. Final Environmental Impact Statement, Volume 1. Minerals Management Service, Alaska OCS Region, Jan 1996. OCS EIS/EA MMS 95-0066.

Montgomery, R.A., J.M. Ver Hoef, and P. Boveng. 2007. Spatial modeling of haul-out site use by harbor seals in Cook Inlet, Alaska. Marine Ecology Progressive Series 341:257-264.

Moore S.E., K.M. Wynne, J.C. Kinney, and J.M. Grebmeier. 2007. Gray whale occurrence and forage southeast of Kodiak Island, Alaska. Marine Mammal Science 23(2):419–428.

Morton A.B., and H.K. Symonds. 2002. Displacement of *Orcinus orca* (L.) by high amplitude sound in British Columbia, Canada. ICES Journal of Marine Science 59:71-80.

Muench, R.D., J.D. Schumacher, C.A. Pearson. 1981. Circulation in the Lower Cook Inlet, Alaska. NOAA Technical Memorandum.

Mulherin, N.D., W.B. Tucker III, O.P. Smith and W.J. Lee. 2001. Marine Ice Atlas for Cook Inlet, Alaska.

National Marine Fisheries Service (NMFS). 2005. Endangered fish and wildlife; Notice of Intent to prepare an Environmental Impact Statement. Federal Register 70:1871-1875.

Pentec. 2005. Marine Fish and Benthos Studies in Knik Arm, Anchorage, Alaska. Prepared for Knik Arm Bridge and Toll Authority and HDR Alaska, Inc. Report 12214-10/12214-12. Prepared by Pentec Environmental, Edmonds, Washington.

Polacheck, T. and L. Thorpe. 1990. The swimming direction of harbor porpoise in relation to survey vessel. Report of the International Whaling Commission, 40, 463-470.

Rice, D.W. and A.A. Wolman. 1971. The life history and ecology of the gray whale (*Eschrichtius robustus*). American Society of Mammalogy, Special Publication 3:1-142.

Rice, D., A. Wolman, H. Braham. 1984. The Gray Whale, *Eschrichtius robustus*. Marine Fisheries Review, 46/4: 7-14. Accessed March 31, 2009 at spo.nmfs.noaa.gov.

Richardson, W.J., and C.I. Malme. 1993. Man-made noise and behavioral responses. Pp. 631-700 In J.J. Burns, J.J. Montague, and C.J. Cowles (eds.). The Bowhead Whale. Society of Marine Mammalogy, Special Publication No. 2.

Richardson, W. J. 1995. "Documented Disturbance Reactions." In Marine mammals and noise, edited by. W. J. Richardson, C. R. Greene, Jr., C. I. Malme, and D. H. Thomson, 241–324. San Diego: Academic Press.

Richardson, W.J., C.R. Greene, Jr., C.I. Malme and D.H. Thomson. 1995. Marine Mammals and Noise. Academic Press, San Diego. 576 pp.

Rugh, D.J., K.E.W. Shelden, C.L. Sims, B.A. Mahoney, B.K. Smith, L.K. (Litzky) Hoberecht, and R.C. Hobbs. 2005. Aerial surveys of belugas in Cook Inlet, Alaska, June 2001, 2002, 2003, and 2004. NOAA Technical Memorandum NMFS-AFSC-149. 71 pp.

Sambrotto, R. N. and C. J. Lorenzen. 1986. Phytoplankton and primary productivity. In: *The Gulf of Alaska Physical Environment and Biological Resources.* D.W. Hood and S.T. Zimmerman eds. OCS Study 86-0095 USDOC, NOAA, NOS, and USDOI, MMS, Alaska OCS Region. Anchorage, AK. pp. 249-282.

Saulitis, E., C. Matkin, L. Barrett-Lennard, K. Heise, and G. Ellis. 2000. Foraging strategies of sympatric killer whale (*Orcinus orca*) populations in Prince William Sound, Alaska. Marine Mammal Science 16(1): 94-109.

Saupe, S., J. Gendron and D. Dasher. 2005. The Condition of Southcentral Alaska's Bays and Estuaries. A Statistical Summary for the National Coastal Assessment Program, Alaska Department of Environmental Conservation, March 15, 2006.

Shelden, K.E.W., D. Rugh, M.A. Mahoney and M.E. Dahlheim. 2003. Killer whale predation in belugas in Cook Inlet, Alaska: implications for a depleted population. Marine Mammal Science 19(3):529-544.

Todd, S., Stevick, P., Lien, J., Marques, F. and Ketten, D. 1996. Behavioural effects of exposure to underwater explosions in humpback whales (*Megaptera novaeangliae*). Canadian Journal of Zoology 74:1661–1672.

Wartzok, D. and D.R. Ketten. Marine mammal sensory systems. Pages 117-148 in J.E. Reynolds III and S.A. Rommel (eds), Biology of Marine Mammals. Washington D.C.: Smithsonian Institution Press, 1999.

Watkins, W.A, K.E. Moore, D. Wartzok and J.H. Johnson. 1981. Radio tracking of finback (*Balaenoptera physalus*) and humpback (*Megaptera novaeangliae*) in Prince William Sound, Alaska Deep-Sea Research 28:577-588.

Watkins, W.A. 1986. Whale reactions to human activities in Cape Cod waters. Marine Mammal Science 2:251-262.

Weilgart, L.S. 2007. The impacts of anthropogenic ocean noise on cetaceans and implications for management. Canadian Journal of Zoology 85:1091–1116.

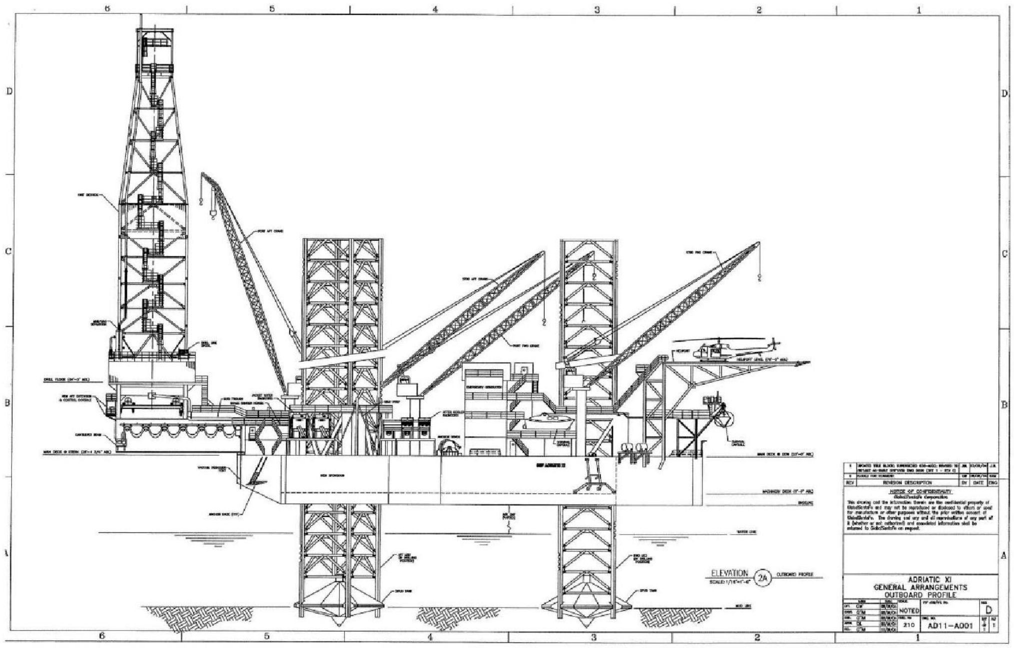
Wolfe, R.J., J.A. Fall, and M. Riedel. 2009. The subsistence harvest of harbor seals and sea lions by Alaska natives in 2008. Alaska Native Harbor Seal Commission and Alaska Department of Fish and Game Division of Subsistence. Technical Paper No. 347, Anchorage. 93 pp.

Zerbini, A.N., J.M. Waite, J.L. Laake and P.R. Wade. 2006. Abundance, trends and distribution of baleen whales off western Alaska and the central Aleutian Islands. Deep-Sea Res. Part I:1772-1790.

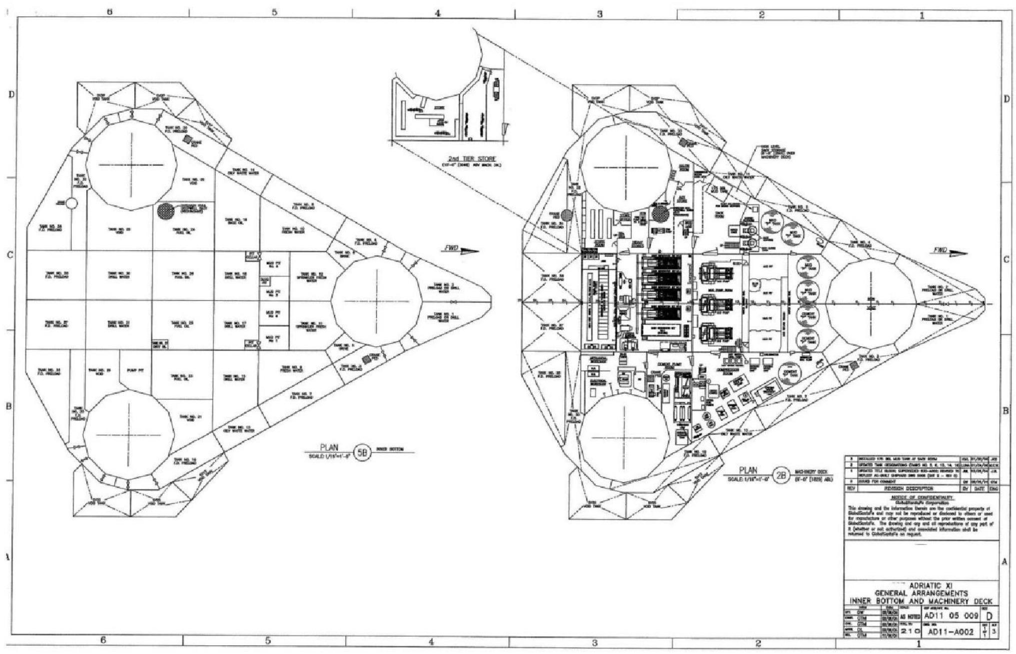
Appendix 1

Endeavour Specifications

Rig Profile View



Adriatic **– General Arrangements Inner Bottom and Machinery Deck**



General Arrangements Main Deck and Accommodation

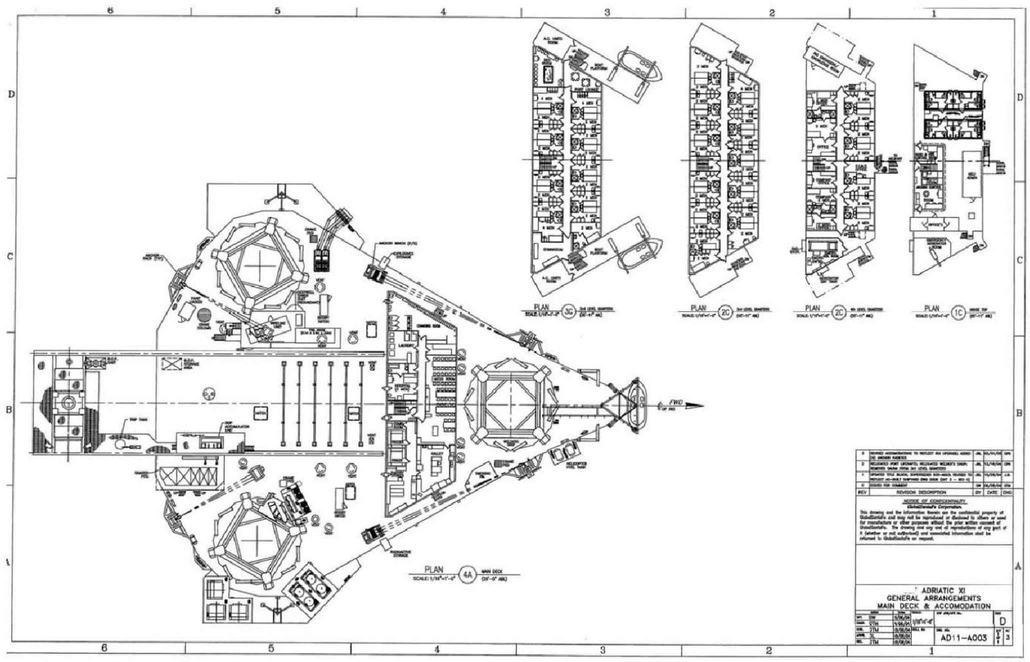
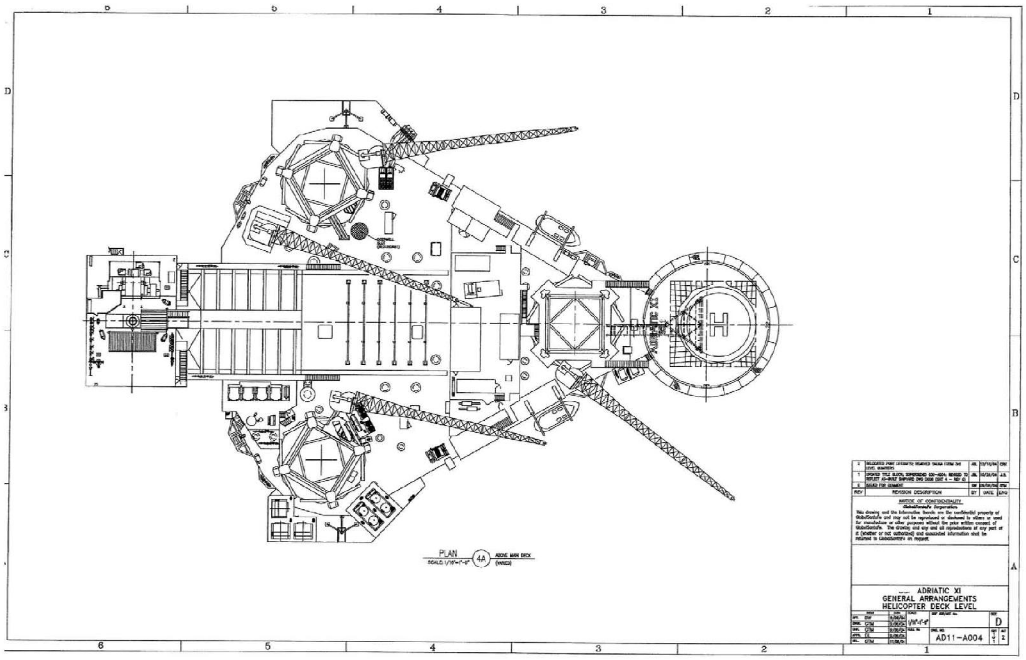


Figure 1.8-4 *Adriatic* – General Arrangements Helicopter Deck Level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GENERAL ARRANGEMENTS
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AD11-A004

Appendix 2

Marine Mammal Monitoring and Mitigation Plan

Marine Mammal Monitoring and Mitigation Plan

BlueCrest Operating Alaska LLC Cosmopolitan State Exploratory Drilling Program

July 2014

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Prepared by

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CONTENTS

1. Introduction

BlueCrest Operating Alaska LLC (BlueCrest) plans to conduct an exploratory drilling program in lower Cook Inlet at Cosmopolitan State well site #B-1 during September and October 2014 (well site #A-1 was drilled in 2013). Both the A-1 and B-1 well locations are shown in Figure 1. Drilling would occur from either the *Endeavour – Spirit of Independence* jack-up rig (previously called the *Adriatic XI*) or the *Spartan 151* jack-up rig, depending on availability. If a rig is not available fall 2014, drilling would be delayed until April 2015. This marine mammal monitoring and mitigation plan (4MP) addresses the drilling and associated activities at Cosmopolitan State #B-1.

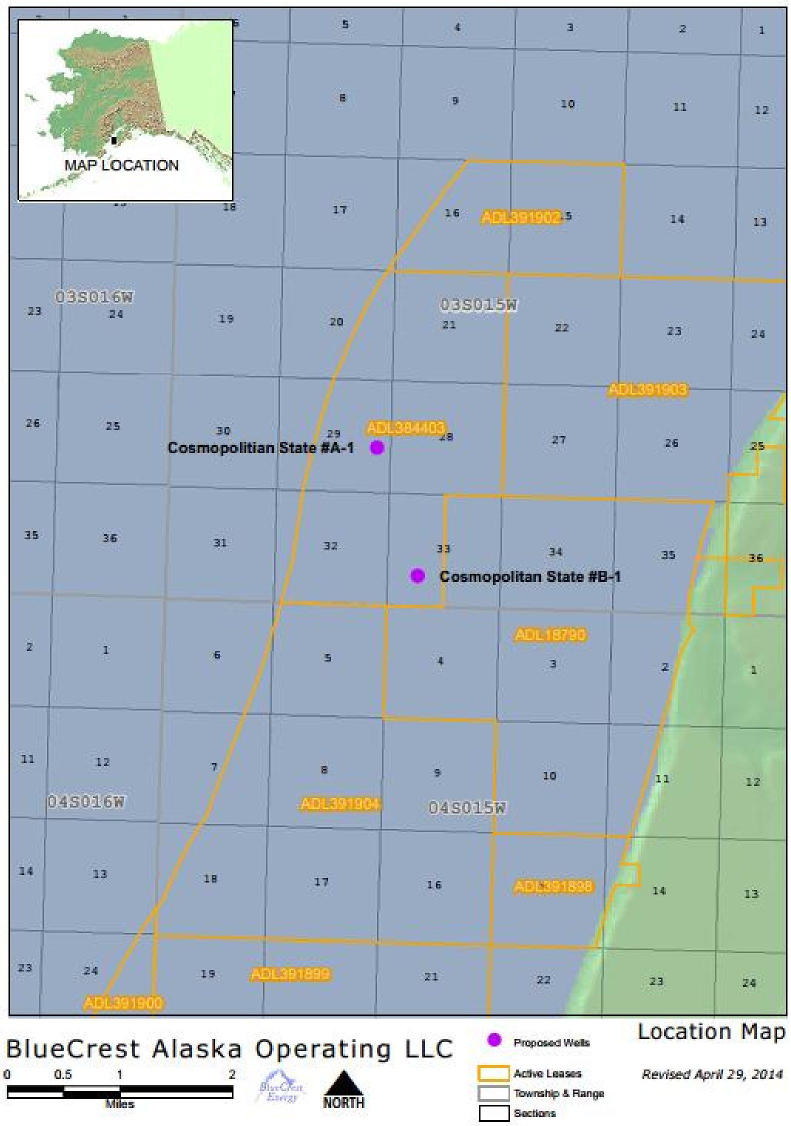

Figure 1. Proposed Project Area for BlueCrest's 2014 Exploratory Drilling Program

Several species of marine mammals inhabit Cook Inlet, any of which could be acoustically harassed by the proposed exploratory drilling activities. Of particular concern is the Cook Inlet beluga whale (*Delphinapterus leucas*), a listed species which summers in upper Cook Inlet and ventures to lower Cook Inlet during the winter. However, the Cosmopolitan State lease area does not fall within Cook Inlet beluga whale critical habitat, thus belugas are less of a concern here.

Other marine mammals that have been found in the vicinity of the Cosmopolitan unit include the harbor seal (*Phoca vitulina*), Steller sea lion (*Eumetopias jubatus*), harbor porpoise (*Phocoena phocoena*), humpback whale (*Megaptera novaeangliae*), minke whale (*Balaenoptera acutorostrata*), gray whale (*Eschrichtius robustus*), and sea otter (*Enhydra lutris*). Killer whales (*Orcinus orca*) may occasionally venture into lower Cook Inlet in search of marine mammal prey.

This 4MP is designed to monitor and mitigate for all marine mammals regardless of status or agency jurisdiction. The primary concern is the harassing levels of underwater noise produced by the drilling program operations. For impulsive noise sources such as seismic profiling or impact hammering, the Level B harassment take threshold is 160 dB re 1µPa-m (rms) while for continuous noise sources such as propeller cavitation of drilling the threshold is 120 dB re 1µPa-m (rms). For sea otters, the 160 dB re 1µPa-m (rms) threshold applies to both impulsive and continuous noise.

For all noise sources the Level A injury take thresholds are 190 dB re 1µPa-m (rms) for pinnipeds and sea otters and 180 dB re 1µPa-m (rms) for cetaceans, although continuous noise sources associated with drilling activities rarely exceed 180 dB re 1µPa-m (rms).

Noise sources from the proposed drilling operations vary greatly with frequency, and not all local marine mammals can effectively hear all noise sources. Pinnipeds (harbor seals and sea lions) and odontocetes (toothed whales such as belugas, harbor porpoise, and killer whales) are high frequency marine mammals with dominant hearing ranges of 10 to 30 kHz for pinnipeds and 12 to 100 kHz for odontocetes (Wartzok and Ketten 1999). Mysticetes (baleen whales such as humpback and minke whales) are low frequency cetaceans with effective hearing between 0.5 and 5 kHz. Thus, odontocetes and pinnipeds would not effectively hear low frequency drilling and cavitation noise, while mysticetes would. Sea otters do not communicated underwater, and there is little evidence on how effectively they can hear underwater as well.

1.1. Exploration Program and Drilling Operations

Specific location of the Cosmopolitan State well site #B-1 shown in Figure 1. Cosmopolitan State #B-1 is located approximately 2.5 miles off Cape Starichkof 6.8 miles north of Anchor Point. The exact well location is latitude N 59°52’13.887”, longitude W 151°52’17.225”, and the water depth is 61 feet. Drilling at Cosmopolitan State #B-1 would occur during September and October 2014. If a jackup drill rig is not available during this time period, or if unforeseen cirmcustances prevent completion of drilling in the fall of 2014, drilling would commence or restart in April 2015. The proposed drill rig, Endeavour, is currently located at Port Graham. It would be moved from their to Cosmopolitan State #B-1 in September and then at completion of the drilling moved either to Port Graham, Homer, or to another project location.

There are four activities proposed to occur well site of relative importance to acoustical harassment:

1. Wet-tow mobilization of the rig to and from lower Cook Inlet and between well locations.
2. Driving of conductor pipe.
3. Exploratory drilling.
4. Vertical seismic profiling (VSP).

In addition, the rig will remain active with generators, pumps, and other standard equipment.

During previous Endangered Species Act (ESA) consultations (culminating in a Letter of Concurrence [LOC] from James Balsiger to Buccaneer Alaska Operations, LLC [the joint operator with BlueCrest during the 2013 drilling at Cosmopolitan State #A-1) dated April 25, 2013,) with the National Marine Fisheries Service (NMFS) it was determined that the while all of the above have the potential to disturb Cook Inlet marine mammals, the conductor pipe driving, and the VSP operations, all impulsive noises, have the greater potential to disturb Cook Inlet marine mammals. All of these operations emit 1-meter source noise levels exceeding 200 dB re 1 µPa-m (root mean square). Based on available literature, the continuous noise from cavitating tug propellers during the rig tows and the actual drilling occur at frequencies below the effective hearing range of toothed cetaceans (such as belugas) and pinnipeds, and at relatively low energy levels relative to the impulsive noise sources. Hydroacoustical tests conducted by Illingworth & Rodkin (2014) in May 2013 revealed that underwater noise levels from drilling and rig generators are below ambient, of little concern regarding harassment of marine mammals. However, the same tests determined that the submersed deep-well pumps that charges the fire-suppression system and cools the generators (in a closed water system) does generate noise levels exceeding 120 dB re 1µPa (at levels requiring marine mammal monitoring). Other well site survey noise sources, such as post-drilling side-scan sonar, will occur at relatively high energy levels, but their frequencies (>200 kHz) are well beyond the effective hearing range of marine mammals (thus, post-drilling sonar surveys are not addressed further). Given the timing and location of the drilling program, potential impacts are more likely limited to the Steller sea lions, harbor seals, minke whales, harbor porpoise, and sea otters.

The mitigation and monitoring measures that are planned to be implemented in association with BlueCrest's planned drilling and associated activities in Cook Inlet are described in the subsequent sections that follow. The focus of the plan is to deploy marine mammal observers in association with any activity that generates noise that could potentially harass marine mammals, and to shut down noise-generating operations at the approach of any marine mammal to the associated Level A take threshold. Observers would not be used during any activity that doesn't generate harassment level noise.

1.2. Generated Noise Levels

1.2.1. Drill Rig Tow

The rig will be wet-towed by two or three ocean-going tugs licensed to operate in the Cook Inlet. Tugs generate their loudest sounds while towing due to the propeller cavitations. While these continuous sounds have been measured at up to 171 dB re 1 µPa-m (rms) at 1-meter source, they are generally emitted at dominant frequencies of less than 5 kHz (Miles et al. 1987, Richardson et al. 1995, Simmonds et al. 2004). Thus, the dominant noise frequencies from propeller cavitation are significantly less than the dominant hearing frequencies for pinnipeds and odontocetes. Still, because it is currently unknown which tugs will be used to tow the rig on each tow (to and from the well site), and there are few sound signatures for tugs in general, it is assumed that noise exceeding 120 dB dB re 1 µPa-m (rms) extends 2,000 feet (600 meters) from the operating tugs (based on a 171 dB re 1 µPa-m (rms) source). The tug's cavitating propellers do not exceed 180 dB re 1 µPa-m (rms) at 1-meter source, thus they do not represent a Level A injury take concern.

1.2.2. Conductor/Drive Pipe Driving

A drive pipe is a relatively short, large-diameter pipe driven into the sediment prior to the drilling of oil wells. This section of tubing serves to support the initial sedimentary part of the well, preventing the looser surface layer from collapsing and obstructing the wellbore. The pipe also facilitates the return of cuttings from the drill head. Drive pipes are usually installed using drilling, pile driving, or a combination of these techniques. In offshore wells, the conductor drive pipe is also used as a foundation for the surface diverter; a 20-inch conductor pipe is normally drilled through the drive pipe and supports the wellhead. BlueCrest proposes to drive approximately 60 meters (200 feet below mudline) of 76.2-centimeter (30-inch) pipe at Cosmopolitan #B-1 prior to drilling using a Delmar D62-22 impact hammer. This hammer has impact weight of 6,200 kg (13,640 pounds) and reaches a maximum impact energy of 224 kilonewton-meters (165,215 foot-pounds) at a drop height of 3.6 meters (12 feet). Illingworth & Rodkin (2014) measured the hammer noise operating from the *Endeavour* in 2013 and found noise levels exceeding 160 dB re 1µPa (rms) out to 1 mile (1.63 kilometers; disturbance zone), 180 dB re 1µPa (rms) to 170 meters (560 feet), and 190 dB re 1µPa (rms) to 180 feet (55 meters; injury zone).

1.2.3. Exploratory Drilling and Deep-well Pumps

BlueCrest proposes to use the jack-up drilling rig *Endeavour* for the Cosmopolitan State program, although the *Spartan 151* will be considered if the *Endeavour* became unavailable. Because the drilling platform and other noise-generating equipment is located above the sea's surface, and there is very little surface contact with the water compared to drill ships and semi-submersible drill rigs, lattice-legged jack-up drill rigs are relatively quiet (Richardson et al. 1995, Spence et al. 2007).

The *Spartan 151*, the only other jack-up drilling rig operating in the Cook Inlet, was hydroacoustically measured by Marine Acoustics, Inc. (2011) while operating in 2011. The survey results showed that continuous noise levels exceeding 120 dB re 1µPa extended out only 164 feet (50 meters), and that this noise was largely associated with the diesel engines used as hotel power generators.

The *Endeavour* was hydroacoustically tested during drilling activities by Illingworth & Rodkin (2014) in May 2013 while the rig was operating at a Cosmopolitan #A-1. The results from the sound source verification indicated that noise generated from drilling or generators were below ambient. The generators used on the *Endeavour* are mounted on pedestals specifically to reduce noise transfer through the infrastructure, and they are enclosed in an insulated engine room, which may further have reduced underwater noise transmission to levels below those generated by the *Spartan 151.* Also, as mentioned above, the lattice legs limit transfer of noise generated from the drilling table to the water.

However, the sound source verification revealed that the submersed deep-well pumps that charges the fire-suppression system and cools the generators (in a closed water system) does generate noise levels exceeding 120 dB re 1µPa out a distance of approximately 984 feet (300 meters). It was not clear at the time of measurements whether the noise was direct result of the pumps or was from the systems discharge water falling approximately 40 feet (12 meters) from the deck. Thus, after the falling water was enclosed in pipe extending below the water surface in an effort to reduce the noise levels, the pump noise levels were re-measured in June 2013 (I&R 2014) with results indicating that piping the falling water had a modicum of effect on reducing underwater noise levels; nevertheless, the 120-dB radius still extended out to 850 feet (260 meters) in certain directions, and noise exceeding the 160-dB radius to 10 feet (3 meters).

1.2.4. Vertical Seismic Profiling

Data on geological strata depth collected during initial seismic surveys at the surface can only be inferred. However, once a well is drilled, accurate follow-up seismic data can be collected by placing a receiver at known depths in the borehole and shooting a seismic airgun at the surface near the borehole. This gathered data provides not only high resolution images of the geological layers penetrated by the borehole, but can be used to accurately correlate (or correct) the original surface seismic data. The procedure is known as vertical seismic profiling, or VSP, and can include seismic shots adjacent to the well hole, or 1-mile walkaway surveys in four cardinal directions.

BlueCrest intends to conduct VSP operations at the end of drilling each well using an array of airguns with total volumes of between 9.83 and 14.42 liters (600 and 880 cubic inches). Each VSP operation is expected to last less than one or two days. Illingworth & Rodkin (2014) measured noise levels associated with VSP conducted at Cosmopolitan State #A-1 in 2013. The results indicated that the 190 dB radius (Level A take threshold) from source was 75 meters (246 feet), the 180 dB re 1µPa (rms) radius at 240 meters (787 feet), and the 160 dB radius (Level B disturbance take threshold) at 2.47 kilometers (1.54 miles).

2. Mitigation Measures

2.1. Drill Rig Tow

The initial wet-towing of the drill rig would occur early September 2014 with the rig moved from its current location at Port Graham to Cosmopolitan State #B-1. If the program is delayed enough to prevent a September start, then the wet-tow would occur in April 2015.

The expected source levels from tugs during wet-tow operations are expected to be well less than 180 dB, thus there are no Level A injury concerns relative to noise. The estimated distance to the 120-dB isopleth (the Level B harassment threshold), assuming a 171 dB re 1µPa source and using Collins et al.'s (2007) 18.4 Log r spreading model determined from Cook Inlet, is 2,000 feet (600 meters).

Because the ocean tugs will be under tow while they are generating noises of concern they will be traveling at very slow speeds (1 to 5 knots) providing sufficient time for marine mammals to move from the vicinity and avoid any possible injury take due to collision or noises exceeding injury thresholds. Altering courses or speeds to avoid harassment takes will be conducted when feasible, but completely shutting engines down would represent a major (and perhaps illegal) safety concern given the inherent hazards of towing at sea, thus, while marine mammals will be monitored, no safety shutdowns will occur, however, marine mammal monitoring will occur during all tow events.

2.2. Conductor/Drive Pipe Driving

Soon after the drill rig positioned on the well head, the conductor pipe will be driven as the first stage of the drilling operation. At least two marine mammal observers (one operating at a time) will be stationed aboard the rig during this two to three day operation monitoring a 1-mile (1.6-kilometer) shutdown safety zone (see Appendix A for safety zone angles). The impact hammer operator will be notified to shutdown hammering operations at the approach of a marine mammal to the safety zone. Also, a ramp up of the hammering will begin at the start of each hammering session. The ramp-up procedure, detailed in Appendix B, involves initially starting with three soft strikes, 30 seconds apart. This delayed-strike start alerts marine mammals of the pending hammering activity and provides them time to vacate the area. Monitoring will occur during all hammering sessions.

2.3. Submersed Deep-well Pumps

Hydroacoustic tests conducted by Illingworth & Rodkin (2014) in May 2013, while the rig was operating at Cosmopolitan State #B-1), showed that the submersed deep-well pumps that charge the fire-suppression system and cool the generators (in a closed water system) generate noise levels exceeding 120 dB re 1µPa out a maximum distance of approximately 853 feet (260 meters). Because the distance to the 120 dB radius exceeds the 25-meter limit written in the LOC, marine mammal monitoring is required from the *Endeavour* at all times the pumps are operating (or essentially at all times the rig is operating). Two marine mammal observers, working in shifts, will continue to monitor from the rig during all periods of rig operation. Temporary shutdown of the pump system will occur at the approach of an ESA-listed marine mammal to the 853-foot (260-meter) shutdown zone.

2.4. VSP Operations

As with the conductor pipe driving, marine mammal observers will be redeployed during the VSP operations to monitor a shutdown safety zone. Initially, the zone was estimated at 1.24-miles (2-kilometers), based on use of a 600 cubic inch airgun array. However, Illingworth & Rodkin (2014) measured noise levels during VSP operations associated with BlueCrest post-drilling operations at the Cosmopolitan State #B-1 site during July 2013. The results indicated that for the 720 cubic inch airgun array used during the operation produced noise levels exceeding 160 dB re 1 µPa out to a distance of approximately 8,100 feet (2,470 meters). All future VSP monitoring will involve a 1.55-mile (2.5 kilometer) shutdown zone. The airgun operator will be notified to shut down firing of the guns at the approach of a marine mammal to the safety zone. Also, a “soft start” ramp up of the guns will begin at the start of each airgun session.

2.5. Summary of Monitoring Zones

- Wet-tow – 2,000 feet (600 meters), no shutdown, only avoidance.
- Driving of conductor pipe – 1.0 mile (1.63 kilometers).
- Deep-well pump operation – 853 feet (260 meters).
- Vertical seismic profiling (VSP) – 1.55 miles (2.5 kilometers).

3. Marine Mammal Observers

3.1. Number of Observers

3.1.1. Drill Rig Tow

The initial rig tow from Port Graham to Cosmopolitan #B-1 is expected to last less than 12 hours. A single observer will monitor for marine mammals from the helicopter platform (bow) of the drill rig positioned about 100 feet above the waterline. Two observers,working alternate shifts, will be used for any subsequent rig tow expected to last more than 12 hours or when two observers are already stationed aboard the rig for other purposes (e.g., monitoring deep-well pumps).

3.1.2. Conductor Pipe Driving

Conductor pipe driving is expected to take two to three days to complete. Two marine mammal observers, working alternate shifts, will be stationed aboard the drill rig during all conductor driving activities at the well. The observers will operate from a station as close to the well head as safely possible.

3.1.3. Deep-well Pump

Two marine mammal observers, working alternate shifts, will work aboard the drill rig during all periods that the deep-well pump is operating. The observers will operate from multiple stations on the rig, recognizing that the shutdown radius begins from the submersed pump housed inside the forward jack up leg.

3.1.4. VSP Operations

As with the conductor driving, two observers will monitor all VSP activities. Monitoring during zero-offset VSP will be conducted by two marine mammal observers operating from the drill rig. During walk-away VSP operations, an additional two marine mammal observers will monitor from the seismic source vessel.

3.2. Observer Qualifications

Only trained marine mammal observers will be used during this project. All observers will either have previous experience monitoring for marine mammals, or will go through a rigorous marine mammal monitoring training course. Less experience observers will be paired with veterans. Observers will also be provided with field guides, instructional handbooks, and a contacts list to assist in assuring data are collected effectively and accurately.

4. Monitoring Methodology

4.1. Monitoring at Night and in Poor Visibility

Some wet-tows may occur during the fall when Alaska days are short. However, because there are no injury-take concerns with the wet-tows, and only a very low potential for acoustical harassment, no special considerations will be made to monitor during poor visibility conditions. Exploratory drilling and deep-well pump operation will occur around the clock regardless of weather or light conditions, but because any potential Level B harassment zone is expected to be very close to the drill rig (a few tens to hundreds of meters at most), few marine mammals would escape detection. Also there are no injury take concerns with exploratory drilling and pumps. Monitoring during hours of darkness will occur for the conductor driving and VSP operations using night scopes if necessary.

4.2. Field Equipment

Standard marine mammal observing field equipment will be used including reticule binoculars (10x42), big-eye binoculars (30x), inclinometers, and range-finders. As there are no injury-take concerns associated with the rig tows, exploratory drilling, or deep-well pump operations, no special equipment (e.g., night-scopes, FLIRs) will be used to monitor those activities during low light conditions. Night scopes may be used to monitor at least the Level A injury zones during the conductor pipe driving and VSP activities.

4.3. Field Data Recording

All location, weather, and marine mammal observation data will be recorded onto a standard field form. Field forms will be printed on Rite-in-the-Rain® paper, and attached to the daily report forms. Global positioning system (GPS) and weather data will be collected at the beginning and end of a marine mammal monitoring period and at every half-hour in between. Position data will also be recorded at the change of an observer or the sighting of a marine mammal. Enough position data will be collected to eventually map an accurate charting of any vessel travel. Recorded marine mammal data will also include species, group size, behavior, and any apparent reactions to the project activities. Any behavior that could be construed as a take will also be recorded in the notes. (Because observers will be constantly moving about the rig observing from various unprotected vantage points without power sources, data will not be collected electronically.)

4.4. Field Reports

Daily field reports will be prepared that include daily activities, marine mammal monitoring efforts, and a record of the marine mammals, and their behaviors and reactions, recorded that day. The daily reports will be used to develop an annual 90-day report.

5. Reporting

The lead marine mammal observer will generate daily reports providing information on each of the previous day's marine mammal observations and on any shutdowns that might have occurred. At the completion of each well, a 90-day report will be prepared that will include a compendium of the marine mammals observed during the monitoring activity, and the location of each animal relative to the rig or to mapped vessel track lines (wet-tow and walk-away VSP). Specific reported information will include distances animals were observed from the vessels or rig, and the reaction classification of each.

6. Sound Source Verification

Sound source verification (SSV) measurements have already been conducted for the *Endeavor* and all noise generating activities planned at Cosmopolitan State #B-1 by Illingworth & Rodkin (2014). Hydroacoustical testing of the *Spartan 151* was also conducted by MAI (2011), although it is not clear whether deep-well pump noise levels were measured.

7. Literature Cited

Blackwell, S.B. 2005. Underwater measurements of pile-driving sounds during the Port MacKenzie dock modifications, 13-16 August 2004. Rep. from Greeneridge Sciences, Inc., Goleta, CA, and LGL Alaska Research Associates, Inc., Anchorage, AK, in association with HDR Alaska, Inc., Anchorage, AK, for Knik Arm Bridge and Toll Authority, Anchorage, AK, Department of Transportation and Public Facilities, Anchorage, AK, and Federal Highway Administration, Juneau, AK. 33 pp.

Collins, K. A. MacGillivray, and S. Turner. 2007. Underwater source level measurements of airgun sources from ConocoPhillips' 2007 Beluga 3D seismic survey, Cook Inlet, Alaska. Unpublished report prepared by JASCO Research Ltd., for Veritas DGC. 27 pp.

Illingworth & Rodkin, Inc. 2014. 2013 Cook Inlet Exploratory Drilling Program – Underwater Sound Source Verification Assessment. Report prepared for BlueCrest Energy, Inc. Illingworth & Rodkin, Inc., Petaluma, CA. 20 pp.

Marine Acoustics, Inc. 2011. Underwater Acoustic Measurement of the Spartan 151 Jack-up Drilling Rig in the Cook Inlet Beluga Whale Critical Habitat. Prepared for Furie Operating Alaska, LLC, Anchorage, AK. 40 pp.

Miles, P.R., C.I. Malme, and W.J. Richardson. 1987. Prediction of drilling site-specific interaction of industrial acoustic stimuli and endangered whales in the Alaskan Beaufort Sea. OCS Study MMS 87-0084. BBN Report No. 6509. BBN Inc., Cambridge, Massachusetts. 341 pp.

Richardson, W.J., C.R. Greene, Jr., C.I. Malme, and D.H. Thomson. 1995. Marine Mammals and Noise. Academic Press, San Diego. 576 pp.

Simmonds, M., S. Dolman, and L. Weilgart. 2004. Oceans of Noise 2004, A WDCS Science Report. The Whale and Dolphin Conservation Society, Brookfield House, 38 St. Paul St., Chippenham, Wiltshire. SN15 1LJ.

Spence, J., R. Fischer, M. Bahtiarian, L. Boroditsky, N. Jones, and R. Dempsey. 2007. Review of Existing and Future Potential Treatments for Reducing Underwater Sound from Oil and Gas Industry Activities. Prepared for: Joint Industry Programme on E&P Sound and Marine Life, 209-215 Blackfriars Road, London SE1 8NL, UK. Prepared by: NOISE CONTROL ENGINEERING, Inc. 799 Middlesex Turnpike Billerica, MA 01821. NCE REPORT 07-001.

Wartzok, D. and D.R. Ketten. 1999. Marine mammal sensory systems. *in* J.R. Reynolds, III and S. Rommel, eds. Marine Mammals. Smithsonian Institution Press, Washington, D.C.

Appendix A – Inclinometer Angles

Inclinometer Angle to Distance Relative to Eye Height Above the Water.

Height Above Water	Distance (meters) 100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500
10	5.7	2.9	1.9	1.4	1.1	1.0	0.8	0.7	0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2
15	8.5	4.3	2.9	2.1	1.7	1.4	1.2	1.1	1.0	0.9	0.8	0.7	0.7	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.3
20	11.3	5.7	3.8	2.9	2.3	1.9	1.6	1.4	1.3	1.1	1.0	1.0	0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5
25	14.0	7.1	4.8	3.6	2.9	2.4	2.0	1.8	1.6	1.4	1.3	1.2	1.1	1.0	1.0	0.9	0.8	0.8	0.8	0.7	0.7	0.7	0.6	0.6	0.6
30	16.7	8.5	5.7	4.3	3.4	2.9	2.5	2.1	1.9	1.7	1.6	1.4	1.3	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.7
35	19.3	9.9	6.7	5.0	4.0	3.3	2.9	2.5	2.2	2.0	1.8	1.7	1.5	1.4	1.3	1.3	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.8	0.8
40	21.8	11.3	7.6	5.7	4.6	3.8	3.3	2.9	2.5	2.3	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.1	1.0	1.0	1.0	0.9
45	24.2	12.7	8.5	6.4	5.1	4.3	3.7	3.2	2.9	2.6	2.3	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.4	1.3	1.2	1.2	1.1	1.1	1.0
50	26.6	14.0	9.5	7.1	5.7	4.8	4.1	3.6	3.2	2.9	2.6	2.4	2.2	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.4	1.3	1.2	1.2	1.1
55	28.8	15.4	10.4	7.8	6.3	5.2	4.5	3.9	3.5	3.1	2.9	2.6	2.4	2.2	2.1	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.4	1.3	1.3
60	31.0	16.7	11.3	8.5	6.8	5.7	4.9	4.3	3.8	3.4	3.1	2.9	2.6	2.5	2.3	2.1	2.0	1.9	1.8	1.7	1.6	1.6	1.5	1.4	1.4
65	33.0	18.0	12.2	9.2	7.4	6.2	5.3	4.6	4.1	3.7	3.4	3.1	2.9	2.7	2.5	2.3	2.2	2.1	2.0	1.9	1.8	1.7	1.6	1.6	1.5
70	35.0	19.3	13.1	9.9	8.0	6.7	5.7	5.0	4.4	4.0	3.6	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	2.0	1.9	1.8	1.7	1.7	1.6
75	36.9	20.6	14.0	10.6	8.5	7.1	6.1	5.4	4.8	4.3	3.9	3.6	3.3	3.1	2.9	2.7	2.5	2.4	2.3	2.1	2.0	2.0	1.9	1.8	1.7
80	38.7	21.8	14.9	11.3	9.1	7.6	6.5	5.7	5.1	4.6	4.2	3.8	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.3	2.2	2.1	2.0	1.9	1.8
85	40.4	23.0	15.8	12.0	9.6	8.1	6.9	6.1	5.4	4.9	4.4	4.1	3.7	3.5	3.2	3.0	2.9	2.7	2.6	2.4	2.3	2.2	2.1	2.0	1.9
90	42.0	24.2	16.7	12.7	10.2	8.5	7.3	6.4	5.7	5.1	4.7	4.3	4.0	3.7	3.4	3.2	3.0	2.9	2.7	2.6	2.5	2.3	2.2	2.1	2.1
95	43.5	25.4	17.6	13.4	10.8	9.0	7.7	6.8	6.0	5.4	4.9	4.5	4.2	3.9	3.6	3.4	3.2	3.0	2.9	2.7	2.6	2.5	2.4	2.3	2.2
100	45.0	26.6	18.4	14.0	11.3	9.5	8.1	7.1	6.3	5.7	5.2	4.8	4.4	4.1	3.8	3.6	3.4	3.2	3.0	2.9	2.7	2.6	2.5	2.4	2.3
105	46.4	27.7	19.3	14.7	11.9	9.9	8.5	7.5	6.7	6.0	5.5	5.0	4.6	4.3	4.0	3.8	3.5	3.3	3.2	3.0	2.9	2.7	2.6	2.5	2.4
110	47.7	28.8	20.1	15.4	12.4	10.4	8.9	7.8	7.0	6.3	5.7	5.2	4.8	4.5	4.2	3.9	3.7	3.5	3.3	3.1	3.0	2.9	2.7	2.6	2.5
115	49.0	29.9	21.0	16.0	13.0	10.9	9.3	8.2	7.3	6.6	6.0	5.5	5.1	4.7	4.4	4.1	3.9	3.7	3.5	3.3	3.1	3.0	2.9	2.7	2.6
120	50.2	31.0	21.8	16.7	13.5	11.3	9.7	8.5	7.6	6.8	6.2	5.7	5.3	4.9	4.6	4.3	4.0	3.8	3.6	3.4	3.3	3.1	3.0	2.9	2.7
125	51.3	32.0	22.6	17.4	14.0	11.8	10.1	8.9	7.9	7.1	6.5	5.9	5.5	5.1	4.8	4.5	4.2	4.0	3.8	3.6	3.4	3.3	3.1	3.0	2.9

Appendix B – Ramp-up Procedures

The intent of ramp-up is to warn marine mammals pending seismic or hammering operations and to allow sufficient time for those animals to leave the immediate vicinity. Under normal conditions, animals sensitive to these activities are expected to move out of the area. For all seismic surveys and pipe/pile driving using an impact hammer, use the ramp-up procedures described below to allow marine mammals to depart the safety and harassment zones before operations begin.

Measures to conduct ramp-up procedures are as follows:

1. Visually monitor the safety zone and adjacent waters for the presence of marine mammals for at least 30 minutes before initiating ramp-up procedures. If none are detected, you may initiate ramp-up procedures.
2. For seismic, initiate ramp-up procedures by firing a single airgun. The preferred airgun to begin with should be the smallest airgun, in terms of energy output (dB) and volume (in3).
3. Continue ramp-up by gradually activating additional airguns over a period of at least 30 minutes, but no longer than 40 minutes, until the desired operating level of the airgun array is obtained.
4. For impact hammering, "soft-start" technique shall be used at the beginning of each day's pipe/pile driving activities or if pipe/pile driving has ceased for more than one hour to allow any marine mammal that may be in the immediate area to leave before pile driving reaches full energy.
5. Begin impact hammering soft-start with an initial set of three strikes from the impact hammer at 40 percent energy, followed by a one minute waiting period, then two subsequent 3-strike sets.
6. Immediately shut down all airguns and hammers at any time a marine mammal is detected entering or within the safety zone. You may recommence seismic and hammering operations only when the exclusion zone has been visually inspected for at least 30 minutes to ensure the absence of marine mammals.

Initial seismic and hammering starts should not begin during periods of poor visibility (e.g., night, fog, wind). Any shut-down due to a marine mammals sighting within the safety zone must be followed by a 30-minute all-clear period and then a standard, full ramp-up. Any shut-down for other reasons resulting in the cessation of the sound source for a period greater than 30 minutes, must also be followed by full ramp-up procedures. In recognition of occasional, short periods of the cessation of airgun firing or hammering for a variety of reasons, periods of airgun silence not exceeding 30 minutes in duration will not require ramp-up for the resumption of seismic or hammering operations if: (1) visual surveys are continued diligently throughout the silent period (requiring daylight and reasonable sighting conditions), and (2) no marine mammals are observed in the safety zone.

Appendix 3

Oil Spill and Pollution Discharge Prevention and Mitigation Measures

Oil Spill and Pollution Discharge Prevention and Mitigation Measures

[Modified from the Biological Assessment prepared as part of the Cosmopolitan ESA consultation.]

1 Oil Spills

A potential effect of the proposed natural gas exploration activities is an oil spill. As with any oil and gas operation, effects from any large oil spill (more than 1,000 bbl. [42,000 gallons]) represents a major concern. Although the likelihood of a spill is remote, if it were to occur, a spill could have the potential to create long term, if not permanent, damage to the environmental resources in Cook Inlet. BlueCrest has prepared an Oil Discharge Prevention and Contingency Plan (ODPCP) that will be used in the unlikely event of a spill. Alaska's Department of Environmental Conservation (ADEC) approved BlueCrest's through Buccaneer, its partner at the time) ODPCP on August 29, 2012, which covers operations in the upper Cook Inlet from April 15 to October 31.

If a spill were to occur, it could adversely affect harbor porpoise and harbor seals, both directly and indirectly. Drilling will be conducted during the summer, and potentially fall, which are the seasons with the mildest temperature, weather, and sea condition (open water season when open pack ice conditions are less than 10 percent concentration) for this region. BlueCrest considered these environmental conditions when selecting the jack-up rig, equipment placement, and operations, to minimize the possibility of oil discharge.

BlueCrest (through Buccaneer) conducted extensive modeling in its ODPCP to determine oil spill migration if a spill occurred. The trajectory of oil would be dependent on wind speed, direction, and ocean currents at the time of and directly after the spill. Tidal fluctuations in the main body of Cook Inlet regularly reach 7.6 m (25 ft.) and exhibit currents in excess of 5 knots (6 mph) at full tidal flow (NOAA 2008). If a spill were to occur, real time data would be required to assess the trajectory of the released oil.

The ODPCP identifies measures to be taken in the event of an oil spill. Wildlife protection strategies may entail, in order of priority:

- Containment and control to limit the spread and area influenced by the spill;
- Hazing of birds and mammals to prevent them from entering the spill area; and
- Capture and relocation of wildlife at direct threat.

BlueCrest will be working with Cook Inlet Spill Prevention and Response, Inc. (CISPRI), which is certified as a U.S. Coast Guard oil spill removal organization and State of Alaska Primary Response Action Contractor serving the Cook Inlet region of Alaska. BlueCrest will follow the procedures as outlined in CISPRI's Technical Manual, Wildlife Tactics. Most procedures discussed in the CISPRI Technical Manual are associated with responses for either waterfowl or marine mammals. CISPRI will dedicate personnel and equipment as appropriate in support of wildlife during a spill. The Planning Section Chief will work to implement a Wildlife Plan addressing those species anticipated to be at risk and needing protection.

1.1 Cetaceans

The effects of oil spills on cetaceans such as harbor porpoises are generally unknown; however, some generalizations can be made regarding impacts from oil on individual whales based on present knowledge and from data collected on spills in similar regions, such as the *Exxon Valdez* oil spill in Prince William Sound, Alaska. Although cetaceans are capable of detecting oil, they do not seem to avoid the oil (Geraci 1990). Harbor porpoises swimming through an oil spill could be affected in several ways: skin contact with the oil; ingestion of oil; respiratory distress from hydrocarbon vapors; contaminated food sources; and displacement from feeding areas. Actual impacts would depend on the extent of duration of contact, and the characteristics (type and age) of the oil. Harbor porpoises could be affected by residual oil from a spill even if they were not present during the oil spill. However, the greatest potential threat to harbor porpoises from an oil spill is the inhalation of toxic vapors that concentrate above oil slicks as they surface to breath, and in extreme cases could result in sudden death (Geraci 1990). Geraci (1990) reviewed a number of studies pertaining to the physiologic and toxic impacts from oil on whales and concluded there was no definitive evidence that oil contamination had been responsible for the death of a cetacean. Cetaceans observed during the *Exxon Valdez* event made no effort to alter their behavior in the presence of oil (Harvey and Dahlheim 1994; Loughlin 1994). Dahlheim and Matkin (1994) concluded that because the highest recorded mortality rate of North Pacific killer whales occurred in 1989 and 1990, which coincided with the Exxon Valdez oil spill, there was a correlation between the loss of killer whales and the spill, but they could not identify a clear cause and effect relationship.

Any diminishment of feeding habitat during the summer months due to an oil spill could adversely affect the energy balance for harbor porpoises. The impacts from oil exposure to Cook Inlet harbor porpoises would also depend upon how many animals came into contact with oil. If oil found its way into nearshore feeding areas during summer months (*e.g.*, river mouths with eulachon runs), a significant proportion of the upper Cook Inlet population of harbor porpoise might be exposed. However, such a trajectory north into upper Cook Inlet summering feeding areas is very unlikely from the Cosmopolitan State well site.

1.2 Pinnipeds

Pinnipeds in general do not readily avoid oil (St. Aubin 1990), and mortality can occur, as evidenced by the estimated loss of 300 harbor seals from the *Exxon Valdez* spill. Pups seem to be the most vulnerable, either from the physical effects of heavy coatings of crude oil, or from the masking of identification odors preventing mothers from recognizing them. However, St. Aubin (1990), in his extensive investigation on oil effects on pinnipeds, stated “Pinnipeds show little behavioral or physiologic reactions to the noxious characteristics of oil”. Large scale pinniped mortality from oil has not been observed, and the thermal regulation impacts from oil fouling appear to be limited to fur seals (St. Aubin 1990). In controlled experiments, Kooyman et al. (1976) found oil to have little effect on the insulative value of sea lion pelts. Inhaling oil toxins can cause death, but not likely at the vapor concentrations found in a cold water oil spill (St. Aubin 1990).

1.3 Spill Prevention and Risk Analysis

Spill prevention is a primary goal for BlueCrest. BlueCrest has planned formal routine rig maintenance and surveillance checks as well as normal inspection and equipment checks to be conducted on the jack-up rig daily. The following steps will be in place to prevent oil from entering the water:

- Required inspections will follow standard operating procedures.
- Personnel working on the rig will be directed to report any unusual conditions appropriate personnel.
- Oily equipment will be regularly wiped down with oil absorbent pads to collect free oil. Drips and small spillage from equipment will be controlled through use of drip pans and oil absorbent drop clothes.
- Oil absorbent materials used to contain oil spills or seeps will be collected and disposed of in sealed plastic bags or metal drums and closed containers.
- The platform surfaces will be kept clean of waste materials and loose debris on a daily basis.
- Remedial actions will be taken when visual inspections indicate deterioration of equipment (tanks) and/or their control systems.
- Following remedial work, and as appropriate, tests will be conducted to determine that the systems function correctly.

Drilling and completion fluids provide primary well control during drilling, work over, or completion operations. These fluids are designed to exert hydrostatic pressure on the wellbore that exceeds the pore pressures within the subsurface formations. This prevents undesired fluid flow into the wellbore. Surface mounted blowout preventer (BOP) equipment provides secondary well control. In the event that primary well control is lost, this surface equipment is used to contain the influx of formation fluid and then safely circulate it out of the wellbore.

The BOP is a large, specialized valve used to seal, control, and monitor oil and gas wells. BOPs come in variety of styles, sizes, and pressure ratings. For Cook Inlet, the BOP equipment used by BlueCrest will consist of:

- Three BOPs pressure safety levels of: 1) 5,000 pounds per square inch (psi) 2) 10,000 psi, and 3) 15,000 psi;
- A minimum of three 35 cm (13 5/8 in), 10,000 psi WP ram type preventers;
- One 35 cm (13 5/8 in) annular preventer;
- Choke and kill lines that provide circulating paths from/to the choke manifold;
- A two choke manifold that allows for safe circulation of well influxes out of the well bore; and
- A hydraulic control system with accumulator backup closing.

The wellhead, associated valves, and control systems provide blowout prevention during well production. These systems provide several layers of redundancy to ensure pressure containment is maintained. Well control planning is performed in accordance with Alaska Oil and Gas Conservation Commission (AOGCC) and Bureau of Safety and Environment Enforcement (BSEE) regulations. The operator's policies and recommended practices are, at a minimum, equivalent to BSEE regulations. BOP test drills are performed on a frequent basis to ensure the well will be shut in quickly and properly. BOP testing procedures will meet American Petroleum Institute Recommended Practice No. 53 and AOGCC specifications. The BOP tests will be conducted with a nonfreezing fluid when the ambient temperature around the BOP stack is below 0° C (32° F). Tests will be conducted at least weekly and before drilling out the shoe of each casing string. The AOGCC will be contacted before each test is conducted, and will be onsite during BOP tests unless an inspection waiver is approved.

In addition to the above water BOP system, a comparison of the Deep Water Horizon Gulf of Mexico incident to the Cook Inlet exploration indicates the following risk reductions for the BlueCrest exploration:

1.3.1 **Deep Water Horizon**

- Gulf of Mexico
- Water depth greater than 5,000 feet
- Geological formation pressures unknown
- 50 miles offshore
- Floating drill rig

1.3.2 **BlueCrest Exploration Wells**

- Cook Inlet
- Water depth less than 100 feet
- Geological formation pressures established and well known
- Less than 10 miles offshore
- Stationary drill rig anchored to the seabed

Significant drilling on the Outer Continental Shelf in Alaska, including parts of Cook Inlet, has not occurred since the early 1990s. During exploration in Alaska Outer Continental Shelf waters from 1982 to 1991, 52 exploratory wells were drilled with five spills greater than one oil barrel (bbl.; 42 gallons); the total spillage from these events was 45 bbl. (1,890 gallons) (MMS 1996). From these data, Minerals Management Service determined a spill rate of 11 spills per 100 wells with an average spill size of nine bbl. (378 gallons).

Major spills could be caused by failure of a storage tank or mud tank. These tanks are routinely tested for structural integrity, so the most likely cause of failure would be due to significant impact from onsite equipment. A spill of this type is not known to have occurred at an exploration site in Alaska and, with monitoring, is expected to have a very low probability of occurrence.

Oil spill risk in Cook Inlet is lessened to some degree with the advancement of drilling technologies and safety assurances; and because formation pressures are generally known and understood in this area with previous oil development. Offshore oil spill records in Cook Inlet during 1994-2011 show only three spills during oil exploration: two oil spills at the UNOCAL Dillon Platform in June 2011 (two gallons) and December 2001 (three gallons); and one oil spill at the UNOCAL Monopod Platform in January 2002 (one gallon) (ADNR 2011). During the same time, 71 spills occurred offshore in Cook Inlet during oil production. Most spills ranged between 0.0011 and 1 gallon (42 spills); with three spills larger than 200 gallons: 210 gallons in July 2001 (Cook Inlet Energy Stewart facility); 250 gallons in February 1998 (King Salmon Platform); and 504 gallons in October 1999 (UNOCAL Dillon Platform). All 71 crude oil spills from the offshore platforms, both exploration and production, totaled less than 2,140 gallons. Based on historical data, most oil spills have been small.

During the 62 years of oil and gas exploration and development in Cook Inlet, there has not been a single oil well blowout, although there have been two incidents at gas wells, which makes it difficult to assign a precise risk factor to the possibility to such an event for Cook Inlet; but is thought to be an extremely low probability. There have been four natural gas blowouts in Cook Inlet since 1962

Beluga whales are not expected to be near the exploration drilling rig, as they are distributed well north of these drill sites during the summer; and harbor porpoise and harbor seals are not regularly observed in this area. Therefore, in light of the small probability of a spill occurring; if a spill were to occur, the small probability for it to persist during the time when local marine mammals are expected to be in the area of the spilled oil; and the spill response measures required for this project, it is unlikely that these marine mammals would be contacted by oil. Significant adverse effects would only be expected if several of these low probability events occurred at the same time. As such, an oil spill presenting harm, injury, or harassment to Cook Inlet beluga whales, harbor porpoises, and harbor seals is extremely unlikely to occur, and is therefore, discountable.

1.4 Pollution Discharge

The drill rig *Endeavour* is operating under the Alaska Pollutant Discharge Elimination System (APDES) general permit AKG-31-5021 for wastewater discharges (ADEC 2012). This permit authorizes discharges from oil and gas extraction facilities engaged in exploration under the Offshore and Coastal Subcategories of the Oil and Gas Extraction Point Source Category (40 CFR Part 435).

Twelve effluents are authorized for discharge into Cook Inlet once ADEC discharge limits have been met. The authorized discharges include: drilling fluids and drill cuttings, deck drainage, sanitary waste, domestic waste, blowout preventer fluid, boiler blow down, fire control system test water, uncontaminated ballast water, bilge water, excess cement slurry, mud cuttings cement at sea floor, and completion fluids. Areas prohibited from discharge in the Cook Inlet are 10-meter (33-foot) isobaths, 5-meter (16-foot) isobaths, and other geographic area restrictions (AKG-31-5021.I.C.).

The *Endeavour* is also authorized under EPA's Vessel General Permit (VGP) for deck wash down and runoff, gray water, and gray water mixed with sewage discharges. The effluent limits and related requirements for these discharges in the VGP are to minimize or eliminate to the extent achievable using control measures (best management practices) (EPA 2011). The control measures must be technologically available and economically practicable and achievable in the light of best marine practices.

NMFS reviewed the Revised Biological Evaluation, prepared by the Environmental Protection Agency (EPA), for the Cook Inlet National Pollutant Discharge Elimination System (NPDES). In their letter dated October 13, 2006, NMFS concurred with EPA's determination that the reissuance of the NPDES permit is not likely to adversely affect Steller sea lions. NMFS did not agree or disagree with the same determination for Cook Inlet beluga whales, but requested future analysis on potential bioaccumulation effects. However, NMFS' concerns were directed towards waters in beluga critical habitat area 1 north of the Cosmopolitan State #B-1 well site. It is not clear how NMFS might view the determination relative to upper Cook Inlet populations of harbor seals and harbor porpoise.

During the summer harbor porpoises and harbor seals are concentrated near river mouth feeding areas and haul outs (Boveng et al. 2012). Therefore, it is unlikely that harbor porpoises or harbor seals would be contacted by discharge effluent, especially given the authorized discharge limitations. Significant adverse effects from discharge are unlikely, any harm, injury, or harassment to local marine mammals is unlikely to occur, and is therefore, discountable.