9.17. Cook Inlet Beluga Whale Study

9.17.1. General Description of the Proposed Study

9.17.1.1. Study Goals and Objectives

The goals of this study are threefold: 1) to provide current, fine-scale information on Cook Inlet Beluga Whale (*Delphinapterus leucas*; CIBW) distribution and movements within the Susitna River delta, 2) to correlate these data with information on the ecology and habitat parameters of CIBW and their prey species, and 3) record incidental observations of all marine mammals sighted during beluga whale studies. Information is needed regarding CIBWs, their prey species and critical habitat in the Susitna River delta to assess potential effects from changes in the lower river that may result from the construction and operation of the Susitna-Watana Hydroelectric Project (Project). During the open water season (approximately April through October) CIBWs primarily feed on salmon and eulachon which will be investigated under the Fish Distribution in the Middle and Lower River Study (Section 9.6), Salmon Escapement Study (Section 9.7) and the Eulachon Study (Section 9.16). In addition, the following studies will provide data necessary to assess potential impacts to CIBW critical habitat: Baseline Water Quality Study (Section 5.5), Water Quality Modeling Study (Section 5.6), Geomorphology studies (Sections 6.5 and 6.6), Ice Processes Study (Section 7.6), and Fish and Aquatics Instream Flow Study (Section 8.5). Collectively, this information will be used by the Federal Energy Regulatory Commission (FERC) in its National Environmental Policy Act (NEPA) and licensing processes; for the National Marine Fisheries Service (NMFS) Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA) consultations; and for the development of any necessary protection, mitigation and enhancement (PM&E) measures.

Three objectives have been identified for this study:

1. Document CIBW and other marine mammals in the Susitna River delta, focusing on CIBW distribution and upstream extent;
2. Document CIBW group size, group composition and behavior within the Susitna River delta;
3. Collect data necessary to evaluate the relationships between potential hydropower-related changes in the lower river, CIBW in-river movements, and CIBW prey availability.

9.17.2. Existing Information and Need for Additional Information

Cook Inlet Beluga Whales reside in Cook Inlet year-round, which makes them geographically and genetically isolated from other beluga stocks in Alaska (Allen and Angliss 2012). Given their limited geographic range and small population size (~300 animals), changes in environmental conditions may influence their distribution within the Inlet. Since the early 1990s a variety of studies have been conducted to assess CIBW spatial and temporal distribution. Beginning in 1993, aerial surveys have been conducted annually by the NMFS-National Marine Mammal Laboratory. These surveys are flown in June and August with effort concentrated along northern, coastal waters of the Inlet (within 1.5 km from shore) with reduced survey effort in the middle and southern portions of the Inlet (NMFS 2008, Hobbs et al. 2011). Additionally, aerial surveys for beluga whales were completed in 1982 and 1983 as part of the original licensing effort (Harza-Ebasco 1985). In addition to aerial surveys, land- and boat-based surveys have been conducted to investigate CIBW movement and residency patterns in the Susitna Flats and adjacent areas. These efforts have been focused on characterizing distribution and habitat use by individuals and groups of whales (Funk et al. 2005; Prevel-Ramos et al. 2006, Markowitz and McGuire 2007, Markowitz et al. 2007, Nemeth et al. 2007 McGuire et al. 2008, McGuire and Kaplan 2009, McGuire et al. 2009, 2011a,b). Researchers have also applied 15 satellite tags to 15 whales in to examine year-round movements of CIBWs, which has shown that whales are present in Upper Cook Inlet even when ice is present. These surveys have all documented large summer aggregations of CIBWs in Upper Cook Inlet, particularly in late summer and fall (Funk et al. 2005, NMFS 2008, Allen and Angliss 2012).

While the aforementioned studies have provided valuable information regarding CIBW distribution in Cook Inlet, fine-scale information of the Susitna River delta over the entire open-water season is needed to effectively assess potential Project-related effects to CIBW distribution and movement patterns.

Due to a significant population decline (current population ~ 300 animals), the CIBW was listed as an endangered species under the ESA in October 2008 (73 FR62919). As a result, critical habitat for CIBWs was designated in April 2011 (76 FR20180; Figure 7.17-1). When determining critical habitat, the NMFS identified the following five primary constituent elements (PCEs) essential to the conservation of the Cook Inlet Beluga Whale:

1. Intertidal and subtidal waters of Cook Inlet with depths <30 feet (mean lower low water, MLLW) and within 5 miles of high and medium flow anadromous fish streams;
2. Primary prey species consisting of four species of Pacific salmon (Chinook, sockeye, chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod and yellowfin sole;
3. Waters free of toxins or other agents of a type and amount harmful to Cook Inlet Beluga Whales;
4. Unrestricted passage within or between the critical habitat areas; and
5. Waters with in-water noise below levels resulting in the abandonment of critical habitat areas by Cook Inlet Beluga Whales.

Based on these criteria, NMFS identified two specific marine area types in Cook Inlet that contained one or more PCE. Type 1 critical habitat encompasses 1,909 square kilometers (738 square miles) of Cook Inlet northeast of a line from the mouth of Threemile Creek to Point Possession. Type 1 critical habitat has the highest concentrations of beluga whales from spring through fall. Type 2 critical habitat consists of 5,891 square kilometers (2,275 square miles) of less concentrated spring and summer beluga whale use, but known fall and winter use areas. It is located south of Type 1, and includes nearshore areas along the west side of the Inlet and Kachemak Bay on the east side of the lower inlet.

Type 1 critical habitat extends into the Susitna River approximately 8.6 nautical miles from mean lower low water (MLLW) and the Susitna Flats portion of upper Cook Inlet appears to be important calving grounds for CIBWs (Huntington 2000). Based on the documented use of CIBWs in the Susitna River mudflats and the potential of the Project to affect physical features of these mudflats, CIBW critical habitat may be altered (PCE 1).

Seasonal movement and density patterns of CIBWs, as well as site fidelity, appear to be closely linked to prey availability. These patterns coincide with seasonal salmon and eulachon concentrations (Moore et al. 2000). Therefore, any Project related impacts to fish abundance, run timing and/or density may have indirect impacts on CIBWs (PCE 2). CIBWs have been documented upriver in Cook Inlet tributaries during spring, summer, and fall. Presence of CIBWs is confirmed at numerous rivers, including the McArthur, Beluga, Lewis, Theodore, Ivan, Susitna, and Little Susitna on the west side of Upper Cook Inlet. Historic records indicate that CIBWs have been seen in the eastern channel of the Susitna River as far as 30 to 40 miles upriver, yet are most commonly found within the first 5 miles of the Susitna River delta (Funk et al. 2005). The current upstream extent in the Susitna River is unknown.

In addition to CIBWs, other marine mammals have been documented in Cook Inlet, particularly harbor seals (*Phoca vitulina*) and harbor porpoise (*Phocoena phocoena*). Harbor seals in Alaska are not classified as strategic or depleted stocks under the MMPA and are not listed as threatened or endangered under the ESA (Allen and Angliss 2012). The most recent population estimate for the Cook Inlet/Shelikof Strait harbor seal stock is 22,900 (Allen and Angliss 2012). Harbor seals are distributed throughout Cook Inlet with higher concentrations in lower Cook Inlet compared to the upper inlet. However, sightings of harbor seals in the upper inlet have been increasing over the past few years. The most recent aerial survey documented approximately 1,750 harbor seals in the Susitna River delta (NMFS 2011).

Harbor porpoise in Cook Inlet belong to the Gulf of Alaska stock, which is not classified as a strategic or depleted stock under the MMPA and is not listed as threatened or endangered under the ESA (Allen and Angliss 2012). The most recent abundance estimate is 31,046 for Gulf of Alaska harbor porpoise. Harbor porpoise have been documented throughout Cook Inlet using both visual and acoustic techniques (NMFS 2011, ADFG 2009, 2011). While unlikely, resident killer whales (*Orcinus orca*) have also been acoustically detected in upper Cook Inlet (ADFG 2011).

9.17.3. Study Area and Timing

To assess potential Project-related impacts to CIBWs and other marine mammals, it is necessary to determine the spatial and temporal use of the Susitna River delta by marine mammals, particularly CIBWs. Therefore, the project will be conducted over the open water season (April through October) in the Susitna River delta, up to RM50 (Figure 1). Due to logistics and safety concerns, as well as lower concentrations of belugas in the Susitna River during winter months (as documented through satellite tags), winter surveys (November through March) will not be conducted.

9.17.4. Study Methods

9.17.4.1. Document CIBW and Other Marine Mammal Presence Within the Susitna River Delta

Aerial surveys conducted by the NMFS occur only in June and August; therefore, the distribution of CIBWs throughout the open water season is not well-documented. Fine-scale information on CIBW seasonal distribution, particularly during times coinciding with spawning and migrations of prey species, is needed to evaluate potential project-related impacts to CIBWs, critical habitat, and prey availability. To address this current lack of information, this study proposes to conduct aerial surveys for CIBWs in the Susitna River delta (Figure 1) during the open water season. The survey schedule will consist of 15 to 20 surveys per year depending on weather conditions, aircraft availability, and timing, which will not interfere with NMFS aerial surveys:

- Two in mid-late April (or after ice-out)
- Three in May
- Three in June (in addition to the NMFS survey)
- Three in July
- Three in August (in addition to the NMFS survey)
- Two in September
- Two in October (or until freeze-up)

This schedule will allow for increased survey effort during the spawning season of prey species (May and June) and during times when beluga calves may be present (July and August). The survey schedule will be adjusted as necessary to avoid potential interference with the NMFS surveys in June and August. Each survey will be scheduled for 4 flight hours to ensure adequate coverage of the Susitna River delta up to RM50 and will allow for additional time to circle around areas where CIBWs are encountered. Flights will be scheduled around low and high tides. Surveying during low tide is most effective for documenting group sizes as animals will be congregated in areas due to lower water levels. While, surveying during high tide will be advantageous for determining the northern extent of belugas in the Susitna River. If possible, both low and high tides will be surveyed in the same day (i.e. 2 hrs for each tide). Flights will be conducted at 1,000 feet to avoid disturbance to marine mammals and, by extension, avoid the need for a marine mammal take permit.

The aerial survey team will consist of one pilot and two experienced marine mammal observers (MMOs), one of which will serve as the data recorder. Survey protocol will follow Hobbs et al. (2011) and will generally include the following steps. The MMOs will scan the water visually to locate CIBWs via unaided eyes. Data will be recorded on a hand-held GPS system (i.e Archer) which will be programmed with a custom data acquisition program. For each sighting, the time and position will be captured through the GPS-enabled data program. The MMOs will enter the angle of the sighting, which will be obtained from an inclinometer to obtain the degrees relative to the survey aircraft. Data for marine mammals will include location, group size, group composition (i.e., adults, juveniles, and cow-calf pairs), and overall group behavior. Environmental data will be updated every 30 minutes. Effort data recorded will include environmental conditions which can affect the observers' ability to sight animals (e.g., high sea state, glare, and sun position).

While all marine mammal sightings will be documented during the aerial surveys, more detailed methods will be used when a group of CIBWs is encountered. Each observer will independently count the number of animals in each group and multiple passes (up to five) may be performed to get the most accurate count of each CIBW group. All counts from both observers will be combined and the median will be used to achieve the most accurate group size and reduce the effect of outliers within counts (Hobbs et al. 2011). Video and still cameras will be available to document encounters, when possible, but will not be used for group counts. Additionally, the team will report any observations of stranded or distressed marine mammals immediately to the NMFS.

9.17.4.2. Document CIBW group size, group composition and behavior in the Susitna River

While aerial surveys are appropriate to document the spatial distribution of CIBWs in the Susitna River delta, these surveys only represent a short time period (i.e., hours). To increase the ability to detect CIBW presence in the Susitna River, particularly to document group composition and individual behavior (i.e. foraging), a combination of live-feed remote video camera systems and still cameras will be utilized. Live-feed cameras can provide real-time data over long time periods (i.e., weeks to months). Remote camera systems also allow for data collection without disturbing study animals and provide details that cannot be obtained through aerial surveys, such as the presence of calves. This technology was successfully used in the Little Susitna River for CIBWs in 2011 by the Alaska Sea Life Center. In addition to documenting CIBWs, this technology was also successful at identifying harbor seals within the river.

Live-feed cameras (up to four, depending on feasibility) will be established at the mouth of the Susitna River and still cameras (up to four, depending on feasibility) will be placed up to RM 10. Camera stations will be placed in locations that will provide the best field of view, but may be restrained by access and permit stipulations. Locations will be identified in early 2013. Additional photographic data from cameras installed further upstream to monitor ice processes and in-stream flow will be examined for the presence of CIBWs. The video camera system will utilize remotely operated camera technology (see More Wildlife Systems, Homer, AK), which will allow observers to remotely manipulate the cameras (e.g., pan, zoom, capture still images, wipe lens, etc) in real-time via a microwave link. The camera systems will be mounted to 9-meter steel towers embedded in the ground. Batteries, electronics, and the recharging system to run the cameras will be located in hard cases mounted at the base of the steel towers and the live images from the cameras will be transmitted via microwave signal to a receiver.

Observer monitoring shifts will be scheduled to cover up to 7 days a week with a primary focus on high-water periods. Monitoring effort will be targeted around a range of tides with the majority of effort at high tide. Scans of the study area will be conducted every 20 minutes throughout each monitoring shift. For each scan, the observers will position the camera at the farthest south or north position and slowly move the camera through the study area. Camera movement will be incremental, not continuous. With each movement of the camera the observers will pause long enough to determine if whales were present before moving the camera. Scans will last between 10 and 15 minutes, but may be longer if belugas are present to allow for accurate data collection. During intervals between scans, the cameras will be positioned at a single location and checked frequently for opportunistic sightings. The location of the cameras between scans will be positioned towards the area with greatest possibility of having an opportunistic sighting determined by distance from the camera and visibility due to current tidal stage.

Data Collection Overview

The study area will be divided into grids to allow documentation of activity within the camera's field of view. When belugas are present, observers will log group location, size, composition, and behaviors onto data sheets which will be entered into a database. Once a group is sighted an observer will continue to follow the group, as time, presence of other beluga groups, and conditions allow, with the goal being to get the most comprehensive data from the study area. The cameras will have more than one path to allow for independent movement and view of the study area. This will allow for focused observations to occur while still conducting a scan. This allow for full assessment of the study area while still enabling the data collection on focal groups.

Behavior Logs

Beluga behavior will be recorded by activity codes onto data sheets that allow the recording of the top three activities of each group. The primary activity will represent the activity of the group as a whole, and will be determined first (e.g., traveling). Secondary and tertiary activities occurring within only a portion of the total group location will also be noted (e.g., tail slapping). If observers are able to obtain close-up video of whales with distinctive markings, still photos of these events will be collected for potential use in photo-identification. Presence and behavior of any other marine mammals or humans (including vessel traffic), will also be recorded, and video of interesting events will be recorded and archived.

Group Counts

Each camera site will have one or more cameras. The sites with more than one camera will have the ability for independent operation for each camera, called "paths." The two paths would allow for concurrent movement of both cameras. With this setup one camera would have a wide angle overview of the study site and could provide broad sweeps over the area to look for other groups while still maintaining the first group in view. The second camera would focus on each group for counts and observations. This would be similar to an on-site human observer that would be able to use peripheral vision to note new activity in the river while doing focal observations on a specific group. The method of tracking and recoding behaviors would allow the capture of travel up river while still collecting focused group information and behaviors. Depending on the number of camera stations and the amount of overlap in coverage some camera sites may only have one camera.

Two observers will be assigned to every shift. Upon sighting a group of whales one observer will follow the group to accurately assess location, composition, and behavior. The second observer will continue to scan the study area for the presence of other groups of whales.

Within the database, whale sightings will be assigned two identification numbers, a “day group” number reflecting the actual group number recorded on the data sheet and an “archive group” which would remain the same for successive sightings of the same group. For example, a group sighted on four successive scans would be assigned “day group” numbers of 1, 2, 3, and 4 for each scan, but the “archive group” number would remain the same for all four scans. If a single group of whales split into distinct segments, letters will be used to denote subgroups of the same parent group (e.g. group 1 split into group 1a, 1b, etc.). Day group numbers will be reset at the beginning of each new monitoring day and archive group numbers were assigned consecutively for the duration of the study period. If two distinct groups (group 1 and group 2) merged (group 1 joined group 2) the combined group was given the archive group number of the group that was joined (in this case group 2 archive number). This method of documentation allows for detailed tracking of animal groups, movements and interactions without inflating animal numbers.

For reporting purposes, beluga whale “groups” will be in reference to archive groups in order to accurately reflect the total number of groups and individuals observed. Beluga whale “sightings” will be in reference to behavior, composition, and/or location data recorded within the confines of a single scan (day group) in order to reflect dynamic changes within the study area by a single group.

Data can be accessed in a real-time format as needed for planned activity in the river. Post collection data will be presented in reports monthly that will reflect monitoring effort, beluga activity (presence, group size, location, composition) as well as environmental conditions.

9.17.4.3. Collect Data Necessary to Evaluate the Relationship Among Potential Hydropower-Related Changes in the Lower River, CIBW In-River Movements, and Prey Availability

Satellite tagging of CIBWs and hydrodynamic statistical modeling of CIBW distribution from aerial surveys and tagging data indicate that seasonal CIBW distributions are correlated with water temperature, ice coverage, and the seasonal flow patterns of various rivers (Goetz et al. 2012). This suggests that availability of salmon and other fish (i.e., eulachon) in river mouths influence CIBW movements (Ezer 2011). CIBWs use the Susitna River delta at least from late-April through September (NMFS 2008) with the spring timing coincident with the spawning migrations of first eulachon and then Pacific salmon into the river. Therefore, availability of prey species was one of the PCEs used to designate critical habitat in 2011 (76 FR 20180). These findings suggest that changes in environmental conditions as a result of development projects, such as Susitna-Watana Hydroelectric Project, may affect CIBW distribution, critical habitat and/or prey availability. This study, as well as other proposed studies related to CIBW prey species (Fish Distribution in the Middle and Lower River [Section 9.6] and Eulachon Study [Section 9.16]), water quality (Baseline Water Quality Study and Section 5.6 Water Quality Modeling Study [Sections 5.5 and 5.6, respectively]), and geomorphology (Section 6.5) will collect new data and synthesize existing data that will be used in combination with existing CIBW models to facilitate future evaluation of Project impacts (Figure 9.17-2).

Changes in sediment transport downstream of the Watana Dam may occur due to the regulated outflows and sediment trapping in the reservoir. The effect of altered flows and sedimentation on fish habitats and their associated populations was a focus of study in the 1980s (ADF&G 1983a, b; Barrett et al. 1984; Vincent-Lang and Queral 1984) and will be investigated again as part of the Geomorphology Study. Additionally, the Instream Flow Study (Section 8.5) will model the hydraulics of the Susitna River below the proposed project to investigate whether the existing channel morphology will remain the same, or at least be in “dynamic equilibrium”, once the proposed Project is implemented.

Changes in temperature may impact CIBWs, particularly during times when calves are present. Continuous temperature monitoring and models developed in the Ice Processes and Water Quality studies (Section 5.5 and 5.6) will inform the predictive model as to how the mainstem river may respond to Project operations, including seasonal changes to the hydrograph and daily and weekly load-following. Impact analyses will examine whether these changes in water temperature could affect aquatic life in the Project area. Temperature changes could also influence the timing of fish migrations which could potentially alter prey availability for CIBWs.

While the Project could potentially impact prey and/or critical habitat (as stated above), the Project would be built at approximately RM185 and Project-related impacts are anticipated to decrease with increasing distance from the Project. Studies conducted in the 1980s as part of the original licensing effort, support the idea that impacts will decrease with distance downstream. CIBWs are rarely sighted north of RM5 in the Susitna River. Therefore, direct impacts to CIBW movements are expected to negligible.

One PCE is the intertidal and tidal areas less than 30’ at river mouths and the flow regulation at RM 184 could potentially physically alter these habitats in an adverse manner. However, the degree of Project effects on discharge is likely small or even negligible compared to the high tidal flux in the Susitna delta. To assess the likelihood and degree of this potential impact, AEA will prepare an oceanographic analysis. This analysis combined with ongoing flow, sediment and water quality modeling will characterize the daily and seasonal variability from marine waters on the Susitna delta and put these into perspective with seasonal and Project-induced changes in discharge from the Susitna River. [AEA is reviewing potential models for this effort. Details on the model will be included in the final RSP]

Finally, in the absence of winter studies on CIBW distribution and prey availability, due to safety and logistical concerns, modeling efforts and subsequent impact analyses will assume that whales are present year-round in the Susitna River delta and that they may be foraging.

9.17.5. Consistency with Generally Accepted Scientific Practices

The study methods presented are consistent with methods commonly followed in investigations of marine mammal distribution. Aerial surveys are commonly used for documenting marine mammal distribution and have been employed by the NMFS for CIBW abundance surveys since 1993 (Hobbs et al. 2011). Aerial surveys were also used to document CIBWs in the study area during the original licensing effort (Harza-Ebasco 1985). The proposed method for live-feed remote video cameras has been successfully used to document CIBWs and other marine mammal movements and behaviors in large river systems in Alaska (Easly-Appleyard et al. 2012). High Resolution cameras are also used by NMFS to document CIBW group counts and group composition (Hobbs et al. 2011, Hobbs et al. 2012). [AEA will insert details on modeling efforts when a model is chosen for the RSP]

9.17.6. Schedule

The anticipated field schedule for 2013 and 2014 will run from late April (or ice-out) through the end of October. Each year, 15-20 aerial surveys will be conducted:

- Two in mid-late April (or after ice-out)
- Three in May
- Three in June (in addition to the NMFS survey)
- Three in July
- Three in August (in addition to the NMFS survey)
- Two in September
- Two in October (or until freeze-up)

This schedule for aerial surveys will allow for increased survey effort during the spawning season of CIBW prey species (May and June) as well as during times when calves may be present (July and August). The survey schedule will be adjusted, as needed, based on weather conditions, aircraft availability, and to avoid potential interference with NMFS surveys in June and August.

Remote cameras will be installed in late April and will operate until the end of October. Data analyses will be completed by the middle of November of each year.

[Details on modeling schedule will be included in final RSP]

Quality Assurance (QA)/Quality Control (QC) reviews on the data analyses will be completed by the end of November each year.

Reporting will be completed in the first quarter of 2014 (Initial Study Report) and 2015 (Updated Study Report), one and two years respectively from FERCs Study Plan Determination (i.e. February 2013).

9.17.7. Level of Effort and Cost

Field work will occur daily from late April through September. Aerial survey teams will consist of three people (one pilot and two MMOs) and up to four observers will be utilized for remote-camera monitoring and data analysis (depending on the number of cameras installed). Each aerial survey is scheduled for 4 hours for a total of 72 flight hours each year. Approximate yearly cost for aerial surveys is $300,000 and approximate cost for remote-camera equipment and operations is $300,000 per year. Modeling efforts will cost approximately $50,000.

9.17.8. Literature Cited

Alaska Energy Authority (AEA). December 29, 2011. *Pre-application document: Susitna-Watana Hydroelectric Project, FERC Project No. 14241*.Prepared for the Federal Energy Regulatory Commission.

Allen, B.M., and R. P. Angliss. 2010. *Alaska marine mammal stock assessments, 2009*. U.S. Department of Commerce, NOAA Technical Memorandum NMFSAFSC-206. Seattle, Washington: National Marine Fisheries Service.

Allen, B.M., and R. P. Angliss. 2011. *Alaska marine mammal stock assessments, 2010*. U.S. Department of Commerce, NOAA Technical Memorandum NMFSAFSC-223. Anchorage, Alaska: National Marine Fisheries Service.

Easly-Appleyard, B., Pinney, L., Polasek, L., Prewitt, J. and T. McGuire. 2012. Alaska SeaLife Center Cook Inlet Beluga Whale Remote Monitoring Pilot Study May – August 2011. Final Report submitted to NMFS, 49p.

Ezer, T. 2011. Using inundation modeling and remote sensing data to study hydrodynamic and environmental impacts on the survival of Cook Inlet’s Beluga whales. Final Report for the period: 1-October, 2010 to 30-Deptember, 2011. Norfolk, Virginia: Report prepared under Project RFQ# NOAA_NMFS_AKR_10_0802_2G for National Oceanic & Atmospheric Administration by Center for Coastal Physical Oceanography, Old Dominion University.

Funk, D.W., T. M. Markowitz, and R. Rodrigues, eds. 2005. *Baseline studies of beluga whale habitat Use in Knik Arm, Upper Cook Inlet, Alaska, July 2004—July 2005*. Prepared for the Knik Arm Bridge and Toll Authority, Anchorage, AK, the Department of Transportation and Public Facilities, Anchorage, AK, and the Federal Highway Administration, Juneau, Alaska by LGL Alaska Research Associates, Inc., Anchorage, AK, in association with HDR Alaska, Inc., Anchorage, AK, Goetz, K.T., Rugh, D.J., Read, A.J., and Hobbs, R.C. 2007. Habitat use in a marine ecosystem: beluga whales, *Delphinapterus leucas*, in Cook Inlet, Alaska. *Marine Ecology Progress Series* 330:247-256.

Goetz, K. T., Montgomery, R. A., Ver Hoef, J. M., Hobbs, R. C. and D. S. Johnson. 2012. Identifying essential summer habitat of the endangered beluga whale, *Delphinapterus leucas*, in Cook Inlet, Alaska. *Endangered Species Research* 16:135-147.

Hobbs, R. C., C. L. Sims, and K. E. W Shelden. 2011. Estimated abundance of belugas in Cook Inlet, Alaska, from aerial surveys conducted in June 2011. Unpublished report. National Marine Fisheries Service, National Marine Mammals Laboratory.

Hobbs, R., C. Sims, K. Shelden, L. Vate Brattström, and D. Rugh. 2012. Annual calf indices for beluga whales (*Delphinapterus leucas*) in Cook Inlet, Alaska, 2006-2010. AFSC Processed Rep. 2012-05, 29 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115.

Harza-Ebasco Susitna Joint Venture (Harza-Ebasco). 1985. *Fish, wildlife, and botanical resources for the Susitna Hydroelectric Project. Exhibit E, Volume 9*. Prepared for the Alaska Power Authority by the Harza-Ebasco Susitna Joint Venture, Anchorage, Alaska.

Markowitz, T.M., and McGuire, T.L., eds. 2007. *Temporal-spatial distribution, movements and behavior of beluga whales near the Port of Anchorage, Alaska*. Prepared for Integrated Concepts and Research Corporation and the U.S. Department of Transportation Maritime Administration by LGL Alaska Research Associates, Inc., Anchorage, Alaska.

Markowitz, T.M., McGuire, T.L., and Savarese, D.M. 2007. *Monitoring beluga whale (*Delphinapterus leucas*) distribution and movements in Turnagain Arm along the Seward Highway*. Final report prepared for HDR and the Alaska Department of Transportation and Public Facilities by LGL Alaska Research Associates, Inc., Anchorage, Alaska.

McGuire, T.L., and Kaplan, C.C. 2009. *Photo-identification of beluga whales in Upper Cook Inlet, Alaska*. Final report of field activities in 2008. Prepared for National Fish and Wildlife Foundation, Chevron, and ConocoPhillips Alaska, Inc by LGL Alaska Research Associates, Inc., Anchorage, Alaska,

McGuire, T.L., M.K. Blees, and M.L. Bourdon. 2011a. *The development of a catalog of left-side digital images of individually-identified Cook Inlet beluga whales* Delphinapterus leucas. Final Report 910 prepared for the North Pacific Research Board .

—. 2011b. *Photo-identification of beluga whales in Upper Cook Inlet, Alaska*. Final report of field activities and belugas resighted in 2009. Prepared for National Fish and Wildlife Foundation, Chevron, and ConocoPhillips Alaska, Inc. by by LGL Alaska Research Associates, Inc., Anchorage, Alaska.

McGuire, T.L., Kaplan, C.C., and Blees, M.K. 2009. *Photo-identification of beluga whales in Upper Cook Inlet, Alaska*. Final report of belugas resighted in 2008. Prepared for National Fish and Wildlife Foundation, Chevron, and ConocoPhillips Alaska, Inc., by LGL Alaska Research Associates, Inc., Anchorage, Alaska, McGuire, T.L., Kaplan, C.C., Blees, M.K., and Link, M.R. 2008. *Photo-identification of beluga whales in Upper Cook Inlet, Alaska*. 2007 annual report. Prepared for Chevron, National Fish and Wildlife Foundation, and ConocoPhillips Alaska, Inc. by LGL Alaska Research Associates, Inc., Anchorage, Alaska.

Moore, S.E., K.E.W. Shelden, L.K. Litzky, B.A. Mahoney and D.J. Rugh. 2000. Beluga whale, (*Delphinapterus leucas*), habitat associations in Cook Inlet, Alaska. *Marine Fisheries Review* 62(3):60–80.

Nemeth, M.J., Kaplan, C.C., Prevel-Ramos, A.M., Wade, G.D., Savarese, D.M., and Lyons, C.D. 2007. *Baseline studies of marine fish and mammals in Upper Cook Inlet, April through October 2006*. Final report prepared for DRven Corporation by LGL Alaska Research Associates, Inc., Anchorage, Alaska.

National Marine Fisheries Service (NMFS). 2008. Endangered and threatened species: endangered status of the Cook Inlet beluga whale; Final Rule. *Federal Register* 73:62919-62930.

Prevel-Ramos, A.M., Markowitz, T.M., Funk, D.W., and Link, M.R. 2006. *Monitoring beluga whales at the Port of Anchorage: Pre-expansion observations, August–November, 2005*. Prepared for Integrated Concepts and Research Corporation, the Port of Anchorage, and the U.S. Department of Transportation Maritime Administration by LGL Alaska Research Associates, Inc., Anchorage, Alaska.

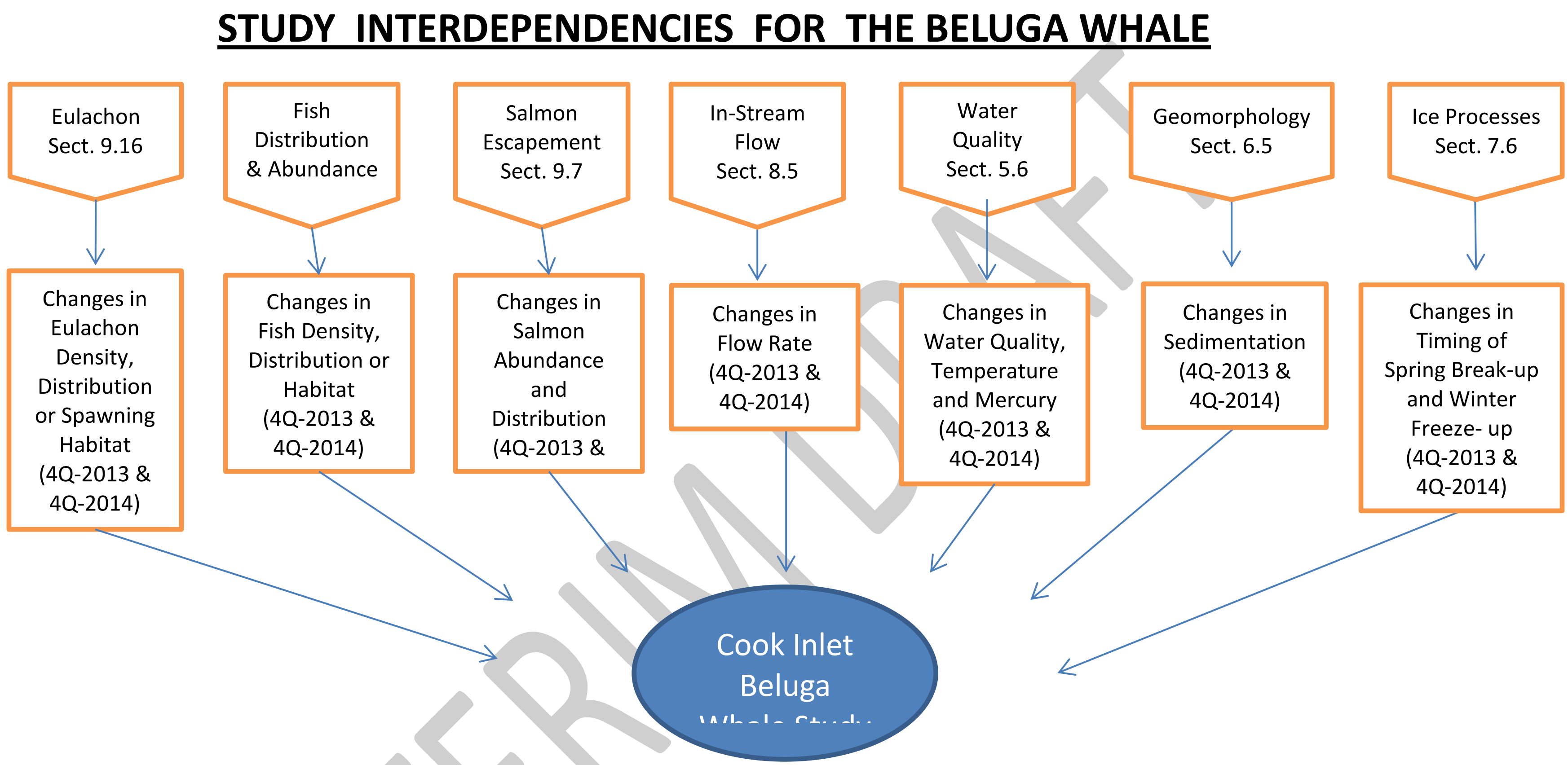

Figure 9.17-2. Beluga Whale Study Interdependencies.

9.17.9. Figures

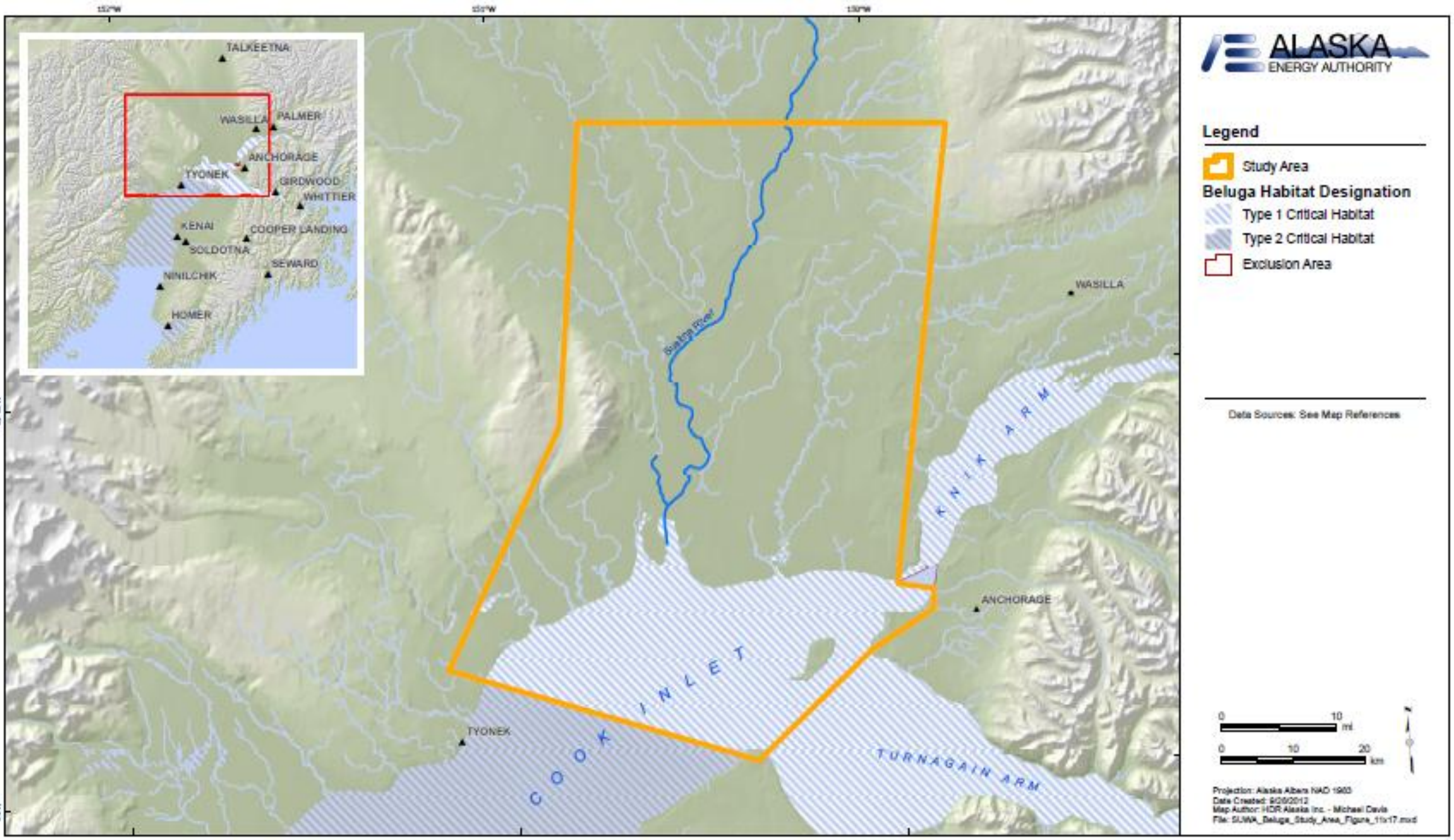

Figure 9.17-1. Study Area for Beluga Study

Table 9.17-1. Schedule for implementation of the Beluga Study.

Activity	2012				2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
Permit Applications			——	——	--------								
2013 Aerial Surveys						——	——	--------					
2013 Camera Surveys						——	——	--------					
2013 Initial Modeling Effort							——	--------					
Initial Study Report								---——	Δ				
2014 Aerial Surveys										——	——	--------	
2014 Camera Surveys										——	——	--------	
2014 Revised Modeling Effort											——	--------	
Updated Study Report												——	▲

Legend:

—— Planned Activity
----- Follow up activity (as needed)
Δ Initial Study Report (ILP due date 2-3-2014)
▲ Updated Study Report (ILP due date 2-2-2015)