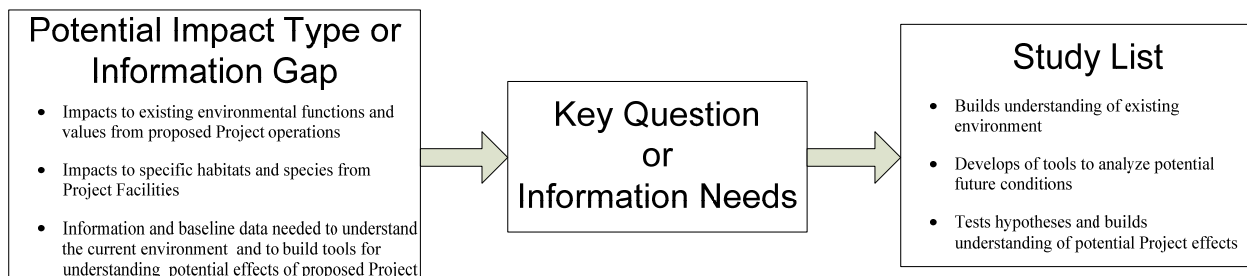


5 PRELIMINARY ISSUES AND STUDIES LIST

5.1. Introduction

Based on review of the existing information, field reconnaissance conducted in 2008 (as described in Section 4 of this PAD), and preliminary discussions with agencies, tribes, and other stakeholders, TDX has identified 18 potential impact types or information gaps that provide an organizing framework for the Chakachamna licensing studies. From this list, key questions or information needs are identified that will require a multi-disciplinary approach to reach an understanding of how the proposed Project may affect the areas resource values. Forty-three discreet studies have been identified that will form the basis for determining potential Project effects, as well as potential PMEs. In addition to these 43 studies, which will form the basis of two Proposed Study Plans (PSP-1 and PSP-2), TDX has also identified 7 engineering and feasibility studies that will proceed along a parallel track with the environmental studies, but which will not be part of the PSPs.



Proposed studies for each resource area are described briefly in this summary and the following subsections.

The lack of baseline environmental data for the Project area presents challenges for developing a base of knowledge sufficient to answer key questions about potential Project impacts. Therefore, a number of key questions and information needs are focused on developing basic information about the Project area. The lack of existing information also makes thorough analysis of potential effects difficult. TDX proposes that the formal study plan developed in support of the licensing process be conducted in two phases. Phase 1 study plan development will be initiated in 2009 and will generate essential data (e.g., hydrologic, imagery, bathymetry) in 2010 to design the balance of the environmental studies that will be initiated in 2011.

Appendix 5-1 presents an approach for developing the PSPs as part of the formal licensing process described in Section 2 of this PAD. TDX developed this appendix in response to stakeholder requests for an initial vision of how the study program will be approached and how key questions will be framed and answered. Appendix 5-1 presents the conceptual framework for study planning, outlines the study components and objectives for each of the 43

environmental studies identified to date, and describes in general terms the timeframe TDX is anticipating for the completion of the studies and for answering the identified key questions.

5.1.1. Potential Impact Types and Information Needs

A. Impacts to existing environmental functions and values from proposed Project operations

1. Impacts resulting from increased Chakachamna Lake water level fluctuation
2. Impacts resulting from reduced flows in the Chakachatna River
3. Impacts resulting from increased flows in the McArthur River
4. Impacts resulting from water temperature changes
5. Impacts resulting from tailrace outflow, such as false attraction of spawning salmon and dissolved gas saturation
6. Impacts resulting from the Chakachamna Lake intake structure
7. Impacts resulting from potential blockage of fish passage into and out of Chakachamna Lake via the Chakachatna River
8. Potential impacts to high profile species, special status species, or species with special designations (not limited to listed species)
9. Potential impacts to non-game fish protected under Alaska's Comprehensive Wildlife Conservation Strategy (CWCS) and other Species of Concern in the Project area
10. Potential impacts to federally designated Essential Fish Habitat (EFH)

B. Impacts to specific habitats and species from Project facilities

11. Potential impacts of roads and transmission lines
12. Potential impacts of port or barge landing facilities
13. Impacts resulting from general Project activity, including ground disturbance, that may be associated with pre-Project studies, construction, and operation (including post-construction activities)

C. Information and baseline data needed to understand the current environment and to build tools for understanding potential effects of the proposed Project

14. Establishment of a multi-year climatologic data record for the Project area and to understand long-term climatic trends

15. Establishment of a multi-year hydrologic and groundwater data record for Chakachamna Lake, the Chakachatna River, and the McArthur River
16. Establishment of a baseline water quality data record for which bodies of water?
17. Development of baseline mapping tools for fisheries and wildlife assessments
18. Description and associated engineering of proposed Project operations and facilities

5.1.2. Chakachamna Study List

A list of environmental and engineering studies that will need to be completed to inform the license application is provided below. Details on study objectives, approach, and general timeframe are provided in Appendix 5-1. The list is divided generally by resource area; however, the studies will be interdisciplinary to the extent necessary.

An additional category of studies that are primarily engineering in nature has also been provided. Of these engineering focused studies, several are likely to have resource implications and will therefore be included in the PSPs. Studies that have been identified as necessary for engineering and feasibility but which do not have a direct impact on environmental resources are also identified in this list, but have not been detailed in Appendix 5-1, and will not be part of the PSPs; these studies are denoted with an asterisk (*).

Geology, Soils and Climate

1. Glaciology and Geological Processes Study
2. Lake Shoreline Topography and Erosional Processes Study
3. Sediment Transport and Geomorphology Study
4. Meteorological/Climatological Study

Water Resources

5. Chakachamna Lake Bathymetry
6. Chakachamna Lake Fluid Dynamics Modeling
7. Chakachamna Lake Limnology Study
8. Stream Water Quality and Productivity Monitoring
9. Integrated Surface and Groundwater Hydrology Study

Fisheries and Aquatic Resources

10. Chakachamna Lake Juvenile Sockeye Salmon Studies
11. Chakachamna Lake Sockeye Salmon Abundance, Distribution, and Run Timing
12. Lake Trout Abundance, Distribution, and Life History in Chakachamna Lake
13. System-wide Resident and Rearing Fish Distribution and Abundance Study
14. System-wide Salmon Spawning Distribution Study
15. Fish Passage Structure Design Evaluation
16. Tailrace Attraction Risk Assessment
17. Entrainment Risk Assessment
18. Nitrogen Saturation/Total Dissolved Gas Risk Assessment
19. Stream Macroinvertebrate Study
20. Aquatic Habitat Modeling and Instream Flow Study
21. Intertidal and Sub-tidal Habitat Survey
22. Ramping Rate Study

Terrestrial Resources

23. Raptor Survey
24. Shorebird Survey
25. Passerine/Songbird Survey
26. Waterfowl/Waterbird Survey
27. Chakachamna Lake Breeding Waterbird Survey
28. Noxious Weeds/Invasive Plant Species Survey
29. Rare, Threatened, and Endangered (RTE) Plant Species Survey
30. Vegetation Mapping and Classification
31. Wetlands Mapping and Functional Assessment
32. Wildlife Survey and Habitat Use Mapping

33. Forestry Study

Cultural Resources

34. Subsistence and Cultural Uses Study

35. Historical and Archeological Resources Survey

Recreation Resources and Land Use

36. Recreational Use Assessment

37. Land Use Study

Visual and Aesthetic Resources

38. Aesthetic/Visual Resources Study

Socioeconomic Resources

39. Socioeconomics Survey

Engineering and Feasibility

40. Hazards Assessment Study

41. Construction Methods Impacts Study/ Best Management Practices

42. Reservoir Operations Modeling

a. Ramping Rates

b. Power Study Modeling*

43. Geotechnical Studies

a. Hydropower Facilities

b. Fish Passage Structures

44. Project Site Topography and Bathymetry*

45. Access Facilities (Lands, Roads, Bridges, Marina)*

46. Transmission Line Study*

47. Power Market Analysis and Economic Studies*

- 48. Project Cost and Schedule Updates*
- 49. Project Feature Optimization Study*

5.2. Phased Study Plan Development and Implementation

As described previously, TDX is proposing to phase development of the formal environmental study program into separate Proposed Study Plans (PSPs). The Phase 1 Proposed Study Plan (PSP-1) and the Phase 2 Proposed Study Plan (PSP-2) will be developed in 2009 and 2010, respectively.

The overall objective of studies included in PSP-1 will be to generate essential data (e.g., hydrologic, imagery, bathymetry) that may be required to advance Project design and provide background information required for the effective implementation of the balance of the environmental studies that will be planned in 2010 and implemented in 2011. Of the 43 identified environmental studies identified above, TDX anticipates that PSP-1 will describe about eight priority study programs plus one support task (imagery development):

- **Project Imagery Including Base Map Development and Area Topography:** While not listed as a formal study, this support element will be required for project planning; mapping study areas and habitats; and referencing data collected from all studies. It will also provide input to engineering planning.
- **Chakachamna Lake Bathymetry:** Delineation of the geometry and topographic details of the Chakachamna Lake basin are essential for input to the multidisciplinary fluid dynamics modeling study to be initiated in 2011 and also provides information required for assessment of fish passage issues related to lake tributaries. Additionally, accurate bathymetry is required to determine reservoir volumes needed for engineering analysis.
- **Chakachamna Lake Limnology Study:** Determination of baseline physical and biological characteristics of Chakachamna Lake, such as water temperature and turbidity profiles; current velocity and direction; and biological productivity, is essential for input to the fluid dynamics modeling study to be initiated in 2011 and also helps inform fisheries studies to be conducted concurrently.
- **Integrated Surface and Groundwater Hydrology Study:** A thorough understanding of water movements within the Project areas is essential for assessing several important issues including wetland maintenance and fish habitat maintenance. The information also will provide necessary input to the Aquatic Habitat Modeling/Instream Flow and Sediment Transport and Geomorphology Studies to be initiated in 2011. Because hydrological conditions vary from year to year, it is essential to begin the period of record as soon as possible

- **Chakachamna Lake Juvenile Sockeye Salmon Study:** A major Project issue concerns the provision of passage for juvenile salmon outmigrating from Chakachamna Lake. The timing of this outmigration has a direct bearing on the design of fish passage structures and, consequently, the information needs to be available early in the Project design process. Additional start-up urgency is suggested by the fact that study methods applicable to the challenging conditions at Chakachamna Lake may require significant development time.
- **Chakachamna Lake Sockeye Salmon Abundance and Run Timing:** The extent to which sockeye salmon use Chakachamna Lake and its tributaries is an important Project consideration, and the timing of the adult salmon migration is important for the design of fish passage structures and operations planning. Monitoring salmon entering Chakachamna Lake will involve the use of complex bioacoustic techniques which will require substantial time to setup and troubleshoot. The overall effort will require multiple years of data.
- **System-wide Salmon Spawning Distribution:** Information regarding the distribution of salmon within the Chakachamna and McArthur River systems is essential for assessing Project impacts and is needed for input to the Aquatic Habitat Modeling/Instream Flow Study effort to begin in 2011. This complex study should start as soon as possible to begin the period of record and allow time for the development of techniques to capture and track salmon within the extensive study area.
- **Raptor Survey:** Surveys to locate nesting raptors (and other specially designated bird species) will be required prior to potential disturbance such as helicopter overflights, and, therefore will be need to be conducted before initiation of other study programs.
- **Wetlands Mapping and Functional Assessment – Hydric Soils Indicators in Ash-Derived Soils Component:** An interdisciplinary effort with the Integrated Surface and Groundwater Hydrology Study, this soils study is required to accurately identify, map, and describe the functions of wetlands in the project area, and, therefore, is required prior to initiation of the 2011 wetlands mapping effort.

PSP-2 will describe the balance of the environmental study program, including plans for continuing some of the PSP-1 studies as appropriate to complete Project objectives. The PSP-1 study list may be modified prior to plan submittal to accommodate Project needs and stakeholder concerns

5.3. Geology and Soils

5.3.1. Identification of Issues and Study Needs

Based on meetings with stakeholders, correspondence from federal and state agencies, and review of relevant literature, TDX Power has identified the following geology and soils resource

issues and study needs. The issues are grouped by category. The studies needed to assess each issue are listed with the issue. Additionally, this section is further subdivided into issues and studies that address potential resource impacts and issues and studies that are necessary from an engineering and feasibility perspective. Information collected by the proposed studies will be used to describe the existing environment, assess potential impacts, and provide essential information that will help to avoid or mitigate Project impacts.

5.3.2. Issues and Studies Related to Potential Project Impacts

As described in Section 4.3.7, the following potential project impacts on geology and soils of the project area have been identified:

Impacts resulting from increased Chakachamna Lake water level fluctuation

- Possible down-cutting of channel between Kenibuna and Chakachamna Lakes and subsequent lowering of Kenibuna Lake levels as a result of Project operations.
Study: Sediment Transport and Geomorphology Study
- Possible down-cutting of fluvial fan at outlet of Naglishlamina River as a result of Project operations.
Study: Sediment Transport and Geomorphology Study
- Possible down-cutting of fluvial fan at outlet of Chilligan River as a result of Project operations.
Study: Sediment Transport and Geomorphology Study
- Impact of periods of lake drawdown on the erosive effects Chakachatna River on the Barrier Glacier; potential for increased likelihood of outburst floods.
Study: Glaciology and Geological Processes Study
- Potential for flooding of terminus of Barrier Glacier and impact on rate of disintegration of glacier.
Study: Glaciology and Geological Processes Study
- Potential impacts of Project operations on sediment transport and deposition in Kenibuna Lake and associated impacts on the Neacola River, Igitna River, and Another River deltas.
Study: Sediment Transport and Geomorphology Study
- Impact of lake level fluctuations on shoreline erosion.
Study: Chakachamna Lake Shoreline Erosion Study

Impacts resulting from reduced flows on the Chakachatna River

- Impact on stream morphology and channel maintenance, especially in the intertidal wetland area.

Studies:

- Sediment Transport and Geomorphology Study
- Aquatic Habitat Modeling and Instream Flow Study

Impacts resulting from increased flows on the McArthur River

- Impact on stream morphology and channel maintenance, especially in the intertidal wetland area.

Studies:

- Integrated Surface and Groundwater Study
- Sediment Transport and Geomorphology Study
- Aquatic Habitat Modeling and Instream Flow Study
- Potential for project operations to contribute to erosion in the McArthur River.
Study: Sediment Transport and Geomorphology Study
- Potential impact of increased flows on terminus of the Blockade Glacier.
Study: Glaciology and Geological Processes Study

Potential impacts of roads and transmission lines

- Potential contribution of road and transmission line construction to erosion in the Project area

Study:

- Sediment Transport and Geomorphology Study
- Lands, Roads, Bridges, and Transmission Line Study
- Construction Methods Impacts Study / Best Management Practices
- Potential contribution of road and transmission line operation to erosion in the Project area
Studies:
 - Erosion Study
 - Lands, Roads, Bridges, and Transmission Line Study

5.3.3. Studies Related to Engineering, Hazard Assessment, and Feasibility

- Construction related impacts – deposition of tunnel excavation material
Study: Construction Methods Impacts Study / Best Management Practices
- Hazard assessment of glacier damming of the Nagishlamina River Valley and potential for outburst floods that influence conditions at the outlet from Chakachamna Lake
Study: Glaciology and Geological Processes Study
- Potential changes in the mass balance of the Glaciers and resulting influence on the hydrologic balance of the lake-river system.
Studies:

- Glaciology and Geological Processes Study
- Meteorological/Climatological Study
- Potential for flooding of the Chakachatna River Valley as a result of the melting of glacier ice on Mt. Spurr during an eruption and potential impacts on Project facilities
 - Studies:
 - Glaciology and Geological Processes Study
 - Hazards Assessment
- Hazards associated with accelerating the retreat of Barrier Glacier due to the flow of hot volcanic debris onto the glacier.
 - Studies:
 - Glaciology and Geological Processes Study
 - Hazards Assessment Study
- Need for updated (or additional) seismicity studies
 - Study: Hazards Assessment Study, to include:
 - Identification (or creation) of an updated seism-tectonic model for the area;
 - Review and selection of attenuation relationships
 - Establishment of return functions and maximum magnitudes of each zone or specific feature contributing to the hazards
 - A probabilistic analysis
 - Deterministic analysis as appropriate
 - Selection of the seismic hazard and response spectra
- Optimization of powerhouse location, based on power production models and economic consideration of potentially higher costs for excavations associated with potentially poorer quality rock.
 - Study: Construction Methods Impacts Study / Best Management Practices

5.3.4. Relevant Plans

No relevant resource management plans have been identified relating to soils and geology.

5.4. Water Resources

5.4.1. Identification of Issues and Study Needs

Based on meetings with stakeholders, correspondence from federal and state agencies, and its consultants TDX Power has identified the following water resource issues and study needs. The issues are grouped by category. The studies needed to assess each issue are listed with the issue. Information collected by the proposed studies will be used to describe the existing environment,

assess potential impacts, and provide essential information that will help to avoid or mitigate Project impacts.

Studies needed to establish a Multi-Year Climatologic Data Record for the Study Area

- Establish a record of both short-term and seasonal recordings of air temperature and precipitation.
Study: Meteorological / Climatological Study
- Examine potential interaction between long term climatic change and total and seasonal water availability for hydropower generation
Studies:
 - Meteorological / Climatological Study
 - Glaciology and Geological Processes Study

Establishment of a Multi-Year Climatologic Data Record for the Study Area and to understand long-term climatic trends

- Establish a record of both short-term and seasonal fluctuations in surface water flows and levels and water temperature and pressures.
Study: Integrated Surface and Groundwater Hydrology Study
- Establish a record of both short-term and seasonal fluctuations in groundwater elevations to determine flow paths throughout the study area.
Study: Integrated Surface and Groundwater Hydrology Study
- Investigate how much water is draining off hill slopes adjacent to river systems downstream of Chakachamna Lake.
Study: Integrated Surface and Groundwater Hydrology Study

Studies needed to establish a baseline water quality data record

- Establish a record of both short-term and seasonal fluctuations in water quality data (including dissolved oxygen, conductivity, turbidity, and pH) in Chakachamna Lake, and the Chakachatna and McArthur rivers, particularly in support of fisheries habitat data collection.
Studies:
 - Chakachamna Lake Limnology Study
 - Stream Water Quality and Productivity Monitoring

Impacts resulting from reduced flows on the Chakachatna River

- Delineation of flow paths and quantification of water discharge between the outlet of Chakachamna Lake and the confluence with the McArthur River to provide insight into flow distribution between Chakachamna River and Noaukta Slough, downstream distributaries of the river, and adjacent wetland complexes.
Studies:
 - Integrated Surface and Groundwater Study:
 - A planning task to identify and integrate the needs of wetlands, fisheries, and instream flow studies and create a strategic plan for monitoring.
 - A monitoring task to install continuously-recording groundwater and surface water stations in selected areas identified in the planning task.
 - A mapping and reconnaissance-level field task to identify surface and groundwater features and large-scale trends where continuous gaging may not be feasible or necessary.
 - A modeling task to describe probable water movements.
 - Aquatic Habitat Modeling and Instream Flow Study
- Changes in hydrology may affect traditional subsistence use of the Chakachamna River and riparian habitats.
Study: Subsistence and Cultural Use / Traditional Cultural Properties Study

Impacts resulting from increased flows on the McArthur River

- Delineation of flow paths and quantifying water discharge between the proposed powerhouse tailrace location on the McArthur River and the confluence with Cook Inlet to provide insight into flow distribution between McArthur River and Noaukta Slough tributaries, downstream distributaries of the river, and adjacent wetland complexes.
Studies:
 - Integrated Surface and Groundwater Study:
 - A planning task to identify and integrate the needs of wetlands, fisheries, and instream flow studies and create a strategic plan for 2010 monitoring.
 - A monitoring task to install continuously-recording groundwater and surface water stations in selected areas identified in the planning task.
 - A mapping and reconnaissance-level field task to identify surface and groundwater features and large-scale trends where continuous gaging may not be feasible or necessary.
 - A modeling task to describe probable water movements.
 - Aquatic Habitat Modeling and Instream Flow Study
- Changes in hydrology may affect traditional subsistence use of the McArthur River and riparian habitats.
Study: Subsistence and Cultural Use / Traditional Cultural Properties Study

5.4.2. Relevant Plans

The following resource management plans and directives provide guidance and direction for protection of water resources:

- ADF&G. 2007. Aquatic Resources Implementation Plan for Alaska's Comprehensive Wildlife Conservation Strategy, September 2006. Alaska Dept. of Fish and Game, Div. of Sport Fish.
- ADF&G. 1994. Trading Bay State Game Refuge and Redoubt Bay Critical Habitat Area Management Plan. Prepared by Divisions of Habitat and Restoration and Wildlife Conservation.
- ADF&G. 2006. Our Wealth Maintained: A Strategy For Conserving Alaska's Diverse Wildlife And Fish Resources. Alaska Department of Fish and Game, Juneau, Alaska. xviii+824 pp.
- Kenai Peninsula Borough (KPB). 2005. 2005 Kenai Peninsula Borough Comprehensive Plan. KPB Planning Department. Soldotna, Alaska.
- Kenai Peninsula Borough Coastal Management Program and LaRoche and Associates. 2008. Kenai Peninsula Borough Coastal Zone Management Plan. Kenai Peninsula Borough. Soldotna, Alaska.
- NPS (Lake Clark National Park). 2004. Strategic Plan for Lake Clark National Park and Preserve October 1, 2004 - September 30, 2008.

5.5. Fish and Aquatic Resources

5.5.1. Identification of Issues and Study Needs

Based on meetings with stakeholders, correspondence from federal and state resource agencies, and its consultants TDX Power has identified the following fish and aquatic issues and study needs . The issues are grouped by category. The studies needed to assess each issue are listed with the issue. Information collected by the proposed studies will be used to describe the existing environment, assess potential impacts, and provide essential information that will help to avoid or mitigate Project impacts.

Potential impacts to Non-Game fish protected under Alaska's Comprehensive Wildlife Conservation Strategy (CWCS) and other Species of Concern in the Project area

- Assess potential Project impacts to protected Non- Game Fish
Studies:
 - System-wide Resident and Rearing Fish Distribution and Abundance
 - Intertidal and Subtidal Habitat Survey

- Assess potential Project impacts on other non-game species, including sand lance and lampreys

Studies:

- System-wide Resident and Rearing Fish Distribution and Abundance
- Intertidal and Subtidal Habitat Survey

Potential impacts to federally designated Essential Fish Habitat (EFH)

- Identify the limits and extent of the EFH for the above anadromous and marine fish species and refine as detailed studies progress through the licensing process

Studies:

- System-wide Salmon Spawning Distribution
- Chakachamna Lake Bathymetry
- Chakachamna Lake Sockeye Salmon Abundance, Distribution, and Run Timing
- Chakachamna Lake Juvenile Sockeye Salmon Studies
- System-wide Resident And Rearing Fish Distribution and Abundance
- Intertidal and Subtidal Habitat Survey

Impacts resulting from increased Chakachamna Lake water level fluctuation

- Assess accessibility of Chakachamna and Kenibuna Lake tributary streams to sockeye salmon and other species from Chakachamna Lake when water levels are low.

Studies:

- Chakachamna Lake Sockeye Salmon Abundance, Distribution, and Run Timing
- Chakachamna Lake Juvenile Sockeye Salmon Studies
- System-wide Resident and Rearing Fish Distribution and Abundance
- Chakachamna Lake Bathymetry
- Lake Shoreline Topography and Erosional Processes
- Ramping Rate Study

- Assess potential for down-cutting of channel between Kenibuna and Chakachamna lakes and subsequent lowering of Kenibuna Lake levels.

Study: Lake Shoreline Topography and Erosional Processes

- Assess potential for flooding of spawning and incubation habitats in lower reaches of Chakachamna Lake tributary streams when lake water level is high.

Studies:

- System-wide Salmon Spawning Distribution
- Lake Trout Abundance, Distribution, and Life History in Chakachamna Lake
- Chakachamna Lake Bathymetry
- Lake Shoreline Topography and Erosional Processes

- Assess potential for loss of spawning and incubation habitat value for lake spawning sockeye salmon and lake trout in Chakachamna Lake due to lake level fluctuation.

Studies:

- Chakachamna Lake Sockeye Salmon Abundance, Distribution, and Run Timing
- Lake Trout Abundance, Distribution, and Life History in Chakachamna Lake
- Chakachamna Lake Bathymetry
- Assess potential for loss of sockeye salmon rearing habitat value in Chakachamna Lake due to fluctuating water levels, including effects of fluctuations on fish food organisms.
Studies:
 - Chakachamna Lake Juvenile Sockeye Salmon Studies
 - Chakachamna Lake Bathymetry
 - Chakachamna Lake Limnology Study
- Assess potential for impacts on fish resources in Lake Clark National Park, from possible fluctuations in Kenibuna Lake levels as they might affect lake and tributary stream productivity and access to fish.
Studies:
 - System-wide Salmon Spawning Distribution
 - Chakachamna Lake Sockeye Salmon Abundance, Distribution, and Run Timing
 - Chakachamna Lake Bathymetry
 - Lake Shoreline Topography and Erosional Processes
 - Chakachamna Lake Limnology Study
- Assess potential impacts on productivity in Chakachamna Lake and tributaries (including Kenibuna Lake) as result of Project operations
Studies:
 - Operations Modeling
 - Chakachamna Lake Limnology Study

Impacts resulting from Chakachamna Lake intake structure

- Entrainment of fish, primarily juvenile sockeye salmon, in the intake and subsequent mortality.
Studies:
 - Chakachamna Lake Juvenile Sockeye Salmon Studies
 - Lake Trout Abundance, Distribution, and Life History in Chakachamna Lake
 - System-wide Resident and Rearing Fish Distribution and Abundance
 - Chakachamna Lake Bathymetry
 - Chakachamna Lake Limnology Study
 - Chakachamna Lake Fluid Dynamics Modeling
 - Entrainment Risk Assessment
- Effect of deep water intake on lake currents, water temperature, turbidity, and other water quality parameters.
Studies:
 - Chakachamna Lake Fluid Dynamics Modeling
 - Chakachamna Lake Limnology Study

Impacts resulting from potential blockage of fish passage into and out of Chakachamna Lake via the Chakachatna River

- Potential for upstream passage barriers to spawning areas because of structures at the lake outlet or impassable river flows.

Studies:

- System-wide Salmon Spawning Distribution
- Chakachamna Lake Sockeye Salmon Abundance, Distribution, and Run Timing
- Integrated Surface and Groundwater Study
- Operations Modeling
- Chakachamna Lake Bathymetry
- Aquatic habitat Modeling and Instream Flow Study

- Risk of Chakachamna Lake levels being too low to allow upstream passage of sockeye salmon via the natural Chakachatna River channel during dry years.

Studies:

- Chakachamna Lake Sockeye Salmon Abundance, Distribution, and Run Timing
- Integrated Surface and Groundwater Study
- Operations Modeling
- Chakachamna Lake Bathymetry
- Aquatic habitat Modeling and Instream Flow Study
- Meteorological/Climatological Study

- Potential blockage of out-migrating juvenile sockeye salmon.

Studies:

- Integrated Surface and Groundwater Study
- Chakachamna Lake Juvenile Sockeye Salmon Studies
- Operations Modeling
- Chakachamna Lake Bathymetry

- Potential blockage of up- and downstream migrating resident fish species.

Studies:

- Integrated Surface and Groundwater Study
- Operations Modeling
- Chakachamna Lake Bathymetry
- Aquatic habitat Modeling and Instream Flow Study
- System-wide Resident And Rearing Fish Distribution and Abundance

- Effectiveness of various alternative fish passage structure options to provide passage at varying lake levels.

Study: Evaluation of design options.

- Changes in distribution and/or numbers of fish may affect subsistence use.

Study: Subsistence and Cultural Use / Traditional Cultural Properties Study

Studies needed to assess Project impacts as a result of reduced flows in the Chakachatna River

- Potential project impacts on invertebrates/Ephemeroptera, Plecoptera, Trichoptera (EPT) species as an indicator of water quality
Studies:
 - Stream Macroinvertebrate Study
 - Stream Water Quality and Productivity Monitoring
- Fish habitat value in the river mainstem, pre-project vs. post-project; Optimization of instream flows relative to habitat suitability for key fish species and life history stages.
Studies:
 - Integrated Surface and Groundwater Study
 - Aquatic habitat Modeling and Instream Flow Study
 - System-wide Salmon Spawning Distribution
 - System-wide Resident And Rearing Fish Distribution and Abundance
 - Ramping Rate Study
- Impact on near-surface ground water upwelling in fish use zones, especially in sloughs and side channels.
Studies:
 - Integrated Surface and Groundwater Study
 - Aquatic habitat Modeling and Instream Flow Study
- Impact on flow, hydrology, and fish use of Noaukta Slough.
Studies:
 - Integrated Surface and Groundwater Study
 - Aquatic habitat Modeling and Instream Flow Study
 - System-wide Salmon Spawning Distribution
 - System-wide Resident And Rearing Fish Distribution and Abundance
 - Ramping Rate Study
- Impact on stream morphology and channel maintenance
Studies:
 - Integrated Surface and Groundwater Study
 - Sediment Transport and Geomorphology Study
 - Aquatic habitat Modeling and Instream Flow Study
 - Vegetation Mapping and Classification
- Impact on wetland, intertidal, and off-channel fish habitats.
Studies:
 - Integrated Surface and Groundwater Study
 - Sediment Transport and Geomorphology Study
 - Aquatic habitat Modeling and Instream Flow Study
 - Vegetation Mapping and Classification
 - System-wide Salmon Spawning Distribution

- System-wide Resident And Rearing Fish Distribution and Abundance
- Changes in distribution and/or numbers of fish may affect subsistence use.
Study: Subsistence and Cultural Use / Traditional Cultural Properties Study.

Impacts resulting from increased flows on the McArthur River

- Potential project impacts on invertebrates/Ephemeroptera, Plecoptera, Trichoptera (EPT) species as an indicator of water quality
Studies:
 - Stream Macroinvertebrate Study
 - Stream Water Quality and Productivity Monitoring
- Potential impacts to fish habitat value in the river mainstem, pre-project vs. post-project; Increased winter flows may impact biota that has adapted to base flow regimes
Studies:
 - Integrated Surface and Groundwater Study
 - Aquatic habitat Modeling and Instream Flow Study
 - System-wide Salmon Spawning Distribution
 - System-wide Resident And Rearing Fish Distribution and Abundance
 - Ramping Rate Study
- Impact of increased flows on near-surface ground water upwelling in fish use zones, especially in sloughs and side channels.
Studies:
 - Integrated Surface and Groundwater Study
 - Aquatic habitat Modeling and Instream Flow Study
 - System-wide Salmon Spawning Distribution
 - System-wide Resident And Rearing Fish Distribution and Abundance
- Impact of increased McArthur River flow on flow, hydrology, and fish use of Noaukta Slough and surrounding wetlands.
Studies:
 - Integrated Surface and Groundwater Study
 - Aquatic habitat Modeling and Instream Flow Study
 - System-wide Salmon Spawning Distribution
 - System-wide Resident And Rearing Fish Distribution and Abundance
- Impact on stream morphology and channel configuration downstream from the tailrace;
Studies:
 - Integrated Surface and Groundwater Study
 - Sediment Transport and Geomorphology Study
 - Aquatic habitat Modeling and Instream Flow Study
 - Vegetation Classification/Wildlife Use Mapping
- Impact on wetland, intertidal, and off-channel fish habitats.
Studies:

- Integrated Surface and Groundwater Study
- Sediment Transport and Geomorphology Study
- Aquatic habitat Modeling and Instream Flow Study
- Vegetation Classification/Wildlife Use Mapping
- Ramping Rate Study
- Changes in distribution and/or numbers of fish may affect subsistence use.
Study: Subsistence and Cultural Use / Traditional Cultural Properties Study

Impacts resulting from water temperature changes

- Assess Chakachamna and McArthur River, Noaukta Slough, and Chakachamna Lake water temperatures and model post-project changes.

Studies:

- Stream Water Quality and Productivity Monitoring
- Operations Modeling
- Aquatic habitat Modeling and Instream Flow Study
- Impact of water temperature changes on salmon spawning success including initial attraction to the spawning area, timing of spawning, length of incubation.

Studies:

- Stream Water Quality and Productivity Monitoring
- Aquatic habitat Modeling and Instream Flow Study
- System-wide Salmon Spawning Distribution
- Impact on timing and success of spawning for rainbow trout.

Studies:

- Stream Water Quality and Productivity Monitoring
- Aquatic habitat Modeling and Instream Flow Study
- System-wide Resident And Rearing Fish Distribution and Abundance

Impacts resulting from tailrace outflow

- Impacts to water chemistry, productivity, and turbidity

Studies:

- Chakachamna Lake Limnology Study
- Stream Water Quality and Productivity Monitoring
- Sediment Transport and Geomorphology Study

- Potential for false attraction of Chakachamna Lake tributary sockeyes to the McArthur River tailrace

Studies:

- Operations Modeling
- Chakachamna Lake Sockeye Salmon Abundance, Distribution, and Run Timing
- Tailrace Attraction Risk Assessment Study

- Potential for false attraction of Chakachatna River salmon spawners to the McArthur River tailrace.
Studies:
 - Operations Modeling
 - System-wide Salmon Spawning Distribution
 - Tailrace Attraction Risk Assessment Study
- Impact of delay of spawning.
Studies:
 - Chakachamna Lake Sockeye Salmon Abundance, Distribution, and Run Timing
 - System-wide Salmon Spawning Distribution
 - Tailrace Attraction Risk Assessment Study
- Potential for nitrogen gas saturation and impacts on fish resources
Studies:
 - System-wide Resident And Rearing Fish Distribution and Abundance
 - System-wide Salmon Spawning Distribution
 - Nitrogen Saturation/Total Dissolved Gas Risk Assessment

Studies Related to Power Tunnel Construction

- Loss of aquatic habitat due to disposal of rock spoil into drainage ways.
Study: Construction Methods Impacts Study/Best Management Practices
- Water quality problems associated with spoil disposal sites.
Studies:
 - Glaciology and Geological Processes Study
 - Construction Methods Impacts Study/Best Management Practices

Studies needed to plan roads and transmission lines

- Fish passage and habitat maintenance at roadway and construction pad drainage structures.
Studies:
 - Roads, Bridges, and Transmission Line Study
- Increased access and fishing pressure on area streams.
Study: Recreational Use Assessment

Potential impacts of port or barge landing facilities

- Assessment of direct impact to intertidal and subtidal organisms from filling and in-water structures
Studies:

- Intertidal and Sub-tidal Survey
- Construction Methods Impacts Study/Best Management Practices
- Obstruction of fish movements along the Cook Inlet shoreline.
Studies:
 - Intertidal and Sub-tidal Survey
 - Construction Methods Impacts Study/Best Management Practices

5.5.2. Relevant Plans

- The following resource management plans and directives provide guidance and direction for protection of fish resources and aquatic habitats:
- ADF&G. 2007. Aquatic Resources Implementation Plan for Alaska's Comprehensive Wildlife Conservation Strategy, September 2006. Alaska Dept. of Fish and Game, Div. of Sport Fish.
- ADF&G. 1994. Trading Bay State Game Refuge and Redoubt Bay Critical Habitat Area Management Plan. Prepared by Divisions of Habitat and Restoration and Wildlife Conservation.
- ADF&G. 2006. Our Wealth Maintained: A Strategy For Conserving Alaska's Diverse Wildlife And Fish Resources. Alaska Department of Fish and Game, Juneau, Alaska. xviii+824 pp.
- Kenai Peninsula Borough (KPB). 2005. 2005 Kenai Peninsula Borough Comprehensive Plan. KPB Planning Department. Soldotna, Alaska.
- Kenai Peninsula Borough Coastal Management Program. 2008. Kenai Peninsula Borough Coastal Zone Management Plan. Kenai Peninsula Borough. Soldotna, Alaska.
- NPS (Lake Clark National Park). 2004. Strategic Plan for Lake Clark National Park and Preserve October 1, 2004 - September 30, 2008.
- USFWS. 2008. U. S. Fish and Wildlife Service website: Endangered and Threatened Species.

5.6. Wildlife and Botanical Resources

5.6.1. Identification of Issues and Study Need

Based on meetings with stakeholders, correspondence from federal and state agencies, and review of relevant literature TDX Power has identified the following wildlife resource issues and study needs . The issues are grouped by category. The studies needed to assess each issue are listed with the issue. Information collected by the proposed studies will be used to describe the existing environment, assess potential impacts, and provide essential information that will help to avoid or mitigate Project impacts.

5.6.1.1. Wildlife Resources

Development of baseline mapping tools for fisheries and wildlife assessments

- Need comprehensive habitat mapping for fisheries and wildlife assessments.

Studies:

- Vegetation Mapping and Classification
- Wetlands Mapping and Functional Assessment

Potential impacts to high profile species, special status species, or species with special designation

- Need for basic population assessment and monitoring of avian species in project area; potential for disturbance (e.g. from helicopter overflights) of wildlife species during critical life stages.

Studies:

- Waterfowl/Waterbird Survey
- Shorebird Survey
- Raptor Survey
- Passerine/Songbird Survey

Impacts resulting from general project activity, including ground disturbance, that may be associated with pre-project studies, construction and operation

- Potential for general disturbance (e.g. from helicopter overflights) of wildlife species during critical life stages.

Studies:

- Waterfowl/Waterbird Survey
- Shorebird Survey
- Raptor Survey
- Passerine/Songbird Survey
- Wildlife Survey and Habitat Use Mapping

- Potential impact of Project on bird populations of Trading Bay State Game Refuge.

Studies:

- Integrated Surface and Groundwater Hydrology Study
- Wetlands Mapping and Functional Assessment
- Waterfowl/Waterbird Survey
- Shorebird Survey
- Raptor Survey
- Passerine/Songbird Survey

Impacts resulting from increased Chakachamna Lake water level fluctuation

- Potential for loss of, or increase in, shoreline habitats used by wildlife species due to lake level fluctuations; resulting effects on wildlife populations.

Studies:

- Wildlife Survey and Habitat Use Mapping
- Chakachamna Lake Breeding Waterbird Survey
- Waterfowl/Waterbird Survey
- Shorebird Survey
- Passerine/Songbird Survey
- Wetland Mapping and Functional Assessment
- Vegetation Mapping and Classification
- Chakachamna Lake Bathymetry
- Shoreline Topography and Erosion Study

- Changes in distribution and/or number of fish consumed by wildlife species.

Studies:

- Waterfowl/Waterbird Survey
- Shorebird Survey
- Raptor Survey
- Wildlife Survey and Habitat Use Mapping

- Changes in breeding and rearing habitat and nesting success of waterbirds using Chakachamna lake.

Studies:

- Chakachamna Lake Breeding Waterbird Survey
- Waterfowl/Waterbird Survey
- Vegetation Mapping and Classification
- Wetland Mapping and Functional Assessment
- Shoreline Topography and Erosion Study

Impacts resulting from reduced flows on the Chakachatna River

- Loss or increase in riparian habitats used by wildlife species due to hydrologic changes; resulting effects on wildlife populations (e.g., effects of loss of high flows in Chakachatna River on early successional riparian habitat for beavers, moose, passerines)

Studies:

- Integrated Surface and Groundwater Hydrology Study
- Sediment Transport and Geomorphology Study
- Wetland Mapping and Functional Assessment
- Vegetation Mapping and Classification
- Wildlife Survey and Habitat Use Mapping

- Assess significance of wetland areas for spring and fall staging of migratory birds; assess potential for project impacts to change habitat functions and values

Studies:

- Integrated Surface and Groundwater Hydrology Study
- Sediment Transport and Geomorphology Study
- Wetland Mapping and Functional Assessment
- Vegetation Mapping and Classification
- Waterfowl/Waterbird Survey
- Shorebird Survey
- Assess potential for impacts due to changes in distribution and/or number of fish used by wildlife species.
Studies:
 - Wildlife Survey and Habitat Use Mapping
 - Waterfowl/Waterbird Survey
 - Raptor Survey
 - Instream Flow Incremental Method (IFIM) Study

Impacts resulting from increased flows on the McArthur River

- Loss or increase in riparian habitats used by wildlife species due to hydrologic changes; resulting effects on wildlife populations (e.g., effects of loss of high flows in McArthur River on early successional riparian habitat for beavers, moose, passerines)
Studies:
 - Integrated Surface and Groundwater Hydrology Study
 - Sediment Transport and Geomorphology Study
 - Wetland Mapping and Functional Assessment
 - Vegetation Mapping and Classification
 - Wildlife Survey and Habitat Use Mapping
 - Waterfowl/Waterbird Survey
 - Shorebird Survey
 - Passerine/Songbird Survey
- Assess significance of wetland areas for spring and fall staging of migratory bird; assess potential for project impacts to change habitat functions and values.
Studies:
 - Integrated Surface and Groundwater Hydrology Study
 - Wetland Mapping and Functional Assessment
 - Vegetation Mapping and Classification
 - Waterfowl/Waterbird Survey
 - Shorebird Survey
- Assess potential changes in distribution and/or number of fish used by wildlife species.
Studies:
 - Wildlife Survey and Habitat Use Mapping
 - Waterfowl/Waterbird Survey
 - Raptor Survey
 - Instream Flow Incremental Method (IFIM) Study

Studies needed for Project engineering, hazard assessment, and feasibility

- Loss of important wildlife habitat due to disposal of rock spoil.

Studies:

- Wildlife Surveys and Habitat Use Mapping
- Passerine/Songbird Survey
- Construction Method Impact Study

Studies needed to plan and understand effects of roads and transmission lines

- Disturbance to wildlife populations due to initial habitat disturbance and subsequent corridor maintenance.

Studies:

- Lands, Roads, and Bridges Study
- Noxious Weeds/Invasive Species Study
- Waterfowl/Waterbird Survey
- Shorebird Survey
- Passerine/Songbird Survey
- Raptor Survey
- Wildlife Survey and Habitat Use Mapping

- Potential for bird deaths (particularly bald eagles) because of electrocution or collisions with transmission lines.

Studies:

- Raptor Survey
- Waterfowl/Waterbird Survey
- Shorebird Survey

Potential impacts of port or barge landing facilities

- Disturbance to marine fauna due to construction.

Studies:

- Intertidal and Sub-tidal Habitat Survey
- Construction Methods Impacts Study

- Disturbance of underwater areas that could be designated as “critical habitat” for the newly listed Cook Inlet beluga whale population.

Studies:

- Track designation of “critical habitat”, due October 2009.

5.6.1.2. Botanical Resources

Studies to assess general project activity, including ground disturbance, which may be associated with pre-project studies, construction and operation

- Potential for disturbance to important commercial plant species: white spruce exists on Tyonek Native Corporation lands in the Project area, mainly south of the Chakachatna River and north of the Trading Bay State Game Refuge.

Studies:

- Vegetation Mapping and Classification
 - Forestry Study
 - Construction Methods Impacts Study
- Potential for disturbance to plants of cultural importance because of their value for subsistence:

Studies:

- Vegetation Mapping and Classification
 - Construction Methods Impacts Study
 - Subsistence and Cultural Use / Traditional Cultural Properties Study
- Need to assess impacts to rare plant species tracked by the Alaska Natural Heritage Program (AKNHP).

Studies:

- Vegetation Mapping and Classification
 - Rare, Threatened, and Endangered (RTE) Plant Species Survey
 - Construction Methods Impacts Study
- Assessment of noxious weeds and susceptibility of Project area to invasive species

Studies

- Vegetation Mapping and Classification
- Noxious Weeds/Invasive Plant Species Survey
- Construction Methods Impacts Study

Studies needed to plan and understand effects of roads and transmission lines

- Construction and maintenance impacts on vegetation and wetlands, including potential for introducing noxious weeds and invasive species

Studies:

- Vegetation Mapping and Classification
- Wetlands Mapping and Functional Assessment
- Construction Methods Impact Study

- Increased recreational pressure for hunting, fishing, and backcountry activities (hiking and rafting) due to increased access with potential impacts to rare plants, if present, and wetlands.

Studies: Recreational Use Assessment

Potential impacts of port or barge landing facilities

- Potential for disturbance of vegetation and wetlands by construction.

Studies:

- Vegetation Mapping and Classification
- Wetlands Mapping and Functional Assessment
- Construction Methods Impacts Study

5.6.2. Relevant Plans

Management of wildlife and their habitats in the Project area are guided by several sources and documents.

- Alaska Natural Heritage Program (AKHNP), 2000, Contingency Planning - Sensitive Areas, Rare Plant Species Map Series. Environment and Natural Resources Institute, University of Alaska Anchorage. <http://aknhp.uaa.alaska.edu>
- ADF&G. 1994. Trading Bay State Game Refuge and Redoubt Bay Critical Habitat Area Management Plan. Prepared by Divisions of Habitat and Restoration and Wildlife Conservation.
- ADF&G. 2006. Our Wealth Maintained: A Strategy For Conserving Alaska's Diverse Wildlife And Fish Resources. Alaska Department of Fish and Game, Juneau, Alaska. xviii+824 pp.
- ADF&G. 2007. 2007-2008 Alaska bear and wolf control supplement. Alaska Department of Fish and Game. Juneau, Alaska
- Boudreau, T.A. 2005. Units 19ABC&D and 21A&E caribou management report. Pages 113-125 in C. Brown, editor. Caribou management report of survey and management activities 1 July 2003 – 30 June 2004. Alaska Department of Fish and Game. Project 3.0. Juneau, Alaska.
- Del Frate, G. G. 2003. Unit 16 wolf management report. Pages 109-117 in C. Brown, editor. Wolf management report of survey and inventory activities 1 July 1999–30 June 2002. Alaska Department of Fish and Game. Juneau, Alaska.
- Del Frate, G. G. 2004. Unit 16B moose management report. Pages 233–245 in C. Brown, editor. Moose management report of survey and inventory activities 1 July 2001–30 June 2003. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.
- Kavalok, T. 2004. Unit 16 black bear management report. Pages 195-208 in C. Brown, editor. Black bear management report of survey and inventory activities 1 July 2001–30 June 2004. Alaska Department of Fish and Game. Juneau, Alaska.

- Kavalok, T. 2004b. Unit 16 furbearer management report. Pages 193-212 in C. Brown, editor. Black bear management report of survey and inventory activities 1 July 2000–30 June 2003. Alaska Department of Fish and Game. Juneau, Alaska.
- Kavalok, T. 2005. Unit 16 brown bear management report. Pages 157-168 in C. Brown, editor. Brown bear management report of survey and inventory activities 1 July 2002–30 June 2004. Alaska Department of Fish and Game. Project 7.0. Juneau, Alaska.
- Kenai Peninsula Borough (KPB). 2005. 2005 Kenai Peninsula Borough Comprehensive Plan. KPB Planning Department. Soldotna, Alaska.
- Kenai Peninsula Borough Coastal Management Program and LaRoche and Associates. 2008. Kenai Peninsula Borough Coastal Zone Management Plan. Kenai Peninsula Borough. Soldotna, Alaska.
- NPS (Lake Clark National Park). 2004. Strategic Plan for Lake Clark National Park and Preserve October 1, 2004 - September 30, 2008. (<http://www.nps.gov/lac/parkmgmt/>)
- National Marine Fisheries Service. 2008. Conservation Plan for the Cook Inlet beluga whale (*Delphinapterus leucas*). National Marine Fisheries Service, Juneau, Alaska.
- NOAA National Marine Fisheries Service. 2007. Federal Register: Vol. 72, No. 76, April 20, 2007, Proposed Rules. Pages 19854 – 19862
- NOAA National Marine Fisheries Service. 2008. Endangered and Threatened Species; endangered Status for the Cook Inlet Beluga Whale. Federal Register: Vol. 73, No. 205, October 22, 2008, Rules and Regulations. Pages 62919 – 62930. (<http://www.fakr.noaa.gov/frules/73fr62919.pdf>)
- Seaduck Joint Venture. 2008. The website for the Sea Duck Joint Venture. Accessed at <http://www.seaduckjv.org/infoseries/toc.html>
- USFWS. 2000-2008. Canada Lynx (*Lynx canadensis*) Listing Status web page. <http://ecos.fws.gov/speciesProfile/SpeciesReport.do?sPCODE=A073>
- USFWS. 2002. Birds of conservation concern 2002. Division of Migratory Bird Management, Arlington, Virginia. 99 pp. (<http://migratorybirds.fws.gov/reports/bcc2002.pdf>)
- USFWS. 2008. U. S. Fish and Wildlife Service website: Endangered and Threatened Species. (<http://www.fws.gov/endangered/>)
- USFWS. 2008 . U.S. Fish and Wildlife Service Species Assessment and Listing Priority Assignment Form: Olive-sided flycatcher, Alaska specific review only, September 2008. (http://alaska.fws.gov/fisheries/endangered/pdf/OSFY_spp_assessment.pdf)
- USFWS. 2008 . USFWS website: Alaska Region Migratory Bird Management Overview. <http://alaska.fws.gov/mbsp/mbm/landbirds/landbirds.htm>).
- U.S. Code 16 Subchapters II and III. 1918, as amended 1936, 1960, 1968, 1969, 1974, 1978, 1986, and 1989. Migratory Bird Treaty Act and Migratory Bird Conservation.

- U.S. Code 16 668-668d, 54 Stat. 250. 1940, as amended 1940, 1959, 1962, 1972, and 19778. Bald Eagle and Golden Eagle Projection Act of 1940.

5.7. Wetland, Riparian & Littoral Habitat

5.7.1. Identification of Issues and Study Needs

TDX Power has identified the following Wetland, Riparian & Littoral Habitat issues and study needs derived from meetings with stakeholders, correspondence from federal and state agencies, and its consultants. The issues are grouped by category. The studies needed to assess each issue are listed with the issue. Information collected by the proposed studies will be used to describe the existing environment, assess potential impacts, and provide essential information that will help to avoid or mitigate Project impacts.

Development of baseline wetland identification tools for wetlands mapping

- Need to develop soil type specific hydric soil indicators for delineation of wetlands.

Studies:

- Hydric Soils Indicators in Ash-derived Soils Study

Impacts resulting from increased Chakachamna Lake water level fluctuation

- Changes in vegetation in littoral, riparian, and wetland habitats around the shores of Chakachamna Lake due to fluctuation in the water surface elevation of the lake.

Studies:

- Vegetation Mapping and Classification
- Operations Model
- Sediment Transport and Geomorphology Study
- Bathymetry and Basin Topography Study
- Lake Shoreline Topography and Erosional Processes Study
- Wetland Mapping and Functional Assessment

Impacts resulting from reduced flows on the Chakachatna River

- Assessment of potential impacts to riparian vegetation and adjacent lower elevation wetlands due to hydrologic changes, mainly in Noaukta Slough and Trading Bay State Game Refuge.

Studies:

- Integrated Surface and Groundwater Hydrologic Study
- Vegetation Mapping and Classification
- Wetland Mapping and Functional Assessment

Impacts resulting from increased flows on the McArthur River

- Assessment of potential impacts to riparian vegetation and adjacent lower elevation wetlands due to hydrologic changes, mainly in Noaukta Slough and Trading Bay State Game Refuge.

Studies:

- Integrated Surface and Groundwater Hydrologic Study
- Vegetation Mapping and Classification
- Wetland Mapping and Functional Assessment

Studies needed for Project engineering, hazard assessment, and feasibility

Study: Construction Methods Impact Study

Studies needed to plan and understand effects of roads and transmission lines

- Construction and maintenance impacts on vegetation and wetlands, including potential for introducing noxious weeds and invasive species

Studies:

- Vegetation Mapping and Classification
- Wetlands Mapping and Functional Assessment
- Construction Methods Impact Study

- Increased recreational pressure for hunting, fishing, and backcountry activities (hiking and rafting) due to increased access with potential impacts to rare plants, if present, and wetlands.

Studies: Recreational Use Assessment

Potential impacts of port or barge landing facilities

- Potential for disturbance of vegetation and wetlands by construction.

Studies:

- Vegetation Mapping and Classification
- Wetlands Mapping and Functional Assessment
- Construction Methods Impacts Study

5.7.2. Relevant Plans

Management of vegetation, wetlands, and habitats in the Project area are guided by several sources and documents.

- AKEPIC Database. 2005. Alaska Exotic Plant Information Clearinghouse Database. Available at: <http://akweeds.uaa.alaska.edu>. Retrieved 5 January 2007.

- Alaska Natural Heritage Program (AKHNP), 2000, Contingency Planning - Sensitive Areas, Rare Plant Species Map Series. Environment and Natural Resources Institute, University of Alaska Anchorage. <http://aknhp.uaa.alaska.edu>
- ADF&G. 1994. Trading Bay State Game Refuge and Redoubt Bay Critical Habitat Area Management Plan. Prepared by Divisions of Habitat and Restoration and Wildlife Conservation.
- ADF&G. 2006. Our Wealth Maintained: A Strategy For Conserving Alaska's Diverse Wildlife And Fish Resources. Alaska Department of Fish and Game, Juneau, Alaska. xviii+824 pp.
- Kenai Peninsula Borough (KPB). 2005. 2005 Kenai Peninsula Borough Comprehensive Plan. KPB Planning Department. Soldotna, Alaska.
- Kenai Peninsula Borough Coastal Management Program and LaRoche and Associates. 2008. Kenai Peninsula Borough Coastal Zone Management Plan. Kenai Peninsula Borough. Soldotna, Alaska.
- NPS (Lake Clark National Park). 2004. Strategic Plan for Lake Clark National Park and Preserve October 1, 2004 - September 30, 2008. (<http://www.nps.gov/lac1/parkmgmt/>)
- U.S. Code 33 1343 Section 404. 1977. Clean Water Act. (Section 404 - discharge of dredged or fill material into the navigable waters of the U.S.).

5.8. Recreation and Land Use

5.8.1. Identification of Issues and Study Needs

TDX Power has identified the following recreation and land use issues and study needs derived from meetings with stakeholders, correspondence from federal and state agencies, and its consultants. The issues are grouped by category. The studies needed to assess each issue are listed with the issue. Information collected by the proposed studies will be used to describe the existing environment, assess potential impacts, and provide essential information that will help to avoid or mitigate Project impacts.

Studies to assess impacts of increased Chakachamna Lake water level fluctuation

- Effects on travel around the shoreline in summer and winter.
Studies:
 - Recreational Use Assessment
 - Land Use Study
- Impacts to recreational uses such as boating, fishing, and hunting.

Study Recreational Use Assessment

Studies needed to assess potential blockage of fish passage into and out of Chakachamna Lake via the Chakachatna River¹

- Changes in distribution and/or numbers of fish in Lake may impact how lake is used for recreation.

Studies:

- Recreational Use Assessment
- Chakachamna Lake Sockeye Salmon Abundance and Run Timing

Studies needed to assess Project impacts as a result of reduced flows on the Chakachatna River²

- Effects on recreational use of the Chakachatna River, such as fishing and rafting.

Study: Recreational Use Assessment

Studies needed to assess Project impacts as a result of increased flows on the McArthur River³

- Increased flow may affect recreational use of the McArthur River, such as fishing and rafting.

Study: Recreational Use Assessment

- Changes in distribution and/or numbers of fish may affect recreational use.

Study: Recreational Use Assessment

Studies needed plan and understand effects of roads and transmission lines

- Increased recreational pressure, such as hunting, fishing, and backcountry activities (hiking, skiing, rafting, and snowmachining), due to increased access.

Studies:

- Recreational Use Assessment
- Land Use Study

¹ Studies to address changes in distribution and/or numbers of fish used for subsistence as discussed in Table 4.8-2 are discussed in Section 5.4.

² Studies to address changes in distribution and/or numbers of fish that may affect subsistence use as discussed in Table 4.8-2 are discussed in Section 5.4.

³ Studies to address changes in distribution and/or numbers of fish that may affect subsistence use as discussed in Table 4.8-2 are discussed in Section 5.4.

5.8.2. Relevant Plans

Relevant local, state, or regional land use and recreation plans include *Alaska's Outdoor Legacy Statewide Comprehensive Outdoor Recreation Plan (SCORP) 2004-2009*, *Kenai Peninsula Borough Coastal Zone Management Plan*, *Kenai Area Plan*, *Trading Bay State Game Refuge and Redoubt Bay Critical Habitat Area Management Plan*, and the *Strategic Plan for Lake Clark National Park and Preserve October 1, 2004 - September 30, 2008*. In addition to the recreation and land use management plans, ADF&G has developed state management plans for game species that may affect recreational hunting and subsistence use in the vicinity of the Project: *Black bear management report of survey and inventory activities 1 July 2001–30 June 2004*, *Brown bear management report of survey and inventory activities 1 July 2004–30 June 2006*, *Dall Sheep Management Report of Survey and Inventory Activities 1 July 2001–30 June 2004*, *Furbearer Management Report of Survey-Inventory Activities 1 July 2003–30 June 2006*, *Moose Management Report of Survey and Inventory Activities 1 July 2003–30 June 2005*, *Wolf Management Report of Survey and Inventory Activities 1 July 2002–30 June 2005*.

Alaska's Outdoor Legacy Statewide Comprehensive Outdoor Recreation Plan (SCORP) 2004-2009

Alaska's current SCORP guides recreation-related acquisition, facility development, and policy for the State of Alaska for 2004 through 2009 (ADNR 2004). The goals of the SCORP are to:

- Provide recreation agencies and communities with a reference to outdoor recreation preferences, use trends, and issues relevant to Alaska through 2009;
- Identify statewide capital investment priorities for acquiring, developing, and protecting outdoor recreation resources;
- Identify the State's priorities, strategies, and actions for the obligation of its Land and Water Conservation Fund (LWCF) apportionment; and
- Provide information that agencies and communities need to develop project proposals eligible for LWCF assistance.

The chief goal for outdoor recreation providers is to offer a range of opportunities for responsible use of Alaska's recreation resources while protecting natural values. The SCORP identifies four recreation issues and goals, one of which includes aspects related to aesthetic/visual resources, along with recommended strategies to meet these goals:

- Issue 1: Lack of Adequate Funding

Goal: Secure a reliable source of funding for outdoor recreation in Alaska. Develop programs that allow important projects to be completed and maintained. Strengthen mutually beneficial relationships with other agencies, private sector and user groups.

Recommended Strategies: support ongoing efforts to reform the Land and Water Conservation Fund Grant (LWCF) Program; continue interagency communication and

cooperative efforts; privatize selected services, facility operation, and maintenance; strengthen alternative funding mechanisms and programs; develop alternative funding sources.

- Issue 2: Opportunities to Meet Recreation Needs in Communities

Goal: Support efforts to assist communities in meeting the outdoor recreation needs of their citizens.

Recommended Strategies: give some communities a higher priority for LWCF matching grants; develop alternative funding sources; design facilities to reflect economic realities and sustainable practices.

- Issue 3: Improved Access to Outdoor Recreation Resources (includes discussion of transportation enhancements [including acquisition of scenic easements and scenic or historic sites, scenic highway programs, and scenic beautification], Trails and Recreational Access for Alaskan (TRAAK) [including transportation enhancements, the Scenic Byways Program, and the Recreation Trails Program], disabled access, and trail identification/legal access)

Goal: Provide more convenient, legal, and barrier-free access to outdoor recreation opportunities on Alaska's public lands and waters.

Recommended Strategies: implement Intermodal Surface Transportation Efficiency Act (ISTEA) provisions; improve access to water based recreation; develop inventory of barrier free outdoor recreation facilities; continue cooperative planning efforts with "barrier-free" advocacy groups; consider incompatibility among users and user values; continue the identification and legal dedication of existing trails.

- Issue 4: Shortage of Tourism Opportunities on Public Lands

Goal Support and promote balanced use and development of Alaska's public lands for outdoor recreation and nature-based tourism.

Recommended Strategies: expand cooperative planning and marketing efforts; maintain and expand private-public nature-based tourism partnerships; promote private sector development on public lands where appropriate; develop year round tourism destinations and related services on public lands; increase capital spending to rehabilitate and expand facilities, expand public use cabin system; promote the Alaska Public Lands Information Centers.

Kenai Peninsula Borough Coastal Zone Management Plan

The Kenai Peninsula Borough Coastal Management Plan was developed to provide local information and policies that carry out the objectives of the Alaska Coastal Management Program. The plan provides the Kenai Peninsula Borough with a tool for evaluating proposed developments within its coastal zone. The boundary of the Kenai Peninsula Borough and the Kenai coastal district are the same. Within that boundary, there is an area called the “coastal zone.” This coastal zone is subject to coastal zone management.

As discussed in Section 4.8.4, all lands and waters of the Kenai Peninsula Borough coastal zone are included within the “Recreation” designation and a portion of the Project area near the coast is included in the area designated as Recreation Use. Federal lands are excluded from the coastal zone and the recreation designation. The goals and objectives of the Kenai Peninsula Borough Coastal Management Plan (Kenai Peninsula Borough Coastal Management Program 2008) related to recreational resources include the following:

- Goal 3.1: To maintain the Borough's variety of high quality recreational opportunities to meet the needs of residents and visitors.
 - Objective 3.1.1: To encourage the well-planned development of recreation and tourism facilities and area wide trail systems by public agencies and private citizens where there is local support.
 - Objective 3.1.2: To minimize conflicting uses in designated recreation areas.
 - Objective 3.1.3: To maintain public access to water bodies and recreation areas and facilitate provision of additional access where necessary and desirable.
 - Objective 3.1.4: To minimize the adverse impacts of access on sensitive environments
- Goal 3.3: To encourage provision of facilities for outdoor and indoor recreational for borough residents and visitors.
 - Objective 3.3.1: Support improved, environmentally responsible angler access facilities on major rivers in the Borough.
- Goal 3.4: To plan for future recreational use of borough land that has recreational value.
 - Objective 3.4.1: Identify borough lands with recreational value that provide access to coastlines or recreational areas.
 - Objective 3.4.2: To maintain information about and support other groups in establishing and maintaining a network of trails to provide recreation and transportation opportunities.

- Objective 3.4.3: Work with the ANDR and local organizations to inventory existing and potential recreational trails on the Kenai Peninsula.
- Objective 3.4.4: Develop access management plans to avoid or minimize the adverse impacts of access.

The Statewide Standards relevant to recreational resources also address coastal access. Districts and state agencies shall ensure that projects maintain and, where appropriate, increase public access to, from, and along coastal water.

Kenai Area Plan

The Kenai Area Plan directs how ADNR will manage state uplands, tidelands, and submerged lands within the planning boundary, including the Project area (ADNR 2001). The state land use plans determine management intent, land-use designations, and management guidelines that apply to all state lands in the planning area. The plan is used by staff within the ADNR Division of Mining, Land, and Water when reviewing and making decisions on authorizations for use of state land, including permits, leases, sales, conveyances, and right-of-way. The plan is also used by the ADNR Divisions of Forestry, Agriculture, Parks and Outdoor Recreation. The Division of Oil and Gas also uses the plan in its mitigation measures. The Kenai Peninsula Borough and federal government also have plans and planning efforts that directly and indirectly affect state lands. Camping, hiking, boating, hunting, and fishing generally do not require authorization on state lands.

Goals of state lands in the planning area include:

- Economic development - provide opportunities for jobs and income by managing state land and resources to support a self-sustaining local economy;
- Fiscal costs - locate settlement uses where there is sustainable economic base and where necessary services can be efficiently provided;
- Public health and safety - maintain or enhance public health and safety for users of state land and resources;
- Public use - provide and enhance opportunities for public use of state lands, including hunting, fishing, boating, and other types of recreation;
- Quality of life - maintain or enhance the quality and diversity of the natural environments and protect heritage resources and the character and lifestyle of the community;
- Settlement - provide opportunities for private ownership and leasing of land currently owned by the state; and

- Sustained yield - maintain the long-term productivity and quality of renewable resources and all other state-owned replenishable resources on a sustained-yield or optimum-sustained yield basis, including fish, wildlife, rangelands, and forests.

Specific to public recreation, the goals of the plan include providing lands for accessible outdoor recreational opportunities with well-designed, maintained and conveniently located recreation facilities; providing undeveloped lands for recreation pursuits that do not require developed facilities. These opportunities would be realized by:

- Developing a State Park System of recreation areas, trails, waysides, rivers and sites that provide a wide range of year-round outdoor recreation opportunities for all ages, abilities and use preferences in close proximity to population centers and major travel routes.
- Providing recreation opportunities on less developed land and water areas both within the State Park System as well as areas outside the system, which serve multiple purposes.
- Encouraging commercial development of recreation facilities and services through land sales, leases, and permits where public recreation needs can most effectively be provided by private enterprise. In some units, the plan specifically allows for commercial recreation leasing.
- Providing for public open space that is readily accessible to communities and is sufficient to meet existing and future needs for public recreation land in developed areas.
- Protecting scenic beauty.

Specific to trails and access, the goals of the plan include the following:

- Public Use Opportunities - Ensure adequate opportunities for public use of important recreation, public access and historic trails of regional and statewide significance. Also provide for future trail and access needs.
- Local Trails - Assist in establishing local trail systems that provide access to public land and water and community facilities.
- Trail Corridors - Protect or establish trail corridors to meet projected future use requirements as well as protecting current use.

Management guidelines in the plan related to trails and access include consideration for aesthetic/visual resources.

Additionally, the plan identifies specific goals associated with the following resources related to public recreation and aesthetic resources:

- Transportation and utilities - Design a transportation system and authorize vehicle uses in a manner that has minimal adverse impacts on local residents, the environment, fish and wildlife resources, and aesthetic and cultural features.
- Shorelines, stream corridors and wetlands - Protect and enhance a variety of public recreation and tourism opportunities along waterbodies including both wilderness and developed recreational and tourism activities and protect the visual quality of waterbodies.
- Forestry - Ensure that the state forestlands support tourism, maintain opportunities for diverse recreational activities in a variety of settings, and promote scenic quality.

Trading Bay State Game Refuge and Redoubt Bay Critical Habitat Area Management Plan

The purpose of the Trading Bay State Game Refuge and Redoubt Bay Critical Habitat Area Management Plan (ADF&G,1994), which is applicable to state owned land only, is to provide consistent long-term guidance to ADF&G and other agencies involved in managing the refuge and critical habitat area. It presents management goals for the refuge and critical habitat area and their resources, and identifies policies to be used in determining whether proposed activities within the refuge and critical habitat area are compatible with the protection of fish and wildlife, their habitats and public use of the refuge and critical habitat area. The plan does not specifically identify recreation needs in the Project vicinity or Project area. According to the plan, activities that occur within the Trading Bay State Game Refuge will reflect the following goals in accordance with the purpose for which the area was established:

- Fish and wildlife populations and their habitat - manage the refuge to maintain and enhance fish and wildlife populations and their habitat.
- Public use - manage the refuge to maintain and enhance public use of fish, wildlife, and refuge lands and waters consistent with the other goals of the management plan.
 - Maintain public access to and within the refuge.
 - Maintain and, if compatible with existing public use as described in the regulations establishing the refuge, improve opportunities for waterfowl, moose, and bear hunting, trapping, and fishing within the refuge.
 - Maintain and, if compatible with existing public use as described in the regulations establishing the refuge, improve opportunities for wildlife viewing, photography, and general recreation in a high quality environment.
 - Make information about the refuge available to the public.
- Multiple use - manage multiple uses, including oil and gas, in the refuge in a manner compatible with the above goals of the management plan.

Strategic Plan for Lake Clark National Park and Preserve October 1, 2004 - September 30, 2008 (Lake Clark Strategic Plan)

The most recent Lake Clark Strategic Plan contains long-term goals, which target in quantifiable, measurable ways what will be accomplished toward achieving the overall mission goals and mission (NPS 2008). The following recreation and subsistence-related long-term goal targets of the strategic plan address park-specific outcomes:

- By September 30, 2008, 2,445,300 acres (99% of 2,470,000 acres) of designated wilderness in Lake Clark National Park and Preserve will meet wilderness character objectives.
- By September 30, 2008, 2 (29% of 7) species of Lake Clark National Park populations of native plant and animal Species of Management Concern are managed to self sustaining levels. Lake Clark National Park and Preserve is authorized for subsistence use and primary subsistence species include salmon, caribou, moose, brown bear and Dall sheep. To ensure these species are maintained at natural and healthy population levels in the park and healthy population levels in the preserve, harvest trend analyses are utilized to support the subsistence management plan for the park.
- By September 30 of 2008, three segments, (100% of 3 segments) of Wild and Scenic Rivers in Lake Clark National Park and Preserve will continue to meet heritage resource objectives.
- By September 30, 2008, Lake Clark National Park and Preserve does not have an approved plan that addresses the management of wilderness (or backcountry) resources. The staff at Lake Clark National Park and Preserve will write a statement to demonstrate the need for funding to develop a Wilderness Plan for the area.
- By September 30, 2008, 95% of visitors to Lake Clark National Park and Preserve are satisfied with appropriate park facilities, services, and recreational opportunities.
- By September 30, 2008, 85% of Lake Clark National Park and Preserve visitors understand and appreciate the significance of the park.
- By September 30, 2008, 25% (9 of 37) other facilities (non-building asset types), non-historic, are in fair to good condition as measured by the Facilities Condition Index at Lake Clark National Park and Preserve.
- By September 30, 2008, Lake Clark National Park has eight community partnerships designed to enhance the park's ability to manage recreation activities seamlessly.

Black Bear Management Report of Survey and Inventory Activities 1 July 2001–30 June 2004 (Black Bear Management Report)

The ADF&G Game Management Unit 16, located west of the lower Susitna River and upper Cook Inlet, contains large areas of unaltered wildlife habitat and includes the Project area and Lake Clark National Park. The Black Bear Management Report (Kavalok 2005) reported harvest rates of black bears have been increasing.

According to the Black Bear Management Report, the ADF&G management goal for black bears in Unit 16 is to provide the greatest opportunity to participate in hunting black bears with the objective of a three-year average harvest of greater than 270 black bears in Unit 16 (greater than 225 in Unit 16B, the subunit containing the Project area and Lake Clark National Park) with greater than 30% being female (Kavalok 2005). Because the population objective of black bear is unverifiable, the Black Bear Management Report recommends that a tooth specimen be collected from bears during sealing to collect age data on harvested bears.

Brown Bear Management Report of Survey and Inventory Activities 1 July 2002–30 June 2004 (Brown Bear Management Report)

The Brown Bear Management Report (Kavalok 2007) reported harvest rates of brown bears in 2005 in Unit 16. According to the Brown Bear Management Report, the ADF&G management goal for brown bears in Unit 16 is to allow the number of breeding females in the population to decrease by providing optimal opportunity to hunt brown bears with the objective of allowing human use to reach a three-year average harvest of 28 females older than two years (Kavalok 2007). The Brown Bear Management Report reports that management objectives were exceeded during the report period and that bear viewing and hunting are becoming more popular in Unit 16. It recommends that ADF&G closely monitor the harvest of brown bears to identify and avoid any serious declines in the population.

Dall Sheep Management Report of Survey and Inventory Activities 1 July 2001–30 June 2004 (Dall Sheep Management Report)

The Alaska Range West is a popular Dall sheep hunting area even though it is not road accessible. Aircraft transportation is the primary mode of transportation for sheep hunters and guides are required for nonresident sheep hunters throughout Alaska. From 1983 to 2000, an average of 220 hunters used the Alaska Range West annually, and average annual harvest was 123 rams.

According to the Dall Sheep Management Report, the ADF&G management goals for Dall sheep in Unit 16B (among others) include providing a sustainable opportunity to harvest Dall sheep rams from a naturally regulated population, providing an opportunity to harvest Dall sheep rams under aesthetically pleasing conditions, and providing an opportunity to view and photograph Dall sheep (Szepanski 2005). The growth of the guide and outfitter industry in the Alaska Range West was unregulated during the reporting period for the Dall Sheep Management Report and crowded hunting conditions may have reduced the quality of the hunting experience in the more accessible drainages. The Dall Sheep Management Report recommends continued aerial surveys

and monitoring or sheep harvest reports, determining the conditions that hunters find “aesthetically pleasing,” and assessment of hunter satisfaction with hunting experiences.

Furbearer Management Report of Survey-Inventory Activities 1 July 2003–30 June 2006
(Furbearer Management Report)

Recreational cabins and fishing and hunting lodges are scattered throughout the unit, many of which have winter caretakers who hunt and trap furbearers. Because of its proximity to Alaska’s largest population centers, the area receives a large amount of year-round recreational use and a few local residents trap full time to generate income, primarily from marten and beaver.

According to the Furbearer Management Report (Peltier 2007), ADF&G management goals for furbearers in Unit 16 include providing the opportunity to trap and hunt furbearers, maintaining an optimal sustained harvest of furbearers, and developing measurable population objectives for all fur species (Peltier 2007). Unit 16 trappers reported that all species were common or abundant in 2003–2006, except lynx and wolverine which were reported as scarce in 2004–2005. Trappers reported small prey species as abundant. The lack of data on population density, composition, and productivity of furbearers makes it difficult to determine if harvests are optimal. The Furbearer Management Report recommends that indirect survey techniques be conducted annually (Peltier 2007).

Moose Management Report of Survey and Inventory Activities 1 July 2003–30 June 2005
(Moose Management Report)

According to the Moose Management Report, the ADF&G management goal for moose in Unit 16B is to maintain and enhance the moose population to provide for high levels of human consumptive use (Peltier 2006a). The Moose Management Report recommends gathering additional information (e.g., accurate estimates of wolf and bear populations) to better manage moose in Unit 16B, a long-term monitoring program, and consideration of prescribed burns for habitat enhancement (Peltier 2006a).

Wolf Management Report of Survey and Inventory Activities 1 July 2002–30 June 2005
(Wolf Management Report)

According to the Wolf Management Report, the ADF&G management goal for wolves in Unit 16 is to retain desirable predator/prey ratios and provide a sustainable harvest of wolves (Peltier 2006b). The human-use objective is to allow maximum opportunity for harvest while maintaining minimum wolf population objectives. The Wolf Management Report recommends that surveys be conducted every three years to assess wolf numbers and that managers consider that Unit 16B is an intensive management area for moose (Peltier 2006b).

5.9. Aesthetic/Visual Resources

TDX Power has identified the following aesthetic/visual resource issues and study needs derived from meetings with stakeholders, correspondence from federal and state agencies, and its

consultants. The issues are grouped by category. The studies needed to assess each issue are listed with the issue. Information collected by the proposed studies will be used to avoid or mitigate Project impacts.

5.9.1. Identification of Issues and Study Needs

Impacts resulting from increased Chakachamna Lake water level fluctuation

- Changes in lake level fluctuations may affect the experience of Chakachatna Lake as a visual resource.

Studies:

- Aesthetic/Visual Resources Study
- Operations Model

Impacts resulting from reduced flows on the Chakachatna River

- Reduced flow may affect the experience of the Chakachatna River as a visual resource.

Study:

- Aesthetic/Visual Resources Study

Impacts resulting from increased flows on the McArthur River

- Increased flow may affect the experience of the McArthur River as a visual resource.

Study: Aesthetic/Visual Resources Study

Potential impacts of roads and transmission lines

- New road corridors and transmission line facilities may impact visual resources.

Studies:

- Aesthetic/Visual Resources Study
- Construction Methods Impact Study

5.9.2. Relevant Plans

Management plans relevant to aesthetic/visual resources include the SCORP (ADNR 2004) and the Kenai Area Plan (ADNR 2001).

SCORP 2004-2009

Alaska's current SCORP guides recreation-related acquisition, facility development, and policy for the State of Alaska for 2004 through 2009 (ADNR 2004). The goals of the SCORP are to:

- Provide recreation agencies and communities with a reference to outdoor recreation preferences, use trends, and issues relevant to Alaska through 2009;
- Identify statewide capital investment priorities for acquiring, developing, and protecting outdoor recreation resources;
- Identify the State's priorities, strategies, and actions for the obligation of its Land and Water Conservation Fund (LWCF) apportionment; and
- Provide information that agencies and communities need to develop project proposals eligible for LWCF assistance.

The chief goal for outdoor recreation providers is to offer a range of opportunities for responsible use of Alaska's recreation resources while protecting natural values. The SCORP identifies four recreation issues and goals, one of which includes aspects related to aesthetic/visual resources, along with recommended strategies to meet these goals:

- Issue 1: Lack of Adequate Funding

Goal: Secure a reliable source of funding for outdoor recreation in Alaska. Develop programs that allow important projects to be completed and maintained. Strengthen mutually beneficial relationships with other agencies, private sector and user groups.

Recommended Strategies: support ongoing efforts to reform the Land and Water Conservation Fund Grant (LWCF) Program; continue interagency communication and cooperative efforts; privatize selected services, facility operation, and maintenance; strengthen alternative funding mechanisms and programs; develop alternative funding sources.

- Issue 2: Opportunities to Meet Recreation Needs in Communities

Goal: Support efforts to assist communities in meeting the outdoor recreation needs of their citizens.

Recommended Strategies: give some communities a higher priority for LWCF matching grants; develop alternative funding sources; design facilities to reflect economic realities and sustainable practices.

- Issue 3: Improved Access to Outdoor Recreation Resources (includes discussion of transportation enhancements [including acquisition of scenic easements and scenic or historic sites, scenic highway programs, and scenic beautification], Trails and

Recreational Access for Alaskan (TRAAK) [including transportation enhancements, the Scenic Byways Program, and the Recreation Trails Program], disabled access, and trail identification/legal access)

Goal: Provide more convenient, legal, and barrier-free access to outdoor recreation opportunities on Alaska's public lands and waters.

Recommended Strategies: implement Intermodal Surface Transportation Efficiency Act (ISTEA) provisions; improve access to water based recreation; develop inventory of barrier free outdoor recreation facilities; continue cooperative planning efforts with "barrier-free" advocacy groups; consider incompatibility among users and user values; continue the identification and legal dedication of existing trails.

- Issue 4: Shortage of Tourism Opportunities on Public Lands

Goal Support and promote balanced use and development of Alaska's public lands for outdoor recreation and nature-based tourism.

Recommended Strategies: expand cooperative planning and marketing efforts; maintain and expand private-public nature-based tourism partnerships; promote private sector development on public lands where appropriate; develop year round tourism destinations and related services on public lands; increase capital spending to rehabilitate and expand facilities, expand public use cabin system; promote the Alaska Public Lands Information Centers.

Kenai Area Plan

Developed by ADNR, the Kenai Area Plan directs how ADNR will manage state uplands, tidelands, and submerged lands within the planning boundary, including the Project area (ADNR 2001). The state land use plans determine management intent, land-use designations, and management guidelines that apply to all state lands in the planning area. The plan is used by staff within the ADNR Division of Mining, Land, and Water when reviewing and making decisions on authorizations for use of state land, including permits, leases, sales, conveyances, and right-of-way. The plan is also used by the ADNR Divisions of Forestry, Agriculture, Parks and Outdoor Recreation. The Division of Oil and Gas also uses the plan in its mitigation measures. The Kenai Peninsula Borough and federal government also have plans and planning efforts that directly and indirectly affect state lands. Camping, hiking, boating, hunting, and fishing generally do not require authorization on state lands.

Goals of state lands in the planning area include:

- Economic development - provide opportunities for jobs and income by managing state land and resources to support a self-sustaining local economy;

- Fiscal costs - locate settlement uses where there is sustainable economic base and where necessary services can be efficiently provided;
- Public health and safety - maintain or enhance public health and safety for users of state land and resources;
- Public use - provide and enhance opportunities for public use of state lands, including hunting, fishing, boating, and other types of recreation;
- Quality of life - maintain or enhance the quality and diversity of the natural environments and protect heritage resources and the character and lifestyle of the community;
- Settlement - provide opportunities for private ownership and leasing of land currently owned by the state; and
- Sustained yield - maintain the long-term productivity and quality of renewable resources and all other state-owned replenishable resources on a sustained-yield or optimum-sustained yield basis, including fish, wildlife, rangelands, and forests.

Specific to public recreation, the goals of the plan include providing lands for accessible outdoor recreational opportunities with well-designed, maintained and conveniently located recreation facilities; providing undeveloped lands for recreation pursuits that do not require developed facilities. These opportunities would be realized by:

- Developing a State Park System of recreation areas, trails, waysides, rivers and sites that provide a wide range of year-round outdoor recreation opportunities for all ages, abilities and use preferences in close proximity to population centers and major travel routes.
- Providing recreation opportunities on less developed land and water areas both within the State Park System as well as areas outside the system, which serve multiple purposes.
- Encouraging commercial development of recreation facilities and services through land sales, leases, and permits where public recreation needs can most effectively be provided by private enterprise. In some units, the plan specifically allows for commercial recreation leasing.
- Providing for public open space that is readily accessible to communities and is sufficient to meet existing and future needs for public recreation land in developed areas.
- Protecting scenic beauty.

Specific to trails and access, the goals of the plan include the following:

- Public Use Opportunities - Ensure adequate opportunities for public use of important recreation, public access and historic trails of regional and statewide significance. Also provide for future trail and access needs.
- Local Trails - Assist in establishing local trail systems that provide access to public land and water and community facilities.

- Trail Corridors - Protect or establish trail corridors to meet projected future use requirements as well as protecting current use.

Management guidelines in the plan related to trails and access include consideration for aesthetic/visual resources. Additionally, the plan identifies specific goals associated with the following resources related to public recreation and aesthetic resources:

- Transportation and utilities - Design a transportation system and authorize vehicle uses in a manner that has minimal adverse impacts on local residents, the environment, fish and wildlife resources, and aesthetic and cultural features.
- Shorelines, stream corridors and wetlands - Protect and enhance a variety of public recreation and tourism opportunities along waterbodies including both wilderness and developed recreational and tourism activities and protect the visual quality of waterbodies.
- Forestry - Ensure that the state forestlands support tourism, maintain opportunities for diverse recreational activities in a variety of settings, and promote scenic quality.

5.10. Cultural Resources

5.10.1. Identification of Issues and Study Needs

Based on meetings with stakeholders, correspondence from federal and state agencies, and its consultants TDX Power has identified the following cultural resource issues and study needs . The issues are grouped by category. The studies needed to assess each issue are listed with the issue. Information collected by the proposed studies will be used to avoid or mitigate Project impacts.

TDX Power has identified a preliminary Area of Potential Effects (APE) based on the Project boundary; as described in section 4.10; however the APE has not been finalized with FERC, the State Historic Preservation Office (SHOP); tribes, and federal agencies. In will not be possible to develop final inventory, evaluation, and impact assessments until the APE is formally established. Establishment of the APE will be a collaborative effort between TDX Power, the SHPO, tribes, federal agencies, and FERC.

Studies needed plan and understand effects of roads and transmission lines

- Impacts on cultural resources due to construction impacts and increased recreational activity adjacent to and in areas reached by access roads.

Studies:

- Subsistence and Cultural Use / Traditional Cultural Properties Study
- Historic and Archaeological Resources Study
- Recreation Use Assessment

Studies to assess impacts of increased Chakachamna Lake water level fluctuation

- Impacts on cultural resources of the lake due to lake level fluctuations and reservoir operations.

Studies:

- Historic and Archaeological Resources Study
- Subsistence and Cultural Use / Traditional Cultural Properties Study
- Erosion Study

Studies needed plan port or barge landing facilities

- Impacts on cultural resources or subsistence use of shoreline due to Project operations and activities related to construction and operation of port or barge landing facilities

Study: Historic and Archaeological Resources Study

Studies needed to assess Project impacts as a result of reduced flows on the Chakachatna River

- Assessment of subsistence use of potentially affected areas; determine how reduced flows may impact subsistence use or impact cultural resources

Studies: Subsistence and Cultural Use / Traditional Cultural Properties Study

Studies needed to assess Project impacts as a result of increased flows on the McArthur River

- Assessment of subsistence use of potentially affected areas; determine how increased flows may impact subsistence use or impact cultural resources

Study: Subsistence and Cultural Use / Traditional Cultural Properties Study

5.10.2. Relevant Plans

- ADF&G. 1994. Trading Bay State Game Refuge and Redoubt Bay Critical Habitat Area Management Plan. Prepared by Divisions of Habitat and Restoration and Wildlife Conservation.
- Kenai Peninsula Borough (KPB). 2005. 2005 Kenai Peninsula Borough Comprehensive Plan. KPB Planning Department. Soldotna, Alaska.
- Kenai Peninsula Borough Coastal Management Program. 2008. Kenai Peninsula Borough Coastal Zone Management Plan. Kenai Peninsula Borough. Soldotna, Alaska.
- NPS (Lake Clark National Park). 2004. Strategic Plan for Lake Clark National Park and Preserve October 1, 2004 - September 30, 2008. (<http://www.nps.gov/lacl/parkmgmt/>)
- U.S. Department of the Interior. 1966. National Historic Preservation Act. 36 CFR Part 60.
- U.S. Department of the Interior. 2004. 36 CFR Part 800. Protection of Historic Properties: incorporating amendments effective August 5, 2004.

5.11. Socioeconomic Resources

5.11.1. Identification of Issues and Study Needs

Based on from meetings with stakeholders, correspondence from federal and state agencies, and review of relevant literature TDX Power has identified the following socioeconomic resource issues and study needs . The issues are grouped by category. The studies needed to assess each issue are listed with the issue. Additionally this section is further subdivided into issues and studies that address potential resource impacts and issues and studies that are necessary from an engineering project economics perspective. Information collected by the proposed studies will be used to describe the existing environment, assess potential impacts, and provide essential information that will help to avoid or mitigate Project impacts.

Potential effect of the project on socioeconomic resources

- Assessment of socioeconomic effects on local and regional economy related to Project construction
Study: Socioeconomic Assessment
- Assessment of socioeconomic effects on local and regional economy related to Project operations
Study: Socioeconomic Assessment
- Potential effects of the Project on tourism and potential for expanding role of tourism to support the local economy
Study: Socioeconomic Assessment

5.11.2. Relevant Plans

- Kenai Peninsula Borough (KPB). 2005. 2005 Kenai Peninsula Borough Comprehensive Plan. KPB Planning Department. Soldotna, Alaska.
- Municipality of Anchorage. 2001. Anchorage 2020: Anchorage Bowl Comprehensive Plan. Prepared by Planning Department, Municipality of Anchorage, Anchorage, Alaska.
- Tyonek Native Corporation (TNC). West Cook Inlet: 2008 and Beyond. Tyonek Native Corporation, Anchorage, Alaska. Website accessed April 2009.
<http://www.tyonek.com/lands.php>

5.12. Tribal Resources

5.12.1. Identification of Issues and Study Needs

No interest has been expressed to date in specific resource areas pertaining to the development of the Chakachamna Hydroelectric Project. Numerous studies are being planned that will provide information on potential impacts to tribal resources. These studies include [list]. As information becomes available, it will be shared with appropriate tribal contacts and next steps determined. If the need for additional information is identified, TDX will consider the potential corresponding studies that may be warranted, and those additional studies TDX determines are needed will be scoped as appropriate in conjunction with the formal study phase of the Chakachamna Project licensing.

5.12.2. Relevant Plans

The federal, state, and tribal comprehensive waterway plans and resource management plans that are listed as relevant for other resource areas described in this section 5 of the PAD are also relevant to tribal resources, to the extent that there are tribal interests in the other resources areas.

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