USDA

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Forest Service

Tongass
National Forest
R10-MB-628

February 2009

Angoon Hydroelectric Project

Final Environmental Impact Statement

Tongass National Forest
Admiralty Island National Monument
Juneau, Alaska

Angoon Hydroelectric Project EIS - Key Acronyms and Other Terms

ACMP	Alaska Coastal Management Program	GIS	Geographic Information System
ADFG	Alaska Department of Fish and Game	HUC	Hydrologic Unit Code (United States Geological Survey)
ADNR	Alaska Department of Natural Resources	IDT	Interdisciplinary Team
AHMU	Aquatic Habitat Management Handbook	kV	Kilovolts
ANCSA	Alaska Native Claims Settlement Act (1972)	LTA	Land Type Association
ANILCA	Alaska National Interest Lands Conservation Act (1980)	LUD	Land Use Designation
BA	Biological Assessment	LWD	Large Woody Debris
BE	Biological Evaluation	MIS	Management Indicator Species
BMP	Best Management Practice	MMI	Mass Movement Index
CEQ	Council on Environmental Quality	NEPA	National Environmental Policy Act
CFR	Code of Federal Regulations	NFMA	National Forest Management Act (1976)
cfs	Cubic feet per second	NFS	National Forest System
CZMA	Coastal Zone Management Act (1972)	NHPA	National Historic Preservation Act
DEIS	Draft Environmental Impact Statement	NMFS	National Marine Fisheries Service
EFH	Essential Fish Habitat	NOI	Notice of Intent (to publish an EIS)
EIS	Environmental Impact Statement	RMA	Riparian Management Area
EPA	Environmental Protection Agency	ROD	Record of Decision
ESA	Endangered Species Act	SHPO	State Historic Preservation Office
FEIS	Final Environmental Impact Statement	SUA	Special Use Authorization
FERC	Federal Energy Regulatory Commission	TES	Threatened and Endangered Species
Forest Plan	Tongass Land and Resource Management Plan	TUS	Transportation and Utility Systems
Forest Service	United States Department of Agriculture Forest service	USACE	United States Army Corps of Engineers
FSH	Forest Service Handbook	USDA	United States Department of Agriculture
FSM	Forest Service Manual	USFWS	United States Fish and Wildlife Service
		USGS	United States Geological Survey

Cover photo: Thayer Creek

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USDA United States Department of Agriculture | Forest Service | Alaska Region Tongass National Forest | 648 Mission Street Ketchikan, AK 99901 Phone: (907) 225-3101 Fax: (907) 228-6215

File Code: 1950-3
Date: February 20, 2009

Dear Planning Participant:

Enclosed is your copy of the Final Environmental Impact Statement (Final EIS) for the Angoon Hydroelectric Project on Admiralty Island, Tongass National Forest.

The Final EIS analyzes four action alternatives for developing hydroelectric power utilizing Thayer Creek and one no-action alternative. Kootznoowoo Inc.'s development proposal (their Selected Project Arrangement) serves as the basis for the terms and conditions displayed in all four action alternatives in this EIS. The action alternatives are modifications, in the form of terms and conditions in the Special Use Authorization (SUA) to Kootznoowoo Inc.'s Selected Project Arrangement, that reduce potential effects to resources in the project area and that allow alternatives to meet specific requirements found in the 2008 Tongass Land and Resource Management Plan (Forest Plan).

The Record of Decision (ROD) has not been signed at this time. I plan to release the ROD at least one month later than this Final EIS to provide an opportunity for the public and agencies to review the Final EIS. The ROD will document my decision on the Selected Alternative and the facts considered in reaching the decision. The effective date of implementation for the decision and the Notice of Rights of Appeal will also be specified in the ROD.

For more information or additional copies of the EIS, contact Michelle Putz at the Supervisor's Office at 907-747-4278 during regular business hours, Monday to Friday, 8:00 am to 4:30 pm.

Thank you to those who took time to review and comment on the Draft Environmental Impact Statement. Your interest in the management of the Tongass National Forest is appreciated.

Sincerely,

FORREST COLE
Forest Supervisor

Enclosure

Final Environmental Impact Statement

Angoon Hydroelectric Project

Forest Service, U.S. Department of Agriculture
Alaska Region, Tongass National Forest

Lead Agency:	USDA Forest Service Tongass National Forest 648 Mission Street Ketchikan, AK 99901
Responsible Official:	Forrest Cole, Forest Supervisor Tongass National Forest
For Further Information Contact:	Pete Griffin, District Ranger Juneau Ranger District 8510 Mendenhall Loop Road Juneau, Alaska 99801 (907) 789-6244

Abstract

Kootznoowoo Inc.'s proposal is to construct a hydroelectric plant and associated facilities at Thayer Creek on Admiralty Island. The Forest Supervisor of the Tongass National Forest will decide the required terms and conditions, if any, to be included in the Special Use Authorization (SUA) to protect resource values within the project area related to the construction and operation of a hydroelectric facility on Thayer Creek.

The hydroelectric facility would serve the community of Angoon, as directed in the Alaska National Interest Lands Conservation Act of 1980 (ANILCA). In 2003, Kootznoowoo, Inc., the village corporation for the Angoon Community Association, asked the Forest Service to begin the National Environmental Policy Act (NEPA) process necessary to develop a hydroelectric facility. In 2004, Kootznoowoo submitted an application requesting Forest Service authorization for the project. The project is within the Kootznoowoo Wilderness on Admiralty Island National Monument, Admiralty Island, Tongass National Forest, in Southeastern Alaska. The project area is approximately 50 air miles south of Juneau.

Kootznoowoo's Selected Project Arrangement, the basis for the action alternatives in this EIS, included a diversion dam, intake structure, marine facility, three access roads, two staging areas, transmission lines, a power plant, a surge tank, 6,100 feet of 42-inch diameter pipeline and 510 feet of 36-inch diameter pipe. The hydroelectric plant would be a run-of-river facility using only the water available in the natural flow of the river. Under normal conditions, run-of-river facilities involve minimal water storage, and power generation fluctuates with the stream flow. The proposed facility would create a 10-20 acre pond behind a small dam.

This environmental impact statement describes and evaluates the environmental effects of the three action alternatives and the no-action alternative.

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Summary

Angoon Hydroelectric Project

Summary

1. WHAT ACTION IS PROPOSED?

In 2003, Kootznoowoo, Inc. (Kootznoowoo), the Alaska Native Claims Settlement Act (ANCSA) corporation for the city of Angoon, asked the Forest Service to begin the National Environmental Policy Act (NEPA) process necessary to develop a hydroelectric project to lower the cost of power generation and electric bills in Angoon. In 2004, Kootznoowoo requested Forest Service terms and conditions for the Angoon Hydroelectric Project.

The hydroelectric facility proposed by Kootznoowoo to the Forest Service is described in The *Angoon Hydrologic Project Feasibility Evaluation Report* (Feasibility Report) prepared for Kootznoowoo by HDR Alaska, Inc. in 2000, and is identified in that report as the Selected Project Arrangement.

Kootznoowoo's Selected Project Arrangement included building a diversion dam, intake structure, marine facility, three access roads, two staging areas, transmission lines, a power plant, a surge tank, 6,100 feet of 42-inch diameter pipeline and 510 feet of 36-inch diameter pipe. The hydroelectric plant would be a run-of-river facility using only the water available in the natural flow of Thayer Creek. The project area is located within Admiralty Island National Monument, Tongass National Forest, Alaska. The proposed hydroelectric dam would be constructed on Thayer Creek with power delivered to Angoon. The project area was defined through the Alaska National Interest Lands Conservation Act of 1980 (ANILCA) as T. 49 S., R. 67 E. and T. 50 S., R 67 E, Copper River Base and Meridian.

The Forest Service Proposed Action (Alternative 2) includes modifications, in the form of terms and conditions in the Special Use Authorization (SUA), to Kootznoowoo's Selected Project Arrangement to reduce potential effects to resources in the project area and to meet specific requirements found in the 2008 Tongass Land and Resource Management Plan (Forest Plan).

The terms and conditions proposed are generally project design elements – many of them Best Management Practices (BMPs) and practices related to meeting specific requirements in the Forest Plan – intended to reduce potential effects to resources in the project area (see Sections 2.2 and 2.3.2 in the Final Environmental Impact Statement - FEIS). These elements are related to engineering and structural specifications, resource protection requirements, and safety requirements in addition to other special clauses deemed appropriate by the Forest Service. Chapter 2 describes the proposed action in detail in Section 2.3.3.

2. WHY IS THIS PROPOSED?

In 2003, Kootznoowoo asked the Forest Service to begin the NEPA process necessary to develop a hydroelectric project to lower the cost of power generation and electric bills in Angoon. In 2004, Kootznoowoo requested Forest Service terms and conditions for the Angoon Hydroelectric Project.

Through the Alaska National Interest Lands Conservation Act of 1980 (ANILCA), Congress has:

- granted Kootznoowoo certain rights for development of a hydroelectric facility at Thayer Creek;
- mandated the decision space and level of involvement of the Secretary of Agriculture (Forest Service); and
- specifically exempted the hydropower project from the requirements of the Wilderness Act.

The Purpose and Need for the Proposed Action is to comply with the requirements of ANILCA Section 506(a) by establishing resource protection measures to be required for the development of the hydroelectric project proposed by Kootznoowoo at Thayer Creek within Admiralty Island National Monument. ANILCA granted Kootznoowoo the right to develop the hydroelectric project subject to conditions prescribed by the Forest Service for protection of water, fishery, wildlife, recreational, heritage, and scenic values of Admiralty Island.

3. WHAT OTHER ACTION/S WOULD MEET THE SAME NEED?

Two additional action alternatives (Alternatives 3 and 4) are described and considered in the Final EIS. The action alternatives are all based on the Selected Project Arrangement proposal submitted by Kootznoowoo. Alternatives 3 and 4 include changes to the components to meet specific requirements found in the Forest Plan that reduce potential effects to resources in the project area. See Chapter 2 of the Final EIS for a complete description of the alternatives and for maps displaying the components of Kootznoowoo's proposal that would change by alternative.

ALTERNATIVE 3

Alternative 3 was developed as a means of reducing the amount of vegetative clearing required along the transmission line corridor, reducing potential effects to fish habitat in Thayer Creek, and reducing potential effects of road and pipeline/penstock construction on karst terrain and on steep slopes along Thayer Creek. Consideration of a buried transmission line is also a requirement of the Forest Plan. Under Alternative 3 the terms and conditions included in the SUA would be the same as those displayed for all the action alternatives (see Elements Common to the Action Alternatives, 2.3.2). To reduce resource effects, Alternative 3 would also result in the following changes to the Proposed Action (see Figures 2-3 and 2-2):

- Require that all transmission lines be buried where feasible
- Require a higher level of water discharge into the bypass reach on Thayer Creek. A minimum instream flow of 40 cubic feet per second (cfs) would be maintained at all times to minimize freezing temperatures and loss of stream continuity in the bypass reach.
- Require that all water not needed for power generation be returned to Thayer Creek at the diversion dam and sent through the bypass reach.
- Require that the tailrace discharge be returned above or immediately below the lowest anadromous fish barrier on Thayer Creek to minimize the length of anadromous stream affected by the diversion.
- Require that the road from the marine facilities to the powerhouse be rerouted to minimize effects to areas identified as high vulnerability karst and the streams that flow to the features and that the diversion dam access road be rerouted away from steep slopes along Thayer Creek
- Require that the dam include a low gate feature to pass bedload during specified windows of high flows in May-June and September-October.
- Require that floating wood accumulating behind the dam be disposed of into the bypass reach during high flows in May-June and September-October.
- Require that trees that are in the reservoir be left standing to avoid ground disturbance associated with cutting and removal and to provide habitat complexity.

ALTERNATIVE 4

Alternative 4 was developed to eliminate uplands impacts associated with the construction of an access road and transmission line from the marine facilities to Kootznahoo Inlet; Alternative 4 would do this by submerging the transmission line in Chatham Strait. Consideration of a submerged transmission line is also a requirement of the Forest Plan. Under Alternative 4 the terms and conditions included in the special use authorization would be the same as those displayed for all the action alternatives (see Elements Common to the Action Alternatives, 2.3.2). This alternative would be similar to Alternative 3, except that Kootznoowoo would not be authorized to construct an overland transmission line from the marine facility to Kootznahoo Inlet. The only feasible way for Kootznoowoo to comply with this restriction would be to utilize a submarine transmission cable laid off-shore of Admiralty Island to the City of Angoon (Figure 2-4).

4. WHAT WOULD IT MEAN TO NOT MEET THE NEED?

Under the No Action alternative (Alternative 1), the Forest Service would not issue a special use authorization (SUA) for the project, and the proposed project would not be constructed. Diesel generators would continue to be used to supply energy for the community of Angoon unless alternative energy sources are developed. Although selection of this alternative would deny Kootznoowoo the statutory rights granted by

ANILCA, CEQ regulations (40 CFR 1502.14d) require that a “no action” alternative be analyzed in every EIS. This alternative represents the existing condition against which other alternatives are compared.

Under the No Action alternative, electricity prices, already exceptionally high, would continue to fluctuate based on crude oil prices, potentially leading to further population decline. Continuing high electrical rates would also limit opportunities for economic growth and the present high rate of unemployment would continue or increase.

Under Alternative 1, diesel generator capacity is and would remain limited. With fuel deliveries by barge of 27,000 to 38,000 gallon range at each delivery, five times per year, the potential for a large fuel spill exists. The consequences of a spill would be devastating to Angoon as well as commercial and recreational fisheries. Additionally under Alternative 1 the current permit would allow for considerable growth in fossil fuel use with corresponding carbon dioxide and air pollution emissions.

Other resources in the Project Area, such as water, fish, wildlife and recreation would not be affected by the No Action alternative – natural processes and existing uses would continue in this largely unmodified area.

5. WHAT ARE THE EFFECTS OF THE ALTERNATIVES?

Table S-1 displays the actions of the alternatives. Table S-2 displays a very brief summary of the effects of the alternatives. Chapter 3 of the FEIS further describes the effects of the alternatives on the Project Area’s resources.

Table S-1. Comparison of Alternatives by Activity

Activity	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Buried Trans. line	Alternative 4 Submerged Trans. Line
Special Use Authorization	No	Yes	Yes	Yes
Above-ground transmission line	0	6.2 miles	minimized	minimized
Buried transmission line	0	0	6.2 miles as feasible	2.2 miles as feasible
Submerged transmission line	0	0.5 mile	0.5 mile	4.6 miles
Access Rd Marine Fac. to Powerhouse	0	2.2 miles	2.2 miles	2.2 miles
Access Rd Powerhouse to Dam	0	1.4 miles	2.1 miles	2.1 miles
Access Rd Marine Fac. to Kootznahoo Inlet	0	4.0 miles	4.0 miles	0
Temporary Access Rd Surge Tank	0	0.2 mile	0	0
Road/Trans Line Clearing Width	0	46-200 feet	46-70 feet (50 feet avg.)	46-70 feet (50 feet avg.)
Diversion Dam Access Road Location	None	On steep slopes in Thayer Cr canyon	Reroute avoids steep slopes in Thayer Creek canyon	Reroute avoids steep slopes in Thayer Creek canyon
Pipeline Location	None	Follows the contour in Thayer Creek canyon	Follows the contour in Thayer Creek canyon	Follows the contour in Thayer Creek canyon
Penstock Location	None	Same for all alternatives	Same for all alternatives	Same for all alternatives
Marine Facility	None	Same for all alternatives	Same for all alternatives	Same for all alternatives
Switchyards	0	3	3	3
Tailrace Discharge location	None	450 feet downstream of fish barrier	Above or immediately below the lowest anadromous fish barrier	Above or immediately below the lowest anadromous fish barrier

Table S-2. Comparison of Alternatives by Resource

Activity	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Buried Trans Line	Alternative 4 Submerged Trans Line
Geology				
Effects to karst	No Effect	0.2 mile of road cross high vulnerability karst lands; sediment and debris would enter karst system. A Forest Plan amendment would be needed	Due to avoidance there are no effects	Due to avoidance there are no effects
Soil				
Project area exposed to surface erosion (acres)	0	45.5	48.2	24.9
Road in areas over 67% slope (feet)	0	1,650	1,500	150
Water[1]				
Minimum Instream Flow (CFS)	26 (predicted natural extreme minimum flow)	20	40	40
Winter Streamflow	No effect	Moderate effects	Moderate effects	Moderate effects
Summer Streamflow	No effect	Minor effects	Minor effects	Minor effects
Spring and Fall Streamflow:	No effect	Negligible effects	Negligible effects	Negligible effects
Sediment supply from above dam	No effect	Minor to moderate	Negligible to minor	Negligible to minor
Large wood supply	No effect	Minor	Negligible	Negligible
Winter minimum water temperature and dissolved oxygen	No effect	Moderate effects	Moderate effects	Moderate effects
Summer maximum water temperature	No effect	Minor effects	Negligible to minor effects	Negligible to minor effects
Erosion and sediment (from ground-disturbing activities)	No effect	Major effects	Minor effects	Minor effects

[1] Impacts increase from no effect to negligible to minor to moderate to major; definitions of the level of effects are located in Chapter 3 in the Water Resources section.

Activity	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Buried Trans Line	Alternative 4 Submerged Trans Line
Fisheries				
Effects of flows on fish and fish habitat	No change (no effect)	For Reaches B & C: Low flow periods would extend earlier into the fall and later into the spring; would support few, if any, incubating eggs or resident fish through the winter; may freeze for longer periods in the winter or increase to potentially lethal temperatures during the summer.	This alternative will mimic more natural flow regimes. Dewatering will be less likely. Additional flow will provide increased pool depth, greater stream connectivity, and decrease harmful icing conditions	This alternative will mimic more natural flow regimes. Dewatering will be less likely. Additional flow will provide increased pool depth, greater stream connectivity, and decrease harmful icing conditions
Effects due to location of discharge water from the power plant	No change (no effect)	Discharge location would likely cause a moderate reduction in anadromous fish populations	Flows would mimic natural conditions; little potential effect to anadromous fish and habitat below the barrier	Flows would mimic natural conditions; little potential effect to anadromous fish and habitat below the barrier
Effects to Thayer Creek from road parallel to Thayer Creek	No change (no effect)	Road could degrade riparian habitat and increase the suspended sediment load.	Greatly reduced potential for landslides and introducing sediment and debris into creek	Greatly reduced potential for landslides and introducing sediment and debris into creek
Vegetation				
Sensitive Plants	No effect	No adverse effect	No adverse effect	No adverse effect
Invasive Species	No effect	Low potential to introduce invasive species in area up to 40 acres	Low potential to introduce invasive species in area up to 40 acres	Low potential to introduce invasive species in area up to 30 acres
Wetlands				
Linear miles of road built on wetlands	0	2.6 miles	2.6 miles	1.1 miles

Activity	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Buried Trans Line	Alternative 4 Submerged Trans Line
Biodiversity and Wildlife				
Effect on Connectivity (acres of productive old-growth removed from beach fringe and riparian management)	0	57	28	23
Effects on Management Indicator Species and Migratory Birds	No Effect	Small loss (less than 1%) of potential habitat; expected to maintain viable, well dispersed populations of MIS.	Small loss (less than 1%) of potential habitat; expected to maintain viable, well dispersed populations of MIS.	Small loss (less than 1%) of potential habitat; expected to maintain viable, well dispersed populations of MIS.
Relative Effects of Alternatives on Management Indicator Species and Migratory Birds	No Effect	Greatest effect of action alts. on MIS because of larger acreage of forest habitat converted for transmission line clearing and easier access	Intermediate effect of action alts. on MIS because access is similar to Alt. 2, but forest habitat loss is lower than Alt. 2	Lowest impact of action alts. on MIS because it affects the least POG and foraging habitat, and provides the least access improvement
Threatened, Endangered, and Sensitive Species				
BE Effects Determination for humpback whale and Steller sea lion	No effect	No effect	No effect	No effect
BE Effects Determination for Kittlitz's murrelet, osprey, Peale's peregrine falcon, and trumpeter swan	No impacts	No impacts	No impacts	No impacts
BE Effects Determination for Northern goshawk	No impacts	May impact individuals	May impact individuals	May impact individuals

Activity	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Buried Trans Line	Alternative 4 Submerged Trans Line
Scenery	No Effect	Most visibility of the transmission line. Constructs access roads and transmission line above ground	Some visibility of the transmission line. Constructs access roads, and buries majority of transmission line along road corridor	Least visibility of the transmission line. Constructs access roads, and submerges majority of transmission line under water
Cultural Resources	No Historic Properties Affected	Historic Properties not adversely affected	Historic Properties not adversely affected	No Historic Properties Affected
Subsistence	No Effect	Does not pose a significant possibility of a significant restriction on subsistence	Does not pose a significant possibility of a significant restriction on subsistence	Does not pose a significant possibility of a significant restriction on subsistence
Wilderness[2]				
Effects (outside the project area) to "undeveloped" and "outstanding opportunities for solitude" Wilderness characteristics	No Effect	Most negative effects due to visibility and maintenance of road and transmission line.	Some negative effects due to road; less visible impact due to buried line.	Least negative effects due to elimination of the overland transmission corridor.
Socio-economics				
Estimated cost comparison for transmission lines[3]	None	$1,235,000	$1,303,000	$1,415,000

[2] The Forest Service recognizes that Congress exempted the project area from requirements of the Wilderness Act through ANILCA section 506 (a)(3)(D)

[3] Alternative costs differ primarily in terms of construction and maintenance costs of the transmission line. Dollar values are from an estimate done in 2000.

6. WHAT FACTORS WILL BE USED IN MAKING THE DECISION?

Based on the environmental analysis in this EIS, the Tongass Forest Supervisor will decide the required terms and conditions, if any, to be included in the SUA to protect water, fisheries, wildlife, recreation, heritage, and scenic values of Admiralty Island potentially affected by this project. Authorities to prescribe these conditions are found in the Federal Land Policy and Management Act of October 21, 1976 and ANILCA.

7. WHAT MONITORING IS NECESSARY?

Monitoring requirements are established in the approved Plans of Operations required by the Forest Service SUA and in permits and approvals issued by other State and Federal agencies. Monitoring related to concerns with karst and caves, vegetation, soils and wetlands, cultural resources, fisheries and water resources, wildlife, and design plans is prescribed. Kootznoowoo, Inc. and the Forest Service hold most of the monitoring responsibilities. Additional detail on resource monitoring, including water resource monitoring, is found in Chapter 2, Table 2.1.

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Angoon Hydroelectric Project Final EIS

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Appendices

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Chapter 1
Purpose and Need

Changes Between Draft and Final EIS

Chapter 1, Purpose and Need

- Revised and reformatted to better reflect Kootznoowoo Inc.'s rights and Forest Service decision space in this project
- Discussion of the Proposed Action has been expanded to clearly describe all measures, including monitoring and mitigation, deemed necessary to meet Forest Plan standards and guidelines.
- Permits, Licenses and Certifications section states that prior to construction, Kootznoowoo, Inc. is responsible for obtaining any necessary permits and reviews from federal and state agencies. Section includes a comprehensive list of permits, licenses and certifications required by various agencies including:
  - AK Dam Safety certification.
  - Identifies the need for both a water rights permits and Title 16 permit
  - The need for compliance with AK Coastal Zone Management Program
  - Identifies the need for an "authorization for occupancy and use of tidelands and submerged lands" permit through the AK DNR.
- Graphics have been updated and revised to improve clarity
- Included an executive summary of the Feasibility Report as an Appendix to the FEIS
- Per the 2008 Forest Plan the Thayer Creek/Angoon Hydroelectric project corridor are now assigned a Transportation and Utility System (TUS) Land Use Designation (LUD).

1. Chapter 1, Purpose and Need

1.1 INTRODUCTION

The United States Department of Agriculture Forest Service (Forest Service) has prepared this Environmental Impact Statement (EIS) on the Angoon Hydroelectric Project in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations. The EIS discloses the direct, indirect, and cumulative environmental effects and any irreversible or irretrievable commitment of resources that would result from the three action alternatives and the no-action alternative.

This EIS is prepared according to the format established by Council on Environmental Quality (CEQ) regulations implementing NEPA (40 CFR 1500-1508). Chapter 1, in addition to explaining the purpose and need for the proposed action, discusses how the Angoon Hydroelectric Project relates to the 2008 Tongass Land and Resource Management Plan (Forest Plan; USDA Forest Service 2008a), and identifies issues driving the EIS analysis. This EIS summarizes or incorporates by reference more detailed or voluminous analyses where appropriate.

The Forest used a systematic interdisciplinary approach to analyze the proposed action and alternatives, determine environmental effects, and prepare the EIS. The analysis was coordinated with appropriate federal, state, and local agencies, and federally recognized tribes.

Additional documentation, including more detailed analyses of project-area resources, may be found in the EIS planning record located at the Admiralty Island National Monument Office in Juneau, Alaska. Other published reference documents are available at public libraries throughout Southeast Alaska as well as at the Forest Supervisor's Offices in Ketchikan, Petersburg, and Sitka. The Forest Plan is also available on the internet.

1.2 PROJECT AREA

The project area is located within Admiralty Island National Monument, Tongass National Forest, Alaska. The project area was defined through the Alaska National Interest Lands Conservation Act of 1980 (ANILCA) as T. 49 S., R. 67 E. and T. 50 S., R 67 E, Copper River Base and Meridian. The proposed hydroelectric dam would be constructed on Thayer Creek with power delivered to Angoon. The city of Angoon is approximately 50 miles south of Juneau and the project area is just north of Angoon along the east shoreline of Chatham Strait (Figures 1-1 and 1-2). This hydroelectric reserve lies about 27 miles south of an existing hydroelectric power system that serves Green Creek.

Figure 1 - 1
Angoon Hydroelectric Project Area - Vicinity Map.

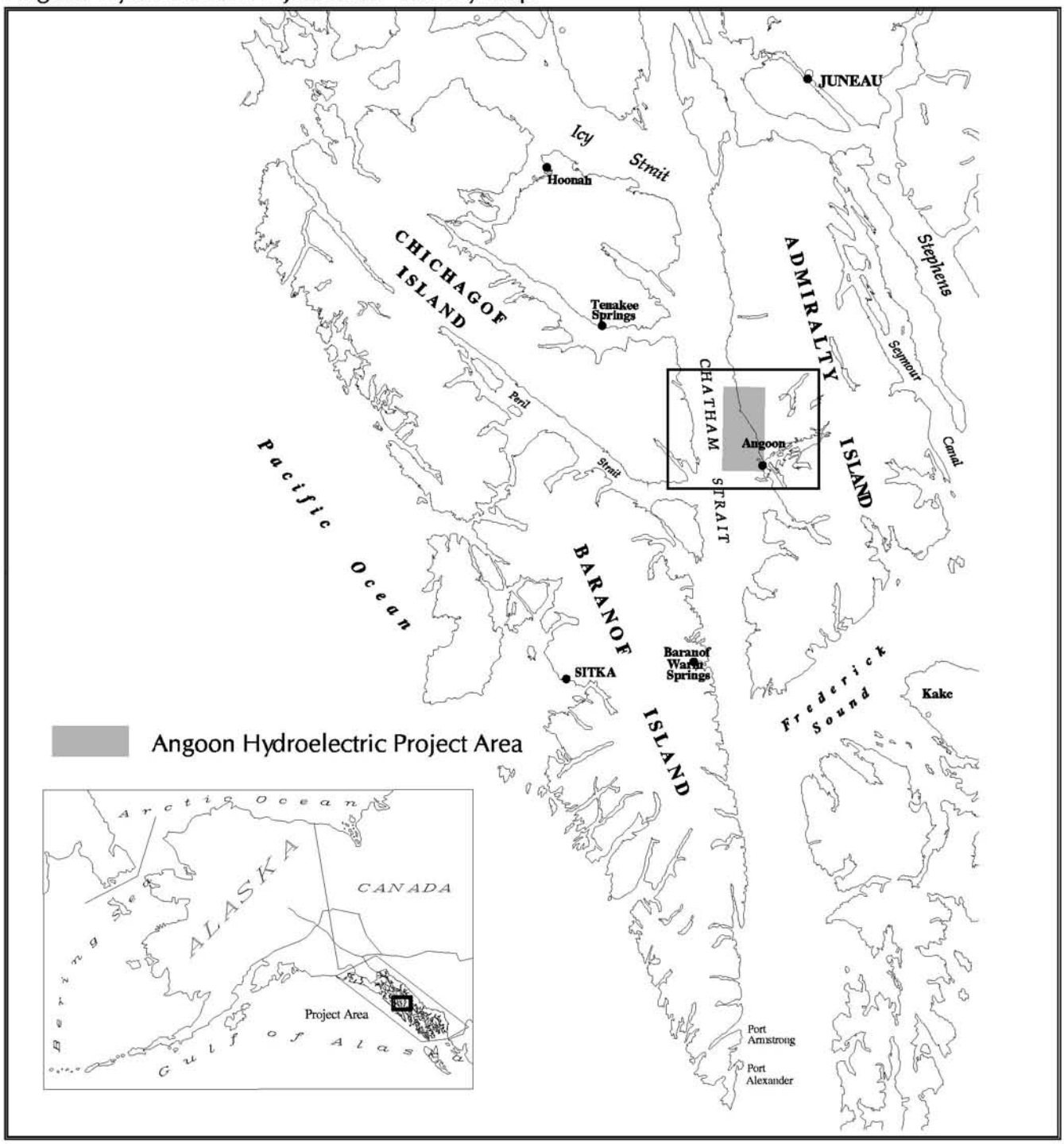
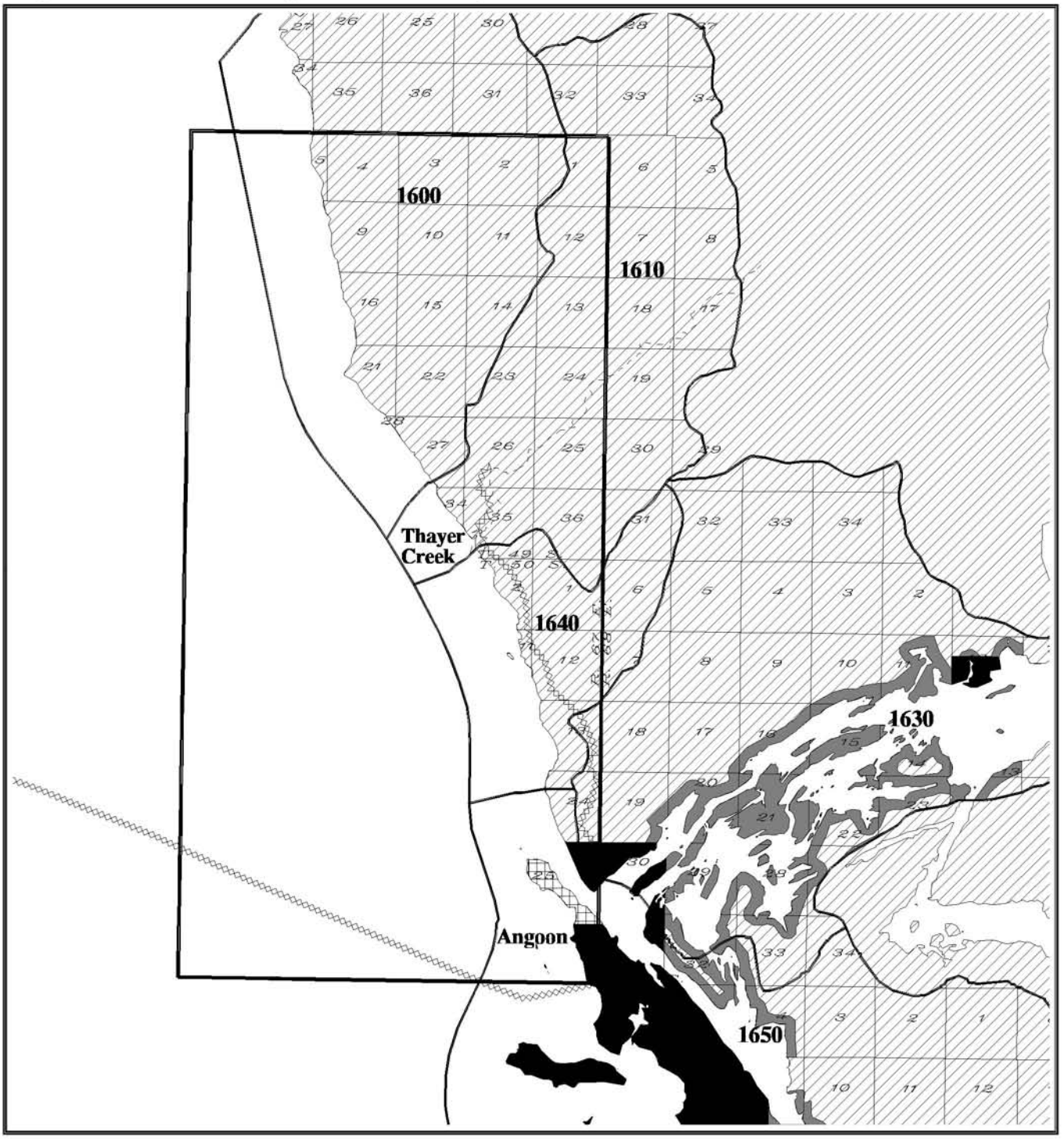


Figure 1 - 2
Project Area Land Use Designation (LUD) Map



Source: TLMP 2008

Wilderness Monument
Semi-Remote Recreation
Non–National Forest Land
P.L. 96-487 Sec. 506(a)(3)(c) Corridor Lands
1640 VCU Number
Value Comparison Unit (VCU)
Project Boundary
Potential Power Transmission Corridor

N W E S

1 0.5 0 1 2 Miles
Scale in Miles

Land ownership in the project area is mixed. The Forest Service manages the majority of the land within the project area as part of the Kootznoowoo Wilderness. In the southern portion of the project area, the lands within section 25, T. 50 S., R. 67 E. and section 30, T. 50 S., R. 68 E. are private land, with surface rights owned by Kootznoowoo, Inc., and subsurface interests owned by Sealaska, Inc. (see Figure 1-2). The City of Angoon boundaries include section 24, T. 50 S., R. 67 E. and section 19, T. 50 S., R. 68 E.

Bureau of Land Management records indicate that all of T. 67 E., R. 49 S., was selected by Sealaska in 1974 under the Alaska Native Claims Settlement Act (ANCSA). If constructed, the Angoon Hydroelectric project will be located, in part, in this township. The Sealaska selection still appears on the records, even though P.L. 95-178, (November 15, 1977, amendment to ANCSA) states that the Regional Corporation for southeastern Alaska cannot receive lands on Admiralty Island in the Angoon withdrawal area. Therefore, the Angoon Hydroelectric project would not be affected by Sealaska's ANCSA selection and reciprocally, the project will not affect the Sealaska selection. The only foreseeable event that could change this land status would be new legislation, which is not anticipated.

No Native Allotments under the Alaska Native Allotment Act are filed within the project area. There is no Federal ownership of lands in sections 25 and 36, T. 50 S., R. 67.

1.3 PROPOSED ACTION

A Federal agency proposed action exists when the agency is actively preparing to make a decision on the action. This serves as a starting point for the NEPA analysis, and gives the public and other agencies specific information on which to focus comments. Using these comments and information from preliminary analysis, alternatives to the proposed action are developed, which address significant issues while still meeting the purpose and need for the action.

In 2003, Kootznoowoo, Inc. (Kootznoowoo), the ANCSA corporation for the city of Angoon, asked the Forest Service to begin the NEPA process necessary to develop a hydroelectric project to lower the cost of power generation and electric bills in Angoon. In 2004, Kootznoowoo requested Forest Service terms and conditions for the Angoon Hydroelectric Project.

The hydroelectric facility proposed by Kootznoowoo to the Forest Service is described in The *Angoon Hydrologic Project Feasibility Evaluation Report* (Feasibility Report) prepared for Kootznoowoo by HDR Alaska, Inc. in 2000, and is identified in that report as the Selected Project Arrangement.

Kootznoowoo's Selected Project Arrangement included a diversion dam, intake structure, marine facility, three access roads, two staging areas, transmission lines, a power plant, a surge tank, 6,100 feet of 42-inch diameter pipeline and 510 feet of 36-inch diameter pipe. The hydroelectric plant would be a run-of-river facility using only the water available in the natural flow of the river. Under normal conditions, run-of-river facilities involve minimal water storage, and power generation fluctuates with

the stream flow. Appendix A contains the executive summary from the HDR feasibility report. The planning record includes the entire report.

The Forest Service Proposed Action (Alternative 2) includes modifications, in the form of terms and conditions in the Special Use Authorization (SUA), to Kootznoowoo's Selected Project Arrangement to reduce potential effects to resources in the project area and to meet specific requirements found in the Forest Plan. Chapter 2 describes the proposed action in detail. Appendix B, Road Cards, displays the potential road locations identified for the project.

1.4 DECISION FRAMEWORK

The framework for this decision is somewhat unusual in that through the Alaska National Interest Lands Conservation Act of 1980 (ANILCA), Congress has:

- granted Kootznoowoo certain rights for development of a hydroelectric facility at Thayer Creek;
- mandated the decision space and level of involvement of the Secretary of Agriculture (Forest Service); and
- **specifically exempted the hydropower project from the requirements of the Wilderness Act**.

The Forest Service decision is limited to setting terms and conditions necessary for resource protection. Other federal and state agencies have jurisdiction over certain aspects of the project and will use this EIS as a basis for their permitting decisions (see section 1.9 Permits, Licenses, and Certifications, below).

ANILCA specifically recognized the needs of the city of Angoon. Section 506(a)(1) of the Act states:

> Congress hereby recognizes the necessity to reconcile the national need to preserve the natural and recreation values of the Admiralty Island National Monument with the economic and cultural needs and expectations of Kootznoowoo, Incorporated, and Sealaska, Incorporated, as provided by the Alaska Native Claims Settlement Act and this Act.

ANILCA Section 506(a)(3) further states:

> …subject to valid existing right, there is hereby granted to Kootznoowoo, Incorporated… (B) The right to develop hydroelectric resources on Admiralty Island within township 49 south, range 67 east, and township 50 south, range 67 east, Copper River Base and Meridian, subject to such conditions as the Secretary of Agriculture shall prescribe for the protection of water, fishery, wildlife, recreational, and scenic values of Admiralty Island.

ANILCA Section 506(a)(3)(D) limits the extent of the conditions that the Secretary of Agriculture (through the Forest Service) can prescribe by excluding the provisions of the Wilderness Act of 1964 on the right to develop hydroelectric resources:

> (D) Any right or interest in land granted or reserved in paragraphs (3) (A, B, and C) shall not be subject to the provisions of the Wilderness Act.

Except for the land necessary for the hydroelectric facilities developed by Kootznoowoo, the majority of the land within the boundary of the area described by ANILCA, as well as the rest of the Kootznoowoo Wilderness, will continue to be managed by the Forest Service as a Wilderness under the 1964 Wilderness Act and ANILCA (see Figure 1-2).

This means that Kootznoowoo has the statutory right to develop, own, and operate a hydroelectric power facility within the confines of the legal description. It also means that the Forest Service (for the Secretary of Agriculture) must be responsive to this mandate, and may prescribe certain conditions for the protection of potentially affected resources on Admiralty Island.

On January 23, 2001, the Federal Energy Regulatory Commission (FERC) filed an order finding that no FERC license would be required for the Angoon Hydroelectric Project. The ruling stated that FERC has no jurisdiction on National Monument status lands administered by the Forest Service. For hydropower projects FERC is generally the lead federal agency with their license being the permitting document. Since they do not have jurisdiction on the Angoon Hydropower Project, the Forest Service is the lead agency with the SUA becoming the controlling document.

The NEPA decision to be made by the Forest Service will determine the terms and conditions in the SUA to protect water, fisheries, wildlife, recreational, heritage, and scenic values within the project area. Authorities to prescribe these conditions are found in the Federal Land Policy and Management Act of October 21, 1976 and ANILCA. The final design and construction of the project must be consistent with the Record of Decision (ROD) for this EIS. Any future changes to the design and construction of the project will be the responsibility of Kootznoowoo and may require Kootznoowoo to prepare a supplemental EIS before the Forest Service issues a SUA.

On August 11, 2004, the Regional Forester delegated the authority to sign the ROD and SUA for this project to the Tongass Forest Supervisor. **The Forest Service will not issue a SUA to Kootznoowoo until all required state water use permits have been secured by Kootznoowoo.**

1.4.1 DECISIONS TO BE MADE

Based on the environmental analysis in this EIS, the Tongass Forest Supervisor will decide the required terms and conditions, if any, to be included in the SUA to protect water, fisheries, wildlife, recreation, heritage, and scenic values of Admiralty Island potentially affected by this project.

If changes to the terms and conditions included in this EIS occur or new information is brought forward, the Tongass change analysis process would be used to determine whether additional environmental analysis and public involvement are necessary and to document any modifications to the project in the project record.

1.5 PURPOSE AND NEED

The Purpose and Need for the Proposed Action is to comply with the requirements of ANILCA Section 506(a) by establishing resource protection measures to be required for the development of the hydroelectric project proposed by Kootznoowoo at Thayer Creek within Admiralty Island National Monument. ANILCA granted Kootznoowoo the right to develop the hydroelectric project subject to conditions prescribed by the Forest Service for protection of water, fishery, wildlife, recreational, heritage, and scenic values of Admiralty Island.

Kootznoowoo, the City of Angoon, and the Angoon Community Association (the federally recognized tribe from Angoon) are proposing this project with the expectation that it would reduce the cost of power generation in Angoon and result in lower electric rates for Angoon residents. The project is expected to benefit the local economy by providing sufficient power for future growth of the community.

1.6 RELATIONSHIP TO THE FOREST PLAN

National Forest planning takes place at several levels, including the national, regional, forest, and project levels. The Angoon Hydroelectric Project EIS is a project-level analysis; its scope is confined to addressing the significant issues and possible environmental consequences of the project. It does not attempt to address decisions made at higher levels. It does, however, implement direction provided at those higher levels.

The Forest Plan embodies the provisions of the National Forest Management Act (NFMA), its implementing regulations, and other guiding documents. The Forest Plan sets forth in detail the direction for managing the land and resources of the Tongass National Forest. The Forest Plan is the result of extensive analysis, which is addressed in the Forest Plan FEIS (USDA Forest Service 2008b). Where appropriate, the Angoon Hydroelectric Project EIS tiers to the Forest Plan, as encouraged by the CEQ regulations implementing NEPA.

Kootznoowoo's right to develop hydroelectric resources within the Kootznoowoo Wilderness Area was granted under ANILCA. The 2008 Tongass Land and Resource Management Plan (Forest Plan), identifies Thayer Creek as a hydroelectric project reserve and includes a potential power transmission corridor from Thayer Creek to Angoon. The reserve and transmission corridor are assigned a Transportation and Utility System (TUS) Land Use Designation (LUD); see Figure 1-2. The Forest Plan standards and guidelines for TUS serve as the basis for evaluating the proposed action.

The 2008 Forest Plan provides the following objectives for the TUS LUD:

- The TUS LUD takes precedence over any underlying LUD (subject to applicable laws). As such, it represents a "window" through the underlying LUD through which roads and/or utilities can be built

- Transportation Utility Systems may dominate the seen foreground, yet are designed with consideration for the existing form, line, color, and texture of the characteristic landscape.
- Minimize and/or mitigate adverse effects to wildlife habitat and populations to the extent feasible.
- Maintain the present and continued productivity of anadromous fish and other fish habitat to the extent feasible.

The LUD adjacent to the project area is Wilderness National Monument. ANILCA Section 506(a)(3)(D) specifically excludes the provisions of the 1964 Wilderness Act on Kootznoowoo's right to develop hydropower. Under NEPA, however, the Forest Service is obligated to disclose the anticipated direct and indirect effects to key resources, including adjacent Wilderness.

The Forest Plan includes Forest-wide goals and objectives, as well as area-specific, LUD goals, objectives, and desired conditions. Applicable Forest-wide goals and objectives related to this project include the following:

- Develop and manage roads and utility systems to support resource management activities; recognize the potential for future development of major Transportation and Utility Systems.
- Manage designated Wilderness to maintain an enduring wilderness resource while providing for public purposes of recreational, scenic, scientific, educational, conservation, and historical use, as provided in the Wilderness Act of 1964 and ANILCA.
- Provide a diversity of opportunities for resource uses that contribute to the local and regional economies of Southeast Alaska.
- Minimize sediment transported to streams from land-disturbing activities.
- Maintain and restore the biological, physical, and chemical integrity of Tongass National Forest waters
- Maintain or restore the natural range and frequency of aquatic habitat conditions on the Tongass National Forest to sustain the diversity and production of fish and other freshwater organisms.
- Minimize the destruction, loss, or degradation of wetlands and preserve and enhance wetland functions and values.
- Maintain habitat capability sufficient to produce wildlife populations that support the use of wildlife resources for sport, subsistence, and recreational activities.
- Provide for the continuation of subsistence uses and resources by all rural Alaskans.
- Provide Forest visitors with visually appealing scenery, with emphasis on areas seen along the Alaska Marine Highway, tour ship and small boat routes, state highways, major Forest roads, and from popular recreation places; recognize that in other areas where landscapes are altered by management activities, the activity may visually dominate the characteristic landscape.

- Identify, evaluate, preserve, and protect heritage resources.
- Maintain, to the extent practical, the natural karst processes and the productivity of the karst landscape while providing for other land uses where appropriate.

1.6.1 FOREST-WIDE STANDARDS AND GUIDELINES

Forest-wide standards and guidelines were defined for all resources and documented in Chapter 4 of the Forest Plan. Standards and guidelines were designed so that all activities are integrated to meet land allocation objectives. The Forest-wide standards and guidelines applicable to the Angoon Hydroelectric Project are listed in Chapter 2 under Elements Common to All Action Alternatives.

1.6.2 TUS LUD MANAGEMENT PRESCRIPTIONS

In addition to the Forest-wide standards and guidelines for all resource areas, the management prescriptions for the TUS LUD provide specific direction in the form of LUD standards and guidelines for several resource areas that may be affected by the Angoon Hydroelectric Project. These include geology and soils, water resources, fisheries, vegetation, wildlife, visual resources, and cultural resources, and are included in Chapter 3 of the Forest Plan (USDA Forest Service 2008a).

1.7 PUBLIC INVOLVEMENT

1.7.1 SCOPING

The CEQ defines scoping as "...an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action" (40 CFR 1501.7). Among other things, the scoping process is used to invite public participation, to help identify public issues, and to obtain public comment at various stages of the NEPA process. Although scoping is to begin early, it is an iterative process that continues until a decision is made. In addition to the specific activities described below, the Angoon Hydroelectric Project has been listed on the Tongass National Forest Schedule of Proposed Actions since April 2004.

Public scoping for the Angoon Hydroelectric Project started with publication of the Notice of Intent on October 14, 2004 (Federal Register, Volume 69, No. 198, pages 60976-60978). A project scoping notice was sent to interested members of the public at that time. The mailing list for the notice consisted of 84 tribes and corporations, individuals, agencies, private businesses, and nongovernmental organizations. The *Juneau Empire* advertised an invitation to attend public meetings. Representatives of the Forest Service and Kootznoowoo hosted scoping meetings on October 14, 2004, in Angoon and October 15, 2004 in Juneau. Public comments were solicited at the meetings, and comments were received in writing throughout the formal scoping period (through October 29, 2004).

Total attendance at these two 2004 public meetings was 22 individuals. Angoon and Juneau residents contributed both spoken and written comments. The letters include the following:

- Federal agencies: One letter was received from the National Marine Fisheries Service (NMFS).
- State agencies: One letter was received from the Alaska Department of Fish and Game (ADFG).
- Organizations: Letters were received from Friends of Admiralty Island, Southeast Alaska Conservation Council and the Sierra Club.
- Individuals: Three e-mail messages were received from members of the public. One member of the public submitted a written comment at the Juneau public meeting.

1.7.2 CONSULTATION WITH TRIBAL GOVERNMENTS

The National Historic Preservation Act (1966 as amended) strengthens the relationship between the Forest Service and Indian Tribes (defined as federally recognized tribes, Alaska Native Corporations and Native Hawaiian Organizations) in consultation regarding site significance and the potential affects on historic and archaeological sites. Executive Order 13175 requires that federal agencies consult with tribes during planning activities.

In 2003 Kootznoowoo asked the Forest Service to begin the NEPA process necessary to allow them to develop a hydropower facility at Thayer Creek. Since then the Admiralty Island National Monument Ranger and various staff members have met with representatives and leaders of Kootznoowoo, the Angoon Community Association and elected officials of Angoon to clarify their proposal, provide updates and consult with them regarding specific aspects of the project. As required by Executive Order 13175, this consultation and coordination began early in the process and continued as both routine consultation meetings and project specific briefings. Notes and summaries of these meetings can be found in the EIS planning record.

1.7.3 MEETINGS AND CONSULTATION WITH AGENCIES AND OTHERS

Consultation with many State and Federal agencies started in 2005 for this project and continued through 2009. Consultation with the State Historic Preservation Officer (SHPO) in terms of eligibility of sites for inclusion on the National Register of Historic Places and effects has been ongoing since December 2005. The Forest Service consulted with the US Fish and Wildlife Service (USFWS) about bald eagle management for this project including transmission line design and bald eagle surveys starting in January 2005. Further consultation will be initiated if an encroachment upon the 330-foot buffer for any eagle nest is unavoidable. Consultation with National Marine Fisheries Service (NMFS) related to marine mammals was initiated early in the process, and continued in 2008.

Forest Service representatives held a meeting with representatives of Alaska Department of Fish and Game (ADFG), USFWS, and NMFS on May 19, 2008, in Juneau. The Forest Service presented information and an update on the project and the group discussed information needs related to aquatic effects. On August 5, 2008, Rich Jackson of the Corps of Engineers and Peter Naoroz of Kootznoowoo Inc. accompanied Forest Service personnel in the field on the proposed Angoon Hydroelectric Project. Jackson consulted with Forest Service personnel and Naoroz about the requirements and expectations for the permit issued by the Corps of Engineers under Section 404 of the Clean Water Act. Additional meetings were held with agencies and Kootznoowoo representatives in the winter of 2008/2009. Essential Fish Habitat (EFH) consultation with NMFS was initiated in November 2008. Contacts were made with NMFS during and after their 45-day review. As of February 2009, NMFS has sent the Forest Service no comments on the EFH determination and no conservation recommendations.

1.7.4 DRAFT ENVIRONMENTAL IMPACT STATEMENT

Availability of the Draft EIS was announced through a Notice of Availability in the Federal Register on May 25, 2007, and through a legal notice in the *Juneau Empire*. The Notice of Availability started a 45-day comment period that began May 26. The Forest Service also mailed copies of the Draft EIS to federal and state agencies, Alaska native tribes and corporations, and municipal offices, and anyone else who had requested them.

After the Draft EIS was distributed, two open houses were held to provide information to those interested in the project. One open house was held in Angoon on June 27, 2007; 20 people attended. Twenty-two people attended the second open house in Juneau on June 28, 2007. A meeting was also held on August 1, 2007, with four individuals representing Kootznoowoo and interested local groups.

Fourteen agencies, organizations, and individuals submitted written comments on the Angoon Hydroelectric Project Draft EIS. The Interdisciplinary Team (IDT) used these comments to further refine and develop this FEIS (please see information regarding Changes Made between Draft and Final EIS on the backs of the chapter divider pages). The comments and the Forest Service responses to these comments are displayed in Appendix C of this FEIS.

1.8 ISSUES

The scoping process identified a number of concerns related to the project. Some concerns related to procedural matters and others related to potential effects to specific resources in the project area. None of the resource-specific concerns, however, provided specific links to the proposed action.

The Proposed Action displayed in the DEIS was designed to meet the standards and guidelines in the 1997 Forest Plan and 2003 Supplement. Since release of the DEIS a new Forest Plan has been completed and additional field work has raised concerns

about steep ground along Thayer Creek and karst features near the shoreline. Since the 2008 Forest Plan requires that buried and submerged transmission lines be considered for all hydropower projects, an additional action alternative (Alternative 3) was considered and analyzed. A submerged transmission line was considered in the DEIS (Alternative 2a) and is displayed in a slightly modified form as Alternative 4 in the FEIS. These two alternatives to the Proposed Action address most concerns raised for this project.

In addition to being required by the Forest Plan, Alternative 3 was developed as a means of reducing the amount of vegetative clearing required along the transmission line corridor, reduce potential effects to fish habitat in Thayer Creek and to reduce potential effects of road and pipeline/penstock construction on steep slopes along Thayer Creek and minimize effects to areas identified as high vulnerability karst and the streams that flow to the features.

In addition to being required by the Forest Plan, Alternative 4 was developed to eliminate uplands impacts associated with the construction of an access road and transmission line from the marine facilities to Kootznahoo Inlet.

Concerns that were considered in this analysis, but determined not to be significant in the NEPA context are discussed below.

Issue 1: The Forest Service must ensure adequate review of fisheries, water quantity, and water quality in Thayer Creek; wildlife; road construction and maintenance; watershed analysis; subsistence, recreation, and commercial use; cultural and historic sites; and alternatives, mitigation, and financial assurances. Also ensure consistency with Magnuson-Stevens Act and Clean Water Act requirements.

Conclusion after Consideration: This issue is addressed by existing statutory requirements and regulations related to the project. Scoping, agency coordination and public involvement are required elements of the NEPA process. This analysis and decision must meet the consultation and coordination requirements of existing state and federal laws, regulations and the Forest Plan.

Issue 2: The proposed action has the potential for negative effects to the area, wildlife, and cultural resources.

Conclusion after Consideration: The preliminary analysis of the Proposed Action did not indicate major effects to project area resources; subsequent field work identified some concerns with steep slopes and karst features. Alternatives 3 and 4, in addition to being required by the 2008 Forest Plan, incorporate changes to the Proposed Action to address these resource concerns.

There are no threatened and endangered terrestrial species in the project area. The proposed action requires that final construction design meets Forest Plan Standards and Guidelines. In terms of heritage, our review of the proposed project has resulted in the documentation of nine historic and archaeological sites within the vicinity of the project area. These sites were evaluated and five were determined to be eligible for listing on the National Register of Historic Places and effects to these sites need to be considered. The analysis of the effects to the historic properties resulted in a determination of "No historic properties affected" for Alternatives 1 and 4 and

through implementation of avoidance terms and conditions a determination of "No Adverse Effect" for implementation of Alternatives 2 or 3. This analysis was submitted to the SHPO for review and their concurrence in December 2008. We received concurrence with our determination of effect in a letter dated January 5, 2009 provided stipulations in this FEIS are followed.

Issue 3: The Forest Service should consider lowering the height of the transmission cable from 35 to 25 feet.

Conclusion after Consideration: This is a final design element that will be determined by topography and the technical requirements for an overhead transmission line. A difference in pole height of 10 feet would have little, if any, effect on area resources since it would not affect clearing limits (clearing limits are related to tree height not cable height) or be noticeable from identified viewing points.

1.9 PERMITS, LICENSES, AND CERTIFICATIONS

Prior to construction, Kootznoowoo is responsible for obtaining any necessary permits and reviews from federal and state agencies. These include:

U.S. Army Corps of Engineers

- Approval of discharge of dredged or fill material into waters of the United States (Section 404 of the Clean Water Act of 1977, as amended)
- Approval of construction of structures or work in navigable waters of the United States (Section 10 of the Rivers and Harbors Act of 1899)

U.S. Environmental Protection Agency

- Permits under Clean Water Act Sections 401, 402, and 404

State of Alaska, Department of Fish and Game

- Fish Habitat (Title 16) Permit

State of Alaska, Department of Natural Resources

- Authorization for occupancy and use of tidelands and submerged lands
- Alaska Coastal Management Program
- Water Rights Permit
- Hazard Potential Classification and Jurisdictional Review (to determine if Alaska Dam Safety Program certification is needed)

State of Alaska, Department of Environmental Conservation

- Solid Waste Disposal Permit (Section 402 of the Clean Water Act)

1.10 APPLICABLE LAWS AND EXECUTIVE ORDERS

Shown below is a partial list of federal laws and executive orders pertaining to this project. While most pertain to all federal lands, some of the laws are specific to Alaska.

Migratory Bird Treaty Act of 1918 (as amended)

Bald and Golden Eagle Act of 1940 (as amended)

National Historic Preservation Act of 1966 (as amended)

National Environmental Policy Act (NEPA) of 1969 (as amended)

Clean Air Act of 1970 (as amended)

Alaska Native Claims Settlement Act of 1971

Coastal Zone Management Act of 1972 (as amended)

Marine Mammal Protection Act of 1972

Endangered Species Act (ESA) of 1973 (as amended)

Clean Water Act of 1977 (as amended)

American Indian Religious Freedom Act of 1978

Alaska Native Interest Lands Conservation Act (ANILCA) of 1980

Archaeological Resource Protection Act of 1980

Federal Cave Resource Protection Act of 1988

Native American Graves Protection and Repatriation Act of 1990

Magnuson-Stevens Fishery Conservation and Management Act of 1996

National Transportation Policy (2001)

Executive Order 11593 (cultural resources)

Executive Order 11988 (floodplains)

Executive Order 11990 (wetlands)

Executive Order 12898 (environmental justice)

Executive Order 12962 (aquatic systems and recreational fisheries)

Executive Order 13112 (invasive species)

Executive Order 13175 (consultation and coordination with Indian tribal governments)

Executive Order 13212 (actions to expedite energy projects)

Executive Order 13302 (amending E.O. 13212)

Chapter 2
Alternatives

Changes Between Draft and Final EIS

Chapter 2, Alternatives

- Expanded to include a more detailed description of the 'selected project arrangement' provided to the Forest Service by Kootznoowoo, Inc. in the Feasibility Evaluation Report prepared for Kootznoowoo, Inc. by HDR Associates.
- Focused on terms and conditions for resource protection rather than optimizing project layout. The project components and conditions are clearly spelled out for all the alternatives.
    - No Action (alt 1)
    - Proposed Action (alt 2) – based on DEIS/Selected Project Arrangement
    - Buried Transmission line (alt 3) – TLMP requirement/reduced clearing/avoid karst/avoid steep ground
    - Submerged/buried Transmission line (alt 4) – TLMP requirement/shorter upland corridor/avoid karst/avoid steep ground
- Graphics were updated and revised for clarity
- Includes additional information related to a submerged transmission line and adds an alternative that considers a buried transmission. The Forest Plan requires the consideration of both submerged and buried transmission lines.
- More clearly explains that the alternatives considered in the EIS are based on specific resource concerns.
- FEIS has been revised to clearly show the terms and conditions, which would apply to all action alternatives as well as those specific to each alternative, including BMPs and formal plans.
- States that all access roads would be closed to motorized vehicular use unrelated to project construction, maintenance, and operation.
- Some road/line and other facility locations were adjusted to reduce construction complications and impacts to resources. Distances and acreages were updated and rounded to match GIS locations; numbers may vary slightly from those displayed in the DEIS and specialist reports.
- An alternative comparison table was added.

2. Chapter 2, Alternatives, Including the Proposed Action

2.1 INTRODUCTION

This chapter describes and compares the alternatives considered by the Forest Service for the Angoon Hydroelectric Project. It includes a discussion of how alternatives were developed, elements/terms and conditions to reduce or eliminate adverse environmental impacts, a description of the alternatives considered in detail, and a comparison of the alternatives.

Some of the information used to compare alternatives at the end of Chapter 2 is summarized from Chapter 3, Affected Environment and Environmental Consequences. Chapter 3 contains the detailed scientific basis for establishing baselines and measuring the potential environmental consequences of each of the alternatives. For a full understanding of the effects of the alternatives, readers will need to consult Chapter 3.

2.2 ALTERNATIVE DEVELOPMENT PROCESS

In January 1999, Kootznoowoo, Inc. (Kootznoowoo) contracted HDR Alaska, Inc. to conduct a study to provide a basis for deciding whether the Angoon Hydroelectric Project was feasible enough to proceed with permitting and design efforts. Among other tasks, the study evaluated the feasibility of several alternative project arrangements, evaluated the hydrology of Thayer Creek, and analyzed the economic feasibility of the project (HDR Alaska 2000). The report evaluated three primary alternative arrangements for supplying water to the powerhouse: (1) pipeline and penstock, (2) directional-drilled tunnel, and (3) conventional tunnel. The report also considered four alternative arrangements for a transmission line to the city of Angoon: (1) overhead line, (2) buried line, (3) submerged line, and (4) a combination of overhead, buried, and submerged line. At a review meeting in April 1999, Kootznoowoo selected the pipeline-and-penstock alternative with an overhead transmission line to Kootznahoo Inlet and submarine crossing to Angoon for further refinement, particularly to reduce construction costs and improve access to the project site. The other alternatives were found to be too risky and costly or to have too little power generation capacity.

The hydroelectric facility proposed by Kootznoowoo to the Forest Service is described in The *Angoon Hydrologic Project Feasibility Evaluation Report* (Feasibility Report) prepared for Kootznoowoo by HDR Alaska, Inc. in 2000 and is identified in that report as the Selected Project Arrangement. An Executive Summary is provided as Appendix A to the EIS and the full report is included in the planning record.

The HDR Selected Project Arrangement was presented to the Forest Service by Kootznoowoo and was accepted as the applicant's proposal. Terms and conditions were then added to Kootznoowoo's Selected Project Arrangement, as authorized by ANILCA, to reduce potential effects to resources in the project area and to meet specific requirements found in the Forest Plan. The Forest Service Proposed Action (Alternative 2) includes these

modifications, in the form of terms and conditions in the Special Use Authorization (SUA), for resource protection.

The action alternatives are all based on the Selected Project Arrangement proposal submitted by Kootznoowoo. Each action alternative displays the individual components of the applicant's proposal that are included in that alternative. Alternatives 3 and 4 include changes to the components to meet specific requirements found in the Forest Plan that reduce potential effects to resources in the project area. The preferred alternative is Alternative 3. However, any of the alternatives may be selected in the Record of Decision for the Final EIS.

The HDR Feasibility Evaluation Report (HDR Alaska 2000) describes existing Angoon electrical loads and resources and includes a development schedule and economic analysis.

2.3 ALTERNATIVES CONSIDERED IN DETAIL

2.3.1 ALTERNATIVE 1 (NO ACTION)

Under the No Action alternative, the Forest Service would not issue a special use authorization (SUA) for the project, and the proposed project would not be constructed. Diesel generators would continue to be used to supply energy for the community of Angoon unless alternative energy sources are developed. Although selection of this alternative would deny Kootznoowoo the statutory rights granted by ANILCA, CEQ regulations (40 CFR 1502.14d) require that a "no action" alternative be analyzed in every EIS. This alternative represents the existing condition against which other alternatives are compared. The map for Alternative 1, the No-Action Alternative, is the project area map for LUDs and the TUS corridor (See Chapter 1, Figure 1-2); it represents the current condition of the project area.

2.3.2 ELEMENTS COMMON TO THE ACTION ALTERNATIVES

Kootznoowoo's development proposal serves as the basis for the terms and conditions displayed in the action alternatives in this EIS. Where the terms and conditions vary among alternatives, those terms and conditions are listed by alternative. Listed below are the terms and conditions to be included in the SUA that are the same for all the action alternatives:

General

- As part of the SUA, and prior to project implementation, the proponent would be required to supply plans and other information for Forest Service review and approval. The Forest Service reviews and approves all technical aspects of the project, including design plans, site plans, and specifications.
- The SUA contains terms and conditions related to engineering and structural specifications, land-use and administrative fees, resource protection requirements, and safety requirements in addition to other special clauses deemed appropriate by the Forest Service. The Forest Service is responsible for the regulation and monitoring of construction, operation, and fee collection.

- The Forest Service may require special plans of the holder, for example:
    - Abandonment
    - Borrow pit restoration
    - Clearing and disposal
    - Cultural resource management
    - Environmental Compliance and Monitoring
    - Erosion control
    - Fire
    - Fish and wildlife management
    - Flood plain and wetland protection
    - Grading and profile
    - Hazardous substances management
    - Landscape management
    - Public Information
    - Recreation
    - Reservoir/conveyance operation and maintenance
    - Revegetation and/or rehabilitation
    - Road maintenance
    - Safety
    - Sensitive plants/animals protection
    - Sewage/refuse disposal
    - Spill Prevention
    - Spoil disposal
    - Timber removal
    - Transportation
    - Water resources protection

See Hydroelectric Handbook – Typical Order of Events for Exempted Project (FSH 2709.15 Ch 24.3) and Summary of Special Use Authorization Content (FSH 2709.15 Ch 61.6 – Exhibit 1)

- The Forest Service would review construction plans, specifications, and geotechnical information concerning all facilities on National Forest System lands as part of the SUA operating plan.
- Before issuing the SUA, the Forest Service would require a final safety and engineering review of the project design
- Ground-disturbing activities associated with the Angoon Hydroelectric project are considered nonpoint pollutant sources under Clean Water Act Sections 208 and 319. Best Management Practices (BMPs) are recognized as the primary control mechanisms for nonpoint source pollution on National Forest System lands. Alaska's Nonpoint Source Pollution Control Strategy (ADEC 2007) describes site-specific application of BMPs, with a monitoring and feedback mechanism, as the approved strategy for controlling nonpoint source pollution. BMPs are described in the Forest Service's Soil and Water Conservation Handbook (USDA Forest Service 2006). BMPs 12.10 and 12.14 address water resource protection in Special Use Permits and

Utility Corridors. This EIS and accompanying road cards describe the site-specific application of BMPs for this project. The project proponent will be required to specify BMPs in operating plans subject to further review and approval by the Forest Service.

- At a minimum, the dam must be designed for a 100-year flood, in accordance with State of Alaska guidelines for low hazard dams (Alaska Department of Natural Resources 2005).
- To minimize ground disturbance and water quality impacts, use of ground-based equipment for construction, operation, and maintenance activities will require minimum standard road construction approved by the Forest Service. Forest Service engineers indicate that road clearing width/road corridors needed for this project's roads would generally be between 46 and 70 feet, dependent on slope, with 50 foot widths being the average.
- No ground-based equipment will be authorized off roads for any activity unless approved site-specifically by the Forest Service.
- Merchantable timber removed for facility construction will be appraised and sold to the permittee through a settlement contract (36 CFR 223.12 Permission to cut, damage, or destroy trees without advertisement). The contract will outline the requirements associated with National Forest timber removal and disposal per applicable manual direction and federal regulations. No timber can be harvested from within 100 feet of Thayer Creek (to meet Tongass Timber Reform Act buffers).
- The facilities, roads, and transmission lines must be designed to meet all applicable Forest Plan standards and guidelines.
- Roads developed to implement this project would be for high-clearance vehicles and heavy equipment (see Road Cards in Appendix B).
- Roads constructed for the project would be closed to all motorized uses unrelated to project construction and operation; the project proponent will be responsible for installing effective road closure devices as well as for road maintenance and erosion control.
- If camps are needed in the project area, camps will be located in areas identified for disturbance such as staging areas, rock pits or building sites.

In addition to the above, the following specific conditions would be applied to reduce or mitigate adverse effects on specific natural resources in the project area:

Geology and Soils

- BMPs include, but are not limited to:
    - Road location avoids unstable, sensitive, or fragile areas (BMPs 14.2, 14.7).
    - Road design and construction maintains natural drainage and controls excavation and sidecast material (BMPs 14.3, 14.9, 14.12).
    - Erosion control measures apply to all disturbed areas and are consistent with invasive species policy (BMPs 12.17, 14.5, 14.8, 14.10, 14.11, 14.18).

- Design-level geotechnical studies must be completed before final layout and design of the project to avoid building project features on unstable slopes.
- Roads shall be held to the minimum feasible number, width and total length consistent with the intended purpose (see Road Cards in Appendix B).

Water Resources

- BMPs include, but are not limited to:
    - Road-stream crossings (including penstock crossing) would be designed to avoid constricting bankfull channel width. Class I, II, and III stream crossings would pass, at minimum, a 50-year flood event (BMP 14.17).
    - Construction of road-stream crossings would minimize disturbance and sediment production (BMPs 14.10, 14.14, 14.17, 14.19).
    - Clearing for roads and/or transmission line corridors would minimize tree-felling in designated streams (see road cards). If debris entering stream has debris dam or diversion potential it must be removed within 48 hours unless approved by the Forest Service (BMP 13.16).
- The dam would be designed to allow flushing of sediment and large wood into the bypass reach on an as-needed basis.
- The project would divert no more than 82 cfs (cubic feet of water per second) of streamflow from Thayer Creek. This amount is based on the proponent's intent to install two turbines, each rated for 41 cfs (HDR 2000). The proponent is responsible for obtaining a water right for diversion from Alaska Department of Natural Resources.
- All diverted streamflow would be returned from the powerhouse to the Thayer Creek.
- The powerhouse may not release heated water to Thayer Creek (see monitoring plan).
- The powerhouse must be designed to provide flow downstream of the powerhouse in the event of an unplanned shutdown of the intake or pipeline.
- A plan to collect streamflow data in Thayer Creek would be approved by the Forest Service prior to final design.
- A monitoring plan addressing instream flows, floating debris and sediment at the dam, and stream temperature, ice accumulation, streambed substrate and large wood in the anadromous fish reach would be required.

Fisheries

- Resource-specific BMPs include, but are not limited to:
    - BMP 12.17- Revegetation of Disturbed Areas
    - BMP 13.16- Stream Channel Protection
    - BMP 14.6- Timing restrictions for construction activities

- Instream construction may only occur during low-flow periods (Aug-Sept or Dec-Mar) and employ sediment and erosion control BMPs to minimize downstream sedimentation and direct impacts to resident and anadromous fish.
- No in-water work in salt water may occur from March 15-June 15 to protect spawning herring and migrating juvenile salmon unless approved by ADFG.
- The intake structure at the diversion dam must be properly installed and screened to protect resident fish. Refer to NMFS reference on intake screen criteria (NMFS 1996).
- Design of the diversion dam must safely pass fish downstream subject to approval by ADFG.
- Design of the tailrace discharge structure must include outfall protection, such as a concrete pad or placed riprap, to decrease or eliminate scouring and sedimentation. Must also be designed so as to not be an attractant flow to escaping fish or allow access to the tailrace.
- Road-stream crossings of Class I and II streams (designated in road cards) would be designed to accommodate fish passage (BMPs 14.17, 12.5)
- A plan to monitor fish populations in the anadromous habitat is required. Refer to Forest Service guidelines for population assessment (Bryant 2000)
- Floating wood accumulating behind the dam must be disposed of into the bypass reach during high flows in May-June or September-October

Vegetation

- Avoid disturbance of grassy areas on the west side of the small island near the marine facilities to reduce chance of spread of non-native species present.
- Prior to construction, the district botanist will mark, on the ground or on aerial photos, the boundaries of the known rare plant populations in or near the proposed project footprint.
- To avoid rare plants, spoils will not be deposited in the large tall sedge fen meadow between the power house and dam.
- To avoid the introduction of invasive species into the project area, plants native to the area should be used for any revegetation or restoration work.
- Construction vehicles and equipment must be washed before being delivered to the project site.
- Erosion control measures will use weed-free materials. Re-vegetation seed mixtures must be approved by the Forest Service.

Wetlands

- BMPs include, but are not limited to:
    - Roads location and design minimizes number, width and total length of roads on wetlands. Avoid high value wetlands (BMP 12.5)

  - Road construction would minimize excavation and overburden disposal in wetlands (BMPs 14.3, 14.9, 14.12, 14.19).

- No discharge of dredged or fill material shall be permitted in wetlands if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem in light of overall project purposes (U.S. Army Corps of Engineer guidelines) .
- The project proponent must acquire a Section 404 permit from the Army Corps of Engineers.
- Rock pits and staging areas may not be located on wetlands.
- Minimum road clearing and side ditching must be used when building roads in wetlands.
- Minimize the loss of tall sedge fen wetlands, which are scarce wetland types on the Tongass National Forest and provide valuable habitat to several terrestrial animals.

Wildlife

- No vegetation removal is permitted within a 330-foot radius of an active bald eagle nest between March 1 and August 31.
- No active or inactive bald eagle nest trees may be cut down.
- No blasting is allowed within one half mile and repeated helicopter flights are not allowed within a quarter mile of active bald eagle nests. Any restrictions placed upon project activity to minimize disturbance to nesting eagles may be removed if the nest(s) becomes inactive after May 31. Variances to these conditions must be approved through consultation with the USFWS.
- Design and build transmission lines to provide avian safety following design standards and recommendations in Avian Power Line Interaction Committee (2006).
- Prevent habituation of bears to human food/garbage and reduce the chances of human/bear incidents. All camps and work sites are required to use bear-proof garbage disposal methods and store food in bear-proof containers.
- Where practical, road construction and other development activities are not permitted within 500 feet of the anadromous portion of Thayer Creek to minimize effects to brown bear use of key foraging areas.
- To prevent over-exploitation of fish and wildlife resources, the permittee shall develop measures to control hunting, trapping, and fishing within the project boundary by the construction workforce and describe in the Fish and Wildlife Management Plan how prohibitions of hunting, trapping and fishing would be implemented and enforced.

Threatened, Endangered, and Sensitive Species

- If any previously undiscovered sensitive plants are encountered before or during implementation of the project the Forest Service must be notified immediately to

evaluate the potential risk to the population and recommend avoidance or mitigation measures.

- Check trees for goshawk nests prior to cutting; report goshawk sightings or nests to the Forest Service for follow-up.
- If previously undiscovered active goshawk nests are found, establish a nest management zone consisting of 100-acres of productive old growth centered on the nest. No continuous disturbance likely to result in nest abandonment is permitted within 600 feet of the nest between March 15 and August 15 (USDA 2008a).
- A minimum 330-foot buffer must be marked around any osprey nest tree found in or near the project area before or during implementation of the project (USDA 2008a). No activities "likely to disturb nesting activity" may occur within this buffer until the nesting season ends.

Scenery

- The smallest area needed for the marine facility would be cleared of trees and vegetation. During construction, shoreline rocks would be protected from scarring or damage.
- In the Lakes Viewshed (Figure 3-5, Chapter 3), a minimum of 100-foot wide buffer of mature trees must be maintained between the project elements and lakeshores, where feasible.
- Where feasible, a windfirm buffer of mature trees must be left along the shoreline in the Chatham Strait Shoreline Viewshed (Figure 3-5, Chapter 3), to screen the transmission facilities, access road and construction staging area from the Visual Priority Travel Routes and Use Areas.
- Project elements, including buildings, the pipeline, transmission poles, and generation facilities must be constructed of visually compatible materials or painted earth-tone colors to blend with the surroundings.

Cultural Resources

- A Forest Service approved archaeologist must be present on-site during project layout and construction to monitor changes between the approved design and actual layout.
- If an historic property cannot be avoided during layout, or a new site is discovered during construction, project work will cease until a mitigation plan is developed. A mitigation plan will be developed in consultation with the State Historic Preservation Office (SHPO), Kootznoowoo, Inc., the Forest Service, the Angoon Community Association, and the City of Angoon. A Memorandum of Agreement formalizing the mitigation plan and a timeline for its completion will be executed prior to proceeding.
- The Admiralty National Monument Ranger must be contacted immediately and work cease if historic properties or cultural materials not previously considered, are noted during project implementation.
- Should human remains be encountered during project implementation all work in the locality will cease and the Forest Archaeologist and the Alaska State Troopers shall

be contacted. If Native American remains are encountered on National Forest System lands the Forest will follow Native American Graves Protection and Repatriation Act regulations set forth in 43 CFR 10. Federally recognized Tribes and ANCSA Corporations will be notified of inadvertent discoveries and consulted to determine an action plan on how to proceed.

2.3.3 ALTERNATIVE 2 (PROPOSED ACTION)

The Proposed Action consists of the terms and conditions described in the section above to be included in the SUA based on the following components from the Selected Project Arrangement proposal submitted by Kootznoowoo.

The list of project components below and Figures 2-1 and 2-2 display the major improvements proposed by Kootznoowoo or those assumed necessary to implement the Proposed Action and include the following:

Marine Facilities to Power Plant

1. Permanent facilities located 1.8 miles south of the outlet of Thayer Creek consisting of mooring buoys and a garage for operation and maintenance vehicles at the mooring facility.
2. Temporary facilities, including a barge landing, staging areas, and a construction camp during project construction.
3. A 2.2-mile, 12.5 kV overhead transmission line segment from the powerhouse to the marine facilities suspended on 35-foot high wooden utility poles
4. A 2.2-mile access/maintenance road paralleling the transmission line from the marine facilities to the power plant. As proposed, approval of this road location would require a non-significant amendment to the Forest Plan to allow for road construction over areas identified as high vulnerability karst and the streams that flow to the features.

Power Plant to Diversion Dam

5. A 10-foot high diversion dam on Thayer Creek, approximately 1.5 miles upstream from the mouth of Thayer Creek at an elevation of approximately 250 feet above sea level.
6. A 10- to 20-acre impoundment above the diversion dam.
7. An intake structure with a trashrack, transition section, shutoff valve, sluiceway, and control facilities at the diversion dam.
8. A 1.2-mile, 42-inch diameter pipeline from the intake structure to the powerhouse. The pipeline would be secured to the ground by a system of nylon straps and galvanized steel cable, and to the maximum extent possible would be routed around trees and other obstacles.
9. A 510-foot long, 36-inch diameter penstock from the downstream end of the pipeline to the powerhouse.

10. A 240-foot long, six-foot diameter surge tank above the junction of the pipeline and penstock, with a ¼ mile temporary road built for tank construction.
11. A power plant structure, about 30 feet by 68 feet and 25 feet high, to house two generating units with a total generating capacity of 1,000-kilowatt; the power plant is located about 450 feet downstream of the waterfall.
12. A 1.4-mile access/maintenance road from the powerhouse to the diversion dam/intake structure. As proposed, approval of this road location would require a non-significant amendment to the Forest Plan to allow for road construction in the Thayer Creek canyon.
13. A water release control structure at the diversion dam to maintain a minimum instream flow of 20 cfs (cubic feet of water per second) at all times below the diversion dam.
14. A spoils/staging area.

Marine Facilities to City of Angoon

15. A 4.2-mile, 12.5 kV overhead transmission line segment from the marine facility to Kootznahoo Inlet suspended on 35-foot high wooden utility poles.
16. A 4.2-mile access/maintenance road paralleling the transmission line from the marine facilities to Kootznahoo Inlet.
17. A 0.5-mile (4,600 feet) submarine cable segment from the northern shore of Kootznahoo Inlet to the City of Angoon.
18. Two electrical switch yards near the shoreline where the submarine cable enters and exits Kootznahoo Inlet

Kootznoowoo's Selected Project Arrangement proposed a tree clearing width for the overhead powerlines/access road of 25 to 30 feet. Discussions with local utility companies indicate that these narrow clearing widths for the powerline are likely inadequate from a practical and maintenance perspective since trees would endanger the line. This EIS analysis assumes that the clearing width will be up to one tree height on either side of the centerline of the overhead transmission line/access road (total clearing width of up to 200 feet). Forest Service engineers indicate that for safety and other reasons road clearing would likely average 50 feet wide.

Adjustments to the overhead line and access road clearing corridor may be necessary because of the close proximity of the wilderness boundary (in Section 18, T. 50 S., R.68 E.) and the lakes (in Section 13, T. 50 S., R.67 E.). These adjustments could include reducing the width of the corridor to stay within the ANILCA sections and reduce impacts to scenery at the lakes.

The Forest Service assumes that the access/maintenance road between the marine facilities and Kootznahoo Inlet will end before a large notch in the hillside (at about mile 0.8) and start again on the other side of the notch. This assumption is based on the proposed roads' ability to provide maintenance access from both ends of the road as well as the high cost and un-analyzed impact of crossing this 100-foot deep, 635-foot wide notch (see Road Cards in

Figure 2-1 Alternative 2, Proposed Action

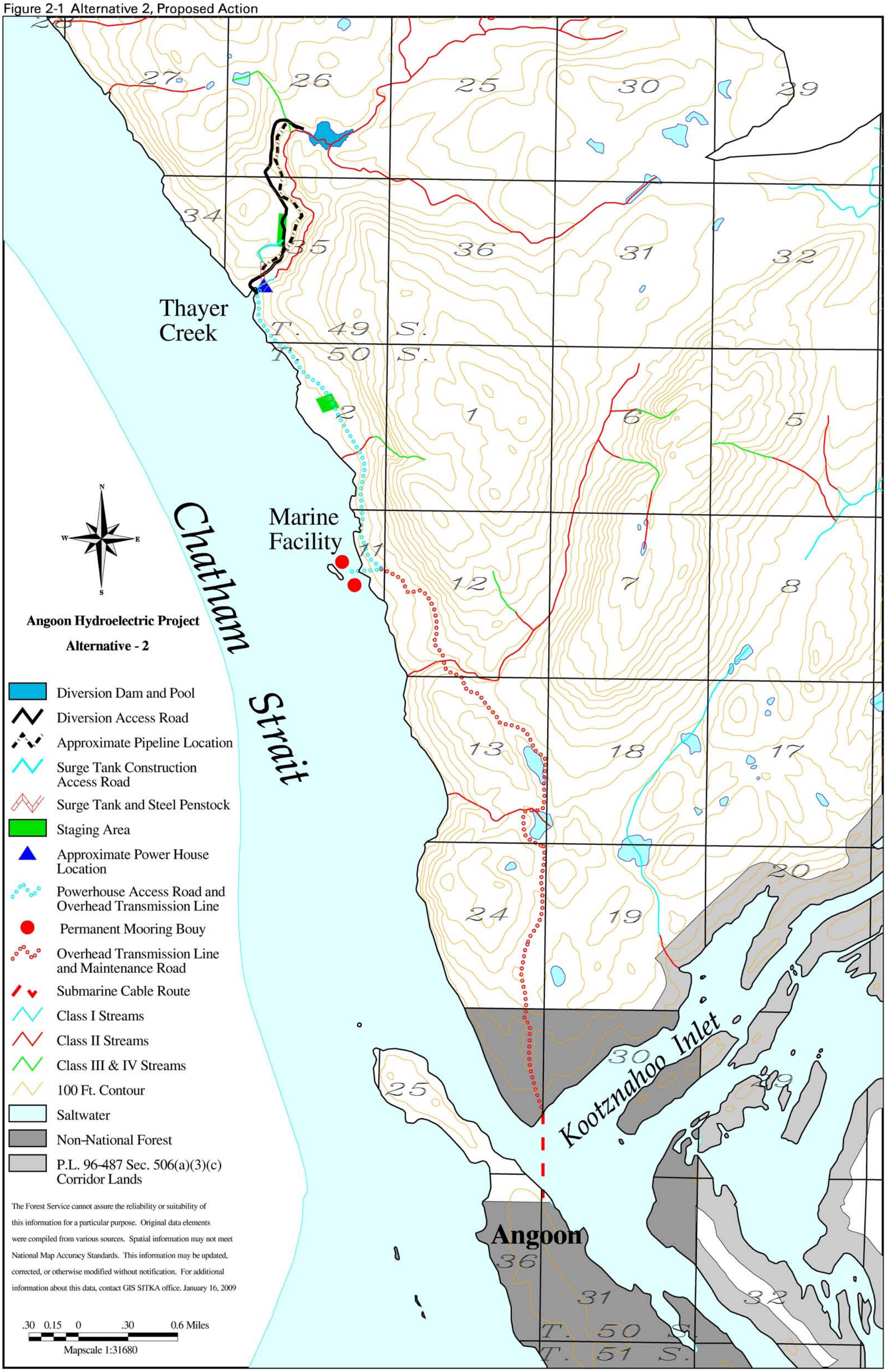


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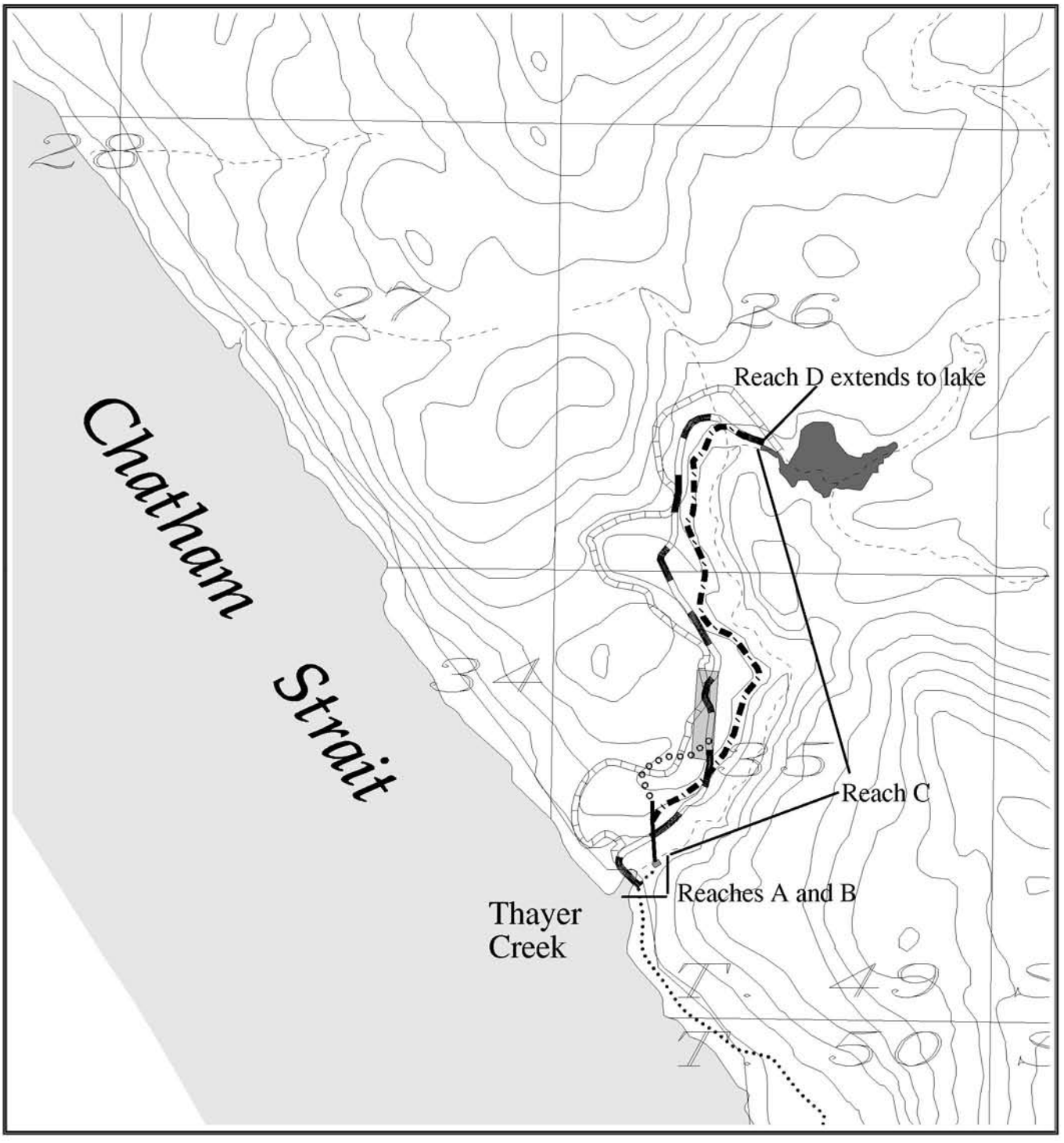
Figure 2-2 Magnified View of Power House to Diversion Dam for Angoon Hydroelectric Project Alternatives 2, 3, & 4



Appendix B). Additional analysis of effects would be required and additional terms and conditions applied prior to a road and bridge being built across this notch.

The section of powerline corridor in the northeast corner of Section 13 (T. 50 S., R. 67 E.) would receive additional on-site evaluation prior to clearing to insure it is located below the ridge with minimal southeast exposure to avoid a wind tunnel effect and reduce wind throw risk.

Kootznoowoo's Selected Project Arrangement did not specify what would occur with any trees inundated by water in the reservoir. For the analysis of Alternative 2, the Forest Service assumed that these trees would be left standing.

2.3.4 ALTERNATIVE 3 (BURIED TRANSMISSION LINE)

Alternative 3 was developed as a means of reducing the amount of vegetative clearing required along the transmission line corridor, reducing potential effects to fish habitat in Thayer Creek, and reducing potential effects of road and pipeline/penstock construction on karst terrain and on steep slopes along Thayer Creek. Consideration of a buried transmission line is also a requirement of the Forest Plan. Under Alternative 3 the terms and conditions included in the SUA would be the same as those displayed for all the action alternatives (see Elements Common to the Action Alternatives, 2.3.2). To reduce resource effects, Alternative 3 would also result in the following changes to the Proposed Action (see Figures 2-3 and 2-2):

- Require that all transmission lines be buried where feasible
- Require a higher level of water discharge into the bypass reach on Thayer Creek. A minimum instream flow of 40 cfs would be maintained at all times to minimize freezing temperatures and loss of stream continuity in the bypass reach.
- Require that all water not needed for power generation be returned to Thayer Creek at the diversion dam and sent through the bypass reach.
- Require that the tailrace discharge be returned above or immediately below the lowest anadromous fish barrier on Thayer Creek to minimize the length of anadromous stream affected by the diversion.
- Require that the road from the marine facilities to the powerhouse be rerouted to minimize effects to areas identified as high vulnerability karst and the streams that flow to the features and that the diversion dam access road be rerouted away from steep slopes along Thayer Creek. The final locations of these facilities must be approved by the Forest Service.
- Require that the dam include a low gate feature to pass bedload during specified windows of high flows in May-June and September-October. Although bedload sources have been identified within the bypass reach, bedload passage through the dam will minimize effects on channel stability and fisheries downstream of the dam.

- Require that floating wood accumulating behind the dam be disposed of into the bypass reach during high flows in May-June and September-October. Although large wood sources have been identified within the bypass reach, wood passage through the dam will minimize effects on channel stability and fisheries downstream of the dam.
- Require that trees that are in the reservoir be left standing to avoid ground disturbance associated with cutting and removal and to provide habitat complexity.

The following project components (as displayed in Figures 2-3 and 2-2) are improvements proposed by Kootznoowoo or those assumed necessary to implement Alternative 3. Items in Kootznoowoo's Selected Project Arrangement that are affected by the terms and conditions related to Alternative 3 are highlighted in the list of components below:

Marine Facilities to Power Plant

1. Permanent facilities located 1.8 miles south of the outlet of Thayer Creek consisting of mooring buoys and a garage for operation and maintenance vehicles at the mooring facility.
2. Temporary facilities, including a barge landing, staging areas, and a construction camp during project construction.
3. **A 2.2-mile, 12.5 kV transmission line segment, buried where feasible, along the access road from the powerhouse to the marine facilities**
4. **A 2.2-mile access/maintenance road paralleling the transmission line from the marine facilities to the power plant and rerouted to maintain a minimum 100-foot buffer from areas identified as high vulnerability karst and the streams that flow to the features.**

Power Plant to Diversion Dam

5. A 10-foot high diversion dam on Thayer Creek, approximately 1.5 miles upstream from the mouth of Thayer Creek at an elevation of approximately 250 feet above sea level.
6. A 10- to 20-acre impoundment above the diversion dam.
7. An intake structure with a trashrack, transition section, shutoff valve, sluiceway, and control facilities at the diversion dam.
8. A 1.2-mile, 42-inch diameter pipeline from the intake structure to the powerhouse. The pipeline would be secured to the ground by a system of nylon straps and galvanized steel cable, and to the maximum extent possible would be routed around trees and other obstacles.
9. A 510-foot long, 36-inch diameter penstock from the downstream end of the pipeline to the powerhouse.
10. A 240-foot long, six-foot diameter surge tank above the junction of the pipeline and penstock, potentially with a temporary road built for tank construction.
11. A power plant structure, about 30 feet by 68 feet and 25 feet high, to house two generating units with a total generating capacity of 1,000-kilowatt; the power plant is located about 450 feet downstream of the waterfall.
12. **A 2.1-mile access/maintenance road from the powerhouse to the diversion dam/intake structure that avoids steep and unstable slopes.**

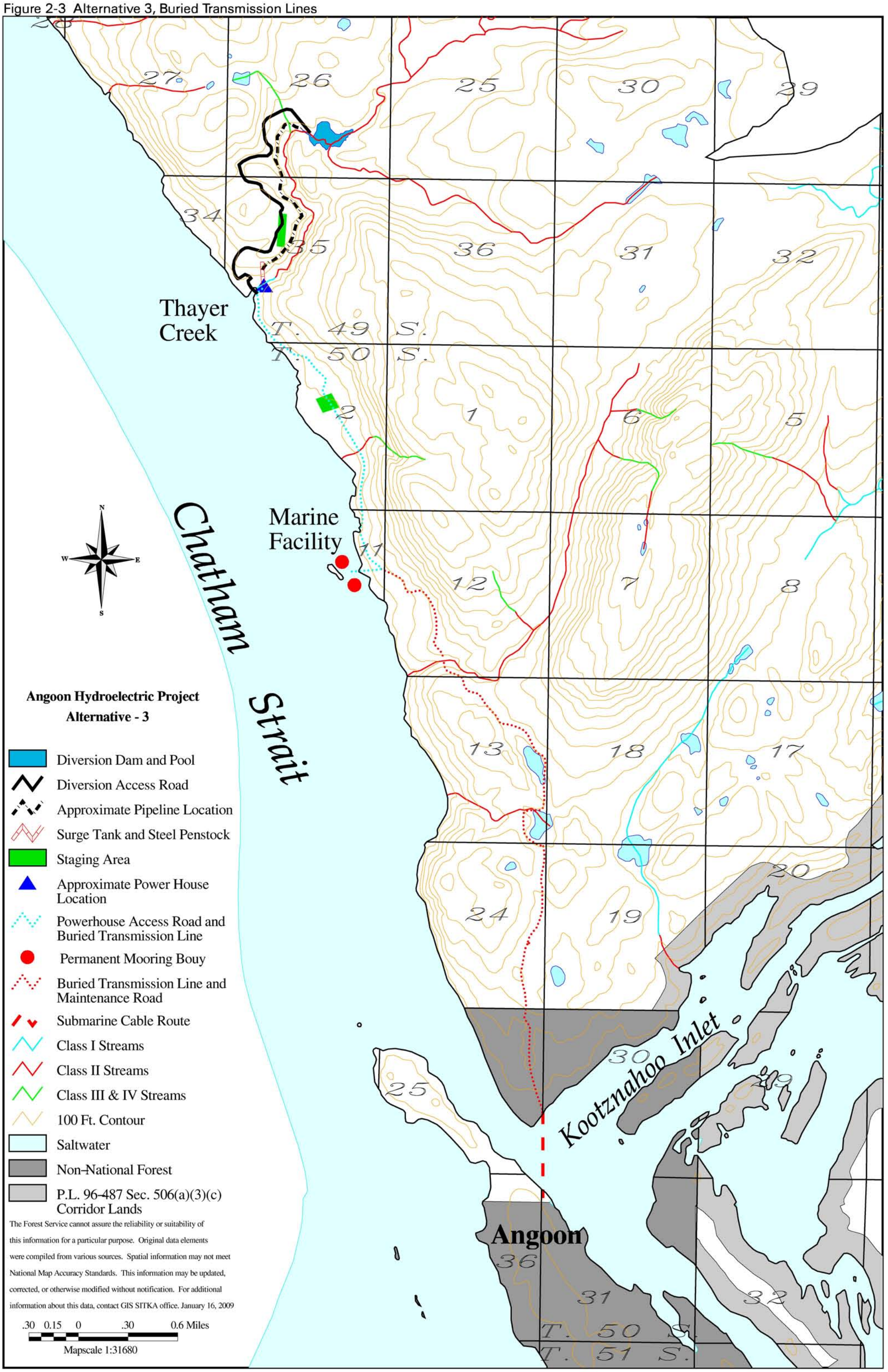
13. **A water release control structure at the diversion dam to maintain a minimum instream flow of 40 cfs (cubic feet of water per second) at all times below the diversion dam.**
14. A spoils/staging area.

Marine Facilities to City of Angoon

15. **A 4.2-mile, 12.5 kV transmission line segment, buried where feasible, from the marine facility to Kootznahoo Inlet**
16. A 4.2-mile access/maintenance road paralleling the transmission line from the marine facilities to Kootznahoo Inlet.
17. A 0.5-mile (4,600 feet) submarine cable segment from the northern shore of Kootznahoo Inlet to the City of Angoon.
18. Two electrical switch yards near the shoreline where the submarine cable enters and exits Kootznahoo Inlet.
19. **Clearing width along all transmission lines/access roads of 46-70 feet.**

The Forest Service assumes that the access/maintenance road between the marine facilities and Kootznahoo Inlet will end before the notch (at about mile 0.8) and start again on the other side of the notch. This assumption is based on the proposed roads' ability to provide maintenance access from both ends of the road as well as the high cost and un-analyzed impact of crossing this 100-foot deep, 635-foot wide notch (see Road Cards in Appendix B). Additional analysis of effects would be required and additional terms and conditions applied prior to a road and bridge being built across this notch.

Figure 2-3 Alternative 3, Buried Transmission Lines



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2.3.5 ALTERNATIVE 4 (SUBMARINE CABLE)

Alternative 4 was developed to eliminate uplands impacts associated with the construction of an access road and transmission line from the marine facilities to Kootznahoo Inlet; it would do this by submerging the transmission line in Chatham Strait. Consideration of a submerged transmission line is also a requirement of the Forest Plan. Under Alternative 4 the terms and conditions included in the special use authorization would be the same as those displayed for all the action alternatives (see Elements Common to the Action Alternatives, 2.3.2); to reduce resource effects, Alternative 4 would also result in the following changes to the Proposed Action (see Figures 2-4 and 2-2):

- No authorization for a transmission line corridor from the marine facility to Kootznahoo Inlet
- Require that all upland transmission lines be buried where feasible
- Require a higher level of water discharge into the bypass reach on Thayer Creek. A minimum instream flow of 40 cfs would be maintained at all times to minimize freezing temperatures and loss of stream continuity in the bypass reach.
- Require that all water not needed for power generation be returned to Thayer Creek at the diversion dam and sent through the bypass reach.
- Require that the tailrace discharge be returned above or immediately below the lowest anadromous fish barrier on Thayer Creek to minimize the length of anadromous stream affected by the diversion.
- Require that the road from the marine facilities to the powerhouse be rerouted to minimize effects to areas identified as high vulnerability karst and the streams that flow to the features and that the diversion dam access road be rerouted away from steep slopes along Thayer Creek. The final locations of these facilities must be approved by the Forest Service.
- Require that the dam include a low gate feature to pass bedload during specified windows of high flows in May-June and September-October. Although bedload sources have been identified within the bypass reach, bedload passage through the dam will minimize effects on channel stability and fisheries downstream of the dam.
- Require that floating wood accumulating behind the dam would be disposed of into the bypass reach during high flows in May-June and September-October. Although large wood sources have been identified within the bypass reach, wood passage through the dam will minimize effects on channel stability and fisheries downstream of the dam.
- Require that trees that are in the reservoir would be left standing to avoid the ground disturbance impacts associated with cutting and removal and to provide habitat complexity.

This alternative would be similar to Alternative 3, except that Kootznoowoo would not be authorized to construct an overland transmission line from the marine facility to Kootznahoo

Inlet. The only feasible way for Kootznoowoo to comply with this restriction would be to utilize a submarine transmission cable laid off-shore of Admiralty Island to the City of Angoon (Figure 2-4).

The following project components (as displayed in Figures 2-4 and 2-2) are improvements proposed by Kootznoowoo or those assumed necessary to implement Alternative 4. Items in Kootznoowoo's Selected Project Arrangement that are affected by the terms and conditions related to Alternative 4 are highlighted in the list of components below:

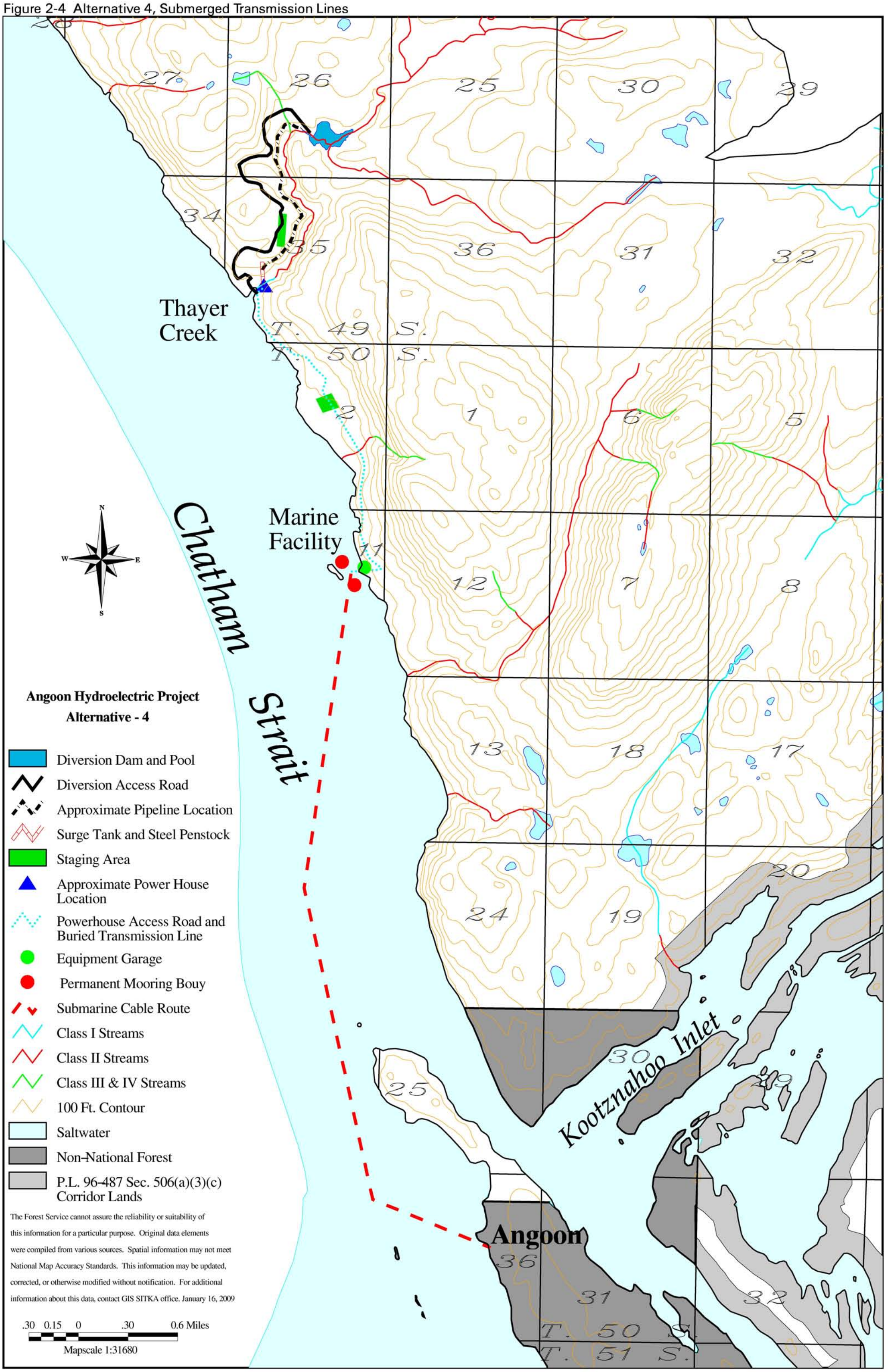
Marine Facilities to Power Plant

1. Permanent facilities located 1.8 miles south of the outlet of Thayer Creek consisting of mooring buoys and a garage for operation and maintenance vehicles at the mooring facility.
2. Temporary facilities, including a barge landing, staging areas, and a construction camp during project construction.
3. **A 2.2-mile, 12.5 kV transmission line segment, buried where feasible, along the access road from the powerhouse to the marine facilities**
4. **A 2.2-mile access/maintenance road paralleling the transmission line from the marine facilities to the power plant and rerouted to maintain a minimum 100-foot buffer from areas identified as high vulnerability karst and the streams that flow to the features.**

Power Plant to Diversion Dam

5. A 10-foot high diversion dam on Thayer Creek, approximately 1.5 miles upstream from the mouth of Thayer Creek at an elevation of approximately 250 feet above sea level.
6. A 10- to 20-acre impoundment above the diversion dam.
7. An intake structure with a trashrack, transition section, shutoff valve, sluiceway, and control facilities at the diversion dam.
8. A 1.2-mile, 42-inch diameter pipeline from the intake structure to the powerhouse. The pipeline would be secured to the ground by a system of nylon straps and galvanized steel cable, and to the maximum extent possible would be routed around trees and other obstacles.
9. A 510-foot long, 36-inch diameter penstock from the downstream end of the pipeline to the powerhouse.
10. A 240-foot long, six-foot diameter surge tank above the junction of the pipeline and penstock, potentially with a temporary road built for tank construction.
11. A power plant structure, about 30 feet by 68 feet and 25 feet high, to house two generating units with a total generating capacity of 1,000-kilowatt; the power plant is located about 450 feet downstream of the waterfall.
12. **A 2.1-mile access/maintenance road from the powerhouse to the diversion dam/intake structure that avoids steep and unstable slopes. Clearing width would be 25-30 feet.**
13. **A water release control structure at the diversion dam to maintain a minimum instream flow of 40 cfs (cubic feet of water per second) at all times below the diversion dam.**
14. A spoils/staging area.

Figure 2-4 Alternative 4, Submerged Transmission Lines



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Marine Facilities to City of Angoon

15., 16., and 17. would not be needed in Alternative 4.

18. Two electrical switch yards, one near the shoreline where the submarine cable enters Chatham Straits at the marine facilities and one where it leaves Chatham Straits near the existing generating facilities in Angoon.

19. A 4.6-mile submerged transmission line from the marine facilities to the city of Angoon. The power cable, submerged up to 600 feet in Chatham Strait, would pass to the outside of Danger Point and connect to the distribution system at the existing diesel power plant.

20. Clearing width along all transmission lines/access roads of 46-70 feet.

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

In January 1999, Kootznoowoo authorized HDR to conduct a study to provide a basis for deciding whether the Angoon Hydroelectric Project was feasible enough to proceed with permitting and design efforts. Among other tasks, the study evaluated the feasibility of several alternative project arrangements, evaluated the hydrology of Thayer Creek, and analyzed the economic feasibility of the project (HDR Alaska 2000). Options presented in the HDR Feasibility Evaluation Report were reviewed and considered for inclusion in the EIS. The results are discussed below.

The report evaluated five alternative project arrangements to develop hydropower facilities at Thayer Creek and a sixth alternative that would have incorporated a water supply line to the city of Angoon. The water supply line is outside the scope of the ANILCA reservation and will not be considered. The feasibility report is available in the project record.

The following three alternatives were based on a generating capacity of 1000 kw, using two turbines, and varied primarily in the means of conveying water from the diversion dam to the powerhouse:

(1) **pipeline and penstock** - This component is part of the "Selected Project Arrangement" submitted by Kootznoowoo to the Forest Service. It is common to all action alternatives in the EIS

(2) **directional-drilled tunnel** - Directional drilling, while advancing in its capabilities, has not yet been used successfully for a hydroelectric project, and is experimental technology in this application. This alternative was not carried through analysis because of the higher costs and the probability of unexpected costs because the technology is experimental.

(3) **conventional tunnel -** This alternative was not considered in detail in the EIS because of the higher cost of drilling the tunnel and the lower power generation capacity. This alternative would not have met the existing power needs of Angoon for approximately 10 days a year, and 19 days per year if Angoon grew by 50%.

A fourth alternative considered reducing the generating capacity of the facility to 500 Kw as a cost saving measure, either by using a single turbine or two 250 Kw turbines. This alternative was not considered in detail in the EIS since it would only meet the existing needs of Angoon and not allow for future growth which is a goal of the proposal.

The above four alternatives assumed that power from the project would be transmitted to Angoon via a submarine cable originating at Thayer Creek and extending to the diesel plant in Angoon.

The fifth alternative in the HDR Report considered three overland transmission line options:

(1) An overhead transmission line from the powerhouse to Kootznahoo Inlet, and then a submerged line across the Inlet.

(2) A buried transmission line from the powerhouse to Kootznahoo Inlet, and then a submerged line across the Inlet.

(3) A combination buried transmission line to the marine facility and then a submarine line to the existing diesel plant in Angoon.

All three of the above transmission line options were considered in the EIS. A submarine transmission line from the mouth of Thayer Creek was not considered in detail in the EIS since it would require construction at the mouth of Thayer Creek and because an access road from the marine facility to the powerhouse is necessary for operation of the facility and would provide a more convenient and less expensive route for that portion of the transmission line with little additional effect on the area resources.

Some commenters suggested that alternative sources of electrical power be considered in this EIS. These suggested sources included intertie connections to either the existing intertie at Hawk Inlet north of the project area or via a series of overland and submarine transmission lines to Hoonah or an alternative hydropower site in Favorite Bay. As discussed in Chapter 1 of this EIS, Congress has granted Kootznoowoo certain rights for development of a hydroelectric facility at Thayer Creek; and mandated the decision space and level of involvement of the Secretary of Agriculture (Forest Service). This EIS is being prepared in response to a decision by Kootznoowoo to exercise those rights granted by ANILCA at Thayer Creek. While other sources of electrical power may be available to Angoon in the future, consideration of sources other than Thayer Creek at this time is outside the scope of this EIS.

2.5 MONITORING

Monitoring requirements are established in the approved Plans of Operations required by the Forest Service SUA and in permits and approvals issued by other State and Federal agencies. Additional detail on resource monitoring, including water resource monitoring, is found in the resource reports (see for example Thompson 2009). Table 2.1 summarizes the monitoring requirements and authority for each resource.

Table 2-1. Monitoring

Resource Item or Activity to Monitor	Method of Monitoring	Frequency of Monitoring	Threshold of Variability	Action to be Taken	Authority	Responsible Party
Project Final Design Plans						
Design and construction plans of all authorized facilities in the project proposal	Review and approve plans, drawings, and location of facility and development staking.	Once prior to authorizing the start of construction.	Nonconformance with approved design specifications or permit requirements	Determined by authorized agencies	Forest Service ROD, Plans of Operations, Section 404 permit, ADNR title 38 permit	Forest Service, USEPA, USACE, and ADNR, Kootznoowoo
Karst and Cave Resources						
Locations for roads, transmission cables, and all related facilities	Review and approve plans, drawings, and location of facility and development staking.	Once prior to authorizing start of construction.	Karst surface features will be located and identified in the field. A 100-foot, no disturbance buffer will separate construction activities from karst surface features (USDA Forest Service 2008a)	Construction will only be authorized if field review of survey staking and submitted plans and drawings are approved by the Forest Service.	Federal Cave Resources Protection Act, Tongass Forest Plan, Forest Service ROD	Forest Service
Soils and Wetlands						
Locations for roads, transmission cables, and all related facilities	Review and approve plans, drawings, and location of facility and development staking.	Once prior to authorizing the start of construction.	Non-conformance with approved design specifications or permit requirements	Determined by authorized agencies	Forest Service ROD, Plans of Operations, Section 404 permit	Forest Service, USEPA, USACE, and ADNR, Kootznoowoo Inc.

Table 2-1. Monitoring

Resource Item or Activity to Monitor	Method of Monitoring	Frequency of Monitoring	Threshold of Variability	Action to be Taken	Authority	Responsible Party
Fisheries/Water Resources						
Pre-project Streamflow and Temperature Data Collection	Rantz et al (1982)	Continuous, begin as soon as practical	n/a (pre-project requirement)	Refine project design and operating plans	Project ROD	Kootznoowoo
Post-project Instream Flow Monitoring	Rantz et al (1982)	Continuous	As determined by instream flow requirement	Reduce diversion to accommodate instream flow requirement	Project ROD	Kootznoowoo
Post-project Stream Temperature Monitoring	U.S. Environmental Protection Agency. 2003. EPA Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards. EPA 910-B-03-002.	Continuous	1) verify return flow temperature is within 2^{o} C of receiving waters, and 2) trigger visual monitoring of frozen streambed conditions if Reach B is bypassed (below).	Consult and review with USFS and ADFG	Project ROD	Kootznoowoo
Post-project Frozen Streambed Monitoring	To be developed by Kootznoowoo with review and approval by USFS	As triggered by stream temperature monitoring (once annually at minimum)	To be determined	Consult and review with USFS and ADFG	Project ROD	Kootznoowoo
Post-project Bedload and Floating Debris Monitoring	To be developed by Kootznoowoo with review and approval by USFS	Spring and Fall High Flows	To be determined	Pass sediment and debris into bypass reach	Project ROD	Kootznoowoo

Table 2-1. Monitoring

Resource Item or Activity to Monitor	Method of Monitoring	Frequency of Monitoring	Threshold of Variability	Action to be Taken	Authority	Responsible Party
Pre- and Post-project Reach B Streambed and Large Wood Monitoring	USFS 2001	Every five years	If the gravel component (currently 32% by pebble count) declines. If total wood counts decrease below the 25th percentile of reference conditions (Bryant et al 2004)	Forest Service and Alaska Department of Fish and Game will consider results and possible actions in response.	Project ROD	Kootznoowoo
Pre- and Post-project salmonid population monitoring in Reach B	Bryant (2000)	Annually after spring snow melt	If population estimates for coho, Dolly Varden, or steelhead decrease below the _*__ percentile of reference conditions (under Alt. 2 only). *to be determined	Forest Service and Alaska Department of Fish and Game will consider results and possible actions in response.	Project ROD	Kootznoowoo
Vegetation						
Rare and sensitive plant populations	Conduct inspections of facility and development staking.	Once prior to authorizing start of construction.	Evidence of sensitive/rare plant populations in development areas.	Construction will only be authorized if field review of survey staking and submitted plans and drawings are approved by the Forest Service.	Forest Service ROD.	Forest Service
Invasive plant populations	Conduct inspections of facilities and developments	Annually for first 3 years following construction, and biennially thereafter for the life of the project.	Evidence of invasive plant populations in development areas.	Control high priority invasive plant infestations. Report inspections and control actions to District Botanist.	Forest Service ROD, EO 13112	Kootznoowoo

Table 2-1. Monitoring

Resource Item or Activity to Monitor	Method of Monitoring	Frequency of Monitoring	Threshold of Variability	Action to be Taken	Authority	Responsible Party
Timber Removal: Compliance with timber sale contract provisions and brush disposal plan	Conduct onsite inspections	Before, during and after harvest activities	Compliance with contract clauses and brush disposal plan provisions.	Return to compliance	36 CFR part 233	Forest Service
Wildlife						
Bald eagle nests related to construction activity	Visual survey, using water or air craft with ground searches under nest trees if necessary	Nests within ½ mile of project activities should be surveyed twice during March1 to May 31. Nests active after this period should be monitored weekly until young have fledged.	Zero project related activity within the management zone of active nests unless a variance is obtained from the USFWS	Cease construction activities within management zone of active nests	Bald Eagle Protection Act	Kootznoowoo
Road Closures	On the ground survey	Periodic visits, particularly during hunting season	Any evidence of unauthorized use	Report unauthorized use to the Forest Service	Forest Service ROD, Project ROD; Violators would be ticketed by the FS under 36 CFR 261.54(b)	Kootznoowoo

Table 2-1. Monitoring

Resource Item or Activity to Monitor	Method of Monitoring	Frequency of Monitoring	Threshold of Variability	Action to be Taken	Authority	Responsible Party
Cultural Resources/Effects to Historic Properties						
Ground disturbing activities	Qualified archaeologist to monitor ground disturbance according the terms of the SUA.	During ground disturbance	Effect to historic property	Work will cease and the Forest Service will be notified. Work will proceed only after the consultation process has been completed and a plan to mitigate the effects has been developed if needed.	NHPA NAGPRA	Kootznoowoo Inc, in consultation with Forest Service and SHPO

2.6 COMPARISON OF ALTERNATIVES

The following subsections summarize the major components and the effects of the No Action, and action alternatives as presented in Chapter 3 of the EIS.

Table 2-2. Comparison of Alternatives by Activity

Activity	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Buried Trans. line	Alternative 4 Submerged Trans. Line
Special Use Authorization	No	Yes	Yes	Yes
Above-ground transmission line	0	6.2 miles	minimized	minimized
Buried transmission line	0	0	6.2 miles as feasible	2.2 miles as feasible
Submerged transmission line	0	0.5 mile	0.5 mile	4.6 miles
Access Rd Marine Fac. to Powerhouse	0	2.2 miles	2.2 miles	2.2 miles
Access Rd Powerhouse to Dam	0	1.4 miles	2.1 miles	2.1 miles
Access Rd Marine Fac. to Kootznahoo Inlet	0	4.0 miles	4.0 miles	0
Temporary Access Rd Surge Tank	0	0.2 mile	0	0
Road/Trans Line Clearing Width	0	46-200 feet	46-70 feet (50 feet avg.)	46-70 feet (50 feet avg.)
Diversion Dam Access Road Location	None	On steep slopes in Thayer Cr canyon	Reroute avoids steep slopes in Thayer Creek canyon	Reroute avoids steep slopes in Thayer Creek canyon
Pipeline Location	None	Follows the contour in Thayer Creek canyon	Follows the contour in Thayer Creek canyon	Follows the contour in Thayer Creek canyon
Penstock Location	None	Same for all alternatives	Same for all alternatives	Same for all alternatives
Marine Facility	None	Same for all alternatives	Same for all alternatives	Same for all alternatives
Switchyards	0	3	3	3
Tailrace Discharge location	None	450 feet downstream of fish barrier	Above or immediately below the lowest anadromous fish barrier	Above or immediately below the lowest anadromous fish barrier

Table 2-3. Comparison of Alternatives by Resource

Activity	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Buried Trans Line	Alternative 4 Submerged Trans Line
Geology				
Effects to karst	No Effect	0.2 mile of road cross high vulnerability karst lands; sediment and debris would enter karst system. A Forest Plan amendment would be needed	Due to avoidance there are no effects	Due to avoidance there are no effects
Soil				
Project area exposed to surface erosion (acres)	0	45.5	48.2	24.9
Road in areas over 67% slope (feet)	0	1,650	1,500	150
Water[1]				
Minimum Instream Flow (CFS)	26 (predicted natural extreme minimum flow)	20	40	40
Winter Streamflow	No effect	Moderate effects	Moderate effects	Moderate effects
Summer Streamflow	No effect	Minor effects	Minor effects	Minor effects
Spring and Fall Streamflow:	No effect	Negligible effects	Negligible effects	Negligible effects
Sediment supply from above dam	No effect	Minor to moderate	Negligible to minor	Negligible to minor
Large wood supply	No effect	Minor	Negligible	Negligible
Winter minimum water temperature and dissolved oxygen	No effect	Moderate effects	Moderate effects	Moderate effects
Summer maximum water temperature	No effect	Minor effects	Negligible to minor effects	Negligible to minor effects
Erosion and sediment (from ground-disturbing activities)	No effect	Major effects	Minor effects	Minor effects

[1] Impacts increase from no effect to negligible to minor to moderate to major; definitions of the level of effects are located in Chapter 3 in the Water Resources section.

Activity	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Buried Trans Line	Alternative 4 Submerged Trans Line
Fisheries				
Effects of flows on fish and fish habitat	No change (no effect)	For Reaches B & C: Low flow periods would extend earlier into the fall and later into the spring; would support few, if any, incubating eggs or resident fish through the winter; may freeze for longer periods in the winter or increase to potentially lethal temperatures during the summer.	This alternative will mimic more natural flow regimes. Dewatering will be less likely. Additional flow will provide increased pool depth, greater stream connectivity, and decrease harmful icing conditions	This alternative will mimic more natural flow regimes. Dewatering will be less likely. Additional flow will provide increased pool depth, greater stream connectivity, and decrease harmful icing conditions
Effects due to location of discharge water from the power plant	No change (no effect)	Discharge location would likely cause a moderate reduction in anadromous fish populations	Flows would mimic natural conditions; little potential effect to anadromous fish and habitat below the barrier	Flows would mimic natural conditions; little potential effect to anadromous fish and habitat below the barrier
Effects to Thayer Creek from road parallel to Thayer Creek	No change (no effect)	Road could degrade riparian habitat and increase the suspended sediment load.	Greatly reduced potential for landslides and introducing sediment and debris into creek	Greatly reduced potential for landslides and introducing sediment and debris into creek
Vegetation				
Sensitive Plants	No effect	No adverse effect	No adverse effect	No adverse effect
Invasive Species	No effect	Low potential to introduce invasive species in area up to 40 acres	Low potential to introduce invasive species in area up to 40 acres	Low potential to introduce invasive species in area up to 30 acres
Wetlands				
Linear miles of road built on wetlands	0	2.6 miles	2.6 miles	1.1 miles

Activity	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Buried Trans Line	Alternative 4 Submerged Trans Line
Biodiversity and Wildlife				
Effect on Connectivity (acres of productive old-growth removed from beach fringe and riparian management)	0	57	28	23
Effects on Management Indicator Species and Migratory Birds	No Effect	Small loss (less than 1%) of potential habitat; expected to maintain viable, well dispersed populations of MIS.	Small loss (less than 1%) of potential habitat; expected to maintain viable, well dispersed populations of MIS.	Small loss (less than 1%) of potential habitat; expected to maintain viable, well dispersed populations of MIS.
Relative Effects of Alternatives on Management Indicator Species and Migratory Birds	No Effect	Greatest effect of action alts. on MIS because of larger acreage of forest habitat converted for transmission line clearing and easier access	Intermediate effect of action alts. on MIS because access is similar to Alt. 2, but forest habitat loss is lower than Alt. 2	Lowest impact of action alts. on MIS because it affects the least POG and foraging habitat, and provides the least access improvement
Threatened, Endangered, and Sensitive Species				
BE Effects Determination for humpback whale and Steller sea lion	No effect	No effect	No effect	No effect
BE Effects Determination for Kittlitz's murrelet, osprey, Peale's peregrine falcon, and trumpeter swan	No impacts	No impacts	No impacts	No impacts
BE Effects Determination for Northern goshawk	No impacts	May impact individuals	May impact individuals	May impact individuals

Activity	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Buried Trans Line	Alternative 4 Submerged Trans Line
Scenery	No Effect	Most visibility of the transmission line. Constructs access roads and transmission line above ground	Some visibility of the transmission line. Constructs access roads, and buries majority of transmission line along road corridor	Least visibility of the transmission line. Constructs access roads, and submerges majority of transmission line under water
Cultural Resources	No Historic Properties Affected	Historic Properties not adversely affected	Historic Properties not adversely affected	No Historic Properties Affected
Subsistence	No Effect	Does not pose a significant possibility of a significant restriction on subsistence	Does not pose a significant possibility of a significant restriction on subsistence	Does not pose a significant possibility of a significant restriction on subsistence
Wilderness[2]				
Effects (outside the project area) to "undeveloped" and "outstanding opportunities for solitude" Wilderness characteristics	No Effect	Most negative effects due to visibility and maintenance of road and transmission line.	Some negative effects due to road; less visible impact due to buried line.	Least negative effects due to elimination of the overland transmission corridor.
Socio-economics				
Estimated cost comparison for transmission lines[3]	None	$1,235,000	$1,303,000	$1,415,000

[2] The Forest Service recognizes that Congress exempted the project area from requirements of the Wilderness Act through ANILCA section 506 (a)(3)(D)

[3] Alternative costs differ primarily in terms of construction and maintenance costs of the transmission line. Dollar values are from an estimate done in 2000.

Chapter 3
Environment and Effects

Changes Between Draft and Final EIS

Chapter 3, Affected Environment and Environmental Effects

- Resource sections and analysis were adjusted, as needed, to reflect changes in the alternatives, terms and conditions, and other adjustments as described in Chapter 2.
- Additional field work was conducted; resource sections and analysis incorporated additional field data information and observations.
- Resource sections were re-organized to provide better readability.
- In response to comments we added more information on existing conditions and effects to many resource sections.
- A Transportation section was added. Road cards providing site-specific information about roads were added as Appendix B.
- A summary Essential Fish Habitat (EFH) section was added to reflect consultation done with the National Marine Fisheries Service between Draft and Final EIS.

3. Affected Environment and Environmental Consequences

3.1 INTRODUCTION

This chapter describes the affected environment and assesses the environmental consequences of the four alternatives presented in Chapter 2. For each resource area, the analysis is broken into two main subsections – affected environment and effects of project components. The affected environment subsections describe the current conditions of the resource, against which the anticipated direct and indirect environmental effects of the alternatives are evaluated. Then, for each resource, the next subsection discusses the effects of the project. Unavoidable adverse impacts and irreversible and irretrievable resource commitments are summarized. Cumulative effects are presented at the end of this chapter. The specific order of the sections is as follows:

Geology (section 3.2)
Soils (section 3.3)
Water Resources (section 3.4)
Fisheries (section 3.5)
Vegetation (section 3.6)
Wetlands (section 3.7)
Biodiversity and Wildlife (section 3.8)
Threatened, Endangered, and Sensitive Species (section 3.9)
Scenery (section 3.10)
Cultural Resources (section 3.11)
Subsistence (section 3.12)
Wilderness (section 3.13)
Social Economics (section 3.14)
Transportation (section 3.15)
Unavoidable Adverse Impacts and Irreversible and Irretrievable Resource Commitments (section 3.16)
Cumulative Effects (section 3.17)

3.2 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES - GEOLOGY

This section discusses land types and geology in the Angoon Hydroelectric Project area, as well as the potential effects associated with the alternatives. The information in this section was drawn from the karst and cave resource report prepared for this project. This report is on file at the Admiralty Island National Monument office.

3.2.1 AFFECTED ENVIRONMENT—LAND TYPES AND GEOLOGY

Watersheds are defined as the area that contributes surface and subsurface water to a single point. Key Thayer Creek watershed components include stream channels, groundwater, riparian areas, wetlands, lakes, hillslopes, and soils. These components transport, filter, and store water and sediment. This section discusses project features that influence hillslope stability, soil erosion, and karst features.

The project area spans three ecological subsections -- Hood-Gambier Carbonates, Mitchell-Hasselborg Lowlands, and Thayer Lake Granitics. The names of these ecological subsections are indicative of project area geology.

HOOD-GAMBIER CARBONATES

Most of the project facilities lie in this ecological subsection. Because of fractures in the underlying carbonates (limestones and marbles), high annual precipitation, and peat lands adjacent to the carbonate bedrock, karst has developed to varying extents. Generally, glacial deposits cover the carbonate rock at lower elevations.

The land types associations found in this ecological subsection are hills and lowlands. The hills have gently sloping terrain with relief less than 2,000 feet with no alpine vegetation on the summits. Most of the soils are derived from glacial till, are well-drained, and support productive forest cover types. Sedge fens and forested wetlands are the most common wetlands.

Lowlands are gentle, glacial topography with a higher percentage of wetland. Mineral soils are derived from glacial till and somewhat poorly drained. Wetlands types are bogs, poor fens, or forested wetlands.

MITCHELL-HASSELBORG LOWLANDS

Glaciers eroded the dominantly quartz arenite tertiary sediments of the Kootznahoo formation and the older basalts and cherts of the Devonian/Silurian volcanics to form this ecological subsection. The process of glaciation has a stronger effect on the development of this ecological subsection than the underlying geology.

The land types associations found in this ecological subsection are hills and lowlands. Vertical relief is the only difference between the two land types. All mineral soils are derived from glacial till with thick, organic horizons. Mineral soils are well-drained and support

highly productive forest cover. Organic soils are very thick, and support forested and bog wetlands.

THAYER LAKE GRANITICS

This ecological subsection consists of glacially scoured granitic bedrock made up of quartz monzonite and quartz diorite from the cretaceous period, with low relief and gentle slopes.

The land type association is primarily lowland, typified by glacial till slopes and plains. Mineral soils are 'poorly drained' to 'somewhat poorly drained'. They support low productivity, mixed conifer forest. Organic soils are 'poorly drained' to 'very poorly drained'. Bogs and poor fens are the wetlands that develop in this ecological subsection and land type association. These types of wetlands are common in Southeast Alaska.

3.2.1.1 Affected Environment - Karst Geology

Karst is a unique landform that develops by dissolving of carbonate rock, primarily limestone and marble. As the rock dissolves, underground drainage systems develop that can be expressed as surface features. Examples of these features include: streams that sink below ground (losing streams), depressions, sinkholes, collapsed channels, and caves.

According to current USGS geologic mapping, dark gray to white, medium to thick-bedded marble and calcareous phyllite of the Gambier Bay Formation underlies much of the project area. Geologic inventory within the project area confirmed the presence of marble underlying portions of the proposed access road alignment. The dam site is underlain by granite, not interbedded marble and calcareous phyllite as previously mapped; this makes a much better foundation for the dam. Cliffs exposed along the beach south of Thayer Creek consist of dark gray to white marble. Glacial till and glacial marine sediments overlie much of the bedrock in the area. These conditions may have created the surface flow drainage networks that led to the development of the karst systems.

In the northern third of the project area, Section 2, T. 50 S., R. 67 E., karst systems have developed where surface drainages flow to one of the marble beds striking roughly parallel to the shore. Twenty-five karst features were inventoried including sinkholes, losing streams, resurgences, and one cave. The streams appear to sink along the eastern side of the marble band, flow along the strike, and resurge at either end of the band. These features are considered high vulnerability karst. The areas adjacent to the proposed access road north of Thayer Creek to the diversion dam and the transmission line corridor were inventoried and no additional karst resources noted.

3.2.2 DIRECT AND INDIRECT EFFECTS ON LANDTYPES AND GEOLOGY

3.2.2.1 Effects – Karst Geology

ALTERNATIVE 1 (NO ACTION)

There would be no change to the existing condition because no new activities would occur.

ALTERNATIVE 2 (PROPOSED ACTION)

Approximately 0.2 miles of the access road between the marine facilities and powerhouse would be constructed across high vulnerability karst lands. The proposed alignment is slightly up slope and proximal to the karst systems identified, crossing the streams which sink into those systems. The sediment and debris generated as a result of the road construction would enter the karst systems via the streams which flow into them, eventually delivering sediment to the streams that the karst systems contribute to. An amendment to the Forest Plan would be needed to construct the access road across the inventoried high vulnerability karst areas.

ALTERNATIVES 3 AND 4

As described in Chapter 2, a no-disturbance buffer with a minimum width of 100 feet is required around karst features and the streams that flow to them (2008 Forest Plan pp 4-24 to 4-25, II Management, H, 1 (Road Construction) (a-d), 3 (Karst Feature Buffers) (a-f.)). The access road between the marine facilities and powerhouse would be routed around these buffers to limit sediment and debris associated with road construction from entering the karst system via the sinking streams. With the total avoidance of these karst features and the small streams which flow into them no effects to the karst systems is anticipated.

3.3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES - SOILS

This section discusses soil productivity, surface erosion, and mass wasting in the Angoon Hydroelectric Project area, as well as potential effects associated with the alternatives. The information in this section was drawn from the soils and wetlands report. This report is on file at the Admiralty Island National Monument office. The effects analysis area for soil resources are the watersheds in which development is proposed. Watersheds are used as the analysis area because erosion processes and specific erosion events are contained within them.

3.3.1 AFFECTED ENVIRONMENT—SOILS

3.3.1.1 Affected Environment - Soil Productivity

Soil productivity is the capacity of soil to support plant growth based on the chemical, physical, and biological properties of the soil. Virtually all soils in the project area have an intact, organic mat that prevents detrimental erosion or keeps it at a low level. However, a few existing landslides contribute to erosion and are discussed in the Mass Wasting Section. There is no existing human-induced detrimental erosion within the wilderness portion of the project area.

3.3.1.2 Affected Environment - Surface Erosion

Surface erosion is not pervasive in the project area. Virtually all soils in the project area have an intact, organic mat that prevents surface erosion or keeps it at a low level. However, a few existing landslides contribute to surface erosion and are discussed in the Mass Wasting Section. There is no existing human-induced surface erosion within the wilderness portion of the project area

3.3.1.3 Affected Environment - Landslides (Mass Wasting)

No landslides exist within the proposed road corridor and project footprint, but they do exist within the affected watersheds (see Water Section page 3.4.1.2, discussion about Reach C).

Slopes over 67%, a major concern related to landslides when building roads, exist in the project area, particularly between the proposed power plant site and the diversion dam (see Road Card Maps, Appendix B). The road corridor for Alternatives 3 and 4 between the power plant and the diversion dam contains approximately 150 feet of slopes greater than 67% along a 700 foot segment of the proposed alignment, while Alternative 2, contains over 300 feet. The road corridor between the marine facilities and the power plant, for all action alternatives, is entirely on slopes less than 67%. From the marine facilities to Kootznahoo Inlet, the transmission line and access road for Alternatives 2 and 3 cross two areas with slopes greater than 67%, including approximately a 350 foot segment and a 1,000-foot segment along the initial 5,000 feet of the alignment.

3.3.2 DIRECT AND INDIRECT EFFECTS ON SOILS

3.3.2.1 Effects - Soil Productivity

Removal of the organic surface exposes the soil to erosion and loss of the organic rooting substrate. Keeping the surface horizon intact is vital to maintain soil productivity.

Regional Soil Quality Standards require a "minimum of 85 percent of an area be left in a condition of acceptable productivity potential for trees and other managed vegetation following land management activities." Although road construction and rock pit development remove forest soils for plant growth, classified roads are considered part of the transportation system not the productive soil base. Consequently, classified roads, the rock pits needed to support them, and project facility sites are not considered detrimental disturbance from a soil productivity perspective (Forest Service Manual 2554.03).

The only remaining effect on soil productivity and detrimental disturbance is landslides (see Landslides Section and Table 3-1).

ALTERNATIVE 1

Soil productivity would be controlled by natural processes in the project area.

ALTERNATIVES 2, 3, AND 4

Soil productivity could potentially be impacted by human-induced landslides (see Mass Wasting section). Nevertheless, all alternatives would meet Regional Soil Quality Standards since landslides would be well below the 15% threshold.

3.3.2.2 Effects – Surface Erosion

Road construction would expose surfaces to erosion. All roads contribute to erosion effects. Landslides, both human-induced and naturally occurring, expose surfaces to erosion.

Sediment can be delivered to streams at road crossings. Short-term effects are associated with road construction activity. The erosion of road surfaces and cut-and fill-slopes produces long-term effects. Road cuts can intercept the shallow subsurface flow along a hillside and concentrate runoff into ditch lines which may erode exposed surface soils and deliver sediment to streams at crossings. This process can also increase the effective drainage network as road ditches intercept runoff and can form new channels. Sediment-plugged culverts become sediment sources when stream flow is strong enough to remove the culvert and associated sediment. Cut bank erosion and slumping are also potential sediment sources.

ALTERNATIVE 1

Soil, surface water drainage, and erosion hazards would be controlled by natural processes in the project area under Alternative 1 because no construction would occur.

ALTERNATIVES 2, 3 AND 4

A site-specific, detailed erosion control plan would be required as part of an approved operating plan for all action alternatives. The erosion control plan would address construction

and operation of all project facilities, including the marine facilities, diversion dam and intake, pipeline, penstock, surge tank, powerhouse and switch yard, access roads, transmission cable, barge landing, staging areas, construction camp, and rock and borrow sites.

In Alternative 2, because of steep slopes and the proximity of the diversion dam access road to Thayer Creek, full bench road construction, minimal excavation width and geotechnical studies would be required for final project design (BMP 14.7). The potential for surface erosion along this road would be reduced, but not eliminated, by implementation of appropriate BMPs. Nevertheless, surface erosion is expected and sediment would likely enter Thayer Creek. Because the diversion dam access road in Alternatives 3 and 4 would be rerouted to avoid most steep slopes, the potential for road related sediment to enter Thayer Creek is much lower.

Estimated acres exposed to surface erosion for all alternatives are included in Table 3-1. These estimates are based on past experience with road construction in Southeast Alaska in which 4.8 acres of disturbance is associated with the construction of one mile of road, and one acre of disturbance per mile of road is associated with rock pit development.

Table 3-1. Potential for Surface Erosion – Acres of Disturbance

Disturbance Type	Alt. 1	Alt. 2	Alt. 3	Alt. 4
	Acres	Acres	Acres	Acres
Classified Road Construction	0	37.7	39.3	20.6
Rock Pit Development	0	7.8	8.3	4.3
Human-Induced Landslides	0	unknown	unknown	unknown
Total Affected Acres	**0**	**45.5**	**48.2**	**24.9**
Percent of Soils Analysis Area[2]	**0**	**0.09[1]**	**0.10**	**0.05**

[1] Landslide potential, resultant surface erosion and resource damage may be greater for this alternative because of road location along Thayer Creek.
[2] Analysis Area consists of the watersheds on which proposed activities occur (see Soil and Wetland Resource Report).

3.3.2.3 Effects - Landslides (Mass Wasting)

Road building on slopes exceeding 67%, regardless of soil drainage, are considered to have an increased landslide potential and should be avoided where feasible (USDA Forest Service 1997).

ALTERNATIVE 1

The potential for landslides would be controlled by natural conditions under Alternative 1 since no development would occur. Evidence of existing landslides or mass wasting along the road corridor was not observed during field surveys of the project area.

ALTERNATIVE 2

The road corridor for Alternative 2 between the power plant and the diversion dam contains over 300 feet of slopes greater than 67% (see Road Cards, Appendix B). The potential for landslides during and after construction on these slopes is higher than for the segment of road that would bypass these steep slopes and, if landslides occurred, would adversely affect the hydrology and fish resources in the lower 1,300 feet of Thayer Creek.

For all action alternatives the road corridor between the marine facilities and the power plant is entirely on slopes less than 67%.

In Alternatives 2 and 3 the transmission line/maintenance road corridor between the marine facilities and Kootznahoo Inlet includes two segments located on slopes greater than 67%. One 350-foot segment is located approximately ½-mile south of the marine facility and a second 1,000-foot segment occurs approximately ½-mile beyond the first. A landslide along the first segment would remove surface vegetation and expose underlying soil to accelerated surface erosion but, because of its location, would not significantly affect downstream hydrology and fish resources since there are no fish streams between this segment and salt water. The second segment poses the greater risk of landslides and, since it is located adjacent to a stream channel, potential landslides would impact downstream hydrology and fish resources. If the final design for the transmission line and road interrupts the road at this segment, steep slopes may be avoided. This would require access from both ends of the transmission line.

Implementation of BMPs 14.7 and 14.12 would reduce the risk of landslides. Timing restrictions (BMP 14.6) to avoid road construction during periods of high precipitation would also reduce the risk of mass failures.

ALTERNATIVE 3

Alternative 3 was designed, in part, to minimize road construction on steep, potentially unstable, slopes. The road corridor between the power plant and the diversion dam would be rerouted to avoid steep slopes adjacent to Thayer Creek. The new location, however, still crosses approximately 150 feet of slopes greater than 67% along a 670 foot road segment facing Chatham Straits adjacent to the mouth of Thayer Creek. Potential landslides along this segment would not enter Thayer Creek and would not adversely affect downstream hydrology and fish resources.

Except as described above, the potential for mass wasting from construction on steep slopes in Alternative 3 is the same as that for Alternative 2.

ALTERNATIVE 4

Alternative 4 was also designed, in part, to minimize road construction on steep, potentially unstable, slopes. The road corridor for Alternative 4 between the power plant and the diversion dam is located along the same route as in Alternative 3 and would have similar soil-related effects.

Since Alternative 4 would utilize a submerged transmission line from the marine facility to Angoon, no overland construction would occur south of the marine facility. This would

eliminate mass wasting risks associated with the two areas of steep slopes described in Alternatives 2 and 3.

Except as described above, the potential for mass wasting from construction on steep slopes in Alternative 4 is the same as that for Alternative 2.

3.4 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES - WATER RESOURCES

This section discusses water quantity and water quality in the Angoon Hydroelectric Project area, as well as the potential effects associated with the alternatives. The information in this section was drawn from the water resources specialist report prepared for this project, which is on file at the Admiralty Island National Monument office.

3.4.1 AFFECTED ENVIRONMENT – WATER RESOURCES

The project area has a maritime climate with cool summers and relatively mild winters. Precipitation is abundant year-round and conditions are frequently overcast or foggy. Annual precipitation is estimated at about 100 inches (Wiley and Curran 2003). Review of climate data from Angoon suggests that precipitation in the project area could be lower. Estimates of mean annual precipitation in Angoon range from 42 to 53 inches (Western Regional Climate Center [WRCC] 2008).

The average annual temperature is approximately 41 degrees Fahrenheit (°F), ranging from winter lows of -10°F and summer highs of about 85°F (HDR Alaska 2000). The lower elevations of the project area are in a transient snow zone, where freezing conditions are common in the winter, but rarely extend longer than a week (WRCC 2008). The Thayer Creek watershed extends from tidewater to 3,890 feet at Thayer Mountain and encompasses 64 square miles. Thayer Lake, at an elevation of approximately 368 feet, has a surface area of approximately 2,809 acres (4.4 square miles) and provides some natural regulation of the flows in Thayer Creek below the lake (HDR Alaska 2000). Many unnamed streams drain into Thayer Lake.

Thayer Creek flows from the west-southwest arm of Thayer Lake for approximately 6 miles through a broad, flat valley at a mild grade. It then enters a deeply incised, steep forested canyon for approximately 7,500 feet with many cascades and falls. The proposed hydroelectric diversion site is at the upstream end of the canyon.

At its downstream end, the canyon concludes in two waterfalls that prohibit upstream migration of fish. Additional details are found in the Fisheries Resource Report. There is one plunge pool of unknown depth at the base of the downstream falls, after which the stream gradient decreases to about one percent, with continuous riffle to tidal influence. This lowest segment of Thayer Creek, from falls to tidal influence, is about 1020 feet long. The proposed hydroelectric powerhouse is on the south bank of the creek in this area.

Several small, unnamed tributaries join Thayer Creek in the canyon. In July 2008, only the two largest (on the north side) contained measurable streamflow, each less than one cubic foot per second (cfs).

Coastal areas and streams north and south of Thayer Creek will also be affected by the project access roads and/or transmission line. The road cards describe the affected streams.

3.4.1.1 Affected Environment - Water Quantity

STREAMFLOWS

Because streamflow data are incomplete for Thayer Creek, a comparison was made to the adjacent Hasselborg Creek watershed for the purpose of evaluating project feasibility (HDR Alaska 2003). The USGS maintained a gauging station on Hasselborg Creek for 17 years between July 1951 and September 1968. The Water Resources Report (Thompson 2008) contains a detailed comparison of the two watersheds. The basins are very similar, providing a reasonable basis for estimating Thayer Creek streamflow from the Hasselborg Creek streamflow record. Based on the ratio of respective drainage areas, Thayer Creek streamflows at the diversion site have been estimated as 114% of the Hasselborg Creek streamflows at the USGS gage site. The extreme minimum flow recorded at Hasselborg is 23 cfs, which would translate to a predicted minimum of 26 cfs at Thayer Creek. The extreme maximum flow recorded at Hasselborg is 2,220 cfs which translates to a predicted maximum of 2,530 cfs at Thayer Creek.

Figure 3-1 displays the predicted Thayer Creek mean daily streamflow, based on the Hasselborg Creek streamflow record.

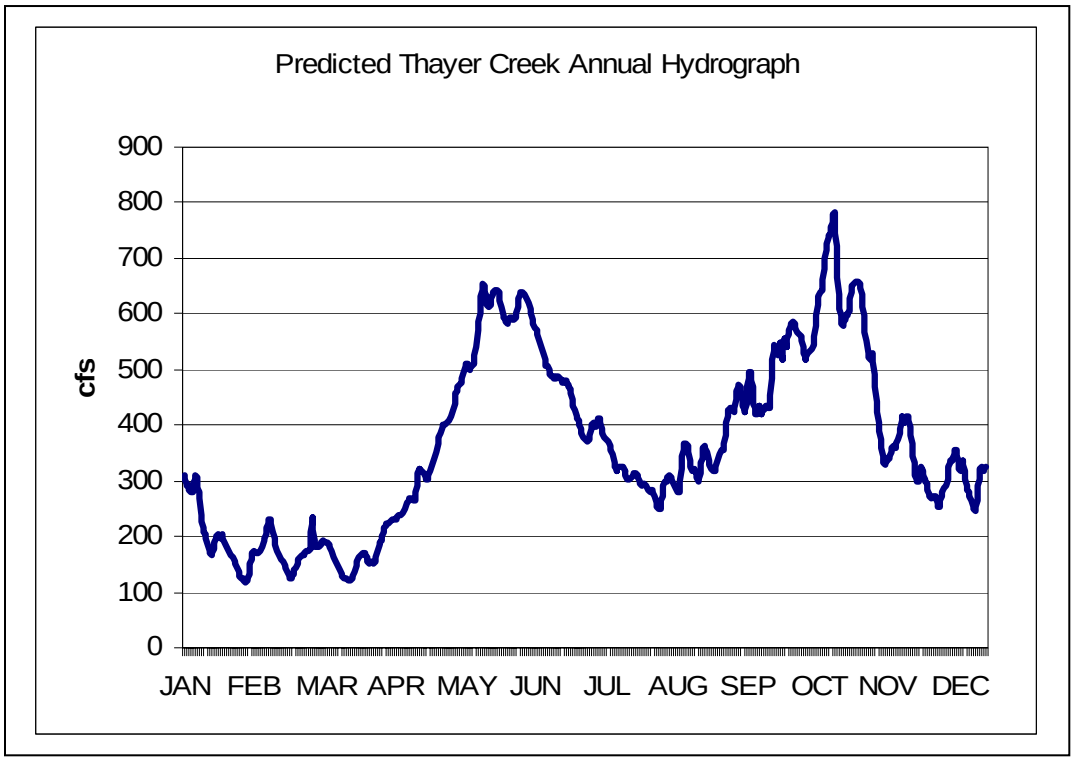


Figure 3-1. Mean Daily Streamflow, Thayer Creek, based on Hasselborg Creek streamflow record

3.4.1.2 Water Quality

Water quality parameters most likely to be impacted by the Angoon Hydroelectric Project include turbidity, sediment, temperature, and dissolved oxygen in streambed materials prone

to freezing in winter. Since there is no existing large scale human-caused disturbance in these watersheds, water quality is currently influenced only by natural processes.

We divided Thayer Creek into four reaches (segments), referred to as A through D (see Figure 2-2 in Chapter 2), progressing from tidal influence in an upstream direction. The Water Resources Report (Thompson 2008) provides a detailed description of the reaches.

The break between Reaches A and B is indistinct in the field; the primary differentia is the extent of tidal influence upstream. These reaches comprise the anadromous fish portion of Thayer Creek; they are sometimes combined in the discussion for convenience. Total combined length of Reach A and B is about 1020 feet.

Reach A is an ES4-Large Estuarine Channel (Paustian 1992) which is frequently influenced by saltwater during high tides. A debris jam controls flow into a side channel with dominant substrate of gravel. This side-channel is inundated during high tides. Otherwise dominant substrate in this reach is large cobble, similar to Reach B. There are no pools in Reach A. Sediment and turbidity increase during high flows triggered by spring snowmelt and fall rains. Cool stream temperatures are normally maintained from the shaded reach upstream, but can be warmed by tidal influence during very warm summer days. In winter, sustained flow from Thayer Lake and tidal influence would help maintain stream temperature above freezing during extended cold weather (Sheridan 1961). Dissolved oxygen is likely near saturation year-round.

Reach B is an LC2-Moderate Gradient Contained Narrow Valley Channel (Paustian 1992). This reach extends from tidal influence to the downstream end of the canyon. There is one plunge pool of unknown depth at the base of the downstream falls. Wood in Reach B stores sediment, creates quiet water during high flows, and directs water into a short (75 ft) side-channel. Sediment is efficiently transported through this channel. Fine sediment in particular is rapidly flushed through this reach and only notable near the banks and in the side channel. Sediment and turbidity increase during high flows triggered by spring snowmelt and fall rains. Cool stream temperatures are maintained by forest shade and rapid, turbulent flow in the summer. In winter, sustained flow from Thayer Lake and turbulent flow would help maintain stream temperature above freezing during extended cold weather, especially when snow and ice cover is present (Sheridan 1961). De-watered streambeds may freeze during low winter flows, especially where flow is divided into multiple threads across the riffle and no snow is present. Dissolved oxygen is likely near saturation year-round except where the stream is frozen solid into the streambed.

Reach C comprises the majority of the bypass reach (below the diversion site). This is a MC3-Deeply Incised Contained Channel (Paustian 1992). The dominant streambed material in this canyon is bedrock. We verified the presence of numerous small slope failures and tributaries supplying large wood, gravel and cobbles to the stream. Sediment is efficiently transported through this channel. Sediment and turbidity increase during high flows triggered by spring snowmelt and fall rains. Cool stream temperatures are maintained by forest shade and rapid, turbulent flow in the summer. In winter, sustained flow from Thayer Lake and turbulent flow help maintain stream temperature above freezing during extended cold weather, but it is likely that shallow water freezes during low winter flows especially where the stream is divided into multiple threads over cascades. Dissolved oxygen is likely near saturation year-round except where the stream is frozen.

Reach D, above the proposed diversion site, is a stable FP5-Wide Low Gradient Flood Plain Channel (Paustian 1992). The dominant streambed material in this reach is sand and gravel. Large wood enters the stream from riparian forest and is important for sediment storage, channel stability, and fish habitat. Sediment is stored in this channel during much of the year, but is mobilized during high flows in spring and fall. Although Thayer Creek has high sediment-transporting power due to its large contributing watershed, the presence of Thayer Lake, which intercepts many headwater tributaries and traps sediment, limits sediment supply from most of the watershed. Sediment and turbidity increase during high flows triggered by spring snowmelt and fall rains. Cool stream temperatures are maintained by forest shade and deep pools in the summer. In winter, deep pools and sustained flow from Thayer Lake maintain stream temperature above freezing during extended cold weather. Dissolved oxygen is likely near saturation year-round.

3.4.2 DIRECT AND INDIRECT EFFECTS ON WATER RESOURCES

Effects to water resources are summarized in Table 3-2 and explained further in the analysis that follows the table.

Table 3-2. Potential Effects of the Angoon Hydroelectric Project on Water Resources[1]

Measure	Alt 1	Alt 2	Alt 3	Alt 4
Minimum Instream Flow (CFS)	26 (predicted natural extreme minimum flow)	20	40	40
Channel Types (lengths) in Bypass Reach	Not applicable	MC3 (7,500 ft) LC2 (450 ft)	MC3 (7,500 ft)	MC3 (7,500 ft)
Winter Streamflow: (~Dec–Mar)	No effect[2]	Moderate effects[2]	Moderate effects However, 40 cfs provides deeper flow than 20 cfs	Moderate effects However, 40 cfs provides deeper flow than 20 cfs
Summer Streamflow: (~Aug-Sep)	No effect	Minor effects[2]	Minor effects	Minor effects
Spring and Fall Streamflow: (~Apr-Jul, Oct-Nov)	No effect	Negligible effects[2]	Negligible effects	Negligible effects
Sediment supply from above dam	No effect	Minor to moderate: dam incorporates sluice for bedload but frequency sediment release unclear.	Negligible to minor: SUA stipulates routine passage of natural bedload during high flow events	Negligible to minor: SUA stipulates routine passage of natural bedload during high flow events
Large wood supply	No effect	Minor: Supply limited to sources in bypass reach	Negligible: SUA stipulates routine passage of wood during high flow events	Negligible: SUA stipulates routine passage of wood during high flow events
Winter minimum water temperature and dissolved oxygen	No effect	Moderate effects	Moderate effects However, 40 cfs provides deeper flow than 20 cfs (Alt 2).	Moderate effects However, 40 cfs provides deeper flow than 20 cfs (Alt 2).
Summer maximum water temperature	No effect	Minor effects:	Negligible to minor effects	Negligible to minor effects
Erosion and sediment (from ground-disturbing activities)	No effect	Major effects	Minor effects	Minor effects

[1] All effects are on Thayer Creek; erosion and sediment effects are for all project area streams

[2] Effects Definitions are further described below.

ALL ALTERNATIVES – EFFECTS DEFINITIONS:

No effect – resource measure is not impacted.

Stream flow:

Negligible: naturally occurring high flows will not be measurably affected by diversion.

Minor: diversion will diminish naturally occurring summer low flows but they are likely to be shorter duration than winter low flows, recovering rapidly in response to rain

Moderate: diversion will diminish naturally occurring winter low flows in stream reaches supporting resident and anadromous fish. Winter low flows will last longer and/or occur more frequently.

Water temperature/dissolved oxygen:

Negligible to minor: diminished flow levels are unlikely to measurably increase temperatures in stream reaches supporting resident fish.

Minor: diminished flow levels are likely to increase temperature during warm weather, especially in stream reach supporting anadromous fish which lacks pools

Moderate: minimum flow will not prevent periodic freezing in stream reaches supporting resident and anadromous fish. Dissolved oxygen will be depressed in dewatered/frozen spawning gravels

Erosion and Sediment:

Minor: all facilities located to avoid or unstable terrain. All facilities governed by erosion control plans & BMPs to be approved by FS

Major: road and pipeline locations on unstable terrain would not meet Forest Plan Standards and Guidelines for Soil and Water. Otherwise all facilities governed by erosion control plans & BMPs to be approved by FS

3.4.2.1 Effects - Water Quantity

The Water Resources Report (Thompson 2008) discusses a range of instream flow requirements from 0 to 50 cfs, consistent with the power generation assumptions considered in HDR (2000). The project proponent did not conduct an instream flow analysis. For the purposes of displaying effects in this EIS, we have selected instream flow requirements of 20 cfs (Alternative 2) or 40 cfs (Alternatives 3 and 4). These flows encompass the range of predicted extreme low flows in Thayer Creek. All alternatives would affect fish habitat in the bypass reach, especially during periods of naturally occurring low flows. The effects are likely to be most severe in winter, but would be incrementally less with increasing instream flow requirements. The Record of Decision for this project will identify a minimum instream flow requirement, or it may defer the requirement to be negotiated between the proponent and the State of Alaska as part of the ACMP and/or Title 16 permitting processes. The Special Use Authorization will include a minimum instream flow requirement of at least 20 cfs, and monitoring requirements to validate effects on fish habitat and adapt requirements as necessary in consultation with ADFG.

ALTERNATIVE 1 (NO ACTION)

Under the No Action alternative, stream flows throughout the project area would be controlled by natural events and would retain their current volume and pattern.

ALTERNATIVE 2 (PROPOSED ACTION)

Alternative 2 would affect streamflow in the bypass reach of Thayer Creek, from the diversion dam to the tailrace from the powerhouse. The proposed diversion dam would be located at the upstream end of the canyon, creating an impoundment with surface area of 10 to 20 acres. The project would operate as run-of-the-river with no active storage (inflow to impoundment always equals outflow). A maximum of 82 cfs would be diverted from Thayer Creek, with minimum instream flow of 20 cfs through the bypass reach. A flow of 20 cfs was intended to approximate natural low flows at Thayer Creek (HDR Alaska 2000). Diverted streamflow would be returned to Thayer Creek from the power house approximately 450 feet downstream of the lower barrier falls1 in the vicinity of transition between Reaches A and B.

HDR Alaska summarized an operations model developed specifically for this project (HDR Alaska 2000) that displays the relationship between streamflow and power generation under various assumptions.

"Generally, the [predicted] flow in Thayer Creek is much greater than necessary to generate all of Angoon's power requirements. However, under some conditions, the flows drop low enough that the hydro generation will need to be supplemented from other sources (e.g. the existing diesel generators)." (ibid, page 28)

They concluded that this project would supply all of Angoon's power needs at current load levels over 99% of the time, requiring supplemental power about two days per year. HDR Alaska's operations model includes load-following capability and variables for headwater, tailwater, and generating and transmission efficiencies. Our conclusions, using only predicted annual and monthly flow duration curves, are slightly different.

Flow duration curves display the percent of time that predicted streamflow in Thayer Creek equals or exceeds values associated with power generation and a range of instream flow requirements. We analyzed two power generation scenarios. One turbine capacity, which approximates current power demand at Angoon (HDR Alaska 2000), is calculated as 41 cfs plus minimum instream flow of 20 cfs for a total of 61 cfs. Two turbine or maximum power capacity is calculated as 82 cfs plus minimum instream flow of 20 cfs for a total of 102 cfs.

Figure 3-2 displays the predicted annual flow duration curve for Thayer Creek.

[1] HDR (2000) described the powerplant discharge at 300 feet downstream of the barrier falls. Based on the description of the powerhouse location in HDR 2000, we measured this distance in the field as about 450 feet.

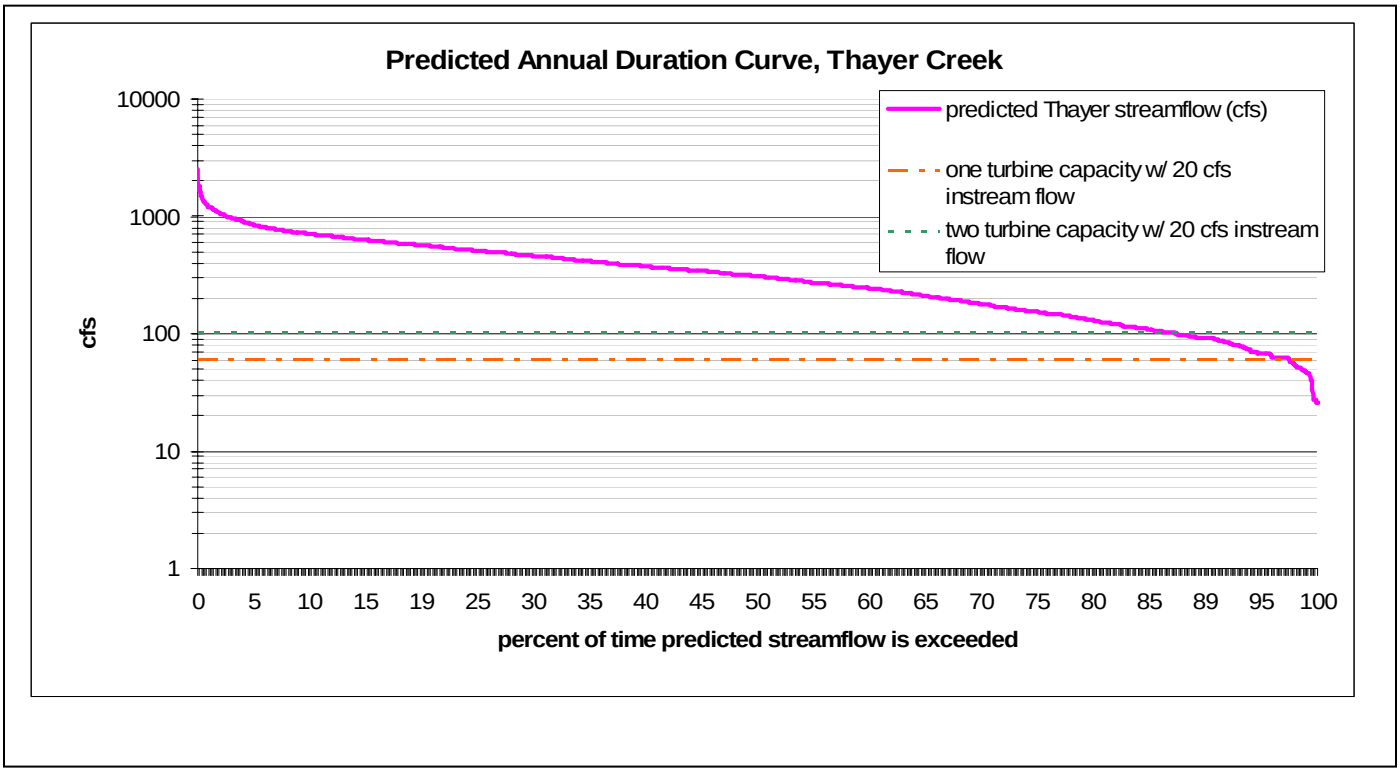


Figure 3-2. Predicted Annual Flow Duration Curve for Thayer Creek, comparing two power capacities with a 20 cfs instream flow requirement.

Appendix A contains annual duration curves for instream flow requirements of 0, 20, 30, 40 and 50 cfs; results are summarized in Table 3-3. For Alternative 2, we predict that streamflow may be insufficient to meet current power generation demand combined with instream flow requirement for about 15 days per year.

Table 3-3. Results of Annual Flow Duration Curves (Appendix A).

Power Capacity	Instream Flow Requirement				
	0 cfs	**20 cfs**	**30 cfs**	**40 cfs**	**50 cfs**
	Percent of time predicted streamflow equals or exceeds power capacity				
two turbine capacity	92	87	83	81	80
one turbine capacity	99	96	94	92	89
	Predicted days of shortage				
two turbine capacity	29	47	62	69	73
one turbine capacity	4	15	22	29	40
	HDR predicted days of shortage				
HDR's 'max potential'	26.9	47.1	*	*	75.6
HDR's 'existing load'	0	2.2	*	*	16.9

* HDR Alaska did not display results of their operations model for 30 or 40 cfs instream flow requirements.

An analysis of monthly flow duration curves (Appendix B) shows that January, February, and March are likely to be the most limiting months in terms of the percentage of time that streamflow might not be sufficient for power generation. In March, assuming minimum instream flow of 20 cfs, we predict Thayer Creek streamflow is likely to be sufficient to meet the one turbine capacity 94% of the time.

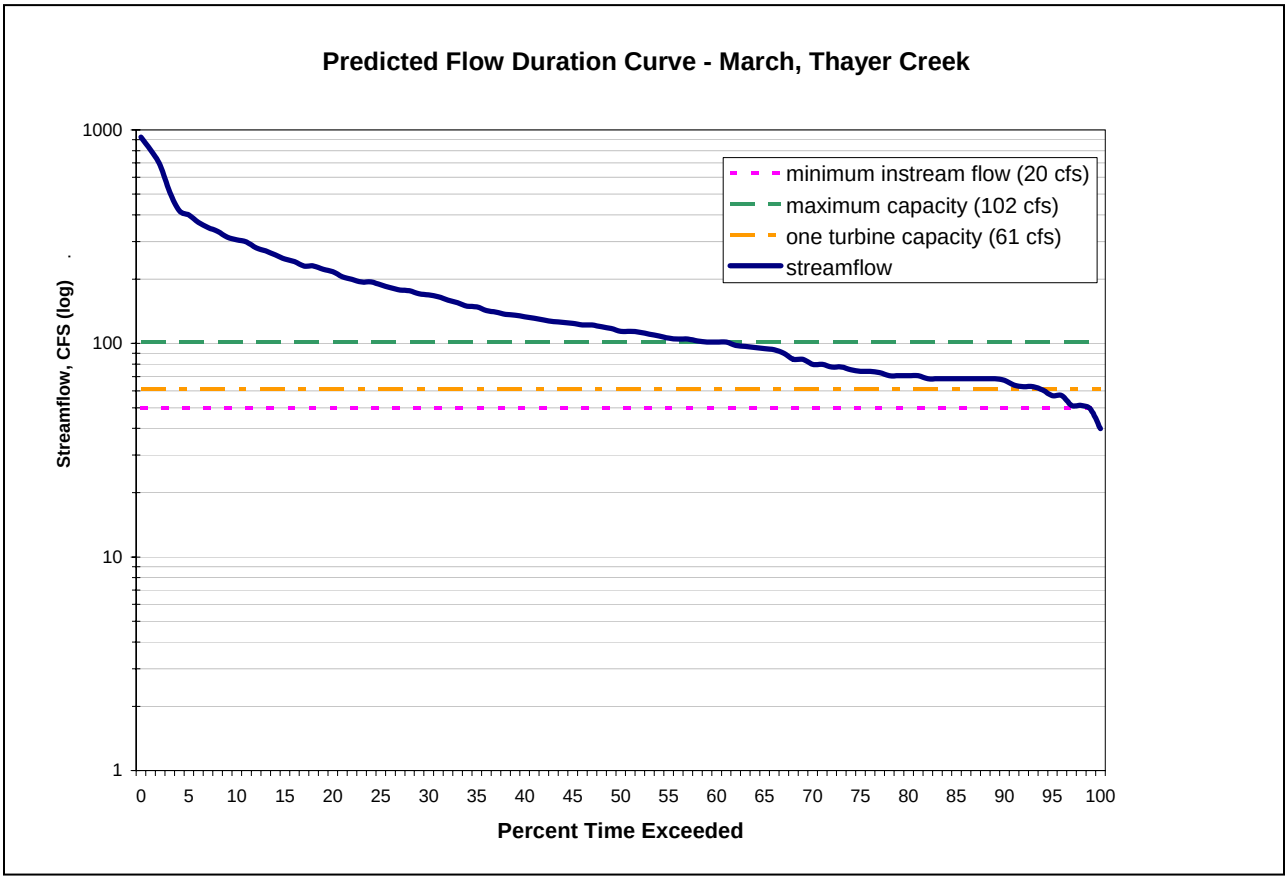


Figure 3-3. Predicted flow duration curve (March) – Thayer Creek

This information is shown for all months in Table 3-4. The analysis at this more detailed scale is not expected to exactly match the results of the annual duration curve, and is only intended to display which months might be more limiting.

Table 3-4. Percent time predicted Thayer Creek streamflow equals or exceeds power capacity for Angoon Hydroelectric Project by month.

Predicted Days of Shortage													
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	total
20 cfs - Max Power	10	11	12	3	0	0	1	3	2	0	2	4	48
20 cfs - One Turbine	4	2	2	0	0	0	0	0	0	0	1	1	10
30 cfs - Max Power	12	12	14	5	0	0	1	4	2	0	2	5	57
30 cfs - One Turbine	4	5	6	2	0	0	0	0	0	0	1	2	20
40 cfs - Max Power	14	13	16	5	0	0	1	5	2	1	3	7	66
40 cfs - One Turbine	5	6	9	2	0	0	0	0	1	0	1	2	27
50 cfs - Max Power	15	14	18	6	0	0	1	5	2	1	3	8	74
50 cfs - One Turbine	8	10	10	3	0	0	0	2	1	0	1	3	39

We surveyed a channel cross section near the downstream end of the bypass reach (in the LC2 channel – Reach B). Figure 3-4 displays a prediction of what the stream would look like in the lowest portion of the bypass reach if only the minimum instream flow (in this case 20 cfs) is present.

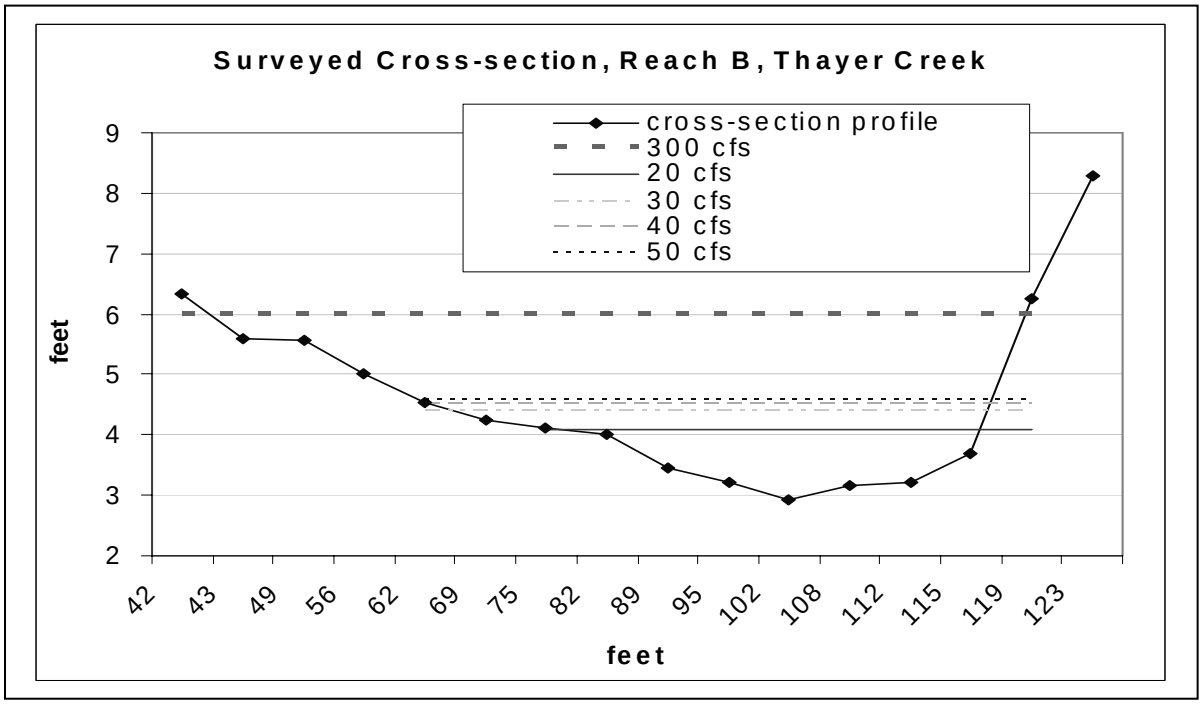


Figure 3-4. Modeled instream flow levels in surveyed cross-section of Thayer Creek Reach B, 450 feet downstream from the barrier falls.

In a highest water removal scenario, when only the minimum instream flow is in the bypass reach, the maximum water depth is predicted to be about 1.1 foot. A minimum instream flow of 20 cfs may keep the deepest part of the stream from freezing during extended cold weather, but it will likely result in freezing temperatures in shallow areas of the stream. In Reach C, low flows are not likely to be concentrated in a single thread channel, but spread out into multiple rivulets over numerous cascades which are more likely to freeze. The small tributaries in the bypass reach are unlikely to contribute any measurable streamflow during low flow periods.

In summary, Alternative 2 would have moderate effects on streamflow in bypass reaches B and C. Effects are considered moderate because they would be measurable at the stream reach scale and could last more than a week. Flow diversion will diminish naturally occurring winter low flows in stream reaches supporting resident and anadromous fish. Winter low flows will last longer and/or occur more frequently.

ALTERNATIVE 3 (BURIED TRANSMISSION LINES)

Alternative 3 would have similar effects on streamflow as Alternative 2, except that minimum instream flow is higher (40 cfs) and the tailrace discharge location is at or above the lowest fish barrier, so the stream reach supporting anadromous fish is not affected by the diversion. Alternative 3 would have moderate effects on streamflow in bypass Reach C. The diversion will diminish naturally occurring low flows in stream reaches supporting resident fish. Winter low flows will last longer and/or occur more frequently. 40 cfs provides deeper flow and submerges more of the channel than 20 cfs.

ALTERNATIVE 4 (SUBMERGED TRANSMISSION LINES)

Alternative 4 would have the same effects on streamflow as Alternative 3.

3.4.2.2 Effects - Water Quality

ALTERNATIVE 1 (NO ACTION)

Under the No Action alternative, water quality would be determined by natural events.

ALTERNATIVE 2 (PROPOSED ACTION)

In Alternative 2, short-term turbidity and suspended sediment transport would occur intermittently during instream construction of the intake and dam. These are considered minor effects; although measurable, they are temporary and localized.

The dam incorporates a sluice for bedload flushing but the frequency or means of flushing is not specified. A reduction in bedload transport would occur while the impoundment fills. Once the pond fills, bedload is likely to deposit at the upstream end of the pond and may not ever reach the dam unless the impoundment water level is intentionally drawn down during high flows. Bedload sediment is also supplied downstream of the diversion from small tributaries and steep, eroding canyon walls in Reach C. This sediment source partly alleviates the loss of sediment from Reach D, but it is possible that streambed materials in the bypass reach could coarsen over time. Since streambed materials in Reach B may already be considered relatively coarse, loss of fine materials from upstream could further limit spawning habitat in Reach B. The extent and magnitude of the effects of the dam on

sediment supply in the bypass reach are uncertain. We have characterized them as minor to moderate and we have identified relevant monitoring requirements for Reach B.

The effects of the dam on large wood supply would be minor. Large wood sources were identified within the bypass reach. We have identified relevant monitoring requirements for Reach B.

Streamflow diversion may indirectly result in extended periods of freezing stream temperature. Minimum flow of 20 cfs will not prevent periodic freezing in stream reaches supporting resident and anadromous fish. Dissolved oxygen will be depressed in dewatered/frozen spawning gravels (Becker and Neitzel 1985). We have identified relevant monitoring requirements for Reach B.

Alternative 2 would construct a total of about 7.8 miles of access road including 0.2 miles of temporary road to install a surge tank. The proposed road does not avoid unstable terrain, particularly in the vicinity of the Thayer Creek canyon. The road location described in HDR 2000 is not consistent with Best Management Practices and would not meet Forest Plan Standards and Guidelines for Soil and Water. Roads under this alternative would have major effects on water quality since they are likely to result in long term instability and chronic sediment sources in the immediate vicinity of Thayer Creek. If Alternative 2 is selected, the access road location would have to be modified to be consistent with the Forest Plan and may need to be modified to be consistent with the Clean Water Act.

Otherwise, all facilities constructed for the Angoon Hydroelectric Project would be governed by erosion control plans containing site specific BMPs for minimizing erosion and sediment transport. These include the dam, the dam access road, the pipeline, a penstock and bridge crossing Thayer Creek, the powerhouse, a road from the powerhouse to the marine facilities, and a road under the transmission line. Road-related BMPs and road-stream crossings are described in the Road Cards. BMPs are expected to limit erosion and sediment to minor effects; short term and localized. Kootznoowoo would be responsible for road maintenance.

The transmission lines would have minimal effects on water quality. Under Alternative 2, the transmission lines would extend aerially from the power plant to a switch yard at Kootznahoo Inlet, and then be submerged across Kootznahoo Inlet to another switch yard at Angoon.

ALTERNATIVE 3 (BURIED TRANSMISSION LINES)

Effects of Alternative 3 on water quality are similar to Alternative 2 with the following exceptions:

The SUA would stipulate dam design and operation to routinely pass natural bedload during spring and fall high flows, using a sediment pass-through technique (Wang and Locher 1996). A low-level outlet would be opened at the beginning of a flood event to draw the impoundment down well before the peak flood flow occurs. This increases the flow velocity through the impoundment and transports sediment further downstream. This procedure reduces the deposition of material in the upper reaches of the impoundment (Wang and Locher 1996). Effects on sediment supply from upstream of the dam would be considered negligible to minor.

Streamflow diversion may indirectly result in extended periods of freezing stream temperature. Minimum flow of 40 cfs will not prevent periodic freezing in stream reaches

supporting resident fish. Dissolved oxygen will be depressed in dewatered/frozen spawning gravels.

Alternative 3 would construct a total of about 8.3 miles of access road. We assumed that the transmission line would be buried under the road, requiring increased excavation and more ground disturbance than typical logging road construction. The proposed road avoids unstable terrain, is consistent Best Management Practices and would meet Forest Plan Standards and Guidelines for Soil and Water. Road and pipeline under this alternative would have minor effects on water quality, short term and localized. Other facilities and affects would be as described in Alternative 2.

ALTERNATIVE 4 (SUBMERGED TRANSMISSION LINES)

Effects of Alternative 4 on water quality are similar to Alternative 3 with the following exceptions:

Alternative 4 would construct a total of about 4.3 miles of access road. The proposed road avoids unstable terrain, is consistent Best Management Practices and would meet Forest Plan Standards and Guidelines for Soil and Water. Road and pipeline under this alternative would have minor effects on water quality, short term and localized.

The marine effects of the submerged transmission line are addressed in the Fisheries Section.

3.5 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES - FISHERIES

This section discusses fish and fish habitat in the Angoon Hydroelectric Project area, as well as the potential effects associated with the alternatives. The information in this section was drawn from the fisheries specialist report prepared for this project, which is on file at the Admiralty Island National Monument office.

3.5.1 AFFECTED ENVIRONMENT - FISHERIES

The previous section of this document discusses the hydrology of the project area in detail as well as potential effects of various project components under each alternative.

FISH SPECIES

The majority of Thayer Creek contains only resident fish, due to a natural fish barrier located approximately 335m (1,020ft) from the mouth that precludes anadromous access upstream. However, this section of stream, much of it tidally influenced, estuarine-type channel, supports anadromous salmonids and contains limited salmon spawning habitat.

The ADFG Anadromous Waters Catalog lists only pink and chum salmon in Thayer Creek. However, in early July 2004, Forest Service resource specialists sampled fish species within Thayer Creek using minnow traps. They trapped both coho salmon fry and juvenile steelhead trout downstream of the anadromous barrier (Reaches A and B, see Figure 2-2 in Chapter 2). Coho fry ranging in size from 40mm (1.5in) to 80mm (3.25in) were observed, with many located in quiet seasonal side pools along the main channel. Steelhead juveniles were approximately 150mm (6in) long. Adult pink and chum typically enter the creek in late July to spawn (Pers. Comm., Kevin Monagle 2008). No adult salmon or trout were observed during the survey. Based on the presence of coho and steelhead fry, it is reasonable to assume that Dolly Varden would also be present within Reach A and B during the fall spawning season. No fish were noted in Reach C, while numerous cutthroat trout ranging in size from 100mm (4in) to more than 200mm (8in) were observed within Reach D.

Fish use of the anadromous reach likely includes spawning and rearing for chum, pink, and coho salmon, and Dolly Varden. Seasonal rearing habitat is available for steelhead and cutthroat trout and juvenile coho salmon. Upstream of the barrier, resident fish, primarily cutthroat trout, are present. The source for these fish would be Thayer Lake and Reach D.

Federally listed salmon and steelhead stocks (e.g., Puget Sound Chinook salmon) are not present within the project area; they are found only on the outer coast of the Tongass National Forest (USDA Forest Service 1997). The Tongass Land and Resource Management Plan (USDA Forest Service 2008a) identified three Forest Service Region 10 sensitive fish species that occur on the Forest. These include the Fish Creek chum salmon, the Island Chinook salmon, and the northern pike. The northern pike is found only on the Yakutat forelands and the Fish Creek chum salmon occurs near Hyder. The Island Chinook salmon occurs naturally on islands including runs in King Salmon Creek and Wheeler Creek.

Although these sites are on Admiralty Island, they are not within the project area and would thus not be affected by the proposed project.

3.5.1.1 Affected Environment - Fish Habitat

The Forest Service geographic information system (GIS) stream layer mapping identified four distinct channel types in Thayer Creek within the project area (Table 3-5) differentiated according to the Channel Type User Guide (USDA Forest Service 1992). A Forest Service fisheries specialist conducted a site visit in July 2004. Visual observations confirmed the channel type descriptions listed in Table 3-5. For the purposes of this discussion, the four reaches of Thayer Creek will be referred to as A through D, progressing from the mouth in an upstream direction.

Table 3-5. Thayer Creek Channel Types within the Angoon Hydroelectric Project Area

	Reach Label and Channel Type			
	A	**B**	**C**	**D**
Parameter	**Large Estuarine Channel (ES4)**	**Moderate Gradient Contained Narrow Valley Channel (LC2)**	**Deeply Incised Contained Channel (MC3)**	**Wide Low Gradient Flood Plain Channel (FP5)**
Reach –from high tide line	0 to 620 ft	620 to 1020 ft	1,020 to 8,500 ft	8,500 to 31,000 ft
Channel Length (feet)	<620	<400	<7,500	22,500
Stream Gradient (%)	<1	<2	<4	<2
Bankfull Width (feet)	<90	<80	<66	>66
Dominant Substrate	Gravel to cobble	Small to large cobble	Small gravel to bedrock	Sand to cobble
Process Group	Estuarine	Large contained	Moderate gradient contained	Floodplain
Function	Sediment deposition	Sediment transport	Sediment transport	Sediment deposition

Several waterfalls are located in Reach B, preventing upstream use of Thayer Creek by anadromous salmonids. Within Reach B, a downstream barrier falls approximately 1,020 ft from tidewater appears to be passable to coho salmon, Dolly Varden, steelhead, and cutthroat trout, but not pink or chum salmon. Roughly 15 feet upstream from these falls is a second set of 10-foot high falls, which form an upstream migration barrier to all fish.

Reaches A and B have a shallow, anadromous channel morphology, with only one qualifying pool (at the base of the falls), and limited large woody debris (LWD-only 8 key pieces total).

It is unlikely that adult fish overwinter in these stream reaches. Qualifying pools must have a residual depth of 16.5 inches (0.42m) for a channel 90 ft wide (USFS 2001). Overall, the quality of anadromous spawning habitat is moderate for pink and chum, but considered poor for all other species, which in turn limits fish production. Substrate of the lowest 1,020ft of Thayer Creek (anadromous section) is composed of river deposit consisting of gravelly sand and rounded cobbles (Harza 1995).

Harza (1995) reported that the habitat within Reach C was relatively poor, with extremely limited fish spawning, rearing, and holding habitat throughout the reach, although they indicated that the reach may be used by a small number of resident cutthroat trout. Visual observations from the canyon rim noted numerous riffle and fall complexes, some of which may be barriers to upstream migration of cutthroat trout. MC3 channel types offer little spawning or rearing habitat for salmonids (USDA FS 1992). For safety reasons it was not feasible to survey the creek within the canyon. The Forest Service does not have population data for cutthroat trout in Reach C, but agree with Harza's assessment that it would support small resident populations. With limited quality habitat available, eventually these fish would conceivably make their way to saltwater. Movement upstream into Reach D is prevented by the barrier falls found at the upper end of Reach C.

Reach D contains very productive spawning and rearing habitat for resident fish, consisting of numerous LWD complexes, side channels, beaver ponds, robust vegetation, clean gravels, and deep undercut banks. FP5 channel types provide high value to resident freshwater species because of the excellent rearing habitat available in association with side channels, accumulations of LWD, and off-channel pools.

3.5.2 DIRECT AND INDIRECT EFFECTS ON FISHERIES

Table 3-6. Potential Effects of the Angoon Hydroelectric Project on Fisheries

Fisheries Component Affected	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Min cfs bypass reach (reach B&C)	n/a	20 cfs	40 cfs	40 cfs
Dewatered Class I habitat (feet)	0	450	0	0
Dewatered Class II habitat (feet)	0	7,500	7,500	7,500
Number Class I-III stream crossings	0	4	4	2
Total Affected Habitat (feet)	**0**	**7,950**	**7,500**	**7,500**

3.5.2.1 Effects – Fish and Fish Habitat

All action alternatives would affect reaches A through D of Thayer Creek and the aquatic life that inhabits the stream, with negligible effects on small amounts of beach, intertidal, and benthic habitat within Chatham Strait. The effects can be divided into several major components, for which effects from project construction and operation are discussed in detail below. The primary project elements that have potential to affect fish and aquatic resources are: (1) diversion dam and intake; (2) power plant discharge; (3) access roads, overhead

transmission lines, and staging areas; and (4) marine facilities. Table 3-6 summarizes the fisheries habitat components affected by the project.

ALTERNATIVE 1 (NO ACTION)

Because no development would occur within the project area, natural stream processes would continue, which would control fish habitat and populations.

ALTERNATIVE 2 (PROPOSED ACTION)

Several potential effects are associated with the construction and operation of the diversion dam, sluice, and intake. The 10-foot high dam would completely block all upstream fish passage and most downstream passage. A dam could interfere most with the downstream movement of resident cutthroat trout from Reach D to Reach C. A sluice at the dam would need to allow for the safe downstream passage of fish. Natural conditions are less than ideal for the downstream migration of fish due to the prevalence of exposed rock and lack of pools. Since the water intake will be properly situated and screened to keep fish out, turbine operation of the dam should not cause direct fish injury or mortality (NMFS 1996).

Timing dam construction during low-flow periods, exclusion of fish from the work area (BMP 14.15), and the application of BMP 14.14, Control of In-Channel Operations, would minimize injury or death of fish during dam construction. Fish could be injured or killed during construction due to human or mechanical disturbance within the stream channel or increased downstream sedimentation without these controls in place.

A 10 to 20-acre pond would be impounded behind the 10 foot high dam for 750 feet upstream (HDR Alaska 2000). This ponded area in Reach D would flood riparian forest and result in the submersion of spawning riffles. Although some spawning habitat would be lost, a large quantity of high-quality spawning habitat exists upstream. The loss of spawning habitat would be compensated by increased cutthroat trout rearing and overwintering habitat provided by the diversion pond. The cutthroat trout population, therefore, would likely remain stable.

Development of the hydroelectric project would reduce flows in approximately 1.5 miles (7,950 feet) of Thayer Creek, which includes all of Reach B and C. The applicant would be required to maintain a minimum, year-round in-stream flow below the dam to provide some level of habitat and connectivity during low flow periods for resident and anadromous fishes. The in-stream flow would be provided through the sluice constructed in the dam. There are three perennial tributary streams below the proposed diversion dam that collectively contribute less than 1 cfs to the affected reaches.

Once the storage capacity of the dam is attained, flows in excess of the intake capacity (approx. 82 cfs) would spill over the dam into Thayer Creek (Reach C). With potential withdrawal of up to 82 cfs, low flow periods in the bypass (Reaches B and C) would be extended earlier into the fall and later into the spring than would occur naturally. As water becomes less available in the fall due to freeze-up, low flows in the bypass will occur earlier than under natural conditions as water is removed for power generation. In the spring, anticipated maximum demand for water (82 cfs) will prolong low flow conditions in the bypass reach as excess water slowly becomes naturally available. Excess water can be defined as that amount above 102 cfs: 20 cfs minimum recommended flow + 82 cfs for

power generation. For example, in winter when natural flows are low and energy demands are high, the diversion would reduce stream flows of 100 cfs to approximately 20 cfs. This scenario would very likely prevent fish from overwintering in the bypass. Therefore, under the Proposed Action, Reaches B and C would support few, if any, incubating eggs or resident fish through the winter when flows are most critical.

Changes to the flow regime and volume of flow would have little effect on sediment and LWD transport (see hydrology effects, above). A short-term reduction in bedload sediment supply would occur while the pond fills, as would some coursing of the downstream channel substrate.

It is unlikely that water withdrawal from Thayer Creek could lead to lethal high temperatures (>12°C) in the dewatered section as 82 cfs would be a relatively insignificant amount when compared to flow levels normally found during the summer. Thayer Lake is located approximately 6 miles upstream of the proposed impoundment and would no longer influence water temperatures. Any effects from the creation of a 20 acre impoundment on water temperatures would be negligible due to the relatively small size.

The water discharge structure at the power plant would be designed with a perched ledge and a concrete pad or rip-rap to dissipate outfall energy and prevent fish from entering the discharge structure. The outfall protection, rip-rap or concrete pad, would decrease or prevent scouring and downstream sedimentation. Without these design features fish could swim up the discharge pipe and be injured or killed, or redds could be smothered by fine sediment created by scour and erosion at the outfall. With these features operation of the power plant and the discharge of water would not kill or injure salmon or reduce their populations.

Since the power house discharge would enter Thayer Creek below the anadromous fish barrier, approximately 450 feet of anadromous fish habitat would be affected. Minimum in-stream flow requirements would be designed to maintain the existing quality of this habitat as much as feasible.

Flow reduction in the 450 feet of anadromous fish habitat in Reach B would cause a seasonal loss of spawning and rearing habitat for pink, chum, and coho salmon and Dolly Varden char. It would also cause a seasonal loss of rearing habitat for steelhead and cutthroat trout. Competition for habitat between individual fish may increase, although the lower 570 feet of Thayer Creek below the power plant discharge contains moderate-quality rearing and spawning habitat, and natural hydrologic regimes would remain in this area. Therefore, the proposed discharge location would likely cause a moderate reduction in anadromous fish populations.

Construction and operation of access roads, overhead transmission lines, the powerhouse, and associated staging areas would require permanent and temporary clearing of vegetation and ground-disturbing activities that could potentially serve as sediment sources. These features, if placed immediately adjacent to Thayer Creek, could degrade riparian habitat and increase the suspended sediment load. Potential effects to aquatic resources from riparian disturbance could include reduced stream shading, litterfall, and LWD recruitment.

The access roads would generally be located at least 200 feet from Thayer Creek. Reach B and C, the primary stream sections potentially affected by these features, is entrenched in a steep canyon with vertical separation from project facilities. The separation between the

facilities and the creek and the application of BMP's described in the soils and hydrology sections above, would prevent sedimentation in Thayer Creek.

In Alternative 2, transmission lines and associated access road extend from the power plant on the south side of Thayer Creek to Kootznahoo Inlet. There would be three Class II stream crossings on this route. These crossings would need to pass a minimum of 50-year flood events and abide with State of Alaska fish passage standards with minimal downstream scour (BMP 14.17 - Bridge and Culvert Design and Installation). Roads would be designed with a sufficient number of relief culverts and culverts sized to maintain natural drainage and flow patterns (BMP14.3 b).

Construction and operation of the marine facilities and installation of the submarine lines would have minor effects on aquatic habitat. Effects from the construction of the temporary barge landing could result in the alteration or loss of a small amount of beach and nearshore habitat. However, based on the small area of habitat disruption, the temporary nature of the facilities, and the planned regrading and revegetation of the beach to a pre-project condition, these effects would not affect aquatic life, including salmonids.

Aquatic resources would not be affected by the installation of two mooring buoys because of the relatively small area they would occupy. Similarly, the laying of 4,600 feet of submarine lines on the bottom of Kootznahoo Inlet (Alternative 2) or the laying of about 5 miles of submarine lines 600 feet deep in Chatham Strait (Alternative 4) would not affect nearshore, littoral, or benthic habitats. The amount of space taken up by the lines relative to the habitat within Kootznahoo Inlet or Chatham Strait would be minor.

ALTERNATIVE 3 (BURIED TRANSMISSION LINE)

Alternative 3 differs from Alternative 2 (Proposed Action) in eight conditions which would be included in the special use authorization (see 2.3.4 Alternative 3 in Chapter 2 of this EIS).

The effects of the project on fish resources in the project area would be the same as in the Proposed Action with the following differences.

By burying the transmission lines under this alternative, the minimum distances needed for vegetation removal would decrease, but the amount of excavation work required for installation would increase. It is difficult to say whether buried lines with less vegetation disturbance or overhead lines with more vegetation disturbance would result in greater construction disturbance. The route would not cross any Class I streams but would cross one Class II stream between the power plant and marine facility and two Class II streams between the marine facility and Kootznahoo Inlet. Since the transmission line would be located either within or immediately adjacent to the access/maintenance road, compliance with BMPs during road construction would essentially also control sediment during transmission line installation. Following installation the area would revegetate and, since the road would be used only for line maintenance, sediment production would be minimal. The potential for significant effects to fish is very low.

The requirement to discharge water from the power plant above or immediately below the lowest anadromous fish barrier would significantly reduce potential effects to anadromous fish and habitat below the barrier described under Alternative 2 (Proposed Action) since flows would mimic natural conditions. It would minimize the potential for possible channel scour in the anadromous reach of Thayer Creek.

By requiring that the diversion dam access road avoid the steep slopes along Thayer Creek, the potential for introducing sediment and debris into Thayer Creek from slope failures and road surfaces is greatly reduced. This alternative also requires the road from the marine facility to the powerhouse be rerouted away from karst features. Other potential routes are somewhat longer but are less likely to result in road related landslides that could reach Thayer Creek.

An increase in the required minimum flow (from 20 to 40 cfs) will decrease the negative dewatering effects of the diversion dam. Additional flow will provide increased pool depth, greater stream connectivity, and decrease harmful icing conditions during the critical winter period.

Returning water not needed for power generation at the diversion dam will mimic more natural flow regimes. If less than 82 cfs is required to meet power demands, routing it through the bypass reach, as opposed to the power house, will decrease or negate many of the concerns related to dewatering. This will be especially important during low flow periods (Jan-Mar).

Passing bedload that builds behind the diversion dam during high flow periods through addition of a low gate feature to pass bedload will minimize concerns related to channel stability and fisheries. The movement of bedload throughout Thayer Creek (including the bypass reach) is critical to maintain natural stream functions and providing the required source of cobble and gravel for salmonid spawning and rearing. It is not known what level of bedload will accumulate behind the diversion dam, but incorporating this feature post-construction may not be feasible.

The downstream passage of floating wood that accumulates behind the diversion dam is critical to maintain natural stream functions. Large woody debris adds complexity to streams. A primary benefit to fish is the creation and deepening of pools, which provide critical overwinter refugia for rearing salmonids. Maintaining the natural movement of LWD from Reach D into Reach C by requiring that floating wood from behind the dam be disposed of into the bypass reach will decrease impacts to fisheries when compared to the proposed action.

Numerous natural slope failures exist along the Reach C corridor and likely constitute the majority of bedload and LWD input downstream. The diversion dam is proposed where Thayer Creek transitions from an FP5 to MC3 channel type. Sediment loads naturally “fall out” of the water column at this site and should not be considered the primary source of bedload for Reach A or B downstream. It is expected bedload and LWD inputs in Reach C will continue to move downstream during high flow events, despite the maximum possible removal of 82 cfs.

Leaving existing mature trees standing in the reservoir created by the diversion dam should decrease impacts from ground disturbance. Removal of the trees could cause additional erosion, increasing fine sediment levels in the creek. Excess silt and sand are considered harmful to incubating salmonid eggs.

ALTERNATIVE 4 (SUBMERGED TRANSMISSION LINE)

Alternative 4 differs from Alternative 2 (Proposed Action) in eight conditions which would be included in the special use authorization (see 2.3.4 Alternative 3 in Chapter 2 of this EIS).

The applicant may not construct the proposed overland transmission line and access road from the marine facility to Kootznahoo Inlet.

Alternative 4 differs from Alternative 3 only in that an overland transmission line route to Kootznahoo Inlet would not be authorized. Therefore, the effects of this alternative on fish resources in the project area are the same as described in Alternative 3 with the following exceptions.

Since no overland transmission line or maintenance road would be authorized under this alternative there would be about 4.2 miles less of maintenance road and two fewer Class II stream crossings than in Alternatives 2 or 3. The potential to introduce sediment into fish-bearing streams (other than Thayer Creek), while low under Alternatives 2 and 3, is mostly eliminated under Alternative 4.

The buried segment of the transmission line along the power plant access road in this alternative would require additional ground disturbance with the potential to introduce sediment into streams. This segment of the transmission line route crosses one Class II stream. As with Alternatives 2 and 3, the potential for significant effects to resident fish along this segment is minimal.

Laying of 5 miles of submarine lines up to 600 feet deep in Chatham Strait would not affect nearshore, littoral, or benthic habitats. The amount of space taken up by the lines relative to the habitat within Chatham Strait would be minor. The line itself would be a concern for commercial fishermen targeting bottom fish such as halibut and black cod, although the potential for line damage or gear loss in this location and at 600-foot depth is small. Commercial fishing along west Admiralty Island does not currently include long-lining. There should be no impacts to the occasional use of lower Thayer Creek by salt-water species (flounder, sculpin, forage fish, etc) as the flow regime in this area will not be altered.

ESSENTIAL FISH HABITAT

The Magnuson-Stevens Fishery Conservation Act (1996) requires that all federal agencies consult with the National Marine Fisheries Service (NMFS) when any project "may adversely affect" essential fish habitat. The Angoon Hydroelectric Draft EIS was sent to NMFS in 2007 and an Essential Fish Habitat (EFH) assessment was provided to NMFS in November 2008; a summary, directly quoted from that assessment, is included here. No comments or conservation recommendations were received from that consultation.

Essential Fish Habitat Summary for Angoon Hydroelectric Project

Fish impacts may result if the project affects critical, unique, or limiting habitats used for spawning, rearing, feeding, migration, etc. The National Marine Fisheries Service (NMFS) defines essential fish habitat (EFH) as those waters and substrate necessary to fish for

spawning, breeding, feeding, or growth to maturity. “Necessary” means the habitat required to support a sustainable fishery and a healthy ecosystem; and “spawning, breeding, feeding, or growth to maturity” covers a species full life cycle.

Descriptions of the Proposed Action and alternatives to the Proposed Action are found in Chapter 2 of this FEIS.

Potential Adverse Effects of the Actions:

Adverse impacts may result from direct effects of project configuration and operation or secondary effects during the construction phase. Potential impacts from the Proposed Action that may adversely affect essential fish habitat which warrant consideration include: 1) habitat loss and alteration, 2) sediment disturbance during construction, 3) disturbance to marine fishery, and 4) an outfall design which could become an attractant flow.

For the purposes of this discussion, the four reaches of Thayer Creek will be referred to as A through D, progressing from the mouth in an upstream direction.

1) Habitat loss and alteration

Reaches A and B have a shallow, anadromous channel morphology, with only one qualifying pool (at the base of the falls in Reach B), and limited large woody debris (LWD). It is unlikely that adult fish overwinter in Reaches A or B due to the lack of pools. Overall, the quality of anadromous spawning habitat is moderate for pink and chum, but considered poor for all other species, which in turn limits fish production.

The construction of a dam on Thayer Creek could alter the movement of bedload and LWD from upstream habitat into Reaches A and B. The availability of spawning gravels and LWD could decrease over time from lack of replacement as the proposed dam would prevent the natural movement of materials downstream. The loss of bedload and LWD could have a negative impact on channel stability and may adversely affect EFH. However, the diversion dam is proposed where Thayer Creek transitions from an FP5 to MC3 channel type. Sediment loads naturally “fall out” of the water column at this site and should not be considered the primary source of bedload for Reach A or B. Also, numerous natural slope failures exist along the Reach C corridor and likely constitute the majority of bedload and LWD input downstream. Bedload and LWD inputs in the bypass will continue to move downstream during high flow events.

During periods of low flow, the majority of Reach B (approx. 450ft) could become effectively dewatered with the maximum removal of 82 cfs. This constitutes roughly 40% of the anadromous spawning habitat available for salmon. It would also cause a seasonal loss of rearing habitat for juvenile coho and steelhead. Predicted low flows (Dec-Mar) coincide with incubating salmonid eggs. Minimum instream flow requirement of 20 cfs, as presented in the Proposed Action, would likely create harmful icing conditions for egg incubation and alevin development in the dewatered section of Reach B. If flows of 20 cfs in the bypass are not adequate to maintain water temperatures, the stream may freeze for longer periods in the winter. 82 cfs is considered a relatively insignificant amount when compared to flow levels normally found during the summer.

Once the storage capacity of the dam is attained, flows in excess of the intake capacity (approx. 82 cfs) would spill over the dam into Thayer Creek. With potential maximum

withdrawal, low flow periods in the bypass (Reach B and C) would occur earlier in the fall and extend later into the spring than would occur naturally. As water becomes less available in the fall due to freeze-up, low flows in the bypass will occur earlier than under natural conditions as water is removed for power generation. In the spring, anticipated maximum demand for water will prolong low flow conditions in the bypass as excess water slowly becomes available naturally. This scenario would likely prevent fish from overwintering in the bypassed section of the anadromous reach due to a lack of continuity and an increase in harmful frazil ice (Cunjak, 1996). Therefore, under the Proposed Action, Reach B would support few, if any, incubating eggs or overwintering fish when flows are most critical. Loss of habitat from dewatering and an alteration of the flow regime are the primary impacts which may adversely affect EFH.

Under Alternatives 3 and 4, the tailrace discharge will be returned to the creek above or immediately below the lowest anadromous barrier. This change would effectively negate the potential for adverse effects to EFH in terms of habitat loss or alteration.

2) Construction disturbance

Sediment effects during construction work along Thayer Creek and three unnamed Class II streams along the transmission corridor may negatively impact spawning salmon, cover redd sites, or disturb rearing and foraging fish. Construction and operation of access roads, overhead transmission lines, the power plant, and associated staging areas would require permanent and temporary clearing of vegetation and ground-disturbing activities (including culvert installation) that could potentially serve as sediment sources. These features, if placed immediately adjacent to Thayer Creek or the unnamed creeks along the transmission corridor, could degrade riparian habitat and increase the suspended sediment load. Potential effects to EFH from riparian disturbance could also include reduced stream shading, litterfall, and LWD recruitment.

The separation between the facilities and the creek and the application of Best Management Practices (BMP's) could prevent sedimentation in Thayer Creek. Compliance with BMP's would control sediment levels during construction of the power plant access road and the proposed transmission line. Following installation the area would revegetate and, since the road would be used only for line maintenance, sediment production would be minimal. The potential for adverse effects to fish is very low.

Under Alternative 3 (buried cable), the transmission line along the power plant access and maintenance roads would require additional ground disturbance with potential to introduce sediment into streams. With an underground line, the minimum distance needed for vegetation removal would decrease, but the amount of excavation work required for installation would increase.

Since no overland transmission line or maintenance road from Kootznahoo Inlet to the marine facility would be authorized under Alternative 4 there would be two fewer stream crossings than in Alternative 2 or 3. There would remain a buried line and access road from the power plant to the marine facility, which crosses only one Class II creek. The potential to introduce sediment into fish-bearing streams (other than Thayer Creek), while low under Alternatives 2 and 3, is mostly eliminated under Alternative 4.

3) Marine fishery disturbance

Construction and operation of the marine facilities and installation of submarine lines would have minor effects on aquatic habitat. Construction of the temporary barge landing could result in the alteration or loss of a small amount of beach and nearshore habitat. However, based on the small area of disruption, the temporary nature of the facilities, and the planned regrading and revegetation of the beach to a pre-project condition, these effects would not affect aquatic life.

Aquatic resources would not be affected by the installation of two mooring buoys because of the relatively small area they would occupy. Similarly, the laying of 4,600ft of submarine lines on the bottom of Kootznahoo Inlet or the laying of 5 miles of submarine lines 600ft deep in Chatham Strait would not affect nearshore, littoral, or benthic habitats. The amount of space taken up by the lines relative to the habitat within Kootznahoo Inlet or Chatham Strait would be minor. There should be no impacts to the occasional use of lower Thayer Creek by salt-water species (flounder, sculpin, forage fish, etc.) as the flow regime in this area will not be altered.

4) Avoiding outfall attractant flow

The water discharge structure at the power plant would be designed with a perched ledge and a concrete pad or rip-rap to dissipate outfall energy and prevent fish from entering the discharge structure. The outfall protection would decrease or prevent scouring and downstream sedimentation. With these features, operation of the power plant and the discharge of water would not kill or injure salmon or reduce their populations.

Conclusion:

Reduction of Thayer Creek flows and the loss of approximately 40% of the existing anadromous fish habitat may adversely affect the EFH (under the Proposed Action). Competition for habitat between individual fish may increase, although the lower 570ft of Thayer Creek below the power plant discharge contains moderate-quality rearing and spawning habitat, and natural hydrologic regimes would remain in this area. Therefore, the proposed discharge alteration would likely cause a moderate reduction in anadromous fish populations, primarily pink and chum salmon.

Timely implementation of instream activities will help limit impacts to both the freshwater and saltwater fishery. Forest Service Standards and Guidelines, as well as BMP’s for instream work will be followed to minimize disturbances.

Overall project effects on EFH appear to be relatively incremental and small due to the limited affected area and the abundance of similar habitat types in adjacent areas. The affected area does not contain unique habitat nor is considered to be limited in availability. In the opinion of the Forest Service, EFH would not be impacted such that fishery sustainability or ecosystem health would be impaired.

Alternative project actions to consider as mitigation:

1. Tailrace discharge shall be returned above or immediately below the lowest anadromous fish barrier on Thayer Creek.

The requirement to discharge water from the power plant closer to the fish barrier would significantly reduce or eliminate potential effects to anadromous fish and habitat below the barrier described under Alternative 2 (Proposed Action).

2. All water not needed for power generation shall be returned to Thayer Creek at the diversion dam and sent through the bypass reach.

Returning water not needed for power generation at the diversion dam will mimic more natural flow regimes. Minimizing water withdrawal where feasible would be especially important during low flow periods (Jan-Mar).

3. A minimum flow of 40 cfs should be maintained at all times to minimize icing conditions and loss of stream continuity in the bypass reach.

An increase in the proposed minimum flow (from 20 cfs to 40 cfs) will decrease negative effects from overwintering conditions. Additional flow will provide increased pool depth, greater stream connectivity, and a decrease in harmful icing conditions for overwintering fish.

4. The diversion dam access road will avoid the steep slopes along Thayer Creek

By requiring the diversion dam access road avoid the steep slopes along Thayer Creek the potential for introducing sediment and debris into Thayer Creek from slope failures and road surfaces is greatly reduced.

5. Require the dam to include a low gate feature to pass bedload during specified windows of high flows (May-June and Sept-Oct).

Passing bedload that builds behind the diversion dam during high flow periods will minimize concerns related to channel stability and fisheries.

6. Dispose of floating wood that accumulates behind the dam into the bypass reach during high flows.

The downstream passage of floating wood that accumulates behind the diversion dam is also critical to maintain natural stream functions. Large woody debris adds complexity to streams and provides critical overwinter refugia for rearing salmonids.

3.6 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES - VEGETATION

This section describes the vegetation resources of the Angoon Hydroelectric Project area, as well as the potential effects associated with the Proposed Action and alternatives. Information in this section was drawn from the botany resource report, biological evaluation of plants, and weed risk assessment.

Plant and animal species listed by the EPA as Threatened or Endangered under the Endangered Species Act, as well as Forest Service, Region 10, sensitive species are discussed separately in Section 3.9. Fish and wildlife species that provide subsistence resources are addressed in Section 3.12.

3.6.1 AFFECTED ENVIRONMENT - VEGETATION

3.6.1.1 Affected Environment – Vegetation and Rare Plants

Plant communities in the project area include conifer forest, deciduous/spruce woodland, scrub-shrub habitat, beach, forested wetlands, meadows, fens, and muskeg. Most vegetation in the beach fringe is high-volume old-growth spruce-hemlock forest. Elsewhere in the project area, common vegetation types include muskeg and old-growth forest in other volume classes. Vegetation along Thayer Creek includes shrubby and open gravel bars, wet meadow with ponds in an old oxbow, riparian vegetation, and forest edge. Beaches and adjacent areas include sandy, gravelly, and rocky areas containing uplifted beach meadow; and forest fringe.

Much of the forest along Thayer Creek, downstream of the proposed diversion dam, is on steep slopes with a sparse understory, interspersed with shrubby gaps and patches of devil's club in seepy areas. Two large wet meadow areas occur along the road and transmission line corridor between Thayer Creek and the marine facility proposed under Alternative 2. The meadow nearest the stream had a few small western hemlock trees on mounds and thick, tall shrubby areas among the dense herbaceous cover. The second meadow is more open and less shrubby, with meandering wet trenches. The proposed route between the power plant and Kootznahoo Inlet passes through forested areas that include patches of young second growth resulting from wind throw, dense shrubs in gaps, and large areas with little or no understory. Meadows, muskegs, and two small lakes are also present along this route.

The State of Alaska list of rare plants, with global and state rankings is used as general guidance in determining which plants to address in a project level analysis. Although they may be common elsewhere, plants on the Tongass are considered rare and of special interest if they are known to be scarce on the forest or because limited information is available concerning their distribution, and/or are ranked as rare plants in the state at S1 or S2 levels. S1 plants are considered critically imperiled in state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state. S2 plants are considered imperiled in state because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state. Rankings of S3 – S5 designate progressively less rare or vulnerable. The species of interest may vary depending on the location of the

proposed project. Management objectives for rare plants are to avoid, minimize or mitigate adverse effects to rare plants and populations during project planning, such as considering providing protection by avoiding known rare plant populations during project activities (Forest Plan 2008, pg. 4-41).

Three species of rare plants were found in the project area. Rattlesnake grape fern (*Botrychium virginianum*) and marsh bluegrass (*Poa leptocoma*) are ranked S2, imperiled in the state because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state. Inland sedge (*Carex interior*) is ranked S1, critically imperiled in the state because of extreme rarity or some factor(s) making it especially vulnerable to extirpation from the state.

Three populations of rattlesnake grape fern were found in the meadows at the northern ends of 2 small lakes near the road and transmission line corridor between marine facilities and Stillwater Anchorage proposed under Alternatives 2 and 3. These widely dispersed plants were growing in moist areas near the lakes in sites dominated by short sedge muskeg and forested wetland/muskeg.

A small population of inland sedge inhabits the wetter portions of a large, sedge and herb meadow east of the proposed dam access road route (Alts. 2, 3, and 4) above Thayer Creek. This meadow developed in an abandoned beaver pond and is proposed as a primary spoils disposal site.

Marsh bluegrass was found along the upper beach fringe of the small island near the marine facilities proposed in the action alternatives (2, 3, & 4). Marsh bluegrass is usually found in wet places along streams, in open subalpine to alpine ridges and meadows.

3.6.1.2 Affected Environment – Forest Wind Throw Potential

The loss of trees, singly or in groups to the effects of wind is the number one factor affecting stand structure and development in southeast Alaska. Existing wind throw is an important indicator of wind throw hazard as well as exposure to prevailing storm winds and proximity to other wind generated stands.

In this project area, high wind throw hazard was generally determined to be in areas with exposure to prevailing southeast winds. These are areas where high wind speed and turbulence are likely to occur during storm events. Areas that are more topographically sheltered from direct storm winds have less evidence of past wind damage and are rated moderate to low for wind throw risk.

Wind throw potential in proximity to the proposed powerline and access road corridors was determined to be low to moderate except within the northeast corner of Section 13 in Township 50 S., Range 67 E. This corner of Section 13 contains a southeast oriented ridge with existing nearby wind generated young growth forest. The proposed powerline location appears to be well below the ridge through a small saddle and on the opposite side from the existing wind generated stands. This location appears to be more topographically sheltered and may minimize wind throw potential.

3.6.1.3 Affected Environment - Invasive Plant Species

Invasive species are defined as species that are non-native (also called alien or exotic) to the habitat under consideration and 2) whose purposeful or accidental introduction causes, or is likely to cause, economic or environmental harm or harm to human health (Executive Order 13112). Reduction of impacts from invasive species is second on the list of six goals in the Forest Service Strategic Plan for Fiscal Years 2004 through 2008. Management objectives for invasive species include prevention of introduction and spread; early detection and rapid response; control and management; and rehabilitation and restoration (Tongass Forest Plan 2008, pg. 4-22). Invasive plants receive an invasiveness ranking designated by the Alaska Natural Heritage Program (ANHP), with 100 being the highest. Forest Service Manual 2000 (chap. 2080) Supplement No. R10 TNF-2000-2007-1 offers new guidelines for invasive species management. The supplement lists invasive plants that the Tongass is actively controlling across the forest using the ANHP ranking project results. Some of these high priority species are to be actively controlled where feasible. Others will be actively controlled only in certain locations, such as wilderness. Invasive plants found on Admiralty National Monument (ANM) are managed through the Invasive Plant Plan for ANM (Lerum 2005) which prioritizes and plans inventories, control treatments, rehabilitation/restoration projects, and monitoring.

Five non-native species were found in the project area in 2004.

- Kentucky bluegrass (*Poa pratensis*),
- foxtail barley (*Hordeum jubatum*),
- common chickweed (*Stellaria media*),
- field mustard (*Brassica rapa*)
- common dandelion (*Taraxacum officinale*)

All five species were found on the small peninsula/island near the proposed marine facility. Common chickweed was also found in the beach fringe just south of the mouth of Thayer Creek. Of the five species, field mustard is the only high priority species and is one to be actively controlled only in certain places. A subsequent visit in 2008 did not detect any field mustard, Kentucky bluegrass, or common chickweed at the peninsula/island site. The remaining infestations will be included in the Invasive Plant Plan for ANM (Lerum 2005) for control and monitoring.

Kentucky bluegrass is usually found on disturbed sites and competes with native species, changing the plant community composition and lowering its diversity. It spreads by seed and rhizomes, has been used for roadside soil stabilization and is commonly used in lawns. It has a moderate invasive ranking of 57.

Foxtail barley is ranked at 63 but is not on the Tongass high priority list. This species is found on open ground, in meadows, waste places, roadsides, riparian areas, beaches and other disturbed sites. Thick patches on beach open areas and in beach meadows are known at the head of Hawk Inlet north of the project area. The long awns may cause sores around the eyes, noses, throats, and ears of animals. There is currently disagreement on the nativity of this species in Alaska.

Common chickweed, ranked as 52, is not considered high priority. Its favored habitats are moist woodlands and uplands, usually in disturbed habitats. This annual plant reproduces by

seed or stems rooting at internodes. Large patches are known along the beach fringe at the head of Hawk Inlet.

Field mustard is not currently ranked. Over 60 infestations of this species are known on southern Admiralty Island beaches. This plant is moderately salt tolerant and is adapted to coarse to fine textured, fertile soils. It spreads by seeds, of which it produces large numbers.

Common dandelion (rank 62) is one of the most widespread non-native plant species in North America. This plant is an early colonizer of disturbed areas, competes with native plants for light, water, nutrients, and pollinators, and may moderately impact natural succession. Common dandelion is so well established across the Tongass and impossible to eradicate, that it is not a high priority for control. It may, however, be treated if in small isolated populations in vulnerable areas such as wilderness.

3.6.2 DIRECT AND INDIRECT EFFECTS ON VEGETATION

Table 3-7 summarizes the effects to vegetation by area affected.

Table 3-7. Potential Effects of the Angoon Hydroelectric Project on Vegetation

Disturbance Type	Alt. 1	Alt. 2	Alt. 3	Alt. 4
	Acres[1]	Acres[1]	Acres[1]	Acres[1]
Structures[2]	0	11-21	11-21	11-21
Roads[2]	0	27.4	29.8	15.5
Temporary features[3]	0	2.0	2.0	2.0
Total Affected Acres	**0**	**40.4-50.4**	**42.9-52.9**	**28.5-38.5**

[1] Acreages are approximate.

[2] It is assumed that vegetation will be eliminated for at least the life of the project in these footprints. Dam impoundment area may vary between 10 and 20 acres; road prisms 30 feet wide.

[3] It is assumed that vegetation will be destroyed during the construction phase in staging areas and camp facilities, but will be re-vegetated naturally or artificially after construction.

3.6.2.1 Effects – Vegetation and Rare Plants

ALTERNATIVE 1 (NO ACTION)

No effects are expected because a hydroelectric project will not be built.

ALTERNATIVES 2 (PROPOSED ACTION)

Implementation of nearly all project components would require some clearing of existing vegetation. Permanent removal of vegetation would occur in the following areas:

- (1) within the footprint of the power plant (less than 0.5 acre);
- (2) for the garage at the marine facilities (large enough to house a pickup and small backhoe);

- (3) within road prisms (28.1 acres)
- (4) in the water impoundment behind the diversion dam (10 to 20 acres).

Vegetation clearing for two construction staging areas (6 acres each) and a spoils disposal area (3 acres) would be permanent during construction. The staging sites would be reclaimed and re-vegetated if not needed for equipment and material storage following construction.

Additional effects on vegetation would occur in the cleared corridors for the access road / transmission lines right-of-way. Except for the road prism itself, effects in these areas would consist largely of changing the existing vegetation type from forest to shrub-dominated communities. The corridor clearing width would vary along the route but would be approximately one tree-height (up to 100 feet) on either side of the transmission line to protect the line from wind throw. The total amount of clearing cannot be determined until final layout and design of the transmission line. Rare plants were found inhabiting wet meadows adjacent to the road corridor between marine facilities and Stillwater Anchorage. Road construction may alter hydrologic processes that would adversely change habitat conditions for these plants.

The average clearing width for the access road between the powerhouse and the dam would be 50 feet since no transmission line is included. Adjacent to this road corridor rare plants were found inhabiting a wet meadow, part of which was proposed as a spoils disposal site. Spoils disposal on top of the rare plants would crush and bury individual plants and possibly extirpate the population in the meadow.

The feasibility evaluation report (HDR Alaska 2000) noted that few trees would probably need to be cut along the pipeline route between the diversion dam and the power plant. Instead, the pipeline would be routed between trees and secured to the ground by a system of nylon straps and galvanized steel lines. Pipeline installation would crush, trample, or uproot vegetation for the current growing season. Shade from the pipeline may inhibit or prevent plant growth by occupying the space otherwise available for plants or by shading the plants.

Vegetation changes both upstream and downstream of the dam would have the indirect effect of modifying the hydrology. Plant species adapted to greater soil moisture and occasional inundation would become established in areas adjacent to water impounded above the dam. Downstream, riparian vegetation would change in response to decreased water availability.

ALTERNATIVE 3 (BURIED TRANSMISSION LINE)

Essentially effects would be the same as for Alternative 2. The change in road routes between dam and powerhouse, and powerhouse and marine facilities would have similar effects to vegetation as Alternative 2 routes. Effects to rare plants between powerhouse and dam, and between marine facilities and Stillwater Anchorage would be similar to those of Alternative 2. Although the transmission line would be buried where feasible, there would still be an access/maintenance road. The clearance width, however, may be narrower along buried sections and therefore effects would be reduced in those sections.

ALTERNATIVE 4 (SUBMERGED TRANSMISSION LINE)

Effects on vegetation and rare plants would be the same as Alternative 3 for the activities between the dam and marine facility. An additional footprint area for the substation structure

at the marine facility would eliminate vegetation but not affect rare plants. There would be no effects to vegetation or rare plants between the marine facility and Stillwater Anchorage because there will not be a road or transmission line.

3.6.2.2 Effects – Forest Wind Throw Potential

ALTERNATIVE 1 (NO ACTION)

No effects on the forest and wind throw are expected from project activities because a hydroelectric project would not be built.

ALTERNATIVE 2 (PROPOSED ACTION)

Wind throw risk was evaluated based on aerial photo interpretation and GIS analysis for the overhead powerlines and access road corridors (assuming a total clearing width of up to 200 feet) considering prevailing wind direction, topography and the proximity to other wind generated stands.

Overall wind throw risk was determined to be low to moderate based on the orientation of the cleared corridors in relation to prevailing storm winds and topographical features. Exposed edges adjacent to the resulting corridors would be expected to have an increased risk of wind throw in the form of individual or small groups of trees the first few years following clearing. Over time trees along these exposed edges will develop greater windfirmness.

Depending on the actual on-the-ground location of the powerline corridor that travels through the northeast corner of Section 13, in relation to the adjacent southeast running ridge, it may be subject to higher wind throw risk and thus the likelihood of many blown-down trees. This section of powerline corridor may warrant additional on-site evaluation prior to clearing to insure it is located below the ridge with minimal southeast exposure to avoid a wind tunnel effect and substantially reduce wind throw potential.

ALTERNATIVES 3 AND 4

Alternatives 3 and 4 propose an underground powerline with a corridor clearing width of 46-70 feet. Effects to windthrow risk would be minimal since the corridor is narrower (in Alternative 3) and avoids the higher windthrow risk area completely in Alternative 4. Wind throw risk in Alternative 4 would be the lowest of the action alternatives, but slightly greater than the no action alternative.

3.6.2.3 Effects – Invasive Plant Species

ALTERNATIVE 1 (NO ACTION)

No effects on invasive plant species are expected from project activities because a hydroelectric project would not be built. Existing populations of invasive plants are not expected to spread into undisturbed areas.

ALTERNATIVE 2 (PROPOSED ACTION)

Small infestations of five invasive species were found on a small island/peninsula near the marine facility site, and one at the mouth of Thayer Creek. Three of the five on the island have since disappeared. Since no project activity is proposed near the sites, the remaining populations are not expected to be to be spread by those activities.

All action alternatives require that equipment be washed prior to mobilization to the project area to minimize the potential for introducing invasive plants. Some potential still exists that construction equipment could still be contaminated with seeds and other parts of invasive weed species. If established, invasive plant species may crowd out native species, be unpalatable or injurious to native wildlife, and decrease native plant species diversity in the project area. Monitoring for new introductions and control of high priority infestations will be conducted by the proponent and should be effective to minimize the potential for introducing and spreading invasive plants.

ALTERNATIVE 3 (BURIED TRANSMISSION LINE)

The potential to introduce invasive species would be similar for Alternative 2 and 3. Although the transmission line would be buried where feasible under Alternative 3, both alternatives include a similar access/maintenance road along the same corridor.

ALTERNATIVE 4 (SUBMERGED TRANSMISSION LINE)

The potential to introduce invasive species would be similar for Alternative 2, 3 and 4 between the dam and marine facility. There would be no potential to introduce invasive species between the marine facility and Stillwater Anchorage because there would not be a road or transmission line.

3.7 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES - WETLANDS

This section describes the wetland resources of the Angoon Hydroelectric Project area, as well as the potential effects associated with the Proposed Action and alternatives. Information in this section was drawn from the soils and wetlands, and supplemental soil, geologic, and wetland information resource reports.

3.7.1 AFFECTED ENVIRONMENT - WETLANDS

Wetlands are defined as: "those areas that are inundated or saturated by surface or groundwater with a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (40 CFR 230.41(a)(1)). Identification of wetlands is based on the Corps of Engineers three-parameter system described in U.S. Army Corps of Engineers Wetlands Delineation Manual (WTI 1995). Wetlands are identified as areas having hydric soils, hydrophytic vegetation, and wetland hydrology.

Wetlands provide various ecological functions, including surface flow and groundwater regulation, sediment retention, nutrient storage, and temperature moderation. They provide terrestrial, aquatic and marine wildlife habitats, biological diversity, and wood fiber. Wetland areas also provide socio-economic benefits, which include areas for wildlife viewing, hunting and recreation, habitat for commercial fishing (salmon) stocks, development sites (such as buildings and roads), community water supplies, and timber harvesting.

Five broad types of wetland types based on wetland habitats as mapped in the Ketchikan Area Soil Survey (see Table 3-8 below and maps in the Road Cards, Appendix B) and five categories using the national Wetland Inventory Mapping Convention occur in the analysis area. These wetlands have different soil and vegetative communities, occupy different landscape positions, and have somewhat different functions and values. Table 3-8 includes existing lengths of wetlands on the proposed road and transmission line corridors. For definitions and functions of the various wetlands, refer to the Soil and Wetland Resource Report and Classification of Wetlands and Deepwater Habitats of the United Stated (Cowardin et al. 1979). Also included in the Resource Report are wetland maps of the area and field data sheets.

Tall Sedge Fens are the high value wetlands within the larger overall landscape that are also present within the wetland mapping extent

3.7.1.1 Effects – Wetlands

The road alignment displayed in Alternative 2 was provided by Kootznoowoo as part of their Selected Project Arrangement. Following publication of the DEIS additional field studies were completed by Forest Service specialists to better define the road corridors and collect supplementary resource data. Based on this field data, portions of the road segments from the marine facilities to the powerhouse and from the powerhouse to the diversion dam were

modified in Alternatives 3 and 4 to reflect terms and conditions required to avoid steep slopes and karst terrain. The road segment from the marine facility to Kootznahoo Inlet is the same in Alternatives 2 and 3 and not present in Alternative 4.

Table 3-8. Existing Wetland Condition, Road Effects on Wetlands, and Avoidance of Steep Slopes and Wetlands

Wetland Types	National Wetland Inventory	Road Corridor Wetlands Composition 300 yards either side of road	Wetlands Linear Distribution Wetland Types/Percent of Total Road Length						
			Alt. 1	Alt. 2		Alt. 3		Alt. 4	
		% of corridor	NA	Linear Feet	%	Linear Feet	%	Linear Feet	%
Forested Wetland[1]	PF04b	14.7	0	8,962	21.6	8,811	20.1	3,078	13.6
Scrub-Shrub/Short Sedge/ Muskeg	PSS4/ PML1b, PSS4b	2.9	0	458	1.1	467	1.1	467	2.1
Tall Sedge Fens	PEM2F	2.0	0	412	1.0	125	0.3	125	0.6
Forested Wetland/ Muskeg	PSS4b, PF04b, PML1b,	6.1	0	3,685	9.1	4,462	10.4	2,272	10.0
Lakes and Ponds	PUB	1.1	0	0	0.0	0	0.0	0.0	0.0
Total Wetland		**26.8**	**0**	**13,517**	**32.8**	**13,865**	**31.9**	**5942**	**26.3**
Non-wetlands Less than 67% slope	U	62.9	0	27,254	65.6	29,548	67.0	16,519	75.0
Non-wetlands Greater than 67% slope[2]	U	10.3	0	650	1.6	500	1.2	150	0.7
Total Wetland and Non-wetland		**100**	**0**	**41,421**	**100**	**43,913**	**100**	**22,611**	**100**

Source: D. Silkworth, GIS, 2008

[1] Includes wetland types Forested Wetland and the Forested Wetland portion of Forested Wetland/Upland Mosaic (50%).

[2] Field estimates used for slopes over 67%. Estimates do not include an approximate1000 feet of road on slopes over 67% slope located approximately 1 mile south of the marine facility.

Wetland effects are displayed above as linear feet of roads located on each wetland type and as a percentage of the total road length. The table also includes data from a wide corridor extending 300 yards either side of the proposed road alignments to display the average existing wetland distribution along the alignment. A comparison of the linear distribution of affected wetlands types versus the general distribution of wetland types in the corridor demonstrates the relative success of attempts to avoid important wetland types in each alternative.

Management objectives for wetlands are to avoid the alteration of, or new construction in wetlands, wherever there is a practicable, environmentally preferred alternative considering the functions of wetlands as well as other non-wetland ecosystem in the project area (Forest Plan 2008, pg 4-88). Management activities try to maintain the natural and beneficial wetland values and functions, and avoid adverse impacts and the loss of high value wetlands, especially fens (Forest Plan 2008, pg 4-88).

Kootznoowoo must acquire an Army Corps of Engineers (USACE) Section 404 permit under the Clean Water Act to dredge or fill in a wetland. USACOE guidelines state that no discharge of dredged or fill material shall be permitted in wetlands if there is a practicable alternative to the proposed discharge which would have less adverse impact. They presume that practicable alternatives exist unless clearly demonstrated otherwise. Where it is necessary to cross wetlands, roads must be of the minimum length and width necessary to achieve their purpose. Roads would also be designed to prevent restriction of flood flows and the disruption of aquatic species migration or movement (BMP 12.5 – Wetland Identification, Evaluation, and Protection). Other BMPs, for example 14.2 – Location of Transportation Facilities, and 14.3 – Design of Transportation Facilities, would be applied to minimize the disruption of wetland function and value

Classified roads typically include a road surface approximately 14-foot wide and a roadside ditch and/or fill-slope varying in width based on slope, topography, soil type, and drainage. In general, the area of direct soil disturbance would average 35-40 feet, including clearing

ALTERNATIVE 1 (NO ACTION)

Since no development would occur under the No Action alternative natural processes would continue to control wetland development in the project area.

ALTERNATIVE 2, 3, AND 4

There would be a permanent loss of wetlands within road prisms and at construction sites, e.g., power plant, port facilities. However, as indicated in the table above, roads under all action alternatives would be built on proportionally fewer Scrub-Shrub/Short Sedge/ Muskegs, Tall Sedge Fens, and Lakes and Ponds wetlands than are naturally present along the corridor. Tall Sedge Fens are considered the high value wetlands present along the corridor. Scrub-Shrub/Short Sedge/ Muskegs are less common than Forested Wetlands (2.9 vs 14.7%) within the 600-yard wide road corridor, and consequently are somewhat more valuable for diversity reasons.

Nevertheless, Forested Wetlands are impacted proportionately higher by the road than their natural occurrence within the 600–yard wide corridor. Forested Wetlands are the hardest

wetland type to avoid since they often exist at the base of steep slopes and often surround Tall Sedge Fens and Scrub-Shrub/Short Sedge/ Muskegs. Avoiding these wetland types often requires that roads be located on Forested Wetlands.

Several potential effects are associated with the construction and operation of the diversion dam. The 10-foot high dam would impound stream flow and form a 10 to 20-acre pond. The pond would flood tall sedge fens, shrub/scrub, and forested wetlands. Similar wetland communities may develop adjacent to the pond, and vegetation species changes to more saturated conditions would be expected. Below the dam, species adapted to drier soil condition would encroach into the current riparian zone as stream volume decreases, especially during the growing season.

All action alternatives propose staging areas and a powerhouse. These project components are proposed be built on land that is approximately 5% Tall Sedge Fens and 27% other wetlands (Forested Wetlands).

Road construction and spoil disposal cover vegetation with rock and soil and cause the permanent loss of wetlands covered by the road prism and subtle changes in vegetation for distances of up to 20 feet on the downhill side of the road. The introduction of fill material for road construction may affect surface or subsurface hydrology. In some cases, ponding may occur on the upstream side of the road bed; in others, side ditches or coarse fill may act as a conduit, reducing saturation of soils in the vicinity of the roadway. McGee (2000) found that drainage ditches collect and divert overland flow and shallow subsurface flow to the nearest stream channel, and do not greatly reduce soil wetness adjacent to the road prism. These and other effects may influence wetland vegetation in the vicinity of road corridors.

3.8 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES – BIODIVERSITY AND WILDLIFE

This section describes the wildlife resources of the Angoon Hydroelectric Project area, and the potential effects associated with the proposed alternatives. Information in this section comes from the wildlife resource reports.

Threatened or Endangered animal species as well as Forest Service, Region 10 sensitive species are addressed separately in Sections 3.9 (and 3.5 for Fish); fish and wildlife species that provide subsistence resources are addressed in Section 3.5 and 3.12.

3.8.1 AFFECTED ENVIRONMENT – BIODIVERSITY AND WILDLIFE

The analysis area for wildlife is defined as the two Wildlife Analysis Areas (WAA; 4042, 4054) that incorporate the project area. WAA are geographical areas defined by Alaska Department of Fish and Game (ADFG) to monitor and manage wildlife populations. The Analysis Area includes approximately 126,920 acres.

Old-growth habitat may be characterized by the amount of productive old-growth (POG) that is present. POG is defined as having a timber volume of greater than 8,000 board feet per acre (Forest Plan p. 7-29) which corresponds to low, medium, and high volume strata. POG generally provides important cover and forage habitat for wildlife because the dense canopy reduces snow accumulations in the understory during the winter but is open enough to provide understory vegetation during the spring, summer and fall.

Currently, an estimated 92% (116,737 acres) of the analysis area is classified as forested. An estimated 14% (17,346 acres) of the total area and 15% of the forested area is classified as volume class 6 and 7. Approximately half of the forested area is classified as high volume strata.

Forest types are predominantly western hemlock (*Tsuga heterophylla*) and mixed hemlock/Sitka spruce (*Picea sitchensis*) but there are stands of Sitka spruce, mountain hemlock (*Tsuga mertensiana*), red alder (*Alnus rubra*), and black cottonwood (*Populus balsamifera trichocarpa*).

Much of this analysis was conducted using Tongass National Forest GIS databases. Effects to species are generally shown as acres of suitable habitat impacted and the potential for disturbance. The impacted acreage is compared to that available within the analysis area and relative to the other alternatives. In general, impacts to habitat are assumed to be long-term (i.e., life of project, greater than 10 years) while disturbances are expected to be short-term (i.e., during construction, one to five years) or sporadic (maintenance).

3.8.1.1 Affected Environment - Management Indicator Species

National Forest Management Act (NFMA) regulations require that fish and wildlife habitats be managed to maintain viable populations of species well distributed across the National Forest. Population viability is defined as a fish or wildlife population that has the estimated number and distribution of reproductive individuals to insure its continued existence is well

distributed in the planning area (36 CFR 219 and USDA FS 2008a). Analysis of impacts to Management Indicator Species (MIS) is one way to address this direction. MIS are wildlife species whose responses to land management activities are thought to reflect the likely responses of other species with similar habitat requirements (USDA FS 2008b). Under the MIS concept, the responses to management activities of a relatively few species are studied and monitored in an effort to ascertain the impacts to entire assemblages of species and associated habitats.

Thirteen MIS have been identified for the Tongass National Forest (USDA Forest Service 2008b). Three MIS (black bear, wolf, and mountain goat) do not occur on Admiralty Island (MacDonald and Cook 2007, p. 71, 76, and 104) and are not addressed in this discussion. Minimal impact is expected to the Vancouver Canada goose so it is not included here, but the analysis can be reviewed in the project MIS report.

Bald Eagle: Most bald eagles in southeast Alaska nest in coniferous forest habitats along the coastline and associated saltwater inlets, but may also nest along rivers and lakes (Sidle et al. 1986). Trees selected for nesting are usually among the largest in the stand, provide an unobstructed view of the water, have large limbs, and often have bushy, broken, or deformed tops. Over 90 percent of nests are within 300 feet of the shoreline (Hodges and Robards 1982 in Sidle et al. 1986).

Perching sites are important components of nesting habitat. Tall trees with open crowns, snags, trees with exposed lateral limbs, or trees with dead tops provide perching sites. Perching sites are used to scan for food, protect their nests from avian predators, eating, mating displays, and to signal territory occupation.

Bald eagle populations in southeast Alaska appear to have stabilized since the early 1980s (Jacobson and Hodges 1999, Schempf 2008). Bald eagles are present year-round in the analysis area. The Tongass NF GIS database shows 99 historic bald eagle nests in the analysis area. A survey conducted for this project by the US Fish and Wildlife Service (FWS) found an additional eight nests in the vicinity of the project, although the Stillwater Anchorage area across from Angoon was not surveyed (M. Jacobson 2006). This survey found only one of the historic nests within the surveyed section. The survey was done in October so there was no indication whether they had been used for nesting that year or not. Based on a GIS analysis, two of the new nests are within 330 feet of a project feature (building, road/transmission line and associated clearing, etc) and all eight are within ½ mile of a project feature. Two historic nests are within 330 feet of project features and eight are within ½ mile.

Brown Bear: Although brown bears will use a diversity of habitats, brown bears studied on Chichagof Island primarily selected for estuary and closed forested riparian habitats (Schoen and Beier 1990, p. 18; Flynn et al. 2007, p. 18 - 19). The late summer season has been identified as the most critical or limiting period for brown bear. Bears concentrate along low-elevation coastal salmon streams from mid July through early September. Salmon are an important food source for accumulation of energy reserves to sustain bears over-wintering in dens. During this late summer season, bears typically use riparian forest habitat or forested streams associated with anadromous fish runs (Schoen and Beier 1990). Bears use this habitat for fishing along river banks, for foraging on succulent vegetation and berries, and for security and thermal cover.

Winter denning begins in October and November. Mean elevation and slope of 121 den sites of radio-collared bears from Admiralty and Chichagof islands were 2100 ft and 35 degrees (Schoen et al. 1987). Fifty-two percent of those dens occurred in old-growth forest habitat. Though cave denning was common on Admiralty Island, many dens were excavated under large-diameter old-growth trees or into the bases of large snags (Schoen et al. 1987).

Roads are detrimental to bears because they increase opportunities for human - bear interactions. Roads provide easier access and bring increases in human activity, which may result in increased disturbance and direct human-induced deaths of bears through increased legal hunting, illegal kills, wounding losses, and from defense of life and property. Roads vary in their impact to bears. Arterial and collector roads accessible to vehicles have greater impacts on bears than local roads and roads closed to vehicular traffic. Roads closed administratively (e.g., with gates or excavated pits) are likely to still have some level of off-road vehicle traffic. All roads, regardless of closure, still have the potential for supporting additional human foot traffic which also influences bear populations. There are no existing roads in the analysis area except for roads in the town of Angoon.

There is suitable habitat throughout the project area. During field review of the project, bear sign was regularly seen but was most prevalent around the lower (anadromous) section of Thayer Creek, where there is an extensive trail network as well as day bedding sites. This lower section of Thayer Creek is the only anadromous fish reach within the footprint of the project.

Admiralty Island is within Game Management Unit (GMU) 4, which encompasses Admiralty, Baranof, and Chichagof islands, and includes one of the highest concentrations of brown bears in the world (ADFG 2000, p. 1). Unit 4 brown bear populations are stable or slightly increasing (Mooney 2007a, p. 23). The most recent population estimate for Admiralty Island is 1560 bears (Mooney 2007a, p. 24). Nineteen bears have been reported harvested in the analysis area in the last 10 years (Scott 2008). Only two of those were reported to have been taken in the minor harvest units affected by the project.

Marten: Habitat requirements for marten reflect a strong interaction between food, cover, climate, and predation, with forest cover being particularly important for travel, denning and resting sites, hunting, and avoiding predation and inclement weather (Flynn et al. 2004). In southeast Alaska, marten depend on POG forests because they intercept snow, provide cover and denning sites, and provide habitat for prey species used by marten. An estimated 70% (89,143 acres) of the analysis area (126,910 acres) is characterized by POG habitat. Due to lower snow accumulation, habitats at lower elevations have higher value for wintering marten. Coastal habitats (beach fringe) and riparian areas have the highest value, followed by upland habitats below 1,500 feet in elevation. Approximately 94% (76,658 acres) of the POG occurs below 1,500 feet elevation and 15,510 acres (17%) of POG occur within riparian management areas and the beach fringe. High value marten habitat is defined as high volume strata old-growth stands below 1500 feet in elevation. There are an estimated 52,504 acres of high-value marten habitat in the analysis area.

Roads reduce habitat value by providing human access which may result in increased harvests of marten. Marten are easily trapped and can be over harvested (Quick 1956, Hodgman et al. 1994). Trapping pressure may be higher along roads connected to major

communities. There are no existing roads in the analysis area except for roads in the town of Angoon.

The ADFG currently permits unlimited trapping of marten in the analysis area (GMU 4) from December 1 to February 15. Trapping efforts fluctuate year-to-year depending on fur prices, fuel prices, winter weather conditions, the current economy, and marten populations. Between the 2001-2002 and 2005-2006 seasons, annual harvest from GMU 4 was 1405 marten. Fifty-six marten were reported harvested within the analysis area in the last ten years. All were from the two minor harvest units adjacent to Angoon and none were from the Thayer Creek drainage.

Sitka Black-tailed Deer: Deer are an important subsistence and general (sport) harvest species. The harvest of deer is addressed in the Subsistence Report.

The quantity, quality, distribution, and arrangement of winter habitat is considered the most limiting factor for deer in southeast Alaska (USDA FS 2008b, p. 230). Low-elevation, high-volume POG habitats are particularly important to deer, especially during severe winters (Doerr et al. 2005, Hanley and Rose 1987, Kirchhoff and Schoen 1987). These mature old-growth stands intercept snow, provide thermal cover, and support the largest biomass of herb and shrub forage for deer (Alaback 1982, Hanley and McKendrick 1985). The TNF GIS database estimates that there are 53,491 acres of POG below 800 feet elevation within the analysis area. Of these, 18,854 acres are high volume strata on south and west aspects, the most valuable winter habitat. Deer and their sign (tracks, pellet groups) were noted during field review of the project area.

Construction of roads fundamentally changed the way deer are harvested in southeast Alaska (Mazza 2003). This can increase harvest by increasing efficiency, and opening previously unharvested areas up to hunting pressure.

Cavity dependent MIS (brown creeper, hairy woodpecker, red-breasted sapsucker, red squirrel): Brown creepers, hairy woodpeckers, red-breasted sapsuckers, and red squirrels nest or den in tree cavities in southeast Alaska. These species depend on cavities in the large-diameter snags characteristic of productive old growth stands. Degradation of habitat via the harvesting of large, live trees, salvage-logging practices that remove dead or dying trees, and the increasing fragmentation of forests are threats to these species. Edge sensitivity may be responsible for the sensitivity of brown creepers to forest fragmentation. The brown creeper, hairy woodpecker, and sapsucker rely on productive old growth forest habitat for nesting and foraging. The brown creeper is associated with high volume stands that include large-diameter, old trees that provide abundant prey. Sapsuckers will use a more open, low volume, productive old-growth. The hairy woodpecker and sapsucker are primary cavity excavators that use snags and partially dead trees for nesting and foraging. The availability of suitable habitat for roosting and foraging is an important constraint on the habitat suitability for these species. Spruce trees and mature old growth forest have the highest values for red squirrel habitat because of the cone-producing qualities and cavities in trees and snags. Productive old-growth forests provide the best snag habitat over the long-term.

Brown creepers, hairy woodpeckers, red-breasted sapsuckers, and red squirrels were all observed during field surveys in 2007 and 2008.

River Otter: Habitat selection by river otters appears to be related to the availability of food resources and adequate cover (Larsen 1983; Woolington 1984). Old-growth forests have the highest habitat value, providing canopy cover, large-diameter trees and snags, and burrow and den sites.

Throughout most of the year the majority of river otter activity occurs within 100 feet of the shoreline (Larsen 1983; Woolington 1984). However, from May through July female river otters use inland habitats generally within 0.5 mile of the coastline as natal denning sites (Woolington 1984). Natal dens occurred on well drained sites near streams in old growth habitats. Stream courses were used as travel corridors between natal den sites and foraging areas on the coastline.

During the period 1995–2002, river otter populations apparently increased slightly, to moderate levels, and populations appear to be stable (Mooney 2007b). Forty-three river otters were reported harvested within the analysis area in the last ten years. All were from the two minor harvest units adjacent to Angoon and none were from the Thayer Creek drainage.

One river otter was observed during field surveys in 2004, although sign was common. Suitable habitat is abundant in the analysis area.

3.8.1.2 Affected Environment - Migratory Birds

Neotropical migratory birds (referred to as migratory birds) are far ranging species that require a diversity of habitat for foraging, breeding, and wintering. Over 100 species of birds migrate from the lower forty-eight states, Central and South America, to nesting, breeding, and rearing grounds in Alaska. Most of the birds fly to the interior or northern Alaska and only pass through Southeast Alaska on their way to the breeding grounds. However, some breed in the project area.

The Migratory Bird Treaty Act of 1918 (amended in 1936 and 1972) prohibits the taking of migratory birds, unless authorized by the Secretary of Interior. Executive Order 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds) provides for the conservation of migratory birds and their habitats and requires the evaluation of the effects of Federal actions on migratory birds, with an emphasis on species of concern. Federal agencies are required to support the intent of the migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities and by avoiding or minimizing, to the extent practicable, adverse impacts on migratory birds when conducting agency actions.

Of the 37 migratory birds and birds of conservation concern potentially found on the Tongass National Forest, 14 use hemlock/spruce/cedar forest as primary habitat for known or probable breeding. Another eight species use spruce/hemlock/cedar forest as secondary habitat (Tongass National Forest MBTA list). Three species use shrub thickets as primary nesting habitat. The other species use habitats that are not found the project area or that will not be affected by project activities. Most of the hemlock/spruce/cedar nesting species (11 of 14) are considered common or abundant, while only one of the shrub nesting species is considered common. Species on the list verified as occurring in the analysis area during field surveys include: chestnut-backed chickadee, golden-crowned kinglet, varied thrush, red-breasted sapsucker, northwestern crow, Pacific-slope flycatcher, Steller's jay, Townsend's warbler, and rufous hummingbird. In addition, breeding bird surveys at Hawk Inlet on

Admiralty Island have also detected blue grouse, marbled murrelet, and western wood pewee. Red-breasted sapsuckers are addressed in more detail above under MIS.

3.8.2 DIRECT AND INDIRECT EFFECTS ON WILDLIFE

3.8.2.1 Effects - Management Indicator Species

ALTERNATIVE 1 (NO ACTION)

Implementing alternative 1 would cause no direct effects to any MIS. There is a slightly higher risk of a fuel oil spill in the vicinity due to Angoon's reliance on fuel oil for electric generation under this alternative. A spill could result in direct mortality to individuals and/or eggs of species such as eagles, otters, and migratory species that use beach areas (e.g., northwestern crows) as well as sublethal effects such as increased contaminants loads from foraging on contaminated prey. A spill could affect salmon, other fish, and invertebrate prey populations for several years.

ALTERNATIVES 2, 3, AND 4

Angoon will still receive petroleum fuel deliveries under the action alternatives for home heating, vehicle fuels, and back-up electricity generation. However, the probability of a spill will be reduced compared to the no action alternative. If a spill were to occur the effects would be the same.

All action alternatives would result in a small loss (less than 1%) of potential habitat. Of the action alternatives, Alternative 4 would have the least impact on MIS because it affects the least POG and foraging habitat (both vegetative and anadromous fish habitat), and provides the least access improvement. Alternative 2 would have the greatest effect on MIS because of, mainly, its larger acreage of forest habitat converted for transmission line clearing. Thayer Creek provides a vertical migration corridor for brown bears and deer and the 42 inch pipe paralleling the creek could present a barrier to bears and deer, particularly cubs and fawns. Although adult animals could cross over the 42-inch diameter pipe, young animals would have a more difficult time getting over it. Considering the steep ground it will be traversing, even adults may have to be selective about where they cross over or under the pipeline. Pipeline effects would be the same for all alternatives. The greatest impact to bears is the development of facilities in the Thayer Creek riparian area, which is the same between Alternatives 2, 3, and 4. However, implementation of terms and conditions such as the timing and nest buffer measures for eagles or development of measures to control hunting would minimize direct and indirect effects to MIS. Under all action alternatives, a slight decrease in breeding densities of cavity dependent MIS could occur in the immediate vicinity of the project but would not be detectable at the scale of the analysis area. All alternatives would be consistent with the Forest Plan conservation strategy and would be expected to maintain viable, well dispersed populations of bald eagle, brown bear, marten, Sitka black-tailed deer, cavity dependent MIS, and river otters.

ALTERNATIVE 2 (PROPOSED ACTION)

Bald eagle: Approximately 57 acres of POG forest habitat within the beach fringe (0.6% of total acres of beach fringe POG in the analysis area) would be converted to non-forest with a concurrent loss of suitable nesting, perching, and roosting habitat. Five known nests could be affected by roads/transmission lines and associated forest clearing within the 330 foot nest buffer. These nests and the project components will need to be ground verified at the time of construction. If they can not be avoided the project proponent will need to work with the FWS to obtain a variance for working within the nest buffer. Direct effects would include disturbance during construction activities and loss of habitat within the nest buffer including perching trees and suitable nest trees. To mitigate the possibility of nest abandonment, no project related activities would be allowed within the 330 foot buffer when nests are active. There are an estimated 13 known current or historic nests within ½ mile of project components for which timing restrictions on blasting may need to be implemented. Blasting within ½ mile is possible with concurrence of the FWS based on specific site conditions. The activity status of the nest and suitable site conditions would need to be field verified by the proponent and FWS. These conditions should avoid direct impacts to these nests caused by blasting activities.

Although the APLIC standards and design recommendations (APLIC 2006) for construction of the line to reduce the likelihood of eagles (and other raptors) being killed or injured by collision or electrocution would be required, there would still be some risk associated with Alternative 2 above that for Alternatives 3 and 4 where the line is buried or submerged.

Brown bear: Less than one percent (143 acres) of the POG in the analysis area will be lost. POG provides denning habitat for brown bears. However, Schoen et al. (1987) found that while bears on Admiralty Island may den at almost any elevation; the average den elevation was 2100 feet. The project occurs at or below 500 feet, so no substantial effects to denning habitat are expected. Much of the POG along the transmission line would be converted to brush which could improve berry production and foraging opportunities for bears.

This alternative would remove some high quality riparian POG and increase human access. During construction, bears foraging on salmon could be displaced. As part of the Special Use Permit (SUP) stipulations, the project proponent would need to follow Forest Plan Standards and Guidelines for bears to reduce the likelihood of bear/human interactions. The main disturbance and human interaction concerns are during construction. Bears most likely will adapt to the noise and presence of the powerhouse and associated facilities after construction is completed.

This alternative would construct 7.6 miles of permanent roads which would improve human access to the area. To reduce impacts to brown bears and other harvested species, the SUP authorization will include a requirement that the project proponent install effective road closure devices to ensure that the roads are closed to motorized traffic except what is necessary for operation and maintenance of the project. However, the roads will be open to foot traffic. This would improve human access to Thayer Creek for activities such as bear watching and hunting, thus increasing the likelihood of bear/human interactions. Either activity would stress bears and reduce or modify their use of this foraging area.

Thayer Creek provides a vertical migration corridor for brown bears and the 42 inch pipe paralleling the creek could present a barrier to bears, particularly cubs. Pipeline effects would be the same for all alternatives.

Changing the flow regime in Thayer Creek could affect bears by changing the distribution and productivity of salmon. The location of the power plant discharge for Alternative 2 is expected to result in dewatering 300 – 450 feet of lower Thayer Creek or up to 40% of the anadromous fish spawning habitat during low flows (Schneider 2008). It is unknown what effect this would have on the fish population in Thayer Creek. This dewatering would occur during December through March, which would kill fish eggs and alevins. Dewatering would not occur during the summer when bears would be foraging, so it is unlikely to change bear foraging habitat, i.e., fish distribution during spawning.

Marten: POG provides suitable denning and foraging habitat for marten. Approximately 143 acres, or less than one percent, of the POG in the analysis area will be converted to unsuitable habitat by implementing Alternative 2.

Roads can increase access for trapping. The southern terminus at Stillwater Anchorage in Kootznahoo Inlet is approximately 0.8 miles from the Angoon boat ramp. To reduce impacts to marten and other harvested species, the SUP authorization will include a requirement that the project proponent install effective road closure devices to ensure that the roads are closed to motorized traffic except what is necessary for operation and maintenance of the project. Although the roads would improve access for foot traffic, it is unlikely that this would lead to a substantial increase in trapping effort.

Localized disturbances during construction could temporarily displace some marten.

Sitka black-tailed deer: Loss of winter habitat is the primary impact to deer. Under Alternative 2, 143 acres of POG would be lost. All of it is under 800 feet elevation. This is 0.3 percent of the POG under 800 feet elevation in the analysis area.

This alternative would construct 7.6 miles of roads which would improve human access to the area for deer hunting. To reduce impacts to deer and other harvested species, the SUP authorization will include a requirement that the project proponent install effective road closure devices to ensure that the roads are closed to motorized traffic except what is necessary for operation and maintenance of the project. However, the roads will be open to foot traffic.

Thayer Creek provides a vertical migration corridor for deer and the 42 inch pipe paralleling the creek could present a barrier, particularly to fawns.

Cavity dependent MIS: Cavity dependent MIS would be primarily affected by loss of POG nesting and foraging habitat and potential loss of active nests during construction. Alternative 2 would result in the long-term conversion of 143 acres of POG to non-suitable habitat. Brown creepers avoid edges so in addition to the acres cleared; there would be additional acres that would become unsuitable due to edge effects. Alternative 2 would create up to 15.2 miles of new forest edge (7.6 road miles times two). Under Alternative 2, a slight decrease in breeding density could occur, because acres of suitable habitat affected are large in relation to breeding territories which are thought to be 15 acres or less (Wiggins 2005, p. 23). This would occur in the immediate vicinity of the project and would not be detectable at the scale of the analysis area.

Destruction or abandonment of nests occurs when forest clearing activities happen during the nesting and early brood rearing season (approximately from April into August). Once the young have fledged or are mobile (red squirrels) they may be disturbed but should be able to avoid direct mortality.

River otter: River otters would be most affected by loss of denning habitat (POG) in the beach fringe and the riparian area of Thayer Creek. An estimated 57 acres of POG in the beach fringe and eight acres in riparian management areas (2.5 acres are in both the beach fringe and RMA) would be removed by implementing Alternative 2.

Disturbance during construction could displace otters foraging or denning in the vicinity. After project completion they would likely adapt to the presence of facilities since generally people will be absent.

The presence of roads could increase access for trapping. Alternative 2 would construct approximately 7.6 miles of road. The southern terminus at Stillwater Anchorage in Kootznahoo Inlet is approximately 0.8 miles from the Angoon boat ramp. The SUP authorization will include a requirement that the project proponent install effective road closure devices to ensure that the roads are closed to motorized traffic except what is necessary for operation and maintenance of the project. This should reduce the likelihood that a substantial increase in trapping effort will occur as a result of the new roads.

Dewatering of Thayer Creek below the anadromous fish barrier would reduce the quantity and quality of foraging habitat for otters.

ALTERNATIVE 3 (BURIED TRANSMISSION LINE)

Bald eagle: Approximately 28 acres (0.3% of total acres of beach fringe POG in the analysis area) of POG forest habitat within the beach fringe would be converted to non-forest. Four nests could be affected by roads/transmission lines and associated forest clearing within the 330 foot nest buffer. Because of the reduced clearing width in Alternative 3 compared to Alternative 2, it may be easier to locate the features outside of the 330 foot buffer. At the least, there would be fewer acres of suitable habitat lost to forest clearing. There are an estimated 15 nests within ½ mile of project components for which timing restrictions on blasting may need to be implemented. This alternative would essentially eliminate the likelihood of eagles being injured or electrocuted along the transmission line because it will be buried as much as practicable.

Brown bear: Approximately half the acreage of POG will be lost in Alternative 3 (71 acres) compared to Alternative 2. This is due to the buried transmission line and narrower clearing limits. In Alternative 3, the power plant discharge will be required to return water above or immediately below the anadromous fish barrier (300 – 450 feet above the return in Alternative 2). This would eliminate dewatering of the reach below the barrier and reduce effects to fish, and reduce the potential effects to anadromous fish and habitat (Schneider 2008). It is assumed that this would maintain bear foraging opportunities close to the existing condition. The other effects described for Alternative 2 would be essentially the same in Alternative 3.

Marten: Alternative 3 would have similar but reduced effects compared to Alternative 2. It would result in the long-term conversion of 71 acres of POG to non-suitable habitat and

construction of 8.3 miles of road. Trapping access and disturbance effects would be similar to Alternative 2.

Sitka black-tailed deer: Alternative 3 would have similar effects as Alternative 2. Seventy-one acres of POG (<0.1% in analysis area) would be converted to road, brush, and facilities. As with Alternative 2, all affected POG is below 800 feet elevation. This alternative would construct 8.3 miles of road. This would not result in improved access compared to Alternative 2 because the roads would start and end at the same locations. Effects from the pipeline would be the same.

Cavity dependent MIS: Alternative 3 would have similar but reduced effects to cavity dependent MIS compared to Alternative 2. Seventy-one (71) acres of POG would be converted to unsuitable habitat and an estimated 16.6 miles of new forest edge would be created. Alternative 3 is less likely to result in a localized reduction in breeding density compared to Alternative 2.

River otter: Implementing Alternative 3 would result in the loss of 28 acres of beach fringe POG, four acres of RMA POG (one acre is in both the beach fringe and RMA), and construction of 8.3 miles of road. Trapping access and disturbance effects would be similar to Alternative 2. Thayer Creek would not be dewatered below the anadromous fish barrier so foraging habitat would not be affected.

ALTERNATIVE 4 (SUBMERGED TRANSMISSION LINE)

Bald eagle: Approximately 23 acres (0.2% of total acres of beach fringe POG in the analysis area) of POG forest habitat within the beach fringe would be converted to non-forest. Four nests could be affected by roads/transmission lines and associated forest clearing within the 330 foot nest buffer. There are estimated 12 nests within ½ mile of project components for which timing restrictions on blasting may need to be implemented. This alternative would essentially eliminate the likelihood of eagles being injured or electrocuted along the transmission line because it will be buried as much as practicable or submerged.

Brown bear: Alternative 4 would affect the least POG (39 acres). As in Alternative 3, the power plant discharge will be required to return water above or immediately below the anadromous fish barrier which would reduce the potential effects to anadromous fish and habitat (Schneider 2008) and maintain bear foraging habitat. By eliminating the upland transmission line between the marine facility and Kootznahoo Inlet, this alternative provides the least increase in access.

Marten: Alternative 4 would have the least impacts to marten of the action alternatives with 39 acres of POG converted to unsuitable habitat, and 4.3 miles of road constructed.

Sitka black-tailed deer: Alternative 4 would affect the least amount of deer winter habitat of the action alternatives. By eliminating the upland transmission line and road between the marine facility and Kootznahoo Inlet, this alternative provides the least access improvement. Effects from the pipeline would be the same.

Cavity dependent MIS: Alternative 4 would have the least impacts to cavity dependent MIS of the action alternatives because it affects the least amount of POG and creates the fewest miles (8.6) of forest edge.

River otter: Implementing Alternative 4 would result in the loss of 23 acres of beach fringe POG, two acres of RMA POG (one acre is in both the beach fringe and RMA), and construction of 4.3 miles of road. The road in Alternative 4 would end at the marine facility and not extend to Kootznahoo Inlet. Disturbance effects would be less overall, but would be the same as alternatives 2 and 3 in the Thayer Creek area. Thayer Creek would not be dewatered below the anadromous fish barrier so foraging habitat would not be affected.

3.8.2.2 Effects – Migratory Birds

ALTERNATIVE 1 (NO ACTION)

Under the No Action alternative, no habitat conversion or any associated disruption of wildlife habitat, or wildlife productivity would occur. Effects related to a potential oil spill could harm some species of migratory birds.

ALTERNATIVES 2, 3, AND 4

Effects to birds would be related to loss of habitat and nest destruction or abandonment if management activities occur in suitable nesting habitat during the breeding/nesting period, which generally begins in May and ends in September when young birds have fledged. The primary habitat that would be affected by these projects is the hemlock/Sitka spruce forest, but shrub thicket habitat would also be affected. Alternative 2 would impact 166 acres of hemlock/spruce forest and 14 acres of shrub thickets. The acres affected in each habitat type are a small percentage of the acres available within the analysis area.

Alternative 2 would create an estimated 15.4 miles of forest edge. For species such as the varied thrush and Townsend's warbler, edges reduce the effectiveness of interior habitat and increase the potential for nest-site predation from avian predators that are associated with forest edges and fragmented landscapes. Some species, such as Steller's jay and northwestern crow favor edge habitats and would benefit from the creation of edges.

In Alternative 3, effects to these birds would be similar to those described for Alternative 2 with 82 acres of hemlock/spruce forest and 15 acres of shrub thickets affected and 16.8 miles of edge habitat created.

For Alternative 4, effects to these birds would be similar to those described for Alternatives 2 and 3 but on a smaller scale. Alternative 4 would impact 47 acres of hemlock/spruce forest and 15 acres of shrub thickets and would create an estimated 8.5 miles of edge habitat.

While some effects to individuals are likely (e.g., nest destruction, disturbance, increased predation), no population level effects to any migratory bird species or bird species of conservation concern are expected from any of the alternatives.

3.9 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES - THREATENED, ENDANGERED, AND SENSITIVE SPECIES

Biological evaluations (BEs) were prepared for threatened or endangered species listed under the Endangered Species Act (ESA), as well as species on the Forest Service, Region 10 Sensitive Species list (FSM 2672.4). The objectives of the BEs were:

1) to ensure that Forest Service actions do not contribute to the loss of viability or trend toward federal listing of any native or desired non-native plant or animal species;
2) to ensure that actions of federal agencies do not jeopardize or adversely modify critical habitat of federally listed species; and
3) to provide a process and standard that ensures threatened, endangered, and sensitive species receive full consideration in the decision-making process.

The BEs for plants and animals are on file at the Admiralty Island National Monument office.

3.9.1 AFFECTED ENVIRONMENT - THREATENED, ENDANGERED, AND SENSITIVE SPECIES

The following sections describe the existing condition of threatened, endangered, and sensitive species and their habitats in the Angoon Hydroelectric project area. The wildlife biologist reviewed published literature and information on the NMFS web site to develop the discussions of ESA-listed species below. Information about Forest Service sensitive animal species was based on reviews of district wildlife files, letters, scientific literature, and Forest Plan standards and guidelines.

The botanist reviewed the Regional Forester's Sensitive Species List, Alaska Natural Heritage Program database records, the Tongass National Forest plant survey GIS database, botanical literature (Hitchcock et al. 1955; Hultén 1968), maps, and aerial photos. The Forest Service botanist conducted field surveys of the project area in 2004 and in 2008.

3.9.1.1 Affected Environment - ESA-Listed Species

Several Alaska threatened, endangered, and proposed species do not occur on the Tongass National Forest, or in or near the analysis area. These species will not be affected and will not be addressed further in this EIS.

The following ESA-listed species may occur in the project area or in waters adjacent to the project area:

- humpback whale (*Megaptera novaeangliae*)
- Steller sea lion (*Eumetopias jubatus*)

Humpback whales are common in the inside waters of the Alexander Archipelago and are regularly sighted in the Inside Passage and coastal waters of the southeast Alaska panhandle

from Yakutat Bay south to Queen Charlotte Sound. Humpback whales feed in southeast Alaskan panhandle waters from about May through December, although some have been seen every month of the year. Peak numbers of whales are usually found in near shore waters during late August and September, but substantial numbers usually remain until early winter (NMFS 1991b). No critical habitat has been designated for this species in Alaskan waters.

Humpback whales are known to occur in the marine waters adjacent to the project area. They were sighted on a regular basis in Chatham Strait during field work. They are capable of accessing Kootznahoo Inlet, although the strong tides and shallow areas make it unlikely they regularly use the area. No surveys were conducted specifically for humpback whales.

The eastern Alaska distinct population segment of Steller (northern) sea lions is listed as threatened under the ESA. The Steller (northern) sea lion ranges from Hokkaido, Japan, through the Kuril Islands and Okhotsk Sea, Aleutian Islands and central Bering Sea, Gulf of Alaska, Southeast Alaska, and south to central California (NMFS 1992). Steller sea lion habitat includes marine and terrestrial areas that they use for a variety of purposes. Adult Steller sea lions congregate at rookeries for breeding and pupping. Rookeries are generally located on relatively remote islands, often in exposed areas that are not easily accessed by humans or mammalian predictors (NMFS 2008).

Critical habitat including haulout and rookery sites has been designated for this species. Major rookeries and haulouts in Southeast Alaska are identified in 50 CFR 226. Critical habitat includes a terrestrial zone, an aquatic zone, and an air zone that extend 3,000 feet (0.9 km) landward, seaward, and above, respectively, each major rookery and major haulout in Southeast Alaska.

There is no critical habitat in the analysis area. The nearest rookery is White Sisters, on the outside of Chichigof Island, approximately 85 miles away through Peril Strait. The nearest haulout is Tenakee Cannery Point approximately 23 miles from the project. Sea lions occur in the marine waters adjacent to the project area. No surveys were conducted specifically for sea lions.

3.9.1.2 Affected Environment - Forest Service Sensitive Species

ANIMALS

The Regional Forester's Sensitive Species List for Region 10 identifies four sensitive wildlife species on the Tongass National Forest. These are the Queen Charlotte goshawk (*Accipiter gentilis laingi*), Peale's peregrine falcon (*Falco peregrinus pealei*), osprey (*Pandion haliaetus*), and trumpeter swan (*Cygnus buccinator*). In addition, the BE addressed potential effects on Forest Service sensitive fish species and Kittlitz's murrelet, a candidate for listing under the ESA. Surveys were conducted for goshawk only.

QUEEN CHARLOTTE GOSHAWK

The Queen Charlotte goshawk is identified as a species of concern throughout its range and is identified as a sensitive species by the Alaska Region of the USFS. The goshawk is a wide-ranging forest raptor that occupies old-growth forest habitat in Southeast Alaska. POG forest is an important component of goshawk habitat use patterns in Southeast Alaska and at

all scales (nest tree, nest site, post-fledging areas) goshawks select POG forest types. Non-productive forest types and young-growth stands are also used to a lesser extent, and in some areas these matrix lands may be important for long-term goshawk management (Reynolds et al. 1992). Most other habitat types (such as alpine, subalpine, muskeg, and clearcuts) were used infrequently or avoided by goshawks.

Suitable nest site habitat consists of large trees with a dense canopy and generally an open under-story averaging 12 to 37 acres in size (Flatten et al. 2001). On average, nest trees occur at 423 feet elevation but generally do not occur above 1000 feet (Titus et al. 1994, page 5).

Foraging areas comprise the largest percentage of the goshawk's home range. Foraging habitat is characterized by forested stands with a greater diversity of age classes and structural characteristics (e.g., snags, woody debris) than nesting areas (Reynolds et al. 1992, page 16). In Southeast Alaska, prey includes Steller's jays (*Cyanocitta stelleri*), grouse (*Dendragapus* spp.), varied thrush (*Ixoreus naevius*), red squirrel (*Tamiasciurus hudsonicus*), and woodpeckers (Picidae) (Titus et al. 1994, page 6).

Based on this information, suitable nesting habitat for this analysis was considered to be POG forest below 1200 feet in elevation (pre-existing GIS break point). The GIS database indicates an estimated 68,319 acres of suitable nesting habitat for goshawks in the analysis area.

There are no known goshawk nests in the analysis area. The closest known nest is between Thayer and Distin Lakes approximately 8 miles east of the powerhouse site. It was active when last checked in 2005. Parts or all of the transmission line/road corridor route was surveyed for goshawk in 2004, 2007, and 2008 using broadcast survey techniques. No goshawks were located on any surveys.

Approximately 45 percent of the powerline corridor consists of suitable nesting habitat for goshawks. Nearly all forested areas in the project area provide potentially suitable foraging habitat.

PEALE'S PEREGRINE FALCON

Peale's peregrine falcons nest on cliffs from 65 to 900 feet in height along the outer coast of the Gulf of Alaska (USDA 2008b, p. 3-229). Nest distribution is closely associated with large seabird colonies located on the outer coasts or nearby islands. Suitable nesting habitat does not occur in the analysis area. There are no known nests in the area.

OSPREY

Ospreys are specialized raptors that are not commonly observed in Southeast Alaska. Fifteen nests have been documented in the Stikine area and one in the Ketchikan area. Osprey nests in Southeast Alaska usually occur in broken-top spruce trees or western hemlock snags.

There is abundant potentially suitable nesting and foraging habitat in the analysis area. For this analysis, POG in the beach buffer (9867 acres) and riparian management areas (5820 acres, with 211 acres in both) is considered suitable. No ospreys are known to nest in the area, although they migrate through southeast Alaska and likely pass through the analysis area. There is a historical record of an osprey sighted in the Killisnoo area of Admiralty Island (Blatt 1995), which is about 2 air miles south of Angoon along Chatham Strait. Boat-

based surveys were conducted along the coast during July of 2004, and found no ospreys in the area.

TRUMPETER SWAN

Trumpeter swans breed in Alaska and winter along the Pacific Coast from the Alaska Peninsula to the mouth of the Columbia River (Bellrose 1980, p. 90). Swans also pass through Southeast Alaska in the spring and fall during migration to and from their breeding grounds. The breeding range of the trumpeter swan in Alaska is concentrated along the Alaska Gulf coast and other wetland areas in central and southern central Alaska (Bellrose 1980, p. 88). Limited nesting occurs in southeast Alaska. Nesting habitat for swans includes shallow, still-water ponds, lakes and marshes with emergent vegetation for foraging and hiding cover (Hansen et al. 1971).

There is little if any suitable nesting habitat in the analysis area. There are some small lakes with emergent vegetation that could provide nesting habitat but these lakes were not ground verified to determine if the type of vegetation meets swan nesting requirements. The FWS does not conduct nesting surveys in this area due to the low probability for nesting swans and there are no reports of swans nesting in the area. Migrating and wintering swans are known to occur in Mitchell Bay, approximately 9 miles east of the project area, where estuarine conditions provide suitable habitat. The most recent winter surveys found five swans in Mitchell Bay (Hodges 2001).

KITTLITZ'S MURRELET

Kittlitz's murrelet is a small diving seabird whose entire North American population, and most of the worlds population, inhabits Alaskan coastal waters discontinuously from Point Lay south to the northern portions of Southeast Alaska (USFWS 2002). The Kittlitz's murrelet population has shown a significant decline.

During the breeding season, Kittlitz's murrelets congregate near tidewater glaciers and offshore of remnant high-elevation glaciers. Their winter range is not well known but probably pelagic (Day et al. 1999). Nesting habitat includes unvegetated scree fields, coastal cliffs, barren ground, rock ledges, and talus above timberline in coastal mountains in the vicinity of glaciers, cirques near glaciers or recently glaciated areas (Day et al. 1999). They forage extensively near outflow from glaciers, both tidewater and retreated glaciers with turbid glacial streams, primarily within 200m from shore (Day et al. 1999).

There is no nesting habitat or glacially influenced waters in the project area. No Kittlitz's murrelets have been reported in the analysis area.

PLANTS

General habitats or plant communities in the project area include conifer forest, open forest, forest edge, riparian areas, gravel bars, beach, forested beach fringe, beach meadows, non-forested wetlands, wet meadows, fens, shallow freshwater, ponds and lakes and their margins, and muskeg.

In July and August of 2004 and August of 2008 botanical field surveys were conducted in potential construction and clearing areas for this project. Survey intensity varied among activity areas, depending on the likelihood for sensitive plant habitat to be present in a

particular area. Areas with the greatest potential of supporting sensitive species (e.g., beach meadows, wet areas, streamside habitats) received the most scrutiny. In such areas, the botanist conducted a complete examination of specific areas of the project after walking through the project area. Surveys in areas with a lower likelihood of supporting sensitive species (e.g., open forest, forest edge) consisted of a single walk-through of the project area.

No sensitive plants were found within areas likely to be affected by project activities.

Table 3-9. Sensitive Plants Suspected to Occur in the Immediate Vicinity of the Angoon Hydroelectric Project Area

Species	Occurrence	Habitat Associations
no common name (*Botrychium tunux*)	Suspected	Maritime beach meadows, upper beach meadows, and well-drained open areas.
no common name (*Botrychium yaaxudakeit*)	Suspected	Maritime beach meadows, upper beach meadows, and well-drained open areas.
Wright filmy fern (*Hymenophyllum wrightii*)	Suspected	Humid shaded boulders, cliffs and damp woods and occurs at the base of trees and rock outcrops or in crevices of tree trunks. Occurs in coastal areas of Southeast Alaska.
truncate quillwort (*Isoetes truncata*)	Suspected	Aquatic. Grows immersed in shallow water of lakes and ponds.
Calder lovage (*Ligusticum calderi*)	Suspected	Subalpine boggy meadows, meadows and forest edges.
pale poppy (*Papaver alboroseum*)	Suspected	Open areas, rock outcrops, sandy, gravelly, well-drained soils, mesic to dry alpine. Sea level to ~6,000 feet elevation. Known in south-central Alaska.
loose-flowered bluegrass (*Poa laxiflora*)	Suspected	Upper beach meadows, open forests, and low-elevation streamside banks.
Kamchatka alkali grass (*Puccinellia kamtschatica*)	Suspected	Wet habitat on the coast and in upper beach meadows, limited to the south coast of Alaska from the Aleutian Islands to the northern portion of Southeast Alaska.
Unalaska mist-maid (*Romanzoffia unalaschcensis*)	Suspected	Beach terraces or moist banks, wet rock outcrops and rock crevices. Ranges from eastern Aleutians, Alaska Peninsula, and Kodiak to Southeast Alaska.
circumpolar starwort (*Stellaria ruscifolia* ssp. aleutica)	Suspected	Moist gravelly sites along creeks. Range limited to coastal Southeast and south-central Alaska and the Aleutian islands.

Source: Anderson 2004.

Table 3-9 summarizes the sensitive plant species for which preferred habitats exist in the project area. Of the three species that are known to occur on the Juneau Ranger District, only one (*Poa laxiflora*) has been documented on Admiralty Island approximately 20 to 30 miles

from the project area. The nearest known locations of the other two species (*Arnica lessingii* ssp. *norbergii* and *Puccinellia kamtschatica*) are on the mainland, 40 to 50 miles from Angoon.

3.9.2 DIRECT AND INDIRECT EFFECTS ON THREATENED, ENDANGERED, AND SENSITIVE SPECIES

3.9.2.1 Effects – ESA Listed Species

ALTERNATIVE 1 (NO ACTION)

The no action alternative would not impact any suitable habitat nor result in disturbance to individual ESA listed species. There is a low probability, but slightly higher risk of a fuel oil spill in the vicinity due to Angoon's reliance on fuel oil for electric generation under this alternative. Whales and sea lions would likely be able to avoid direct mortality related to a spill but sublethal exposure to contaminants and impacts to prey populations and distribution could occur.

ALTERNATIVES 2, 3, AND 4

None of the action alternatives will detrimentally impact any critical habitat nor cause disturbance above existing levels to individual humpback whales or Steller sea lions. Under all action alternatives there would be no effect on ESA-listed species. The rationale for this finding includes the following:

- The project activities will occur primarily on land. Effects to the marine environment would be limited to installing mooring buoys and laying power lines on the bottom of Chatham Strait or across Kootznahoo Inlet. These developments would not occur in critical habitat or interfere with the species use of the area. Angliss and Outlaw (2008) did not report any known cases of whale entanglement in submarine power or communication cables.
- This alternative would cause an increase in local small boat traffic. It is expected that the increase as a result of project activities will be a small proportion of the ambient boating activity. Boat operations will be required to observe NMFS regulations to avoid disturbing all marine mammals.
- The probability of an oil spill will be reduced compared to the no action alternative. If a spill were to occur the effects would be the same.
- Given the assumptions that a cable-laying ship would be traveling slowly and for a short period, it would appear unlikely that laying a submarine cable would measurably impact humpback whales. It is expected that the cable laying ship would not present a risk of disturbance or collision to whales or sea lions above existing activities in the area.
- Based on the low density of sea lions in the area and the small increase in vessel traffic for this project compared to existing uses, disturbance to sea lions is expected to be negligible.

3.9.2.2 Effects –Forest Service Sensitive Species

ALTERNATIVE 1 (NO ACTION)

The no action alternative would not impact any suitable habitat nor result in disturbance to individual sensitive species. There is a low probability, but slightly higher risk of a fuel oil spill in the vicinity due to Angoon's reliance on fuel oil for electric generation under this alternative. Although unlikely, a spill could result in direct mortality to wildlife present in the area as well as contamination of habitat.

ALTERNATIVES 2, 3, AND 4

Under all action alternatives there would be no effect on sensitive fish species or Peale's peregrine falcon, Kittlitz's murrelet, trumpeter swan, or osprey. The rationale for this finding includes the following:

- The project area does not provide suitable habitat for Peale's peregrine falcon, or Kittlitz's murrelet, or Fish Creek chum salmon, Island king salmon, or northern pike .
- All applicable Forest Plan standards and guidelines relating to soil, water, wildlife, and other resources will be implemented.
- No suitable habitat for trumpeter swans will be affected by any action alternative. Swans use wintering habitat in the analysis area but project activities are not likely to disturb them.
- Apparently suitable habitat for osprey will be affected by all action alternatives. However, the lack of documented use of that habitat by osprey and the small percent of habitat affected, make it unlikely that any individual osprey would be affected. If any active nests are found before or during implementation of the project, activities that would likely disturb nesting osprey will be prohibited within a minimum 330-foot radius of the nest.

Suitable habitat for goshawks will be affected by all action alternatives. There is potential for disturbance of unknown goshawk nests. Implementing alternatives 2, 3, or 4 of the Angoon Hydroelectric Project may impact individuals but is not likely to cause a trend to federal listing or a loss of viability to northern goshawks. Alternative 2 would eliminate 143-acres, or less than one percent, of the suitable habitat (POG under 1200 feet elevation) in the analysis area. POG would be converted to bare ground (roads, rock pits), buildings, or cleared and maintained as shrub fields without large trees. These are not suitable nesting habitats.

Foraging or undiscovered nesting goshawks could be disturbed by project activities, especially during the construction phase. Construction and forest clearing activities during the nesting season through fledging (approximately April through July) could result in nest destruction or abandonment. The projected transmission line and road locations were surveyed; however, goshawks often move nest sites from one year to the next. Terms and conditions would reduce the potential to affect goshawk.

In Alternative 2, the transmission line is entirely above ground. The proponent would be required to follow the APLIC standards and design recommendations (APLIC 2006) for

construction of the line to reduce the likelihood of raptors being killed or injured by collision or electrocution. Goshawks do not often utilize power poles for perching the way buteos and eagles do. However, this alternative would still represent an increased risk for collisions compared to the alternatives where the line is buried or submerged.

Alternatives 2 and 3 would have similar effects to Alternative 2, with less goshawk habitat impacted and lower collision risk; Alternative 4 would have the least affect to goshawk and their habitat. All alternatives would be consistent with the Forest Plan conservation strategy and would be expected to maintain a viable well dispersed population of goshawks across the Tongass NF.

PLANTS

The proposed project would not adversely affect sensitive plants. This determination was based on the following:

- A qualified botanist conducted thorough surveys at the proper time of year and found no sensitive plants.
- Plants native to the area and originating near the project area would be used for any re-vegetation or restoration work.
- Prior to construction, the district botanist will mark, on the ground or on aerial photos, the boundaries of the known rare plant populations in or near the proposed project footprint.
- If any previously undiscovered sensitive plants are encountered before or during implementation of the project the Forest Service must be notified immediately to evaluate the potential risk to the population and recommend avoidance or mitigation measures.
- To avoid rare plants, spoils will not be deposited in the large tall sedge fen meadow between the power house and dam.

3.10 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES - SCENERY

Visual resource analysis evaluates the perception of change to the scenic integrity, or apparent naturalness of a landscape which might occur from disturbance created by alteration. Potential changes to scenery are evaluated from Visual Priority Travel Routes and Use Areas identified in the Forest Plan. The effects of proposed project elements are discussed from the point of view of viewers looking toward the project area from these locations. Changes that viewers might perceive are based on potential modifications to the color, texture, reflectivity, shape, and other visual characteristics of the landscape and proposed project elements.

Potential changes to the scenery are also discussed from the perspective of viewers seeing the landscape in the foreground (0 to 1/2 mile distant), middleground (1/2 to 4 miles distant), or background (4 miles and greater in distance). These distance categories recognize that the perception of detail in the visual environment is much lower when a landscape is viewed from a distance than from nearby. Many types of changes that would be noticed by a viewer close to a modified landscape would not be perceived as a modification when viewed from farther away.

3.10.1 AFFECTED ENVIRONMENT – SCENERY

This section describes the existing visual character of the scenery in the project area. The discussion emphasizes effects from areas that are visible from the Visual Priority Travel Routes and Use areas identified in the Forest Plan. Those portions of the project area not visible from designated Visual Priority Travel Routes and Use Areas are also discussed, although in less detail.

The project area is located in the Admiralty-Chichagof visual character type and displays many of the characteristic features of the type. Rugged, rocky shorelines are adjacent to forested hillsides with relatively little variation in vegetation. Beyond, in the far background behind the site, alpine features of Admiralty Island are sometimes visible. The flatter areas of the project area include chains of small lakes. Although it is not in the project area, nearby Thayer Lake is one of the landmarks of this visual character area.

Visual Priority Travel Routes and Use Areas near the project area are cruise ship and small boat routes in Chatham Strait extending from the shoreline to the cruise ship and ferry route 5 to 10 miles in distance. In general, topography and vegetation screen the views to many of the proposed project elements.

The following subsections describe the visual character of the project area in more detail, describing the project area as a series of viewshed, shown in Figure 3-5. A viewshed is defined as an area characterized by consistent patterns of topography, aspect, vegetation, and visibility from Visual Priority Travel Routes and Use Areas. While the area within an individual viewshed is not uniform, it is similar enough that proposed project actions would be expected to have a similar effect throughout the viewshed.

3.10.1.1 Affected Environment – Scenery

THAYER CREEK VIEWSHED

Except for the creek mouth, this viewshed is generally not visible from designated Visual Priority and Use Areas.

This viewshed includes the reach of Thayer Creek from the location of the proposed diversion dam to the creek mouth. The topography is generally a steep-sided creek channel with a narrow band of riparian forest adjacent to the creek and upland forest on the valley walls. In this viewshed the riparian forest extends approximately one hundred feet from the stream, and riparian vegetation is generally more visually diverse and lighter colored than the adjacent hillside coniferous forest. The extension of riparian vegetation to the shoreline provides visual cues to viewers seeing the stream mouth in the foreground or middle ground that this is a location where a stream enters Chatham Strait. The contrast between riparian vegetation and the nearby shoreline vegetation are not significant enough to be visible in the background.

CHATHAM STRAIT SHORELINE VIEWSHED

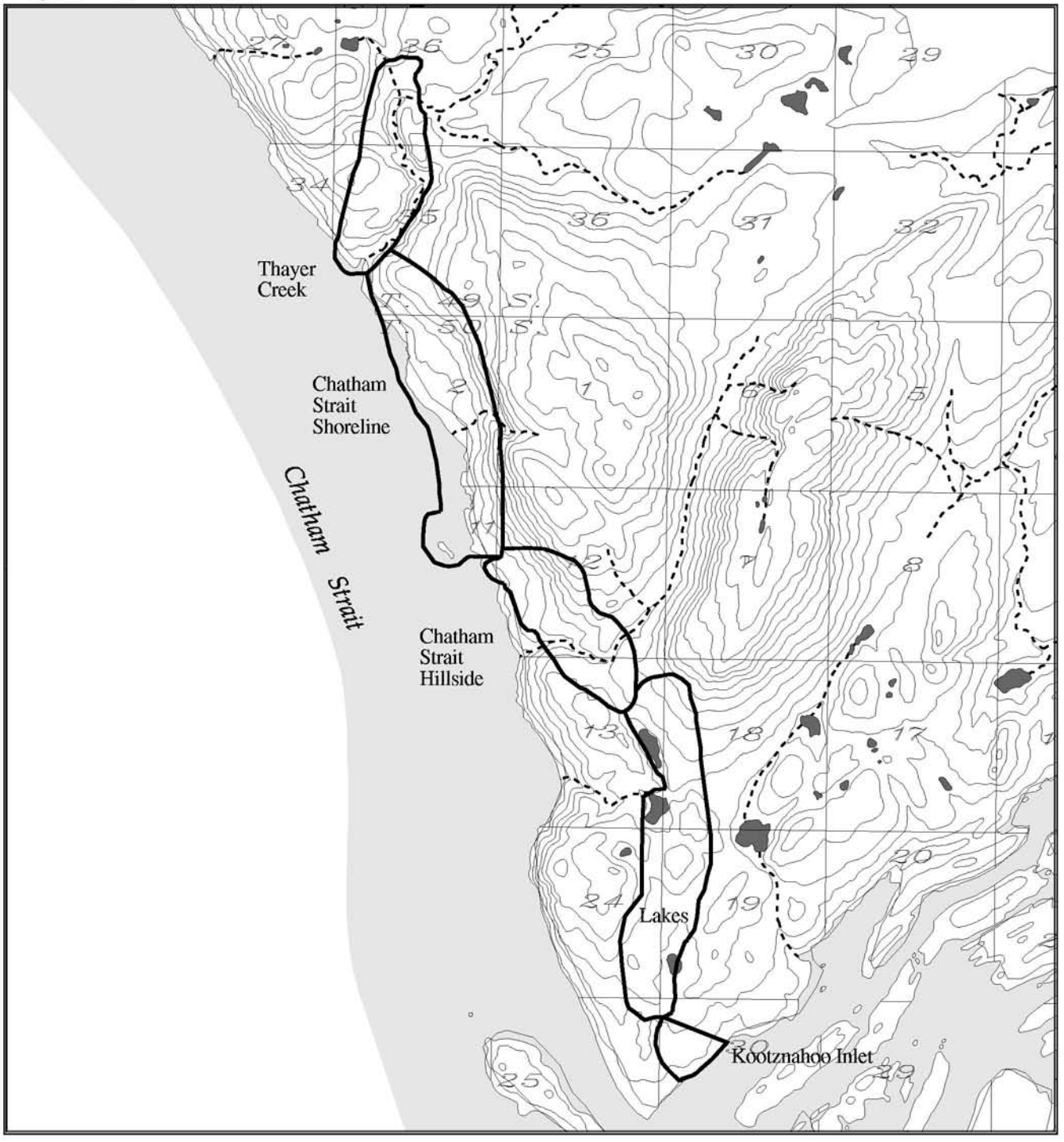
Portions of this viewshed are prominently visible from locations within Chatham Strait. The shoreline area (including the proposed landing site) and the hillside inland of the bench area are important elements of the view to this area. The bench area is generally screened from view, and modifications in this part of the viewshed would either not be visible or would show only a minor change to the existing scenic character.

This viewshed encompasses the area from the mouth of Thayer Creek to the proposed marine facilities. The topography of steep forested hillsides rise behind a narrow forested plateau along the shoreline, with a very narrow fringe of rocky beach. The scenic character of the landscape is dominated by the horizontal banding of shoreline elements where the water meets the shore. The area at the water's edge and in the intertidal zone is unvegetated except for various seaweeds clinging to the rocky shore. This band is generally dark in color, with the regularly wetted rocks and intertidal vegetation blending into a dark gray-brown color. Horizontal bands of lighter-colored barnacles are visible to viewers near the shore. Immediately above the intertidal zone, the shrub understory is visible, blocking views into the trunks of the adjacent coniferous forest. The understory shrubs generally have a brighter green color than the adjacent conifers. Conifers growing near the shoreline are smaller than those growing further inland; light green lichen is a striking visual feature.

The horizontal banding of the shoreline scenery is prominent when viewed from the foreground or middleground. Within each band, the color and texture of the scenery is generally uniform along the shoreline, with breaks in the pattern occurring only where there is an underlying landscape change, for example at a creek mouth or a large rock outcrop.

The proposed barge landing site is a rocky outcrop extending into Chatham Strait. Depending on the tide, it could be perceived by viewers as a small island, although it is connected to the shoreline by a narrow, unvegetated strip of land. The portion of the outcrop furthest from the shore is large enough to support shoreline conifers. This section is oriented at a right angle to the portion of the outcrop connecting to shore; the area behind it is screened from most viewpoints in Chatham Strait by the vegetated section of the outcrop.

Figure 3 - 5
Project Area Viewsheds



CHATHAM STRAIT HILLSIDE VIEWSHED

This viewshed is prominently visible from Chatham Strait, a designated Visual Priority Travel Routes and Use Area.

This viewshed includes the area from the proposed barge landing site to the ridgeline above Chatham Strait. The hillside rises gently for approximately 0.25 mile before steepening into a series of forested cliff bands. Above the cliffs, the slope eases to the ridgeline, a little over 0.5 mile from the shore. Slopes below the cliff average approximately 25 percent, with scattered benches and steeper areas. Vegetation is uniform even-aged coniferous forest, with trees approximately 75 to 100 feet tall.

The texture of the hillside is generally fine and uniform. Color is gray-green typical of coniferous forest in Southeast Alaska – a combination of the underlying color of the conifers and lichen. The existing condition is a good representation of the typical visual character, as would be used to evaluate consistency with scenery goals and objectives. Currently, no evidence of disturbance – either natural or as a result of management actions – is easily discernible by a casual viewer.

LAKES VIEWSHED

This viewshed is not visible from designated Visual Priority Travel Routes and Use Areas.

This viewshed begins on the far side of a ridgeline from Chatham Strait and continues to a ridgeline that then drops to Kootznahoo Inlet. This area is more topographically and botanically diverse than the shoreline viewsheds, including gently rolling hills and valleys and a few small lakes. The area is completely screened from Visual Priority Travel Routes and Use Areas by the prominent ridgeline separating this viewshed from Chatham Strait. The location is also screened from the community of Angoon and boaters in Kootznahoo Inlet by topography and vegetation.

The scenery is characterized by a matrix of uniform coniferous forest surrounding small complexes of lake and wetland vegetation. The coniferous forest is darker green than the shoreline forest, showing less of the lichen color that dominates the forest above. There is a strong contrast between the forested matrix and the lake/wetland vegetation areas, which are lighter in color, more diverse in texture, and more likely to have seasonal variations in appearance because of the dominance of deciduous plants. There is also a prominent difference in scale between the forested and lake/wetland vegetation, which is generally less than one-quarter of the height of the surrounding forest.

The perception of this landscape depends strongly on the location of the viewer. Larger landscape patterns are likely seen only from the air because of the limited vantage points for seeing this unit from the ground. The relatively few visitors who view this landscape from the ground are likely to be limited to shorter views, either from within the forest or from one of the small lakes. Viewers on a boat or floatplane on one of the lakes may see a small portion of the viewshed at any time because the forest directly adjacent to the lakes and associated wetlands effectively screens the relatively flat adjacent topography.

KOOTZNAHOO INLET VIEWSHED

This viewshed is not visible from designated Visual Priority Travel Routes and Use Areas. It is visible from the community of Angoon's waterfront area. Because it is not located in the National Forest, it is not subject to Forest Plan standards and guidelines for scenery.

This viewshed includes a hillside dropping towards Kootznahoo Inlet and the shoreline of the inlet. The area is located outside of the National Forest, in the community of Angoon. This landscape is characterized by a gently sloping hillside extending to the shoreline. It is more topographically varied than the hillside rising from Chatham Strait described earlier, with some benches, rolls, and broken terrain, but without prominent cliff bands. Vegetation is generally uniform coniferous forest, with some diversity of texture and form resulting from the varying topography. The shoreline is characterized by a broader intertidal zone than the Chatham Strait shore, with some grassy flats before the beginning of the coniferous forest. There is also some scattered development along the shoreline including piers and shoreline facilities. The opposite shoreline is heavily developed with piers and structures supporting the community of Angoon, creating a fairly complex visual landscape for small boats and floatplanes on the inlet.

3.10.2 DIRECT AND INDIRECT EFFECTS ON SCENERY

For this project the standards and guidelines for acceptable levels of change to scenery are adopted in the Transportation and Utility System Management Prescription of the Forest Plan. The Goal of this prescription is to provide for, and/or facilitate the development of existing and future major public Transportation and Utility Systems. The allowable deviation to the scenic environment from a naturally intact landscape would be a Low Scenic Integrity Objective (SIO). Under this standard, management activities that may be visually prominent in the landscape are allowed, but they must use the form, line, color, texture, and/or scale of that landscape in the design of the activity where possible. The degree of the effects of the project are evaluated from different viewing distances (foreground, middle ground, and background), and also their duration. For example, exposed road cuts may be visually prominent when first constructed, but become less so over time as vegetation matures and the road cut blends into the surrounding landscape.

3.10.2.1 Effects – Scenery

ALTERNATIVE 1 (NO ACTION)

Under the No Action alternative the project area would continue to develop under a natural regime of succession and disturbance. Some natural disturbances reduce the perceived visual quality of a landscape; however, the visual character of the landscape as an outcome of unimpaired natural processes is a desired characteristic of Wilderness.

EFFECTS COMMON TO ALTERNATIVES 2, 3, AND 4

In general, topography and vegetation screen the views to many of the proposed project elements. Under all action alternatives, most of the proposed project would not be visible from Visual Priority Travel Routes and Use Areas. Under all action alternatives the proposed power production facilities and associated transmission areas along Thayer Creek would be

screened from Visual Priority Travel Routes and Use Areas because they will be located behind a prominent ridgeline and would not be visible from Chatham Strait. Portions of the project area that may be visible include the proposed landing area and a segment of the transmission facility that is located on the hillside between the shoreline area and the top of the prominent ridge. The power generation and transmission facilities along Thayer Creek would be visible to occasional backcountry travelers.

Under all action alternatives some elements of the project would be visible from the Visual Priority Travel Routes and Use Areas, modifying the scenery and having an effect on viewers' experience of the landscape. Changes to the visual environment would occur in two ways. First, clearing forest vegetation would change visual patterns in the landscape. The second type of change would be the addition of built elements to the landscape that contrast with the surrounding natural environment. Because the landscape surrounding the proposed project area is designated Wilderness, the contrast between the proposed facility and the adjacent forest would be greater than in other settings where more human modifications to the scenery are present.

Under all action alternatives port facilities and a temporary barge landing would be constructed at a prominent rock outcrop in the Chatham Strait Shoreline viewshed. The proposed port facilities would be permanent, while the barge landing site would be restored as closely as possible to original conditions following the completion of the project. Because of their location it is not possible to completely buffer the port facilities with vegetation. Modifications to this rocky point would be visible in the foreground and middleground from small boat routes in Chatham Strait. It may be possible to locate the port facilities between the outcrop and the shoreline, where they would be screened by the bulk of the outcrop from most viewing directions. All port and barge landing facilities, including any buoys, ramps, and access roads, would contrast with the undeveloped character of the wilderness coastline.

The permanent modifications for the port facilities would likely be small-scale, and would not be prominent from Visual Priority Travel Routes and Use Areas. They would mostly be visible to small boats, including human-powered craft, which follow the shoreline closely. Assuming that (1) all barge landing facilities would be temporary, (2) development impact would be limited, and (3) restoration would be included in the project, then effects of the barge landing on scenic resources would be temporary.

The diversion dam and intake would not be visible from any Visual Priority Travel Routes and Use Areas. These facilities may be seen by recreational users of Thayer Creek. The diversion dam and intake would largely be located within the stream channel, be relatively small, and be designed to minimize their contrast with the surrounding landscape.

The pipeline, surge tank, and penstock would not be visible from designated Visual Priority Travel Routes and Use Areas. The only likely viewers of these facilities would be guests from the lodge on Thayer Lake. For these viewers, the pipeline, surge tank, and penstock would likely contrast with the surrounding landscape in line and form. The pipeline would be a long, large scale horizontal element unlike naturally occurring forest landscape elements. Depending on the final location of the pipeline, it may be effectively screened by understory plants. The surge tank and penstock would also be large, geometric structures, but would be partially screened by topography.

The effects of the powerhouse and switch yard would be similar to those of the surge tank and penstock described above. These large features would not be visible from Visual Priority Travel Routes and Use Areas and would not likely be viewed except by occasional travelers along Thayer Creek.

Staging areas and construction camp locations would be buffered from view by vegetation, and would likely only be visible to occasional recreational visitors. Assuming that these areas are restored following the completion of construction, visual effects would be minor and temporary under both action alternatives.

Rock and borrow sites, needed for the construction of the access road would not likely be visible from Visual Priority Travel Routes and Use Areas unless they are developed in the Chatham Straits Hillside Viewshed. The TUS land use designation includes guidelines for the selecting the location, design, and restoration of rock and borrow sites.

All action alternatives would meet the standards and guidelines of the scenery resource for the TUS land use designation as described in the Forest Plan. The project elements described under the action alternative would meet or exceed the low scenic integrity objective as described in the standards and guidelines from all viewing distances

ALTERNATIVE 2 (PROPOSED ACTION)

Access roads would provide service access to each of the facilities. Under Alternative 2, access roads and transmission lines would extend from the power generation site to Kootznahoo Inlet.

The visual impact of roads depends on the relationship of the road to topography and the viewer. Where forested landscapes are relatively level or gently rolling, roads are not prominent visual features. Where the terrain is steeper, roads and their associated clearing can be much more prominent. Under this alternative all transmission lines are overhead lines supported on 40 foot wooden poles with clearing limits of 15 feet on one side of the transmission line and 20-30 feet on the other side to include the service road. Experience with similar transmission lines in remote locations in SE Alaska indicates that clearing limits of approximately one tree height from the transmission line are more realistic to avoid line damage and associated power interruptions. Regardless of initial design, it is likely that trees will ultimately be cleared to these limits to protect the powerline. Because tree heights and topography vary along the routes, clearing limits for both the road and powerline will also vary. In general the transmission line would traverse forested lands with tree heights of approximately 100 feet requiring clearing limits of about 200 feet.

In forested areas, transmission line structures generally repeat the dominant vertical lines of the surrounding coniferous trees. The electrical lines themselves are not similar to other lines and shapes in the forest, and often have different reflective qualities, making them more visually prominent from foreground and middleground views. In the background, power poles and transmission lines are generally less prominent than their associated cleared areas. Clearing associated with power lines would create effects similar to those of proposed access roads.

Under Alternative 2 power poles may be visible in the middleground from some viewpoints within Visual Priority Travel Routes and Use Areas, but would generally be screened by vegetation and likely would not be distinguishable from surrounding forest.

Two lakes in the Lakes Viewshed are adjacent to the proposed transmission line route. Lakes are visited for recreation or subsistence uses more frequently than the surrounding forest, and would be more likely to serve as viewing locations for the project elements. Where possible, the transmission lines would maintain a minimum 100-foot buffer from the lakes in this unit.

The transmission line corridor would be visible from Kootznahoo Inlet and parts of the community of Angoon. The rolling topography and mature vegetation on the hillside would screen portions of the transmission line and reduce its visual prominence. Also under this alternative, a structure would be located near the shoreline on the north side of Kootznahoo Inlet to make the transition from aboveground to submarine transmission line. This structure would be designed to blend with the surrounding landscape as much as possible. The shoreline in this area already has some developed structures, however, so the contrast between the power facility and the surrounding landscape would not be as great.

ALTERNATIVE 3 (BURIED TRANSMISSION LINE)

Under this alternative the transmission line and service road would follow much the same route as Alternative 2 but the line would be buried where feasible and would generally be located within the clearing limits of the service road.

In the Chatham Strait Hillside viewshed, effects under Alternative 3 would be significantly less than Alternative 2 by burying the transmission cable and reducing the width of the corridor. As described in the HDR Feasibility Evaluation Report, the service road, on relatively flat ground, would require a clearing width of 20-30 feet (though clearing may vary and be closer to 46-70 feet). Effects in the Lakes Viewshed would be similar to Alternative 2. The visibility of the transmission line corridor would be reduced from that of Alternative 2 achieving a higher level of scenic integrity than required under the Forest Plan.

ALTERNATIVE 4 (SUBMERGED TRANSMISSION LINE)

Under this alternative no project facilities would be located in the Chatham Straits Hillside, Lakes, or Kootznoowoo Viewsheds, eliminating potential scenic effects within those viewsheds. Within the Thayer Creek and Chatham Straits Shoreline viewsheds the scenic effects are similar to Alternative 3 since the transmission line would be buried where feasible under both alternatives, minimizing clearing of vegetation.

The underwater transmission line corridor would not be visible, although some project elements on the shoreline, such as the switchyards at either terminus of the underwater line, may be visible in the foreground and middleground to small boats in Chatham Strait.

The final location of the switch yards would incorporate screening vegetation where feasible. This structure would meet or exceed the low scenic integrity objective by incorporating design elements that blend with the color of the natural surroundings. Under Alternative 4, the powerline would extend to the shoreline at the barge landing location, and a structure at the shoreline would be required to make the transition from above-ground to underwater transmission cable. This structure would likely be visible in the foreground and middleground to small boats in Chatham Strait.

Under Alternative 4 access roads and transmission lines would only extend from the power generation site to the port facilities. Alternative 4 would include less modification to the underlying landscape than Alternatives 2 and 3 and would have correspondingly less visual impact. Alternative 4 would require 4.1 fewer miles of transmission corridor through the most visible portions of the project area than Alternatives 2 and 3. This alternative would also avoid modification to the landscape in the Chatham Straits Hillside and Kootznahoo Inlet Viewsheds that would be visible from small boats. Although views from aircraft are specifically excluded from consideration as Visual Priority Travel Routes and Use Areas, there is a relatively high volume of floatplane traffic that views the project area, including regularly scheduled flights between Juneau and Angoon. The reduced length of transmission corridor and access road in Alternative 4 would also reduce the impact of the project for viewers in airplanes, where transmission facilities can not be screened effectively.

3.11 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES - CULTURAL RESOURCES

36 CFR Part 800 regulations, which implement the National Historic Preservation Act (NHPA), as amended, require federal agencies to take into account the effects of their undertakings on historic properties, in consultation with other interested parties. Historic properties include any prehistoric or historic district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places (National Register). The information in this section was drawn from the archaeological survey report prepared for this project, which is on file at the Admiralty Island National Monument office.

3.11.1 AFFECTED ENVIRONMENT – CULTURAL RESOURCES

The following subsections describe the cultural prehistory and history of the project area, as well as the process by which area cultural resources were investigated and evaluated. Section 106 is the portion of the NHPA that requires federal agencies to consider the effects of their undertakings on historic resources. To complete the Section 106 review, agency staff conduct heritage resource surveys to identify any cultural resources or areas of traditional use within a project area that might be impacted by a proposed activity. Before beginning on-the-ground archaeological surveys, cultural resource specialists review what is known about the prehistoric and historic use in the project area and evaluate any sites for significance. Avoidance of sites or protection of significant sites is considered prior to project implementation.

Information sources for the background review and literature search within the project area included selected works of Frederica de Laguna, Madonna Moss, Charles Mobley, and others working in the vicinity of Angoon and on Admiralty Island. These reports, books and articles document ongoing inventories and archaeological surveys relating to archaeological sites, in addition to ethnographic and historic overviews for the area. In addition, the Forest Service consulted the Angoon Community Association, Kootznoowoo, Inc., Central Council of Tlingit and Haida Indian Tribes, Sealaska Corporation, and the City of Angoon in July 2004 regarding potential cultural resource concerns associated with the proposed project.

The Forest Service archaeologist completed field reviews in 2004, 2005, and 2008 having surveyed approximately surveying 65 acres of area identified as having a high sensitivity for the presence of cultural material resources. Project areas that fall within the high-sensitivity zone include the port facilities, portions of the road, the powerhouse location, and segments of the access roads that are in the vicinity of the powerhouse. The temporary barge landing and garage location, as well as the location where the submarine lines will transition from an overhead to a submarine lines, are also within the high-sensitivity zone. These areas are below 100 feet in elevation, in the vicinity of an anadromous fish stream or coastline, or in the vicinity of a reported or documented archaeological site or site associated with an oral history.

The survey team identified six newly recorded sites, representing both prehistoric and historic use of the project area and continuous use of the landscape over time. Cultural resource specialists evaluated the sites for eligibility for inclusion on the National Register

and to assess the effects of the proposed undertaking on those sites eligible for the National Register.

No historic lode or placer mining occurred within the area of potential effect. Field investigators identified and investigated one karst landform within the project area. This was a sinkhole approximately 130 feet in diameter and 30 feet deep. At its western edge, a karst limestone cave was located approximately 25 feet long and 6 feet high at its entrance. The cave floor was dry with a small stream percolating into gravel at its north end. No sign of human use was noted at the time of investigation, and no potential leads were identified.

CULTURAL OVERVIEW

Prehistory and Ethnohistory

Marine adapted peoples have occupied southeast Alaska for at least the last 10,000 years. This maritime life-style has persisted through the millennium and remains important to the regional economy and traditional subsistence users. A Holocene period cultural sequence developed for southeast Alaska is based on an archaeological record pieced together by relatively few intensively investigated sites. The Early, Middle and Late periods of the northern Northwest Coast cultural sequences represent coarse divisions of cultural development (Moss 1998:92-102). The microblade tool tradition is a defining characteristic of the Early Period (10,000-5,000 B.P.). Sites dating to this period have been found in the northern Southeast Alaska on both the mainland and island locations, including Ground Hog Bay (JUN-037) and Hidden Falls (SIT-119).

The Middle Period (5,000-1,500 B.P.) is defined by an increase in the number and size of archaeological sites, more diversified bone tool assemblages and wood stake fish weirs and traps. Sites dating from this period include the North Point Site (SUM-025), Favorite Bay Fish Weir (SIT-033) and Killisnoo Picnic Ground Midden (SIT-124).

A continuation of site types from the Middle Period, an increase in fort sites, and written history accounts help define the Late Period (1,500 B.P.-A.D. 1741). Sites on Admiralty Island that date from this era include Daxat Kanadaa (SIT-244), Marten's Fort (SIT-171) and Garnes Point Shell Midden (SIT-304). The Late Period represents cultural continuity between the Middle Period and historic period.

Tlingit migration and settlement theories often center on events rather than dates. A major theme in Tlingit legend depicts a great flood. Many clans claim local origin while others claim settlement after the flood. The latter groups are said to have sought refuge from the flood on mountains and returned to the coast after the waters receded (Arndt et al. 1987:88). Resident groups encountered during Tlingit migration and settlement were either absorbed or pushed out (Arndt et al. 1987:87).

The project area is in the traditional territory of the Angoon Tlingit, the Xutsnoowú kwáan, who occupied the shores of Chatham Straits on Admiralty Island from Point Marsden southward as far as Chapin Bay and on Chichagof and Baranof Island from Basket Bay to Gut Bay (Goldschmidt and Haas, 1998). The Angoon Tlingit include the following clans:

Eagle/Wolf	*Raven*
Wooshkeetaan	Deisheetaan
Teikweidi	Aanxaakhittaan
Daklaweidi	

History

In 1794 Vancouver's voyage visited and described a settlement on Admiralty Island, describing a bay southeast of Pt. Parker "…where many of the natives in their canoes were assembled." At what was probably the entrance to Kootznahoo Inlet Vancouver wrote:

> On either side of the entrance some new habitations were constructing, and for the first time during our intercourse with the North West American Indians, in the vicinity of these habitations were found some square patches of ground in a state of cultivation." (in Moss 1989:31)

Tlingit contact with Russian and European explorers and fur traders increased in the early to mid-1800s. An 1880 census report lists two settlements of the Khootznahoo Tribe with a total population of 666. One settlement was Augoon, with 420 inhabitants and another Scutskon, with 246 inhabitants (Petroff 1880). The census data of 1890 gives a population for the "Hutznahu tribe" as 420 (235 males, 185 females). The reported population of Angoon was 381 (200 males, 181 females) with 22 houses sheltering 113 families. Another 79 people lived in Killisnoo (Porter 1893).

Following the Russian "sale" of Alaska to the United States in 1867, the military rule of the region is notable for the unfortunate shelling of Angoon. There are several version of the bombardment. In 1882 the American warship Corwin, under the command of Commander Merriman, bombarded the town of Angoon in response to the Tlingit demand for compensation for an accidental death. The destruction of Angoon by the United States naval forces is probably that incident in the community's history which is today most prominent in the minds of the people (de Laguna 1960:158).

On August 20, 1902 the Alexander Archipelago Forest Reserve was established and the Tongass Forest in July 1907. In 1908 the Alexander Archipelago and the Tongass Forest were consolidated into a single national forest, the Tongass National Forest, with a total area of 6.7 million acres and it was enlarged again in 1909 adding another 8.7 million acres (Rakestraw 1994).

3.11.1.1 Affected Environment - Historic and Prehistoric Sites in the Project Area

Review of literature and archival materials identified three previously documented sites in the vicinity of the project area. These are Turn Point Village, Thayer Creek Village, and Stillwater Garden Site. All three sites are outside the area of potential effect; therefore, Forest Service cultural resource specialists did not evaluate these sites for eligibility for inclusion on the National Register. All three sites are potentially eligible for inclusion, however, under Criterion D, based on their potential to yield information important to prehistory.

During field investigations in 2004 and 2005, field investigators identified six newly recorded sites and evaluated them for inclusion on the National Register (see Table 3-10). One site, Thayer Creek Cabin Remains, was determined not eligible because it did not meet any of the criteria for significance identified in 36 CFR 60.4. The other five sites are eligible for inclusion on the National Register. Three of the five sites, Stillwater Depressions, Stillwater Anchorage Collapsed Structure, and Rusty Traps Historic Site, were determined significant under Criterion D, for their potential to yield information important in prehistory or history. The other two sites, West Stillwater Anchorage Historic Cabin and Brightman SUA Residence, were determined significant under Criterion A, for their association with events that have made a significant contribution to the broad patterns of history.

3.11.2 DIRECT AND INDIRECT EFFECTS ON CULTURAL RESOURCES

3.11.2.1 Effects – Historic and Prehistoric Sites

Table 3-10. Historic and Prehistoric Sites in the Angoon Hydroelectric Project Area, Determinations of Eligibility, and Determinations of Effect

Site Name	Site Type	NRHP Eligibility	Criterion[1]	Potential Project Effects
Turn Point	Village	Not Evaluated	N/A	Outside area of potential effect
Thayer Creek	Village	Not Evaluated	N/A	Outside area of potential effect
Stillwater Garden	Garden	Not Evaluated	N/A	Outside area of potential effect
Thayer Creek Cabin Logs	Historic camp	Not Eligible	N/A	N/A
Stillwater Depressions	Prehistoric village	Eligible	D	No Effect
Stillwater Anchorage Collapsed Structure and Shed	Historic cabin	Eligible	D	No Adverse Effect in Alternatives 2 and 3 No Effect in Alternatives 1 and 4
Rusty Traps Historic Site	Historic cabin	Eligible	D	No Adverse Effect in Alternatives 2 and 3 No Effect in Alternatives 1 and 4
West Stillwater Anchorage Cabin	Historic cabin	Eligible	A	No Effect
Brightman Special Use Residence	Historic cabin	Eligible	A	No Effect

Source: Gilliam et al. 2005

[1] Criteria for inclusion on National Register of Historic Places, per 36 CFR 60.4: A - association with events that have made a significant contribution to the broad patterns of history; D - potential to yield information important to prehistory or history; N/A – Not Applicable..

ALTERNATIVE 1 (NO ACTION)

Under this alternative, historic properties throughout the project area would not be affected and they would retain their integrity and natural setting.

ALTERNATIVE 2 (PROPOSED ACTION)

Archaeologists assessed the potential for the proposed Angoon Hydroelectric Project to affect the five historic and prehistoric sites in the project area that are eligible for inclusion on the National Register. The project should be designed to avoid all known sites that are eligible for inclusion on the National Register. This would require integrating the design and engineering specifications with an archaeologist during all phases of project planning, layout and during initial project implementation.

Alternative 2 would potentially impact historic properties at the southern terminus of the overhead transmission line segment and the access/maintenance road paralleling the transmission line. The proposed electrical switch yard, where the submarine cable enters Kootznahoo Inlet, would also potentially impact historic properties in the vicinity. Implementation of Alternative 2 would result in an elevated risk of impacts to undetected sites throughout the project area through ground disturbance associated with building roads, transmission line corridor, powerhouse construction, dam, marine facility, garage, and temporary camp and facilities built to serve during project construction.

The three previously documented sites in the vicinity of the project area are spatially separated from the project footprint and would not be impacted by the proposed project: Turn Point Village is southwest of the project area, Thayer Creek Village is on the north side of the mouth of Thayer Creek, and Stillwater Garden Site is east of a small stream that borders the project area to the east.

During project layout and design the engineers should work closely with the archaeologist to ensure historic properties are avoided through careful planning. The archaeologist will also be required to be on site during project implementation to ensure avoidance of the site during project layout was successful.

ALTERNATIVE 3 (BURIED TRANSMISSION LINE)

Alternative 3 would potentially impact historic properties at the southern terminus of the overhead/buried transmission line segment and the access/maintenance road paralleling the transmission line. The proposed electrical switch yard where the submarine cable enters Kootznahoo Inlet could also impact historic properties in the vicinity unless measures are taken to carefully avoid the sites.

The three previously documented sites in the vicinity of the project area are spatially separated from the project footprint and would not be impacted by the proposed project: Turn Point Village is southwest of the project area, Thayer Creek Village is on the north side of the mouth of Thayer Creek, and Stillwater Garden Site is east of a small stream that borders the project area to the east.

Implementation of Alternative 3 would result in an elevated risk of impacts to undetected sites throughout the project area due to the increased amount of ground disturbance along the 2.2 mile transmission line segment from powerhouse to marine facilities as well as the 4.2 mile transmission line segment from the marine facility to Kootznahoo Inlet in addition to ground disturbance associated with building a road, the transmission line corridor, powerhouse construction, dam, pipeline and penstock, marine facility, garage, and temporary camp and facilities built to serve during project construction.

During project layout and design the engineers should work closely with the archaeologist to ensure historic properties are avoided through careful planning. The archaeologist will also be required to be on site during project implementation to ensure avoidance of the site during project layout was successful.

ALTERNATIVE 4 (SUBMARINE CABLE)

Historic properties would not be expected to be affected under Alternative 4, as this alternative was developed to eliminate uplands impacts associated with the construction of an access road and transmission line. The southern terminus of the submarine cable would be near the existing generating facilities in Angoon.

Implementation of Alternative 4 would result in a decreased risk of impacts to undetected sites throughout the project area due to the decreased amount of ground disturbance associated with a submarine cable. However there would continue to be potential for affects to undetected sites along the 2.2 mile transmission line segment and access road from the powerhouse to marine facilities as well as the construction of a powerhouse, marine facilities, and temporary camp and facilities built to serve during project construction.

3.12 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES - SUBSISTENCE

This section discusses the subsistence resources of the Angoon Hydroelectric Project area as well as the potential effects associated with the alternatives. Information in this section was drawn from the Wildlife Specialist report for this project which in turn tiers to the detailed subsistence information and analyses in the Forest Plan FEIS (USDA Forest Service 2008b).

Section 810 of ANILCA requires the Forest Service to evaluate the potential effects on subsistence uses and needs, followed by specific notice and determination procedures should there be a significant possibility of a significant restriction of subsistence uses.

An ANILCA 810 analysis commonly focuses on those food-related resources most likely to be affected by habitat degradation associated with land management activities and addresses three factors related to subsistence uses: 1) resources distribution and abundance; 2) access to resources; and 3) competition for the use of resources. The evaluation determines whether subsistence uses within the project area or portions thereof may be significantly restricted, as defined by the Alaska Land Use Council, by any of the proposed alternatives.

3.12.1 AFFECTED ENVIRONMENT - SUBSISTENCE

The following paragraphs summarize the subsistence resources of the project area and characterize the subsistence use of the area by local residents. The Forest Plan FEIS subsistence analysis found that the primary subsistence resource likely to be significantly affected by the Forest Plan alternatives was Sitka black-tailed deer. As a result of their association with old-growth forest habitat, deer are considered the "indicator" for potential subsistence resource consequences concerning the abundance and distribution of the resources. Additional information and analysis about the community of Angoon is presented in Section 3.11 (Socioeconomics). Section 3.4 describes fisheries resources and effects in greater detail, and wildlife resources, including deer, are addressed in Sections 3.6 (Wildlife) and 3.7 (Threatened, Endangered, and Sensitive Species).

3.12.1.1 Affected Environment - Subsistence Use and Resources in the Project Area

Subsistence hunting, fishing, and gathering activities are important to the residents of Angoon. Angoon is considered rural under ANILCA and is one of the most traditional Tlingit villages in Southeast Alaska. The community places a high value on Native cultural heritage and tradition, including subsistence hunting, fishing and gathering, and sharing harvest products. The use of locally available wild foods makes important contributions to the local economy, providing a significant and reliable source of food to nearly all residents (George and Bosworth 1988).

ADFG household surveys indicate that between 97 and 100 percent of Angoon's households harvested and used from 216 to 244 pounds of subsistence resources perperson per year. Salmon (71-82 pounds/person) and deer (51-73 pounds/person) are the most used resources

followed by halibut, harbor seal, and marine invertebrates. Berries, herring roe, and seaweed/kelp had high rates of use but lower pounds per person (ADFG 2001).

The project occurs in Wildlife Analysis Areas (WAA) 4042 and 4054. These WAA are important to Angoon residents' subsistence deer harvest. ADFG hunter survey reports indicate that residents of Juneau, Haines, and Sitka harvest deer in these WAA, but they do not obtain a large proportion of their deer here.

Based on ADFG harvest estimates for the area, demand appears stable for the last 11 seasons with average deer harvest for all hunters at 43.5 deer harvested per year in WAA 4042 and 31 deer per year in WAA 4054 (Scott 2008). Angoon hunters take approximately half of the deer harvested in these WAA (USDA FS 2008b). Current harvest rates in these two WAA are well below the sustainable harvest with reasonable success threshold of ten percent of carrying capacity (USDA FS 1997).

3.12.2 DIRECT AND INDIRECT EFFECTS ON SUBSISTENCE

The following subsections describe the effects on Sitka black-tailed deer that would be expected to result from project implementation. Effects on fisheries resources are described in Section 3.5. The proposed Angoon Hydroelectric Project would not be expected to significantly restrict any other subsistence uses within the project area.

3.12.2.1 Effects – Subsistence Use and Resources in the Project Area

ALTERNATIVE 1 (NO ACTION)

Alternative 1 would have no effects on subsistence resources because there would be no project related changes to deer abundance and distribution, access, or competition.

ALTERNATIVES 2, 3, AND 4

Based on the MIS analysis for deer, no substantial changes in deer distribution or abundance are expected from implementing any alternative. Alternative 2 would cause the loss of 0.3% of the quality deer winter habitat in the analysis area, while Alternatives 3 and 4 would cause the loss of less than 0.1% of the quality deer winter habitat. Alternatives 2 and 3 would provide 7.6 and 8.3 miles of new road, closed to motorized traffic, respectively. The new road would provide a relatively easy walking path into the area where none existed before and result in improved access for hunters. Access improvements would be less for Alternative 4 compared to Alternatives 2 and 3. There would be a longer boat ride through less protected water to access the road from Angoon. This alternative would still improve access for hunters compared to the existing condition.

These alternatives are not expected to cause a long-term increase in competition for use of resources in the analysis area. Existing harvest of deer is well below what should be sustainable. This alternative would not favor any other community or group over Angoon residents. During construction, some or most of the construction workers may be from communities other than Angoon. This alternative could increase hunting demand in the analysis area during the construction period but would not be expected to increase demand over the long term. The SUA will include a stipulation that Kootznoowoo develop measures

to control hunting, trapping, and fishing within the project boundary by the construction workforce.

These alternatives do not pose a significant possibility of a significant restriction on subsistence.

3.13 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES - WILDERNESS

The following paragraphs discuss the Wilderness character of the area surrounding the Angoon Hydroelectric Project area, and the potential effects associated with the alternatives. Congress through ANILCA exempted the project area from requirements of the Wilderness Act (ANILCA 506 (a)(3)(D)). This analysis focuses on the effects this project may have on wilderness resources outside of the defined project area, T.49S. R.67E. and T.50S. R.67E. Copper River Base and Meridian. The information in this section was drawn from the Wilderness resource report prepared for this project, which is on file at the Admiralty Island National Monument office.

3.13.1 AFFECTED ENVIRONMENT - WILDERNESS

The proposed project is largely located within the Kootznoowoo Wilderness. The project area and transmission corridor are assigned a Transportation and Utility System Land Use Designation (TUS LUD). A portion of the proposed access road and powerline route is on lands owned by Kootznoowoo, Inc., just north of Kootznahoo Inlet. The Wilderness Act of 1964 directs "each agency administering any area designated as wilderness shall be responsible for preserving the wilderness character of the area." Section 2(c) defines four qualities of wilderness that managers try to preserve:

Untrammeled, or unhindered and free from modern human control, including places where natural forces operate without man's management and manipulation.

No management actions taken in the project area have manipulated the vegetation, soils or watershed function. No animal species have been introduced to this project area, although red squirrels have established themselves throughout Admiralty Island from an introduction approximately 60 years ago. There is no management presence at Thayer Creek or along the proposed road corridor to Angoon, in contrast to the regular presence of rangers in Mitchell Bay. No permits are required to visit the project area. There are no designated campsites required for recreational camping, nor any Forest Closure Orders limiting access to forest lands.

Natural, where ecological systems are substantially free from the effects of modern civilization such as manipulation of vegetation, soils, air quality or other physical and biological components of Wilderness.

No roads or trails have been constructed in the project area. Timber harvest has taken place in the past, but has been limited to hand logging of single trees or possibly of small stands. Botanical surveys have found five species of exotic plants along shorelines. Populations of fish and wildlife appear to be unaffected by habitat alteration, invasive species, or other human activities.

Undeveloped, or without permanent improvements or modern human occupation such as structures, habitations, dams, or other evidence of human presence or occupation.

Thayer Creek flows unimpeded from its source at Thayer Lake to its outlet at Chatham Strait. The stream meanders slowly through several miles of riparian habitat before descending precipitously through a narrow gorge just above the mouth. There is another small section of meander near the mouth on a relatively level bench bordering Chatham Strait. There are no human structures or facilities along the length of Thayer Creek, nor along the proposed road corridor linking the creek to Angoon. One undeveloped campsite is located on the bank of the creek near the mouth, but it contains little evidence of only temporary human use. Other current evidence of human use includes three white metal cross memorials on the peninsula approximately 1.8 miles south of Thayer Creek. There are no current cabins or tent platforms authorized by the Forest Service and no known trespass structures.

Outstanding Opportunities for Solitude or a Primitive and Unconfined Type of Recreation, this is the one quality that defines the human experience in Wilderness. It also includes the values of inspiration or of physical and mental challenge as defined in FSM 2320.3, Wilderness Management.

The project area borders Chatham Strait and is a few miles from the community of Angoon. People use the area for subsistence deer hunting and fishing, largely along the shoreline. Recreational fishing, boating, and picnicking also occur along the shore, especially near the mouth of Thayer Creek. Industrial, recreational, and community boat traffic in Chatham Strait reduce opportunities for solitude along the shore. Opportunities for solitude farther inland are much higher because there is little on-shore use during most of the year. The Forest Plan designates most of the shoreline of west Admiralty Island, including the project area, in the "Primitive" class of the Recreation Opportunity Spectrum. The management standards for this class include encounters with two or fewer other groups per day and no other groups seen from campsites. Although access by water and aircraft is allowed under ANILCA exceptions to the Wilderness Act, use ashore involves walking and hiking off trail. There are no noticeable signs or interpretive facilities, nor any management presence.

Despite the proximity to the community of Angoon and history of subsistence use, the project area has a high degree of natural and undeveloped conditions, and it contains outstanding opportunities for solitude or primitive and unconfined experiences. The Wilderness character is very high, as is typical for most of the Kootznoowoo Wilderness.

3.13.2 DIRECT AND INDIRECT EFFECTS ON WILDERNESS

3.13.2.1 Effects – Wilderness

ALTERNATIVE 1 (NO ACTION)

Under the No Action alternative, no change in the Wilderness character of the project area or the surrounding Wilderness would be expected.

ALTERNATIVES 2, 3, AND 4

All action alternatives would diminish the wilderness character in the project area. The developments associated with Alternatives 2, 3, and 4 would manipulate vegetation, disturb the ground and build and maintain facilities and structures. However, these actions and facilities are allowed and appropriate in the TUS LUD. Since Congress exempted the project

area from requirements of the Wilderness Act through ANILCA section 506 (a)(3)(D) this section focuses on the effects in adjacent wilderness lands.

The effects of all action alternatives on adjacent Wilderness character outside the project area (those areas not exempted from the Wilderness Act) are as follows:

Negative effects on the **Untrammeled** and **Natural** aspects of Wilderness character would likely be confined to the project area, whereas effects to the **Undeveloped** aspect would occur beyond the project area. Any action alternative would decrease the primeval character and influence of the Wilderness as a whole if new structures and developments are installed. Some of the developments may be noticeable to anyone using the air or water travel routes along east Chatham Strait. **Effects to the Outstanding opportunities for solitude or primitive and unconfined recreation**, would also occur beyond the project area. Lands to the north and east of the project area will be less remote as a result of the structures, installations and roads constructed under any action alternative. Since roads will be closed to unauthorized entry they will not improve access to adjacent Wilderness lands but they will be visible or the authorized use of them will be audible from some of the adjacent lands.

Alternative 2 would have the largest effect on Wilderness character in the Kootznooowoo Wilderness as a whole. The inclusion of more road and more suspended transmission line would not only be more visible from adjacent areas, but may also require more maintenance and the associated use of vehicles and other motorized or mechanized tools that impact the undeveloped condition of Wilderness character.

Alternative 3 would reduce the amount of visible impact but still requires a maintenance corridor overland from Kootznahoo Inlet.

Alternative 4 would have the least impact of the action alternatives because of the elimination of the overland transmission corridor beyond the marine facility.

3.14 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES - SOCIAL ECONOMICS

3.14.1 AFFECTED ENVIRONMENT – SOCIAL ECONOMICS

The following information is summarized from information provided by Kootznoowoo in the HDR Feasibility Evaluation Report as well as public comments during preparation of this EIS. The HDR report also includes socio-economic data from other sources.

3.14.1.1 Affected Environment - Economics

POPULATION

According to the latest population estimate available from the U.S. Census Bureau, the population in the city of Angoon was 487 people in 2004, down from 573 people in 2000, and 638 people in 1990 (U.S. Census Bureau 1990, 2000, 2004). This downward population trend is likely due to lack of high-paying jobs in Angoon (USDA Forest Service 2002b). More than 80 percent of the population is American Indian/Alaskan Native (U.S. Census 2000).

COMMUNITY COHESION

Translated from Tlingit, Angoon means "Town on the Portage" and is the only permanent community on Admiralty Island (Kootznoowoo 2006). Tlingit culture places a strong emphasis on family and kinship. Angoon is divided up into clans, and the predominant clan in Angoon is the Bear Clan (USDA Forest Service 2006). Within each clan are various houses. In Tlingit villages like Angoon, clan houses remain an important part of daily life, and are used to host meetings and celebrations. Angoon's strong indigenous heritage is evident in the painted fronts of the 16 clan houses (Welcome to Alaska 2006). In addition to the clan houses, Angoon has modern houses, school buildings, a general store, a lodge, and a bed and breakfast. There are no restaurants.

According to the U.S. Census, there were 228 housing units in Angoon in 2000 (U.S. Census 2000). Thirty-three of these units were vacant, and of these vacant housing units, 22 were used for seasonal, recreational, or occasional use. Of the occupied housing, 123 were owner-occupied and 72 were renter occupied.

Western culture has greatly influenced Angoon, and there is a concern about the loss of the Tlingit language and way of life (USDA Forest Service 2002b). Due to increasing contact with the western world, community leaders are looking for ways to maintain the Tlingit cultural identity. Angoon is a dry community; it is illegal to possess alcohol anywhere within the village limits.

RECREATION

Tourists use the area for sport fishing and camping (USDA Forest Service 2002b). Three outfitters are authorized to operate on National Forest in the area. Other outfitters work on private lands and the surrounding marine waters in Mitchell Bay and Chatham Straits.

ECONOMY

Commercial fishing is a major source of income in Angoon, and 59 residents hold commercial fishing permits (Welcome to Alaska 2006). A shellfish farm venture was recently funded by state and federal grants. The largest employer in Angoon is the Chatham School District. Logging on Prince of Wales Island provides occasional jobs. Subsistence remains an important part of the lifestyle. The most important resources are deer, salmon, bear, halibut, shellfish, geese, and berries. In a 2001 survey, Angoon residents ranked subsistence use 10 out of 10 in terms of importance to the community (USDA Forest Service 2002b).

The unemployment rate in 1999 was 12.95 percent, although 50 percent of all adults were not in the work force (Welcome to Alaska 2006). Per capita income in Angoon in 1999 was $11,357 and median household income was $29,861 (U.S. Census 2000). Almost 30 percent of the population (160 people), was living under the poverty level in 1999. According to the Mitchell Bay Landscape Assessment, Angoon shows potential signs of economic distress (USDA Forest Service 2002b).

A Cold Storage Fish Buying Station was recently constructed in Angoon. The community of Angoon identified this project, as well as the hydroelectric project and others during a 2001 town meeting on economic development (USDA Forest Service 2001).

PUBLIC SERVICES

Angoon has one school attended by about 125 students (Welcome to Alaska 2006). The Angoon Health Clinic provides health services, and Angoon EMS/Ambulance provides auxiliary health care. Scheduled and charter float plane services are available from the state-owned seaplane base on Kootznahoo Inlet. Angoon has a deep draft dock, a small boat harbor, and state ferry terminal. The Alaska Marine Highway provides regular ferry service to Angoon. Freight arrives by barge and ferry.

The Federal Aviation Administration (FAA) is proposing to build an airport to provide commercial service to the City of Angoon. The analysis for an environmental impact statement is currently ongoing.

Utilities

Angoon has a piped drinking water system, and more than 95 percent of the homes in the community have complete plumbing (Welcome to Alaska 2008). A secondary treatment plant processes sewage, which flows to an ocean outfall. The City collects refuse and hauls it to a landfill located approximately 2 miles from Angoon. Angoon is accessible only by float plane or boat (Welcome to Angoon 2008).

The Inside Passage Electrical Cooperative (IPEC) a non-profit, member owned electrical utility serves Angoon, Hoonah, Kake, Kluckwan and the Chilkat Valley. IPEC is the electrical utility provider certified by the Regulatory Commission of Alaska (RCA) to generate and sell electricity in Angoon using diesel-fueled generators. The two existing diesel-fueled generators have a combined capacity of 1,115 kilowatts (one at 565 kW and one at 550 kW).

In 2006 IPEC purchased 167,379 gallons of diesel fuel which was delivered by barge over a marine transfer pipe facility to bulk fuel storage tanks. IPEC has three 20,000 gallon bulk

fuel tanks and a 2,000 gallon day tank at Angoon for a total capacity of 62,000 gallons. Fuel was delivered to IPEC's tanks five times in 2006, sometimes during inclement weather (IPEC 2007).

IPEC's average cost of fuel has risen from $0.7932 per gallon in 1998 to $2.4893 in 2006; an increase of 314%. IPEC's member-owners already pay some of the highest electric rates in the nation, with the 2006 average cost of $0.4623 per kWh. The fuel component of IPEC's cost per kWh sold increased from $0.0811 in 1998 to $0.1998 in 2006 (IPEC 2007). Fuel efficiency based on the average efficiency achieved in 1997 is 13.2 kWh/gallon of diesel fuel (HDR 2000).

Existing Electrical Loads

For the period 1992-97, energy sales in Angoon increased each year until 1997, when sales decreased 10%. By 2000 peak loads in Angoon were relatively stable at approximately 425 kW, and average electrical loads were about 230 kW (HDR, 2000). The loads are somewhat seasonal, with peak loads in the winter months. The table below provides a typical monthly distribution of peak and average loads. Note that the loads shown in Table 3-11 are average values for five years of data. In any one year there may be much greater variability in the loads.

Table 3-11. Alternative 2 (Proposed Action) costs (in year 2000 dollars)

Month	Peak Load, kW	Average Load, kW
January	407	265
February	411	290
March	394	223
April	371	247
May	340	215
June	326	196
July	293	180
August	304	195
September	327	211
October	349	219
November	404	256
December	425	230

Source: HDR Alaska, Inc. 3 March 2000

AIR QUALITY AND CARBON DIOXIDE EMISSIONS

Because of Angoon's location at the entrance to Mitchell Bay along Chatham Straits seasonal wind patterns tend to provide adequate dispersal of airborne pollutants from domestic and industrial sources. The two diesel generators that currently provide electrical power for Angoon operate under the State of Alaska Air Permits Program Preapproved Emissions Limit (PAEL) and are listed as a fuel limited facility (PAEL number AQ0101PL201). Under this program the Angoon facility is limited to a maximum annual consumption of 324,282 gallons of diesel fuel. During 2006 the facility used 153,591 gallons; well within authorized limits. While fuel consumption varies based on electrical demand this represents an average consumption of approximately 420 gallons/day.

The increase in carbon dioxide levels in the atmosphere is of particular concern as the effects of climate change are being felt around the world. Diesel fuel emits approximately 22 pounds of carbon dioxide for each gallon of fuel burned. Since the existing facility burned 153,591 gallons of diesel in 2006 that represents about 1,700 tons per year or an average of 4.7 tons per day.

3.14.2 DIRECT AND INDIRECT EFFECTS ON SOCIAL ECONOMICS

3.14.2.1 Effects – Economics

ALTERNATIVE 1 (NO ACTION)

The two existing diesel-fueled generators have a combined capacity of 1,115 kilowatts (one at 565 kW and one at 550 kW). Diesel generators of this size should last, if properly maintained, for 150,000 or more operating hours.

The existing diesel generator capacity is sufficient to meet loads through 2027 if peak requirements increase at 1 percent annually. However, if the resources are retired prior to then or loads increase at a greater rate, then capacity shortfalls would occur prior to 2027. A 2 percent load growth would result in capacity shortfalls after 2014 (HDR 2000).

With fuel deliveries by barge of 27,000 to 38,000 gallon range at each delivery, five times per year, the potential for a large fuel spill exists. The consequences of a spill, either during fuel delivery or from bulk storage facilities, would be devastating to the waterfront and surroundings of Angoon as well as commercial and recreational fisheries in, and adjacent to, Mitchell Bay.

Under the No Action alternative, electricity prices, already exceptionally high, would continue to fluctuate based on crude oil prices, potentially leading to further population decline. Continuing high electrical rates would also limit opportunities for economic growth and the present high rate of unemployment would continue or increase.

Under Alternative 1 (No Action) the current permit would allow for considerable growth in fossil fuel use with corresponding carbon dioxide and air pollution emissions.

ALTERNATIVES 2, 3, AND 4

All action alternatives would result in the development of a hydroelectric facility at Thayer Creek which would greatly reduce dependence on existing diesel generation facilities. Because of variations in water flow in the creek, no alternative would meet peak electrical demands at all times. One, or both, of the existing generators would be needed to insure uninterrupted electrical power but would only be needed during outages at the hydropower facility or when seasonal demand exceeded available generating capacity. As a result, some bulk fuel storage would continue to be required as well as routine maintenance of the generators.

The project has the potential to generate about 8.5 million kWh/year, which is over 4 times the annual Angoon energy requirement based on 2000 consumption figures (2.0 million kWh/year). The HDR report concluded that the hydropower project, based on minimum in-stream flow requirements of 20 cfs (Alternative 2), would be able to supply all of Angoon's

power needs at 2000 load levels over 99% of the time, with supplementary diesel generation required on an average of 2 days per year. This would likely coincide with periods of low flow in Thayer Creek and high electrical demand in winter. Future growth in electrical demand, and/or higher minimum in-stream flow requirements, would result in additional co-generation requirement. Following publication of the DEIS additional modeling of seasonal flows was done based on extensive flow data from Hasselborg Creek. The modeling generally agreed with the HDR conclusions although the days needed for supplementary generation vary somewhat based on this newer, more accurate data. See section 3.4.2.1, Hydrology in this EIS for more detailed information. That information indicates the number of days requiring supplementary diesel generation would be 4 days at 2000 load levels in Alternative 2.

The specific effects of hydropower development on the electrical rates for Angoon include a number of variables that cannot be accurately predicted at the conceptual stage. The HDR feasibility report includes an update of the 1998 Angoon Power Supply Study to provide an estimate of costs in 2000 dollars. The report also provides a detailed description of several factors including:

- future operation/ownership of the facility,
- present and predicted future fuel costs and consumption,
- average cost of power at 10, 30 and 50 years, with and without project development,
- potential growth in electrical demand and
- potential future availability of other electrical sources.
- Funding sources for construction

Under all action alternatives, assuming grant funding of construction, Angoon would realize reduced electrical rates which would remain relatively stable over the life of the project.

Alternative 2 (Proposed Action) was developed based on the Selected Project Arrangement provided to the Forest Service by Kootznoowoo. Table 3-12 is a summary of estimated construction costs for Alternative 2 (HDR 2000). A much more detailed construction cost discussion is included in the feasibility report, which may be found in the planning record.

Table 3-12. Alternative 2 (Proposed Action) costs (in year 2000 dollars)

Description	Amount
Land and land rights	741,000
Mobilization and logistics	543,000
Structures and improvements	1,587,000
Reservoirs, dams and waterways	715,000
Turbines and generators	366,000
Accessory electrical equipment	110,000
Misc. mechanical equipment	789,000
Substation equipment and structures	48,000
Transmission line	1,173,000
TOTAL DIRECT CONSTRUCTION COST	**6,072,000**
Contingencies	
Equipment	120,000
Transmission line	240,000
General	440,000
TOTAL CONTINGENCY	**800,000**
TOTAL CONSTRUCTION COSTS	**6,872,000**
Permitting and Engineering	
Licensing/Permitting	578,000
Design Engineering	400,000
Construction Management	250,000
TOTAL PERMITTING AND ENGINEERING	**1,228,000**
TOTAL PROJECT COST	**8,100,000**

Operating and maintenance cost for both the hydropower facility and backup diesel facility were estimated by HDR at about $85,000 per year in 1999 dollars.

Construction of the project would take 1 to 2 years and additional employment and income may be created while the project is being constructed. Short-term construction activities are not expected to adversely affect Angoon although housing needs and logistical support during construction may temporarily increase population and stimulate some sectors of the local economy. Existing public services and utilities would not be adversely affected.

It is assumed that operation of the hydroelectric facility would utilize the same number of staff that operate the diesel facility and no long term increase in direct employment would occur.

An indirect effect of all action alternatives would be that some of the economic development projects identified by the community of Angoon would be more economically feasible, particularly those with high electricity demands. These economic development projects

would in turn create jobs for the community and keep the population from declining further. During an Economic Initiatives town meeting in 2001, the community of Angoon identified the hydroelectric project as one of the top 11 high priority economic development projects (USDA Forest Service 2002b).

Alternative 3 and 4 differ economically from the Proposed Action (Alternative 2) primarily in terms of construction and maintenance costs of burying the transmission line (Alternative 3) or utilizing a buried/submarine transmission line (Alternative 4). Alternatives 3 and 4 would reduce or eliminate certain adverse resource effects created by the Proposed Action but would result in differing costs and have differing advantages and disadvantages.

Table 3-13, derived from data provided by Kootznoowoo in their feasibility study (HDR 2000), summarizes both the cost differences and general trade-offs for each transmission line configuration.

Table 3-13. Transmission Line Configuration Comparison

Transmission Line Configuration	Total Length	Estimated Cost	Advantages	Disadvantages
Overhead Transmission Line, submerged at Kootznahoo Inlet crossing (Alternative 2)	6.6 miles	$1,235,000	Least expensive Routine maintenance Standard technology	Most clearing needed, Prone to weather damage, Frequent maintenance
Buried Transmission Line, submerged at Kootznahoo Inlet crossing (Alternative 3)	6.6 miles	$1,303,000	Moderate cost Minimal maintenance Routine maintenance Standard technology Reduced clearing Protected from weather damage Low maintenance	Installation costs uncertain - may vary with terrain and subsurface
Buried/Submerged Transmission Line in Chatham Straits (Alternative 4)	6.9 miles	$1,415,000	Least upland impacts Low maintenance Protected from weather damage	Most expensive Specialized/expensive installation Specialized/expensive maintenance Upland installation costs uncertain - may vary with terrain and subsurface

An overhead transmission line represents the least expensive configuration to construct, although it is much more susceptible to damage during severe weather than a buried or submerged line. Because there would be no connection to the Angoon road system, repair and maintenance, especially during winter months, would be relatively difficult and expensive. In order to reduce the potential for wind throw damage under Alternative 2 vegetation would have to be cleared for approximately one tree-height on either side of the overhead line. The cost of clearing and continued maintenance of this corridor would, to some degree, offset the additional cost of burying the transmission line.

Alternative 3 would require that the transmission line be buried where technically feasible to minimize the visual effects of clearing and of an overhead line. As displayed above, this type of installation is somewhat more expensive than an overhead line but is a common method and practice in the industry. At this conceptual stage there is insufficient field information for an accurate assessment of subsurface conditions along the proposed route. As a result installation costs are more uncertain and may increase considerably if extensive bedrock excavation is required. Because a buried line would be relatively protected from weather related damage, maintenance costs would be lower and reliability of the system higher than with an overhead line. As a result the unanticipated costs of diesel generation during power outages would be less.

Submerged electrical transmission lines are fairly common but costly, and require specialized, expensive equipment for installation and maintenance. Because this specialized equipment is not readily available, a failure of a submerged line would likely result in significant delays for repairs and extended dependence on diesel power generation. Backup generators and fuel storage facilities would have to be designed to accommodate these delays.

Under all action alternatives the need for supplemental diesel generation would be controlled by minimum in-stream flow requirements, electrical demand and unplanned power outages. The discussion of hydrology and potential interruptions in hydropower generation are discussed in the hydrology section of this chapter along with estimated days of diesel generation for each alternative. As with the No Action alternative, the diesel facility would be well within current air quality permit requirements and emissions would be proportional to the days of operation.

In general the highest demand and lowest stream flows occur during winter months. Higher minimum in-stream flow requirements under Alternatives 3 and 4 could result in the need for more diesel generation during this period. Alternative 2, because the overhead line is more susceptible to damage during winter storms, could also result unplanned diesel use. The submerged transmission line in Alternative 4 would not be significantly affected by weather conditions but, if damaged, would be difficult to repair and likely require extended dependence on diesel generation. The buried line required in Alternative 3 would be best protected from weather damage and, as with an overhead line, could be repaired using normal practices and equipment so as to reduce repair time.

In terms of recreation, during the construction period for the approved facilities, one of the approved outfitters may suffer some short-term affects due to the increased activities in the area. This outfitter is approved for brown bear hunting within Unit 04-10. The hunting unit is large enough that he will be able to provide a service to his clients away from the construction area. The other two outfitters are permitted for day use and overnight hiking trips that are well outside the analysis area.

In terms of fuel, spills, and carbon dioxide emissions, less fuel would be needed to generate electricity under the action alternatives; therefore, fewer fuel deliveries would be needed. By reducing the number and size of fuel deliveries, the potential for a large fuel spill is reduced in Alternatives 2, 3, and 4. As with other emissions, the production of carbon dioxide would be proportional to the need for supplementary diesel generation under each alternative.

3.15 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES - TRANSPORTATION

The following paragraphs discuss the Transportation facilities related to Angoon Hydroelectric Project area, and the potential effects associated with the alternatives. The information in this section was drawn from the Transportation resource report prepared for this project, which is on file at the Admiralty Island National Monument office.

3.15.1 AFFECTED ENVIRONMENT - TRANSPORTATION

The proposed project is largely located within the Kootznoowoo Wilderness and a portion on lands owned by Kootznoowoo, Inc. There are no roads on the Admiralty Island portion of the project area.

3.15.2 DIRECT AND INDIRECT EFFECTS ON TRANSPORTATION

Table 3-14. Roads on the Angoon Hydroelectric Project

Description	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Miles of New Forest Road*	0.0	7.6	8.3	4.3

* 0.2 miles of temporary road will be built to the surge tank and decommissioned in Alternative 2.

3.15.2.1 Effects – Transportation

ALTERNATIVE 1 (NO ACTION)

Under the No Action alternative, no change in the transportation facilities of the project area would be expected; the area would remain inaccessible to motorized vehicles.

EFFECTS COMMON TO ALL ACTION ALTERNATIVES

The proposed roads present challenges typical to Southeast Alaska road construction. There are road segments where sides slopes greater than 67% will be encountered. In the following section and in the road cards, the road segment from the marine facilities to the power plant is called the "Powerhouse" road, the segment from the power plant to the diversion dam is called the "Pipeline" road, and the segment from the marine facilities to Angoon is called the "Line" road. The Line road is divided by a large stream near MP 0.8. The preliminary road location did not attempt to find a crossing, which would be very difficult and expensive. Rather, multiple road headings, one from the Angoon side and one from the Little Island side were located instead. A bridge will be necessary across Thayer Creek. Other large stream crossings will require large culverts or bridges. Best Management Practices will be implemented to protect resources before, during, and after road construction. Specific BMPs and additional details about the roads are provided in the road cards. All new road locations and design will meet Forest Plan Standards and Guidelines (2008 Forest Plan, pages 4-80

through 4-87). Effects of roads on other resources are discussed in those resource sections and reports.

The use of the proposed road segments will be limited to administrative and project use only. A physical closure device, such as a gate, would be installed near Angoon to prevent motor vehicle use. The road system will be under the jurisdiction of Kootznoowoo, Inc.

ALTERNATIVE 2

Alternative 2 as proposed consists of road construction on karst terrain for segments of the Powerhouse road. To construct road in this location would require a non-significant amendment to the Forest Plan. The Pipeline road parallels Thayer Creek and would be very costly to construct due to the amount of full bench construction and rock outcrops. The Line road as proposed under this alternative would cross a 100-foot deep notch and require a large bridge. The road would be significantly more difficult to construct because of steep grades and slopes than the road shown in Alternative 3 and the Road Cards.

ALTERNATIVE 3

The proposed road segment from the Thayer Creek bridge site to the dam site was located in Alternatives 3 and 4 to avoid the steep slopes directly above Thayer Creek. An effort was also made to skirt around the wetland areas whenever possible. Alternative 3 as proposed avoids much of the difficult road construction challenges and all of the karst encountered in Alternative 2. Alternative 3 road route follows the preferred road location. Details for the roads are contained in the Road Cards.

ALTERNATIVE 4

Alternative 4 would construct the Pipeline and Powerhouse roads along the same alignment as Alternative 3. Details of these roads are contained in the Road Cards. The Line road would not be required since a submarine cable would be installed from the Marine Access Facility to the Village of Angoon.

3.16 UNAVOIDABLE ADVERSE IMPACTS AND IRREVERSIBLE AND IRRETRIEVABLE RESOURCE COMMITMENTS

3.16.1 UNAVOIDABLE ADVERSE IMPACTS

GEOLOGY

Once a road cut is made across the landscape it is difficult to return to the natural slope profile and drainage conditions. The facilities proposed for this project are the only sources of ground disturbance in the area. Consequently, erosion or drainage from them, as controlled through the application of BMPs described above, would be small relative to the project area. If in the future the project is abandoned, an abandonment plan prepared as part of the SUA would prescribe the removal of all authorized improvements and restoration of the sites (SUA clause V.d). In addition the Code of Federal Regulations (36CFR 261.9, 261.10) provides the means to enforce the removal and restoration of improvements, if necessary. BMPs 14.5, 14.8, 14.18, 14.24, and 14.25 would be applied during site restoration operations to reduce erosion and restore vegetation.

WATER RESOURCES

Short-term turbidity and sedimentation would increase in Thayer Creek below the diversion because of the developments that would occur under Alternatives 2, 3, and 4. Gravel road segments near creeks, or ditches that drain to the creek would deliver fine sediment to Thayer Creek during storm runoff periods. The application of BMPs, limited use of the roads, and regular maintenance of the roads and facilities would prevent or reduce the level of sedimentation to near natural levels.

The reduction of stream flow between the diversion dam and the power plant would continue as long as the plant is in operation. Required instream flows would maintain sufficient flows to maintain channel configuration and function. In addition, high flows would continue to flow through the stream channel and would maintain a flow pattern similar to natural conditions.

If in the future the power plant is abandoned the natural level and pattern of flow would be restored by removal of the diversion dam and pipeline.

FISHERIES

Reduction of Thayer Creek flows and loss of cutthroat trout and anadromous fish habitat would be an unavoidable adverse impact associated with this project. If in the future the project is abandoned, an abandonment plan prepared as part of the SUA would prescribe the removal of all authorized improvements and restoration of the sites (SUA clause V.d), including the dam. Stream flows and the sediment budget would be restored in Reaches C and B, and fish would be able to recolonize them.

VEGETATION

Even with the implementation of design elements intended to minimize the potential negative effects of Alternatives 2 , 3, and 4, project implementation would result in unavoidable adverse impacts to vegetation (including beach fringe), and wetlands.

WETLANDS

Avoidance of wetlands where practicable, along with implementation of mitigation measures, would likely reduce but not entirely eliminate adverse affects to wetlands. Such affects would include permanent loss of wetlands within road prisms and at construction sites, e.g., power plant, port facilities. In addition, the introduction of fill material for road construction may affect surface or subsurface hydrology. In some cases, ponding may occur on the upstream side of the road bed; in others, side ditches or coarse fill may act as a conduit, reducing saturation of soils in the vicinity of the roadway. These and other effects may also influence wetland vegetation in the vicinity of road corridors.

WILDLIFE

Reduced stream flow in Thayer Creek below the diversion dam would reduce the availability of habitat and foraging opportunities for river otter and some migratory bird species. In addition, reduced availability of suitable spawning substrate would diminish foraging opportunities for wildlife species that depend on salmon, such as brown bear. Also, the increased human presence associated with project construction and operation would inevitably increase the risk of human/bear encounters. Some old-growth forest habitat would be converted to road, buildings, shrub, and aquatic habitat.

THREATENED, ENDANGERED, AND SENSITIVE SPECIES

Elevated levels of human activity associated with construction and maintenance of the hydroelectric facility and related project components may disturb species that are sensitive to human presence, such as Queen Charlotte goshawk and osprey. Clearing of vegetation for the transmission lines, access roads, and construction staging areas would reduce the availability of potential nesting and foraging habitat for Queen Charlotte goshawks. Clearing that occurs near the shoreline may reduce the availability of potential nesting, feeding, and perching trees for osprey. These habitat changes may affect individuals but would not cause a trend toward listing.

SCENERY

The project area is in designated Wilderness, and currently does not include any visible signs of modification from the natural landscape. Viewers would perceive any visible modification to the project area that does not look like a natural disturbance or landscape pattern as an adverse effect. Although all action alternatives would meet the standards and guidelines for the Transportation and Utilities Systems (TUS) land use designation, all three action alternatives include elements that would be visible and contrast with the surrounding landscape.

As recognized by the standards and guidelines for the TUS land use designation, major infrastructure projects generally contrast with the surrounding forestland, often leading to

impacts on the scenery for sensitive viewers. Visitors to the project area who have an expectation of viewing wilderness would likely perceive the changes to the landscape negatively.

CULTURAL RESOURCES

Any ground-disturbing activity carries the risk of damage to buried or otherwise hidden historic properties. Measures can be taken to avoid affects to know historic properties include the working closely with the archaeologist during project lay out to avoid adverse effects to historic properties supplemented with the presence of archaeological monitors during project construction. These two measures would be expected to minimize the potential for adverse effects to significant historic and prehistoric resources.

SUBSISTENCE

Impeding deer movement by the development of the transmission lines and road, and laying the pipeline is an unavoidable impact on Sitka black-tail deer. While individual deer, especially fawns, may be unable to negotiate the obstacles, the deer population overall would be able to circumvent them and maintain normal movement patterns.

WILDERNESS

All action alternatives would diminish the untrammeled, natural, and undeveloped characteristics of the project area, and outstanding opportunities for solitude characters in the project area. Negative effects on the untrammeled and natural aspects of Wilderness character would likely be confined to the project area, whereas effects to the undeveloped aspect and outstanding opportunities for solitude would occur beyond the project area. The Forest Service recognizes that Congress exempted the project area from requirements of the Wilderness Act through ANILCA section 506 (a)(3)(D).

SOCIAL ECONOMICS

The proposed project would not have any unavoidable adverse impacts on social economics in Angoon.

3.16.2 IRREVERSIBLE AND IRRETRIEVABLE RESOURCE COMMITMENTS

An irreversible commitment of resources refers to the loss of production or use of a resource due to a land use decision, that once execute, cannot be changed. An irretrievable commitment of resources applies to losses of production or use of renewable resources for a period of time.

Minor amounts of soil loss and displacement would result from any of the alternatives. Overall, there would be some soil loss due to erosion, and a slight increase in sediment production with any of the action alternatives. Road construction in Alternatives 2, 3, and 4 would cause the greatest concentration of soil displacement and sediment movement. BMPs would be adequate to keep impacts within acceptable limits set forth in the Forest Plan.

Soil loss from roads and rock used for road construction would be irreversible. Wetland loss from roads, staging areas and a powerhouse would be irreversible since they would be rocked over.

Wilderness and scenic values in the project area, fish habitat in the bypass section of Thayer Creek, and some wildlife habitat would be irretrievable during the life of the hydroelectric facilities. If the project is abandoned, these uses would be restored though possibly not to the current level.

3.17 CUMULATIVE EFFECTS

Resource-appropriate areas for cumulative effects analysis were identified in resource reports. For example, the soil and wetland analysis areas for cumulative effects are all watersheds on which road building may occur, and the cumulative effects area for water resources includes the Thayer Creek watershed and the coastal areas and unnamed streams from immediately north of Thayer Creek south to Kootznahoo Inlet.

This project is located mainly in the Admiralty Island National Monument and Kootznoowoo Wilderness. The project area is covered under the Alaska National Interest Lands Conservation Act of 1980 (ANILCA). However, the act specifically exempted the hydropower project from the requirements of the Wilderness Act. Therefore, the proposed hydroelectric facility and associated development is the first development allowed within the Wilderness portion of the project area. Other activities such as recreational use and activity related to a private sport-fishing lodge at Thayer Lake occur in the Wilderness area but are not known to have any effects on streamflow or water quality.

Because most resources' cumulative effects areas lie within the Wilderness area near the proposed project, this is the only development, past, present, or future with effects on those resources. With no overlap in space or time of other activities that would add to the impacts of this project for all resource but wildlife, fisheries, and socioeconomics, no cumulative effects on those resources would occur under any alternative.

For fisheries, with the analysis area being a Wilderness National Monument LUD, past and future effects to fisheries will likely be minimal. Given the distance of approximately 6 miles to the lodge, this project will have no effects on the fishery-related operations of the private sport-fishing lodge at Thayer Lake. Cumulative effects could include delayed recolonization of cutthroat trout in the bypass reach of Thayer Creek as a result of lodge-related fishing pressure, but given the size of Thayer Lake, impacts from this sport-fishing would be negligible.

An airport facility for Angoon has been proposed and is being analyzed. The proposed location is approximately three air miles southeast of Angoon on the northeast side of Favorite Bay. A very small portion of the proposal is in Wilderness area. The proposed airport would occupy an estimated 270 acres, plus a 3.5 acre "apron" for the terminal and tie-downs, and an access road from Angoon (alternatives range from 2.0 – 4.4 miles of new road). Portions of the proposed airport are only a short straight-line distance (approximately 3 air miles) from the Angoon Hydroelectric Project, but a long traverse over land. No improvements would connect the two projects.

While this project does fall within cumulative effects analysis area for wildlife, the airport proposal is in a very preliminary stage. All displayed alternatives in ADOT 2007 would impact low elevation forest, but the effects in terms of location and acreage of habitat are currently unknown. The airport is intended to provide improved access for Angoon. Whether this would increase outside hunters' competition for local subsistence resources is unknown. The airport road would provide easier access for deer hunting close to Angoon. Further details on impacts to subsistence resources are unknown at this time. The airport EIS will further analyze cumulative effects if over-lapping effects are expected.

The development of hydroelectric power in combination with other recent efforts to provide economic stability to Angoon, such as the Cold Storage Fish Buying Station, tourism-related businesses, and the proposed construction of an airport, would cumulatively benefit the economy of Angoon. The airport is intended to provide improved access for Angoon. Whether this would increase recreational, hunting, or subsistence use of the Angoon hydroelectric project area is unknown.

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Chapter 4
Lists

Changes Between Draft EIS and Final EIS

Chapter 4 –

- IDT membership changes were made.
- The mailing list, literature cited list and the index were updated.

4. Lists

4.1 LITERATURE CITED

Specialist Reports prepared for both the Draft EIS and the Final EIS of this project are referenced throughout the Draft and Final EIS. Those documents are available for review in the project record, but have not been included in the literature cited list below.

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4.2 LIST OF PREPARERS

This Final EIS was prepared by Forest Service resource specialists. The list below identifies the individuals responsible for conducting and documenting the analyses in this Final EIS.

4.2.1 Forest Service Interdisciplinary Team

Contributor	Title and Office	Project Role
Dennis Rogers	ID Team Leader, Admiralty Island National Monument	ID Team Leader
Ellen Anderson	Botanist, Juneau Ranger District	Threatened, Endangered, and Sensitive Plants and Invasive Plants
Jim Baichtal	Forest Geologist, Supervisor's Office	Karst
Jennifer Berger	Special Use Permit Administrator, Juneau Ranger District/Admiralty Island National Monument	Lands and Special Use Permits
Dennis Chester	Wildlife Biologist, Juneau Ranger District	Wildlife
Myra Gilliam	Archaeologist, Admiralty Island National Monument	Cultural Resources
Vaughn Hazel	Construction Engineer, Supervisor's Office	Road/Powerline Location and Construction
John Neary	Wilderness Field Manager, Admiralty Island National Monument	Wilderness
Michelle Putz	Writer/Editor, Supervisor's Office	Writer/Editor
Pete Schneider	Fisheries Biologist, Juneau Ranger District	Fisheries
Darin Silkworth	Soil Scientist, Supervisor's Office	Soils and Wetlands
Quentin Smith	Civil Engineer, Wrangell Ranger District	Road/Powerline Location and Construction
Jim Steward	Landscape Architect, Supervisor's Office	Scenery
Julianne Thompson	Hydrologist, Supervisor's Office	Water Resources

4.3 LIST OF FEIS RECIPIENTS

The following agencies, organizations, and individuals were provided with a copy of the Angoon Hydroelectric Project Final Environmental Impact Statement.

4.3.1 AGENCIES

Alaska Department of Natural Resources, Div. of Coastal & Ocean Management (formerly OPMP)
Alaska Department of Transportation
(State of Alaska) Citizens Advisory Commission on Federal Areas
(Alaska) State Historic Preservation Officer
U.S. Environmental Protection Agency, Region 10
National Marine Fisheries Service
U.S. Army Corps of Engineers
U.S. Department of the Interior, Office of Environmental Policy & Compliance
U.S. Fish and Wildlife Service
USDA Forest Service, Supervisor's Offices, Ketchikan, Petersburg, and Sitka
USDA Forest Service, Regional Office, Juneau
USDA Forest Service, Tongass National Forest, Admiralty National Monument
USDA Forest Service, Tongass National Forest, District Offices

4.3.2 TRIBES AND TRIBAL CORPORATIONS

Angoon Community Association
Central Council Tlingit & Haida Indian Tribes of Alaska
Goldbelt Incorporated
T&H Central Council
Kootznoowoo, Inc.
Sealaska Corporation

4.3.3 LIBRARIES

Alaska State Library
Angoon Public Library
Craig Public Library
Douglas Public Library
Elfin Cove Public Library
Haines Public Library
Hollis Public Library
Hoonah Public Library
Hyder Public Library
Juneau Public Library
Kake Community Library

Kasaan Community Library
Ketchikan Public Library
Kettleson Memorial Library
Mendenhall Valley Public Library
Pelican Public Library
Petersburg Public Library
Skagway Public Library
Stratton Library
Tenakee Springs Public Library
Thorne Bay Community Library
Wrangell Public Library
University of Minnesota, Forestry Library
USDA Forest Service, National Agricultural Library

4.3.4 ORGANIZATIONS AND BUSINESSES

Alaska Power & Telephone Co.
Angoon Trading Co., Inc.
Bear Creek Outfitters, Inc.
Center for Science in Public Participation
City and Borough of Juneau, Community Development Department
Coeur Alaska, Inc.
Friends of Admiralty Island
Inside Passage Electric Cooperative (IPEC)
Juneau Empire
Southeast Alaska Conservation Council
Southeast Conference
Thayer Lake Lodge
The Wilderness Society

4.3.5 PUBLIC OFFICIALS AND OFFICES

Mayor-City of Angoon
Mayor-City of Hoonah
Mayor-City of Pelican
Mayor-City of Tenakee Springs
State Representative Albert Kookesh

4.3.6 INDIVIDUALS

Don Bremner
Gina Evans
Carl Ferlauto
Matilda Gamble
Marian George

Floyd Kookesh
Peggy Metcalf
Peter Metcalfe
Mike Nelson
A. DeWitt Paul
Vern Rauscher
Jan Trigg
Scott Willis

4.4 LIST OF FEIS NOTIFICATIONS

The following agencies, businesses, and organizations were sent a letter summarizing the EIS and notifying them of the website location of the Angoon Hydroelectric Project Final Environmental Impact Statement.

Alaska Department of Environmental Conservation, Division of Air and Water Quality
Alaska Department of Fish and Game
Alaska Department of Fish and Game, Division of Subsistence
Alaska Department of Fish and Game, Office of Habitat Management and Permitting
Alaska Department of Fish and Game, Sport Fish Division
Alaska Department of Fish and Game, Department of Wildlife Conservation
Alaska Department of Governmental Coordination
Alaska Department of Natural Resources, Division of Mining, Land, & Water
Advisory Council on Historic Preservation
Federal Aviation Administration
Federal Energy Regulatory Commission (FERC)
Federal Highway Administration
NOAA Office of Policy and Strategic Planning
U.S. Army Engineer, Pacific Ocean Division
U.S. Coast Guard
U.S. Department of Energy
USDA APHIS PPD/EAD
USDA Natural Resources Conservation Service, National Environmental Coordinator

Alaskans for Juneau
Audubon Alaska, Anchorage
Audubon Society, Juneau
Campaign to Safeguard America's Waters
Cascadia Wildlands Project
Earth Justice Legal Defense Fund
Friends of Berners Bay
Gateway Technologies, Inc.
HDR Alaska
KTOO
Meridian Environmental
Sierra Club, Juneau Group

Taku Conservation Society

State Senator Georgianna Lincoln
Senator Tom Begich
Representative Don Young

William Brent
Betsy Burdett
William M. Cox, MD
Andrea Doll
I. Cannon Geary
Steve Gilbertson
Karla Hart
Molly Hodges
John Hudson
Morry Israel
Mark Kistler
Deborah L. Levine
Debbie Manion
Samual McBean
Ben Mitchell
Daniel Nelson
Maryellen Oman
Jerry Reinwand, LLC
B. Sachau
Lynn J. Schimmels
John R. Swanson
Curtis Terrall
William Leighty and Nancy Waterman

4.5 INDEX

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