

LEG. FINANCE - BILLS 1979 - 1980 1255

SB 63 cont. , 1255

DESIGN

Activity Designation: D-25

Activity: Conduct foundation-type studies.

Description: This will involve a study of various types of footings for the various towers and the different types of foundation material that will be encountered. Close coordination will be maintained with foundations personnel during this study. Some areas may be in permafrost, some on rock, some on gravel and others in muddy or boggy areas. This study will be made almost simultaneously with D-24. In some areas consideration may be given to using a recast foundation carried to the site by helicopter or truck.

Seasonal Constraint: Site visits in summer or fall.

Cost: \$30,000

DESIGN

Activity Designation: D-26

Activity: Conduct substation studies.

Description: This will determine requirements for substations, their location, and general layout. It will include the investigation of location for substations at all line terminations including expected future expansion. It might involve some research into special items for cold weather. Field verification of locations would be made. Preliminary studies would look at economical and operational advantages of various bus schemes and breaker arrangement for each installation. Number of circuit breakers and ratings of power transformers will also be determined. Major equipment items such as transformers, circuit breakers, lightning arrester and switches will be included. Protective relaying, supervisory controls, telemetry, and related communication equipment for each switchyard and substation will be investigated.

Seasonal Constraint: Verification of sites in summer or fall.

Cost: \$114,000

DESIGN

Activity Designation: D-27

Activity: Conduct switchyard studies.

Description: This study will consist of the locating and laying out of switchyards. This will include ties between powerhouse and switchyards as well as possible tie in at a switchyard of a line coming in from another dam. Research may be necessary into special items for cold weather. Major equipment items such as transformers, circuit breakers, lightning arrestors, and switches will be included. Protective relaying, supervisory controls, telemetry, and related communication equipment required will be investigated. This study will be made in conjunction with D-26.

Seasonal Constraint: None

Cost: \$76,000

DESIGN

Activity Designation: D-28

Activity: Estimate transmission facilities cost.

Description: Initially this will involve estimating alternative routes as well as type of line construction for project feasibility. A detailed cost estimate will also be made of final located transmission line and supporting facilities.

Seasonal Constraint: None

Cost: \$18,000

DESIGN

Activity Designation: D-29

Activity: Conduct route studies.

Description: This activity will select the routes for construction and permanent access to the Upper Susitna basin and selected dam sites. In the preliminary stages alternate routes will be located from both the Anchorage-Fairbanks highway and the Denali highway. Map and aerial photo reconnaissance will be made followed by field reconnaissance along alternate routes. Preliminary route selection will be followed by field verification. Final location will be an iterative process of adjusting locations and grades based on field and office meetings with personnel working on foundations and structures (bridges). Clearing requirements and disposition of merchantable and nonmerchantable timber will be determined.

Seasonal Constraint: On-site investigations will be made in the summer.

Cost: \$78,000

DESIGN

Activity Designation: D-30

Activity: Conduct bridge studies.

Description: These studies will determine number and type of bridges required on the access routes to the dams. They will include temporary and permanent bridges of wood, steel, and concrete construction. The designer must work closely with the foundations people as well as the route selection personnel. Foundation design may vary from rock to permafrost. At some point in the study on-site investigations will be required of the final route location. These visits will involve all disciplines to insure that final selection is the best location and the most economical.

Seasonal Constraint: Foundations information and site investigations are restricted to period when no snow is on the ground.

Cost: \$60,000

DESIGN

Activity Designation: D-31

Activity: Estimate selected route costs.

Description: This will include construction estimates of alternate routes including bridges, culverts, etc., to allow selection of a final route. A detailed cost will be prepared for the final route.

Seasonal Constraint: None

Cost: \$21,000

DESIGN

Activity Designation: D-32

Activity: Conduct field survey.

Description: A study will be made of aerial photos for the reservoir area to determine areas which may require clearing. Some on site inspections will be required to verify photo studies or to obtain data not available on the photos. Sufficient information will be required to provide an estimate of clearing costs.

Seasonal Constraint: This can best be accomplished during summer.

Cost: \$8,000

DESIGN

Activity Designation: D-33

Activity: Conduct marketability and disposal study.

Description: This will be a study of trees within reservoir area to determine types, size, and quantities. Market location will be determined for feasibility of marketing the trees. Disposal methods and areas will be studied to determine disposal methods that are economical and environmentally sound. Possible logging roads should be considered in this phase. Study will require some on site investigation and some soils information in any proposed burial areas.

Seasonal Constraint Best accomplished during summer.

Cost: \$20,000

DESIGN

Activity Designation: D-34

Activity: Estimate clearing costs.

Description: Detailed estimate will include a study of the economics of removing timber for sale versus disposal on site. Disposal will look at burning and burying. Removal will have to consider requirements for additional roads into the reservoir area.

Seasonal Constraint: None

Cost: \$8,000

DESIGN

Activity Designation: D-35

Activity: Determine camp requirements.

Description: An estimate will be made of the number of construction management personnel on site as well as the number of operations and maintenance personnel to run the project. The requirements for buildings and camp support facilities will then be developed. This will also require a determination of how construction support offices will be handled, staffed, and located. This should include a determination of whether one camp could support more than one dam site. Once these requirements have been determined the location and layout of camps can proceed. This does not include facilities for contractor personnel.

Seasonal Constraint: None

Cost: \$30,000

DESIGN

Activity Designation: D-36

Activity: Study location and layouts.

Description: This will involve a selection process of picking a camp location(s) (including site visits) which will best support the scheme of construction management and project operations. It will involve siting and sizing a camp to handle the number of persons and type of activities involved. Consideration will have to be given to living accommodations, working spaces, equipment storage, and maintenance, schooling, etc. Water, sewage, garbage, lights, etc., will have to be considered.

Seasonal Constraint: Site visits will be made in summer.

Cost: \$40,000

DESIGN

Activity Designation: D-37

Activity: Estimate camp costs.

Description: A detailed cost estimate of the construction camp facilities required to support construction management as well as the permanent camp facilities which will support the project operation scheme will be made.

Seasonal Constraint: None

Cost: \$10,000

DESIGN

Activity Designation: D-38

Activity: Study upstream and downstream effects.

Description: This study will make a cursory investigation of the effects the various dam pools have on upstream and downstream river levels. The selected plan will require a much more detailed investigation of the effects the dams have on upstream and downstream river levels. Some of the items to be investigated are as follows: bank erosion, stream flows, flow effects on fisheries, requirements for reregulating dam, downstream flooding, etc. These studies could dictate the need for a reregulating dam, bank protection, flood plain zoning, channel excavation, and realignment.

Seasonal Constraint: Some field work would be required in summer months.

Cost: \$75,000

DESIGN

Activity Designation: D-39

Activity: Determine model studies to consider.

Description: This activity would take place after the selected plan is determined. From the various areas of hydraulic concern, one would work up a list of desirable model studies which should be made prior to final design. Some of these model studies would probably be started prior to completion of detailed feasibility studies if required to assure design verification for estimate of project costs.

Seasonal Constraint: None

Cost: \$4,000

REAL ESTATE (RE)

THE REAL ESTATE ACTIVITIES HAVE A TWOFOLD PURPOSE. THE FIRST IS TO DETERMINE OWNERSHIP OF LAND IN THE PROJECT AREA AND ESTABLISH LAND VALUE. THE SECOND IS TO ARRANGE FOR ENTRY TO PRIVATE LAND FOR PURPOSES OF ACCESS OR FIELD WORK.

INVESTIGATIONS AND DETERMINATIONS.

1. Conduct real estate field investigations.
2. Make real estate legal determinations.

RIGHTS OF ENTRY.

3. Obtain rights of entry for survey and exploration at dam sites.
4. Obtain rights of entry for survey and exploration along access road.
5. Obtain rights of entry for survey and exploration along transmission corridor.

REAL ESTATE

Activity Designation: RE-1

Activity: Conduct real estate field investigations.

Description: This activity will begin with an aerial inspection to familiarize real estate personnel with the physical characteristics affecting land value in the project area. Ownership information will then be gathered from records of assessors, recorders, BLM and the State Division of Lands. Interviews will be conducted with land owners and area residents to acquire knowledge of future developments, and to assemble information on opinions regarding the proposed project. From these interviews and the information developed in other studies (EC-4 through 6 and PM-2 through 4), the local area's development trends will be assessed. Comparable sales data will be collected to determine the market value of the project areas.

Seasonal Constraint: None

Cost: \$7,000

REAL ESTATE

Activity Designation: RE-2

Activity: Make real estate legal determinations.

Description: Title evidence as to ownership will be secured, and the validity of interests will be determined. Also, such outstanding interests as mining claims, nature claims, easements, etc., will be researched. An investigation will be conducted and a determination made of compensable interests, if any, of the rights held by third parties in the real estate to be acquired. A compensable interest study must be written for each such interest. Also, legal research will be conducted as to the effect of the Alaska Native Claims Settlement Act, the Alaska Statehood Act, and other applicable laws on the existing power site withdrawal.

Seasonal Constraint: None

Cost: \$33,000

REAL ESTATE

Activity Designation: RE-3, 4, 5

Activity: Obtain rights of entry, as necessary, prior to entry at damsites, along the access route, and along the transmission corridor.

Description: Land owners in the project area will be contacted by mail, telephone, and personal visits to obtain the proper authorization for entry in order to conduct reconnaissance and exploration. The effort involved in arranging entry to the dam and reservoir areas is relatively minor because of the power withdrawal status of the prospective dam sites and of portions of the reservoir sites. More time-consuming will be seeking permission for entry from property owners along the access and transmission routes.

Seasonal Constraint: None

Cost: \$19,000

CULTURAL RESOURCES (C)

THESE ACTIVITIES OUTLINE FIELD AND LITERATURE SURVEYS TO LOCATE, MAP, AND DESCRIBE THE SIGNIFICANT ARCHEOLOGICAL AND HISTORIC SITES WITHIN THE PROJECT AREA. THE SURVEY FINDINGS ARE THEN INCORPORATED IN THE DETAILED FEASIBILITY ANALYSIS.

ARCHEOLOGICAL

1. Conduct an archeological reconnaissance.

HISTORICAL

2. Locate, map, and describe all significant historic properties within areas of project impact.

CULTURAL RESOURCES

Activity Designation: C-1

Activity: Conduct an archeological reconnaissance.

Description: This study will consist of selected field examinations of the proposed project area(s). The study will be designed to test and refine data from the Preliminary Assessment, entitled "Heritage Resources Along the Upper Susitna River," prepared by the Alaska Division of Parks in August 1975. The study will provide factors on which an intensive survey can be planned and budgeted. It will also include field examination of selected and potential prehistoric properties identified in the Preliminary Assessment. The objective here will be to determine the probable number and types of prehistoric resources within the project areas and the probable impact of the project on those resources.

At the end of the field work, a Cultural Resources Reconnaissance Report (the Cultural Resources Appendix) will be prepared which will also include data related to historic resources identified under Activity C-2. The report will estimate the number and probable distribution of sites within the project areas, and will recommend a research design and subsequent cost estimate for the program. The intensive survey will not be undertaken until after the project feasibility analysis has been completed and a decision is made regarding project construction. At that time, and prior to construction impacts, an intensive on-the-ground survey of the project area will be undertaken, under separate contract, to locate all the cultural resources within that area and to evaluate the impact of the project upon those resources. The intensive survey would still involve only minimal field testing as necessary to determine potential eligibility of sites for inclusion in the National Register.

Seasonal Constraint: Field work can be accomplished only during snow-free periods when soils are unfrozen.

Cost: \$100,000

CULTURAL RESOURCES

Activity Designation: C-2

Activity: Locate, map, and describe all significant historic properties within areas of direct project impact.

Description: The purpose of this study is to identify all significant historic properties which would be impacted by the project, describe what types of impacts will occur, and recommend procedures for mitigation or preservation of such sites. Work will primarily be accomplished by searching documents related to historical aspects of the immediate project area(s), and to the specific historic properties located within project impact areas. This research will establish the settlement, construction, occupation, and related historical record of events which followed the discovery of the Susitna River by Captain James Cook in 1778. Field work related to this activity will be relatively minor, primarily consisting of search for or verification of properties described in existing documents, and will be accomplished concurrently with prehistoric survey activities described in C-1. Results of the historic properties survey will be included as appropriate in the Cultural Resources Reconnaissance Report described under C-1.

Seasonal Constraint: Field work will be subject to the same constraints as activity C-1.

Cost: \$10,000

FIELD CAMP (FC)

THE TWO ACTIVITIES IN THIS CATEGORY ADDRESS THE EFFORT REQUIRED IN DESIGNING, CONSTRUCTING, AND OPERATING A CAMP AND AN AIRSTRIP IN THE PROJECT AREA DURING THE PROJECT FEASIBILITY ANALYSIS. THE FACILITIES WILL BE USED BY PEOPLE ENGAGED IN SURVEY, BIOLOGICAL, GEOLOGICAL, AND HYDROLOGICAL FIELD WORK.

FIELD CAMP

1. Design, construct, and operate field camp.

AIR FIELD

2. Design and construct airstrip.

FIELD CAMP

Activity Designation: FC-1/1a

Activity: Design, construct, and operate field camp.

Description: This activity will consist of the design, construction, and operation of a field camp for personnel required for early drilling, surveying, environmental studies, etc. Camp size and use is based on an average of 40 people in camp 180 days per year, and over a 3 year period. This estimate is based on the assumption that at the end of the 3-year use period, camp removal cost would equal salvage value. Leaving the camp in place would result in a cost saving for later project work. The camp will be of modular construction, and probably will be lifted in by Sky-crane.

Seasonal Constraint: None

Cost: \$1,500,000 (\$1,000,000 operations ^{1/}
500,000 design, purchase, and construction)

^{1/} Operation cost is based on an average of 40 men @ \$50/day for 180 days per year for a 3 year period.

FIELD CAMP

Activity Designation: FC-2

Activity: Design and construct airstrip.

Description: This activity consists of the design and construction of a small landing strip, 100 feet by 2,000 feet, near the camp. This strip will initially be a small bush strip, with the possibility that size will be increased when construction commences. The airstrip will be used to support the field camp.

Seasonal Constraint: Construction after break-up.

Cost: \$125,000

BIOLOGICAL STUDIES (B)

THESE ACTIVITIES DESCRIBE THE FIELD WORK AND IMPACT ANALYSIS ASSOCIATED WITH THE BIOLOGICAL ENVIRONMENT AFFECTED BY THE PROJECT. FIRST, THE ABUNDANCE, DISTRIBUTION, AND HABITAT REQUIREMENTS OF VARIOUS SPECIES ARE DETERMINED THROUGH FIELD SURVEYS. UTILIZING INFORMATION RELATED TO PRE- AND POST-PROJECT HYDROLOGIC CONDITIONS, THE IMPACTS ON CRITICAL HABITAT ARE IDENTIFIED AND EVALUATED. PROBABLE EFFECTS OF THE PROJECT ON PLANTS AND ANIMALS ARE IDENTIFIED. MITIGATIVE OR ENHANCEMENT MEASURES ARE DETERMINED.

VEGETATIVE COVER.

1. Obtain necessary aircraft/satellite imagery and utilize manual interpretive techniques and automatic data processing techniques to type vegetation within areas of project impact.

STUDIES OF AQUATIC ANIMAL AND PLANT LIFE.

2. Identify and determine project impacts on significant invertebrate species.

ANADROMOUS FISHERY STUDIES.

3. Determine relative abundance, distribution, migrational characteristics, and habitat requirements of anadromous fish within impacted areas, and locate and define the seasonal freshwater habitat requirements important to the successful migration, spawning, incubation, and rearing of these species.
4. Determine project effects on anadromous fish.

RESIDENT FISH STUDIES.

5. Determine relative abundance, distribution, and habitat requirements of resident fish within impacted areas, and locate habitat critical to successful spawning and rearing of these species.
6. Determine project effects on resident fish.

ESTUARINE STUDIES.

7. Identify and assess effects of altered outflow of the Susitna River upon the estuarine area in upper Cook Inlet estuary.

BIOLOGICAL STUDIES (cont.)

MOOSE STUDIES.

8. Identify and map moose habitat within impacted areas, locate critical habitat, determine habitat condition and carrying capacity, and identify water conditions associated with moose habitat.
9. Identify moose subpopulations and determine the seasonal distribution, movement patterns, size and trend of those subpopulations within areas of project impact, and determine the timing and degree of subpopulation dependency on impacted habitat.
10. Determine impact of project upon moose habitat and populations.

CARIBOU STUDIES.

11. Identify and map caribou habitat associated with alternate transmission corridors and areas subject to impoundment and determine the seasonal ranges and migration routes of caribou with emphasis on traditional migration routes with respect to the proposed impoundment areas.
12. Determine project impacts upon Nelchina caribou herd.

STUDIES OF OTHER MAMMALS.

13. Inventory the number, size, territory, and other essential activity areas and determine and evaluate probable project impacts on wolf packs which inhabit areas that will be directly impacted by the project.
14. Estimate black and brown/grizzly bear populations and distribution in the project impact area and determine and evaluate probable project impacts.
15. Determine the general abundance and distribution of wolverines in the project impact area and determine and evaluate probable project impacts.
16. Determine the relative abundance of Dall sheep inhabiting mountains adjacent to the project impact area and delineate seasonal ranges. Determine and evaluate probable project impacts.
17. Determine the relative abundance and distribution of fur bearer, small game, nongame, and bird species in the proposed impoundment areas and determine and evaluate probable project impacts.

STUDIES OF RARE AND ENDANGERED SPECIES.

18. Determine whether any rare and endangered species of plants, fish, birds, mammals, or other wildlife are present in the project area, and evaluate impacts of the proposed action on these species.

BIOLOGICAL STUDIES (cont.)

STUDIES RELATED TO ECONOMIC VALUE OF FISH AND WILDLIFE.

19. Determine annual harvest rates of species of fish and wildlife utilized for commercial and recreational purposes, and estimate changes expected as a result of the project. Determine importance of impacted species to regional populations.
20. Identify and display damages to fish and wildlife in monetary terms and determine measures required to reduce or offset damages or to enhance existing habitat.

IMPACTS OF ENERGY ALTERNATIVES.

21. Identify and describe environmental components and impacts related to each alternative identified as a possible solution to electrical energy needs.

BIOLOGICAL STUDIES

Activity Designation: B-1

Activity: Obtain necessary aircraft/satellite imagery and utilize manual interpretation and automatic data processing techniques to type vegetation within impoundment areas, downstream flood plain, and along transmission corridors.

Description: LANDSAT-1 and 2 and/or ERTS imagery will be compiled from existing depositories, or obtained by special photography requests which may be necessary to reflect seasonal variations in vegetative types. From this imagery, a vegetation map(s) will be prepared utilizing appropriate computer facilities in cooperation with the BLM Application System Verification Test. Ground truth field investigations will be required to verify computer map delineations and questionable interpretations. It is essential that the principal investigators of the biological studies work directly with the habitat mappers.

Seasonal Constraint: Limited to snow-free periods. Most work will be accomplished in seasons of vegetative growth.

Cost: \$158,000

BIOLOGICAL STUDIES

Activity Designation: B-2

Activity: Identify significant aquatic invertebrate and vegetation species and determine project impacts.

Description: Significant aquatic invertebrate and vegetation species will be sampled within the impacted areas. This baseline survey will include the mainstream Susitna, its sloughs and tributaries above and below the dam. Invertebrate specimens are to be preserved and identified, and quantitative studies conducted whenever possible. Spatial and seasonal distribution and abundance are to be described for aquatic vegetation. Using this data, an evaluation will be made of the impacts the project will have on these species. Effects of changes in temperature, nutrients, suspended sediment, fluctuation and velocity, and secondary effects resulting from changes in aquatic vegetation, fish population/densities, etc., should be determined.

Seasonal Constraint: None

Cost: \$127,000

BIOLOGICAL STUDIES

Activity Designation: B-3/3a

Activity: Determine relative abundance, distribution, migrational characteristics, and habitat requirements of anadromous fish within impacted areas, and locate and define the seasonal freshwater habitat requirements important to the successful migration, spawning, incubation, and rearing of these species.

Description: Investigations will be conducted in areas within the drainage that may potentially be impacted by project development. Specific studies will be designed to determine relative abundance and migrational characteristics and timing of each anadromous species during juvenile and adult life history stages, to inventory and describe the existing hydrological, physical, and limnological conditions affecting the life history stages of anadromous fish, and to determine the contribution of potentially affected stocks to the salmon production within Cook Inlet as a whole, and specifically, their contribution to the production within the Susitna River drainage. This work will be accomplished by field survey crews using mechanical and electronic gear, nets, and by aerial surveys. As critical habitat areas are identified, study emphasis will be concentrated in these locations.

The investigations and results will be reviewed annually to reevaluate the potential project impacts and redefine the study direction, as necessary.

Seasonal Constraint: None

Cost: \$1,061,000

BIOLOGICAL STUDIES

Activity Designation: B-4

Activity: Determine and evaluate project impacts on anadromous fish. '

Description: This activity will consist of determining the types and magnitude of effects which the project is likely to have upon anadromous fish. On the basis of data gathered pursuant to activity B-3, the effects of altered river flow and changes in water quality characteristics will be evaluated utilizing information obtained from other activities. These include water quality studies (physical, chemical, and biological characteristics), determination of annual and seasonal flow duration, peak and volume curves, low flow frequency analysis, average annual sediment load, water surface profiles and winter ice conditions, with and without the project, and downstream physical effects resulting from changes in flow regime.

Seasonal Constraint: None

Cost: \$83,000

BIOLOGICAL STUDIES

Activity Designation: B-5/5a

Activity: Determine relative abundance, distribution, and habitat requirements of resident fish within impacted areas, and locate habitat critical to the successful migration, spawning, incubation, and rearing of these species.

Description: Data relevant to resident fish species will be coordinated with anadromous fish studies downstream from Devil Canyon. Special attention will be given those areas important to resident fish which may not coincide with anadromous fish habitat. Resident fish studies consisting of inventories of distribution and abundance will also be conducted along the Susitna River mainstem and its tributaries upstream from Devil Canyon to the mouth of the Tyone River and streams bisected by transmission corridors. Of particular importance in this study will be the determination of winter distribution and habitat requirement within areas subject to project impact. Studies will be made of the tributaries where it is suspected that resident fish predominantly reside during the summer months, and the mainstem Susitna River where many of these same fish may winter. Study of streams along transmission line corridors will be limited to those identified as having some direct impact from project construction.

The investigations and results will be reviewed annually by the professionals conducting the studies to reevaluate the potential project impacts and redefine the study direction as necessary.

Seasonal Constraint: None

Cost: \$778,000

BIOLOGICAL STUDIES

Activity Designation: B-6

Activity: Determine and evaluate project impacts on resident fish.

Description: The purpose of this activity is to determine the types and magnitudes of effects which the project is likely to have on resident fish, pursuant to an evaluation of data obtained from activity B-5 and other studies related to describing and evaluating physical conditions without and with the project. Information required in this analysis includes physical, chemical, and biological water data, determination of flow regime without and with the project, changes in sediment load and transport downstream, and entrapment rates, distribution and stratification within reservoirs, erosion potential in reservoir active storage zone and associated implications for water quality, ice conditions on reservoirs and downstream, and reservoir and downstream hydraulic effects of impoundment and altered flow regime. Downstream habitat changes will be determined, as will habitat lost (through inundation) or potentially created (access to streams formerly hydraulically blocked within reservoir areas) upstream from the dams. The potential for establishment of viable fisheries within the impoundments will also be assessed as part of this activity. Changes related to such things as velocity, predation, food production, cover, silt load, temperature, stream inundation, stream flow, and water quality will be evaluated in determining the likely effects of the project upon resident fish species.

Seasonal Constraint: None

Cost: \$83,000

BIOLOGICAL STUDIES

Activity Designation: B-7

Activity: Identify and assess effects of altered outflow of the Susitna River upon the estuarine area in Upper Cook Inlet.

Description: Comments from numerous sources, including state officials responsible for sport and commercial fishing, indicate a concern for changes which might occur in existing habitat quality within Upper Cook Inlet, particularly the estuarine area at the mouth of the Susitna River. Baseline studies will be conducted to determine existing water quality and biological productivity within the estuarine area and the lower reach of the Susitna River. Points of consideration for studies not covered in those already cited include an evaluation of such things as sediment load, nutrient load, primary productivity, fresh/salt water stratification (wedges), tidal influence, and current regimes.

After sufficient hydrologic and hydrographic data has been collected and evaluated it will be reviewed to determine if the estuarine area will be significantly impacted by the project. They will determine the need for and the extent of further studies.

Seasonal Constraint: None

Cost: \$232,000

BIOLOGICAL STUDIES

Activity Designation: B-8/8a

Activity: Identify and map moose habitat within impact areas, locate critical habitat, determine current habitat condition and trends, determine carrying capacity, and identify water conditions associated with moose habitat.

Description: Available information indicates a heavy dependence upon the river bottoms and adjacent lands for winter range both above and below the proposed damsites. The purpose of this study is to identify and map vegetative types which provide moose habitat within the impoundment areas and downstream flood plain, and adjacent lands lost directly to flooding or potentially affected directly or indirectly by changes in flow regime. Downstream work will be accomplished in areas of project impact. In conjunction with activity B-9, areas of critical winter habitat will be defined, located, and mapped. Verification of use of plant species identified as preferred winter browse, the intensity of such use, and the general condition of key browse species will be accomplished by field surveys consisting of locating and tagging and annually measuring browse growth and utilization. Browse growth rates will be established following the season of active annual growth in the fall, and utilization will be determined prior to new plant growth the following spring. Intensity of previous utilization will be determined and the general conditions and vigor of key species established. Results of this activity, along with data collected under activity B-9, will be utilized to estimate carrying capacity of winter ranges potentially affected by the project.

Location and abundance of moose browse is largely determined by soil moisture, which in turn is determined by conditions affecting the groundwater table. Plant species and areas representative of subclimax conditions are generally most productive of quality moose browse. It is suspected that the current pattern of natural annual flooding on the Susitna River produces conditions conducive to good moose browse production. The purpose of this study is to identify permanent and cyclic (annual) water conditions which affect browse production. This will require an analysis of historic seasonal streamflow data to identify the magnitude and frequency of flows which impart the most profound effect on vegetation. The area of concentration for this portion of the study consists of lands subjected to annual inundation along the mainstem Susitna River between Portage Creek and the mouth of the Chulitna River. Flooding

patterns without and with the project will be mapped on overlays on moose browse. On the basis of these comparisons, impacts on existing browse patterns and production will be estimated.

The investigations and results will be reviewed annually to reevaluate the potential project impacts and redefine the study direction, as necessary.

Seasonal Constraint: None

Cost: \$400,000

BIOLOGICAL STUDIES

Activity Designation: B-9/9a

Activity: Identify moose subpopulations and determine the seasonal distribution, movement patterns, size and trend of those subpopulations within areas of project impact, and determine the timing and degree of subpopulation dependency on impacted habitat.

Description: The purpose of this study is to identify moose populations utilizing habitat subject to direct and indirect impact of the project, determine seasonal ranges and migration patterns of moose populations, determine what segments of each identified population utilize areas subject to direct or indirect project impact, and determine to what degree these animals are dependent on that habitat. Any apparent trend in moose populations will be identified and evaluated. Work will be accomplished by marking a number of moose in representative locations with radio transmitters, and by periodically locating and mapping their positions by aerial survey. This program will permit mapping of moose concentrations and movement, and will provide information required to determine sex and age composition of animals using various areas. Also, it will be possible to determine seasonal use of habitat types. Distribution and movement will be delineated by plotting locations on an overlay of the vegetative-type map prepared under activity B-1. This activity will furnish information which, in conjunction with data obtained from activity B-8, can be utilized to identify critical habitat as well as numbers of moose utilizing the study area. This procedure will be used to determine the yearly distribution of moose utilizing the impact area. The use of radios to transmit movement and population data will be supplemented by aerial reconnaissance to visually count moose, map concentrations, and determine sex and age composition of animals observed. Some of this information will be obtained during aerial surveys being conducted primarily for other purposes.

The investigations and results will be reviewed annually to reevaluate the potential project impacts and redefine the study direction, as necessary.

Seasonal Constraint: None

Cost: \$624,000

BIOLOGICAL STUDIES

Activity Designation: B-10

Activity: Determine and evaluate project impacts on habitat and subpopulations of moose.

Description: Utilizing data obtained from activities B-1, 8, and 9, this study will determine both short- and long-term effects which the project is likely to have upon moose in the Susitna River drainage. The implications of total loss of all habitat subject to inundation will be assessed and evaluated as will the more subtle change expected to occur downstream as a result of changes in annual flooding patterns and a permanently altered river flow regime. Changes in present annual river flow and flood plain groundwater profiles will be evaluated as to the anticipated effects on riparian vegetation. Primary emphasis below the dams will be upstream from the confluence with the Chulitna River, with some analysis of possible changes between Chulitna River and Upper Cook Inlet. Impacts upon moose will be evaluated in terms of numbers likely to be lost, reduced, or forced to accept other available habitat.

Seasonal Constraint: None

Cost: \$42,000

BIOLOGICAL STUDIES

Activity Designation: B-11/11a

Activity: Identify and map caribou habitat associated with alternate transmission corridors and areas subject to impoundment and determine the seasonal ranges and migration routes of caribou with emphasis on traditional migration routes with respect to the proposed impoundment areas.

Description: The purpose of this study is to identify caribou habitat within areas subject to project impact. Work will consist of identifying and mapping vegetative types known to provide caribou habitat. Vegetative-type maps provided by activity B-1 will be utilized as a base for producing overlays identifying and outlining vegetation known to be utilized by caribou. These maps will in turn be used as a base for overlays reflecting seasonal distribution of caribou.

The distribution studies will identify and quantify, to the extent practicable, caribou populations potentially affected by the project. Drastic declines have been reported in recent years in the Nelchina caribou herd. Current population condition and trend must be established in order to be able to recognize and identify impacts which may be attributable to the project. Baseline data collection will be accomplished by methodical aerial surveys. Populations will be quantified and mapped as to seasonal location and distribution. Aerial transects will be established and consistently flown in the same patterns to provide gross distribution and use data. Where animals are observed, intensive coverage of surrounding areas will be made in an attempt to obtain accurate counts. Particular emphasis during aerial surveys will be placed on determining the location and timing of migratory movement within the vicinity of the reservoirs. Caribou movement is known to vary from year to year; however, large numbers are known to usually cross the Susitna River in the vicinity of the reservoirs, particularly as they move from calving grounds to summer range. This activity will be supplemented by aerial surveys made in conjunction with moose radio tracking flights. Frequency of surveys will be increased during periods of spring migration.

The investigations and results will be reviewed annually to reevaluate the potential project impacts and redefine the study direction, as necessary.

Seasonal Constraint: None

Cost: \$126,000

BIOLOGICAL STUDIES

Activity Designation: B-12

Activity: Determine and evaluate project impacts upon Nelchina caribou herd.

Description: The purpose of this activity is to determine, on the basis of data collected pursuant to activity B-11, the impacts which the project is likely to have on the Nelchina caribou herd. Two types of impacts are anticipated: one related to the influence of transmission lines on caribou movement and habitat utilization, and the other related to the construction of reservoirs bisecting migration routes between calving and summering grounds. Although little caribou habitat is likely to be destroyed by transmission line construction, more subtle impacts (related to increased accessibility of people and the consequent increased possibility of wild fire, and the visual contrast and sound associated with transmission lines) may have varying degrees of effects upon caribou, depending on the corridors chosen for construction of transmission facilities. Some caribou habitat may be inundated by reservoirs, but use of areas lying within the canyon of the Susitna River is probably minimal and transitory. Nevertheless, the time and duration of caribou use and the numbers utilizing the impoundment areas must be established before any conclusions can be made. Caribou are good swimmers, as evidenced by the numbers of newborn calves which apparently successfully cross the present river. However, it is not known whether deep water impoundment would provide more or less of a barrier. A major concern is that the creation of ice shelves formed as the impoundment is drawn down could significantly restrict movement and perhaps cause considerable mortality.

Seasonal Constraint: None

Cost: \$15,000

BIOLOGICAL STUDIES

Activity Designation: B-13/13a

Activity: Inventory the number, size, territory, and other essential activity areas and determine and evaluate probable project impacts on wolf packs which inhabit areas that will be directly impacted by the project.

Description: The number of wolf packs and numbers of wolves in each pack will be inventoried, and territories and other essential areas will be located using radio-collar techniques and aerial surveys. Wolf relationships to various prey species in the project impact areas will be determined. This activity will be closely integrated with moose and caribou studies. A large part of the data required for this study will be obtained incidentally to aerial and ground surveys conducted in conjunction with other activities, particularly B-9 and B-11. Probable project impacts will be determined and evaluated.

The investigations and results will be reviewed annually to reevaluate the potential project impacts and redefine the study direction, as necessary.

Seasonal Constraint: None

Cost: \$76,000

BIOLOGICAL STUDIES

Activity Designation: B-14/14a

Activity: Estimate black and brown/grizzly bear populations and distribution in the project impact area and determine and evaluate probable project impacts.

Description: Estimates of black and brown/grizzly bear populations and distributions in the project impact area, specifically the areas to be inundated, will be made. Most of these data will be obtained incidentally to aerial and ground surveys conducted in conjunction with other activities and by using radio collar techniques. Probable project impacts will be determined and evaluated.

The investigations and results will be reviewed annually to reevaluate the potential project impacts and redefine the study direction, as necessary.

Seasonal Constraint: None; however, field work will be concentrated during spring and fall.

Cost: \$49,000

BIOLOGICAL STUDIES

Activity Designation: B-15 /15a

Activity: Determine the general abundance and distribution of wolverines in the project impact area and determine and evaluate probable project impacts.

Description: Estimates of the general abundance and distribution of wolverines in the project impact area will be made using aerial and ground surveys, and radio collar techniques. Most of these surveys will be made incidentally to other activities. Probable project impacts will be determined and evaluated.

The investigations and results will be reviewed annually to reevaluate the potential project impacts and redefine the study direction, as necessary.

Seasonal Constraint: None

Cost: \$32,000

BIOLOGICAL STUDIES

Activity Designation: B-16/16a

Activity: Determine the relative abundance of Dall sheep inhabiting mountains adjacent to the project impact area and delineate seasonal ranges. Determine and evaluate probable project impacts.

Description: There is the possibility of adverse impacts on Dall sheep populations from human disturbance as a result of construction activities and increased access. Aerial surveys will be conducted to determine the size of the sheep population and to delineate seasonal ranges. Probable project impacts will be determined and evaluated.

Seasonal Constraint: None

Cost: \$6,000

BIOLOGICAL STUDIES

Activity Designation: B-17/17a

Activity: Determine the relative abundance and distribution of fur bearer, small game, nongame, and bird species in the proposed impoundment areas and determine and evaluate probable project impacts.

Description: Little is known about the abundance and distribution of fur bearers, small game, nongame, and bird species in the project impact area. Limited aerial and ground surveys will be made in conjunction with other activities. Limited trapping will also be conducted. Distribution will be correlated with the vegetation-type maps produced under activity B-1. Probable project impacts will be determined and evaluated.

Seasonal Constraint: None

Cost: \$20,000

BIOLOGICAL STUDIES

Activity Designation: B-18

Activity: Determine whether any rare and endangered species of plants, fish, birds, mammals, or other wildlife are present in the project area, and evaluate impacts of the proposed action on these species.

Description: Any rare or endangered species in the area of project impact will be identified in the course of other biological field investigations. Species lists should essentially be completed by the end of the second year of field studies which will be undertaken to identify vegetation, fish, birds, mammals, and other organisms. Upon identification of a rare or endangered species, intensive investigations of that particular organism will be undertaken immediately to determine its use, distribution, and number within impacted areas. The extent to which any of these factors will be influenced by the project will be determined and evaluated. Where applicable and possible, mitigative measures will be identified and evaluated. At the present time the peregrine falcon is the only endangered species known to occur in the area.

Seasonal Constraint: None; however, bulk of work will occur during snow-free periods.

Cost: \$29,000

BIOLOGICAL STUDIES

Activity Designation: B-19

Activity: Determine annual harvest rates of species of fish and wildlife utilized for commercial and recreational purposes, and estimate changes expected as a result of the project. Determine importance of impacted species to regional populations.

Description: This study is essential to the accomplishment of activity B-20. Harvest of game animals, fur bearers, and sport and/or commercial species of fish will be determined by a combination of sampling devices including field checks (i.e., creel census), road blocks, established check stations, questionnaires, commercial fish ticket data, and returns from tagged animals. (Tagging, if accomplished, will be done primarily in relation to other biological studies.) This information will be evaluated in terms of physical effects of the project upon habitat and the extent to which improved accessibility by hunters and trappers may impact various species. The importance of impacted populations to regional populations will be determined by correlating estimated changes in harvest rate to average annual harvest.

Seasonal Constraint: None

Cost: \$172,000

BIOLOGICAL STUDIES

Activity Designation: B-20

Activity: Identify and display damages to fish and wildlife in monetary terms and determine measures required to reduce or offset damages or to enhance existing habitat.

Description: This study is a requirement of the Fish and Wildlife Coordination Act of 1958, as amended. Procedures are outlined in Engineer Regulation 1105-2-129. Damages to fish and wildlife resources will be identified, and the economic value of such damages will be evaluated in monetary terms. Losses to the fish and wildlife resources causing a reduction in recreational fishing and hunting opportunities will be evaluated by procedures comparable to those used in evaluating benefits from these activities. Losses in commercial products (such as fish and pelts) will be expressed in monetary terms using the market values to the primary producers of the product net of associated production costs. Nonmonetary damages, including those impacts affecting the ecosystem and environmental quality, will be described in sufficient detail to support a judgement as to the cost that would be justified to prevent or offset them. Measures which are required for mitigating or compensating for damages shall be described. The costs will be determined, as will residual damages to fish and wildlife resources. If enhancement features are found to be justified, they will also be expressed in monetary terms. Benefits attributable to hunting and fishing, including sport fishing for anadromous fish as a direct result of the enhancement of fish and wildlife resources, will be evaluated in the same way as other forms of recreation. Data will be furnished through ongoing or previously conducted studies.

Seasonal Constraint: None

Cost: \$100,000

BIOLOGICAL STUDIES

Activity Designation: B-21

Activity: Identify and describe environmental components and impacts related to each alternative identified as a possible solution to electrical energy needs.

Description: This activity requires a description of the environmental setting and the nature and use presently made of the environment associated with each alternative evaluated in the preliminary screening. This will be followed by a description of the environmental components affected by each alternative. The basis for estimating impacts of alternatives will be the comparison of existing physical, biological, and socio-economic characteristics of water and land supply, use and control, with and without a given action. Where quantitative data is lacking or not applicable, changes from the base condition will be sufficiently described to permit comparing various alternatives in regard to the relative magnitude of impacts associated with each alternative. Data required for this level of evaluation will be based essentially on existing sources.

Seasonal Constraint: None

Cost: \$50,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION (RRP)

THIS FINAL CATEGORY OF ACTIVITIES IS A CONSOLIDATION OF ALL THE WORK ITEMS ASSOCIATED WITH THE ACTUAL WRITING OF REPORTS AND THEIR REVIEW. THE RESOURCES REQUIRED FOR CONDUCTING SEVERAL PUBLIC MEETINGS ARE ALSO INCLUDED.

INITIAL PUBLIC INVOLVEMENT.

1. Conduct initial public meeting with supporting public involvement activities.

PRELIMINARY SCREENING.

2. Prepare preliminary hydrology studies report.
3. Prepare preliminary site selection report.
4. Prepare preliminary environmental studies report.
5. Prepare preliminary marketability analysis.
6. Prepare and submit draft plan formulation report.
7. Conduct second public meeting.

REPORT PREPARATION.

8. Prepare Hydrology appendix.
9. Prepare Power Studies appendix.
10. Prepare Site Selection appendix.
11. Prepare Plan Formulation appendix.
12. Prepare Transmission Facilities appendix.
13. Prepare Access appendix.
14. Prepare Foundation and Materials appendix.
15. Prepare Real Estate appendix.
16. Prepare Design and Cost Estimate appendix.
17. Prepare Marketing Analysis appendix.
18. Prepare Environmental Studies appendix.
19. Prepare Recreation appendix.
20. Prepare Cultural Resources appendix.
21. Prepare and submit draft Project Analysis.
22. Prepare and submit supplemental EIS.
23. Prepare and submit Project Feasibility Analysis, Main Report.

FINAL REPORTS AND REVIEWS.

24. Conduct Final Review.
25. Prepare and submit revised Project Feasibility Analysis Report.
26. Prepare and submit revised Supplemental EIS.

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-1

Activity: Conduct initial public meetings.

Description: The initial public meetings will be held as early as possible after initiation of the project feasibility analysis. The purpose of this early public involvement is to inform the public of the post-authorization planning being undertaken and to elicit public response to the planned studies. Information contained in the Plan of Study will be widely distributed in advance of the meetings and will serve as the primary topic for discussion.

Cost: \$15,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-2

Activity: Prepare preliminary hydrology studies report.

Description: This document will provide the information to be used in the power studies and plan formulation for preliminary screening. Primary information will include monthly streamflows for each of the damsites to be evaluated. It will also include information on evapotranspiration rates for the critical streamflow period, elevation capacity curves for the reservoirs, and preliminary information on the spillway design flood.

Seasonal Constraint: None

Cost: \$3,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-3

Activity: Prepare preliminary site selection report.

Description: This report will present the analysis and considerations that went into developing hydro plans for the initial screening of alternatives. It will include a discussion of preliminary site layouts and cost estimate.

Seasonal Constraint: None

Cost: \$3,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-4

Activity: Prepare preliminary environmental studies report.

Description: This activity will consist of preparing a summary description and comparison of the biological and socio-economic impacts of the various alternative solutions selected for analysis. Data upon which this activity is based will be assembled under activity B-21 and EC-3. The contents of this report will be utilized in the preliminary screening.

Seasonal Constraint: None

Cost: \$3,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-5

Activity: Prepare preliminary marketability analysis.

Description: This report will present the review of load growth and marketing assumptions to be used in evaluating the economic feasibility of the various plans for hydro development. It will include, as a minimum, seasonal load duration curves, power demand projections, and other marketing assumptions on the saleability of Susitna power during the early years of operation and over its economic life. This information will be used to support the preliminary screening.

Seasonal Constraint: None

Cost: \$3,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-6

Activity: Prepare and submit draft plan formulation report.

Description: The results of the preliminary screening of energy alternatives will be presented in a plan selection report. Those alternatives, at least one of which will be a nonhydro plan, that merit further study will be identified and carried forward for additional refinement and evaluation during the detailed feasibility analysis. The report will contain a description of each alternative plan, the power capability and associated benefits of each plan, differential environmental impacts and plan costs.

Seasonal Constraint: None

Cost: \$6,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-7

Activity: Conduct second level public meetings.

Description: This second set of public meetings is designed to foster public participation in the screening of alternative energy plans. Additionally, input will be sought from residents of the immediate project area to establish a most probable future that will serve as a frame of reference in the impact assessment process. In advance of the meetings, informational material summarizing the preliminary screening process will be widely disseminated.

Seasonal Constraint: None

Cost: \$15,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-8

Activity: Prepare Hydrology appendix.

Description: This activity entails the compilation and presentation of the basic hydrologic information upon which the project will be based. Streamflow data will include extended monthly volumes for the three existing stations and the six new gages to be installed. The streamflow throughout the basin will then be characterized by a number of statistical techniques to include seasonal flow duration curves, peak and volume frequency curves, and low flow frequency curves. The collection of data will allow a definitive description of the hydrology and climate within the basin and along the transmission line corridor. Also presented will be sediment transport studies that will attempt to define total sediment transport rates, reservoir entrapment rates, and downstream channel changes as a result of reservoir deposition. The appendix will address the potential for discharge control and the possibility of handling reservoir sediment stratification. The results of water quality studies, erosion potential investigations, ice studies, and spillway design flood analyses will also be included.

Seasonal Constraint: None

Cost: \$14,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-9

Activity: Prepare Power Studies appendix.

Description: This appendix will include all power studies to be conducted for plan formulation and more specifically for indepth analysis of the selected plan of development. Power studies for plan formulation will entail seasonal regulation analysis and hourly studies to determine the need for a reregulation reservoir. These studies will establish the energy capabilities of the various plans of development for a number of assumed dam heights and active storage volumes. There will be no attempt to incorporate economic evaluation into these studies as this will be accomplished under plan formulation. For the selected plan, a number of load shape studies will be conducted to determine the optimum mode in which the projects should be operated. The report will include head duration curves, tailwater duration curves, turbine efficiency curves, and suggested operating role curves.

Seasonal Constraint: None

Cost: \$14,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-10

Activity: Prepare Site Selection appendix.

Description: The purpose of this activity is to present the dam sites identified and the considerations which resulted in specific recommendations as to dam types and heights for each site. Findings of the preliminary geologic studies which assessed suitability of foundations, quantity and quality of construction materials and good and bad physical features will be presented. In particular, features which will limit the height or type of dam considered at a site will be noted. Mass quantities and cost height relationships will be prepared, preliminary analyses performed and the favorable and unfavorable points of each site evaluated. This activity will also present the mechanics of the reviewing process and the rationale by which the specific sites were selected.

Seasonal Constraint: None

Cost: \$14,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-11

Activity: Prepare Plan Formulation appendix.

Description: The purpose of this appendix will be to present the procedures and rationale by which the recommended plan of development is selected. The basic procedure will entail objective identification, assessment of available alternatives, and comparison of alternatives from the primary standpoints of economic enhancement and environmental preservation. Plan selection will be based on that plan which provides the greatest contributions to the study objectives. Formulation will require a synopsis of the findings of the power economics analysis, hydropower operation studies, and an impact assessment associated with the various alternative energy resources as well as specific development plans within the Upper Susitna Basin. Because of their obvious inability to meet the study objectives many of the energy alternatives can be eliminated early in the study process. After preliminary screening, the selected plan or plans will be refined as to dam height, operating characteristics, etc., and this refinement process will also be included in this appendix. The economic and effect assessment will be presented not only for the most feasible plan for hydro development, but also for the most likely energy alternative that would be developed if the hydro system were not.

Seasonal Constraint: None

Cost: \$14,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-12

Activity: Prepare Transmission Facilities appendix.

Description: This appendix will present the studies involved in selecting of transmission line routes, towers, conductor and hardware, substations and switchyards, and other items of the transmission facilities. The alternate routes studied, the foundation studies, studies on towers, hardware and conductors, and clearing considerations will be included in the appendix with a final recommendation of the selected route, tower types and all hardware.

Seasonal Constraint: None

Cost: \$14,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-13

Activity: Prepare Access appendix.

Description: Under this activity the access route alternatives will be outlined, and the considerations which resulted in the selection of a specific route will be presented. Vertical and horizontal alignments will be shown and their advantages and disadvantages relative to grade, curvature, distance, bridge requirements and foundations will be presented. Particular emphasis will be placed on the requirement for an all weather access and the potential winter problems of snow and ice. Bridge needs will be assessed and preliminary designs included. Foundation conditions as revealed by preliminary explorations will also be included in this appendix.

Cost: \$10,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-14

Activity: Prepare Foundations and Materials appendix.

Description: The results of the exploration, testing and evaluation for geological and foundation conditions will be presented in a Foundations and Materials appendix. Special emphasis will be placed on presenting the results of seismic testing and determination of the design earthquake.

Seasonal Constraint: None

Cost: \$14,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-15

Activity: Prepare Real Estate appendix.

Description: Data previously collected will be synthesized into a workable format. A draft will be prepared of all pertinent real estate data to include an overall real estate project map with more detailed segment maps. A gross appraisal will be prepared with supporting narrative to provide technical justification for land costs.

Seasonal Constraint: None

Cost: \$40,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-16

Activity: Prepare Design and Cost Estimates appendix.

Description: The purpose of this appendix will be to describe the various features of the selected plan and to identify feature costs. Included will be discussions of dam type and height, foundation conditions, material sources, and general configuration of spillway and outlet works, penstocks and powerhouse, intake systems and gates, and other dam features. Other project components such as construction facilities and reservoir clearing will also be described.

Seasonal Constraint: None

Cost: \$20,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-17

Activity: Prepare Marketing Analysis appendix.

Description: This report will summarize the various power market studies and will present the load growth and power system assumptions that underlie the detailed feasibility analysis. In addition, it will contain a detailed assessment of existing power plant retirement and financial feasibility based on the selected plan.

Seasonal Constraint: None

Cost: \$7,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-18

Activity: Prepare Environmental Studies appendix.

Description: This work will consist of a consolidation and summarization of the results of the biological and socio-economic studies. As such, it will serve as a reference document for the impact assessment process and for preparation of the Environmental Impact Statement Supplement.

Cost: \$14,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-19

Activity: Prepare Recreation appendix.

Description: The Recreation appendix will be prepared upon completion of all recreation-related activities. Plates detailing proposed recreational developments will be prepared following selections of the best alternative scheme. The process of recreation plan selection will also be explained.

Seasonal Constraint: None

Cost: \$14,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-20

Activity: Prepare Cultural Resources appendix.

Description: This Culcural Resources Reconnaissance Report will present the findings of both the archeological and historical studies. Included will be information relating to the number and types of archeological and historical resources in the project area and the probable impact of the project on those resources.

Seasonal Constraint: None

Cost: \$14,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-21

Activity: Prepare and submit draft project analysis.

Description: The results of the detailed feasibility studies of the best plan identified will be presented in a project analysis report. The analysis will be made using the detailed information and data obtained from marketing, environmental, hydrological, and foundation studies. The marketing studies will entail refined cost estimates based on expanded information available from the foundation exploration program and project benefits will be determined from power studies and production cost analysis. The environmental studies will provide sufficient information to allow identification of probable magnitude of impacts and evaluation of project feasibility. Power studies will be derived from output provided by hydrological evaluation. The report will provide a firm basis for recommending for or against construction of the project.

Seasonal Constraint: None

Cost: \$50,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-22

Activity: Prepare and submit supplemental EIS.

Description: This work will consist of further summarization of all environmental, economic, social, and engineering studies accomplished during the project feasibility analysis. Impacts from the various features of the project will be evaluated and presented narratively. Detailed information will be presented on the recommended plan, while impacts of alternative actions will be described sufficiently to fully inform readers and decision makers of the trade-offs and reasons involved in their rejection.

Seasonal Constraint: None

Cost: \$26,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-23

Activity: Prepare and submit Project Feasibility Analysis, Main Report.

Description: Following completion of the detailed feasibility studies, the detailed dam design, and the various appendices, the Main Report will be prepared. It will be a summary document that explains the sequential planning steps that resulted in the recommended plan, the various elements of that plan, and the associated costs and benefits. It will also present recommendations for plan implementation.

Seasonal Constraint: None

Cost: \$21,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-24

Activity: Conduct final review.

Description: This activity establishes time and resources for a thorough review of the project feasibility analysis. Included as part of this review will be coordination of draft documents with concerned Federal and State agencies, as well as a third set of public meetings.

Seasonal Constraint: None

Cost: \$45,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-25

Activity: Prepare and submit revised Project Feasibility Analysis Report.

Description: After all work indicated by the final review is completed and after the report has been revised to reflect input from public involvement and interagency coordination, the final report will be prepared and submitted.

Seasonal Constraint: None

Cost: \$40,000

REPORTS, REVIEWS, AND PUBLIC PARTICIPATION

Activity Designation: RRP-26

Activity: Prepare and submit revised Supplemental EIS.

Description: Work will be initiated immediately upon receipt of comments following the 45-day review period to prepare written responses to individual comments. This will require an intensive effort over a short time span by a task group familiar with DEIS and by other specialists who developed data for the project feasibility analysis.

Seasonal Constraint: None

Cost: \$67,000

AVAILABLE DATA

A number of documents are available which discuss the general setting of the Upper Susitna River Basin and the surrounding communities that would be served by the proposed hydro project. Also available are several reports which address specific development of the Susitna Basin. The following list of reports includes only some of the more pertinent studies relative to the Railbelt environment. More detailed is the listing of the reports which describe studies of the Upper Susitna River Basin. Many of the reports consist of one-of-a-kind documents which are available only through the Corps of Engineers or other agencies, while others can be obtained through libraries, governmental agencies, or private organizations.

Beck, R.W., and Associates and Ralph R. Stefano and Associate, Engineering and Economic Studies for the City of Anchorage, Alaska Municipal Light and Power Department, August 1970.

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- U.S. Department of the Army, Corps of Engineers, Office of the Chief of Engineers, Cook Inlet and Tributaries, 1950.
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GLOSSARY

adit - a horizontal gallery driven from the surface giving access to a work area.

alluvium - material eroded, transported, and deposited by streams.

anemometer - a device which measures air speed.

arcuate - bow shaped or bent.

aquifer - a subsurface zone that yields economically important amounts of water to wells.

backwater curve - a curve showing high-water surface on a given stream resulting from downstream obstructions, or high stages in an intersecting stream.

batholith - a huge mass of igneous rock of irregular shape and great extent in all dimensions.

bell mouth - flared mouth on a pipe opening.

block faulting - see fault block.

B.O.D. - biochemical oxygen demand.

bus - a set of two or more electric conductors that serve as common connections between load circuits and each of the polarities (direct current) or phases (alternating current) of the source of electric power.

C.O.D. - chemical oxygen demand (of water).

critical path method (CPM) - a method of scheduling activities by which the activities are placed in sequential order and given time estimates so that the most time-consuming activity is identified. The most time-consuming activity, or series of interdependent activities, constitute the critical path.

dendritic - having a branching, treelike pattern or structure.

dependable capacity - the assured peak load; carrying ability of a plant or system under adverse water conditions for the time interval and period specified when related to the characteristics of the load to be supplied, expressed in kilowatts (or megawatts).

diastrophism - process or processes by which the earth's crust is deformed; the results of this action.

drawdown - the distance that the water surface of a reservoir is lowered from a given elevation as the result of the withdrawal of water.

elevation versus capacity curves - graphic representation of the relationship between the elevation and the storage capacity of a reservoir.

fault - a fracture in rock along which the adjacent rock surfaces are differentially displaced.

fault block - a rock mass which is bounded by faults.

firm energy - energy required to be available at all times.

frazil ice - a spongy accumulation of ice crystals which form in super-cooled turbulent water.

glacial moraine - an accumulation of glacial debris (drift) deposited by glacial action.

grout curtain - a row of drilled holes filled with grout under pressure to form a seepage barrier under a dam.

head - (of pressure) - height of a column of fluid necessary to develop a specific pressure.

hydrograph - a graphical representation of stage, flow, velocity, or other characteristics of water at a given point as a function of time.

hydrometeorological - that part of meteorology directly related to hydrologic problems such as flood control, irrigation, or hydroelectric power.

initial sunk costs - project costs previously expended.

in situ - in the original location.

invert - the floor or bottom of a conduit.

lateral slipping - horizontal movement of rock along a fracture.

limnological - related to the science of life and conditions for life in lakes, ponds and streams.

manuscript mapping - original drawing produced from mapping instrument.

orographic effects - effects on air currents caused by mountains.

passerines - perching birds.

penstock - a closed water conduit controlled by valves and located between the intake and the turbine in a hydroelectric plant.

photomosaic - composite photograph made up of individual, small-area photos placed side by side.

photo/topo - the mapping of surface features by means of aerial photography.

picture point aerial photography - photographs taken after target panels are placed on the ground or after existing objects are identified which can later be located in the photography.

plate jacking test - a test for quality of foundation rock, in which plates are cemented to rock walls (usually of a tunnel), then pressure is applied by a huge hydraulic jack. Deflection of the rock under pressure, and rebound of the rock after the pressure is removed, gives indication of the quality of the foundation.

rime icing - a milky, opaque, granular deposit formed by the rapid freezing of super-cooled water drops on an exposed surface; composed essentially of separate ice granules.

riparian - living or located on a riverbank.

river cross section - a depiction of the contours of the river bottom.

secondary energy - electric energy having limited availability. In a good water year, a hydro plant can generate energy in excess of its prime energy capability. This excess energy is classified as secondary energy because it is not available every year, and varies in magnitude in those years when it is available.

shotcrete - pneumatically placed concrete.

steel bent - a framework support transverse to the length of a structure.

tailwater rating curve - depiction of discharges (flow rates at given instants expressed as volume per unit of time) in relation to the elevation of the water surface. These curves indicate discharge for various stage elevations.

tectonics - a branch of geology dealing with rock structure and external forms of the earth's crust.

telemetry - transmitting of instrument readings to a remote location by means of wires, radio, etc. Remote metering.

tiltmeter - an instrument used to measure small changes in the tilt of the earth's surface, usually in relation to a liquid-level surface or to the rest position of a pendulum.

user day values - Cost/benefit values derived from calculations in which a user day is defined as any part of a day spent in a particular recreational activity.

volcanism - the movement of molten rock from the interior of the earth into the crust and to the surface.

water surface profile - a graph showing the relationship of water surface elevation to location, the latter generally expressed as distance above the stream mouth. It is generally drawn to show surface elevation for the crest of a specific flood, but may be prepared for conditions at a given time or stage.

Table 1. Tabulation of Program Activities According to Cost and Year of Accomplishment.

	Cost (\$1,000)	Year			
		1	2	3	4
SURVEY (SY)					
RIVER CROSS SECTION					
1. Obtain river cross sections at preliminary sites.	50	*			
2. Obtain river cross sections downstream.	300	*			
MAPPING					
3. Map potential reservoir sites.	460	*			
4. Obtain controlled photo/topo along access route.	225	*	*		
5. Obtain controlled photo/topo along transmission corridor.	70	*			
6. Obtain controlled photo/topo at Watana damsite.	15	*			
7. Obtain controlled photo/topo at Devil Canyon.	60	*			
HYDROLOGY (HY)					
IMPLEMENT A DATA COLLECTION PROGRAM.					
1. Collect climatologic data for basin and transmission line.	423	*	*		
2. Install and operate additional stream gages and continue stream gaging.	300	*	*		
3. Collect water data.	60	*	*	*	
DESCRIBE HYDROMETEOROLOGICAL SETTING OF BASIN.					
4. Describe hydrometeorological setting.	8		*		
CONDUCT PRE-PROJECT STREAMFLOW ANALYSIS.					
5. Extend streamflow and correlate with longest record.	10	*			
6. Develop annual and seasonal flow duration curves.	2		*		
7. Develop peak and volume frequency curves.	2		*		
8. Develop low flow frequency analysis for critical period.	10		*		
CONDUCT RESERVOIR AND DOWNSTREAM SEDIMENT STUDIES.					
9. Determine average annual total load.	35	*	*		
10. Determine entrapment rates and reservoir distribution.	20		*	*	
11. Determine reservoir suspended sediment stratification.	15	*			
12. Determine effect on downstream channel.	20		*		

	Cost (\$1,000)	Year			
		1	2	3	4
HYDROLOGY (HY (Cont.))					
SPILLWAY DESIGN FLOOD DERIVATION.					
13. Obtain final Probable Maximum Precipitation from HMB-NWS.	1		*		
14. Recalibrate basin Model.	25		*		
15. Determine Probable Maximum Flood and route through reservoir.	15		*		
WATER SURFACE PROFILE DETERMINATION.					
16. Determine wter surface profiles from Talkeetna to Watana.	25		*	*	
CONDUCT ICE STUDIES.					
17. River and reservoir conditions.	130		*	*	
18. Review literature about existing storage projects in arctic conditions.	20		*		
WIND AND ICE STUDIES REQUIRED FOR TRANSMISSION LINE DESIGN.					
19. Conduct literature search and limited field survey.	15		*		
POST PROJECT STREAMFLOW ANALYSIS.					
20. Develop post-project frequency curves.	1		*		
21. Determine post-project downstream water surface profiles.	20		*		
RESERVOIR FILLING SCHEDULES.					
22. Develop reservoir filling schedules.	9		*	*	*
GLACIAL BALANCE STUDIES.					
23. Conduct mass water yield studies.	55		*	*	*
24. Conduct mass sediment yield studies.	55		*	*	*
EVAPOTRANSPIRATION STUDIES.					
25. Determine evaporation rates.	10		*		
OTHER ACTIVITIES.					
26. Provide preliminary spillway design flood.	1		*		
27. Determine elevation versus capacity relationships.	8		*		
ENVIRONMENTAL (EN)					
WATER QUALITY STUDIES.					
1. Collect chemical and biological water quality data.	140		*	*	*

	Cost (\$1,000)	Year			
		1	2	3	4
ENVIRONMENTAL (EN) (Cont.)					
2. Reservoir temperature stratification studies and reservoirs water quality modeling.	150		*	*	
3. Analyze spillway and outlet works for dissolved gas production.	20		*		
4. Assess erosion potential in active storage zone.	20		*		
ECONOMICS (EC)					
MISCELLANEOUS ECONOMIC STUDIES.					
1. Perform employment benefit analysis.	5			*	
2. Prepare flood damage prevention analysis.	12	*	*		
SOCIO-ECONOMIC IMPACT STUDIES.					
3. Conduct preliminary socio-economic impact studies for initial screening of alternatives.	11	*			
4. Develop detailed profiles of socio-economic conditions in the immediate project area, the region, and the State.	15	*	*		
5. Forecast future "without-project" conditions.	15			*	
6. Forecast future "with project" conditions.	20			*	
7. Identify and evaluate significant socio-economic effects.	6			*	*
RECREATION (R)					
RECREATION PLAN					
1. Conduct data search and evaluation.	5	*			
2. Conduct supply and demand analysis.	20	*			
3. Develop alternative plans for public recreation and related resources uses.	15		*		
4. Conduct cost/benefit evaluation of alternative plans and select final plan.	16		*	*	
PLAN FORMULATION (PF)					
REVIEW OF PREVIOUS STUDIES.					
1. Review 1976 feasibility report.	1	*			
2. Update power values.	3	*			

	Cost (\$1,000)	Year			
		1	2	3	4
PLAN FORMULATION (PF) (Cont.)					
EVALUATION CRITERIA.					
3. Establish evaluation criteria.	5	*			
PLANS AND PRELIMINARY EVALUATION.					
4. Identify possible solutions.	8	*			
ANALYZE SPECIFIC PLANS OF HYDROPOWER DEVELOPMENT.					
5. Establish site layouts.	40	*			
6. Conduct mass take-offs and provide cost estimates.	-	*			
7. Assess reregulation dam costs.	1			*	
8. Develop power benefits and assess economic attractiveness.	10	*			
IMPACT IDENTIFICATION AND EVALUATION.					
9. Make preliminary assessment of alternatives.	5	*			
ON-GOING EVALUATION OF ALTERNATIVES.					
10. Update the impact analysis as needed.	20			*	*
IDENTIFICATION OF HYDRO SYSTEM OPERATION IN REGIONAL LOAD.					
11. Study feasibility of future units and downstream reregulation.	4			*	
12. Conduct hourly loading studies.	3			*	
13. Assess sensitivity to load growth.	1			*	
ALTERNATIVE SYSTEM STUDIES.					
14. Conduct system studies on alternative developments.	20			*	
BENEFIT AND COST CALCULATION.					
15. Collect and compare benefit and cost estimates.	3			*	
POWER STUDIES (PS)					
MISCELLANEOUS POWER STUDIES.					
1. Identify optimum dam heights, reservoir storage and optimum power.	40	*			
2. Conduct hourly simulated operation.	70			*	
3. Evaluate downstream impacts with and without a regulating dam.	40			*	
4. Develop production cost model.	48			*	

	Cost (\$1,000)	Year			
		1	2	3	4
POWER MARKET STUDIES (PM)					
PRELIMINARY LOAD GROWTH ANALYSIS.					
1. Update power market analysis from feasibility report.	6	*			
DETAILED LOAD GROWTH AND POWER MARKET ANALYSIS.					
2. Prepare socio-economic base study.	75	*			
3. Forecast future development.	28	*			
4. Prepare employment and population forecasts.	11	*			
5. Describe existing and planned power generation through 1985.	3	*			
6. Assess electric energy use trends.	15	*			
7. Develop electricity demand forecasts by sector.	50	*			
8. Develop load distribution data and duration curves.	15	*			
9. Assess long term power outlook and system requirements.	25	*	*		
10. Evaluate the retirement of existing and planned power plants.	14	*			
11. Evaluate alternative power sources.	75		*		
12. Assess project financial feasibility.	30			*	*
FERC LICENSE					
13. Prepare material for draft FERC license.	150				*
FOUNDATIONS AND MATERIALS (FM)					
REGIONAL GEOLOGY.					
1. Conduct regional geology study, fault study, and seismicity evaluation.	470	*			
SEISMIC MONITORING.					
2. Install seismic monitoring system.	310	*			
3. Operate seismic monitoring system and analyze data.	225	*	*	*	*
ACCESS ROAD.					
4. Select route.	18	*			
5. Conduct site geology and soils study.	370		*	*	*
6. Explore and test for access road.	1,460		*	*	*
TRANSMISSION LINE.					
7. Select route.	35	*			
8. Conduct site geology and soils study.	185		*	*	
9. Explore and test.	830		*	*	
10. Conduct foundation and materials design.	80		*	*	