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Alaska Research Associates

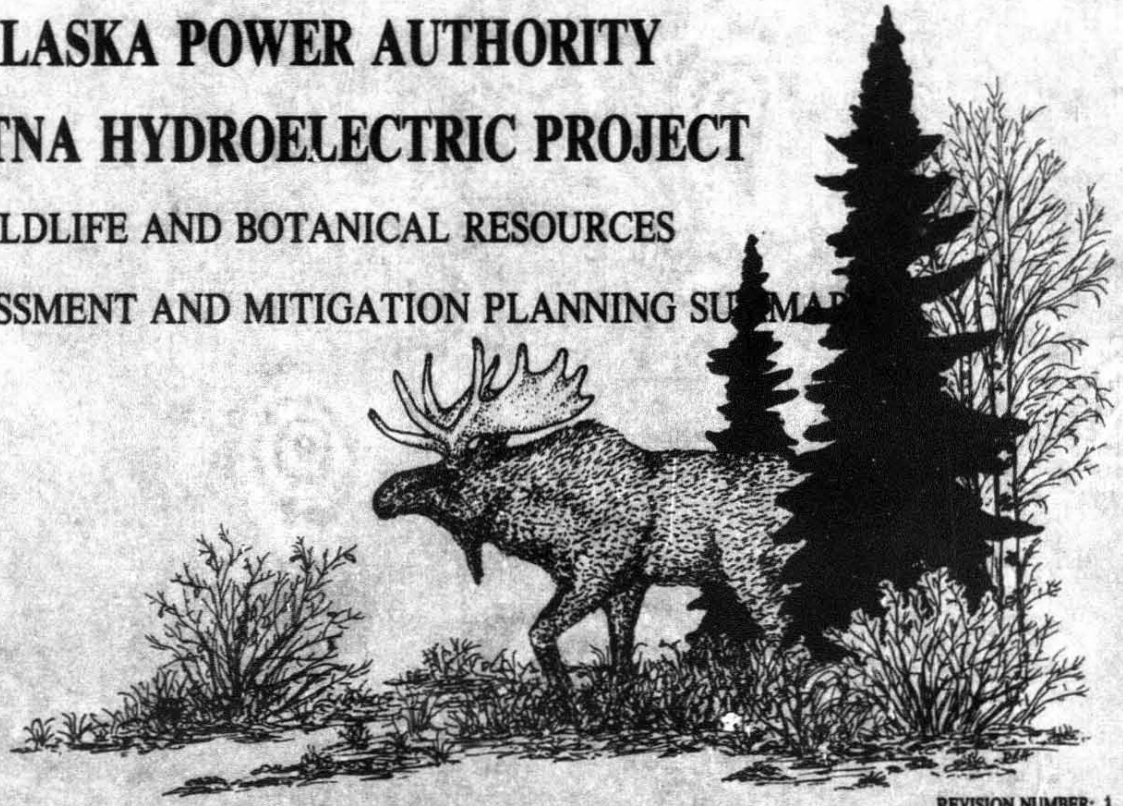
DRAFT

# ALASKA POWER AUTHORITY

# SUSITNA HYDROELECTRIC PROJECT

## WILDLIFE AND BOTANICAL RESOURCES

## IMPACT ASSESSMENT AND MITIGATION PLANNING SUMMARY



FOR:
HARZA-EBASCO SUSITNA JOINT VENTURE
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DRAFT

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# SUSITNA HYDROELECTRIC PROJECT

## WILDLIFE AND BOTANICAL RESOURCES

## IMPACT ASSESSMENT AND MITIGATION PLANNING SUMMARY


Report by

LGL Alaska Research Associates, Inc.


Under Contract to

Harza-Ebasco Susitna Joint Venture

Prepared for

Alaska Power Authority


REVISION 1

FEBRUARY 1985

# PREFACE

This document provides an overview of potential impacts of the Susitna Hydroelectric Project on wildlife and botanical resources of the project area, and indicates the status of planning to mitigate those impacts. The purpose is to provide a working record of impact assessment and mitigation planning in the form of a summary that is updated periodically. During the course of major energy development projects, the tracking of environmental concerns from impact assessment through mitigation proposals and subsequent action can become a cumbersome process. The following summary is organized in matrix format to ease this process and to provide quick reference to current impact and mitigation reasoning. This record is presented to encourage input by all interested parties and to inform decision-makers of the current state of thought concerning relevant resource issues.

Much of the information contained in this planning summary is based on Exhibit E of the project license application to the Federal Energy Regulatory Commission (FERC) (APA 1983a). However, many of the impact assessments and mitigation plans presented in the license application have been considerably refined since license application submittal in February 1983, with additional quantification and detail achieved through further baseline study and data analysis. Updates and refinements are being documented on a continuing basis in successive revisions of the project Mitigation Plan for Wildlife and Botanical Resources (LGL 1985) and in individual reports prepared by project biologists. The planning summary provides an ongoing tracking system for these updates and refinements, and contains references to the appropriate source documents. Descriptions of ongoing and planned studies are from the Alaska Power Authority's Fiscal Year 1985 plan of study for terrestrial programs.

For completeness, all potential botanical and wildlife impact mechanisms identified in project-related documents and review comments on those documents are included here. Most of the potential impact mechanisms listed in the matrix have been identified by project biologists on the basis of studies sponsored since 1980 by the Alaska Power Authority. Other impact mechanisms suggested by resource agencies are also listed. Although they have received attention, the inclusion of these additional hypotheses does not imply that they are based on results of studies by project biologists, or that the suggested mechanisms are expected to produce important impacts.

A potential impact mechanism (whether adverse or beneficial) is considered to be <u>important</u> if, in the judgment of project biologists, that mechanism is likely to produce an observable and persistent change, not attributable to natural fluctuations, in the size or productivity of a wildlife population, or if the mechanism is likely to reduce the maximum sustainable size of a wildlife population (LGL 1985). About 21 percent of the impact mechanisms listed in the planning summary are currently considered to be in this category. For most of these, sufficient information already exists to support ongoing mitigation planning, and additional studies are not considered to be necessary. The remaining potentially important mechanisms are receiving further study, and the list of topics requiring such study is shortening as results accrue.

Potential impact mechanisms not judged to be important will not be subject to further studies or mitigation planning beyond standard engineering and construction practice and, in some cases, field monitoring.

The rationale for determining whether a potential impact mechanism is or is not important is provided in Section 2 (Species Accounts) of the wildlife mitigation plan (LGL 1985). That document is cross-referenced with this planning summary. Future releases of the planning summary will be consistently revised to reflect current information on impact assessment and mitigation planning as reported in the wildlife mitigation plan.

The planning summary is organized to show for each potential impact mechanism the current assessment status, ongoing or planned studies, monitoring plans, and proposed mitigation measures. The major column headings describe the steps in the planning process as follows:

I) <u>Affected Species or Group</u>: lists each species or group of species of concern in the project area and surrounding region.

II) <u>Potential Impact Mechanism</u>: briefly explains how specific project components may affect the listed species or group. Mechanisms judged to be <u>important</u> are underlined.

(continued on next page)

III) Impact Assessment Status: provides an evaluation of the potential impact, including its perceived importance to the affected species or group and any quantification of the impact that has been developed.

IV) Ongoing and Planned Studies: provides a summary of investigations in progress or planned for the near future that are relevant to refining the particular impact assessment or proposed mitigation measures.

V) Proposed Monitoring Activities: summarizes field monitoring programs that are proposed to be conducted during project construction and operation to document impacts and to assist in mitigating them.

VI) Proposed Mitigation Measures: summarizes measures that have been proposed to assist in mitigating the effects of the pertinent impact mechanism.

In cases where the contents of a matrix cell have been changed from the previous revision of the planning summary, the text is preceded by an asterisk (*).

Each cell of the matrix can be uniquely identified by column (vertical) and row (horizontal). To identify a particular cell, it should be cited first by the Affected Species or Group letter; second, by the Impact Mechanism number; and third, by column heading III, IV, V, or VI. For example, the cell on page 1 describing proposed measures to mitigate permanent loss of moose habitat due to the impoundments and other permanent facilities would be cited as A-1/VI. This format provides a shorthand notation that allows specific topics within the planning summary to be cited quickly and precisely in communications concerning impact assessment and mitigation.

A Literature Cited section is provided at the end of this document. Successive revisions of the planning summary will include an increasing number of citations; the goal is to provide document and page references for all project-related reports and other project communications in which a particular impact mechanism, impact assessment, existing or proposed study, proposed monitoring program, or proposed mitigation plan is discussed.

Ongoing studies sponsored by the Alaska Power Authority are continuing to provide new and updated information pertinent to the evaluation of potential impacts. Subsequent revisions of this document will include information provided by these studies and by refinements to impact assessments and mitigation plans, in some cases altering the conclusions contained herein.

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| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (A) Botanical Resources | (1) Permanent loss of vegetation from impoundments, access roads, transmission lines, and other permanent facilities. | Permanent loss of about 45,688 acres of primarily forest and shrubland vegetation types (APA 1983b). | 1:63,360-scale vegetation mapping emphasizing understory shrub species has been completed and is currently being digitized (Jan. 1985) (APA 1984, FY85 Task 8). Wetlands mapping has been completed (APA 1984, FY85 Task 7). These map products will provide more precise quantification of vegetation types and acreages to be affected. | | Mitigation plan provides for minimization, rectification, reduction, and compensation of impacts in a variety of ways (APA 1983a, pp. E-3-252 to 285).<br><br>Minimize facility dimensions (APA 1983a, p. E-3-291 #1).<br><br>Consolidate structures (APA 1983a, p. E-3-291 #2).<br><br>Site facilities in areas of low biomass (APA 1983a, p. E-3-291 #3).<br><br>Site facilities to minimize clearing of less abundant vegetation types (APA 1983a, p. E-3-291 #4).<br><br>Site facilities to minimize clearing of vegetation types productive as wildlife habitat components (APA 1983a, p. E-3-291 #5).<br><br>Minimize volume requirements for borrow extraction (APA 1983a, p. E-3-291 #6).<br><br>Disposal of spoil within the impoundments or previously excavated areas (APA 1983a, p. E-3-292 #7).<br><br>Acquisition of replacement lands for implementation of habitat enhancement measures (APA 1983a, p. E-3-292 #12).<br><br>Avoidance of the Prairie Creek, Stephan Lake, Fog Lakes, and Indian River areas by access routing (APA 1983a, p. E-3-292 #14).<br><br>Siting and alignment of facilities to avoid wetlands to the maximum extent feasible (APA 1983a, p. E-3-292 #18).<br><br>Agency coordination and participation in detailed planning of civil engineering measures to minimize potential wetlands impacts (APA 1983a, p. E-3-292 #19).<br><br>Minimize loss of forest areas through alignment of access roads and tranmission corridors and other measures (APA 1983a, pp. E-3-539 #23, E-3-525 #1, E-3-526 #2). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
|---|---|---|---|---|---|
| (A) Botanical Resources (cont.) | (2) Temporary loss or alteration of vegetation from temporary facilities, disturbed areas, and transmission lines. | Temporary loss or alteration of about 15,267 acres of vegetation (APA 1983b). | | Monitor progress of rehabilitation to identify locations requiring further attention (APA 1983a, p. E-3-292 #11). | Minimize facility dimensions (APA 1983a, p. E-3-291 #2).<br><br>Consolidate structures (APA 1983a, p. E-3-291 #2).<br><br>Site facilities in areas of low biomass (APA 1983a, p. E-3-291 #3).<br><br>Site facilities to minimize clearing of less abundant vegetation types (APA 1983a, p. E-3-291 #4).<br><br>Minimize volume requirements for borrow extraction (APA 1983a, p. E-3-291 #6).<br><br>Dispose of spoil within the impoundments or previously excavated areas (APA 1983a, p. E-3-292 #7).<br><br>Dismantle nonessential structures as soon as they are vacated (APA 1983a, p. E-3-292 #9).<br><br>Develop a comprehensive site rehabilitation plan (APA 1983a, p. E-3-292 #10).<br><br>Develop an environmental briefings program for all field personnel (APA 1983a, p. E-3-292 #13).<br><br>Restrict public access during construction by gating the access road (APA 1983a, p. E-3-292 #15).<br><br>Use of signs and possibly regulatory designations and measures to discourage use of ORVs and ATVs (APA 1983a, p. E-3-292 #16).<br><br>Site and align facilities to avoid wetlands to the maximum extent feasible (APA 1983a, p. E-3-292 #18).<br><br>Agency coordination and participation in detailed planning of civil engineering measures to minimize potential wetlands impacts (APA 1983a, p. E-3-292 #19).<br><br>Minimize habitat loss by side borrow techniques for road construction, spoil deposition in impoundments or depleted borrow areas, and consolidation of project facilities (APA 1983a, p. E-3-526 #2).<br><br>Fertilize and allow revegetation of disturbed sites (APA 1983a, p. E-3-526 #3).<br><br>Minimize loss of forest areas through alignment of access roads and transmission corridors and other measures (APA 1983a, pp. E-3-539 #23, E-3-525 #1, E-3-526 #2). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
|---|---|---|---|---|---|
| (A) Botanical Resources (cont.) | (3) Temporary loss or alteration of vegetation communities due to forest clearing operations in the impoundment zone. | Impacts similar to (A-1) will occur 1 to 2 years earlier; effects will be greatest on forest vegetation types (LGL 1985, section 2.1). | 1:63,360-scale vegetation mapping emphasizing understory shrub species has been completed and is currently being digitized (Jan. 1985) (APA 1984, FY85 Task 8). | | Designate compensation lands for habitat management (APA 1983a, p. E-3-292 #12).<br><br>Employ habitat management measures in middle basin and on other lands to compensate for permanent habitat loss (APA 1983a, p. E-3-527 #6).<br><br>Develop moose carrying capacity model to allow refinements to impact predictions and planned mitigation measures (APA 1983a, p. E-3-530 #7). |
| | (4) Loss or alteration of vegetation due to erosion resulting from slides, flows, and slumpages along impoundment shores. | About 2,104 acres of vegetation upstream of the Watana Dam site and a small acreage in Devil Canyon will be subject to loss and alteration through: a) destabilization of till, b) blowdowns, c) thawing of permafrost, d) desiccation of exposed soils, and e) changes in drainage patterns. Impacts may occur irregularly along 70 miles of impoundment shores. | | Monitor progress of rehabilitation to identify locations requiring further attention (APA 1983a, p. E-3-292 #11). | Develop a comprehensive site rehabilitation plan (APA 1983a, p. E-3-292 #10).<br><br>Designate compensation lands for habitat management (APA 1983a, p. E-3-292 #12).<br><br>Fertilize and allow revegetation of disturbed sites (APA 1983a, p. E-3-256 #3).<br><br>Employ habitat management measures in middle basin and on other lands to compensate for permanent habitat loss (APA 1983a, p. E-3-527 #6).<br><br>Develop moose population model to allow refinements to planned mitigation measures. |
| | (5) Damage to vegetation near cleared areas and along impoundment shores from wind and dust. | Blowdown of trees may occur near cleared areas and along impoundment shores, mainly affecting black spruce stands. Wind-blown dust may affect vegetation through alteration of snowmelt regimes and changes in the chemical composition of soils. | | Monitor progress of rehabilitation to identify locations requiring further attention (APA 1983a, p. E-3-292 #11). | Minimize facility dimensions (APA 1983a, p. E-3-291 #1).<br><br>Consolidate structures (APA 1983a, p. E-3-291 #2).<br><br>Minimize volume requirements for borrow extraction (APA 1983a, p. E-3-291 #6).<br><br>Dispose of spoil within the impoundments of previously excavated areas (APA 1983a, p. E-3-292 #7).<br><br>Develop a comprehensive site rehabilitation plan (APA 1983a, p. E-3-292 #10).<br><br>Fertilize and allow revegetation of disturbed sites (APA 1983a, p. E-3-526 #3).<br><br>Employ measures to control road dust (APA 1983a, p. E-3-511). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
|---|---|---|---|---|---|
| (A) Botanical Resources (cont.) | (6) Damage and alteration of vegetation along the access roads due to dust deposition, erosion, leaching of nutrients in drained areas, water-logging in areas of blocked drainage, and thawing of adjacent permafrost. | Dust impacts will occur within a few hundred yards of a road; zones of blocked or altered drainage may extend to a mile from a road. | | Monitor progress of rehabilitation to identify locations requiring further attention (APA 1983a, p. E-3-292 #11). | Site facilities in areas of low biomass (APA 1983a, p. E-3-291 #3).<br><br>Site facilities to minimize clearing of vegetation types productive as wildlife habitat components (APA 1983a, p. E-3-291 #5).<br><br>Development of a comprehensive site rehabilitation plan (APA 1983a, p. E-3-292 #10).<br><br>Designation of compensation lands for implementation of habitat management measures (APA 1983a, p. E-3-292 #12).<br><br>Siting and alignment of facilities to avoid wetlands to the maximum extent feasible (APA 1983a, p. E-3-292 #18).<br><br>Agency coordination and participation in detailed planning of civil engineering measures to minimize potential wetlands impacts (APA 1983a, p. E-3- 292 #19).<br><br>Habitat loss will be minimized by side borrow techniques for road construction, spoil deposition in impoundments or depleted borrow areas, and consolidation of project facilities (APA 1983a, p. E-3-526 #2).<br><br>Fertilization and revegetation of disturbed sites (APA 1983a, p. E-3-526 #3).<br><br>Habitat management measures in middle basin and on other lands to compensate for permanent habitat loss (APA 1983a, p. E-3-527 #6). |
| | (7) Alteration of soil surface albedo in cleared areas may affect vegetation. | Impact not quantified. Changes in albedo can produce changes in surface hydrology, affecting the type of vegetation that becomes established (APA 1983a, p. E-3-227). | Expected impact severity not sufficient to require study. | Monitor progress of rehabilitation to identify locations requiring further attention (APA 1983a, p. E-3-292 #11). | Minimize facility dimensions (APA 1983a, p. E-3-291 #1).<br><br>Consolidate structures (APA 1983a, p. E-3-291 #3).<br><br>Site facilities to minimize clearing of vegetation types productive as wildlife habitat components (APA 1983a, p. E-3-291 #5).<br><br>Develop a comprehensive site rehabilitation plan (APA 1983a, p. E-3-292 #10). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
|---|---|---|---|---|---|
| (A) Botanical Resources (cont.) | (8) Increased incidence of disease or insect infestations due to clearing activities. | | Expected impact severity not sufficient to require study. | | Impoundment clearing will not begin until 2 or 3 years before filling; patches of vegetation will be left until just before filling (APA 1983a, p. E-3-525 #1).<br><br>Clear impoundments prior to flooding and remove floating debris to reduce hazards to crossing (APA 1983a, p. E-3-530 #9).<br><br>Burn slash piles to minimize effects of insects and disease (APA 1983a, p. E-3-271 and 509). |
| | (9) Increased risk of fire from increased human activities and easier access. | | A quantitative prediction of the extent of impact will not be undertaken. | Monitoring will include attention to potential fire hazards. | Develop an environmental briefings program for all field personnel (APA 1984a, p. E-3-292 #13).<br><br>Develop a comprehensive site rehabilitation plan (APA 1983a, p. E-3-292 #10).<br><br>Restrict public access during construction by gating the access road (APA 1983a, p. E-3-292 #15).<br><br>Use of signs and possibly regulatory designations and measures to discourage use of ORVs and ATVs (APA 1983a, p. E-3-292 #16).<br><br>Phased implementation of the project Recreation Plan with interagency review and concurrence (APA 1983a, p. E-3-292 #17).<br><br>Prohibit public access to immediate project area during construction (APA 1983a, p. E-3-534 #14). |
| | (10) Alteration of vegetation due to flooding along impoundment shores and delta formation where creeks enter the impoundments. | Impact not quantified but not expected to be a significant loss; some alteration of vegetation types will occur. | Expected impact severity not sufficient to require study. | | No mitigation appears to be feasible. |
| | (11) Alteration of vegetation successional patterns in downstream floodplains due to flow regulation and resultant changes in stream morphology and ice scouring effects. | Impact not yet quantified. | Downstream vegetation studies conducted in summer 1984; impact analysis currently in progress (APA 1984b, FY85 Task 15). | Monitor changes in downstream vegetative cover (APA 1983a, p. E-3-523 #2). | Develop moose population model to allow refinements to mitigation measures (APA 1983a, p. E-3-530 #7).<br><br>Designate compensation lands for habitat management (APA 1983a, p. E-3-292 #12). |

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| (A) Botanical Resources (cont.) | (12) Alteration of vegetation communities due to climatic changes near the reservoirs. | Effects may extend 2 miles from the reservoirs and would be most noticeable along the south shores. Probably extent of effects on vegetation has not been quantified. | Impact mechanism will be addressed and clarified through impact assessment refinement (APA 1984b, FY Task 5). | No specific monitoring activities are planned. | Use of multilevel intake structures on the dams to maintain downstream river temperatures as close to normal as possible (APA 1983a, p. E-3-526 #5). |
| | (13) Damage to understory vegetation from rime ice and hoar frost deposition caused by persistent fog banks near the reservoirs and open-water reaches downstream. | Impact not quantified, but rime icing will be limited to the immediate area around the spillways. Hoar frost is expected near open water but is not expected to be an important negative impact. | Impact mechanism will be addressed and clarified through impact assessment refinement (APA 1984, FY85 Task 5). | Monitor changes in downstream vegetative cover (APA 1983a, p. E-3-523 #2). | Mitigation not expected to be required; probably not feasible in any case. |
| | (14) Increase in damage and alteration of vegetation communities due to increase in use of off-road vehicles near project facilities. | Impact not quantified. | | Monitor progress of rehabilitation to identify locations requiring further attention (APA 1983a, p. E-3-292 #11). | Develop a comprehensive site rehabilitation plan (APA 1983a, p. E-3-292 #10).<br><br>Develop an environmental briefings program for all field personnel (APA 1983a, p. E-3-292 #13).<br><br>Restrict public access during construction by gating the access road (APA 1983a, p. E-3-292 #15).<br><br>Use of signs and possibly regulatory designations and measures to discourage use of ORVs and ATVs (APA 1983a, p. E-3-292 #16).<br><br>Phased implementation of the project Recreation Plan with interagency review and concurrence (APA 1983a, p. E-3-292 #17).<br><br>Prohibit public access to immediate project area during construction (APA 1983a, p. E-3-534 #14). |
| | (15) Removal of overstory vegetation in forested portions of the transmission corridors. | Will affect about 6,017 acres (2,557 from Healy to Fairbanks, 3,404 from Healy to Willow, 1,274 from Willow to Cook Inlet, 46 from Watana to Devil Canyon, and 462 from Devil Canyon to Gold Creek) of habitats containing trees, producing an increase in shrub-type vegetation. | | | Design transmission corridors to allow selective cutting of trees and to accommodate uncleared low shrub and tundra vegetation within rights-of-way (APA 1983a, p. E-3-292 #8).<br><br>Employ selective clearing in transmission corridors, permitting seral vegetation up to 10 ft in height (APA 1983a, p. E-3-526 #4). |
| | (16) Blockage of sediment transport by the impoundments may increase erosion downstream, affecting vegetation on islands in the floodplain. | Impact not quantified. | Downstream impact assessment is currently in progress (APA 1984b, FY85 Task 15). | Collect data on changes in downstream vegetative cover (APA 1983a, p. E-3-523 #2). | Mitigation not feasible. |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
|---|---|---|---|---|---|
| (A) Botanical Resources (cont.) | (17) Potential removal or alteration of habitats for endangered plant species. | Impact not quantified. No endangered species have been found in surveys to date. | Previous studies provided sufficient information for impact assessment. No further studies planned. | No monitoring planned; endangered species not known to occur in project area. | Site facilities to minimize clearing of less abundant vegetation types (APA 1983a, p. E-3-291 #4).<br><br>Design transmission corridors to allow selective cutting of trees and to accommodate undisturbed low shrub and tundra vegetation within rights-of-way (APA 1983a, p. E-3-292 #8).<br><br>Use of signs and possibly regulatory designations and measures to discourage use of ORVs and ATVs (APA 1983a, p. E-3-292 #16). |
| | (18) Leaching of potentially toxic heavy metals, such as mercury, from flooded soils and vegetation into the reservoir impoundment. | Impact not quantified. May affect primarily predatory fish, raptors, and carnivorous mammals. | A literature search and analysis of the potential for leaching from soils and vegetation into impoundments is in progress (Aquatic FY85 Task 51). | Need for monitoring will be determined, based on impact assessment. | Mitigative measures not planned at this time. |
| (B) Moose | (1) Clearing of vegetation in the impoundment area will reduce winter carrying capacity prior to flooding. | Clearing will reduce winter carrying capacity of the impoundment zone 2-3 years prior to filling (APA 1983a, p. E-3-398, Table E.3.145; LGL 1985, p. 2.2-8). | Refinement of population (APA 1984b, FY85 Task 16) and carrying capacity (APA 1984b, FY85 Task 11) models to better estimate impacts on moose and determine acreage of habitat compensation is being conducted. | Monitor browse production on lands enhanced for moose browse (APA 1983a, p. E-3-525 #11). | Impoundment clearing will not begin until 2 or 3 years before filling; patches of vegetation will be left until just before filling (APA 1983a, p. E-3-525 #1).<br><br>Designate compensation lands for habitat management measures (APA 1983a, p. E-3-292 #12).<br><br>Employ habitat management measures in middle basin and on other lands to compensate for permanent habitat loss (APA 1983a, p. E-3-527 #6). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (B) Moose (cont.) | (2) Permanent habitat loss due to the impoundments and other permanent facilities. | Habitat-based assessment is in progress; refinement of moose carrying capacity model will quantify estimated impact magnitude (APA 1983a, pp. E-3412 to 414; LGL 1985, p. 2.2-8). | * Refinement of population (APA 1984b, FY85 Task 16) and carrying capacity (APA 1984b, FY85 Task 11) models to better estimate impacts on moose and determine acreage of habitat compensation is being conducted and planned. 1:63,360 scale vegetation mapping and digitizing emphasizing understory moose forage is currently underway and is scheduled for completion in January 1985 (APA 1984, FY85 Task 8). A browse inventory (APA 1984b, FY85 Task 13) planned for FY85-86 will support the ongoing carrying capacity model development. Identification and assessment of candidate compensation lands is underway (APA 1984b, FY85 Task 12). Field studies of downstream disturbed areas are planned (APA 1984b, FY85 Task 14). Continued monitoring of moose habitat use and winter snow severity (APA 1984b, FY85 Task 10) are underway.<br><br>Impacts will be further addressed through impact assessment refinement (APA 1984, FY85 Task 5). | Monitor browse production on lands enhanced for moose browse (APA 1983a, p. E-3-525 #11). | Impoundment clearing will not begin until 2 or 3 years before filling; patches of vegetation will be left until just before filling (APA 1983a, E-3-525 #1).<br><br>Selective clearing in transmission corridor, permitting seral vegetation to grow up to 10 ft in height (APA 1983a, p. E-3-526 #4).<br><br>Transmission corridors will provide almost 78,100 acres of winter habitat of reasonable quality (APA 1983a, p. E-3-528, Table E.3.145).<br><br>Habitat enhancement measures in middle basin and on replacement lands to compensate for permanent habitat loss (APA 1983a, p. E-3-527 #6).<br><br>Acquisition of replacement lands for implementation of habitat enhancement measures (APA 1983a, p. E-3-292 #12). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (B) Moose (cont.) | * (3) Permanent loss and alteration of moose habitat will occur as a result of access road and railroad corridor construction, maintenance, and use. | * Borrow areas and gravel berms for roads and railroad will remove about 1,100 acres (447 ha) of vegetation. Direct loss of forage may be relatively small, but effective loss may be greater if disturbance results in avoidance (LGL 1985, p. 2.2-9). | * Refinement of population (APA 1984b, FY85 Task 16) and carrying capacity (APA 1984b, FY85 Task 11) models to estimate impacts on moose and determine acreage required for habitat compensation is being conducted. 1:63,360-scale vegetation mapping and digitizing to include access corridors and emphasizing understory moose forage is currently under way and is scheduled for completion in January 1985 (APA 1984b, FY85 Task 8). A browse inventory (APA 1984b, FY85 Task 13) planned for FY85-86 will support the ongoing carrying capacity model development. Identification and assessment of candidate compensation lands is under way (APA 1984b, FY85 Task 12).<br><br>Impacts will be further addressed through impact assessment refinement (APA 1984b, FY85 Task 5). | Monitor browse production on lands enhanced for moose browse (APA 1983a, p. E-3-525 #11). | Minimize habitat loss by side borrow techniques for road construction, spoil deposition in impoundments or depleted borrow areas, and consolidation of project facilities (APA 1983a, p. E-3-526 #2).<br><br>Fertilize and allow revegetation of disturbed sites (APA 1983a, p. E-3-526 #3).<br><br>Employ habitat management measures in middle basin and on other lands to compensate for permanent habitat loss (APA 1983a, p. E-3-527 #6).<br><br>Incorporate changes to design and alignment of access road to reduce impacts on moose (APA 1983a, p. E-3-533 #11).<br><br>Minimize loss of forest areas through alignment of access road and transmission corridors, and other measures (APA 1983a, pp. E-3-539 #23, 525 #1 to 526 #2).<br><br>Minimize loss and alteration of habitat, particularly less abundant habitats and sensitive wildlife habitats (APA 1983a, pp. E-3-291, 292 #1-11).<br><br>Designate lands for habitat management measures (APA 1983a, p. E-3-292 #12).<br><br>Avoid the Prairie Creek, Stephan Lake, Fog Lakes, and Indian River areas by access routing (APA 1983a, p. E-3-292 #14).<br><br>Design and align roads and railroad to minimize impacts on wetlands (APA 1983a, p. E-3-292 #18, 19). |
| | * (4) Impeded drainage caused by access road and railroad berms may alter moose habitat as a result of flooding of forest or shrubland areas. | * Altered surface water drainage will cause very localized moose habitat alteration. There is equal likelihood that either higher or lower quality habitats will result. No net important impact is anticipated (LGL 1985, p. 2.2-9). | * Impact severity not sufficient to require study. | | Minimize loss of forest areas through alignment of access road and transmission corridor, and other measures (APA 1983a, p. E-3-539 #23, 525 #1 to 526 #2).<br><br>Design and align roads and railroad to minimize impacts on wetlands (APA 1983a, p. E-3-292 #18, 19). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (B) Moose (cont.) | (5) Temporary loss of winter habitat will occur on borrow sites. | * Winter habitat for an estimated 37 moose will be affected based on preliminary carrying capacity data. Revegetation is likely to restore these areas as moose habitat within 2-20 years following disturbance (APA 1983a, Table E.3.145; LGL 1985, p. 2.2-9). | Refinement of population (APA 1984b, FY85 Task 16) and carrying capacity (APA 1984b, FY85 Task 11) models to estimate impacts on moose and determine acreage requirements for habitat compensation is being conducted. | Monitor browse production on lands managed for moose browse (APA 1983a, p. E-3-525 #11). | * Habitat loss will be minimized by depositing spoil in impoundments or depleted borrow areas, and consolidation of project facilities (APA 1983a, p. E-3-526 #2).<br><br>Fertilize and allow revegetation of disturbed sites (APA 1983a, p. E-3-526 #3).<br><br>Employ habitat management measures in middle basin and on other lands to compensate for permanent habitat loss (APA 1983a, p. E-3-527 #6).<br><br>Designate lands for habitat management measures (APA 1983a, p. E-3-292 #12).<br><br>Design and align roads and railroad to minimize impacts on wetlands (APA 1983a, p. E-3-292 #18, 19). |
| | * (6) Habitat quality may temporarily decrease near the reservoir margins as a result of locally high densities of moose dispersing from impounded areas. | * Heavier browsing of shrubs growing near the reservoir margins will occur as wintering moose congregate. Overbrowsing of the shrubs is not considered important because of the low densities of shrubs. Habitat quality will not be substantially reduced below the current low levels (LGL 1985, p. 2.2-9). | * Refinement of population (APA 1984b, FY85 Task 16) and carrying capcity (APA 1984b, FY85 Task 11) models to estimate impacts on moose and determine acreage requirements for habitat compensation is being conducted. | Monitor browse production on lands managed for moose browse (APA 1983a, p. E-3-525 #11). | Impoundment clearing will not begin until 2 or 3 years before filling; patches of vegetation will be left until just before filling (APA 1983a, p. E-3-525 #1).<br><br>Employ habitat management measures in middle basin and on other lands to compensate for permanent habitat loss (APA 1983a, p. E-3-527 #6).<br><br>Designate lands for habitat management measures (APA 1983a, p. E-3-292 #12). |
| | * (7) Accidental fires resulting from human activities may temporarily degrade some moose habitat. | * Fires may degrade some moose habitat over the short term, but regenerated vegetation on burns will provide productive moose habitat several years later (APA 1983a, p. E-3-398, Table E.3.145; LGL 1985, p. 2.2-10). | A literature review of habitat enhancement techniques has been conducted. Field studies of downstream disturbed areas are planned (APA 1984b, FY85 Task 14). | | Prohibit public use of access road and airfield during construction (APA 1983a, p. E-3-534 #12, 14).<br><br>Develop an environmental briefings program for all field personnel (APA 1983a, p. E-3-292 #13). |
| | * (8) Loss of moose habitat due to erosion of impoundment shorelines will continue following flooding. | * Erosion resulting from slides and flows will be confined to the immmediate shorelines, where colonization of disturbed soils by plants beneficial to moose could supply forage that will offset any adverse impact with a net beneficial impact (LGL 1985, p. 2.2-10). | * Previous studies provided sufficient information for impact assessment. No further studies are planned. | | Employ habitat management measures in middle basin and on other lands to compensate for permanent habitat loss (APA 1983a, p. E-3-527 #12, 14).<br><br>Designate lands for habitat management measures (APA 1983a, p. E-3-292 #12). |

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| (B) Moose (cont.) | * (9) Habitat quality for moose will improve along the transmission line corridor because vegetation will be maintained in early successional stages. | * About 41,521 acres (16,810 ha) of forested vegetation will be cleared. Regrowth will be permitted to attain a maximum height of 10 ft (3 m) before reclearing. This represents a beneficial impact for moose populations wintering along the transmission line corridor (LGL 1985, p. 2.2-10). | A literature review of habitat enhancement techniques has been completed. Field studies of disturbed areas are planned (APA 1984b, FY85 Task 14). | | Selective clearing in transmission corridor, permitting seral vegetation to grow up to 10 ft in height (APA 1983a, p. E-3-526 #4). |
| | * (10) Alteration of moose habitat downstream of Devil Canyon will occur due to altered seasonal and annual flow regimes of the Susitna River. | * Decreased summer flows, and decreased frequency and severity of summer floods, will promote encroachment of pioneering vegetation (e.g. willows). However, in the absence of frequent disturbance all successional stages of vegetation will advance, resulting in habitat values declining over time (LGL 1985, pp. 2.2-10-11). | Refinement of downstream vegetation impact assessment to better assess effects on moose habitat will continue (APA 1984b, FY85 Tasks 5, 15, 23). | Collect data on changes in downstream vegetative cover (APA 1983a, p. E-3-523 #2). | Use of multilevel intake structures on the dams to maintain downstream river temperatures as close to normal as possible (APA 1983a, p. E-3-526 #5).<br><br>Habitat enhancement measures in middle basin and on replacement lands to compensate for permanent habitat loss (APA 1983a, p. E-3-527 #6). |
| | * (11) Local climatic changes resulting from the impoundments including increased summer rainfall, increased winds, cooler summer temperatures, increased early winter snowfall, hoar frost deposition on vegetation in winter, delayed spring plant phenology, and changes in plant species composition may reduce habitat carrying capacity for moose. | * The impoundments will moderate local seasonal temperatures. Effects will be localized around the impoundments, with the maximum effect at the prevailing windward shoreline. Slight, but immeasurable precipitation increases of summer rainfall and early winter snowfall may occur. Hoar frost depositon may form on vegetation near the impoundment margins prior to ice formation on the reservoir surface, but measurable increases above pre-project conditions would be negligible. Cooler spring temperatures may delay phenological development. Numerous other local factors combine to make changes in phenology difficult to attribute to climate alterations. Other project-induced factors may positively influence early plant development. Climatic changes are not expected to measureably reduce habitat carrying capacity for moose (LGL 1985, pp. 2.2-11-12). | * Previous studies provided sufficient information for impact assessment. No further studies are planned. | | |

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| (B) Moose (cont.) | * (12) Open and warmer water in downstream areas may alter plant phenology and affect spring forage and cover for moose. | * Open and warmer water in early spring would serve both to retard river ice development in late winter and to melt existing river ice faster. Both would tend to promote early, rather than late, development of vegetation (LGL 1985, p. 2.2-12). | Impact severity not sufficient to require study. | | Use of multilevel intake structures on the dams to maintain downstream river temperatures as close to normal as possible (APA 1983a, p. E-3-526 #5). |
| | (13) Vegetation icing (hoar frost) downstream may render some browse unavailable, and metabolic demands of moose may increase as a result. | * Open water may be present down to about Gold Creek with both dams in operation. Although accumulation of hoar frost may make some browse unavailable, it is unlikely that this will occur because of the relatively narrow lead of open water. Moose are not known to avoid eating browse with hoar frost attached. Hoar frost accumulates on vegetation under current conditions and is not likely to appreciably increase as a result of the project (LGL 1985, p. 2.2-12). | * Impact severity not sufficient to require study. | | Use of multilevel intake structures on the dams to maintain downstream river temperatures as close to normal as possible (APA 1983a, p. E-3-526 #5). |
| | (14) Drifting snow from the frozen impoundment surface may preclude use of a narrow band of winter browse along the impoundment shore. | * The magnitude of the effects of snow drifting from the frozen impoundments will depend on several factors. Any snow accumulations that occur are expected on the south and west shorelines. Most of the drifting snow will be intercepted by the decreasing reservoir levels and the resulting ice shelves and cracks that are formed. It is unlikely that sufficient quantities of snow will accumulate along impoundment shorelines to restrict movements of moose or cover browse that may be growing there (LGL 1985, pp. 2.2-12-13). | * Impact severity not sufficient to require study. | | |
| | (15) Drifting snow in the transmission line corridor may preclude use of winter browse. | * Vegetation will be permitted to reach 10 ft in height before re-clearing the transmission corridor. Maintenance of this dense shrub growth will intercept blowing snow (LGL 1985, p. 2.2-13). | * Impact severity not sufficient to require study. | | Selective clearing in the transmission corridor, permitting seral vegetation to grow up to 10 ft in height (APA 1983a, p. E-3-526 #4).<br><br>Minimize loss of forest areas through alignment of access road and transmission corridor, and other measures (APA 1983a, p. E-3-539 #23). |

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| (B) Moose (cont.) | (16) Delayed melting of snow drifts in a narrow band along both impoundment shorelines and the transmission corridor may reduce availability of spring forage. | * This impact is not expected to occur (LGL 1985, p. 2.2-13) (see also Impacts B-14 and B-15). | * Impact severity not sufficient to require study. | | |
| | (17) Snow drifts may impede movements south and southwest of the reservoir and reduce the value of the Fog Lakes area as winter range. | * This impact is not expected to occur. The value of the Fog Lakes area will be unaffected by drifting snow (LGL 1985, p. 2.2-13) (see also Impact B-14). | * Impact severity not sufficient to require study. | | |
| | (18) Open water and/or ice shelving in the impoundments may block access to traditional calving and wintering areas. | Some moose may not cross the impoundment due to ice blockage and visual barrier effects. Moose will probably alter seasonal movements and crossings to maximize use of surrounding browse and forage supplies (APA 1983a, pp. E-3-409-410; LGL 1985, p. 2.2-13). | * Previous studies provided sufficient information for impact asessment. No further studies are planned. | Collect records of impoundment crossings and impoundment-caused mortality during open-water period (APA 1983a, p. E-3-524 #14). | Clearing of impoundments prior to flooding and removal of floating debris to reduce hazards to crossing (APA 1983a, p. E-3-530 #9). |
| | (19) Open water downstream may restrict movements across the river and to island wintering areas, and attempted crossings of open river areas in winter may lead to mortality. | * Moose are unlikely to cross open water in winter (most crossings were from May to November [APA 1983a, p. E-3-410]). Open water leads occur under current conditions along most of the Susitna River during the winter, which effectively functions to limit many river crossings (LGL 1985, p. 2.2-14). | * Previous studies provided sufficient information for impact assessment. No further studies are planned. | | Use of multilevel intake structures on the dams to maintain downstream river temperatures as close to normal as possible (APA 1983a, p. E-3-526 #5). |
| | (20) Displacement of moose during reservoir filling years and alteration of movements between winter and summer range after project completion could increase predation rates, possibly driving moose populations to low levels which may be maintained there by continued predation. | * Decreases in numbers or productivity of moose caused by project-related increases in predation could be caused by these artificial local increases in densities. This would probably increase the direct mortality of moose, especially calves. This effect would probably diminish or disappear after several years as relative densites of predators and moose became stabilized (LGL 1985, p. 2.2-14). | Moose calf mortality study (APA 1984b, FY85 Task 9) and moose population modeling (APA 1984b, FY85 Task 16). | Collect information on wolf populations throughout construction and into operation (APA 1983a, p. E-3-525 #7).<br><br>Collect information on bear populations and distribution of bear harvest (APA 1983a, p. E-3-534 #14). | |

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| (B) Moose (cont.) | (21) Increase in mortality of moose may occur due to hunting and poaching. | * Hunting can be regulated by the appropriate state agency, but increased poaching resulting from increased access is difficult to control (APA 1983a, Table E.3.145). Moose are currently poached along the Susitna River; increased access will almost surely antagonize this illegal take of animals in the absence of intensive enforcement measures (LGL 1985, p. 2.2-14). | Further data collection and analysis regarding current and future use of wildlife in the project area is planned (APA 1984c, Social Science FY85 Recreation Tasks 4-6). | | Public access to access road and airfield prohibited during construction (APA 1983a, p. E-3-534; LGL 1985, p. 2.2-20 #12, 14).<br><br>Use of project facilities or equipment by employees and families for hunting and trapping will be prohibited (APA 1983a, p. E-3-534 #14; LGL 1985, p. 2.2-20).<br><br>Recommendations for restrictions to hunting regulations to reduce hunting pressure (APA 1983a, p. E-3-534 #14).<br><br>Discouragement of off-road recreational vehicle activity, and phasing in of recreational plan to limit recreational impacts on vegetation and wildlife (APA 1983a, p. E-3-292 #16, 17). |
| | (22) Ice shelving or floating debris may cause direct mortality to moose attempting to cross the impoundment. | * Under current conditions, moose are occassionally injured or killed as they cross the river. The numbers of moose accidently killed each year as a result of impoundment hazards is unlikely to exceed 1% of the population occurring within 5 miles of the impoundment. This impact could be expected to decrease even further through time (APA 1983a, p. E-3-411, Table E.3.145; LGL 1985, p. 2.2-14). | * Impact severity not sufficient to require study. | Collect records of impoundment crossings and impoundment-caused mortality during open-water period (APA 1983a, p. E-3-524 #4). | Clearing of impoundments prior to flooding and removal of floating debris to reduce hazards to crossing (APA 1983a, p. E-3-530 #9). |
| | (23) Increase in mortality may occur due to train and automobile collisions caused by increases in traffic levels. | * During construction and operation of the access roads and railway, it is likely that some moose will be killed as a result of collisions with vehicles and trains (APA 1983a, pp. E-3-477-478, Table E.3.145). Moose will suffer higher mortality rates during the construction period. However, most of the conditions necessary for producing a critical problem will not occur during winter over most of the length of the access roads and railways (LGL 1985, pp. 2.2-14-15). | * Previous studies provided sufficient information for impact assessment. No further studies are planned. | Collect mortality data on road and railroad collisions (APA 1983a, p. E-3-523 #1). | Possible controls on volume, speed, and frequency of access road traffic (APA 1983a, p. E-3-534 #12). |

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| (B) Moose (cont.) | (24) Drifted snow along railroad and road access corridors and roadway berms may impede movements of moose and/or subject them to higher risk of collision mortality. | * There is evidence that moose may elect to walk on roadways and railroad tracks that have been plowed for snow removal (APA 1983a, pp. E-3-479 to 480), but there is no evidence to suggest that moose would be inescapably trapped by drifted or plowed snow along those corridors (LGL 1985, p. 2.2-15). | * Impact severity not sufficient to require study. | Collect mortality data on road and railroad collisions (APA 1983a, p. E-3-523 #1). | Changes in design and alignment of access road to reduce impacts on moose (APA 1983a, p. E-3-533 #11).<br><br>Possible controls on volume, speed and frequency of access road traffic (APA 1983a, p. E-3-534 #12). |
| | (25) Alteration of moose distribution may occur due to corridor traffic and disturbance. | * Activities along access corridors will probably disturb the normal activities of some moose attempting to cross corridors, particularly during the construction period and during hunting season (APA 1983a, p. E-3-479, Table E.3.145; LGL 1985, p. 2.2-15). However, major disruptions of seasonal migrations are unlikely to occur (LGL 1985, p. 2.2-15). | Impact severity not sufficient to require study. | Collect mortality data on road and railroad collisions (APA 1983a, p. E-3-523 #1). | Major ground activity will be prohibited near sensitive wildlife areas during sensitive periods (APA 1983a, p. E-3-532 #10).<br><br>Changes in design and alignment of access road to reduce impacts on moose (APA 1983a, p. E-3-533 #11).<br><br>Possible controls on volume, speed, and frequency of access road traffic (APA 1983a, p. E-3-534 #12).<br><br>Public access to access road and airfield prohibited during construction (APA 1983a, p. E-3-534 #12, 14).<br><br>Planning and development of an environmental briefings program for all field personnel (APA 1983a, p. E-3-292 #13).<br><br>Avoidance of the Prairie Creek, Stephan Lake, Fog Lakes, and Indian River areas by access routing (APA 1983a, p. E-3-292).<br><br>Discouragement of off-road recreational vehicle activity, and phasing in of recreational plan to limit impacts on vegetation and wildlife (APA 1983a, p. E-3-292 #14). |

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| (B) Moose (cont.) | (26) Increase in ground-based human activity (road traffic, village activities, dam construction) may preclude use of some areas by moose, particularly sensitive areas such as calving sites and winter habitat. | * Moose appear to be more tolerant of disturbances than most ungulates, particularly if disturbances are predictable, neutral, stimuli, such as moving vehicles. Areas near sources of disturbance would probably continue to be used if facilities sites are restricted to as small an area as possible, if hunting from project facilities is prohibited, and if moose are not directly approached and harassed by machines or project personnel (APA 1983a, pp. E-3-402-403, Table E.3.145; LGL 1985, p. 2.2-15). | Previous studies provided sufficient information for impact assessment. No further studies are planned. | | Major gound activity will be prohibited near sensitive wildlife areas during sensitive periods (APA 1983a, p. E-3-532 #10).<br><br>Public access to access road and airfield prohibited during construction (APA 1983a, p. E-3-534 #12, 14).<br><br>Use of project facilities or equipment by employees and familes for hunting and trapping will be prohibited (APA 1983a, p. E-3-534 #14).<br><br>If needed, recommendations to ADF&G for restrictions to hunting regulations to reduce hunting pressure (APA 1983a, p. E-3-534 #14).<br><br>Discouragement of off-road recreational vehicle activity, and phasing in of recreational plan to limit recreational impacts on vegetation and wildlife (APA 1983a, p. E-3-292 #16, 17). |
| | (27) Increase in aircraft overflights may stress animals or preclude use of some areas. | * Aircraft enroute to or from the Watana airstrip may cause minor disturbances to moose, but ample evidence of habituation to aircraft overflights suggest that little or no impact will occur (APA 1983a, pp. E-3-403 to 404, Table E.3.145; LGL 1985, p. 2.2-15). | Previous studies provided sufficient information for impact assessment. No further studies are planned. | | Aircraft will maintain minimum altitudes of 1000 ft above ground level during flights (APA 1983a, p. E-3-531 #10).<br><br>Planning and development of an environmental briefings program for all field personnel (APA 1983a, p. E-3-292 #13). |
| | (28) Prior to filling, clearcut areas in the impoundment may inhibit movements due to slash piles and human disturbance. | * Noisy and unpredictable activities will probably cause avoidance of the active clearing area (APA 1983a, p. E-3-403, Table E.3.145). However, moose are expected to utilize forage newly made available in cleared areas. Slash piles will be burned, and are not expected to inhibit movements of moose (LGL 1985, pp. 2.2-15-16). | Impact severity not sufficient to require study. | | Impoundment clearing will not begin until 2 or 3 years before filling; patches of vegetation will be left until just before filling (APA 1983a, p. E-3-525 #1).<br><br>Major ground activity will be prohibited near sensitive wildlife areas during sensitive periods (APA 1983a, p. E-3-532 #10). |

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| (B) Moose (cont.) | (29) Increase in disturbance over the entire basin may occur due to increases in human recreational activities. | * This impact is difficult to quantify (APA 1983a, Table E.3.145). Except for recreational hunting which can be regulated by ADF&G, this impact is not expected to reduce moose productivity or population numbers in the Susitna Basin (LGL 1985, p. 2.2-16). | This impact mechanism will receive further attention during impact assessment refinement (APA 1984b, FY85 Task 5). | | Public access to access road and airfield prohibited during constriction (APA 1983a, p. E-3-534).<br><br>Use of project facilities or equipment by employees and families for hunting and trapping will be prohibited (APA 1983a, p. E-3-534).<br><br>Planning and development of an environmental briefings program for all field personnel (APA 1983a, p. E-3-292).<br><br>Discouragement of off-road recreational vehicle activity, and phasing in of recreational plan to limit recreational impact on vegetation and wildlife (APA 1983a, p. E-3-292). |
| (C) Caribou | (1) Permanent loss of 0.3 % of total range (low quality grazing habitat) due to the impoundments and transmission corridors. | * Impact not expected to be significant (LGL 1985, p. 2.3-8). | Continued studies of movements and range use (APA 1984b, FY85 Task 22). | | |
| | (2) Temporary alteration and permanent loss of 0.3% of summer range for bulls due to borrow sites. | * Impact not expected to be significant (LGL 1985, p. 2.3-8). | Continued studies of movements and range use (APA 1984b, FY85 Task 22). | | Revegetation and fertilization of disturbed sites (APA 1983a, p. E-3-526 #3). |
| | (3) Decrease in range values due to increased risk of fire. | * Difficult to quantify; but not expected to cause a significant decrease in total range availability (LGL 1985, p. 2.3-8). | Continued studies of movements and range use (APA 1984b, FY85 Task 22). | | Public access to access road and airfield prohibited during construction (APA 1983a, p. E-3-534 #12, 14).<br><br>Discouragement of off-road recreational vehicle activity, and phasing in of recreational plan to limit recreational impacts on vegetation and wildlife (APA 1983a, p. E-3-292 #16-17). |
| | (4) Increase in accident mortality associated with ice shelving, drifting ice flows, floating debris, and extensive mud flats along the impoundment shore. | * Impact difficult to quantify or predict; may be serious, or may result in little adverse impact (LGL 1985, p. 2.3-8). | Continued studies of movements, range use, population size, and productivity; continued studies of movements of upper Susitna-Nenana subherd and its population size (APA 1984b, FY85 Task 22). | * Collect data on caribou movements and population size, especially as relates to impoundment crossing (LGL 1985, p. 2.3-8).<br><br>Collect records of impoundment crossings and impoundment-caused mortality during open-water period (LGL 1985, p. 2.3-8). | Clearing of impoundments prior to flooding and removal of floating debris to reduce hazards to crossing (APA 1983a, p. E-3-530 #9).<br><br>* Support of the proposed Nelchina Public Use Area, or of projects to offset population limiting factors (e.g., predation or hunting) on the Nelchina herd in nearby areas could be used to compensate for project-related losses, should they occur (LGL 1985, p. 2.3-8). |

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| (C) Caribou (cont.) | (5) Increased legal harvest levels may result from increased road access by hunters to caribou range. | * Because caribou hunting is regulated by permit, increased access will affect only the distribution of legal hunters, not their total numbers. The maximum number of animals legally harvested in the project vicinity will not increase unless so warranted by the ADF&G (LGL 1985, p. 2.3-8). | Sufficient information is available for impact predictions. | | Use of project facilities or equipment by employees and families for hunting and trapping will be prohibited (APA 1983a, p. E-3-534 #14). |
| | (6) Increased mortality may result from increased road access by illegal hunters to caribou range. | * Increased poaching may occur but not expected to cause population effects (LGL 1985, p. 2.3-8). | Sufficient information is available for impact predictions. | | Public access to access road and airfield prohibited during construction (APA 1983a, p. E-3-534 #12, 14).<br><br>Discouragement of off-road recreational vehicle activity, and phasing in of recreational plan to limit recreational impacts on vegetation and wildlife (APA 1983a, p. E-3-292 #16-17).<br><br>Use of project facilities or equipment by employees and families for hunting and trapping will be prohibited (APA 1983a, p. E-3-534 #12, 14). |
| | (7) Increase in collision mortality due to construction traffic and increased recreational traffic. | * Impact difficult to predict but not expected to cause population effects (LGL 1985, p. 2.3-9). | Continued studies of movements and range use of herd and subherds (APA 1984b, FY85 Task 22). | Collect mortality data on road and railroad collisions (APA 1983a, p. E-3-523 #1). | Changes in design and alignment of access road to reduce impacts on caribou and other species (APA 1983a, p. E-3-533 #11).<br><br>* Use of buses and prohibition of personal vehicles on the access road during construction (LGL 1985, p. 2.3-9).<br><br>Public access to access road and airfield prohibited during construction (APA 1983a, p. E-3-534 #12, 14).<br><br>Discouragement of off-road recreational vehicle activity, and phasing in of recreational plan to limit recreational impacts on vegetation and wildlife (APA 1983a, p. E-3-292 #16-17). |
| | (8) Disturbance of calving cows by aircraft overflights may cause direct calf mortality. | * Project not expected to significantly increase harassment, particularly with regulation of project aircraft (LGL 1985, p. 2.3-9). | Sufficient information is available for impact assessment and mitigation planning. No studies are planned. | | Aircraft will maintain minimum altitudes of 1000 ft above ground level during flights, and possibly 2000 ft over calving areas (APA 1983a, p. E-3-416 and 531 #10).<br><br>Aircraft landings will be prohibited within calving areas in Talkeetna Mountains, 15 May-30 June (APA 1983a, p. E-3-531 #10).<br><br>Planning and development of an environmental briefings program for all field personnel (APA 1983a, p. E-3-292 #13). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (C) Caribou (cont.) | * (9) Increased predation mortality on caribou prevented from reaching areas they normally use. | * Impact may or may not be important, depending on degree of herd movement restrictions caused by project facilities (LGL 1985, p. 2.3-9). | | * Collect data on caribou movements and population size (APA 1983a, p. E-3-523 #3). | * Changes in design and alignment of access road to reduce impacts on caribou and other species (APA 1983a, p. E-3-533 #11). |
| | (10) Potential effects of the impoundment as a barrier to movements include: a) reduction in the frequency of crossing of the Watana impoundment area with consequent decreases in use of portions of the range; b) isolation of subherds having separate calving grounds; c) increased energy expenditure due to lengthened migration routes, possibly resulting in reduced viability of newborn calves and other consequences of reduced physical condition. | * Impact difficult to quantify or predict; altered movements are not likely to produce population-level effects (LGL 1985, p. 2.3-10). | Continued studies of movement of herd, range use, population size, and productivity; continued studies of movements of upper Susitna-Nenana subherd and its population size (APA 1984b, FY85 Task 22). | Collect data on caribou movements and population size, especially as relates to impoundment crossing (APA 1983a, p. E-3-523 #3).<br><br>Collect records of impoundment crossings and impoundment-caused mortality during open-water period (APA 1983a, p. E-3-524 #5). | Clearing of impoundments prior to flooding and removal of floating debris to reduce hazards to crossing (APA 1983a, p. E-3-530 #9). |
| | (11) Drifted snow south and southwest of the reservoir may block movements to portions of the range. | * Impact not quantified, but not expected to be significant (LGL 1985, pp. 2.3-5 and 10). | Continued studies of movements of herd (APA 1984b, FY85 Task 22). | Collect data on caribou movements and population size, especially as relates to impoundment crossing (APA 1983a, p. E-3-523 #3).<br><br>Collect records of impoundment crossings and impoundment-caused mortality during open-water period (APA 1983a, p. E-3-524 #4). | |
| | (12) Blockage or alteration of herd movements by the access road. | * Blocked crossing of the access road is not anticipated to cause population-level effects (LGL 1985, p. 2.3-10). | Continued studies of movements and populations size of subherd (APA 1984b, FY85 Task 22). | Collect data on caribou movements and population size (APA 1983a, p. E-3-523 #3). | Changes in design and alignment of access road to reduce impacts on caribou (APA 1983a, p. E-3-533 #11).<br><br>* Use of buses and prohibition of personal vehicles on the access road during construction (LGL 1985, p. 2.3-9). |
| | (13) Avoidance of construction sites and clearing operations, particularly by cows and calves due to human disturbance. | * Impact not quantified but not expected to result in any population effects (LGL 1985, p. 2.3-10). | Continued studies of movements of herd (APA 1984b, FY85 Task 22). | Collect data on caribou movements and population size (APA 1983a, p. E-3-523 #3). | Impoundment clearing will not begin until 2 or 3 years before filling; patches of vegetation will be left until just before filling (APA 1983a, p. E-3-525 #1).<br><br>Clearing activities will be prohibited near concentrations of migrating caribou during sensitive periods (APA 1983a, p. E-3-532 #10). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (C) Caribou (cont.) | (14) Increased energy demands particularly to pregnant cows (or cows with calves) due to disturbance by construction traffic on the access road between the Denali Highway and Watana. | * Impact not quantified, but not expected to result in population-level effects (LGL 1985, p. 2.3-10). | Continued studies of movements of the herd and subherd (APA 1984b, FY85 Task 22). | Collect data on caribou movements and population size (APA 1983a, p. E-3-523 #3). | Changes in design and alignment of access road to reduce impacts on caribou (APA 1983a, p. E-3-533 #11).<br><br>* Use of buses and prohibition of personal vehicles on the access road during construction (LGL 1985, p. 2.3-9). |
| | (15) Overflights by aircraft may adversely impact caribou through increased energy costs. High levels of disturbance may affect productivity (groups with females and calves are most sensitive). | * Impact not quantified, but not expected to be significant if pilots maintain sufficient altitude (LGL 1985, p. 2.3-10). | Sufficient information is available for impact assessment and mitigation planning. No further studies are planned. | | Aircraft will maintain minimum altitudes of 1000 ft above ground level during flights, and possibly 2000 ft over calving areas (APA 1983a, pp. E-3-416 and 531 #10).<br><br>Aircraft landings will be prohibited within calving area in Talkeetna Mountains 15 May-30 June (APA 1983a, p. E-3-531 #10).<br><br>Planning and development of an environmental briefings program for all field personnel (APA 1983a, p. E-3-292 #13). |
| | (16) Changes in range use, disruption of migration patterns and abandonment of traditional calving areas may result from an increase in recreational activities and an increase in non-project development activities, both facilitated through increased access. | * Difficult to predict but not anticipated to cause population-level impacts (LGL 1985, p. 2.3-11). | Continued studies of movements and range use (APA 1984b, FY85 Task 22). | Collect data on caribou movements and population size (APA 1983a, p. E-3-523 #3). | Changes in design and alignment of access road to reduce impacts on caribou and other species (APA 1983a, p. E-3-533 #11).<br><br>Public access to access road and airfield prohibited during construction (APA 1983a, p. E-3-534 #12, 14).<br><br>Discouragement of off-road recreational vehicle activity, and phasing in of recreational plan to limit recreational impacts on vegetation and wildlife (APA 1983a, p. E-3-292 #16-17). |
| (D) Dall Sheep | (1) Partial inundation of the Jay Creek mineral lick. Inundation will cover over 22% of the lick surface area during the months of maximum use. At maximum impoundment level in October, 42% of lick surface will be flooded. | * Unlikely that sheep will discontinue use of the lick due to partial inundation (APA 1983a, pp. E-3-419 to 420, Table E.3.148). In addition, sites to be inundated accounted for only 2.6% of licking in 1983 (Tankersley 1984). Impact not anticipated to be important (LGL 1985, pp. 2.4-6 to 7). | * Sufficient information is available for impact assessment and mitigation planning. | Collect information on sheep use of the mineral lick after inundation (APA 1983a, p. E-3-524). | If needed, exposure of new soil at Jay Creek mineral lick (APA 1983a, p. E-3-534 #13). |
| | (2) Areas of the lick below maximum fill level may suffer some leaching and erosion, making this area less valuable as a lick site. | * Erosion may increase availability of minerals, however this is not anticipated to affect the quality of the lick significantly. Impact of leaching has not been fully quantified (LGL 1985, p. 2.4-7). | * Sufficient information is available for impact assessment and mitigation planning. | Collect information on sheep use of mineral lick and on leaching of soils after inundation (APA 1983a, p. E-3-524 #5). | If needed, exposure of new soil at Jay Creek Mineral lick (APA 1983, p. E-3-534 #13). |

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| (D) Dall Sheep (cont.) | (3) Watana impoundment may delay spring phenology and lead to increased snow acumulation in south-facing slopes of Watana Hills. | * Impact not expected to be significant (LGL 1985, p. 2.4-7). | Impact severity not sufficient to require study. | | |
| | (4) Increase in accident mortality due to ice shelves on lower sections of the Jay Creek mineral lick in early spring. | * Unlikely to cause mortality of more than a few sheep, not expected to cause population-level impacts (LGL 1985, p. 2.4-7). | | Collect information on sheep use of the mineral lick after inundation (APA 1983, p. E-3-524). | |
| | * (5) Increased legal harvest levels may result from increased hunter access to Dall sheep range. | * Total number of legally harvested sheep regulated by ADF&G and should not increase substantially (LGL 1985, pp. 2.4-7 to 8). | | | |
| | * (6) Increased mortality may result from increased access by poachers to Dall sheep range. | * Increase in illegal harvest not expected to be significant to overall population levels (LGL 1985, p. 2.4-8). | | | Use of project facilities or equipment by employees and families for hunting and trapping will be prohibited (APA 1983a, p. E-3-534 #14).<br><br>If needed, recommendations for restrictions to hunting regulations to reduce harvest pressure (APA 1983a, p. E-3-534 #14). |
| | (7) The Watana impoundment may block some movement to lick sites on the east side of Jay Creek. | * Sheep may cross open water or ice, move upstream 1 mile before crossing, or not cross the impoundment, potentially reducing the availability of lick sites on the east side of Jay Creek. However, the main lick on the west side of the creek will remain available, therefore not resulting in an important level of impact (LGL 1985, p. 2.4-8). | | Collect records of impoundment crossings and impoundment-caused mortality during open-water period (at Jay Creek) (APA 1983a, p. E-3-524 #4).<br><br>Collect information on sheep use of mineral lick and on leaching of soils after inundation (APA 1983a, p. E-3-524 #5). | * Clearing of impoundments prior to flooding and removal of floating debris to reduce hazards to crossing (APA 1983a, p. E-3-530 #9). Special attention to removal of debris in the lower Jay Creek area will be accomplished (LGL 1985, p. 2.4-12).<br><br>If needed, exposure of new soil at Jay Creek mineral lick (APA 1983a, p. E-3-534 #13). |
| | (8) Increased metabolic energy requirements and abandonment of some areas due to aircraft overflights. | Impact not quantified but not expected to be significant if height restrictions are maintained (APA 1983a, pp. E-3-418 to 419, Table E.3.148). | Sufficient information is available for impact assessment and mitigation planning. No studies planned. | | Aircraft will maintain minimum altitudes of 1000 ft above ground level during flights (APA 1983a, p. E-3-531 #10).<br><br>Planning and development of an environmental briefings program for all field personnel (APA 1983a, p. E-3-292 #13). |

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| (D) Dall Sheep (cont.) | (9) Disturbance of sheep utilizing low elevation winter and spring habitats due to impoundment clearing activities. | Impact not quantified. Disturbance will occur only over the short-term period of impoundment clearing and will probably not produce a serious population effect (APA 1983a, Table E.3.148). | | | Impoundment clearing schedule to be determined in consultation with resource agencies (APA 1983a, p. E-3-526 #1). |
| | (10) Disturbance from aircraft landings, clearing activities, and recreational boats near the Jay Creek mineral lick may affect its use by sheep. | * Impact not quantified; but not expected to be significant with planned project controls, provided there is little recreational disturbance. Frequent visits could result in abandonment of the lick with resultant changes in distribution and local population levels (APA 1983a, p. E-3-420, Table E.3.148; LGL 1985, p. 2.4-8). | Sufficient information is available for impact assessment and mitigation. No studies planned. | Collect information on sheep use of mineral lick and on leaching of soils after inundation (APA 1983a, p. E-3-524 #5). | Aircraft will maintain minimum altitudes of 1000 ft above ground level during flights (APA 1983a, p. E-3-531 #10).<br><br>* Aircraft landings and boat traffic will be prohibited within 0.5 mile of Jay Creek licks, 1 May -15 July (APA 1983a, p. E-3-531 #10; LGL 1985, p. 2.4-11).<br><br>* Major ground activity (including boat and floatplane use) will be prohibited within 0.5 mile of Jay Creek licks, 1 May-15 July (APA 1983a, p. E-3-532 #10; LGL 1985, p. 2.4-11).<br><br>* Impoundment clearing will avoid the Jay Creek lick area from 1 May-15 July (LGL 1985, p. 2.4-11). |
| (E) Brown Bear | (1) Permanent loss of some spring feeding habitat due to impoundments. | Of radio-collared brown bears present in the project area, 50% in 1980 and 61% in 1981 moved into the future impoundment zones in spring. This loss is expected to be most important to brown bear populations in spring when greatest use of inundated and adjacent areas occurs. Some use also occurs in summer and fall. (APA 1983a, p. E-3-420 to 425, Table E.3.149). | Continued studies of habitat use and timing, den site characteristics, and seasonal food habits (APA 1984b, FY85 Task 17). | Collect information on bear populations and distribution of bear harvest (APA 198a, p. E-3-534 #14). | Habitat enhancement and protection measures on replacement lands to compensate for permanent habitat loss may benefit bears (APA 1983a, p. E-3-527 #6). |
| | (2) Impoundment clearing will affect habitat quality for brown bears in spring. | Impact not expected to be significant in the 2-3 years before filling (APA 1983a, p. E-3-422, Table E.3.149). | Continued studies of seasonal food habits (APA 1984b, FY85 Task 17). | Collect information on bear populations and distribution of bear harvest (APA 1983a, p. E-3-534 #14). | Impoundment clearing will not begin until 2 or 3 years before filling; patches of vegetation will be left until just before filling (APA 1983a, p. E-3-525 #1). |
| | (3) Displacement of bears from presently used habitats (especially in spring) may result in locally more dense populations and greater intraspecific competition and strife in adjacent areas. | May affect cub survival, increase predation pressure on ungulates, increase intraspecific mortality, and decrease reproduction. | Continued studies of seasonal habitat use and food habits (APA 1984b, FY85 Task 17). | Collect information on bear populations and distribution of bear harvest (APA 1983a, p. E-3-534 #14). | |

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| (E) Brown Bear (cont.) | (4) Loss or alteration of habitat due to borrow sites. | Impact not quantified. Habitat values may increase on reclaimed areas during early stages of plant succession (APA 1983a, p. E-3-421 to 422). | Continued studies of habitat use and timing (APA 1984b, FY85 Task 17). | | Habitat loss will be minimized by side borrow techniques for road construction, spoil deposition in impoundments or depleted borrow areas, and consolidation of project facilities (APA 1983a, p. E-3-526 #2).<br><br>Revegetation and fertilization of disturbed sites (APA 1983a, p. E-3-526 #3). |
| | (5) Potential impact on denning areas due to impoundment shore erosion. | Impact may occur on potential or unknown den sites, but has not been quantified; not expected to be significant (APA 1983a, Table E.3.149). | Continued studies of den site characteristics (APA 1984b, FY85 Task 17). | | |
| | (6) Broken ice and ice shelving, open water in the impoundments, roads, and other facilities may block or hinder access to habitually used areas. | Impact not quantified and difficult to predict (APA 1983a, pp. E-3-426, 483, 484, Table E.3.149). | Continued studies of seasonal habitat use and movements (APA 1984b, FY85 Task 17). | Collect records of impoundment crossings and impoundment-caused mortality during open-water period (APA 1983a, p. E-3-524 #4). | Clearing impoundments prior to flooding and removal of floating debris to reduce hazards to crossing (APA 1983a, p. E-3-530 #9). |
| | (7) Reductions in upstream ungulate prey populations may cause corresponding reductions in available food supply for bears, especially in the spring. | Impact not quantified (APA 1983a, pp. E-3-425, 426, Table E.3.149). | Continued studies of seasonal food habits of bears (APA 1984b, FY85 Task 17). Moose calf mortality study (APA 1984b, FY85 Task 9). | | Impacts from decreased prey availability should be reduced by measures to mitigate impacts to ungulate populations (APA 1983a, p. E-3-536 #16). |
| | (8) Possible reduction in availability of animal prey (e.g., salmon, moose) and vegetable foods in downstream reaches. | Mitigation for salmon and moose may negate this aspect of the impact. Altered plant succession may reduce or increase plant foods available to bears. | Downstream moose studies (APA 1984b, FY85 Task 23). Downstream hydrologic and vegetative studies (APA 1984b, FY85 Task 15). Salmon studies (APA 1984a, Aquatic FY85 Tasks 12-16). | Collect data on changes in downstream vegetative cover (APA 1983a, p. E-3-523 #2). | Impacts from decreased prey availability should be reduced by measures to mitigate impacts to salmon and ungulate populations (APA 1983a, p. E-3-536 #16). |
| | (9) Lower population sizes and decreased recruitment of bears in the study area may result in fewer subadults from the study area available to disperse out to and populate adjacent areas. | Impact difficult to quantify, but may affect nearby populations. | Opportunistic information on dispersal in the course of marked bear studies (APA 1984b, FY85 Task 17). | | |
| | (10) Increase in mortality of bears due to attraction to human refuse and revegetated areas near construction sites, and the resultant increase in the incidence of human/bear encounters, resulting in destruction of the "offending bear". | Impact not quantified and difficult to predict (APA 1983a, p. E-3-523 to 424, Table E.3.149). | Sufficient information is available for impact assessment and mitigation. No studies planned. | Collect information on bear populations and distribution of bear harvest (APA 1983a, p. E-3-534 #14). | Education program, and strict garbage-control measures and enforcement to prevent creation of nuisance animals (APA 1983a, p. E-3-535 #15).<br><br>Planning and development of an environmental briefings program for all field personnel (APA 1983a, p. E-3-292 #13). |

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| (E) Brown Bear (cont.) | (11) Greater susceptibility of bears (particularly habituated bears) to hunting and poaching mortality due to improved access in the area. | Hunting policy for the project area currently allows liberal brown bear harvest levels which can be regulated in the future. Losses to poachers will be an unavoidable adverse impact (APA 1983a, pp. E-3-423, 426, 484, Table E.3.149). | Sufficient information is available for impact assessment and mitigation planning. No studies are planned. | Collect information on bear populations and distribution of bear harvest (APA 1983a, p. E-3-534 #14). | Public access to access road and airfield prohibited during construction (APA 1983a, p. E-3-534 #12, 14).<br><br>Use of project facilities or equipment by employees and families for hunting and trapping will be prohibited (APA 1983a, p. E-3-534 #14).<br><br>If needed, recommendations for restrictions to hunting regulations to reduce hunting pressure (APA 1983a, p. E-3-534 #14).<br><br>Discouragement of off-road recreational vehicle activity, and phasing in of recreational plan to limit recreational impacts on vegetation and wildlife (APA 1983a, p. E-3-292 #15-17). |
| | (12) Avoidance of traditional use areas caused by increase in human activity at construction sites and operations facilities. | Impact includes loss of feeding habitat near access corridors, villages, airstrips, and borrow sites. Some bears may be displaced or alter their movements; others may habituate and lead to human/bear inter-action problems (APA 1983a, p. E-3-424, Table E.3.149). | Continued studies of habitat use and timing (APA 1984b, FY85 Task 17). | Collect information on bear populations and distribution of bear harvest (APA 1983a, p. E-3-534 #14). | Possible controls on volume, speed and frequency of access road traffic (APA 1983a, p. E-3-534 #12).<br><br>Avoidance of the Prairie Creek and Stephan Lake areas by access routing (APA 1983a, p. E-3-292 #14). |
| | (13) Disturbance from access corridors, villages, airstrips, and clearing of transmission line may displace bears from current denning areas. | Significant impact not expected because brown bear dens are typically at higher elevations than proposed project facilities; identified dens are not in the vicinity of such facilities (Miller 1984, Table 23 and Fig. 8). | Continued studies of den site characteristics (APA 1984b, FY85 Task 17). | Collect information on den locations throughout construction (APA 1983a, p. E-3-524 #6). | Ground activity will be prohibited within 0.25 miles of known active bear dens 15 September-15 May (APA 1983a, p. E-3-532 #10).<br><br>Planning and development of an environmental briefings program for all field personnel (APA 1983a, p. E-3-292 #13). |
| | (14) Overflights or harassment by aircraft may disrupt feeding, resting and denning activities. | * Impact difficult to quantify, however some habituation to overflights would be expected. | Sufficient information is available for impact assessment and mitigation planning. No studies are planned. | | Aircraft will maintain minimum altitudes of 1000 ft above ground level during flights (APA 1983a, p. E-3-531 #10).<br><br>Planning and development of an environmental briefings program for all field personnel (APA 1983a, E-3-292 #13). |

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| (E) Brown Bear (cont.) | (15) Recreational disturbance facilitated by increased access may cause avoidance of traditional use areas and may lead to increase in human/bear interactions. | Impact not quantified, but could be significant. Most significant impact would likely be from recreational activity in the Prairie Creek-Stephen Lake area -- a traditional area for summer feeding on salmon (APA 1983a, p. E-3-421, Table E.3.149). | Continued studies of seasonal habitat use and food habits (APA 1984b, FY85 Task 17). | | Public access to access road and airfield prohibited during construction (APA 1983a, p. E-3-534 #12, 14).<br>Avoidance of the Prairie Creek and Stephan Lake areas by access routing (APA 1983a, p. E-3-292 #14).<br>Discouragement of off-road recreational vehicle activity, and phasing in of recreational plan to limit recreational impacts on vegetation and wildlife (APA 1983a, p. E-3-292 #16-17). |
| (F) Black Bear | (1) Permanent loss of high quality forest habitats due to impoundments. | Will exclude black bears upstream from Watana Creek and significantly lower populations in the project area (APA 1983a, p. E-3-427, Table E.3.150). | Continued monitoring of black bear populations and movements in the area is planned (APA 1984, FY85 Task 17). | Collect information on bear populations and distribution of bear harvest (APA 1983a, p. E-3-534 #14). | Habitat enhancement and protection measures on replacement lands to compensate for permanent habitat loss will provide some benefits for black bears (APA 1983a, p. E-3-527 #6). |
| | (2) Loss of cover and foraging areas in forest habitats due to impoundment clearing. | This will be realized prior to impoundment filling due to clearing activities (APA 1983a, p. E-3-428, Table E.3.150). | Continued monitoring of black bear populations and movements in the area is planned (APA 1984b, FY85 Task 17). | | Impoundment clearing will not begin until 2 or 3 years before filling; patches of vegetation will be left until just before filling (APA 1983a, p. E-3-525 #1). |
| | (3) Temporary loss of forest habitats in borrow sites. | Impact represents a temporary loss of habitat for black bears. Revegetation will provide spring forage during early successional stages, and regrowth of forest will provide continued habitat for bears (APA 1983a, p. E-3-427, Table E.3.150). | Continued studies of black bear populations and movements (APA 1984b, FY85 Task 17). | | Habitat loss will be minimized by side borrow techniques for road construction, spoil deposition in impoundments or depleted borrow areas, and consolidation of project facilities (APA 1983a, p. E-3-526 #2).<br>Revegetation and fertilization of disturbed sites (APA 1983a, p. E-3-526 #3).<br>Minimize loss and alteration of habitat, particularly less abundant habitats and sensitve wildlife habitats (APA 1983a, p. E-3-291 #1-11). |
| | (4) Permanent loss of some den sites due to impoundments, and due to disturbance and displacement from construction and operation facilities and activities. | Of known black bear dens in the project area, 54% were in the Watana and 6% were in the Devil Canyon impoundment zones (Miller 1983). | Identification of active den sites of black bears will continue (APA 1984b, FY84 Task 17). | Collect information on black bear den locations throughout construction (APA 1983a, p. E-3-524 #6). | Major ground activity will be prohibited within 0.25 miles of all known active bear dens between 15 September and 15 May (APA 1983a, p. E-3-532 #10). |
| | (5) Possible impact on den sites due to impoundment shore erosion. | Impact not quantified; potential or unknown den sites may be affected but impacts are not expected to be significant (APA 1983a, Table E.3.150). | Continued studies of den site characteristics (APA 1984, FY85 Task 17). | Collect information on den locations throughout construction (APA 1983a, p. E-3-524 #6). | |

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| (F) Black Bear (cont.) | (6) Habitat alteration along the transmission corridor. | Positive and negative impacts on black bears. Loss of forest habitats along the corridor will constitute some habitat loss, although spring forage within the corridors will provide added food (APA 1983a, p. E-3-494, Table E.3.150). | Continued studies of black bear habitat use and movements (APA 1984, FY85 Task 17). | Collect information on bear populations and distribution of bear harvest (APA 1983a, p. E-3-534 #14). | Selective clearing in transmission corridor, permitting seral vegetation up to 10 ft in height (APA 1983a, p. E-3-526 #4).<br><br>Minimize loss of forest areas through alignment of access road and transmission corridor, and other measures (APA 1983a, p. E-3-539 #23). |
| | (7) Reduction in availability of low shrub habitats in spring due to delayed melting of snow drifts south and southwest of the impoundment. | Impact not quantified, but not expected to be significant (APA 1983a, Table E.3.150). | Impact severity not sufficient to require study. | Collect information on bear populations and distribution of bear harvest (APA 1983a, p. E-3-534 #14). | |
| | (8) Reductions in prey populations, if they occur (e.g., salmon, moose), would negatively impact black bears in downstream areas. | Project impacts on some food resources of black bears are as yet uncertain, and bears may not be adversely affected (APA 1983a, p. E-3-429, Table E.3.150). | Continued investigations of bear food habits will better document important food sources for black bears (APA 1984b, FY85 Task 17). | Collect information on bear populations and distribution of bear harvest (APA 1983a, p. E-3-534 #14). | Impacts from decreased prey availability should be reduced by measures to mitigate impacts to salmon and ungulate populations (APA 1983a, p. E-3-536 #16). |
| | (9) Increased availability of early spring forage downstream from impoundments due to alteration of vegetation phenology. | No noticeable impact expected on black bears (APA 1983a, p. E-3-429). | Impact severity not sufficient to require study. | Collect data on changes in downstream vegetative cover (APA 1983a, p. E-3-523 #2). | Use of multilevel intake structures on the dams to maintain downstream river temperatures as close to normal as possible (APA 1983a, p. E-3-526 #5). |
| | (10) Decreased availability of early successional vegetation types due to river hydrologic changes downstream of the impoundments. | Impact not quantified but not expected to be significant (APA 1983a, p. E-3-429, Table E.3.150). | Continued refinement of downstream hydrology modeling may better enable prediction of effects on black bears (APA 1984b, FY85 Tasks 5, 15 and 23). | Collect data on changes in downstream vegetative cover (APA 1983a, p. E-3-523 #2). | |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (F) Black Bear (cont.) | (11) Some indirect habitat loss (especially berry foraging shrubland) and possible blockage of movements to important habitat areas due to avoidance of construction sites, access roads, impoundment clearing activities, and recreational use of the area. | Impact not quantified, although some habituation to human activities will occur (APA 1983a, p. E-3-427, Table E.3.150). | Continued studies of habitat use and black bear movements (APA 1984b, FY85 Task 17). | Collect information on bear populations and distribution of bear harvest (APA 1983a, p. E-3-534 #14). | Impoundment clearing will not begin until 2 or 3 years before filling; patches of vegetation will be left until just before filling (APA 1983a, p. E-3-525 #1).<br><br>Possible controls on volume, speed and frequency of access road traffic (APA 1983a, p. E-3-534 #12).<br><br>Public access to access road and airfield prohibited during construction (APA 1983a, p. E-3-534 #12).<br><br>Avoidance of the Fog Lakes and Indian River areas by access routing (APA 1983a, p. E-3-292 #14).<br><br>Disccuragement of off-road recreational vehicle activity, and phasing in of recreational plan to limit recreational impacts on vegetation and wildlife (APA 1983a, p. E-3-292 #16, 17). |
| | (12) Broken ice and/or ice shelving, open water in the impoundments, roads, and other facilities may block or hinder access to habitually used areas (e.g., seasonally used feeding areas). | Impact not quantified but not expected to be significant (APA 1983a, Table E.3.150). | Continued study of bear habitat use and movements (APA 1984b, FY85 Task 17). | Collect records of impoundment crossings and impoundment-caused mortality during open-water periods (APA 1983a, p. E-3-524 #4). | Clearing of impoundments prior to flooding and removal of floating debris to reduce hazards to crossing (APA 1983a, p. E-3-530 #9). |
| | (13) Increase in interspecific competition with and predation by brown bears and intraspecific competition among black bears during dispersal from impoundment zones. | Impact difficult to quantify (APA 1983a, Table E.3.150). | Investigations of bear movements and mortality sources are continuing (APA 1984b, FY85 Task 17). | Collect information on bear populations and distribution of bear harvest (APA 1983a, p. E-3-534 #14). | |
| | (14) Lower population sizes and decreased recruitment of bears in the study area may result in fewer subadults from the study area available to disperse out to and populate adjacent areas. | Impact difficult to quantify, but may affect nearby populations. | Opportunistic information on dispersal in the course of marked bear studies (APA 1984b, FY85 Task 17). | | |
| | (15) Increase in mortality of bears due to attraction to human refuse, revegetated areas near construction sites, and increases in human/bear encounters, resulting in destruction of the "offending bear". | Destruction of some black bears likely during construction phases (APA 1983a, p. E-3-427, Table E.3.150). | Sufficient information is available for impact assessment and mitigation planning. No studies are planned. | | Education programs and strict garbage-control measures and enforcement to prevent creation of nuisance animals (APA 1983a, p. E-3-535 #15).<br><br>Planning and development of an environmental briefings program for all field personnel (APA 1983a, p. E-3-292 #13). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (F) Black Bear (cont.) | (16) Greater susceptibility of habituated bears to hunting and poaching mortality. | Hunting mortality can be regulated, although increased poaching losses may represent an unavoidable adverse impact (APA 1983a, Table E.3.150). | Sufficient information is available for impact assessment and mitigation planning. No studies are planned. | Collect information on bear populations and distribution of bear harvest (APA 1983a, p. E-3-534 #14). | Use of project facilities or equipment by employees and families for hunting and trapping will be prohibited (APA 1983a, p. E-3-534 #14).<br><br>If needed, recommendations for restrictions to hunting regulations to reduce hunting pressure (APA 1983a, p. E-3-534 #14). |
| | (17) Disturbance from aircraft overflights may disrupt normal feeding, resting and denning activities. | Impact not quantified, but not expected to be significant (APA 1983a, Table E.3.150). | Sufficient information is available for impact assessment and mitigation planning. No studies are planned. | | Aircraft will maintain minimum altitudes of 1000 ft above ground level during flights (APA 1983a, p. E-3-531 #10). |
| (G) Wolf | (1) Permanent loss of portions of territories of at least six packs. | Impact represents an absolute habitat loss for wolves, but is unlikely to affect local wolf populations. Wolf numbers are currently highly regulated by trapping and removal for game management purposes (APA 1983a, p. E-3-431, Table E.3.151). | Continued studies of wolf pack sizes and distributions (APA 1984b, FY85 Task 28). | Collect information on wolf populations throughout construction and into operation (APA 1983a, p. E-3-525 #7). | |
| | (2) Inundation of parts of ranges of six packs will cause upheaval of the historical distribution of packs due to associated social strife. | Impact will occur over the short term, when ungulate prey populations are also undergoing shifts; effects are not expected to be significant (APA 1983a, p. E-3-431, Table E.3.151). | Continued studies of wolf pack sizes and distributions (APA 1984b, FY85 Task 28). | Collect information on wolf populations throughout construction and into operation (APA 1983a, p. E-3-525 #7). | |
| | (3) Reduction of carrying capacity of wolves due to reduction of moose (and other prey) carrying capacities. | Impact not quantified (APA 1983a, pp. E-3-430 and 431, Table E.3.151). | Continued studies of wolf pack sizes and distributions (APA 1984b, FY85 Task 28).<br><br>Studies of moose calf mortality and of wolf predation during a severe winter (APA 1984b, FY85 Tasks 9 and 10). | Collect information on wolf populations throughout construction and into operation (APA 1983a, p. E-3-525 #7). | Impacts from decreased prey availability to wolves should be reduced by measures to mitigate impacts to ungulate populations (APA 1983a, p. E-3-536 #16).<br><br>Habitat enhancement measures for moose in the middle basin and on replacement lands to compensate for permanent habitat loss (APA 1983a, p. E-3-527 #6). |
| | (4) Increase in wolf numbers near the impoundment zones due to displacement of moose caused by impoundment clearing activities. | Short-term beneficial impact (APA 1983a, p. E-3-431, Table E.3.151). | Continued studies of wolf pack sizes and distributions (APA 1984b, FY85 Task 28). | Collect information on wolf populations throughout construction and into operation (APA 1983a, p. E-3-525 #7). | Impoundment clearing will not begin until 2 or 3 years before filling; patches of vegetation will be left until just before filling (APA 1983a, p. E-3-525 #1). |
| | (5) Presence of the impoundment and dam facilities may hinder movement of some packs to caribou and moose calving areas. | Impact not quantified (APA 1983a, Table E.3.151). | Continued studies of wolf pack distributions (APA 1984b, FY85 Task 28). | Collect records of impoundment crossings and impoundment-caused mortality during open-water period (APA 1983a, p. E-3-524 #4). | Clearing of impoundments prior to flooding and removal of floating debris to reduce hazards to crossing (APA 1983a, p. E-3-530 #9). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (G) Wolf (cont.) | (6) Wolves may use the access road to their benefit when hunting ungulate prey. | Beneficial impact not quantified; not expected to be significant (APA 1983a, Table E.3.151). | Impact severity not sufficient to require study. | | |
| | (7) Open water downstream from the dams may hinder movements of wolves. | Impact not quantified; not expected to be significant (APA 1983a, Table E.3.151). | Continued studies of wolf pack distributions (APA 1984b, FY85 Task 28). | | |
| | (8) Increased mortality of wolves due to hunting, poaching, and trapping. | Hunting of wolves can be regulated, but increased poaching losses may represent an unavoidable adverse impact (APA 1983a, p. E-3-485 and 518, Table E.3.151). | Sufficient information is available for impact assessment and mitigation planning. No studies are planned. | | Use of project facilities or equipment by employees and families for hunting and trapping will be prohibited (APA 1983a, p. E-3-534 #14).<br><br>If needed, recommendations for restrictions to hunting regulations to reduce hunting pressure (APA 1983a, p. E-3-534 #14). |
| | (9) Wolves are likely to avoid areas of intense human activity (e.g., construction areas) or heavy road traffic, at least initially. | Some habituation will likely occur; impact not expected to be significant (APA 1983a, p. E-3-430, Table E.3.151). | Continued studies of wolf pack distributions (APA 1984b, FY85 Task 28). | Collect information on den locations throughout construction (APA 1983a, p. E-3-524 #6). | Ground activity will be prohibited within 0.25 miles of known active wolf dens or rendezvous sites between 1 May and 31 July (APA 1983a, p. E-3-532 #10).<br><br>Possible controls on volume, speed and frequency of access road traffic (APA 1983a, p. E-3-534 #12). |
| | (10) Disturbance of wolves by human activities or aircraft at den sites could lead to pup mortality if the dens are abandoned during the early weeks of a pup's life. | Impact not quantified (APA 1983a, p. E-3-430, Table E.3.151). | Continued studies of wolf pack distributions (APA 1984b, FY85 Task 28). | Collect information on den locations throughout construction (APA 1983a, p. E-3-524 #6). | Aircraft will maintain minimum altitudes of 1000 ft above ground level during overflights (APA 1983a, p. E-3-531 #10).<br><br>Aircraft landings will be prohibited within 0.25 miles of known active wolf dens or rendezvous sites during 1 May to 31 July (APA 1983a, p. E-3-531 #10).<br><br>Ground activity will be prohibited within 0.25 miles of known active wolf dens or rendezvous sites between 1 May and 31 July (APA 1983a, p. E-3-531 #10).<br><br>Planning and development of an environmental briefings program for all field personnel (APA 1983a, p. E-3-292 #13). |
| | (11) Wolves may habituate to human use areas and have the potential to become nuisance animals, increasing the likelihood of destruction of the "offending wolf". | Destruction of some nuisance wolves may occur if mitigation measures are not enforced (APA 1983a, p. E-3-430, Table E.3.151), however, this impact is unlikely to be significant in these heavily exploited wolf populations. | Impact severity not sufficient to require study. | | Education program, and strict garbage-control measures and enforcement to prevent creation of nuisance animals (APA 1983a, p. E-3-535 #15). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (G) Wolf (cont.) | (12) Disturbance at den sites from increased access for recreational activities could lead to pup mortality if dens are abandoned during early weeks of a pup's life. | Impact not quantified (APA 1983a, p. E-3-430, Table E.3.151). | Continued studies of wolf pack distributions (APA 1984b, FY85 Task 28). | Collect information on den locations throughout construction (APA p. E-3-524 #6). | Public use of access road and airfield prohibited during construction (APA 1983a, p. E-3-534 #12, 14).<br><br>Discouragement of offroad recreational vehicle activity, and phasing in of recreational plan to limit recreational impacts on vegetation and wildlife (APA 1983a, p. E-3-292 #16-17). |
| (H) Wolverine | (1) Permanent loss of winter foraging habitat due to impoundments. | Winter habitat for several wolverines will be lost; changes in movements, densities and productivity will affect surrounding populations (APA 1983a, p. E-3-432 to 433, Table E.3.151). | Opportunistic collection of data during wolf surveys. | | |
| | (2) Secondary loss of small mammal and grouse prey bases. Changes in prey density will affect movements, population densities, and productivity. | Difficult to predict whether increases in ungulate carrion availability will offset losses of smaller prey (APA 1983a, p. E-3-433, Table E.3.152). | Impact severity not sufficient to require study. | | |
| | (3) Temporary increase in availability of prey in areas adjacent to impoundment clearing zones. | Impact represents a short-term beneficial effect (APA 1983a, Table E.3.152). | Impact severity not sufficient to require study. | | |
| | (4) Increase in carrying capacity of the transmission corridor for moose and ptarmigan may beneficially impact wolverines. | Impact represents a small but beneficial effect on wolverines (APA 1983a, Table E.3.152) | Impact severity not sufficient to require study. | | Selective clearing in the transmission corridors, permitting seral vegetation up to 10 ft in height (APA 1983a, p. E-3-526 #4). |
| | (5) Increase in mortality due to hunting, trapping, and poaching. | Impact not quantified but likely the most important impact on wolverines. Hunting and trapping can be regulated, but poaching may represent an unavoidable adverse impact (APA 1983a, p. E-3-486, Table E.3.152). | Sufficient information is available for impact assessment and mitigtation planning. No studies are planned. | | If needed, recommendations for restrictions to hunting and trapping regulations to reduce harvest pressure (APA 1983a, p. E-3-534 #14).<br><br>Use of project facilities or equipment by employees and families for hunting and trapping will be prohibited (APA 1983a, p. E-3-534 #14).<br><br>Public access to access road and airfield prohibited during construction (APA 1983a, p. E-3-534 #12, 14). |
| | (6) Disturbance and habitat loss due to impoundment clearing will displace wolverines, particularly in winter. | Impact will be similar to (H)(1) and will occur 1-2 years prior to impoundment filling (APA 1983a, Table E.3.152). | Opportunistic collection of data during wolf surveys. | | Impoundment clearing will not begin until 2 or 3 years before filling; patches of vegetation will be left until just before filling (APA 1983a, p. E-3-525). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (H) Wolverine (cont.) | (7) Alteration of use patterns due to presence of the impoundments and changes in home range boundaries. | Conflicting data on home range boundaries of wolverines and terrain features make this impact difficult to predict; not expected to be significant (APA 1983a, p. E-3-432). | Opportunistic collection of data during wolf surveys. | | |
| | (8) Avoidance of all areas of human activity (including access road during heavy traffic periods and areas with high levels of recreational activity), at least initially, causing some changes in use patterns or preclusion of use in some areas. | Impact not quantified; not expected to be significant unless high levels of recreational disturbance occur (APA 1983a, p. E-3-486, Table E.3.152). | Opportunistic collection of data during wolf surveys. | | Possible controls on volume, speed and frequency of access road traffic (APA 1983a, p. E-3-534 #12).<br><br>Public access to access road and airfield prohibited during construction (APA 1983a, p. E-3-534 #12).<br><br>Discouragement of off-road recreational vehicle activity, and phasing in of recreational plan to limit recreational impacts on vegetation and wildlife (APA 1983a, p. E-3-292 #16-17). |
| (I) Belukha | (1) Water temperature changes at the mouth of the Susitna River due to the project may affect calving. | Water temperatures will not change significantly at the river mouth; impact not expected to occur (APA 1983a, p. E-3-433). | Impact severity not sufficient to require study. | | Use of multilevel intake structures on the dams to maintain downstream river temperatures as close to normal as possible (APA 1983a, p. E-3-526 #5). |
| | (2) Food supplies of belukhas may be decreased due to alterations or blockage in the availability of spawning streams for salmon. | Salmon decreases would at most be 5-8% of Susitna river stocks; impact not expected to be significant (APA 1983a, p. E-3-434). | Impact severity not sufficient to warrant further study. | | Impacts from decreased prey availability will be rectified by measures to mitigate impacts to salmon populations (APA 1983a, p. E-3-536 #16). |
| (J) Lynx | (1) Permanent habitat loss due to impoundments. | Impact will result in loss of habitat for probably all lynx (a few animals), within the middle basin (APA 1983a, p. E-3-440 to 442). | Continued surveys of furbearer distribution will improve impact assessment and mitigation planning (APA 1984b, FY85 Task 26, subtask 1). | | |
| | (2) Loss of habitat in impoundment areas due to clearing operations. | Short-term impact that will precede habitat loss due to impoundment filling (APA 1983a, Table E.3.157). | Continued surveys of furbearer distribution will improve impact assessment and mitigation planning (APA 1984b, FY85 Task 26, subtask 1). | | Impoundment clearing will not begin until 2 or 3 years before filling; patches of vegetation will be left until just before filling (APA 1983a, p. E-3-525 #1). |
| | (3) Loss of forest habitats due to the transmission corridors. | Impact will result in loss of 3831 acres of forest habitats useful to lynx (APA 1983a, Table E.3.86). | Previous studies have provided sufficient information for impact assessment. No further studies are planned. | | Selective clearing in the transmission corridor, permitting seral vegetation up to 10 ft in height (APA 1983a, p. E-3-526 #4).<br><br>Minimize loss and alteration of habitat, particularly less abundant habitats and sensitive wildlife habitats (APA 1983a, p. E-3-291 to 292 #1-11). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (J) Lynx (cont.) | (4) Loss of habitat due to borrow sites and other areas that will be reclaimed. | Removal of 3,341 acres of spruce forest habitats. Revegetation will probably not return habitat to spruce communities during the license period (APA 1983a, Table E.3.157). | Previous studies have provided sufficient information for impact assessment. No further studies are planned. | | Revegetation and fertilization of disturbed sites (APA 1983a, p. E-3-526 #3) will provide some foraging habitat prior to forest succession. |
| | (5) Impoundments will block movements and impede dispersal of lynx. | Redistribution of home ranges to conform to impoundment shores will occur (APA 1983a, Table E.3.157). | This impact mechanism will receive further attention during impact assessment refinements (APA 1984b, FY85 Task 5). | | Clearing of impoundments prior to flooding and removal of floating debris to reduce hazards to crossing (APA 1983a, p. E-3-530 #9) will aid dispersal but will not completely mitigate barrier effects. |
| | (6) Increase in the incidence of road kills due to presence of the access corridor. | Impact not quantified but not expected to be significant (APA 1983a, Table E.3.157). | Impact severity not sufficient to require further study. | Collect mortality data on road and railroad collisions (APA 1983a, p. E-3-525 #1). | |
| | (7) Increase in mortality due to hunting, trapping, and poaching. | Hunting and trapping can be regulated, but poaching losses may represent an unavoidable adverse impact (APA 1983a, Tabel E.3.157). | Surveys of trappers are continuing to document current harvest levels (APA 1984b, FY85 Task 20). | | Use of project facilities or equipment by employees and families for hunting and trapping will be prohibited (APA 1983a, p. E-3-534 #14).<br><br>If needed, recommendations for restrictions to hunting and trapping regulations to reduce harvest pressure (APA 1983a, p. E-3-534 #14). |
| | (8) Avoidance of some areas near intense human activities (e.g., construction zones) due to disturbance. | Lynx are uncommon and will be able to avoid developed areas. Not expected to be a significant impact (APA 1983a, Table E.3.157). | This impact mechanism will receive further attention during impact assessment refinements (APA 1984b, FY85 Task 5). | | Major ground activity will be prohibited near sensitive wildlife areas during sensitive periods (APA 1983a, p. E-3-532 #10).<br><br>Prohibition of access during construction, discouragement of offroad recreational vehicle activity, and phasing in of recreational plan to limit recreational impacts on vegetation and wildlife (APA 1983a, p. E-3-292 #15-17). |
| (K) Coyote | (1) Increase in coyote population may occur near developed areas. | Impact represents a beneficial effect on coyotes (APA 1983a, p. E-3-439). | Continued surveys of furbearer distribution, including downstream areas, will document changes in coyote populations (APA 1984b, FY85 Task 26, subtask 1). | | |
| (L) Red Fox | (1) Habitat alterations due to impoundment clearing and reclaimed lands will increase prey availability. | Impact represents a beneficial effect on foxes (APA 1983a, Table E.3.156). | Impact severity not sufficient to require further study. | | Revegetation and fertilization of disturbed sites (APA 1983a, p. E-3-526 #3). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (L) Red Fox (cont.) | (2) Open water downstream may hinder movements in winter. | Impact not quantified but not expected to be significant (APA 1983a, Table E.3.156). | Impact severity not sufficient to require study. | | Use of multilevel intake structures on the dams to maintain downstream river temperatures as close to normal as possible (APA 1983a, p. E-3-526 #5). |
| | (3) Increase in mortality due to hunting, trapping, and poaching | Hunting and trapping can be regulated, but poaching losses may represent an unavoidable adverse impact (APA 1983a, p. E-3-439, Table E.3.156). | Surveys of trappers are continuing to document current harvest levels (APA 1984b, FY85 Task 20). | | Use of project facilities or equipment by employees and families for hunting and trapping will be prohibited (APA 1983a, p. E-3-534 #14).<br><br>If needed, recommendations for restrictions to hunting and trapping regulations to reduce harvest pressure (APA 1983a, p. E-3-534 #14). |
| | (4) Habituation of foxes to human presence may lead to increase in mortality due to destruction of problem animals. | May represent an important impact on local fox populations (APA 1983a, p. E-3-440, Table E.3.156). | This impact mechanism will receive further attention during impact assessment refinements (APA 1984b, FY85 Task 5). | | Education programs and strict garbage control measures and enforcement to prevent creation of nuisance animals (APA 1983a, p. E-3-535 #15). |
| | (5) Abandonment of some den sites may occur due to human disturbance. | Some negative effects may occur but habituation to human activities is very likely; impact not expected to be significant (APA 1983a, p. E-3-439; Table E.3.156). | Surveys of fox den use in areas of potential impact (APA 1984b, FY85 Task 26, subtask 3). | Collect information on fox den locations throughout construction (APA 1983a, p. E-3-524 #6). | Major ground activity will be prohibited near sensitive wildlife areas during sensitive periods (APA 1983a, p. E-3-532 #10). |
| (M) Beaver | (1) Permanent loss of habitat for a few beaver due to impoundments and other permanent facilities. | Impact is of minor significance to area populations due to the small numbers affected (APA 1983a, Table E.3.153). | Beaver cache surveys may be extended to include the impoundment zones to confirm numbers of beaver affected (APA 1984b, FY85 Task 18, subtask 1). | | Development of downstream beaver carrying capacity model to yield better impact predictions and refinements to mitigation measures (APA 1983a, p. E-3-537 #18).<br><br>Enhancement of sloughs downstream from Devil Canyon (APA 1983a, p. E-3-537 #19). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (M) Beaver (cont.) | (2) Loss of some habitat for both species due to siltation of ponds, alteration and drainage patterns, and disturbance near access roads and borrow pits (primarily in the Deadman Creek area). | Impact is of minor significance to area populations due to the small numbers affected (65 beaver) (APA 1983a, pp. E-3-434 to 436, Table E.3.153). | Previous surveys have provided sufficient information for impact assessment. No further work is planned. | Collect information on beaver distribution in Deadman Creek and in downstream floodplain (APA 1983a, p. E-3-525 #8). | Habitat loss will be minimized by side borrow techniques for road construction, spoil deposition in impoundments or depleted borrow areas, and consolidation of project facilities (APA 1983a, p. E-3-526 #2).<br><br>Modifications of borrow requirements and techniques to minimize loss of habitat for aquatic furbearers (APA 1983a, p. E-3-536 #17).<br><br>Development of downstream beaver carrying capacity model to yield better impact predictions and refinements to mitigation measures (APA 1983a, p. E-3-537 #18).<br><br>Enhancement of sloughs downstream from Devil Canyon (APA 1983a, p. E-3-537 #19).<br><br>Minimize loss of forest areas through alignment of access road and transmission corridor, and other measures (APA 1983a, p. E-3-539 #23).<br><br>Minimize loss and alteration of habitat, particularly less abundant habitats and sensitive wildlife habitats (APA 1983a, p. E-3-291 to 292 #1-11).<br><br>Design and alignment measures to minimize impacts on wetlands (APA 1983a, p. E-3-292 #18, 19). |
| | (3) Increased winter flows, stabilized flows, and lack of ice cover will benefit beaver downstream. | Impact represents a beneficial effect on beavers and will probably compensate for losses due to the impoundments and other facilities (APA 1983a, p. E-3-434 to 436, Table E.3.153). | Additional information will be obtained from downstream hydrologic and vegetation modeling (APA 1984a, Aquatic FY85 Task 4A; APA 1984b, FY85 Task 15).<br><br>Efforts to refine the beaver population model and field studies to provide information for modeling will continue (APA 1984b, FY85 Tasks 18, 19 and 20). | Collect data on changes in downstream vegetative cover (APA 1983a, p. E-3-523 #2).<br><br>Collect information on beaver distribution in Deadman Creek and in the downstream floodplain (APA 1983a, p. E-3-525 #8). | Development of downstream beaver carrying capacity model to yield better impact predictions and refinements to mitigation measures (APA 1983a, p. E-3-537 #18).<br><br>Enhancement of sloughs downstream from Devil Canyon (APA 1983a, p. E-3-537 #19). |
| | (4) Downstream daily flow fluctuations may freeze out or flood beaver lodges and/or food caches in winter. | Short-term flow fluctuations in winter are not anticipated to be of a magnitude detrimental to beaver survival (APA 1983a, p. E-3-469). | Information from ice-modeling efforts is being incorporated in the beaver model (APA 1984b, FY85 Task 19). | | Development of downstream beaver carrying capacity model to yield better impact predictions and refinements to mitigation measures (APA 1983a, p. E-3-537 #18). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (M) Beaver (cont.) | (5) Increase in mortality due to hunting, trapping, and poaching. | Hunting and trapping can be regulated, but poaching losses may represent an unavoidable adverse impact (APA 1983a, p. E-3-436, Table E.3.153). | Surveys of trappers are continuing to document current harvest levels (APA 1984b, FY85 Task 20). | | Use of project facilities or equipment prohibited to employees and families for hunting and trapping (APA 1983a, p. E-3-534 #14).<br><br>If needed, recommendations for restrictions to hunting and trapping regulations to reduce harvest pressure (APA 1983a, p. E-3-534 #14). |
| (N) Muskrat | (1) Permanent loss of habitat for 5-10 muskrats due to impoundments and other permanent facilities. | Impact is of minor significance to area populations due to the small numbers affected (APA 1983a, Table E.3.153). | | | Enhancement of sloughs downstream from Devil Canyon (APA 1983a, p. E-3-537 #19). |
| | (2) Loss of some habitat for muskrats due to siltation of ponds, alteration of drainage patterns, and disturbance near access roads and borrow pits (primarily in the Deadman Creek area). | Impact is of minor significance to area populations due to the small numbers affected (APA 1983a, pp. E-3-434 to 436, Table E.3.153). | Previous surveys have provided sufficient information for impact assessment. No further work is planned. | | Habitat loss will be minimized by side borrow techniques for road construction, spoil deposition in impoundments or depleted borrow areas, and consolidation of project facilities (APA 1983a, p. E-3-526 #2).<br><br>Modifications of borrow requirements and techniques to minimize loss of habitat for aquatic furbearers (APA 1983a, p. E-3-536 #17).<br><br>Enhancement of sloughs downstream from Devil Canyon (APA 1983a, p. E-3-537 #19).<br><br>Minimize loss of forest areas through alignment of access road and transmission corridor, and other measures (APA 1983a, p. E-3-539 #23).<br><br>Minimize loss and alteration of habitat, particularly less abundant habitats and sensitive wildlife habitats (APA 1983a, p. E-3-291 to 292 #1-11).<br><br>Design and alignment measures to minimize impacts on wetlands (APA 1983a, p. E-3-292 #18, 19). |
| | (3) Increased winter flows, stabilized flows, and lack of ice cover will benefit muskrat downstream. | Impact represents a beneficial effect on muskrat and will probably compensate for losses due to the impoundments and other facilities (APA 1983a, p. E-3-434 to 436, Table E.3.153). | Additional information will be obtained from downstream hydrologic and vegetation modeling. | Collect data on changes in downstream vegetative cover (APA 1983a, p. E-3-523 #2). | Enhancement of sloughs downstream from Devil Canyon (APA 1983a, p. E-3-537 #19). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (N) Muskrat (cont.) | (4) Increase in mortality due to hunting, trapping, and poaching. | Hunting and trapping can be regulated, but poaching losses may represent an unavoidable adverse impact (APA 1983a, p. E-3-436, Table E.3.153). | Surveys of trappers are continuing to document current harvest levels (APA 1984b, FY85 Task 20). | | Use of project facilities or equipment prohibited to employees and families for hunting and trapping (APA 1983a, p. E-3-534 #14).<br><br>If needed, recommendations for restrictions to hunting and trapping regulations to reduce harvest pressure (APA 1983a, p. E-3-534 #14). |
| (O) River Otter | (1) Permanent loss of riparian and aquatic river otter habitats in the proposed impoundment zones. | * Elimination of 86 miles (138 km) of mainstem river habitat and 39 miles (65 km) of stream habitat (APA 1983a, p. E-3-84 and 129). | | | * Set aside other lands used by river otter to prevent further decline of otter habitat. |
| | * (2) Habitat alterations downstream of the impoundments. | The total area of habitat likely to be lost to otters because of reduced flows has not been determined (LGL 1985, p. 2.15-7). | Additional information will be obtained from downstream hydrologic and vegetation studies (APA 1984a, Aquatic FY85 Task 4A; APA 1984b, FY85 Task 15). | * Collect data on changes in downstream vegetative cover (APA 1983a, p. E-3-523 #2). | |
| | (3) Habitat alteration and temporary habitat loss due to clearing forest and brush from the impoundment zones. | Short-term impact affecting the same populations affected by impoundment filling. Impact would occur 2-3 years prior to filling (APA 1983a, Table E.3.155). | | | |
| | * (4) Increased water temperature downstream from the impoundments affecting otter habitat. | * Increased water temperature would cause delayed ice formation, affecting amount of aquatic habitat usable, and prey numbers and distribution (APA 1983a, p. E-3-111). The net change in available habitat or food availability has not been determined. | Additional information will be obtained from downstream hydrologic and vegetation studies (APA 1984a, Aquatic FY85 Task 4A; APA 1984b, FY85 Task 15). | | * Use of multilevel intake structures on the dams to maintain downstream river temperatures as close to preproject temperatures as possible (APA 1983a, p. E-3-526 #5). |
| | * (5) Delayed spring ice break-up. | * Spring ice break-up in the mitigation would be delayed and less severe. Continued ice cover would reduce amount of foraging habitats. Break-up in side channels and sloughs would not occur, further reducing availability of spring foraging habitat until the ice melts (APA 1983a, p. E-3-90; LGL 1985, p. 2.15-7 to 8). | * Information from ice-modeling could be used to determine magnitude of habitat alteration (APA 1984b, FY85 Task 15). | | |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (0) River Otter (cont.) | * (6) Change in beaver numbers downstream from the impoundments and consequent effects on otter habitat. | * Should project actions result in increased beaver numbers, resting and denning habitats for river otters might be increased. Probably would not result in any appreciable increase in otter numbers (LGL 1985, p. 2.15-8). | * Additional information will be obtained from downstream hydrologic and vegetation studies (APA 1984a, Aquatic FY Task 4A; APA 1984b, FY85 Task 15). | * Collect data on changes in downstream vegetative cover (APA 1983a, p. E-3-523 #2). Collect information on beaver distribution, abundance and overwinter survival (APA 1984b, FY85 Task 18, subtasks 1 and 3). | |
| | * (7) Changes in water quality. | * Water turbidity downstream of the dams would be decreased in summer and increased in winter from present conditions, neither of which would be a significant impact on the ability of otter to forage for available prey (LGL 1985, p. 2.15-8). Water turbidity in the impoundments would not be expected to impact on the ability of otter to forage for available prey. Water runoff from fuel storage facilities, solid waste disposal and the construction village is not expected to reach water bodies because of construction designs (APA 1983a, p. E-3-128). | | | * Water for camp and construction use would be treated before discharge back into the Susitna River. Storm drainage and oily water runoff from the construction camp would be collected and treated (APA 1983a, p. E-3-128). A Spill Prevention Containment and Countermeasure Plan (SPCC) would be developed. |
| | (8) Permanent loss of habitat to access corridors. | * Would result in minor loss of habitat where routes cross wetlands or streams (APA 1983a, Tables E.3.20 and E.3.21). Unless construction changed or eliminated water courses, the impact would not be important to river otters (LGL 1985, p. 2.15-8). | | | Habitat would be minimized by side borrow techniques for road construction, spoil deposition in impoundments or depleted borrow areas, and consolidation of project facilities (APA 1983a, p. E-3-526 #2).<br><br>Modification of borrow requirements and techniques to minimize loss of habitat for aquatic furbearers (APA 1983a, p. E-3-536 #17).<br><br>Minimize loss of forest areas through alignment of access road and transmission corridor and other measures (APA 1983a, E-3-291, 292 #1-11).<br><br>Minimize loss and alteration of habitat, particularly less abundant habitats and sensitive wildlife habitats (APA 1983a, p. E-3-291, 292 #1-11). |
| | (9) Increased small mammal populations in reclaimed areas. | * It is not likely that increased small mammal populations as a result of reclaimed areas would benefit otter populations (LGL 1985, p. 2.15-8). | | | Revegetation and fertilization of disturbed sites (APA 1983a, p. E-3-526 #3). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (O) River Otter (cont.) | * (10) Loss of habitats used by river otters for travel routes. | Data not available to determine the number of otter moving through the impoundment area, or to quantify the importance of the dam sites to traveling otters. Impact not likely to have an important impact on otter movements (LGL 1985, p. 2.15-8). | | | |
| | (11) Increased otter mortality resulting from increased hunting and trapping pressure. | * Increased access to the project area and increased human population would likely result in increased trapping pressure which may cause adverse impacts on the otter population (APA 1983a, Table E.3.155; LGL 1985, p. 2.15-9). | Surveys of trappers are continuing to document current harvest levels (APA 1984b, FY85 Task 20). | | Use of project facilities or equipment by employees and families for hunting and trapping will be prohibited (APA 1983a, p. E-3-534 #14).<br><br>If needed, recommendations for restrictions to hunting reguiations to reduce harvest pressure (APA 1983a, p. E-3-534 #14).<br><br>* Lands selected to compensate for lost wildlife habitat could be a source of river otters that could colonize areas vacated because of increased mortality (LGL 1985, p. 2.15-13). |
| | (12) Increased otter mortality resulting from poaching. | Illegal shooting and trapping might increase with increased human population and access, but would probably not be an important adverse impact on the otter population (LGL 1985, p. 2.15-9). | | | |
| | * (13) Increased otter mortality resulting from collisions of wildlife and vehicles. | * Mortality caused by increased vehicle traffic would be an adverse impact, but not likely to become important (LGL 1985, p. 2.15-10). | * Impact severity not sufficient to require study. | | |
| | * (14) Permanent abandonment of areas because of disturbance and harassment during construction activities. | * Otters would initially leave construction areas because of disturbance, but permanent habitat loss would prevent otters from occupying the area inundated by the impoundments. Disturbance along access routes would probably not result in complete abandonment of the area along those routes (LGL 1985, p. 2.15-10). | | | Major ground activity will be prohibited near sensitive periods (APA 1983a, p. E-3-532 #10).<br><br>Possible controls on volume, speed and frequency of access road traffic (APA 1983a, p. E-3-534 #12).<br><br>Prohibition of access during construction, discouragement of offroad recreational vehicle activity, and phasing in of recreational plans to limit recreational impacts on vegetation and wildlife (APA 1983a, p. E-3-292 #15-17). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (O) River Otter (cont.) | * (15) Permanent abandonment of areas because of disturbance and harassment resulting from increased recreational use of waterways. | * Increased recreational use of the waterways contributing to direct harassment and disturbance of otters could cause otters to abandon areas without sufficient escape cover. The importance of this potential adverse impact would depend upon recreational use patterns (APA 1983a, p. E-3-505; LGL 1985, p. 2.15-10). | | | Prohibition of access during construction, discouragement of offroad recreational vehicle activity, and phasing in of recreational plans to limit recreational impacts on vegetation and wildlife (APA 1983a, p. E-3-292 #15-17). |
| (P) Marten | (1) Permanent habitat loss due to impoundments. | Impact will result in loss of habitat for approximately 100 marten within the middle basin (APA 1983a, p. E-3-440 to 442). | * Previous studies provided sufficient information for impact assessment. No further studies planned. | | |
| | (2) Permanant loss of some habitat for marten due to the access corridor. | Impact will likely result in redistribution of home ranges of affected furbearers (APA 1983a, p. E-3-487, Table E.3.157). | Impact severity not sufficient to require further study. | | Habitat loss will be minimized by side borrow techniques for road construction, spoil deposition in impoundments or depleted borrow areas, and consolidation of project facilities (APA 1983a, p. E-3-526 #2).<br><br>Minimize loss of forest areas through alignment of the access road and transmission corridor, and other measures (APA 1983a, p. E-3-539 #23).<br><br>Minimize loss and alteration of habitat, particularly less abundant habitats and sensitive wildlife habitats (APA 1983a, pp. E-3-291 to 292 #1-11). |
| | (3) Loss of habitat in impoundment areas due to clearing operations. | Short-term impact that will precede habitat loss due to impoundment filling (APA 1983a, Table E.3.157). | Continued surveys of furbearer distribution will improve impact assessment and mitigation planning (APA 1984b, FY85 Task 26, subtask 1). | | Impoundment clearing will not begin until 2 or 3 years before filling; patches of vegetation will be left until just before filling (APA 1983a, p. E-3-525 #1). |
| | (4) Loss of forest habitats due to the transmission corridors. | Impact will result in loss of 3831 acres of forest habitats useful to marten, (APA 1983a, Table E.3.86). | Previous studies have provided sufficient information for impact assessment. No further studies are planned. | | Selective clearing in the transmission corridor, permitting seral vegetation up to 10 ft in height (APA 1983a, p. E-3-526 #4).<br><br>Minimize loss and alteration of habitat, particularly less abundant habitats and sensitive wildlife habitats (APA 1983a, p. E-3-291 to 292 #1-11). |
| | (5) Loss of habitat due to borrow sites and other areas that will be reclaimed. | Removal of 3341 acres of spruce forest habitats. Revegetation will probably not return habitat to spruce communities during the license period (APA 1983a, Table E.3.157). | Previous studies have provided sufficient information for impact assessment. No further studies are planned. | | Revegetation and fertilization of disturbed sites (APA 1983a, p. E-3-526 #3) will provide some foraging habitat prior to forest succession. |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (P) Marten (cont.) | (6) Impoundments will block movements of marten and impede dispersal. | Redistribution of home ranges to conform to impoundment shores will occur (APA 1983a, Table E.3.157). | * Previous studies have provided sufficient information for impact assessment. No further studies are planned. | | Clearing of impoundments prior to flooding and removal of floating debris to reduce hazards to crossing (APA 1983a, p. E-3-530 #9) will aid dispersal but will not completely mitigate barrier effects. |
| | (7) Open water downstream will block movements of marten. | Marten usually align home ranges along rivers and other water bodies. Impact not expected to be significant (APA 1983a, Appendix E11J, Volume 10B). | Previous studies have provided sufficient information for impact assessment. No further work is planned. | | Use of multilevel intake structures on the dams to maintain downstream river temperatures as close to normal as possible (APA 1983a, p. E-3-526 #5). |
| | (8) Increase in the incidence of road kills due to presence of the access corridor. | Impact not quantified but not expected to be significant (APA 1983a, Table E.3.157). | Impact severity not sufficient to require further study. | Collect mortality data on road and railroad collisions (APA 1983a, p. E-3-525 #1). | |
| | (9) Increase in mortality due to hunting, trapping, and poaching. | Hunting and trapping can be regulated, but poaching losses may represent an unavoidable adverse impact (APA 1983a, Table E.3.157). | Surveys of trappers are continuing to document current harvest levels (APA 1984b, FY85 Task 20). | | Use of project facilities or equipment by employees and families for hunting and trapping will be prohibited (APA 1983a, p. E-3-534 #14).<br><br>If needed, recommendations for restrictions to hunting and trapping regulations to reduce harvest pressure (APA 1983a, p. E-3-543 #14). |
| | (10) Avoidance of some areas near intense human activities (e.g., construction zones) due to disturbance. | Marten are unlikely to be affected, or will be able to avoid developed areas. Not expected to be a significant impact (APA 1983a, Table E.3.157). | Impact severity not sufficient to require further study. | | Major ground activity will be prohibited near sensitive wildlife areas during sensitive periods (APA 1983a, p. E-3-352 #10).<br><br>Prohibition of access during construction, discouragement of offroad recreational vehicle activity, and phasing in of recreational plan to limit recreational impacts on vegetation and wildlife (APA 1983a, p. E-3-292 #15-17). |
| (Q) Mink | (1) Permanent habitat loss due to the impoundments. | Elimination of a substantial portion of good quality habitat (53 miles of mainstem plus 9.7 miles of stream habitat) will occur (APA 1983a, p. E-3-436, Table E.3.155). | Distribution of furbearers in the downstream area and in the impoundment zones will be studied (APA 1984b, FY85 Task 26, subtask 1). | | |
| | (2) Habitat loss due to impoundment clearing activities and resultant decrease in cover and prey availability. | Short-term impact affecting the same populations affected by impoundment filling. Impact will occur 203 years prior to filling (APA 1983a, Table E.3.155). | Distribution of furbearers in the downstream area and in the impoundment zones will be studies (APA 1984b, FY85 Task 26, subtask 1). | | Impoundment clearing will not begin until 2 or 3 years before filling; patches of vegetation will be left until just before filling (APA 1983a, p. E.3.525 #1). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (Q) Mink (cont.) | (3) Habitat loss due to the access corridor. | Proposed road route will remove 12.3 miles of stream shore habitats along Deadman Creek (APA 1983a, p. E-3-438). | Previous studies provided sufficient information for impact assessment. No further studies are planned. | | Habitat loss will be minimized by side borrow techniques for road construction, spoil deposition in impoundments or depleted borrow areas, and consolidation of project facilities (APA 1983a, p. E-3-526 #2).<br><br>Modifications of borrow requirements and techniques to minimize loss of habitat for aquatic furbearers (APA 1983a, p. E-3-536 #17).<br><br>Minimize loss of forest areas through alignment of access road and transmission corridor and other measures (APA 1983a, p. E-3-539 #23).<br><br>Minimize loss and alteration of habitat, particularly less abundant habitats and sensitive wildlife habitats (APA 1983a, p. E-3-291, 292 #1-11). |
| | (4) Increase in small mammal prey in reclaimed areas. | This impact represents a beneficial impact to mink, although benefits will probably be of little significance (APA 1983a, Table E.3.155). | Impact severity not sufficient to require study. | | Revegetation and fertilization of disturbed sites (APA 1983a, p. E-3-526 #3). |
| | (5) Increase in beaver population, stabilization of water levels, and open water downstream will benefit mink. | Impact represents a beneficial effect on mink (APA 1983a, Table E.3.155). | Surveys of furbearer populations and distribution in the downstream area are planned (APA 1984b FY85 Task 26, subtask 1). | | Enhancement of sloughs downstream from Devil Canyon (APA 1983a, p. E-3-537 #19). |
| | (6) Increase in mortality due to hunting, trapping, and poaching. | Hunting and trapping can be regulated, but poaching losses may represent an unavoidable adverse impact (APA 1983a, Table E.3.155). | Surveys of trappers are continuing to document current harvest levels (APA 1984b FY85 Task 20). | | Use of project facilities or equipment by employees and families for hunting and trapping will be prohibited (APA 1983a, p. E-3-534 #14).<br><br>If needed, recommendations for restrictions to hunting regulations to reduce harvest pressure (APA 1983a, p. E-3-534 #14). |
| | (7) Abandonment of habitat near construction zones and recreation areas due to human disturbance. | Effects would be most noticeable on the remaining habitat areas along the upper reaches of tributary creeks near the impoundments (APA 1983a, p. E-3-438, Table E.3.155). | This impact mechanism will receive further attention during impact assessment refinement (APA 1984b, FY85 Task 5). | | Major ground activity will be prohibited near sensitive wildlife areas during sensitive periods (APA 1983a, p. E-3532 #10).<br><br>Prohibition of access during construction, discouragement of off-road recreational vehicle activity, and phasing in of recreational plan to limit recreational impacts on vegetation and wildlife (APA 1983a, p. E-3-292 #15-17). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (R) Weasels | (1) Permanent habitat loss due to impoundments. | Impact will result in loss of habitat for approximately 5% of the population of weasels within the middle basin (APA 1983a, p. E-3-440 to 442). | Continued surveys of furbearer distribution will improve impact assessment and mitigation planning (APA 1984b FY85 Task 26, subtask 1). | | |
| | (2) Permanent loss of habitat for weasel due to the access corridor. | Impact will likely result in redistribution of home ranges of affected furbearers (APA 1983a, p. E-3-487, Table E.3. 157). | Impact severity not sufficient to require further study. | | Habitat loss will be minimized by side borrow techniques for road construction, spoil deposition in impoundments or depleted borrow areas, and consolidation of project facilities (APA 1983a, p. E-3-526 #2).<br><br>Minimize loss of forest areas through alignment of the access road and transmission corridor, and other measures (APA 1983a, p. E-3-539 #23).<br><br>Minimize loss and alteration of habitat, particularly less abundant habitats and sensitive wildlife habitats (APA 1983a pp. E-3-291 to 292 #1-11). |
| | (3) Loss of habitat in impoundment areas due to clearing operations. | Short-term impact that will precede habitat loss due to impoundment filling (APA 1983a, Table E.3.157). | Continued surveys of furbearer distribution will improve impact assessment and mitigation planning (APA 1984b FY85 Task 26, subtask 1). | | Impoundment clearing will not begin until 2 or 3 years before filling; patches of vegetation will be left until just before filling (APA 1983a, p. E-3-525 #1). |
| | (4) Loss of forest habitats due to the transmission corridors. | Impact will result in loss of 3831 acres of forest habitats useful to weasels (APA 1983a, Table E.3.86). | Previous studies have provided sufficient information for impact assessment. No further studies are planned. | | Selective clearing in the transmission corridor, permitting seral vegetation up to 10 ft in height (APA 1983a, p. E-3-526 #4).<br><br>Minimize loss and alteration of habitat, particularly less abundant habitats and sensitive wildlife habitats (APA 1983a, p. E-3-291 to 292 #1-11). |
| | (5) Loss of habitat due to borrow sites and other areas that will be reclaimed | Removal of 3341 acres of spruce forest habitats. Revegetation will probably not return habitat to spruce communities during the license period (APA 1983a, Table E.3. 157). | Previous studies have provided sufficient information for impact assessment. No further studies are planned. | | Revegetation and fertilization of disturbed sites (APA 1983a, p. E-3-526 #3) will provide some foraging habitat prior to forest succession. |
| | (6) Impoundments will block movements and impede dispersal of weasels. | Redistribution of home ranges to conform to impoundment shores will occur (APA 1983a, Table E.3.157). | This impact mechanism will receive further attention during impact assessment refinement (APA 1984b, FY85 Task 5). | | Clearing of impoundments prior to flooding and removal of floating debris to reduce hazards to crossing (APA 1983a, p. E-3-530 #9) will aid dispersal but will not completely mitigate barrier effects. |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (R) Weasels (cont.) | (7) Increase in the incidence of road kills due to presence of the access corridor. | Impact not quantified but not expected to be significant (APA 1983a, Table E.3.157). | Impact severity not sufficient to require further study. | Collect mortality data on road and railroad collisions (APA 1983a, E-3-525 #1). | |
| | (8) Open water downstream will block movements of weasels. | Weasels probably align home ranges along rivers and other water bodies. Impact not expected to be significant (APA 1983a, Appendix E11J, Volume 10B). | Previous studies have provided sufficient information for impact assessment. No further work is planned. | | Use of multilevel intake structures on the dams to maintain downstream river temperatures as close to normal as possible (APA 1983a, p. E-3-526 #5). |
| | (9) Increase in mortality due to hunting, trapping, and poaching. | Hunting and trapping can be regulated, but poaching losses may represent an unavoidable adverse impact (AjPA 1983a, Table E.3.157). | Surveys of trappers are continuing to document current harvest levels (APA 1984b, FY85 Task 20). | | Use of project facilities or equipment by employees and families for hunting and trapping will be prohibited (APA 1983a, p. E-3-534 #14).<br><br>If needed, recommendations for restrictions to hunting and trapping regulations to reduce harvest pressure (APA 1983a, p. E-3-534 #14). |
| | (10) Avoidance of some areas near intense human activities (e.g., construction zones) due to disturbance. | Weasel are unlikely to be affected or will be able to avoid developed areas. Not expected to be a significant impact (APA 1983a, Table E.3. 157). | * Impact severity not sufficient to require further study. | | Major ground activity will be prohibited near sensitive wildlife areas during sensitive periods (APA 1983a, p. E-3-532 #10).<br><br>Prohibition of access during construction, discouragement of off-road recreational vehicle activity, and phasing in of recreational plan to limit recreational impacts on vegetation and wildlife (APA 1983a, p. E-3-292 #15-17). |
| (S) Small Mammals | (1) Permanent habitat loss due to impoundments and other project facilities. | Habitats lost are similar to those of birds [see Section (Z)(1)]. Normally rapid population turnover rates and reshuffling of territories by small mammals will minimize immediate impacts; however, long-term loss of habitat will reduce overall populations (APA 1983a, p. E-3-461). | Previous studies provided sufficient information for impact assessment. No further studies planned. | | Selective clearing in transmission corridor, permitting seral vegetation up to 10 ft in height (APA 1983a, p. E-3-526 #4).<br><br>Minimize loss and alteration of habitat, particularly less abundant habitats and sensitive wildlife habitats (APA 1983a, pp. E-3-291 to 292 #1-11). |
| | (2) Increase in numbers of certain species in revegetated areas of reclaimed borrow sites. | Impact represents a beneficial effect on most small mammal species (APA 1983a, p. E-3-462). | Impact severity not sufficient to require study. | | Selective clearing in transmission corridor, permitting seral vegetation up to 10 ft in height (APA 1983a, p. E-3-526 #3). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (S) Small Mammals (cont.) | (3) Displacement during impoundment filling of small mammals that have recolonized disturbed areas in the impoundment clearing zone. | Temporary adverse impact, which resulted from a previously beneficial effect on small mammal populations (APA 1983a, Appendix E11J, Volume 10B). | Impact severity not sufficient to require study. | | Impoundment clearing will not begin until 2 or 3 years before filling; patches of vegetation will be left until just before filling (APA 1983a, p. E-3-525 #1). |
| (T) Waterbirds | (1) Permanent loss of river and stream habitats for waterfowl, shorebirds, dippers, and kingfishers due to impoundments. | Numbers of birds affected have not been estimated but impact is unlikely to have a major population effect. Effects will be greatest on riverine species, particularly harlequin duck, common and red-breasted mergansers, spotted sandpiper, semi-palmated plover, and dipper (APA 1983a, pp. E-3-454 to 455). | Previous studies provided sufficent information for impact assessment. No further work is planned. | | |
| | (2) Alteration of shoreline nesting habitats due to impoundment clearing and facility site clearing. | Temporary impact; in most areas preceding impoundment filling by 2 to 3 years (APA 1983a, p. E-3-455). | Impact severity not sufficient to require study. | | Habitat loss will be minimized by side-borrow techniques for road construction, spoil deposition in impoundments or depleted borrow areas, and consolidation of project facilities (APA 1983a, p. E-3-526 #2).<br><br>Design and alignment measures to minimize impacts on wetlands (APA 1983a, p. E-3-292 #18, 19). |
| | (3) Transmission corridor may cross waterfowl nesting areas or movement corridors, resulting in displacement of breeding birds (particularly trumpeter swans), or mortality due to transmission line collisions. | Impact not quantified (APA 1983a, p. E-3-496 to 497). | Surveys of all affected areas for trumpeter swans and nests, including the transmission corridor (APA 1984b, FY85 Task 24). | Collect information on swan nest locations throughout construction (APA 1983a, p. E-3-525 #10). | Major ground activity will be prohibited within C.5 miles of waterbodies use by swans when they are present (APA 1983a, p. E-3-532 #10).<br><br>Design and alignment measures to minimize impacts on wetlands (APA 1983a, p. E-3-292 #18, 19). |
| | (4) Increased mortality of gamebirds due to hunting and poaching. | Hunting can be regulated but poaching losses may represent an unavoidable adverse impact. | Impact severity not sufficient to require study. | | Use of project facilities or equipment prohibited to employees and families for hunting and trapping (APA 1983a, p. E-3-534 #14).<br><br>If needed, recommendations for restrictions to hunting regulations to reduce hunting pressure (APA 1983a, p. E-3-534 #14). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (T) Waterbirds (cont.) | (5) Avoidance by waterbirds of areas of intense human activity (e.g., construction zones, impoundment clearing activities recreational areas). | Impact not quantified, but not expected to be significant (APA 1983a, pp. E-3-455 and 491). | Impact severity not sufficient to require study. | Collect information on swan nest locations throughout construction (APA 1983a, p. E-3-525 #10; APA 1984b, FY85 Task 24). | Aircraft will maintain minimum altitudes of 1000 ft above ground level during flights (APA 1983a, p. E-3-531 #10).<br><br>Aircraft will maintain a 0.25 mile buffer around lakes used by trumpeter swans during the nesting period (APA 1983a, p. E-3-531 #10).<br><br>Major ground activity will be prohibited within 0.5 miles of waterbodies used by swans when swans are present (APA 1983a, p. E-3-532 #10).<br><br>Prohibition of access during construction discouragement of off-road recreational vehicle activity, and phasing in of recreational plan to limit recreational impacts on vegetation and wildlife (APA 1983a, p. E-3-292 #15-17). |
| (U) Bald Eagle | (1) Permanent loss of 3 nesting locations and hunting habitat for bald eagles due to the impoundment. | Nesting location loss will affect 2-3 pairs of bald eagles. Loss of hunting habitat will not be as important as loss of nest sites, because presence of suitable nest trees is probably more limiting (APA 1983a, pp. E-3-443 to 451; LGL 1984; LGL 1985, pp. 2.20-1 to 3). | Food habits and foraging range of bald eagles will be studied. Information will be used for mitigation planning efforts to help determine the optimal locations of artificial eagle nests (APA 1984b FY85 Task 21). | * Surveys of middle basin raptor nests and nesting locations will continue to document use areas prior to, during, and after construction (LGL 1985, Section 3.4). | * Construction of artificial nest sites for bald eagles (dependent on agency approval) are proposed to compensate for the 3 nest sites lost by inundation. A fourth nest site at the edge of the impoundment will be stabilized to prevent damage by moving ice or other factors and establishment of alternate artificial nest sites nearby is planned (LGL 1985, Section 3.4). |
| | (2) Loss of 3 nesting locations of bald eagles due to impoundment clearing. | Loss will affect 2-3 pairs of bald eagles but will be short term, prior to permanent loss as described in U-1. | | * Surveys of middle basin raptor nests and nesting locations will continue to document use areas prior to, during, and after construction (LGL 1985, Section 3.4). | * Curtailment of clearing operations within 0.5 mile radius of nests within the impoundment zone prior to impoundment filling (LGl 1985, Section 3.4).<br><br>* Implementation of artificial nest site mitigation measures (if approved). See above in U-1. |
| | (3) Loss of nest sites and habitat alteration due to secondary impacts of erosion, blowdowns, etc., on forest vegetation. | Impacts not quantified, but not expected to be significant (APA 1983a, Appendix E11J, Volume 10B). | Impact severity not sufficient to require study. | | |
| | (4) Detrimental impacts on salmon and other fish prey in downstream areas could affect bald eagle habitat quality. | Proposed mitigation of impacts to salmon should also lessen impacts on bald eagles. Not expected to be significant (APA 1983a, Appendix E11J, Volume 10B). | Surveys of bald eagle nest sites in downstream reaches are planned and will provide baseline population data for future monitoring studies (APA 1984b, FY85 Task 27). | | Impacts from decreased prey availability should be reduced by measures to mitigate impacts to salmon populations (APA 1983a, p. E-3-536 #16). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (U) Bald Eagle (cont.) | (5) Increase in electrocution of bald eagles on transmission towers. | Impact difficult to quantify. Selected tower and line configuration for permanent transmission line is unlikely to cause electrocution. Electrocution may occur on 34 kv construction transmission line if used (APA 1983a, p. E-3-497, Table E.3.159; LGL 1985, Section 3.4). | Previous studies provided sufficient information for impact assessment. No further studies are planned. | | Pole-line configurations and possible perch guards to avoid raptor electrocution will be used on permanent transmission lines (APA 1983a, p. E-3-539 #22; LGL 1985, p. 3.4-8). Use of diesel generators for power sources during construction may eliminate electrocution potential on temporary line (LGL 1985, p. 3.4-8). |
| | (6) Potential abandonment of 2 bald eagle nests due to disturbance along access corridors. | Nesting locations are within 0.5 mile (to railroad) and just beyond 0.5 mile (access road) of nests. | | Surveys of middle basin raptor nests and nesting locations will continue to document use areas and potential disturbance effects prior to, during, and after construction (LGL 1985, Section 3.4). | The Denali Highway-to-Watana access road was realigned to avoid (remain 0.5 miles distant from) the vicinity of nest BE-6, the recommended distance to avoid disturbance impacts (APA 1983a, p. E-3-537 #10, Fig. E.3.81; LGL 1985, Section 3.4). The railroad route cannot be realigned to avoid nest BE-8 beyond 0.25 miles. Placement of artificial nest structure farther away from the railroad will be done if disturbance effects occur (LGL 1985, Section 3.4).<br><br>Curtailment of construction activities during the sensitive (nesting) period in the vicinity of active nests will also occur (LGL 1985, Section 3.4). |
| | (7) Potential abandonment of bald eagle nests along the transmission route due to disturbance. | Impact not completely quantified, but not likely to affect bald eagles. | Surveys to identify bald eagle nest sites along the proposed transmission corridor are planned (APA 1984b, FY85 Task 27). | Surveys flown prior to line construction will identify any newly established nest sites which may be located within the corridor (APA 1984b, FY85 Task 27). | Present route has taken into consideration known bald eagle nests and will remain at least 0.5 miles from nest sites (LGL 1985, Section 3.4). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (U) Bald Eagle (cont.) | (8) Increase in disturbance due to aircraft traffic, construction activity and recreational activity that is facilitated by increased access. | Impact not quantified but may cause abandonment of nests or nest failure (APA 1983a, p. E-3-451 to 454, Table E.3. 159). | | Collect information on active raptor nest locations throughout construction (APA 1983a, p. E-3-525 #9). | Aircraft will maintain minimum altitudes of 1000 ft above ground level during flights (APA 1983a, p. E-3-531 #10).<br><br>Aircraft landings will be prohibited within 0.25 miles of active bald eagle nests between 15 March and 31 August (APA 1983a, p. E-3-531 #10).<br><br>Raptor protection criteria (LGL 1985, pp. 3.4-2 to 3).<br><br>Changes in facility siting or alignment or in construction schedules to avoid disturbance to raptor nest sites (APA 1983a, pp. E-3-533 #10, including specific measures for specific sites).<br><br>Public access to access road and airfield prohibited during construction (APA 1983a, p. E-3-534 #12, 14).<br><br>Discouragement of off-road recreational vehicle activity, and phasing in of recreational plan to limit recreational impacts on vegetation and wildlife (APA 1983a, p. E-3-292 #16-17). |
| (V) Golden Eagle | (1) Permanent loss of 5 nesting locations of golden eagles due to the impoundments. | Will result in loss or displacement of 2-3 pairs of eagles (LGL 1984, p. 7). | * Surveys of middle basin raptor nests and nesting locations will continue to document use areas prior to, during, and after construction (LGL 1985, Section 3.4). | | * Construction of artificial nest sites on nearby cliffs for golden eagles are proposed to compensate for loss of nesting locations (APA 1983a, p. E-3-538 and 539; LGL 1985, Appendix A). Hunting habitat exists mainly at elevations above the impoundments and will not be affected. |
| | (2) Increase in electrocution of golden eagles on transmission towers. | Impact difficult to quantify. Selected tower and line configuration for permanent transmission line is unlikely to cause electrocution. Electrocution may occur on 34 kv construction transmission line if used (APA 1983a, p. E-3-497, Table E.3.159; LGL 1985, Section 3.4). | Previous studies provided sufficient information for impact assessment. No further studies are planned. | | |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (V) Golden Eagle (cont.) | (3) Effective loss of nesting locations due to disturbance at borrow pits, near clearing activities, and along the access corridor. | * Total of 14 nesting locations are in areas subject to potential disturbance effects (LGL 1984, pp. 2 to 4). Disturbance effects at nest GE-18 may occur within 0.5 mile of the nest sites and will continue through operation phases due to the presence of the transmission corridor, road, bridge, and dam site (LGL 1985, Section 3.4). | * Surveys of middle basin raptor nests and nesting locations will continue to document use areas prior to, during, and following construction (LGL 1985, Section 3.4). | | * Curtailment of clearing operations within 0.5 mile of any active nesting locations during the sensitive (nesting) period will occur (LGL 1985, Section 3.4).<br><br>* Curtailment of some borrow excavation activities at affected pits during the sensitive period may be necessary, or, if impractical, construction of alternate artificial nest sites in nearby areas to compensate for effective nest loss due to disturbance (LGL 1985, Section 3.4).<br><br>* Construction of alternate nest site(s) for GE-18 may be necessary if disturbance effects are anticipated (LGL 1985, Section 3.4). |
| | (4) Increase in disturbance due to aircraft traffic, construction activity and recreational activity that is facilitated by increased access. | Impact not quantified but may cause abandonment of nests or nest failure (APA 1983a, p. E-3-451 to 454, Table E.3. 159). | | Collect information on active raptor nest locations throughout construction (APA 1983a, p. E-3-525 #9). | Aircraft will maintain minimum altitudes of 1000 ft above ground level during flights (APA 1983a, p. E-3-531 #10).<br><br>Aircraft landings will be prohibited within 0.5 miles of active golden eagle nests between 15 March and 31 August (APA 1093a, p. E-3-531 #10).<br><br>Raptor protection criteria (LGL 1985, pp. 3.4-2 to 3).<br><br>Changes in facility siting or alignment or in construction schedules to avoid disturbance to raptor nest sites (APA 1983a, pp. E-3-533 #10, including specific measures for specific sites).<br><br>Public access to access road and airfield prohibited during construction (APA 1983a, p. E-3-534 #12, 14).<br><br>Discouragement of off-road recreational vehicle activity, and phasing in of recreational plan to limit recreational impacts on vegetation and wildlife (APA 1983a, p. E-3-292 #16-17). |
| (W) Gyrfalcon | (1) Possible loss of a nesting location due to borrow site K and disturbance from the transmission corridor. | Recent surveys found no suitable nesting habitat for gyrfalcons within 0.25 mile of the borrow site or the transmission corridor (LGL 1985, in prep.). | | | Adherence to raptor protection criteria will be maintained (LGL 1985, pp. 3.4-2 to 3). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (W) Gyrfalcon (cont.) | (2) Potential abandonment of several raptor and raven nests or nesting locations (including a peregrine falcon nest) due to human activities along the transmission corridor. | Impact not completely quantified but will affect 2 gyrfalcon nesting locations if construction activities occur during nest site attendance periods (APA 1983a, pp. E-3-452 to 454, Table E.3.159). | Surveys to look for and determine use of raptor nest sites along the transmission corridor (APA 1984b, FY85 Tasks 24 and 29). | Collect information on active raptor nest locations throughout construction (APA 1983a, P. E-3-525 #9). | Raptor protection criteria (LGL 1985, pp. 3.4-2 to 3).<br><br>Changes in facility siting or alignment or in construction schedules to avoid disturbance to raptor nest sites (APA 1983a, pp. E-3-537 #20, E-3-533 #10). |
| | (3) Increase in disturbance due to aircraft traffic, construction activity and recreational activity that is facilitated by increased access. | Impact not quantified but may cause abandonment of nests or nest failure (APA 1983a, p. E-3-451 to 454, Table E.3. 159). | | Collect information on active raptor nest locations throughout construction (APA 1983a, p. E-3-525 #9). | Aircraft will maintain minimum altitudes of 1000 ft above ground level during flights (APA 1983a p. E-3-531 #10).<br><br>Aircraft landings will be prohibited within 0.25 miles of active gyrfalcon nests between 15 February and 15 August (APA 1983a, p. E-3-531 #10).<br><br>Raptor protection criteria (LGL 1985, pp. 3.4-2 to 3).<br><br>Changes in facility siting or alignment or in construction schedules to avoid disturbance to raptor nest sites (APA 1983a, pp. E-3-533 #10, including specific measures for specific sites).<br><br>Public access to access road and airfield prohibited during construction (APA 1983a, p. E-3-534 #12, 14).<br><br>Discouragement of off-road recreational vehicle activity, and phasing in of recreational plan to limit recreational impacts on vegetation and wildlife (APA 1983a, p. E-3-292 #16-17). |
| (X) Peregrine Falcon | (1) Potential abandonment of a peregrine falcon nesting location due to disturbance along the transmission corridor. | * Nest sites reported to be within the transmission corridor near the Nenana River crossing at Nenana are not suitable for nesting peregrines according to a 1984 survey of the area. One historical nesting site is within 1.4 miles of the proposed route (LGL 1985, in prep.). | | Surveys to document use of potential nest sites near the transmission corridor are planned through construction and operation phases (APA 1983a, p. E-3-525 #9; LGL 1985, in prep.). | Adherence to raptor protection criteria will be maintained (LGL 1985, pp. 3.4-2 to 3).<br><br>* A section 7 consultation (Endangered Species Act 1973) with the USFWS will be conducted to ensure protection of the historical nesting site (LGL 1985, in prep.).<br><br>Changes in facility siting or alignment or in construction schedules to avoid disturbance (APA 1983a, p. E-3-537 #20, Appendix 3.I). |
| (Y) Other Raptors and Raven | (1) Permanent loss of nesting locations and foraging habitat due to the impoundments, access road, borrow sites, and other permanent project facilities. | Complete quantification for all raptors and ravens is not possible but will affect northern goshawk, sharp-shinned hawk, red-tailed hawk, merlin, great horned owl, northern hawk-owl, boreal owl, common raven and possibly northern harrier, great gray owl and short-eared owl. | Previous studies have provided sufficient information for impact assessment. No further work is planned. | | * Protection of forested land on compensation lands and creation of openings for moose browse will protect nest sites and provide foraging habitat for raptors, although some absolute loss of habitat (particularly for resident species) will probably occur as a residual impact (LGL 1985, in prep.). |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (Y) Other Raptors and Raven (cont.) | (2) Loss of nest sites and foraging habitat due to impoundment clearing. | Impact will preceed eventual permanent loss by 2-3 years (APA 1983a, Table E.3.159). | Previous studies have provided sufficient information for impact assessment. No further work is planned. | | Impoundment clearing will not begin until 2 or 3 years before filling (APA 1983a, p. E-3-538). |
| | (3) Loss of nest sites and habitat alteration due to secondary impacts of erosion, blowdowns, etc., on forest vegetation. | Impacts not quantified, but not expected to be significant (APA 1983a, Appendix E11J, Volume 10B). | Impact severity not sufficient to require study. | | |
| | (4) Potential abandonment of raptor or raven nests or nesting locations due to human activities along the transmission corridor. | Impact not quantified but not expected to be important (LGL 1985, in prep.). | Surveys for trumpeter swan and bald eagle nests along the transmission corridor will also take note of obvious nests of other species (APA 1984b, FY85 Task 24). | | Realignment of the transmission corridor may be possible in order to avoid known raptor nest sites. Clearing of the transmission corridor will probably improve hunting opportunities for most species (LGL 1985, in prep.). |
| | (5) Increase in disturbance due to aircraft traffic, construction activity and recreational activity that is facilitated by increased access. | Impact not quantified but may cause abandonment of nests or nest failure (APA 1983a, p. E-3-451 to 454, Table E.3. 159). | | Collect information on active raptor nest locations throughout construction (APA 1983a, p. E-3-525 #9). | Aircraft will maintain minimum altitudes of 1000 ft above ground level during flights (APA 1983a, p. E-3-531 #10).<br><br>Raptor protection criteria (LGL 1985, pp. 3.4-2 to 3).<br><br>Changes in facility siting or alignment or in construction schedules to avoid disturbance to raptor nest sites (APA 1983a, pp. E-3-533 #10, including specific measures for specific sites).<br><br>Public access to access road and airfield prohibited during construction (APA 1983a, p. E-3-534 #12, 14).<br><br>Discouragement of off-road recreational vehicle activity, and phasing in of recreational plan to limit recreational impacts on vegetation and wildlife (APA 1983a, p. E-3-292 #16-17). |
| (Z) Terrestrial Birds | (1) Permanent habitat loss due to the impoundments and other permanent project facilities. | Loss of 45,688 acres of habitats used by over 100,000 birds, resulting in possible loss and displacement of breeding, migrating, and resident birds (APA 1983a, pp. E-3-456 to 459, Tables E.3.165 and 166; APA 1983b). | Planned surveys of winter bird use of the impoundment zones will improve impact assessment and mitigation planning efforts (APA 1984b, FY85 Task 25). Numbers of birds affected will be revised following completion of vegetation maps. | | * Impoundment clearing will not begin until 2 or 3 years before filling; patches of vegetation will be left until just before filling (APA 1983a, E-3-525 #1), and clearing requirements for many project facilities will be reduced (APA 19983a, p. E-3-253).<br><br>* Protection of forest lands and proposed habitat compensation lands will benefit forest-inhabitating birds and provide some compensation for further loss of bird habitat (LGL 1985, pp. 2.26-13 to 17). Species preferring shrub or tundra habitats will probably not be severely affected. |

| (I) Affected Species or Group | (II) Potential Impact Mechanism | (III) Impact Assessment Status | (IV) Ongoing and Planned Studies | (V) Proposed Monitoring Activities | (VI) Proposed Mitigation Measures |
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| (Z) Terrestrial Birds (cont.) | (2) Alteration of habitats for birds due to the transmission corridor. | A preliminary estimate of 10,515 acres indicates that habitat for over 2000 breeding birds will be affected (APA 1983a, p. E-3-490; APA 1983b, Tables E.3.79, 80, and 86). | Previous studies provided sufficient information for impact assessment. Numbers of birds affected will be revised following completion of vegetation maps. | | Selective clearing in transmission corridor, permitting seral vegetation up to 10 ft in height (APA 1983a, p. E-3-526 #4).<br><br>Minimize loss of forest areas through alignment of transmission corridor (APA 1983a, p. E-3-539 #23).<br><br>Minimize loss and alteration of habitat, particularly less abundant habitats and sensitive wildlife habitats (APA 1983a, pp. E-3-291 and 292 #1-11). |
| | * (3) Alteration of forested habitats for birds due to borrow sites, camps, and villages. | * Alteration of 4,752 acres of habitat will occur (APA 1983b, Tables E.3.83 and 84). | * Previous studies provided sufficient information for impact assessment. Estimates of numbers of birds affected will follow completion of vegetation maps. | | * Revegetation and fertilization of disturbed sites will rectify some effects (APA 1983a, p. E-3-526 #3).<br><br>* Minimize alteration of less abundant habitats and sensitive wildlife areas (APA 1983a, pp. E-3-291 to 292, #1-11). |
| | (4) Increase in breeding habitat for some species due to vegetation encroachment on downstream river floodplains. | Impact represents a beneficial effect on most birds (APA 1983a, p. E-3-459). | Impact not sufficient to require study. | Collection of data on changes in downstream vegetative cover (APA 1983a, p. E-3-523 #2). | |
| | (5) Loss of nest sites and habitat alteration due to secondary effects of erosion, blowdowns, etc., on forest vegetation. | * Impact not quantified but not expected to be significantly widespread to affect bird populations (APA 1983a, Appendix E11J, Volume 10B). | Impact severity not sufficient to require study. | | |
| | (6) Increase in mortality due to collisions with transmission lines and towers. | * Impact difficult to prevent and population loss is predicted to be insignificant (APA 1983a, p. E-3-497). | Impact severity not sufficient to require study. | | |
| | (7) Avoidance of areas of intense human activity (e.g., construction zones, impoundment clearing activities, recreational activities) due to disturbance. | Impact not quantified (APA 1983a, p. E-3-460), but not expected to be significant for most species. | Impact severity not sufficient to require study. | | Prohibition of access during construction, discouragement of off-road recreational vehicle activity, and phasing in of recreational plan to limit recreational impacts on vegetation and wildlife (APA 1983a, p. E-3-292 # 15-17). |

## LITERATURE CITED

Alaska Power Authority. 1983a. Before the Federal Energy Regulatory Commission. Application for license for major project. Susitna Hydroelectric Project. Exhibit E. Anchorage. 13 volumes.

Alaska Power Authority. 1983b. Responses to FERC supplemental information request of April 12, 1983. Filed with FERC July 11.

Alaska Power Authority. 1984a. Susitna Hydroelectric Project. Draft aquatic plan of study. Fiscal year 1985. Doc. no. 591. Prepared for Alaska Power Authority. Anchorage.

Alaska Power Authority. 1984b. Susitna Hydroelectric Project. Draft terrestrial plan of study. Fiscal year 1985. Doc. No. 1110. Prepared for Alaska Power Authority. Anchorage.

Alaska Power Authority. 1984c. Susitna Hydroelectric Project. Draft social science program study tasks. Fiscal year 1985. Prepared for Alaska Power Authority. Anchorage.

LGL Alaska Research Associates, Inc. 1984. Summary Statement on Nest Losses and Conflicts for Bald and Golden Eagles in the Susitna Hydroelectric Project Area. Report to the Alaska Power Authority. Anchorage.

LGL Alaska Research Associates, Inc. 1985. Susitna Hydroelectric Project, Mitigation Plan for Wildlife and Botanical Resources. Report to Alaska Power Authority. Anchorage.

Miller, S.D. 1983. Susitna Hydroelectric Project. Phase II progress report. Big game studies. Vol. VI. Black bear and brown bear. Alaska Department of Fish and Game. Anchorage.

Miller, S.D. 1984. Susitna Hydroelectric Proejct. Draft Phase II progress report. Big game studies. Vol. VI. Black bear and brown bear. Alaska Department fo Fish and Game. Anchorage.