14

TASK 7

ENVIRONMENTAL STUDIES

DRAFT WILDLIFE MITIGATION OPTION PAPER

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ALASKA POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT

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INTRODUCTION

This paper, together with the Susitna Hydroelectric Fish and Wildlife Mitigation Policy, represents the product of the wildlife mitigation planning that has taken place during the two-and-one-half year feasibility study and license application effort. Presented are approaches to mitigate impacts predicted to occur if the Susitna hydroelectric project is constructed. This paper does not, however, reflect decisions made prior to this study--the location of such project facilities as the access road, for example--that have a mitigative effect. Such decisions indicate that the planning process, from its early stages, included a certain level of mitigation. This paper addresses impacts that could not be avoided during that phase of the project.

The purpose of the program described herein is to insure that the negative impacts on wildlife resources that will occur as a result of the Susitna project will be mitigated to the greatest extent possible. The program was developed according to the approach described in the Susitna Hydroelectric Fish and Wildlife Mitigation Policy. It must be understood that achieving an appropriate level of mitigation for a project such as Susitna is complicated and requires considering a broad range of problems. Some of these problems have obvious and simple solutions; others, however, cannot be adequately solved with presently available scientific knowledge.

A major problem with many impact issues related to this project involved predicting the magnitude of the impact on the wildlife resource. This difficulty was especially true for impacts dealing with the behavior of animals and less so for those involved in quantifying habitat loss. In many cases, the lack of precise estimates of the number of animals that could be impacted also complicated planning of the appropriate level of mitigation. Thus, for the purpose of mitigation planning, in cases where precise population estimates were

lacking and where the impact is dependent upon behavioral responses of the animals, a worst-case impact level was assumed. It was felt that this conservative approach would establish the degree of mitigation planning necessary to insure that the resulting benefit to the wildlife resource at least equaled the negative impacts brought about by the project.

Assessing the impacts and associated mitigation options demonstrated that no single approach was suitable to address all impact issues effectively. The analysis of mitigation options identified two distinct types of impact problems pertaining to the issue of mitigation. The first type of impact (Type 1) affords practical options for mitigation. The second type of impact (Type 2) is one in which no conventional options exist, impacts are difficult to predict and quantify, and current scientific knowledge regarding the issue is so limited that research efforts would be required that are beyond the applicant's reasonable responsibility. Type 2 impacts are obviously the most demanding in a mitigation program.

The present program was formulated with these two types of impact in mind. Where practical mitigation options existed, they were reviewed, and the most appropriate and promising are discussed here. If additional study needs were identified, they were also included in the program. To deal with Type 2 impacts and with those Type 1 impacts where practical solutions did not totally mitigate the impact, some unconventional actions were incorporated into the program. Several such innovative options were considered, and, again, the most promising are presented.

This report presents the mitigation program on the basis of the two types of impacts described above. Also attached, is documentation of the analysis of mitigation options, in particular, those pertaining to Type 1 impacts. Details of the baseline information and impact predictions for each resource issue are referenced to the appropriate sections of the feasibility report.

The mitigation program outlined in this report should, if implemented, serve to benefit the overall wildlife resource of Alaska to a degree which will at least offset the negative consequences of the Susitna project. The options available for mitigating these losses have been limited to a great extent by the fact that the key species involved are wilderness species; thus, conventional management techniques are often inappropriate. Moreover, compared to information on the wildlife resource in many other portions of the country, less is known about the basic life history, predator/prey dynamics, and habitat requisites of Alaskan wildlife.

The Alaska Power Authority has committed to additional studies to quantify impacts further and to refine mitigation planning and techniques. Thus, the mitigative actions delineated in this paper will be further developed and adjusted on the basis of additional studies.

TYPE 1 IMPACTS

The following impacts are those for which some conventional mitigation options, ranging from avoidance through compensation, have been identified. The options described should be useful in lessening the negative impacts identified. Also identified with each impact issue are additional study needs. These are study efforts that should be conducted prior to implementing the mitigation option. In most cases, the indicated study needs have been proposed for Phase II of the Susitna studies. Not included in this category are monitoring-type study efforts that are part of the mitigation program.

Watana and Devil Canyon Impoundments - Cliff-nesting Raptors

Impact - As a result of inundation, a total of 42.5 km of good nesting cliffs will be lost. This reduction in the number of available nesting sites will increase the importance of the remaining 25.8 km of good nesting cliffs in the vicinity of the proposed impoundments.

Reference Sections[a] - Baseline: 3.2(c)(iv)
Impact: 3.6(a)(iii) and 3.6(b)(iii)

Mitigative Action-

1. Recreation facilities could be so located to avoid bringing people close to cliff-nesting sites. Such placement would be most appropriate at nesting sites that would not be disturbed by other project components.

2. Activities associated with clearing woody material from the impoundments could be scheduled to avoid at critical times for the raptors, those areas where suitable nesting habitat is expected to remain following flooding.

3. If the raptor population is reduced because of a lack of suitable nesting sites, consideration could be given to erecting artificial nest platforms on some of the remaining cliffs.

Anticipated Results - Although it would be impossible to avoid this impact, the magnitude of the impact would be minimized by adopting these measures. The unavoidable loss of nesting sites is considered as a Type 2 impact issue.

Additional Study Needs - None

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a. The reference sections refer to the appropriate portions of the Susitna Hydroelectric Feasibility Report.

Northern Segment of the Transmission Line - Peregrine Falcon

Impact - That segment of the proposed transmission line from Healy to Fairbanks will pass close to an inactive peregrine falcon nesting site along the Tanana River. If the nest is active during the construction period, it is possible that construction-related activities may disturb the birds.

Reference Sections - Baseline: 3.4(b)
Impact: 3.8(b)

Mitigative Action - The potential for disturbing nesting peregrines could be reduced by first determining if the nest is active, and if so, scheduling construction in the area so as to avoid any disturbing activities during the nesting period.

Anticipated Results - This potential impact could be avoided entirely by taking the proposed mitigative action.

Additional Study Needs - None

Watana and Devil Canyon Impoundments - Bald Eagle

Impact - The two impoundments will result in the loss of two of the six known active bald eagle nests and the one known inactive nest in the area.

Reference Sections - Baseline: 3.2(c)(iv)
Impact: 3.6(a)(iii) and 3.6(b)(iii)

Mitigative Action -

1. During the clearing of woody material from the impoundments, clumps of tall spruce trees (where they are available) could be left uncut along the shoreline at one-to two-kilometer

intervals. The selected trees would be located in the cleared zone near the the normal high pool level but far enough away to avoid their being washed away during unusually high water periods. If adequate perching sites are unavailable, artificial perching sites could also be provided.

2. Following inundation, monitoring of eagle nesting would help to determine if the birds are successfully locating and using alternative nesting sites. If the eagle population appears to suffer by failing to use the remaining nesting opportunities, artificial nest platforms could be erected in suitable locations.

Anticipated Results - Although it will be impossible to avoid this impact, the mitigative actions should at least minimize the magnitude of the impact and possibly compensate for the loss.

Additional Study Needs - None

Watana and Devil Canyon Impoundments - Moose

Impact - The inundation resulting from the two impoundments will reduce the carrying capacity of the upper basin. Downstream from Devil Canyon to Cook Inlet, plant succession trends may also be altered as a result of flow regulation. Consequently, the amount of winter browse may be reduced over time, thereby affecting moose that rely on this area during severe winters.

Reference Sections - Baseline: 3.2(a)(i) and 3.2(a)(ii)
Impact: 3.6(a)(i), 3.6(b)(i), and 3.6(d)(i)

Mitigative Action - Moose habitat management programs could be conducted along the lower Susitna River, downstream from Talkeetna, in order to counterbalance the possible loss of winter browse resulting from alterations in flow and also to compensate,

at least partially, for habitat loss in the upper basin. Management efforts might be directed toward two general areas. First, in order to provide improved browse conditions for moose that range west of the Susitna, vegetation on selected river islands could be burned, or where mature balsam poplar is present, commercial logging could be conducted. Second, habitat management efforts could be conducted in selected areas east of the Parks Highway/Alaska Railroad corridor. This approach would benefit those moose that range east of the river into the foothills of the Talkeetna Mountains. Management efforts east of the two major transportation corridors are desirable to reduce the need for moose to cross these corridors; such crossings result in substantial mortality. These selected east-side management areas could be improved for moose by either prescribed burning, commercial logging, or mechanical crushing, depending on the suitability and acceptability of these techniques.

Since moose in the upper basin function as a key species in the wildlife community of that area, habitat management efforts could also be considered for the areas adjacent to the impoundments. Prescribed burning is probably the only management technique that might improve this area's carrying capacity. Since information concerning the effects of fire at higher elevations is lacking, however, the suitability of this procedure is unclear. As part of the mitigation program, then, the applicant could investigate the feasibility of prescribed burning here and, if the technique is demonstrated to be suitable, at least a limited burning program could be developed to compensate for the reduced carrying capacity caused by the project.

The prime focus for mitigating the loss of moose habitat should still be the downstream area because this area is more conducive to successful management. While the magnitude of the downstream management program would be contingent upon the possibility of improving moose habitat in the upper basin, its actual scope will complement the upper basin plan and, in fact, allow for complete

mitigation. In other words, if it is shown that prescribed burning will not produce the desired results, then the management effort downstream would be increased; on the other hand, if it appears that through prescribed burning, moose populations in the upper basin can be increased, then the downstream program would be reduced. If, for some reason, management efforts in the lower basin also prove unacceptable, then a search could ensue for alternative management opportunities.

Anticipated Results - The moose management program would result in an increased carrying capacity in the downstream area as compensation both for the reduction that will occur in the upper basin and for those reductions that may occur along the lower river. If burning is successful, compensation would also occur in the upper basin.

Additional Study Needs - Further quantification of the habitat loss in the upper basin is needed in order to determine the magnitude of the management effort that will be required. For example, browse surveys should be performed. Preliminary studies are also necessary to identify potential areas for moose habitat management in the lower basin. The proposed management approach is biologically feasible. There are, however, questions concerning land ownership, plant ecology, the acceptability of prescribed burning to the public, and numerous other issues that will have to be addressed in the selection of lands for management.

As indicated above, additional study is needed to determine the feasibility of prescribed burning in the upper basin. Research efforts should include insuring that the currently planned BLM burn in the Alphabet Hills, for example, provides the answers to critical questions concerning prescribed burning and its usefulness as a habitat management technique. The entire issue of habitat management as a form of compensation within the upper basin depends upon the outcome of that study effort.

Watana Impoundment - Dall Sheep

Impact - The impoundment created by the Watana dam will seasonally flood a portion of the Jay Creek mineral lick and, thus, may negatively impact the sheep population that currently uses it.

Reference Sections - Baseline: 3.2(a)(viii)
Impact: 3.6(a)(i)

Mitigative Action - The schedule for clearing woody material from the Watana impoundment could be arranged so that no clearing activities would take place within 2 kilometers of the Jay Creek lick during the months of May and June when sheep use the area. Following inundation, monitoring efforts should be undertaken to document the reaction of sheep to the change and the extent to which they continue to use the lick. If the lick is abandoned following the impoundment filling or if the use of it is substantially reduced, an artificial lick could be established using mineral blocks specifically designed to match or to improve upon the chemical composition of the current lick. The artificial lick could be placed within the natural range of this sheep herd and situated where sheep would be less vulnerable to wolf predation than they currently are when they use the Jay Creek lick.

Anticipated Results - Avoiding the Jay Creek lick during clearing of the impoundment should allow the sheep to continue using the lick prior to flooding. If reservoir filling results in abandonment of the lick, the creation of an artificial lick will compensate for the loss attributable to the project.

Additional Study Needs - It will be necessary to determine the chemical composition of the Jay Creek lick in order to prepare comparable mineral blocks should the need arise. Continued monitoring of sheep should be done to gain an understanding of the degree of their use of this and other licks and, thus, of the severity of any negative impact thay may occur.

Watana Impoundment - Caribou

I. Impact - A possibility exists that the ice conditions and/or any floating debris associated with the Watana impoundment will act as a barrier to migrating caribou.

Reference Sections - Baseline: 3.2(a)(iii)
Impact: 3.6(a)(i)

Mitigative Action - Any negative impacts resulting either from ice conditions or floating debris could be minimized through the following actions:

1. Prior to flooding, all woody material could be totally cleared from the impoundment.

2. If floating debris develops so as to represent an impediment to caribou or any other big game species, a removal program could be immediately undertaken.

3. If, while enroute to its calving area, the Nelchina herd encounters hazardous ice conditions in the reservoir, it may completely resist crossing the impoundment. If this situation occurs, the herd will either develop a new calving area or transfer major calving activities to an area used only marginally or occasionally as a calving area. In that event, the applicant could petition the appropriate state or federal agencies to take whatever action is necessary to insure that the herd will remain undisturbed while it establishes its new calving site.

4. In order to determine when the above-mentioned measures are needed, the Nelchina herd should be monitored during filling of the reservoir and after construction is completed. This monitoring should be conducted during the late winter period, through calving, and as far enough into the post-calving

period as is necessary to determine if any aspect of the impoundment is interfering with the herd's movement. Monitoring would have to continue until the results demonstrate that the impoundment does not represent a barrier or until the herd has successfully readjusted to any changes brought about by the project.

Anticipated Results - Since it is difficult to predict either the likelihood of this impact's occurring or the magnitude of any negative consequences that could result, it can only be anticipated that taking the stated actions will lessen the probability of a negative impact as well as reduce the magnitude of any impact that does occur. Since the possibility exists that a negative impact could occur regardless of any preventative measure, this issue is also considered as a Type 2 impact.

Additional Study Needs - Although no specific studies are needed to implement the above action, continued monitoring of the Nelchina herd would be valuable so that if the animals undertake a major river crossing prior to inundation, the area used for crossing could be accurately defined. In this way, once the important areas are clearly identified, they can be monitored following flooding. The upper Susitna-Nenana subherd should also be so monitored because this herd occupies an area that may represent an alternative calving area for the main herd.

II. Impact - The activities associated with clearing woody material from the Watana impoundment will disturb caribou migration to the calving area south of the river and/or post-calving movements to the area north of the river.

Reference Sections - Baseline: 3.2(a)(iii)
Impact: 3.6(a)(i)

Mitigative Action - Clearing schedules could be flexible enough so that no clearing activity will take place in the areas used by migrating caribou during the time of their movements. To

determine if the clearing activities might conflict with the herd's movements and thus need to be modified, the Nelchina herd could be monitored during late winter and early spring, and again following calving.

In addition, if woody material is burned following clearing, uncut travel lanes could be left for caribou to use. Three or four lanes each at least 0.8 km-wide and continuous from one side of the impoundment zone to the other would probably be sufficient. These lanes should be located between Deadman and Jay creeks and the woody material within them removed immediately prior to inundation. These lanes could be located at points that are expected to be safe crossings after the impoundment has been filled, so that the herd could continue to use the same crossing locations.

Anticipated Results - An appropriate clearing schedule would minimize any disturbance of the Nelchina herd's migration during clearing of the impoundments.

Additional Study Needs - Although no specific studies are needed in order to implement the action described above, continued monitoring of the Nelchina herd should be conducted so that any impact could be predicted and the appropriate mitigative steps taken.

Construction Camps/Villages and All Access Roads - Red Fox, Bears, Wolverine, Pine Marten, Ground Squirrel, Gulls, and Raven

Impact - These species will be negatively affected by any illegal feeding by personnel associated with the construction and operation of the project. Improper disposal of garbage would also result in a negative impact to these species.

Reference Sections - Baseline: 3.2(b)(i), 3.2(b)(ii), 3.2(a)(vi), 3.2(a)(vii), 3.2 (c)(iii), 3.2(c)(iv), and 3.2(d)(i)
Impact: 3.6(a), 3.6(b), and 3.6(e)

Mitigative Action - The following options could be taken:

1. Secure garbage containers could be available in all work areas, and all refuse could be promptly collected and either incinerated or disposed of in the landfill.

2. All landfills could be covered with soil on a daily basis.

3. All camp facilities (especially landfills) could be securely fenced, with the bottom edge of the fence buried at least 0.5 m (18 in.) below the ground surface.

4. Work crews could be hired and charged with promptly picking up all discarded refuse from work areas and along all roads associated with the project.

5. A mandatory education program could also be developed for all project personnel and designed to educate workers to the problems, both biological and legal, associated with feeding wild animals.

6. State laws prohibiting the feeding of wild animals should be strictly enforced, and repeated violators could be dismissed from their employment and permanently prohibited from future work on any aspect of the project.

Anticipated Results - The above steps will minimize and, it is hoped, avoid the negative consequences of this impact.

Additional Study Needs - None

Construction Camps and Villages - Red Fox and Wolf

Impact - The housing of domestic dogs at the camps and villages creates the potential for introducing rabies into the native canid population. Improper dog control could also produce a population of feral dogs.

Reference Sections - Baseline: 3.2(b)(i) and 3.2(a)(iv)
Impact: 3.6(a)(i), 3.6(a)(ii), 3.6(b)(i), and 3.6(b)(ii)

Mitigative Action - During the construction period, dogs could be prohibited at the camps and villages, thereby avoiding this potential impact. During operation, dogs could be allowed in the permanent town and the impact could still be avoided, or at least minimized, by requiring registration of all dogs. To prevent the introduction of rabies, certification of immunization should be required. The potential problem of dogs' becoming feral could be reduced by requiring dogs to be under the control of the owner at all times. Any dog found outside of the camp area and not under direct control of the owner could be destroyed by camp security personnel if reasonable attempts to capture the animal fail.

Anticipated Results - If properly enforced by camp authorities, these actions will greatly minimize the likelihood of introducing rabies into the native canid population as well as reduce the possibility of establishing a feral dog population.

Additional Study Needs - None

Access Roads, Construction Camps and Recreation Facilities - All Upstream Furbearer and Big Game Species

Impact - These project components will result in increased human activity and resulting disturbance and harassment of wildlife.

Reference Sections - Baseline: 3.2(a) and 3.2(b)
Impact: 3.6(a), 3.6(b), and 3.6(e)

Mitigative Action - The specific steps that could be taken to mitigate this impact differ during the construction and the post-construction periods and are thus discussed separately.

During the construction period, all project personnel could have no greater access to the upper basin than that available to the general public except, of course, access to the actual construction sites. All project personnel could be required to travel directly from the start of the access road to the camp or work area without stopping, except for emergencies. Personnel could be prohibited from leaving the access roads or work sites for any reason, including to hunt or trap. Construction managers could attempt to schedule the movement of construction vehicles to leave uninterrupted "windows" of traffic during which animals will be able to cross the access roads without encountering vehicles. Such "windows" would be particularly important during the time period extending from two hours before sunset to two hours after sunrise.

During the post-construction period, when the road (at least to Devil Canyon) will be open to the general public, it will be the responsibility of the Alaska Department of Fish and Game to monitor the status of the area's big game populations to a degree sufficient to determine if a detrimental harvest level is taking place. Should such a harvest level be detected, ADF&G could implement the necessary regulations to correct the situation. To minimize undue disturbance of wildlife and to prevent damage to vegetation, ATV use could be barred from originating at project facilities on the north side of the river. In other words, no ATVs would be permitted to pass the Devil Canyon dam site. If it is decided to permit public access as far as the Watana dam, access from the road or dam sites could be allowed only by foot or on horseback. When a specified destination exists (the Watana dam), there will be a tendency for the present network of ATV trails from the Denali Highway to be extended. Therefore, a prohibition of ATV travel to the Watana dam site from the Denali Highway may also be appropriate.

Anticipated Results - The measures described above will help minimize the impact of disturbance on the wildlife resource. Since this impact can not be totally avoided, it is also considered as a Type 2 impact.

Additional Study Needs - None

All Access Roads - Moose

Impact - Moose may be killed as a result of collisions with vehicles using both the main access road and the access roads to borrow areas.

Reference Sections - Baseline: 3.2(a)(ii)
Impact: 3.6(c)(i) and 3.6(e)(i)

Mitigative Action - The following steps could be taken to minimize this impact:

1. Areas of high collision potential could be identified and warning signs erected to alert motorists of the possibility of encountering moose.

2. Speed limits could be established to limit travel to speeds which will lessen the potential for collisions with animals while still permitting the timely movement of vehicles.

3. During winters, when snow is quite deep, numerous pull-off areas could be plowed clear to permit moose to move off the road. Appropriate areas could be identified based on the location of winter moose concentrations and associated snow depths.

4. In conjunction with other worker orientation/education programs, an attempt could be made to impress upon workers the value of wildlife and the need to avoid killing animals through collisions with vehicles.

Anticipated Results - The above actions will minimize this impact.

Additional Study Needs - None

Borrow Areas, Access Roads to Borrow Areas, and Temporary Camp and Construction Areas - All Furbearer Species, Many Avian and Small Mammal Species, and All Big Game Species Except Dall Sheep

Impact - These project components represent a temporary loss or alteration of habitat for the indicated wildlife resources.

Reference Sections - Baseline: 3.2
Impact: 3.6(a), 3.6(b), and 3.6(c)

Mitigative Action - This impact could be mitigated through a combined program of restoration and compensation. Since the use of these project components will be temporary, efforts could be undertaken to restore the above-mentioned areas following their use. All topsoil removed from these areas could be stockpiled and saved. In addition, all topsoil removed from areas that will be permanently disturbed could be saved and added to these stockpiles. When an area is no longer in use, the topsoil could be redistributed and the area regraded, if necessary, to avoid erosion. Restored areas could then be seeded lightly with grasses and fertilized to stimulate the initial growth of native vegetation. During the first year of restoration, a fertilizer mix high in phosphorus (such as N, P, K, 10-20-10, or 8-32-16) could be applied in amounts sufficient to supply 85-110 kg of nitrogen per hectare. During the second growing season, these areas would be fertilized at half the initial treatment rate. During the third growing season, they would be fertilized at one-third the initial rate. The placement of willow cuttings in the ground during seeding of grasses could also be performed to increase the habitat value of the area for species such as moose.

Since a restoration effort would probably not totally restore the disturbed areas to the same level of usefulness to wildlife that currently exists, some compensation measures would be needed in regard to this impact. Compensation efforts directed at loss of moose habitat caused by the impoundment and other project facilities could be increased to cover the reduced carrying

capacity brought about by these project components. Efforts would be concentrated along the lower Susitna River and are described in the section of this report headed Watana and Devil Canyon Impoundments - Moose.

Anticipated Results - It is impossible to determine how much the proposed restoration effort will successfully mitigate the habitat losses resulting from these temporary use areas. The proposed effort should, however, restore the areas involved to some degree of usefulness. Furthermore, by increasing the moose compensation effort downstream, the loss attributable to these temporary areas should be mitigated.

Additional Study Needs - At present, no specific studies are required to determine the feasibility of this approach, other than those mentioned in regard to the moose habitat effort. Some additional site specific work will have to be done prior to restoration in order to insure that the most appropriate combination of seeding and fertilizer is used, including the application rate and timing.

Air Traffic - All Big Game Species, Raptors, and Trumpeter Swans

Impact - These species will be negatively impacted as a result of disturbance from air traffic, especially low-flying, large helicopters.

Reference Sections - Baseline: 3.2(a), 3.2(c)(iii), and 3.2(c)(iv)
Impact: 3.6(a)

Mitigative Action - The following restrictions could be enforced to reduce the impact of air traffic on wildlife:

1. All air traffic could fly directly to and from the camps or work sites with no unnecessary diversions.

2. Flight distances and weather permitting, all project-related air traffic could maintain an altitude of at least 150 m (500 ft.) above ground throughout the upper basin at all times.

3. A minimum altitude of 300 m (1000 ft.) above ground could be maintained in the following areas:

   - caribou calving area (May and June) and any post-calving aggregations (June and July)

   - wolf dens (April through July)

   - bald eagle nests (15 March - 31 August), including a horizontal restriction zone of a 0.4-km (0.25 mi) radius

   - gyrfalcon nests (15 February - 15 August), including a horizontal restriction zone of 0.4-km (0.25 mi) radius

   - golden eagle nests (1 April - 31 August), including a horizontal restriction zone of 0.8-km (0.50 mi) radius

   - the Jay Creek sheep lick (May and June)

   - trumpeter swan nests near the Oshetna River and other adjacent areas in the upper reaches of the Watana impoundment (May through July).

Anticipated Results - The implementation of these restrictions should minimize the disturbance and allow, in the case of some species, for animals to become acclimated to the presence of aircraft and their disturbing influence.

Additional Study Needs - Prior to the continuation of air-supported activities, additional surveys should be conducted to determine sensitive locales where restrictions are required. After

inundation, some of these sensitive areas will likely change, and, therefore, at least three to five years of monitoring should follow flooding to locate sensitive sites. Following this study period, and for as long as air support is needed, the locations of such sites could be updated annually on the basis of both incidental information and surveys scheduled at three-year intervals.

TYPE 2 IMPACTS

The following list of impacts are considered Type 2 impacts; in other words, they are impacts for which no conventional form of mitigation was identified. They could not be avoided by modification of the project without affecting power output; they could not be effectively minimized or reduced; and no habitat manipulation options were available to use in a compensatory effort. Some of the impacts listed below were also identified as Type 1 impacts. They are included here because it is likely that the options proposed in the discussion of Type 1 impacts will not totally mitigate the impact. In most of the Type 1 impacts also discussed below as Type 2, the proposed options served to minimize the magnitude of the impact but will not compensate for the remaining level of impact. The impact issues are first identified, including a brief description of the impact and reference citations concerning the appropriate sections of the feasibility report that can be consulted for more information. Following the list of impact issues, two approaches to mitigation are presented and discussed.

Watana and Devil Canyon Impoundments - Mink and River Otter

Impact - Creation of both impoundments and associated facilities will result in the loss of riverine and terrestrial habitat and an associated decrease in the available food base.

Reference Sections - Baseline: 3.2(b)(iv) and 3.2(b)(v)
Impact: 3.6(a)(ii), 3.6(b)(ii), and 3.6(c)(ii)

Watana and Devil Canyon Impoundments - Pine Marten

Impact - Creation of both impoundments and, to a lesser degree, associated facilities will result in the loss of pine marten habitat.

Reference Sections - Baseline: 3.2(b)(ii)
Impact: 3.6(a)(ii) and 3.6(b)(ii)

Watana and Devil Canyon Impoundments - Forest-dwelling and Riverine Bird and Small Mammal Species

Impact - The two impoundments will inundate a large percentage of the forested habitats in the vicinity of the project, with a resulting negative impact on those bird and small mammal species that utilize these habitat types.

Reference Sections - Baseline: 3.2(c) and 3.2(d)
Impact: 3.6(a)(iii) and 3.6(b)(iii)

Watana and Devil Canyon Impoundments - Bald Eagle

Impact - The two impoundments may result in reduction of bald eagle feeding habitat.

Reference Sections - Baseline: 3.2(c)(iv)
Impact: 3.6(a)(iii) and 3.6(b)(iii)

Watana and Devil Canyon Impoundments - Black Bear and Brown Bear

Impat - Both black and brown bears will be negatively impacted by the loss of habitat caused by the two impoundments. Black bears will probably be more severely affected than brown bears from this habitat loss. Both species may also suffer if the operation of the Devil Canyon dam reduces the number of spawning salmon between Devil Canyon and Talkeetna.

Reference Sections - Baseline: 3.2(a)(vi) and 3.2(a)(vii)
Impact: 3.6(a)(i), 3.6(b)(i), 3.6(c)(i), 3.6(d)(ii) and 3.6(e)(i)

Operation of the Devil Canyon Dam - Downstream Beavers

Impact - Changes in the flow regime caused by the Devil Canyon dam will affect beavers living downstream from the dam. Although increased winter flows may be of benefit to beavers, reduced summer flows may limit available sloughs for use by these aquatic furbearers. The daily fluctuations in flow may also cause unstable ice conditions and make it very difficult for beavers to maintain winter food caches.

Reference Sections - Baseline: 3.2(b)(iii)
Impact: 3.6(d)(iii)

Watana and Devil Canyon Impoundments - Wolf and Wolverine

Impact - The two impoundments and their associated facilities will result in a loss of habitat for both wolves and wolverines. These two species, particularly wolf, will also be impacted by a reduction in the number of moose present in the area. As a result, the long-term carrying capacity for wolves and wolverines will be lowered by the project.

Reference Sections - Baseline: 3.2(a)(iv) and 3.2(a)(v)
Impact: 3.6(a)(i), and 3.6(b)(i), and 3.6(c)(i)

Watana and Devil Canyon Impoundments - Cliff-nesting Raptors

Impact - As a result of inundation, a large percentage of the good cliff-nesting sites will be lost. If raptors do not use alternative nesting sites successfully, then the population of cliff-nesting raptors in the area will be reduced.

Reference Sections - Baseline: 3.2(c)(iv)
Impact: 3.6(a)(iii) and 3.6(b)(iii)

Watana Impoundment - Caribou

Impact - The possibility exists that ice conditions associated with the Watana impoundment will act as a barrier to migrating caribou. If other mitigation measures fail to avoid this impact, the Nelchina herd could suffer some level of negative impact.

Reference Sections - Baseline: 3.2(a)(iii)
Impact: 3.6(a)(i)

Permanent Access Roads and Camp Facilities - All Furbearer Species, Many Avian and Small Mammal Species, and All Big Game Species Except Dall Sheep

Impact - These project components will represent a permanent loss of habitat for the indicated wildlife resources.

Reference Sections - Baseline: 3.2
Impact: 3.6(a), 3.6(b), and 3.6(c)

Access Roads, Construction Camps and Recreation Facilities - All Upstream Furbearer and Big Game Species

Impact - These project components will result in increased human activity, resulting in disturbance and harassment of wildlife. Although this impact can be minimized to some degree, it cannot be totally avoided.

Reference Sections - Baseline: 3.2(a) and 3.2(b)
Impact: 3.6(a), 3.6(b) and 3.6(e)

Mitigative Action - Without question, the most difficult aspect of dealing with Type 2 impacts is determining the level of mitigation needed to offset the anticipated impacts. The fact that Type 2 impacts are not only difficult to predict but, more importantly, difficult to quantify means that any proposed mitigative action

must be flexible enough so that, as the actual impact is monitored, the mitigation program can be adjusted in such a manner as to reflect an appropriate level of effort. Because of the problems associated with determining the appropriate level of mitigation to propose in regard to Type 2 impacts, it will therefore, be necessary for the final decision to be based primarily upon a negotiated agreement among all concerned parties.

In order to deal effectively with the difficult task of mitigating Type 2 impacts, the applicant could take two actions. The first concerns the concept of replacement lands. This idea, proposed by the Alaska Department of Fish and Game, was reviewed and found to have sufficient merit to warrant its inclusion in the Susitna wildlife mitigation program.

In brief, the goal of using replacement lands as a form of mitigation is to protect the wildlife resource in some other area from the types of future development that would be detrimental to the resource. In the short term, a land set aside does not compensate for losses resulting from the Susitna project because no new wildlife resources or habitat would be created. When replacement lands are secured, however, the long-term protection of the resource can be considered a benefit that would help to offset the negative consequences of the Susitna project. Without such action, there would be a continual decline in the resource. Since, from a management standpoint, little can presently be done other than to protect lands occupied by the wilderness-type species involved, this approach does represent a viable solution to at least a part of the mitigation problem. An associated advantage is that the resource would be safeguarded and would thus be available for management at some future time, when new techniques may be available.

There are, admittedly, several questions associated with using replacement lands as a form of mitigation. The first is

determining which lands to designate as replacement lands. Because many Type 2 impacts are not habitat related and since all land is not of equal value as wildlife habitat, it would not suffice simply to designate an equal amount of acreage as replacement for the habitat that will be impacted. Both the overall quality of the habitat must be considered as well as its critical value to certain species. For some species, such as moose and caribou, such a determination will not be difficult, since they tend to use certain areas, like calving grounds or riparian wintering areas. The identification of such critical areas for other species, however, will be more difficult. Therefore, the selection of replacement lands must consider two major elements: critical areas for important species that can be identified and the total habitat value of the area in question. Depending upon the outcome of this selection analysis, the amount of land set aside as replacement might be greater than the area impacted by the Susitna project, or if several critical areas are located, or land of greater habitat value is found, the total land selected may be less than that impacted by the project.

The types of activities allowed on such land should be emphasized. Any use that would not be detrimental to the wildlife resource could be permitted. Certain types of mineral extraction, hunting, trapping, and most recreation activities could be permitted if they do not interfere with seasonally important wildlife activities, such as caribou calving. In other words, the land would be open to the public for a wide variety of uses as long as such uses do not result in a reduction in the wildlife resource.

The second action that the applicant could take to mitigate Type 2 impacts is the establishment of a wildlife research station in the upper Susitna basin. The purpose of a research station is to compensate for the negative impacts of the project by advancing understanding of the ecological relationships of the wildlife resource and thus improving the chances of successfully managing that resource in the future. As stated in the introduction, a

a major problem encountered during the Susitna impact and mitigation studies has been the lack of a solid research base concerning many species. Compared to wildlife species in other parts of the country, very little is presently known about the basic life history, predator/prey dynamics, and habitat requisites of many species inhabiting Alaska. The goal is, therefore, to further our knowledge of wildlife ecology and to collect data in such a manner as will benefit wildlife throughout Alaska, in particular interior Alaska. In addition, since most of the past research in Alaska has focused on a few areas, such as Point Barrow, Prudhoe Bay, Fairbanks, along the Trans Alaska Pipeline, and the Kenai Peninsula, information concerning wildlife in other parts of Alaska is especially lacking. The upper Susitna basin and, in general, that area south of the Alaska Range has only recently begun to attract concentrated research efforts.

The concept of a permanent research station has additional merit, since its work could be combined with the monitoring efforts called for in the mitigation policy statement. This approach would permit the determination of the effectiveness of mitigation efforts as well as the documentation of impacts that actually occur as a result of the project and would, thus, be useful in predicting and mitigating the impacts of future development projects.

Contributing to the attractiveness of a wildlife research station is the valuable opportunity that will exist. First of all, permanent support facilities will be available at the two dam sites. This arrangement would greatly reduce the overall cost of research activities, since the logistic expenses associated with operating in remote wilderness areas is often the major cost item in research projects. Second, a sound and comprehensive data base will already exist, since a minimum of four to five years of baseline data will be collected prior to the initiation of construction. Thus, research projects could be directed at specific questions without first obtaining the rudimentary

understanding of the area that is usually needed. By capitalizing upon this opportunity, researchers could offer overall benefits to Alaskan wildlife that would offset the negative consequences of the Susitna project.

Obviously, details concerning the organization and operation of the research station would depend upon negotiations between the Power Authority, FERC, and the appropriate state agencies. For basic consideration, however, the following is proposed. If approved, the station could be supported by the Power Authority for a minimum of 20 years. This time period was selected both because of the long life spans of many big game species and also because of the need to conduct long-term research if acceptable levels of data validity are to result. Following the 20-year minimum time period, the Power Authority would review the need for additional research efforts with FERC and, based on that review, either terminate the facility or renew the commitment for support of the facility.

The Power Authority would provide basic support for the station, including office and laboratory facilities, housing for permanent and transient investigators, funding for a permanent director and support staff (secretarial/clerical), and use of air-support facilities. The initial development of the station would also be funded by the Power Authority and would include research items such as laboratory and communications equipment, computer terminals, and office supplies.

In addition to establishing the station, the Power Authority would provide an annual base amount of research funds to be divided evenly between the Alaska Department of Fish and Game and the University of Alaska. These monies would be used by the two organizations to conduct research directed at documenting the impacts of the project as well as analyzing the ecology of the species involved. The director of the station would have authority to approve and coordinate all research efforts conducted

through this facility. In addition to the base level funds provided by the Power Authority, the two participating organizations would be allowed to utilize funding from other sources, with the Power Authority providing the above-mentioned facility and logistic support. The costs involved in establishing the station, the annual base funding support, and the cost of supporting research funded from other sources would, of course, require more detailed analyses before appropriate figures could be included in this program.

Anticipated Results - Although Type 2 impacts are difficult to predict quantitatively, it is anticipated that by obtaining replacement lands and by taking advantage of the opportunities offered by a long-term research station, sufficient benefits to the wildlife resource would result as to compensate for the negative impacts that will occur as a result of the Susitna project. The mitigation monitoring program, along with associated ecology studies conducted through the research station, will enable a quantification of the magnitude of the Type 2 impacts that actually occur. The flexibility associated with the level of effort expended in securing replacement lands and research efforts will, thus, permit a reevaluation of the situation at a later date and allow for possible adjustments in mitigative effort to more accurately compensate for losses incurred by the wildlife resource.

Additional Study Needs - The key element in selecting replacement lands would be identifying critical areas for consideration, in combination with determining both the habitat value of lands lost because of the project and the habitat value of candidate lands for replacement designation. In order to assess habitat value, the habitat analysis conducted during the early portion of Phase I could be refined. This approach is explained in a Phase I subtask report and may serve as a useful means of assessing habitat value. Along with the refinement of the habitat value analysis, initial steps could be taken to establish criteria for identifying and selecting candidate lands that represent critical areas for wildlife.

Many details would also have to be addressed in regard to the wildlife research station. Steps could be taken to develop preliminary cost estimates associated with establishing the station and with providing annual support. Since the station would also function as part of the mitigation monitoring program, it would be necessary to estimate the level of monitoring effort and the associated funding that would be required by the monitoring program. To estimate how much support would be needed to cover research activities funded from outside sources, beyond the annual funding commitment of the Power Authority, the two associated organizations would have to provide preliminary estimates of the level of funding they would be able to obtain from other sources.

Wildlife Resource	Impact	Options Considered	Recommended*	Rejected	Rejection Reason
Cliff-nesting raptors	Flooding of nesting habitat	- Lower pool elevation		X	Project Conflict
		- Avoid conflict with recreation facilities	X		
		- Schedule clearing to avoid nest sites during nesting period	X		
		- Consider artificial nest platforms	X		
		- Replacement lands & research station	X		
Peregrine falcon	Disturbance due to transmission line construction	- Determine if nest site is active	X		
		- Schedule construction to avoid nest during nesting period	X		
Bald eagle (upstream)	Habitat loss	- Leave clumps of trees along impoundment	X		
		- Monitor nesting after filling	X		
		- If necessary, provide artificial nest platforms	X		
		- Stock fish		X	Impoundment conditions may not be suitable. Cost may not be justified.
Moose	Habitat loss in upper basin & possible reduction of browse along lower river	- Lower pool elevation		X	Probable conflict
		- Habitat management			
		lower river	X		
		upper basin	X(pending further study)		
		- Replacement lands & research station	X		

* Recommended for further consideration.

Wildlife Resource	Impact	Options Considered	Recommended	Rejected	Rejection Reason
Dall Sheep	Loss of mineral lick	- Lower pool elevation		X	Project conflict
		- Schedule clearing to avoid lick during May and June	X		
		- Determine mineral composition of lick	X		
		- Monitor sheep following flooding	X		
		- If necessary, create artificial lick	X		
Caribou	Barrier created by floating debris	- Clear only drawdown zone		X	Probably would not prevent woody material from floating to surface
		- Clear entire impoundment	X		
		- Debris removal program, if necessary	X		
Caribou	Barrier created by ice conditions	- Monitor movements	X		
		- Erect fences to direct herd to safe crossing		X	May not be effective & may conflict with other species
		- Protect new calving area if established	X		
		- Replacement lands & research station	X		
Caribou	Disturbance during clearing	- No action		X	Important to allow uninterrupted movement prior to filling
		- Do not clear impoundment		X	Floating debris represents a more severe potential problem
		- Monitor movements	X		
		- Stop clearing if herd approaches	X		
		- Leave uncut travel lanes until filling	X		

Wildlife Resource	Impact	Options Considered	Recommended	Rejected	Rejection Reason
Red fox, bears, marten, ground squirrel, gulls, & raven	Illegal feeding by project personnel	- Proper disposal of refuse	X		
		- Fence facilities	X		
		- Education program	X		
		- Enforce state laws	X		
Red fox & wolf	Domestic dogs-rabies and feral population	- Total prohibition of dogs		X	May be difficult to enforce and legality questionable
		- Prohibition of dogs during construction	X		
		- Registration & rabies certification during operational phase	X		
Upstream furbearers & big game species	Disturbance from human activity	Construction Phase			
		- Restrict worker access	X		
		- Unrestricted worker access		X	Would permit extensive disturbance & localized heavy hunting & trapping
		Operation Phase			
		- Unrestricted public access		X	Would permit extensive disturbance & localized heavy hunting & trapping, as well as vegetation damage
		- Control of ATV use by public	X		
		- Monitoring of game populations	X		
		- Replacement lands & research station	X		
Most species except Dall sheep	Temporary loss of habitat	- Do nothing		X	It would take a very long time for natural processes to create usable habitat
		- Restoration of temporary use areas	X		

Wildlife Resource	Impact	Options Considered	Recommended	Rejected	Rejection Reason
Big game, raptors, & trumpeter swans	Disturbance from air traffic	- No restrictions		X	Would fail to mitigate this impact
		- Specific altitude, location, & time restrictions	X		
Mink & river otter	Habitat loss	- Stock impoundments with fish		X	Conditions may not be suitable & cost may not be justified
		- Replacement lands & research station	X		
Pine marten	Habitat loss	- Habitat management		X	Not feasible
		- Replacement lands & research station	X		
Forest-dwelling & riverine bird & small mammal species	Habitat loss	- Habitat management		X	Not feasible
		- Replacement lands & research station	X		
Black bear & brown bear	Habitat loss & loss of spawning salmon	- Habitat management		X	Probably not feasible
		- Mitigation of salmon loss	X		
		- Replacement lands & research station	X		
Downstream beavers	Possible food cache problems due to fluctuating winter flows	- Reduced fluctuations		X	Project conflict
		- Replacement lands & research station	X		
Wolf & wolverine (upstream)	Habitat loss & reduced food base (moose)	- Habitat management		X	Not feasible
		- Moose management	X (pending further study)		

Wildlife Resource	Impact	Options Considered	Recommended	Rejected	Rejection Reason
Most species except Dall sheep	Permanent habitat loss	- Habitat management		X	Not feasible
		- Replacement lands & research station	X		
Big game	Avoidance of impoundment during clearing	- Delay clearing until just prior to filling		X	Impact will be short term & specific problem areas are covered under separate impact issues
Big game	Avoidance of borrow areas & associated roads	- Schedule movement of equipment so as to allow undisturbed use by animals during a part of each day		X	Of questionable value & project conflict
All wildlife species	Unauthorized fires	- Fire suppression program		X	Unnecessary since it will be part of camp operation anyway; fire is not unnatural; some fires may not represent a negative impact
Moose	Collisions with vehicles	- Identify areas of high collision potential	X		
		- Restrict vehicle speed	X		
		- Plow pull-off areas when deep snow prevails	X		
		- Education program	X		

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DRAFT ANALYSIS OF WILDLIFE MITIGATION OPTIONS

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PRIORITY RATING

OF

IMPACT ISSUES

PREFACE

This document is a preliminary draft working paper of possible wildlife mitigation options being considered in connection with the Susitna Hydroelectric Project. It should not be considered as any type of commitment by the Alaska Power Authority (APA).

This document was prepared in November and discussions are continuing with the design team to modify design and operation of the Susitna project so as to mitigate adverse impacts.

Sections in this document entitled "Recommended Course of Action" include options under consideration. As it will not be possible to implement all of the actions, APA is requesting members of the Fish and Wildlife Mitigation Review Group comment on which options are considered to be the most cost effective, most practical to implement, and most important considering the resource and the degree of impact likely to occur.

Following receipt of these comments, continued studies and final design and operation decisions, mitigation options will be reviewed and deleted or added as appropriate. It is expected the process of arriving at final mitigation decisions will be a continuous one involving APA, its consultants, and the regulatory agencies.

SUSITNA HYDROELECTRIC PROJECT

DRAFT ANALYSIS OF WILDLIFE MITIGATION OPTIONS

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December 9, 1981

PRIORITY RATING CRITERIA

CRITERION A - IMPORTANCE OF RESOURCE

2 pts. - low importance

4 pts. - moderate importance

6 pts. - high importance

CRITERION B - LIKELIHOOD OF NEGATIVE IMPACT OCCURRING

1 pt. - low likelihood

2 pts. - moderate likelihood

3 pts. - high likelihood

CRITERION C - SEVERITY OF IMPACT TO RESOURCE

1 pt. - low severity

2 pts. - moderate severity

3 pts. - high severity

POSSIBLE SCORE TOTALS AND ASSOCIATED PRIORITY RATINGS

Priority 1 (high) = 10 to 12 pts.

Priority 2 (moderate) = 7 to 9 pts.

Priority 3 (low) = 4 to 6 pts.

PRIORITY RATING OF IMPACT ISSUES

IMPACT ISSUE #	CRITERIA A	CRITERIA B	CRITERIA C	TOTAL	PRIORITY RATING
1	4	2	3	9	2
2	4	3	2	9	2
3	4	2	2	8	2
4	4	1	2	7	2
5	2	3	1	6	3
6	6	3	2	11	1
7	4	3	3	10	1
8	6	3	1	10	1
9	6	2	2	10	1
10	6	2	1	9	2
11	6	1	2	9	2
12	4	2	2	8	2
13	6	2	3	11	1
14	6	2	1	9	2
15	6	2	2	10	1
16	6	3	2	11	1
17	6	3	2	11	1
18	6	2	1	9	2
19	6	2	1	9	2
20	6	3	3	12	1
21	4	1	2	7	2
22	6	1	2	9	2
23	6	2	2	10	1

IMPACT ISSUE: 1 PRIORITY RATING: 2

PROJECT COMPONENT(S): Watana and Devil Canyon Impoundments

WILDLIFE RESOURCE: Mink and river otter

DESCRIPTION OF IMPACT: Loss of riverine and terrestrial habitat and an associated decrease in the available food base

MITIGATION OPTIONS: Due to the nature of this impact, compensation is the only form of mitigation that is feasible. In-kind compensation would require taking appropriate steps to insure that the aquatic habitat created by the impoundments supplies an adequate food base for these two furbearer species. If that approach is not possible, some form of out-of-kind compensation will be required.

DISCUSSION: There will be a negative impact on mink and river otter as a result of the elimination of a considerable amount of both terrestrial and riverine habitat. Conversely, the creation of two large impoundments will result in a net increase in the amount of aquatic habitat available. The important question is how suitable will the impoundments be in providing available feeding opportunities for mink and river otter. The impoundments may, without any action on the part of the applicant, provide an adequate food base to compensate for the predicted loss. Until further details are available it is difficult to quantify this potential. There are thus three scenarios associated with this situation: 1) the impoundments will be suitable for a healthy fisheries resource and that resource will develop naturally, 2) the reservoirs will be suitable for the establishment of a fisheries resource but it will require the introduction of fish to stimulate the growth of that resource, and 3) the impoundments will not be capable, from a limnological standpoint, of supporting an adequate fisheries resource.

RECOMMENDED COURSE OF ACTION:

1. Determine the suitability of the impoundments to support fish
2. If the impoundments prove suitable, a stocking program to stimulate and maintain a fisheries resource should be developed.
3. If the development of a fisheries resource, either naturally or as a result of artificial means, is not feasible, compensate for this loss in some out-of-kind fashion.

IMPACT ISSUE: 2 PRIORITY RATING: 2

PROJECT COMPONENT(S): Watana and Devil Canyon Impoundments

WILDLIFE RESOURCE: Pine marten

DESCRIPTION OF IMPACT: Habitat loss as a result of flooding

MITIGATION OPTIONS: It will be impossible to avoid this impact entirely, and unless a project with a lower pool elevation is selected, no minimization opportunities exist. Therefore the only feasible form of mitigation is through compensation in an out-of-kind manner.

DISCUSSION: Due to the nature of pine marten habitat, it will be impossible to manage or create compensatory habitat in the project area. In addition, this species will be impacted in the project area to a severe extent because the bulk of suitable marten habitat lies within the projected impoundment zones.

RECOMMENDED COURSE OF ACTION: Compensate for the loss of marten habitat and the resultant impact on marten by improving the habitat for some other species either within the project area or outside of the project area. Since the marten is an important resource to trappers, any out-of-kind compensatory action should be directed at other furbearer species if at all possible.

IMPACT ISSUE: 3 PRIORITY RATING: 2

PROJECT COMPONENT(S): Watana and Devil Canyon Impoundments

WILDLIFE RESOURCE: Cliff-nesting raptors

DESCRIPTION OF IMPACT: Reduction in the number of suitable cliff-nesting sites and an associated increase in importance of remaining sites

MITIGATION OPTIONS: Although it will be impossible to avoid this impact, it will be possible to minimize the magnitude of the impact by taking action to allow raptors to utilize the remaining sites. If the raptors do not find the remaining nest sites acceptable, or if efforts recommended to protect these sites fail, it is unlikely that the impact can be compensated for in any in-kind manner, thus necessitating an out-of-kind act of compensation. The following options exist and would serve to minimize the impact by protecting remaining sites.

1. Planning by people such as recreation specialists could attempt to avoid schemes that would bring people in proximity to cliff-nesting sites, at least during the sensitive time period (gyrfalcon: 2/15 - 8/15 and golden eagle: 4/1 - 8/31) or until June 1 when monitoring efforts have determined that a nesting site is inactive.
2. Activities associated with the clearing of woody material from the impoundments could be scheduled so as to avoid those areas where suitable nesting habitat should remain following flooding.
3. During the construction and operation phases of the project, helicopter traffic could be restricted, unless absolutely necessary, from those areas that are suitable nesting sites. This restriction would pertain only to the sensitive time period. See Impact Issue #23 for details on air traffic restrictions.

DISCUSSION: It is necessary that raptors currently nesting along the river not be unduly harassed during the construction phase. This will increase the likelihood of these birds utilizing alternative sites as presently used sites are inundated. It will be possible to identify potential alternative sites prior to the start of construction. If these sites can be protected, the impact associated with the loss of presently used sites may be minimized.

RECOMMENDED COURSE OF ACTION: It is recommended that the three options previously identified be implemented. Option 1 should be initiated now so that recreation planners can take this matter into consideration as early on in their efforts as possible. Option 2 may or may not be necessary depending on the proximity of areas to be cleared to nesting sites. Due to topographic factors, the amount of clearing that would be necessitated near nesting sites will probably be minimal. If a total abandonment of nesting sites occurs, the possibility of erecting artificial nest platforms could also be investigated.

IMPACT ISSUE: 4 PRIORITY RATING: 2

PROJECT COMPONENT(S): Watana and Devil Canyon Impoundments

WILDLIFE RESOURCE: Bald eagle

DESCRIPTION OF IMPACT: Loss of nesting and feeding habitat

MITIGATION OPTIONS: A variety of steps can be taken to minimize, and if necessary, compensate for the loss of nesting sites and feeding habitat.

1. During the clearing of the impoundments, clumps of tall spruce trees (if available) could be left uncut along the impoundment at 1/2 to 1-mile intervals. These trees should be located in the cleared zone as far from the normal high pool level as possible to avoid their being washed away during unusually high water periods. If other conditions permit the existence of a high eagle population, artificial perching sites could be provided.

2. Following inundation, eagle nesting could be monitored to determine if eagles are successfully locating and using alternative sites. If it is determined that the eagle population has suffered due to a failure to use the remaining nesting opportunities, artifical nesting platforms could be erected in suitable locations.

3. If limnological conditions are suitable, and the impoundments have not naturally developed a suitable fisheries resource, efforts could be undertaken to stock suitable fish species to generate a good food base for bald eagles.

DISCUSSION: Although some eagle nests and suitable nesting sites will be lost as a result of the project, the creation of two large impoundments may, if suitable conditions exist, result in a greater abundance of bald eagles using this area in the future than are currently found here. If the proper steps are taken, this potential increase in eagle abundance could function as a form of out-of-kind compensation to offset losses suffered by other species.

RECOMMENDED COURSE OF ACTION: The three options identified above should be implemented. Of these options, the monitoring of eagle populations and the establishment of a fisheries resource are the most important and are critical to the successful mitigation of this impact.

On the other hand, in the upper basin it appears that the only practical option is prescribed burning, and some question exists as to the ability of this technique to produce the desired results under the environmental conditions present. An argument against an upstream management effort is that in doing so the habitat would be so altered as to enable the existence of a moose population at an artifically high level, and unless long-term management efforts are continued, there would ultimately be a reduction in carrying capacity. Of course management efforts in the downstream area may also result in a high moose population that would require long-term management efforts to provide for the continued existence of a higher moose density. By not directing management efforts in the upstream area, moose population would be allowed to be lowered and reach a new level that natural conditions would be able to support without continued management efforts. On the other hand, the status of moose in the upper basin is important to a variety of other species, including wolves and bears, which prey on moose; caribou, which would probably incur higher wolf predation if the moose population decreased; and also numerous scavengers, such as the wolverine and red fox that frequently utilize wolf-killed moose for food. Therefore, allowing the project to reduce the carrying capacity of the upper basin for moose would have indirect impacts on other species. The impact on sportsmen, although not a biological consideration, should also be factored into the choice. Failing to support upstream moose would not be taken favorably by those hunters that use the area, but likewise the improvement of moose habitat in the downstream area would be viewed positively by sportsmen in that area. Also to be considered is the fact that improved access into the upper basin will probably result in greater hunting pressure and an associated demand for game. An associated aspect of the moose habitat management issue is the impact that management efforts will have on other species. Some species will also benefit from this type of moose mitigation, while other species

will be negatively influenced. As noted in the list of mitigation options, both the upstream and downstream areas may not be acceptable and management efforts could be considered for other appropriate portions of the state. Possible areas of consideration could be portions of the upper Susitna basin far removed from the project area, the Tanana Flats near Fairbanks, the Kenai Peninsula, etc.

RECOMMENDED COURSE OF ACTION: It is recommended that plans be developed to improve moose habitat in both the upper basin adjacent to the impoundments, and also in the lower basin (see Impact Issue #13). Research efforts should first be undertaken to gain an understanding of how burning will affect vegetation in the upper basin and, if the results are favorable, a program of prescribed burning should be undertaken. Since the effectiveness of burning is currently questionable,a program of moose habitat improvement along the lower river should also be developed. The ultimate decision as to the distribution of effort between these two areas will have to await the determination as to the usefulness of burning in the upper basin. The following specific recommendations can be made in regard to the two management areas:

Upstream - Investigate the suitability of burning for moose habitat management.

- Conduct detailed browse utilization, productivity, and availability studies in order to determine the extent to which compensation is needed and the level of effort required to achieve that level of compensation.
- Gather more complete information on moose distribution in the upper basin and also conduct snow depth studies in areas identified as potential management areas in order to insure that browse resulting from management efforts will be available to moose in winter.

- Any burning program should take into consideration impacts on other wildlife species and be conducted in such a fashion as to minimize any negative impacts, for example, all burns should be of a linear configuration and oriented parallel to caribou migration routes since recently burned areas have proven to function as a barrier to migrating caribou.

Downstream
- Mature timber on selected islands should be logged
- Selected islands that do not contain mature cottonwood trees should be burned.
- Suitable areas east of the river should be identified and a program of moose habitat management developed that utilizes burning, logging, crushing, or a combination of all three depending on the situation.

IMPACT ISSUE: 6 PRIORITY RATING: 1

PROJECT COMPONENT(S): Watana and Devil Canyon Impoundments

WILDLIFE RESOURCE: Upper basin moose population

DESCRIPTION OF IMPACT: Habitat loss

MITIGATION OPTIONS: The only form of mitigation that can be considered in regard to this impact issue is compensation. It should be feasible through habitat management to compensate for the loss that will be incurred. In considering habitat management, it must first be determined where compensation efforts should be implemented. The efforts could be directed in any of the following areas: 1) the upper basin adjacent to the new impoundments, 2) selected portions of the lower basin, 3) a combination of upstream and downstream areas, or 4) some area totally removed from the influence of the project.

Upstream habitat management - the only practical approach to improving moose habitat in the upstream area may be through prescribed burning.

Downstream habitat management - in the downstream area it would be possible to improve moose habitat either directly on river islands and/or associated riparian areas, or in more upland situations east of the river. On the islands with more mature stands of timber, logging operations should provide the needed habitat alterations, with the possibility of prescribed burning in those areas that do not contain mature cottonwood trees. In upland areas, either burning, crushing, logging, or a combination of all three are possible management options.

DISCUSSION: In deciding where (upstream vs. downstream) to institute management efforts to compensate for loss of moose habitat, the first question is whether or not the mitigation effort should be implemented in the immediate vicinity of the impact (upstream) or if more distant areas are acceptable (downstream). The major argument in favor of a downstream effort is that along the lower river there are proven techniques available that will, with a high degree of certainty, be effective in achieving the desired goal.

IMPACT ISSUE: 7 PRIORITY RATING: 1

PROJECT COMPONENT(S): Watana and Devil Canyon Impoundments

WILDLIFE RESOURCE: Black bear

DESCRIPTION OF IMPACT: Habitat loss, including the elimination of most denning and foraging areas in the vicinity of the project

MITIGATION OPTIONS: The only option in regard to this impact issue is compensation by improving black bear habitat in some other area, or compensating in an out-of-kind fashion through some other species.

DISCUSSION: The black bear population in the project area will be severely impacted since the impoundments will result in the elimination of most of the suitable black bear habitat in the area. The presence of a large and healthy brown bear population and the restriction of forested habitats to the river area preclude the existence of a black bear population in adjacent areas. Since there is no possibility of managing the adjacent areas for black bears, the only choice is to either compensate through mitigation efforts directed at other species, or to attempt to improve black bear habitat in areas outside of the upper basin. Although the black bear is an abundant species in Alaska, as evidenced by the liberal game regulations pertaining to this species, future demands for this species as a game animal will probably increase and efforts to compensate for the predicted loss, and thus insure the availability of black bears in the future, should be considered.

RECOMMENDED COURSE OF ACTION: The loss of black bears should be compensated for by improving the status or abundance of other species, moose being the most likely species. If moose habitat management efforts are implemented along the lower river, it is suggested that a thorough review of the habitat requirements of black bears be conducted and any reasonable efforts be taken in conjunction with moose management to improve the same areas for

black bears, keeping in mind, however, that allowing or encouraging greater black bear abundance could reduce moose calf survival and thus be counterproductive in regard to the goals of the moose management program.

IMPACT ISSUE: 8 PRIORITY RATING: 1

PROJECT COMPONENT(S): Watana and Devil Canyon Impoundments

WILDLIFE RESOURCE: Brown bear

DESCRIPTION OF IMPACT: Loss of spring foraging habitat as a result of inundation

MITIGATION OPTIONS: Out-of-kind compensation is the only form of mitigation that can be considered in regard to this impact issue.

DISCUSSION: The distribution of the brown bear, unlike the black bear, is not as restricted to the impoundment area in the upper basin, and thus the inundation of that area will result in the elimination of only a portion of the total area used by this species. At the present time it is impossible to predict how much the loss of this area, which is frequented during spring, will mean to the brown bear population. It will be impossible, as in the case of the black bear, to manage other areas of the project area for the loss that will occur here. This loss will be, however, only one of several different forms of project-related impacts that will be directed towards brown bears, and although it may not be in itself of a critical nature, it may, in conjunction with other impacts represent a severe influence on the future of this species in the project area.

RECOMMENDED COURSE OF ACTION: Since little can be done to directly compensate for this impact, it is recommended that, 1) compensation efforts directed towards other species be increased in order to compensate for this impact on brown bears, and 2) recommendations made in regard to other impacts on this species be implemented in order to reduce the combined impact on brown bears.

IMPACT ISSUE: 9 PRIORITY RATING: 1

PROJECT COMPONENT(S): Watana and Devil Canyon Impoundments

WILDLIFE RESOURCE: Wolf

DESCRIPTION OF IMPACT: Habitat loss and reduction in food base (moose)

MITIGATION OPTIONS: The only form of mitigation feasible to minimize this impact is to take steps to maintain the present abundance of moose in the upper basin. If this is not possible, the impact on this species will have to be compensated for in some other manner.

DISCUSSION: The extent to which the reduction in moose will impact this species is difficult to predict although it will certainly have some negative impact. Although wolves feed on moose, they also kill numerous caribou; however, the distribution of caribou varies both from year to year, and also among seasons. Thus caribou do not represent as consistently available a source of food as do moose. Whether or not the upper basin can successfully be managed for moose is questionable (see discussion on impact issue #6). The extent to which the moose population can be maintained through management efforts is thus currently unknown and location of moose management efforts and their success will be one factor that will greatly influence the future status of wolves in the upper basin.

RECOMMENDED COURSE OF ACTION: It is recommended that the suggestions concerning the management of upper basin moose as made in Impact Issue #6 be implemented. The project will impact wolves in other ways, and although each impact may not appear severe by itself, collectively they do represent a major impact on this species; therefore, whenever possible other recommendations made in regard to other impact issues concerning this species should be implemented.

IMPACT ISSUE: 10 PRIORITY RATING: 2

PROJECT COMPONENT(S): Watana Impoundment

WILDLIFE RESOURCE: Dall sheep

DESCRIPTION OF IMPACT: Possible loss of the Jay Creek mineral lick

MITIGATION OPTIONS: Compensation of this loss is the only form of mitigation that may be possible. It could be possible to replace the inundated mineral lick with an artificial lick at a different location, but still within the range of the sheep that currently use the Jay Creek lick.

DISCUSSION: At the present time it appears that at least a portion of the Jay Creek lick will be inundated during a part of the year. It is possible, however, that the lick will not be under water during May and June, when most use of the lick occurs. It remains speculative as to whether or not the lick will still be usable, or acceptable to sheep under project conditions. It is also unknown as to how dependent the sheep population is in regard to this lick. However, considering the frequency of use, and the willingness of sheep to expose themselves to predation in order to reach the lick, it must be of some significance to them.

RECOMMENDED COURSE OF ACTION: The following steps to mitigate this impact are recommended:

1. Efforts currently underway to determine the chemical composition of the lick and the number of sheep using the lick should continue.
2. Following inundation, monitoring efforts should be undertaken to actually document the reaction of sheep to the change and the extent to which they continue to use the lick.
3. If the lick is abandoned following flooding, or use substantially reduced, an artificial lick should be established using salt blocks specifically designed to match or improve upon the chemical composition of the current lick and placed within the natural range of these sheep, preferably in a less vulnerable location.

IMPACT ISSUE: 11 PRIORITY RATING: 2

PROJECT COMPONENT(S): Watana Impoundment

WILDLIFE RESOURCE: Caribou

DESCRIPTION OF IMPACT: The possibility exists that during April and May the drawdown zone of the Watana Impoundment and the associated ice conditions may function as a barrier to the migratory movement of the Nelchina caribou herd to the calving area.

MITIGATION OPTIONS: If it is demonstrated that caribou attempt to utilize hazardous crossing points, this impact may be minimized by erecting fences in such a manner as to direct migrating caribou to safer crossing points. If the Nelchina herd finds the impoundments a total barrier, and if attempts to direct them to safe crossing points fail, the only other mitigation option is to insure that the area they select for calving be totally protected during the calving period.

DISCUSSION: The severity of this impact will depend on three factors: 1) whether or not the Nelchina herd has to cross the impoundment in a north to south direction en route to the calving area, 2) whether or not they are able to locate safe crossing points, and 3) if they are forced to calve in a new area whether or not that area will prove suitable for successful calving. Although the Nelchina herd has in the past frequently wintered north of the Susitna River and thus crossed the river as they move to the calving area on the south side of the river, during the past few years they have wintered east of the calving area, particularly on the Lake Louise Flats, and thus have moved in a westerly direction to reach the calving area. It is impossible to predict whether or not this current movement pattern will persist after the impoundment is created, although considering the tendency of caribou herds to suddenly shift migratory patterns, it is likely that sometime following inundation they will again winter north of

the river and be faced with the necessity of crossing the impoundment. The ice conditions that will be present during a crossing will probably vary greatly from area to area and year to year and it is presently predicted that caribou will attempt to locate safe crossing points and thus avoid hazardous crossing conditions. If they fail at this effort to select safe crossing points, it will be possible to erect fences to alter their direction of movement in such a manner as to guide them to safer points. If all of this fails and the herd is totally blocked by the Watana Impoundment and is thus forced to calve elsewhere, it will be critical to monitor the situation and through whatever action is necessary, insure the total protection of the herd as it is faced with the difficult task of adjusting to a new calving situation.

RECOMMENDED COURSE OF ACTION: Due to the unknowns associated with mitigating this potential impact, the first and most critical need is to monitor the movements of the herd from late winter through the calving period. This monitoring effort should continue until it is demonstrated that the herd has either successfully negotiated the impoundment in a spring migration movement or has established a new calving area. In other words, the monitoring effort should continue for at least several years following the first attempt of the herd to cross the impoundment, and of course it is impossible to predict at this point how long it will be until the Nelchina herd actually attempts a crossing. During the first several springs following the initiation of operation, a reconnaisance survey should be conducted to ascertain the condition of drawdown ice conditions and map the location of both hazardous and safe crossing points. This information will be needed if an attempt is made to alter the direction of migratory movement by fencing. Depending on this review of crossing conditions, a plan for establishing temporary fences should be prepared, and if it appears that traditional crossing points will be difficult for caribou to negotiate, the necessary fencing material should be secured and placed in the field so that if monitoring efforts indicate the likelihood of an attempted crossing, they can be erected quickly during the migration

period. The purpose of the fencing is to create a visual, and not necessarily a physical barrier. Thus relatively cheap material such as snow fencing or even burlap sheets can be used. In order to avoid undue interference with other species, the fences should be used only when necessary, and only during the period when the herd is migrating towards the river and when hazardous ice conditions prevail. The last recommendation is that any new calving area that may be established due to the Watana Impoundment blocking migration be totally protected during the calving period, including a total closure of all human activity as well as air traffic restrictions specifying a minimum flight altitude of at least 1,000 feet above ground during the calving period and over the post-calving aggregation.

IMPACT ISSUE: 12 PRIORITY RATING: 2

PROJECT COMPONENT(S): Operation of Devil Canyon Dam

WILDLIFE RESOURCE: Beavers inhabiting the Susitna River downstream from the Devil Canyon Dam

DESCRIPTION OF IMPACT: Due to flow regulation by the Devil Canyon dam there will probably be a change in the number of sloughs available for use by these aquatic furbearers. The daily fluctuations in flow may also result in unstable ice conditions and make it very difficult for beavers to maintain winter food caches.

MITIGATION OPTIONS: The predicted impact on aquatic furbearers in this area can be minimized by reducing the degree of daily flow fluctuations during the winter months and operating in a fashion as to provide flow regimes as close to natural conditions as possible.

DISCUSSION: The exact extent of this impact is difficult to predict at this time and will differ between the area north and the area south of Talkeetna. Although there may be less summer habitat available, it is possible that higher winter flows may actually increase the amount of suitable overwintering habitat for beavers; however, if unstable ice conditions exist due to daily fluctuations there could be a net decrease in beaver abundance because they will not be able to maintain food caches which are normally frozen in place by ice. It is anticipated that ice problems would be most prevalent north of Talkeetna which has comparatively fewer beavers than the area south of Talkeetna. In addition to serving as an important fur resource, beavers inhabiting the floodplain of the lower Susitna River also aid in the creation of moose browse by cutting trees and opening areas for the generation of early successional shrub species. Thus any negative impact on beavers in this area could indirectly reduce the winter carrying capacity for moose. At this point in time it is impossible to state what proportion of the moose browse is the result of beaver activity in comparison to other factors influencing the generation of browse.

RECOMMENDED COURSE OF ACTION: To the greatest extent possible, daily fluctuations in winter flow from the Devil Canyon dam should be as small as practical. Also, in order to determine the degree to which negative impacts on beavers will reduce winter moose browse, further study of downstream beavers, especially below Talkeetna, should be undertaken. This is necessary in order to totally assess impacts of the project on downstream moose populations and thus the level of compensatory moose management required (see Impact Issue #'s 6 and 13).

IMPACT ISSUE: 13 PRIORITY RATING: 1

PROJECT COMPONENT(S): Operation of Devil Canyon Dam

WILDLIFE RESOURCE: Moose inhabiting the area downstream from the Devil Canyon Dam

DESCRIPTION OF IMPACT: South (downstream) from Devil Canyon there may be an alteration of plant succession trends due to flow regulation causing a possible reduction over time in the amount of winter browse available to moose that rely on this area during winter, especially when deep snows prevail.

MITIGATION OPTIONS: There are several management techniques that could be employed to improve moose habitat in this area in order to compensate for possible reductions in the quantity of browse.

1. commercial logging of mature cottonwood trees on the islands
2. prescribed burning of islands that are not dominated by mature cottonwood trees
3. logging, burning, or crushing of vegetation in upland areas east of the river

DISCUSSION: Based on the information currently available, it is difficult to accurately predict the extent of the impact that will occur in regard to this area. Although trends will be predictable, due to the nature of the river and the number of factors that influence the creation and movements of islands, it will probably be impossible to ever determine the actual quantity of browse that will be lost as a result of the project. If the regulation of the river does cause a reduction in the creation of new islands, and thus areas suitable for the invasion of browse species such as willow, it is expected that two changes will occur. First, many areas that would be washed away under present flow conditions will remain secure enough for the development of moose browse, thus resulting in a possible short-term (15 to 25 years) increase in the amount of browse available to moose. However, as plant succession proceeds and the vegetation matures

beyond the point of serving as suitable browse, there will be a gradual long-term reduction in the capacity of the riparian area to support moose under deep snow conditions, thus causing an associated reduction in the abundance of moose on both sides of the river.

RECOMMENDED COURSE OF ACTION: In order to compensate for the possible loss of moose browse it is recommended that a habitat management program be developed to improve the habitat in the area south of Devil Canyon to support wintering moose. As previously discussed (Impact Issue #6), this area may also function as a means of compensating for moose habitat losses in the upper basin. The first step will be to identify appropriate areas for management activities, including consideration of land ownership and vegetation types, and correlating this information with census and movement data being collected by ADF&G. Where appropriate, blocks of mature trees should be removed by means of commercial logging operations. Prescribed burning should also be considered, but due to the extent of human habitation in this area there may be severe constraints on burning opportunities. The use of a vegetation crusher can also be considered in areas where burning and logging are not feasible. Although moose currently use the riparian area during severe winters, and although some management efforts should be directed to those areas, serious consideration should be given to managing habitat east of the Parks Highway and the Alaska Railroad. Many moose that use the river move down from the foothills of the Talkeetna Mountains, located to the east, and in doing so incur high mortality in crossing the railroad and highway. Therefore, if management efforts are directed at areas east of these two transportation corridors, migratory moose would no longer have to cross this area. On the other hand, many moose move to the river from the west and therefore adequate management efforts directly on the river itself should also be undertaken to provide browse for these moose.

IMPACT ISSUE: 14 PRIORITY RATING: 2

PROJECT COMPONENT(S): Clearing of woody material from Devil Canyon and Watana Impoundments

WILDLIFE RESOURCE: All upstream big game species

DESCRIPTION OF IMPACT: Big game species will avoid the area being cleared during the period of clearing.

MITIGATION OPTIONS: In order to minimize the magnitude of this impact on animals existing adjacent to the proposed impoundment zones, the woody material could be cleared from the floodplain of the river, progressing up the sides of the impoundment as the impoundment is filled. This would also leave more habitat intact for a larger time period since clearing would not have to start until dam construction is almost complete, and thus reducing the temporal magnitude of the habitat loss that will result from the impoundment.

DISCUSSION: There is little justification to expend a large mitigative effort in this area since this impact will be relatively short in duration and will basically impact animals that will be far more severely impacted by inundation and the associated permanent loss of habitat. In addition, there will be differences in the severity of the disturbance depending on the associated big game species.

RECOMMENDED COURSE OF ACTION: Other than the above-mentioned option of clearing ahead of filling, the only other recommendation concerns the Jay Creek mineral lick. Since sheep may be able to use this lick following inundation (see Impact Issue #10), it is recommended that no clearing be conducted within one mile of the lick during the months of May and June. If clearing operations continue year round, woody material near the lick should be removed during some other time of the year, preferably during the winter. This will enable the uninterrupted use of the lick by sheep and possibly allow for continued use following filling.

IMPACT ISSUE: 15 PRIORITY RATING: 1

PROJECT COMPONENT(S): Clearing of woody material from the Watana Impoundment

WILDLIFE RESOURCE: Caribou

DESCRIPTION OF IMPACT: There may be disturbance of caribou migrating to the calving area south of the river and/or post-calving movement to the area north of the river.

MITIGATION OPTIONS: Two options exist to avoid or minimize the magnitude of this impact, 1) schedule clearing activities to avoid crossing areas during the migratory period, and 2) leave uncut travel lanes to provide sheltered routes across the impoundment zone during the construction period.

DISCUSSION: Due to the unpredictable nature of caribou movement patterns, it is possible that during the clearing period there will not be a major movement of the Nelchina herd through the impoundment zone en route to or from the calving area. Such movements have occurred in the past and therefore the possibility does exist that the herd will attempt to cross the river during the period of clearing. In order to avoid undue disturbance of this critical activity, all possible efforts should be taken to minimize disturbance of migrating caribou. In order to accomplish this, late winter and early spring monitoring of the herd will be required to predict if action is necessary. Clearing schedules should be flexible enough to accommodate a shift in the location of clearing efforts if necessary. It can be argued that little attention should be devoted to this short-term impact since a reservoir will ultimately cover the area in question. Even though the disturbance of migration caused by clearing activities is, admittedly, a short-term impact, it is also one of many forms of impact that the Nelchina herd will be subject to as a result of the project. Each impact may not by itself represent the

potential for severely impacting the herd, but collectively there could be a major disruption of the activities of this herd with associated negative consequences. Therefore, it is important that each caribou-related impact issue be mitigated to the fullest extent possible in order to avoid the collective results of all forms of impact. The major issue in this case is disrupting the movement of the herd to their calving area. If the herd is permitted to cross the river during the clearing operation and successfully crosses the river during the filling operation, chances of successful crossings after filling will be increased.

RECOMMENDED COURSE OF ACTION: Travel lanes should be left uncut until absolutely necessary. These lanes should be located between Deadman and Jay creeks and should each be 1/2-mile wide. Three or four such lanes should be adequate and continue from the north through the south slopes of the impoundment zone. During the clearing period the Nelchina herd should be monitored by ADF&G, especially in late winter and early spring in order to determine the possibility of the herd attempting to cross the river from north to south. If monitoring efforts indicate that a crossing will occur, clearing operations should be halted in the crossing area for the four to six week period that crossing normally takes place. This will likely occur from early April to mid-May. The monitoring effort should continue during the early post-calving period and work halted if it appears that the post-calving aggregation of cows and calves will cross the river moving north.

IMPACT ISSUE: 16 PRIORITY RATING: 1

PROJECT COMPONENT(S): Construction camps and all access roads

WILDLIFE RESOURCE: Red fox, wolf, black bear and brown bear

DESCRIPTION OF IMPACT: Illegal feeding of animals and improper disposal of garbage

MITIGATION OPTIONS: The following options exist to avoid and/or minimize impacts associated with the feeding of wild animals by humans and the acquired dependency of wild animals on available refuse.

1. All camp facilities (especially landfills, if used) could be securely fenced with the bottom edge of the fences buried 18" below ground.
2. Secure garbage containers could be available in all work areas and all refuse collected and incinerated.
3. Work crews could be hired and charged with picking up all discarded refuse from all work areas and along all access roads.
4. State laws prohibiting the feeding of wild animals could be strictly enforced by security personnel and repeated violators dismissed from their position of employment and permanently prohibited from future work on any aspect of the project.
5. A mandatory education program for all project personnel could be prepared and implemented.

DISCUSSION: This is one impact that can, through proper planning and a concerted effort, be minimized, if not totally avoided. The key element in the successful execution of these options lies with personnel responsible for the actions of all workers associated with the construction effort. It is therefore critical that all supervisory personnel be impressed with the need to prevent illegal feeding and are committed to maintaining a preventative program to that end. All construction contracts and union agreements entered into for this project should clearly

identify the agreed-upon rules and regulations that pertain to this issue and also identify the consequences to workers who fail to comply.

RECOMMENDED COURSE OF ACTION It is recommended that all five (5) options identified as mitigation options be implemented during the construction and operational phases of the project.

IMPACT ISSUE: 17 PRIORITY RATING: 1

PROJECT COMPONENT(S): Main access road, borrow areas, access roads to borrow areas, and construction camps

WILDLIFE RESOURCE: All furbearer species, many avian and small mammal species, and all big game species except Dall sheep

DESCRIPTION OF IMPACT: Habitat loss as a result of these project components

MITIGATION OPTIONS: The magnitude of this impact can be avoided to some degree by arranging camp facilities in as compact a fashion as possible and keeping them as close to work areas as feasible. Permanent facilities (main access road and permanent camp facilities) will represent a permanent loss of habitat and compensatory actions through habitat management will be required. Temporary facilities (borrow areas, roads to borrow areas, and temporary camp facilities) could be restored to a condition that would provide usable wildlife habitat.

DISCUSSION: There are basically three levels of consideration involved with this issue. First, the magnitude of the habitat loss associated with these project components can be minimized to some degree through careful planning. Secondly, temporary use areas, such as borrow areas and portions of camp facilities, can be restored in a manner that will allow for future use by wildlife. And thirdly, unavoidable losses that will result from the permanent portion of the project can be mitigated through compensatory action.

RECOMMENDED COURSE OF ACTION: The following steps are recommended to mitigate the anticipated habitat losses associated with the abovementioned project components.

1. Camp facilities should be arranged in as compact a fashion as possible and located as close to work areas as possible, in order to avoid undue habitat disturbance.

2. Temporary use areas (borrow areas, roads to borrow areas, and temporary portions of the camp) should be restored following use. All top soil removed from these areas should be stockpiled and saved. In addition, any top soil removed from areas that will be permanently disturbed should also be saved and added to the stockpiles. Following use of each area, the top soil should be reapplied and regraded if necessary to avoid erosion. The areas should then be lightly seeded with grasses, and fertilized in order to stimulate the initial growth of native vegetation. It is recommended that during the first year the reclamation areas be fertilized with a mix high in phosphorus (10-20-10 or 8-32-16) and applied at a rate sufficient to supply 75-100 pounds of nitrogen per acre. During the second growing season these areas should be refertilized at a rate 1/2 that of the initial treatment, and during the third growing season at a rate 1/3 that of the initial treatment.

3. To compensate for permanent losses to big game and furbearer species it is recommended that habitat management efforts directed toward moose be increased to compensate for these losses. In the case of avian species, it is recommended that advantage be taken of the newly created aquatic habitat -- represented by the impoundments and that efforts be expended to utilize these impoundments to improve habitat for certain waterfowl in order to compensate for the loss of terrestrial habitat and associated terrestrial species. Efforts should be expended to insure that an adequate fisheries food base exists in the impoundments. This may entail the stocking of appropriate fish species. Obviously, it must first be established as to whether or not the impoundments will be limnologically suitable to support a good fisheries resource. Following the establishment of a food base, it is recommended that nest boxes be erected in adjacent forest areas to provide nesting opportunities for cavity-nesting waterfowl such as goldeneyes and buffleheads.

IMPACT ISSUE: 18 PRIORITY RATING: 2

PROJECT COMPONENT(S): Borrow areas and access roads to borrow areas

WILDLIFE RESOURCE: All upstream big game species except Dall sheep

DESCRIPTION OF IMPACT: Avoidance reaction during construction period and resulting in loss of habitat use

MITIGATION OPTIONS: The only feasible option to minimize the magnitude of this impact is to schedule activity and equipment movement in such a fashion as to allow animals to utilize the area adjacent to the borrow areas for a portion of the day.

DISCUSSION: The concept of limiting human activity in these areas to certain portions of the day may prove effective for only some species. It is likely that moose would benefit from such an arrangement while more wilderness species such as the wolf and wolverine would not respond positively to such an approach.

RECOMMENDED COURSE OF ACTION: Since the duration of this impact will be for only the construction period, and since it is likely that any scheduling program would be only partially effective, it is recommended that no action be taken to mitigate this impact. Instead, mitigative action should be applied towards the restoration of these areas and thus the securing of long-term availability of the habitat that will be disturbed as a result of borrow areas and the associated access roads.

IMPACT ISSUE: 19 PRIORITY RATING: 2

PROJECT COMPONENT(S): Main access road and all access roads to borrow areas

WILDLIFE RESOURCE: Moose and caribou

DESCRIPTION OF IMPACT: Mortality caused by collisions with vehicles

MITIGATION OPTIONS: Although it is unlikely that this type of impact can be totally avoided, there are steps that can be taken to minimize the magnitude of this impact. Construction workers, and especially truck drivers, could be exposed to an educational program describing the value of wildlife in the area and the need to minimize impact through careful and thoughtful driving. Speed limits could be posted and enforced that would reduce the frequency of collisions. During winter months when moose and caribou may frequent the road as a result of superior traveling conditions, numerous pull-off areas could be plowed clear to give animals an escape opportunity in order to avoid vehicles.

DISCUSSION: The severity of this impact will depend on several factors, the volume and speed of project-associated traffic, the attitude of the drivers, and the depth and duration of winter snow.

RECOMMENDED COURSE OF ACTION: In conjunction with the educational program recommended to reduce the illegal feeding of animals (see Impact Issue #16) an attempt should be made to impress on workers, especially those workers that will be driving trucks and other large equipment, as to the value of wildlife and the need to avoid killing animals through collisions with vehicles. It is also recommended that speed limits be established on the access road and strictly enforced. The suggested rate of speed will have

to depend on the design speed of the road, the types of vehicles using the road, etc. It is recommended that the speed limit be kept as low as possible while still allowing for the timely movement of equipment and personnel. Due to the increased frequency of collisions after dark, it would be advantageous to have two speed limits, one for daylight hours and a lower limit for night. The placement of warning signs at known crossing points should be considered to alert motorists to the increased likelihood of encountering moose on the road. It is also recommended that during winter plowing operations numerous pull-off areas be provided along the road in order to provide opportunities for moose to get out of the way of vehicles. The number of such pull-off areas and the spacing between them will probably vary depending on the associated vegetation cover type and the distribution of moose. Therefore, it is suggested that prior to road construction, and following a decision as to the exact route, areas be identified where pull-off points will be needed as well as which areas will not require such action.

IMPACT ISSUE: 20 PRIORITY RATING: 1

PROJECT COMPONENT(S): Access road and construction camps

WILDLIFE RESOURCE: All upstream furbearer and big game species, except Dall sheep

DESCRIPTION OF IMPACT: Increased human activity associated with improved access and the resulting disturbance and harassment of wildlife, and increased hunting and trapping pressure

MITIGATION OPTIONS: During both the construction and post-construction period there are three options in regard to human access and activity in the project areas. First of all, no effort could be taken to restrict or control human access or activity; and secondly, efforts could be taken to totally restrict additional activity. There is of course a compromise option in which human access would be permitted during certain times of the year and/or in certain areas.

DISCUSSION: The improved access associated with the Susitna Project, and the potential impact on both furbearer and big game species, may represent the most severe single avenue of impact resulting from this project, possibly exceeding in magnitude impacts associated with habitat loss due to inundation and other habitat disturbing aspects of the project. It is therefore very important that the negative aspects of this source of impact be minimized to the greatest extent possible. Due to the differences in control options available, and also differences in the magnitude of the impact potential, this issue will be considered separately for the construction period and the post-construction period.

Construction Period - during this period there will be a great number of people in the area throughout the year and the potential for disturbing wildlife is very high. However, during this period the opportunity for controlling human activity is greatest since

the majority of personnel in the area will be under the direct control of the camp manager and will be in the area solely for work purposes. It is anticipated that no public access will be allowed during the construction period. Therefore, although the potential for negative impact is greatest during the construction period, the opportunity to minimize that impact is also available and should be used.

Post-construction Period - It is anticipated that following construction the access road will be open to the general public for whatever use they wish to make of it. The magnitude and nature of human activity during this period should differ from the construction period and thus different considerations apply to mitigation options.

RECOMMENDED COURSE OF ACTION: The recommended mitigation actions for this impact differ from the construction to the post-construction period and are thus described separately.

Construction Period - The general policy suggested for the construction period is that project personnel have no greater access to the upper basin than that available to the general public. It is therefore recommended that all project personnel be required to travel directly from the start of the access road to the camp or work area without stopping except for emergencies. Personnel should not be permitted to leave the access road for any reason including to hunt or trap. If a route from Watana to the Denali Highway and/or a northern route between Watana and Devil Canyon is selected, it is recommended that from mid-April to mid-September all traffic on these routes be restricted to a time period extending from two hours after sunrise to two hours before sunset in order to provide opportunities for big game species, especially caribou and brown bears, to cross the highway without being disturbed by traffic.

Post-Construction Period - Following the construction period, when the road is opened to the general public, it is recommended that ADF&G monitor the status of big game populations in the area and

take whatever regulatory steps can be practically implemented to prevent a game harvest in excess of that which would allow for a sustained yield. In order to minimize undue disturbance of caribou during the calving and post-calving period it is recommended that ATV activity from the access road be prohibited from May 1 to August 15 of each year. This will also help reduce long lasting destruction of vegetation by ATV activity.

IMPACT ISSUE: 21 PRIORITY RATING: 2

PROJECT COMPONENT(S): Construction camps

WILDLIFE RESOURCE: Red fox and wolf

DESCRIPTION OF IMPACT: Possible introduction of rabies by domestic dogs and the establishment of a feral dog population

MITIGATION OPTIONS: There are two options available to avoid or minimize the possibility of this impact taking place: 1) total prohibition of all dogs in the camp facilities, or 2) regulations concerning the housing and control of domestic dogs.

DISCUSSION: It is our understanding that at the present time rabies and feral dogs are not a problem in the upper Susitna basin. The housing of domestic dogs at the camp facilities represents the potential for both of these situations to change with potentially severe impacts to native carnivores, especially foxes and wolves which are highly susceptible to rabies. The establishment of a feral dog population would also be a negative impact although the severity of that impact is less than the scenario of a rabies epidemic.

RECOMMENDED COURSE OF ACTION: It is recommended that camp residents be permitted to house domestic dogs at the camp under the following conditions.

1. All dogs must be registered with the camp manager and certification of rabies immunization be provided and updated at appropriate intervals.
2. Dogs must be under control at all times.
3. Any dogs found outside of the fenced camp area, and not under direct control of the owner, shall be destroyed by camp security personnel if attempts to capture the dogs prove futile.

IMPACT ISSUE: 22 PRIORITY RATING: 2

PROJECT COMPONENT(S): Construction camps and access roads

WILDLIFE RESOURCE: All upper basin wildlife species

DESCRIPTION OF IMPACT: Possible habitat destruction or alteration resulting from unauthorized fires

MITIGATION OPTIONS: In order to avoid this impact, preventative measures could be taken to minimize the potential for uncontrolled fires occurring. Adequate fire fighting equipment could be made available to extinguish any fires that occur.

DISCUSSION: Although the avoidance of this impact is fairly simple and obvious, since the consequences of fire can be extensive, it is important that the proper precautions be recommended and strictly adhered to.

RECOMMENDED COURSE OF ACTION: As part of the education/orientation program recommended for workers (Impact Issues 16 and 19), a portion should deal with fire prevention and fire fighting plans as well as addressing the need for fire prevention and the potential harm to wildlife that could result. A program of fire prevention and fire fighting plans should be prepared by the camp manager and strictly enforced. Adequate fire fighting equipment and knowledgeable operators should also be available in the event that a fire occurs. In order to identify the potential for fires occurring, and thus the level of preventative measures needed during periods of high fire potential, camp personnel should periodically contact the BLM for an evaluation of fire potential. This will be especially important during periods of hot, dry weather.

IMPACT ISSUE: 23 PRIORITY RATING: 1

PROJECT COMPONENT(S): Air traffic

WILDLIFE RESOURCE: All big game species, raptors, and trumpeter swans

DESCRIPTION OF IMPACT: Disturbance of normal activities as a result of air traffic, especially low-flying, large helicopters

MITIGATION OPTIONS: Although there is no way to totally avoid disturbing wildlife as a result of air traffic associated with the Susitna Project, there are several options available to minimize this impact. In general, it will require restrictions in both altitude and location of flying activity to keep the disturbance factor to a minimum. Seasonal restrictions will also prove helpful in some cases. Since wildlife species vary in their sensitivity to aircraft disturbance, restrictions could be developed to avoid the most sensitive species (such as brown bears and wolves) and be more liberal concerning certain areas or times of the year that are important to less sensitive species (such as moose).

DISCUSSION: It is anticipated that over time some species will accommodate to air traffic and the negative aspects of disturbance will be reduced. Other species, trumpeter swans, brown bears, and wolves, for example may be negatively impacted before any such adjustment level is achieved, if it is ever achieved. Therefore, it is very important that air traffic restrictions be designed to minimize impact on such sensitive species, while at the same time not being over restrictive in regard to less sensitive species.

RECOMMENDED COURSE OF ACTION: In order to minimize disturbance due to air traffic the following restrictions are recommended.

1. All air traffic should fly directly to and from the camp or work sites with no unnecessary diversions.

2. Flight distances and weather permitting, all air traffic should maintain at least 500 feet altitude above ground throughout the upper basin during all seasons.
3. A minimum altitude of 1,000 feet above ground should be maintained in the following areas unless landing or taking off.
   - caribou calving area (May and June) and over any post-calving aggregations (June and July)
   - wolf dens (April through July)
   - bald eagle nests (3/15 - 8/31) including a horizontal restriction zone of a 0.25 mile radius
   - gyrfalcon nests (2/15 - 8/15) including a horizontal restriction zone of a 0.25 mile radius
   - golden eagle nests (4/1 - 8/31) including a horizontal restriction zone of a 0.50 mile radius
   - the Jay Creek sheep lick (May and June)
   - nesting trumpeter swans near the Oshetna River and other adjacent areas in the upper reaches of the Watana Impoundment (May through July)

Obviously some of these areas will have to be identified on a yearly basis in order to keep the location of such critical areas accurately updated and available for review by personnel responsible for controlling air traffic.