Docket No. CP80-

ENVIRONMENTAL ENGINEERING MANUAL

Exhibit Z-1.1

Volume III

ALASKA SEGMENT

ALASKA NATURAL GAS TRANSPORTATION SYSTEM

Alaskan Northwest Natural Gas Transportation Company

United States of America
Before the
Federal Energy Regulatory Commission

Docket No. CP80-

ENVIRONMENTAL ENGINEERING MANUAL

Exhibit Z-1.1

Volume III

Application of
ALASKAN NORTHWEST NATURAL GAS TRANSPORTATION COMPANY

For a Final Certificate of Public Convenience and Necessity Pursuant to Section 7 (C) of the Natural Gas Act, as amended, and Section 9 of the Alaska Natural Gas Transportation Act of 1976 to construct and operate the Alaska Segment of the Alaska Natural Gas Transportation System.

July 1, 1980

EXHIBIT Z-1.1

ENVIRONMENTAL ENGINEERING MANUAL

ALASKAN NORTHWEST NATURAL GAS TRANSPORTATION COMPANY

ALASKA SEGMENT OF THE
ALASKA NATURAL GAS TRANSPORTATION SYSTEM

VOLUME III

EXHIBIT Z-1.1

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1.0 INTRODUCTION

The Alaska Highway Pipeline Project has a history of positive response to environmental issues. These environmental issues were important to the proceedings leading to the President's Decision and Report, dated September 22, 1977, where it was found that the project was in compliance with the requirements of the National Environmental Policy Act of 1969, 91-190, 83 Stat. 852, Title 1, Section 102. This environmental finding of the President's Decision was ratified by joint resolution of Congress (Public Law 95-158).

1.1 PRECEPTS OF ENVIRONMENTAL ENGINEERING

The protection of the environment is a fundamental task which affects every other aspect of project management. The President's Decision establishes the principle that environmental considerations be integrated into the earliest stages of engineering design and construction planning. Northwest Alaskan Pipeline Company (NWA) and Fluor Engineers and Constructors, Inc. (the Project Management Contractor, or PMC) established Environmental Engineering Departments to achieve this integration in an efficient manner. The precepts, or operational premises, of the Environmental Engineering Departments are discussed below.

1.1.1 Use of Existing Resources

Central to the planning of the project is the reliance on the many existing engineering resources, including physical facilities currently in place, as well as the experience and data from previous projects in Alaska. A precept of Environmental Engineering is to take maximum advantage of these resources.

The project corridor has an infrastructure of roads, material sites, camp locations, etc. The original environmental interest in situating the gas pipeline along the TAPS/ Alaska Highway corridor was due to the existence of this infrastructure. The alternative to using these existing facilities would be to impact undisturbed terrain.

There also exists a significant amount of environmental data on the project corridor. Environmental Engineering has organized and evaluated much of this existing information. This facilitated the identification of the additional information which was needed to: (1) fill data gaps and (2) establish a specific environmental baseline for the gas line project.

1.1.1 Use of Existing Resources (Continued)

An additional resource is the group of experienced personnel who participated in the planning and the construction of TAPS. Environmental Engineering has made a concerted effort to utilize their valuable experience, whether as staff consultants, contractors, or agency contacts.

1.1.2 Integration into the Project

The success of the project's environmental effort will ultimately be measured by the quality of the environment after the construction has taken place and the pipeline is in operation. The construction effort will be carried out according to the final engineering designs, construction schedules and construction methods contained in the Notice-To-Proceed Applications (NTPAs). To most effectively participate in the development of those documents, Environmental Engineering has a precept of integration into the working processes and products of the other disciplines. This aids in a consistent approach and better communication of the environmental process.

Environmental input (criteria, guidelines, consultation) must be received in proper sequence with the needs of the design and planning process. Without this interaction, the group would only serve a review function, causing the inefficient incorporation of protection strategies. While the responsibility for interaction is shared by all the other disciplines, Environmental Engineering initiates the compatible scheduling of environmental activities.

A further requirement is for Environmental Engineering to investigate the format and the level of detail to be exhibited in the end products of the disciplines. Environmental consequences can arise from seemingly insignificant or unspecified details. These details must be analyzed and addressed in the planning process, and then solutions must be incorporated into the final design and scheduling documents.

1.1.3 Integrity of Environmental Documents

A third precept of Environmental Engineering program is to produce and continually update a set of documents which provide environmental input to the other project disciplines. A document system has been developed to specifically serve the engineering design, the construction schedule, and the construction plans for the project. Documents which demonstrate sophistication but are limited to only a singular purpose or time frame are kept to a minimum.

1.1.3 Integrity of Environmental Documents (Continued)

Environmental Engineering communicates through a set of "living" multi-purpose documents. As a system, they provide systematic environmental guidance to the preconstruction design and planning efforts. To remain effective, their integrity or validity is maintained by frequent updates as project needs and details come into focus. The central document of the Environmental Engineering program is this Environmental Engineering Manual which provides the immediate goals of each environmental program, the developmental milestones to achieve those goals, and the manner in which each program contributes to design and planning elements. The current document system is described in Section 5.0, "Working Documents." A brief overview of each is provided here:

1.1.3.1 Environmental Control Schedules - A series of critical path schedules that outline the interaction between Environmental Engineering and the other disciplines.

1.1.3.2 Environmental Training Materials - A library of plans and communication tools for the performance of the Environmental Orientations and the Environmental Briefings.

1.1.3.3 Environmental Protection Plans - Documents integral to the Notice-To-Proceed Applications (NTPAs) that will demonstrate the results of the environmental programs for the particular activity and location for which an application is filed.

1.2 ORGANIZATION

The President's Decision requires NWA "...to construct, operate, maintain the pipeline with maximum concern for the protection of environmental values." Compliance with the President's mandate requires that environmental considerations be integrated into all relevant project activities in order to obtain final designs, construction schedules, and construction methods that are environmentally acceptable. The organization described below implements this mandate; see Figure Z-1.1.

1.2.1 Corporate Level

NWA has established a position of Vice President, Environmental Affairs who will report on environmental policy directly to the company President. In addition to this policy role, the Vice President will provide direction for the PMC on environmental matters, and will supervise NWA Environmental Engineering. The Vice President, Environmental Affairs will be the chief technical liaison with government environmental personnel.

1.2.2 Department Level

Environmental Engineering is organized into six programs; three of which perform a "line" function (Biological, Physical, and Civil Programs), and three of which perform a "staff" function (Field Operations, Environmental Planning and Information Management).

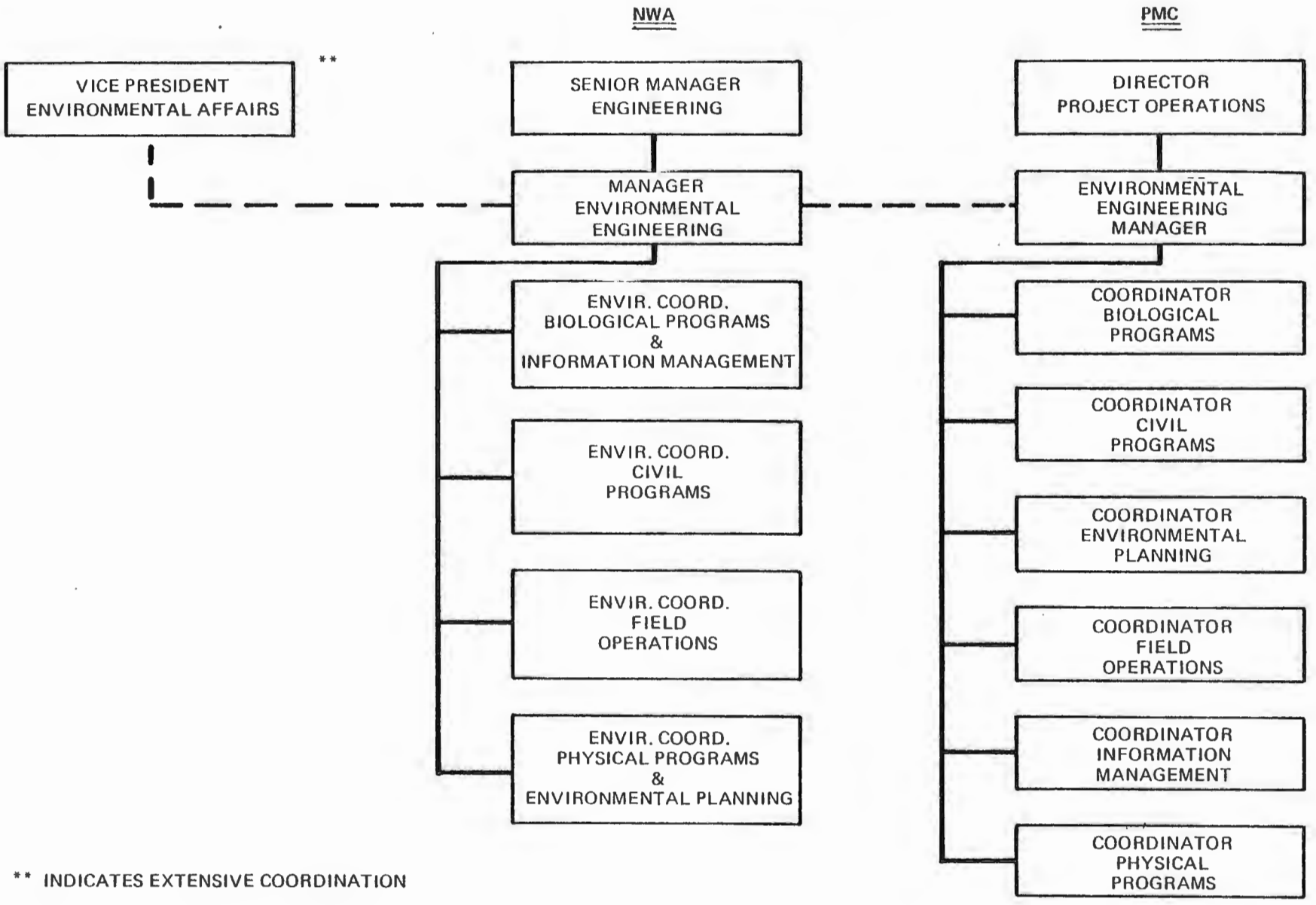
1.2.2.1 Biological Programs - The Biological Programs develop the strategies for protection of those biological and cultural resources potentially affected by the project.

1.2.2.2 Physical Programs - The Physical Programs plan for the life support systems at temporary and permanent facilities, review all project operations affecting air and water quality, and plan for the handling, storage, and ultimate disposal of oily and hazardous materials.

1.2.2.3 Civil Programs - The Civil Programs will specifically address the final design of civil engineering features, the scheduling of civil and pipeline construction, and the selection of construction techniques.

1.2.2.4 Field Operations - A variety of functions are coordinated under this program. At this stage of the project, the primary responsibility of the program is to coordinate

ALASKA SEGMENT ENVIRONMENTAL ENGINEERING ORGANIZATION CHART



** INDICATES EXTENSIVE COORDINATION

FIGURE Z-1.1-1

1.2.2.4 Field Operations (Continued)

environmental input to the land use permit applications for engineering field programs. As this includes the environmental assessment of sites selected for further engineering study, the program ensures the liaison between the environmental programs and the interim products of the other disciplines. This allows the other environmental programs to pursue their intermediate and long-term goals without significant interruption. In the future, this program will serve as a coordination point for environmental field personnel who are assigned to the pipeline section management organizations.

1.2.2.5 Environmental Planning - This program will ultimately coordinate the development of the Environmental Protection Plans which will be contained in the NTPAs. The initial task of the program is to evaluate the environmental programs in their achievement of intermediate and long-term goals.

1.2.2.6 Information Management - This program ensures that the Environmental Engineering document system is serving the needs of the project, and that the other environmental programs are maintaining the integrity of their distributed environmental information. It also serves as the technical contact for agency environmental information systems.

1.2.3 NWA/PMC Interface

Environmental Engineering utilizes many experienced consultants and contractors who are hired by the PMC. The PMC Environmental Engineering Manager manages the consultants/ contractors on a day-to-day basis as directed and monitored by the NWA Manager-Environmental Engineering.

1.3 INTERACTION WITH FEDERAL AND STATE AGENCIES

1.3.1 Informal Technical Discussion

NWA encourages informal technical discussions between Environmental Engineering and govermental personnel. Since the origin of the project, this approach has provided the framework for a valuable exchange of technical input and opinions. A direct result of this approach has been the avoidance of surprises when formal positions are made known. An indirect result has been an increased concentration on issues which must be addressed in the NTPAs.

1.3.2 Establishment of the Working Groups

NWA, the Office of Federal Inspector (OFI), and the State Pipeline Coordinator's Office (SPCO) have agreed to institutionalize these informal technical discussions. Three "Working Groups" have been established, one for Biological Programs, one for Physical Programs, and one for Civil Programs. Each Group consists of an NWA, a PMC, an OFI, and an SPCO representative. The Groups meet approximately every six weeks for approximately three days.

These sessions are give-and-take sessions between the working staff of major project participants. An agenda is agreed upon prior to the meetings.

A feature common to all three Working Groups is the development and tracking of Environmental Control Schedules. The Schedules are actually developed by NWA and the PMC, but there are identified periods for agency review of draft technical papers. These technical papers are circulated within the Working Group prior to formal transmittal between NWA and the agencies, and comments on the papers are received in a similar manner.

1.3.3 Review of Environmental Protection Plans

It is NWA's intention that these Working Groups be a forum for agency input into the development of the Environmental Protection Plans. The "1.6.1 plans" required by the draft project stipulations are being addressed in the present Working Groups.

1.4 SUMMARY OF THE ENVIRONMENTAL ENGINEERING ACTIVITIES

1.4.1 Biological Programs

NWA has been active in biological field studies since 1976. The early work concentrated on the "Delta South" portion of the route to support Alcan's environmental case in the Federal Power Commission competitive hearings. In 1978, the field studies were expanded to include the "Delta North" portion of the route. By the end of 1979, sufficient environmental data had been collected to support the design basis included in the FERC filing. Field studies during 1980 and 1981 will complete the environmental data needed to support in the final design phase of the project. In 1982, NWA will initiate the field monitoring aspects of the Biological Programs, which will continue through the construction and the initial operation of the gas line system.

The Biological Programs are described in detail within Section 2.0 of this Manual.

NWA has adopted a systematic approach to the conduct of its Biological Programs, which can be summarized as follows:

- Analyze the potential impact of project actions.
- Identify the environmental information needed to develop protection strategies.
- Organize and evaluate the information currently in existence, including interviews with knowledgeable individuals and a search for unpublished data.
- Conduct field studies to fill the information gaps.
- Integrate protection strategies into the engineering designs, constructon schedules, and construction methods.
- Monitor the success of the protection strategies.

The results of the Biological Programs are reflected in the interim products of the design and planning disciplines. Certain route modifications have been made primarily for environmental reasons, general construction schedule restraints have been identified, and those construction

1.4.1 Biological Programs (Continued)

methods which raise environmental issues are being addressed in a variety of project field programs.

1.4.2 Physical Programs

Physical Programs has been established as a primary technical point of contact between SPCO and OFI environmental engineers and the project effort. NWA and PMC environmental engineers work closely with them to identify the key air, water, and wastewater issues, and to jointly explore appropriate solutions. Early recognition of the experiences of other arctic endeavors is an important step toward achieving an environmentally effective design for the project.

The Physical Programs are identified and discussed in detail within Section 3.0 of this Manual.

Physical Programs has to date focused on the life support systems incorporated in the design basis included in the FERC filing, and on the preparation of Environmental Control Schedules for activities during the preconstruction and construction periods.

During the final design phase, detailed and comprehensive plans will be developed for all project activites that have implications to the major Physical Program categories.

1.4.3 Civil Programs

The President's Decision requires that NWA "...provide for the timely integration of environmental mitigation and restoration practices with the activity which creates the need for the restoration or mitigation."

Environmental participation in the design and planning of the project is carried out under all of the environmental programs. Environmental support of the design basis included in the FERC filing has been provided through the Biological and Physical Programs. During the final design phase, however, Environmental Engineering will initiate "tailored" civil programs to more specifically address the project activities which raise the majority of environmental issues.

Certain studies related to restoration have been conducted previously by NWA. Programs of this nature will become the responsibility of Civil Programs.

1.4.3 Civil Programs (Continued)

The Civil Programs are discussed in general terms within Section 4.0 of this Manual.

1.5 INTERACTION WITH PROJECT DISCIPLINES

1.5.1 Evaluation of the Major Milestone Schedule

The Major Milestone Schedule shows completion dates for final designs and construction plans. The products, at that point, will have incorporated the results of the environmental programs, and should be environmentally acceptable for NTPs as written.

The major milestones represent a culmination of: the application of project criteria, the elimination of alternatives, and the commitment of resources to site-specific designs. During the processes leading to those milestones, Environmental Engineering must provide timely input to the engineers and planners so that their products are not delayed. This means that the baseline data acquisition phases of the various environmental programs must be virtually completed by the fall of 1981.

1.5.2 Development of Environmental Control Schedules

Each of the design and planning disciplines develops a schedule for the production of its final products. The typical schedule will contain a series of interim products, and may contain a directional element, e.g., progression from north to south in accomplishing the next level of design. The schedules are dynamic, as they are impacted by project events and the results of field programs. The schedules may be primarily for communication with management, consequently, the schedules may not describe the detailed processes leading to an interim product.

The disciplines' schedules are not, however, detailed enough for the planning of environmental activities. Environmental Engineering has therefore undertaken the production of Environmental Control Schedules, which plan out the interaction of the environmental group with the other disciplines, and which indicate specific environmental input to the design and planning process.

The result is a series of control points where, for example, the discipline can efficiently incorporate the protection strategies required to make a design environmentally acceptable, or where, as another example, Environmental Engineering can justify the commitment of personnel resources to a more exhaustive assessment of a specific design or plan.

1.5.3 Implementation During Final Design Phase

The Environmental Control Schedules provide a "roadmap" for project interaction on environmental issues. They cannot, by themselves, perform the following necessary functions during the final design phase: (1) ensure that the interaction is occuring in an efficient manner, (2) contain the specific input from Environmental Engineering, and (3) establish policy for resolution of conflicts.

The interaction is a responsibility shared by all the disciplines, not just Environmental Engineering. All of the affected NWA and PMC Managers and Directors are responsible for soliciting and incorporating environmental input, and for ensuring that the design and planning contractors do likewise.

The specific environmental input is relayed in a variety of forms. Much of the input will occur orally in meetings and planning sessions. Written input is contained within the system of environmental documents, which underlines the need for maintaining their integrity. Finally, the NTPAs will contain the results of the input via the Environmental Protection Plans.

Overall policy guidance is provided by the President's Decision, and its requirements to avoid "trade-offs" between environmental issues and economics sets a high standard of performance.

In the daily business of project planning, NWA and the PMC will encounter many situations where the standard is put to a test. The evidence shows a consistent positive response as demonstrated by the close technical contact between the project's environmental staff and the agencies, by the successful operation of the current environmental programs, and by the results of the design basis included in the FERC filing. That positive response will continue into the final design phase.

1.5.4 Notice-To-Proceed Applications

The President's Decision requires NWA to "...prepare a plan of operation which integrates environmental protection with the proposed schedule of construction and operations...". NWA will comply with this requirement via the Notice-To-Proceed process outlined in the draft DOI Stipulations (Section 1.2). NWA will apply for permits in a systematic fashion for each pipeline spread and major activity within each spread (e.g., material site development, civil construction, stream crossings,

1.5.4 Notice-To-Proceed Applications (Continued)

pipeline construction, hydrotesting, etc.). Each application will include a detailed design of the proposed project action, an environmental assessment of the proposed action, and a schedule for the activity. The Environmental Protection Plans will be provided as this environmental assessment. They will not only assess the impact of the activity, but will demonstrate the incorporation of environmental protection strategies into the activities under application.

1.6 PROJECT ENVIRONMENTAL MILESTONES

1.6.1 Project Origin to Presidential Decision

- Alaskan Arctic Gas Pipeline Company and Canadian Arctic Gas Pipeline Company jointly filed with the Federal Power Commission a proposal to transport Alaska Natural Gas through a 48-inch pipeline across Canada -- March 1974.

- El Paso Alaska Company filed with the FPC its proposal to transport Alaska natural gas through a combined pipeline/cryogenic tanker system -- September 1974.

- Alcan Pipeline Company filed with the FPC a proposal for an overland 42-inch gas transportation system across Canada -- July 1976. The general route proposed by Alcan had been recommended earlier by FPC staff in reviewing alternates to the other competing proposals. Included in Alcan's filing was the Environmental Report for its system.

- Alcan biological field studies initiated -- July 1976.

- FPC FEIS on the Alcan Pipeline Company proposal issued -- September 1976.

- Congress passed Alaska Natural Gas Transportation Act, establishing expedited process for reaching a decision on the competing proposals -- October 1976.

- Alcan Pipeline Company filed with FPC its 48-inch express line alternative for delivery of Alaska gas. Included in the filing was an Environmental Assessment for the revised project -- March 1977.

- FPC issued its recommendation to the President. Commissioners were evenly split between the Alcan proposal and that of Arctic Gas consortium -- May 1977.

- Presidential Decision selects the Alcan project for conditional certificate -- September 1977.

1.6.2 Presidential Decision to FERC Filing

- Northwest Alaskan (previously Alcan) Pipeline Company established -- January 1978.

1.6.2 Presidential Decision to FERC Filing (Continued)

- Land use permit applications filed by NWA with company-authored environmental restrictions -- April 1978.
- Fluor Engineers and Constructors, Inc. retained as PMC -- April 1978.
- 1978 field programs in fisheries, endangered species, raptors, sandhill cranes, archaeology, and erosion control.
- 1979 field programs in fisheries, waterbirds, sandhill cranes, endangered species, raptors, archaeology, and restoration.
- DOI reroute environmental evaluations -- August/December 1979.
- Biological and Physical Programs fully established -- November 1979.
- "Environmental Engineering 1980 Planning" issued -- December 1979.
- 1980 field programs in all fish and wildlife areas, archaeology, revegetation, and visual resources.
- Prevention of Significant Deterioration application filed with EPA -- March 1980.
- Working Groups established -- March 1980.
- Civil Programs fully established -- June 1980.

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2.0 BIOLOGICAL PROGRAMS

2.1 FISHERIES

2.1.1 Background

Construction and operation activities of the chilled gas line may directly impact fish and fish habitat at several hundred locations. Project activities have the potential to disrupt the physical/chemical environment on which fish are dependent, to the short- or long-term detriment of fish and their habitats.

Major categories of potential impact include:

- Immediate damage to existing fish stocks or recruitment caused by direct, induced mortality such as may result from blasting, toxic substances, or sediment deposited over eggs.

- Delayed damage to existing fish stocks or recruitment caused by secondary or tertiary events acting against the population; such as increased sediment that may reduce food availability and subsequently reduce fecundity.

and, as impacts to fish habitat:

- Short-term rendering of a portion of available habitat temporarily unsuitable for any reason; (for example temperature, dissolved oxygen, pH, turbidity, or other parameters) for the species or life history stages that otherwise would utilize it.

- Long-term rendering of a portion of available habitat "permanently" unsuitable by eliminating the type of habitat, by obstructing access to it, or by inducing unlivable conditions (either continuous or intermittent), for the species or life history stages that otherwise would utilize it.

Project activites are being structured to avoid significant impacts on fish and their habitat.

2.1.2 Objectives

The major objectives of NWA's remaining fisheries research are to: (1) complete baseline data collection, supplemental to existing information, on fish and their habitats in waters

2.1.2 Objectives (Continued)

potentially affected by the project. These data include species and life history stages present, as well as key fish areas including, but not limited to spawning beds, rearing areas, overwintering areas, and major fish migration routes, (2) continue to evaluate and integrate both baseline and problem-related fisheries information into design, scheduling, construction, and operation of the gas line where the project and fisheries interact, such as route and facility locations, and site-specific crossing design.

2.1.3 Synopsis of Previous Work

The NWA fisheries program was initiated with four studies during 1976. The first study (Van Hyning, 1976a) was a preliminary visual examination of aquatic systems crossing the Alaska Highway between Delta Junction and the Border. Observations were made on the general characteristics of each waterbody and were supplemented by existing literature and interviews with ADF&G personnel familiar with the area.

The second study completed in 1976 was a fisheries survey of the Tanana River tributaries along the gas pipeline route (Valdez, 1976). The study investigated existing fish populations in streams and lakes adjacent to or traversed by the pipeline corridor between Delta Junction and the Yukon Border. In addition, physical data and macroinvertebrates present were also recorded. Unpublished information from local residents and employees of ADF&G was also included in this report.

The third report produced in 1976 dealt with fish species present and their periods of sensitivity in fish streams crossed by the proposed gas pipeline (Anonymous, 1976). This study directly incorporated data from JFWAT along that portion of the proposed route where it paralleled the TAPS project, and fish survey data collected along the proposed route from Delta Junction to the Yukon Border (Valdez, 1976). Critical periods were determined by fish presence.

The final report in 1976 dealt with salmon in the upper Tanana River (Van Hyning, 1976b). Although salmon are known to be abundant in the lower Tanana River and its tributaries, little specific information was available on the spawning areas. However, aerial and ground surveys during the estimated peak of spawning revealed that few salmon spawned between Delta Junction and the Canadian border.

2.1.3 Synopsis of Previous Work (Continued)

During 1977 and 1978 two studies were conducted. The first study was a fall and winter fish study on the upper Tanana River drainage (Van Hyning, 1978). This study was conducted with visual observations from the ground and air and standard methods were used to collect chemical and biological data. This was the first overwintering study conducted for this area. No significant overwintering areas were discovered in any tributaries to the Tanana River.

The second study completed in 1978 was a field validation of fish streams between the Canadian Border and Delta Junction (Anonymous, 1978). Streams not previously known to support fish were investigated. This report presented a summary of stream, physical, chemical, and fish data through the use of existing literature and field surveys.

An integrated program of studies was initiated in 1979 to more completely describe the fisheries along the proposed route centerline at various seasons of the year. The first study dealt with fishery resources during the winter (Chihuly, et al. 1979a) and the second study investigated spring fishery resources (Chihuly, et al. 1979b). The other two investigations were fall and early winter studies which focused on streams that needed additional study, as identified in the previously conducted winter and spring studies (Chihuly, et al. 1980a and 1980b). These four studies combine known fishery informaton with new field data to equalize the amount of fishery resource information along the entire pipeline route. This information, contained in the aforementioned reports, has been correlated and synthesized into a summary report (Chihuly, et al. 1980c).

2.1.4 Work in Progress

The 1980/1981 fisheries program will have two parts: (1) field investigations to continue baseline data gathering, and (2) consulting services of fisheries biologists to fully implement integration of fisheries information into project final design and schedules.

2.1.4.1 1980/1981 Fisheries Field Investigation - As described in Section 2.1.3 and in the existing literature, considerable information is currently available for company and agency use in making sound decisions affecting fisheries. However, not all areas affected by the project have this level of information, and therefore additional studies are being conducted as new needs are identified.

2.1.4.1.1 Objectives of the Field Investigations - The 1980/1981 field studies are to investigate the presence and species/size composition of fish in streams potentially affected by the project where available fishery data are inadequate for the full development of environmentally acceptable project final designs and schedules.

Observations and sampling results of any key habitats such as spawning, rearing, or overwintering areas are to be recorded, as are any observed migrations.

Observations of any stream features or conditions affecting fish utilization of habitat such as impassable natural or artificial barriers are to be recorded.

2.1.4.1.2 Project Status: Centerline - The proposed centerline route for the gas pipeline has been modified in consideration of additional geotechnical, environmental and engineering field data, government concerns,and refined analysis. The revised route sheets have been provided to the consultant.

2.1.4.1.3 Project Status: Facilities - Potential material sources have been delineated in the Exploration Material Site (EMS) Program. These EMS sites are of greater areal extent than the ultimately mined sites; mining plan boundaries will be developed after environmental and technical field information have been gathered. (NOTE: New regulations and guidelines affecting floodplain sites have been provided to the consultant.)

Compressor station locations have been identified for the revised route. Sites have received preliminary environmental analysis, and field investigations will be conducted when and where necessary.

Access road locations are under development. Existing access roads including those of TAPS will be used; from Delta to the Canadian border, new access road construction will be necessary. Preliminary access road locations from Prudhoe Bay to the border have been made available to the consultant for analysis and necessary field work.

Preliminary camp and airstrip locations will be provided to the consultant. Three camps are planned for the Delta Junction to the Canadian border segment of the project. Preliminary locations of other project facilities, such as pipe storage yards, will be provided to the consultant as they become available.

2.1.4.1.4 Description of Services to be Performed - A professional consultant will define, develop, and implement the Fisheries Field Program. To fulfill the objectives of the field investigations, the consultant will review the adequacy of existing fishery data for all streams and waterbodies potentially affected by the project. Subsequently, areas of these streams and waterbodies for which existing fishery data are inadequate for final pipeline designing and scheduling will be investigated. Services will specifically include the following:

- Consultant will review project information supplied by the Project Management Contractor (PMC). This information will include color aerial stereo pair photographs, route sheets, and any other information on the pipeline itself or its related facilities, such as material sites and access roads.

- Consultant will review all pertinent fishery data, both project sponsored and any other sources including published literature and unpublished government information. Pertinent project documents will be provided to the consultant.

- Consultant will utilize the expertise of project and agency personnel, as needed, in the development of the field investigations. The technical, biological, and engineering expertise available will be necessary for evaluating proposed project activities and potential fisheries impacts.

- Consultant will identify by appropriate means the streams and waterbodies for which seasonal fishery data are inadequate for final pipeline design and schedules, and which therefore require field investigations.

- Consultant will develop, report, and employ defensible physical and/or biological criteria by which the stream selections are made.

- Consultant will develop plans to investigate the above streams and waterbodies where and when seasonal use data are inadequate.

- Consultant will conduct the investigations in a professional manner and comply with all regulations and permit requirements.

2.1.4.1.4 Description of Services to be Performed (Continued)

- o Consultant will record biological, chemical, and physical data in a form compatible with AIMS input format and content.

- o Results for each stream or waterbody investigated will include at the minimum:

  - absence or species/size composition of fish;
  - observed fish migrations or movements;
  - key fish areas such as spawning beds, rearing areas, overwintering areas, and major migration routes;
  - any unique or unusual stream features or conditions affecting fish utilization of habitat; and,
  - physical and chemical water data;

- o Consultant will transmit copies of all field data forms to the PMC within two weeks of completing any seasonal phase of field work.

- o Consultant will prepare a report of each seasonal investigation to include:

  - narrative text of standard scientific format describing methods, materials, techniques, observations, results, and any other information pertinent to the study;
  - tables, figures, maps, and illustrations as needed. A tabular presentation of the overall results will be included; and,
  - a suitable abstract.

2.1.4.2 Fisheries Consultant - The services of fisheries biologists are being obtained to work in close association with hydrology, civil, pipeline design groups and fisheries field groups to assure fisheries protection in all fields of design and scheduling refinement.

The biologists' major functions will be to:

- o Review project information supplied by the PMC. This information will include color aerial stereo pair photographs, route sheets, and any other information on the pipeline itself or its related facilities such as material sites and access roads.

2.1.4.2 Fisheries Consultant (Continued)

- Review all pertinent fishery data, both project-sponsored and any other sources, including published literature and unpublished government information. Pertinent project documents are provided to the consultant.
- Utilize the expertise of project and agency personnel, as needed, to identify fisheries/construction problems experienced in Alaska by TAPS, Division of Highways, or other construction activities.
- Participate in crossing design and technique development to relate site-specific features of each crossing to total crossing design.
- Assist in schedule development to derive best feasible stream crossing times.
- Participate in mining plan development, especially floodplain sites.
- Participate in civil and erosion control design.
- Pursue fisheries concerns related to any aspect of the project.
- Have overall input into all portions of the project affecting fisheries to assure fish passage and protection.

2.1.5 Mitigation Approach

The most effective mitigation strategy is total avoidance. Where this can not be done, effective mitigation for fisheries is a combination of timing, location, and techniques. The selection of timing, location, and techniques is based on knowledge, not only of fish and their habitat (both in biological and physical terms), but also of the pipeline project.

Where spatial or temporal avoidance cannot be achieved, the following basic criteria guide the development process from baseline information to final site-specific mitigation measures:

2.1.5 Mitigation Approach (Continued)

- Species Selective - Some species are more "important" from an ecological, commercial, subsistence, or recreational standpoint than others (e.g., salmonids are usually more valued than sculpins). The role of each species in each aquatic ecosystem must be evaluated individually.

- Life History Stage Selective - Some life history stages of fish are more sensitive to disturbance than others. In conjunction, different species tie their life cycles to the climatic seasons differently. These sensitive stages are associated with key habitat (e.g., spawning and overwintering areas). Avoidance of key stages and habitat is a major component of mitigation.

- Localization - This is modified avoidance by attempting to reduce the quantitative exposure of fish to the disturbance.

- Duration - Any disturbance and the effects of that disturbance should be short term.

NWA recognizes the need to minimize the detriment to sensitive arctic ecosystems. This consideration is one of the most important assets of the route selected for the gas line. Some of the sensitive areas that exist along the route have already been subjected to prolonged disturbance and inventory surveys, the latter having occurred primarily along the oil pipeline corridor. Hence, the proximate ecosystem characteristics and extent are fairly well documented, as is their susceptibility to pipeline construction and/or highway effects.

NWA uses the experience gained from TAPS construction and environmental personnel familiar with pipeline construction in Alaska. These personnel have been working in close cooperation with state and Federal regulatory agencies.

NWA has initiated a thorough program for mitigating ecological impacts by which relevant field data are being obtained, effective mitigative techniques are being developed and strong management guidance is being provided to ensure that the techniques are properly implemented. With respect to implementation, NWA will condition its relationships with construction contractors in a manner that will promote compliance with environmental stipulations and will educate all personnel to the consequences of failing to satisfy these requirements.

2.1.5 Mitigation Approach (Continued)

Using the above criteria, the first step toward mitigating impacts on fish species has been detailed preconstruction baseline studies appropriate for developing adequate stream crossing times, locations and techniques on a site-by-site basis. Identification of streams along the route as to fish presence by species and size composition coupled with a knowledge of sensitive areas and times of fish life history (such as spawning or overwintering periods), is essential to determining mitigation techniques necessary to meet fish passage and protection criteria.

As the above studies develop new information, the results are applied to the problem of determining both general crossing techniques and site-specific designs. Many fishery problems at stream crossings can be overcome by proper timing of construction. Sensitive and critical times for fish streams are represented on the construction planning "March Charts." Streams that freeze solid are best crossed during winter, avoiding flowing water. Crossing of streams that are dry in late summer produces little erosion. However, the majority of interior streams must be crossed wet for they flow continually. These crossings will be planned so as to avoid key times, e.g., spawning and overwintering periods.

Settling basins, diversions, flumes and a variety of other techniques will be used to minimize sediment input to streams.

A source of sediment occurs when pumping a wet ditch to reduce the water level before lowering the pipe. Pump outfalls will be selected to avoid direct discharge to fish streams or lakes. Effluent high in suspended solids will be discharged to settling basins or onto vegetated areas to filter out fine particles.

Fish stream crossing structures must pass fish. Culverts will be sized and positioned adequately to allow fish passage. Bedding requirements of at least six inches below the thalweg will be maintained and damming and channel alteration in fish streams will be minimized. Where such activities are necessary, they will be undertaken during non-critical times.

Plans for stabilization of all stream banks will be developed prior to beginning the crossing. Hydraulic changes involving fish streams will be minimized. Streams will be crossed at right angles to the banks wherever possible. In areas where hydraulic changes cannot be avoided, natural hydraulics will be reestablished to the maximum practicable extent.

2.1.5 Mitigation Approach (Continued)

Blasting for trench excavation and site preparation will be necessary for much of the route. (An information review and analysis of blasting and its effects on aquatic organisms is continuing.) Blasting techniques and schedules are being developed to minimize adverse impacts to fish populations and habitats.

Project studies are being undertaken to predict the likelihood of induced aufeis or intragravel flow changes. In most cases, minor route deviations will successfully avoid critical areas or reaches in streams.

Restrictions on personnel fishing near the pipeline route will be established in conjunction with the Alaska Department of Fish and Game.

Programs have been initiated to reduce accidental spillage of toxic materials. Cleanup teams and facilities will be trained and stationed at each camp. A handbook describing cleanup techniques will be prepared.

2.1.6 Literature Cited

Anonymous. 1976. A list of fish streams crossed by the proposed Alcan gas pipeline in Alaska, including fish species present, and periods of sensitivity. Bio/West, Inc., Logan, Utah. 21 p.

Anonymous. 1978. Field validation of fish streams between the Canadian Border and Delta Junction for Northwest Alaskan Pipeline Company. Dames and Moore, Anchorage, Alaska. 15 p.

Chihuly, M., D. Ward, P. Craig and R. McMillan. 1979a. Winter fisheries survey and provisional list of waterbodies along the Alaskan gas pipeline route (Prudhoe Bay to the Yukon Territory) proposed by Northwest Alaskan Pipeline Company. LGL Ecological Research Associates, Inc., Fairbanks, Alaska. 274 p.

Chihuly, M., D. Ward, P. Craig, R. McMillan, R. Morrison. 1979b. Spring fisheries survey and provisional list of waterbodies along the Alaskan gas pipeline route (Prudhoe Bay to the Yukon Territory) proposed by Northwest Alaskan Pipeline Company. LGL Ecological Research Associates, Inc., Fairbanks, Alaska. 211 p.

2.1.6 Literature Cited (Continued)

Chihuly, M., D. Ward, R. McMillan, R. Morrison, T. Olson, A. Sekerak. 1980a. (Draft) Fall fisheries survey and provisional list of waterbodies along the Alaskan gas pipeline route (Prudhoe Bay to the Yukon Territory) proposed by Northwest Alaskan Pipeline Company. LGL Ecological Research Associates, Inc., Fairbanks, Alaska. 178 p.

Chihuly, M., R. McMillan, R. Morrison, T. Olson, A. Sekerak. 1980b. (Draft) Early winter fisheries survey and provisional list of waterbodies along the Alaskan gas pipeline route (Prudhoe Bay to the Yukon Territory) propoed by Northwest Alaskan Pipeline Company. LGL Ecological Research Associates, Inc., Fairbanks, Alaska. 153 p.

Chihuly, M., R. McMillan, R. Morrison, T. Olson, A. Sekerak, R. Neterer and J. Burr. 1980c. Fisheries resources along the Alaskan gas pipeline route (Prudhoe Bay to the Yukon Territory) proposed by Northwest Alaskan Pipeline Company. LGL Ecological Research Associates, Inc., Fairbanks, Alaska. Two volumes. 665 p.

Valdez, R.A. 1976. Fisheries survey of Tanana River tributaries along the gas pipeline route. Bio/West, Inc., Logan, Utah. 58 p.

Van Hyning, J.M. 1976a. A reconnaissance of the fish resources of the Northwest Pipeline Corporation Corridor-Alaska Border to Delta Junction. Report to Gulf Interstate Engineering Company. Fairbanks, Alaska. 28 p.

Van Hyning, J.M. 1976b. Salmon surveys of the upper Tanana River, 1976. Prepared for Gulf Interstate Engineering Company, NERKA, Inc., Fairbanks, Alaska. 31 p.

_____. 1978. Fall and winter fish studies on the upper Tanana River drainage. Aquabionics, Inc., Fairbanks, Alaska. 77 p.

2.2 ENDANGERED SPECIES

2.2.1 Background

Two subspecies of peregrine falcon, the Arctic peregrine falcon (Falco peregrinus tundrius) and the American peregrine falcon (F.p. anatum), are protected endangered species under the 1973 Endangered Species Act (as amended). The falcons are also protected by DOI Stipulations. This is the only species with this status along the pipeline route.

Of wide distribution, the peregrine falcon has been driven from large expanses of its native range because of human activities. Peregrines have been declining in numbers world-wide since the 1950's; by the mid-1960's, there were no nesting peregrines east of the Rockies. The peregrine population has decreased 40-60 percent in Alaska in the last 20 years (Anonymous, 1978a). The majority of the data suggests that the effects of chlorinated hydrocarbons are the principal factor influencing the decline of peregrine populations.

Peregrine falcon nesting sites are usually on a rocky ledge on a high cliff. Some of these sites identified along the pipeline route are at Sagwon Bluffs and vicinity (a BLM area of critical environmental concern), and Franklin Bluffs, both along the Sagavanirktok River. Peregrines also nest in the Bluffs along the Tanana River and other similar areas along the pipeline route.

River bluffs, upland cliffs, and tors can be disturbed by various types of human activity. Disturbance during nesting can result in: (1) abandonment or failure of a nesting attempt, (2) decreased clutch size, (3) reduced hatching success, (4) a reduced number of fledglings, (5) a higher post-fledging mortality, and (6) failure to return to the disturbed site, even if young fledge successfully (Kessel, 1978). Hence, disturbance can be a causative factor for decreasing peregrine falcon reproduction.

Because of its endangered status and its sensitivity to disturbance, NWA has initiated special management techniques and restrictions for its protection throughout preconstruction, construction, and operation phases of the project.

2.2.2 Objectives

The major objectives of NWA's continuing peregrine research are to continue: (1) to identify nesting habitat of peregrines and their status, (2) to update information on the habits and behavior of peregrines, (3) to refine protection strategies, and (4) to identify future monitoring studies.

2.2.3 Synopsis of Previous Work

Several studies of peregrine falcons have been conducted along the pipeline route by NWA, contractors, and government agencies.

Prior to and during construction of TAPS, raptor surveys and monitoring were conducted for all of the important peregrine habitat areas within the alignment. To assure adequate protection of peregrines, NWA initiated additional studies to update and supplement existing data. In 1977, investigators from the University of Alaska conducted information reviews and limited field observations (Kessel, 1978; Spindler and Kessel, 1977). Intense survey efforts were conducted in spring 1979 by Roseneau and Bente (1979).

Literature review has preliminarily addressed peregrine life history; however, further review of ongoing and existing studies on peregrine behavior, especially hunting habitat preference, is required. Additional studies under way or planned to collect data on the peregrine are outlined in Section 2.2.4 under "Work in Progress" and in the Environmental Control Schedule for Biological Programs.

2.2.4 Work in Progress

The 1979 field studies determined the status of known and historical peregrine nesting sites along the pipeline. Some new and potential sites have also been identified.

The 1979 survey conducted by Roseneau and Bente (1979) provided a successful starting point for continued preconstruction monitoring of the status of peregrine falcon nest sites along the pipeline corridor. Preconstruction monitoring is continuing in 1980.

NWA has continued to retain Mr. David Roseneau, a well-respected raptor specialist, to assist in the development of protection strategies and future monitoring studies. Mr. Roseneau is a member of the Alaska Peregrine Falcon Recovery Team (APFRT). This interagency body, established pursuant to the Endangered Species Act of 1973, is charged with preparing recovery plans and establishing protective restrictions. Mr. Roseneau also prepared NWA's draft Biological Assessment for Endangered Species and Associated Raptors (Northwest Alaskan Pipeline Company, 1979).

Specific studies underway or currently planned for 1980 are outlined below. Schedules for implementation of the tasks are also indicated.

2.2.4.1 Work Scope - The following work scope was developed with PMC's peregrine consultant, Mr. David Roseneau. It also includes consideration of the IFWTF revised study proposals (Anonymous, 1978b).

The 1980 raptor studies are a continuation of work done by NWA to date. It is anticipated that work will continue throughout preconstruction and construction phases of the project. The work planned for 1980, however, will consist of the following tasks that address both peregrines and nonendangered raptors:

- Task 1 - Pre-leaf-out Field Survey - Aerial, fixed-wing survey of the entire route and ancillary facilities particularly material sites, access roads, and compressor stations were conducted in spring prior to leaf out, and before all the snow is gone to facilitate location of tree nests. Agency input was utilized prior to defining the study area. The entire line was flown, but concentrated efforts were expended between the Yukon River and the border.

  This task emphasized the identification of nesting habitat utilized by raptors other than peregrines. The contractor, however, was also instructed to record the locations of previously unidentified peregrine nests. The report is now being prepared.

- Task 2 - Information and Status Review - A continuing review of existing published and unpublished reports, ongoing studies, and interviews with biologists involved in peregrine behavior studies with emphasis on peregrine falcon hunting. This information will be combined with the results of NWA's studies to date to determine the present status of the peregrine along the proposed route. Also, it will be determined what additional studies or work is required to provide adequate protection to these species.

2.2.5 Schedule

The following preliminary milestones have been established:

Milestone		Date
o Task 1 -	Pre-leaf-out Survey Initiated	Apr. 10, 1980
	Draft report submitted	June 30, 1980
	Maps submitted	June 30, 1980
o Task 2 -	Information Review	June 15, 1980

2.2.6 Mitigation Approach

Disturbance to peregrines can occur as a result of pipeline system preconstruction, construction, and operation activities. It has been and continues to be NWA's approach to spatially and/or temporally avoid key wildlife areas. Using this approach, there should be no significant adverse impacts to peregrine falcons or their habitat.

The APFRT has recommended restrictions regarding the nesting sites of the two subspecies of peregrine falcons in Alaska (review draft of APFRT "Recovery Plan," June 1979). These recommendations have taken into consideration various recommendations from the literature regarding human activities near raptor nest sites as well as the opinions and advice of the APFRT and other experienced raptor biologists.

The following restrictions have been applied to past, current, and planned activities:

- Nesting Habitat - Includes all active or historical nesting areas.

  Surface - Prohibit all human activities, unless specifically authorized, within one mile of nesting cliffs between April 1 and August 15.

  Air - Prohibit all aircraft within 1,500 feet of the surface and within a horizontal distance of one mile of nesting cliffs between April 1 and August 15.

- Hunting Habitat - Includes those areas within fifteen (15) miles of the nesting cliff(s) which constitute peregrine falcon prey habitat.

  Prohibit ground surface disturbance on a large scale which could detrimentally and significantly alter prey habitat.

  Prohibit the use of pesticides and other environmental pollutants detrimental to the peregrine or its food source.

It should be noted that the APFRT recognizes that these guidelines may not apply in all situations, and that a qualified biologist should review specific cases and determine appropriate protective measures. It also should be clarified that the recommendations regarding hunting habitat, as listed above, do not preclude all disturbance within a 15

2.2.6 Mitigation Approach (Continued)

mile radius of a nest site; rather, they recommend against major changes such as draining marshes or otherwise significantly altering the surrounding habitat.

The clearing of the pipeline working width (approximately 100 feet wide), considering the horizontal separation of the clearing from nest sites and its total areal extent, would not constitute a major change in essential habitat for peregrine falcon. Disturbed area restorative measures are aimed at enhancing establishment of native plants, and ultimately, prey habitat.

Controlled blasting techniques will be used during trench blasting in sensitive areas to reduce noise levels. More closely defined sensitive periods and "Construction Windows" are being developed to aid in scheduling of activities to minimize impacts as depicted in the March Charts.

In addition, mitigative measures include the limiting of field surveys by the use of data from other surveys, including agency surveys, and the maintenance of confidentiality of information regarding specific nest site locations to avoid further impacts from the public at large (Northwest Alaskan Pipeline Company, 1979).

Additional peregrine falcon field surveys will be conducted during future nesting periods to determine the status of known sites and the presence of new nest sites. Construction in the proximity of nest sites and habitat will be monitored and post-construction surveys will be conducted to assess the status of the species.

2.2.7 Literature Cited

Anonymous. 1978a. Alaska's wildlife and habitat, Vol. II. State of Alaska, Department of Fish and Game. 74 p (plus maps).

Anonymous. 1978b. Proposed project related fish and wildlife investigations for the Northwest Alaskan Natural Gas Pipeline. A report prepared for the Executive Coordinating Committee (Draft) May 17, 1978. First Rev. May 23, 1978. Second Rev. November 29, 1979.

2.2.7 Literature Cited (Continued)

Kessel, B. 1978. Raptors and raptor habitat along the Alaska portion of the Northwest Alaskan Gas Pipeline corridor. Unpublished report prepared for Northwest Alaskan Pipeline Company. 24 p.

Roseneau D.G., and P.J. Bente. 1979. A raptor survey of the proposed Northwest Alaskan Pipeline Company Gas Pipeline Route: The U.S.-Canada Border to Prudhoe Bay, Alaska. May 31to June 7and July 7, 1979. Prepared for Northwest Alaskan Pipeline Company. 82 p.

Spindler, M.A. and B. Kessel. 1977. Wetland bird populations in the upper Tanana River Valley, Alaska. Unpublished report prepared for Northwest Alaskan Pipeline Company. 69 p.

Northwest Alaskan Pipeline Company. 1979. Biological assessment for endangered species and associated raptors. 5 p.

2.3 BIRDS

2.3.1 Wetland Birds

2.3.1.1 Background - Several areas of important wetland habitat are traversed by the proposed NWA pipeline route. These highly productive areas support a variety of species of wetland birds, including loons, grebes, waterfowl, cranes, shorebirds, and some raptors (Spindler and Kessel, 1977). Two of the most important wetland areas in Alaska are the North Slope coastal plain and the Tetlin-Northway wetlands near the Canadian border. Other lesser wetland habitat areas along the pipeline route include Shaw Creek Flats, Olsen's Lake Flats, Grayling Lake, Galbraith Lake, highland "potholes" east of Slope Mountain, and other scattered ponds along the route.

Pipeline construction and operation-related activities can have adverse impacts on wetland birds and their habitat. Of most concern is the long term impact of loss or alteration of wetland habitat from construction activity. Wetland habitat can be adversely affected either by direct loss from construction in a wetland, or indirectly by alteration from activities adjacent to wetlands, such as alteration of drainages which result in either lowering or raising the water level; excessive sedimentation of lakes or marshland; chronic input from oil spills or other pollutants.

Short-term disturbance can also have serious effects on breeding, nesting, feeding, or molting wetland birds. Disturbance from construction or other human activity during these critical periods can have more than short-term effects. For example, disturbance of most wetland birds in Alaska during nesting can be harmful because most do not try to renest even after the disturbance has ceased (Spindler and Kessel, 1977).

Due to the subsistence, sport, and ecological importance of those species which collectively make up wetland birds, a high priority has been given to minimizing adverse effects.

2.3.1.2 Objectives - The major objectives of NWA's wetland bird studies have been to collect sufficient baseline information on the location, use, and productivity of wetland habitat along the proposed route to define areas of particular concern and attempt to minimize adverse impacts by appropriate mitigative measures. Priority has been given to the study of unavoidable wetland areas.

2.3.1.3 Synopsis of Previous Work - A number of avian studies have been conducted on the North Slope coastal plain in recent years. These include work on the relationship of oil development to waterbirds and their habitats (USFWS, 1977), investigations into the tundra biome in the Prudhoe Bay Region (University of Alaska, 1975), and general wildlife studies.

In addition, other wetland areas along the TAPS pipeline have been studied. However, little data on the impact of development associated with TAPS on wetland bird populations exist. Study of these areas, including areas around the Yukon and Ray Rivers, Olsen's Lake, Grayling Lake, Galbraith Lake, Shaw Creek, and others, has been given a lower priority by NWA since most of the important areas can be avoided.

Waterfowl utilization of the Tetlin-Northway wetlands in the upper Tanana River Valley, make them nearly equal in productivity to the best wetland areas in Alaska. Studies of this area were conducted by the U.S. Fish and Wildlife Service in the late 1950s and early 1960s. King has continued to fly annual transects between Tetlin Lakes and Northway, and until 1977 conducted ground surveys in the Tetlin Lakes area. However, little was known about the utilization of the Tetlin-Northway wetlands outside of these areas prior to studies conducted by Spindler and Kessel in 1977 for NWA. Due to the importance of this area (now the Tetlin Wildlife Refuge), NWA has given it highest priority in initial wetland bird studies.

During May to November 1977, researchers from the University of Alaska, Institute of Arctic Biology (Spindler and Kessel) conducted field surveys of wetland birds along the proposed NWA pipeline route from Tetlin Junction to Little Scottie Creek to: (1) document habitat utilization, (2) estimate the size and composition of the wetland bird population, and (3) determine the wetland bird productivity of the wetland habitats near this portion of the proposed route. This survey concentrated on those wetlands most likely to be impacted by pipeline construction and is discussed by Spindler and Kessel (1977).

In April 1979, additional field studies were initiated by the University of Alaska, concentrating on the Scottie Creek, Desper, and Gardiner Creek areas. Concluded in fall 1979, this work provided additional emphasis on studies of seasonal densities and productivity relative to other environmental factors, in addition to providing documentation for a second year of seasonal utilization of the more significant wetlands along the pipeline, as identified in 1977. A final report for this work is expected in spring 1980.

2.3.1.4 Work in Progress - Upon completion of the Final Report for the 1979 wetland bird studies, adequate data will have been acquired for the Tetlin-Northway wetlands to more accurately assess potential impacts and define mitigating measures for this area. The recommendations received will be reviewed and analyzed for incorporation into facility location refinement, final design and construction scheduling. The 1980 program will include final studies of the remainder of the corridor.

Aerial survey data can be valuable in estimating the productivity of a wetland area relative to other areas surveyed by this method, and thus delineating the more productive habitat along the transect. NWA and USFWS are currently planning to conduct aerial surveys of wetland birds for this purpose. These studies will emphasize the identification of breeding, nesting, staging and feeding areas of shorebirds and waterfowl in order to delineate areas of concentrated use. The spring survey by USFWS is presently underway.

2.3.1.4.1 Work Scope - The following general work scope has been formulated by NWA as a basis for designing and planning 1980 wetland bird studies.

- Information Review - A review of previous studies along the pipeline corridor and adjacent areas. USFWS aerial survey data will also be reviewed and compiled.

- Research Design - Information from the Habitat Evaluation Program and other sources will be utilized to delineate wetlands, particularly those susceptible to siltation or water level changes, and to plan aerial and ground survey transects. Using the data collected from the previous Tetlin-Northway studies, parameters suitable as indicators of wetland productivity will be investigated.

- Field Studies - Aerial surveys will be conducted to estimate density and map distributions of populations in the major wetland areas along the corridor. Ground surveys may be conducted at certain locations. In addition to population estimates, physical parameters will be measured in an attempt to correlate with productivity. Two aerial and ground surveys are being considered: an initial breeding pair survey, and a brood survey. Field data sheets will be made available following surveys.

2.3.1.4.1 Work Scope (Continued)

- Tetlin-Northway Studies - Further field study in this area is not anticipated at this time. However, results of this year's work may suggest further studies. Sensitive wetlands will have to be delineated and the data incorporated into mitigation plans.

- Ongoing work will continue to present wetland data in a useful format for incorporation into protection strategies.

2.3.1.5 Mitigation Approach - The following recommendations (Kessel, 1978a) are being reviewed for incorporation into project final design. They were generated as a result of the 1977 wetland bird studies and are specific to the Tetlin-Northway wetlands (Spindler and Kessel, 1977). The sensitive time periods listed are from Kessel (1978a) and from the ADF&G's "Attachment B: Restriction on Sensitive Wildlife Areas," which were incorporated into the March Charts. Specific dates may vary on an annual basis.

- Open fields, ponds, marshes, and riverbars that thaw first in April and provide resting and feeding areas for migrating wetland birds should remain undisturbed during the migration period (April 15 - May 15; mid-July - mid-October) or when heavily used by birds.

- Disturbance of important nesting areas should be kept to a minimum during the nesting season (May 15 - August 10). Major nesting areas are the pond- and lake-dotted lowlands in the Tanana, Chisana, and Scottie Creek valleys, wherever more than 15 percent of each 1-mile-square block on 1:63,360 USGS maps is occupied by ponds, lakes, meandering streams, and marshes.

- Disturbance near lakes heavily utilized by molting waterfowl should be avoided during the flightless period of molt (July 1 - September 1). Important molting lakes in the Tetlin-Northway area include Midway Lake, Deadman Lake, Eliza Lake, Yarger Lake, Tlocogn Lake, Fish Lake (near Northway), Scottie Creek ponds #16 and #17, Chisana Pond #17A, and the Tetlin lakes (Tetlin, Gasoline, Fish, Dathlalmund, and Old Albert lakes). Aircraft, boats, and off-road vehicles should not be permitted, and even people on foot should not visit and walk near these molt lakes during the flightless period.

2.3.1.5 Mitigation Approach (Continued)

- Wherever possible, even the small, scattered upland ponds that are immediately adjacent to the pipeline route should be protected from disturbance during the migration and nesting season. The aggregate of these small ponds and lakes forms a significant reproductive unit, even though each individual pond has a relatively low productivity.

- Direct disturbance to waterfowl and other wetland birds will be minimal if construction and other human activities are kept at least 0.5 mile from wetland areas that are screened from view by vegetation, hills, etc. At least 1.0 mile distance should be maintained if they are visible from the pipeline and construction pad. Aerial activity of fixed-wing aircraft should be kept above 1000 feet vertical, or 1/2 mile horizontally above ground level (AGL) and at least above 1500 feet for helicopters. Such relatively low flight levels should be kept at a minimum during heavy wetland utilization periods.

- Care should be taken to avoid the destruction of wetland habitat, either directly or indirectly, since such damage will permanently affect the productivity of the area. Any operation which could alter water levels, water temperature, stream flow, turbidity, and otherwise be adverse to the maintenance of aquatic invertebrate populations and of emergent and submerged plants, may cause a decrease in wetland productivity. Specifically, erosion, oil spills, water diversions, channelizations, and stream crossings in any drainage leading to wetland areas should be minimized or avoided.

2.3.2 Sandhill Cranes

2.3.2.1 Background - The NWA pipeline route traverses an important sandhill crane migration route. Two-thirds of the world's population of lesser sandhill cranes pass through the upper Tanana River Valley in spring and fall, enroute to breeding and wintering areas, respectively (Kessel, 1979). Project activities could have an adverse impact on this population during these sensitive periods in their life history. In addition to migrating through the area, there is extensive ground utilization by resting and feeding cranes. Adverse impacts could include disturbance to migrating, resting, or feeding flocks from construction ground or aerial operations, and loss or alteration of habitat important to migrating cranes.

2.3.2.2 Objectives - The objectives of NWA's sandhill crane studies were as follows:

- To determine the numbers, timing, flight routes, and altitude of crane migration through the upper Tanana-Chisana River Valleys and determine predictability of these factors relative to climatic conditions.
- To determine the extent of ground utilization by cranes in the region during migration, and delineate specific ground sites used by feeding and roosting cranes.
- To document the effects of potential disturbance factors (such as aircraft, vehicles, noises, and people) on crane behavior, as opportunities allow such observation.
- To prepare recommendations to mitigate potential adverse effects of pipeline construction and operations-related activites.

2.3.2.3 Synopsis of Previous Work - Prior to 1976, and the initiation of field studies by NWA, little work had been done to characterize lesser sandhill crane migration and ground utilization in Alaska. In 1976, NWA contracted with Dr. Brina Kessel of the University of Alaska to initiate fall migration studies. Studies were continued in the fall of 1977, fall and spring of 1978, and spring of 1979. These three reports represent the first in-depth study of this important sandhill crane migration in Alaska. The spring 1979 work completes two contiguous years of field survey of sandhill crane migration.

More than 150,000 to 200,000 cranes migrate through the upper Tanana River Valley, primarily from the last week of August to the first week of October, and from the last week of April to the middle of May. Kessel (1977, 1978c, 1979) documents the route and timing of migration and describe variances caused by wind speed and direction, and other meteorological factors. Other components of the event are also discussed, such as flight conditions, adverse weather conditions and length of daylight. Ground utilization areas are mapped. Roosting sites were typically characterized by openness and included the following basic types: alluvial islands in wide, braided, glacial riverbeds; extensive wet meadows or those at pond, lake, or creek margins; open, low shrub meadows or bogs; and farm fields. Flocks also roosted on river aufeis (Kessel,1979).

2.3.2.3 Synopsis of Previous Work (Continued)

In addition to mapping migration routes and ground utilization areas, Kessel (1979) presents occasional observations regarding various human impacts.

2.3.2.4 Work in Progress - NWA feels the sandhill crane migration work conducted to date adequately meets the objectives outlined above by providing data for preconstruction planning and mitigation. Moreover, we feel it meets the objectives outlined in the "Proposed Project-Related Fish and Wildlife Investigations for the Northwest Alaskan Natural Gas Pipeline" proposed by the Interagency Fish and Wildlife Advisory Team (November 1979). Kessel's final report was completed in December 1979.

No further preconstruction field work is anticipated. Due to the short duration of sandhill crane presence in the area during migrating seasons, it is felt that avoidance of conflicts with the birds will be possible under all expected circumstances by carefully monitoring areas during migration periods.

NWA is considering further analysis to more fully define potential lesser sandhill crane habitat available in the region. In the past studies, only observed ground utilization areas were mapped. Kessel (1979) did address habitat preference, but no attempt has yet been made to map and quantify the amount of suitable habitat available to the migrating cranes. Results of the Habitat Evaluation Program could be utilized for this purpose.

2.3.2.5 Mitigation Approach - Recommended mitigative measures outlined as part of the Sandhill Crane Final Report are being reviewed by NWA and include the following (Kessel, 1979):

- Prevent alteration of habitat at crane roosting sites. Avoid mining or otherwise disturbing river gravel from known or potential riverbar roost.
- Exercise special caution to minimize possible disturbance interactions with cranes during main migratory periods (April 29 - May 15 and September 5 - September 26).
- Avoid disturbance at sites of ground utilization (roosting and feeding sites) while occupied by cranes. The following restrictions are recommended:

2.3.2.5 Mitigation Approach (Continued)

- Minimum vertical distance of 1,000 feet AGL for small fixed-wing aircraft.
- Minimum vertical distance of 1,500 feet AGL for larger airplanes or helicopters.
- Minimum horizontal buffer zone of 1/2 mile for light to moderate activity near roosts (e.g., automobiles, pick-up trucks, pedestrians).
- Minimum horizontal buffer zone of 3/4 mile for heavy equipment and large trucks.
- Avoid or delay blasting even beyond 1 mile of occupied roosts and while birds are in flight.

o Alert project aircraft to watch for flocks at 500 - 3,500+ feet AGL (to 6,000+ feet in early May) during migratory periods to avoid approaching flocks head-on at the same altitude any closer than 1/2 mile. From any other direction, maintain at least 1/4 mile distance. Helicopters and larger fixed-wing aircraft should increase these distances by 1/2 mile.

Variances to the above restrictions will be considered upon field verification that sandhill cranes are not in the area or based on specific terrain or other relevant factors, as determined by a qualified field biologist.

2.3.3 Upland Birds

2.3.3.1 Background - The major upland game bird species found in Alaska include willow ptarmigan, rock ptarmigan, white-tailed ptarmigan, ruffed grouse, sharp-tailed grouse, and spruce grouse. With the possible exception of the white-tailed ptarmigan, all of these birds have distribution ranges which include areas traversed by the proposed gas pipeline. The most widely distributed and frequently encountered species on the pipeline is the willow ptarmigan. The scarcest of Alaska's upland game birds is the sharp-tailed grouse. To varying degrees, all of these species are important subsistence and sport hunting species. Populations of ptarmigan and grouse are often typified by large periodic density fluctuations in response to natural ecological factors.

Although information on the general distribution and phenology of Alaska's upland birds does exist, data specific to the pipeline route are limited. Timing and location of breeding and nesting areas along the proposed route are only generally known. It appears, based on these data, that the sharp-tailed grouse may be the species most directly affected

2.3.3.1 Background (Continued)

by the pipeline, since one of the most dense concentrations of this species in Alaska occurs along the Alaska Highway and the proposed NWA route from Tanacross to Northway. Communal display grounds (leks) for this species are located along the highway in this area.

Although little specific data exists on upland bird high density use areas, some assessment of potential adverse impacts and mitigative measures can be made on the basis of general distributional and phenological data which do exist.

Upland game bird studies have not yet been conducted by NWA, although cursory observations of sharp-tailed grouse communal display areas were conducted by field crews during sandhill crane surveys. It has been generally held that impacts of pipeline construction and operation to upland birds will probably be minor. Long-term effects may in fact be beneficial in nature due to the creation of game bird habitat by the subsequently revegetated workpad and other disturbed areas.

2.3.3.2 Objectives - The major objectives of NWA's upland game bird studies are:

- To identify major habitat for the sharp-tailed grouse in areas subject to potential impact from the project.
- To delineate high and special use areas and time periods such as display grounds and nesting areas and periods (field work if necessary).
- To determine possible impacts of NWA pipeline construction and operation and to recommend mitigative measures.

2.3.3.3 Synopsis of Previous Work - During the summer of 1977 studies were undertaken by Kessel and Spindler in the upper Tanana River Valley to determine avian species density and habitat utilization of vegetation types typical of those to be crossed by the gas line in interior Alaska. Census plots were selected in each of the six major terrestrial woody avian habitats present. Bird censuses and analysis were conducted. This work ties into the determination of upland bird habitat.

2.3.3.4 Work in Progress - Dr. Kessel is presently completing a directed information review of available data on habitat and behavioral patterns of the sharp-tailed grouse. This study involves a review of literature, agency data, and technical interviews with agency biologists. From this review a determination of the flexibility and adaptability of the sharp-tailed grouse to anticipated effects of pipeline construction and maintenance will be made.

Dr. Kessel will suggest mitigation measures and will make a recommendation as to the need for field studies. If a decision is made that such studies are needed, a consultant will design and conduct such field studies.

2.3.3.5 Mitigation Approach - Specific mitigation techniques for upland birds are yet to be developed. As described above, however, data on distribution, abundance and phenology will be compiled and reviewed with respect to project operations to develop specific measures to be incorporated in the final design and schedule.

2.3.4 Raptorial Birds

2.3.4.1 Background - The NWA pipeline route traverses a wide range of known and potential nesting habitat for non-endangered raptorial birds. Virtually all of the raptor species common to the arctic or subarctic may be encountered along the pipeline route. Key habitats along the route include river bluffs, upland cliffs, and certain large nest trees near rivers and lakes.

The species of primary concern and of highest sensitivity are the large, long-lived raptors, including rough-legged hawk, golden eagle, bald eagle, osprey, and gyrfalcon. These carnivorous species are ecologically important due to their trophic position at the top of the food web.

Although raptor habitat has remained relatively stable in Alaska, population fluctuations do occur, both naturally as a response to prey abundance and other natural factors, and from human-induced changes to raptor habitat, particularly outside Alaska. Urban, agricultural, transportation, and utility development in Alaska are having cumulative adverse effects on these species, and loss of reproduction has occurred (ADF&G, 1978). One of the major causes of human-induced reproductive failure has been disturbance of nesting birds during critical stages of the nesting season. Other adverse effects occur with disturbance to other sensitive habitat, such as hunting grounds.

2.3.4.2 Objectives - The continuing objective of NWA's raptorial bird studies is to provide adequate data to assure protection from pipeline impacts to these sensitive, important species. NWA studies conducted to date have concentrated on the following specific objectives (Kessel, 1978b; Roseneau and Bente, 1979):

The objectives of the 1980 Raptor Studies Program are:

- To continue monitoring the status of known active and historical nesting sites and potential nesting habitat of gyrfalcons and other cliff-nesting raptors in, adjacent to, and near the NWA pipeline corridor, including proposed facilities and material sites.

- To locate any additional nest sites and potential nesting habitat of tree-nesting raptors in, adjacent to, and near the NWA pipeline corridor, including proposed facilities and material sites.

- To continue to evaluate the distribution, density, and seasonal status of raptors in, adjacent to, and near the NWA pipeline corridor, especially with respect to breeding chronology, hunting behavior, and habitat preference.

- To continue to evaluate the vulnerability of raptor nesting and hunting behavior and habitat to potential disturbance during preconstruction, construction, and operation of the NWA pipeline.

- To recommend and refine practical mitigative measures to minimize project-related adverse impacts to raptors, including preliminary dates which might be used to establish restriction periods on construction activities to protect breeding raptors.

2.3.4.3 Synopsis of Previous Work - Considerable work has been done on raptors along the NWA pipeline route, particularly from Prudhoe to Delta Junction. To assure adequate protection of raptors, NWA initiated additional studies to update and supplement existing data. In 1977, investigators from the University of Alaska conducted information reviews and limited field observations (Kessel, 1978b; Spindler and Kessel, 1978).

Studies conducted by NWA to date have adequately addressed some of the objectives listed above. Literature reviews have addressed many of the species of interest, although

2.3.4.3 Synopsis of Previous Work (Continued)

information on nesting chronologies of several species needs further development. A review of ongoing and existing studies on raptor behavior, especially hunting habitat preference, is required.

2.3.4.4 Work in Progress - The 1979 field studies have successfully determined the status of known and historical raptor nesting sites of many raptor species along the pipeline. Some new or potential sites have also been identified. Due to the differences in densities and nesting habitat utilized by the various species common to interior Alaska, there are discrepencies in the level of detail obtained for certain species by the 1979 survey. For instance, locating ground nesting species is more difficult using the survey methods employed to date and therefore data on these raptors may be incomplete. IFWTF (1978) has pointed out that the 1979 survey may also have missed certain tree nests due to the timing of this survey. An earlier aerial survey prior to leaf-out would increase resolution for these tree nesters. Increasing the resolution on some of the other species which were considered inadequately covered by IFWTF would require more intensive sampling methods, due to their low density and/or nesting habits. Maximum resolution would require ground survey of the entire corridor. An alternate approach could utilize the Habitat Evaluation Program in developing a stratified random ground survey. Such a sampling design would yield statistical estimates of density for various species but would not serve to locate specific nests along the entire line. In terms of mitigating impacts to these species, this data would have limited utility. The applicability of this approach to NWA's specific project needs are in question, and will be assessed pending input from our consultant and agency biologists.

Specific studies that are ongoing or currently planned for 1980 are outlined below. Schedules for implementation of the tasks are also indicated.

2.3.4.4.1 Work Scope - The 1980 raptor studies are a continuation of work done by NWA to date towards addressing the program objectives. It is anticipated that work will continue throughout preconstruction and construction phases of the project. The work planned for 1980 will consist of the following tasks:

- Task 1 - Pre-leaf-out Field Survey - Aerial, fixed-wing survey of the entire line and ancillary facilities, particularly material sites, access roads, and compressor stations, were conducted in spring prior to leaf-out, and before all the snow is gone to facilitate location of tree nests. The objectives of this study were to:

2.3.4.4.1 Work Scope (Continued)

- Locate tree nests of various raptorial species, including bald eagle, osprey, goshawk, sharp-shinned hawk, Harlan's hawk, red-tailed hawk, merlin, great horned owl, American kestrel, hawk owl, great gray owl, short-eared owl, Swainson's hawk, and boreal owl.
- Evaluate the vulnerability of eyrie sites to potential disturbance during preconstruction, construction, and operation of the NWA project.
- Evaluate the distribution, density, and status of raptors nesting within and adjacent to the NWA corridor.

In addition, peregrine falcon nesting habitat within or adjacent to the proposed route were located or confirmed.

The study area for the 1980 raptor pre-leaf-out survey included the NWA corridor. However, the total study area and its boundaries (including portions adjacent to the corridor), and the mean and maximum lateral distances from the corridor centerline, were defined following agency consultation. Access to the study area was by fixed-wing aircraft.

Although the entire corridor was flown, more concentrated efforts were expended between the Yukon River and the Alaska-Yukon Border, because most of the species in question are likely to be more abundant there. In addition, the Tanana and Chisana Rivers adjacent to the NWA pipeline corridor were surveyed specifically for bald eagle and osprey nests.

o Task 2 - Information and Status Review - A review of existing published and unpublished reports, ongoing studies, and interviews with biologists involved in raptor behavior studies. This review will cover the following specific topics:

  - A review of habitat use, nesting behavior, territoriality, distribution, and related information for raptors found in Alaska along the proposed pipeline, with emphasis on "low density" species. The review will describe likely nesting habitat for the various species and delineate where such habitat occurs along the pipeline.
  - A review of nesting chronologies for species not previously covered.
  - A review of available information on raptor hunting behavior and habitat preference.

2.3.4.4.1 Work Scope (Continued)

The review will provide an evaluation of and recommendations for technical approaches to future raptor studies which could significantly contribute to the mitigation of potential adverse project-related impacts to raptors.

2.3.4.4.2 Schedule - The following preliminary schedule milestones have been established:

Milestone	Date
o Request for Quotation transmitted to raptor consultant	Apr. 4, 1980
o Task 1 - Pre-leaf-out survey conducted	Apr. 10-25, 1980
o Task 2 - Information review initiated	May 26, 1980

2.3.4.5 Mitigation Approach - Disturbance to raptors can occur as a result of pipeline preconstruction, construction, and operation activities. It has been and continues to be NWA's approach, as depicted on the March Charts, to spatially and/or temporally avoid key wildlife areas. Using this approach, there should be no significant adverse impacts to raptorial species or their habitat.

2.3.4.6 Literature Cited -

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2.3.4.6 Literature Cited (Continued)

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2.4 MAMMALS

2.4.1 Background

Before and during the construction of TAPS, which was completed in 1977, many environmental studies were conducted to assist in planning that project. These included mammal surveys along the TAPS corridor from Prudhoe Bay to Valdez. The results of these studies, conducted by industry and government scientists, have been invaluable for planning by NWA. However, baseline environmental data collected prior to TAPS, particularly wildlife data, may not reflect actual conditions. New impacts may have resulted from the continuing presence of the oil pipeline and haul road, and other developments, such as the Delta Barley project. Mammal data collected for TAPS did not include the NWA corridor from Delta to the border; moreover, differences between the two pipeline projects may have differing effects on mammals. Earlier studies must, therefore, be supplemented and updated by additional surveys and investigations to provide an adequate data base for planning the NWA project.

2.4.2 Objectives

NWA's major objective with respect to mammals, is to minimize adverse effects during construction, operation, and termination of the pipeline system by incorporating appropriate mitigative measures into design and construction planning, and by developing procedural policies to ensure the effective implemention of these measures. To achieve this objective, NWA's Mammals Program emphasizes the following requirements:

- To provide adequate baseline data on mammals and mammal habitat along the NWA pipeline corridor not available from other sources for preconstruction planning, final location of facilities, determining final alignment, construction scheduling, subsistence protection, and to minimize or avoid adverse impacts.

- To evaluate and incorporate measures to mitigate adverse impacts to mammals and their habitat during construction and operation of the NWA project.

- To provide ongoing consulting in the area of mammal studies, such as recommendations for construction and post-construction monitoring efforts.

2.4.3 Synopsis of Previous Work

A considerable body of literature exists concerning the mammals of Alaska and impacts to mammals and their habitat from pipeline and other development activities. Many of these studies were conducted in conjunction with the TAPS and proposed Arctic Gas pipeline projects. In addition to published sources, unpublished data also exists in the files of industrial organizations and government agencies, including Alyeska Pipeline Service Company (APSC), U.S. Fish and Wildlife Service (USFWS), and Alaska Department of Fish and Game (ADF&G).

In general, the body of knowledge available on critical phenological periods for mammals along the corridor is fairly complete. These data need updating, however, to include current research or recent observations. The route from Delta Junction to the Canadian border may have more significant data gaps than that from Delta Junction to Prudhoe Bay. The data must also be compiled and presented in a form which will be of optimal use to pipeline construction planners.

During construction of TAPS, serious problems were encountered with regard to human/animal interactions. The problems included: nuisance attraction of wolves, foxes, and brown and black bears to construction camps and waste disposal facilities; feeding of wildlife; road kills; and potential for disease transmission.

Numerous cases of human/animal interaction problems were documented by agency and industry monitoring personnel on TAPS, and specific suggestions have been made by TAPS and agency biologists.

Preliminary work on mammals conducted by NWA has been documented in the following reports: Bromley and Craig (1976a, 1976b); Bromley (1976a, 1976b).

In addition, a bibliography compiled in 1978 includes references on terrestrial biology relevant to the NWA pipeline project.

2.4.4 Work in Progress

NWA is conducting a Mammals Program involving the following components: information review; agency interaction; study design; and study implementation. This program is designed to meet the objectives outlined in Section 2.4.2 and involves three interrelated and overlapping phases controlled by project deadlines to ensure that necessary data are available for input to the project final design.

2.4.4 Work in Progress (Continued)

The component phases of the studies are summarized as follows:

- Phase 1 - Input to Program Development

  The first phase, which has been completed, is an overall information review of existing mammal data for the NWA pipeline corridor, as well as agency interaction and proposals for future mammal studies. This information is being used as input toward developing the overall mammal program.

- Phase 2 - Baseline Studies

  A baseline data gathering program utilizing inputs from Phase 1, is being conducted. Specific studies of species, species groups, and geographical areas are being focused towards providing the data necessary to minimize adverse impacts to mammals and mammal habitat.

- Phase 3 - Mitigation Studies

  This phase will consist of general and specific field and office studies designed to define and evaluate specific measures to avoid or mitigate adverse impacts expected from pipeline construction and operation.

Following the review of data gathered during implementation of Phases 1, 2 and 3, further studies will be recommended to assess and attempt to quantify expected construction and operation impacts to mammals and mammal habitat.

2.4.4.1 Supplemental Projects - The 1980 work scope requires recommendations from the Contractor regarding future mammal studies including possible construction and post-construction monitoring of project impacts on mammals. These recommendations are presently under review for their applicability to the needs of final design and scheduling.

2.4.5 Program Status

LGL Alaska has been retained to manage and conduct the 1980 Mammals Program under the supervision of Dr. Richard J. Douglass, the Principal Investigator (PI). LGL has subcontracted certain portions of the program to the Institute of Arctic Biology of the University of Alaska; Dr. Erich Follman, Co-PI, will conduct carnivore studies. In addition, LGL has

2.4.5 Program Status (Continued)

established a subcontract arrangement with the University of Alaska Cooperative Wildlife Research Unit, Dr. Ray Cameron, Co-PI, to continue ongoing caribou studies north of the Brooks Range.

All phases of the program have been initiated by the LGL team: Phase 1 (Information Review); Phase 2 (Baseline Studies), and portions of Phase 3 (Mitigation Studies). The tasks currently underway in Phase 2 are Task 1, mapping of existing data; and Tasks 2-5, design and implementation of specific mammal studies which include spring bison, caribou, carnivore, and Dall sheep studies. Phase 3, Task 1, a human-carnivore encounters study is also underway. The status of work on these programs is summarized below.

2.4.5.1 Phase 1 - As the initital part of baseline studies concerning potential mammal-NWA pipeline interaction, LGL conducted a directed literature search to determine studies that should be conducted during early spring 1980. In addition, numerous contacts were made with agency biologists to solicit input. Emphasis was placed on determining the potential for contact between specific mammals and the pipeline. In order to establish the potential for mammal-pipeline interaction, two basic questions were asked:

- What is the late winter and spring distribution (including time of distribution changes) and abundance of various ungulate species in relation to the proposed pipeline corridor?
- Which ungulate species migrate through the proposed pipeline route and where, specifically, do these movements occur?

These two major questions must be answered before subsequent investigations concerning mitigative measures and impacts can proceed. Answers to these questions will provide much of the baseline data necessary to make recommendations to minimize impacts during pipeline construction.

Some general data resulting from the LGL review are now available regarding these questions. In order to fulfill the primary program objectives, however, it will be necessary to obtain more specific information in areas where adequate data are lacking on the distribution, abundance, and movements of ungulates as they relate to the gas pipeline. Many of the studies recommended will also form the basis of subsequent monitoring programs.

2.4.5.2 Phase 2 -

- Task 1 - Mapping - This task involved mapping existing mammal data on NWA route sheets and USGS quadrangle maps. These wildlife maps will form the basis for future study design and field data maps. Mapping is an ongoing task.

- Task 2-5 - Studies Design and Implementation - Specific mammal studies have been proposed as part of this task. Work has been initiated with special emphasis on studies that should be implemented in Spring 1980. Work to date has also emphasized those species which will come in contact with the pipeline. On the basis of work done on this task to date, LGL has recommended certain studies that have been authorized by NWA. The studies are discussed below.

2.4.5.2.1 Caribou Spring Studies - The primary goal of spring caribou studies is to fill gaps in the current knowledge of the distribution and movements of caribou within and adjacent to the NWA pipeline corridor. The avoidance or mitigation of harmful impacts caused by the NWA project upon a highly mobile species such as caribou are dependent upon up-to-date information.

Objective 1 - Determine the late winter distribution and spring movements of caribou within the pipeline corridor and of herds which may encounter the corridor.

Rationale - Current caribou studies along the corridor are limited to the area north of Alyeska Pump Station 4. Ongoing ADF&G studies (partially funded by NWA) which monitor range occupation and seasonal movements in this region will continue in coordination with LGL studies. South of Pump Station 4, the historical winter ranges of both the Porcupine and Western Arctic caribou herds overlap the corridor in the region between Atigun Pass and the Yukon River (Skoog, 1968; Hemming, 1971). Between Delta Junction and the Alaska-Yukon Border, caribou from the Macomb Plateu and Forty-mile herds have recently crossed the Alaska Highway in winter. The traditional winter range of the Forty-mile herd is adjacent to the pipeline corridor in the Ladue River area (Skoog, 1968; Davis et al., 1976). Additional information delineating where and when caribou will most likely encounter the alignment will enable planners to avoid or minimize the detrimental effects of construction and operation through modifications in scheduling, siting, and/or final design.

2.4.5.2.1 Caribou Spring Studies (Continued)

Objective 2 - Locate and characterize caribou-crossing sites along the NWA pipeline corridor.

Rationale - The areas used most frequently by caribou for crossing the pipeline corridor will require special attention during design and construction so that traditional movement patterns are not disrupted. Continuing ADF&G studies (funded in part by NWA) will identify crossing sites north of Alyeska Pump Station 4. Crossing sites in other regions along the corridor need to be identified. Information gathered on environmental characteristics of known crossing sites will enable biologists to predict other sites most likely to be used by caribou.

Methods - In April 1980, an aerial survey of the corridor between Alyeska Pump Station 4 and the Yukon River was conducted. Two observers, plus an observer-navigator and a pilot, flew parallel transects 0.5, 10, and 20 km distant from the corridor (on each side). The location of all caribou and caribou tracks were marked on topographic maps and recorded by habitat type. Caribou tracks observed were followed (up to 15 km) to locate caribou. Survey flights were coordinated with Alaska Department of Fish and Game caribou surveys.

The late winter distribution of the Macomb Plateau and Forty-mile herds in the vicinity of the corridor will be determined by similar surveys. Transects 0.5 and 10 km south, and 0.5 km north of the corridor will be flown between the Little Gerstle and Robertson Rivers, and 0.5 and 10 km on both sides of the corridor between Tok and the Alaska-Yukon Border. During both of these surveys, tracks will be followed (up to 15 km) to locate caribou.

In the course of aerial surveys and road travel, the locations of caribou crossing attempts of roads and pipelines have and will continue to be mapped, and several environmental variables will be measured.

Multi-variate analyses will be applied to crossing data to determine which environmental factors influence caribou selection of cross sites. The locations of observed caribou and caribou tracks have and will continue to be plotted on topographic maps and alignment sheets.

2.4.5.2.2 Bison Spring Studies -

Objectives - Gain information on the spring movements of the various herd segments by occasionally locating these groups and identify specific pipeline corridor crossing sites during the spring and the timing of these crossings.

Rationale - Calving areas, summer range, and some winter ranges have been identified for the Delta Bison herd. However, the timing and routing of movements between these areas are poorly known. The location of trails used by bison to cross the pipeline corridor need to be identified, and the times of the year when bison will contact various sections of the corridor need to be determined more precisely in order to schedule construction and locate facilities such as material sites and storage areas such that there will be a minimal impact on the bison herd.

Methods - Occasional flights (approximately every two weeks) have been made from early March and will continue through June to locate herd segments. This effort has been coordinated with ADF&G personnel in Delta Junction to initially locate the various groups of bison. Bison groups have and will be classified by age and sex from the air to help identify separate groups during later flights. The use of track patterns will help to determine the approximate movements of the various groups.

Snowmobile transects along the pipeline corridor were made from March until breakup to determine bison crossing locations and timing.

Data on the location of each herd segment obtained from ADF&G personnel and during aerial surveys have been and will continue to be plotted on topographic maps of the Delta Junction area. Track patterns observed from the air have been used in conjunction with these locations to describe the spring movements of the herd segments. Crossing locations identified during snowmobile and aerial surveys also have been plotted on these maps.

2.4.5.2.3 Spring Sheep Studies -

Objectives -

- Provide baseline data on the number and composition of sheep using specific wintering and lambing sites along the corridor.

2.4.5.2.3 Spring Sheep Studies (Continued)

- o Identify any lambing or wintering areas along the corridor that have not been previously identified.
- o Identify sites where Dall sheep have crossed the pipeline corridor, and to determine which factors, such as elevation, topography, or valley width, distinguish these sites from locations within sheep range not used as crossing sites.
- o Determine what time of year crossings occur at the locations identified above.

Rationale - The effect of intensified human activity on Dall sheep use of lambing and wintering areas along the corridor is unknown. Studies done in Atigun Canyon (Andersen, 1971; Price, 1972; Summerfield, 1974) and near the headwaters of the Dietrich River (Linderman, 1972) were conducted primarily in the summer months prior to construction of the oil pipeline and haul road, and no further studies have been done on sheep populations near the pipeline corridor. Data on sheep use of areas along the pipeline corridor prior to construction of the gas pipeline is needed for construction scheduling and final placement of certain facilities and will provide a baseline for later comparisons during the construction and operation phases of the gas line.

The timing and locations of corridor crossings by Dall sheep have not been determined. This information will be incorporated into final plans to schedule construction activities and locate material sites, garbage dumps, etc. to ensure minimum impact on the sheep population.

Methods - Three trips to the Brooks Range will be made by camper, two in April and May 1980, which have been completed to determine sheep use of winter ranges along the corridor, and another (ten days) from May 27 to June 5, 1980, to identify lambing areas. During the first trip, specific locations overlooking known winter ranges and lambing areas visible from the haul road have been selected and marked by survey stakes. The exact locations of these sites have been recorded in detail so that they can be found during future surveys. All sheep visible from these sites were counted and classified as either rams, lambs, or "ewes." The "ewe" group includes some yearling rams not discernible from females. Field workers have also select certain side

2.4.5.2.3 Spring Sheep Studies (Continued)

canyons and other areas along the corridor to establish foot/ski trails from which composition counts were made. These routes have been described in detail so they can be followed exactly in subsequent surveys. Sighting locations began at Cathedral Mountain near haul road milepost (M.P.) 110 and ended at Slope Mountain near M.P. 245.

Between these two locations, field workers drove slowly along the haul road, watching for sheep tracks crossing the road. Where sheep crossings occur, a number of variables which might influence why sheep selected the location as a crossing site were measured.

In late May 1980, two biologists will again drive the haul road, making counts from the sighting locations and from the established survey trails up side canyons. Other ski trips into terrain similar to that of known lambing areas will be made to search for lambing areas. A road survey of track crossings will again be conducted during the late May trip.

2.4.5.2.4 Spring Carnivore Studies -

Objectives -

- Determine distribution of canids and ursids along the NWA pipeline corridor between Atigun Pass and the Alaska-Yukon border during spring 1980. Emphasis will be placed on the area between Fairbanks and the Alaska-Yukon border.

- Determine occurrance of critical habitats, movement and concentration areas, critical phenological periods and habitat use by canids and ursids.

Rationale - Knowledge of occurrance and distribution of carnivores along the pipeline corridor is required by DOI Stipulations. Currently, there is insufficient data on carnivore distribution and phenology along the corridor between the Brooks Range and the Canadian Border to ensure compliance of the stipulations.

Initial Phase I efforts identified that some general information on canids and ursids is available for the pipeline corridor. The amount and quality of information varies, with the area north of Delta Junction exhibiting the most complete information. The area between Delta Junction and the border requires the greatest amount of canid and ursid research.

2.4.5.2.4 Spring Carnivore Studies (Continued)

Methods - Aerial surveys have been flown along the pipeline corridor to observe carnivores and their sign. Evidence of other mammals has been recorded and the information given to LGL for their mapping program. Surveys were flown about every two weeks between March 1 and May 1, 1980. After the initial survey flown in early March, subsequent surveys were flown about two to three days after a snowfall so that fresh tracks will be easily discernible to avoid duplicating the recording of old tracks. The survey flights began at Fairbanks/ North Pole and proceed north to Atigun Pass and south to the Alaska-Yukon border.

During the early portion of the survey period only canids and their sign were observed because both black and grizzly bears were still in winter dens. Den abandonment by bears was recorded in April. At that time bears and bear sign was also recorded on the maps. Locations of both bear and canid dens was recorded.

Aerial surveys were flown between the Brooks Range and the Alaska-Yukon border emphasizing the area south of Delta Junction and north of the Yukon River. The Alaska Department of Fish and Game (ADF&G) has good wolf data on the area between Fairbanks and Delta Junction and will continue to obtain information this winter from the scheduled wolf hunt. This area was surveyed while traveling to and from the surveys south of Delta Junction by flying two parallel transects at 0.5-mile intervals. With bears beginning to emerge from dens, this area was surveyed more intensively.

South of Delta Junction aerial surveys were conducted by flying parallel transects which encompass the pipeline corridor. Four to five transects were flown at one-mile intervals. In addition, areas that are likely to be frequented by wolves, such as drainages, lakes and ridges, were surveyed for sign. The combination of transects and surveys of specific habitat types provides a good base for identifying carnivore use areas along the pipeline corridor.

ADF&G has some wolf distribution data between Fairbanks and the Yukon River and very little data between the Yukon River and the Brooks Range. Surveys similar to those for the area south of Delta Junction were flown north of the Yukon River. The area between Fairbanks and the Yukon River entailed less intensive surveys consisting of at least two parallel transects of 1- to 2-mile intervals encompassing the pipeline right-of-way.

2.4.5.2.4 Spring Carnivore Studies (Continued)

Some ground truth work occurred to verify the interpretation of tracks from the air. In certain areas, such as near Delta Junction, the occurrance of wolves, coyotes, red foxes, and feral dogs complicated the interpretation of sign and ground verification of species was necessary.

Contacts with various agency staff, local trappers and other people working along the Trans-Alaska pipeline system is being maintained during the course of this study. Reliable observations made by them was used to expand upon the data collected in the aerial surveys.

2.4.5.3 Phase 3 -

2.4.5.3.1 Task 1 - Human-Carnivore Encounters Study

Objectives -

- Review human-carnivore problems generally and specifically those that were encountered during construction of the TAPS.
- Review laws and regulations regarding this problem, including both existing and proposed laws.
- Develop an analysis of methods to avoid and minimize potential human-carnivore encounters in context of the NWA project.
- Provide recommendations to avoid and minimize potential encounter between pipeline workers and carnivores.

Rationale - Human-carnivore encounters were a serious problem during construction of the TAPS. Animal feeding was a major problem due to active feeding of animals by pipeline employees and improper handling and disposal of foodstuffs and garbage in camps (Milke, 1977). Unfenced camps offered little resistence to animals attracted by foodstuffs, and animals soon became pests. To alleviate the human-carnivore interaction problem many of the bears, wolves, and foxes were trapped and relocated, shot and killed or harassed by helicopters, vehicles, or cracker shells to drive them away (Milke, 1977).

2.4.5.3.1 Task 1 - Human-Carnivore Encounters Study (Continued)

The TAPS experience clearly calls attention to the need of development of techniques and designs to prevent and minimize contacts between carnivores and NWA pipeline workers. The NWA Human-Carivore Encounters Study is designed to study this problem.

Methods - Information obtained from literature reviews and interviews with government and industry personnel formed the basis of this work. Computer searches was used including the Bibliography of Agriculture, Commonwealth Bureau Publication, Biological Abstracts, Environmental Index, and the Fish and Wildlife Reference Service (both Predator Data Base and Pittman-Robertson).

Government employees that worked on the TAPS, others who have dealt with animal nuisance problems, and those involved with the formulation and enforcement of laws and regulations regarding animal problems were interviewed.

Alyeska Pipeline Service Company's past and current animal control facilities and procedures were reviewed and assessed, based on interviews with their staff and review of available information. Information was obtained from the Game Division and Habitat Section of the Interior and Southcentral Offices of the ADF&G, the ADF&G pipeline monitors, the USFWS, the NPS and other agencies and groups as appropriate. Telephone interviews with knowledgeable people out-of-state were included.

Sites where fences and/or other approaches have been used for animal control have been investigated. These include Mt. McKinley Park and selected facilities associated with the TAPS.

Information review and analysis concentrated in two areas: animal feeding and attraction, and methods to avoid or minimize these problems. The latter includes methods of dealing with nuisance animals. These two areas are of greatest concern to the NWA project and, therefore, was emphasized in this study.

2.4.6 Schedule

o Phase 1 - Major Milestones

Milestone	Date
Work Initiated	Dec. 20, 1979
Final Report Due	June 20, 1980

2.4.6 Schedule (Continued)

o Phase 2 - Major Milestones

Milestone	Date
Work Initiated	Dec. 20, 1979
Start of Spring Field Studies	
Bison	Mar. 8, 1980
Caribou	Mar. 11, 1980
Carnivores	Mar. 6, 1980
Dall sheep	Apr. 6, 1980
Final Reports Due	
Bison, caribou, carnivores Dall sheep	Dec. 31, 1980

o Phase 3 - Major Milestones

Task 1

Milestone	Date
Literature Search Initiated	Dec. 7, 1979
Field Work	Apr. 1, 1980
Interviews	Mar. 10, 1980
Draft Final Report	July 15, 1980
Final Report	Aug. 15, 1980

2.4.7 Mitigation Approach

In order to minimize environmental impacts associated with the construction and operation of the project, NWA will continue to incorporate certain mitigative measures in the final design, scheduling as depicted in the March Charts, construction, and operation of the pipeline. These measures will continue to be formulated following collection and evaluation of data according to the program described above.

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2.5 HABITAT EVALUATION

2.5.1 Background

The NWA route traverses numerous biological communities. Each community consists of an interrelated complex of plants and wildlife. Construction and operation of the pipeline system and its ancillary facilities will cause varying degrees of impacts to these communities. Impacts will range from relatively insignificant short-term effects to long-term direct and secondary impacts, which may be irreparable.

Of particular concern are the impacts of activities related to construction, such as clearing vegetation, use of off-road vehicles, potential spillage of hazardous materials, and the actual construction of the pipeline, construction camps, and compressor stations. Of necessity there will be a certain amount of permanent habitat alteration.

Habitat evaluation studies done for TAPS document only the Prudhoe Bay to Delta Junction portion of the NWA route. Futher studies are needed to refine the habitat evaluation from Delta North and to describe the corridor from Delta Junction to the U.S.-Canada border.

2.5.2 Objectives

In order to ensure that unnecessary and avoidable destruction and/or alteration of high value wildlife habitat is minimized during pipeline construction and operation, it is essential that wildlife habitats along the corridor be systematically evaluated.

The objective of NWA-sponsored Habitat Evaluation Program is to obtain information concerning the existence and relative values of various vegetation associations to wildlife. The first phase of the program is the identification of vegetation covertypes along the pipeline route. After this work is completed, the second phase will be to assess the value of these vegetation units to various wildlife species.

The importance of vegetation communities to wildlife will be assessed through field and literature studies. In addition, a determination will be made as to the existence of any rare, endangered, or unusual plant species or associations, or unique and/or sensitive habitats to be crossed by the pipeline. This information will be used in the construction-planning phase for final design to minimize removal of high value wildlife habitat and unique and/or sensitive vegetation associations.

2.5.3 Synopsis of Previous Work

Habitat evaluation studies conducted to date have concentrated specificially on vegetation habitat typing as a preliminary step to determining habitat importance to wildlife. In 1977, Kessel and Spindler (1978) studied the Tetlin-Northway area of the upper Tanana River Valley to determine avian species density and habitat utilization of vegetation types typical of those to be crossed by the proposed pipeline. The major avian habitats and subtypes, ranked in order of avian productivity, were lowland tall shrub thicket, lowland low and medium shrub thickets, lowland white spruce birch woodland, mixed deciduous-coniferous forest, aspen stands, birch stands, black spruce bog, white spruce stands, and black spruce. Diversity in habitat structure was generally correlated with avian species diversity, with the highest species diversity occurring in tall shrub thickets and in mixed deciduous-coniferous forests.

Kessel (1979) conducted further avian habitat classifications in an attempt to correlate avian species occurrence with vegetation associations. The outcome was the identification of major vegetation associations and a listing of characteristic birds. Avian habitats were classified according to basic life form of the vegetation, topography, physical nature of the substrate, and occurrence and characteristics of water and of woody plant growth.

Additional habitat studies by state and Federal agencies, as well as NWA, began in 1979 and are ongoing.

2.5.4 Work in Progress

Wildlife habitat studies are continuing through 1980. Because basic life form and physical structure of vegetation are among the important parameters thought to govern habitat selection by wildlife species, it is necessary to classify habitat by covertype. Additional study and data analysis will produce a qualitative wildlife habitat evaluation.

Initial work on the terrestrial and aquatic habitat mapping project by USFWS and ADF&G, funded by NWA, began in 1979. Vegetation classes along the pipeline route were recorded by covertype mapping based on a modified hierarchical classification system developed by Dyrness and Viereck (1979). Field studies conducted throughout the late spring and summer of 1979 verified covertype signatures on aerial photographs used during the mapping process.

2.5.4 Work in Progress (Continued)

Analysis of species composition on sample plots located in each covertype further defined the community composition.

The study has also produced base maps of color and color infrared oblique photos taken from a small aircraft. These maps will be used for assessing the potential impact of pipeline realignments, siting of facilities including camps, material sites and compressor stations, formulating field techniques for mitigation of disturbed areas and assessment of impact following construction.

2.5.5 Future Work

Upon completion of vegetation covertype mapping, NWA will begin a systematic habitat evaluation. Similar methods to those used by the JFWAT for analyzing wildlife habitat within the TAPS corridor (Pamplin, 1979) will be employed.

The habitat evaluation will consist of assigning relative, qualitative values to basic habitat types. These values will be established by subjectively assessing several indicator species of wildlife in relation to their biological needs (i.e., food, cover and reproduction). In addition to this subjective habitat evaluation by agency biologists, data derived from other completed or ongoing NWA biological studies and associated work will be used to establish relative habitat values.

2.5.6 Schedule

The photo interpretation process of mapping covertypes is projected to be completed April 1980. Final maps are expected to be completed by June 1980. Further data transformation will be necessary to correct the final maps for compatibility with NWA alignment sheets.

Habitat evaluation of mapped covertypes will be completed by December 1980.

2.5.7 Mitigation Approach

NWA is committed to protecting areas of high wildlife habitat value. Kessel (1976) defined two such areas as being mature white spruce forests and wet meadow-marsh-lacustrine waters. These habitats are sensitive areas of particular importance to birdlife.

2.5.7 Mitigation Approach (Continued)

Mature white spruce forests are an uncommon habitat in Alaska because of the hundreds of years required for the trees to reach maturity and because of widescale destruction by human activities (e.g., logging) and forest fires.

The limited distribution of mature stands suggests avoidance as a primary mitigation technique. Accordingly, NWA, with agency concurrence, has rerouted the pipeline to avoid further division of the mature stands along the Dietrich River.

Wet meadow, marsh and lacustrine waters are a complex, variable habitat supporting large numbers of birds. Kessel (1976) describes these areas as major habitat for loons, swans and other waterfowl, cranes, gulls, terns and many species of shorebirds. These wetland areas occur throughout the arctic coastal plain and in the flatland along major interior river systems.

Kessel (1978) suggested the following mitigation which has been adopted by NWA as a result of the 1977 Tetlin-Northway wetland bird study:

"Extra effort will be taken to avoid the destruction of wetland habitat, either directly or indirectly, since such damage will permanently affect the productivity of the area. Any operation which could alter water levels, water temperature, stream flow, turbidity, and otherwise be adverse to the maintenance of aquatic invertebrate populations and of emergent and submerged plants, may cause a decrease in wetland productivity. Specifically, erosion, oil spills, water diversions, channelizations, and stream crossings in any drainage leading to wetland areas will be minimized or avoided."

Covertypes given high habitat values by the ongoing USFWS-ADF&G study will be protected from unncessary and avoidable disturbance. When adverse impacts appear unavoidable, alternatives will be evaluated on a site-specific basis and the least environmentally damaging alternative will be selected.

2.5.8 Literature Cited

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2.6 CULTURAL RESOURCES

2.6.1 Background

Cultural resources include prehistorical or historical archaeological remains, standing historical structures, and sites considered culturally important to the regional inhabitants, such as traditional caribou observation areas. Disturbance to such sites can result in the irretrievable loss of potentially significant knowledge of our past. Disturbance to the scientific integrity of sites can result from direct activities, such as construction disturbance, or from looting or "pot hunting" of archaeological artifacts by treasure seekers. Efforts are continuing to preserve these nonrenewable cultural resources through a program of site identification, avoidance, and if necessary, scientific excavation.

Regulations applicable to cultural resource protection are contained in the Act for the Preservation of American Antiquities, 1906, Stat. (34 Stat. 225; 16 U.S.C. 431, et seq.), the National Environmental Policy Act of 1969 (PL 91-190), the National Historic Preservation Act of 1966 (PL 89-665), Procedures of the Advisory Council on Historic Preservation for the Protection of Historic and Cultural Properties (36 CFR 800), the Alaska Historic Preservation Act of 1975 (Chapter 35), the Indian Religious Freedom Act of 1978 and the proposed Stipulations for the NWA pipeline project.

2.6.2 Objectives

The primary objectives of NWA's cultural resource program are to avoid or minimize adverse impacts to cultural resources resulting from pipeline and related facility construction and to assure compliance with Federal and state requirements regarding conservation and preservation of these nonrenewable resources.

In pursuit of these objectives, the evaluation of all cultural resources is based on the concept of significance as defined by eligibility for inclusion on the National Register of Historic Places.

In March 1978, NWA initiated plans for a cultural resource program to meet the above objectives. The program involves a comprehensive literature review, native contact and intensive field survey of 100 percent of the pipeline route and related facilities to attempt to locate significant cultural resources. Consistent with government guidelines, NWA's primary philosophy has been one of preservation or conservation of these nonrenewable resources through avoidance, rather than mitigation

2.6.2 Objectives (Continued)

by excavation. Where this is not practicable, a professionally planned mitigation program will be developed and executed on a site-specific basis.

The cultural resource program for NWA has been designed and will continue to be developed with input from cognizant agency cultural resources specialists towards developing an effective and responsive research effort.

2.6.3 Synopsis of Previous Work

The Office of History and Archaeology, Alaska Division of Parks maintains updated files on prehistorical and historical Alaskan cultural resources. The inventory includes sites and locations that have been placed on or deemed eligible for inclusion in the National Register of Historic Places.

In general, documentation of known prehistorical, historical, and other cultural resources considered eligible for National Register selection under the Alaska Native Claims Settlement Act (Section 14H(1)) is fairly complete along the southern portion of the pipeline route from Delta Junction to the Canadian border.

Other pertinent reports have been prepared on this portion of the route. A report prepared for the Federal Power Commission in 1975 presents a study of archaeological research potential along the proposed pipeline route. An archaeological survey report published in 1977 by the Office of History and Archaeology, Alaska Division of Parks, provides data from a preliminary survey for projected state highway improvements.

Studies conducted by Alyeska prior to and during construction of the TAPS provide useful data for the portion of the NWA route from Delta Junction to Prudhoe Bay. Much of these data is of only limited usefulness, however, because much of the data has not been formally reported.

Archaeological field surveys and a literature review were initiated by NWA during the summer of 1978 under the direction of principal investigators Drs. J. Aigner and A. Shinkwin of the University of Alaska. Approximately 131 miles of the proposed NWA route between Delta Junction and the Canadian border were subjected to a 100 percent intensive field survey.

2.6.3 Synopsis of Previous Work (Continued)

The field research was supplemented by extensive documentary research and a native contact program. The native program involved interviews with knowledgeable natives and was conducted, in part, with CETA funds and sponsored by the Dena Aka Corporation. The program was implemented to determine if areas of native concern (such as special use areas or areas of religious significance) are located along the alignment, as well as to aid development of a postcontact land use model.

Field work, documentary research, and the native contact program culminated in the submittal of a May 1979 report by Aigner and Shinkwin: "Historic and Prehistoric Land Use in the Upper Tanana Valley: Report on the Archeological Survey Along the Alaska Highway Pipeline from Delta Junction to the Yukon Border." The report was submitted for review to both BLM and the State Historic Preservation Office (SHPO). Notification of concurrence has been received from both providing assurance that those portions of the route examined have been adequately considered and the completed portions of the program are in compliance with regulatory stipulations.

The 1979 archaeological field program, under the direction of Dr. J. Aigner as Principal Investigator, continued with the field survey of portions of the route between Delta and the Yukon border (approximately 59 miles) and 68 material sites which had not been surveyed in 1978, thus virtually completing the archaeological survey and clearance activities for Delta to the border. During the above-mentioned surveys, no significant archaeological sites were found. A draft report has been prepared: "Historic and Prehistoric Land Use in the Upper Tanana Valley II: Supplement to Report on the Archaeological Survey Along the Alaska Highway Pipeline from Delta Junction to the Yukon border."

As part of the 1979-1980 program, an intensive literature search for the northern portion of the route from Delta to Prudhoe Bay was conducted and the report is near completion.

In addition to the originally planned program for 1979, ongoing consulting services were provided by Dr. Aigner and her staff in support of other activities. A draft report on areas of archaeological concern, as expressed by DOI, was prepared. A final report is in preparation. In addition,

2.6.3 Synopsis of Previous Work (Continued)

archaeological field crews have examined proposed compressor station sites, access routes and drill sites to provide archaeological clearances for NWA's borehole drilling activities. Finally, three reports were prepared to support NWA's environmental assessments of 15 proposed reroutes suggested by DOI.

2.6.4 Work in Progress

NWA is continuing intensive cultural resources survey of the remaining portions of the pipeline route and ancillary facilities, including material sites, compressor stations, access roads. In addition, for those significant sites which cannot be avoided, mitigation, such as archaeological excavation, will be accomplished.

Extensive cultural resource programs are planned for the 1980 and 1981 field seasons. Pipeline route and ancillary area surveys will continue north of Delta. Approximately half of the 548 miles of remaining pipeline route will be field surveyed during the 1980 field season. Testing and mitigation studies are anticipated in 1981. Remaining surveys will be completed in subsequent seasons, as will any remaining mitigation efforts. Cultural resources consultants will be available on an ongoing basis, throughout the construction phase of the project, to provide input as pipeline or related facility locations change.

The PMC has prepared a detailed scope of work for 1980 which will include the components outlined below. The schedule is also presented.

2.6.4.1 Work Scope -

- o Continue survey of selected alignment segments from Delta Junction to Prudhoe Bay.
- o Survey of borehole locations along selected alignment segments from Livengood Camp to Prudhoe Bay.
- o Survey of borehole and backhoe trench locations and access routes for material sites.

2.6.5 Schedule

Preparation for field program -- logistics, personnel, permits	Apr.-June 1980
Implementation of field program	June-Sept. 1980
Survey results draft report	Jan. 1981
Final survey report	May 1981

2.6.6 Mitigation Approach

In programs of this magnitude the coordination of several Federal and state agencies and the Advisory Council on Historic Preservation (ACHP) has proven valuable. Procedures for timely processing of determination of National Register eligibility, agency responsibilities, and guidelines for determination of adverse effect and for development of mitigation plans must be established. Informal technical level input has been continually solicited and received from both federal and state archaeologists throughout the design and implementation of NWA's program. The program to date has received tacit acceptance from governmental agency archaeologists.

Although an effective mitigation program can be designed, the absence of formal guidelines by government agencies could present problems in coordination and scheduling and may delay certain aspects of the planned 1980 field program. To avoid such delays, NWA intends to continue close interaction with the agencies in developing a 1981 mitigation program.

As discussed above, NWA's philosophy is for conservation and preservation of cultural sites through avoidance where practicable. Where this is not possible, however, and a site will receive unavoidable direct impacts, NWA's consultants will carry out well designed and implemented scientific investigations including: in-depth literature review and ethnographic research; site survey and accurate mapping and documentation; archaeological excavation and data retrieval; analysis and data interpretation; publication and dissemination of results to the scientific community.

To avoid indirect impacts to sites not directly affected by the pipeline or related facility construction, NWA includes training as part of the environmental briefings program (see Section 5.4). Negative sanctions and stiff penalties for looting and desecrating sites will also be instituted.