Terrestrial and Aquatic Habitat Mapping Along the Alaska Natural Gas Pipeline System

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Contents

List of Illustrations

List of Tables

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ABSTRACT

In 1979 a project was initiated to map terrestrial and aquatic habitats along the proposed Alaskan Natural Gas Pipeline corridor. The gasline route extends from Prudhoe Bay, parallel to the trans-Alaska oil pipeline, to Big Delta, and southeast along the Alaska-Canada Highway to the Canadian border. Mapping was designed to produce standardized covertypes for wildlife studies, selection of temporary and permanent facility sites, pipeline realignments, and assessment of habitats lost from construction. A covertype scheme composed of 69 terrestrial and aquatic habitat types was used during stereoscopic interpretation of 1:24,000 and 1:36,000 true color aerial photographs. Low level 35mm photographs were used to interpret signatures on the smaller scale stereo pairs. Covertypes were delineated on clear stable base acetate overlays that were edited, and transferred onto mylar sheets registered to 1:12,000 enlargements of 1:63,360 U.S. Geological Survey topographic maps. Covertype signatures were verified by overflights in helicopter and fixed-wing aircraft, intensive ground checking, and evaluation of plants collected from vegetation plots within each of the habitats. Approximately 1880 square miles of pipeline corridor habitat were covertyped and mapped in about 400 hours by one person. Ground truth verification occurred from May 15 to August 25, 1979, and June 6 to June 20, 1980. Habitat delineation was sometimes difficult due to snow cover, habitat diversity, presence of permafrost, topographic variations, influence of fire, and plant phenology. The most abundant terrestrial types were conifer, deciduous, and mixed conifer-deciduous forests in the southern portion and alpine and tussock tundra in the north. Wetlands such as sedge-grass meadow and mixed shrub wetland were abundant along most of the route, but sedge-grass and tussock tundra were dominant north of the Brooks Range.

INTRODUCTION

Background

In 1968 oil was discovered in the Prudhoe Bay area on the Arctic Coastal Plain of Alaska. Later confirmed to be one of the largest petroleum reserves in North America, the area also contains over 22.5 trillion cubic feet of natural gas. To make this gas available to consumers in the lower contiguous 48 states, Northwest Alaskan Pipeline Company proposed to the Federal Power Commission an overland transportation route through Alaska to the Canadian Border. The proposed Alaska Natural Gas Transportation System (ANGTS) extends from Prudhoe Bay, south along the Trans-Alaska Pipeline System (TAPS) to Delta Junction, then southwest along Alaska State Highway #2 to the Canadian border where it will hook up with a Canadian pipeline (Figure 1).

Extending through three of Alaska's four physiographic divisions, the 740-mile pipeline route crosses a myriad of biotic and abiotic resources. Beginning at Prudhoe Bay, the pipeline route extends across the Arctic Coastal Plain and Foothill provinces. (Warhaftig 1965). The coastal plain is a poorly drained area underlain by 1000 to 2000 feet of permafrost. Topography is relatively flat, rarely exceeding 30 feet above sea level. An abrupt rise 50-200 feet high delimits the coastal plain from the foothill region. Beginning 60 miles south of Prudhoe Bay, this rolling plateau area is also underlain by permafrost and well drained by small tributaries.

Approximately 160 miles south of Prudhoe Bay the pipeline enters the Brooks Range. This mountainous area contains summits ranging from 4,000 to 8,000 feet with small cirque glaciers common on the higher peaks. Hard and soft sedimentary and volcanic rocks form most of the 80-mile wide range (Warhaftig 1965).

The remaining 500 miles consists of uplands and lowlands of the Northern Plateaus Province (Warhaftig 1965) with areas of discontinuous permafrost. To the north are ridges 1,500 to 3,000 feet in altitude with generally flat valleys 1/4 - 1/2 mile wide. South, through the Yukon-Tanana River Basins,

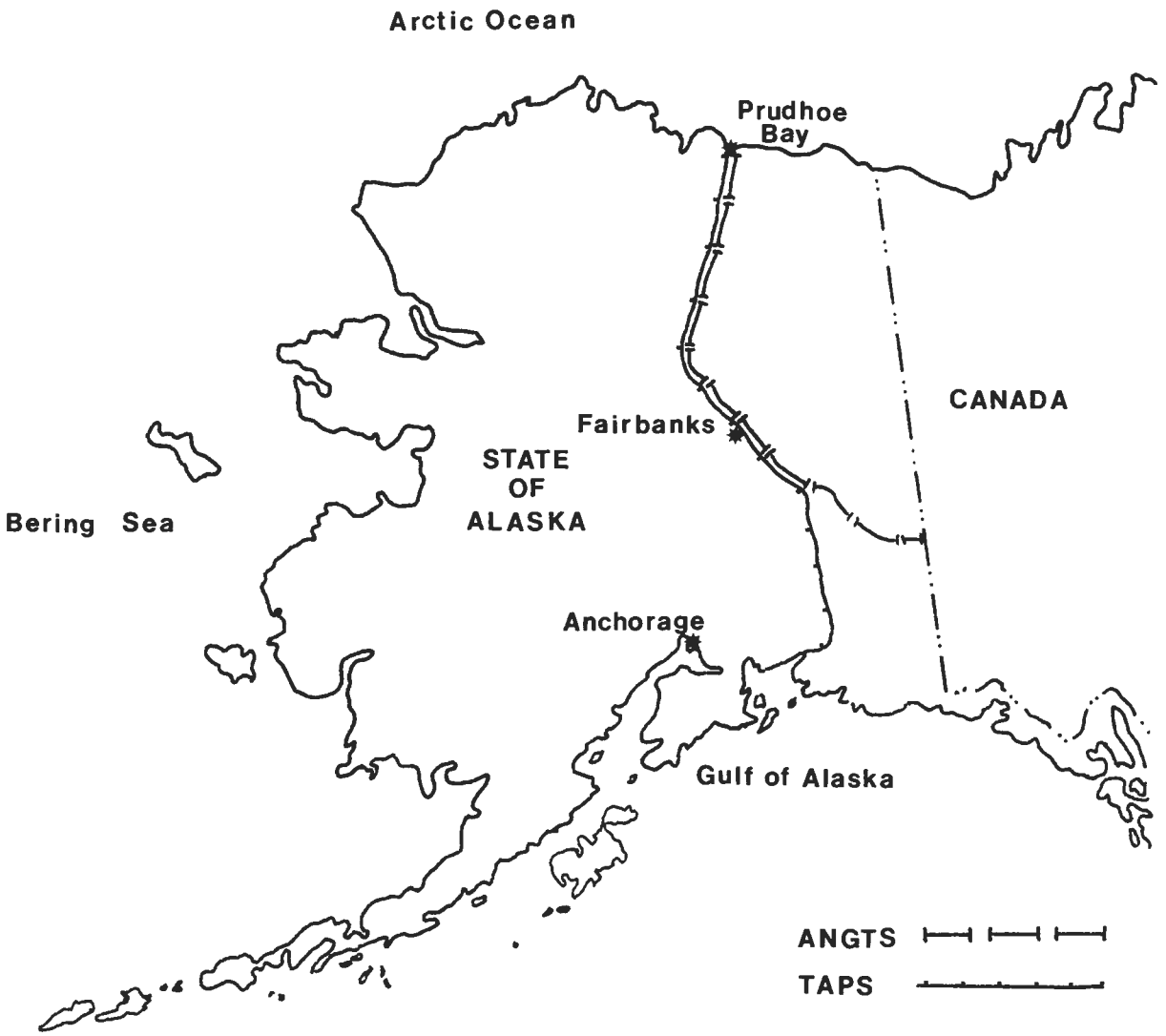


Figure 1. Location of the Alaska Natural Gas Transportation System (ANGTS) in relation to the Trans-Alaska Pipeline System (TAPS).

the topography becomes hilly with ridge crests 500 to 1,500 feet in altitude. Valleys become much wider and in some areas spread out into broad plains with rolling hills and scattered remnants of sand dunes (Warhafting 1965).

Six major drainage basins are traversed by the pipeline. On the north side of the Brooks Range water flow is to the Beaufort Sea by way of the Kuparuk and Sagavanirktok River drainages. In the south, water flows to the Bering Sea through the Chandalar, Koyukuk, Tanana and Yukon River drainages.

Plant communities change markedly along the pipeline route. Major vegetation types on the coastal plain and in the foothill region consist of wet sedge-grass tundra, and moist tundra dominated by tussock-forming sedges and dwarf birch. The Brooks Range is chiefly alpine tundra, although wet and moist tundra occur in the valleys. South of the Brooks Range spruce and spruce-hardwood forest types are most abundant with intermittent areas of bogs, tussock tundra, and alpine tundra. Shrub thickets of alder, willow, and birch occur throughout the entire route along river and stream courses and in transition zones between various vegetation types (Viereck and Little 1972, Kuchler 1976).

Objectives

Section 5 of the Alaska Natural Gas Transportation Act of 1976 (ANGTA) states that "...site-specific terms and conditions will be issued as appropriate to minimize disturbance from construction and operation of the pipeline to rivers, and other water bodies and adjacent land and vegetation...." To administer the above terms and conditions, federal and state agencies in Alaska recognized a need for an adequate inventory of current fish and wildlife habitats associated with the pipeline. Following recommendations by Pamplin (1979), the U.S. Fish and Wildlife Service, Office of Special Studies initiated a project to map the terrestrial and aquatic habitat types associated with the natural gas pipeline. The purpose of the mapping project was to locate, identify, and record on a suitable map base fish and wildlife habitats within the pipeline corridor. The information generated would be

used during all phases of planning, design, construction, operation and termination of the ANGTS. Specific objectives included 1) development of a habitat cover type system; 2) delineation and identification of habitat types on a standard data base; 3) transfer of the habitat types to a map base; and 4) documentation of methods used.

METHODS

Data Base

Because of the lengthy and relatively narrow corridor, conventional 9 x 9 inch true color aerial photography was chosen to identify and map the habitat cover types. Photography exposure dates extended from August 19 to September 7, 1978. Colors ranged from "normal" summer greens in the southeastern portion of the route to a variety of autumn colors from the Yukon River to the Brooks Range. North of the Brooks Range colors were shades of brown except in revegetated areas, which were yellow-green.

Scales used were 1:36,000 for coverage between the Canadian border and Delta Junction and 1:24,000 between Delta Junction and Prudhoe Bay. A smaller scale was used in the southeastern portion of the route to obtain a broad data base in the event major alignment changes were made. From Prudhoe Bay to Delta Junction the proposed gas pipeline alignment closely follows and at times utilizes the existing TAPS work pad. Major deviations in alignment were not expected, which permitted use of a larger scale data base.

Development of Habitat Types

A habitat evaluation program, conducted by Pamplin (1979) for the TAPS, consisted of eleven basic terrestrial types and one wetland type. For more specific information needs, a revised cover type list was developed for mapping the gas pipeline corridor. Habitat types used evolved from combining portions of work done by Viereck and Dyrness (1980) and Cowardin et al. (1979). Major vegetation forms included tundra, shrubland, forest, agri-

culture and vegetated wetlands. Man-made impacts, unvegetated areas, ponds, lakes, streams, and rivers were identified by their physical features (shape, size, pattern, and location). A total of 69 natural and man-made cover types were identified (Table 1). A species level of accuracy was not attempted except for riparian and upland shrub areas due to a lack of distinction between individual plant species on the photography. Narrative descriptions of each habitat type are listed in Appendix A.

Photo Interpretation Procedures

Prior to interpretation, effective areas were delimited on stable base acetate overlays registered to the true color aerial photographs by three fiducial marks and photo numbers. Effective area is here defined as that part of the photo which is delimited by one-half the overlap of two conjugate photos (or alternate photos when level terrain exists) within a flight strip and a side margin of one inch from the edge of the photo. Advantages for using an effective area with an acetate overlay are:

1) to eliminate repetition of work;
2) to enclose that part of the photo with the least amount of displacement;
3) to edit type names or boundaries without damage to the original photograph; and
4) to increase the possible means to transfer habitat types to a map base (i.e. transparency as opposed to an opaque material).

After the effective areas were completed, the overlays were placed in folders labeled with their respective flight line number and filed until needed.

Photo interpretation began by setting up a stereo pair of true color aerial photos for viewing under an Old Delft Scanning Stereoscope.* At least one of the two photos contained an acetate overlay on which habitat delineations were

* Mention of brand names does not mean endorsement by the Federal Government.

Table 1. Types used to map the Alaska Natural Gas Transportation System route and their respective symbols.

Type Symbol	Covertype
01-00	Sedge-Grass Tundra
02-01	Sedge-Tussock Tundra
02-02	Sedge-Shrub Tussock Tundra
03-00	Alpine Tundra
04-00	Mat & Cushion Tundra
05-00	Shrub Tundra
06-01	Tall Shrub-Upland Willow
06-02	Tall Shrub-Upland Mix
06-03	Tall Shrub-Upland Burn
07-01	Tall Shrub-Riparian Willow
07-02	Tall Shrub-Riparian Mix
08-01	Low Shrub-Upland Willow
08-02	Low Shrub-Upland Mix
09-01	Low Shrub-Riparian Willow
09-02	Low Shrub-Riparian Mix
10-00	Mud Flats/Dried Organic Matter on recently drained areas
11-00	Revegetated Sites
12-01	Conifer Forest-Open
12-02	Conifer Forest-Closed
12-03	Conifer Forest-Dwarf
12-04	Conifer Forest-Burned
C - Clouds	

Type Symbol	Covertype
13-01	Deciduous Forest-Open
13-02	Deciduous Forest-Closed
14-01	Mixed Conifer-Deciduous Forest-Open
14-02	Mixed Conifer-Deciduous Forest-Closed
15-00	Unvegetated Floodplain
16-00	Bare Ground (sand dunes, cut banks, talus)
17-00	Agriculture
18-01	Airstrips
18-02	Camps
18-03	Tailing Piles
18-04	Utilities Corridor
18-05	Haul Road
18-06	Material Sites
18-07	Disposal Sites
18-08	Urban Development (including homesteads)
18-09	Storage Pad
18-10	Man Caused Erosion
18-11	Military Establishment
18-12	Primary Roads
18-13	Secondary Roads (side streets, access roads)
18-14	Highway Maintenance Stations
18-15	Pump Stations
18-16	Drill Pad
18-17	Petroleum Feeder Lines
18-18	Holding Pond
18-19	Construction Facilities
S - Shadow	

Type Symbol	Covertype
19-01	Forested Wetland-Conifer
20-01	Mixed Shrub Wetland
21-00	Moss Bog
22-01	Wet Tundra
22-02	Sedge-Grass Marsh
22-03	Brackish Sedge Marsh
23-11	Pond - 0-25% Emergent Cover
23-12	Pond - 25-75% Emergent Cover
23-13	Pond - 75-100% Emergent Cover
23-20	Pond - No Emergent Cover
24-11	Lake - 0-25% Emergent Cover
24-12	Lake - 25-75% Emergent Cover
24-13	Lake - 75-100% Emergent Cover
24-20	Lake - No Emergent Cover
25-01	Stream - Braided
25-02	Stream - Incised
25-03	Stream - Meandering
25-04	Stream - Beaded
25-05	Stream - High Gradient Mountain
26-01	River - Braided
26-02	River - Incised
26-03	River - Meandering

inked. A four-mile wide corridor was mapped when using the 1:36000 scale photography between Delta Junction and the Canadian Border. From Delta Junction to Prudhoe Bay a two-mile wide corridor was mapped using 1:24000 scale photography.

Identification of habitat types was based on the interpreter's prior experience in mapping vegetation, knowledge of the pipeline route and data obtained from field work. Vegetation and physical features were the key characteristics for separating types. To facilitate interpretation, oblique 35 mm photos were exposed from a small plane over areas which showed unknown plant signatures or were inaccessible by foot (Scheierl and Meyer 1977, Hagen and Meyer 1978).

Mapping Conventions

Minimum mapping units that can be accurately covertyped are dependent upon scale and resolution of photography used and scale of final product. Although two scales of photography were used for this project, minimum mapping criteria were standard for both. Terrestrial and vegetated aquatic types were mapped to a 2.5-acre minimum and bodies of water to a 1.0-acre minimum. To facilitate Corps of Engineers permitting under Part 323.4 of Title 33, Code of Federal Regulations (1977), bodies of water 10 acres or more in size were typed as lakes. Water bodies less than 10 acres were typed as ponds. Vegetated wetlands 2.5 acres in size or larger associated with lakes or ponds were delineated and typed separately. Wetlands less than 2.5 acres in size associated with lakes or ponds were included in pond or lake types (see Appendix A, Types 23-11 and 24-11).

In addition to the numbered type symbol, graphic symbols were used for features too small to delineate, mixed and annexed types, and unknown boundaries between two different types (Figure 2).

When two different types were present but could not be separated, both were indicated in fractional form with the more dominant type in the numerator pos-

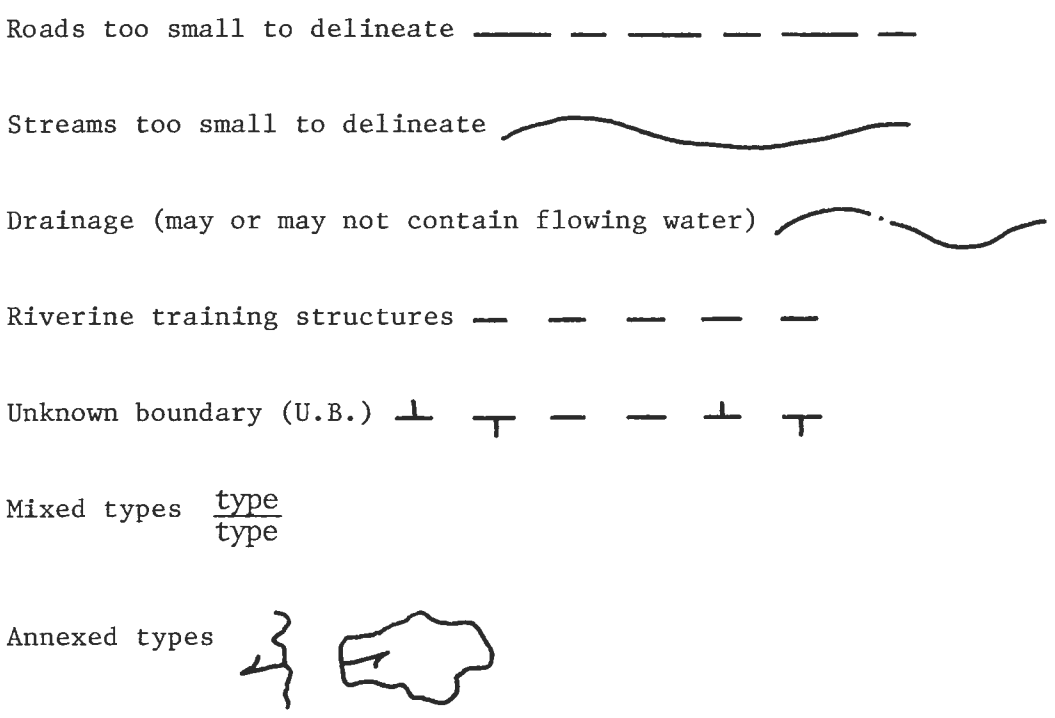


Figure 2. Graphic symbols used during interpretation process.

ition. For example, a dwarf spruce stand (12-03) with an understory of sedge-shrub tussocks (02-02) would be indicated as 12-03/02-02.

Field Reconnaissance

Field reconnaissance was conducted from May 15, 1979 to August 25, 1979 and from June 6, 1980 to June 20, 1980. Photo interpretation was not concurrent with field work due to the relatively short Alaskan summer and lengthy pipeline route. Areas previously interpreted were checked for accuracy with discrepancies noted on copies of the interpreted overlays. Areas not previously interpreted were visited and type of cover present recorded.

Plants were collected opportunistically within each habitat type depending on their floriferous stage, tentatively identified, pressed and stored in the Office of Special Studies, U.S. Fish and Wildlife Service, herbarium. Photos were taken at ground level for use as a record of each habitat type. Sources used for plant identification included: Hulten (1968), Porsild (1957), Argus (1973), and Viereck and Little (1972).

Base Map

U.S. Geological Survey (USGS) topographic maps cover the pipeline route at a scale of 1:63,360. However, gas pipeline alignment sheets used during planning and construction are produced at a scale of 1:12,000. To facilitate concurrent use of habitat maps and alignment sheets, USGS 15-minute quadrangles associated with the gas pipeline route were enlarged to a scale of 1:12,000 and used as base maps. Each quadrangle was divided into nine numbered sections. Those sections which were bisected by the pipeline corridor were photographically enlarged, reproduced on stable mylar and temporarily labeled with the USGS quadrangle and section from which it was reproduced (Figure 3). Gas pipeline alignment sheets were not used as base maps because photographic coverage extended beyond their borders.

Data Transfer and Map Compilation

Acetate overlays containing the delineated habitat information were attached to their respective aerial photos, photographically enlarged to align with the

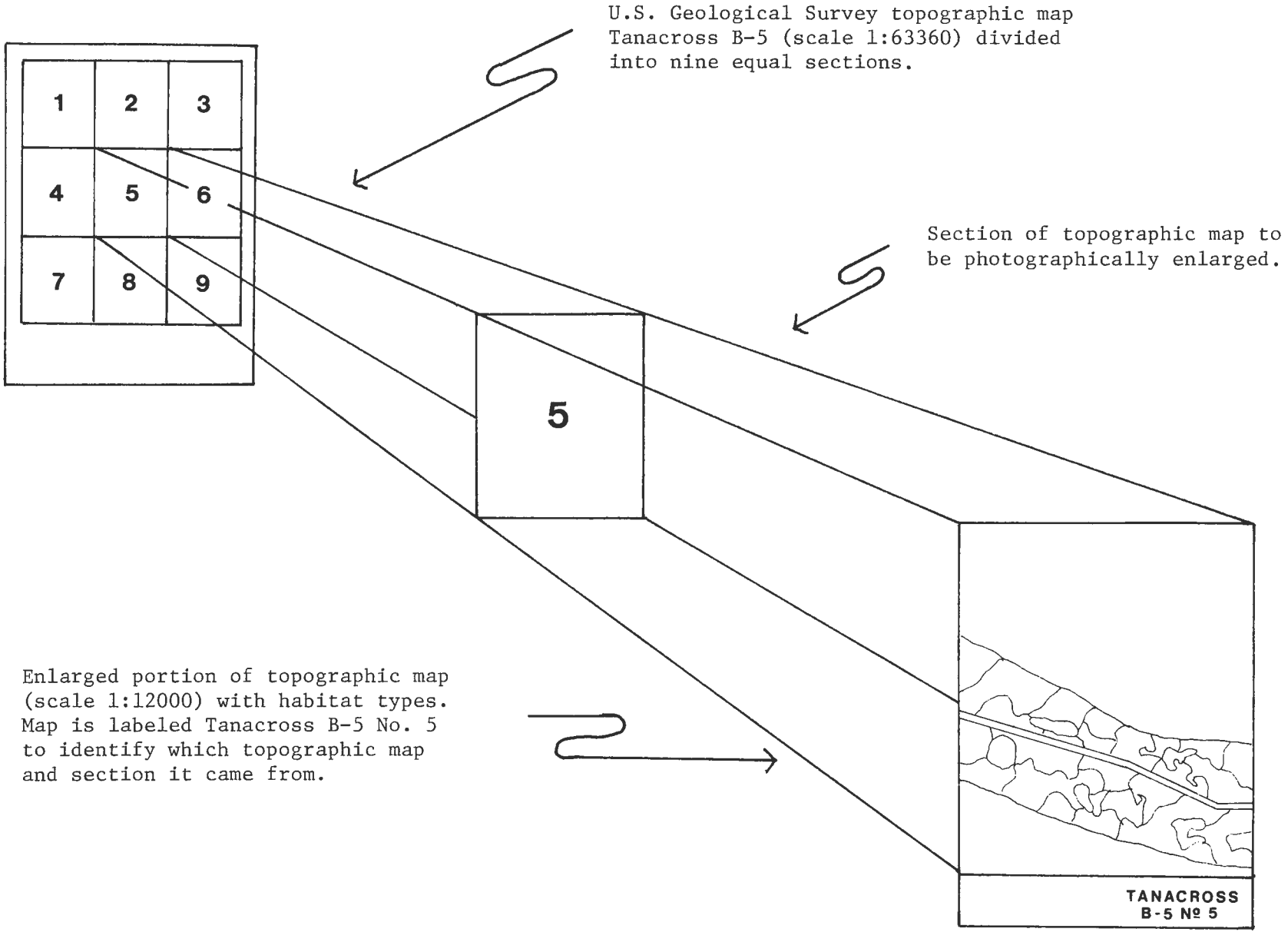


Figure 3. Habitat type base maps were produced by photographically enlarging portions of U.S. Geological Survey topographic maps bisected by the proposed gas pipeline route.

1:12,000 USGS quadrangle enlargements and reproduced. This procedure removed some of the displacement features caused by scale differences between flight lines and, in some cases, adjoining photos, and enabled transfer of habitat types directly onto mylar registered to their respective base maps. Alignment of photograph to base map was accomplished using lakes, ponds, streams, rivers, roads, utility right-of-ways, and other features. Each habitat map was then edited to ensure habitat polygons were labeled correctly and boundaries closed off. Each habitat map and its corresponding topographic base map were numbered consecutively for access and regrouping if separated. Mylars containing habitat types were labeled with the quadrangle and section name of the respective USGS base map to which it was aligned (Figure 4).

RESULTS

Approximately 1,880 square miles of habitat were cover-typed along the ANGTS corridor to produce 218 maps at a scale of 1:12,000. Table 2 shows estimated time accrued in hours and days for various activities during the project. The totals do not include holidays, weekends, annual and sick leave, time spent in meetings, and administrative duties. Also, some activities were conducted simultaneously which required more time than expected.

Major covertypes occurring north of the Brooks Range included sedge-grass tundra (01-00) on the Arctic Coastal Plain and sedge-shrub tussock tundra (02-02) in the foothills region. Throughout the Brooks Range alpine tundra (03-00) was common although sedge-shrub tussock tundra (02-02), low shrub-upland (08-02) and conifer forest (12-02), also occurred. South of the Brooks Range conifer Forest (12-02), deciduous forest (13-02), and mixed forest (14-02) were predominant; with sedge-grass marsh (22-02) and mix shrub wetland (20-01) predominant in the lower wet areas. Tall and low shrub riparian types (07-02 and 09-02 respectively) were common along most of the rivers and streams but low-shrub riparian-willow (09-01) was predominant north of the Brooks Range. Sedge-shrub tussock tundra (02-02) was found throughout the southern portion of the pipeline route, especially where permafrost occurred near the surface.

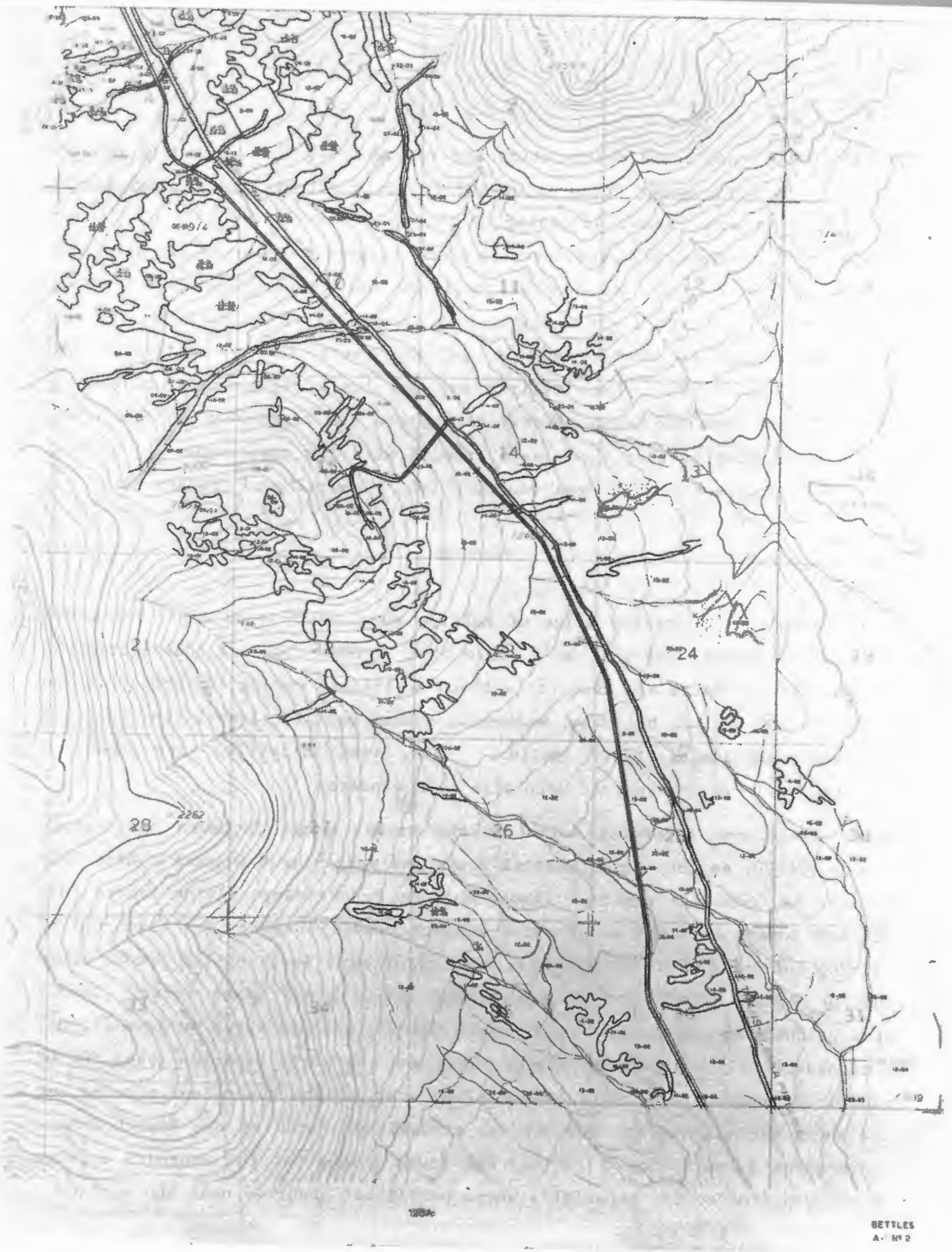


Figure 4. Mylar overlay of habitat types on corresponding base map showing labeling arrangement.

Table 2. Approximate Time Accrued in Hours and Days of Selected Activities for the Terrestrial and Aquatic Habitat Mapping Project

Activity	Hours	Days
Acquisition of background data	---	20
Photo preparation	---	12
Photo interpretation	400	151
Edit of interpreted work	150	47
Field Work	---	111
Map compilation	---	110
Edit of final maps	150	115
Total	700	566

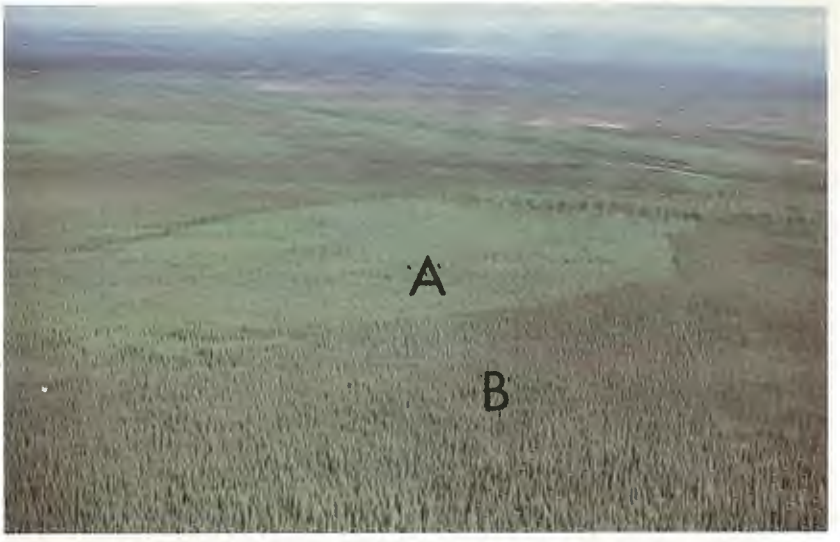
To ensure a minimum map accuracy of 85% approximately 1,363 sites were field verified. Notes from U.S. Fish and Wildlife Service and Alaska Department of Fish and Game field personnel were also used. Photo interpretation was at times difficult due to habitat diversity, presence of permafrost, topographic variations, influence of fire, and plant phenology. Areas affected by the above processes were verified more intensely than areas which were not affected.

Signatures within habitat types varied, especially in closed conifer (type 12-02). Colors ranged from dark green in stands growing on river floodplains to light green on well-drained north facing slopes. A yellow-green signature was present when this type occured over permafrost or as young stands (less than 20 years old).

Confusion of habitat signatures also occurred between types. Closed conifer forest (12-02) was often confused with closed deciduous forest (13-02) and closed mixed forest (14-02) due to effects from plant phenology, influence of fire and presence of permafrost. Areas burned and revegetated with young conifers produce light green to yellow green signatures compared to unburned conifer forests with dark green signatures (Figure 5). Mixed shrub wetland (20-01) and shrub-tussock tundra (02-02) had similar signatures. Although the mixed shrub wetland contains more and varied plant species, major differences between the two types is the occurrence of permafrost and an abundance of Eriophorum sp. tussocks in the shrub-tussock tundra type.

Variable topography produced shadows over many areas causing difficulty in type separation. Habitat types most often affected were closed conifer forest (12-02), closed mixed forest (14-02), low shrub-upland (08-02) and alpine tundra (03-00).

All signatures for habitat types containing deciduous plant species varied with latitude along the ANGTS route. Exposure of the photography occurred during peak of green in the southeastern section of the route, but in the northern portion exposure was taken when deciduous plants exhibited early to



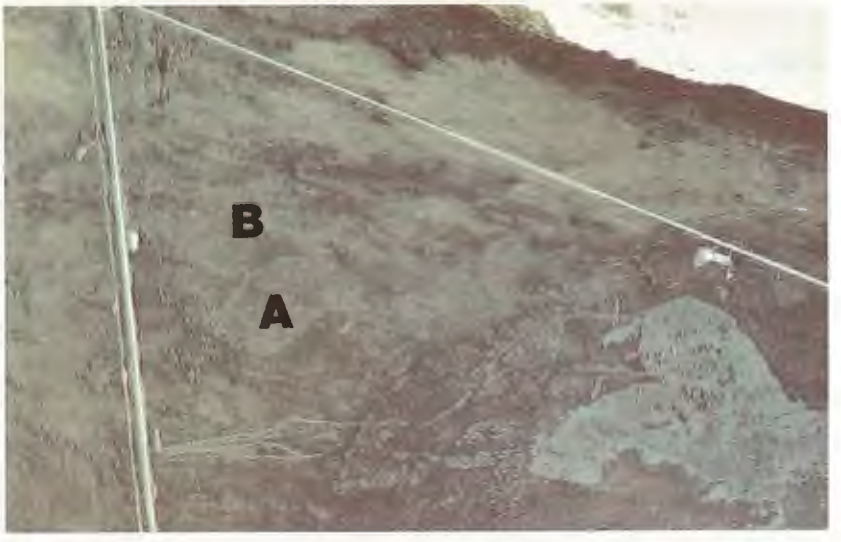


Figure 5. Top - Oblique 35 mm photo of spruce forest (12-02). Area A is a young stand approximately eight feet tall growing in an area which had been burned. Area B is an older stand 20-30 feet tall.

Below - Contact scale of a portion of photo NWAP 28-05 showing differences in signature of spruce forest. A and B correspond to same areas shown in top photo.

late autumn coloration. This facilitated separation of conifer and deciduous forest types (12-02 and 13-02 respectively) in northern areas. The majority of willow riparian (07-01 and 09-01) and mix shrub riparian (07-02 and 09-02) areas also could be separated because of differences in fall signatures between Willow (Salix sp.) produced a yellow signature while other species (Alnus sp., Betula sp., Vaccinium sp.) produced red to red-brown signatures. Caution should be used however when comparing the above colors to signatures produced on other photography. Type of film and processing used, age and temperature of film, and date of exposure may produce signatures different from those mentioned above.

Because of the late photo exposure date for areas north of the Brooks Range, difficulty occurred in separating sedge-grass tundra (01-00), tussock tundra (02-01), shrub-tussock tundra (02-02), mat and cushion tundra (04-00), and shrub tundra (05-00). Most signatures in this area were monotypic which increased the amount of field verification needed to assure accuracy.

One photo was missing from the data base set, resulting in approximately four square miles of vegetation receiving monocular interpretation. Because interpretation was based solely on plant signature, texture, and site, one area was found to be incorrectly typed and was later corrected following field verification. Stereo parallax produces a three-dimensional effect which greatly enhances ability to interpret vegetation and land forms.

An initial use of the terrestrial and aquatic habitat data involved quantification of linear distances of wetlands intersected by the proposed ANGTS alignment. These data were used to identify major areas which required Section 404 Permits from the Corps of Engineers. Wetland types were separated into three groups: A - Avoid During Design; B - Individual Section 404 Permits Required; C - General Permit Required. Table 3 lists preliminary wetland linear distances intersected by the proposed pipeline route for each wetland type by category for which the Corp of Engineers has jurisdiction. Summaries of wetland habitat types intersected by the proposed (May, 1979) pipeline route are listed by photo flight line in Appendix B.

Table 3. Preliminary Linear Distances (in feet) of Wetlands Intersected by the Proposed Pipeline Route* by Type of Permit

Category A - Avoid During Design

Wetland Type (Intersected Distance)	
Ponds	1,250
Lakes	0
Brackish Sedge Marsh	0
(SUBTOTAL)	1,250

Category B - Individual Section 404 Permits Required

Wetland Type (Intersected Distance)	
Ponds (adjoining TAPS/ Haul Road)	5,175
Lakes (adjoining TAPS/ Haul Road)	500
Wet Tundra	13,775
Sedge-Grass Marsh	12,975
Mix Shrub Wetland	42,633
(SUBTOTAL)	75,058

Category C - General Permit Applicable

Wetland Type (Intersected Distance)	
Wet Tundra	41,325
Tall Shrub Riparian	39,800
Low Shrub Riparian	67,250
Mix Shrub Wetland	42,632
Sedge Grass Tundra	207,495
Tussock Tundra	177,900
Forested Wetland	34,150
Moss Bog	0
(SUBTOTAL)	610,552
(TOTAL)	686,860

* As shown on the May 1979 alignment sheets

DISCUSSION

True color aerial photography permitted delineation of 69 different natural and man-made habitat types and man-made facilities along the gas pipeline corridor. Conventional aerial photography was chosen over other airborne or satellite sensing systems because of the potential for more accurate and comprehensible results (Thie 1976). Use of aerial photography for mapping vegetation in Alaska has been documented in the past. Potyondy et al. (1975), Scheierl and Meyer (1976 and 1977), and Hagen and Meyer (1978) mapped vegetation in the Copper River Delta area of the Chugach National Forest using 1:15,840 scale air photos. Portions of Prudhoe Bay were mapped by Webber and Walker (1974) at a scale of 1:6,000. Pamplin (1979) used enlargements of 1:15,840 and 1:36,000 scale photography to determine construction-related impacts on 12 major habitat types along the TAPS.

Original habitat maps were sent to Fluor/Northwest Alaska Pipeline Company for reproduction at scales of 1:12,000 and 1:24,000. The larger scale (1:12,000) will be used for office purposes such as planning and initial permitting. The 1:24,000 or quarter size maps will be produced for easier handling in the field. Habitat map distribution will be accomplished by the Office of the Federal Inspector - Anchorage to various state and federal regulatory agencies associated with the ANGTS. Appendix C lists the names of the completed maps, photos used to compile each map, and respective alignment sheets.

Northwest Alaskan Pipeline Company and various federal and state agencies will use the final habitat maps before, during, and after construction of the gas pipeline. If funding becomes available Alaska Information Management System (AIMS) personnel could digitize and store the information contained on the habitat maps and their respective base maps in the AIMS computer network. This will provide:

1. efficient and rapid retrieval of habitat data
2. rapid update of the habitat maps
3. facilitate cross-referencing with other stored environmental data

Preconstruction activities include determination of pipeline alignment, issuance of wetland and land use permits, preliminary determination of material sites, disposal sites, and temporary and permanent facility locations. The maps will also act as a standard when documenting wildlife

location and habitat use.

During construction the maps will enable engineers to determine types of vegetation expected within an area and modes of equipment needed for its removal and disposal. Pipeline monitors will be able to use the maps for evaluating permits, field design changes, and compliance with environmental stipulations.

Post-construction activities will include restoration and revegetation of disturbed areas. Quantitative assessments of adversely impacted sites can be done from the habitat maps to assure proper mitigative action. Less severely disturbed sites can be restored and/or revegetated with a similar or equal vegetation type by using information from the maps.

Limitations should be realized when using the habitat maps for site specific planning or permitting. Types occurring in the field may not be represented on the final habitat maps because of surface occlusion by canopy cover, shadows, or cloud cover on the base photography. Plant communities too small to accurately identify (image resolution) or smaller than the minimum mapping unit (2.5 acres for vegetated types, 1.0 acre for ponds) were incorporated into adjoining types. Areas requiring site-specific planning should be field verified to determine if important wildlife habitat (e.g. ponds, riparian zones, mixed shrub wetlands) exists. Wetlands may exist (in a legal sense) in any of the mapped covertypes and should be field verified to assure compliance with Corp of Engineers permitting requirements.

Since completion of the habitat maps, the pipeline alignment has changed along some portions of the route, and approximately 30 miles of new alignment exists outside the mapped corridor. Additional aerial photography is needed in these areas so that habitats present can be covertyped and incorporated into the present base maps.

Major changes in vegetative cover have also taken place near Delta Junction, Alaska. During the summer of 1979, large tracts of land were burned by uncontrolled fires, thereby drastically changing the habitat. These areas are not represented on the habitat maps because the air photo data base was exposed in 1978. Smaller sections of land in the same area also have been cleared for

agricultural purposes and are not represented on the habitat maps (Figure 6).

Figure 6. Area near Delta Junction, Alaska which is being cleared for agricultural purposes.

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APPENDIX A

Covertype Descriptions*

*Unless otherwise noted all photographs were taken by the author.

Sedge Grass Tundra (01-00)

Sedge-grass tundra can be found in areas underlain by permafrost, particularly on the Arctic Coastal Plain and arctic foothills or Brooks Range where drainage is poor. Sedges are the primary constituent of these communities often comprising 80% of the vegetation. *Carex aquatilis*, *C. Bigelowii*, *C. saxatilis* and *Eriophorum* sp. are some of the most common species. Grasses of the genera *Arctagrostis*, *Poa*, *Dupontia* and *Hierochloe* may occur. Several species of willows such as *Salix reticulata*, *S. arctica*, *S. lanata* and *S. rotundifolia* are often present. Flowering herbs such as *Saxifraga oppositifolia*, *S. hieracifolia*, *Polygonum viviparum*, *Papaver Hultenii*, *Aster sibiricus* and *Saussurea angustifolia* may also occur. *Dryas integrifolia* is usually present in the form of loose mats. Sedge-grass tundra may be moist but usually does not contain standing water in August.

Sedge-grass tundra, type 01-00, along the Sagavanirktok River south of Prudhoe Bay, Alaska.

Tussock Tundra (02-00)

Tussock tundra may occur along the pipeline route from the northern foothills region of the Brooks Range to the Canadian border.
This type is characterized by loosly formed to compacted tussocks dominated by Eriophorum vaginatum. Carex Bigelowii, Rubus chamaemorus, mosses and lichens may also occur. Shrub species present may include Betula nana, B. glandulosa, Vaccinium vitis-idaea, V. uliginosum, Ledum palustre, Arctostaphylos rubra, Potentilla fruticosa and members of the genus Salix.

Two qualifers are used when identifying Tussock Tundra: sedge (01) and sedge-shrub (02). Sedge tussock type (02-01) indicates that the aerial coverage of shrubs is less than 30 percent. Sedge-shrub tussock (02-02) indicates the presence of shrubs with an aerial coverage of 30 percent or greater.

Sedge-shrub tussock tundra, type 02-02, near the Chatanika River crossing of TAPS.

Alpine Tundra (03-00)

Alpine tundra is characterized by matted vegetation and stunted plant growth due to wind and prolonged snow cover. This type occurs above tree-line on mountain slopes and includes rock talus found above the zone of vegetation.

Heaths and shrubs are common in many alpine communities. Dryas integrifolia and D. octopetala often occur in the form of mats which may stabilize alpine areas. Empetrum nigrum, Arctostaphylos rubra, A. alpina, Vaccinium uliginosum, and V. vitis-idaea, Salix reticulata, S. phlebophylla, S. polaris, S. rotundifolia, S. arctica, S. glauca, and S. planifolia pulchra are often found in dwarfed form. Betula nana, Ledum palustre, Spiraea Beauverdiana and Potentilla fruticosa may also be present.

Alpine tundra areas also contain a relatively high diversity of herbaceous plants such as Saxifraga sp., Anemone narcissiflora, Bupleurum triradiatum, Campanula lasiocarpa, Astragalus sp., Potentilla sp., Polygonum sp., Myosotis sp., Pedicularis sp., and Arnica sp. as well as lichens and mosses.

Alpine tundra, type 03-00, near Atigun Summit in the Brooks Range.

Mat and Cushion Tundra (04-00)

Mat and Cushion Tundra is composed of low forming woody and herbaceous plants. It is differentiated from Alpine Tundra (03-00) by occurring at low elevations, predominantly on dry river terraces on the Arctic Coastal Plain. Plants in this type are prostrate due to wind and low temperatures and are dominated by *Cassiope* sp. and *Dryas* sp. Other species which may occur include *Arctostaphylos rubra*, *Saxifraga* sp., *Empetrum nigrum*, *Vaccinium uliginosum*, *Rhododendron lapponicum*, *Arnica Lessingii*, *Lupinus arcticus*, *Polygonum bistorta*, *Minuartia arctica*, *Juncus* sp., *Senecio atropurpureus*, *Pedicularis* sp., *Oxytropis Maydelliana*, *Stellaria* sp., *Eriophorum* sp., *Carex* sp., *Salix glauca*, *S. arctica* and some lichens.

Mat and cushion tundra, type 04-00, south of Alyeska Pump Station 2, Franklin Bluffs, Alaska.

Shrub Tundra (05-00)

Vegetation in this type is underlain by permafrost and consists primarily of Betula nana and several species of Salix.

Shrub Tundra communities usually contain an overstory of Betula nana and several species of Salix , (including Salix arctica, S. pulchra and S. rotundifolia), a middle layer of Vaccinium ugliginosum and Ledum palustre and an understory of Vaccinium vitis-idaea, Rubus chamaemorus, Eriophorum vaginatum (forming tussocks), Petasites frigidus, Stellaria Edwardsii, lichens and mosses. The height of Betula and Salix varies significantly from site to site. In some areas willows are more predominant than birch. Shrub tundra is well drained although moisture may occur between tussocks (if present).

Shrub Tundra, type 05-00, near slope Mountain, south of Alyeska Pump station 3.

Tall (06-00) and Low (08-00) Shrub Upland

Tall and Low Shrub Upland types are generally composed of species from the genera Salix and Betula. Salix lanata, S. pulchra, S. glauca, S. planifolia var. pulchra, S. bebbiana, S. myrtillifolia, S. hastata, Betula nana, B. glandulosa and B. papyrifera are a few of the more common species present. Vegetation occurring in the understory may include Vaccinium vitis-idaea, V. uliginosum, Alnus sp., Arctostaphylos rubra, Potentilla fruticosa Ledum palustre, Petisites frigidus and Polygonum bistorta.

Tall and Low Shrub Upland types are separated by height differences. Vegetation occurring within the Tall Shrub Upland type (06) range in size from 4-18 feet. A Low Shrub Upland type (08) is used if the vegetation is less than 4 feet.

Three qualifiers are used when identifying Tall and Low Shrub Upland types: Willow, Mix, and Burn. The Willow qualifier (represented as 01) is used when the members of the genera Salix are predominant. The Mix qualifier (represented as 02) is used when a mixture of woody species is present. The Burn qualifier (represented as 03) is used with the Tall Shrub type in areas which have been recently burned. These areas contain a mixture of plant species with burned deadfall trees scattered throughout. These types are found on well-drained sites south of the Brooks Range.

Tall shrub-upland burn, type 06-03, near Delta Junction, Alaska.

Tall (07-00) and Low (09-00) Shrub Riparian

Tall Shrub Riparian types range in height from 4-12 feet. Low Shrub Riparian types occur when the vegetation is less than 4 feet in height. These two classes occur next to and within stream and river channels. The major genera occurring is *Salix*, although *Betula nana*, *B. glandulosa*, *Vaccinum* sp., *Alnus* sp., *Spiraea Beauverdiana*, *Empetrum nigrum*, *Rubus* sp., *Aconitum delphinifolium*, *Polemonium acutiflorum*, *Valeriana capitata*, and *Viola epipsila* subsp. *repens* may be found along with moss and various grasses and sedges.

Two qualifiers are used when identifying this type: Willow and Mix. The Willow qualifier (represented as 01) is used when the major genera present is *Salix*. The Mix qualifier (represented as 02) is used when a mixture of woody species are present.

Low shrub-Riparian willow, type 09-01, along a small drainage west of Sagwon Bluffs.

Mud Flats/Dried Organic Matter (10-00)

This type is commonly associated with portions of lakes and ponds which become exposed by drainage or evaporation. The substrate is usually composed of mud (silts and clays) which occur along lake shorelines and drained basins or organic matter (decomposed plant material) found in some ephemeral ponds. Vegetation on these sites is sparse.

A drained pond, type 10-00, south of Prudhoe Bay, Alaska.

Revegetated Sites (11-00)

This type includes material sites or other areas which have been disturbed due to construction activities and have been revegetated. Most or all of the plant species present are from the family Poaceae and no species identification was attempted.

Revegetated material site, type 11-00, south of Jackson's slough (Middle Fork of the Koyukuk River).

Conifer Forest (12-00)

Picea mariana is the most common species in the conifer forest type, although Picea glauca is common on well drained sites such as hillsides, sandy soil or gravel substrate. Larix laricina is abundant in the Tanana Valley where it occurs mixed with spruce. Heights of these species may range from 10-65 feet.

Although variable in species composition, the understory in a coniferous forest is often composed of Betula nana and members of the genus Salix, Ledum palustre, Rosa acicularis, and Shepherdia canadensis growing approximately .5 to 1.5 feet in height. Arctostaphylos rubra, Vaccinium vitis-idaea, Equisetum pratense, E. silvaticum, Lupinus arcticus, Pedicularis verticillata, Saussurea angustifolia, Artemisia Tilesii, sphagnum moss and lichens may also be present.

The Conifer forest has four possible qualifiers: Open Conifer (12-01), Closed Conifer (12-02), Dwarf (12-03) and Burned (12-04). An Open Conifer forest was used when the conifer species present occupied 5-60% of the area being covertyped. If the ground coverage was greater than 60% it was typed as a Closed Conifer forest. Areas which contained stunted conifers with slow growth rates due to varying soil and harsh climate conditions were typed as Dwarf Conifer (12-03). Burned Conifer forest (12-04) was used to describe areas which had been recently burned with no appreciable growth.

Closed conifer forest, type 12-02, near Tok, Alaska.

Deciduous Forest (13-00)

Populus tremuloides, P. balsamifera, Betula papyrifera, or a combination of the three form most of the deciduous forest types although small amounts of Salix sp. and Picea sp. are sometimes found. The understory of deciduous forests is usually comprised of Shepherdia canadensis, Rosa acicularis, Arctostaphylos rubra, A. uva-ursi, Epilobium angustifolium, Mertensia paniculata, Astragalus sp. and Equisetum sp. as well as lichens and mosses.

Two qualifiers separate deciduous forest into Open (13-01) or Closed (13-02). As in the conifer forest types, 5-60% ground coverage of the deciduous species present designate an Open Forest and 60% or greater designate a Closed Forest.

Closed deciduous forest, type 13-02, north of Alyeska pump station No. 8, south of Fairbanks, Alaska.

Mixed Forest (14-00)

Mixed forests are composed of Picea mariana, P. glauca, Larix laricina, Populus tremuloides, P. balsamifera and Betula papyrifera. Neither conifer nor deciduous species exhibit a clear dominance in this type. One or more species of Salix may be present as an intermediate layer and may attain heights greater than 4 feet. The understory generally consists of Ledum palustre, Shepherdia canadensis, Arctostaphylos sp., Rosa acicularis, Mertensia paniculata, Epilobium angustifolium, Viburnum edule, Linnaea borealis and Lupinus arcticus.

Two qualifiers separate Mixed Forest into Open (14-01) or Closed (14-02). As in the conifer forest types, 5-60% ground coverage of the mixed species present designate an Open Forest and 60% or greater designate a Closed Forest.

Closed Mixed forest, type 14-02, near Northway, Alaska.

Unvegetated Floodplain (15-00) and Bare Ground (16-00)

These two types are used to represent those areas which contain little or no vegetation. Unvegetated Floodplain (15-00) occurs within active stream and river channels and usually consists of gravel to boulder sized rocks, sand (either wind or water deposited), mud flats and/or driftwood debris. Bare ground (16-00) commonly occurs as unvegetated hillsides, talus slopes or cut banks along streams or rivers.

Unvegetated floodplain, type 15-00, along the Middle Fork of the Koyukuk River.

Agriculture (17-00)

This type is used in areas where the natural vegetation has been destroyed for agricultural purposes. This type includes areas used for root crops, small grains, and forage crops. However, the agricultural type was not used if the area had reverted back to a natural state with reinvasion of native plants.

Farming, type 17-00, near Delta Junction, Alaska. Area to left is planted with barley, area to right has recently been cleared and not yet planted.

Man-made Effects (18-00)

This type includes man-made, semi-permanent to permanent disturbances to the native vegetation and surrounding landforms. These areas may or may not be revegetated. Listed below are the qualifiers possible:

01 Airstrips (public, private and military)
02 Construction Camps
03 Tailing Piles
04 Utilities: pipeline (above and below ground) and power lines
05 North Slope Haul Road
06 Material Sites
07 Disposal Sites
08 Urban Development (including homesteads
09 Storage Pad
10 Man-caused Erosion
11 Military Establishments
12 Primary Highways
13 Secondary Highways and Access Roads
14 Highway Maintenance Station
15 Pump Station (Alyeska and military)
16 Drill Pad
17 Petroleum Feeder Lines
18 Holding Pond
19 Construction Facilities (other than camps)

Alyeska Pump Station No. 5, type 18-15, near Prospect, Alaska.

Forested Wetland (19-01)

Picea mariana is the dominant species present in this type although Larix laricina may occasionally occur. Water is often at or near the surface causing shallow root systems. Heights of these two species may vary between four and twenty feet depending on substrate and amount of water present. Species occurring in the understory include Betula nana, Salix sp., Ledum palustre, Equisetum silvaticum, Sphagnum sp., grasses and sedges.

Low oblique photograph of a Forested wetland, type 19-01, near Dot Lake, Alaska.

Mix Shrub Wetland (20-01)

Mix Shrub Wetlands commonly contain a mixture of *Salix* sp. and *Betula* sp. that grow to heights of 3-12 feet. Water tolerant species such as *Salix planifolia* subsp. *pulchra*, *S. hastata*, *S. fuscescens* and *Betula nana* are the more common forms. *Eriophorum* sp. and *Carex* sp. were common as are *Rosa acicularis*, *Potentilla palustris*, *Petasites frigidus*, *Parnassia palustris*, *Iris setosa*, *Vaccinium uliginosum*, *Ledum palustre* and *Senecio pauperculus*.

Mix shrub wetlands contain water at or near the surface but are not underlain by permafrost. Tussocks are common but not a dominant feature.

Mix shrub wetland, type 20-01, east of Tok, Alaska.

Moss Bog (21-00)

This type is characterized by having Sphagnum sp. as the dominant ground cover. Other plants include Picea mariana, Ledum palustre, Vaccinium sp., Rubus chamaemorus, and a sparse occurrence of Eriophorum sp. and Carex sp.

Portion of a small Moss bog, type 21-00, near the Chatanika River.

Wet Tundra (22-01)

Wet Tundra areas are generally vegetated by the genera Carex and Eriophorum. Carex aquatilus, C. saxatilis, Eriophorum angustifolium and E. Scheuchzeri usually comprise more than 90% of the ground cover. Saxifraga hirculus, Pedicularis sudetica, Salix arctica, Caltha palustris, Cardamine sp. and mosses may also occur. One to four inches of standing water is usually present in August. This type is only found on the Arctic Coastal Plain.

Wet tundra, type 22-01, south of Prudhoe Bay, Alaska.

Sedge-grass Marsh (22-02)

Sedge-grass Marsh is dominated by plants from the genus *Carex* which comprise approximately 80% of this type. *Equisetum fluviatile*, *Nuphar polysepalum* and several mosses also occur. *Arctophila fulva* and *Carex aquatilis* are the dominant species on the Arctic Coastal Plain. Sedge-grass marsh is most common along lake and pond margins.

Sedge-grass marsh, type 22-02, near the Tanana River east of Tok, Alaska.

Brackish Sedge Marsh (22-03)

Brackish Sedge Marsh is found in areas influenced by sea water at the Beaufort Sea coast or in river deltas. These areas may be affected by seawater wind blown spray. *Carex subspathacea* and *Puccinellia phryganodes* represent 95% of the plant species present. Other species such as *Stellaria humifusa*, *Sedum rosea* subsp. *integrifolium* and *Elymus arenarius* may also be found. Brackish sedge marshes may be moist or contain standing water depending on drainage.

Brackish sedge marsh, type 22-03, near Prudhoe Bay, Alaska. (Photo by Tom Rothe).

Ponds (23-00) and Lakes (24-00)

Ponds are classified as bodies of water greater than one acre in size but less than 10 acres. Lakes are bodies of water larger than 10 acres.

Ponds and Lakes vary from no vegetative coverage to complete coverage by floating and/or emergent vegetation. Major plants found, include species from the genera Carex and Arctophila as well as Equisetum fluviatile, Nuphar polysepalum and Lemna sp.

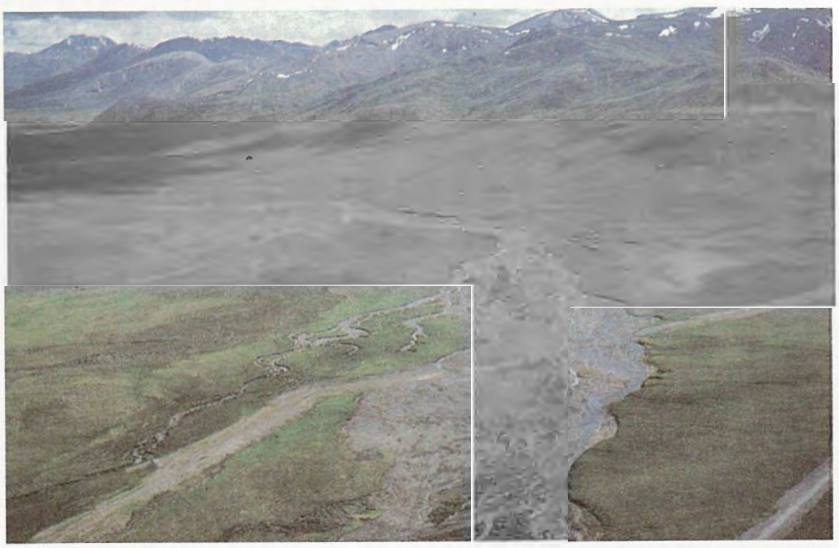
Four qualifiers are used to describe the amount of vegetation cover present. When a water body is free of vegetation, -20 is used after the respective Pond (23) or Lake (24) class (e.g. 23-20 or 24-20). When the water body is vegetated three possible qualifiers may be used to indicate the amount of vegetation present. Coverage of 0-25%, 25-75% and 75-100% are indicated by -11, -12 and -13, respectively. As an example, a Pond having 25-75% of its surfae area covered by vegetation would be labeled as 23-12.

Pond, type 23-12, south of Prudhoe Bay, Alaska. Reddish emergent vegetation is Arctophila fulva.

Streams (25-00) and Rivers (26-00)

Streams and Rivers include those bodies of water contained within an active channel or floodplain and are separated on the basis of size. Streams are identified as having a maximum width of 25 to 30 feet. Channels greater than 30 feet in width are identified as Rivers. Rivers and Streams may flow permanently or intermittently throughout the year depending upon ground water table and annual rainfall. Riverine side channels are included in the River type although the side channel width may be less than 30 feet.

Five qualifiers are used to better describe the Stream or River type: Braided (01), Incised (02), Meandering (03), Beaded (04), and High Gradient Mountain (05). Braided Streams and Rivers are characterized by having two or more interweaving sub-channels located within a main channel and are in an active state of change. A Stream or River which is Incised has one "V" shaped main channel which has cut deeply into the surrounding landform. The Meandering qualifier is used when relatively slow moving water is present and the channel follows a winding and turning course. The Beaded qualifier is used to describe streams north of the Brooks Range and are characterized by having a series of short stream channels connected by small pools. High Gradient Mountain Streams occur in mountainous areas where water flow is relatively fast down a medium to high gradient.



Braided River, type 26-01, shown by the West Fork of the North Fork of the Chandalar River.

Appendix B

Preliminary Linear Distances of Wetlands
Intersected by the Proposed ANGTS Route

Summary of wetland habitat types intersected by the proposed ANGTS Route from the Canadian border to Tetlin Junction, Alaska.

Flight Line Number	LINEAR DISTANCE OF HABITAT TYPES INTERSECTED (Feet) 01-00	02-01	02-02	07-01	07-02	09-01	09-02	Gasline Distance[a]	Inclusive Milepost Numbers
37			975					13,200	739.9-737.4
36			9,000					308,880	737.4-678.9
35								46,992	678.9-670.0
34								34,320	670.0-663.5
TOTALS			9,975					403,392	663.5-739.9

Summary of wetland habitat types intersected by the proposed ANGTS Route from Tetlin Junction to Big Delta, Alaska.

Flight Line Number	LINEAR DISTANCE OF HABITAT TYPES INTERSECTED (Feet) 01-00	02-01	02-02	07-01	07-02	09-01	09-02	Gasline Distance[a]	Inclusive Milepost Numbers
33								186,384	663.5-628.2
32			1,100					71,808	628.2-614.6
31								61,776	614.6-602.9
30								82,896	602.9-587.2
29								44,880	587.2-578.7
28								166,320	578.7-547.2
27								38,016	547.2-540.0
TOTALS			1,100					652,080	663.5-540.0

[a] Distances are inclusive within flight line boundaries.

Summary of wetland habitat types intersected by the proposed ANGTS Route from Big Delta to the Yukon River, Alaska.

Flight Line Number	LINEAR DISTANCE OF HABITAT TYPES INTERSECTED (Feet) 01-00	02-01	02-02	07-01	07-02	09-01	09-02	Gasline Distance[a]	Inclusive Milepost Numbers
26								128,304	540.0-515.7
25			5,050		1,100			98,208	515.7-497.1
24					350			98,208	497.1-478.5
23								141,504	478.5-451.7
22			3,575					125,664	451.7-427.9
21			3,150					233,376	427.9-383.7
20								124,080	383.7-360.2
TOTALS			11,775		1,450			949,344	540.0-360.2

Summary of wetland habitat types intersected by the proposed ANGTS Route from the Yukon River to the Middle Fork of the Koyukuk River, Alaska.

Flight Line Number	LINEAR DISTANCE OF HABITAT TYPES INTERSECTED (Feet) 01-00	02-01	02-02	07-01	07-02	09-01	09-02	Gasline Distance[a]	Inclusive Milepost Numbers
19			1,900					93,456	360.2-342.5
18			600					38,016	342.5-335.3
17					1,650			163,680	335.3-304.3
16			3,425		750			124,608	304.3-280.7
15			8,950		1,450			85,008	280.7-264.6
14			9,000					63,888	264.6-253.7
13			9,625		450			123,552	253.7-230.3
TOTALS			33,500		4,300			692,208	360.2-230.3

[a] Distances are inclusive within flight line boundaries.

Summary of wetland habitat types intersected by the proposed ANGTS Route from the Middle Fork of the Koyukuk River to Atigun Summit, Alaska.

Flight Line Number	LINEAR DISTANCE OF HABITAT TYPES INTERSECTED (Feet)							Gasline Distance[a]	Inclusive Milepost Numbers
	01-00	02-01	02-02	07-01	07-02	09-01	09-02		
12			8,350					45,408	230.3-221.7
11			14,350					52,272	221.7-211.8
10			850		23,350			110,352	211.8-190.9
9				8,000			12,200	98,208	190.9-172.3
8	3,100					17,150	200	104,544	172.3-152.5
TOTALS	3,100		23,550	8,000	23,350	17,150	12,400	410,784	230.3-152.5

Summary of wetland habitat types intersected by the proposed ANGTS Route from Atigun Summit to Prudhoe Bay, Alaska.

Flight Line Number	LINEAR DISTANCE OF HABITAT TYPES INTERSECTED (Feet)							Gasline Distance[a]	Inclusive Milepost Numbers
	01-00	02-01	02-02	07-01	07-02	09-01	09-02		
7	22,400					1,200		79,728	152.5-137.4
6				700				115,632	137.4-115.5
5			65,500		2,000		2,200	180,048	115.5-81.4
4		13,000	19,500				13,400	110,880	81.4-60.4
3	46,850					2,200	18,700	149,952	60.4-32.0
2	51,095							60,720	30.5-19.0
1A	70,875							71,280	19.0-5.5
1	13,175							29,040	5.5-0.0
TOTALS	204,395	13,000	85,000	700	2,000	3,400	34,300	797,280	152.5-0.0

[a] Distances are inclusive within flight line boundaries.

Summary of wetland habitat types intersected by the proposed ANGTS Route from the Canadian border to Tetlin Junction, Alaska.

Flight Line Number	LINEAR DISTANCE OF HABITAT TYPE INTERSECTED (Feet)													
	19-01	20-01	21-00	22-01	22-02	22-03	23-11	23-12	23-13	23-20	24-11	24-12	24-13	24-20
37	1,200													
36		1,000												
35	1,000													
34	2,600	1,900												
TOTALS	4,800	2,900												

Flight Line Number	25-01	25-02	25-03	25-04	25-05	26-01	26-02	26-03	Gasline Distance[a]	Inclusive Milepost Numbers
37			15						13,200	739.9-737.4
36			285						308,880	737.4-678.9
35									46,992	678.9-670.0
34								650	34,320	670.0-663.5
TOTALS			300					650	403,392	663.5-739.9

[a] Distances are inclusive within flight line boundaries.

Summary of wetland habitat types intersected by the proposed ANGTS Route from Tetlin Junction to Big Delta, Alaska.

Flight Line Number	LINEAR DISTANCE OF HABITAT TYPE INTERSECTED (Feet)													
	19-01	20-01	21-00	22-01	22-02	22-03	23-11	23-12	23-13	23-20	24-11	24-12	24-13	24-20
33	4,150	7,900			400		200							
32														
31					1,800									
30														
29					750									
28														
27		75												
TOTALS	4,150	7,975			2,950		200							

Flight Line Number	25-01	25-02	25-03	25-04	25-05	26-01	26-02	26-03	Gasline Distance[a]	Inclusive Milepost Numbers
33	655		165					50	186,384	663.5-628.2
32	90					1,200			71,808	628.2-614.6
31			45						61,776	614.6-602.9
30			175						82,896	602.9-587.2
29			15			1,050			44,880	587.2-578.7
28			60			750			166,320	578.7-547.2
27									38,016	547.2-540.0
TOTALS	745		460			3,000		50	652,080	663.5-540.0

[a] Distances are inclusive within flight line boundaries.

Summary of wetland habitat types intersected by the proposed ANGTS Route from Big Delta to the Yukon River, Alaska.

Flight Line Number	LINEAR DISTANCE OF HABITAT TYPE INTERSECTED (Feet)													
	19-01	20-01	21-00	22-01	22-02	22-03	23-11	23-12	23-13	23-20	24-11	24-12	24-13	24-20
26	11,925	46,275												
25		350												
24	3,800	5,600			375			100						
23		850			2,250			500						
22	4,650	700												
21	3,125	850			100									
20														
TOTALS	23,500	54,625			2,725			600						

Flight Line Number	25-01	25-02	25-03	25-04	25-05	26-01	26-02	26-03	Gasline Distance[a]	Inclusive Milepost Numbers
26			200					900	128,304	540.0-515.7
25			195					125	98,208	515.7-497.1
24			375						98,208	497.1-478.5
23			150					150	141,504	478.5-451.7
22			165		30			125	125,664	451.7-427.9
21			180		180			325	233,376	427.9-383.7
20			15		255				124,080	383.7-360.2
TOTALS			1,280		465			1,625	949,344	540.0-360.2

[a] Distances are inclusive within flight line boundaries.

Summary of wetland habitat types intersected by the proposed ANGTS Route from the Yukon River to the Middle Fork of the Koyukuk River, Alaska.

Flight Line Number	LINEAR DISTANCE OF HABITAT TYPE INTERSECTED (Feet)													
	19-01	20-01	21-00	22-01	22-02	22-03	23-11	23-12	23-13	23-20	24-11	24-12	24-13	24-20
19														
18	1,300													
17														
16	400							50						
15		200												
14		160												
13		1,280												
TOTALS	1,700	1,640						50						

Flight Line Number	25-01	25-02	25-03	25-04	25-05	26-01	26-02	26-03	Gasline Distance[a]	Inclusive Milepost Numbers
19			60		225			1,900	93,456	360.2-342.5
18			30		15				38,016	342.5-335.3
17			75		195				163,680	335.3-304.3
16			115		225			100	124,608	304.3-280.7
15			210		135			195	85,008	280.7-264.6
14			90					100	63,888	264.6-253.7
13	125		335		175	125			123,552	253.7-230.3
TOTALS	125		915		970	125		2,295	692,208	360.2-230.3

[a] Distances are inclusive within flight line boundaries.

Summary of wetland habitat types intersected by the proposed ANGTS Route from the Middle Fork of the Koyukuk River to Atigun Summit, Alaska.

Flight Line Number	LINEAR DISTANCE OF HABITAT TYPE INTERSECTED (Feet)													
	19-01	20-01	21-00	22-01	22-02	22-03	23-11	23-12	23-13	23-20	24-11	24-12	24-13	24-20
12		2,500												
11		2,900			250									
10		6,300												
9		1,700												
8				4,150										
TOTALS		13,400		4,150	250									

Flight Line Number	25-01	25-02	25-03	25-04	25-05	26-01	26-02	26-03	Gasline Distance[a]	Inclusive Milepost Numbers
12			60		15	275			45,408	230.3-221.7
11			90		30	275			52,272	221.7-211.8
10			195		390	450			110,352	211.8-190.9
9					180	410			98,208	190.9-172.3
8					660	205	75		104,544	172.3-152.5
TOTALS			345		1,275	1,615	75		410,784	230.3-152.5

[a] Distances are inclusive within flight line boundaries.

Summary of wetland habitat types intersected by the proposed ANGTS Route from Atigun Summit to Prudhoe Bay, Alaska.

Flight Line Number	LINEAR DISTANCE OF HABITAT TYPE INTERSECTED (Feet)													
	19-01	20-01	21-00	22-01	22-02	22-03	23-11	23-12	23-13	23-20	24-11	24-12	24-13	24-20
7		2,050		4,800	3,000									
6		2,600		1,900			275							
5				23,000	350									500
4				1,400					200	300				
3		75		7,350			300	200		700				
2				3,450						175				
1A				9,050	3,700				750	2,350				
1										325				
TOTALS		4,725		50,950	7,050		575	200	950	3,850				500

Flight Line Number	25-01	25-02	25-03	25-04	25-05	26-01	26-02	26-03	Gasline Distance[a]	Inclusive Milepost Numbers
7					1,205			375	79,728	152.5-137.4
6				165	385				115,632	137.4-115.5
5			205	90	90				180,048	115.5-81.4
4			135						110,880	81.4-60.4
3			210			80			149,952	60.4-32.0
2						2,000			60,720	30.5-19.0
1A			15						71,280	19.0-5.5
1			30			50			29,040	5.5-0.0
TOTALS			595	255	1,680	2,130		375	797,280	152.5-0.0

[a] Distances are inclusive within flight line boundaries.

Summary of unvegetated floodplain distances intersected by the proposed ANGTS route.

Flight Line Number	Intersected Distance[a]	Gasline Distance[b]	Inclusive Milepost Numbers
25	450	98,208	515.7-497.1
13	2,350	123,552	253.7-230.3
12	1,700	45,408	230.3-221.7
11	1,900	52,272	221.7-211.8
10	7,400	110,352	211.8-190.9
9	24,000	98,208	190.9-172.3
8	19,400	104,544	172.3-152.5
3	8,600	149,952	60.4-32.0
TOTAL	65,800		

[a] Distances are in feet.

[b] Distances are inclusive within flight line boundaries.

APPENDIX C

Cross Reference of Completed Maps Photos, and Alignment Sheets

GAS PIPELINE HABITAT EVALUATION PROGRAM CROSS-REFERENCE OF
HABITAT MAPS, AERIAL PHOTOGRAPHS AND PIPELINE ALIGNMENT SHEETS

No.	Map Name		Photo No.*	Photo No.*	Photo No.*	Photo No.*	Alignment Sheet No.**		
1.	Nabesna	C1-9 AB	37002	-	-	-	131	-	-
2.	Nabesna	C1-6 AB	36002	37002	37003	-	131	130	-
			37004	-	-	-	-	-	-
3.	Nabesna	C1-3 AB	36002	36004	-	-	130	129	-
4.	Nabesna	C1-2 AB	36006	-	-	-	129	-	-
5.	Nabesna	D1-9 AB	36006	-	-	-	129	-	-
6.	Nabesna	D1-8 AB	36006	36008	36010	-	129	128	-
7.	Nabesna	D1-7 AB	36008	36010	36012	-	128	-	-
8.	Nabesna	D1-4 AB	36010	36012	-	-	127	128	126
9.	Nabesna	D2-6 AB	36010	36012	-	-	126	127	-
10.	Nabesna	D2-3 AB	36014	36016	-	-	126	125	-
11.	Nabesna	D2-2 AB	36016	36018	-	-	125	-	-
12.	-	-	-	-	-	-	-	-	-
13.	Tanacross	A2-8 AB	36018	36020	36022	-	124	125	-
14.	Tanacross	A2-7 AB	36018	36020	36022	-	124	-	-
15.	Tanacross	A2-4 AB	36022	-	-	-	123	-	-
16.	-	-	-	-	-	-	-	-	-
17.	Tanacross	A3-6 AB	36022	36024	-	-	122	123	-
18.	Tanacross	A3-3 AB	36024	36026	34028	-	121	122	-
19.	Tanacross	A3-2 AB	36026	36028	35003	-	120	121	-
20.	Tanacross	A4-3 CD	35003	-	-	-	-	-	-
20.	Tanacross	A3-1 AB	35003	35005	-	-	119	120	-
21.	Tanacross	B3-8 AB	35003	36028	-	-	119	120	-
22.	Tanacross	B3-7 AB	35005	35007	-	-	119	-	-
23.	Tanacross	B4-9 AB	34003	34004	35005	-	118	119	-
24.	Tanacross	B4-8 AB	34004	33003	35005	-	117	118	-
25.	Tanacross	B4-6 CD	34003	34004	35005	-	118	-	-
25.	Tanacross	B4-7 AB	33005	33007	-	-	116	117	-
26.	Tanacross	B4-5 AB	34004	33003	-	-	117	-	-
27.	Tanacross	B4-4 AB	33005	33007	-	-	116	117	-
28.	Tanacross	B5-9 AB	33006	33007	-	-	116	115	-
29.	Tanacross	B5-6 AB	33007	33009	-	-	116	115	-
30.	Tanacross	B5-5 AB	33011	33013	-	-	114	115	-
31.	Tanacross	B5-4 AB	33013	33014	33015	-	113	114	-
32.	Tanacross	B6-6 AB	33015	33017	33018	-	112	113	-
33.	Tanacross	B6-5 AB	33018	33019	-	-	112	-	-
34.	Tanacross	B6-4 AB	33010	33020	-	-	111	112	-
35.	Tanacross	B6-2 AB	33020	32003	32004	32006	111	110	-
			32006						
36.	Tanacross	B6-1 AB	32005	-	-	-	110	111	-
37.	Tanacross	C6-8 AB	32006	32007	32008	-	110	109	-
38.	Tanacross	C6-7 AB	32007	-	-	-	110	-	-
39.	-	-	-	-	-	-	-	-	-

GAS PIPELINE HABITAT EVALUATION PROGRAM CROSS-REFERENCE OF HABITAT MAPS, AERIAL PHOTOGRAPHS AND PIPELINE ALIGNMENT SHEETS

No.	Map Name		Photo No.*	Photo No.*	Photo No.*	Photo No.*	Alignment Sheet No.**		
40.	Tanacross	C6-4 AB	31004	31006	-	-	109	108	-
41.	Mt. Hayes	C1-6 AB	31006	31007	31008	-	108	-	-
42.	Mt. Hayes	C1-3-AB	30003	31007	31008	-	107	108	-
43.	Mt. Hayes	C1-2 AB	30003	30004	30005	-	107	106	-
44.	Mt. Hayes	C1-1 AB	30005	30006	30007	30008	106	105	-
45.	Mt. Hayes	C2-3 AB	30008	30009	30010	29003	105	104	-
			29004	-	-	-	-		- -
46.	Mt. Hayes	C2-2 AB	29003	29004	30010	-	104	-	-
47.	Mt. Hayes	D2-9 AB	29004	28002	-	-	-		- -
47.	Mt. Hayes	D2-8 CD	29004	28002	-	-	103	104	-
48.	Mt. Hayes	D2-7 AB	28002	28003	28005	28007	103	102	-
49.	Mt. Hayes	D3-9 AB	28007	28009	-	-	102	-	-
50.	Mt. Hayes	D2-4 AB	28005	-	-	-	102	-	-
51.	Mt. Hayes	D3-6 AB	28007	28009	-	-	101	102	-
52.	Mt. Hayes	D3-5 AB	28009	28010	28011	-	100	101	-
52.	Mt. Hayes	D3-4 CD	28011	-	-	-	-		- -
53.	Mt. Hayes	D3-2 AB	28013	28011	-	-	100	-	-
54.	Mt. Hayes	D3-1 AB	28011	28013	28015	-	099	100	-
55.	Mt. Hayes	D4-3 AB	28015	-	-	-	098	099	-
56.	Mt. Hayes	D4-2 AB	28018	-	-	-	-		- -
57.	Big Delta	A4-9 AB	28017	28018	28019	-	098	097	-
58.	Big Delta	A4-8 AB	28019	27003	-	-	097	-	-
59.	Big Delta	A4-5 AB	27005	27007	27003	-	097	096	-
60.	Big Delta	A4-4 AB	26003	26005	27005	-	095	096	-
61.	Big Delta	A4-1 AB	26005	26007	26008	26009	095	094	-
62.	Big Delta	A5-3 AB	26008	26009	-	-	094	-	-
63.	Big Delta	B4-7 AB	26009	26011	-	-	-		- -
64.	Big Delta	B5-9 AB	26009	26011	26013	-	093	094	-
65.	Big Delta	B5-8 AB	26013	26015	-	-	093	094	-
66.	Big Delta	B5-6 AB	26015	26016	26017	26018	092	-	-
67.	Big Delta	B5-4 AB	26020	-	-	-	091	-	-
68.	Big Delta	B5-5 AB	26018	26019	25004	-	091	092	-
69.	Big Delta	B5-2 AB	26019	25004	-	-	091	-	-
70.	Big Delta	B5-1 AB	25004	25006	25008	-	090	091	-
71.	Big Delta	B6-3 AB	25012	25010	25009	25008	089	090	-
72.	Big Delta	B6-2 AB	25010	25012	-	-	090	-	-
73.	-	-	-	-	-	-	-		--
74.	Big Delta	C6-8 AB	25012	25014	24002	-	089	-	-
75.	Big Delta	C6-7 AB	24002	24004	24006	-	087	088	-
76.	Big Delta	C6-4 AB	24006	24008	24010	-	086	087	-

GAS PIPELINE HABITAT EVALUATION PROGRAM CROSS-REFERENCE OF
HABITAT MAPS, AERIAL PHOTOGRAPHS AND PIPELINE ALIGNMENT SHEETS

No.	Map Name		Photo No.*	Photo No.*	Photo No.*	Photo No.*	Alignment Sheet No.**		
77.	Fairbanks	C1-6 AB	24012	24010	24008	-	086	-	-
78.	Fairbanks	C1-3 AB	24012	24013	23002	-	085	086	-
79.	Fairbanks	C1-2 AB	23004	23002	-	-	084	085	-
80.	Fairbanks	D1-9 AB	24016	-	-	-	-	-	-
81.	Fairbanks	D1-8 AB	24016	23004	23006	-	083	084	-
82.	Fairbanks	D1-7 AB	23006	23008	23010	-	083	-	-
83.	Fairbanks	D1-4 AB	23010	23012	23014	-	082	083	-
84.	Fairbanks	D2-6 AB	23014	23012	-	-	081	082	-
85.	Fairbanks	D2-3 AB	23014	23016	23017	23018	081	082	083
86.	Fairbanks	D2-2 AB	23018	23019	23020	22002	080	-	-
87.	-	-	-	-	-	-	-		-
88.	Livengood	A2-8 AB	22002	22003	22004	22005	079	080	-
			22007	-	-	-	-	-	-
89.	Livengood	A2-7 AB	22005	22007	22008	-	079	078	-
90.	Livengood	A2-4 AB	22007	22008	22009	22010	077	078	-
		22011	22012	-	-	-	-		
91.	Livengood	A3-6 AB	22012	22013	-	-	077	-	-
92.	Livengood	A2-1 AB	22012	22013	-	-	-	-	-
93.	Livengood	A3-3 AB	22013	22014	22015	22016	076	077	-
			22017	21002	-	-	-	-	-
94.	Livengood	A3-2 AB	21002	21003	-	-	076	-	-
95.	Livengood	B3-9 AB	21002	21003	21004	-	075	-	-
96.	Livengood	B3-8 AB	21003	21003	21006	21008	075	074	-
97.	Livengood	B3-7 AB	21008	21006	-	-	074	-	-
98.	Livengood	B3-5 AB	21008	21010	-	-	074	-	-
99.	Livengood	B3-4 AB	21008	21010	21012	-	074	073	-
100.	Livengood	B4-6 AB	21012	21014	-	-	-	-	-
101.	Livengood	B3-1 AB	21012	21014	-	-	073	-	-
102.	Livengood	B4-3 AB	21014	21015	21017	-	072	-	-
103.	Livengood	B4-2 AB	21019	21017	-	-	071	-	-
104.	Livengood	C4-9 AB	21019	21021	-	-	071	-	-
105.	Livengood	C4-8 AB	21021	21023	21024	-	071	070	-
106.	Livengood	C4-7 AB	21024	21026	-	-	070	-	-
107.	Livengood	C4-4 AB	21026	21027	21018	21029	069	070	-
108.	Livengood	C5-6 AB	21028	21029	21030	21032	068	069	-
109.	Livengood	C5-3 AB	21030	21032	20002	20004	068	-	-
110.	Livengood	C5-2 AB	20002	20004	20006	20007	067	068	-
111.	Livengood	C5-1 AB	20007	20009	-	-	067	-	-
112.	Livengood	D5-8 AB	20006	20007	20009	-	067	-	-
113.	Livengood	D5-7 AB	20009	20010	20011	20012	066	067	-
		20013	-	-	-	-	-	-	

GAS PIPELINE HABITAT EVALUATION PROGRAM CROSS-REFERENCE OF HABITAT MAPS, AERIAL PHOTOGRAPHS AND PIPELINE ALIGNMENT SHEETS

No.	Map Name		Photo No.*	Photo No.*	Photo No.*	Photo No.*	Alignment Sheet No.**		
114.	Livengood	D6-9 AB	20012	20013	20014	20015	065	066	-
			20017	-	-	-	-	-	-
115.	-	-	-	-	-	-	-	-	-
116.	Livengood	D6-6 AB	20014	20015	20017	20018	064	065	-
			20019	19002	-	-	-	-	-
117.	Livengood	D6-5 AB	20017	20019	19002	19003	064	-	-
			19005	-	-	-	-	-	-
118.	Livengood	D6-4 AB	19005	-	-	-	-	-	-
119.	Livengood	D6-2 AB	19003	19005	19007	-	063	-	-
120.	Livengood	D6-1 AB	19005	19007	19009	19011	062	063	-
121.	Tanana	D1-3 AB	19009	19011	19012	-	063	-	-
122.	Beaver	A6-7 AB	19012	19011	18002	-	-	-	-
123.	Bettles	A1-9 AB	18002	18003	-	-	060	061	-
124.	Bettles	A1-8 AB	18003	18003	-	-	-	-	-
125.	Bettles	A1-6 AB	18004	18005	18006	17002	059	060	-
126.	Bettles	A1-5 AB	17002	17003	17005	-	059	060	-
127.	-	-	-		-	-	-	-	-
128.	Bettles	A1-2 AB	17007	17009	17009	-	058	059	-
129.	Bettles	A1-1 AB	17007	17009	-	-	058	-	-
130.	Bettles	B1-8 AB	17007	17009	17010	-	057	-	-
131.	Bettles	B1-7 AB	17009	17010	17011	17012	056	057	-
			17013	-	-	-	-	-	-
132.	Bettles	B1-4 AB	17012	17013	17014	17015	056	-	-
			17016	17017	-	-	-	-	-
133.	Bettles	B2-6 AB	17014	17015	17016	17017	055	-	-
			17018	17019	-	-	-	-	-
134.	-	-	-	-	-	-	-	-	-
135.	Bettles	B2-3 AB	17019	17020	17021	17022	054	055	-
136.	Bettles	B2-2 AB	17021	17022	17023	17024	054	-	-
137.	Bettles	C2-9 AB	17023	17024	-	-	-	-	-
138.	Bettles	C2-8 AB	17024	16003	16005	16007	053	-	-
139.	Bettles	C2-6 AB	16007	16009	16011	-	052	-	-
140.	Bettles	C2-5 AB	16007	16009	16011	-	052	-	-
141.	Bettles	C2-3 AB	16011	16013	16014	-	051	-	-
142.	Bettles	C2-2 AB	16011	16013	16015	-	051	-	-
143.	Bettles	D2-9 AB	16015	16017	16019	15002	049	050	-
			15003	15004	-	-	-	-	-
144.	Bettles	D2-8 AB	16015	16017	16019	15002	050	-	-
145.	Bettles	D2-6 AB	15003	15004	15005	-	048	049	-
146.	Bettles	D1-4 AB	15006	15007	15008	-	048	-	-
147.	Bettles	D1-1 AB	15009	15010	15011	15012	047	048	-
148.	Bettles	D1-2 AB	15013	15015	15017	15018	047	-	-
			15019						

GAS PIPELINE HABITAT EVALUATION PROGRAM CROSS-REFERENCE OF HABITAT MAPS, AERIAL PHOTOGRAPHS AND PIPELINE ALIGNMENT SHEETS

No.	Map Name		Photo No.*	Photo No.*	Photo No.*	Photo No.*	Alignment Sheet No.**		
149.	Wiseman	A1-7 AB	14005	150017	15018	-	046	-	-
150.	Wiseman	A1-8 AB	14003	14004	14006	15018	046	047	-
151.	Wiseman	A1-4 AB	14006	14008	14009	14010	045	046	-
152.	Wiseman	A1-5 AB	14008	14009	14010	-	045	046	-
153.	Wiseman	A1-1 AB	13003	13004	14010	-	044	045	-
154.	Wiseman	A1-2 AB	13004	13005	13006	-	044	-	-
155.	Wiseman	B1-8 AB	13008	13008	13009	-	042	043	-
156.	Wiseman	B1-9 AB	13009	13010	13011	13012	043	-	-
157.	Wiseman	B1-6 AB	13012	13013	13014	13015	042	-	-
158.	Wiseman	B1-3 AB	12001	12002	12003	12004	040	041	-
			13015	-	-	-	-	-	-
159.	Chandalar	B6-1 AB	12003	12004	12005	12006	040	-	-
160.	Chandalar	B6-2 AB	11003	12006	-	-	-	-	-
161.	Chandalar	C6-7 AB	11003	11004	11005	11006	039	-	-
162.	Chandalar	C6-8 AB	11003	11004	11005	11006	039	-	-
163.	Chandalar	C6-5 AB	11006	11008	11009	11010	038	039	-
164.	Chandalar	C6-2 AB	10004	10005	10006	10007	036	037	-
			10008	11010	-	-	-	-	-
165.	Chandalar	D6-8 AB	10008	10009	10010	10012	036	-	-
166.	Chandalar	D6-7 AB	10018	-	-	-	035	-	-
167.	Chandalar	D6-4 AB	10014	10015	10016	10017	034	035	-
168.	Chandalar	D6-5 AB	10016	10017	10018	10019	034	035	-
			09002	-	-	-	-	-	-
169.	Chandalar	D6-1 AB	09002	09003	09004	10012	034	-	-
170.	Chandalar	D6-2 AB	09004	09005	09006	09007	033	034	-
171.	Philip Smith Mts.	A5-8 AB	00907	00908	00909	00911	032	033	-
172.	Philip Smith Mts.	A5-9 AB	00911	00912	00913	00915	032	-	-
173.	Philip Smith Mts.	A5-6 AB	09015	09016	09017	08002	031	-	-
			00804	-	-	-	-	-	-
174.	Philip Smith Mts.	A5-3 AB	00804	00805	00806	00807	029	030	-
175.	Philip Smith Mts.	A4-1 AB	00805	00806	00807	-	030	-	-
176.	Philip Smith Mts.	B5-9 AB	00809	-	-	-	029	-	-
177.	Philip Smith Mts.	B4-7 AB	00809	00811	00812	00814	028	029	-
178.	Philip Smith Mts.	B4-4 AB	00814	00815	00816	07004	027	028	-
179.	Philip Smith Mts.	B4-1 AB	07004	07005	07006	-	027	-	-
180.	Philip Smith Mts.	B5-3 AB	07005	07006	07007	07009	026	027	-
			07010	-	-	-	-	-	-
181.	Philip Smith Mts.	C5-9 AB	07010	07011	07012	06002	025	026	-
182.	Philip Smith Mts.	C5-6 AB	06002	06003	06004	06005	024	025	-
183.	Philip Smith Mts.	C4-4 AB	06005	06007	06008	-	023	024	-
184.	Philip Smith Mts.	C4-1 AB	06008	06009	06011	06012	023	-	-
185.	Philip Smith Mts.	C4-2 AB	06012	06014	06016	-	022	-	-
186.	Philip Smith Mts.	C4-3 AB	06014	06016	05002	-	021	-	-
187.	Philip Smith Mts.	D4-9 AB	05002	05003	05004	-	020	021	-

GAS PIPELINE HABITAT EVALUATION PROGRAM CROSS-REFERENCE OF HABITAT MAPS, AERIAL PHOTOGRAPHS AND PIPELINE ALIGNMENT SHEETS

No.	Map Name		Photo No.*	Photo No.*	Photo No.*	Photo No.*	Alignment Sheet No.**		
188.	Philip Smith Mts.	D4-6 AB	05004	05005	05006	05007	019	020	-
189.	Philip Smith Mts.	D3-4 AB	05007	05019	05010	-	-	-	-
190.	Philip Smith Mts.	D4-3 AB	05010	05012	05014	-	018	019	-
191.	Philip Smith Mts.	D3-1 AB	05010	05012	05014	-	-	-	-
192.	Sagavanirktok	A4-9 AB	05014	05016	05018	-	017	-	-
193.	Sagavanirktok	A3-7 AB	05016	05027	05028	-	017	-	-
194.	Sagavanirktok	A4-6 AB	05018	05020	05022	-	015	016	-
195.	Sagavanirktok	A3-4 AB	05018	05020	05022	05024	-	-	-
196.	Sagavanirktok	A4-3 AB	05024	05026	04002	-	014	015	-
197.	Sagavanirktok	B3-1 AB	05024	05026	04002	-	015	-	-
198.	Sagavanirktok	B4-9 AB	04002	04004	-	-	-	-	-
199.	Sagavanirktok	B3-7 AB	04002	04004	04006	-	013	014	-
200.	Sagavanirktok	B3-4 AB	04006	04008	04010	04011	012	013	-
			01002[t]	01004[t]	02002[t]	-	-	-	-
201.	Sagavanirktok	B3-5 AB	04010	04011	04012	-	-	-	-
202.	Sagavanirktok	B3-1 AB	04012	04013	02002[t]	02004[t]	012	-	-
203.	Sagavanirktok	B3-2 AB	04013	04014	03003	-	011	012	-
204.	Sagavanirktok	C3-7 AB	03003	03005	03007	-	010	011	-
205.	Sagavanirktok	C3-8 AB	03003	03005	03007	-	010	011	-
206.	Sagavanirktok	C3-4 AB	03007	03009	03011	-	009	010	-
207.	Sagavanirktok	C3-5 AB	03007	03009	03011	-	-	-	-
208.	Sagavanirktok	C3-1 AB	03011	03013	03015	03017	008	009	-
209.	Sagavanirktok	D3-7 AB	03017	03019	03021	-	007	008	-
210.	Sagavanirktok	D3-4 AB	03021	03023	03024	02002	006	007	-
			02004	-	-	-	-	-	-
211.	Sagavanirktok	D4-6 AB	03021	03023	03024	02002	-	-	-
212.	Sagavanirktok	D4-3 AB	02002	02004	02005	-	-	-	-
213.	Sagavanirktok	D3-1 AB	02004	02005	02006	02008	005	-	-
214.	Beechey Point	A3-7 AB	02006	02008	02010	01A004	004	005	-
215.	Beechey Point	A3-8 AB	02008	02010	-	-	004	-	-
216.	Beechey Point	A3-4 AB	01A004	01A006	01A008		003	-	-
217.	Beechey Point	A3-5 AB	02014	02016	01A004	01A006	003	004	-
218.	Beechey Point	A3-1 AB	01A008	01A010	01A012	-	002	-	-
219.	Beechey Point	A3-2 AB	01A010	01A012	02016	02018	-	-	-
			01003	01005	-	-	-	-	
220.	Beechey Point	A3-3 AB	01003	02018	-	-	-	-	-

GAS PIPELINE HABITAT EVALUATION PROGRAM CROSS-REFERENCE OF HABITAT MAPS, AERIAL PHOTOGRAPHS AND PIPELINE ALIGNMENT SHEETS

No.	Map Name		Photo No.*	Photo No.*	Photo No.*	Photo No.*	Alignment Sheet No.**		
221.	Beechey Point	B3-7 AB	01A012	07017tt	07019tt	08017tt	001	-	-
			98918tt	-	-	-	-	-	-
222.	Beechey Point	B3-8 AB	01005	01007	07017tt	06017tt	001	-	-
			05027tt						

* Unless otherwise noted, photos are from the 1978 true color set of photography taken by Northwest Alaskan Pipeline Company.

**All alignment sheet numbers are from the May 1979 Series (4680-12-00-B-C)

t These photos were exposed in June 1979 by Northwest Alaskan Pipeline Company during a reflight mission at a scale of 1:24000.

tt These photos of Prudhoe Bay were exposed in July 1979 by Air Photo Tech. at a scale of 1:18000.