1980 RAPTOR AND WATERFOWL MONITORING ALONG FOOTHILLS PIPELINE ROUTE IN SOUTHERN YUKON

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SUMMARY

This report presents findings from the first year of a raptor and waterfowl monitoring program carried out from April to October 1980 along the Foothills (South Yukon) gas pipeline corridor. Major emphasis was placed on monitoring in construction sections 4 and 5, the sections slated for initial construction. The objective was to obtain baseline data on raptor and waterfowl populations in the period preceding construction, for comparison with similar information to be obtained during and after construction. Experimental populations were within 2 km of the pipeline route in the case of waterfowl, and 3.2 km for raptors. Control areas or populations were beyond those limits.

The spring waterfowl migration was monitored at the only two important staging areas in the southern Yukon which are crossed by the pipeline corridor - the outlets of Marsh and Teslin Lakes. A third area outside the corridor (Tagish Narrows) was monitored as a control. Both aerial and ground counts were made at intervals through April and early May. Data obtained included the number and kinds of waterfowl present, and specific locations where the birds were concentrated.

Waterfowl production was monitored at a total of 28 ponds in 3 areas within the corridor through construction sections 4 and 5. Indicated breeding pair (I.B.P.) counts were made at all ponds in May, and broods were counted at the same ponds in July and August. Counts were made from a helicopter, supplemented by some ground observations.

All lakes in the corridor through construction sections 4 and 5, as well as the shoreline of Kluane Lake within the corridor, were surveyed once in August for late summer staging waterfowl. No significant concentrations were found.

The fall waterfowl migration was monitored at a number of sites both east and west of Whitehorse. This involved two series of aerial surveys, one in September and one in October, timed to coincide with the peaks of goose and swan movements. Site selection was based on the findings of surveys carried out for Foothills Pipe Lines Ltd. in previous years. Numbers were generally low, and no further monitoring of fall migration appears warranted.

All known bald eagle nest sites in and adjacent to construction sections 1-5 were monitored, with the sites outside the corridor serving as controls. All known golden eagle nest sites in the corridor through construction sections 4 and 5

were monitored, as were all nesting sites in a control area adjenct to the corridor in the same area. Nests were visited by helicopter at about 1 month intervals, from late April through July, and data obtained on the status of the sites and the contents of active nests. A total of 8 active bald eagle nests and 22 golden eagle nests were monitored.

Recommendations for future monitoring, and suggestions for modification to the program are made. Data sheets, maps and photographs supplement the report.

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1. INTRODUCTION

1.1 Scope of the Studies

The major purpose of the 1980 monitoring program was to initiate a series of baseline surveys which would serve to measure the extent of South Yukon pipeline construction impact on bald and golden eagles and waterfowl. The surveys were designed to determine abundance and/or reproductive success of those birds at selected study areas or sites. Field work began April 23 and ended October 22, 1980. All field surveys were carried out by Gary G. Anweiler.

There have been many previous surveys of waterfowl and nesting raptors along a corridor encompassing the South Yukon pipeline alignment, and some of the results provide useful background for on-going monitoring. However, those surveys were mostly done to aid in route selection, project design and siting of ancillary facilities, and in most cases the corridor was broad and data were grouped for large or imprecisely defined areas.

The earlier surveys, and other design considerations, have resulted in route selection and construction timing constraints such that wildlife impacts are expected to be minimal. However, unavoidable impacts could occur and it is the purpose of this monitoring program to measure the extent of these, if any, on eagles and waterfowl. It was not an objective to monitor all potentially disturbed individuals or populations along the route, but rather to sample important or discrete areas as a basis for extrapolation to the entire route. It is anticipated that any adverse effects which are identified by the monitoring program are those where mitigative measures were considered to be impractical or unnecessary.

Present monitoring is designed to show, if possible, population parameters before, during, and after pipeline construction. Relatively exact routing of the line is now known, and it was thus possible to select study areas or sites of known distance from potentially disturbing activity. An objective was to survey both potentially disturbed (experimental) populations and more distant control areas.

This and future monitoring is meant primarily to evaluate direct disturbances on birds, i.e. blasting, machine noise, traffic movement or human presence. Indirect impacts which may result from habitat alteration are not being studied, although such information could accrue in the case of waterfowl production habitat.

Emphasis in 1980 was on construction segments 4 and 5 because earliest construction is scheduled for those areas. It was desired to have at least two years of pre-construction baseline data for any area monitored. Monitoring will not necessarily be carried out in all construction segments. The 1980 program was somewhat experimental, and will probably be modified slightly in 1981. However, survey areas and procedures are expected to change little once the 1981 design is finalized.

Since the 1980 work was only the first step in a monitoring program that will go on for several years, we have attempted no detailed statistical analyses or comparisons with the scientific literature. Much of the report is in the form of data forms and study area maps.

We feel that this monitoring program is of more than academic interest. Results from those segments constructed first could aid in mitigation of impacts in locations constructed later, and results of the entire program should aid in impact prediction, mitigation, and design of monitoring programs for other northern projects.

1.2 Objectives.

Spring and Fall Waterfowl Migration

- to obtain data on the number and kinds of waterfowl at known migration habitats along the pipeline corridor prior to pipeline construction, for comparison with similarly obtained data collected during and after construction.
- to accurately delineate survey areas, and to determine where within those areas concentrations of waterfowl were present.

Waterfowl Production

- to obtain data on waterfowl production at a sample of ponds along the pipeline corridor, prior to construction, for comparison with similarly obtained data collected during and following construction.

Late Summer Waterfowl Staging

- to identify those waterbodies within the corridor in construction sections 4 and 5 used by large numbers of waterfowl during the late summer staging period, and to obtain data on the normal numbers of waterfowl present on them prior to construction for comparison with similarly obtained data collected during and following construction.

Raptor Production

- to obtain data on occupancy and reproductive success of eagle nests along the corridor, prior to construction for comparison with similarly obtained data collected during and after construction.

1.3 Acknowledgements.

Thanks are expressed to the following people who helped in a number of ways:

Doug Burles, Parks Canada warden, who showed us a number of eagle nests in Kluane Park, and who assisted on several of the raptor surveys.

Malcolm Dennington, Canadian Wildlife Service biologist, who provided copies of waterfowl data in his care.

Gillian McKee, Court Fooks and Ross Eccles, of the Foothills staff who provided data and other assistance.

Dean Elston and Drew Dunn, Foothills Pipe Lines Ltd., who took care of logistical arrangements at Whitehorse.

Lois Hill, Carl Zia, Wayne Eng, and other helicopter pilots who provided safe transportation and assisted in a number of ways on the surveys.

The staff at the Talbot Arms Motel, whose hospitality made staying with them a pleasure.

1.4 Glossary of Terms

waterfowl: includes the following groups of birds: loons, grebes, coots, ducks, geese and swans.

staging areas: areas where numbers of birds, mainly waterfowl, concentrate during or as a prelude to migration, usually for an extended period of time.

broods: one or a group of young waterfowl, assumed to be the product of a single pair of adults.

dabbling ducks (dabblers): a category of ducks sharing certain physiological and behavioral characteristics. Includes the surface-feeding ducks such as mallard, pintail, teal and wigeons.

diving ducks (divers): a category of ducks sharing certain physiological and behavioral characteristics. Includes scaup, goldeneye, bufflehead, scoters and mergansers.

Bucephala: the genus of duck containing the goldeneyes and bufflehead.

raptor nest site, or "site": a nest or group of nests concentrated in an area and assumed to all occur within the area defended by a single pair of adults. A modified version of "territory".

active nest: a nest in which eggs or young are present.

alternate nests: the other nests occcuring at a site containing an active nest. Used in previous years and possibly re-used in future years.

2. METHODS

2.1 Waterfowl

Survey design was intended to sample those aspects of the seasonal life cycle indicated in Table 1. Experimental areas (potentially disturbed locations) were within 2 km of the pipeline alignment; control areas were at varying distances beyond that. The number and location of sample areas depended upon:

- the importance of habitats within 2 km of the line (levels of waterfowl use),
- the number of important locations for each seasonal activity along the line (within 2 km),
- accessibility of survey areas by air or ground.

General location of waterfowl monitoring activity is shown in Figure

2.1.1 Spring Staging and Migration

Important late winter-early spring waterfowl staging areas in the southern Yukon have been identified by Mossop (1976). Those crossed by the pipeline corridor, at the outlets of Marsh Lake and Teslin Lake, were monitored. A third area outside the pipeline corridor, Tagish Narrows, was monitored as a control.

Two methods were used to count waterfowl at these sites; aerial surveys were flown by helicopter and counts were made from a series of points on the ground using a spotting scope.

Aerial surveys of all areas were flown on April 23, 25, and May 2, using a piston-drive Hiller 12 on the first survey and a Bell 206B jetranger on the others. One observer accompanied the pilot on all surveys. Heights and speeds varied as conditions warranted, with lower altitudes and greater speeds used in areas where few birds were present, and slower speeds and greater altitudes where concentrations were encountered. Surveys took place between 1400 and 1700 hours, and included all open water areas at each location. The number and species of all waterfowl were recorded, and locations where concentrations of birds were observed marked on 1:50,000 topographic maps of the area. On the first and last surveys, Nisutlin Bay, Morley Bay, and Eagle Bay were surveyed in addition to the 3 monitoring sites.

Table 1. - Purpose, location and dates of waterfowl monitoring surveys in 1980.

Surveys	Survey Areas or Sites		Survey Method*	Survey Dates
	Corridor	Control		
1. Spring Migr.	Marsh & Teslin	Tagish	R/W	Apr. 23,25; May 2
	" "	"	Grd	Apr. 25,26,27
2. Production				
- Breeding Prs.	Quill Cr. Area (14 ponds)	nil	R/W	May 24 & 25
			Grd	May 28
	Duke R. Area (7 ponds)	nil	R/W	May 24 & 25
	Jarvis R. Area (7 ponds)	nil	R/W	May 26
			Grd	May 26 and 29
- Broods	Quill Cr. Area (14 ponds)	nil	R/W	July 16 and 19; Aug. 19
			(Grd)	July 17
	Duke R. Area (7 ponds)	nil	R/W	July 16 and 19; Aug. 19
	Jarvis R. Area (7 ponds)	nil	"	July 18 and 20; Aug. 19
			Grd.	July 18
3. Late Summer Staging	Production Ponds plus all or part of 4 lakes	nil	R/W	Aug. 19

Table 1. (Cont'd.)

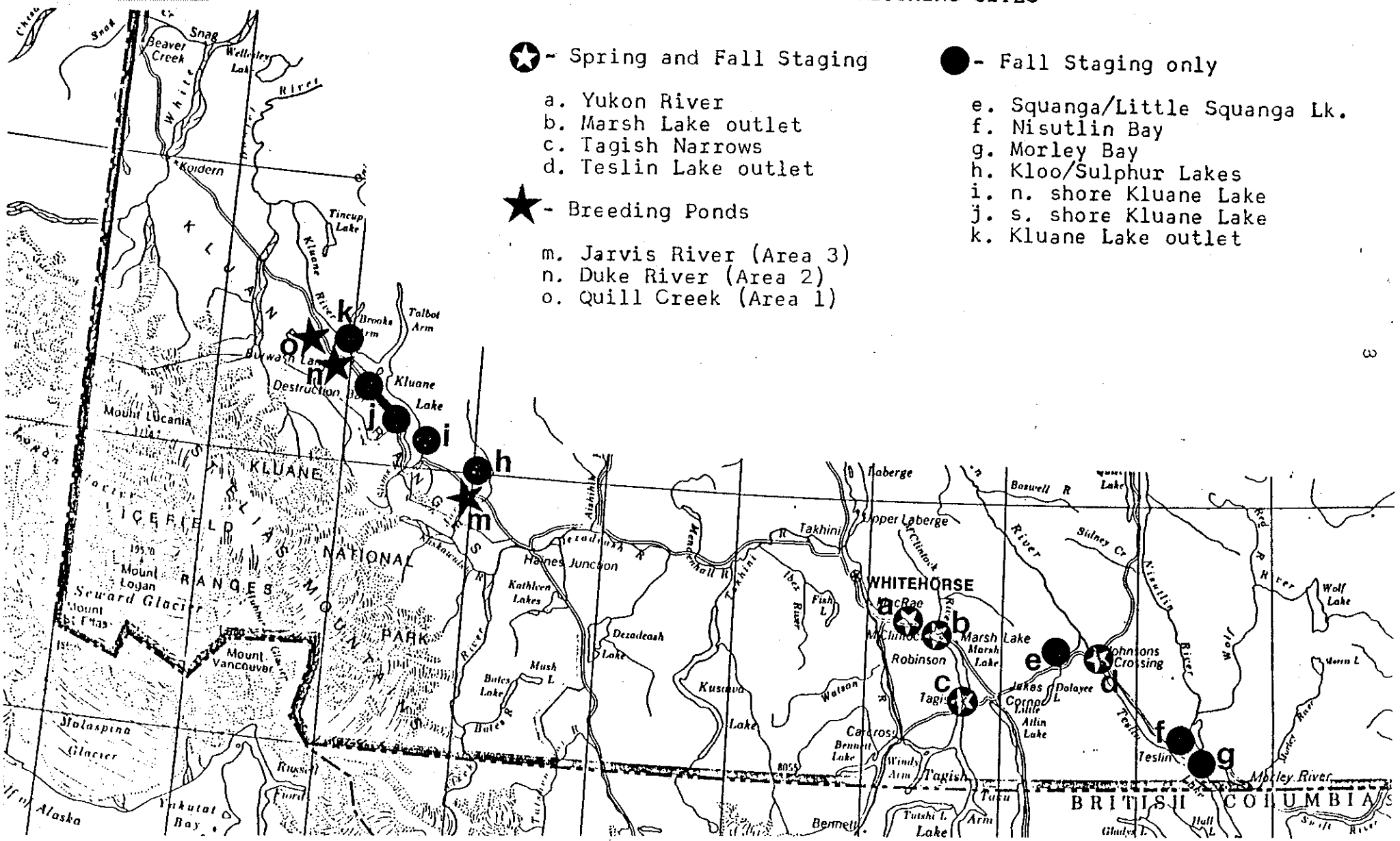
Surveys	Survey Areas or Sites		Survey Method*	Survey Dates
	Corridor	Control		
4. Fall Migr.				
	Eastern (6 areas)	Tagish and Little Squanga	F/W	Sept. 16, 18 and 20
				Oct. 17, 19 and 21
	Western (3 areas)	Kloo Lk. and Kluane Lake outlet	F/W	Sept. 15, 17 and 19
				Oct. 16, 18 and 20

* R/W = helicopter; F/W = fixed wing aircraft; Grd = observation from the ground
( ) = partial survey

MAP NO. 1

WATERFOWL MONITORING SITES

- ✪ - Spring and Fall Staging
  - a. Yukon River
  - b. Marsh Lake outlet
  - c. Tagish Narrows
  - d. Teslin Lake outlet
- ★ - Breeding Ponds
  - m. Jarvis River (Area 3)
  - n. Duke River (Area 2)
  - o. Quill Creek (Area 1)
- ● - Fall Staging only
  - e. Squanga/Little Squanga Lk.
  - f. Nisutlin Bay
  - g. Morley Bay
  - h. Kloo/Sulphur Lakes
  - i. n. shore Kluane Lake
  - j. s. shore Kluane Lake
  - k. Kluane Lake outlet



After the second survey we decided to use ground surveys instead of aerial surveys. It was observed on the aerial surveys that good road access was available in all three areas. Also, the survey craft was causing considerable disturbance to the birds, and it was very difficult to obtain accurate counts or to identify the species of ducks as they milled about in confusion.

On April 25, 26 and 27 a number of observation points were located on or near the roads in each area from which all open water areas could be censused using a 20-45 power zoom scope. Counts were made at each area on these days, recording the same data as on the aerial surveys.

At this time it was also found that the Canadian Wildlife Service was counting waterfowl from the same ground observation points in the Yukon River-Marsh Lake and Tagish Narrows areas. These counts had begun on April 8, and were taking place at about 2-4 day intervals. These data were obtained and combined with ours. On days when independent counts were made by two different observers, we used the highest count for each group (ducks, swans, and geese) in our tabulations.

A few earlier counts, begun on March 31, were made at about two week intervals at the Marsh Lake-Yukon River area by Ross Eccles of the Foothills staff. These counts were obtained from some of the same ground observation points, and were added to our data.

Surveys of these areas from previous years were reviewed, summarized, and compared with our data.

2.1.2 Production.

Three areas where groups of ponds were present within 2 km of the alignment in construction segments 4 and 5 were selected for monitoring. Fourteen ponds were located in the Quill Creek area, and 7 each in the Duke River and Jarvis River areas (Maps 6 - 8). An additional 7 ponds were added to the Quill Creek area after the surveys had started, at Foothills' request.

Two methods were used to monitor waterfowl production. Two counts of indicated breeding pairs were made at all ponds in late May, a day or two apart. Broods were counted on all ponds in July, again with two surveys of each pond, a few days apart. One additional survey was made of all ponds on August 19, to check for late broods missed on the earlier surveys.

Indicated breeding pair surveys were made from a helicopter and on foot. Ponds in the Quill Creek and Duke River area were surveyed by helicopter on May 24 and 25, between 9:30 and 10:30 AM. Each pond was slowly circled at an altitude of about 40 meters. All waterfowl observed were noted, and it was recorded whether the bird was a lone male or female, a pair with extra male(s), or a group, with the number of each sex in the group. The ponds at the Jarvis River were surveyed only once by helicopter, on May 26, again at 9:30 AM. A Bell 206B was used on all aerial surveys, with one observer accompanying the pilot. Some ponds in the Quill Creek area were also visited on the ground, and the same data recorded by walking around most of the pond and scanning the shoreline with a scope. All ponds in the Jarvis River area were surveyed twice from the ground, once after the helicopter survey on May 26 and again on May 29. The second ground survey at the Jarvis River area was made because a helicopter was not available for a second aerial survey at that time.

Indicated breeding pairs were calculated from the data. Only lone males and females, pairs, and groups of three or less males were used in these calculations. Excess males observed with pairs were not included for blue-winged teal scaup, or white-winged scoters. In larger groups of birds, the total number of females only was used in the calculations.

One interesting observation on these surveys was that at many ponds the observer attracted the attention of a lesser yellowlegs, which proceeded to fly about him calling in alarm. This attracted the attention of every duck on the pond, and all proceeded to swim over to see what the commotion was about. It was not unusual to have 5 or 6 pairs of ducks and grebes gathered a few meters off shore in front of the observer while he sat quietly with the scope.

Broods were counted on the same ponds in the Quill Creek and Duke River areas between 19:00 and 21:00 hours on July 16 and 19, and in the Jarvis River area on July 18 and 20, during the same hours. A bell Long-Ranger helicopter was used, with one observer accompanying the pilot. The shoreline of each pond was slowly circled at an altitude of about 10 meters, and all broods counted. Data for each brood included species,

number of young, and the age class based on Gollop and Marshall (1954). A number of ponds in the Quill Creek area were also visited on foot on July 17, as were all ponds in the Jarvis River area on July 18. The same data were recorded. Counts were made by walking around most of the pond and scanning the shoreline with a scope. A second aerial brood count was made at all ponds on August 19, in conjunction with a late summer staging survey. Only broods of age class II or younger were recorded during this survey.

2.1.3 Late Summer Staging.

The small lakes and the section of Kluane Lake shoreline within the pipeline corridor in construction segments 4 and 5 were surveyed on August 19 for use by staging waterfowl. A bell 206B jet-ranger helicopter was used with one observer accompanying the pilot. The shorelines of survey areas were flown at an altitude of about 50 meters and a speed of about 120 km. per hour, and all waterfowl recorded. These were identified to species where possible. All ponds surveyed earlier for breeding waterfowl were also included in this survey.

2.1.4 Fall Migration

The fall waterfowl migration was monitored with two series of aerial surveys timed to coincide with the peak of swan and goose migrations. Sites to be monitored were selected by examining previous fall surveys along the pipeline corridor, and identifying those areas where swans had been seen, where geese were found on two or more surveys and numbers reached 50, and where ducks were present on more than 50 percent of the surveys and numbers reached 500 or more. A number of sites were identified between Whitehorse and Morley Bay in the east and from Sulphur Lake to the west of Kluane Lake in the west. Two sites east of Whitehorse and two west of Whitehorse were also selected as control areas, based on the presence of characteristics similar to those of the areas surveyed (i.e.: Lake outlets, small lakes).

All sites east and west of Whitehorse were surveyed 3 times in September and 3 times in October, with the western and eastern areas surveyed on alternate days. A fixed-wing aircraft was used for all

surveys, including a wheel-equipped Cessna 206 and both wheel and float-equipped Cessna 185 and 172s. One observer accompanied the pilot on all surveys. Heights and airspeeds averaged about 50 meters and 130 k.p.h. All shorelines were surveyed in each survey area, with the plane flying parallel to and about 150 meters offshore. Where necessary, additional transects were flown to cover the entire area, as was the case at sites like the Kluane River outlet and the marshy section of the Yukon River above the bridge. One transect was flown down the center of the larger lakes, such as Squanga, to check for waterfowl away from the shorelines where most were concentrated.

Flights were timed to begin at 9 AM, and the September surveys did so; however, in October problems were encountered with early morning fogs, and the last 5 surveys began at 12:30 - 1300 hours.

In each area, all waterfowl were counted and identified to species, where possible. Notes were also made on where in each area the birds were concentrating.

Previous surveys of the same areas were reviewed, and a summary of the findings compared with ours.

2.2 Raptorial Birds

Only nesting by bald and golden eagles was considered during this program. Other raptors are either too scarce for any meaningfull results to be obtained, or nest in dense forest cover and cannot be inventoried by conventional means. Nesting was considered to be the life history event most vulnerable to disturbance. Study areas in 1980 were all west of Whitehorse, because important nesting habitats occur there, particularly for golden eagles, and because 1980 data were needed for construction segments 4 and 5 in order to satisfy the requirement for two years of pre-construction monitoring. Potentially disturbed (experimental) nests were considered to be those within 3.2 km (2 mi.) of the pipeline alignment, although corridor width could be reduced later for purposes of analysis. Control nests were located more than 3.2 km from the alignment.

Table 2. - Location, purpose and date of raptor nest monitoring surveys, 1980

	Bald Eagle	Golden Eagle
Number of Nests		
- Corridor	4	11
- Control	4	12
Study Area Location		
- Corridor	km 80-258	Constr. Segments 4 and 5
- Control	Jarvis R. to Sanpete Creek	Kluane Ranges
Purpose and Date of Survey*		
- No. of active sites	Apr. 29-May 1	Apr. 29-May 1
- No. of eggs produced	May 22-23	May 22-24
- No. of young hatched	June 17	June 16-19
- No. pre-fledging young	July 17	July 15-16
- " " " " in late nests	Aug. 19**	Aug. 19**

* all surveys were by helicopter

** combined raptor nest-waterfowl survey

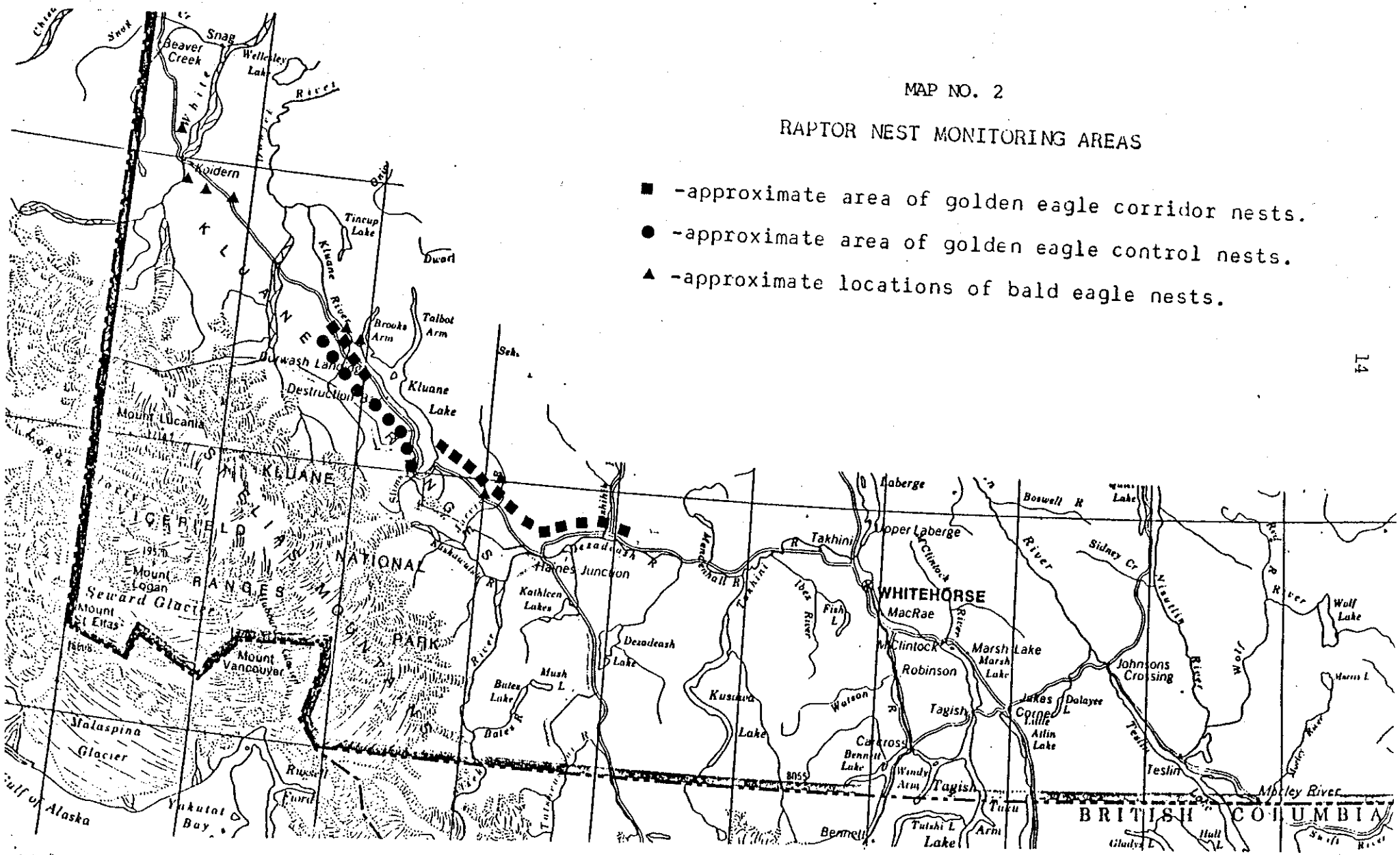
MAP NO. 2

RAPTOR NEST MONITORING AREAS

■ -approximate area of golden eagle corridor nests.

● -approximate area of golden eagle control nests.

▲ -approximate locations of bald eagle nests.



2.2.1 Bald Eagles

Bald eagle nests along or near the pipeline corridor have been located on previous surveys carried out for Foothills (Windsor, 1978; Blood & Associates, 1979). All nests in and adjacent to the 6.4 km wide corridor through construction segments 1 to 5 were monitored (Map 2). Those outside the corridor were monitored as controls. Nests were visited by helicopter, either a Bell 206B jet-ranger or a Bell Long-ranger, with one observer accompanying the pilot on most surveys. All observations were made from the helicopter, and no nests were checked from the ground.

Surveys were made at roughly one month intervals, the first on April 29-May 1 and the last on July 19. Two nests were also checked on August 19 during other work. The status of each nest was recorded on the first survey, and the contents examined and recorded on all others.

On the initial survey, all nests were checked for occupancy. If an adult eagle was seen on a nest, we left the area immediately without disturbing it. Most incubating birds could be seen from about one-half km distance, and it was not necessary to approach any closer. None of the birds were flushed on this survey. At sites where nests were not occupied we searched the surrounding area for about 2 km to look for new nests or adult birds.

On the second survey, May 22, all nest sites were again visited. The incubating birds were flushed by approaching to within 20 or 30 meters, and the contents of the nest noted. We did not remain at nest sites for more than a minute or two. Sites where birds were not found on the first visit were checked again and the surrounding area searched.

On the third survey, June 17, only nests which were active on the last survey were checked. Adults were flushed, if on the nest, and the number of young and their estimated age noted. The presence of one or both adults and their behavior was also recorded.

Active nests were checked again on July 17, and the number of young and their stage of growth noted. A final visit to two nests was made on August 19 during a waterfowl survey.

All data were recorded on forms during or immediately following the surveys.

2.2.2 Golden Eagles

Golden eagle nests along and near the pipeline have also been located during previous surveys for Foothills (Windsor, 1978, Blood & Associates, 1978; 1979). In 1980, all nests within the 6.4 km wide corridor through construction segments 4 and 5 were monitored (Map 2). In addition, all nests in a block along the northeast flank of the Kluane Ranges, from Quill Creek to the Slims River delta, were monitored as a control sample. Most control nests had also been located on the earlier surveys referred to above; others were shown to us by D. Burles, a Parks Canada warden.

Surveys were made using a helicopter, either a Bell 206B jet-ranger or a Bell Long-ranger. Two observers accompanied the pilot on most surveys. Additional searching of some areas was done on foot, using a scope.

The intial survey took place between April 29 and May 1. All sites where golden eagles had previously been reported nesting within the study areas were checked. If an active nest was located, we immediately left the area, and did not check other reported nests within 1 kilometer. No birds were flushed on this survey. In areas where we could not locate an active nest, the area was searched thoroughly for a new or previously unreported nest. The presence or absence of eagles in each area was also noted. After the survey was finished, up to a half day was spent on the ground at sites where no eagles were seen or where no active nests were located, in order to try and locate an active nest if one was present or satisfy ourselves that no eagles were in fact using the site. If a nest reported for a site was not located on the aerial survey, we searched for it from the ground. This was accomplished by aerial drop-off near such sites, by hiking from the Alaska Highway or other access roads, or by searching with a spotting scope from distant vantage points. Thoroughness of ground checks and methods employed varied with time available and ruggedness of terrain.

On the second survey, May 22-24, all sites were visited. On this survey we attempted to flush all incubating birds and record nest contents. Birds were flushed by approaching as closely as possible to the nest, and hovering until the bird flushed. Those that flushed did so within a few seconds of our arrival, or more often as we approached.

However, most refused to flush, even if we hovered beside the nest for several minutes. At these nests, if possible, a man was put on the ground at the nearest landing place and climbed as close to the nest as he could in an attempt to flush the bird by shouting and clapping. In most cases the bird still refused to flush unless the person could climb to a point opposite or above the bird in full view of it. In most cases this was not possible without special equipment, and we were unable to flush the bird.

In areas where active nests had not been located on the first survey, or where we had been unable to locate a reported nest, we again searched the area thoroughly. Additional time was spent on the ground after the survey flight in those areas and a watch kept for adult birds; suitable nest cliffs were again scanned with a scope.

On the third survey, June 16-19, only the active nests were checked. Adults were flushed where possible, and nest contents recorded. Even at this date some adults refused to flush from the nest.

On July 15-16, all active nests were again visited, and the number and size of young noted. If the nest was empty, a brief search of the surrounding area was made for fledged young. Most nests were not closely approached on this survey in order to avoid causing premature fledging of the young. The young at this time were of a size that allowed them to be counted from several hundred meters away in most cases.

On August 19, two nests that held late-hatched young were visited again, in conjunction with a waterfowl survey.

3. RESULTS

3.1 Waterfowl

3.1.1 Spring Migration

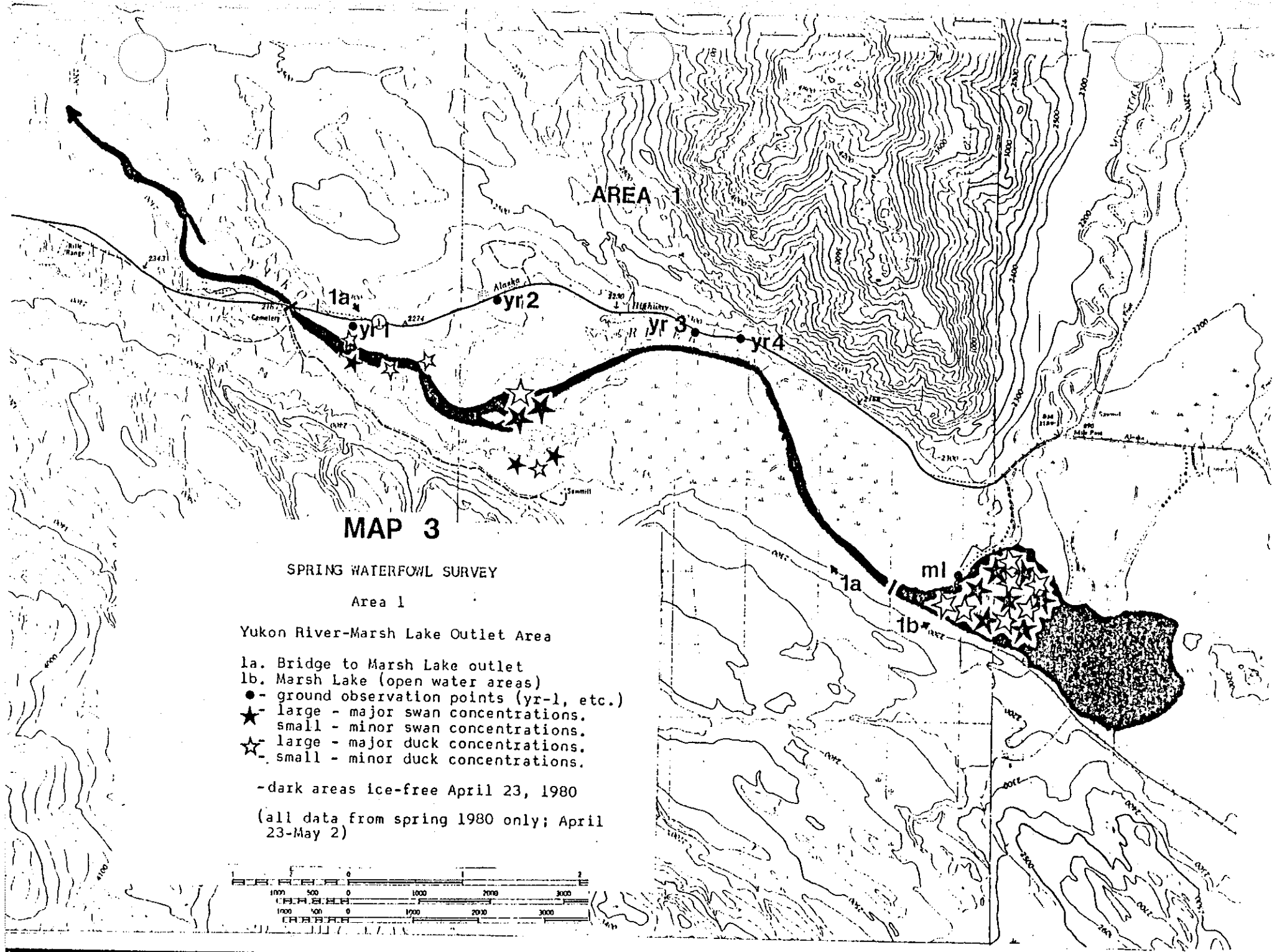
Previous studies by the Yukon Territorial Government in southern Yukon (Mossop, 1976) or for Foothills Pipe Lines along the proposed gas pipeline corridor (Foothills, 1977a, 1978b) have identified several spring waterfowl staging areas. No important sites were found along the corridor west of Whitehorse, but two were identified to the east; the Yukon River-Marsh Lake outlet area and the outlet of Teslin Lake. Both of those areas were included in the 1980 monitoring program, as was a third site well outside the corridor (Tagish Narrows) as an experimental control.

All three areas remain ice-free throughout the winter in some years, and provide open water for returning waterfowl far in advance of break-up in the spring. These areas are considered to be of great importance to northwestern waterfowl populations, by allowing the birds to move north earlier than would otherwise be possible. The three areas surveyed are all important staging areas, and those crossed by the pipeline corridor are 2 of only 5 major spring staging areas identified in the southern Yukon (Mossop, 1976).

3.1.1.1 The Survey Areas

Area 1: Yukon River-Marsh Lake Outlet. The survey area included all open water from the Yukon River bridge to Marsh Lake (Area 1a) and around the outlet of Marsh Lake (Area 1b). On the aerial surveys we included most of the river from Whitehorse to the bridge as well, but few waterfowl were encountered along that reach, and those data have been excluded. The survey area, areas where waterfowl concentrated, and the ground observation points are shown on Map 3.

Mossop (1976) stated that open water was present here year-round during some winters. On March 12, 1976, he found an open water channel 3 meters wide extending from Marsh Lake about 3 km downstream. By April 15, open water extended downstream to the bridge. When we first surveyed the area (April 23, 1980) the channel was open from Whitehorse to Marsh Lake, and Marsh Lake was open from the outlet to the island. Most of M'Clintock Bay remained ice-covered through



MAP 3

SPRING WATERFOWL SURVEY

Area 1

Yukon River-Marsh Lake Outlet Area

1a. Bridge to Marsh Lake outlet
1b. Marsh Lake (open water areas)
● - ground observation points (yr-1, etc.)
★ - large - major swan concentrations.
small - minor swan concentrations.
☆ - large - major duck concentrations.
small - minor duck concentrations.

-dark areas ice-free April 23, 1980

(all data from spring 1980 only; April 23-May 2)

April. Between Marsh Lake and the bridge, open water was confined to the river channel, and the wide marshy expanse along the river through that section remained ice-covered until May.

The area off the mouth of M'Clintock Bay appears to be shallow and turbid, and attracted the largest concentrations of waterfowl. That area is undoubtedly enriched by material washing down the M'Clintock River, and is a feeding area used by large numbers of swans and ducks. This combination of a river delta associated with a lake outlet was unique among the areas surveyed, and probably contributes to the value of this area to waterfowl.

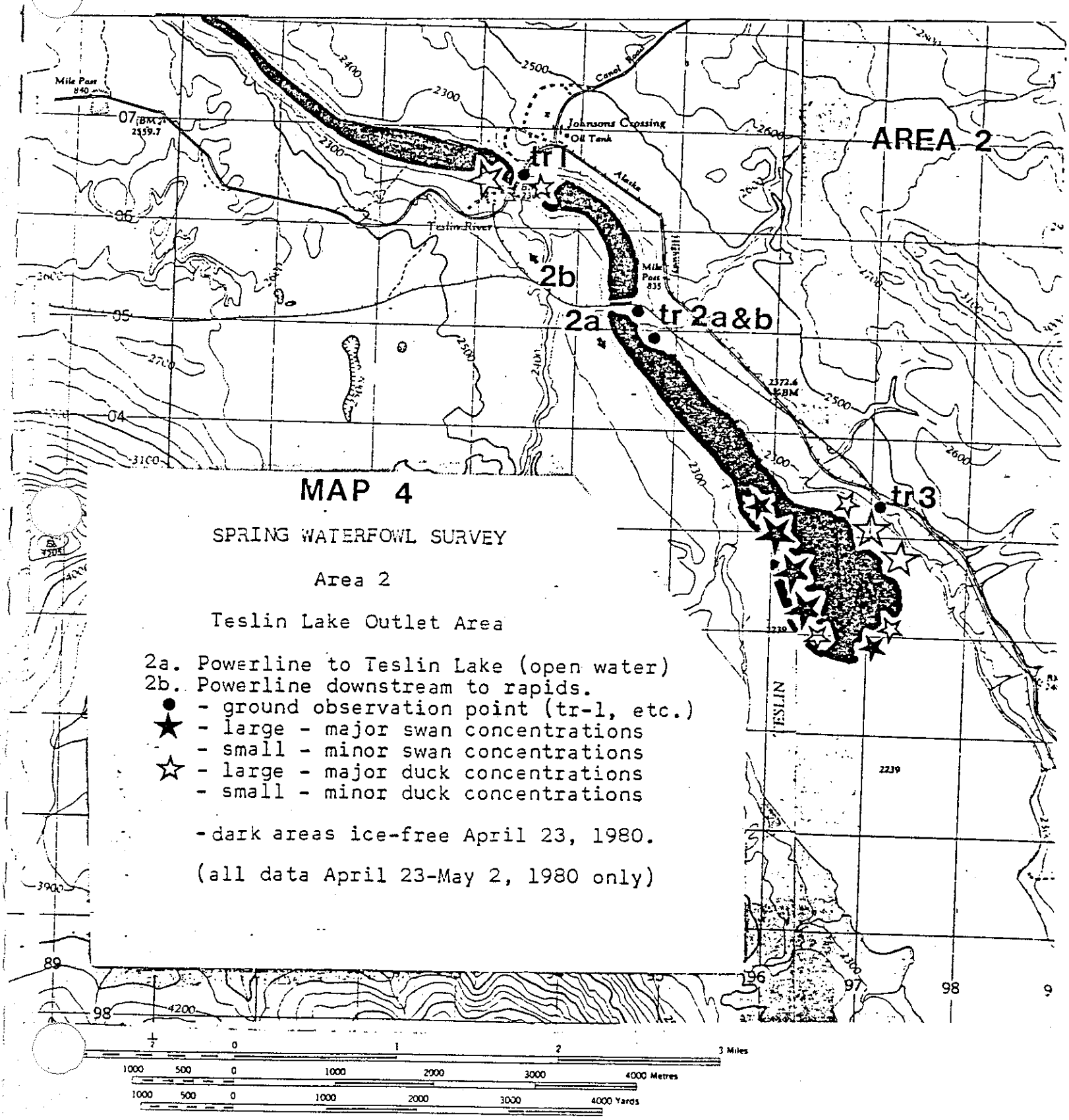
Many cabins have been built along the shore of M'Clintock Bay, some of which appear to be occupied year round, although activity was most noticeable on the weekend. Activity associated with these cabins may be causing some disturbance to the birds at this site already (see Milligan, 1978).

The bulk of the swans and ducks concentrated at the outlet from Marsh Lake, mainly along the edge of the ice at M'Clintock Bay. Smaller concentrations of swans and ducks were also observed around the islands midway between Marsh Lake and the bridge across the Yukon River, an area that may provide a more secure loafing site for the birds. Smaller concentrations of ducks and a few swans were also found at other sites along the Yukon River (see Map 3). Very few geese stop in this area.

The highway parallels the river for most of the distance between the Yukon River bridge and Marsh Lake, and all but a fraction of the open water area can be observed from observation points along the highway, using a scope.

Area 2: Teslin Lake Outlet. The survey area included all open water at the outlet of Teslin Lake and the Teslin River downstream to the rapids, about 4 km downstream of the bridge. (Map 4)

According to Mossop (1976), about 10 hectares remain ice-free here most winters, and some diving ducks have wintered. On March 12, 1976, he found about 200 hectares of the lake ice-free, and open



MAP 4

SPRING WATERFOWL SURVEY

Area 2

Teslin Lake Outlet Area

2a. Powerline to Teslin Lake (open water)
2b. Powerline downstream to rapids.
● - ground observation point (tr-1, etc.)
★ - large - major swan concentrations
- small - minor swan concentrations
☆ - large - major duck concentrations
- small - minor duck concentrations

- dark areas ice-free April 23, 1980.

(all data April 23-May 2, 1980 only)

water extending downstream to the mouth of Squanga Creek. He estimated the area used by staging waterfowl in this area at 800 hectares.

The shoreline of the river and the north side of the lake outlet is high and steep. Along the base of the bluffs on the north shore of the lake, a wide expanse of beach is exposed in the spring, kept wet by water seeping down from the slopes. This beach area attracted many feeding and loafing dabbling ducks. The river bank was a narrow slope of exposed mud, and a small delta had formed at the mouth of a gully near the powerline crossing. The delta showed signs of swans or geese having fed there. Several large exposed mud bars along the river also attracted concentrations of feeding and loafing puddle ducks.

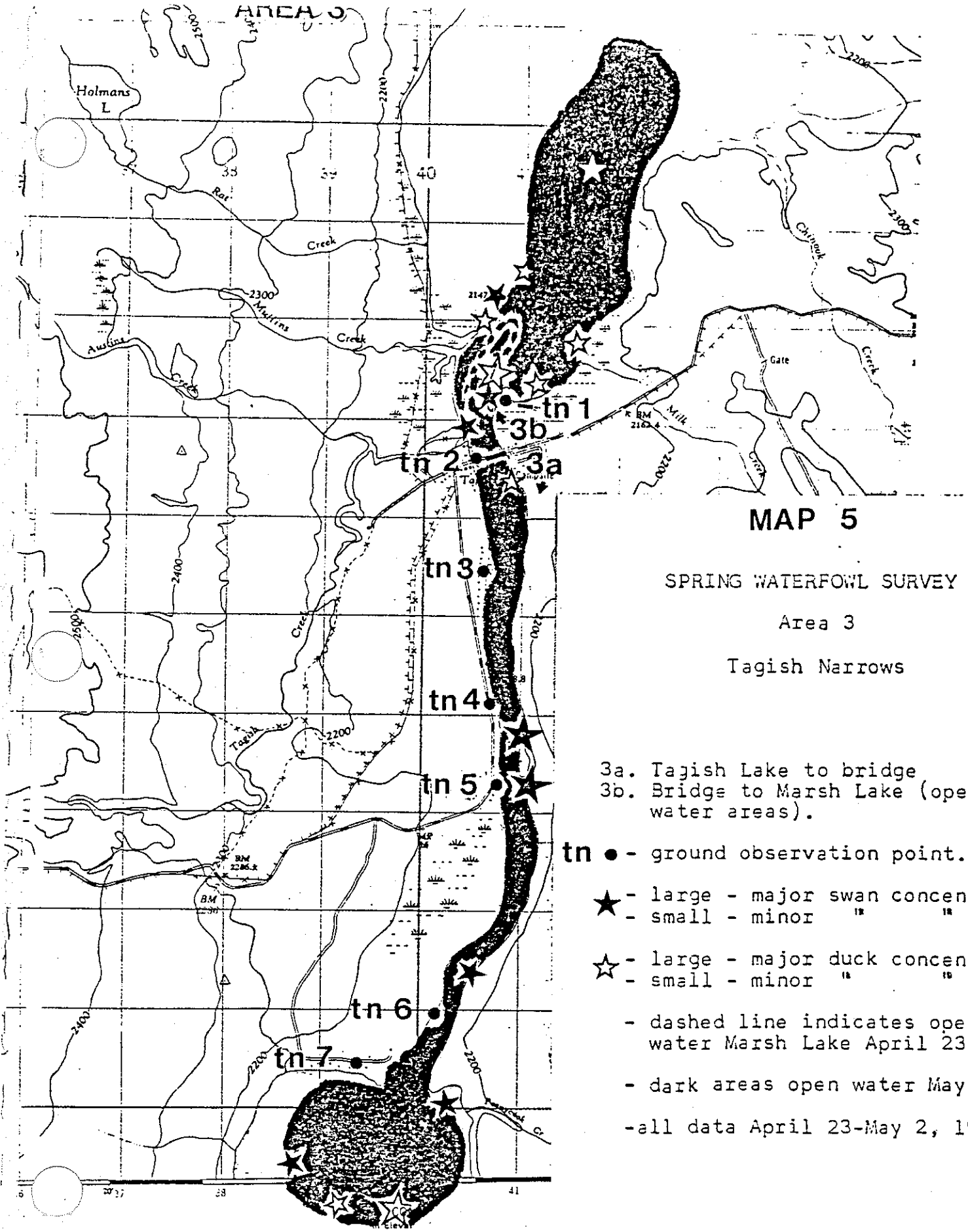
Most swans were found along the ice edge of Teslin Lake, while ducks were found mainly along the exposed beaches below the bluffs or on the mud bars in the river. Few geese were seen here.

The highway crosses the survey area at one point, and parallels it for the rest of the way down Teslin Lake. The lake outlet area is readily surveyed from an observation point on the bluffs, and the river can be censused from the bridge and from a point a few minutes walk from the highway where the power line crosses.

Area 3: Tagish Narrows. The survey area here included all open water at the outlet of Tagish Lake and on the inlet at Marsh Lake, as well as the intervening narrows. (Map 5).

According to Mossop (1976), about 10 hectares remain ice-free here some winters, and a few diving ducks occasionally winter. By March 12, 1976, he found open water from the islands to Tagish Lake, and about 80 hectares open on Tagish Lake. When we first surveyed the area April 23, about 200 hectares of Tagish Lake was open, and open water extended through the entire narrows to Marsh Lake. A narrow finger of open water extended about 1 km into Marsh Lake. By May 2, a large area at the inlet of Marsh Lake was open.

The outlet area from Tagish Lake appeared shallow and sandy, and attracted few waterfowl during the period of our surveys (April 23-May 2). Much of the river bank in the narrows is rather steep,



MAP 5

SPRING WATERFOWL SURVEY

Area 3

Tagish Narrows

3a. Tagish Lake to bridge
3b. Bridge to Marsh Lake (open water areas).

tn ● - ground observation point.

★ - large - major swan concentrat.
- small - minor

☆ - large - major duck concentrat.
- small - minor

- dashed line indicates open water Marsh Lake April 23.

- dark areas open water May 1.

-all data April 23-May 2, 1980.

3 Miles
4000 Metres
4000 Yards
CONVERSION SCALE FOR ELEVATIONS
Metres
Feet

with a border of exposed mud. Several large silty bars have formed at the inlet into Marsh Lake, and most ducks concentrated here. Swans were observed concentrating around the islands in the narrows on the first two surveys, with smaller numbers at the inlet to Marsh Lake and along the ice edge of Tagish Lake. Few geese were seen here.

The narrows here are even more built up than the shore of M'Clintock Bay, with many cabins and a number of wharves. Boat traffic in the channel was noted on several occasions, and may play a part in distributing the birds.

The entire area can be censused from ground observation points along local roads.

3.1.1.2 Survey Results

Owing to the late date that our surveys were initiated (April 23), data obtained at the Yukon River-Marsh Lake area by Ross Eccles (March 31 to April 26) and for the Yukon River-Marsh Lake and Tagish Narrows area by the Canadian Wildlife Service (April 8-April 30) were obtained and combined with ours. Where more than one observer made counts on the same date, the highest count for each group (ducks, swans, and geese) was used.

Large numbers of swans and ducks were found at all three sites, but few geese were seen. Count data are presented in Tables 3-5, while the observations of each observer are included in Appendix 1.

Area 1: Yukon River - Marsh Lake outlet. Coverage at this site extends from March 31 through May 2. Counts in the first half of April were made about once weekly, while for the later period they were at about 2-4 day intervals (Table 3).

Swans. Both trumpeter and whistling swans were observed here, but because of difficulty in separating the two species in the field, swan observations are all combined. Milligan (1978) observed that trumpeter swans arrived in advance of whistling swans, but some remained in the area through May 6 when his surveys terminated. He estimated that trumpeter swans peaked at about 160-170 birds during the third week in April.

Table 3 . - Spring waterfowl counts, 1980. Area 1.: Yukon River-Marsh Lake/M'Clintock River Delta.

Date:		31/03	08/04	13/04	15/04	16/04	19/04	23/04	25/04	26/04	30/04	02/05
Observer:		E	E,A	E	A	A	A	A,B	E,B	A,B	A	B
Area 1a.*	Swans:	0	1	0	-	-	-	123	0	236	0	16
	Geese:	0	0	0	-	-	-	0	4	7	0	0
	Ducks:	11	28	37	-	-	-	791	1094	374	477	100
Area 1b.	Swans:	0	0	34	31	26	439	1353	738	580	104	89
	Geese:	0	0	0	0	0	5	103	40	17	0	0
	Ducks:	0	3	10	54	78	886	1012	±1500	1919	457	430
TOTAL:	Swans:	0	1	34	31+	26+	439+	1476	734	816	104	103
	Geese:	0	0	0	0+	0+	5+	103	44	24	0	0
	Ducks:	11	31	47	54+	78+	886+	1803	±2594	2293	934	530

* Area 1a: Yukon River bridge to Marsh Lake. Area 1b: Marsh Lake/M'Clintock River delta.

Observers: A = K. Asquith, C.W.S. (ground counts); B = G. Anweiler, D.A. Blood & Assoc. (ground count 26/04; all others aerial counts); E = R. Eccles, Foothills Pipe Lines (Yukon) Ltd. (ground counts).

- indicates area not counted this date.

In 1980, the first swan was seen on April 8, but few were present through April 19, when 439 were counted. Numbers peaked at 1476 on April 23. About half that number were present two days later, and had further declined to 104 by April 30. One hundred and three were seen on the last date surveyed, May 2.

Previous surveys, in 1977 and 1978, reported peak counts of 644 on April 26, 1977 (Foothills, 1977a), 2430 on April 24-25, 1978 (Foothills 1978b), and 1900 on April 26, 1978 (Milligan 1978).

Geese. Few geese stop at this site. All geese observed during this study were Canada geese, although Milligan observed up to 16 white-fronted geese here in 1978.

In 1980, the first geese (5) were seen April 19, and the last (24) on April 26; the high count was 103 on April 23.

These figures agree with those of previous surveys. In 1977, a high count of 80 was noted April 13-40 (Foothills 1977a), with a few counted through May 18. In 1978, high counts were 4 on May 16 (Foothills 1978b) and 80 on April 18 (Milligan 1978).

Ducks. Duck species observed here, in approximate order of abundance, were pintail, mallard, American widgeon, goldeneye sp?, green-winged teal, and canvasback. A few blue-winged teal, northern shoveler, redhead, scaup sp?, bufflehead, and common merganser were also seen. The red-breasted merganser was noted in 1978 (Milligan 1978). Goldeneye were most common on the earlier counts, with pintails, mallards, other "dabblers" and canvasbacks appearing later.

In 1980, the first ducks (11) were noted on March 31. Numbers did not reach 100 until April 19, when 886 were counted. The peak occurred about April 25, at 2597 ducks. Numbers declined to 530 by May 2.

Previous Foothills surveys found peaks of 2549 on April 26, 1977, and 1575 on May 9-10, 1978. Milligan (1978) found duck numbers first reached 100 on April 18 (144) and peaked at 1135 on April 27, 1978; however, he did not survey the Yukon River section, and the data are for Marsh Lake only.

Area 2: Teslin Lake outlet. Only four counts were made at this site; 3 aerial surveys and one ground count, all April 23 to May 2. Counts are summarized in Table 4.

Swans. Three hundred and twenty-five swans were present on the first survey, April 23. Only 56 were still here two days later, and all had departed by May 2.

Much larger numbers have been reported in previous years. Mossop counted 1600 swans from the bridge on April 23, 1976. Previous Foothills surveys found highs of 140 on May 3, 1977, and 882 on April 25-26, 1978. However, the earlier Foothills surveys covered a larger area, and so are not strictly comparable.

Geese. Eight Canada geese were found on April 23, and 7 on April 26. Mossop (1976) noted a single Canada goose and 5 white-fronted geese here on April 23, 1976, and 20 Canada geese on May 5. Previous surveys for Foothills found no geese here in either 1977 or 1978.

Ducks. Ducks were present on all surveys, with a high of 1572 on the April 26 ground count. Most of these were dabbling ducks found feeding on the beaches at Teslin Lake, where they were very difficult to see and may have been missed on the aerial counts.

In 1976, Mossop counted 56 ducks here on March 3, and 900 (from the bridge) on May 5. Previous surveys for Foothills are not comparable, as the surveyed area was larger.

The common species of ducks observed here, in approximate order of abundance, were pintail, mallard, American widgeon, goldeneye sp?; a few green-winged teal and canvasbacks were also present.

Area 3: Tagish Narrows. Counts for Tagish Narrows extend from April 8 through May 2. Data are summarized in Table .

Swans. Both species of swans stop here, and the presence of trumpeter swans at this site has led to a proposal for the establishment of a Migratory Bird Sanctuary (Dennington, 1976). Milligan (1978) estimated that 160-170 trumpeter swans were present here at the migration peak, the same number as at Marsh Lake; indeed, he felt that the birds staged at Tagish before moving to Marsh Lake and then

Table 4. - Spring waterfowl counts, 1980. Area 2.: Teslin Lake Outlet

Date:		23/04	25/04	26/04 (ground survey)	02/05
Observer:		B	B	B	B
Area 2a:	Swans:	323	56	154	0
	Geese:	8	0	7	0
	Ducks:	328	93	793	75
Area 2b:	Swans:	2	0	0	0
	Geese:	0	0	0	0
	Ducks:	364	536	779	260
TOTAL:	Swans:	325	56	154	0
	Geese:	8	0	7	0
	Ducks:	693	629	1572	335

Area 2a: Teslin Lake Outlet downstream to the power line crossing.

Area 2b: Teslin River, power line crossing to 4 kilometers downstream of the bridge.

Observer: All G. Anweiler, D.A. Blood & Associates (aerial counts except for ground count 26/04).

Table 5 . - Spring waterfowl counts, 1980. Area 3: Tagish Narrows (Control Area)

Date:		08/04	16/04	19/04	23/04	25/04	26/04	27/04	30/04	02/05
Observer:		A	A	A	A,B	B	B	A,B	A	B
Area 3a:	Swans:	8*	39	242	173	210	55	22	1	0
	Geese:	0*	0	0	2	0	0	0	0	0
	Ducks:	10*	87	280	1045	875	429	108	21	70
Area 3b:	Swans:	5	37	72	447	156	57	28	58	72
	Geese:	0	10	22	33	0	7	0	2	2
	Ducks:	53	389	422	2324	875	1493	735	1332	±800
TOTAL:	Swans:	13+	76	314	620	366	112	50	59	72
	Geese:	0+	10	22	35	0	7	0	2	0
	Ducks:	63+	476	702	3369	1750	1922	843	1353	±870

Observer: A = K. Asquith, C.W.S. (ground counts); B = G. Anweiler, D.A. Blood & Assoc. (all aerial counts except ground count 27/04).

Area 3a: Tagish Narrows, Tagish Lake to bridge. Area 3b: bridge over Tagish Narrows and south end of Marsh Lake (see map).

* indicates partial count only this date.

to the Yukon River. All 1980 swan observations were combined as swan sp?.

Thirteen swans were found on the first survey on April 8. Numbers peaked at 620 on April 23, whereafter they declined rapidly. Seventy-two were still present on the last survey on May 2.

Previous surveys for Foothills found peak numbers of 158 on April 20, 1977 and 809 on April 25-26, 1978. Milligan (1978) recorded a peak of 748 on April 24, 1978.

Geese. The first geese (10) were seen on April 16, and the last (2) on April 30; numbers peaked at 35 on April 23. All geese seen were Canada geese.

Previous surveys for Foothills found 25 geese here on April 20, 1977, and a peak of 6 on May 2, 1978. Milligan (1978) observed the first geese (3) on April 17, a peak of 30 on April 20, and the last (5) on May 5, 1978. He observed both Canada and white-fronted geese, and had a report of snow geese in the area, but did not see them himself.

Ducks. At least 63 ducks were present on the first survey, April 8. Numbers peaked at 3369 on April 23, and an estimated 890 were present on the last survey, May 2.

Mossop estimated 4000 ducks in this area on May 5, 1976. Previous surveys for Foothills found peaks of 2259 on April 26 and 2257 on May 3, 1977, and 1651 on May 9-10, 1978. Milligan recorded a high of 2471 on April 28, 1978.

Other Areas. The other sites checked on the April 23 and May 2 aerial surveys had few waterfowl. Eleven swans and 49 ducks were seen on a small open pool in the corridor at Nisutlin Bay on April 23, and a group of 35 ducks were found at the mouth of the Morley River on the same date. No waterfowl were seen at these sites on May 2.

3.1.2 Production

Waterfowl production was monitored at 28 ponds in three areas along construction segments 4 and 5. Indicated breeding pair counts were made in May, and broods were counted in July and August.

3.1.2.1 The Survey Ponds

Area 1: Quill Creek. Fourteen ponds were selected in the corridor east of Quill Creek. An additional 7 ponds were added part way through the program, but the data from them were not used in our calculations. The ponds are all shown on Map 6.

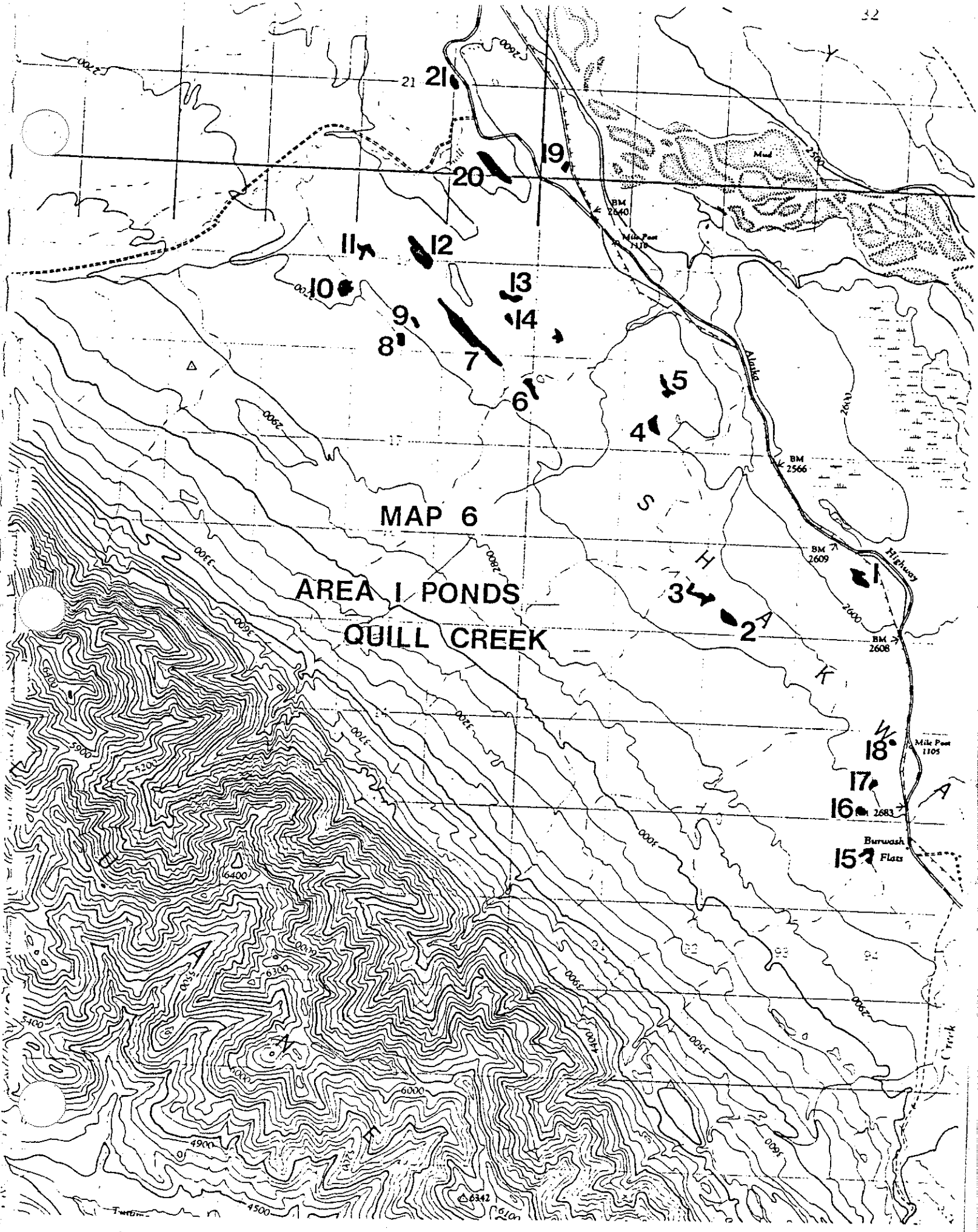
Size of the ponds ranged from an estimated 4.5 hectares to less than 1 hectare, and averaged about 2 hectares. They are located in mature spruce forest, and for the most part are forested to the shore. A characteristic of the ponds in this area is that a section of the surrounding forest has slumped into the pond, typical of ponds in permafrost soils. Shorelines tend to be rather abrupt, and consist of sparsely vegetated mud. Little vegetation is present in the littoral zone, although a few ponds have a small area of sedge marsh.

Area 2: Duke River. Seven ponds were monitored in the corridor east of the Duke River. The locations are shown on Map 7.

These ponds have formed in folds along the base of the mountain, and tend to be long and narrow. In size they range from an estimated 4.5 to less than 1 hectare, and average about 2.8 hectares. Adjacent uplands are mainly forested except for sedge meadows which occur at the ends of the ponds. The shores consist of a narrow band of exposed mud, with little sedge growth present. Sedge marsh is extremely limited, and none of the ponds had areas of slumped forest characteristic of the ponds in area 1.

Area 3: Jarvis River. Seven ponds in the area between Kloo Lake and Sulphur Lake were monitored. The location of each is shown on Map 8.

These ponds tend to be circular in shape, and range in size from an estimated 6.5 to less than 1 hectare, averaging about 2.5 hectares. These ponds have a characteristic wide band of sedge marsh along the shores, backed by brush or open spruce forest. The area north of the highway appears to be an old burn, while that south of the highway is not.


MAP 6
AREA I PONDS
QUILL CREEK
Alaska Highway
Mud
Burwash Flats
Mile Post 1105
Mile Post 1116
BM 2640
BM 2566
BM 2609
BM 2608
2683
1
2
3
4
5
6
7
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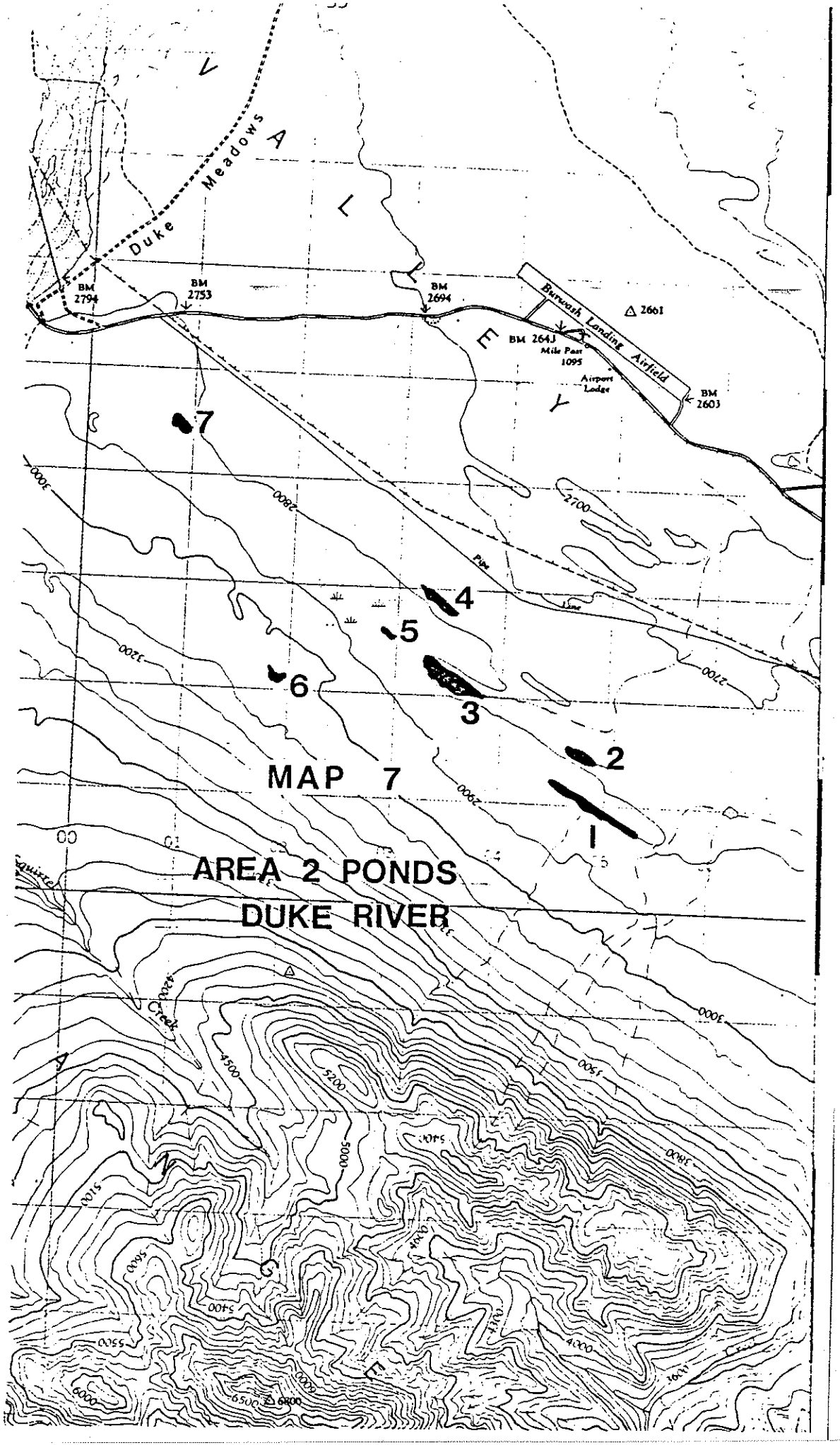
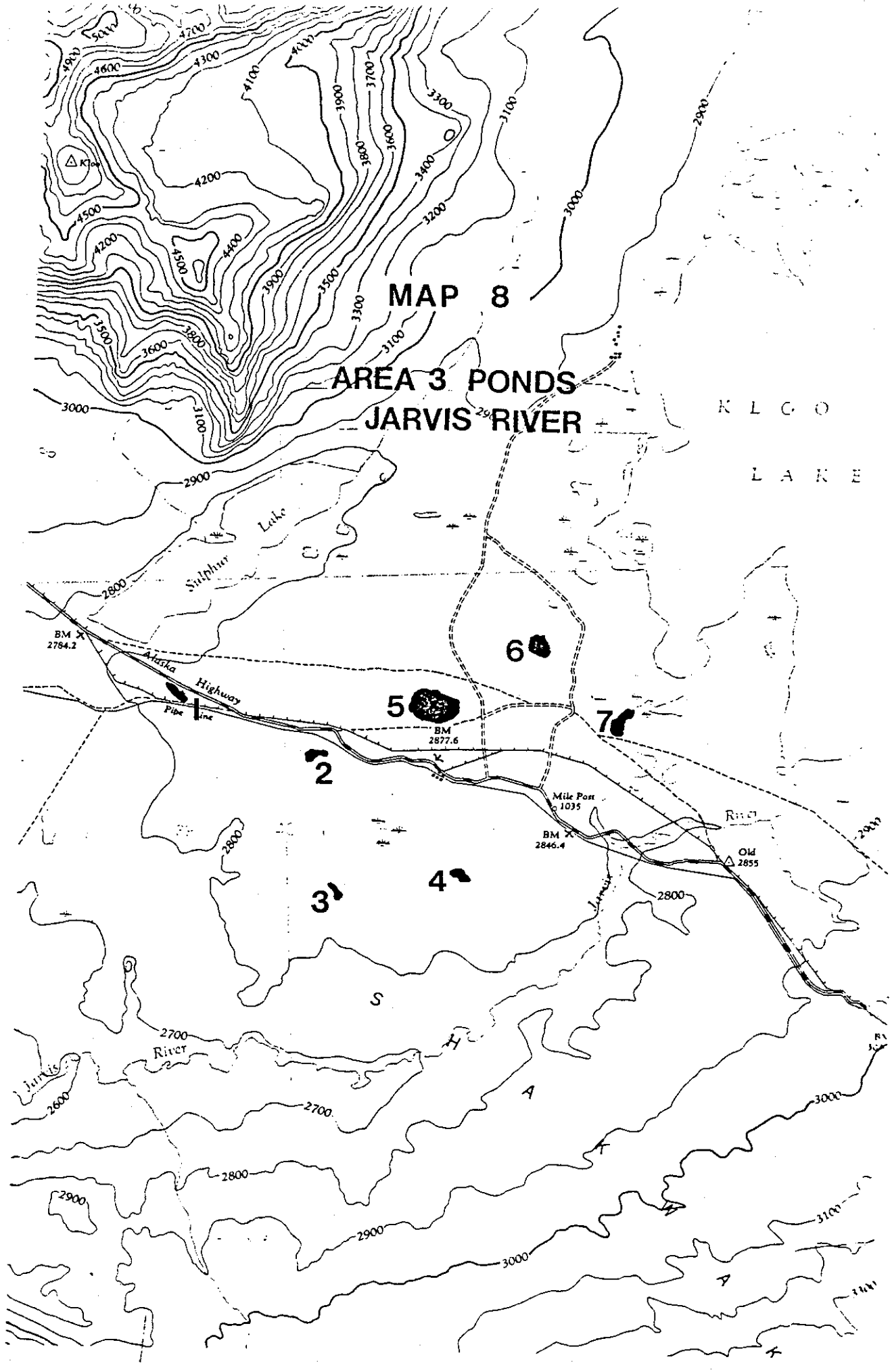

Duke Meadows
BM 2794
BM 2753
BM 2694
Burwash Landing Airfield
△ 2661
BM 2643
Mile Post 1095
Airport Lodge
BM 2603
7
4
5
6
3
2
1
MAP 7
AREA 2 PONDS
DUKE RIVER
Squirrel Creek
Pipe
3000
2800
2700
3200
4500
5200
5000
5100
5400
5500
6000
6500
6800
4000


MAP 8
AREA 3 PONDS
JARVIS RIVER
KLGO
LAKE
Sulphur Lake
Alaska Highway
Pipe Line
BM 2784.2
BM 2877.6
BM 2846.4
Mile Post 1035
Old 2855
Jarvis River
2
3
4
5
6
7

3.1.2.2 Survey Results

Results of the breeding pair and brood surveys are summarized in Tables 6 to 9 . An average of 4.5 pairs of ducks per pond was found on the indicated breeding pair counts, and an average of 2.6 broods of ducks per pond on the production surveys, all ponds combined. Indicated breeding pair counts ranged from 0-22 pairs of ducks per pond, and broods from 0-13 duck broods per pond.

Diving ducks made up 64% of the indicated breeding pairs of ducks and 63.2% of duck broods. Scaup sp? were the most common ducks in all areas, and made up 38.8% of the indicated breeding pairs and 33.5% of the broods. Other common species of diving ducks included buffleheads and goldeneye sp?. A few ring-necked ducks and white-winged scoters were also seen.

Mallards were the most common dabbling ducks on the indicated breeding pair counts (14.1% of all duck pairs) but were surpassed by pintails on the brood counts (13.3% of all duck broods). Other species of dabbling ducks observed were green-winged teal, American widgeon, northern shovelers, and blue-winged teal.

Horned grebes were also observed on many of the ponds, and made up 15.7% of all waterfowl pairs, and 9.5% of all broods. One pair of Arctic loons nested, and a single American coot was seen.

Area 1: Quill Creek. Indicated breeding pair counts for Area 1 are presented in Tables 6and 10; brood count data in Tables 7 and 11.

An average of 2.5 pairs of ducks per pond were found on the indicated breeding pair surveys. Scaup averaged 1.43 pairs per pond, followed by buffleheads (.43 pair) and mallards (.25). Other species present included goldeneye sp?, pintails, American widgeon, blue-winged teal, and green-winged teal. Horned grebes averaged .25 pairs per pond.

An average of 1.5 broods of ducks were found per pond, ranging from 0-4 broods. Scaup made up 35.6% of the duck broods, followed by goldeneyes (20%), buffleheads (17.8%) and pintails (13.3%).

Diving ducks made up 75.6% of the duck broods in this area, and 81.3% of the indicated breeding pairs of ducks, the highest percentages of any area surveyed.

Table 6 . - 1980 Waterfowl indicated breeding pair counts, by species.

Species	Quill Creek*		Duke River		Jarvis River**			All
	24/05	25/05	24/05	25/05	26/05	26/05	29/05	
	Number of Indicated Pairs							
Mallard	5	2	3	3	10	9	5	37
Pintail	0	2	6	8	1	0	0	17
Green-w. teal	0	1	1	1	2	7	8	20
Blue-w. teal	1	0	0	0	0	1	1	3
Amer. widgeon	1	1	0	2	1	2	1	8
North. shoveler	0	0	0	0	3	2	5	10
Total dabblers	7	6	10	14	17	21	20	95
Scaup sp?	21	19	12	14	9	9	18	102
Ring-n. duck	0	0	0	0	0	5	7	12
Barrow's gold.	1	1	0	0	1	3	3	9
Goldeneye sp?	3	0	0	2	0	0	0	5
Bufflehead	6	6	4	3	7	7	5	38
White-w. scoter	0	0	1	0	0	0	0	1
Unid. diver	0	0	1	0	0	0	0	1
Total divers	31	26	17	19	18	24	33	168
Total ducks	38	32	27	33	35	45	53	263
Arctic loon	0	0	1	0	0	0	0	1
Horned grebe	2	5	2	0	5	13	18	45
Amer. coot	0	0	0	0	0	1	0	1
Total waterfowl	40	43	30	33	40	59	71	286

* ponds 1-14 only used in these calculations.

** first survey on foot, all others by helicopter.

Table 7 . - 1980 Waterfowl brood counts, by species.

Species	Area 1 (Quill Creek)*			Area 2 (Duke River)			Area 3 (Jarvis River)**				Total
	16/07	19/07	19/08	16/07	19/07	19/08	18/07	18/07	20/07	19/08	
	Number of Broods										
Arctic loon	0	0	0	1	1	1	0	0	0	0	3
Horned grebe	1	2	0	0	0	0	6	4	5	0	18
Mallard	2	2	0	1	2	0	3	2	1	1	14
Pintail	3	2	1	3	3	1	2	4	2	0	21
Green-wing teal	1	0	0	0	0	0	5	5	5	1	17
Blue-wing teal	0	0	0	0	1	0	0	0	1	0	2
American widgeon	0	0	0	0	0	0	0	0	0	1	1
Northern shoveler	0	0	0	0	1	0	0	1	1	0	3
Scaup sp?	5	10	1	6	7	2	9	7	6	0	53
Ring-neck duck	0	0	0	0	0	0	2	0	1	1	4
Goldeneye sp?	4	5	0	3	4	0	2	1	1	0	20
Bufflehead	4	4	0	1	1	0	3	3	2	1	19
Bucephala sp?	0	1	0	0	1	1	0	0	0	0	3
Unid. diver	0	0	0	1	0	0	0	0	0	0	1
Total broods	20	26	2	16	21	5	32	27	25	5	180
Total duck broods	19	24	2	15	20	4	26	23	20	5	158

* ponds 1-14 only used in these calculations.

** first survey on foot, all others helicopter.

Table 8 . - Species composition of breeding ducks, based on indicated breeding pair (I.P.B.) and brood counts, 1980.

Species	Quill Creek[1]		Duke River		Jarvis River		All Areas	
	I.B.P.	Broods	I.B.P.	Broods	I.B.P.	Broods	I.B.P.	Broods
Mallard	10.0%	8.9%	10.0%	8.1%	18.1%[2]	9.5%	14.1%	8.9%
Pintail	2.9	13.3	23.3	18.9	0.8	10.8[5]	6.5	13.3
Green-winged teal	1.4	2.2	3.3	0	12.8[4]	21.6[2]	7.9	10.8
Blue-winged teal	1.4	0	0	2.7	1.5	1.4	1.1	1.3
American widgeon	2.9	0	3.3	0	3.0	1.4	3.0	0.6
Northern shoveler	0	0	0	2.7	7.5	2.7	3.8	1.9
Total dabblers	18.6	24.4	39.9	32.4	43.7	47.4	36.1	35.8
Scaup sp?	57.1	35.6	43.3	37.8	27.1[1]	29.7[1]	38.8	33.5
Ring-necked duck	0	0	0	0	9.0[5]	5.4	4.6	2.5
Goldeneye sp?	7.1	20.0	3.3	18.9	5.3	12.2[4]	5.3	12.7
Bufflehead	17.1	17.8	11.7	5.1	14.3[3]	12.5[3]	14.5	12.0
Bucephala sp?	0	2.2	0	2.7	0	0	0	1.9
White-wing. scoter	0	0	0	0	0.8	0	0.4	0
Unid. diver	0	0	1.7	2.7	0	0	0.4	0.6
Total divers	81.3	75.6	60.0	67.5	56.5	52.7	64.0	63.2
(n)	70	45	60	39	133	74	263	158

1 ponds 1-14 only used in Quill Creek calculations.

* all goldeneye observations grouped; I.B.P. count figures were: Barrow's - 9; goldeneye sp? - 5.

Table 9 . - Waterfowl indicated breeding pair and brood survey summaries, 1980.

	Quill Creek	Duke River	Jarvis River	All Areas Total
Total I.B.P. Waterfowl[1]	83	63	170	286
Total I.B.P. Ducks	70	60	133	263
Average I.B.P. Waterfowl/Pond[2]	2.96	4.5	8.1	5.2
Average I.B.P. Ducks/Pond	2.5	4.3	6.3	4.4
Total broods waterfowl	48	42	89	179
Total broods ducks	45	39	74	158
Average broods waterfowl/pond[3]	1.6	2.6	4	2.7
Average broods ducks/pond	1.5	2.5	3.3	2.4

1 Total of all counts for all ponds.

2 Calculated by dividing total broods by the number of ponds and the number of surveys.

3 Calculated by dividing the total number by the number of ponds and the number of surveys (July surveys only used).

Table 10. - 1980 indicated breeding pair counts of ducks, by pond. Area 1 - Quill Creek.

Pond	Number of Indicated Pairs		
	Date		
	24/05	25/05	28/05
1	4	7	7
2	4	4	-
3	2	2	-
4	1	1	-
5	2	0	-
6	2	0	-
7	0	0	-
8	3	5	-
9	-	1	0
10	2	4	-
11	1	2	-
12	0	3	-
13	2	1	-
14	15	2	-
15	-	8	5
16	-	0	0
17	-	2	5
18	-	5	6
19	-	3	5
20	-	3	1
21	-	0	2
Total	38	32*	-

(-) indicates pond not surveyed this date. Surveys on 24 and 25/05 by helicopter; 28/05 on foot. All pond numbers correspond to those on map

* ponds 1-14 only included in total for comparative purposes.

Table 11. - 1980 waterfowl brood counts, by pond. Area 1 - Quill Creek.

Pond	Number of Broods			
	Date			
	16/07	17/07	19/07	19/08
1	2	-	3	0
2	1	-	4	0
3	3	-	2	0
4	0 (1)	-	0 (1)	0
5	3	-	2	0
6	1	-	1	0
7	1	-	2	2
8	0	-	0	0
9	1	-	0 (1)	0
10	1	-	1	0
11	0	-	0	0
12	3	-	3	0
13	3	-	4	0
14	0	-	2	0
Sub-total broods	20	-	26	2
Sub-total duck broods	19	-	24	2
15	3	3 (1)	4	0
16	0 (1)	1 (1)	1	0
17	0	0	0	1
18	1	1	0	1
19	0	0	0	0
20	0	0	0	0
21	0	0	0	0
Total broods	25	7	31	4
Total duck broods	23	5	29	4

- Numbers in bracks are non-duck (horned grebe) broods.
- a dash (-) indicates not counted this date.
- all counts by helicopter except 17/07 by foot.

Area 2: Duke River. Indicated breeding pair counts for area 2 are presented in Tables 6 and 12, and brood counts in Tables 7 and 13.

An average of 4.3 pairs of ducks per pond were found in area 2, ranging from 0-18 pairs per pond. Scaup averaged 1.9 pairs per pond, followed by pintails (1.0), buffleheads (0.5) and mallards (0.4). Other species also present were green-winged teal, American widgeon, and goldeneye sp?. One pair of Arctic loons and 2 pairs of horned grebes were also seen.

Duck broods averaged 2.5 per pond, and ranged from 0-11 per pond. Scaup were the commonest (37.8% of duck broods) followed by pintails and goldeneye sp? (18.9% each), and mallards (8.1%). Other broods included blue-winged teal, northern shovelers, and buffleheads. No horned grebe broods were seen, but one young Arctic loon was produced here.

Diving ducks made up 60.0% of the indicated breeding pairs of ducks and 67.5% of broods in area 2.

Area 3: Jarvis River. Indicated breeding pair counts are presented in Tables 6 and 14 , and brood counts in Tables 7 and 15.

Indicated breeding pairs of ducks averaged 6.3 pairs per pond, and ranged from 0-22 pairs per pond. Scaup sp? were the most common, at 1.7 pairs per pond, followed by mallards (1.1), buffleheads (0.9) and green-winged teal (0.8). Other ducks observed included pintails, blue-winged teal, American widgeon, northern shovelers, ring-necked ducks, Barrow's goldeneyes, and white-winged scoters. Horned grebes were also common, and averaged 1.7 pairs per pond. A single American coot was seen.

Duck broods averaged 3.3 per pond, and ranged from 0-12. Scaup were the most common (29.7% of all duck broods), followed by green-winged teal (21.6%), bufflehead and goldeneye (12.2% each). Other broods observed were pintails, blue-winged teal, American widgeon, norther shovelers, and ring-necked ducks. Horned grebes made up 6.3% of all broods seen.

Diving ducks made up 56.5% of the indicated breeding pairs of ducks and 52.7% of duck broods, the lowest percentages of the three areas surveyed.

Table 12 . - 1980 indicated breeding pair counts of ducks, by pond. Area 2 - Duke River.

Pond	Number of Indicated Pairs	
	Date	
	24/05	25/05
1	12	18
2	1	0
3	0	1
4	6	5
5	3	3
6	3	4
7	2	2
Total	27	33

Both surveys by helicopter

Table 13 . - 1980 waterfowl brood counts, by pond. Area 2 - Duke River.

Pond	Number of Broods		
	Date		
	16/07	19/07	19/08
1	6	11	1
2	3	4	0
3	0 (1)	0 (1)	0 (1)
4	1	0	1
5	0	1	0
6	0	1	0
7	5	3	1
Total broods	16	21	4
Total duck broods	15	20	4

Number in brackets is a non-duck (Arctic loon) brood. All counts by helicopter.

Table 14. - 1980 indicated breeding pair counts of ducks, by pond. Area 3 - Jarvis River.

Pond	Number of Indicated Pairs		
	Date		
	26/05*	26/05	29/05
1	0	4	4
2	0	3	4
3	3	3	3
4	6	6	0
5	3	7	22
6	16	15	12
7	7	7	8
Total	35	45	53

* first survey by helicopter, others on foot.

Table 15 . - 1980 waterfowl brood counts, by pond. Area 3 - Jarvis River.

Pond	Number of Broods			
	Date			
	18/07	18/07*	20/07	19/08*
1	0 (1)	0 (1)	0 (1)	0
2	4 (1)	3 (1)	2 (1)	0
3	0 (1)	1 (1)	2 (1)	0
4	0 (1)	1 (1)	1	0
5	6 (2)	3	5 (1)	2
6	4	3	3	2
7	12	12	7	1
Total broods	32	27	24	5
Total duck broods	26	23	20	5

Numbers in brackets non-duck (horned grebe) broods. Counts marked with an asterisk (*) by helicopter; others by foot.

3.1.3 Late Summer Staging

Several small to medium-sized lakes and the shoreline of Kluane Lake within the pipeline corridor through construction segments 4 and 5 were surveyed once in August for post-breeding waterfowl. All the ponds surveyed in July for broods were also checked at this time. Few ducks were found on any of the lakes, and waterfowl numbers on the breeding ponds had declined from the July totals.

3.1.3.1 The Survey Areas

Pine Lake. Pine Lake is a small, deep lake (about 5.5 by 1 km.) crossed by the pipeline corridor between km. posts 288 and 293, north of Haines Junction. The lake contains fish, has a campground and picnic site at the west end, and has few shallow areas where aquatic vegetation is present. A total of 29 ducks was found on Pine Lake.

Sulphur Lake. Another small lake, about 3 by .5 km, the southern two-thirds of which is crossed by the pipeline corridor between km. posts 256 and 257. There is a picnic site and campground at the south end. Parts of the shore zone are shallow, and appear to produce quantities of aquatic vegetation. A total of 234 ducks were found here, mostly on the north half of the lake.

Hungry Lake. A small lake located in a small valley and crossed by the pipeline corridor at km post 245. Only the eastern third of the lake is crossed by the corridor. The lake appears to be fairly deep, with little vegetation in the littoral zone. Only 16 ducks were found here.

Kluane Lake shoreline. The north shore of Kluane Lake from Christmas Bay to the mouth of Cultus Bay falls within the corridor between km. posts 224 and 231. This part of the lake has a sterile sand or rocky shoreline, and aquatic vegetation is almost non-existent. The south shore of the lake from south of Congdon Creek to the mouth of Lewis Creek also falls within the corridor, between km. posts 220 and 194. Most of this shoreline is also sterile, but the deltas of the small streams provide some waterfowl habitat. A total of 100 ducks was seen in the entire Kluane Lake section, most of these on the small deltas.

Breeding Ponds. The breeding ponds are described in section 3.1.2.1. A total of 362 ducks was seen on all ponds combined.

3.1.3.2 Survey Results

Counts for all areas are summarized in Table 16, and the actual counts are presented as Appendix 4. A total of 741 ducks was found in all areas surveyed.

Sulphur Lake attracted more ducks than any of the other waterbodies, but even here duck numbers were low.

3.1.4 Fall Migration (and Staging.)

The fall waterfowl migration was monitored with two series of aerial surveys timed to coincide with the peak of swan and goose migrations. Monitoring sites were identified by reviewing surveys carried out in 1976 and 1978 for Foothills. A number of sites in the corridor both east (eastern sector) and west (western sector) of Whitehorse were monitored, as well as two sites in each sector which were outside of the corridor and served as control areas.

3.1.4.1 The Survey Areas.

The survey areas were divided into two sectors, an eastern sector (Whitehorse to the Morley River) and a western sector (the corridor along construction segments 4 and 5; Kloo Lake to the Kluane Lake outlet.) The surveyed areas are shown on Maps 9 through 21.

Eastern Sector. The following areas were monitored in the corridor east of Whitehorse: the Yukon River from km. post 445 to Marsh Lake; the Marsh Lake outlet area including M'Clintock Bay and the north shore east to Elbow Creek; Squanga Lake; the Teslin Lake outlet downstream to the first rapids; the corridor area of Nisutlin Bay, and most of Morley Bay and the lower Morley River. Areas monitored as controls were Little Squanga Lake and Tagish Narrows (Maps 9-15).

Western Sector. The following areas were monitored within the corridor in the western sector: Sulphur Lake; the north shore of Kluane Lake from Christmas Bay to and including Cultus Bay; the south shore of Kluane Lake from south of Congdon Creek to the mouth of Lewis Creek. Areas outside the corridor monitored as controls included the southern part of Kloo Lake and the Kluane Lake outlet (Maps 16-21).

Table 16 . - Late summer waterfowl staging survey, construction sections 4 and 5. August 19, 1980.

Area	Dabblers	Divers	Other	Total
Pine Lake	1	28	0	29
Sulphur Lake				
- north half	0	154	0	154
- south half	45	35	0	80
Hungry Lake	15	0	1	16
Kluane Lake	83	17	0	100
Sub-total	144	234	1	379
Area 3 ponds				
- Jarvis River	64	61	1	126
Area 2 ponds				
- Duke River	11	36	2	49
Area 1 ponds				
- Quill Creek*	86	96	5	187
Sub-total	161	193	8	362
TOTAL	305	427	9	741

* all 21 ponds included from Quill Creek area.

3.1.4.2 Survey Results

Few swans were found at any sites along the corridor; a total of 89 in the eastern sector and 65 in the western sector. The only site where significant numbers of swans were found was at the Kluane Lake outlet control area.

Geese were also uncommon, with a total of 491 found in the eastern sector and none in the western sector, with the exception of 103 at the Kluane Lake outlet control area. Most geese were found at the Teslin Lake outlet, with a few also present at Morley Bay.

Ducks were found at all sites on most surveys, but counts never exceeded 500 at any one site per survey. Mallards dominated the early counts, and buffleheads the later ones.

Counts for the eastern sector are summarized in Table 17 and the western sector in Table 18 ; actual counts are included as Appendix 5. Duck counts, by species, are shown in Table 19.

Eastern Sector.

Yukon River. No swans or geese were found in this area. Duck counts ranged from 0 on September 16 to 487 on October 21. Ducks were found along the entire survey area, but were most numerous in the marshy section between the highway bridge and Marsh Lake.

Previous surveys carried out for Foothills (Foothills, 1976; 1977b) also failed to observe swans in this area in fall, but found up to 120 geese (September 21-22, 1977) and 778 ducks (October 19, 1977).

Marsh Lake. No swans or geese were found here. The peak duck count was 357 on October 19. Ducks were rather evenly distributed along the entire shoreline of the area surveyed.

Previous surveys for Foothills found a single swan but no geese here in 1976 and 1977. The high duck count on those surveys was 549 on October 19, 1977, but the survey area was not identical to ours.

Squanga Lake. The only swans observed were 15 on the middle of the lake on October 21. No geese were found here. Ducks peaked at 336 on October 19. Ducks tended to be concentrated in the shallow marshy areas along the north shore at the west end of the lake, with smaller numbers at the south end.

Previous surveys for Foothills included both Squanga and Michie Lakes. Only a single swan and no geese were observed; duck counts are not comparable.

Teslin Lake outlet. The only swans seen were a single family group of 7 on October 17, on the lake near the outlet. Geese were present on all the September surveys, with a high of 174 on September 18. Geese were observed along the river both upstream and downstream of the bridge, with most found on Teslin Lake at the outlet. Ducks were evenly distributed, with a peak of 170 on October 21.

Previous surveys for Foothills included an additional downstream section of the Teslin River. They counted up to 6 swans in 1976 and 318 in 1977, and also recorded up to 262 geese.

Nisutlin Bay. No swans or geese, and few ducks were found here. The high count for ducks was 60 on October 19.

Previous surveys for Foothills are not comparable because they included Colwell Bay and the delta of the Nisutlin River, an area known to attract large numbers of waterfowl in the fall.

Morley Bay. Swans were recorded on one survey, a flock of 67 in the mouth of the small bay on the north side on October 17. Geese were present on all September surveys, with a high count of 65 on September 20. Most geese were seen at the mouth of the river. Ducks peaked at 222 on October 17. Concentrations of ducks were noted in the mouth of the small bay on the north side and at the mouth of the Morley River. Smaller numbers were scattered along the lower reach of the river.

Previous surveys for Foothills found swans here in both 1976 and 1977, with peaks of 14 on October 14-15, 1976, and 46 on October 25-26, 1977. High counts recorded for geese were 51 on September 22-23, 1976 and 96 on September 7-8, 1977.

Little Squanga Lake (control area). No swans or geese were found here. Ducks peaked at 36 on October 21.

Tagish Narrows (control area). The only swans observed were a family group of 5 on October 21. No geese were seen. The high duck count was 294 on October 21. Ducks were seen throughout the area, but were most numerous on the Marsh Lake section.

Table 17. - 1980 Fall waterfowl survey results, eastern sector.

Area	Date						Total
	16/09	18/09	20/09	17/10	19/10	21/10	
				SWANS			
Yukon River	0	0	0	0	0	0	0
Marsh Lk. outlet	0	0	0	0	0	0	0
Little Squanga Lk.	0	0	0	0	0	0	0
Squanga Lake	0	0	0	0	0	15	15
Teslin Lk. outlet	0	0	0	7	0	0	7
Nisutlin Bay	0	0	0	0	0	0	0
Morley Bay	0	0	0	67	0	0	67
Tagish Narrows	0	0	0	0	0	5	5
Total	0	0	0	74	0	20	94
				GEESE			
Yukon River	0	0	0	0	0	0	0
Marsh Lk. outlet	0	0	0	0	0	0	0
Little Squanga Lk.	0	0	0	0	0	0	0
Squanga Lake	0	0	0	0	0	0	0
Teslin Lk. outlet	27	174	136	0	0	0	337
Nisutlin Bay	0	0	0	0	0	0	0
Morley Bay	40	49	65	0	0	0	154
Tagish Narrows	0	0	0	0	0	0	0
Total	67	223	201	0	0	0	491
				DUCKS			
Yukon River	0	78	141	399	417	487	1522
Marsh Lk. outlet	54	78	111	357	283	260	1143
Little Squanga Lk.	3	4	3	7	10	36	63
Squanga Lake	13	55	73	236	336	294	1007
Teslin Lk. outlet	55	66	116	83	83	170	573
Nisutlin Bay	20	27	22	43	60	38	210
Morley Bay	85	110	170	222	57	59	703
Tagish Narrows	152	59	103	242	212	294	1062
Total	382	477	739	1589	1458	1638	6283
TOTAL WATERFOWL	449	700	940	1663	1458	1658	6868

Table 18. - 1980 Fall waterfowl survey results, western sector.

Area	Date						Total
	15/09	17/09	19/09	16/10	18/10	20/10	
				SWANS			
Kloo Lake	0	0	0	0	0	3	3
Sulphur Lake	0	0	0	16	23	10	59
Kluane Lake							
- north shore	0	0	0	0	0	0	0
- south shore	0	0	0	3	0	0	3
Kluane Lk. outlet	0	0	0	334*	445	351	1130
Total	0	0	0	353	468	364	1195
				GEESE			
Kloo Lake	0	0	0	0	0	0	0
Sulphur Lake	0	0	0	0	0	0	0
Kluane Lake							
- north shore	0	0	0	0	0	0	0
- south shore	0	0	0	0	0	0	0
Kluane Lk. outlet	0	2	0	2*	43	56	103
Total	0	2	0	2	43	56	103
				DUCKS			
Kloo Lake	59	113	16	93	14	80	375
Sulphur Lake	184	175	50	277	115	150	951
Kluane Lake							
- north shore	0	23	0	46	47	44	160
- south shore	0	26	0	27	0	0	53
Kluane Lk. outlet	10	45	24	60*	135	485**	759
Total	253	382	90	503	311	759	1228
TOTAL WATERFOWL	253	384	90	445	822	1179	2526

* count incomplete because of dense fog.

** ducks estimated only this survey.

Table 19 . - Species composition of Fall ducks, 1980.

	Eastern Sector		Western Sector		Total
	16-20/09	17-21/10	15-19/09	16-20/10	
Mallard	458	367	136	201	1162
Blue-wing teal	2	0	0	0	2
Teal sp?	9	0	3	0	12
Unid. dabblers	225	0	95	0	420
Total dabblers	694	367	124	201	1496
Scaup sp?	294	165	313	30	802
Goldeneye sp?	162	1454	51	105	1772
Bufflehead	62	2462	8	172	2704
Oldsquaw	0	10	0	0	10
Surf scoter	30	0	18	30	78
White-w. scoter	0	0	5	0	5
Scoter sp?	0	8	26	17	51
Merganser sp?	60	88	1	0	149
Unid. divers	97	35	65	126	323
Total divers	705	4222	487	480	5894
Total ducks	1409	4668	725	1484	8286

Western Sector.

Sulphur Lake. Swans were present on all October surveys, with a high of 23 on October 18. No geese were seen. Ducks peaked at 277 on October 17. Most waterfowl were found around the small point on the west side, with smaller numbers on the extreme north and south ends of the lake.

Previous surveys carried out for Foothills failed to find swans or geese here. The peak duck count was 504 on October 4, 1976.

Kluane Lake - north shore. No swans or geese were seen here. The peak duck count was 47 on October 18, nearly all in Cultus Bay.

Kluane Lake - south shore. The only swans seen were 3 on October 16. The peak duck count was 27 on October 16. No geese were seen. The few ducks observed were found on stream deltas.

Previous surveys for Foothills found no swans, but noted geese on the delta of Bock's Brook in both years. A peak of 60 was seen September 23-24, 1976 and 55 on September 21-22, 1977.

Kloo Lake. Only the southern end of the lake was surveyed. The only swans seen were 3 on October 20. No geese were found here. The high duck count was recorded on September 17, when 113 were seen. Most waterfowl were found in the channel around the island in the southwest bay, with smaller numbers noted in the southern ends of both bays.

Previous surveys for Foothills included all of Kloo Lake, and are not comparable.

Kluane Lake outlet. Swans were observed on all counts in October, with a maximum of 445 on October 18. The only geese seen on September surveys were two black brant on September 17; however, Canada geese were present on all October surveys, with a peak of 56 on October 20. The high duck count was an estimated 485 on October 20. Geese and swans were found not only on the mud bars in the mouth of the river; but scattered along the west side of Brooks Arm for some 2-3 km. as well. Most ducks were found on the shallows at the river mouth or in shallow bays on the south side.

Previous surveys for Foothills found up to 110 swans here on October 14-15, 1976 and 160 on October 11-12, 1977. Maximum goose counts recorded were 590 on October 7, 1976 and 45 on October 4-5, 1977. Duck counts are not comparable.

3.2 Raptors

The raptor survey program monitored a number of eagle nests in and adjacent to the pipeline corridor through construction segments 1-5. All bald eagle nesting sites in and adjacent to the corridor in that section were included, as were all golden eagle nests in the corridor through construction segments 4 and 5. Golden eagle nests in a block adjacent to the corridor from the south end of Kluane Lake to Quill Creek were monitored as an experimental control. Nests were visited at about 1 month intervals throughout the nesting period, and data obtained on reproductive effort and success. The approximate study areas are shown on Map 2.

3.2.1 Bald Eagles

Bald eagles are not common along this part of the corridor, and only 9 nesting sites were located on previous surveys (Windsor, 1978; Foothills, 1973c; Blood and Associates, 1978; 1979). Four of these sites are just outside the corridor, and were monitored as controls. The remaining 5 sites are all found within the 6.4 km corridor. Each "site" may contain from 1-3 nests, only one of which is active in any one year.

No new sites were located during the monitoring program. One previously unreported alternate nest was found near the active nest at site 9-4 (Sulphur Lake), and the nest used in previous years at 6-1 (Kluane River) was gone, but a new nest had been constructed at the same location.

Four of 5 sites in the corridor and all 4 sites outside the corridor had active nests in 1980. The only vacant site was 4-4; no adults were seen at this site, and the nest was in disrepair. Two sub-adult eagles were seen there on two occasions.

Seven of the eight active nests were successful in fledging young, for a nesting success of 87.5%. These nests produced a total of 18 eggs (2.25 per nest), 11 hatched, and 10 young fledged (1.25 young per nest, or 1.4 young per nest if only successful nests are considered). Three of the nests produced three-egg clutches, and three of the nests fledged

two young each. Data are summarized in Tables 20 - 21 . Data sheets for each nest are included as Appendix 6.

Corridor nests. Four of the 5 sites in the corridor had active nests. The 4 nests produced 10 eggs (2.5 per nest), 7 hatched, and all young fledged (1.75 per nest).

Control nests. All 4 sites outside the corridor had active nests. The 4 nests prodoced 8 eggs (2.0 per nest), 4 of which hatched, and 3 young were fledged (1.0 per successful nest or .75 per nesting attempt). The nest at Sanpete Creek (Site 3-12) failed during incubation.

Causes of nest failure. The reasons for failure of the nest at Sanpete Creek are not known. When first visited (May 12), one adult was on the nest. It was not approached closely and did not flush. On the second visit (May 22) one adult was again on the nest. It was flushed and the nest contained 2 eggs. We left the area immediately, and noted that the bird returned to the nest before we were out of sight. When next visited (June 17) the nest was empty and no adults were seen in the area.

Timing of reproduction. Bald eagles were first observed at nests on April 5 and 7 (2 nests) by Court Fooks (Fooks, 1980). Both adults were observed working on these two nests (4-1 and 4-3) on April 7. The first eggs were laid about April 15-16, with most nests starting shortly after this date. This is based on backdating the first nest that was observed to have young (May 22) by the known incubation period of 35 days (Godfrey, 1966); all other nests still held eggs at that time, but subsequent observations showed that the young in most nests hatched shortly after this one, based on their comparable sizes. Two late nests did not have eggs until after May 1. The young remained in the nests until early to mid-August. Of two nests checked on August 19, the single young at one had left the nest but was perched in the nest tree; at the other nest (one of the two late nests) the two young were still in the nest.

The nests located beside rivers or streams were occupied in early April, while the two nests located beside large lakes were not occupied until after May 1.

Table 20. - 1980 bald eagle nest observations

Site No.	Eggs	Hatched	Fledged
Corridor			
9-4	2	2	2
4-3	2	2	2
4-1	3	1	1
3-6	3	2	2
Sub-total	10	7	7
Control			
3-12	2	0	0
6-1	2	1	1
6-8A	1	1	1
10-3	3	2	1
Sub-total	8	4	3
Total	18	11	10

Table 21. - Summary of 1980 bald eagle reproductive effort.

	All	Corr.	Cont.
Percent nests successful in fledging	89%	100%	75%
Hatching success all nests	61%	70%	50%
Average number eggs per nest	2.25	2.50	2.0
Average number young/nest (all nests)	1.38	1.75	1.0
Average number young/nest (succ. only)	1.57	1.75	1.3
Average number fledged/nest (all nest)	1.25	1.75	.75
Average number fledged/nest (suc. only)	1.43	1.75	1.0

Reactions of the birds. Bald eagles reacted to the survey craft ideally from our point of view. The incubating birds remained on the nest until we approached to within 30-40 meters, then flushed. They invariably returned to the nest within minutes of our departure.

The birds were obviously agitated, and responded to our presence by calling, facing us and raising their wings slightly. They appeared to be both aggressive and afraid. At no time did they attack the survey craft. The second adult, which was often perched within a few hundred meters of the nest, often flew to a closer perch, or circled below or to the side of the helicopter.

3.2.2 Golden Eagles

Golden eagles are probably the most common breeding raptors along the pipeline corridor. Nine nesting sites were identified within the 6.4 km wide corridor during previous surveys of this area (Foothills, 1978c; Blood and Associates, 1978; 1979). One new site was found during this study, and one of the previously identified sites was found to contain 2 active nests. All were included in the monitoring program.

In addition to these sites, all sites in a block adjacent to the corridor along the northeast flank of the Kluane Ranges, from Quill Creek to the Slims River delta, were also monitored as an experimental control. Most of these sites had also been located during previous surveys, and additional ones were pointed out to us by Doug Burles, a Parks Canada warden. Seventeen sites were included in the control area. Part of the control area is within Kluane National Park, and all of it within the Kluane Game Sanctuary.

Each of these sites, by definition, contains only a single active nest in any one year. Each may contain from 1 to 8 or more nests, and new nests are added from year to year. Some sites identified as belonging to a single pair of birds one year may be found to contain two active nests in another, as was the case at two sites in 1980. Site boundaries may change greatly from year to year, depending on factors such as availability of food, and cannot be rigidly defined.

In all, 10 active nests were monitored in the corridor and 12 in the control area.

Many observations made at golden eagle nests were incomplete because the birds refused to flush and allow the nest contents to be observed. Egg counts were obtained at less than half of the nests, and counts of recently hatched young at only a few more. The minimum number of eggs laid and young hatched had to be inferred from the number of young seen in the nests at a later stage, and undoubtedly underestimated the true numbers. At a few nests young may have fledged between visits, and have been missed on the survey.

Eighteen of the 22 nests were successful in fledging at least 1 young (82% success). A minimum of 37 eggs were produced (1.7 per nest), 31 young hatched (1.4 per nest) and 27 young fledged (1.2 per nest). The latter figure rises to 1.5 per nest if only successful nests are considered. Three nests produced 3-egg clutches, and one successfully fledged 3 young.

Observations for each nest are summarized in Tables 22 and 23. Data sheets for each nest are appended to the report (Appendix 6).

Corridor nests. All but one site (12-1) in the corridor had active nests. One previously identified site proved to be two sites, as two active nests were located (10-2B and 10-2E). One previously unreported site with an active nest (6-4A) was located, and two previously unreported empty (alternate) nests were located at site 11-2. Ten active nests were located in the corridor.

Eight of the 10 nests were successful in fledging young (80%). At least 15 eggs were laid (1.5 per nest), 13 hatched, and 10 young fledged (1.0 per nest, or 1.25 per successful nest). These figures are probably slightly below the true figures.

Two nests failed. These are discussed separately below.

Control nests. Twelve active nests were located in the control area, and 10 of these (83%) were successful in fledging young. Twenty-two eggs are known to have been produced (1.8 per nest), 18 hatched, and at least 17 young fledged (1.4 per nest or 1.7 per successful nest). These figures are probably somewhat below the true figures.

Table 22 . - 1980 Golden Eagle Nest Observations

Site No.	Eggs	Young	Fledged
Corridor			
6-4A	1	1	0
6-2	2+	2+	1+
8-1C	2+	2+	1+
8-2	2+	2+	2
9-2	1+	1+	1
10-1	2	1+	1
10-2E	1+	1	1
10-2E	1+	1	1
10-2B	1+	1+	1
11-1	1+	0	0
11-2D	2+	2+	2
Total	15+	13+	10+
Control			
6-7	3	3	3
7-1	1+	1+	1
7-2	?	?	0
7-3	1+	1+	1
7-4	2	2	2
7-5	2+	2+	2
7-6	3	2+	2
8-3A	1+	1+	1
8-4	2+	2+	2
8-5	3	?	0
8-7C	2+	2+	2
9-5	2	2	1
Total	22+	18+	17

Table 23. - Summary of 1980 golden eagle reproductive efforts.

	Corridor	Control	Both
Percent nests successful	80%	83%	82%
Average no. eggs/nest	1.5	1.8	1.7
Average number fledged/nest	1.0	1.4	1.2
Av. number fledged/succ. nests	1.25	1.7	1.5

One of the sites previously mapped as a single site had two active nests (7-4 and 7-5). A number of previously unreported alternate nests were also located at several sites.

Two nests failed. These are discussed below.

Causes of nest failure. Two nests in the corridor study area failed to fledge young. One of these (11-1), a tree nest, fell during incubation when the branch tore loose from the tree. Remains of a broken egg were found in the nest.

The other nest (6-4A) apparently failed due to human intervention. This nest was located on the banks of the Kluane River, was visible from below, and could be reached on foot with no difficulty. When checked on May 23 it held a young eagle a day or two old. When next checked on June 19, the nest was empty and no adults were seen in the area. The nest contained cigarette butts.

Two nests in the control area failed to fledge young. At nest 7-2, an adult was noted on the nest, apparently incubating, on April 29. It was not approached closely or flushed on this survey. On the next survey, May 22, the nest was empty and no adults were seen in the vicinity. Reasons for failure are not known.

At nest 8-5, the female was observed perched about 20 meters from the nest on May 1. As we approached she flew to the nest and stood on the rim. Two eggs were visible in the nest, and she was not flushed from it. On the next visit, May 23, she flushed as we approached, and the nest held 3 eggs. When next visited on June 18 the nest was empty and no adults were seen in the vicinity. It is possible that our visits to this nest during the laying and incubation period contributed to its failure. It should be noted that this nest was one of the latest to produce eggs, and the birds may have already been under some stress. Cause of nest failure here is uncertain.

Reaction of the birds. Many golden eagles simply refused to flush from the nests, even when we hovered only a few meters away. Birds on nests showed little indication of fear, but rather displayed curiosity or mild hostility. They would cock the head and look at us, but never stood up

or raised their feathers or wings as did bald eagles. In many instances the adult was not shielding young, since they were observed on the nest in front of it. Even when a man was placed on the ground, climbed as close to the nest as possible and shouted, the eagle would not flush unless the man was in clear view.

A few adult eagles flushed from nests as we approached, or as we hovered nearby, but this was the exception rather than the rule. Nests where we created the most disturbance were all successful in fledging young.

At no time did the birds attack the survey craft. At a small number of nests the second adult appeared as we hovered by the nest, but usually it circled below or to the side of the craft at some distance, appearing more curious than alarmed.

At two nests, the adult was seen only when incubating. After the chick hatched, no adults were seen at the nest or in the area, but both fledged successfully.

Timing of reproductive activities. Fooks (1980) observed golden eagles at nest sites along the corridor west of our study area as early as March 13. He observed the birds working on the nests as early as March 19. When we first checked the contents of nests on May 22-24, most already held young, the oldest estimated to be about 10 days old and most a week or less old. Backdating the 43 day incubation period (Godfrey, 1966) shows that most eggs were laid during the first 10 days of April. Some nests were initiated later than this. One nest did not have the full complement of eggs by May 1, and two or three nests were observed to have young about a month younger than most.

Young fledged from the earliest nests prior to the July 18 survey, and were seen either on the ground by the nest or on the wing nearby. All but three nests still held young at that date. One late nest still held young when visited on August 19.

4. DISCUSSION AND RECOMMENDATIONS

4.1 Waterfowl

4.1.1 Spring Migration

Monitoring should be continued at the three sites surveyed in 1980; no new sites need to be added to the program elsewhere along the pipeline corridor. The following changes in procedure are suggested:

1. Future monitoring should be done from the series of ground observation points identified on maps 3, 4, and 5, using a scope of at least 20 power. Aerial surveys are not needed.

2. Counts should begin about April 10, when the first trumpeter swans arrive. They should be continued through April, and preferably to May 10-15.

3. Counts should be made at all sites every 2 or 3 days, as birds can move through the area quickly.

4.1.2 Production

There are no individually outstanding waterfowl production habitats along the pipeline corridor, but many wetland units of moderate or low capability do occur. Because of the relative abundance and broad dispersion of wetland units of one kind or another there is a potential for construction disturbance to have a significant adverse impact on waterfowl nesting success when considered in the context of the entire Yukon alignment. The sample of small wetlands could also serve as a basis for predicting impacts on habitat factors such as water levels, turbidity, or nesting cover.

Thus we feel that continuation of monitoring of waterfowl production is warranted. Study areas in 1980 were all between Haines Junction and the Donjek River, and included only small lakes or ponds, thus they may not provide an entirely representative sample. However, we feel that location along the length of the corridor is not important. If duck production within, for example, 1 km of the line is not adversely affected in the western area, then it is unlikely to be affected in the eastern area. With regard to pond size, we feel that it would be desirable to add one or two larger lakes, particularly if construction will be very close, i.e. Wolverine, Pickhandle, Lake Creek Complex, km 144 lake, Helen

Lake, or km 646 lake. These are generally accessible from the Alaska Highway and thus could be surveyed without helicopter support. As a minimum, two lakes of this type might be surveyed, i.e. Wolverine and km 144. They may also be of significance for late-summer staging.

Waterfowl production monitoring did not include a control area outside of the 2 km corridor. With regard to the small wetlands surveyed in 1980, it is possible that the existing dispersion of ponds from 0.1 to 2.0 km from the line may allow division of the sample into near and "distant" breeding populations. Selection of a control sample of small production wetlands outside of the corridor is not easy because most such areas are away from the Alaska Highway and ground access to them is difficult. In the case of larger production-late summer staging areas, Burwash Lake would be a good control.

At present, we recommend that surveys of the ponds monitored in 1980 be continued in the same way, but ponds 15-21 in Area 1 (Quill Creek), which were added part way through the 1980 program, be omitted. If additional ponds are to be monitored in other construction segments in the future, an attempt should be made to locate those where access from the ground is available. This would allow the observer greater freedom, as he would not have to rely solely on aerial access. Results obtained from ground counts would be comparable in value to those made from the air.

4.1.3 Late Summer Staging

We recommend that the late summer staging survey in construction segments 4 and 5 be discontinued. The lakes in this area attract too few waterfowl at this season to justify continued monitoring. However, lakes that attract larger numbers of waterfowl at this season evidently occur along other segments of the corridor, and possibly should be monitored in future years. Possible lakes of this type include Enger, Wolverine, Pickhandle, Lake Creek Complex, km 144, Helen Lake and km 646. As in the case of production monitoring on larger water bodies, late summer surveys on Wolverine and km 144 lake may be adequate, with Burwash Lake as a control.

4.1.4 Fall Migration

We recommend that monitoring of waterfowl during the fall migration be discontinued. Too few waterfowl were found on the 1980 surveys to justify continuation. No other waterfowl habitats along the corridor appear to need monitoring in fall. Important fall migration areas along the pipeline route all lie outside of the pipeline corridor (i.e. the delta of the Nisutlin River, the outlet of Kluane Lake).

4.2 Raptors

4.2.1 Bald Eagles

The sample of bald eagle nests available to be monitored is relatively small and is scattered from White River to Watson Lake. Thus it will not be possible to compare construction segments or even western and eastern populations. The best that can be done is to monitor a small sample of nests near the line (experimental) and a small sample away from it (control). These need not be grouped in any particular area, although there are advantages for survey efficiency if they are.

The nests surveyed in 1980 were all west of Haines Junction. Some of those were easily investigated while monitoring golden eagle nests, but four were in the Koidern-White River area and required about an additional hour of helicopter time. It may be desirable to discontinue survey of those four nests, and to begin monitoring some nests east of Whitehorse where bald eagles are more common. However, it would probably not be possible to combine the bald eagle surveys east of Whitehorse with surveys for other species.

Past surveys have found about 16 nests in the 200 km stretch from Marsh to Swan Lakes. Some nests are close together and it is probable that about 12 sites or nesting territories are involved, of which 9 are within about 2 km of the line and 3 beyond that. It is not likely that all of those sites would be active in any one year and it is also possible that some have shifted location. However, it would be desirable to augment the 1980 sample with some nests from this area if helicopter time is available. This need not include all 16 of the nests mentioned above (if still extant). The shortage of control nests would mean that all three potential control nests in this 200 km segment should probably be monitored, which in turn would require flying most of the length of that segment.

The following recommendations are made with respect to survey procedure:

1. First survey about April 20-25. All sites to be checked but birds not flushed.
2. Second survey about May 10-15. All sites checked, and birds flushed to count eggs.
3. Third survey about June 10-12. Only sites found active on the first two surveys checked. Birds flushed and young counted.
4. Fourth survey about July 15. All sites active on last survey checked, and young counted.
5. Fifth survey about August 7-10. Only sites active on last survey checked, and young counted.

4.2.2 Golden Eagles

We recommend that sites monitored in 1980 be re-surveyed in 1981. In addition, it would be desirable to add some nests further east along the corridor. We had previously considered that corridor nests and a control study area should be selected east of Whitehorse, but now feel that the Ibex Pass area would be the best addition. The 1980 monitoring involved nests from Aishihik River to Duke River, i.e. at relatively low elevation and in the dry rain-shadow of the St. Elias and Kluane Ranges. Nests in the Ibex Pass area are probably fairly representative of the Whitehorse-Teslin region. In addition, there is a relatively dense nesting population in proximity to the pipeline alignment, and the area is of considerable local interest.

There are 15 to 16 known nesting territories between km 385 and 430, of which 12 are within 3.2 km of the alignment. Of those 12, 9 were occupied in 1979 and 8 were active. This study area should be monitored annually beginning in 1981. In the final analysis of impacts it could be treated both as a separate study population, and combined with the more westerly study area.

Adult golden eagles are very reluctant to flush from the nest when incubating eggs or brooding newly hatched chicks. Harassing them at these times could cause more impact than eventual pipeline construction. Thus it will be necessary to base the impact analysis on incomplete clutch size and early nestling data. It seems preferable to restrict the surveys to

a quick fly-past, particularly those during the early stages of the nesting period. During later stages the adults are frequently away from the nest and, if not, flushing them briefly is not likely to be harmful to the young or to cause the adults to abandon the site.

We recommend the following timing and procedures for 1981 golden eagle monitoring:

1. First survey about April 15. All sites visited, but birds not flushed.
2. Second survey about May 10. All sites checked, but birds not flushed.
3. Third survey about June 6-10. Only active nests need be surveyed. Young counted at nests where birds flush easily.
4. Fourth survey about July 10. Only nests active on last survey visited. Young counted.
5. Fifth survey about July 25; all active nests checked. Young counted.
6. A final survey August 7-10. Only active nests visited, and all young counted.

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