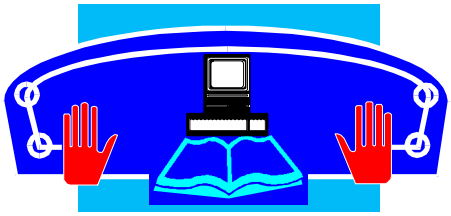

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DESCRIPTIONS OF WATER CROSSINGS AND THEIR USE BY MIGRATORY BARREN-GROUND CARIBOU IN THE DISTRICTS OF KEEWATIN AND MACKENZIE, N.W.T.

Wildlife Service

Northwest Territories Renewable Resources

DESCRIPTIONS OF WATER CROSSINGS AND THEIR USE BY MIGRATORY BARREN-GROUND CARIBOU IN THE DISTRICTS OF KEEWATIN AND MACKENZIE, N.W. T.

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N.W.T. WILDLIFE SERVICE

YELLOWKNIFE, N.W.T.

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ABSTRACT

Migratory barren-ground caribou (*Rangifer tarandus groenlandicus*) swim or wade lakes and rivers at traditional water crossing sites. Land-use related activities are prohibited by the Department of Indian Affairs and Northern Development (DIAND) within a 5-km radius of each of the designated water crossings 15 May - 1 September on the ranges of the Beverly and Kaminuriak caribou herds in the districts of Keewatin and Mackenzie, N.W.T. Locations of designated water crossings were confirmed from mapping trail patterns onto 1:60,000 aerial photographs in 1980. Frequency and period of use of traditional water crossings was described from a literature survey. Further descriptions of trails along the Thelon River and spring-summer use patterns were added in 1981. Of the 27 designated water crossings, 25 (40 sampling sites) were described from the ground. The descriptions of the designated water crossings suggest that caribou most frequently cross at narrows caused by peninsulas or other shoreline irregularities or where there is water turbulence or exposed rocks and gravel bars in the water. Recent declines in the sizes of the Beverly and Kaminuriak herds have apparently altered the pattern of use of migration pathways and associated water crossings.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Migratory barren-ground caribou (*Rangifer tarandus groenlandicus*) cross rivers and lakes at traditional water crossings during seasonal migrations and it is the concentration of caribou at those areas that increases their vulnerability to disturbance by humans. On 27 April 1978, the Department of Indian Affairs and Northern Development (DIAND) prohibited land-use related activities between 15 May and 30 June in designated "Primary Calving Areas" (Fig. 1 - Area A), 30 June to 31 July in "Primary Post-calving Areas" (Fig. 1 - Area B), and within a 4.8 km radius of "Major Crossing Sites" (Fig. 1) year round in the districts of Keewatin and Mackenzie, N.W.T. (Darby 1978) (In 1978 this latter was changed to within 5 km of any Major Crossing Site between 15 May and 1 September). The measures were in response to native concerns expressed at the Baker Lake court case over the potential for disturbance to barren-ground caribou by industrial activities at water crossings.

The water crossings designated in 1978 are used by caribou of the Beverly and Kaminuriak herds during their summer and fall movements. Designation of water crossings Nos. 6-20 (Fig. 1) was based mainly on interviews with residents of Baker Lake, N.W.T. and a literature review by Interdisciplinary Systems. Ltd (1978) . Water crossings Nos. 1-5 and Nos. 21-27 were designated by DIAND in. consultation with the Canadian Wildlife Service (CWS), the N.W.T. Wildlife Service (NWT WS) and the people of Baker Lake.

Recent declines in the sizes of the Beverly and Kaminuriak herds may have resulted in changing patterns of range use (Heard and Decker 1981, Gunn and Decker 1982, Simmons et al. 1979) .

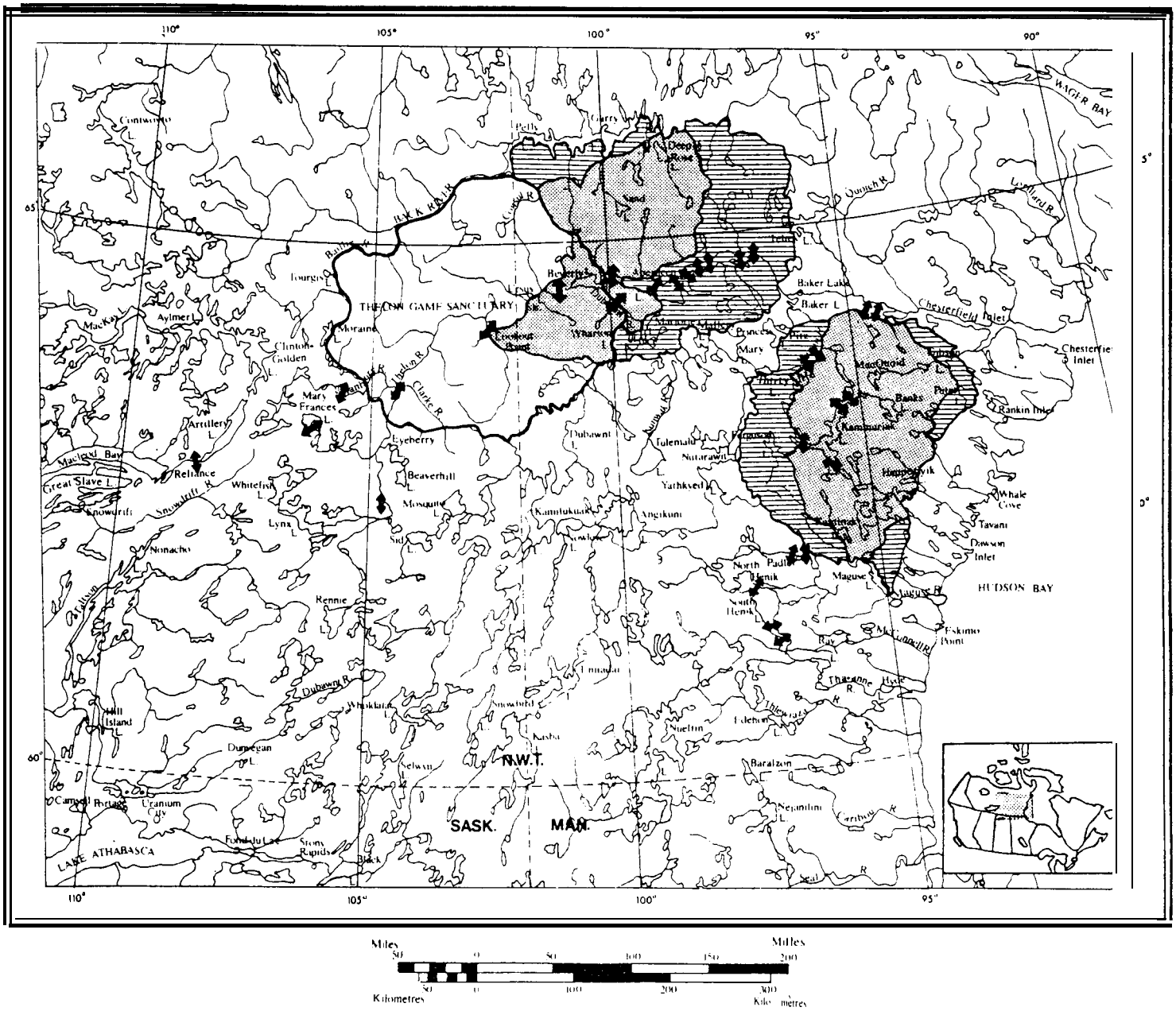

Figure 1. The location of designated water crossings on the spring, summer and fall ranges of the Kaminuriak and Beverly caribou herds, N.W. T.

Additionally, the sources of information used to designate the 27 water crossings covered several decades and the criteria of what constituted a traditional water crossing were not described. Therefore, there is a need for describing past and current use of water crossings. Also there is need for evaluating, if possible, why caribou use specific water crossings.

Five objectives were outlined in the initial study proposal:

1. To confirm the locations of designated water crossings and describe the frequency and period of use both past and present.
2. To describe the topographic features of water crossings, and to identify whether the topographic features could be funneling the approaching caribou toward a particular site.
3. To observe and quantitatively describe the undisturbed behavioral patterns of caribou approaching and at water crossings.
4. To describe the responses of caribou to disturbances at water crossings.
5. To describe the actual and potential types of industrial activities likely at-water crossings and the configurations of stimuli that caribou could be exposed to.

Objectives 1 and 2 were addressed in the first year (1980-81) by conducting a literature review of caribou water crossing activities and on-site examinations of the designated (1980 Caribou Protection Map) water crossings.

In the second year (1981-82) we continued to collect data for Objective 1 and considered use of certain water crossings (central Thelon River) during the frozen river period. We also attempted to meet Objectives 3 and 4 by selecting certain water crossings on the Thelon River for observations. We were unable to meet Objective 5 because of time and fiscal constraints.

STUDY AREA

The Beverly herd's tundra range is divided by four major river systems (Fig. 1) . The Lockhart River flows from Clinton-Colden Lake to Great Slave Lake. The Hanbury River flows east from the Lockhart River near Ptarmigan Lake to the junction of the Hanbury and Thelon Rivers in the Thelon Game Sanctuary (Fig. 2). The Hanbury River system includes Sifton Lake and Lac du Bois and flows into the Thelon River in the Keewatin District flowing from the Thelon-Clarke-Hanbury River junction west to Baker Lake (Fig. 3) . The Dubawnt River flows northeast from Ivanhoe Lake (63°30′ N, 106°25′ W) into the Thelon River (Fig. 3).

The Kaminuriak herd's tundra range is dominated by the Kazan River which flows north from Ennadai Lake to Baker Lake (Fig. 1). The Maguse River system roughly divides the Kaminuriak tundra range into northern and southern halves, and it flows southeast from Imikula Lake to the Hudson Bay coast (Figs. 1 and 5).

The two major lake systems on the Kaminuriak tundra range are the Kaminuriak Lake system which includes Kaminuriak, Parker, Mackenzie (62°39′ N, 95°45′ W) and Ferguson Lakes (Fig. 4). The Henik Lakes system is south of the Maguse River and includes North Henik, South Henik and Roseblade Lakes (Fig. 5).

Spring and Summer Movements

The Beverly caribou herd traditionally winters in northern Saskatchewan and southcentral N.W.T. The Kaminuriak herd traditionally winters in northeastern Saskatchewan, northern Manitoba, and southeastern N.W.T. (Darby 1978) . Both herds begin a

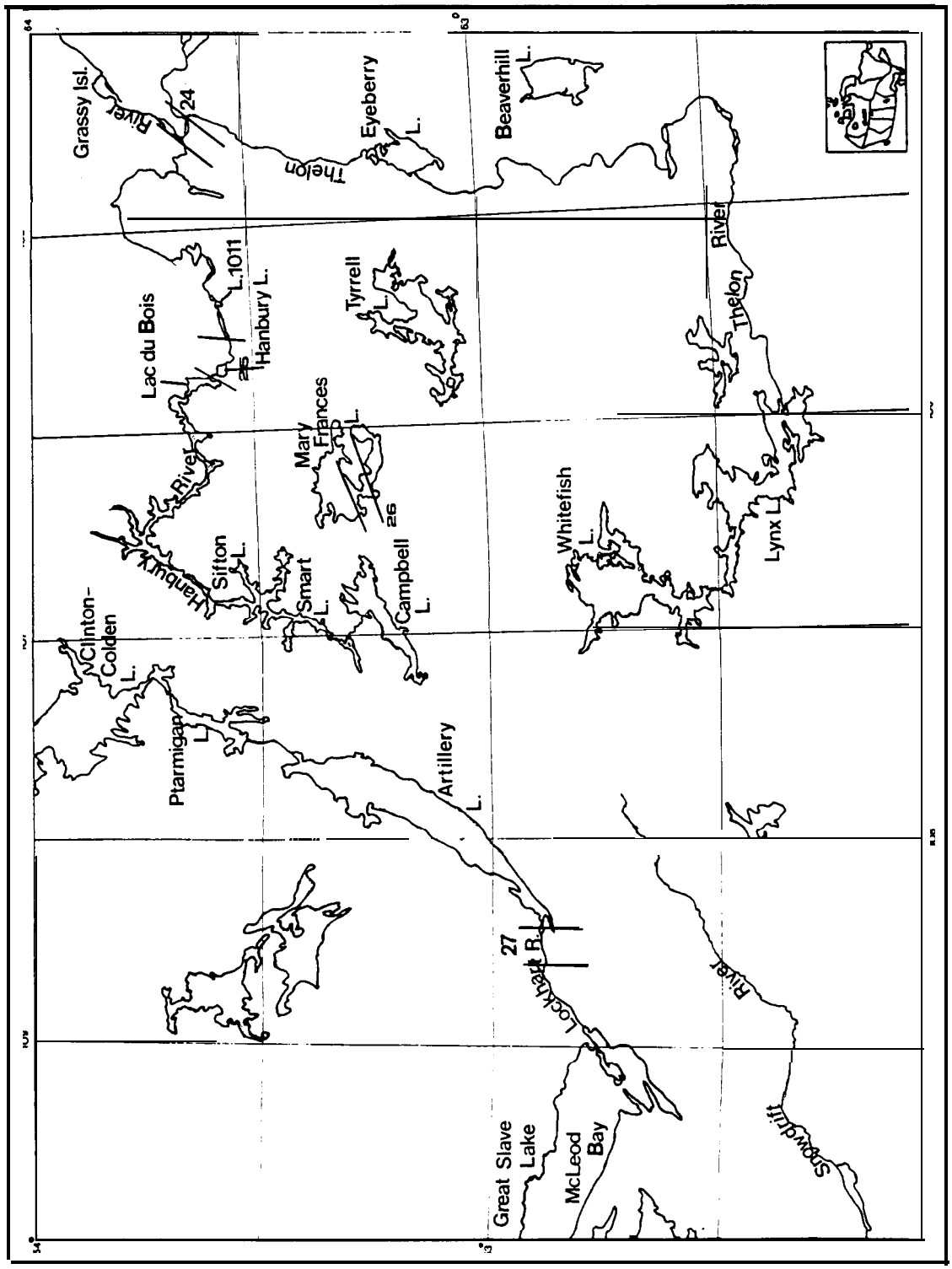

Figure 2. The location of designated water ro ing on the Lockhart, Hanbury and Thelon River systems, N.W.T.

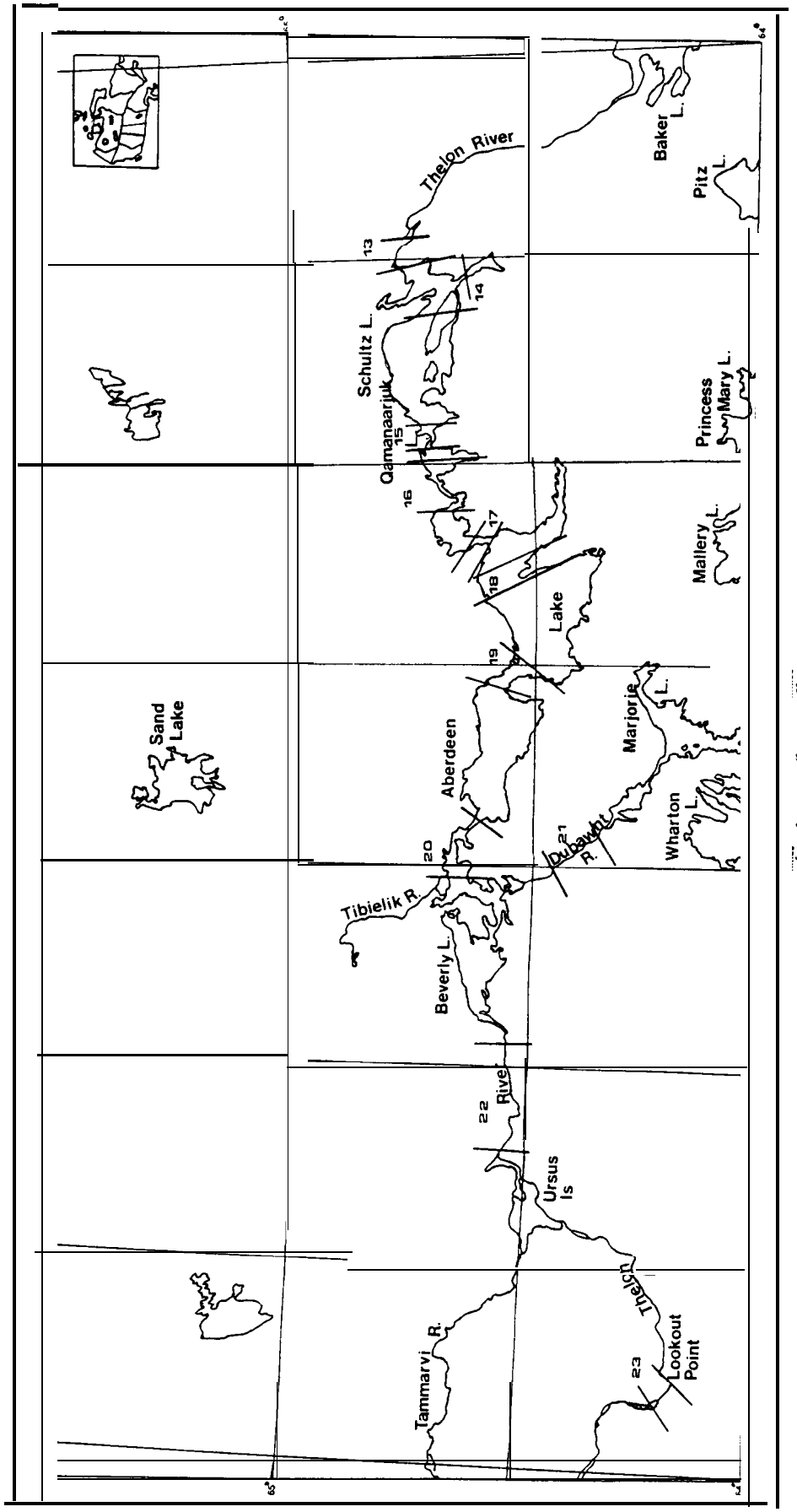

Figure 3. The location of designated water crossings on the Dubawnt and Thelon River systems, N.W.T.

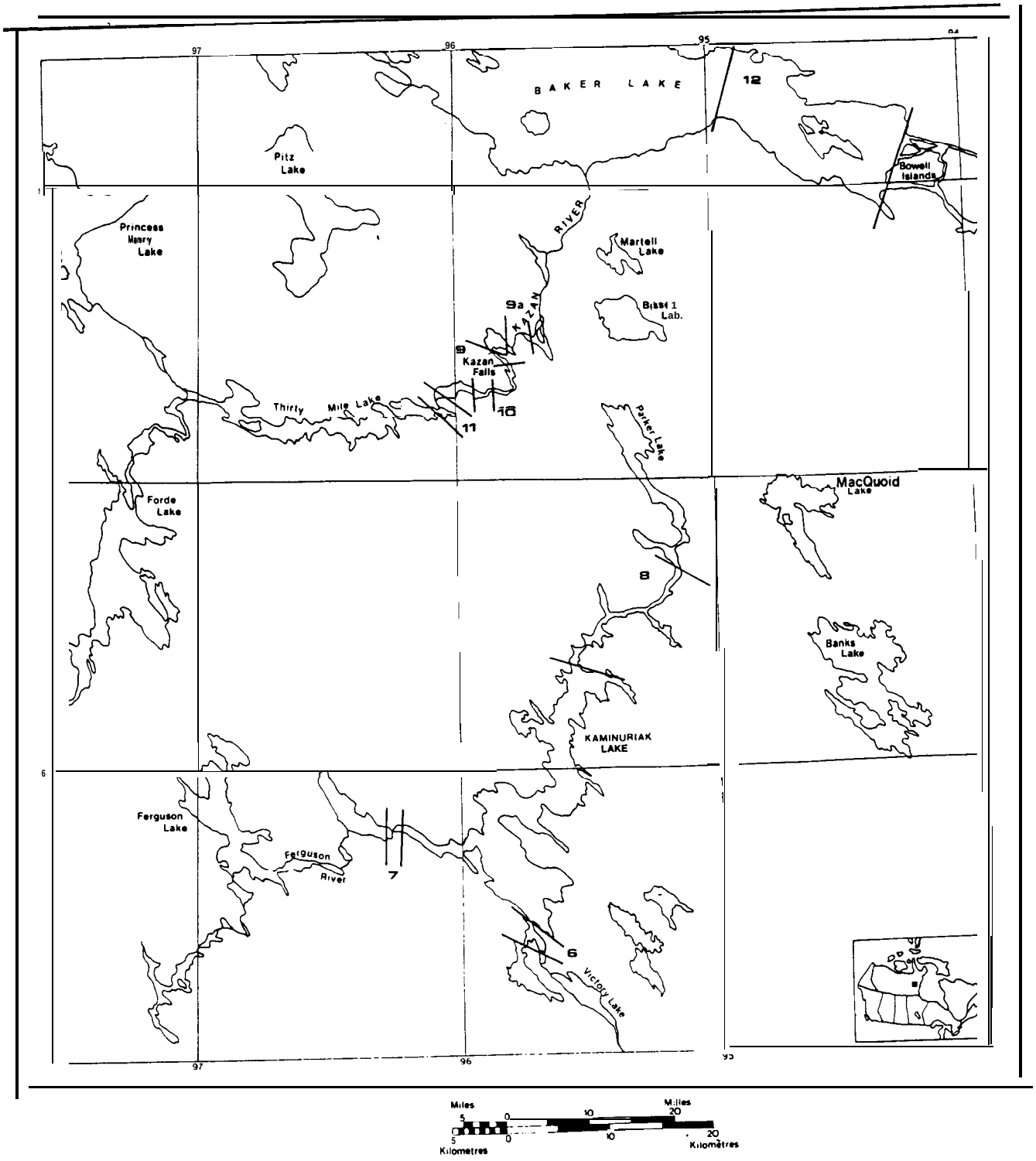

Figure 4. The location of designated water crossings on the Kazan River and Kaminuriak Lake systems, N.W. T.

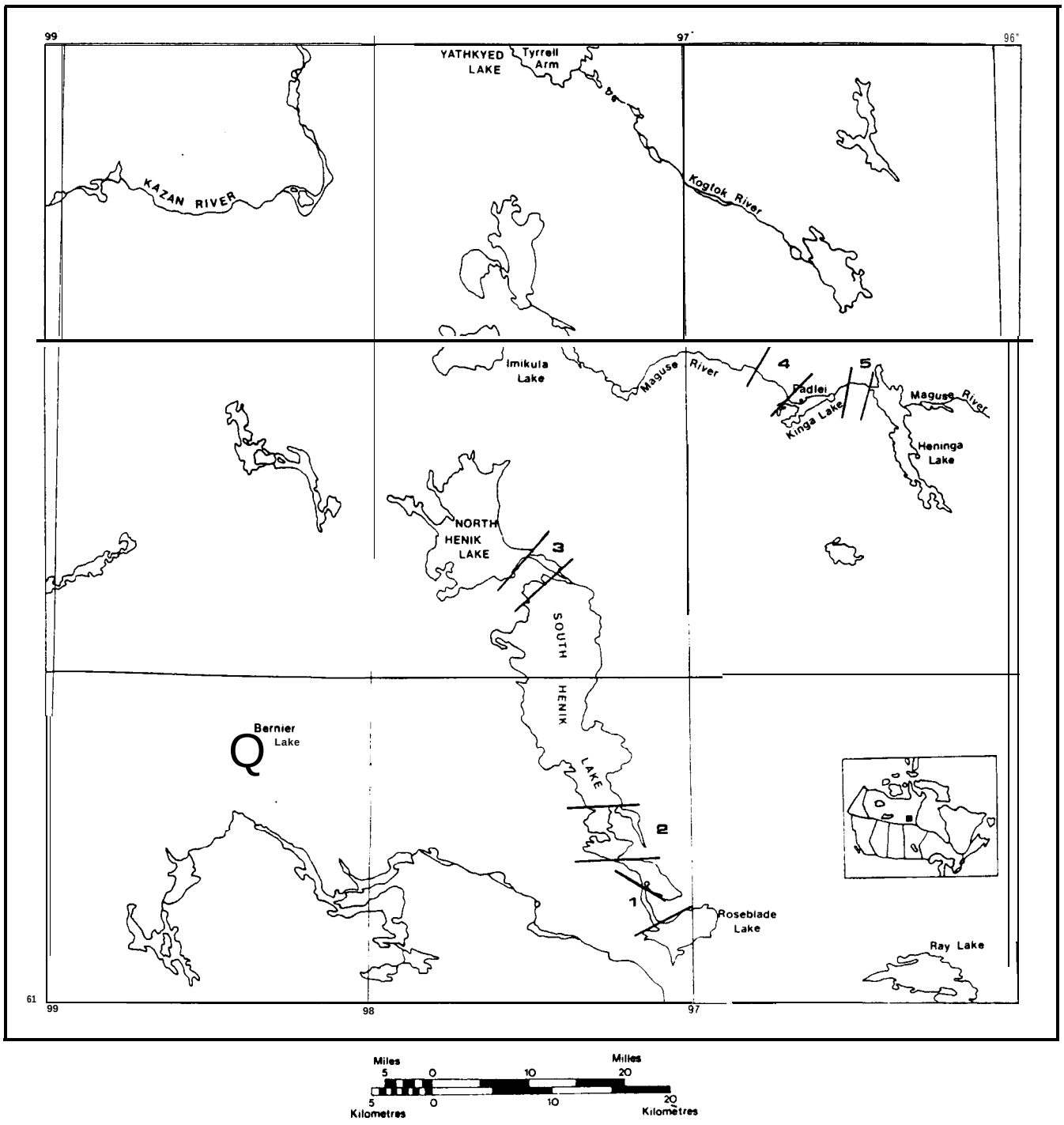

Figure 5. The location of designated water crossings on the Maguse River and the Henik Lakes area.

migration northwards to traditional calving areas (north and south of Beverly Lake for Beverly cows, and east of Kaminuriak Lake for Kaminuriak cows) in early spring, and usually reach the calving areas in late May or early June. Bulls and non-breeders lag behind the cows, and may not reach the calving grounds. Most rivers and lakes encountered on the spring migration are frozen. Most water crossings occur during mid-summer post-calving movements and during late summer and fall movements.

The Beverly cows usually reach their calving grounds north and south of Beverly and Aberdeen Lakes in late May and June (Fleck and Gunn 1982) . Post-calving movements from the 1940's to the early 1960's included some caribou crossing to the north of the Thelon River and continuing northeast and east as far as the Kazan River and Baker Lake (Darby 1978). Since 1960, post-calving movements have been southwest and west either through or north of the Thelon Game Sanctuary (Darby 1978, Darby 1980, Cooper 1981, Clement 1982, D. Thomas pers. comm.). The late summer-fall movements are not well documented but include movements west and south to Clinton-Colden, Artillery and Lynx Lakes before turning southeast then north, which can extend to as far as Aberdeen Lake. Most water crossings (as against spring ice crossings) along the Thelon River system are associated with south and west post-calving movements in July and August. Crossings of the Lockhart and Hanbury systems generally occur during late summer and fall southward migrations toward treeline.

The Kaminuriak herd that winter in the taiga moves north to Kaminuriak Lake crossing frozen rivers and lakes. After calving, cows and calves move northwest toward the Kazan River which is

also the general direction of movements of bulls, subadults and non-breeding cows (Parker 1972a, Darby 1978, Darby 1980, Cooper 1981, Clement 1982) . As with the Beverly herd there is a southward movement toward treeline near the end of July. The movement is a broad front from the Kazan River to the coast of Hudson Bay and brings the caribou across the Ferguson River system, the Maguse River system and Henik Lakes. By mid-August the caribou are dispersed in a large area but in September they start to move toward the south Henik Lake area (Parker 1972a).

METHODS

Examinations of Wat r Crossings, 1980

Patterns of trail systems at 26 of the 27 designated water crossings (Table 1) were drawn onto 1:60,000 aerial photographs. Trails at water crossings Nos. 1-3, 6-8, 13-27 were mapped from a Beaver aircraft at altitudes of 50 to 150 m above ground level (agl). Mapping of water crossings Nos. 4, 5, and 9-11 were from a Hughes 500 helicopter. Water crossing No. 12 was not examined. Our work was conducted out of Baker Lake from 11 July to 12 August, 1980.

At a water crossing we determined where trail systems indicated that most water crossings had occurred and called that area a site. Crossing widths were estimated from aerial photographs. Surface water velocity was measured by a water velocity meter attached to a wading rod or by timing the rate of descent of a stick. Water depths were measured with the wading rod. Rapids, islands, sandbars and exposed rocks were noted.

We described the terrain and ground features from the water-line inland as a series of zones (A-H) according to physical features and range types. We measured slope with a hand-held clinometer and paced the width of terrain zones. We used eight range types to describe ground cover (Thompson et al. 1978); sedge meadow, tussock tundra, dwarf shrub-sedge tundra, dwarf shrub-lichen tundra, lichen-heath tundra, lichen steppes, rock barrens and transition forest. We used 35 mm colour slides to assist in recording features of the terrain and any signs of caribou or human activities.

Table 1. Locations of designated water crossings and dates when sites were described, N.W.T., 1980.

No.	Designated water crossing	Coordinates	Date examined	No. of sites
1	N. of Roseblade Lake	61°10'N,97o02'W	06/08/80	1
2	s. of South Henik Lake	61°87'N,97o11'W	06/08/80	2
3	Henik Lakes narrows	61°44'N, 97°30′W	05/08/80	1
4	Northwest Kinga Lake	61°54'N, 96°48′W	23/07/80[1]	2
5	Maguse River	61°56'N, 96°29′W	23/07/80[1]	2
6	Mackenzie Lake	62°44′N, 95°46'W	05/08/80	1
7	West Kaminuriak Lake	62°54′N, 96°16'W	19/07/80	2
8	North Kaminuriak Lake	63°14'N, 95°12'W	05/08/80	2
9	Kazan Falls	63°44'N, 95°50′w	28/07/80[1]	1
9a	Below Kazan Falls	63°46'N, 95°45′W	28/07/80[1]	1
10	Above Kazan Falls	63°40'N, 95°53'W	28/07/80[1]	1
11	Thirty Mile Lake	63°39'N, 96°06'W	28/07/80[1]	1
12	Christopher Island	64°07'N, 94°34'W	--	--
13	Thelon River	64°47'N, 96°56′W	12/08/80	2
14	East Schultz Lake	64°40'N, 97°10'W	12/08/80	2
15	West Schultz Lake	64°43′N, 97°54′W	08/08/80	1
16	West Qamanaarjuk Lake	64°42′N, 98°07'W	08/08/80	1
17	East Aberdeen Lake	64°37'N, 98°25′W	08/08/80	2
18	E. Central Aberdeen Lake	64°34′N, 98°33′W	04/08/80	1
19	Central Aberdeen Lake	64°34′N, 99°06'W	04/08/80	1

Table 1 continued

No.	Designated water crossing	Coordinates	Date examined	No. of sites
20	West Aberdeen Lake	64°39'N, 99°54'W	04/08/80	2
21	Dubawnt River	64°24'N, 99°53'W	3-4/08/80	2
22	East Thelon Sanctuary	64°33'N, 101°10'W	04/08/80	2
23	Centre Thelon Sanctuary	64°13'N, 102°38'W	03/08/80	2
24	West Thelon Sanctuary	64°37'N, 104°30'W	24/07/80	1
25	Lac du Bois	63°33'N, 105°42'W	24-25/7/80	2
26	Mary Frances Lake	63°17'N, 106°18'W	25/07/80	2
27	Lockhart River	62°54'N, 108°32'W	01/08/80	--

1 Trails were mapped from a helicopter, other sites mapped from Beaver aircraft.

Literature Search

Harper's (1955) extensive bibliography was the primary source for 'references and was supplemented by Banfield's (1954a) summarization of historical records of barren-ground caribou. Literature citations in recent reports were sources for references after 1950.

RESULTS

Expiations of Water Crossings

We mapped trail patterns (Appendix A) at all crossings except No. 12 (Christopher Island). We were unable to land at water crossings Nos. 12 and 27 (Lockhart River) to examine ground features. We examined 40 sites at 25 of the 27 water crossings (Table 2) .

The visibility upon approach to 60% (24) of the water crossing sites examined appeared to be unrestricted (based on the human's eye view). Visibility was restricted by topography at 8 sites, by vegetation (willow shrubs) at 7 sites and by an ice push up at 1 site.

Fifty percent of the water crossing sites (20) were less than 150 m wide; 67.5% (27) were less than or equal to 250 m wide; 80% (32) and 87.5% (35) were less than or equal to 350 m and 1 km, respectively. Five water crossings were greater than 1 km. Water crossings ranged from 25 m to 9 km in width (mean, 700.5 m) . Thirty-four of the 40 water crossing sites were narrower than the mean width.

Most (22) sites had measurable surface water flow (velocity) immediately offshore. Four sites had low velocity (0-0.02 m/see), 12 sites had moderate (0.2-0.5 m/see), and 7 sites had rapid (greater than 0.5 m/see) surface water flow.

Water turbulence (rapids or riffles) was apparent at 16 sites. Of the 24 sites with no apparent water turbulence, six sites had offshore exposed rocks, or vegetated islands. Seventeen sites were at the tips of peninsulas, 12 were narrows or

Table 2. A summary of physical characteristics of designated water crossings on the ranges of the Beverly and Kaminuriak caribou herds, N.W.T., 1980.

Water crossing no.	Site no.	Presence of rapids, riffles	Surface velocity m/see	Rate of dropoff	Width of crossing(m)
1	1		<0.1	rapid	250
2	1		<0.1	gradual	350
	2		<0.1	gradual	650
3	1		<001	rapid	300
4	1		<0.1	gradual	50
	2	present exposed rocks	c.58	gradual	25
5	1	rocks present, midstream	0.27	gradual	60
			1.14		
	2	present gravel bar	0.53	gradual	65
6	1	present exposed rocks	0.71	gradual	35
7	1	present rocks	0.45	gradual	55
	2	present	0.42	gradual	60
8	1		0.21	gradual	30
	2	island	0.13	rapid	75
9	1	rocks present, islands	0.82	gradual	250
9a	1	island	0.52	gradual	200
10	1		0.12	gradual	350
11	1		0.09	gradual	550
13	1	present	<0.1	rapid	250
	2		0.12	rapid	300
14	1	rocks	0.5	gradual	90
	2		<0.1	gradual	2.5 km
15	1		<0.1	moderate	300
16	1		<0.1	rapid	720
17	1		<0.1	rapid	1.8 km
	2		<0.1	gradual	1.0 km
18	1		<0.1	gradual	9.0 km
19	1	islands .	0.31	gradual	7.2 km
20	1	present riffles	<0.1	gradual	180
	2		<0.1	moderate	250
21	1	present exposed rocks	0.47	gradual	120
	2	present	0.53	gradual	120
22	1		0.23	rapid	120
	2	present	1.36	gradual	80
23	1	present	0.34	rapid	180
	2	present gravel bar	0.43	gradual	145
24	1	sand island present	0.55	gradual	50

Table 2 continued

Water crossing no.	Site no.	Presence of rapids, riffles	surface velocity m/see	Rate of dropoff	Width of crossing(m)
25	1	present	0.5	gradual	50
	2	exposed rocks	<0.1	gradual	40
26	1	present island	<0.1	gradual	120
	2		<0.1	gradual	50

1 Rates of dropoff: rapid ≥ 1 m in 3 m from shore; ≤ 1 m in 3.5 m from shore; and gradual < 1 m in 3.5 m from shore.

irregularities in a relatively smooth shoreline. Nineteen of the 23 (non-peninsula) sites had water turbulence, or exposed ground at the crossing. Thirty-eight were peninsulas, shoreline irregularities, or had offshore water turbulence or exposed ground.

The 16 water crossing sites with rapids varied in width from 25 to 250 m (mean, 107.81 ± 73.64 m, SD) and nine of those sites were narrower than the mean width (<108 m).

The substrate on all beach areas at points of entry (zone A) to water crossings were essentially unvegetated. They varied in width from 2 to 120 m before grading up slope into a vegetated zone (mean, 31.88 ± 57.40 m, SD). Twenty-nine of the beaches at water crossings were narrower than the mean width (<32 m). only two beaches exceeded 100 m in width. No comparison was made with beaches on non-crossing sites.

Slope of entry on beaches at water crossings (zone A) ranged from 1 to 25° (mean, 6.85° ± 5.91°, SD) and 24 of the slopes were below the mean gradient (<70). Only four slopes were greater than 19°. No comparison was made with adjacent slopes on non-crossing sites, therefore, no evaluation of any critical steepness of slopes on beaches at water crossings could be made.

The most common range type recorded on the shores adjacent to water crossings was (1) lichen-heath tundra followed by (2) dwarf shrub-lichen tundra, (3) dwarf shrub-sedge tundra, (4) rock barrens, (5) lichen steppe, (6) sedge meadow, (7) tussock tundra and (8) transition forest. Although dwarf shrub-sedge tundra was only the 3rd most cam-non range type recorded, it was the most common range type recorded in zones B and C, closest to the beaches of the crossings (Appendix A).

Past and Current Use of Water Crossings

. River and lake systems were the major routes for human access to the barrens until the advent of aircraft. The use of those waterways, the spectacle of massed caribou, and the dependence of explorers and traders on caribou meat resulted in the recording of many observations of caribou using water crossings (Appendix B).

The relative abundance of observations of caribou at water crossings (Fig. 1) on the Beverly range (Nos. 13-27) are a result of the importance to early explorers of the Lockhart (McLean 1901, Seton 1911, Pike 1917), Back (Anderson 1857, Hanbury 1904, Pike 1917) and Thelon (Hanbury 1903) Rivers as travel routes. Studies of the Thelon Game Sanctuary provided water crossing data for the Lockhart (Hornby 1934), Hanbury (Hoare 1930, Clarke 1940) and Thelon (Hoare 1930, Hornby 1934, Clarke 1940) River systems.

There are few observations of caribou at designated water crossings in the Kaminuriak range (Nos. 1-12), as the Kazan River was the single major exploration route used by early explorers of this region (Hearne 1795, Tyrrell 1897, Birket-Smith 1929, 1933). Biologists recorded observations of caribou at water crossings on the Kazan River (Mallet 1930, Lawrie 1948) system and the Nueltin Lake (Harper 1932, Lawrie 1948) system.

Extensive aerial surveys were conducted in the late 1940's to early 1950's by CWS biolgists to determine overall distribution, movement and abundance of caribou in the N.W.T. Those biologists recorded observations of caribou at water crossings on the Kazan (Lawrie 1948, Loughrey 1956) , Maguse (Banfield 1954a, Kelsall and Loughrey 1955, Loughrey 1956), Lockhart (Banfield 1951, 1954a),

Hanbury (Kelsall 1953), Thelon (Lawrie 1948, Kelsall 1953, Loughrey 1956) and Dubawnt (Lawrie 1948) River systems and the Nueltin Lake (Lawrie 1948, Banfield 1954a, Loughrey 1956) system. The concentration of research efforts on the Beverly herd by CWS biologists from the early 1950's to early 1960's was also responsible for records of sightings on the Lockhart (Kelsall 1953), Hanbury (Kelsall 1968), Thelon (Kelsall 1960, McEwan 1960), and Dubawnt (Kelsall 1960) River systems.

Tagging reports by CWS, NWT WS and Manitoba Game Branch biologists were the source of observations of specific water crossings from 1960 to mid 1970's on the Hanbury (Thomas 1960) and Thelon (Parker 1972b) River systems and the Nueltin Lake (Howard 1961, 1962, Parker 1972b) system.

CWS studies of the Kaminuriak herd in 1966-1968 and 1970 provided reports of caribou using water crossings on the Kaminuriak Lake system (Parker 1972a) and Henik Lakes (Miller 1972).

The first 2 years of the DIAND-NWT WS monitoring program of the Caribou Protection Areas detailed summer movements and caribou use of water crossings of both the Beverly and Kaminuriak herds (Darby 1978, 1980). The subsequent 2 years of the Program had less emphasis on distribution, but nevertheless contributed valuable current descriptions of distribution and use of water crossings (Cooper 1981, Clement 1982).

The review of past use of water crossings is limited both in the details of the observations and by large gaps in time and space (Table 3, Appendix B). Despite the scarcity of references,

Table 3. Summary of evidence of hunting activities at designated water crossings, N.W.T., 1980.

Water crossing no.	Recent hunting sign	Older sign of hunting activity				
		butchered bones	inukshuk	blind	cache	fence	camp
2	x(to east)						
3		X					
4							
5							
7		x					
8			X	X		X	X
10		X			X		
11		X					
13		X	X				
14		X	X				
15		X					
16							
17		X	X		x		
18			X				
19		X					
20		X	X				
21							
22							
23							
25							
26							

records of caribou use of water crossings and evidence of native use of the water crossings for hunting, indicate that caribou have persistently used traditional water crossings. Gaps in our knowledge of long-standing use of crossings do not constitute evidence that the crossings were not used; simply no one was there to record the caribou use of water crossings.

The interpretation of those observations of use of water crossings (Tables 4 and 5) is hampered by lack of details and quantified observations. During the time from about 1900's to the present, there are only two periods when the summer movements were described in consecutive years. Parker (1972a) monitored the movements of the Kaminuriak herd from May to November 1966-68, but the use of water crossings has to be deduced from descriptions of movements from the text or figures. The DIAND-NWT WS monitoring program has provided descriptions for 4 years (1978-81) of movements of the Beverly and Kaminuriak herds between 15 May and 31 July. Even within those relatively short periods, there is annual variation in the pattern of movements.

Range of Beverly Caribou Herd

(1) The Lockhart River System

The use of water crossing No. 27 has been recorded since at least 1917 when Pike (1917) reported native hunting there in July and August. Use by the Beverly caribou herd likely persisted and was observed by Kelsall (1960) in late September, 1957. Subsequently, we have no published observations on the use of the water crossing because it is

Table 4. Summary of observations in the literature of designated water crossings (1904-1978)1 N.W.T.

Water crossing no.	Observation date	Sign	Author and date
1-3	August 1967		F.L. Miller pers. comm.
3	July 1945	carcasses, trails	Manning 1948
4 & 5	July 1954	2	Loughrey 1955
4 & 5	July-August 1966	2	Parker 1972a
4 & 5	" " 1967	2	" "
4 & 5	" " 1968	2	" "
4 & 5	July 1970	caribou trails	F.L. Miller pers. comm.
6	July-August 1966	2	Parker 1972a
7	" " 1%7	2	" "
7	" " 1968	2	" "
8	July 1969	post-calving aggregation seen	" "
10	not specified	traditional hunting area	Birket-Smith 1929
12	not specified	traditional hunting area	Birket-Smith 1929
12	August 1945	trails on shore	Manning 1948
12	August 1944	reported crossing	Manning 1948
13,14,15 and 17	unspecified	archaeological hunting site	Harp 1961
13, 14	unspecified		hunters in IDS 1978
15	August 1904	hunting activity	Hanbury 1904
15,16,17			hunters in IDS 1978
16	July 1959	reported crossing to south	McEwan 1960
15 & 16			hunters in Welland 1976
15 & 16			hunters in Stager 1977
17	July 1973	signs of recent crossing	Hawkins 1973
18			hunters in IDS 1978
19 & 20		archaeological hunting sites	Harp 1961
19	August 1951	caribou drowning	Kelsall 1953
19	August 1956	hunting camp	Loughrey 1956
19 & 20	June-July 1960	caribou moving south	hunters in Welland 1976
19 & 20			hunters in Stager 1977

Table 4 continued

Water crossing No..	Observation date	Sign	Author and date
20	June-July 1960	tagging operation	Parker 1972b
20	" " 1962-65	" "	" "
20	" " 1967	" "	" "
22	June 1960	crossing to north	McEwan .1960
22			hunters in Welland 1976
22			hunters in Stager 1977
23	July 1937	sign of northward movement	Clarke 1940
23	August 1956	sign of southward movement	Loughrey 1956
23	August 1960	sign of southward movement	McEwan 1960
23	August(?) 1962	sign of south ward movement	Ruttan 1962
24	July 1937	sign of northward movement	Clarke 1940
25	July 1937	sign of northward movement	Clarke 1940
25	July-August 1960	sign of southward movement	Thomas 1960
26	July 1960	tagging of southward movement	Parker 1972
26	July 1960	caribou observed	Thcinas 1960
27	August 1917	hunting activity	Pike 1917
27	August 1951	carcasses	Banfield 1951

1 Details of observations in Appendix B.

2 Inferred from figures of movements.

Table 5. Summary of observations of use of water crossings during the Caribou Monitoring Program (1978-81), N.W.T.

Water crossing No.	observation date	Sign	Author and date
2	1980	trails	this report
3	1980	trails	this report
4	June-July 1978	caribou moving north	Cooper 1981
4	July 1980	heavy trails	this report
5	Spring (?) 1980	heavy trails	Cooper 1981
7	June-July 1978	caribou moving south	Darby 1978
7	1980	trails	this report
8	July 1980	trails	Cooper 1981
8	July 1980	few caribou	this report
9	July 1979	caribou moving northwest	Neigo in Darby 1980
10	1980	trails	this report
12	May 1981	caribou moving south	C. Gates pers. comm.
13-17	July 1980	few trails	this report
15	July 1980	few caribou	Cooper 1981
19	July 1980	" "	this report
20	1980	" "	" "
21	1980	" "	" "
22	June-July 1978	caribou moving northwest	Darby 1978
22	July-August 1979	caribou moving south	Darby 1980
22	July 1980	caribou moving south	Cooper 1981
22	July 1980	few trails	this report
23	July 1978	caribou moving north	Darby 1978
23	July-August 1979	caribou moving south	Darby 1980
23	July 1980	heavy trails	this report
24	July 1978	caribou moving south	Darby 1978
24	July 1980	trails	Cooper 1981
25	July 1978	caribou moving south	Darby 1978

Table 5 continued

Water crossing no.	Observation date	Sign	Author and date
25	July 1979	caribou moving south	Darby 1980
25	July 1980	caribou moving south	Cooper 1981
25	July 1981	caribou moving south	A. Gunn field notes
26	July 1980	caribou moving south	Cooper 1981
26	July 1981	caribou moving south	A. Gunn field notes

west of most research and monitoring efforts that have been conducted in the Keewatin. Our finding of a few trails there 'in 1980 suggested continued use by caribou. Other water crossings have been described on the same lake-river system. Seton (1911) observed caribou crossing between Artillery and Ptarmigan Lakes in early August, 1907. Both Pike (1917) and Banfield (1954b) referred to caribou crossing near the south end of Clintpn-Colden Lake in August. In late July 1981, post-calving movements of the Beverly caribou brought them to Ptarmigan Lake and Clinton-Colden Lake (D.C. Thomas pers. comm.) .

(2) Hanbury River System

The Beverly herd is known to have used water crossing No. 25 since at least 1930. Caribou, probably bulls and non-breeders, in sane years cross the river while going north. Clarke (1940) described caribou moving north through the water crossing in early June, 1937. Post-calving aggregations of the Beverly caribou use the water crossing approaching from the northwest in late July and August (Thomas 1960, Darby 1978, Darby 1980, Cooper 1981, this report) . Our observations of trails along the banks of the Hanbury suggested that caribou parallel the river and cross at many sites, which is also noted in the descriptions of caribou in that area (Appendix B).

We found no published accounts of use of water crossing No. 26 before Thomas (1960) but it is not on a canoe route

and is west of the area covered by the Monitoring Program. Thomas' (1960) observation of caribou crossing Mary Frances Lake in late July and August is consistent with observations of the post-calving caribou in late July 1980 and 1981 moving through water crossing No. 26 from the northeast (Cooper 1981, A. Gunn Field notes).

(3) Dubawnt River Syst en

Lawrie (1948) and Kelsall (1960) described post-calving caribou moving east from calving grounds south of the Thelon River in late July, 1948 and mid-July, 1957, respectively. That eastward movement of post-calving caribou toward the Kazan River no longer is observed, possibly because the southern calving ground is not currently used (Fleck and Gunn 1982) .

(4) Thelon River System

The Thelon River system is an extensive obstacle to caribou of the Beverly herd and there are 11 designated water crossings on the river system. The western water crossings in the Thelon Game Sanctuary (Nos. 23 and 24) are used by movements to the southwest of post-calving caribou in July, and cows, bulls and subadults moving north in June. In 1979, spring migration of the breeding cows was about 10 days later than normal and Darby (1980) noted that most cows crossed at or near Lookout Point (No. 23), from 24 May to 9 June. By the beginning of June, the river had broken up and the cows

had to contend with broken ice and open water. The bulls and non-breeders also used water crossing No. 23 in 1979 as in 1978 (Darby 1978, 1980) . The breeding cows again used water crossing No. 24 in mid-May, 1980 and the bulls used it in June 1980 (Cooper 1981). Loughrey (1956) and McEwan (1960) observed southward movement through Lookout Point in August, 1957 and 1959. In 1978, 1979 and 1981 the south and west movements of the post-calving caribou took them further west, especially in 1981, before turning south: the Thelon-Hanbury Rivers were crossed at No. 24 except in 1981 (Darby 1978, 1980; Cooper 1981) . The area east of the confluence of the Thelon and Hanbury Rivers to Grassy Island was also noted by Hornby (1934) and Clarke (1940) as areas where caribou moving south were crossing the Thelon in July.

The area of Ursus Isles which is not designated as a water crossing, is used by northward migrating cows and non-breeders, as is the area east from there to the west end of Beverly Lake, which includes water crossing No. 22. The use is mainly by caribou migrating north which has been reported from 1960 to 1980. There are also earlier observations of large numbers of caribou crossing the Thelon River at the west end of Beverly Lake in August moving south (Kelsall 1960) . Recent reports suggest only stragglers move west along the north shore of Beverly Lake to the Thelon River.

The striking change in the use pattern of water crossings Nos. 13 to 21 since the 1960's is a reflection of the change in the calving and post-calving movements of the

Beverly herd. Those water crossings were used by post-calving cows leaving the calving ground south of the Thelon River and moving east and north. The movements at water crossing (No. 20 between Beverly and Aberdeen Lakes) were documented in 1960, 1962-1965 and 1967 during the tagging of caribou as they moved north in late June and early July. Box Crossing and Sandy Island, which were the main crossing sites at No. 20, are now only used by straggling groups of caribou, as are the water crossings to the east.

Those water crossings on the Thelon River east to Baker Lake were designated mainly on the advice of the hunters of Baker Lake, and the archaeological description of hunting sites support the long association of the hunters' use of those sites. Before the 1960's, the area used for post-calving extended almost to the western banks of the Kazan River and Baker Lake. Since the 1960's, the western edge of the post-calving area appears to have retracted from the southeast. Only small groups of caribou move along the shores of Aberdeen and Schultz Lakes and use those water crossings.

The east end of Baker Lake is designated as water crossing No. 12 which is a large (30 km in length) crossing with Christopher Island in the middle. The crossing is used as an ice crossing in March-May when part of the Kaminuriak herd has wintered north of Chesterfield Inlet and the caribou are returning south as in 1976 (Darby 1978) and 1981 (C. Gates pers. comm.). The water crossing which was identified

by hunters as an important crossing, may have been used possibly in August and later in the fall.

Range of the Kaminuriak Caribou Herd

(1) Kazan River System

Water crossings on the lower Kazan River were identified by hunters of Baker Lake. Darby (1978) mapped the trails along the lower Kazan from Thirty Mile Lake to Baker Lake. The trails parallel almost the entire length of both banks and are concentrated at 13 sites. The post-calving Kaminuriak herd generally moved to the northwest or north toward the lower Kazan River and the shore of Baker Lake in the 1960's (Parker 1972a). In 1964 (Ungungai in Darby 1978) and in July 1979 (Neigo in Darby 1980) caribou were reported to haved crossed the Kazan and in 1980 we found a few trails at water crossing No. 11. In 1978 and 1980-1981 the Monitoring Reports suggested that after calving the cows tended to move east and although sane bulls and non-breeders moved north to the lower Kazan, the trend was less obvious than in the late 1960's. Generally, the use of the water crossings on the Kazan has declined.

(2) The Maguse River System and Henik Lakes Area

Observations of use of water crossing NOS. 1-5 (Fig. 5) in the literature are scarce until Parker's (1972a) observations of the mid-summer migrations from the lower Kazan River

- Baker Lake area from mid-July to mid-August 1966-68. In the late 1970's, there was less use of water crossing Nos. 1-5, although sane use of them was suggested by observations of fresh trails in 1980 (Nos. 2-5).

(3) Kaminuriak Lake Area

The three water crossings (Nos. 6-8) on Kaminuriak Lake (Fig. 5) were used by post-calving caribou during their northwest movement (No. 8) or south mid-summer migrations (Nos. 6 and 7) in June-July 1966-68 (Parker 1972a) . Use of those water crossings was only specified for No. 7 in July 1978 but Nos. 6 and 8 may have been used as in July-August 1979 and 1980.

While compiling a comparative description of the use of the water crossings, several points that limit the extent and strength of the comparisons, have to be remembered. The uniformity of coverage and efforts have always been unbalanced and sometimes unobtainable (eg. Parker's 1972 flight-lines) . The Monitoring Programs, have been reduced, and are now less directed to describing movements and use of water crossings and more to describing caribou distribution relative to land-use activities.

Examination of Caribou Use of Thelon Rivet

In May and July 1980, we used low level helicopter flights (30 -60 m agl) to locate trails along the banks of the Thelon River between the confluence with the Hanbury east to Beverly Lake.

We flew west along the north shore of Aberdeen and Beverly Lakes and along the Thelon River to Ursus Islands on 31 May 1981. The ice was intact on Aberdeen Lake but there were patches of open water between Aberdeen and Beverly Lakes and at the west end of Beverly Lake. The Thelon River was open immediately west of Beverly Lake with pans and chunks of ice being carried by the current: ice shelves were still adhering to the banks.

We found a few old tracks scattered along the north shores of Aberdeen and Beverly Lakes. There were north-south trails and nine caribou (yearlings and subadults) on the large peninsula that forms the eastern edge of Beverly Lake. There were north-south trails at the west end of Beverly Lake and a heavy concentration of trails crossing the Thelon River about 3 km east of the eastern boundary of water crossing No. 22. Along the western-most 7 km of this crossing there were many trails and scattered groups of 10-20 subadult caribou. Heavily used trails were evident on the southern bank where the Thelon River swings northeast from Ursus Islands. Trail wear indicated that a large number of Beverly cows crossed the Thelon River in mid to late May between Ursus Islands and Beverly Lake.

On 22 July, during a flight west along the Hanbury River from water crossing No. 24 to Lac du Bois, we observed 300-500 caribou wading across a shallow rapids about 2 km northwest of water crossing No. 25. Trail wear indicated that recent crossing activity had occurred at numerous localized sites along this portion of the river.

Observations of Caribou Behaviour at Water Crossings

We placed 2-man observation crews at water crossings Nos. 23 and '24 to observe behaviour of caribou from 15 to 23 July, 1981.

We chose water crossing Nos. 23 and 24 because they had been used recently and offered high ground as vantage points to observe the caribou. During this period, only one caribou was observed at Lookout Point (crossing 23 - Fig. 6). On 20-21 July, D.C. Thanas (pers. comm.) observed post-calving aggregations that had moved west from the calving ground. Most caribou were west of Lac du Bois in the area of Ptarmigan and Mary Frances Lakes having moved west through the northern area of the Thelon Game Sanctuary before turning southwest. Therefore, we missed the opportunity to obtain behavioral data at water crossings.

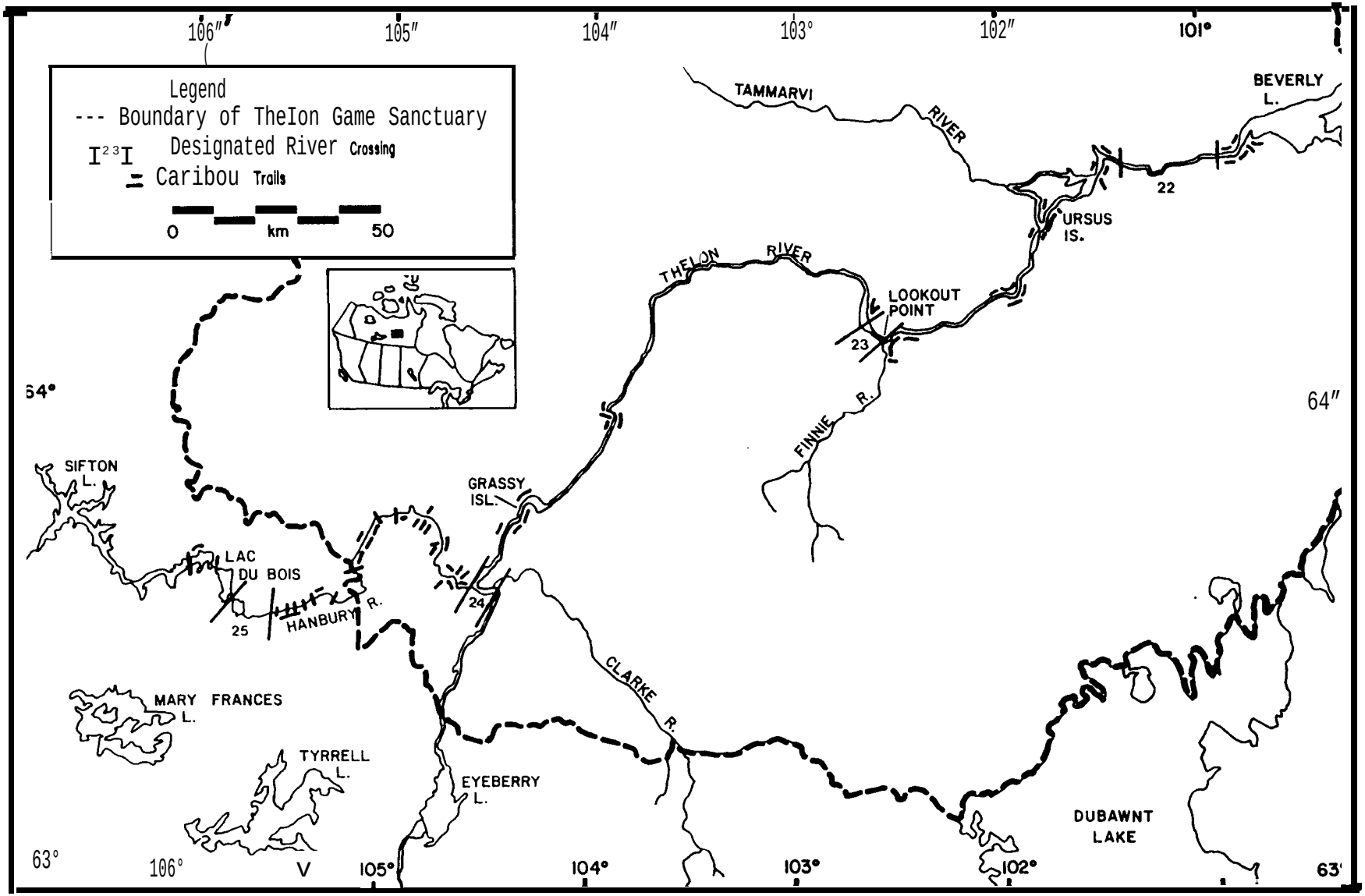

Figure 6. Trail patterns on the Thelon and Hanbury Rivers, N. W. T., 1930.

DISCUSSION

During spring migrations frozen water bodies may facilitate caribou movements as windswept snow is often hard packed and presents relatively easy surface for travel. Herds often follow major drainages whose axes lie along the general direction of migration (Lawrie 1948, Banfiled 1951, Kelsall 1953, Makridin 1962). During summer migrations, snow conditions no longer limit caribou to certain routes and open water bodies are obstacles. Caribou will readily cross open bodies of water, but they tend to follow the shores and concentrate at certain crossing areas.

Our descriptions of the physical characteristics of the water crossings demonstrates that there is not any particular feature or combination of features that identify the water crossings. Caribou frequently cross rivers at rapids and waterfalls: water turbulence was apparent at 16 of 40 sites that we examined. Clarke (1940) stated that caribou use the shallowest places at a river crossing, which are often distinguished by a riffle and the sound of running water. Banfield (1954b) believed that the sound of rushing water attracted caribou because of its similarity to the noise made by a large swimming herd. Kelsall (1968) suggested that rapids and falls are often chosen because rivers are frequently narrower just above rapids than they are at other points.

Most crossing sites at lakes are in the narrowest sections such as at peninsulas, sand spits and islands (Blanchet 1925, Sdobnikov 1958, Kelsall 1968). Most (32) of the designated water crossings were less than 500 m in width and 38 of 40 sites were peninsulas, shoreline irregularities or had offshore water

turbulence and/or exposed ground (such as islands or sandbars). In some cases such as Box Crossing (water-crossing No. 20) the surrounding terrain apparently funnels the caribou toward a particular site to cross, but in most cases we could not determine why one site was chosen in preference to another.

Certain ice conditions may temporarily prevent caribou crossing rivers and other water bodies (Kelsall 1968). Lawrie (1948) observed caribou being turned back by thin ice and open water on Lac Brochet, Saskatchewan. In November 1981, we watched caribou during fall migration and noted that the caribou turned away from thin ice and leads of open water on Scott Lake, on the Saskatchewan-NWT border. Harper (1932) reported that caribou appeared to avoid crossing the frozen Windy River where the ice was breaking up, and crossed on the solid ice on Windy Bay. Once the ice on Windy Bay was unsafe, caribou selected the shorter crossing of Windy River rather than swim 800 m across Windy Bay.

Rivers with loose or pan ice also frequently represent obstacles to migration. Skoog (1968) observed migrations of the Porcupine herd stopping temporarily during the spring break up of the Susitna, Yukon and Colville Rivers until the ice had disappeared. Voisey (cited in Kelsall and Loughrey 1955) suggested that movements of Kaminuriak caribou in the autumn of 1954 were delayed by a late freezing of the Tha-Anne River. The caribou would not cross the river while the ice was moving.

Migratory caribou wear deep, parallel trails into the ground especially along the shores of lakes, converging at the ends of lakes, and at narrows and points (Lawrie 1948, Clarke 1940). The trails are a record of movement patterns but cannot be used to

describe frequency or intensity of use of a given caribou trail as trails are formed on some ground types more than others (LeResche and Linderman 1975). The state of the trail and vegetation can suggest whether the trail was recent (probably less than 1 year old) or older. Our observation of the shores of water bodies suggest that caribou have moved along most shores at sane time. River bank trails were particularly evident along the Kazan River (Darby 1978) and our observations of the Thelon River in 1981 also suggested movements along both banks.

When approaching a river, caribou will often Pause and visually examine the area for prolonged periods prior to crossing (Surrendi and DeBock 1976) . Usually, once the crossing is initiated by an animal the entire group will enter the water (Banfield 1954b, Pruitt 1960, Surrendi and DeBock 1976). Cows, especially cows with calves, will assume leadership of a group (Mallet 1930, Ingstad 1933, Lawrie 1948, Surrendi and DeBock 1976). Harper (1955) reported several occasions where mature bulls led the crossing activities of mixed bands of caribou. Frequently, animals funnel behind the lead caribou until water of swimming depth is reached, after which they swim in single file (Surrendi and DeBock 1976) . Large bands of caribou are likely to cross in several files, or to spread out widely, but disturbed caribou often crowd or bunch while swimming (Surrendi and DeBock 1976).

While crossing shallow rapids, caribou may trot but in deeper water or across a bottom which is rough, rocky and/or slippery, the animals may pick their way quite slowly, unless alarmed near the water's edge, when they then will plunge into a river or bay (Harper 1955) .

Caribou use of water crossings are generally greatest during the morning or late in the evening, with a slack period occurring during the middle of the day (Thomas 1960, Howard 1962). often groups will build up during the afternoon, but wait until night before making a crossing (Howard 1962).

It is important to realize the variation in caribou behaviour at water-crossings. The sex and age of the caribou, season and other variables such as levels of insect harassment all contribute to the variation in caribou behaviour at water-crossings. The urge for caribou to migrate in spring is especially strong for pregnant cows . If deep wet snow hinders movement, the yearlings and subadults may drop behind the pregnant cows. If a lake or river is breaking up or slush is covering the surface, the yearlings may wait, but the cows may cross even under difficult conditions as for example, described by McEwan (1960) in June on Beverly Lake. The existence of only anecdotal accounts of behaviour at water crossings prevents us from evaluating the causes of the variation in behaviour and attributing it to such factors as insect harassment etc. Without an understanding of how caribou normally behave at water-crossings, we cannot readily predict or recognize the effects of human activities on caribou at the water-crossings. Similarly, there are only anecdotal accounts of responses to disturbances while caribou are crossing water and the absence of detailed quantified observations prevents us from drawing any conclusions. Migrating caribou sometimes persist in crossing traditional points despite the presence of human activities (Harper 1955, Jakimchuk et al. 1974, Surrendi and DeBock 1976). Both hunting and tagging accounts have noted the

to residents of Churchill and Eskimo Point, caribou were probably still speared on the lower Kazan River and at the mouths of the Maguse and Thlewiaza Rivers as late as the mid 1950's (Banfield 1954b) .

The impetus for the Protection Measures that prohibit certain human activities at water-crossings came fran assertations of the vulnerability of caribou to disturbance at those sites. The concern of the resident hunters was that disturbance of caribou had already lead to changes in movements and abandonment of specific areas traditional to the people and the caribou. The generality that there has been an apparent change in the movements of caribou is correct, but the cause and effect relationship is only speculation. For instance, the documented decline in the size of the Beverly and Kaminuriak herds (Simmons et al. 1979, Heard and Decker 1981, Gunn and Decker 1982) could explain a change in the pattern of movements. As a herd becomes smaller and uses a smaller range the caribou may stop using certain areas.

Our report compiles the information of summer range use in particular reference to the water crossings. On both the ranges of the Beverly and Kaminuriak herds portions of the summer ranges were not used in the 1960's and 1970's. The resulting changes in movements have decreased the use of the water crossings on the lower Kazan River and the Thelon River between Beverly and Baker Lake. Those are also the areas used by hunters from Baker Lake (Table 3) hence, they acutely felt the impact of the change in movements.

The caribou herd's use of land areas (range) likely reflects combinations of current herd size and existing or Past

environmental factors that exert daily, seasonal and annual pressures on the movements of those caribou. Thus, it can be expected that the pattern of use of water crossing sites will vary from one year to the next. But the relative long-term importance of that water crossing site will remain even though it's use is periodic or sporadic.

Our knowledge is deficient in three major areas of biological importance in evaluating temporal and spatial patterns of movements and distributions of caribou herds: (1) Why caribou herds traditionally use specific migration paths and land areas? (2) What are the absolute and relative strengths of the caribou herd's affinities for specific migration paths and specific areas and time? (3) What are the long-term consequences at the herd level in causing changes in the caribou's use of specific migration paths and land areas? It is impossible for us to predict, on a biological basis, the importance of individual water crossing sites to caribou herds. The possible detrimental influences on the well-being of individual caribou or caribou herds by disruption or displacement of caribou from specific water crossing sites is also unknown. Similarity, we cannot define the "importance" of any one water crossing as we do not know the long-term consequences of causing changes in the use of that water crossing. We will, in the light of our ignorance equate importance with the known use of a water crossing.

Our examination of the trail patterns at the water crossings fran the limited mapping of these trails leads us to emphasize two points. Firstly, the well defined trails at sane sites are outside the designated boundaries and so we recanmend moving the

persistence of caribou to continue swimming across. However, hunters recognized that they had to remain hidden until the animals were in the water and well into the crossing before beginning to hunt so that the caribou would not turn back.

Caribou may abandon or postpone water crossings at traditional sites in response to disturbance. Clarke (1940) described the responses of caribou about to cross the Thelon River when they detected his scent from the opposite bank. One group crossed and one group moved upstream. Harper (1955) reported caribou being deterred from crossing by movements or sounds from his camp on the opposite bank of a river. Lawrie (1948) observed bulls, that were swimming across a bay of Angikuni Lake, turn back in panic from three herring gulls (Larus argentatus) which were resting on the water in their path. Banfield (1951, 1954b) cited instances where activities of hunters camped at a crossing point on a river or lake reportedly turned migrating caribou from their route. Miller (1972) believed that caribou failed to cross the narrows between Henik Lakes because of activity at the camp there. Observations from tagging operations in the N.W.T. indicate that if animals were turned back while crossing, they might recross a day or two later, or move further along the river to cross (Ruttan 1962, Howard 1961). Calef et al. (1976) reported that caribou at river crossings were more likely to panic and run in response to low flying aircraft than in other situations.

Water-crossings are sometimes a potential hazard to caribou and this could contribute to a greater level of excitability as they approach. The excitement may be compounded if there are large numbers of caribou as they communicate their nervousness to

each other. Drowning of caribou has been recorded at water crossings especially when large numbers of caribou attempt to cross water or ice under dangerous conditions (Kelsall 1968). Caribou will swim rivers in hazardous places and although many are swept over rapids, they usually emerge unscathed (Kelsall 1960). Kelsall (1960) believed that caribou were able to meet most circumstances in the water as long as they had sane freedom of movement and some free choice of swimming direction. He suggested that exhaustion from fly harassment may have contributed to adults drowning. Kelsall (1953) found up to 450 caribou along 16 km of the north shore narrows of Aberdeen Lake (water crossing No. 19), which had drowned during the first week of July 1951. Mortality may have been a result of the animals attempting to cross while a strong wind was blowing. Harper (1932) recorded observations of carcasses of bulls and calves that had apparently drowned while crossing a 6 km wide lake on the Thlewiaza River though they may also have perished in an upstream rapid and been washed ashore on the lake.

Caribou calves may be more likely to drown than adults because they are not as strong swimmers. Seventy-six percent of the carcasses observed on Aberdeen Lake by Kelsall (1953) were calves. Ruttan (1962), Thomas (1960), and Hawkins (1973) noted that calves had difficulty swimming in choppy waves.

Caribou swimming rivers with moving ice are frequently trapped, and attempt to climb onto ice pans, which may overturn, causing death by crushing and drowning (Jakimchuk 1974) . Ice shelves persisting against river banks can prevent caribou, especially calves, from climbing out of the water and death by

exposure or drowning may result (Murie 1944, Kelsall 1960, Miller and Broughton 1974). Caribou may break through thin newly formed ice on lakes and if they cannot extricate themselves they drown or may die of exposure and exhaustion after struggling back onto ice (Lawrie 1948, Banfield 1954b) .

The Inuit and Indians were aware of major caribou movements and were able to take advantage of certain predictable locations and times each year to hunt the herds (Blanchet 1930). In late July, August and September, native hunters moved to favoured localities where caribou traditionally reappear on their southward mid-summer migrations and where the hunters frequently made large kills for meat and hides (Tyrrell 1908, Blanchet 1930, Ingstad 1933, Banfield 1951, Loughrey 1956, Surrendi and DeBock 1976).

Lines of piled stones were frequently placed at or near lakes and rivers to guide caribou. Most of those stone fences were located at traditional crossing sites (Schwatka 1885, Tyrrell 1908, Rasmussen 1927, Kelsall 1968) . Pits or hunting blinds were placed near the water, at the apex of many fences to conceal reclining hunters (Clarke 1940, Kelsall 1968). Such an arrangement still exists at water crossing No. 8, site 1 (Kaminuriak Lake) .

The native hunting efforts were most successful once the caribou were swimming and could be speared by hunters in their fast and highly manoeverable kayaks or canoes. The ease and relative reliability of hunting at traditional crossings made it a widespread practice (Tyrrell 1892, McLean 1901, Harper 1932, Lawrie 1948, Brown in Banfield 1954b, Loughrey 1956). According to residents of Churchill and Eskimo Point, caribou were probably

boundary of water crossing Nos. 4, 5, 13, 14, 17, 18, 21, 22 and 23. At the present time, the prohibition of land-use activities within 5 km and the prohibition of blasting or camp construction within 10 km of a designated water crossing provides protection of the approach and departure area. We do not have data to evaluate the need or adequacy of those 5 km and 10 km zones. Secondly, the pattern of the trails paralleling the shores before a crossing site suggests that boundaries of the designated crossing sites may not be sufficient to protect the crossing activity of the caribou. We do not have the data to determine the relationship of trail systems that parallel the banks of long stretches of the rivers and lakes to the designated water crossings, (for example see Darby's (1978) mapping of the lower Kazan River and Figure 5, this report) .

Knowledge to date does not allow us to speculate on the possible consequences of man's influence on caribou at water crossing sites. If the answers are forthcoming they will permit us to make valid predictions on the long-term impact on caribou of human activities at water crossing sites. Therefore, conservative protection measures must persist until wise, biologically sound judgments can be made on possible ameliorating measures that would allow compatable uses of water crossing sites by both man and caribou (Appendix C) .

Observations of caribou crossing activity (Appendix B) are sporadic and incomplete in the literature and provide insufficient data to determine the relative frequency of use of water crossings. The migration routes of caribou, and therefore the water crossings used can vary annually. Changes in range use

possibly associated with the recent declines of the Beverly and Kaminuriak herds have affected the choice, frequency and extent of the use of water crossings.

Recent use of designated water crossing Nos. 22 to 26 on the Thelon and Hanbury Rivers (Table 3) is partly a result of those systems forming a major east-west barrier to caribou migrating approximately north-south to traditional calving areas north of Beverly Lake. Water crossing No. 23 (Centre TheIon Sanctuary) and No. 24 (West Thelon Sanctuary) are also used because of the tendency of caribou to follow natural obstacles until they reach major irregularities in the shoreline which those sites represent. Water crossing Nos. 19-21 were previously used more during pre and post-calving movements of the Beverly herd when traditional calving grounds were located south and north of Aberdeen Lake. Recently calving cows have not used the calving ground south of Aberdeen Lake and post-calving movements are currently not to the north. Thus, crossing Nos. 19-21 are currently not intensively used.

The few recent observations of caribou use of water crossing Nos. 13-19 (except for Pangman's observation of caribou in 1980 at No. 15 in Cooper 1981) is indicative of recent Beverly post-calving movements to the south and west from the calving ground north of Beverly Lake. The designation of water crossing Nos. 13-19 was apparently frcm interviews with hunters (Welland 1976, Stager 1977, IDS 1978). The importance of those sites to traditional hunting activities is supported by archaeological evidence (Harp 1961).

A proposed ranking of Beverly water crossings, in decreasing order of use based on recent crossing patterns are Nos. 22-26; Nos.-19-21, 27, and 13-18. We strongly emphasize that changes in Beverly herd size, migration routes, and location of calving grounds may greatly alter the use of water crossings.

Observations of recent use of water crossings are reported for water crossing Nos. 4, 5, 7, 8 and 9 on the Kaminuriak herd range. There are no recent direct observations of use of water crossing Nos. 1-3, 6, 10, 11 and 12.

The lower Kazan River crossings (9-11) were apparently designated from interviews with hunters (IDS 1978). Archaeological and literature evidence indicates that those sites were also of traditional value for hunting.

There is little recent evidence in literature to support the designation of water crossings Nos. 1-3, 6 and 12, although on-site observations in 1980 suggested that extensive migrations had previously used water crossing No. 3.

A proposed ranking of Kaminuriak water crossings, in decreasing order of use, based on recent crossing activities are: Nos. 4, 5, 7, 8, 9; Nos. 10, 11; and Nos. 1-3 and 6. Crossing 12 is not ranked as trail systems in the area were not examined. Again, we emphasize that changes in Kaminuriak herd size and migration routes may greatly alter the use of water crossings.

SUMMARY

1. During summer migration, water bodies are major obstacles to caribou movements. Caribou tend to follow natural features which causes them to concentrate at traditional crossing points.

2. Caribou most frequently cross at narrows caused by peninsulas, at shoreline irregularities, or where there is water turbulence and/or exposed ground.

3. The responses of caribou to human and other activities while crossing water are variable. Caribou can show persistence in using traditional water crossings, but may also abandon or delay a crossing in response to environmental factors, or human activity.

4. Mortality, especially of calves, occurs during crossing activities under dangerous conditions.

5. Natives traditionally hunted caribou at water crossings. Hunting efforts were most successful when swimming caribou were speared from kayaks or canoes. Stone fences were frequently used to guide caribou to crossing sites.

6. The consequences to caribou of abandonment or delay of use of water crossings in response to disturbance are unknown.

7. Designated water crossings on the Beverly range were ranked based on recent frequency of use, in decreasing order of current use patterns as: Nos. 22-26; Nos. 19-21, 27, and 13-18.

8. Designated crossings on the Kaminuriak range were ranked, based on recent frequency of use, in decreasing order of current use patterns as: Nos. 4, 5, 7, 8, 9; Nos. 10, 11; and Nos. 1-3 and 6.

9. Water crossing No. 12 was not ranked as it was not examined.

RECOMMENDATIONS

The following corrections to the 1980 Caribou Protection Map are proposed:

1. The northern boundary of designated water crossing No. 21 (Dubawnt River) be extended to the mouth of the river.

2. Designated water crossing No. 7 (West Kaminuriak Lake) be placed as on the 1978 and 1979 Caribou Protection Map; at the narrow stretch of river joining the west arm on Kaminuriak Lake to the first unnamed lake to the west.

3. The boundaries of designated water crossing Nos. 4 and 5 (Northwest Kinga Lake, and Maguse River) and No. 10 (above Kazan Falls) be extended to incorporate adjacent regions where trail patterns occur.

4. Water crossing No. 11 (Thirty Mile Lake) be placed on the 1980 Caribou Protection Map as on the 1979 map.

5. The boundaries of designated water crossing No. 24 (West Thelon Sanctuary) be extended to the mouths of the Clarke and Hanbury Rivers, a distance of 2 km above the junctions to the Thelon River.

6. Trail patterns at designated water crossing No. 12 (Christopher Island) be mapped to describe the use and the features of the water crossing.

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APPENDIX A. ascriptions of water crossings used by migratory barren-ground caribou of the Beverly and Kaminuriak herds in the Districts of Keewatin and Mackenzie, N.W.T.

Symbols

- Studied Crossing Site
- A Inukshuk
- Meat Cache
- AAA Stone Fence
- Cabin, Camp, or Dock
- Fishing or Exploration Camp
- o Tent Ring
- Caribou Trail
- Faint Caribou Trail
- Rapids

Vegetation Communities


Water


Mixed Rock and Sand


Boulder


Sand


Sedge Meadow


Tussock Tundra


Dwarf Shrub- Sedge


Dwarf Shrub-Lichen


Lichen - Heath


Lichen Steppe


Rock Barrens

Crossing 1 North of Roseblade Lake 61°10'N 97°06'W

Date 06/08/80

Location

Designated crossing No. 1 is the narrows connecting Roseblade Lake and the first unnamed lake to the north; it is the most southerly crossing on the Henik Lake system (Fig. 5).

Large areas of sedge meadow are situated to the north and east of the crossing, north of Roseblade Lake, and also to the west of the crossing.

Trail Patterns

Trail patterns are readily apparent in the extensive sedge meadow. Trails (Fig. A-la) indicated that many animals moved in an east to west direction and directly approached the crossing by crossing the tundra north of Roseblade Lake. Others travelled along the north shore of Roseblade, then swung to the north for about 1500 m before crossing at the one site. North-south orientated trails suggest that animals moved along the shores before reaching crossings.

Site 1 Description

Site 1 (Fig. A-la) was a point jutting out from the eastern shore of the channel towards a rounded peninsula of the western shore.

The distance across Site 1 was approximately 250 m (Fig. A-lb). Water depth increased rapidly, reaching 1 m, 1.5 m from

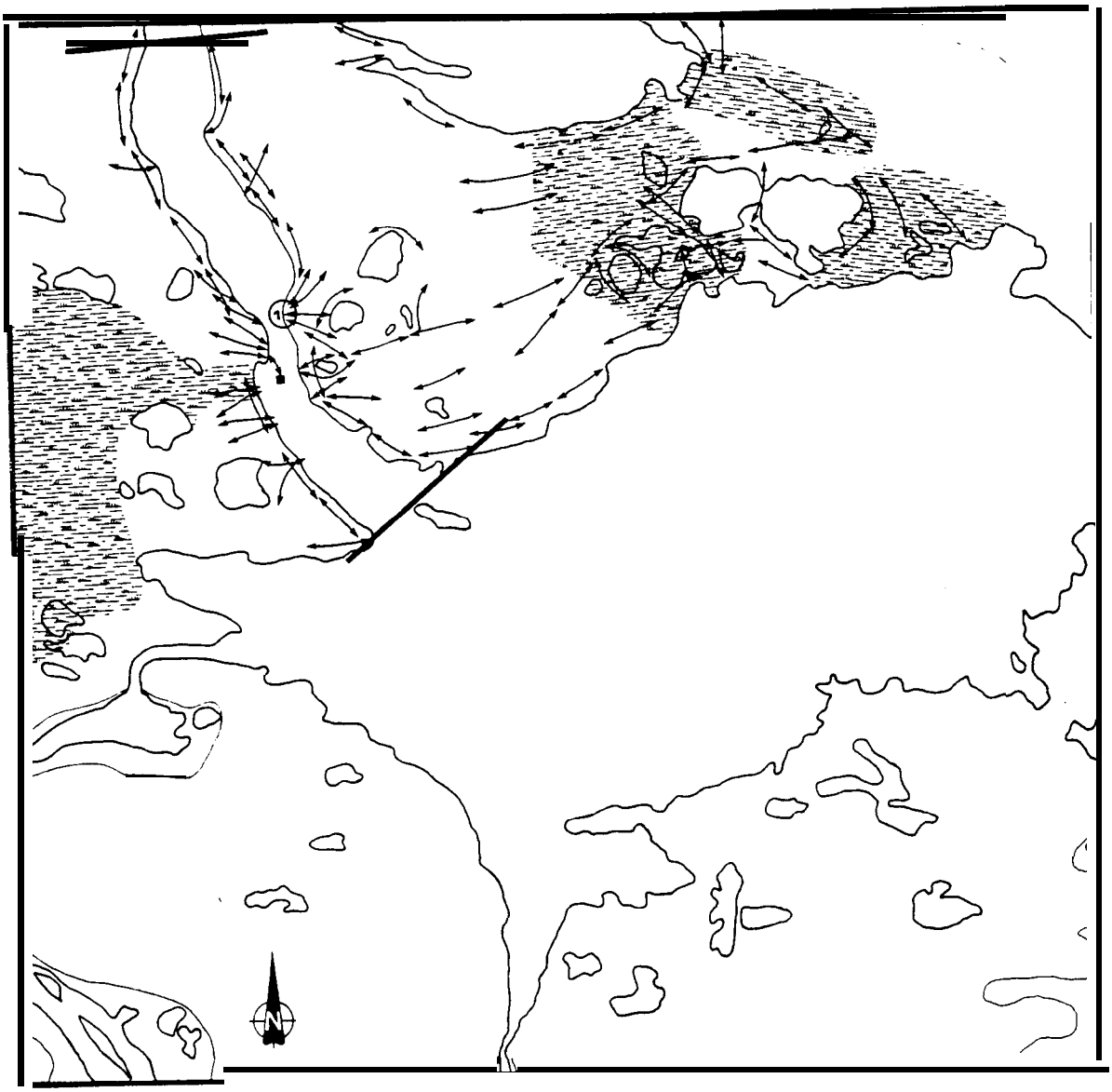


Figure A-1a. Water crossing No. 1.

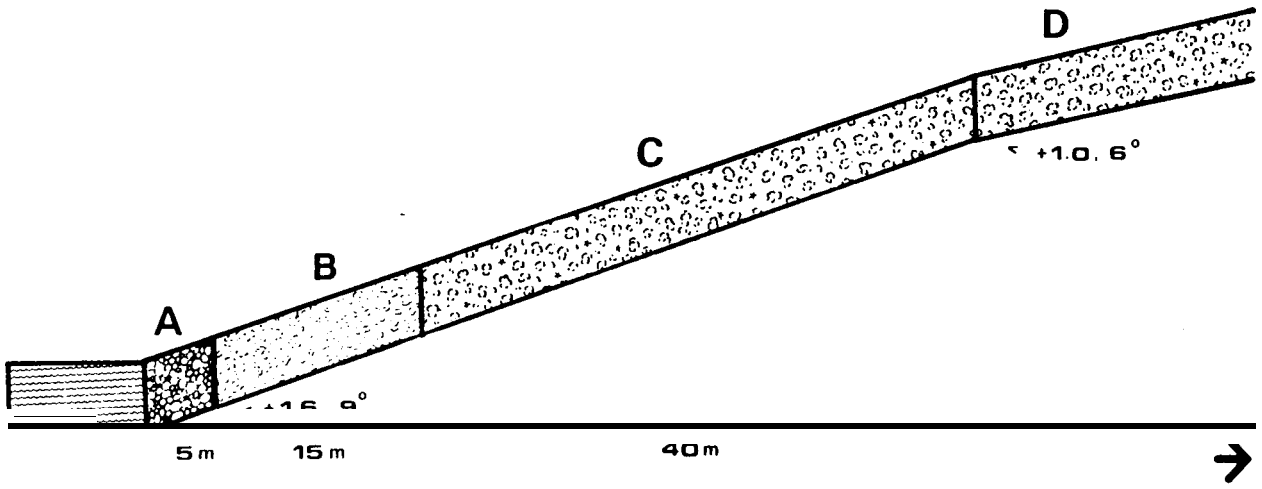


Figure A-1b. Water crossing No. 1, site 1.

shore. The bottom off shore consisted of small rocks and sand patches. Average surface water velocity as measured 1 m from shore, in 1 m of water, was negligible.

Caribou and Human Use of Crossina Site

All trails were overgrown by vegetation indicating little or no recent use (Fig. A-lb). A fuel cache and grub box. were on an ice push-up on the western shore of Site 1.

Crossing 2 South of South Henik Lake 61°18'N 97°19'W

Date 06/08/80

Location

Designated water crossing No. 2 is the channel connecting South Henik Lake and the first unnamed lake to the south (Fig. 5).

Trail Patterns

Trails in the northern regions of the western shore of water crossing No. 2 were faint and appeared old. Trail wear (Fig. A-2a) indicated that most crossing activity occurred at three locations.

Heaviest trail patterns were on the eastern shore where animals concentrated at crossing points, suggesting that most use of the water crossing was from east to west.

Site 1 Description

Site 1 (Fig. A-2a) was the southern tip of a square-ended northeast-southwest running peninsula jutting out from the eastern shore. Trail wear at Site 1 indicated that animals approaching the crossing from the east follow the shore for considerable distances before concentrating at the end of the peninsula. Numerous wide parallel trails ran the length of the peninsula.

The crossing width at Site 1 was approximately 350 m (Fig. A-2b). The bottom was composed of small shingles. Water depth increased to 1 m, 5 m from shore, and 2 m a distance of 10 m from shore. The middle of the site was deep, with a stretch of blue

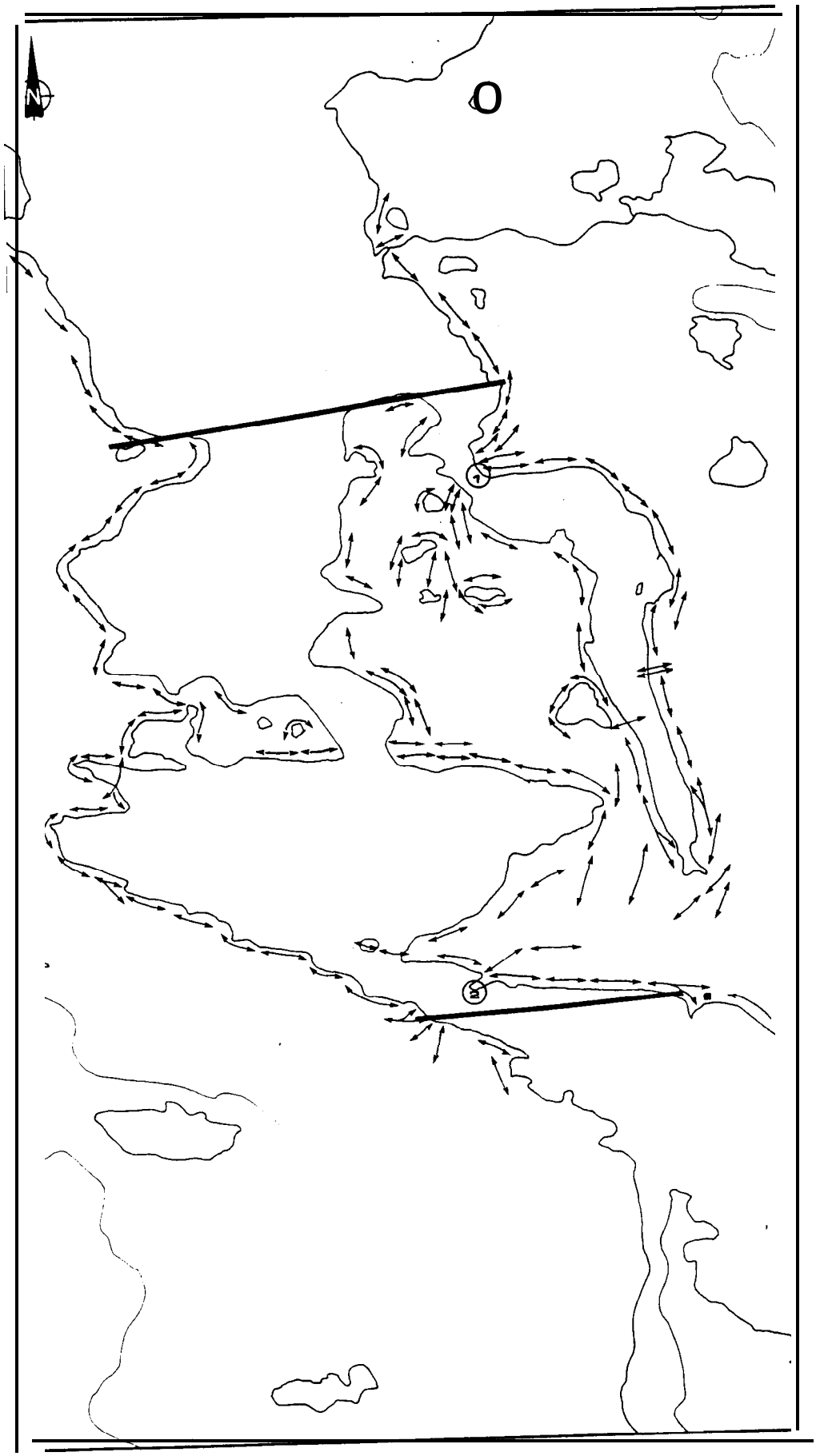
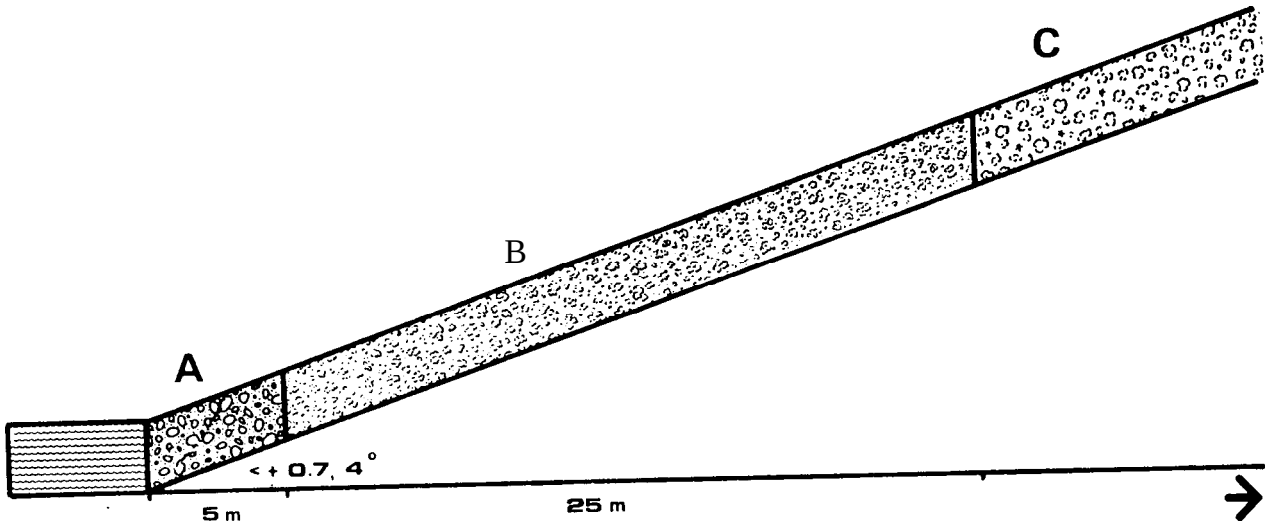


Figure A-2a. Water crossing No. 2.



Horizontal Distance (meters)

Figure A-2b. Water crossing No. 2, site 1.

water approximately 200 m wide. Average surface water velocity immediately off shore was negligible.

Caribou and Human Use Site 1

Trails in muddy areas of the eastern shore indicated that small numbers of animals had moved in a west to east direction previous to the investigation. Old caribou pellets were in Zone B. Trails were heavily overgrown with vegetation, and there were no signs of heavy recent use of this site.

Site 2 Description

Site 2 (Fig. A-2a) was the tip of a narrow northeast-southwest running peninsula jutting out of the southern shore of a larger east-west running peninsula. Trail wear indicated that most animals moved along the south shore of the large east-west running peninsula and crossed at the narrow peninsula.

The south-western bank of Site 2 was composed of a gradually sloping dwarf shrub community.

The crossing width at Site 2 was about 650 m (Fig. A-2c). The bottom immediately offshore was composed of large, algae covered rocks, providing treacherous footing. Water depth increased to 1 m, 6-7 m fran shore. Aver age surface water velocity was negligible.

There were large exposed rocks in the middle of the water crossing and a small willow-covered island to the northwest of Site 2.

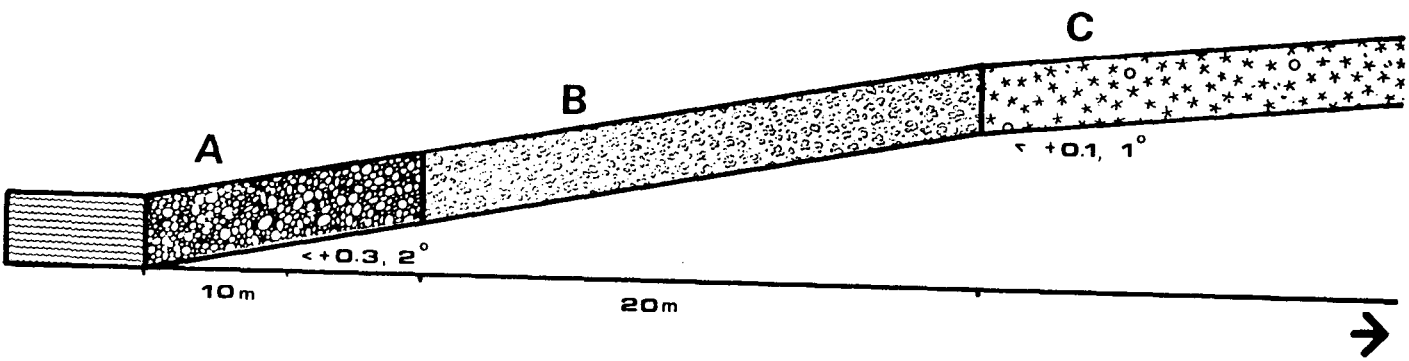


Figure A-2c. Water crossing No. 2, site 2.

Caribou and Human Use of Site 2

Recent trails were in Zone B. Scattered fresh caribou peliets were about 200 m from the shore. Trails were overgrown with vegetation. Most pellets were dry and faded.

A well-maintained hunting camp was to the east of the study site.

Crossing 3 Henik Lakes Narrows 61°44' N 97°30'W

Date 05/08/80

Location

Designated water crossing No. 3 is the narrows between North and South Henik Lakes (Fig. 5).

High relief exposed rock hills dominate both shores of crossing No. 3. Much of the peninsula composing the southern shore of the crossing was bare rock. Exposed rock to the north of the crossing reduced the visibility of some trails.

Trail Patterns

Trail patterns (Fig. A-3a) indicated that most crossing activity occurred at two small peninsulas jutting out from the north shore in a northeast-southwesterly direction.

Description of Site 1

Site 1 was a peninsula (which could have been an island at higher water levels) jutting out from the north shore. Trail patterns formed three avenues of approach to both sides of the site. Trails reached the south shore from the middle of the peninsula after paralleling the south shore of the narrows. Trails reached the north shore after coursing the north shore of the eastern arm of North Henik Lake or after traversing the hills immediately behind the water crossing.

Southwest of Site 1 the shore consisted of sharply rising banks which rose to exposed rock hills.

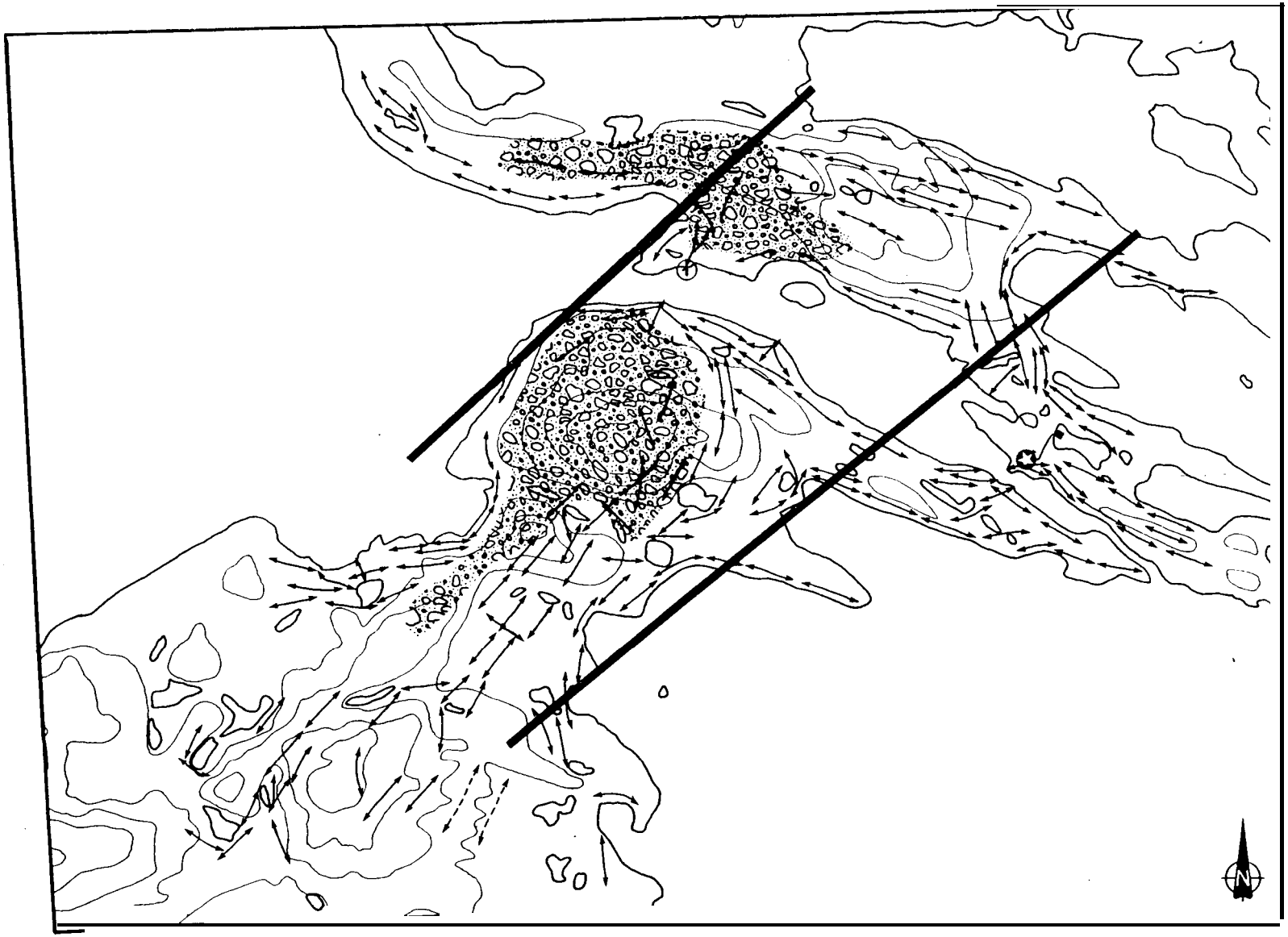
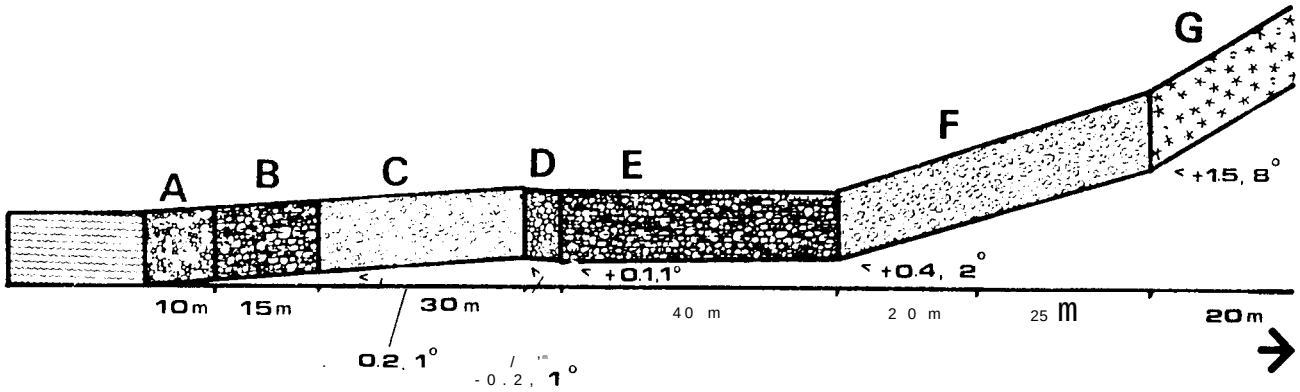


Figure A-3a. Water crossing No. 3.

The width of Site 1 was approximately 300 m (Fig. A-3b). The bottom immediately offshore was composed of large rocks. Water depth increased rapidly, reaching 1 m, 4 m from shore, and more than 2 m, 6 m frcm shore. Surface water velocity immediately offshore was negligible.

Caribou and Human Use of Site 1

Signs of recent crossing activity at Site 1 included caribou hair washed up on the rocks, and freshly browsed willow bushes in Zone C. Torn vegetation in many of the trails indicated that numerous animals passed through Site 1 in the spring of 1980. Dried caribou bones, including skulls and jaw bones were strewn about Zone C. Some old (containing lichen growth) cracked-open leg bones were in Zone C.



Horizontal Distance **(meters)**

Figure A-3b. Water crossing No. 3, site 1.

Crossing 4 Northwest Kinga Lake 61°54'N, 96°48'W

Date 23/07/80

Location

Designated water crossing No. 4 (Fig. 5) is approximately 10 km northwest of the Maguse River above its entrance into Kinga Lake.

Moderate relief hills of bare rock compose most of the region to the south of water crossing No. 4 and some area to the north, reducing visibility of some trails.

Trail Patterns

Trails were easily observed along both banks of the river (Fig. A-4a) .

Trail patterns indicated that caribou crossed the Maguse River at numerous points. Many trails appeared dark and may have been recent. Crossing activity was observed at both study sites.

Site 1 Description

Site 1 (Fig. A-4a) was a land bridge west of where the Maguse River widens before entering Kinga Lake.

The width of Site 1 was approximately 50 m (Fig. A-4b) . There were sane exposed rocks in the middle of the crossing. The bottom immediately offshore was soft and muddy. The water was shallow across Site 1 with a maximum depth of about 1 m. Animals crossing while the author was present were observed to walk across the site. Surface water velocity measured 3 m from shore was negligible.

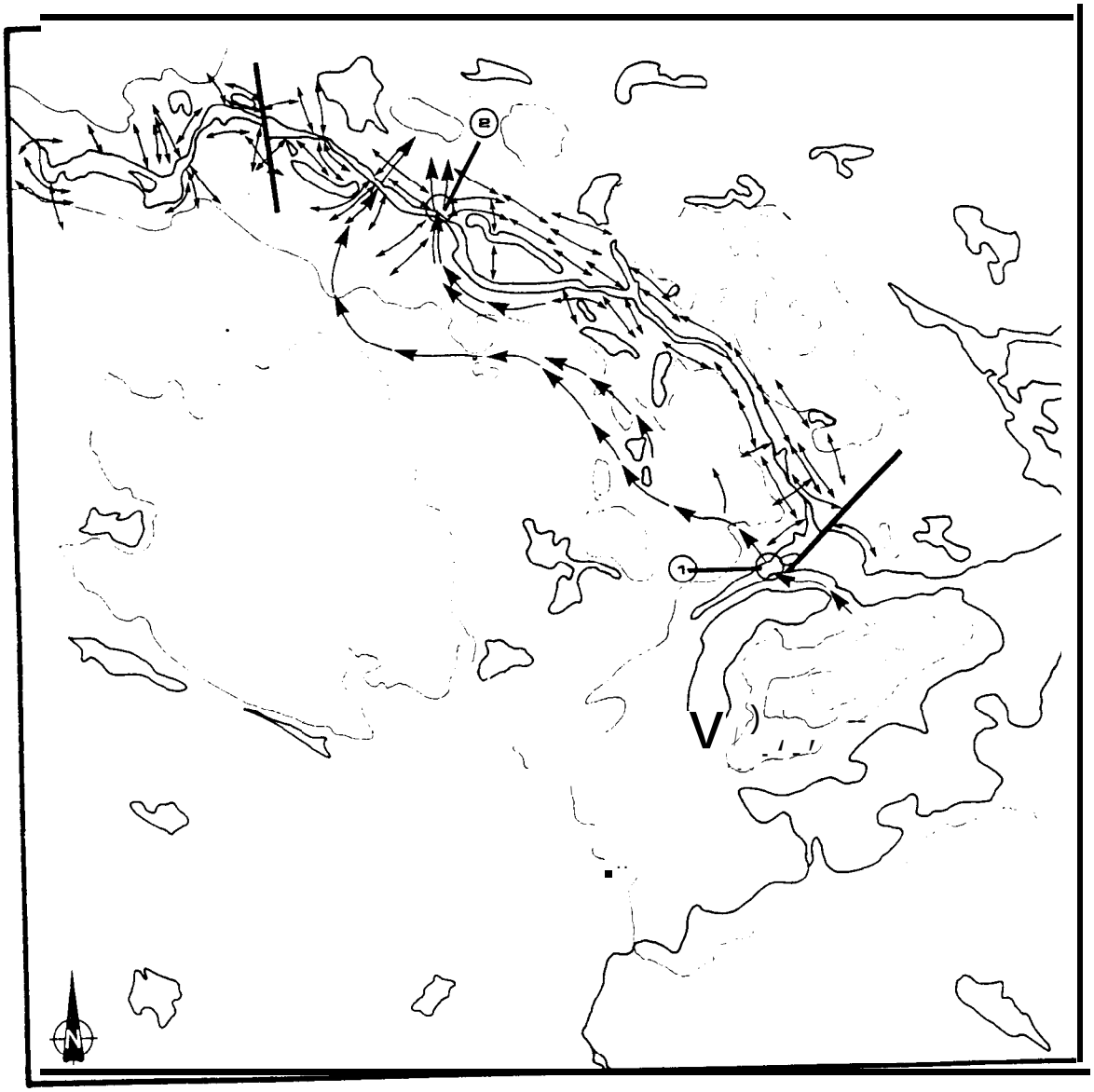


Figure A-4a. Water crossing No. 4.

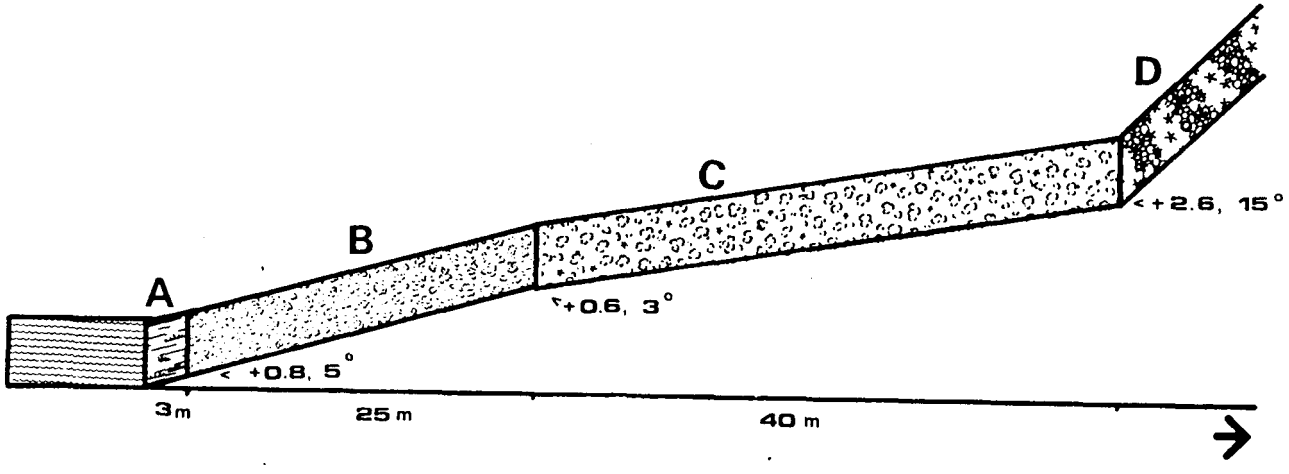


Figure A-4b. Water crossing No. 4, site 1.

Caribou Use of Site 1

An estimated 4,000 caribou of mixed sex and age classes crossed at Site 1 during the investigation. The shore on both sides of Site 1 was torn up and muddy. Bushes along the bank at the points where animals crossed were trampled. Caribou hair was in the bushes, on the shores, and littered over the water surface.

Description of Site 7

Site 2 (Fig. A-4a) was a narrow stretch of the Maguse River. The width of Site 2 was approximately 25 m (Fig. A-4c). There were a series of shallow rapids or riffles most of the way across the site. The water was shallow for most of 'the crossing, attaining a depth of about 1 m. Average surface water velocity as measured 5.7 m offshore at a depth of 15 cm, in 0.3 m of water, was 0.58 m/see.

Caribou Use of Site 2

Caribou were observed crossing Site 2 at a point approximately 200 m upstream during the investigation. Trails were freshly torn up and the shore and water were littered with hair.

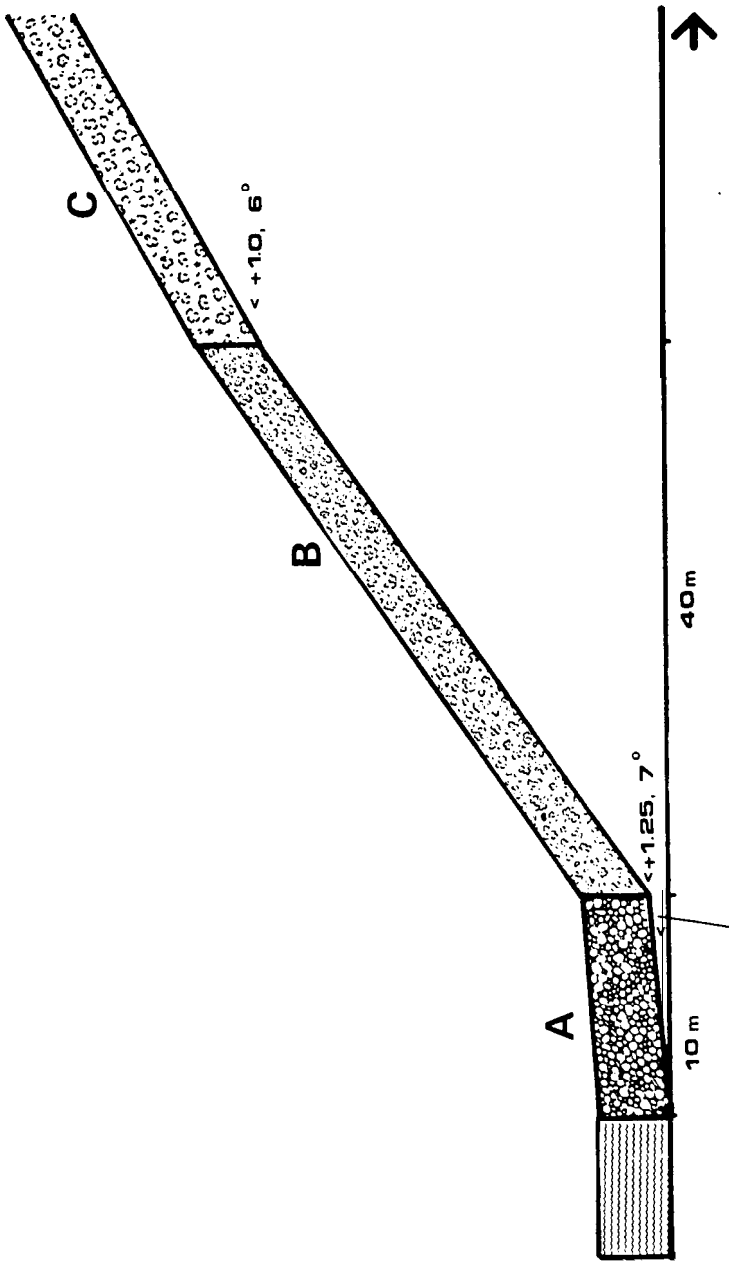


Figure A-4c. Water crossing No. 4, site 2.

Crossing 5 Maguse River 61°56'N, 96°29'W

Date 23/08/80

Location

Designated water crossing No. 5 (Fig. 5) is the Maguse River above where it enters the northwest corner of Heninga Lake.

Numerous bare hills to the south and southwest of water crossing No. 5" reduced visibility of sane trails. Major esker systems ran in a northwesterly direction from the mouth of the Maguse River to a region east of water crossing No. 5. There were also extensive northwest running esker systems to the northeast of water crossing No. 5.

Trail Patterns

Many trails (Fig. A-5a) were dark and appeared recent. Trail patterns indicated that caribou cross the Maguse River at six main points, five of which are outside of the designated crossing area.

Site 1 Description

Site 1 (Fig. A-5a) was a series of rapids flowing into narrows before entering a U bend.

The width of Site 1 was approximately 60 m (Fig. A-5b). Large, scattered boulders created an uneven bottom. Aver age surface water velocity as measured 2.9 m from shore at a depth of 0.6 m, in 0.9 m of water, was 0.27 m/see. The water was rapidly flowing further from shore. Midstream surface velocity as estimated by timing a stick's descent was 1.14 m/see.

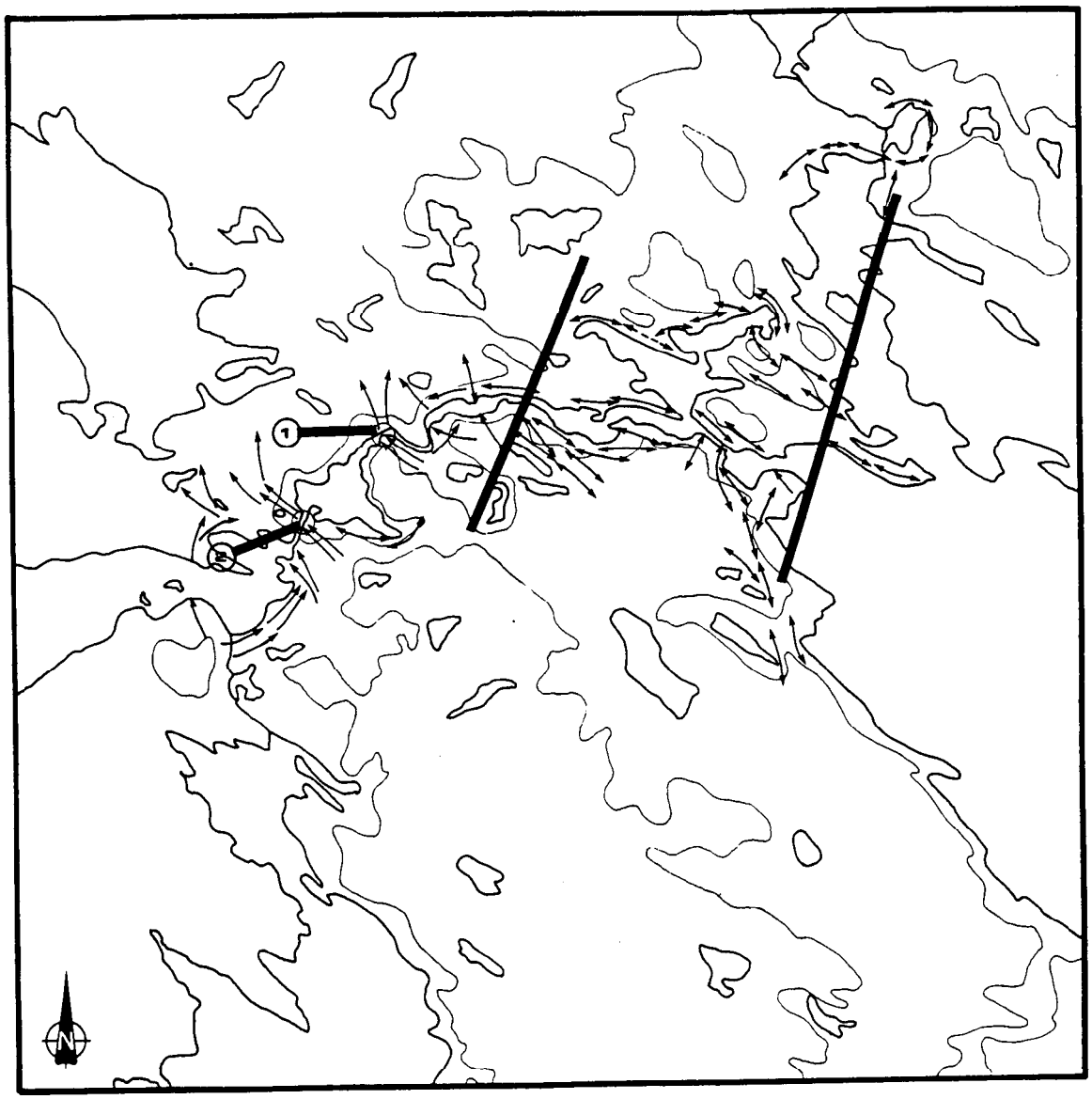


Figure A-5a. Water crossing No. 5.

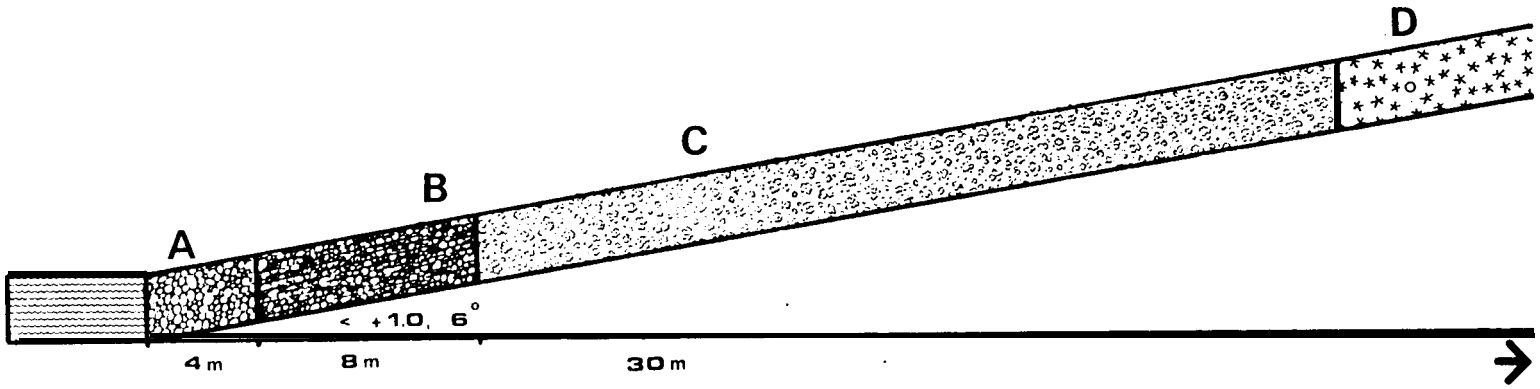


Figure A-5b. Water crossing No. 5, site 1.

Caribou Use of Site 1

One caribou was observed swimming from south to north across Site '1. Four animals crossed upstream in the same direction during the investigation. Large amounts of caribou hair were on the bushes and rocks.

Description of Site 2

Site 2 (Fig. A-5a) was a narrows between two expanses of water. Recent trail patterns coursed the south shores of the water bodies and crossed at Site 2.

Terrain to the north of crossing No. 5 was flat. Low relief hills were to the south of the crossing.

The width of Site 2 was approximately 65 m (Fig. A-SC). The bottom immediately offshore was composed of large rocks. Maximum water depth was approximately 0.6 m - 1 m. Numerous rapids occurred across Site 2. An exposed gravel bar was located in about the middle of the crossing. Average surface water velocity measured 6.3 m. from the north shore at a depth of 0.5 m, in 0.6 m of water, was 0.53 m/see.

Caribou Use of Site 2

Heavy recent trails led north from Site 2. Large amounts of caribou hair were on bushes and in small pools offshore. Tracks were made by adults.

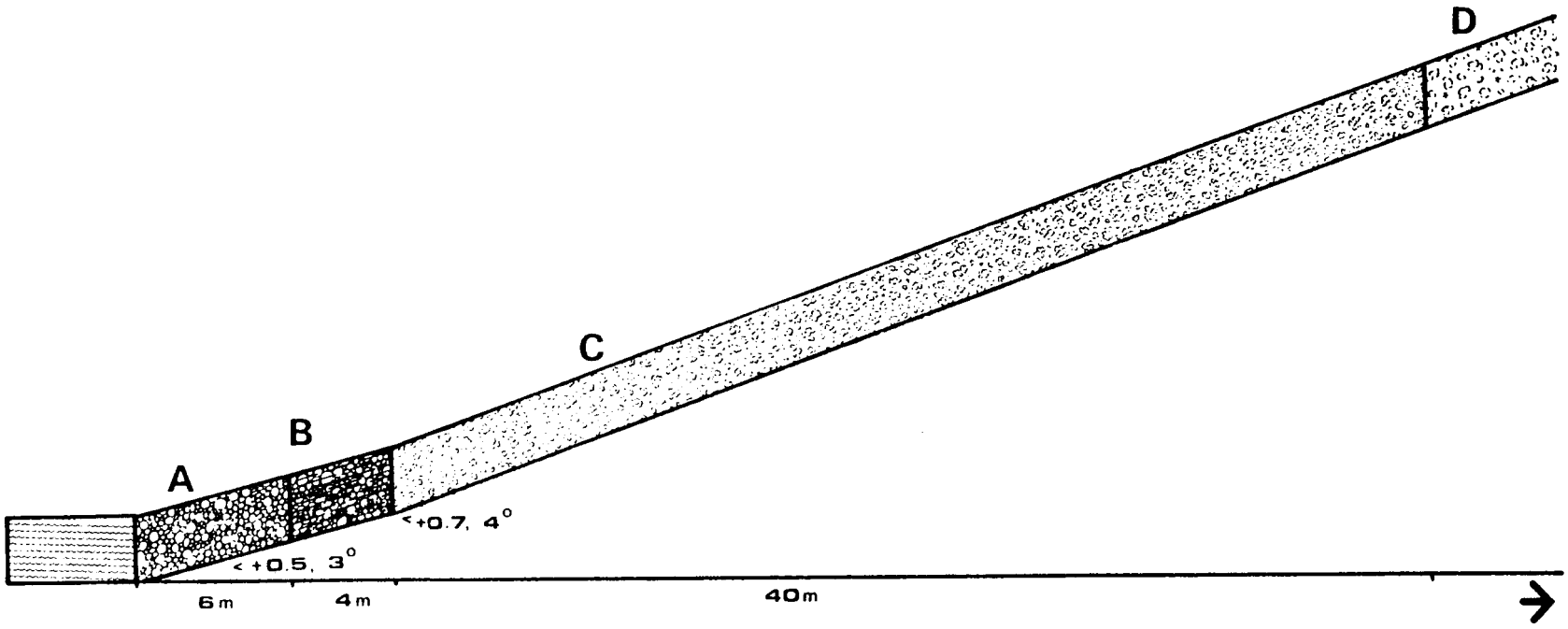


Figure A-5c. Water crossing No. = site 2.

Crossing 6 Mackenzie Lake 62°44'N 95°46'W

Date 05/08/80

Location

Designated water crossing No. 6 (Fig. 4) is the narrows at the south end of Kaminuriak Lake.

A northwest-southeast running esker system bisects the crossing area and runs parallel to the south shore of the Kaminuriak Lake north and west of water crossing No. 6.

Trail Patterns

Trail patterns indicated that most crossing activity occurred at two sites at the north and south ends of the designated area (Fig. A-6a). Trails were difficult to observe in the gravelly central regions of the peninsula east of Site 1.

Site 1 Description

Site 1 (Fig. A-6a) was a narrows between two peninsulas which form the south shore of Kaminuriak Lake.

The eastern shore of Site 1 appeared similar in composition to the western shore.

Site 1 was approximately 35 m wide (Fig. A-6b). Maximum water depth was between 1 and 2 m. There were large riffles present most of the way across Site 1, with large exposed boulders immediately off the west shore.

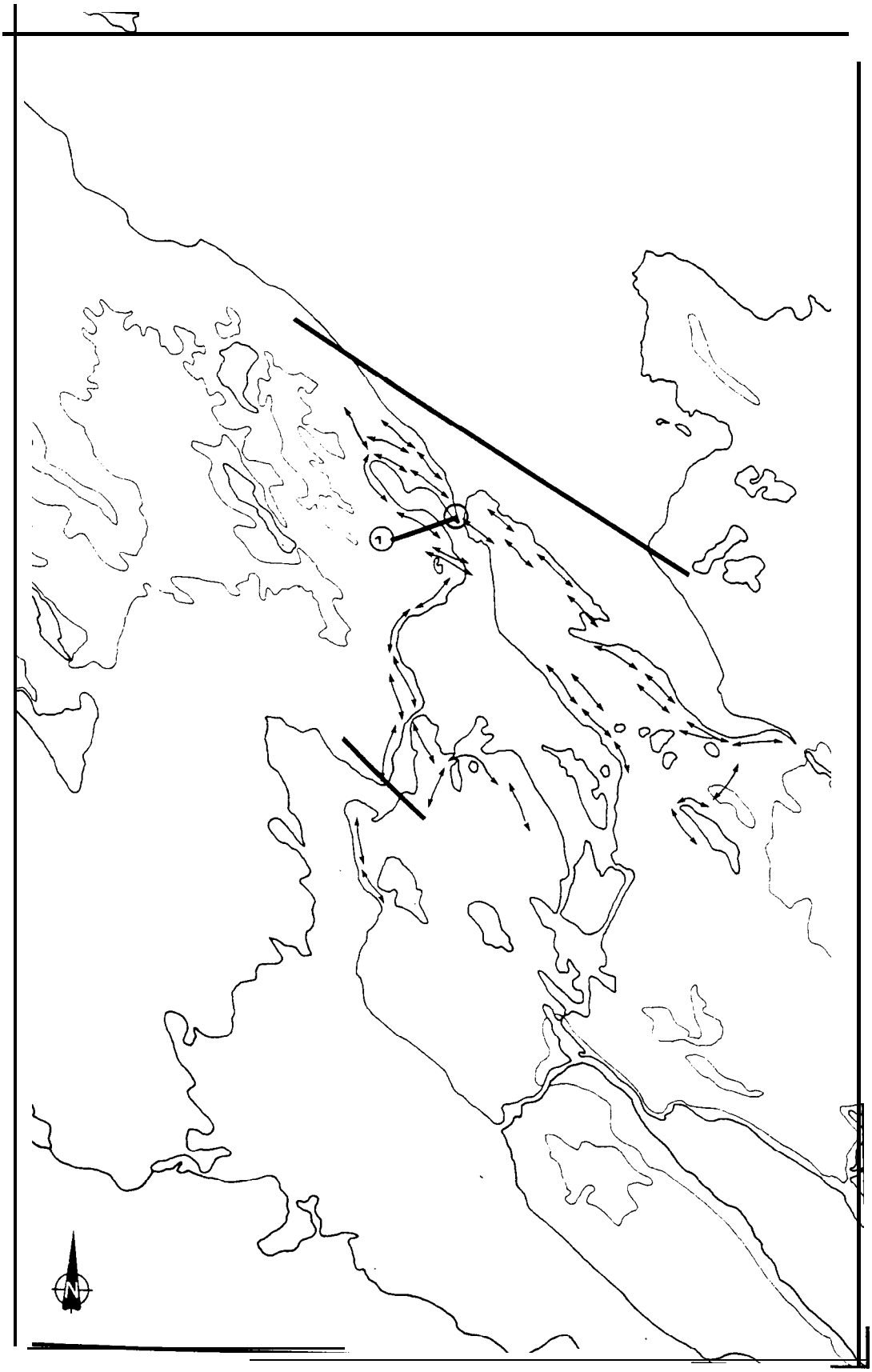
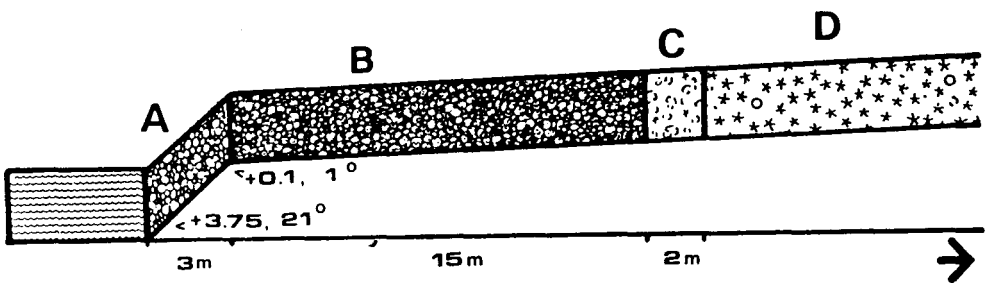


Figure A-6a. Water crossing No. 6.



Horizontal Distance (meters)

Figure A-6b. Water crossing NO. 6, site 1.

The bottom consisted of large boulders, providing difficult footing. Average surface water velocity measured 4 m from shore at a depth of 0.6 m, in 0.9 m of water, was 0.71 m/see.

Caribou Use of Site 1

Signs of caribou activity at Site 1 were numerous with dried caribou pellets scattered throughout Zones B and C. Trails reaching Site 1 from the west were filled with vegetation and did not appear recent.

Crossing 7 West Kaminuriak Lake 62°54'N, 96°16'W

Date 19/07/80

Location

Designated water crossing No. 7 (Fig. 4) is the narrows west of the west arm of Kaminuriak Lake.

Trail Patterns

Trail patterns indicated that the central narrows of water crossing No. 7 has been used extensively in past years. Trails funnel to the central. narrows after coursing the shores on either side (Fig. A-7a). Most trails were deep and vegetation filled, indicating little recent use.

Site 1 Description

Site 1 (Fig. A-7a) was the first set of rapids east of the mouth of the central narrows.

Site 1 was about 55 m wide (Fig. A-7b). Extensive rapids covered most of the site. Large boulders scattered across the stream bed created a varied bottom of shallow (0.3-1.5 m) gravel beds, and deep (5-6 m) pools. Average surface velocity measured 3.2 m from shore, in 0.3 m of water, was 0.45 m/see.

Caribou Use of Site 1

Some trails had torn vegetation, indicating recent use by caribou. Most trails were vegetation filled and did not appear recent.

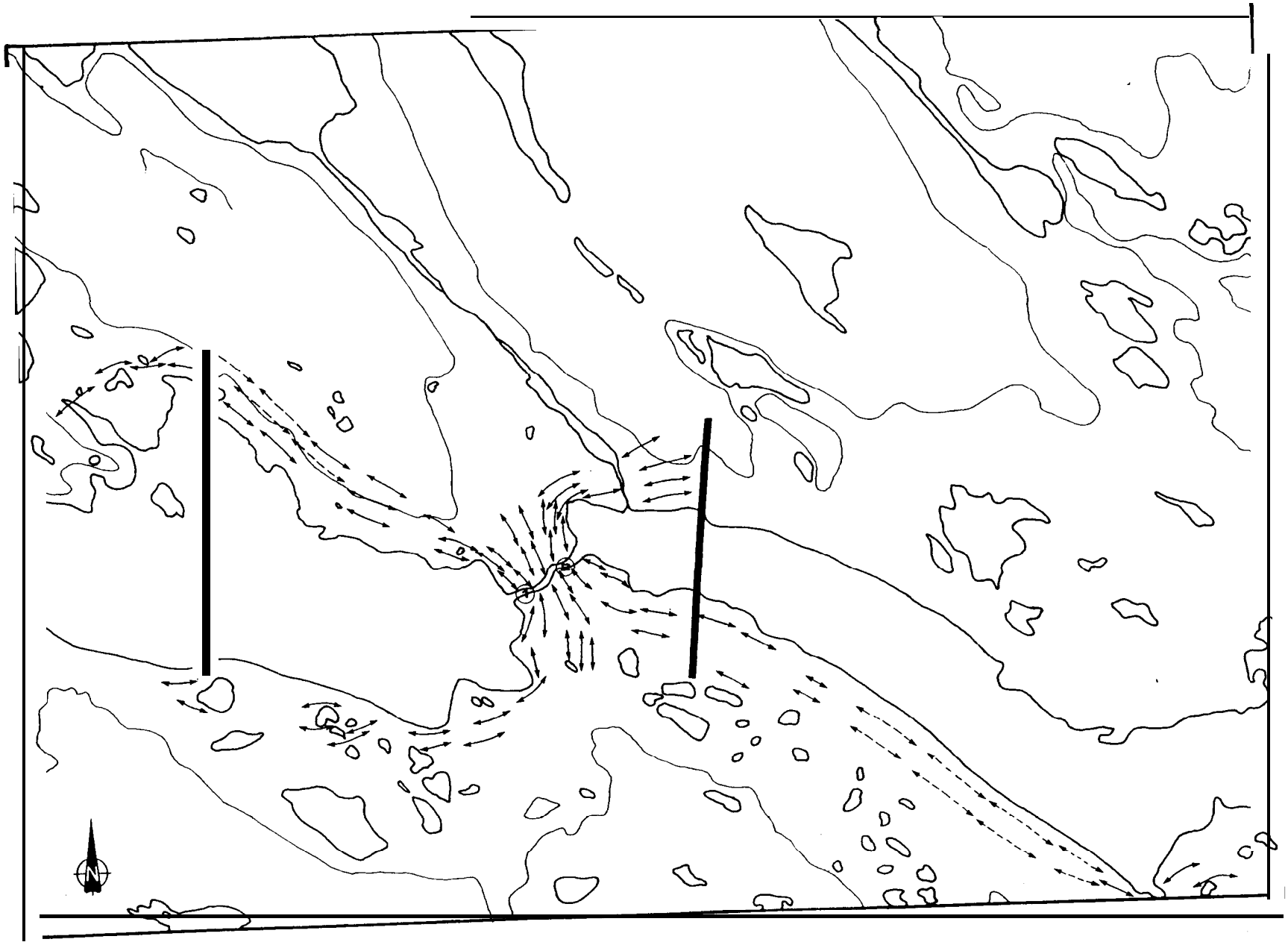
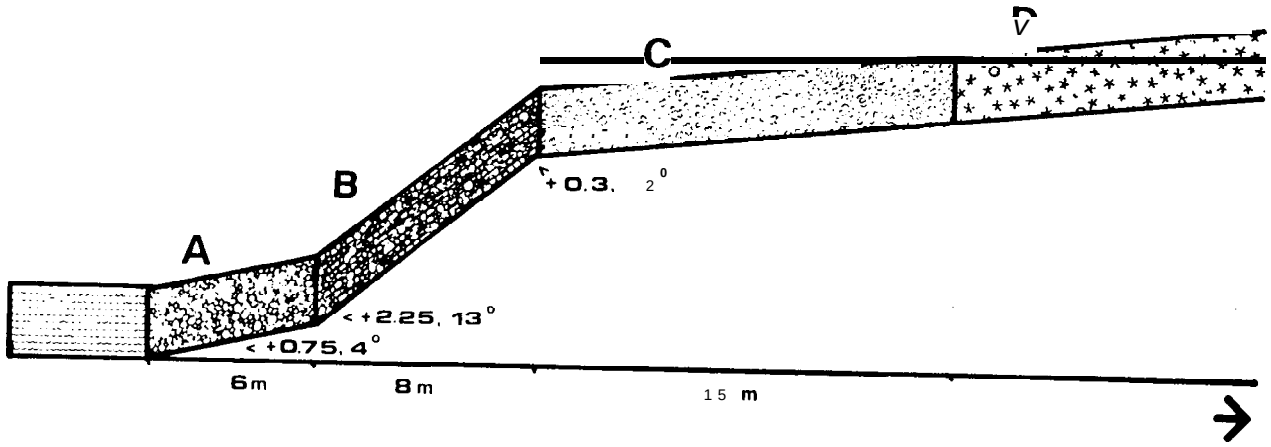


Figure A-7a. Water crossing No. 7.



Horizontal Distance **(meters)**

Figure A-7b. Water crossing No. 7, site 1.

Site 2 Description

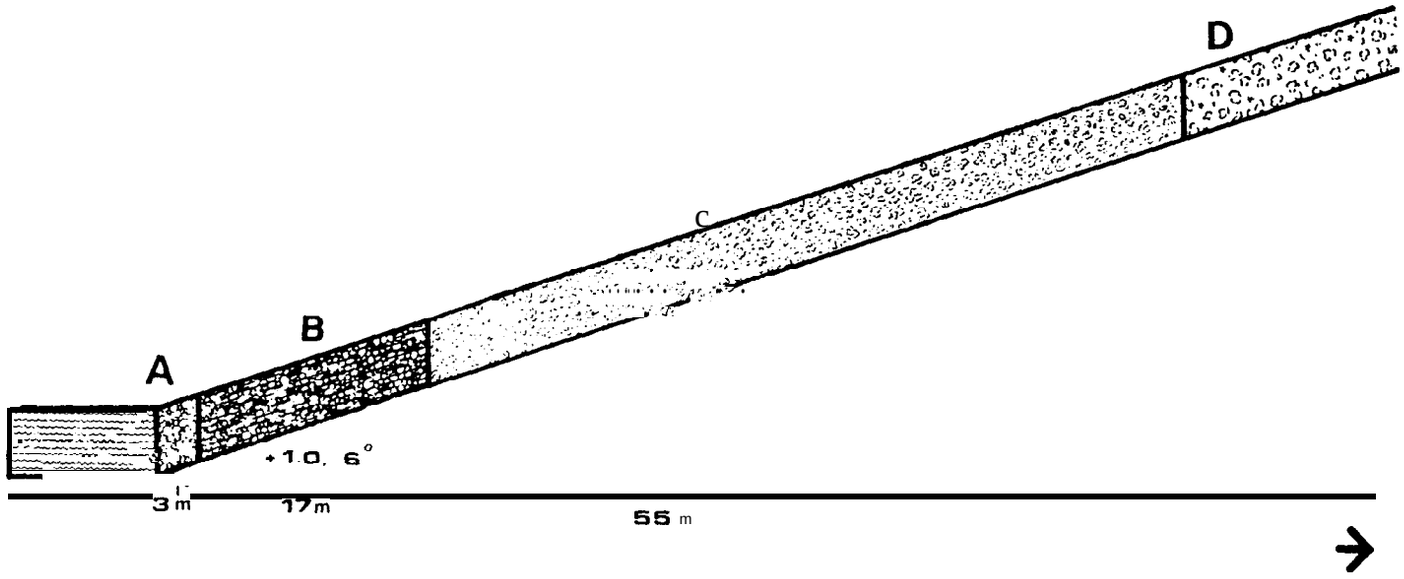
Site 2 (Fig. A-7a) was about 600 m to the east of Site 1.

'The south shore of Site 2 consisted of a moderately sloping sand bank, which levelled off into a dwarf shrub-sedge *or* lichen community. Site 2 was approximately 60 m wide (Fig. A-7c) and shallow (0.3-1 m) except for isolated pools (2-3 m). Average surface water velocity as measured 5.3 m from the shore in 0.6 m of water, was 0.42 m/see.

Caribou Use of Site 2

Signs of recent crossing activity were fresh tracks in muddy areas. Tracks indicated that low numbers of animals had crossed from the north to the south. Caribou hair was on the rocks above the shoreline. The remains of a bull were on the north bank, east of Site 2.

Cracked open caribou leg bones were scattered along the north bank of Zone C.



Horizontal Distance **(meters)**

Figure A-7c. Water crossing No. 7, site 2.

Crossing 8 North Kaminuriak Lake 63°14'N 95°12'W

Date 05/08/80

Location

Designated water crossing No. 8 (Fig. 4) is the northern arm of Kaminuriak Lake. Most of the region consisted of tundra covered, low-relief hills.

Trail Patterns

Trail patterns (Fig. A-8a) indicated that caribou use of the water crossing was in at least 10 regions of crossing No. 8. Most crossings were at the bases of east-west running inlets. Trails coursed the shorelines of crossing No. 8 and crossed peninsulas, narrows and islands. Most small inlets were skirted, or were coursed until a narrows was reached.

Site 1 Description

Site 1 (Fig. A-8a) was a narrows, where a peninsula jutted out from the eastern shore.

The width of the water at Site 1 was approximately 30 m (Fig. A-8b). The bottom consisted of small rocks. Water depth increased gradually. Caribou observed swimming Site 1 walked out approximately 10 m fran shore before swimming. Average surface water velocity as measured 6.7 m from shore at a depth of 0.3 m, in 0.6 m of water, was 0.21 m/see. This velocity may have been affected by wave action.

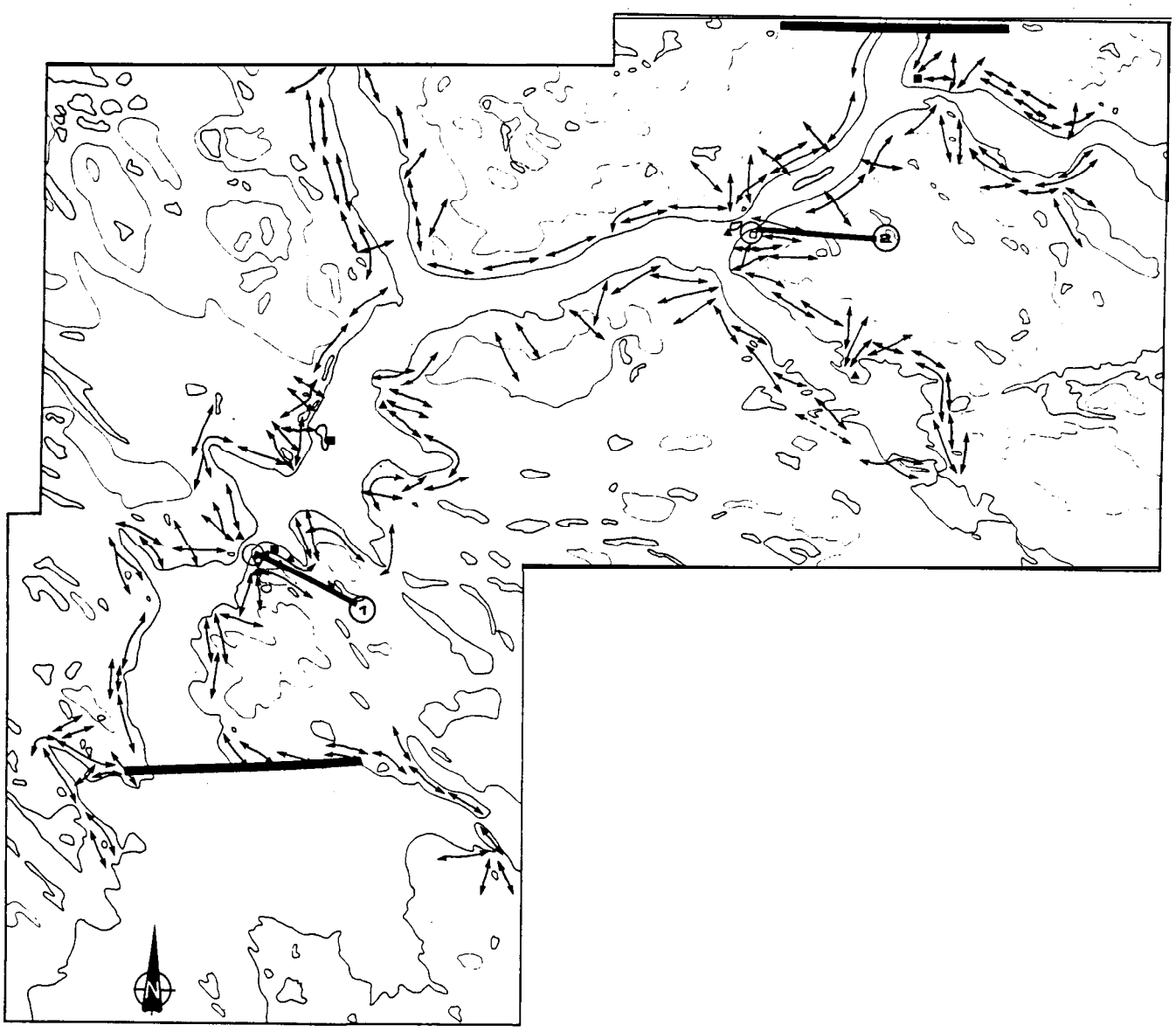
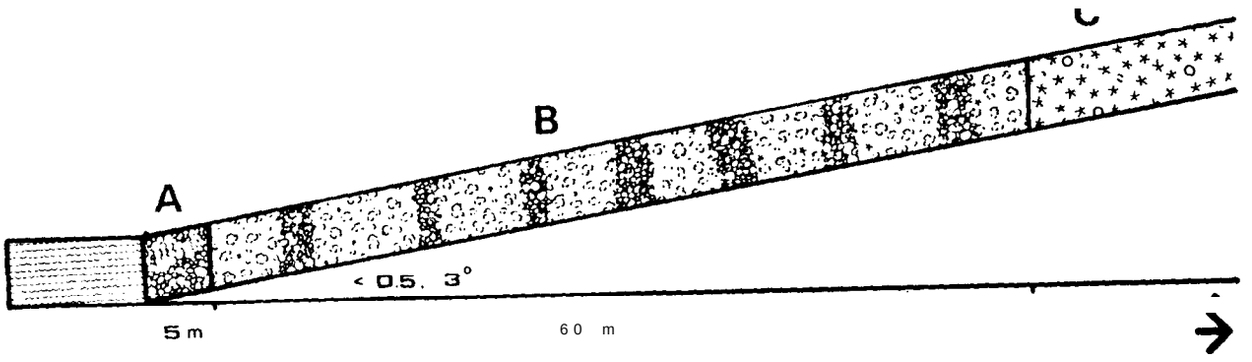


Figure A-8a. Water crossing No. 8.



Horizontal Distance (meters)

Figure A-8b. Water crossing NO. 8, site 1.

Caribou and Human Use of Site 1

Three groups of caribou were observed to cross Site 1 during the 'investigation. Forty animals crossed Site 1 from east to west while the trails were being mapped. Shortly after, five caribou crossed from west to east. While the site was approached on foot, four caribou crossed from the east to the west.

Signs of recent caribou activity included fresh pellets, hair and recent tracks in muddy regions of Zone B.

There was a stone inukshuk on the west shore (north of Site 1), two northeast of Site 1, and one southeast of Site 1. A stone fence angled northwest-southeast from the water's edge back about 50 m. An old Inuit hunting camp was approximately 600 m to the north of Site 1.

Site 2 Description

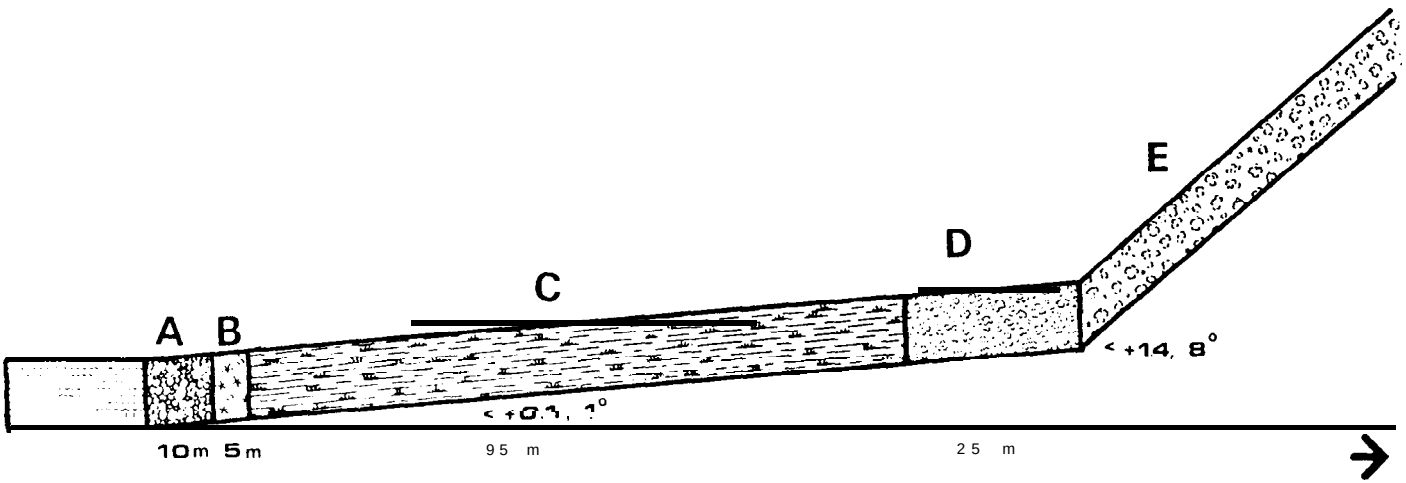
Site 2 (Fig. A-8a) was a narrows where an island divided the water into two roughly equal distances.

Site 2 was approximately 75 m wide (Fig. A-8c) from the shores to the central island. The bottom was composed of medium sized rocks. Water depth increased rapidly, reaching 2 m, 6 m from shore.

Average surface water velocity as measured 6.5 m from the shore in 0.9 m water, was 0.13 m/see. This reading may have been affected by wave action.

Caribou and Human Use of Site 2

Mats of caribou hair and fresh pellets were along the shoreline. Recent caribou tracks were in Zone E.



Horizontal Distance (meters)

Figure A-8c. Water crossing No. 8, site 2.

An inukshuk was located on ‘the southern portion of the central island, and a hunting blind was situated about 5 m off the beach.

Crossing 9 Kazan Falls 63°44'N, 95°50'W

Date 28/07/80

Location

Designated water crossing No. 9 (Fig. 4) is the Kazan River, the Kazan Falls and a series of rapids above the falls.

Trail Patterns

Trails (Fig. A-9a) were deeply worn, and vegetation filled, appearing faint from the air. Trail patterns indicated that use of the crossing was at rapids about 1.5 km above the falls. Most trails coursed the western shore of the river and did not cross the rapids or the falls.

Site 1 Description

Site 1 (Fig. A-9a) was approximately 1.5 km above Kazan Falls. The width of water at Site 1 was approximately 250 m (Fig. A-9b). The bottom was composed of algae covered rocks. The water depth was between 0.3-1 m. Numerous small islands and large exposed rocks were in the middle of the site.

Average surface water velocity as measured 2 m from the shore at a depth of 0.6 m, in 1 m of water, was 0.82 m/see. Surface velocity estimated by timing a stick's descent over a fixed distance was 0.83 m/see.

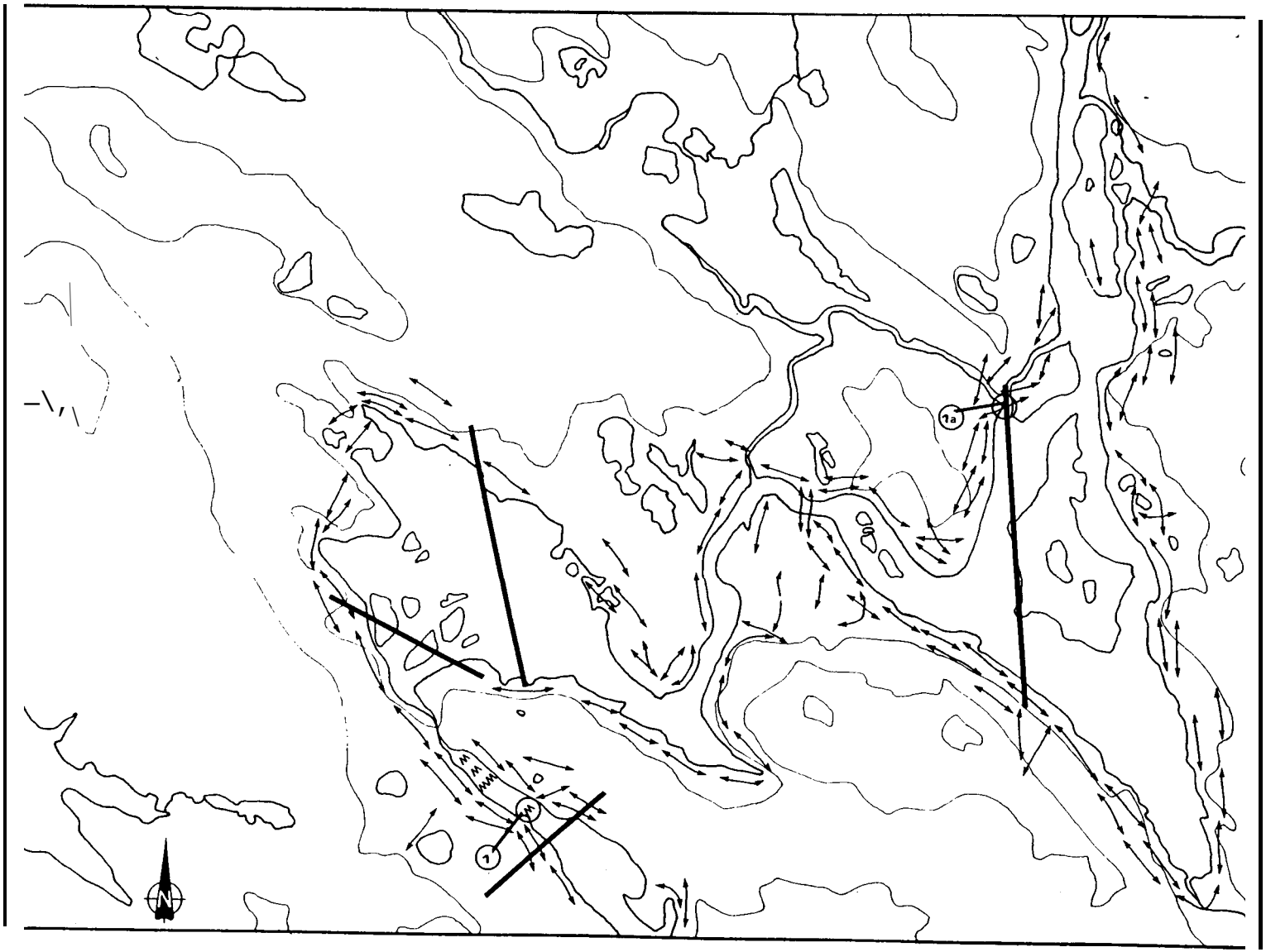
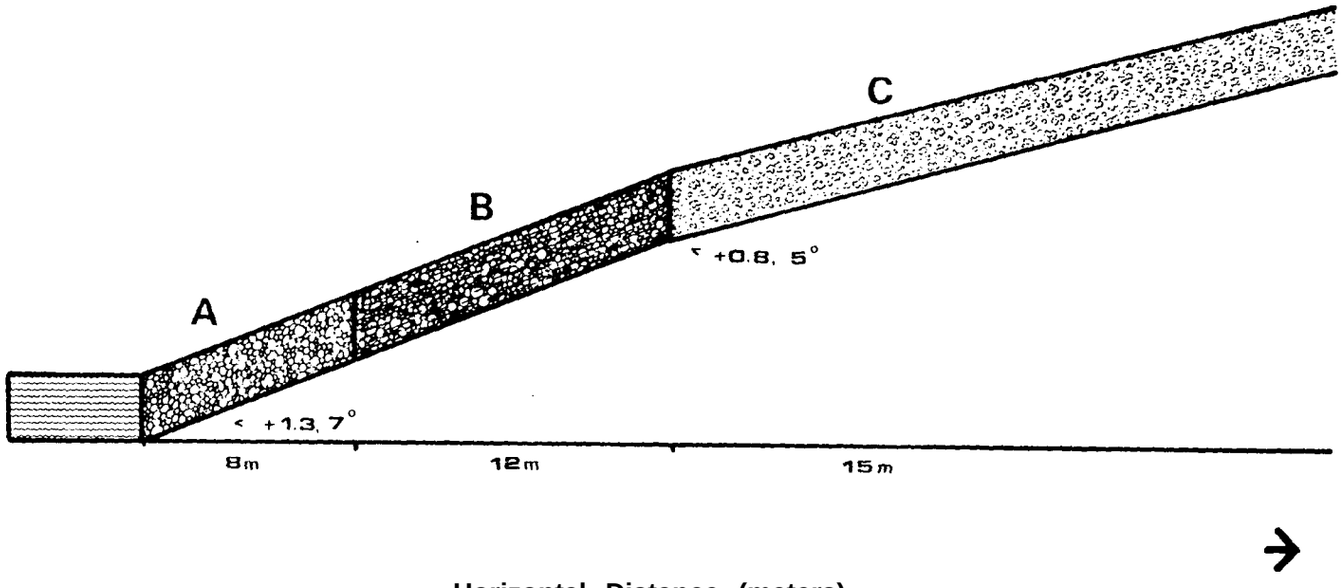


Figure A-9a. Water crossing No. 9 and 9a.



Horizontal Distance (meters)

Figure A-9b. Water crossing No. 9 and 9a, site 1.

Crossing 9a Below Kazan Falls 63°44'N 95°50'W

Date 28/07/80

Location

Designated water crossing No. 9 (9a) (Fig. 4) is the Kazan River below the Kazan Falls.

Trail Patterns

Most trails coursed the eastern shore of Kazan River around the large bend and crossed the river at two point (Fig. A-9a). Those trails were heavily worn but did not appear recent.

Site 1 Description

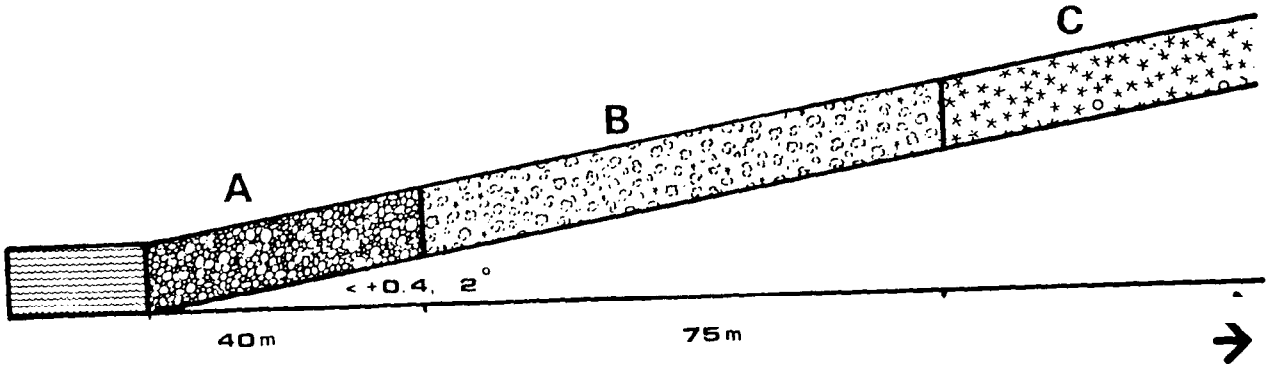
Site 1 (Fig. A-9a) was at the eastern boundary. Deep trails crossed eastwards to a large island in the middle of the river and to a smaller island to the south. The trails were filled with vegetation and did not appear recent.

The distance to the large island immediately offshore was approximately 200 m (Fig. A-9c). The distance from the island to the eastern shore was about 250 m. The bottom composed of small rocks and sand. Water depth increased gradually to 1 m, 5 m from shore.

Average surface water velocity measured 5 m from the shore at a depth of 0.6 m, in 1 m of water, was 0.52 m/see.

Caribou Use of Site 1

Caribou hair formed a scum line about 1 m from the water's edge.



Horizontal Distance (meters)

Figure A-9c. Water crossing No. 9 and 9a, site 2.

Crossina 10 Kazan River above the Falls 63°40'N, 95°53'W

Date 28/07/80

Location

Designated water crossing No. 10 (Fig. 4) is the Kazan River east of Thirty Mile Lake.

Trail Patterns

Trail patterns (Fig. A-10a) were faint and did not appear recent. One crossing site within the designated area may have been extensively used in the past. Recent trails were at the first narrows east of the designated crossing area.

Site1 Description

Site 1 (Fig. A-10a) was the first narrows east of the designated area. The north bank of Site 1 was a steeply rising bank of gravel and sand.

Site 1 was approximately 350 m wide (Fig. A-10b). The bottom consisted of small pebbles and sand, providing good footing. The water appeared to be shallow most of the way across Site 1. The average water velocity measured a distance 9 m from shore at 0.6 m, in 1.0 m of water, was 0.12 m/see. Water in the middle of the crossing appeared to be rapidly flowing.

Caribou and Human Use of Site 1

Dried pellets were scattered throughout the upper portion of Zone A and lower portion of Zone B. Large amounts of human refuse

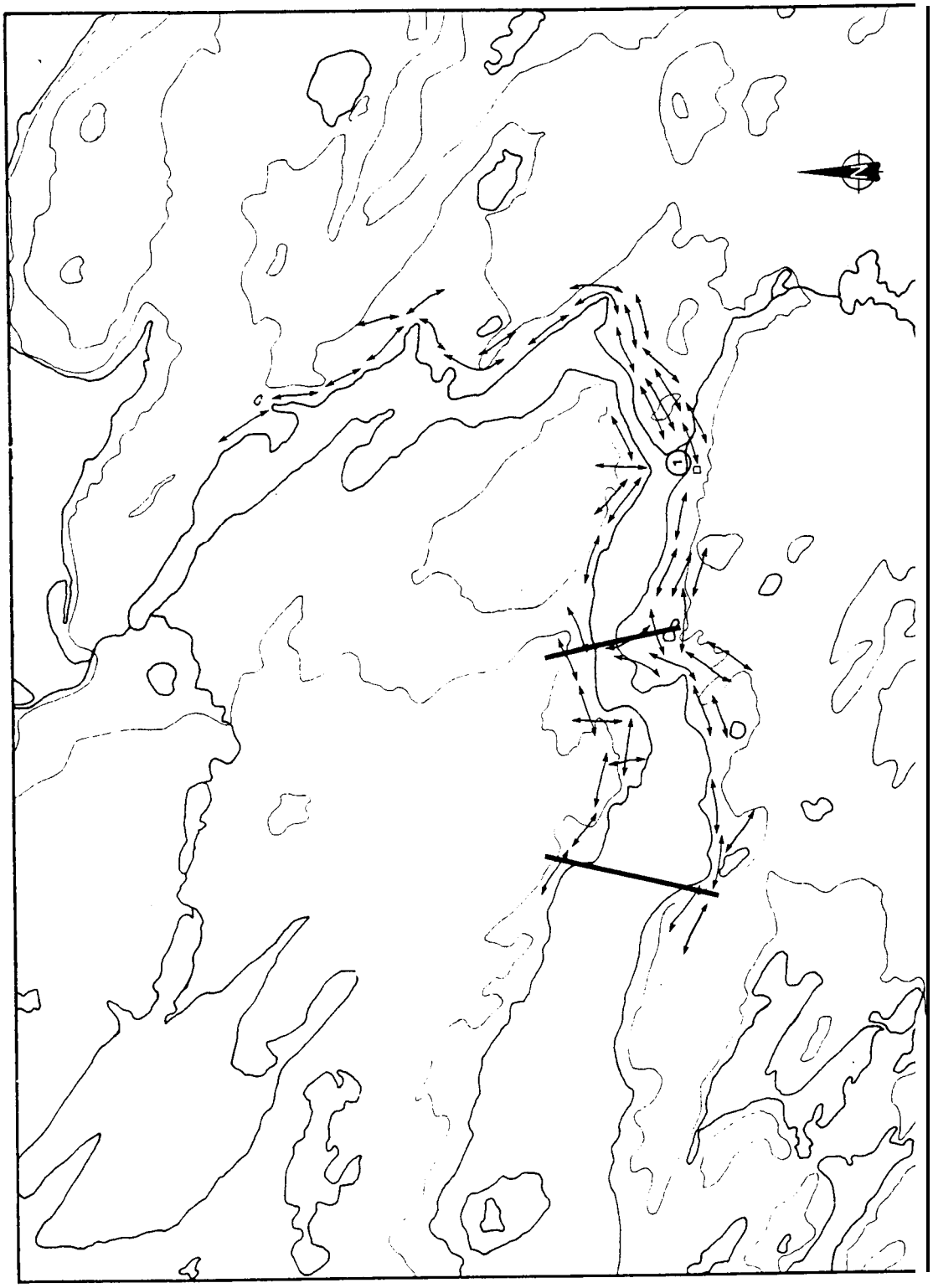


Figure A-10a. Water crossing No. 10.

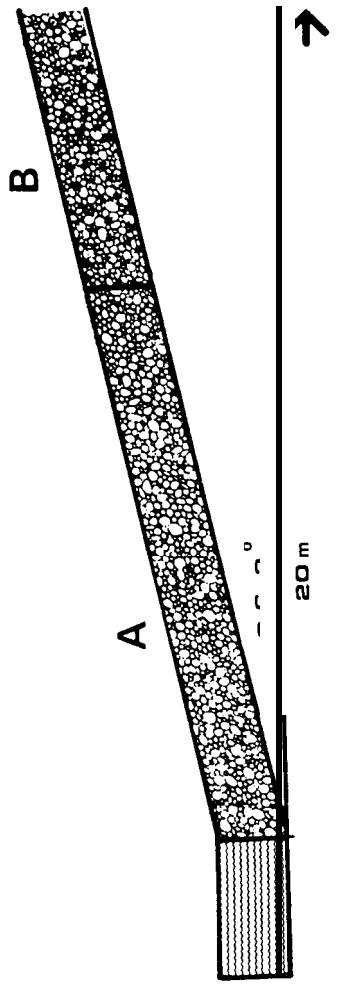


Figure A-10b. Water crossing No. 10, site 1.

and abandoned meat cache were 100 m south of Site 1. A large pile of broken caribou bones, which covered an area of about 40 m^2, was approximately 250 m from the south shore. Most bones were old and contained lichen growth.

Crossing 11 Thirty Mile Lake Area 63°39'N, 96°06'W

Date 28/07/80

Location

Designated water crossing No. 11 (Fig. 4) is the eastern end of Thirty Mile Lake. This crossing was anitted fran the 1980 DIAND Caribou Protection Map.

Trail Patterns

Trail patterns were readily observed from the air. Most trails (Fig. A-ha) paralleled the shores of the river and indicated one main crossing point.

Site 1 Description

Site 1 (Fig. A-ha) was a peninsula which formed the eastern limit of Thirty Mile Lake. Trail wear indicated that animals moved along the shores of the Kazan River, down the length of the peninsula, and crossed southwards fran the southern tip of the peninsula.

The shore southwest of Site 1 was composed of exposed rocks followed by an approximate 25 m zone of sand and a dwarf shrub-sedge community.

Site 1 was approximately 550 m wide (Fig. A-11b). The bottom composed of small rocks and sand. Water depth increased to 15 cm, 2 m from shore. The water appeared shallow (1-3 cm) most of the

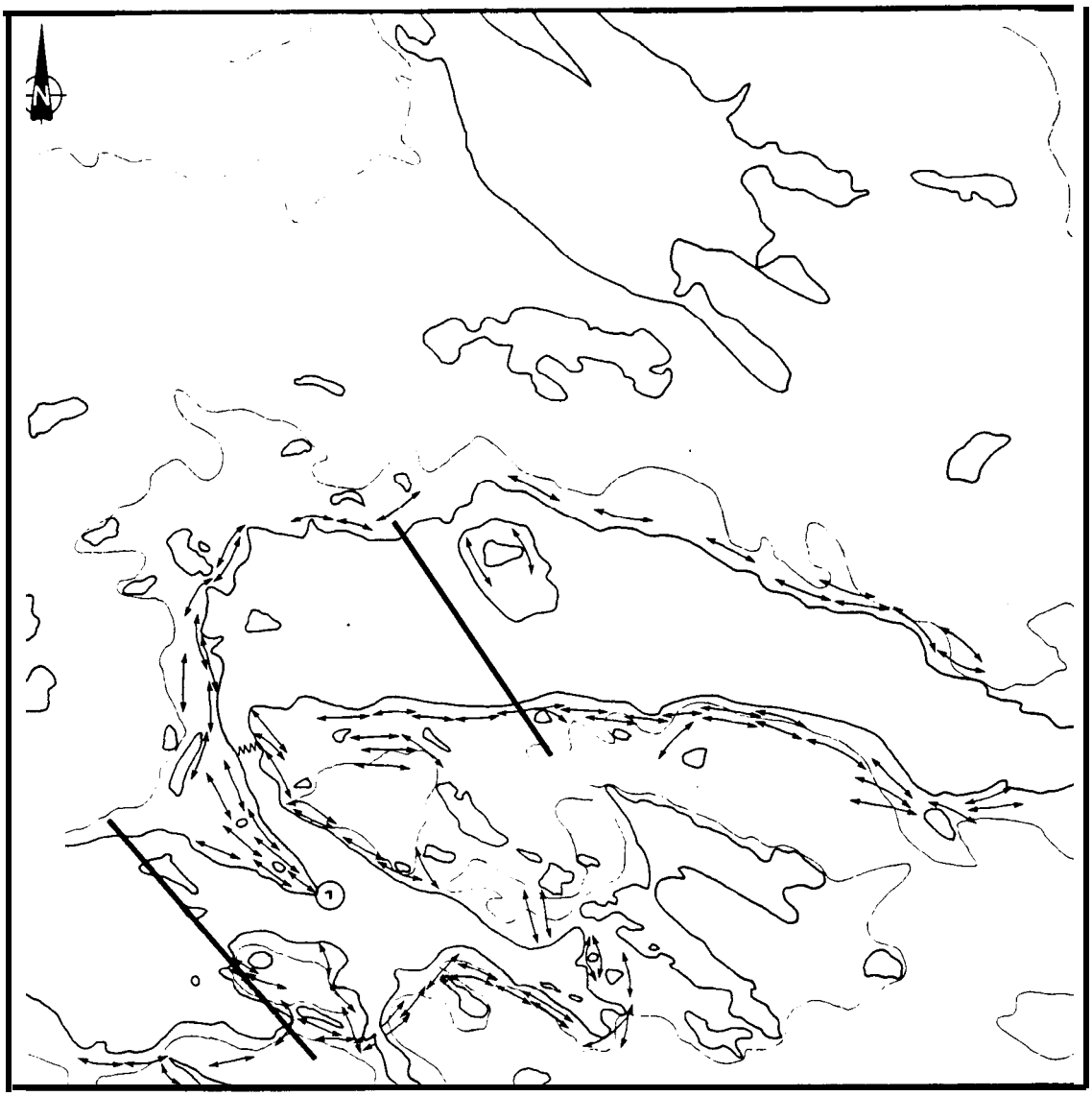


Figure A-ha. Water crossing No. 11.

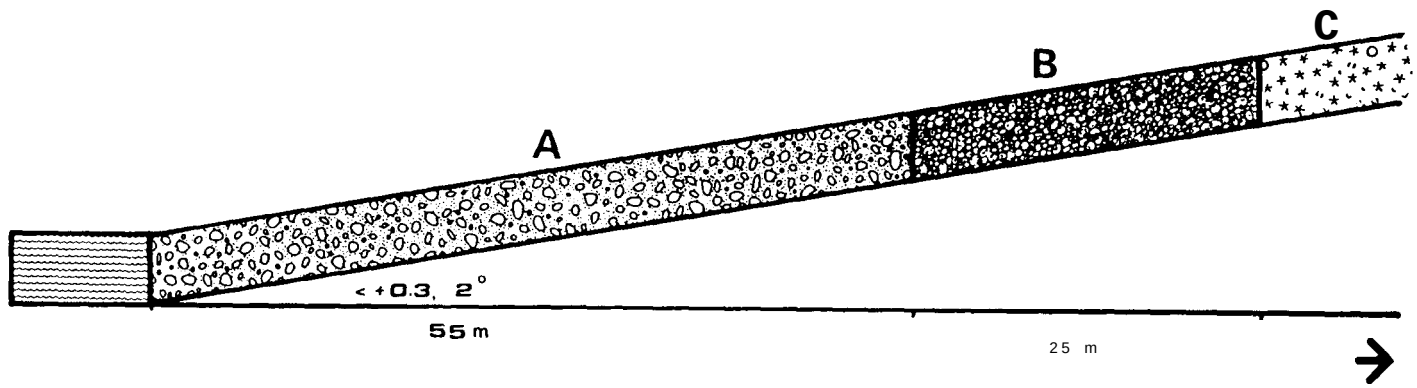


Figure A-11b. Water crossing No. 11, site 1.

way across Site 1. Average surface water velocity as measured 10 m from shore at a depth of 0.6 m, in 0.8 m of water, was 0.09 m/see.

Caribou and Human Use of Site 1

Trails leading to Site 1 were filled with intact vegetation. Many old caribou pellets were in Zone B. Caribou hair was washed up above the waterline.

Split open bones were in the upper regions of Zone A.

Crossing 13 Thelon River 64°47'N 96°56'W

Date *12/08/80*

Location

Designated water crossing No. 13 (Fig. 3) is the extreme eastern end of Schultz Lake, and includes the narrow stretch of Thelon River flowing out of Schultz Lake.

Exposed rock hills to the north and south of water crossing No. 13 limited the visibility of caribou trails.

Trail Patterns

Most trails paralleled the Thelon River for about 600 m back from both shores. Trail patterns (Fig. A-13a) indicated that there were three main areas used by caribou to cross.

Site 1 Description

Site 1 (Fig. A-13a) was located at the major crossing point. The site was the south end of a north-south running square-ended peninsula forming the eastern boundary of water crossing No. 13.

The south shore of Site 1 was composed of about 10 m of moderately sloping gravel and sand beach, a 5 m zone of willows covering a steep bank, and a flat lichen-heath community for approximately 2 km from the site.

The water at Site 1 was approximately 250 m in width (Fig. A-13b). The surface was covered with riffles. A large series of rapids were present to the east and west of the crossing site.

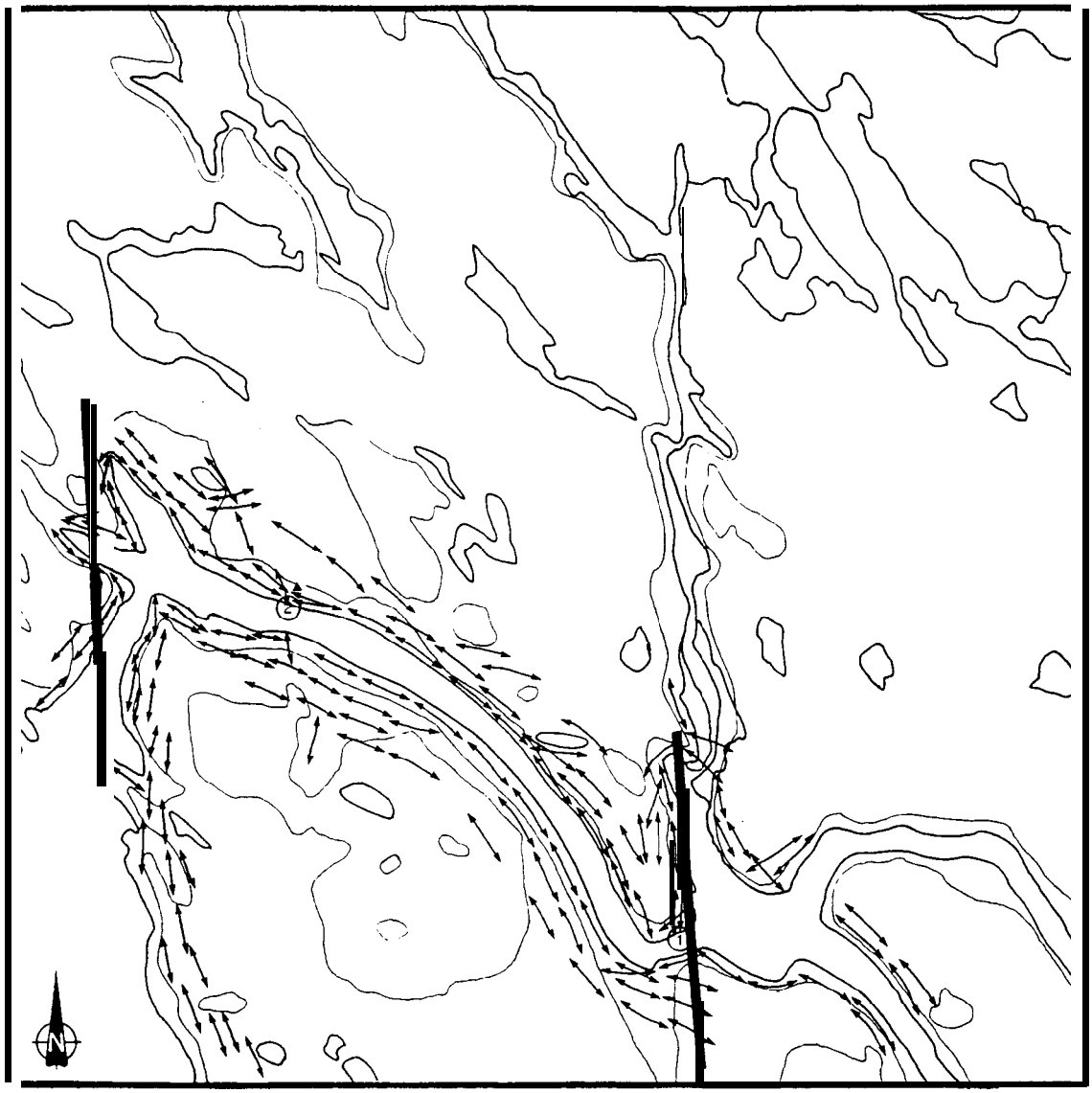


Figure A-13a. Water crossing No. 13.

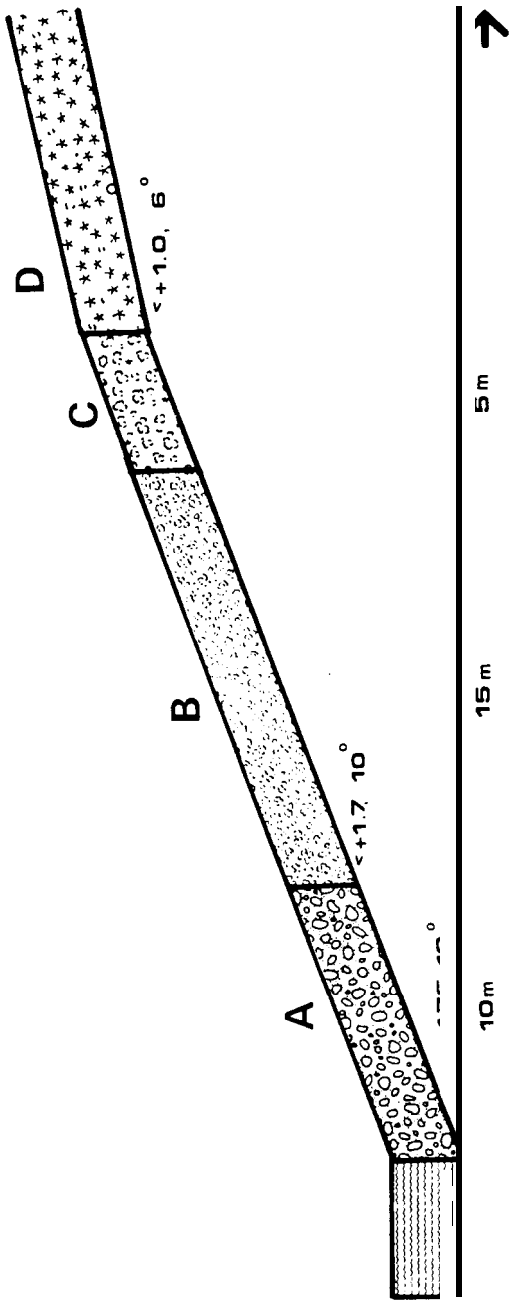


Figure A-13b. Water crossing No. 13, site 1.

The bottom consisted of large algae-covered rocks and sand patches. Water depth increased rapidly, reaching 2 m, 4 m from shore.

Average surface water velocity as measured 2 m from shore at a depth of 0.3 m, in 1 m of water, was negligible. Water in the middle of the channel was flowing rapidly.

Caribou and Human Use of Site 1

Most caribou trails approaching Site 1 were vegetation filled. Some trails may have been recent, as vegetation was torn and faint tracks evident.

Rock piles on top of a cliff southeast of Site 1 may have been inukshuks.

Site 2 Description

Site 2 (Fig. A-13a) was a point of land jutting out of the north shoreline. Most trail patterns paralleled the north and south shores.

The south shore of Site 2 consisted of a gradually sloping sand beach (approximately 10 m wide) followed by similar vegetation zones to the north shore.

The crossing width was approximately 300 m (Fig. A-13c). The bottom was composed of large algae-covered rocks. Water depth increased rapidly so that the bottom could no longer be seen 5 m from shore.

Average surface water velocity as measured a distance 2 m from shore at a depth of 0.6 m in 1 m of water was 0.12 m/see.

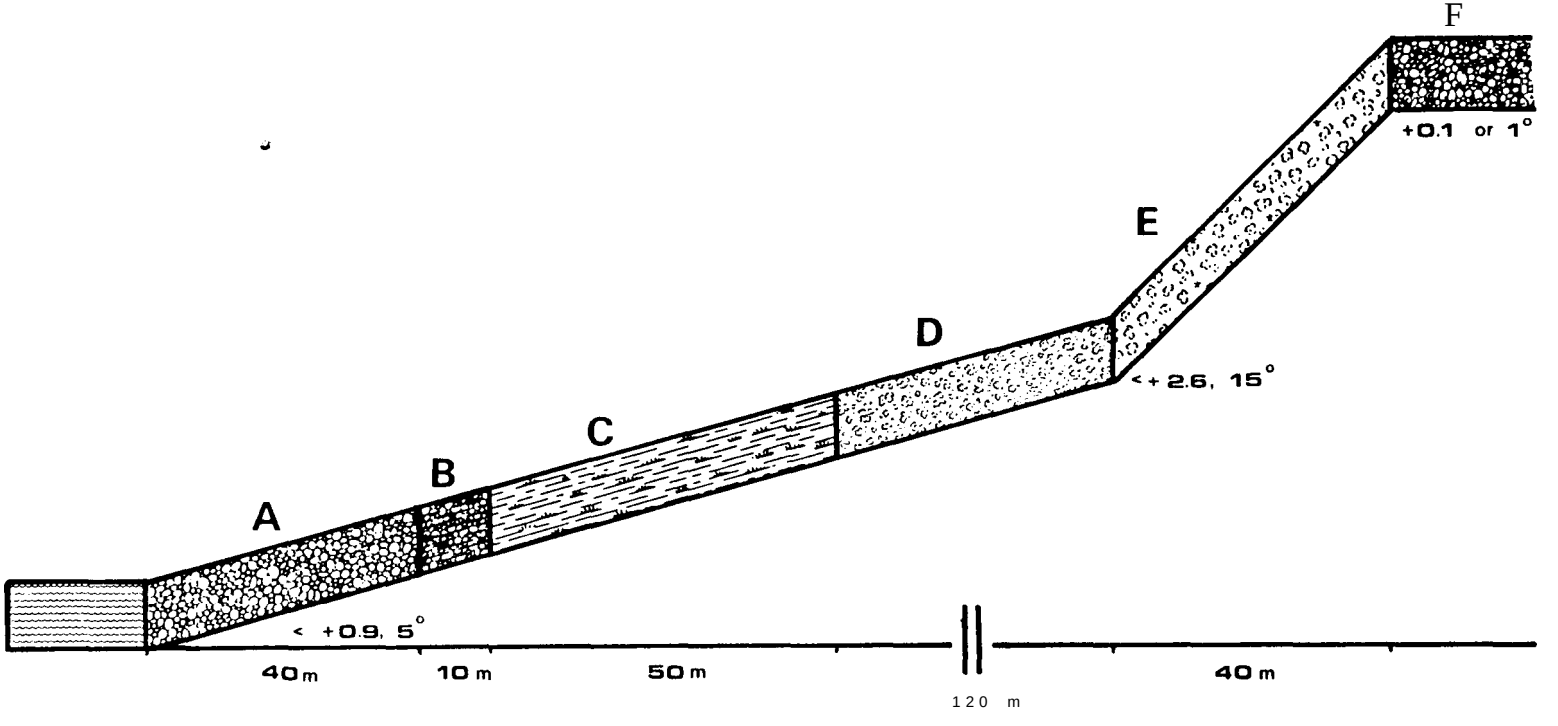


Figure A-13c. Water crossing No. 13, site 2.

Caribou and Human Use of Site 2

Most caribou trails paralleled the river. Tracks indicated that. small numbers of caribou had recently crossed from north to south . A series of inukshuks were in Zone F approximately 300 m north of Site 2. Broken open bones were scattered throughout Zone D.

Crossing 14 East Schultz Lake 64°04'N, 97°10'W

Date 12/08/80

Location

Designated water crossing No. 14 (Fig. 3) is the narrows caused by a large peninsula jutting out of the north shore near the east end of Schultz Lake. It includes the northern half of an inlet that penetrates the southern shore of Schultz Lake.

The north shore of water crossing No. 14 contained large areas of exposed rock which reduced the visibility of some trails.

Trail Patterns

Trail patterns indicated that most crossing activity occurred at three sites. Most trails on the north shore were faint. Some trails running north-south along the eastern shore of the peninsula appeared dark and recent.

Site 1 Description

Site 1 (Fig. A-14a) was the narrowest part of the inlet (240 m). With the low water levels, the shores were separated by a short distance of exposed rocks. Trails funnelled to the site after paralleling the south shore of Schultz Lake and/or north along the eastern shore of the inlet.

The eastern shore had communities similar to the west shore extending to low relief hills approximately 1.5 km to the east (Fig. A-14b).

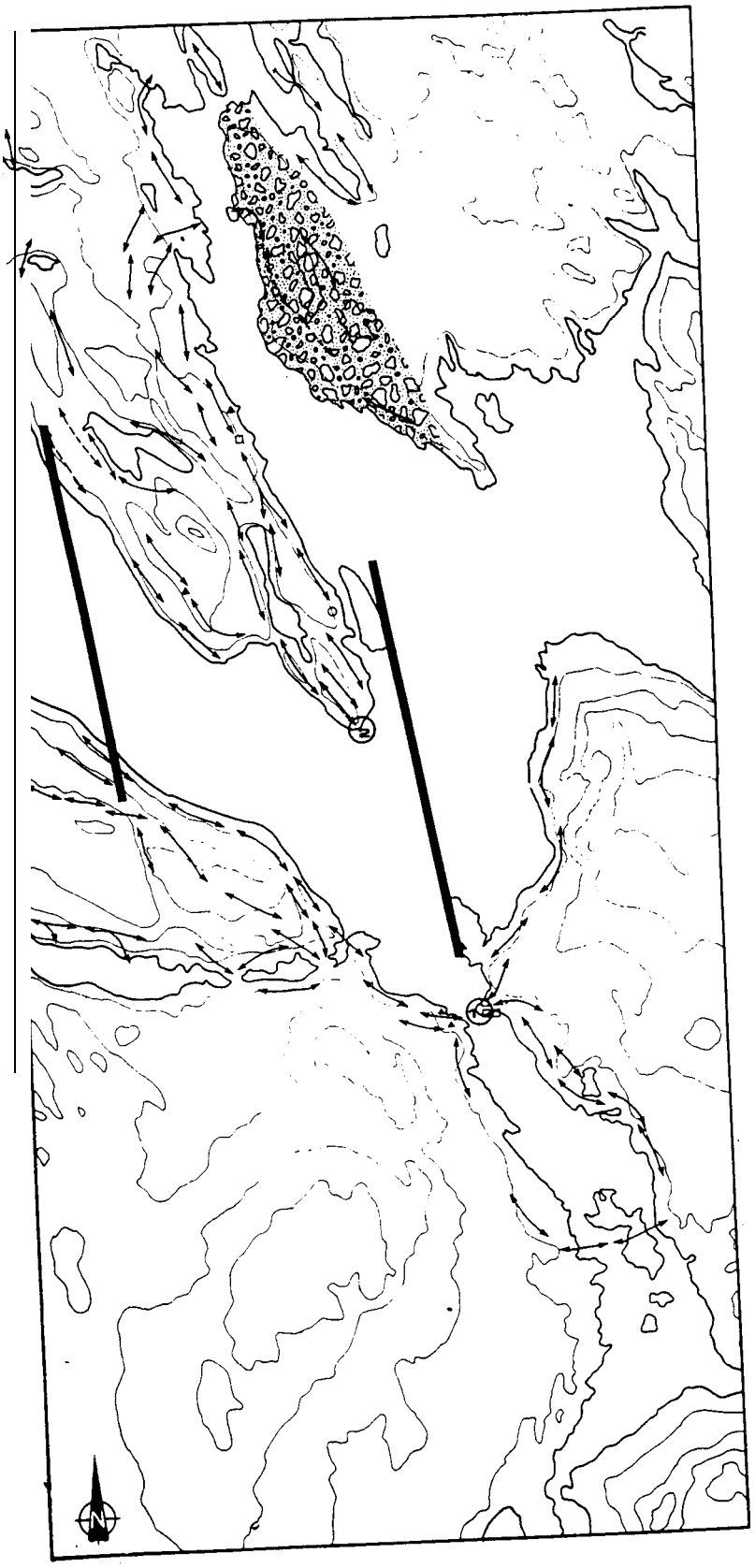
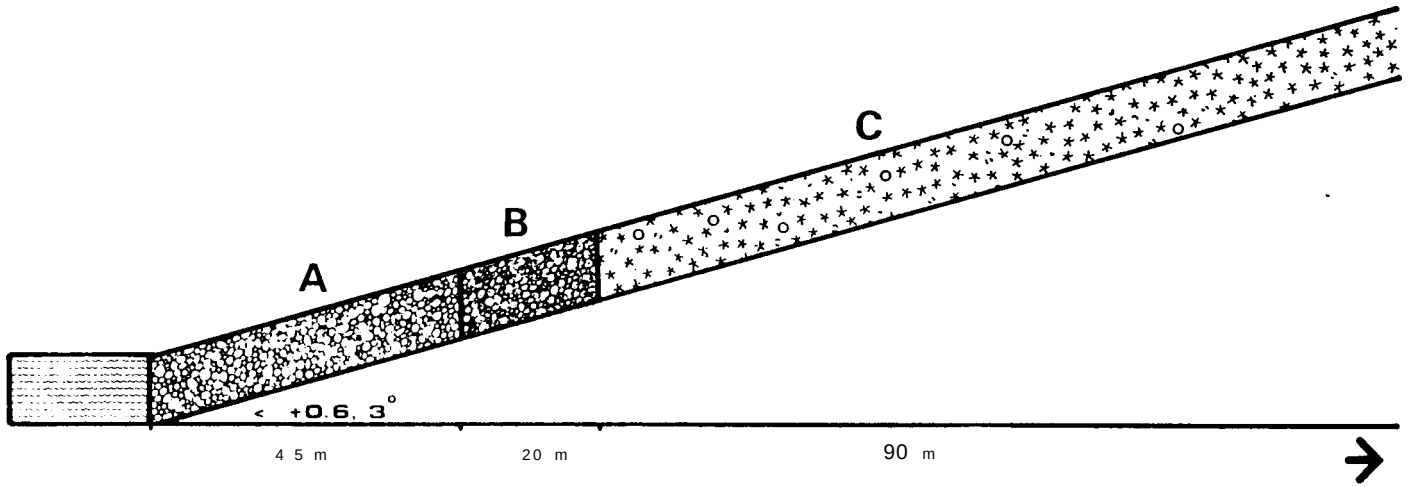


Figure A-14a. Water crossing No. 14.



Horizontal Distance (meters)

Figure A-14b. Water crossing No. 14, site 1.

The water was reduced to a narrow, shallow (0.3 m) stream. Water flow was estimated by timing a stick's descent at 0.5 m/see. The bottom and beaches consisted of large algae-covered rocks, providing treacherous footing.

Car ibou and Human Use of Site 1

Small amounts of caribou hair were washed up on the beach about 30 m from the water's edge.

Numerous caribou racks and split-open bones were scattered throughout Zone C. Most bones had extensive lichen growth. One inukshuk was located to the northeast, and two inukshuks were immediately to the west of the crossing site.

An ice push-up running along the. southern shore of the eastern peninsula (to about 15 m from the current water's edge) had a series of hunting blinds along its north side. Scattered broken bones were along the push-ups. Most of the bones were old and lichen encrusted. Brass pots were found near the push-ups. Old hunting blinds (or meat caches) were along the north shore of the eastern peninsula.

Site 2 Description

Site 2 (Fig. A-14a) was the tip of a north-south running peninsula extending from the north shore of Schultz Lake.

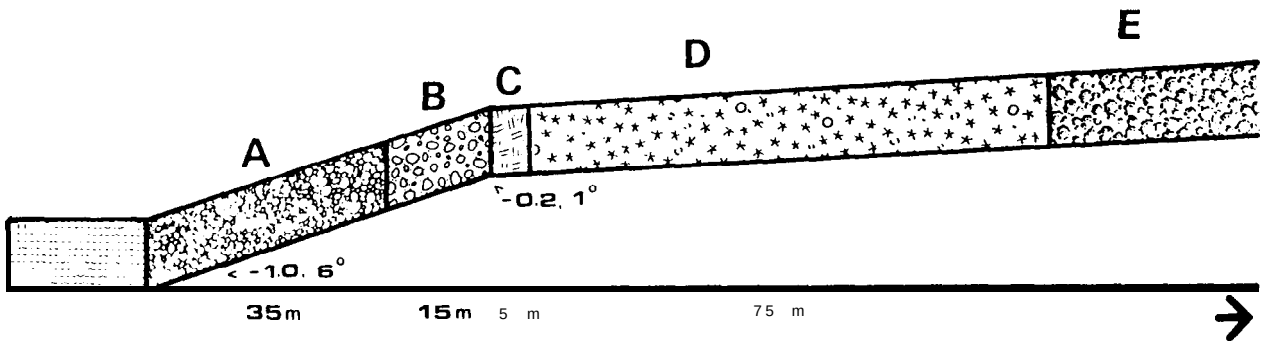
Trail patterns at Site 2 indicated that animals moved south along the peninsula and crossed to the south shore in a south-westerly direction.

The bottom consisted of medium sized flat rocks. Water depth increased gradually, reaching a depth of 0.6 m, 20 m offshore. The distance across Site 2 was about 2.5 km (Fig. A-14c).

Surface water velocity as measured a distance 5 m from shore, was negligible.

Human and Caribou Use of Site 2

Lichen free bones were scattered in the upper portions of Zone A. An inukshuk and a large hunting blind (or meat cache) were on the eastern shore of the peninsula about 6.5 km north of Site 2. The remains of tent foundations were about 2.5 km north of Site 2 on the eastern shore. A single large inukshuk was about 600 m inland from the west shore of the peninsula about 4.5 km north of Site 2.



Horizontal Distance (meters)

Figure A-14c. Water crossing No. 14, site 2.

Crossing 15 West Schultz Lake 64°42' N, 97°54'W

Date 08/08/80

Location

Designated water crossing No. 15 (Fig. 3) is the narrows at the western end of Schultz Lake.

Much of the southern peninsula consisted of exposed rock and gravel which reduced the visibility of trails.

Trail Patterns

Trail patterns indicated that most caribou use of the water crossing was at two sites (Fig. A-15a). Most trails were faint. Sane single trails through tussock tundra regions west of the designated crossing area appeared darker and may have been recent.

Site 1 Description

Site 1 (Fig. A-15a) was a small peninsula jutting out from the north shore. The distance across Site 1 was approximately 600 m.

The south shore opposite Site 1 was composed of gradually sloping sand beaches which levelled into a lichen-heath community (Fig. A-15b).

The bottom immediately offshore was composed of gravel. Water depth increased to 2 m, a distance of 7 m from shore.

Average surface water velocity immediately offshore was negligible. Sane water turbulence was noted 20 m from the shore.

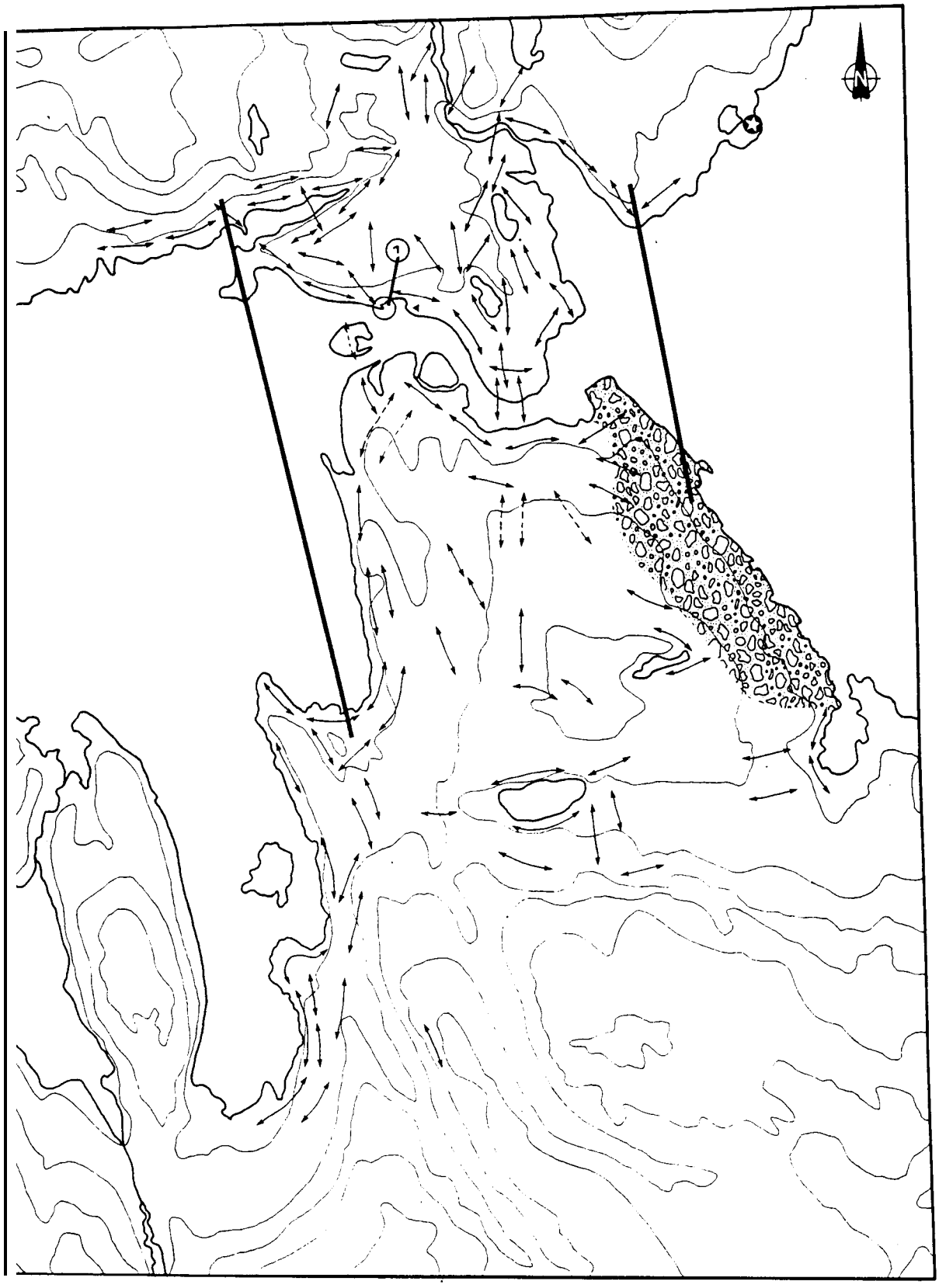


Figure A-15a. Water crossing NO. 15.

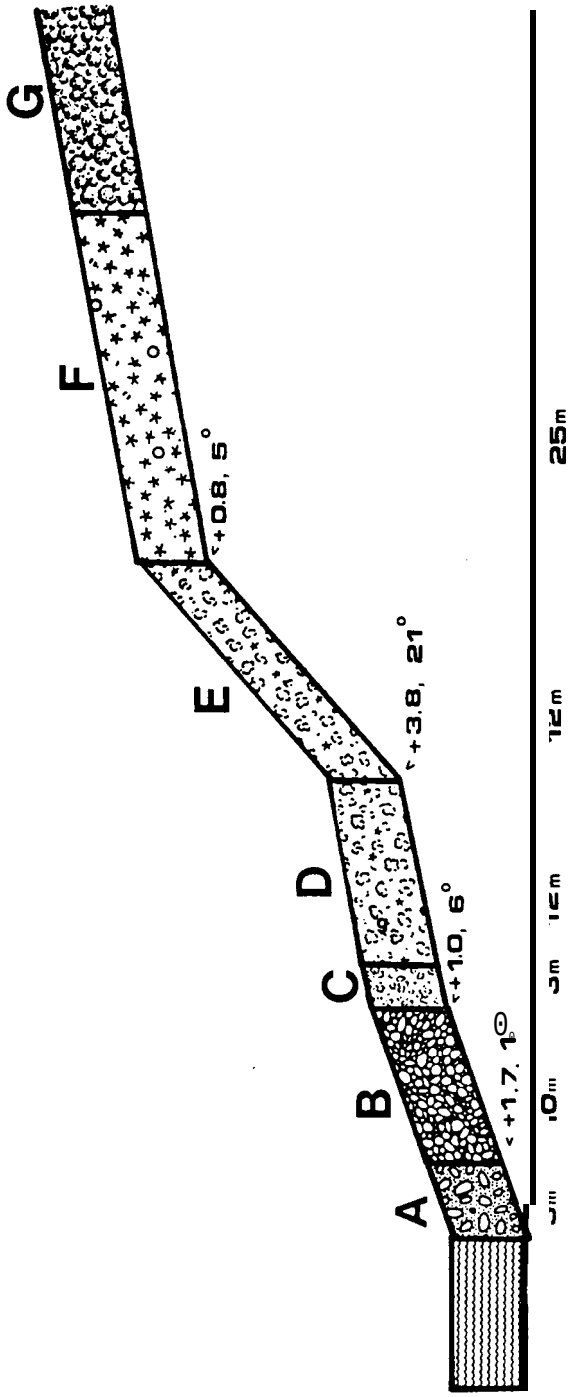


Figure A-15b. Water crossing No. 1도 site 1.

Caribou and Human Use of Site 1

Numerous lichen encrusted bones were scattered about Zones C and F.

Crossing 16 West Qamanaarjuk Lake 64°42'N, 98°07'W

Date 08/08/80

Location

Designated water crossing No. 16 (Fig. 3) is the narrows caused by peninsulas jutting out of the north and south shores of Qamanaarjuk Lake. Large regions of the southern peninsula were exposed rock hills which reduced the visibility of some trails.

Trail Patterns

Trail patterns (Fig. A-16a) indicated that caribou use most of the water crossing was at one site. Some trails were white and deeply worn, indicating heavy past usage.

Site 1 Description

Site 1 (Fig. A-16a) was the southern tip of the large peninsula jutting out from the north shore. Most trails funneled to this site after paralleling the northern shoreline.

The distance to the southern shore was approximately 720 m (Fig A-16b). The bottom was composed of small flat stones and sand, providing good footing. Water depth increased rapidly. The water appeared deep blue about 6 m from shore. Average surface water velocity was negligible.

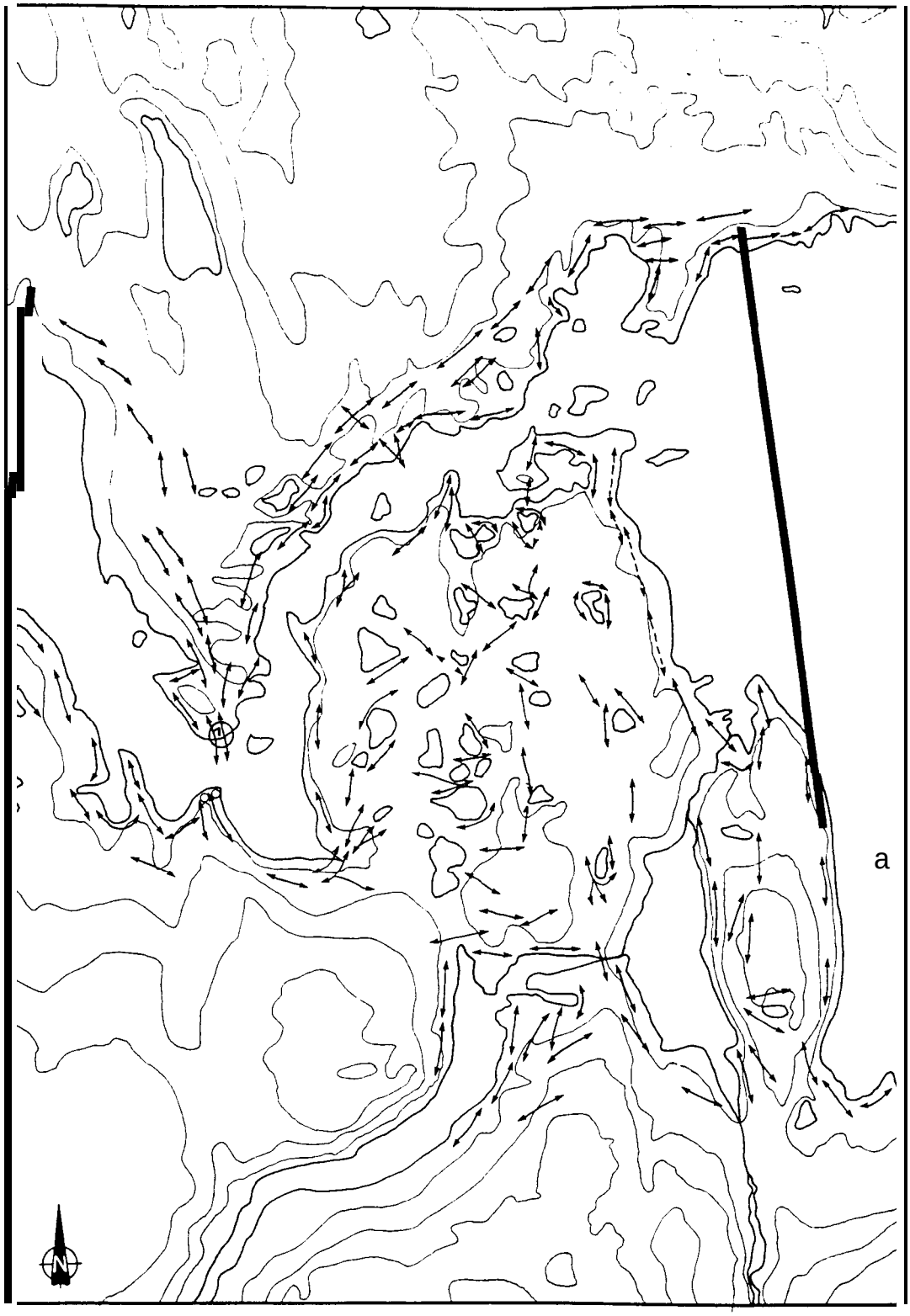


Figure A-16a. Water crossing No. 1s.

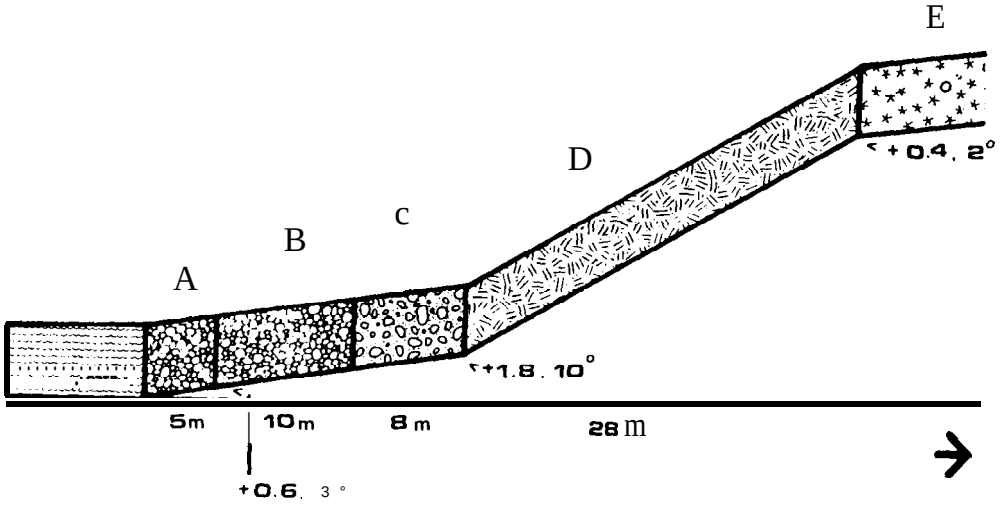


Figure A-16b. Water crossing No. 16, site 1.

Caribou and Human Use of Site 1

Fresh trails ran west to east along the shore, and north to south across Site 1, indicating that caribou used this site prior to investigation.

Crossing 17 East Aberdeen Lake 64°37' N. 98°25'W

Date 08/08/80

Location

Designated water crossing No. 17 (Fig. 3) is the narrows between Aberdeen and Qamanaarjuk Lakes.

Trail Patterns

Trail patterns (Fig. A-17a) indicated that most caribou use was at three sites. Sane trails on the west shore were dark and appeared fresh. Most trails on the east shore were faint.

Site 1 Description

Site 1 (Fig. A-17a) was the north tip of a square-ended, east-west running peninsula which jutted out from the west shore.

The shortest distance to the eastern shore from Site 1 was approximately 1.8 km (Fig. A-17b). The bottom was composed of small stones and sand, providing good footing. Water depth increased rapidly with the water appearing deep blue about 6 m from shore. Average surface water velocity was negligible.

Caribou and Human Use of Site 1

Recent caribou tracks were in sand patches along the shore. They represented small groups of cows and calves moving from west to east.

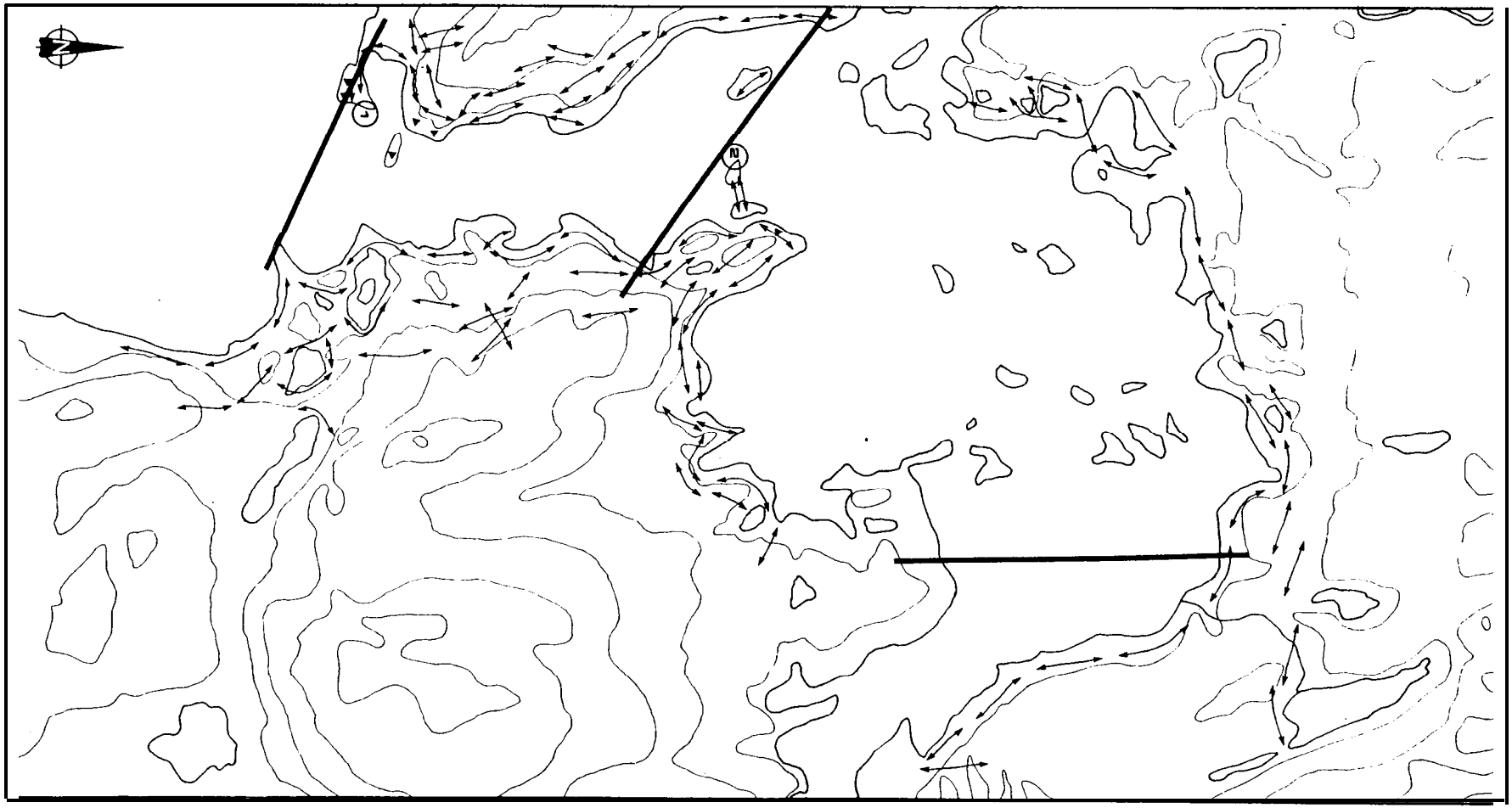
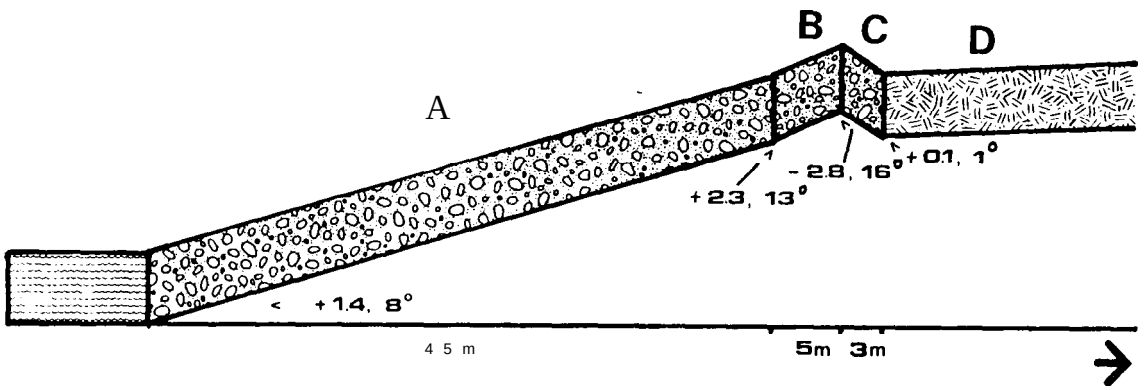


Figure A-17a. Water crossing No. 17.



Horizontal Distance (meters)

Figure A-17b. Water crossing No. 17, site 1.

Inukshuks were on the peninsula and island immediately north of Site 1 (Fig. A-17a), and along the south shore of the studied peninsula. Split open bones were scattered along most of the beach, approximately 20 m from shore.

Site 2 Description

Site 2 (Fig. A-17a) was an east-west running peninsula jutting out from the east shore. Trails funneled into Site 2 from the south shore of Qamanaarjuk Lake and the east shore of the narrows.

The distance to an island west of Site 2 was about 1.0 km (Fig. A-17c). The bottom was composed of large rocks. Water depth increased gradually with deep blue water occurring 10 m from shore. Average surface water velocity was negligible.

Caribou and Human Use of Site 2

Fresh trails were in the sand in Zone E. Most tracks were oriented west to east. Two sets were oriented east to west.

Old split open bones were in Zones B and C, and three meat caches and a large verticle stone marker were in Zone B. Inukshuks were to the north and east of Site 2.

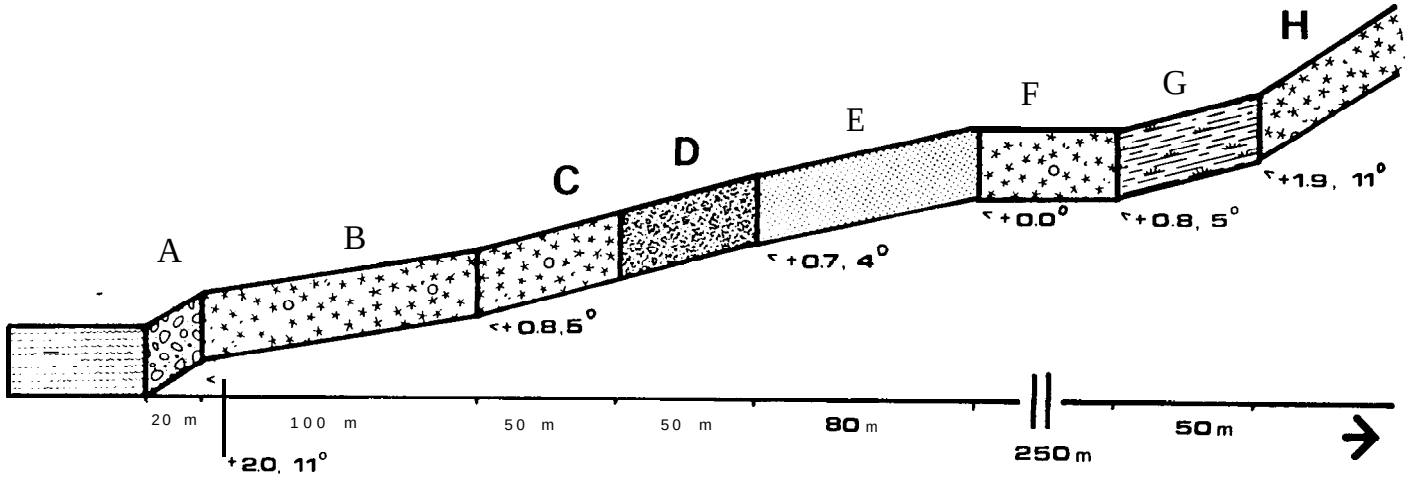


Figure A-17c. Water crossing No. 17, site 2.

Crossing 18 East Central Aberdeen Lake 64°34'N, 98°33'W

Date 04/08/80

Location

Designated water crossing No. 18 (Fig. 3) is the eastern narrows in Aberdeen Lake caused by a large northwest-southeast running peninsula jutting out from the south shore.

Trail Patterns

All trails (Fig. A-18a) appeared faint. Some trails along the northeastern shore of the peninsula were deeply worn, but did not appear recent. Most trails on the north shore paralleled the shoreline. Caribou use of the water crossing was at two sites.

Site 1 Description

Site 1 (Fig. A-18a) was a small, narrow peninsula jutting out from the north shore. The distance to the peninsula from Site 1 was approximately 9 km (Fig. A-18b). The south shore could barely be discerned from Site 1. The bottom was composed of small flat rocks and sand, providing good footing. Water depth increased gradually reaching a depth of 2 m about 20 m from shore. Average surface water velocity was negligible.

Caribou and Human Use of Site 1

There was no evidence of recent caribou activity. One inukshuk was on top of a gravel push-up in Zone B.

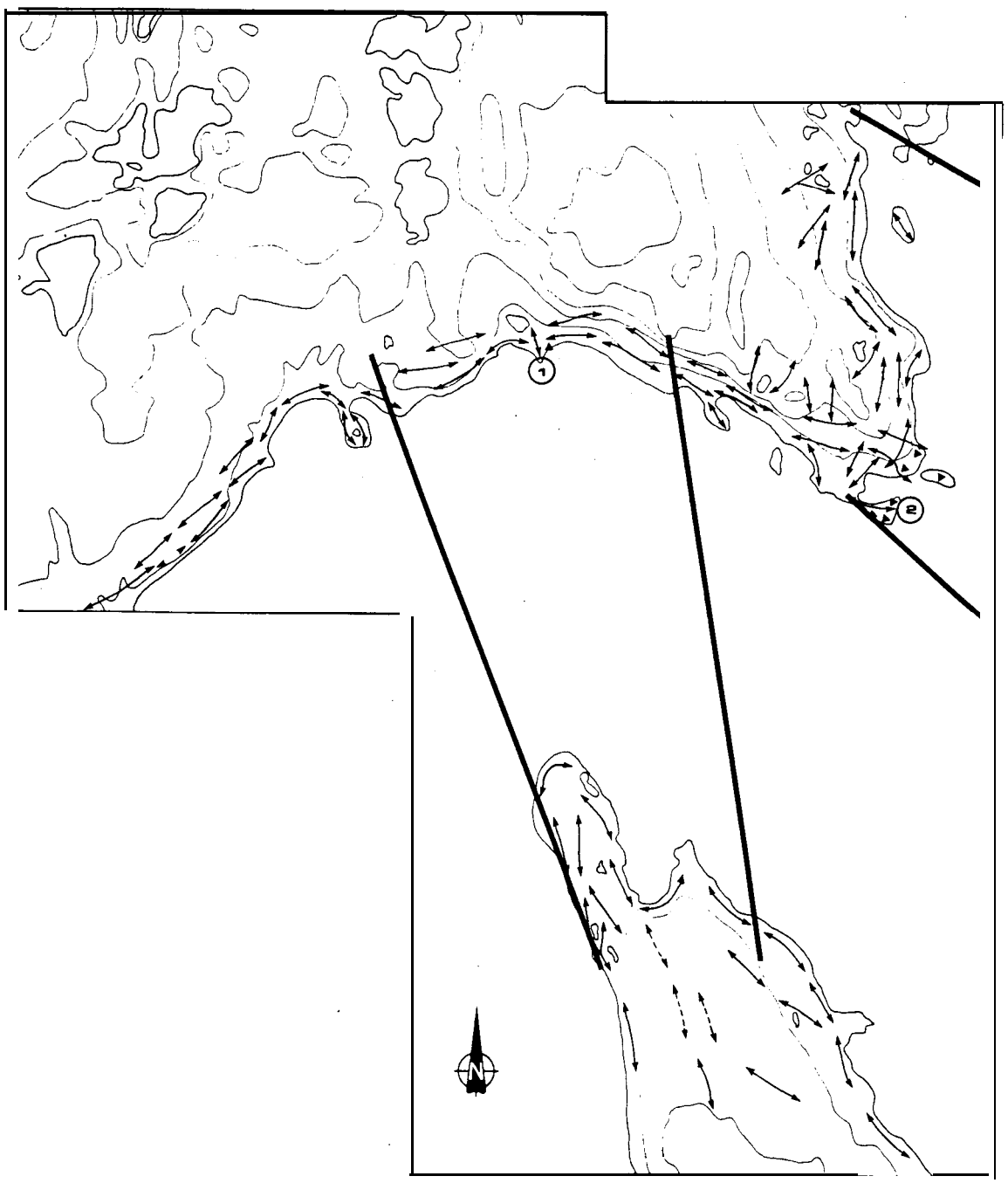


Figure A-18a. Water crossing No. 18.

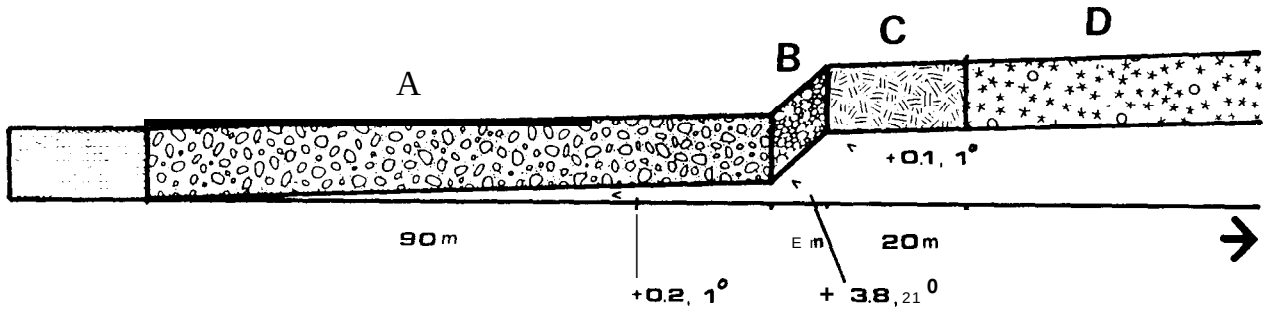


Figure A-18b. Water crossing No. 18, site 1.

Crossing 19 Central Aberdeen Lake 64°34'N 99°06'W

Date 04/08/80

Location

Designated water crossing No. 19 (Fig. 3) is the central narrows caused by a large north-south running peninsula which juts out from the south shore of Aberdeen Lake.

Trail Patterns

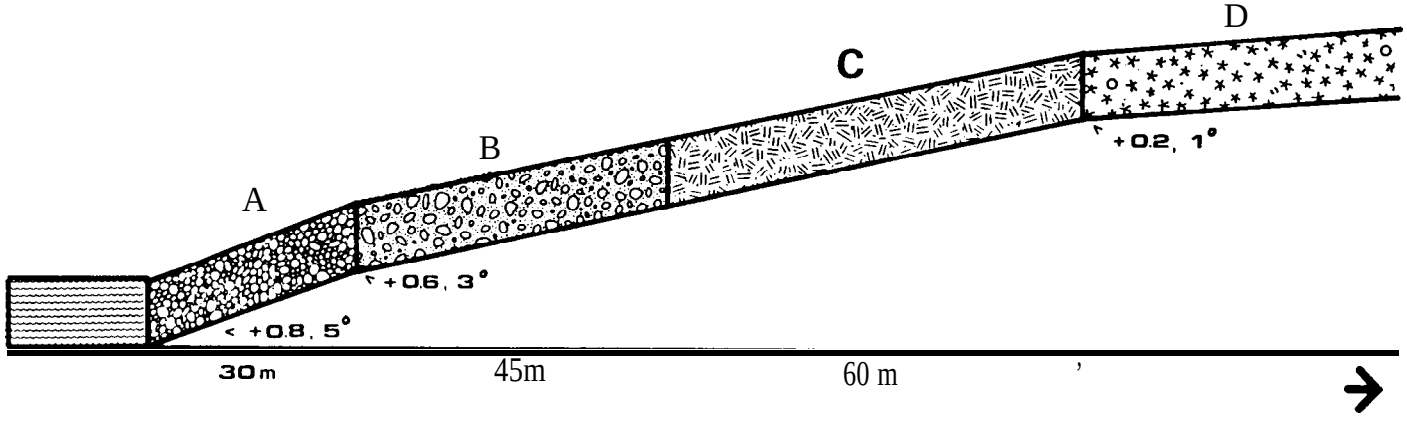
Most trails (especially in the central region of the peninsula) appeared very faint. Trail patterns (Fig. A-19a) indicated that most south to north caribou use of the water crossing was at three locations.

Site 1 Description

Site 1 (Fig. A-19a) was on the northeastern shore of the peninsula. Trails from the central and eastern regions of the peninsula funneled to this and a similar site about 300 m to the west.

The distance to the north shore was approximately 300 m (Fig. A-19b). The bottom was composed of small flat rocks and sand, which provided good footing. Water depth increased gradually, reaching a depth of 2 m about 20 m from shore. Average surface velocity as measured 8 m from shore at a depth of 0.6 m, in 0.8 m of water, was 0.31 m/see.

Figure A-19a. Water crossing NO. 19.



Horizontal Distance (meters)

Figure A-19b. Water crossing No. 19, site 1.

Caribou and Human Use of Site 1

Small numbers of fresh north to south oriented tracks were in Zone D.

Lichen-free cracked-open bones were scattered about Zones C and D.

Crossing 20 West Aberdeen Lake 64°39'N 99°54'W

Date 04/08/80

Location

Designated water crossing No. 20 (Fig. 3) is the Thelon River between Beverly and Aberdeen Lakes.

Large areas of sedge meadow were north, west and south of the crossing.

Trail Patterns

Trail patterns (Fig. A-20a) indicated that caribou use of the water crossing was at four sites. Many trails appeared dark and may have been recently used.

Site 1 Description

Site 1 (Fig. A-20a) was the north bank of the Thelon River northeast of Sandy Island. Most trails concentrated at Site 1 after paralleling the north shore of Aberdeen Lake.

The distance to Sandy Island to the southwest was approximately 180 m (Fig. A-20b). The bottom was composed of algae-covered rocks, providing slippery footing. Water depth increased to 2 m about 15 m from shore. Small riffles were in the middle of the crossing. Average surface water velocity immediately offshore was negligible.

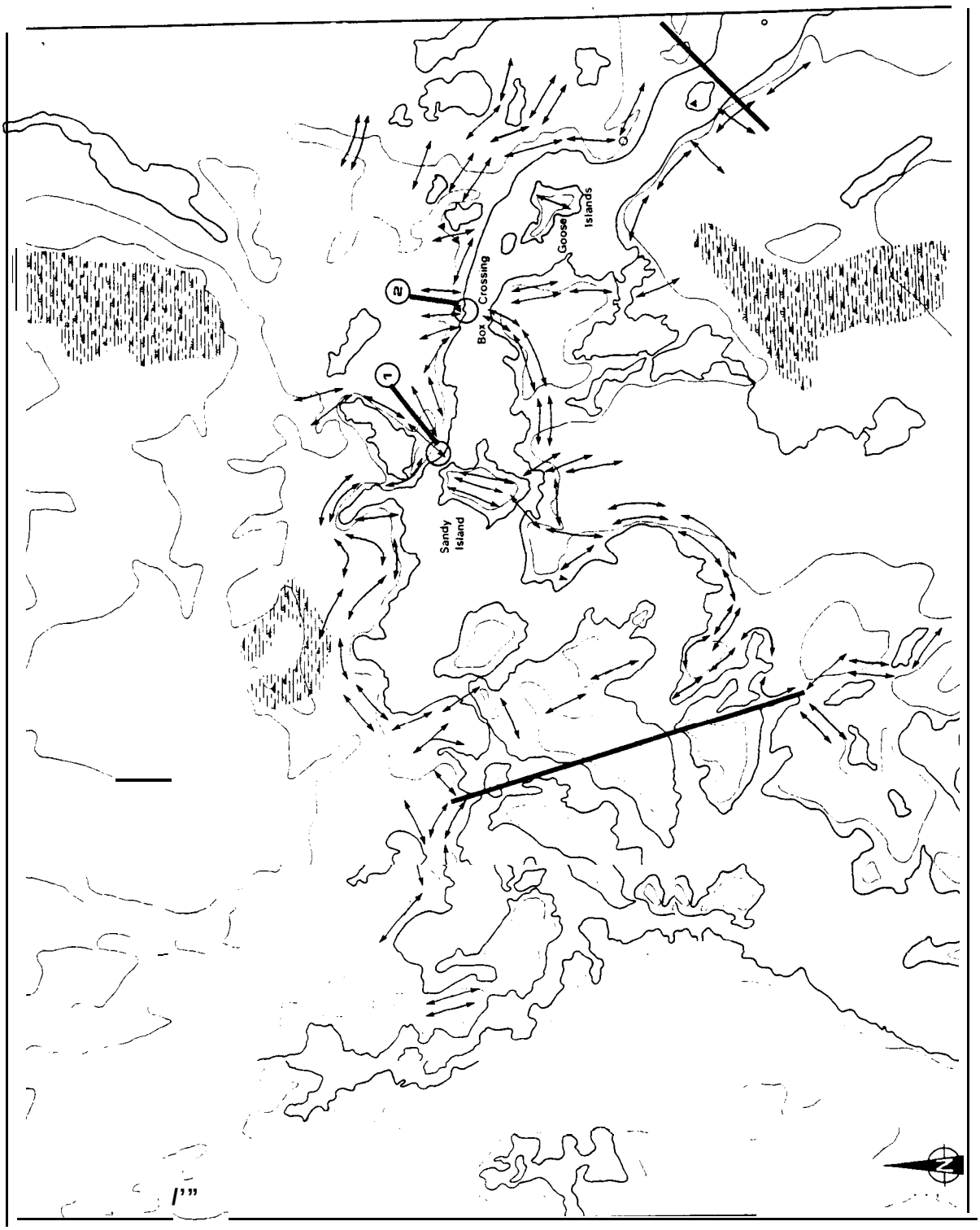


Figure A-20a. Water crossing NO. 20.

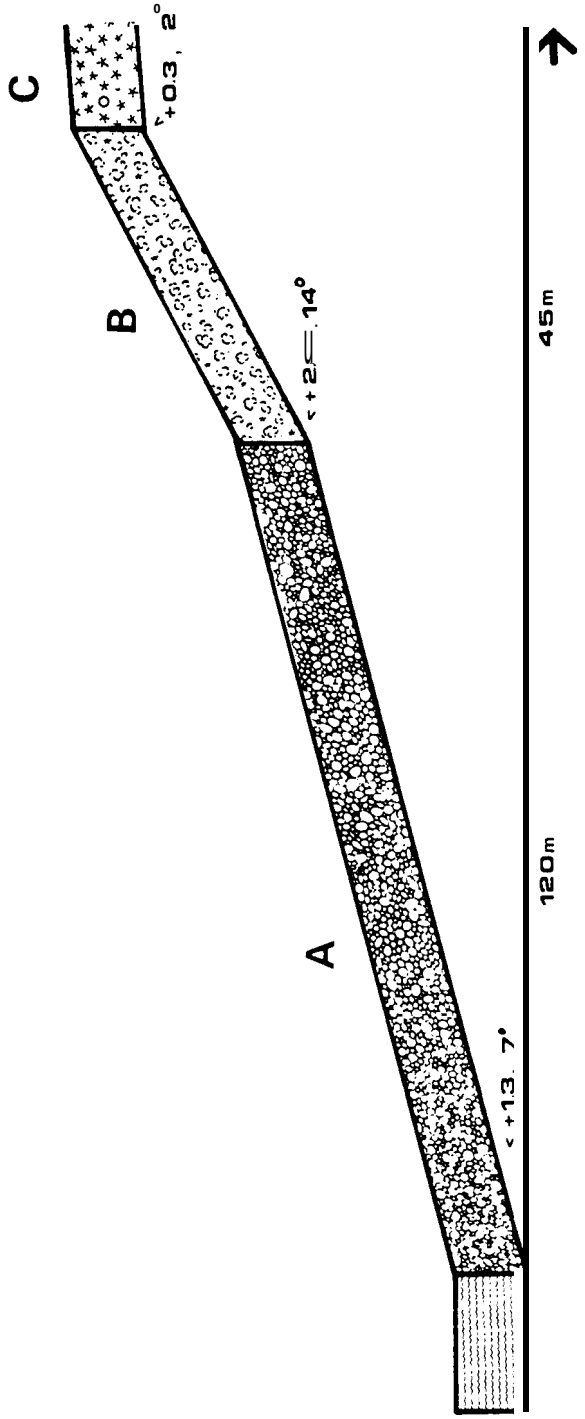


Figure A-20b. Water crossing No. 20, site 1.

Caribou and Human Use of Site 1

Trails from Zone C were 2 m apart, parallel and were worn approximately 10-15 cm through the lichen-heath into the underlying gravel.

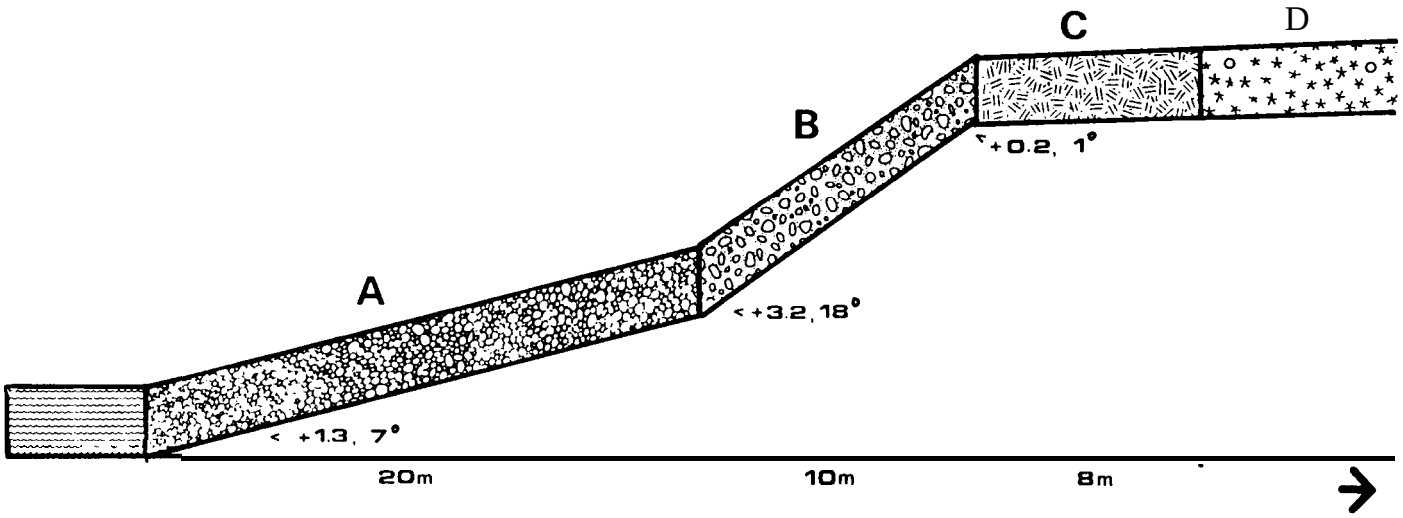
Site 2 Description

Site 2 (Fig. A-20a) was the narrows between Goose and Sandy Islands, on the north bank of Box Crossing. Trails approached the south shore of Site 2 from both sides of the peninsula. Trails approached the north shore of Site 2 after paralleling the Thelon River.

The distance to the south shore of Site 2 was approximately 250 m (Fig. A-20c). The bottom was composed of gravel. Water depth increased to a 2 m depth 7 m from shore. Average surface water velocity as measured 4 m from shore at 0.6 m in 0.8 m of water was negligible.

Human Use of Site 2

Cracked open bones were scattered through Zones B and C. A grave site and camp implements were immediately north of Site 2 in Zone D. Two inukshuks were east of the site.



Horizontal Distance (meters)

Figure A-20c. Water crossing No. 20, site 2.

Crossing 21 Dubawnt River 64°24'N, 99°53'W

Date 03/08/80

Location

Designated water crossing No. 21 (Fig. 3) is the northwest-southeast running portion of the Dubawnt River south of its entrance into Beverly Lake.

Trail Patterns

Trail patterns (Fig. A-21a) indicated that most caribou use of the water crossing was at six locations. Most trails paralleled the river, and converged on points jutting out from either shore.

Site 1 Description

Site 1 (Fig. A-21a) was the first narrows where the river forms a W before entering Beverly Lake. At Site 1, most trails when viewed from the air appeared to cross from west to east from the ends of two northeastward jutting peninsulas. Ground observations indicated that most crossing activity occurs from the bay between the peninsulas.

The distance to the western shore was approximately 120 m (Fig. A-21b). The bottom, composed of gravel and sand, provided good footing. The water was shallow *(0.3-0.6* m) for most of the crossing width. The central and western portions of the crossing were deeper *(1-2* m). A large set of rapids was immediately north of Site 1. Three areas of exposed rocks and sand were in the

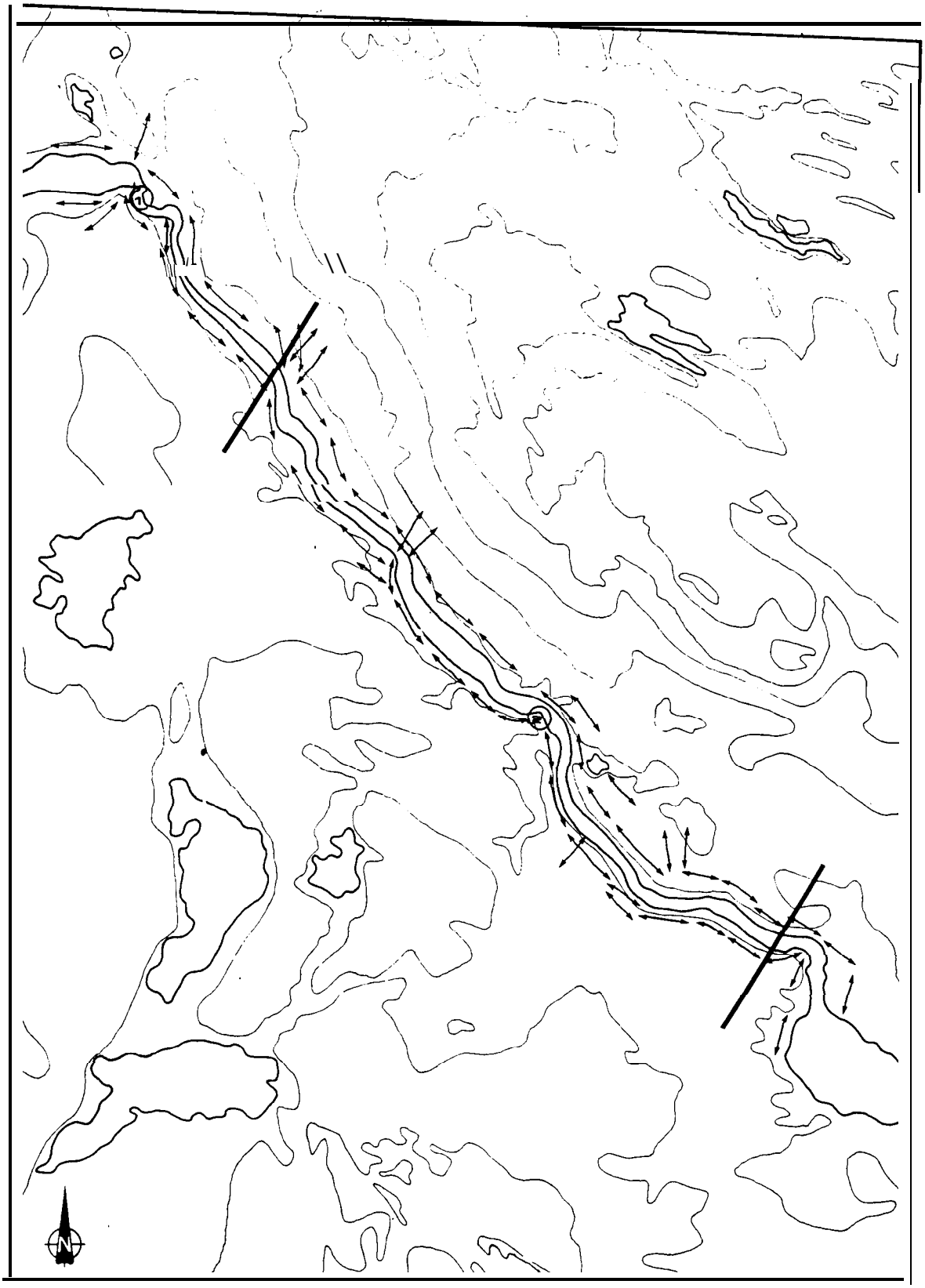


Figure A-21a. Water crossing No. 21.

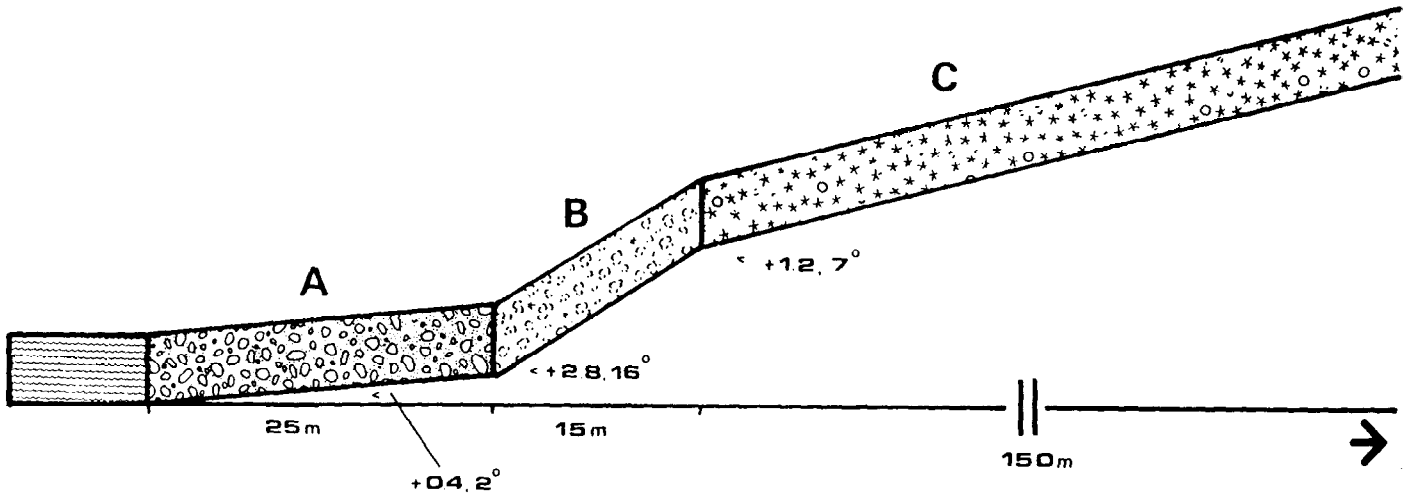


Figure A-21b. Water crossing No. 21, site 1.

crossing area. Average surface water velocity measured 20 m from the eastern shore at a depth of 0.6 m, in 1 m of water, was 0.47 m/see.

Site 2 Description

Site 2 (Fig. A-21a) was a narrows caused by a point of land jutting out fran the west shore.

The distance to the east shore from Site 2 was approximately 120 m (Fig. A-21c). The bottom was composed of gravel, providing good footing. The water was shallow (0.3-2 m) most of the way across Site 2. A series of small rapids occupied the middle of the crossing area. Average surface water velocity was 0.53 m/see.

Caribou Use of Site 2

One caribou was observed moving southwards along the west bank north of Site 2.

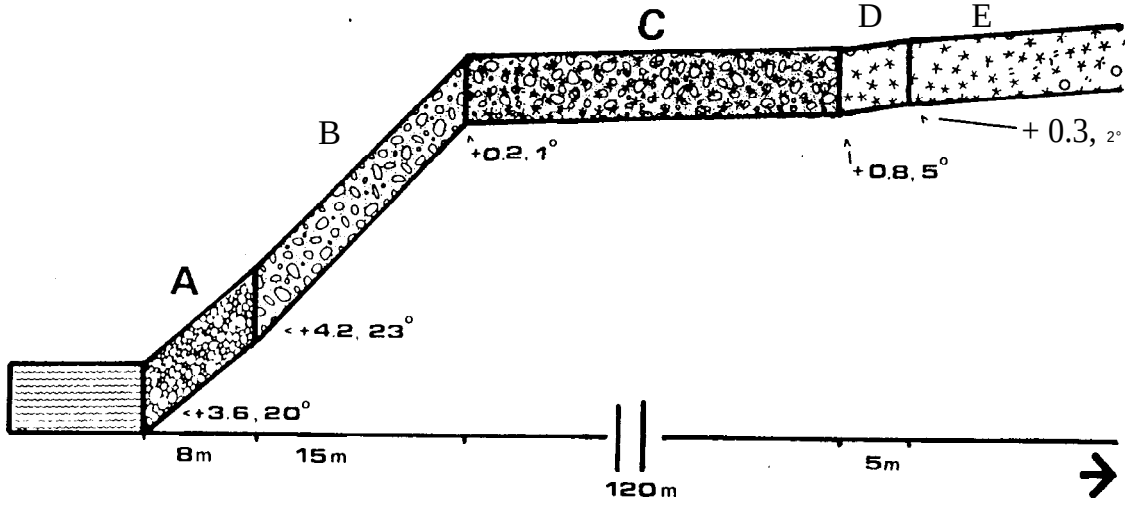


Figure A-21c. Water crossing No. 21, site 2.

Crossing 22 East Thelon Sanctuary 64°33'N. 101°10'W

Date 04/08/80

Location

Designated water crossing No. 22 (Fig. 3) is an east-west running portion of the Thelon River between Ursus Islands and Beverly Lake.

Trail Patterns

Trail patterns (Fig. A-22a) indicated that most caribou use of the water crossing was at four sites, although minor crossings were apparent along most of the designated area. Many trails appeared dark and fresh. Fresh tracks were along banks and on sandbars and mudflats.

Site 1 Description

Site 1 (Fig. A-22a) was a small point jutting out of the south bank, west of Thelon Bluffs. Most trails approached this site after paralleling the south shore of the river.

The distance across Site 1 was approximately 120 m (Fig. A-22b). The bottom was composed of large rocks. Water depth increased to 1 m, 2 m from shore. The remainder of the crossing appeared deep. Average surface water velocity as measured 2 m fran shore in 0.8 m water, at a depth of 0.6 m, was 0.23 m/see.

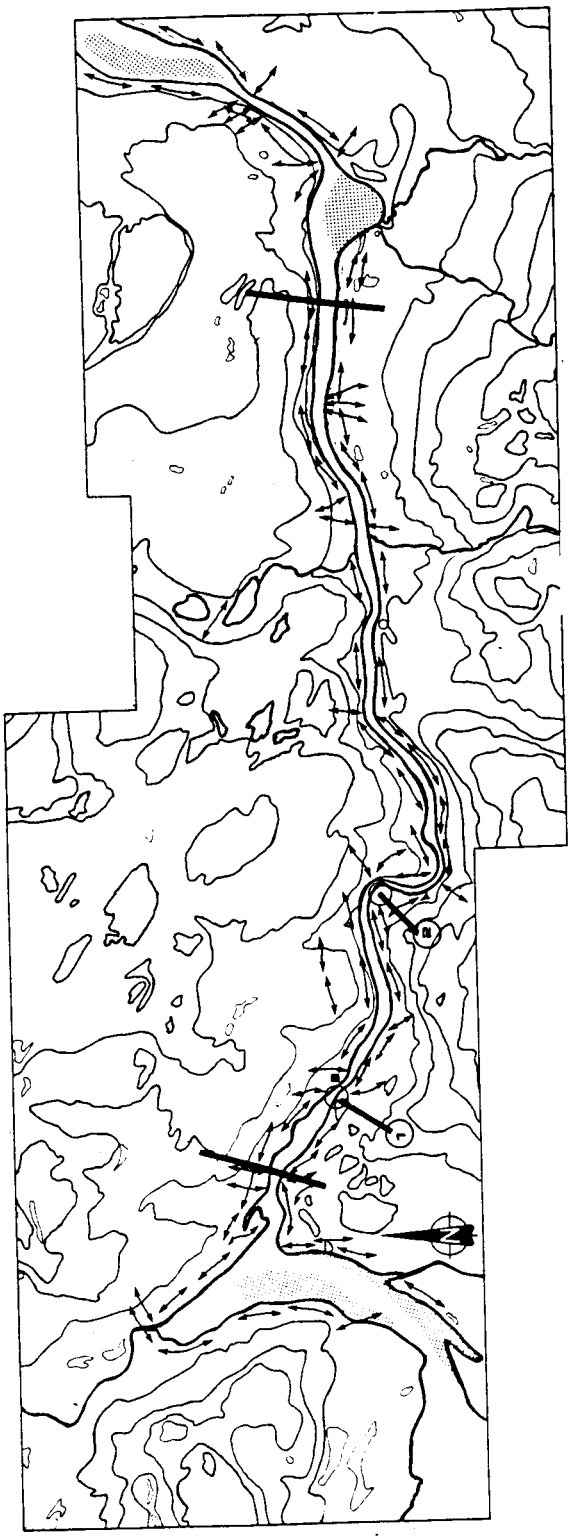


Figure A-22a Water crossing No. 22.

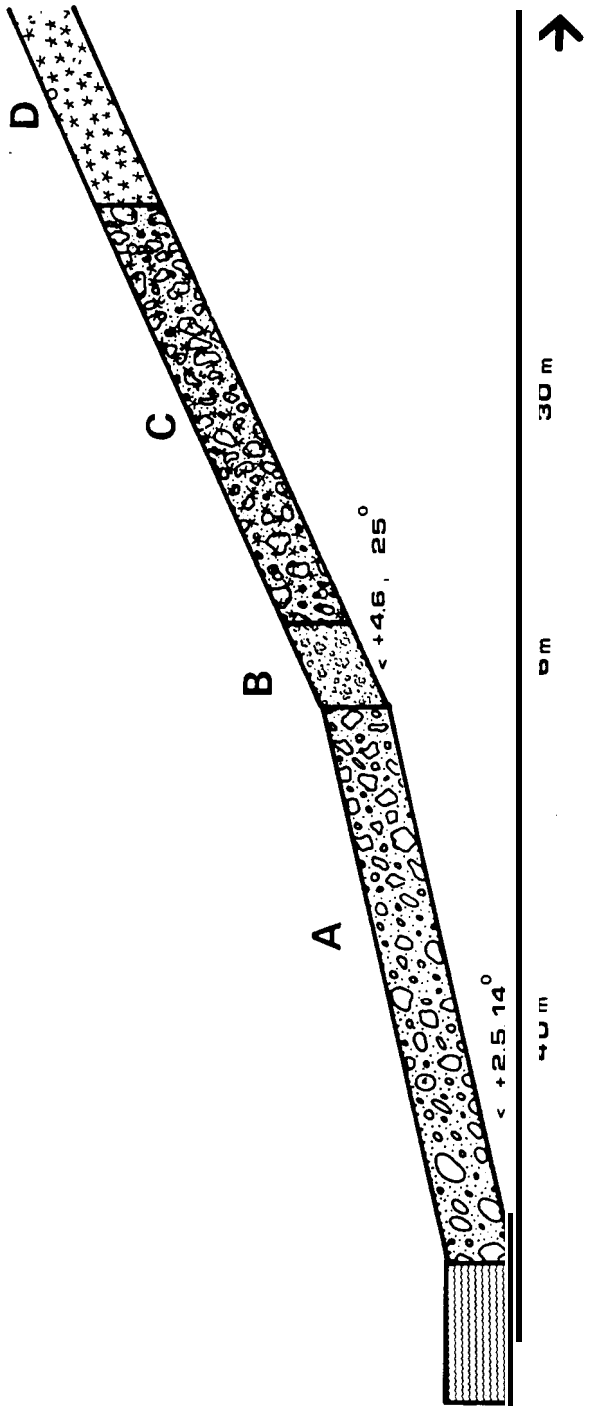


Figure A-22b. Water crossing No. 22, site 1.

Car ibou and Human Use of Site 1

Trails in Zones C and D (Fig. A-22a) were worn through the lichen heath into the underlying gravel, indicating heavy Past usage. Zone B contained many dried caribou pellets.

A Water Surveys cabin was located on the north shore to the east of Site 1.

Site 2 Description

Site 2 (Fig. A-22a) was the west bank opposite the Thelon Bluffs . Most trails approached Site 2 after paralleling the south shore of the Thelon River. Most crossing activity occurred above rapids running the length of the bluffs.

The distance across Site 2 was approximately 80 m (Fig. A-22c) . The bottom was composed of large rocks, providing treacherous footing. The water appeared shallow (0.5-1.5 m) across most of the site. Large rapids with standing waves approximately 0.6 m high occurred immediately below Site 2. Average surface water velocity as measured by timing a stick's descent was 1.36 m/see.

Car ibou and Human Use of Site 2

There were no signs of caribou or human activities at Site 2.

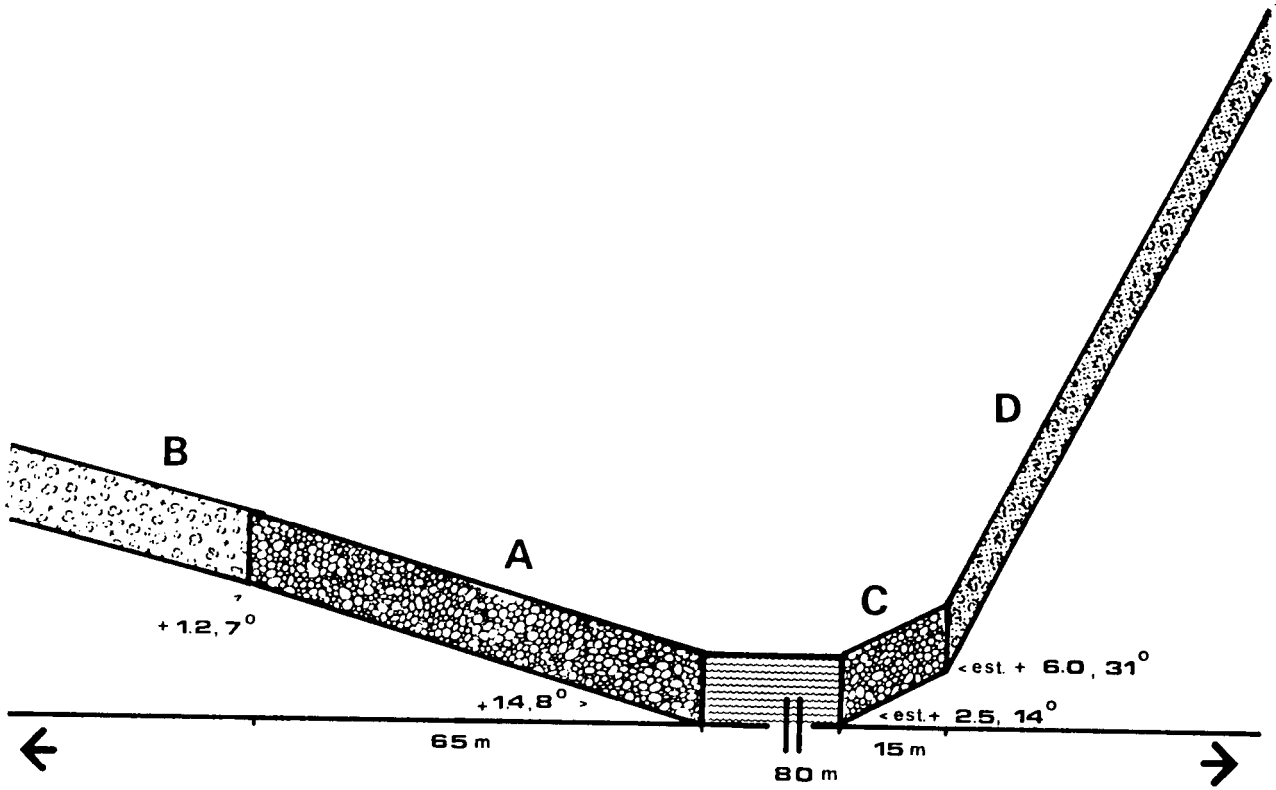


Figure A-22c. Water crossing No. 22, site 2.

Crossing 23 Centre Thelon Sanctuary 64°13'N 102°38'W

Date 03/08/80

Location

Designated water crossing No. 23 (Fig. 3) is where the north-south running Thelon River bends approximately 90° and resumes an east-west direction.

Trail Patterns

Trail patterns (Fig. A-23a) indicated that caribou use of the water crossing was at many locations in this region. Many trails appeared dark and recent.

Site 1 Description

Site 1 (Fig. A-23a) was east of the designated crossing area. Most trails approached Site 1 directly from the north.

The distance across Site 1 was approximately 180 m (Fig. A-23b). The bottom was composed of flat stones, providing good footing. Water depth increased rapidly to 2 m about 4 m from shore. Small riffles were present across most of the site. The average water velocity as measured 1.6 m from shore at 0.6 m depth, in 0.8 m of water, was 0.34 m/sec.

Caribou and Human Use of Site 1

Many fresh caribou pellets were in Zones B and C. Some willows in Zone B had been recently browsed.

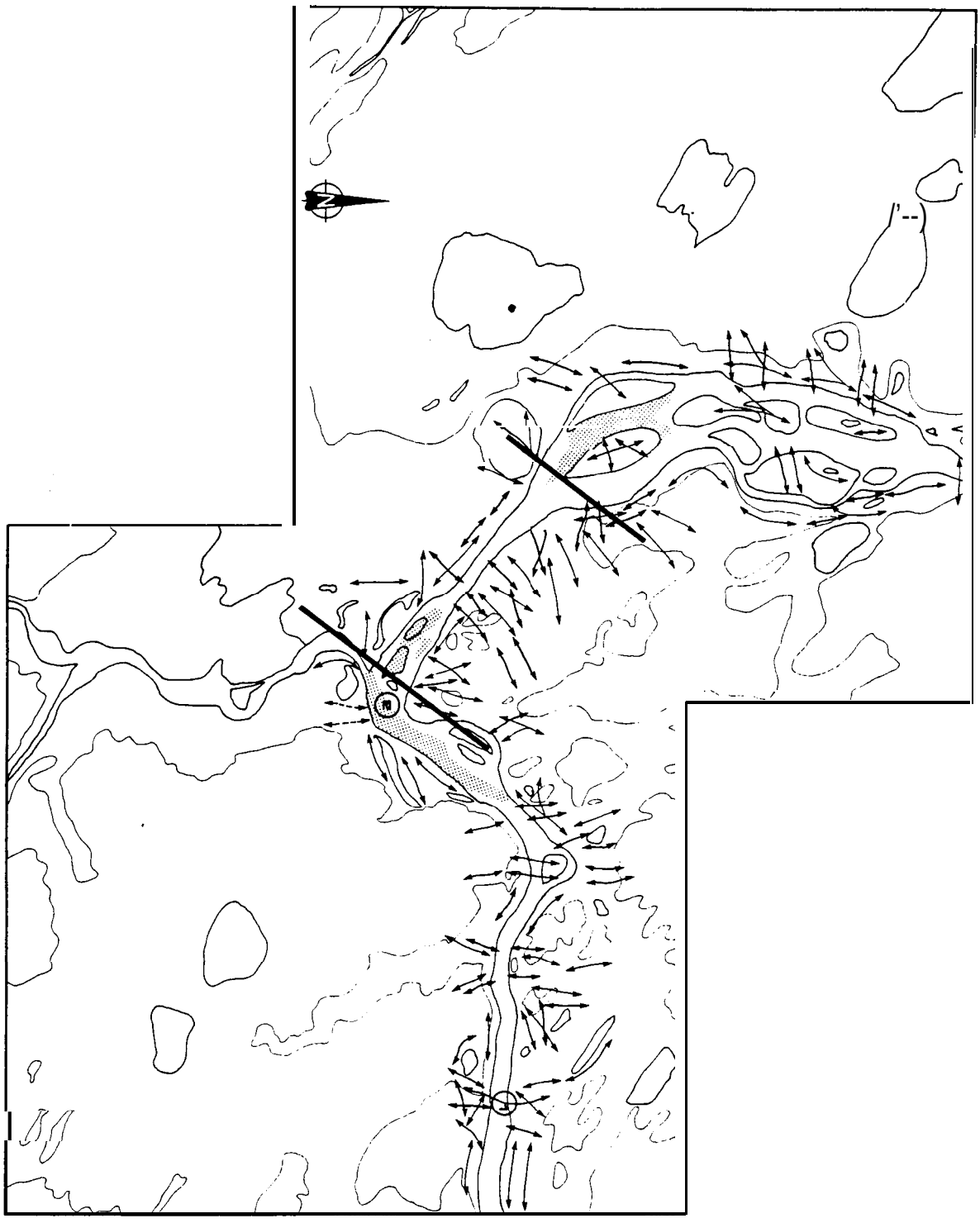
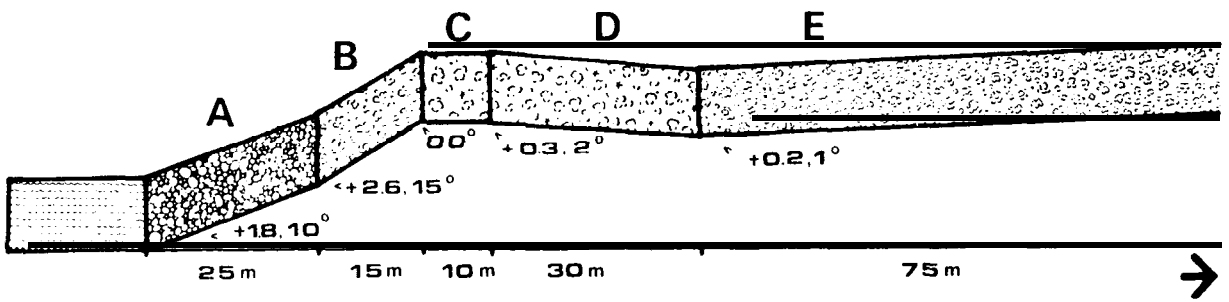


Figure A-23a. Water crossing No. 23,



Horizontal Distance (meters)

Figure A-23b. Water crossing No. 23, site 1.

Site 2 Description

Site 2 (Fig. A-23a) was the southernmost tip of a "U" in the river before it resumed an east-west course. Trails led to both shores of Site 2 from all directions. Most trails led to the north shore directly from the north.

The total width of water at Site 2 was approximately 145 m (Zones A and B) (Fig. A-23c). The water remained shallow (0.6-1.0 m) across the site. The bottom was composed of sand and small pebbles providing good footing. Average surface water velocity as measured 7 m from the south shore at a depth of 0.6 m, in 1.0 m of water, was 0.43 m/see.

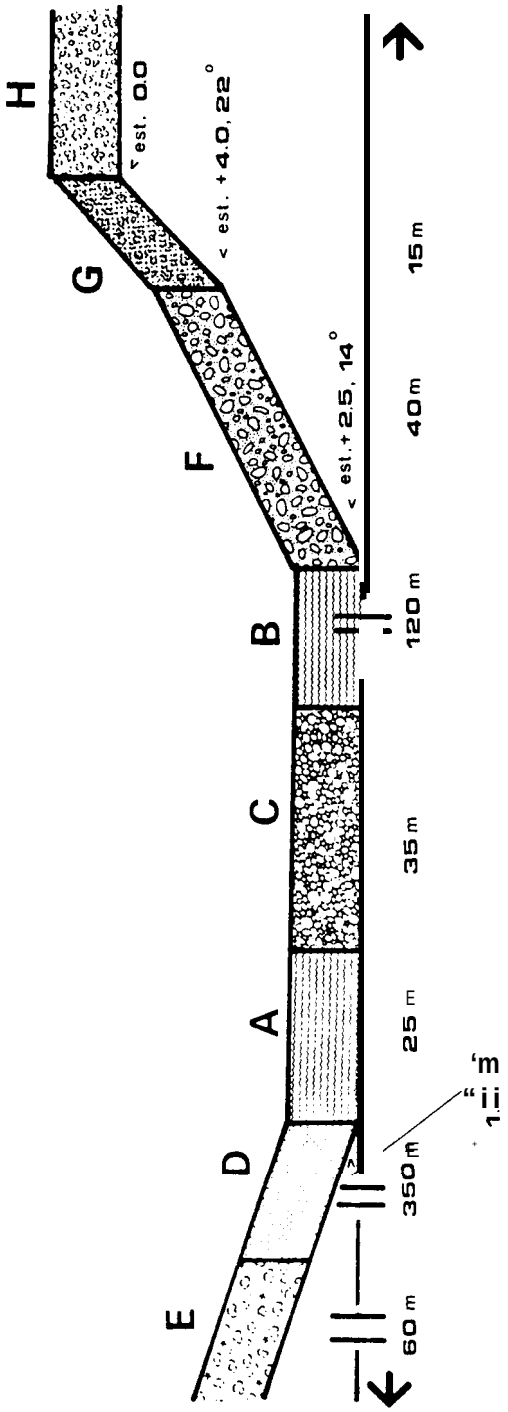


Figure A-23c. Water crossing No. 23, site 2.

Crossing 24 West Thelon .anctuary 63°37' N, 104°30'W

Date 25/07/80

Location

Designated water crossing No. 24 (Fig. 2) is the large "S" bend in the Thelon River at the confluence of the Hanbury and Clarke Rivers. Large areas of exposed sand are to the north and east of the site.

Trail Patterns

Trail patterns (Fig. A-24a) indicated that most caribou use of the water crossing was at the mouths of the Hanbury and Clarke Rivers. Sane of the water crossing was immediately upstream from the mouth of the Hanbury River.

Site 1 Description

Site 1 (Fig. A-24a) was located north of a sand island in the mouth of the Clarke River. Most trails crossed Site 1 after paralleling the north bank of the Thelon River.

The distance across Site 1 was approximately 50 m (Fig. A-24b) . The bottom was composed of sand and rock, providing good footing. Water depth was shallow (0.5-1 m) across Site 1, and there were exposed rocks in the middle of the crossing. Aver age surface water velocity as measured 2 m fran shore at 15 m depth, in 0.3 m of water, was 0.55 m/see.

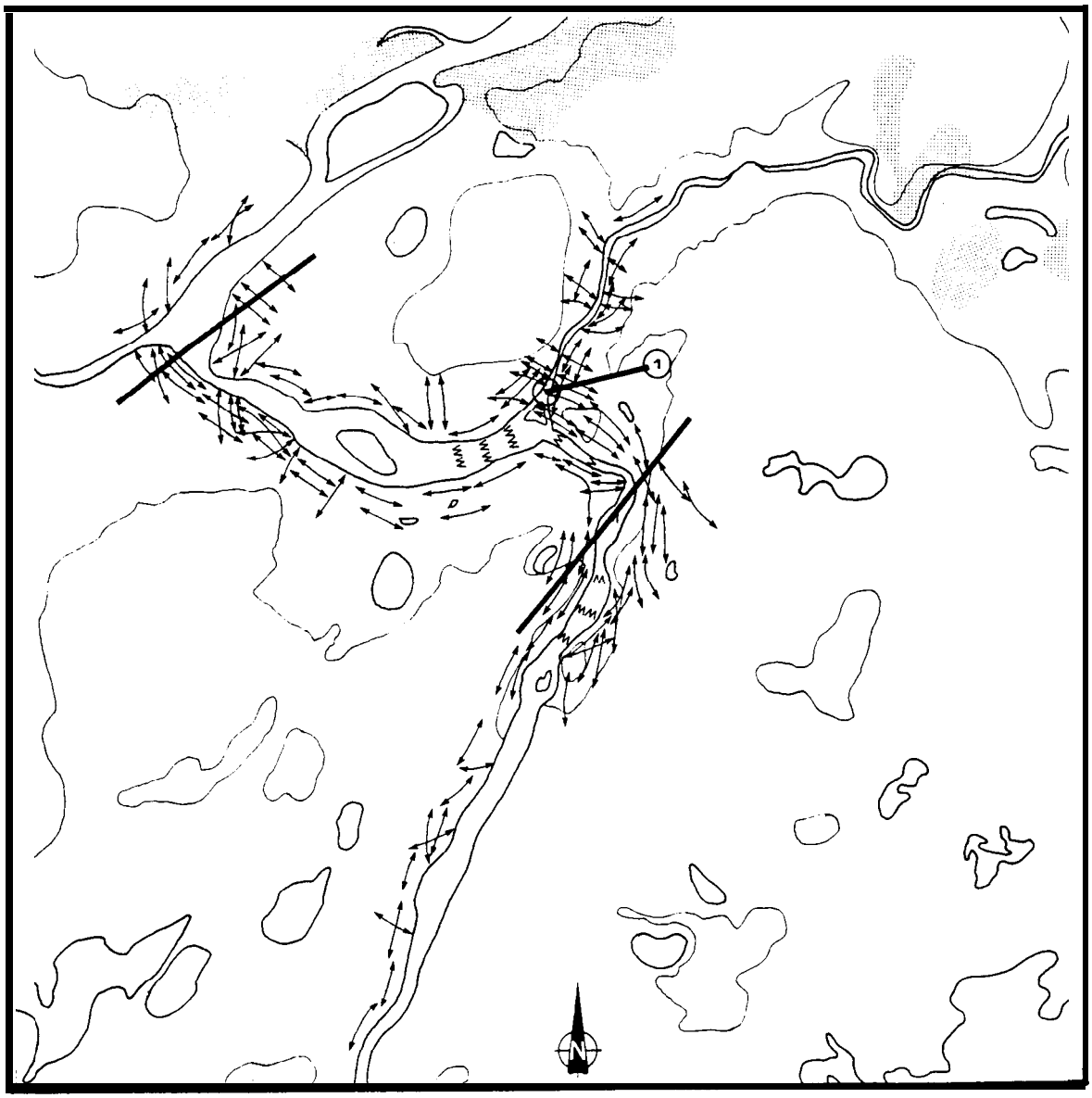
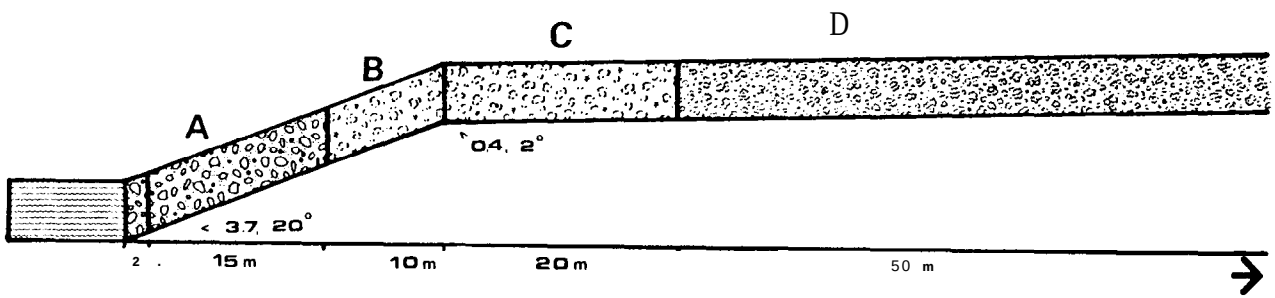


Figure A-24a. Water crossing NO. *24.*



Horizontal Distance (meters)

Figure A-24b. Water crossing NO. 24, site 1.

Caribou Use of Site 1

Fresh caribou pellets were in Zones B and C.

Crossing 25 Lac du Bois 63°33'N 105°42' W

Date 24/07/80

Location

Designated water crossing No. 25 (Fig. 2) is on the Hanbury River south of Lac du Bois. A large north-south running esker runs from the north boundary of crossing No. 25 through Lac du Bois. The surrounding area contains mainly moderate relief and exposed rock hills. The trend of the physiography in the region is northeast-southwest.

Trail Patterns

Trail patterns (Fig. A-25a) indicated that caribou use of the water crossing was at numerous locations along the Hanbury River in this area. Many trails east of Hanbury Lake (in the central crossing region) appeared dark and recent.

Site 1 Description

Site 1 (Fig. A-25a) was a narrows near the eastern boundary of crossing 25. Most trails approached Site 1 directly from the north.

The distance across Site 1 was approximately 50 m (Fig. A-25b). The bottom was composed of flat stones, providing good footing. The water remained shallow (0.5-1.5 m) across the site. Small rapids and riffles were indications of moderate current, which was estimated by timing a stick's descent at 0.5 m/sec.

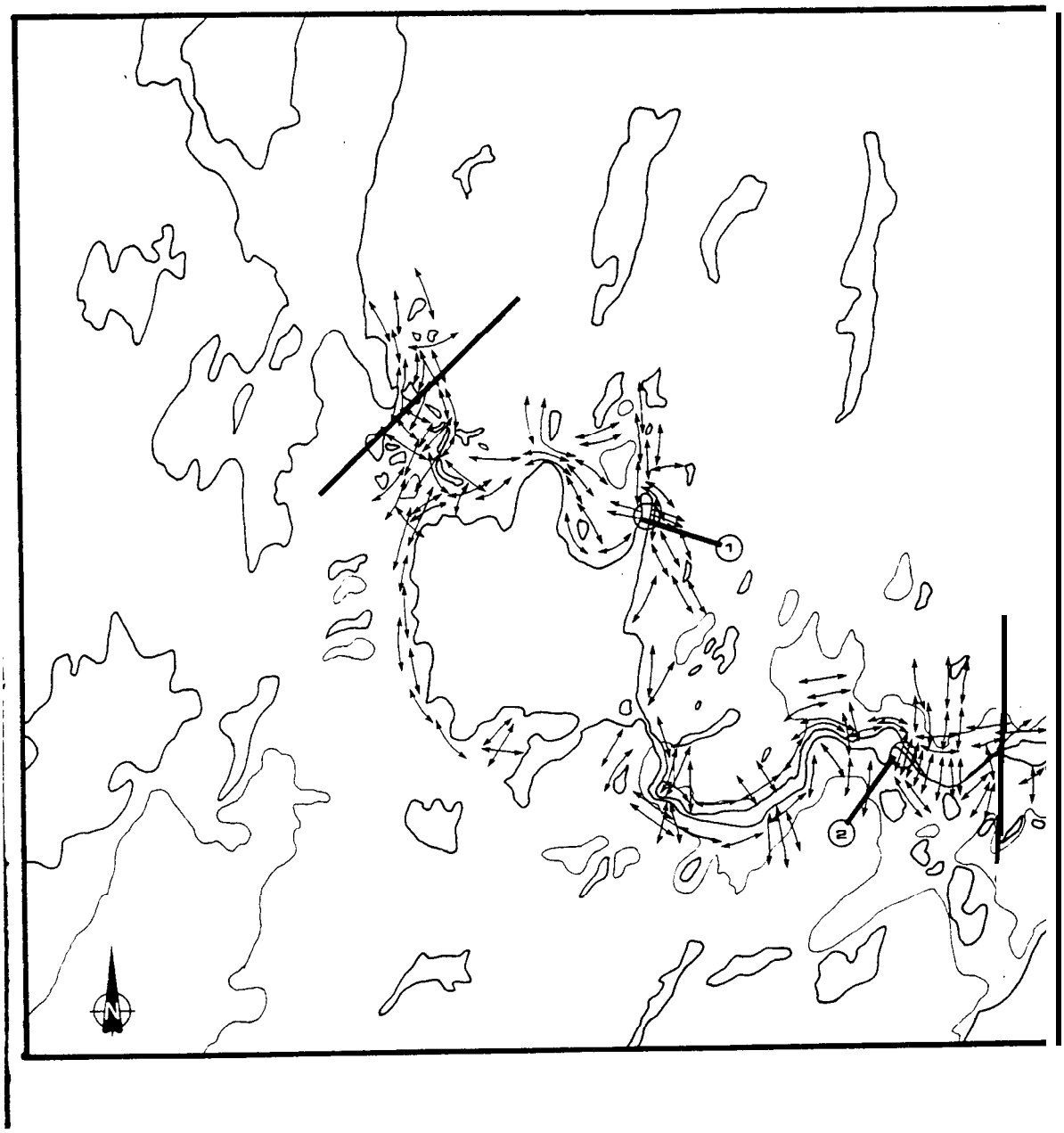


Figure A-25a. Water crossing No. 25.

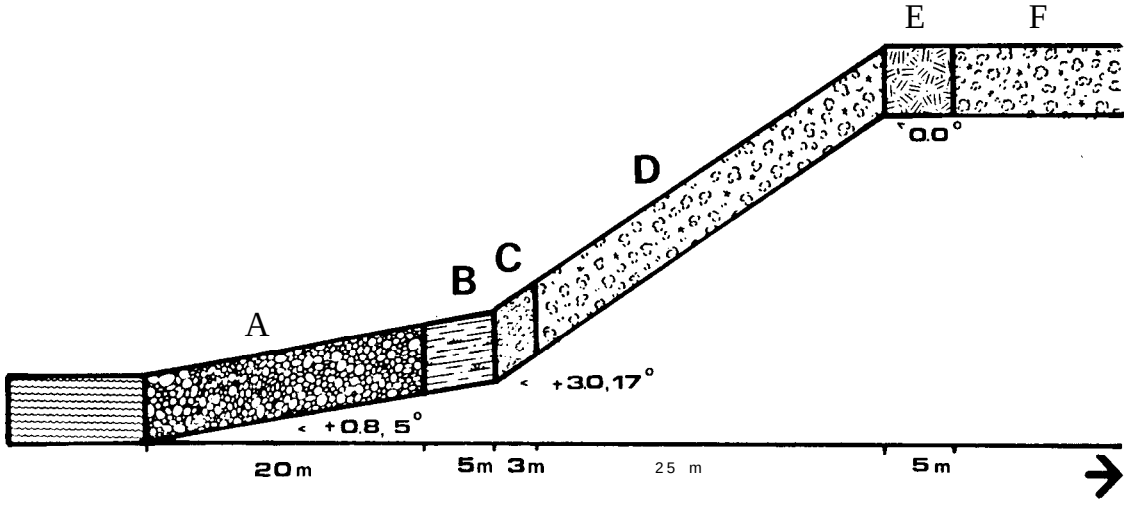


Figure A-25b. Water crossing NO. 25, site 1.

Site 2 Description

Site 2 (Fig. A-25a) was a narrows in a north-south running inlet penetrating the northern shore of Hanbury Lake. Many trails approached Site 2 from the east and north while others bypassed the site by paralleling the eastern shore of the inlet and rounding the northern end.

Caribou Use of Site 2

Recent trails indicated that small numbers of caribou had crossed from east to west.

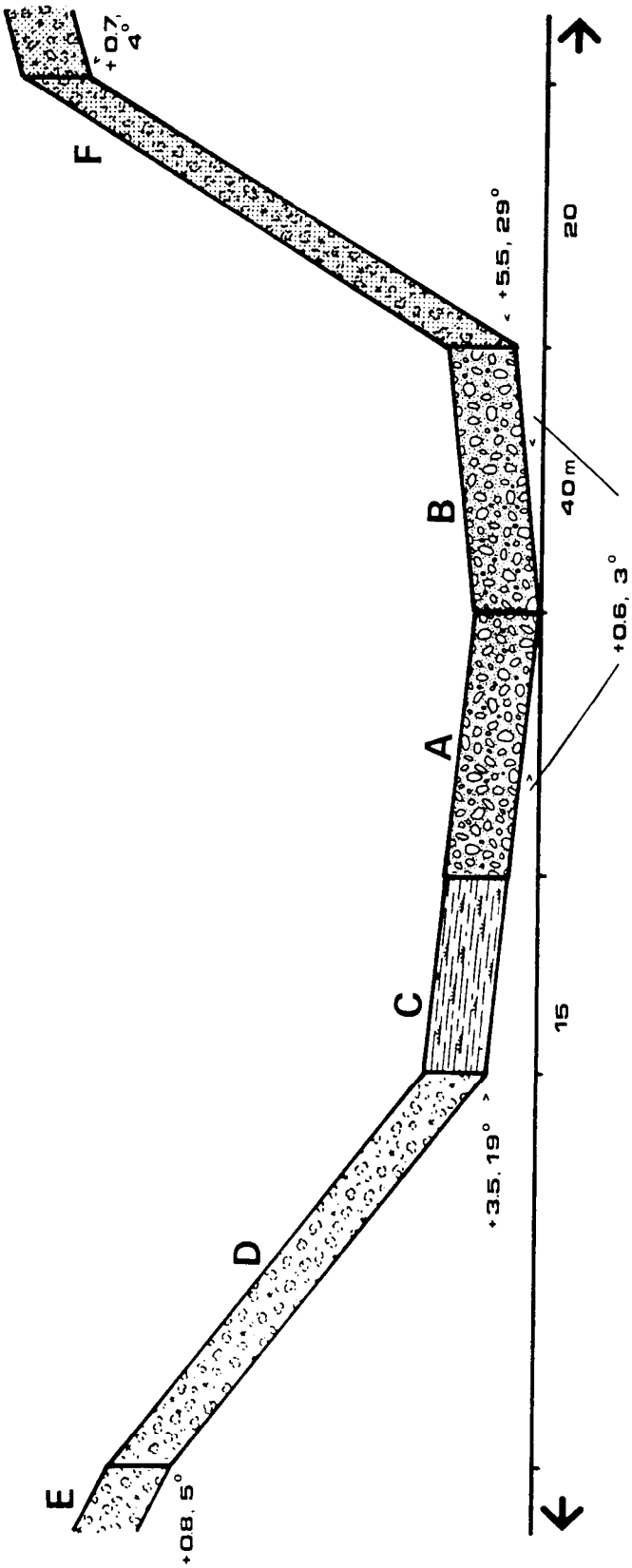


Figure A-25c Water crossing No. 25, site 2.

Crossing 26 Mary Frntes Lake 63°17'N 106°18'W

Date 25/07/80

Location

Designated water crossing No. 26 (Fig. 2) is the narrows created by a large peninsula almost bisecting Mary Frances Lake.

Trail Patterns

Trail patterns (Fig. A-26a) indicated that most caribou use of the water crossing was at four sites. Most trails crossed at the narrows by two east-west jutting "horns" which form the western tips of the central peninsula.

Site 1 Description

Site 1 (Fig. A-26a) was the narrows caused by the northern "horns" as described above. Most trails approached Site 1 after paralleling the northern shore of the central peninsula.

The distance across Site 1 was approximately 120 m (Fig. A-26b). The bottom was composed of flat rocks and mud, providing good footing. Water depth increased gradually, reaching a depth of 1.5 m a distance 8 m from shore. One small island was located approximately 20 m from the western shore. Average surface water velocity was negligible.

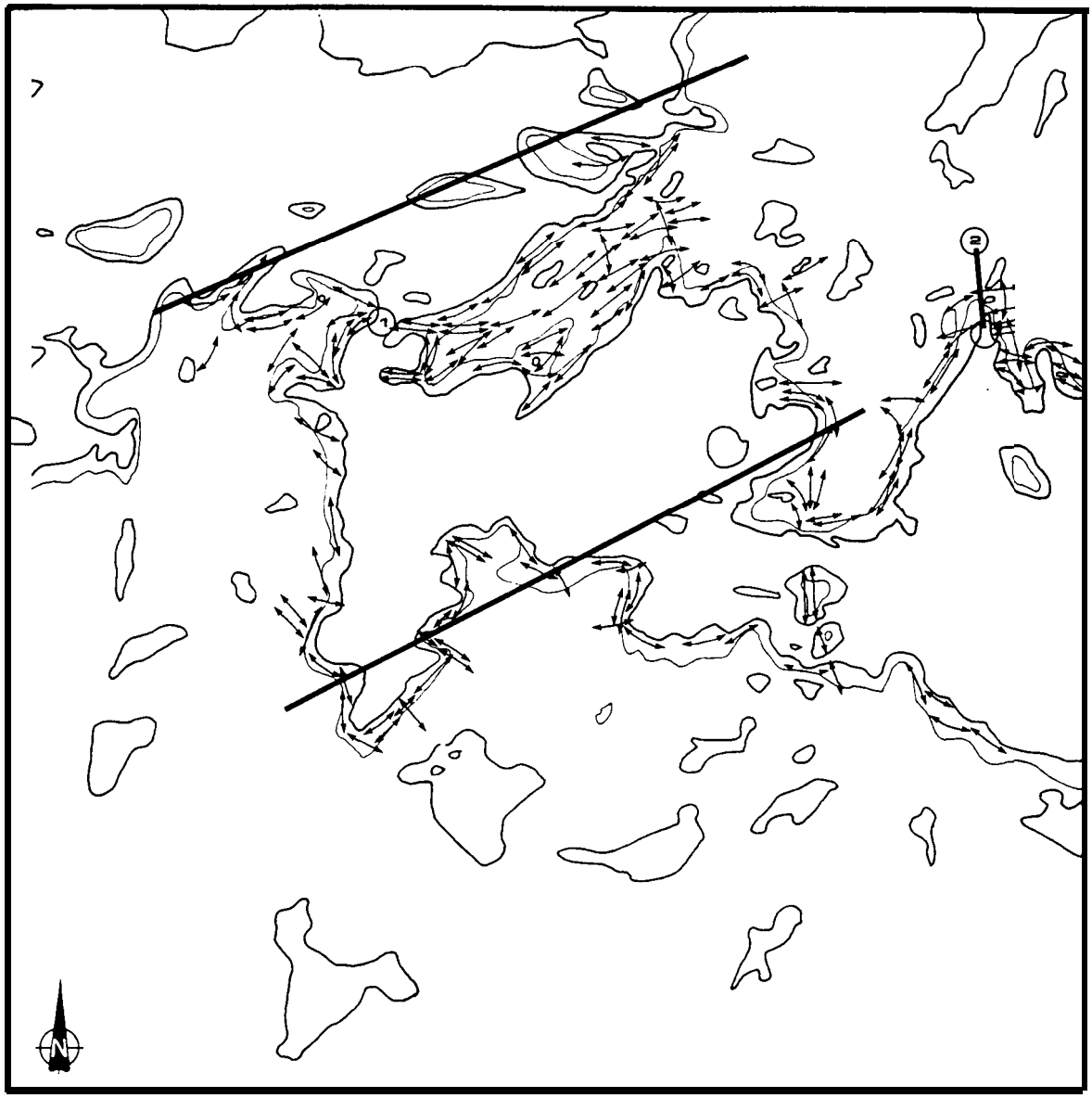
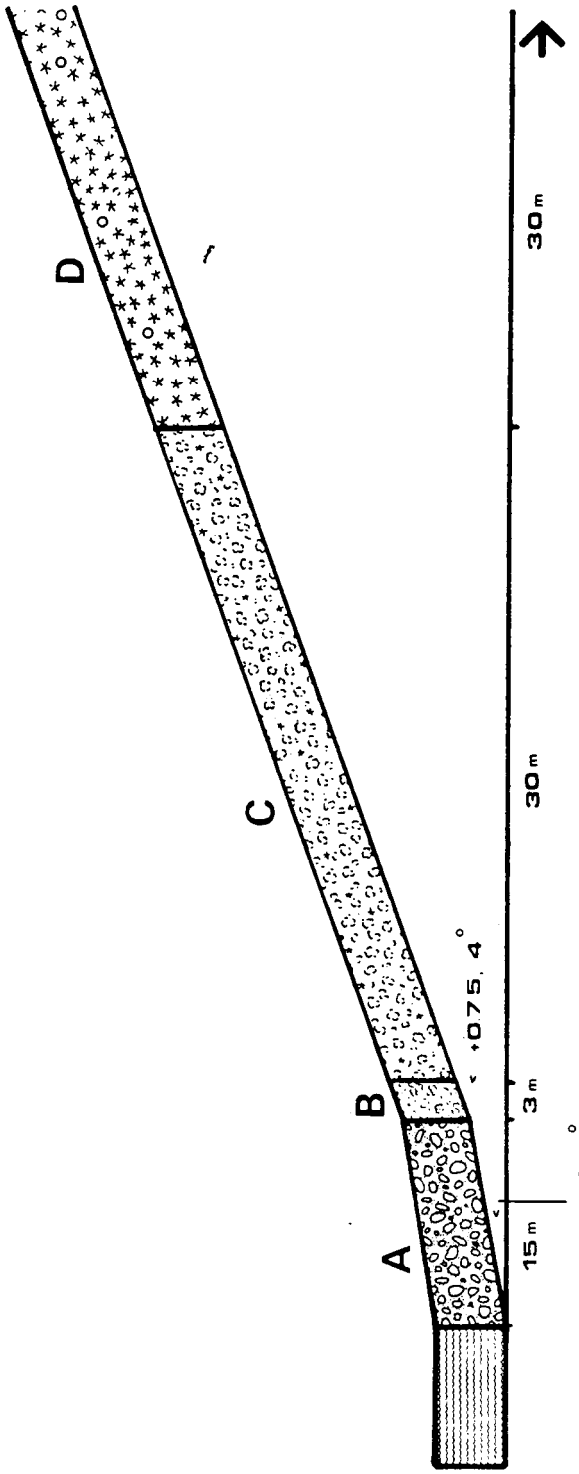


Figure A-26a. Water crossing No. 26.



Horizon al Distance (meters)

Figure A-26b. Water crossing No. 26, site 1.

Caribou Use of Site 1

Scattered groups of bulls were observed on the eastern shore of Site 1 along the central peninsula, but no crossing by the caribou was observed in July, 1980.

Site 2 Description

Site 2 (Fig. A-26a) was a narrows in a north-south running inlet penetrating the northern shore of Lac du Bois. Most trails approached Site 2 from the east and west. Many trails followed an esker which formed both shores of Site 2.

The distance across Site 2 was approximately 50 m (Fig. A-26c). The bottom was composed of sand and gravel, providing good footing. The water depth was between 0.5 and 2 m for most of the crossing distance. Surface water velocity was negligible.

Caribou Use of Site 2

Trails approaching the east shore were deeply worn into the underlying sand and gravel of the esker. Twelve caribou to the northeast of Site 2 appeared to be moving from east to west around the inlet. Some hair was present at the water's edge.

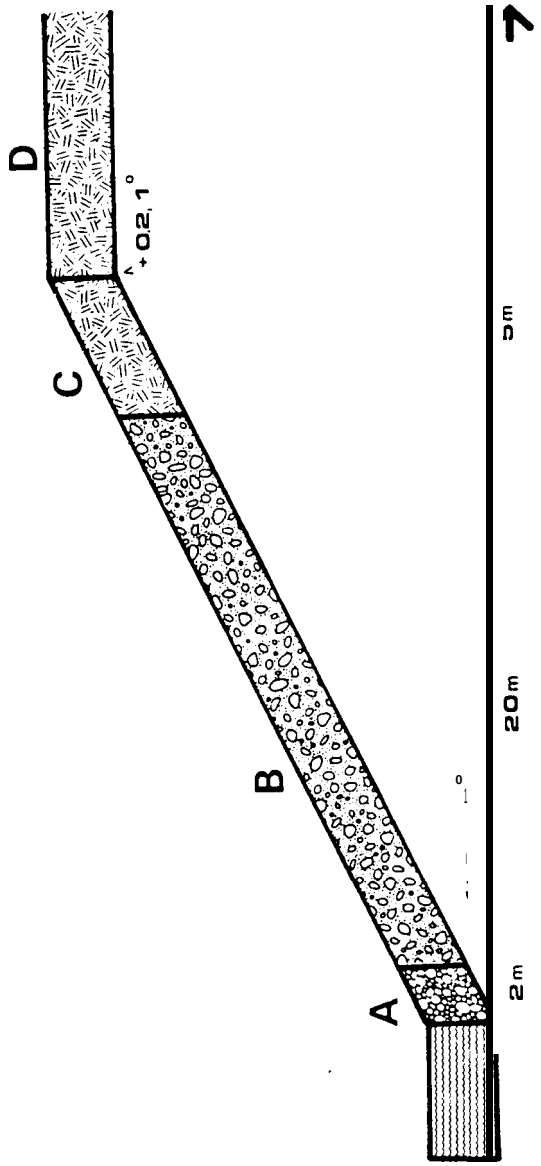


Figure A-26c. Water crossing No. 26, site 2.

Crossing 27 Lockhart River 62°54'N 108°32'W

Date 01/08/80

Location

Designated water crossing No. 27 (Fig. 2) is an east-west running portion of the Lockhart River immediately south of Artillery Lake. Large areas of the region consisted of exposed rock, reducing the visibility of trails.

Trail Patterns

Trail patterns (Fig. A-27a) indicated that caribou use of the water crossing was at nine sites in the designated area. Many trails appeared dark, and may have been recent.

Site Description

No ground site descriptions were undertaken.

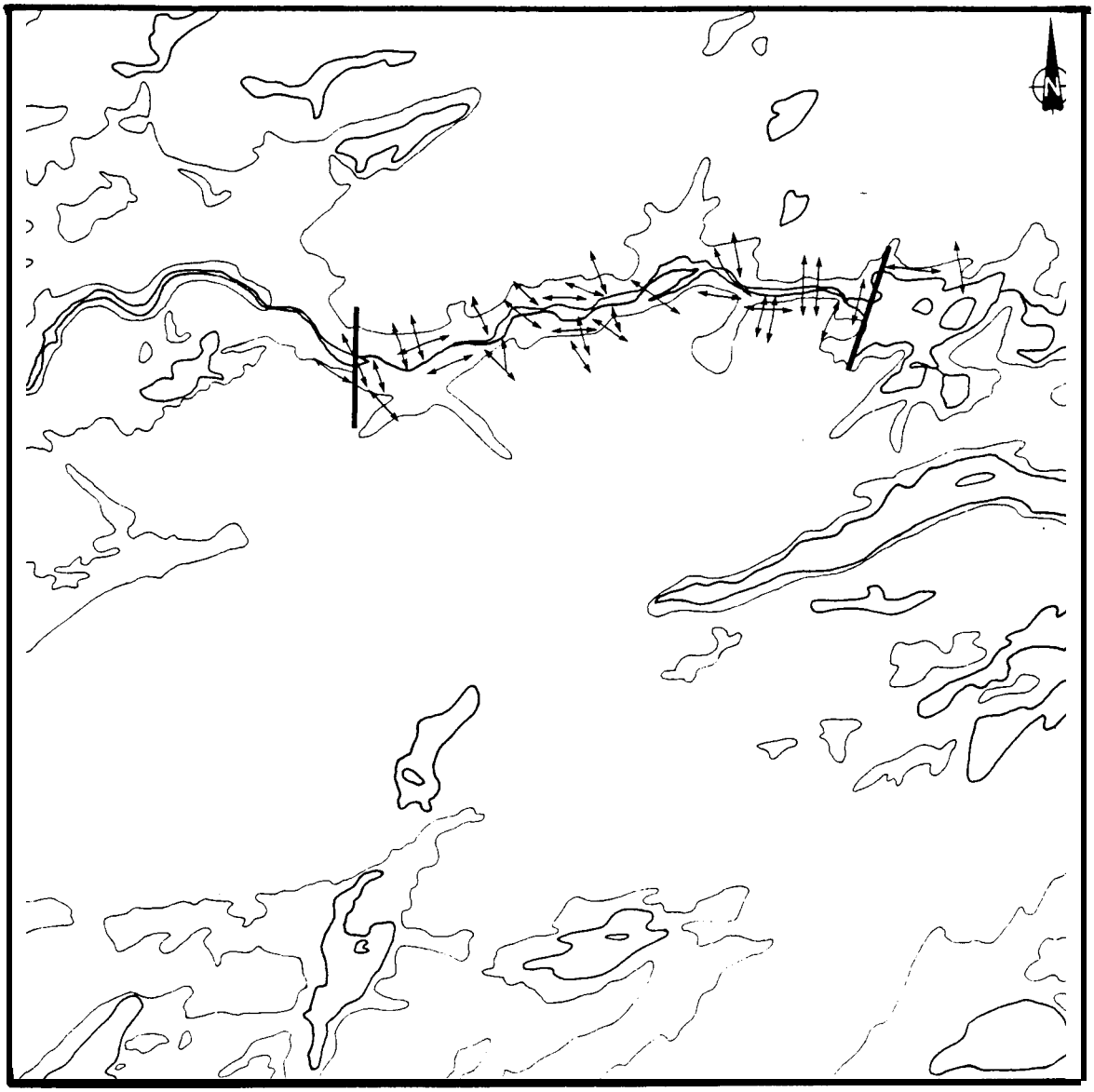


Figure A-27a. Water crossing NO. 27.

APPENDIX B. Literature records of caribou use of water crossings on the Beverly and Kaminuriak herd ranges, Mackenzie and Keewatin Districts, N.W.T.

1. The Lockhart River System

McLean (1901) travelled portions of the lower Lockhart River. He surmised from the score or more carcasses he saw along the river that the numerous rapids and waterfalls caused "the destruction of a great many of the deer (p.6)". He proposed that caribou are drowned or killed by being dashed against the rocks as a result of being carried over the falls.

Seton (1911) witnessed southward moving caribou crossing the Casba (Lockhart) River on 7 August, 1907 at a location between Artillery and Casba (Ptarmigan) Lakes (north of water crossing No. 27 - Fig. A-27a). The animals were coming from the east. Seton reported that members of his party were disturbed by caribou stumbling over the tent guy ropes as they passed through the camp during the night. Seton identified a favourite caribou crossing at Sand Hill Mountain in the channel joining Aylmer and Clinton-Colden (Tha-na-koie) Lakes (Fig. A-1a). He reported three caribou swimming the river on 25 August, 1907.

Pike (1917) reported on the hunting activities of an Indian at the south end of Clinton-Colden Lake "where the rivers leaves the lake in which the caribou swim among the ice (p.219)." Pike stated that the hunter pitched his lodge at this location every summer (July, August). In 1917 Pike observed 50 or 60 bucks lying in shallow water at the edge of the stream in which the Indian had speared them. Pike encountered caribou "continually swimming

across the (Lockhart) river ahead of the canoe (p.22)" as he passed down the Lockhart River, north of Artillery and south of Ptarmigan Lakes. Upon reaching the Lockhart south of Artillery Lake, (water crossing No. 27), Pike witnessed the results of a kill of 326 caribou as they crossed the river moving southwards.

Hornby (1934) observed many caribou on 3 November, 1924 along the shore of Artillery Lake, southwards to the edge of timber. He felt that the caribou were waiting to cross southwards, as the ice was not sufficiently strong.

Banfield (1951) reported that in the course of a patrol Up the Lockhart River, about 19 caribou carcasses were found stranded on gravel bars. Along the shore at the base of the Parry Falls (west of water crossing No. 27) were the remains of 31 additional caribou. Banfield concluded that the animals had been carried over the falls to their death or had perished along the river bank and had been washed downstream.

Banfield (1954b) witnessed a band of 20 caribou swimming caribou narrows, Clinton-Colden Lake on 15 August, 1948. Banfield (pers. comm.) also reported the crossing of about 4,000 animals at the Hanbury portage between the Lockhart (south end Clinton-Colden Lake) and the Hanbury (north end of Smart Lake) River systems and described the crossing:

> "A large band of about 200 trotted rapidly down to the bank and the leaders plunged into the water and started to swim in single file to the south shore. This caused a great deal of splashing to which was added the clamour of the animals. Other nearby bands joined and it was evident that many bands were racing towards the crossing point (p.18)."

Kelsall (1958) observed animals moving southwards in late September 1957 along the west shore of Artillery Lake to the Lock'hart River. He reported that the movements were obstructed by the swift water of the Lockhart River and that while some caribou swam the river, many followed the river westward an unspecified distance before crossing.

2. The Hanbury River System

Hoare (1930) observed caribou swimming the Hanbury River on 3 July, 1929 above the MacDonald Falls, approximately 13 km above 1011 Lake (63°38'N, 105°08'W). The location of the observation is east of water crossing No. 25 (Fig. A-25a) . Hoare did not state which direction the animals were moving.

Clarke (1940) observed an immense northward movement of caribou on 3 July, 1937 while portaging at Grove Rapids (between Lac du Bois and Hanbury Lake), (water crossing No. 25) on Hanbury River. He reported that caribou were "storming up from the river at the foot of Hanbury Lake (p.87)", and that there were numerous herds along the shore of the lake and the left banks of the Hanbury River as far up as Lac du Bois (Fig. A-2a). On 4 July, Clarke travelled down Hanbury Lake and noted signs of crossing activity at the foot of the next rapids, which he named the Caribou Rapids (south of Hanbury Lake, water crossing No. 25). He stated that the herd observed on 3 July had crossed the Hanbury below and through the middle of these rapids. Clarke described the signs of crossing activity as follows:

> ".. like a stock coral. Hardly a foot of ground was without hoof prints. Where the deer had come tramping up from the crossing there was nothing but mud and dust, with a few remnants of willows and dwarf birches (p.88)."

Clarke observed several dead and crippled animals at this site. On 5 July, 1937, Clarke observed numerous herds crossing near the (Caribou) rapids. While traveling down the Hanbury River, he found numerous locations, often at rapids, where trampled ground and a stockyard smell indicated crossing activity had occurred. Clarke recorded two further incidents of caribou moving north across the Hanbury River when on 7 July a herd of 150 animals crossed, and on 12 July when a herd of 200 crossed at the foot of Dickson Canyon.

Clarke (1940) stated that although caribou negotiate most rapids, there are chutes in some of the larger rapids on the Hanbury into which the animals are unable to avoid being drawn. Clarke felt that the canyon region, which is east of 1011 Lake and west of the Hanbury-Thelon River junction was a hazard to the migrating herds. Clarke reported the presence of carcasses in the canyon region in July 1937 particularly below Dickson Canyon and Ford Falls, and some along the river to and including the junction of the Hanbury and Thelon Rivers. He cited evidence obtained by and R.C.M.P. patrol along the Hanbury in 1929. The patrol encountered 525 dead caribou between Ford and Helen Falls.

Kelsall noted caribou carcasses in the vicinity of the lower falls, Hanbury River (in approximately the same vicinity as Clarke's 1937 observation) in 1954 (Kelsall 1954 in Kelsall 1968).

Darby (1980) reported that on 24 July, 1979, canoeists observed large numbers of caribou, mostly cows and calves, crossing the Hanbury River east of Lac du Bois moving west and south.

Cooper (1981) reported more than 300 caribou crossing southward over Hanbury River near Cruikshank Lake on 22 July, *1980.* Cooper did not specify the location of this crossing.

Tagging Operation

Seventy caribou from the Beverly population were tagged from 25 July to 1 August, 1960 at Mary Frances Lake (water crossing No. 26) after the northerly movement across the Thelon River had terminated and the bands were drifting southwest to the treeline (McEwan 1960) . Mary Frances Lake was recommended as a tagging site by Thomas (1960) who, on 24 July, 1960 observed at least 500 animals on the large irregular point in the lake (water crossing No. 26) waiting to cross the channel to the southwest and another 4,000 caribou moving to the crossing places on the point.

3. The Dubawnt River System

Lawrie (1948) observed the heavy trails of a large movement crossing the Dubawnt River. According to Eskimos living in the region, this crossing occurred on 23 July, 1948. The animals continued along the south shore of Aberdeen Lake.

Kelsall (1960) reported the bunching along the Dubawnt River of an estimated 80-100,000 animals in July, 1957. The caribou massed at an unspecified location on the west side of the river before crossing. Kelsall cited an observation by Terry on 17

July, 1957 of five dead calves at a point on the Dubawnt River where an ice shelf persisted against the river bank and where caribou had tried to go ashore. cows and older animals could negotiate the shelf but calves, unable to climb out of the water, had died of exposure. Kelsall (1960) reported an observation by Kuyt on 18 July, 1957 of a cow and calf swimming the Dubawnt River just above the falls (south of water crossing No. 21).

4. The Thelon River System

Harp (1961) examined the archaeology of the lower and middle Thelon in areas that correspond to water crossing No. 20 (West Aberdeen Lake), 19 (Central Aberdeen Lake), 17 (East Aberdeen Lake), 15 (West Shcultz Lake), 14 (East Schultz Lake), and 13 (Thelon River) . Harp suggested from the artifacts at these crossings that the sites fall into two categories: habitation areas occupied by a family or small group of hunters and temporary lookout-workshop sites. The occupation sites were readily identified by tent rings or other dwelling remains and were always associated with caribou crossings. Sane were situated directly at crossings, while others were at lateral distances of up to several miles from a crossing. Harp (1961) suggested such variation 'n dwelling location might indicate a shifting of fording places from time to time throughout the pried of human occupation. The hunting camps were possibly not located in the immediate vicinity of crossings, as their presence would alarm the animals (Birket-Smith 1929). Sites were all situated on high vantage points, particularly at the approaches to water crossings.

At Schultz Lake (water crossing No. 14, near site 1) Harp found three dwelling sites and a lookout site. At the east end of Aberdeen Lake (water crossing No. 17, near site 1) was evidence of three modern (recent) dwellings, two of which were associated with stone cairns, and one kill site. At central Aberdeen Lake (water crossing No. 19, near site 1) Harp discovered several modern tent rings, but no signs of older occupation. Between Beverly and Aberdeen Lakes (water crossing No. 20, at site 1) Harp uncovered evidence of two dwelling sites, one containing recent and old tent rings, a stone cairn located at the end of a stone fence, grave ovals and a workshop site. Harp also discovered numerous sites on the south-central shore of Beverly Lake, and three sites at the west end of Aberdeen Lake.

All 11 of Harp's survey camps located at water crossings produced evidence of modern, recent, and prehistoric habitation. Harp interpreted this as evidence that all of these habitations were situated to intercept the mass movements of caribou.

Hanbury (1904) met large bands of caribou at the head of Aberdeen Lake at the end of July 1904(?) as they migrated to the south . He described a major crossing place at the west end of Schultz Lake (water crossing No. 15) called Udiektellig. When Hanbury arrived at this site at the end of August 1904, a group of natives were camped in preparation for the caribou's southward migration. Hanbury described Udiektellig as being on the north shore of a river connecting large lakes to the east and west. He suggested that at times the slaughter at this crossing was great. Hanbury (1904) described a minor crossing on the TheIon River between Schultz and Baker Lakes (east of water crossing No. *13)*

called Mawrenikyuak, and a major crossing, called Kekektelliq, close to the head of Aberdeen Lake (water crossing No. 20) on the Arkilinik (Thelon) River.

Hanbury reported that while caribou held generally in a northerly or southerly direction they appeared to wander aimlessly, as they would strike a lake like Aberdeen or Baker Lake in the middle of the shore and then follow it until they found a channel which they could swim. He suggested that caribou had no definite routes, and did not seem to remember the crossing places (Hanbury *1904)* .

A crossing listed on Hanbury's (1904) map but not described in his text is Tglor-yu-ettig, located between Aberdeen and Schultz Lakes, on the north shore (between designated water crossing Nos. 16 and 17). This could be the crossing Hanbury refered to when he stated that caribou regularly pass between Aberdeen and Schultz Lakes.

Hoare (1930) reported caribou swimming the Thelon River shortly after the last ice jam went out on 23 June, 1929. The animals crossed from the south shore opposite Hoare's cabin (north of water crossing No. 24) . He observed a large herd of caribou moving south above the Hornby cabin on 22 July, 1929(?) .

Hornby (1934) met between 5,000 and 10,000 caribou migrating south along both banks of the Thelon River about 5 miles below the forks of the Thelon and Hanbury Rivers on 23 and 24 July, 1925. He described what Tyrrell had previously called the "crossing place of deer" as being "at the edge of the timber, especially grass island" (Hornby 1934).

Clarke (1940) reported evidence of a large southward bound herd of caribou passing through the Plover Lake region, north and west of the Hanbury-Thelon junction (water crossing No. 24) shortly before his arrival there on 24 July, 1937. Clarke observed a number of small herds going north along the right bank of the Thelon on 16 July, 1937. He believed that those animals had crossed the upper Thelon just" above the Hanbury-Thelon junction (water crossing No. 24). Fran his camp on the Thelon River opposite the abandoned warden's cabin, Clarke (1940) observed three large bands of caribou on the north side of the river. He stated that one band seemed ready to cross until it got his wind. The animals milled along the shore some distance, and formed into two groups. One group crossed the river (moving south) which was about 600 yards wide. The second group continued to mill on the shore working its way up river in a compact mass until it disappeared fran sight. Clarke witnessed a herd of 75 animals crossing the Thelon just below his camp on the morning of 19 July, 1937. He observed abundant signs of northward movements across the Thelon River at and immediately below Grassy Island, and at the Big Bend (water crossing No. 23) . He saw evidence of animals crossing the river just above the lower Thelon portage. These animals were moving south.

Lawrie (1948) observed a heavy movement of caribou moving north fran the estuary of the Dubawnt River on a narrow front and crossing the narrows between Beverly and Aberdeen Lakes (water crossing No. 20) on 1 June, 1948(?). Lawrie frequently saw animals crossing Beverly Lake (which was open) from north to south as well as appearing from east and west around the end of the lake between 13 June and 10 July, 1948.

Lawr ie discussed mid-summer caribou movements in the Thelon River and Baker Lake regions. He proposed that caribou he observed moving in a southwesterly direction at Beverly Lake on 16 July, 1949 consisted of animals which had previously crossed Beverly Lake over "the great peninsula which thrusts out southwest of the mouth of the Tibielik River (P.10)" (west of water crossing No. 20). Animals sighted moving in a southwesterly direction from Beverly Lake from 19 to 25 July, had moved from the west along the south shore of Beverly Lake and the Thelon River.

Kelsall (1953) reported large numbers of caribou drowning while swimming Aberdeen Lake. On 11 August, 1951 he found dead caribou scattered along a 16 km stretch of the north shore of Aberdeen Lake, including the narrows (water crossing No. 19), which is about 7.2 km wide. He counted 45 carcasses (76% of which were calves) along 1.6 km of shoreline, and based upon the distance sampled he stated that there could have been up to 450 carcasses along the 16 km of shoreline. Kelsall estimated that the drowning had taken place during the first week of July and was caused by a high wind blowing when the animals attempted to cross.

Loughrey (1956) observed a small movement of caribou eastward along the north shore of Aberdeen Lake in late August, 1956. At the same time he reported evidence that a herd of several thousand had crossed at the big bend of the Thelon River (water crossing No. 23, Lookout Point). The tundra on both sides of the river had recently been churned up. He suggested that the animals had come from the northeast and were moving in a southwesterly direction. On 28 August, 1956, Loughrey visited a camp of Eskimos located on the north shore of Aberdeen Lake opposite the narrows at the

middle of the lake (water crossing No. 19) . He reported that the hunters were obtaining caribou from bands moving east along a broad valley on the north shore of the lake.

Kelsall (1960) recorded instances of lakes and rivers acting to cause bunching or dispersal of caribou. He reported a massing of animals during their southward migration along the north shore of Beverly Lake, and to the west along the Thelon River in early August, 1958. Kelsall reported and estimated 64,000 animals crossing the Thelon River in early August, 1958. Most of the animals crossed at a restricted swimming point a few hundred yards in width.

McEwan (1960) reported that McPherson observed between 7,000 and 10,000 caribou crossing to the south side of Qamanaarjuk (Schultz) Lake (water crossing No. 16) on 29 July, *1959.* Other groups of caribou followed the north shoreline of Aberdeen and Beverly Lakes along the TheIon River and crossed at the Thelon Bluffs and Lookout Point (water crossing No. 23). On 4 August, 1959 an estimated 16,000 to 17,000 animals crossed the Thelon River at Lookout Point (crossing 23) moving to the south (McEwan 1960) .

McEwan (1960) reported animals reaching the mouth of the Tibielik River on 25 May, 1960, sane animals having already crossed Beverly Lake to the north shore. He observed a separation of yearlings from pregnant cows as they approached the calving grounds. On 29 May, 1960, caribou crossed Beverly Lake at an unspecified location which was open along the edges and was flooded with about one foot of slush. McEwan observed that most yearlings stayed on the south side instead of crossing the lake.

On 4 June, 1960, McEwan observed a concentration of 2,000 animals moving west along the flooded Thelon River. He felt they crossed the river upstream from the west end of Beverly Lake (water crossing No. 22). McEwan reported a steady flow of animals crossing to the north side of Beverly Lake from 20 June to 5 July, 1960. On 30 June he observed an estimated 500 to 600 animals crossing the islands at the west end of Beverly Lake (east of water crossing No. 22) . McEwan (1960) reported that caribou had crossed the narrow channel about 36 km east of the west end of Aberdeen Lake (water crossing No. 19) prior to 7 and 8 July. At this time about 2,500 to 3,000 animals were moving north towards the crossing point on the tip of the peninsula. He suggested that animals observed on the north shore of Aberdeen Lake on 30 June used this crossing.

Welland (1976) and Stager (1977) described the major caribou crossings west of Baker Lake on the Thelon River system. They stated that important crossings were at the west end of Beverly Lake (water crossing No. 22), the islands between Beverly and Aberdeen Lakes (water crossing No. 20), the central arm of Aberdeen Lake (water crossing No. 19) and the narrows between Aberdeen and Schultz Lakes, particularly in the Qamanaarjuk Lake area (water crossing Nos. 15 and 16). They identified the importance of these crossings after interviews with local native hunters.

Local residents primarily from Baker Lake, identified important river and lake crossing sites for a report by Interdisciplinary systems Limited (IDS 1978) as follows: several very important crossings through the islands area of Thelon River between Beverly

and Aberdeen Lakes, including Box Crossing (water crossing No. 20); the western "fingers" of Aberdeen Lake (water crossing Nos. 18 and 19); the three "fingers" between Aberdeen and Schultz Lakes (water crossing Nos. 15, 16 and 17); and several crossing points on the Thelon River east of Schultz Lake.

Urangesellschaft (1979) reported that no large numbers of caribou used the Schultz Lake crossing (water crossing No. 14) between the middle of June and the end of August 1979.

Darby (1978) described the movements of the Beverly herd, in 1978. He reported that the vanguard of Beverly cows, moving northward during spring migration, crossed the frozen TheIon River at the east end of Ursus Island (west of Beverly Lake) between 15 and 20 May, 1978. From 29 June to 8 July, a field party at Lookout Point (water crossing No. 23) observed approximately 2,500 male and non-breeding caribou crossing the Thelon River moving north within a 10 km stretch of river. Darby stated that during the summer two designated water crossings on the Thelon River were probably used by substantial numbers of caribou. These were:

1. Lookout Point on the Thelon River, in late June and early July (water crossing No. 23).
2. The Thelon River west of Beverly Lake, in late June and early July (water crossing No. 22).

Darby also listed two areas on the Thelon where substantial crossing activity was observed and/or deduced from recorded movements. These were:

1. The Thelon River between Lookout Point and Beverly Lake, in late June to mid-July;
2. The Hanbury and Thelon rivers between Lac du Bois and a

location 16 km upstream from Hornby Point on the Thelon River, from 20 to 22 July.

Darby (1980) reported that most cows of the Beverly herd crossed the Thelon River at or near Lookout Point (water crossing No. 23) between 24 May and 9 June, 1979 while en route to calving grounds north of Beverly Lake. Cows that crossed in early June encountered broken ice and sane open water. Canoeists and an assistant working on Darby's Monitoring Program observed several crossings of caribou in groups of 60 to 3,000 animals at five locations along the Thelon River from Lookout Point to Beverly Lake during the period from 25 July to 6 August, 1979. Caribou were mainly traveling south (Darby 1980).

Tagging Reports -- Thelon River

Parker (1972b) summarized tagging operations conducted by the Canadian Wildlife Service. The main tagging site on the Thelon River was the traditional mid-summer crossing between Beverly and Aberdeen Lakes (water crossing No. 20). Various teams tagged 6,381 caribou at this site in 1960, 1962, 1963, 1964, 1965 and 1967. Animals were tagged in late June and early July during their post-calving movement north from the calving ground.

Thomas (1960) observed most crossing activity at Box Crossing (2.4 km east of Sandy Island) and at Sandy Island (both are part of water crossing No. 20).

McEwan (1960) stated that from 8 to 12 July, 1960, about 1,500 animals in large groups moved across the islands to the north side of Beverly Lake.

Ruttan (1962) stated that a major part of the crossing activity was at Box Crossing area and Sandy Island (water crossing No. '20), although small groups crossed at other points nearby. The Lookout Point crossing (water crossing No. 23) accanmodated many caribou in a later movement southward. Ruttan observed one band of mostly bulls crossing the Thelon River west of Beverly Lake and two bands of bulls approaching this crossing. The main migration northward across the TheIon River occurred between 6 and 16 July, 1962 with the peak being on 14 July.

Hawkins (1973) reported on 1973 tagging operations at the Box Crossing and Sandy Island sites. On 8 June, 1973 Hawkins noted that a sand beach on the north shore of the Thelon River immediately opposite Sandy Island was heavily tracked by caribou, obviously having crossed recently. He observed that the shoreline was littered with caribou hair and saw one dead cow on the shore of Sandy Island. Hawkins suggested that it died after sustaining crushed ribs while swimming through moving ice.

Hawkins *(1973)* described a major crossing point and traditional hunting area 3.2 km below the outlet of Aberdeen Lake (water crossing No. 17) . On 3 July, 1973 he observed much caribou hair and one drowned male calf at this site.

Cooper (1981) reported caribou crossing activities at three designated crossings in 1980. He stated that cows crossed the Thelon River at the Thelon Bluffs (water crossing No. 22) and near Lookout Point (water crossing No. 23) moving northward between early and late May 1980. Pangman (in Cooper 1981) observed about 60 cows and calves moving southward across the Thelon west of Schultz Lake (water crossing No. 15) about 6 August, 1980.

Cooper *(1981)* stated that approximately 3,600 caribou crossed southward over the Thelon River 33 km below Hornby Point (west of water crossing No. 23) on 24 July, 1980.

5. The Kazan River System

Hearne (1795) first mentioned Indians spearing caribou on the Kazan River system. He witnessed this activity on 13 June, 1770 "at a small river called Cathawhachaga, which empties itself into a large lake called Yath-kyed-whoie (Yathkyed), or White Snow Lake". Tyrrell (1897) felt that the crossing observed by Hearne was probably the traditional crossing place above Yathkyed Lake known to the Eskimos as Pal-lel-lue. Tyrrell further described this crossing as being "ten miles below Rocky Islands...where the river is deep and narrow, and the caribou, in their migrations regularly swim across the stream". Tyrrell described a crossing site on Ennadai Lake, where Chipewyan Indians went in the autumn to spear caribou as they crossed the lake. He described this location as a sandy bay about 4.8 km north of the mouth of the (Kazan) river and 1.6 km south of an esker which forms the western shore of the lake, and which runs out into the lake to form a long bare sandy point. Tyrrell noted a heavily marked path further down the Kazan River below Ennadai Lake. He stated that his site was at the foot of 3.2 km of heavy rapids and swift water, and suggested that this was also a favourite caribou crossing. While traveling downriver from the previously described site, Tyrrell saw many bands of caribou, some of which swam the (Kazan) river in front of his canoes.

Tyrrell (1897) met several families of Eskimos encamped in the middle of the east shore of a narrow lake located several miles below Sandy Hill Lake. He suggested that these camps were more or less permanently situated at locations where caribou crossed the river, and that large numbers of animals were often speared at these sites.

Birket-Smith (1929) stated that the Kazan River crossings acted like magnets on the Inuit populations in the region and that they were vital to the existence of the people. Camps were near, but not in the immediate vicinity of major crossings, as their presence could have fightened the animals. Birket-Smith listed numerous crossings considered to be of vital interest to the Eskimos. He mentioned three major sites at the east-west stretch of the Kazan River, Nahiktartorvik and Perqeq (Fig. A-2a) and Qiqertaligjuaq, which possibly was at the narrows in the middle of Thirty Mile Lake. He described one crossing, Aulatsivik, as being at the outlet of the Kazan River from Hikoligjuaq (Yathkyed Lake). North of Yathkyed Lake was Morelrorjuaq, where stone columns were placed to direct the caribou to a specific crossing site. Down the river from Morelrorjuaq was Tuglerutik.

Mallet (1930) described the crossing of Kazan River in late June or early July of an "immense multitude (p.21)" of caribou immediately north of Yathkyed Lake, possibly in the area named Aulatsivik by Birket-Smith. The herd observed by Mallet crossed the river at a point "where the river narrowed to barely one hundred yards (p. 20):" while on its southward migration. The herd was on its southward migration and appeared to Mallet to be led by a doe. The leading animals stopped at the water's edge

which caused the remainder of the herd to bunch up and fan out along the river bank so that "thousands of animals lined the bank for over a mile (p.22)". The lead doe and a group of bucks initiated the crossing. The animals swam to the nearest point on the opposite shore, which was a sandy beach on which Mallet was camped.

In a detailed description of the geography of the Kazan River system, Birket-Smith (1933) described the crossing Aulatsivik as being a low point to the west of the Kazan River mouth (Morjunitjuaq) as it flows out of Yathkyed Lake. He described the crossing Tuglerutik as lying between two seemingly matched hills on either side of the south end of Qamaneq Lake. Birket-Smith (1929) described Nahiktartorvik as being a major crossing, and in 1933 he stated that Nahiktartorvik stands slightly south of the north end of Qamaneq, on the right bank of the river. Birket-Smith detailed the location of two traditional crossings east of Nahiktartorvik, south of a small tributary flowing into the Kazan from Lake Taherjuaq. These crossings are Aulatsiviarjuk and Nabluarvik. He also described two traditional crossings near Petqeq (The Bend), where the Kazan resumes a more northerly course after running northeast from Thirty Mile Lake which must be in the area east of water crossing No. 10. The crossings were Nablorjuaq and Nablutuaq which were located downriver from Petqeq on the right hand bank (Fig. A-2a).

Lawrie *(1948)* observed many animals crossing the Kazan River west of Angikuni Lake on *9* August, 1948. Other animals passed westward along the banks of the Kazan and then moved south past Entah's Lake. On 10 August, 1948, Lawrie discovered a recently

used crossing at the Angikuni narrows (at the opening into the main body of Angikuni Lake) and a second crossing to the southwest across a long arm of Angikuni Lake (Cairn Strait). Lawrie noted Eskimo camps and deer fences at this site. He described both areas as being tracked so heavily "as to be churned into a barnyard mire".

Loughrey (1956) described an Eskimo hunting camp on the eastern shore of the bay at the end of the Tyrrell arm of Yathkyed Lake. At this location, caribou migrating southeast along the east shore of Yathkyed Lake funneled through a valley at the head of the bay.

Welland (1976) listed some of the traditional caribou crossings south and west of Baker Lake from interviews with native hunters from the northwest and central Keewatin Districts. These crossings included Kazan Falls (water crossing No. 9), the east (water crossing No. 11) and west ends of Thirty Mile Lake, the north (water crossing No. 8) and west (water crossing No. 9) branches of Kaminuriak Lake, and the Kunwak River where it flows between the major lakes.

Consultants working for IDS described general summer movements of caribou south of Baker Lake, based on interviews with residents of Baker Lake. One movement involved animals traveling west across Kazan River south of Thirty Mile Lake and north of Forde Lake. The second movement was a western summer movement across Kazan River in the Kazan Falls region (IDS 1978).

Darby (1978) monitored crossing activity along the Kazan River from Angikuni to Baker Lake and concluded that "no substantial numbers of caribou had crossed by the end of field

work on 23 August (p.39)". Darby mapped trail patterns on the lower Kazan River. He suggested that orientation of the trails and their convergence at specific locations indicated that past crossing activity was concentrated in 13 places. Crossings were located at narrows and peninsulas, or across islands, and with the exception of Kazan Falls, the riverbanks at crossing sites had gentle slopes and rock or gravel shores. Darby (1978) saw no evidence of caribou crossing at the Kazan Falls gorge (water crossing No. 9) as was indicated on the 1978 DIAND Caribou Protection Map. Ungungai (cited in Darby 1978) observed evidence of a large herd crossing the Kazan RiverJs mouth in mid-July 1964. Neigo (cited in Darby 1980) observed and estimated 6,000 bulls and non-breeding caribou crossing the Kazan River near Kazan Falls (water crossing No. 9) on 8 July, 1979. The caribou were heading in a northwesterly direction.

Darby (1980) monitored caribou activity from 13 to 29 July and from 21 to 31 August, 1979, downstream from Kazan Falls. During these intervals 12 caribou were observed crossing the river, while many animals were observed on the eastern shore. Darby felt that the position of designated water crossings on the 1979 Caribou Protection Map did not reflect information on caribou trail patterns presented in his 1978 caribou Monitoring Program. He recommended re-evaluation of all designated crossings to ensure that they were correctly located and warranted special protection.

Cooper (1981) observed 300 animals on the north side of the Kazan River east of Thirty Mile Lake on 27 June, 1980. He suggested that the animals had crossed northward over the Kazan River near Kazan Falls (water crossing No. 9).

6. The Maguse River System

Birket-Smith (1929) summarized traditional caribou crossings according to native hunters he met on the Kazan River. He stated that there were crossings at Haunequoq above Mistake Bay (on the Hudson Bay coast) and at Padlitjuaq, the location of which he did not describe. East of Hikoligjuaq (Yathkyed Lake) were: Kertoq on Maguse River, Morjunitjuaq, Tuglerutik, Kumngerudluk, and Nunarjuaq. He did not locate or further describe these locations.

Banfield (1954b) listed well-known crossings in the Keewatin district where caribou were regularly speared. These included crossings at the mouths of the Ferguson, Maguse, and Thlewiaza Rivers on the Hudson Bay coast, east of the designated water crossings (Fig. A-la). According to residents of Churchill and Eskimo Point, caribou were probably still speared at the mouths of the Maguse and Thlewiaza Rivers as late as the mid-1950's (Banfield 1954b).

Kelsall and Loughrey (1955) reported the crossing of the frozen mouths of the Ferguson and Wilson Rivers (east of the designated water crossings) by caribou in late April 1955.

Loughrey (1955) summarized observations by Voisey of a large migration of caribou through the Padlei district on a broad front from Maguse Lake west to Yathkyed Lake in late July 1954.

Loughrey (1956) described the southward summer migrations of the Duck Lake (Kaminuriak) herd. He stated the elements of the herd crossed the Thlewiaza River in the vicinity of Edehon Lake.

Darby (1978) stated that numerous caribou crossed the Maguse River during late July and early August between Maguse Lake and

the coast. He witnessed approximately 7-8,000 caribou crossing the McConnell River heading south on 15 August, 1978 about 30 km east "of Ray Lake. Darby stated that all observed crossing activity on the McConnell occurred within a 13 km stretch of river.

Henik Lakes Area

Manning (1948) observed four caribou carcasses and numerous recent caribou trails at the north end of South Henik Lake on 24-26 July, 1945, which would be in the area of water crossing No. 3.

Banfield (1954a) described spring migration routes of the Saskatchewan (Kaminuriak) herd as crossing North Henik Lake and continuing towards the Ferguson River area.

7. Kaminuriak Lake Area

See Results.

8. Baker Lake and Chesterfield Inlet Area

The literature contains no firsthand observations of water crossing activity in the vicinity of water crossing No. 12 (Christopher Island) .

Rae (1852) reported observations of natives spearing caribou when they swam across Chesterfield Inlet in the autumn" Birket-Smith (1929) reported caribou "as fax as the eYe could 'een on the south shore of Baker Lake in late July, 1922. Birket-Smith

observed the caribou from the island of Orpiktujoq at the west end of Baker Lake and observed that the "whole of the south shore seemed to be alive with animals (p.56)". He named two locations in the Baker Lake area considered to be important caribou crossings by native hunters: Morjunitjuaq at the outlet of Baker Lake to Chesterfield Inlet (water crossing No. 12, Christopher Island), and Kangerjuaq, a few kilometers west of the lake near the mouth of the Thelon River (east of water crossing No. 13). Birket-Smith stated that the crossing at the east end of Baker Lake had been spoiled for hunting by the R.C.M.P. having erected a building at the location.

Hornby (1934) reported that large numbers of caribou had been seen crossing the (Thelon) river close to Baker Lake (east of water crossing No. 13) towards the end of August, 1925.

Manning (1948) observed "very recent" tracks on the shore of Christopher Island (water crossing No. 12) on 23-26 August, 1945. Manning did not describe the number or orientation of the tracks. He reported an observation by Corporal Hamilton of the R.C.M.P. who had seen large numbers of caribou crossing Chesterfield Inlet at its western end (water crossing No. 12) in 1944.

Lawrie (1948) studied mid-summer movements of the Keewatin caribou (Kaminuriak and Beverly herds) in 1948 and 1949. He felt that information respecting the eastern (Kaminuriak) calving and mid-summer migration from that area was limited. Lawrie received reports that when the calves were able to travel, these herds drifted northwesterly towards Baker Lake, and that in previous years, these movements had frequently crossed the east end of Baker Lake and then swung west along its north shore. Lawrie reported that these movements had not occurred recently.

Banfield (1954a) stated that caribou frequented the region fran the lower Thelon from Aberdeen Lake to the eastern end of Baker Lake during the winter months. He proposed that mid-summer movements of the Saskatchewan (Beverly) herd resulted in large-scale eastern movements of caribou in the region of the large lakes on the lower Thelon River. These movements brought large herds to the western end of Baker Lake. He described the animals as passing southeast along the south shore of Baker Lake to the Kazan River, but did not suggest that any large movements passed around either end of Baker Lake.

Eskimos at Baker Lake reported that many caribou crossed the narrows to Bowell Islands (water crossing No. 12) and continued on the north side of Chesterfield Inlet in late June or early July 1972 (Miller 1972) . Miller was unable to substantiate this crossing.

Welland (1976) surveyed native hunters from the Keewatin District to determine important hunting locations. He proposed that the eastern end of Baker Lake was an important crossing area.

The single documented instance of large numbers of caribou occurring around the eastern end of Baker Lake was in March 1976, prior to break up. Fischer et al. (1977) observed an estimated 17, 534 animals concentrated on both sides of Chesterfield Inlet and on Christopher and Bowell Islands. They proposed that these animals represented tundra wintering segments of the Kaminuriak population. Routes to the Baker Lake area from summer ranges north of Chesterfield Inlet remain unclear. Residents of Baker Lake reported to IDS biologists that caribou returned to the area in fall from the south and southeast, moving across or around the

east end of Baker Lake in late fall or early winter (IDS 1978) . Therefore, one cannot be certain to which herd those caribou belonged.

9. The Back River System

Anderson (1857) reported important caribou passes at the rapids between Pelly and Garry Lakes, and at the Hawk Rapids.

Hanbury (1904) reported that Eskimos living on Back River speared caribou at traditional crossing places.

pike (1917) described an important caribou crossing on Back River. His camp was at the point where the Back River runs out of Muskox Lake (64°38'N, 108°14'W). A short distance above his camp was "the best swimming place for caribou known to the Indians (p.286) ". In sane years, immense slaughters were made at this site. Pike identified a crossing site on the east side of the Back River just as it flowed out of an unnamed lake west of Lake Beechey (65o28'N, 107°10'W). Pike observed signs of habitation, including large quantities of muskox and caribou bones and horns. He found hiding places among rocks close to the river and surmised that they had been used for concealing hunters engaged in spearing the swimming caribou.

10. The Nueltin, Duck and Nejanilini Lakes Area

Harper (1932) documented extensive observations of caribou crossing activities and movements in the Windy Bay region of Nueltin Lake. Harper described Windy Bay as "a very definite crossing place for the caribou, as if sane invisible barrier on

each side kept then to a cerain line of march". He quoted a trapper who was familiar with the region as saying that caribou followed an almost identical route across Windy Bay each year. Harper described how the effect of topography on the south shore of Windy Bay funneled animals into a bay (South Bay) at right angles to Windy Bay. The animals then passed north across the ice of Windy Bay from the mouth of South Bay. Harper observed animals crossing northward at the mouth of Windy River from late May to the end of June, 1947. He reported the main southward migration from 24-29 August, 1947.

Harper (1932) described how local topography caused southward moving caribou to pass around the head of Windy Bay and to cross the lowermost portions of Little and Windy Rivers. He suggested that numerous islands in the upper part of Windy Bay posed a barrier to southward moving animals. A minor proportion of the caribou crossed Windy Bay where an island lay close to the north shore. The animals then steered for a small rocky inlet a quarter of a mile northwest of the mouth of South Bay and walked through the shallow bordering waters. Harper proposed that this was an annual route. Most animals, deflected to the west by Windy Bay, proceeded along the north shore of the bay to Little River. At this point animals either crossed the river at its mouth or passed upstr eam and waded across at a rapid. Harper (1932) observed that human and canine presence tended to deflect caribou so that animals crossed Windy River at various points above its mouth.

Lawrie (1948) observed southward crossing activity on Windy Bay of Nueltin Lake on 17 August, 1948. He noted large groups of caribou swimming south across Windy River and Bay and passing

southwest along the shore of the river. Lawrie documented the spearing of swimming caribou from a canoe as the animals crossed Windy Bay.

Lawrie (1948) repeated Harper's (1932) observations of caribou being concentrated by topography south of Windy Bay, Nueltin Lake. He witnessed such concentrating effects during the fall of 1948 when caribou were moving north in the return phase of mid-summer migration. Lawrie added the observation that upon emerging from the valley on the south shore, caribou swam a short distance to an island which had a long northerly directed point almost transecting the bay.

Lawrie (1948) cited observations by Mowat of topographic funneling of caribou at the Deer's Way on the east side of Seal Hole Lake in 1947.

Banfield (1954a) described the spring migration of the Saskatchewan (Kaminuriak) herd as moving along the western shore of Nueltin Lake and across Windy Bay. He proposed that the autumn migration of the Brochet (Kaminuriak) herd extended southward across Windy Bay and along the western shore of Nueltin Lake.

Banfield (1954b) reported that the most important point where Indians speared caribou during the southward caribou migration was at Nejanilini Lake, immediately north of Duck Lake Post, Manitoba. Staunton (cited in Banfield 1954b) stated that animals were speared annually at Nejanilini Lake.

Loughrey (1956) stated that the 1956 mid-summer migration of the Duck Lake (Kaminuriak) herd was unusual in that only a few hundred animals crossed Duck Lake at the narrows at the south end of the Lake. These narrows are the location where Chipewyan

Indians frequently made large kills. Loughrey proposed that the major movement in 1956 was in a general northeasterly direction with crossings being made at the north end of Duck Lake and over the narrow river that joins that lake with Nejanilini Lake.

Loughrey (1956) inspected a crossing at south Nueltin Lake where during the previous autumn (1955) Indians killed about 500 animals.

Kelsall (1968) summarized observations by Robertson 'ho reported on the slaughter of about 450 caribou by six Indian hunters at the Duck Lake narrows in September 1955.

Tagging Reports

Howard (1961, 1962), reported on the tagging of southward migrating caribou at the water crossings in the Little Duck area of northern Manitoba. In 1961 the majority of crossing activity was from about 16 to 17 August. In 1962 most crossing occurred between 16 and 25 August at the main crossing on Nejanillini Lake.

Parker (1972b) summarized the caribou tagging program in the N.W.T. He stated that tagging (at Duck Lake) 'as 'nitiated 'n September, 1959 and continued every fall to 1967.

APPENDIX C. The ranking of designated water crossings relative to past, present and-anticipated mineral exploration activity and on the geology and mineral potential of the area (from updated report by P. Laporte, DIAND, 1980) .

Priority		Crossing
A	9	Kazan Falls
	10	Above Kazan Falls
	11	Thirty Mile Lake
	12	Christopher Island
	14	East Schultz Lake
	15	West Schultz Lake
	16	West Qamanaarjuk Lake
B	4	Northwest Kinga Lake
	13	TheIon River
	17	East Aberdeen Lake
	18	East Central Aberdeen Lake
	20	West Aberdeen Lake
C	3	Henik Lake Narrows
	21	Dubawnt River
D	1	North of Roseblade Lake
	2	South of South Henik Lake
	5	Maguse River
	6	Mackenzie Lake
	7	West Kaminuriak Lake
	8	North Kaminuriak Lake
	19	Central Aberdeen Lake
	25	Lac du Bois
	26	Mary Frances Lake
E	22	East Thelon Sanctuary
	23	Centre Thelon Sanctuary
	24	West Thelon Sanctuary
	27	Lockhart River