

FINAL REPORT
TO
NORTHWEST ALASKAN PIPELINE COMPANY

FIELD VALIDATION OF FISH STREAMS BETWEEN
THE CANADIAN BORDER AND DELTA JUNCTION
FOR NORTHWEST ALASKAN PIPELINE COMPANY

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FIELD VALIDATION OF FISH STREAMS BETWEEN THE CANADIAN BORDER AND DELTA JUNCTION FOR NORTHWEST ALASKAN PIPELINE COMPANY

INTRODUCTION

State and Federal agencies require special provisions for the design and timing of pipeline construction that impacts bodies of water containing fish. Since last minute changes in design or scheduling due to the late discovery of fish in a stream can cause expensive delays, it is to the advantage of the pipeline builder to have early knowledge of all bodies of water containing fish along his proposed pipeline route so that construction planning can take fisheries considerations into account. Several prior studies and/or reviews of the fish resources along the Northwest Gas Pipeline route between Delta Junction and the Canadian border have been completed (Van Hying, 1976 and 1978; Valdez, 1976; and Pearse, 1978). These studies have concentrated primarily on the larger streams or lakes with obvious fish potential. Dames & Moore learned during construction of the Alyeska oil pipeline that it was often the small streams that created difficulties because fish resources were not obvious and were not discovered until construction was well underway. For this reason the present study addressed itself only to those streams or lakes where the presence of fish had not been previously documented. The primary purpose was simply to establish the presence or absence of fish for all bodies of water that will be crossed or encroached upon by the gas pipeline within the study area. The intent of this study was to provide Northwest Pipeline Company with a complete list of fish streams for the pipeline route. This report covers that portion of the route between the Canadian border and Delta Junction, Alaska.

METHODS

SELECTION OF STREAMS AND OTHER BODIES OF WATER

Prior to beginning field work, a preliminary list of possible streams and lakes was compiled using information from aerial photos,

topographic maps, and Northwest Alaskan Pipeline Company photo-mosaic alignment sheets. The list was used as a guide to potential streams along the pipeline route especially in those areas where the proposed pipeline route does not closely follow the Alaskan Highway. Extensive portions of the pipeline route are in close enough proximity to the highway so that drainages crossing the highway can be assumed to also cross the pipeline route. In such areas basic reconnaissance was accomplished adjacent to the highway. All streams containing more than negligible flow were evaluated at the highway and at the pipeline crossing. A significant number of streams were identified in the field that had not been noted from map and photo examination.

STREAM REFERENCE SYSTEM

The locations of bodies of water were referenced primarily to Northwest Alaskan Pipeline Company alignment sheets, Series 1500-P. These sheets provide pipeline mileposts and survey station numbers originating at Delta Junction and proceeding eastward. Streams were also identified by Alaska Highway mileposts to the nearest tenth of a mile. In the case of streams that cross both the pipeline and highway, the highway milepost was provided for the location where the stream crosses the highway. The highway milepost roughly opposite the pipeline location was used to identify lakes or streams that do not cross the highway.

SURVEY METHODS

PHYSICAL DATA

The following physical data were collected for each stream or lake: temperature, depth, width (surface area for lakes), current velocity, flow volume, bed characteristics and bank characteristics. Velocity and flow values were primarily subjective estimates; the small water volume and irregular channel characteristics of most of the streams

made quantitative determinations difficult. Furthermore, the volume of water in the small streams fluctuated widely on a day-to-day basis suggesting that accurate one-time measurements would not be meaningful.

FISH SURVEYS

All waters judged to have any potential as fish habitat were sampled. The primary sampling method used to determine fish presence was electroshocking using a Smith-Root Type VII backpack shocker. The amount of effort spent on any one body of water was dependent on site characteristics. More promising waters generally received more effort than those with marginal habitat. As a minimum, streams were usually shocked in selected stretches both above and below the pipeline crossing and, when appropriate, above and below the highway crossing. Seining with a 10-foot fine-mesh beach seine was used as an alternate sampling method in some situations where the backpack shocker was not appropriate or practical.

RESULTS AND DISCUSSION

The results of the study are tabulated for each stream and lake in sequential order from west to east. All streams and lakes are listed even if they were found to be dry or otherwise unsuitable as fish habitat. The stream inventory includes:

- 58 dry streams or bodies of water that were definitely not fish habitat (not sampled for fish presence and no physical data collected).
- 14 streams with minimal flow that did not contain viable fish habitat at the time of the study (physical data collected but not sampled for fish presence).

- 63 streams and lakes that appeared to contain viable fish habitat (sampled for fish presence).

Of the latter category, only one stream was found to contain fish (N.W. Milepost 92.9). Fair numbers of adult grayling in spawning condition were captured at this location. This stream was sampled only in the vicinity of the highway because the pipeline route was unsurveyed through this segment and inaccessible due to swampy terrain. The proposed pipeline route crosses this fish stream about 750 meters upstream from the highway. Aerial photos show a well defined channel to within 150 meters of the pipeline; therefore, grayling can be assumed to be present to at least that point and possibly at the pipeline itself. The fish population in this stream would be particularly sensitive to disturbance during the spring spawning period (May through June) and during hatching and rearing of young (June and July).

Eight streams were rated by the investigators as being good fish habitat although no fish were observed. Reasons for the lack of fish were not conclusively determined, although four of these streams contained probable blocks to fish passage due to poor placement of highway culverts. An additional eight streams with less favorable fish habitat also contained probable fish blocks at the highway. In some cases the downstream ends of these culverts were perched above the streambed creating definite fish blocks, and in other cases culverts were steeply sloped causing water velocities that would prohibit passage of fish. Some of the streams crossed by the Alaska Highway may have had traditional grayling populations whose spawning grounds were cut off by highway construction leading to eventual elimination of those populations.

It is possible that some of the streams contain fishery resources that were not detected by this study. Grayling spawners, the most likely inhabitants of the smaller streams, may have passed upstream of the sampling locations. However, the water temperatures in the flowing systems ranged from 1° to 8°C. (\bar{x} = 4°C.) which corresponds with the

temperatures at which grayling are known to move into smaller streams (Netsch, 1975; Mac Phee and Watts, 1975). It seems likely that if sizable grayling populations were present in these streams, they would have been detected by the methods employed. Nevertheless, it is recommended that the streams rated as good fish habitat should be re-investigated during the spring of 1979 to evaluate fish presence. Future investigations should occur earlier than the 1978 studies and be carefully timed to coincide with local breakup conditions in order to maximize the likelihood of detecting migrating grayling.

PERSONNEL

This project was directed by James E. Hemming, Dames & Moore, Anchorage. Field investigations were carried out by Dr. Jonathan Houghton of Dames & Moore, Seattle and Mr. John Morsell of Dames & Moore, Anchorage.

REFERENCES

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DAMES & MOORE/NORTHWEST PIPELINE CORPORATION
SMALL STREAM SURVEY REPORT FORM

Survey Number 1, Delta Junction to the Canadian Border, May 30 - June 12, 1978

Stream Location

Alaska Highway Mile Post	Northwest Survey Station	Northwest Mile Post	Temperature (C°)	Depth (cm)	Width ¹ (m)	Velocity (m/s)	Flow (m ³ /s)	Bed	Bank	Fish Species	Notes
1411.1	534+00	10.1	--	--	--	--	--	--	--	--	Dry 5/31, 6/3
1407.2	752+20	14.2	--	--	--	--	--	--	--	--	Dry 5/31, 6/3
1403.9	933+00	17.7	--	--	--	--	--	--	--	--	Dry 5/31, 6/3
1400.1	1133+26	21.5	--	--	--	--	--	--	--	--	Dry 5/31, 6/3
1398.5	1217+40	23.0	--	--	--	--	--	--	--	--	Dry 5/31, 6/3
1397.3	1275+92	24.2	--	--	--	--	--	--	--	--	Dry 5/31, 6/3
1392.1	1563+00	29.6	--	--	--	--	--	--	--	--	Dry 5/31, 6/3
1391.8	1474+00	29.8	--	--	--	--	--	--	--	--	Dry 5/31, 6/3
1390.4	1644+00	31.1	--	--	--	--	--	--	--	--	Dry 5/31, 6/3
1387.9	1776+40	33.6	--	--	--	--	--	--	--	--	Dry 5/31, 6/3
1385.8	1887+42	35.7	--	--	--	--	--	--	--	--	Dry 6/1
1385.7	1890+80	35.8	--	--	--	--	--	--	--	--	Dry 6/1
1385.7	1894+29	35.9	--	--	--	--	--	--	--	--	Standing water only 6/1
1385.6	1900+80	36.0	Unknown	200	7000 ¹	--	--	Grass-mud	Grass	Unknown	Not sampled. Isolated pond 150 ft. west of Haines r.o.w. Two pair scaup and one pair horned grebes observed.
1385.2	1917+00	36.3	14	200	3000 ¹	--	--	Grass-mud	Grass-shrub	None	Shocked. Isolated pond. Beaver use, 1 beaver or muskrat observed. Two pair bufflehead observed.
1384.9	1933+30	36.6	2	10-30	1	0.3-0.9	.06	Silt to gravel	Incised. Mossy soil.	None	Shocked. Possible fish habitat.
1384.1	1973+60	37.4	14	200	5600 ¹	--	--	Grass-mud	Grass	None	Shocked. Isolated pond. One pair bufflehead, 1 green-winged teal observed.
1383.8	1985+60	37.6	15	200	2100 ¹	--	--	Grass-mud	Grass	None	Shocked. Isolated pond. One bufflehead observed.
1383.6	2009+40	38.1	13	100	400 ¹	--	--	Grass-mud	Grass	None	Shocked. Isolated pond.
1382.9	2039+40	38.7	2	10	1	0.3-0.6	0.003	Grass-moss	Grass-moss	None	Shocked. Continuous flow at highway but discontinuous at pipeline r.o.w.
1382.7	2056+70	38.9	2	10-20	0.5	0.1-0.3	0.003	Grass	Grass	None	Not sampled. Unlikely fish habitat.

¹For ponds surface area in m² is given.

DAMES & MOORE/NORTHWEST PIPELINE CORPORATION
SMALL STREAM SURVEY REPORT FORM (Cont.)

Survey Number 1, Delta Junction to the Canadian Border, May 30 - June 12, 1978

Stream Location			Temperature (C°)	Depth (cm)	Width ¹ (m)	Velocity (m/s)	Flow (m ³ /s)	Bed	Bank	Fish Species	Notes
Alaska Highway Mile Post	Northwest Survey Station	Northwest Mile Post									
1382.4	2065+20	39.2	4	10-20	0.5	0.1-0.3	0.003	Grass	Grass	None	Not sampled. Unlikely fish habitat.
1382.3	2068+20	39.2	15 pond 6 inlet	100 10	460 ¹ 1m	0.3	0.003	Grass-mud	Grass	None	Shocked. Pond adjacent to r.o.w. with inlet that crosses r.o.w.
1381.4	2112+00	40.0	15	100-150	2100 ¹	--	--	Mud- Equisetum sp	Grass- Equisetum sp.	None	Shocked. Isolated pond.
1381.3	2120+00	40.1	4	5-20	0.2-0.5	0.1-0.3	0.003	Grass	Grass	None	Shocked. Unlikely fish habitat.
1381.0	2138+80	40.5	Unknown	100-200	900 ¹	--	--	Grass-mud	Marsh	None	Not sampled. Dying lake.
1377.0	2347+40	44.4	7	5-20	0.5-1.5	0.3-0.9	0.06	Grass-moss	Soil-moss- grass	None	Shocked. Possible fish habitat but little spawning potential above highway.
1373.1	2546+40	48.2	3	5-15	0.5-2	0.3-0.6	0.003	Grass-mud	Grass	None	Shocked. Unlikely fish habitat.
1372.4	2584+20	48.9	--	--	--	--	--	--	--	--	Dry 6/2
1369.5	2730+60	51.7	--	--	--	--	--	--	--	--	Dry 6/2
1366.7	2889+10	54.7	--	--	--	--	--	--	--	--	Dry 6/2
1364.4	3003+80	56.9	4	20-150	1.5-4	0.3-1.8	0.2	Silt to gravel	Soil and var- ied vegetation	None	Shocked above and below highway. Appeared to be good fish habitat. Clear brown water. Highway culvert could be fish block.
1363.4	2990+40	57.9	12	10-20	0.3	--	Negli- gible	Grass	Grass	None	Not sampled. Unlikely fish habitat.
1363.1	3063+40	58.1	--	--	--	--	--	--	--	--	Standing water only. 6/3
1361.7	3115+20	59.0	6	10-50	0.3-1	0.1-0.6	0.003	Grass-mud	Grass	None	Shocked. Unlikely fish habitat, marshy area.
1361.7	3125+20	59.2	2	30-150	0.5-4	0.3-0.9	0.08	Mud	Grass-mud	None	Shocked. Possible fish habitat.
1361.7	3126+20	59.2	6	10-50	0.3-1	0.1-0.6	0.01	Grass-mud	Grass	None	Shocked. Fork of previous stream. Unlikely fish habitat.

¹For ponds surface area in m² is given.

DAMES & MOORE/NORTHWEST PIPELINE CORPORATION
 SMALL STREAM SURVEY REPORT FORM (Cont.)

Survey Number 1, Delta Junction to the Canadian Border, May 30 - June 12, 1978

Stream Location

Alaska Highway Mile Post	Northwest Survey Station	Northwest Mile Post	Temperature (C°)	Depth (cm)	Width ¹ (m)	Velocity (m/s)	Flow (m ³ /s)	Bed	Bank	Fish Species	Notes
1361.7 (sampled at highway crossing)	3115+20, 3125+20, 3126+20 - these 3 streams (see above) merge and cross highway at one location.	59.0-59.2	7	20-100	0.5-2	0.3-0.9	0.14	Silt to gravel	Grass-soil	None	Shocked above and below highway. Appeared to be good fish habitat.
1352.8	3603+37	68.3	--	--	--	--	--	--	--	--	Dry 6/2
1352.3	3634+20	68.8	1	10-30	0.5-3	0.2-0.6	0.06	Grass-mud	Grass	None	Shocked above and below highway. Large pool below culvert. Muskeg area.
1351.7	3665+72	69.4	2	10-50	0.3-1	0.3-0.6	0.01	Mud	Grass	None	Not sampled. Unlikely fish habitat.
1351.1	3699+00	70.1	3	10-50	0.3-1	0.3-0.6	0.003	Grass-mud	Grass	None	Not sampled. Unlikely fish habitat.
1350.8	3714+00	70.3	3	20-70	0.3-1.5	0.3-0.9	0.03	Silt to gravel	Grass	None	Shocked. Marginal fish habitat.
1350.2	3742+80	70.9	6	10-150	0.5-3	0.2-0.9	0.03	Silt to gravel	Grass and shrub	None	Shocked. Marginal fish habitat at r.o.w. Large pool below highway culvert. Fish passage probably blocked by culvert.
1350.1	3748+80	71.0	5	10-50	0.3-1	0.3-0.9	0.03	Gravel	Grass-moss	None	Seined. Appeared to be fair fish habitat.
1349.4	3791+60	71.8	3	10-30	0.3-1	0.3-0.9	0.01	Silt to gravel	Grass	None	Shocked above and below highway. Fish passage blocked by highway culvert.
1348.5	3830+60	72.5	20	200	1200 ¹	--	--	Mud	Grass	None	Seined. Isolated pond.
1346.5	3937+49	74.5	--	--	--	--	--	--	--	--	Dry at highway. 6/4
1345.7	3972+95	75.2	--	--	--	--	--	--	--	--	Dry at highway. 6/4
1345.3	4000+56	75.7	--	--	--	--	--	--	--	--	Dry. 6/4
1345.2	4003+52	75.8	--	--	--	--	--	--	--	--	Dry. 6/4

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DAMES & MOORE/NORTHWEST PIPELINE CORPORATION
 SMALL STREAM SURVEY REPORT FORM (Cont.)

Survey Number 1, Delta Junction to the Canadian Border, May 30 - June 12, 1978

Stream Location			Temperature (C°)	Depth (cm)	Width ¹ (m)	Velocity (m/s)	Flow (m ³ /s)	Bed	Bank	Fish Species	Notes
Alaska Highway Mile Post	Northwest Survey Station	Northwest Mile Post									
1344.1	4069+60	77.1	--	--	--	--	--	--	--	--	Dry. 6/1, 6/4
1343.7	4090+60	77.4	9	10-30	0.5-2	0.1-0.6	Hwy. - 0.03 R.O.W. 0.006	Silt to cobble	Grass-mud	None	Shocked above and below highway. Marginal fish habitat below highway and unlikely habitat above. Fish passage probably blocked by highway culvert.
1343.1	4119+40	78.0	--	--	--	--	--	--	--	--	Dry. 6/1, 6/4
1342.1	4168+78	78.9	--	--	--	--	--	--	--	--	Multiple channels. All dry 6/1, 6/4.
	4189+50	79.4	--	--	--	--	--	--	--	--	
1341.0	4227+43	80.1	--	--	--	--	--	--	--	--	Dry. 6/1, 6/4
1340.9	4233+00	80.2	--	--	--	--	--	--	--	--	Dry. 6/1, 6/4
1340.0	4285+30	81.1	--	--	--	--	--	--	--	--	Dry. 6/1, 6/4
1339.8	4296+30	81.3	--	--	--	--	--	--	--	--	Intermittent. 6/1
1338.7	4326+41	81.9	--	--	--	--	--	--	--	--	Multiple channels. All dry. 6/1, 6/4
1339.0	4357+85	82.5	--	--	--	--	--	--	--	--	
1338.2	4387+40	83.1	--	--	--	--	--	--	--	--	Dry 6/1, 6/4
1336.9	4468+00	84.7	3	10-50	0.5-1.5	0.1-0.6	0.006	Silt to sand	Grass	None	Not sampled. Unlikely fish habitat. Ponding on r.o.w.
1336.9	4470+20	84.7	7	10-120	0.5-2.5	0.1-0.3	0.003	Silt to gravel	Grass-mud	None	Seined. Unlikely fish habitat.
1336.9 (sampled at high- way cross- ing)	Streams at 4468+00 & 4470+20 join prior to crossing highway	84.7	6	10-100	1-2	0.2-0.9	0.06	Silt to cobble	Mud-varied vegetation	None	Shocked above and below highway. Appeared to be good fish habitat.
1336.0	4503+00	85.3	--	--	--	--	--	--	--	--	No observations. Isolated pond. Unlikely fish habitat
1333.6	4595+23	87.0	--	--	--	--	--	--	--	--	Dry 6/2. Side channel of Yerrick Creek.
1333.1	4625+00	87.6	Stream 3	5-20	0.5-1	0.3-0.6	0.003	Sand to cobble	Grass	None	Shocked. Pond with inlet stream that crosses r.o.w.
			Pond 9	200	930 ¹	--	--	Grass-mud	Grass	None	
1331.9	4702+45	89.1	--	--	--	--	--	--	--	--	Two channels. Dry at highway. 6/1, 6/4
	4704+90		--	--	--	--	--	--	--	--	
1331.1	4735+50	89.7	3	5-20	0.3-0.5	0.3-0.6	0.003	Mud-leaves	Mud	None	Not sampled. Intermittent flow at r.o.w.

¹For ponds surface area in m² is given.

DAMES & MOORE/NORTHWEST PIPELINE CORPORATION
SMALL STREAM SURVEY REPORT FORM (Cont.)

Survey Number 1, Delta Junction to the Canadian Border, May 30 - June 12, 1978

Stream Location			Temperature (C°)	Depth (cm)	Width ¹ (m)	Velocity (m/s)	Flow (m ³ /s)	Bed	Bank	Fish Species	Notes
Alaska Highway Mile Post	Northwest Survey Station	Northwest Mile Post									
1330.5	4772+00	90.4	6	10-30	0.3-1	0.3-1.5	0.03	Gravel to boulders	Boulders	None	Shocked. Possible fish habitat below highway, high gradient above.
1330.0	4799+70	90.9	1	5-20	0.2-0.5	0.3-0.9	0.003	Mud-grass	Mud	None	Not sampled. Unlikely fish habitat.
1329.8	4811+45	91.1	2	5-20	0.2-0.5	0.3-0.9	0.003	Mud-leaves	Mud	None	Not sampled. Unlikely fish habitat.
1329.5 (sampled at high- way)	4826+80 & 4287+80	91.4	4	10-40	1-2	0.6-1.8	0.14	Cobbles to boulders	Cobbles to boulders	None	Shocked above and below highway. Appeared to be good fish habitat below highway, high gradient a- bove. Fish passage probably blocked by highway culvert.
W. Fork stream crossing at high- way at 1329.5	4826+80	91.4	4	5-20	0.5-1	0.3-0.9	0.01	Silt to sand	Mud	None	Shocked at r.o.w. Possible fish habitat but high gradient.
E. Fork of stream crossing highway at 1329.5	4827+80	91.4	4	5-20	0.5-1	0.6-1.2	0.03	Sand to cobbles	Cobbles	None	Shocked at r.o.w. Possible fish habitat but high gradi- ent. Divides into several forks at r.o.w.
1328.2	4903+40	92.9	3	20-100	0.5-3	0.3-0.9	0.14	Silt	Grass-willow	Gray- ling	Shocked above highway cul- vert. Captured 6 grayling from 170-265 mm (fork length) One pair green-winged teal observed. Unable to access pipeline crossing of this stream because of marshy terrain.
1311.5	5794+00 5814+00	109.7 110.1	--	--	--	--	--	--	--	--	Pipeline crosses same stream 3 times. Dry at highway 6/1, 6/4.
1310.6	5861+15	111.0	--	--	--	--	--	--	--	--	Dry at highway. 6/4, 6/9
1306.8	6065+57	114.9	--	--	--	--	--	--	--	--	Standing water only 6/5, 6/9
1305.4	6130+80	116.3	--	--	--	--	--	--	--	--	Dry. 6/9
1304.5	6178+31	117.0	13	30-100	200 ¹	--	--	Grass-mud	Grass-marsh	None	Shocked. Isolated pond.
1303.7	6221+25	117.8	--	--	--	--	--	--	--	--	Standing water only. 6/5

¹For ponds surface area in m² is given.

DAMES & MOORE/NORTHWEST PIPELINE CORPORATION
 SMALL STREAM SURVEY REPORT FORM (Cont.)

Survey Number 1, Delta Junction to the Canadian Border, May 30 - June 12, 1978

Stream Location

Alaska Highway Mile Post	Northwest Survey Station	Northwest Mile Post	Temperature (C°)	Depth (cm)	Width ¹ (m)	Velocity (m/s)	Flow (m ³ /s)	Bed	Bank	Fish Species	Notes
1302.7	6278+20	118.9	--	--	--	--	--	--	--	--	Standing water only. 6/5
1302.5	6289+32	119.1	2	10-30	0.2-0.4	0.1-0.3	0.003	Mud	Grass	None	Not sampled. Unlikely fish habitat. Highway culvert blocked.
1299.0	6448+60	122.1	--	--	--	--	--	--	--	--	Dry at highway. 6/5
1287.9	6529+20	123.7	3	30-120	0.4-2.0	0.2-0.9	0.03-0.06	Mud	Grass	None	Shocked. Fair fish habitat. Fish passage blocked by highway culvert.
1297.8	6538+20	123.8	--	--	--	--	--	--	--	--	Standing water only 6/5.
1296.7	6591+00	124.8	3	30-150	0.4-3	0.2-9.9	0.06	Mud	Grass	None	Shocked. Fair fish habitat. Fish passage blocked by highway culvert.
1296.6	6596+00	124.9	2	30-50	2000 ¹	--	--	Mud-grass	Marsh	None	Shocked. Isolated pond.
1293.0	6775+40	128.3	--	--	--	--	--	--	--	--	Standing water only 6/9.
1291.7	6837+00	129.5	--	--	--	--	--	--	--	--	Standing water only 6/5, 6/9
1290.6	6890+00	130.4	--	--	--	--	--	--	--	--	Standing water only 6/5
1289.5	6937+91	131.4	--	--	--	--	--	--	--	--	Standing water only 6/5
1287.1	7056+62	133.6	3	20-70	0.3-1.0	0.3-0.9	0.06	Mud	Grass-shrub	None	Shocked at and above power line r.o.w. Marginal fish habitat.
1286.3	7098+20	134.4	2	10-40	0.2-1.5	0.2-0.6	0.03	Mud-grass	Grass-shrub	None	Shocked at highway and at power line r.o.w. Marginal fish habitat to power line and unlikely habitat above.
1285.4	7161+80	135.6	2	20-80	0.4-1.5	0.2-0.6	0.03	Mud	Grass-shrub	None	Seined. Fair fish habitat.
1283.2	7254+61	137.4	3	20-120	0.4-2.0	0.3-0.9	0.06	Mud	Grass	None	Seined. Fair fish habitat.
1282.8	7264+60	137.6	2	10-60	0.3-2.0	0.3-0.9	0.03	Mud	Grass	None	Seined. Marginal fish habitat.
1281.1	7359+20	139.4	3	10-60	0.4-1.0	0.3-0.6	0.01	Silt to sand	Moss-shrub	None	Shocked. Marginal fish habitat. Fish passage probably blocked by highway culvert.
1281.0	7364+00	139.5	Stream 2 Pond 16	10-30 30-120	0.3-0.4 2500 ¹	0.2-0.3 --	0.003 --	Mud-moss Mud	Shrub-moss Shrub- <u>Equisetum sp.</u>	None None	Shocked pond and its inlet stream above highway. Unlikely fish habitat. Negligible flow at pipeline r.o.w.

¹For ponds surface area in m² is given.

DAMES & MOORE/NORTHWEST PIPELINE CORPORATION
 SMALL STREAM SURVEY REPORT FORM (Cont.)

Survey Number 1, Delta Junction to the Canadian Border, May 30 - June 12, 1978

Stream Location

Alaska Highway Mile Post	Northwest Survey Station	Northwest Mile Post	Temperature (C°)	Depth (cm)	Width ¹ (m)	Velocity (m/s)	Flow (m ³ /s)	Bed	Bank	Fish Species	Notes
1278.3	7505+60	142.1	10	10-100	0.5-1.5	Negligible	--	Silt to sand	Mud	None	Shocked pools in creek channel at pipeline. Evidence of flow earlier. Unlikely fish habitat.
1276.3	7589+20	143.7	--	--	--	--	--	--	--	--	Standing water only 6/6.
1275.6	7620+20	144.3	2	10-50	0.3-1.2	0.3-0.9	0.003	Mud-moss	Grass	None	Shocked. Unlikely fish habitat.
1275.2	7639+20	144.7	2	10-30	0.3-0.8	0.3	0.003	Mud-moss	Grass	None	Shocked pool below highway culvert. Unlikely fish habitat at pipeline r.o.w. Highway culvert is fish block.
1274.6	7664+00	145.2	--	--	--	--	--	--	--	--	Standing water only 6/6
1273.7	7707+67	146.0	--	--	--	--	--	--	--	--	Standing water only 6/6
1293.0	7744+12	146.7	3	30-150	0.4-2.0	0.3-0.9	0.11	Silt to gravel	Mixed vegetation	None	Shocked. Appeared to be good fish habitat especially below highway culvert which is probably a block to fish passage. Sampled from 100m below culvert to above pipeline r.o.w. on 6/6. Repeated sampling on 6/9.
1271.9	7800+40	147.7	1	10-30	0.2-1.0	0.2	0.003	Grass	Grass	None	Shocked. Unlikely fish habitat.
1270.4	7868+20	149.0	4	40-100	0.5-1.5	0.3	0.03	Mud	Shrub-moss	None	Shocked. Appeared to be good fish habitat up to 100m above highway. Deep pools but no gravel.
1268.0	7986+00	151.3	--	--	--	--	--	--	--	--	Small isolated pond.
1267.9	7992+00	151.4	--	--	--	--	--	--	--	--	Small isolated pond.
1266.5	8079+40	153.0	5	30-100	0.4-2	0.3-0.9	0.11	Silt to gravel	Grass-shrub	None	Shocked above and below highway and seined at pipeline r.o.w. Appeared to be good fish habitat but highway culvert is definite fish block.
1262.3	8218+12	155.6	5	10-40	0.2-1.5	0.2-0.6	0.006	Grass-mud	Grass	None	Shocked at single highway crossing and seined at pipeline crossings. Marginal fish habitat.
1262.3	8220+12	155.7	5	10-50	0.2-1.5	0.2-0.6	0.01	Grass-mud	Grass	None	
1258.7	8379+00	158.6	3	20-80	0.2-2.0	0.3-0.9	0.03	Grass-mud	Moss-willow	None	Seined several poorly defined tributaries to Silver Creek.

¹ If bank surface area in m² is given

DAMES & MOORE/NORTHWEST PIPELINE CORPORATION
SMALL STREAM SURVEY REPORT FORM (Cont.)

Survey Number 1, Delta Junction to the Canadian Border, May 30 - June 12, 1978

Stream Location

Alaska Highway Mile Post	Northwest Survey Station	Northwest Mile Post	Temperature (C°)	Depth (cm)	Width ¹ (m)	Velocity (m/s)	Flow (m ³ /s)	Bed	Bank	Fish Species	Notes
1253.1	8669+20	164.2	--	--	--	--	--	--	--	--	Standing water only 6/7
1252.8	8688+20 (Tenmile Creek)	164.5	12	30-150	0.5-2.5	0.6-1.5	0.17	Silt to gravel	Mixed vegetation	None	Shocked from below highway to pipeline r.o.w. Appeared to be good fish habitat. Some fast water stretches may limit fish movement.
1242.0	9235+20	174.9	--	--	--	--	--	--	--	--	Standing water only 6/7.
1241.2	9277+00	175.7	--	--	--	--	--	--	--	--	Dry at highway 6/7.
1240.6	9309+50	176.3	15	200	525	--	--	Mud	Grass-shrub	None	Shocked. Series of small ponds with intermittent flow between ponds.
1239.3	9369+60	177.4	--	--	--	--	--	--	--	--	Negligible flow 6/7.
1236.7	9501+00	179.9	8	20-60	0.3-1.2	0.2-0.6	0.01	Mud	Grass-mud	None	Seined. Unlikely fish habitat. Area below pipeline has been dug out for drainage.
1236.3	9520+00	180.3	13	40-100	0.4-2.0	0.2-0.9	0.08	Mud	Grass-mud	None	Shocked. Fair fish habitat.
1235.9	9535+50	180.6	--	10-30	0.2-1.0	0.1-1.0	1.003	Grass	Grass	None	Not sampled. Unlikely fish habitat.
1235.9	9538+00	180.6	5	20-50	0.3-1.2	0.2-0.6	0.01	Mud	Grass-mud	None	Shocked. Unlikely fish habitat, but becomes fair after confluence with above stream.
1234.7	9600+60	181.8	6	40-120	0.3-1.8	0.2-0.6	0.03	Mud	Grass-mud	None	Shocked. Fair fish habitat below highway.
1234.3	9617+60	182.2	--	--	--	--	--	--	--	--	Standing water only 6/8.
1234.2	9623+60 (Sweetwater Creek)	182.3	8	40-100	0.4-2.0	0.2-0.6	0.06	Mud	Grass	None	Shocked above and below highway. Fair fish habitat.
1232.1	9739+20	184.4	--	30-60	0.4-1.5	0.1-0.6	0.01	Grass-mud	Grass-moss	None	Shocked. Unlikely fish habitat near pipeline, possible habitat downstream.
1230.3	9788+80	185.4	17	200	300 ¹	--	--	Mud	Grass-willow	None	Shocked. Isolated pond.
1225.0	10025+00	189.9	--	--	--	--	--	--	--	--	Isolated pond off the r.o.w.
1224.5	10052+00	190.4	20	150	irreg.	--	--	Mud-aquatic vegetation	Grass-shrub-muskeg	None	Shocked. Frost created polyhedra with standing water in bog matrix. Unlikely fish habitat.

¹For ponds surface area in m² is given.

DAMES & MOORE/NORTHWEST PIPELINE CORPORATION
SMALL STREAM SURVEY REPORT FORM (Cont.)

Survey Number 1, Delta Junction to the Canadian Border, May 30 - June 12, 1978

Stream Location			Temperature (C°)	Depth (cm)	Width ¹ (m)	Velocity (m/s)	Flow (m ³ /s)	Bed	Bank	Fish Species	Notes
Alaska Highway Mile Post	Northwest Survey Station	Northwest Mile Post									
1223.4	10100+50	191.4	20	150	250 ¹	--	--	Mud	Grass	None	Shocked. Pond is probably isolated from Scottie Creek except at high flow. Evidence of beaver use.
1222.2	10162+48	192.4	5	10-40	0.2-1.0	0.1-0.3	0.01	Grass-mud	Grass	None	Shocked. Unlikely fish habitat. Large wet area on pipeline r.o.w. drains toward Scottie Creek.
N/A	10244+20	194.0	--	--	--	--	--	--	--	--	Marsh area. No flow.
N/A	10274+20	194.6	5	10-30	0.3-0.8	0.1-0.3	0.003	Grass-mud	Grass	None	Seined. Unlikely fish habitat. ²
N/A	10277+20	194.7	5	10-40	0.3-1.8	0.1-0.3	0.01	Grass-mud	Grass	None	Seined. Marginal fish habitat.
N/A	10282+40	194.7	6	10-30	0.1-0.5	0.1-0.3	0.003	Grass-mud	Grass	None	Not sampled. Unlikely fish habitat.

¹For ponds surface area in m² is given.

²The three streams at MP 194.6 and 194.7 join below pipeline and flow into a large lake that reportedly contains fish.