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POLLUTION OF STREAMS IN THE MAYO DISTRICT, Y. T.

By: R. E. McLaren & K. C. Lucas.

December 7, 1954

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I INTRODUCTION

On September 29th, 1953 the R.C.M.P. detachment at Mayo, Y.T. received a complaint from a resident of the South McQueston River area that it was no longer possible to catch fish in the waters of that stream. The complainant suggested to the R.C.M.P. that "refuse" from the local mine-mills which entered the river through smaller tributaries upstream might be the cause for the decline in the fishery. Subsequent investigation conducted by the R.C.M.P. revealed that mill tailings from Mackeno Mine Milling Co. Ltd. were being dumped in an area drained by Christal Creek and tailings from United Keno Holl Mines Ltd. mill at Elsa were being dumped in an area drained by Flat Creek.

During October, 1953, an R.C.M.P. patrol was carried out on the South McQueston River from McQueston Lake to the mouth of Haggart Creek. In general the results of their survey applied further evidence in support of the alleged pollution of the South McQueston River. Water samples were obtained on this patrol, however their analyses were inconclusive in establishing the presence of cyanide or other toxic metallic ions. Since the cause of the pollution was not definitely ascertained the R.C.M.P. requested that field officers of the Department of Fisheries investigate the problem. Accordingly it was included in the itinerary of the program conducted by Department of Fisheries technical personnel in the Yukon during the summer of 1954.

II RESULTS OF INVESTIGATION

The survey of the South McQueston pollution problem was carried out during the period July 12-16, 1954. During this period the problem was reviewed with the R.C.M.P. officers: the Mackeno and Elsa mills were inspected; Christal, Flat and Haggart Creeks, and the South McQueston River were visited. A site map is included in this report as figure 1 and a more detailed location map is presented in figure 2.

A. Review of Fisheries Problem.

The alleged pollution of the South McQuestion River and its possible effects on the fisheries were discussed with Constable Ferguson at Keno Hill prior to the survey. He had been associated with the problem since its inception and took a very active interest in the investigation. In general the following information was obtained from Constable Ferguson:

1. No grayling have been reported in Christal Creek since the Mackeno Mill started operations in the spring of 1952. Previous to this time, grayling apparently ascended this Creek from the South McQueston River in the spring time to spawn.
2. Numerous reports have been received indicating that grayling have not been caught or observed in the South McQueston River since the spring of 1952.
3. There have been no reports of Flat Creek being a spawning or fishing stream.
4. No information was available with respect to the value of

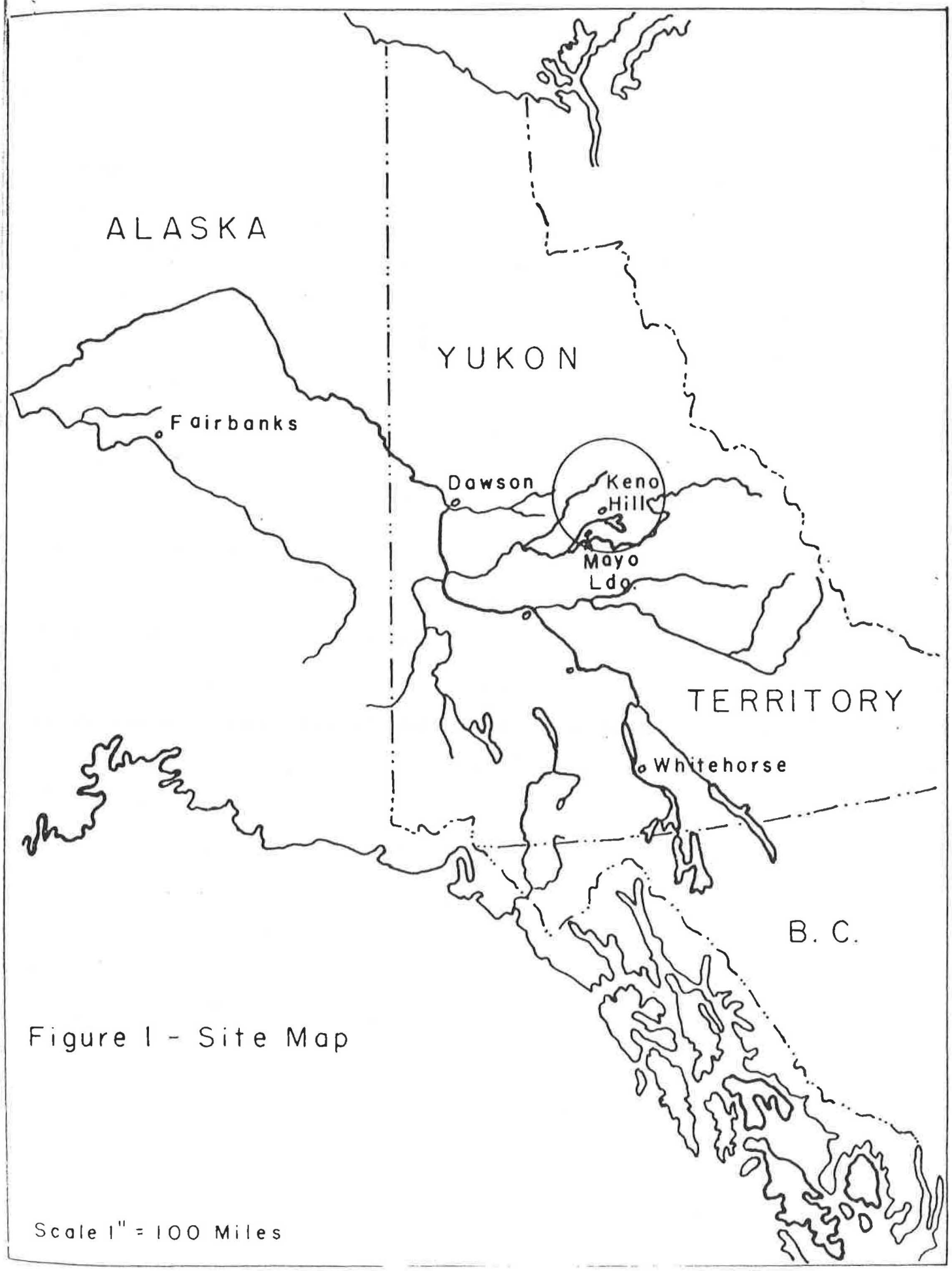

Figure 1 - Site Map

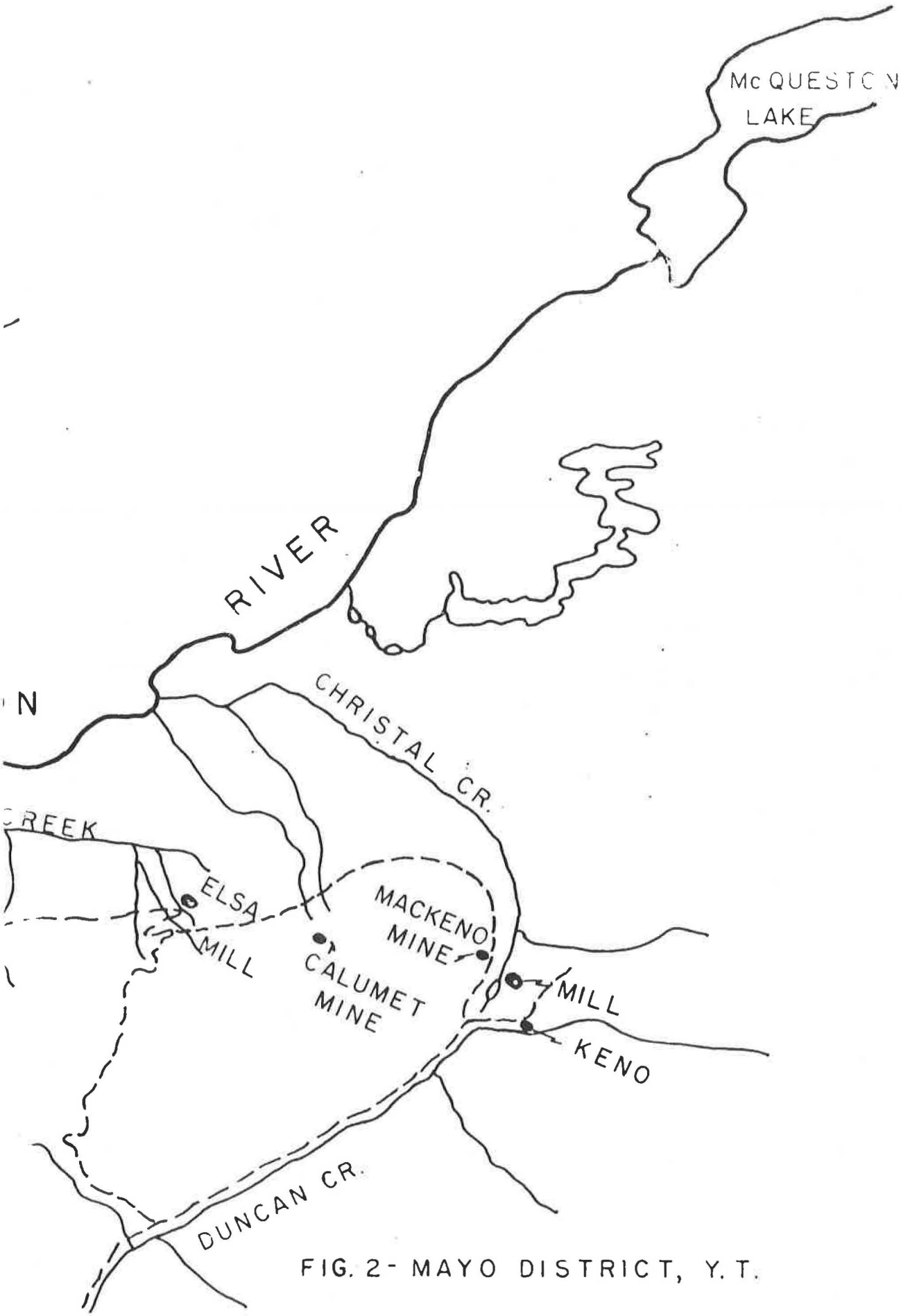

FIG. 2- MAYO DISTRICT, Y. T.

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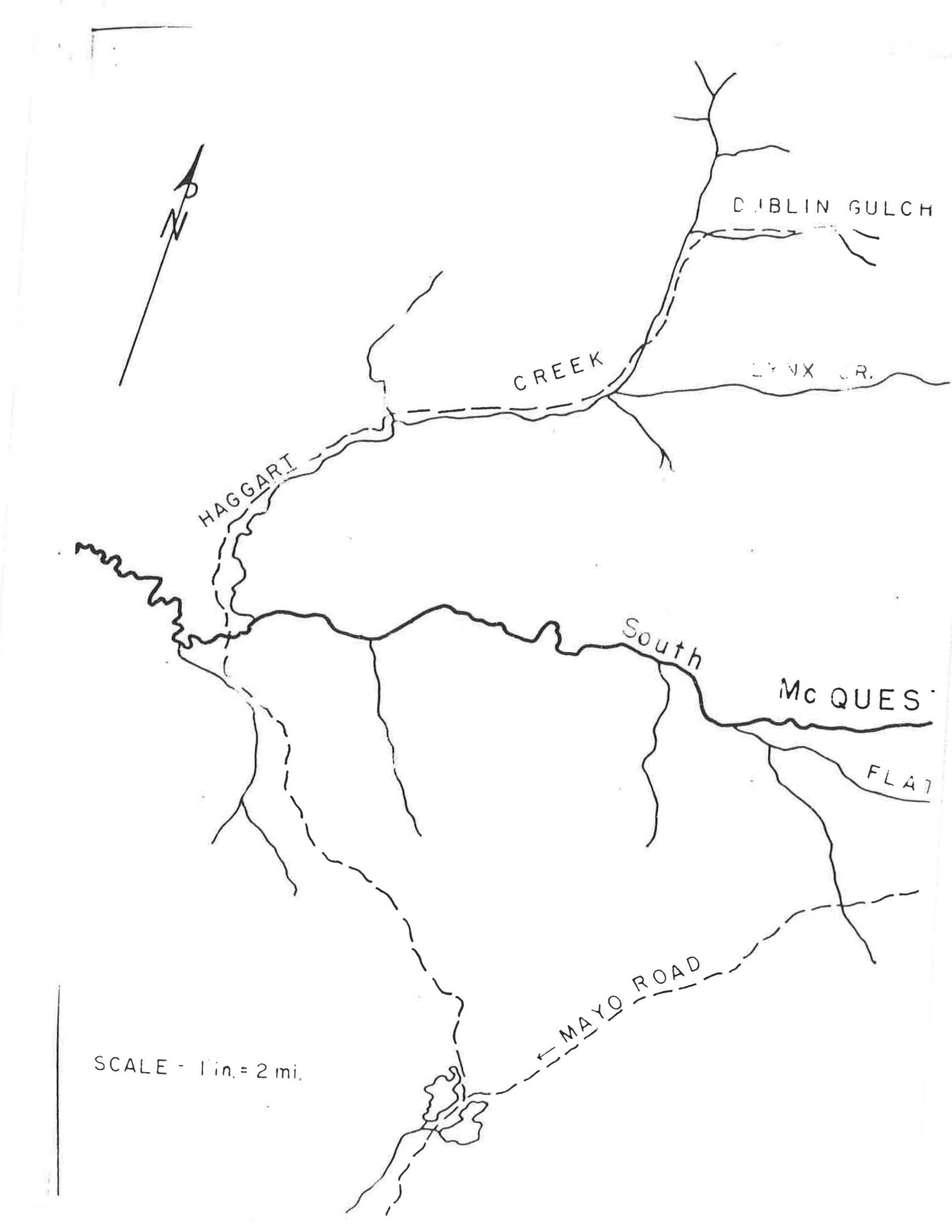
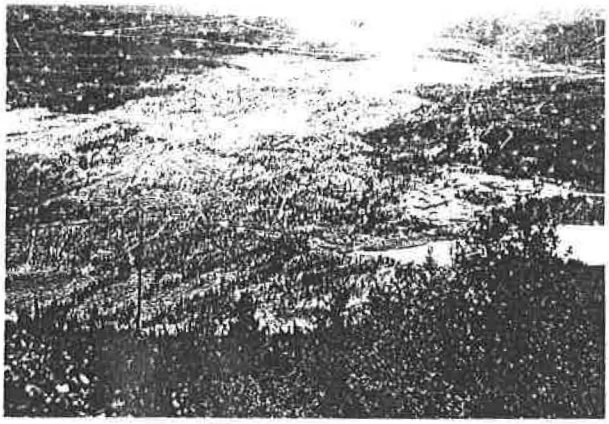

N
DUBLIN GULCH
CREEK
HAGGART
South
Mc QUES
FLAT
MAYO ROAD
SCALE - 1 in. = 2 mi.

Mackeno Mill, in foreground, located adjacent to Christal Lake.

View showing outfall of tailings from Mackeno Mill.

Looking downstream at Christal Creek showing inflow of mill sludge at right.



Looking down on Christal Cr. "flats", which is proposed site for disposal of mill tailings.

Figure 3.

Photographs showing Mackeno Mill, Christal Creek and the disposal of mill tailings.

Haggart Creek as a fisheries stream

5. Water samples taken by the R.C.M.P. October 7, 1953 were originally reported as being taken:

   (a) In South McQueston River upstream from Christal Creek.

   (b) In Christal Creek.

   (c) In Flat Creek.

However, upon being questioned on these locations, Constable Ferguson explained that samples were taken as follows:

   (a) In South McQueston River upstream from Christal Creek, as stated previously.

   (b) In South McQueston River immediately downstream from the mouth of Christal Creek.

   (c) In South McQueston River immediately downstream from the mouth of Flat Creek.

6. Water analysis showed that no sediment was present in the South McQueston River upstream from Christal Creek. However, the analysis showed that the water from Christal Creek was cloudy with greyish sediment and the water from Flat Creek was cloudy with dark brown sediment. Chemical tests were negative for the presence of cyanide or other toxic chemicals.

7. Placer mining is being conducted at Dublin Gulch, located 12 miles upstream from the South McQueston River on Haggart Creek and is causing much turbidity in Haggart Creek.

The fisheries problem in these streams involves primarily the grayling, Thymallus signifer. Although other species of fish and aquatic life are effected by this problem the grayling is apparently the one of most concern to the local residents.

With respect to the life history of the grayling, they spawn in the spring in small creeks, generally tributary to lakes, and in the fall they migrate downstream to the large rivers and lakes. In addition it is understood that numbers of grayling ascend the tributaries of main rivers to spawn.

B. Inspection of Mackeno and Elsa Mills.

1. Mackeno Mill

Mackeno Mill is located near Keno Hill, 40 miles northeast of Mayo, Y.T. The mill has been in operation since the spring of 1952, and processes base metal ores from Mackeno and Belkeno mines. The production of the mill is fairly constant with 120 tons of ore being milled to produce 60 tons of concentrate per day. The ore contains silver, lead and zinc. The flow sheet showing the operation, the point of application, and the purpose of each reagent is shown in Table I. It should be pointed out that the ores from Belkeno mine contain no zinc, and consequently no zinc reagents are used for this ore which is generally milled 3 or 4 days out of each month.

The mill wastes are carried from the mill in a 6-inch diameter wood stave pipeline approximately 750 ft. long. The pipeline discharges on the crest of a slope 100 feet West of Christal Creek and the sludge forms a stream which carries directly in to the creek. At the time of the inspection the discharge of mill tailings was estimated to be ¼ c.f.s., and the discharge of Christal Creek was estimated to be 4 c.f.s. Below the point where the mill tailings entered the stream was extremely turbid. There was little accumulation of tailings at the outfall indicating that they were

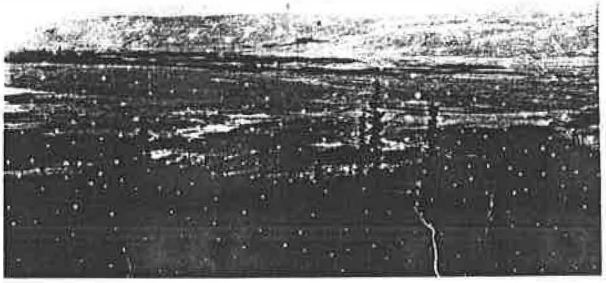
almost completely carried away by Christal Creek. This was further substantiated by the fact that there was no dead vegetation in the area of the outfall or along the creek bank.

Photographs showing the location of the Mackeno Mill, Christal Creek and the tailings outfall are shown in figure 3.

Table I. The sequence of operations, the reagents used and their purpose in a base metal mill.

Flow Sheet	Reagents	Use or Purpose
Ore		
Jaw Crusher		
Ball Mill	Soda Ash NaCN) ZnSO4) /----	PH regulator Depresses (precipitate) zinc in mill so that lead may be -picked up before zinc. ZnSO4 prevents silver going out of solution.
Classifier	Z-5 (Xanthate) Dow Froth A-31 (Air float) Cresylic Acid	
Lead Clotation Cells		Reagents added to classifier carry through to lead flotation cells. Ph is measured in first lead cell and is kept at 7.1
Zinc Flotation Cells	208 CuSO4 Soda Ash Z-9 Xanthate Dow Froth	CuSO4 cleans up Zinc cells from reagent added before.
Thickners		
Filters		
Concentrate		

View of United Keno Mill



View of United Keno Mill Tailing Dump

Figure 4.

Photographs showing United Keno Mill and the Tailing Dump

2. Elsa Mill

United Keno Hill Mill is located at Elsa, on Galena Hill, 32 miles northeast of Mayo, Y.T. The mill has been in operation since 1946 and processes base metal ores from the Elsa and Calumet-Hector properties. The production of the mill is fairly constant with 400 to 500 tons of ore being milled to produce 120 to 140 tons of concentrate per day. The ore contains silver, lead and zinc and the processes involved are much the same as that described previously for the Mackeno mill. A cyanide unit was added to the mill in 1949 and has greatly increased the efficiency of the processing.

The mill tailings, which mount to about 2000 tons of solution per day, are carried to a natural flat near Flat Creek. This creek is a very small stream, discharging 1 to 3 c.f.s., and it passes through approximately 4 miles of muskeg bog in a very flat wide valley before entering the South McQueston River. Observations at the site indicated that Flat Creek was carrying mill wastes from the mill dump either by flowing directly through the margin of the mill dump or by a connecting stream from the mill dump.

These observations were further substantiated through reports submitted by L. Requa, Forest and Game Warden, in which he stated that Flat Creek was very dark brown in colour during the fall of 1953. In this connection it appeared that this condition may have existed only in the last few years because the mill dump, has evidently been spreading towards Flat Creek. This is evident by the condition of the area and the presence of deeply worn channels in older sections of the dump.

Photographs showing the location of the United Keno Hill Mill, and the tailing dump are shown in figure 4.

C. Inspection of Haggart Creek and the South McQueston River

It was learned during the survey that Placer-Mining has been carried out in Haggart Creek since 1902. At present two operations are being conducted, one is being carried out by Wadeo Placers which are located 12 miles up Haggart Creek (above Lynx Creek). A second operation is being carried out by Mr. Taylor at Dublin Gulch. Both of these operations have been active from May to October for the last 3 or 4 years.

During the period of inspection the roads were in such a poor condition that it was not possible to reach the placer operations. However, observations of Haggart Creek and of the South McQueston River below Haggart Creek showed that large amounts of sediment are being carried by these streams. In order to determine what proportion of the South McQueston turbidity was caused by Haggart Creek a survey of the immediate area was undertaken. The results of this survey showed that the South McQueston River above Haggart Creek had a relatively high degree of turbidity and was a "muddy" gray colour. A "clay" deposit was evident on portions of the stream bottom and banks. Haggart Creek also had a high degree of turbidity and was a red-brown colour. Layers of sand lay on the bottom and banks in portions of the stream. The discharge of the South McQueston River above its confluence with Haggart Creek was estimated to be 300 to 500 c.f.s. The discharge of Haggart Creek was estimated to be 20 to 25 c.f.s.

Photographs illustrating the above-mentioned streams and characteristics are presented in figure 5.

III SUMMARY OF INVESTIGATION

The results of the investigation indicate that there is pol-

lution in the South McQueston River and further that it is caused by the discharge of mine-mill wastes into tributary streams. A summary of the results of the investigation with particular reference to the sources of pollution and suggested proposed remedial measures is presented as follows:

A. Mine-Mill Wastes.

1. Mackeno Mill

This mill is considered to be the most serious source of pollution for the following reasons:

1. The pollution of the South McQueston River was first evident in 1952 which coincides with the period the mill started production.
2. The mill tailings are discharged directly into Christal Creek and are subsequently carried into the South McQueston River.
3. Christal Creek is a spawning ground for grayling.
4. Analysis of water samples taken in 1953 by the R.C.M.P. were inconclusive in showing that chemicals toxic to fish were present. In this respect it is pointed out that there are many variables encountered in a sampling program. Generally a sampling program requires the selection of several sampling stations and repeating the sampling over a period of time. From the manner in which the mill wastes are discharged into Christal Creek it is almost certain that CN and other chemicals are present in these waters. In this connection there are two explanations to account for the negative results of the 1953 water sampling. These are as follows

(a) Water samples were not taken in Christal Creek but were obtained in the South McQueston River where dilution would have occurred.

(b) It could have been that Belkeno ore was being milled at that time and as a result no CN would have been present.

At the time of the survey the following proposals were suggested to the Mackeno Mill Superintendent in order to remedy this problem.

1. Extension of the present pipeline for a distance of approximately 1,000 feet to a large flat located on the far side of Christal Creek.
2. If necessary construction of dykes to form a lagoon or pond to ensure that the mill tailings do not flow directly into the creek.

The mill superintendent recognized the problem and indicated that the materials, etc., were on hand and intimated that he would have the work carried out as soon as possible.

B. United Keno Mill

This mill is considered to be a source of pollution for the following reasons:

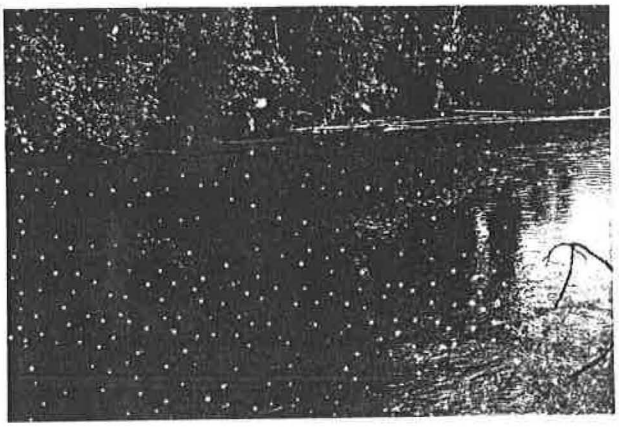
1. Flat Creek is carrying wastes from the mill dump either by flowing directly through the margin of the mill dump or by a connecting stream from the mill dump.
2. This source of pollution has probably existed only in the last few years because the mill dump has gradually spread towards Flat Creek.
3. Although Flat Creek is undoubtedly polluted there is no evidence to suggest that this stream is frequented by grayling or other important species of fish. However, there is evidence to show that Flat Creek carries mill wastes into the South McQueston River and therefore could cause harm to the fish populations indigenous to that stream.

During the survey the mill superintendent was interviewed with respect to the fisheries problem. He understood the problem and ad-

Looking up Haggart Creek from mouth.

Looking downstream on South McQueston River.

Looking up at confluence of Haggart Creek (left) and south McQueston River (right)



Line of demarkation from sediment in Haggart Creek (right) and South McQueston River.

Figure 5, Photographs showing Haggart Creek and the South McQueston River.

mitted that some type of impoundment of the mill tailings would be necessary. Furthermore, he stated that he would investigate the problem as soon as possible in order to ascertain the remedial measures required.

C. Placer Mining

The large amount of sediment deposited in Haggart Creek from the placer operations has undoubtedly affected the fishery in this stream. In addition a large proportion of the turbidity in the South McQueston River is caused by Haggart Creek.

Placer operations on Haggart Creek have been in effect periodically since 1902 and have made an extremely important contribution to the mineral wealth of the area. It is understood at this time that there is no licence required for placer mining in the Y.T., which makes it difficult for the R.C.M.P. to control or investigate pollution problems from this source. It is felt that with reference to Haggart Creek this problem will remain until the placer operations on the creek are terminated.

There is one further point with reference to pollution from the mining industry in the Y.T. and which will be favourable to fishery interests. It is understood that a new mining safety ordinance is expected to be put into effect shortly which will include a provision insisting on the impoundment of mill tailings.