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**Title**

Report of an investigation of alleged pollution  
from certain pulp mills in northern New Brunswick.

**Author**

R. H. M'Gonigle

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REPORT OF AN INVESTIGATION OF ALLEGED POLLUTION  
FROM CERTAIN PULP MILLS IN NORTHERN NEW BRUNSWICK.

by R. H. M'Gonigle

Atlantic Biological Station, St. Andrews, N. B.

During the summer of 1940, it had been planned to make further observations in the Bay Chaleur area, regarding the effect of pollution on the various fisheries. It was not possible to carry out these plans at the times originally arranged, but the area was visited in late November.

Investigations were planned for Bathurst harbour, where pollution affecting the smelt fishery was claimed to exist as a result of the operations of the Bathurst Pulp and Paper Mill, located near the mouth of the Nipisquit river. It was also alleged that dredging operations as carried out in Bathurst harbour had also adversely affected this fishery. It was also claimed that this dredging was required as a result of pollution escaping from the mill.

In addition, the waters about Dalhousie and Campbellton were to be studied, where pollution was claimed to adversely affect the salmon net-fishery. The effect of pollution from the mill at Edmundston was also to be investigated, where it was claimed that the pollution was so great (at times) that interests using the river as far south as Grand Falls (a distance of roughly thirty-five miles) were also adversely affected.

Due to the lateness of the season, it was not possible to make as complete, detailed, a study of the various locations as the situations in each place doubtless warranted. This was due to the freezing of upper Bay Chaleur, accompanied by heavy snows, and rather severe wintery weather. Only at Bathurst was a reasonably

satisfactory study made. This consisted of two parts: a visual survey of the effect of the dredging operations complained of, and a chemical one which duplicated a previous study (Report of an Investigation into an Alleged Pollution in Bathurst Harbour, N. B., submitted February 23, 1937), and which previous study form a valuable control, so that some idea of changes occurring (if any) in the four-year interval may be determined.

The investigations at the other three mills consisted of visual surveys of the areas where it was claimed pollution existed, insofar as this was possible, due to the prevailing snow and ice conditions. Some determinations of the acidity (or otherwise) of the effluents discharging by the various sewers were made at all these mills, and in addition, samples for oxygen analysis were taken below the Edmundston mill, two in the Madawaska river, and one in the Saint John river at Saint Leonards.

#### BATHURST:

The method of making the chemical survey, and the methods employed in the analysis of the samples taken have been given in the previous report (loc.cit.). With the exception of the phosphate analysis, the stations occupied and the samples taken have been so far as possible identical in the two surveys, although samples from 3 metres were taken at this time, in addition to surface and bottom samples.

The following table has been arranged in the same way as that on page 3 of the Report of 1937, to facilitate comparison of the conditions in the two years. This investigation was made November 22, 1940.

High Tide (Ebb): A. M.

Stations	Level (feet)	Temperature		Oxygen adjusted	Salinity %	pH.
		°C	°F			
II	S--0'	1.0	33.8	95.4	0.0	6.6
	B-10'	3.1	37.5	86.3	23.50	8.2
III	S--0'	1.0	33.8	96.9	0.0	6.7
	10'	3.1	37.5	92.9	23.42	8.3
	B-13'	3.2	37.9	89.7	25.23	8.3
IV	S--0'	2.2	36.0	40.3	2.97	6.6
	10'	3.2	37.9	119.7	25.00	6.3
	B-23'	3.6	38.5	88.0	27.50	8.6

Low Tide (Flood): P. M.

II	S--0'	0.8	33.3	73.1	0.0	6.7
	B-10'	2.9	37.2	64.5	21.55	7.4
III	S--0'	0.8	33.3	96.6	0.0	6.7
	10'	3.0	37.4	82.7	21.31	8.2
	B-20'	3.4	38.2	82.4	26.92	8.2
IV	S--0'	1.0	33.8	89.1	2.07	6.9
	10'	2.3	36.2	87.1	16.53*	8.0
	B-16'	3.4	38.2	80.8	26.67	8.2

\*Depth only eight feet.

For the purposes of interpretation of the data secured in the present survey, the salinity values are probably the most important. At almost all stations, the salinity is considerable less than the values recorded for similar stations previously. This reveals the existence of strong freshet conditions at this time. The presence of this freshet had been reported by Inspector Doucet--the analysis presented herewith, compared with the 1936 values indicates the degree of such freshet.

Any increase in water flow through an area subject to pollution, ought to result in an apparent improvement in any existing pollution, provided the amount of pollution itself had not been altered. As compared with 1936, it is evident that there is an improvement in conditions.

This is shewn by the per-cent saturation values for the dissolved oxygen of the water. Enough pollution still is present to reduce oxygen values to about 80% saturation, which is low, but not nearly so low as was found in 1936. Lower values were found at the surface on the ebb (40%) below the mill, and above the mill on the flood (70%). Station III was about 400 ft. from the west shore, the other two Stations II and IV were close to the shore. Further evidence of improvement in conditions is revealed by the chart, in which figures I and II are comparable with the figures I and II of the previous investigation. The great difference in short distances occurring in 1936 are not found in 1940. In fact to reveal the distribution of oxygen saturation, lines have had to be drawn for less differences than in the previous charts. This is important. The colours used in these figures are the same in both reports.

It is believed that the improvement revealed is more apparent than real, and the greater "washing" effect of the freshet is responsible. Only by further studies, at other conditions of river discharge, could this be ascertained for certain.

The visual survey consisted of a visit to the shoals on either side of the channel. These were inspected by boat, and have been produced by the deposit of dredgings from deepening operations of the navigation channel. The extent of these shoals can be readily seen by examination of the Bathurst Harbour chart (No. 413, issued by the Minister of Marine and Fisheries, in 1923). The particular shoal examined was on the east side of the main channel, at "The Forks."

It is claimed: (i) The deposition of this material in the harbour has altered the channels frequented by the

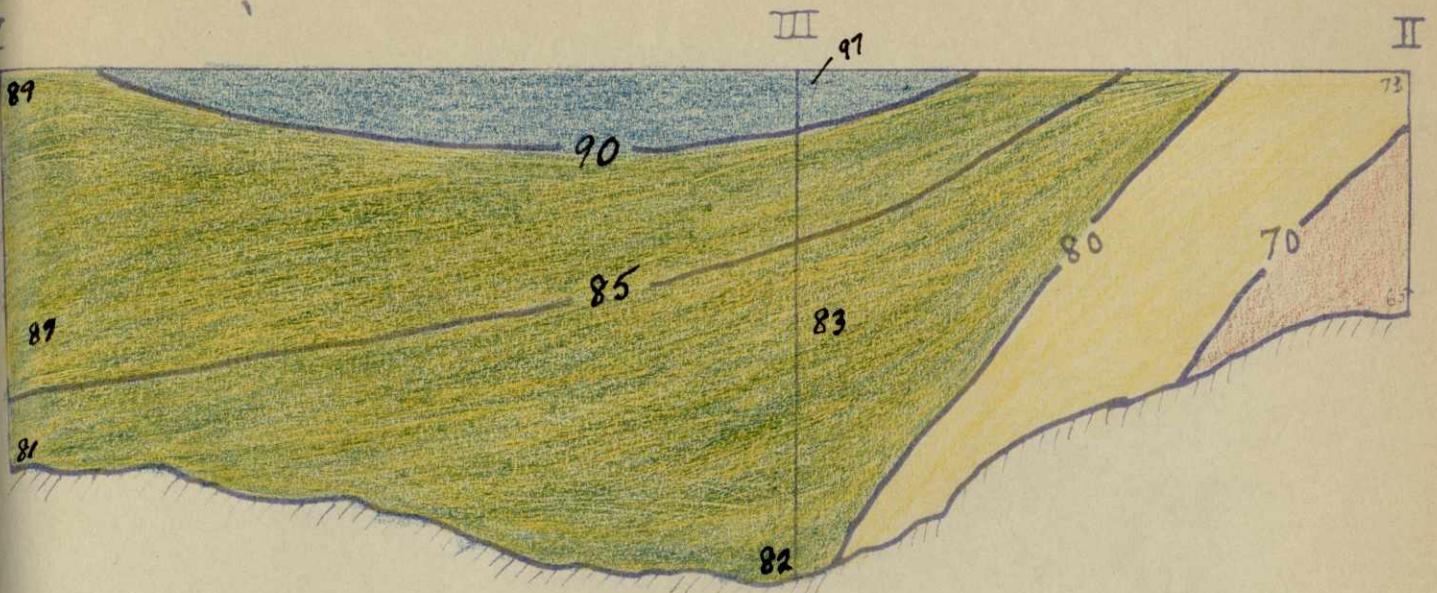


Fig I  
Low-tide - flood

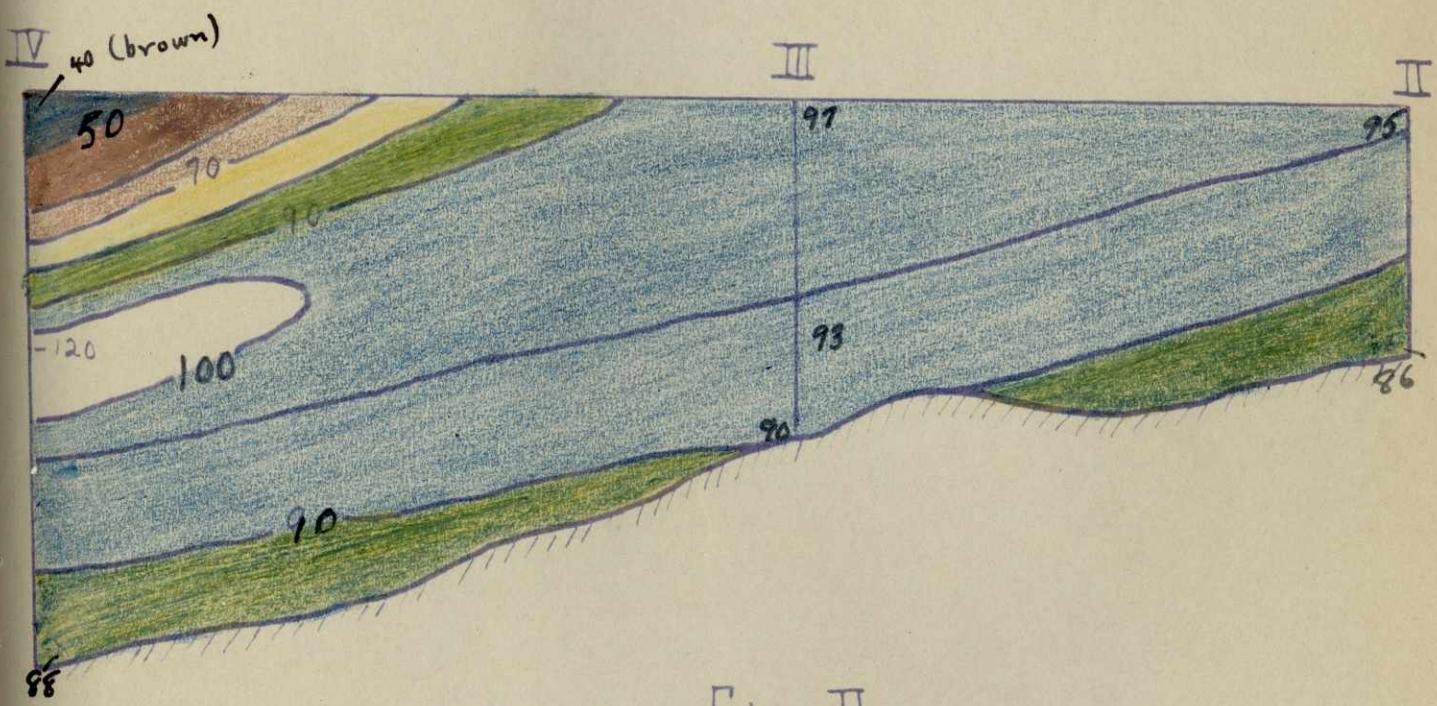


Fig. II  
High-tide - ebb

Roman Numerals indicate Stations  
 Arabic Numerals are Values for Oxygen Saturation - per cent.  
 Bottom indicated by hatching

smelts, to the detriment of the autumn fishery.

(ii) This material has been increasing, due to the operations of the pulp mill and consists largely of "green-sludge," (a limestone effluent) bark, chips, and other materials which has resulted in more rapid filling in of the channel than otherwise would have occurred.

(iii) The evil conditions have been aggravated by dredging operations, in that the materials have not been carried out of the harbour by scows, but just dumped (by suction dredge) up on the existing shoals, whence it rapidly washes back again into the main navigation channel, but as well into the smelt channels.

(iv) Eel-grass, which formerly served to bind and hold this muddy, sludgy, mass has not yet returned to any considerable degree, although conditions in this respect shewed considerable improvement this past season.

Insofar as this present survey is concerned, no evidence of filling of these channels has been secured, because the previously existing conditions were not known. Certain differences of local opinion were discovered in this connection however. It would seem essential that observations over a considerable period of time, at frequent intervals, by some entirely disinterested person (or persons) would be necessary to settle this point. Possibly, the monthly fishery statistice for the region including Bathurst might reveal changes which could shew the fishery was being adversely affected. Consulting these reports (Fig.3, District 6-2) for the four months September, October, November, and December, from

the year 1920 to 1940 (both years inclusive) shows that there have been considerable variations---low values of 105 cwts. in 1927; 106 cwts. in 1937; and 104 cwts. in 1938; with high values of 1,725 cwts. in 1929; and 1,9000 cwts. in 1930. In the past two seasons, the fishery is again increasing, as witness the 317 cwts. reported for the last four months of 1940. These statistics do not support the claim that the fishery has been adversely affected during the past twenty years, at any event. The variations observed are probably due to normal cyclic variations--biological cycles, price cycles, and weather (storm) cycles.

On the shoal examined there was plenty of sawdust, chips, and bark, mixed with mud and sand. Some of this material doubtless has come from logging and booming operations in the harbour, and in all probability some also comes from the Nipisquit river, the bottom of which is full of bark from logging operations, extending to the harbour from at least the head of tide between two to four miles above the mouth of the river. This material is not toxic biologically, for it was full of burrows of very large size, apparently made by the clam (Mya arenaria).

One further comment is necessary re conditions in Bathurst Harbour. At the bottom of page 7 of the previous report of 1937, reference has been made to the effect of the "green sludge" on the nets of the fishermen. Information which has since been obtained by the Atlantic Biological Station, indicates that it is not this material which fills the nets, but masses of sulphur-loving alga or bacteria (Oscillatoria or Beggiatoa). It is provisionally postulated, subject to confirmation by actual observations, that this low plant-form develops during the winter, under the ice,

# SMELT CATCH (c wts.)

DISTRICT 6-2

SEPTEMBER - DECEMBER (incl)  
1920 - 1940.

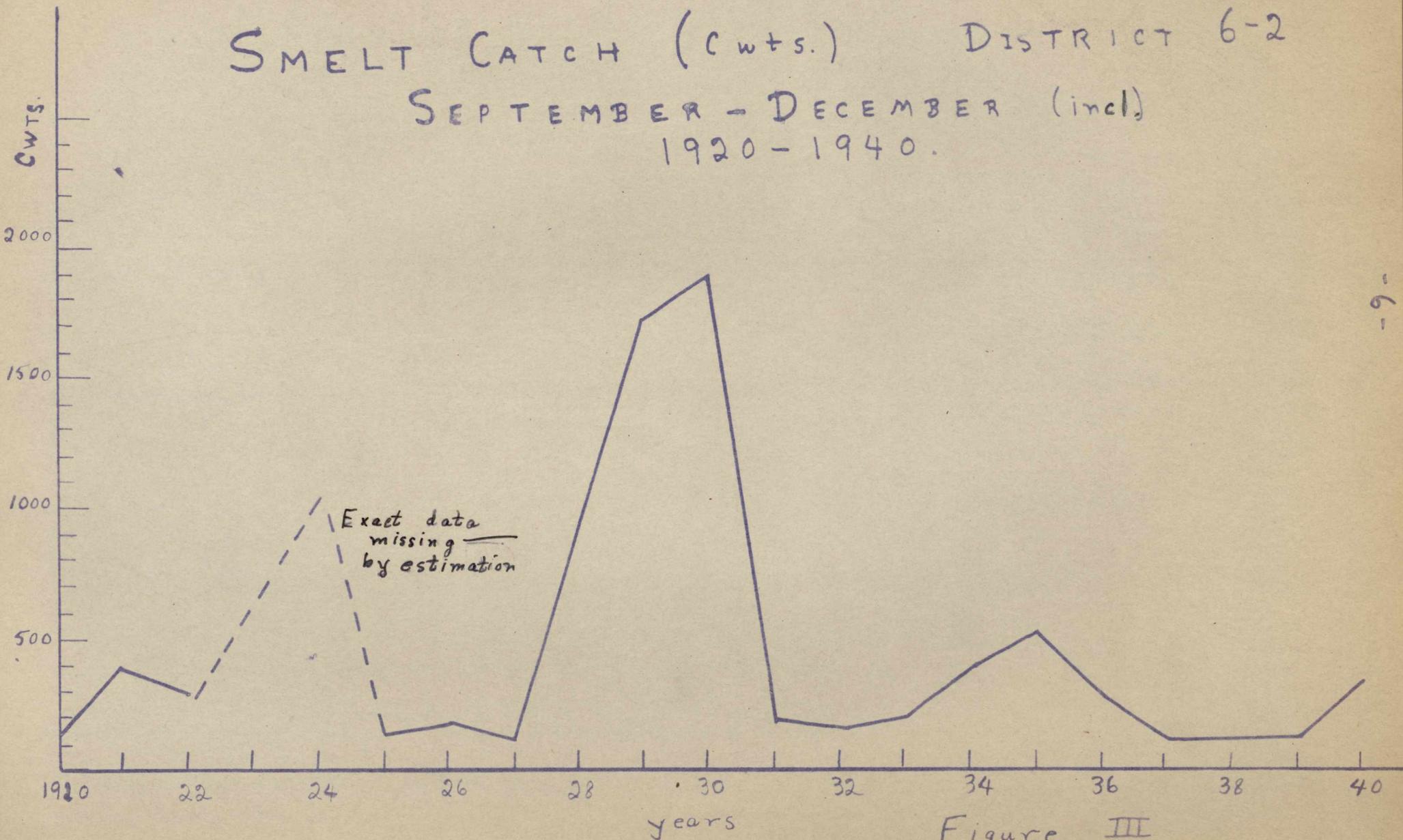


Figure III

where probably increased sulphur tension results from the sealing of the surface, which conditions favour the development of such forms. Normal growth conditions would be responsible for the "explosions" and the foul slimy character of the masses filling the nets. It has been recommended that the nets should be treated with copper preparations, which have a toxic action on algae and similar forms.

### DALHOUSIE

Such investigation as it was possible to carry out, was made November 23, 1940. Considerable snow had fallen, and all boats in the vicinity had been drawn up for the winter, and in any event enough ice had formed to preclude any sampling of the waters, to determine the effects produced by the various effluents, as had been done at Bathurst.

The area investigated is very clearly shown in the Dalhousie Harbour Chart (p.1426, Department of Mines and Resources, issued 1937). The mill occupies a promintory, on the northwest corner of which is located the Railway wharf. The northeast corner has the pulp-mill company's wharf, and a breakwater running off to Dalhousie Island. Booms occupy the northern face. The main sewer from the mill crosses the road leading from the town to the Company's wharf about 750 feet from the town street, and a town sewer crosses the same road about 200 feet from the edge of the town-site. The position of these sewers is indicated on the chart by arrow-heads. Similarly, on the west side, the positions of the various sewers are shewn by arrow-heads. The three furthest from the town-site are all from the pulp-mill--the others being town sewers.

On the east side, the effluent from the main pulp-mill sewer was examined, and the acidity value was found to be pH 6.6-6.9, which is almost neutral. The water was very turbid, with considerable amounts of sawdust. There was no odour. The appearance suggested the normal wash-water of a mechanical pulp-mill.

The beach on the east side was covered by a fine debris of chips, sawdust, and pulp fibre. This extended in all directions as far as one could see.

On the west side, the boiler room sewer (closest to the town-site of the three above referred to) had a clear effluent of pH 8.0. The West sewer nearest the Railway wharf also had a clear effluent of pH 8.0. The middle sewer had only a trickle from it when examined, of pH 7.2, but with a very strong odour of hydrogen sulphide ( $H_2S$ ). The greater part of the beach on the west side was covered to varying depths with coarse chips, bark, and other woody refuse. This was concentrated (deepest) in the angle made by the Railway wharf and the embankment. It was least nearest the town.

The complaints for this location, apart from the fouling of the beaches was that the effluents were driving the salmon offshore so that they did not enter the nets; that the action of the said effluent resulted in rotting of nets, so that their effective life was much reduced; and also that there was a mechanical pollution in the salmon nets, in that the debris from the mill became caught in the meshes, frightening away the fish. This effect was said to extend four to five miles down the shores of Eel Bay.

It was not possible to check up on these last claims. It would be necessary to visit the locality during the salmon fishing season, when it would also be possible to make an adequate chemical

survey.

In order to test the validity of the claim concerning the effect of the effluents in rotting the nets, it would be necessary to have a new net cut up into quarters, one quarter being then exposed at Atholville, Dalhousie, Bathurst, and a control site, where no possibility of pollution exists, such as the Miramichi, for example.

### ATHOLVILLE

The investigation at this pulp-mill was made on November 25, 1940. Here the heavy snows and ice limited observations just as at Dalhousie. Samples were taken from the Main sewer, and from the outflow of the Settling basin (see Figure 4), and also below the junction of the new open ditch, with the ditch from the settling basin. A sample was also taken of the White water. Of these the effluent in the settling basin was found to be very acid--pH 2.0, or even lower. The combined discharge, making a probable effective dilution of the acid liquor ("Hot Liquor") of about 1:50, was found to have a pH value of about 4.0. It is this combined discharge which enters the Restigouche river. This is carried in a ditch across to the eastern shore of Ferguson point, a distance of about 2,000 feet (see Chart of the Restigouche river No. 426, issued in 1927, by the Department of Marine and Fisheries).

The following were the pH values found for the various effluents from the Atholville mill:

Hot liquor	pH 2.0 (possible less)
Main sewer	6.6
White water	6.0
Combined discharge	4.0
Tap water (Campbellton)	7.3 (for comparison)

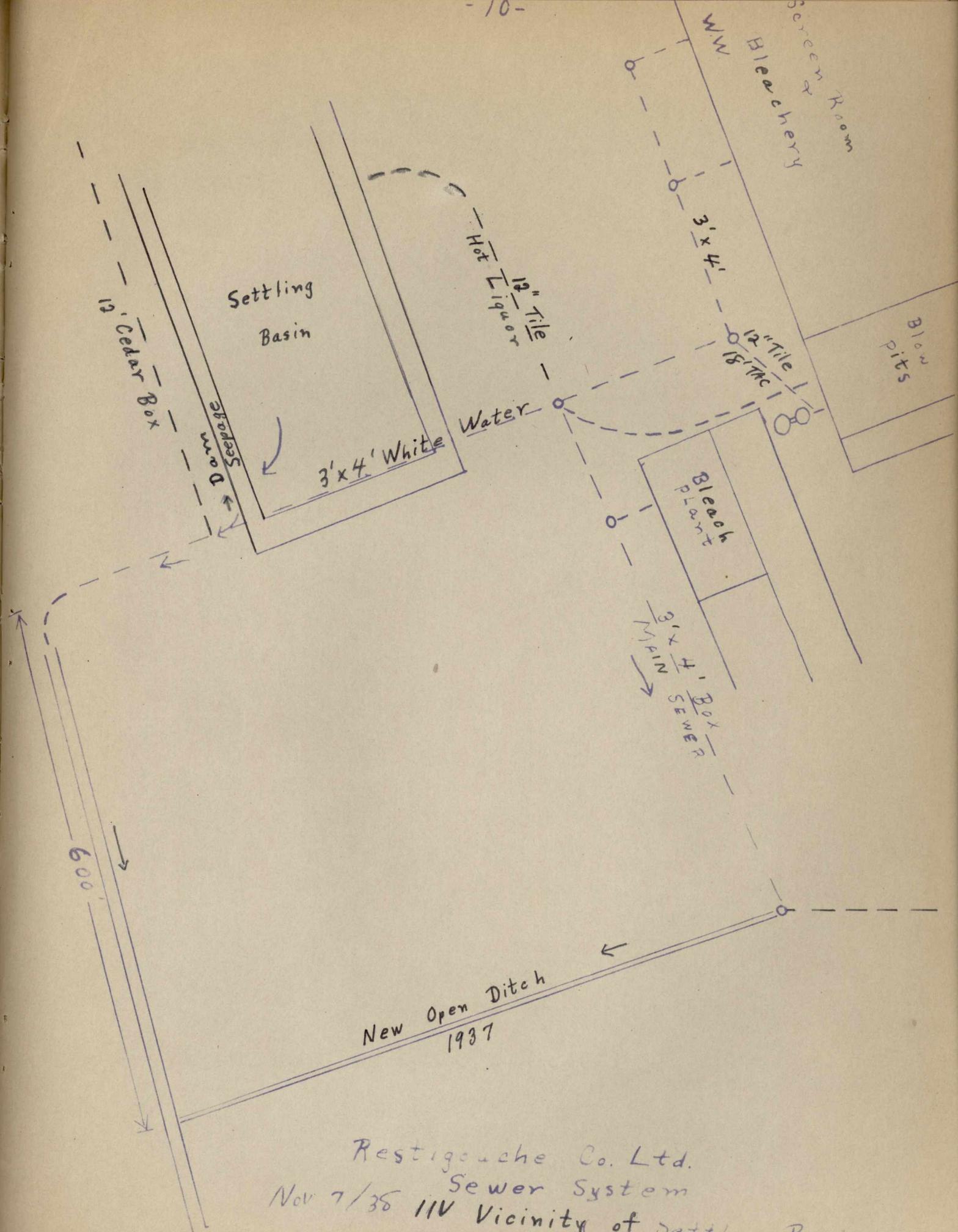
The water entering the river is highly acid, and if not rapidly buffered by the salt content, or diluted by the larger volume of river water, might be very dangerous for considerable distances. This can however only be determined by an adequate chemical survey.

The snow and ice over the tide flats into which this sewer discharged, together with the logs held in the booms made it difficult to determine the effect upon the beach, but an exceptionally large amount of fibre could easily be made out close at hand, samples of which when brought to the laboratory and examined under magnification proved to be made up of much pulp fibre. It was stated that there had been a great escapement of this pulp due to screen failure in the mill. The effect of this when it washes off the beach will be doubtless to pollute mechanically considerable portions of the Restigouche river. Again, on account of prevailing conditions, no determination of the extent of this could be made.

It is also claimed in this locality that nets which would formerly last for from 3 to 4 years fishing would not last only for a single season. The recommendation made above for Dalhousie applies with equal force to this locality.

#### EDMUNDSTON

The investigation here was made on November 28, 1940. Both the Madawaska and the Saint John river were pretty well frozen over. In the pool above the power dam at the mouth of the Madawaska, into which the effluents of the Edmundston pulp-mill discharge had large open areas, and in the Saint John river, there were large floes of cake-ice, which were not tightly frozen,



Restigouche Co. Ltd.  
 Sewer System  
 Nov 7/35 III Vicinity of Settling Basin  
 Figure 4

yet effectively prevented access to the river surface.

The Madawaska was examined from the town bridges, and from a railway bridge at the mouth of the river. The sewer from the pulp mill consisted of an open flume, carried on the trestle-work of the bridge of the Temiscouta Railway, and the effluent from this was sampled, giving a pH value of 4.7, rather like that of the combined discharge from the Atholville mill, and is also a combined effluent. A small discharge from a smaller sewer above the main sewer was also sampled, which yielded a pH value of 6.7. This sewer was thought to be the boiler room discharge. Another sample was taken from the Madawaska river, above the power dam, from the bridge. This sample yielded a pH value of 7.0 and upon being tested for oxygen, was found to have 4.96 cc/L, or a saturation of 49%. Another sample from the railway bridge near the confluence of the Madawaska and the Saint John had a pH value of 6.7, and oxygen values of 5.03 cc/L, or 49.7% saturation. A sample was taken also from the Saint John river at Saint Leonards, through a hole in the ice from the International highway bridge, and this sample yielded a pH value of 7.1, and gave oxygen values of 9.11 cc/L, or 90.0% saturation.

The chief complaint at Edmundston was that the Madawaska river was used as a settling pool, that it above the power dam, and when this basin became too full, the gates in the dam are opened, and a large mass of pulp fibre, chips, bark, and other dabr<sup>is</sup> is raked out into the Saint John river. The Madawaska river is of no value as a fishing river below St. Jacques, where the pulp logs are dumped into the river, and the river was full of pulp-wood from St. Jacques to Edmundston in September, 1940. The bottom is also covered with bark, and sunken logs.

However, it was claimed that this mass of collected debris from above the dam in the Madawaska when floated out into the Saint John causes pollution as far south as Grand Falls, where the fibrous matter gets into racks, and into the turbines of the power development at that point.

There is a very extensive still-water above the dam at Grand Falls, where it might be possible by a chemical survey to determine the extent of any such unfavourable pollution by means of a chemical survey, during the period of low water in late summer.

#### CONCLUSIONS

1. Gross mechanical pollution exists at all the points investigated.
2. Chemical pollution exists at Bathurst and at Atholville.  
The extent of this pollution was determined for Bathurst, but not for any other point.
3. So far as this investigation was able to determine, the conditions at Bathurst are improved as compared with 1936, but it is believed that this is more apparent than real, due to prevailing freshet conditions.
4. The gross pollution of the nets at Bathurst is thought to be due to algal or bacterial (Beggiatoa) development.
5. Further investigations at all points are required on account of the lateness of the season this year, although at Bathurst, a study might be made with advantage during the course of the smelt fishery, to determine conditions responsible for the growths fouling the nets.

6. Investigations ought to be made during the period of warm water, least run-off, and the time of the salmon fishery, at the Dalhousie and Atholville mills, to determine the conditions in the water, as they are reputed to affect that fishery.
7. Investigation is required in the Saint John river to determine the importance and extent of pollution from the Edmondston mill. The pollution in the Madawaska river is easily observed, but it might require an engineer to determine, by surveys and soundings how extensive it is.

March 28, 1941.