SAUBLE RIVER WATERSHED
BEACHES IMPACT STUDY
- 1986 -

Prepared For: Ministry of the Environment
Southwestern Region

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ABSTRACT

Southern Ontario beaches have been increasingly plagued by closures due to bacterial contamination. The Grey Sauble Conservation Authority, funded by the Ministry of the Environment, carried out a study of the Sauble River System to investigate and develop ways to alleviate this situation at Sauble Beach.

Through water quality analysis and the visual inspection of watercourses, it was determined that 82% of tributaries sampled had average fecal coliform counts greatly exceeding Ministry criteria. The lower velocity and higher volume of the main river kept levels generally below the guideline during base flow conditions. Major bacterial sources observed in study area streams were open livestock accesses, runoff from barnyard and manure storage areas and in some places wildlife and human contributions.

A program of information and education was undertaken to increase public awareness of the pollution problem on the river. Previously there has been little incentive to change traditional land use practices which may contribute to degraded water quality.

Demonstration projects, increased OSCEPAP funding and continued efforts by the Ministry of the Environment and the Grey Sauble Conservation Authority are recommended as actions toward the improvement of water quality on the Sauble River.

1.0 INTRODUCTION

The Rural Beaches Management Strategy was developed in response to recent widespread beach closures in southern Ontario due to bacterial pollution. The bacterial levels affecting beach areas have been related to rural land use activities, more specifically livestock management practices which may involve inadequate manure storage and utilization. Along with this problem are poor agricultural techniques which allow excessive soil erosion and a lack of stream conservation practices.

Through the Beaches Strategy, the Ontario Ministry of the Environment has initiated a multi-year project to finance studies and corrective measures in areas where beaches have been affected by bacterial pollution.

In 1985, the Ontario Ministry of the Environment's "Beaches Prioritization" meetings resulted in the identification of seven watershed areas as having beaches impacted predominately by agricultural land use practices. As the Sauble was among the priority watersheds, an agreement was made in April of 1986 between the Ministry of the Environment and the Grey Sauble Conservation Authority to carry out a study of the Sauble River and its tributaries in relation to bacterial pollution on Sauble Beach. Figure 1 illustrates the location of the Sauble River study area.

2.0 BACKGROUND

2.1 The Watershed

The Sauble River system (Figure 2) is composed of two branches; the north known as the Rankin River and the south or main branch referred to as the Sauble River. The headwaters of the main channel rise at an elevation of 282 metres near the village of Desboro in Sullivan Township, 19 kilometres southwest of Owen Sound.

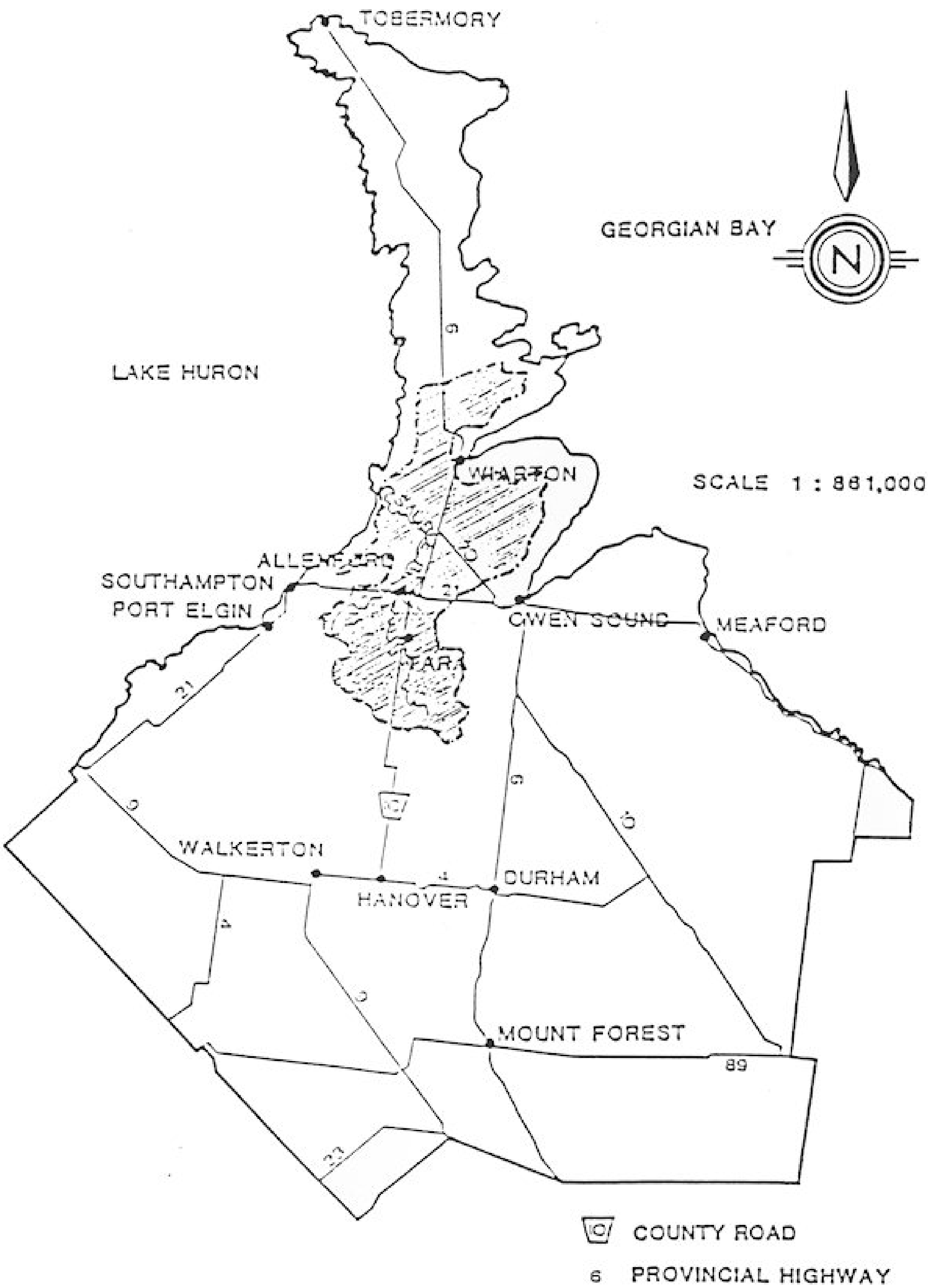

Figure 1: Sauble River Watershed Study Area.

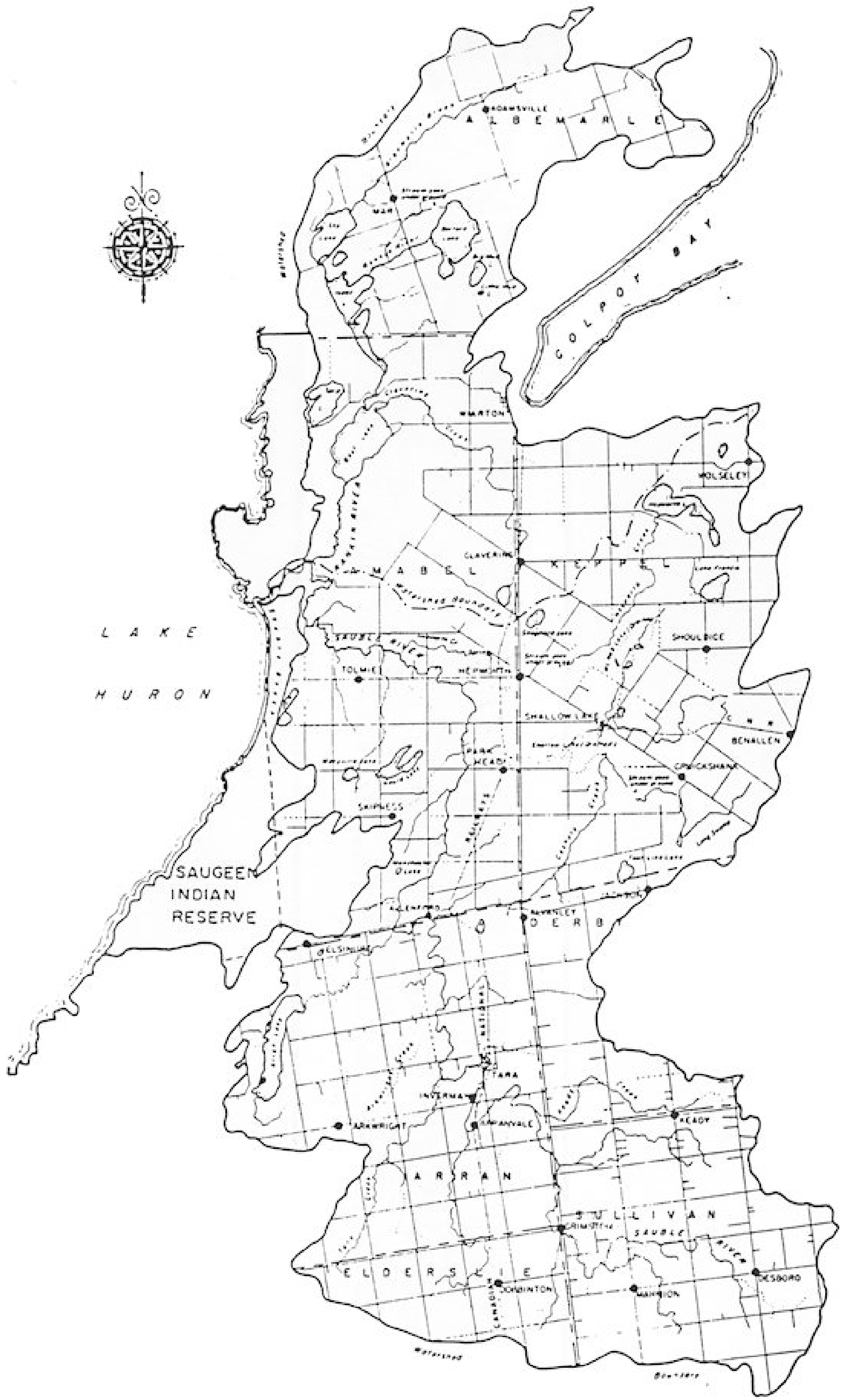

Figure 2: Map of the Sauble River Watershed.

This system drains approximately 700 km^2.

The Rankin system drainage area includes parts of Albemarle, Keppel and Amabel Townships draining 263 km^2 through a series of interconnected lakes. The Sauble River flows on a meandering course of 82 kilometres northwest through Sullivan, Arran and Amabel Townships while tributaries drain parts of Elderslie and Derby Townships.

The Sauble River has a mild slope with gradients of only 0.5 metres per kilometre occurring for significant distances. The Rankin River is even flatter with a gradient of 0.06 metres per kilometre through the lower chain of lakes.

Though the river valley is shallow, reaching a maximum depth of 9.1 metres in the Park Head area, the tributary streams are in general much steeper than the main river. During periods of high runoff events, tributaries deliver more water than the main river can accommodate, resulting in flooding of the wide, shallow channel.

2.2 Agricultural Land Use

Agriculture in the Sauble River basin is concentrated in the southern half of the watershed. The Sauble River Watershed map (Appendix C) accompanying this report shows the spatial distribution of various land use activities within the region.

Artificial drainage in the study area began before the 1900's and increased until the 1920's with a resurgence of activity since 1950. Statistical information (Ecologistics, 1984) suggests that there has been a general intensification of cropping practices throughout the study area since the 1960's.

2.3 Water Quality

Historically, water quality in the study area probably suffered its greatest decline at the turn of the century when forest cover was removed and agricultural land use commenced. Since then, stream-dissected bottom lands have been traditional pasture areas while barns have been located near watercourses for convenient water supply. Both have inherent impacts on water quality.

Prior to this study, there has been a general lack of water quality information throughout the Sauble drainage system. The southern headwater area was investigated in 1984 but very little was known about the main river to the north or the Rankin system with no water quality information for the northern tributary screams.

The 1984 drainage report on the water quality of the upper Sauble River showed high levels of total, background and fecal coliforms, fecal streptococci and *Pseudomonas aeruginosa* during the months of September through December. Out of fifty sample stations, only two exhibited acceptable levels of total and fecal coliforms and *Pseudomonas aeruginosa* during all three sample series. It was reported that even these stations had slightly higher than desirable levels of fecal streptococci (Ecologistics, 1984).

The 1984 study concluded that the water quality and aquatic communities of the upper Sauble River are of poor quality with livestock and open agricultural drains being the primary cause of the degradation.

3.0 OBJECTIVES

The primary objective of this study was to identify the sources of bacterial contamination contributing most significantly to Sauble Beach. A second objective of the study was to promote the implementation of remedial practices on priority farms utilizing the Ontario Soil Conservation and Environmental Protection Assistance Program (OSCEPAP).

To achieve these goals, a three part program was utilized:1) the establishment of water sampling stations at strategic locations to monitor water quality and aid in identifying areas of concern, 2) the physical inspection of the watershed for signs of land use impacts and pollution sources and 3) the organization of a program of information and education to promote the use of OSCEPAP grants to correct identified pollution problems.

4.0 METHODS

4.1 Water Sampling Program

The primary objective of the water sampling program was to identify major sources of bacteria affecting water quality on Sauble Beach.

To this end, the entire watershed was surveyed through the interpretation of aerial photographs. Agricultural operations within a 150 metre proximity of watercourses were delineated as potential water quality impact sites. Resulting mapwork described the locations of 342 preliminary target farms to be assessed through subsequent field work. The locations of these farms in study area number one also determined the placement of sampling stations with upstream-downstream evaluation where possible. The above-below potential source area sampling method was utilized in an attempt to verify pollution contributions by various land use activities.

As there was no water quality information available on the watershed north of Highway 21 and very little on the southern areas, a comprehensive evaluation of water quality in the basin was required with consideration of the limitations of the study.

In order to fulfill this requirement without overloading the Ministry of Environment lab in London, a program of sampling was developed to document specific problem areas in the initial study zone while providing data for the northern and southern basins on a more general basis (Figure 3).

In the more generalized study area south of Highway 21, 15 sample stations were established. The less agricultural Rankin River System was monitored with three sample stations while the central preliminary study area was assigned 31 sample stations.

Sampling was carried out on a bi-weekly basis over a twenty week period from mid-June to the end of October. It was anticipated that this time frame would provide a good variation of seasonal conditions and sufficient sample numbers for the statistical analytic requirements of this project.

Station record cards were completed at each sample site while a log book was utilized to record specific conditions in the stream and the surrounding areas, along with colour slides of any unusual phenomenon that might affect water quality.

Individual water quality components for each sample site were monitored throughout the season on an extensive set of graphs. Varying levels of bacteria were observed through analysis for fecal coliforms, fecal streptococci, *E. coli* and *Pseudomonas aeruginosa*. Chemical elements analyzed included free ammonia, total kjeldahl, nitrite, nitrate, total phosphorous, dissolved reactive phosphorous, pH, chloride, conductivity and turbidity.

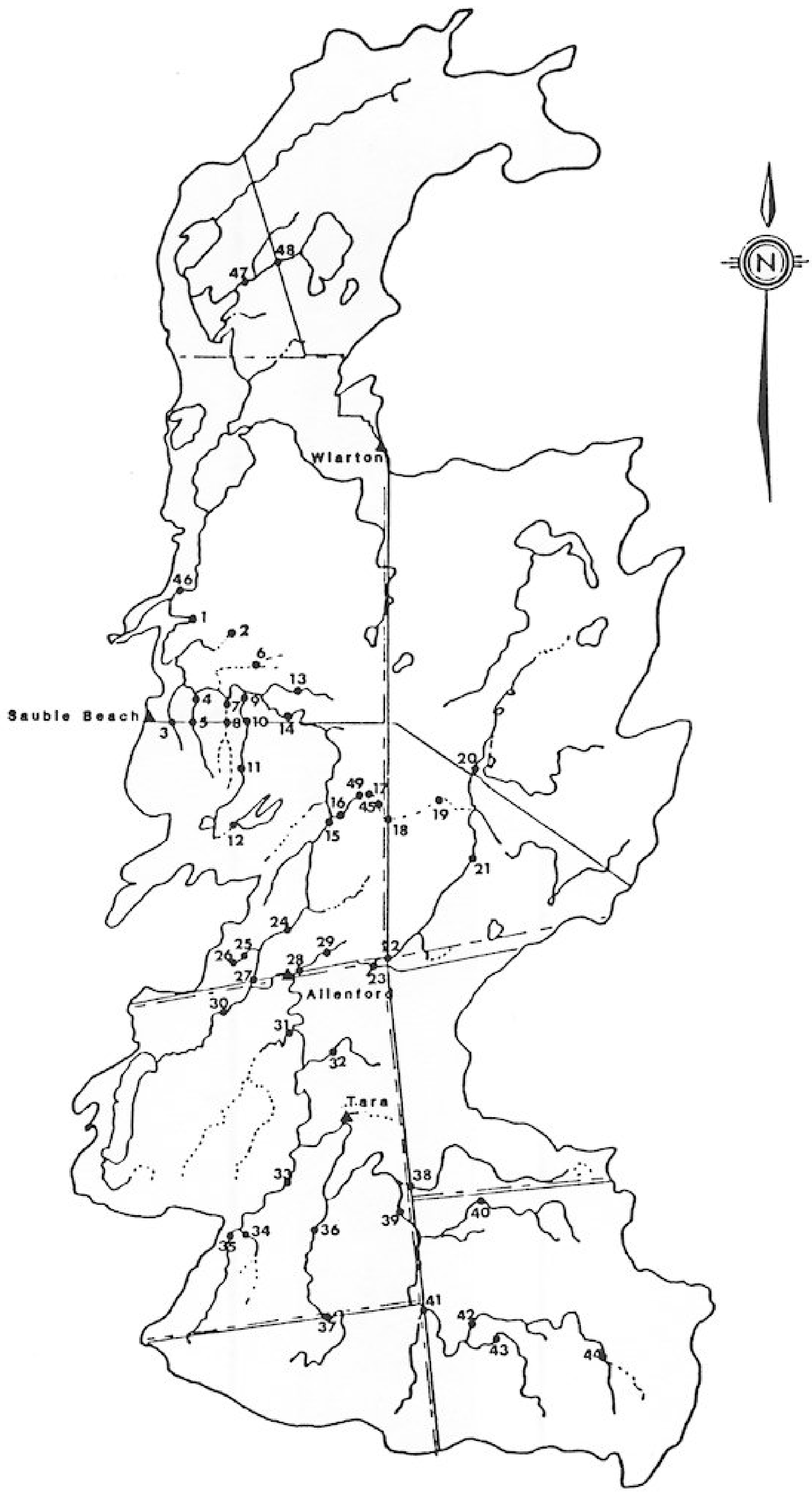

Figure 3: Location of water sampling sites in the Sauble Watershed, 1986 Beaches Impact Study.

Sample transport to the Ministry of the Environment lab in London was by courier from Owen Sound. The perishable nature of the samples combined with the inflexibility of the sampling schedule proved limiting to the collection of event and special samples. Unforeseen difficulties at the microbiology laboratory resulted in the loss of most fall runoff bacterial parameter data. Chemical analysis was unaffected.

4.2 Visual Survey

The visual survey component of the study was carried out to locate areas of water quality impairment and to evaluate possible contaminant sources. The survey also provided a convenient opportunity to establish contact with landowners in the watershed.

Aerial photography was utilized in the field to record perceived problem locations with reference to OMAF tile drainage records and topographical maps. Land use activities along each stream were noted and a written drainage system description followed each field investigation.

All landowners were visited prior to the field survey in order to gain permission to access streams and drains on private land. Time spent in contact with people living along the river system was an invaluable public relations activity.

In many cases, landowners were asked for recollections of past water conditions on the Sauble River system for inclusion in the study as background information.

4.3 Information and Education

Past studies (UTRCA, 1984 and Balint 1984) carried out in the Lake Simcoe basin and the Pittock Reservoir watershed have indicated that a substantial proportion of farmers do not realize that common livestock management practices can have negative environmental effects. The fact that many farmers expressed an interest in obtaining information on the nature of the problem indicates the need for effective communication at all stages of the Beaches Management Strategy.

Information and education activities were therefore ongoing throughout the project with landowner contact to increase awareness of conservation issues and improve relations with the public.

Discussion with landowners typically included a description of program activities and goals, local water quality and stream conservation practices including manure management.

An understanding of the landowner's perception of the water quality problem was usually gained with his idea of causes and necessary remedial actions. The OSCEPAP program was also outlined and OMAF literature was left with the landowner.

Efforts to increase public awareness of the water pollution problem were in the form of letters to watershed landowners, newspaper and news magazine articles and a presentation to township representatives. Local fall fairs were attended with a display focussing on water quality concerns.

5.0 RESULTS

5.1 Water Sampling Program

The bi-weekly sampling program began on June 17, 1986 and continued through to October 29, 1986. A total of 10 samples per site were to have been obtained over the summer and fall months for the observance of some seasonal variation and to obtain sufficient data for statistically viable results.

Closure of the London microbiology lab for renovations resulted in the loss of bacterial data for four sample returns per site during the fall runoff season. The remaining total number of samples is felt to be sufficient to provide general documentation of bacterial levels at the various sites on the river system. Chemical analysis was unaffected by the microbiology lab closure.

Average bacterial water quality data are presented in Table 1 with average chemical data in Table 2.

5.1.1 Fecal Coliforms

Figure 4 illustrates the average levels of fecal coliforms observed at each station over the June through August sampling period. Of the tributary stations sampled, 82% had average levels exceeding Ministry criteria for bathing water quality. The main river stations (Figure 5) show average levels below the criteria for stations north of Allenford because of increased dilution and slower velocities of the larger river.

Fecal coliforms are known to originate in the intestinal tract of warm blooded animals. They are able to survive in an environment of soil, water or sediment but will not multiply and are usually not pathogenic. These bacteria indicate the presence of disease-causing bacteria.

Fecal coliforms enter the stream from overland flow, subsurface flow or through the disturbance of organisms in bottom sediments. Bohn and Buckhouse (1985) described the cyclic nature of fecal coliform bacteria levels which fluctuate on a daily basis in response to physical factors such as stream stage, water temperature and direct solar radiation. Storm and runoff events also cause an increase in fecal coliform levels due to the suspension of sediments which bacteria can adhere to (Bohn and Buckhouse, 1985).

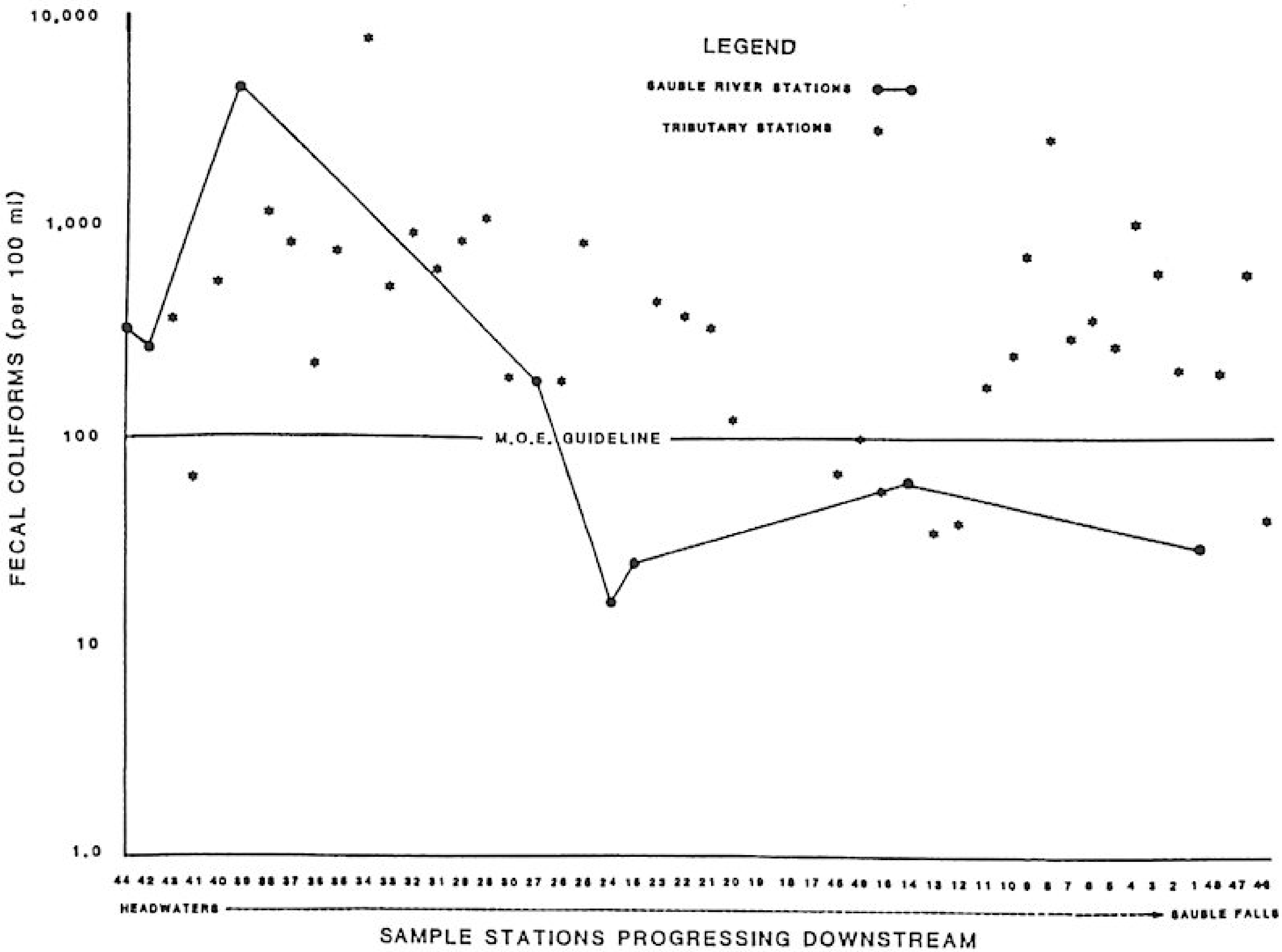

Figure 4: Average concentrations of Fecal Coliforms (per 100m1) measured at the Sauble River and tributary sampling stations, June - August, 1986.

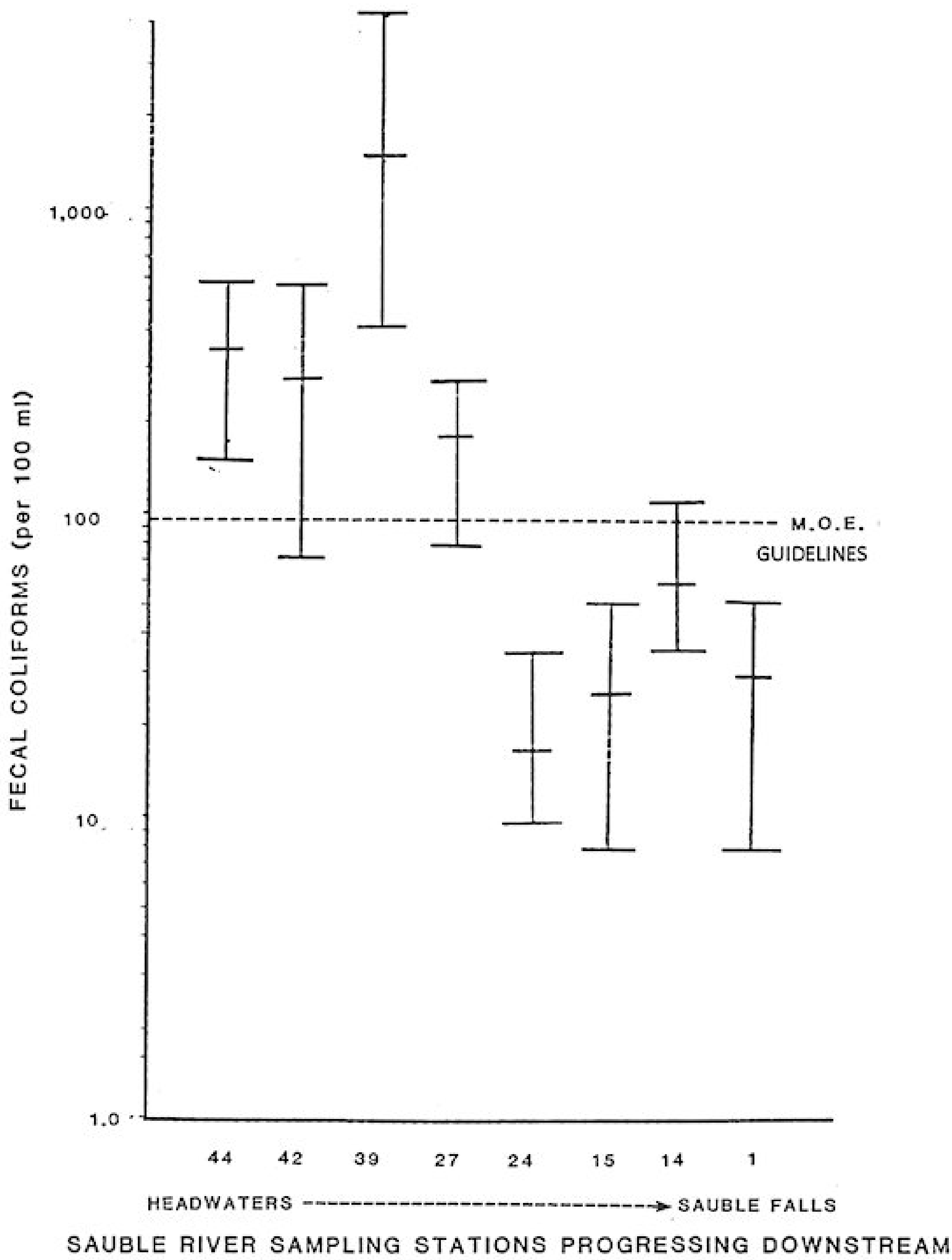

Figure 5: Average concentrations of Fecal Coliforms (per 100ml) measured at sampling stations along the Sauble River, June - August, 1986.

Table 1: Average Bacterial Water Quality Data (Org./100ml), June-August, 1986.

Township	Station Number	Fecal Coliform	Fecal Streptococci	*Pseudomonas aeruginosa*	*E. coli*
Amabel	001	30	8	4	27
Amabel	002	213	213	4	173
Amabel	003	603	132	4	538
Amabel	004	1005	784	4	976
Amabel	005	270	166	4	266
Amabel	006	365	360	4	358
Amabel	007	298	443	4	163
Amabel	008	1260	3147	4	1154
Amabel	009	730	208	4	641
Amabel.	010	294	235	4	255
Amabel	011	172	495	4	152
Amabel	012	39	21	4	43
Amabel	013	35	18	4	20
Amabel	014	59	24	4	50
Amabel	015	25	394	4	18
Amabel	016	55	104	4	43
Amabel	017				
Keppel	018				
Keppel	019				
Keppel	020	119	126	4	112
Keppel	021	329	178	4	296
Keppel	022	369	246	4	366
Arran	023	435	236	4	422
Amabel	024	16	13	4	16
Amabel	025	868	309	4	792
Amabel	026	178	158	4	168
Amabel	027	177	158	4	137
Amabel	028	1026	507	26	912
Amabel	029	860	331	4	645
Arran	030	195	69	4	141
Arran	031	625	319	7	361
Arran	032	923	327	4	819
Arran	033	527	345	4	443
Arran	034	1816	552	4	1624
Arran	035	777	283	4	691
Arran	036	235	184	4	213
Arran	037	863	246	4	699
Derby	038	1038	218	4	855
Arran	039	1472	269	4	737
Sullivan	040	564	301	6	457
Sullivan	041	66	52	4	156
Sullivan	042	270	240	4	186
Sullivan	043	367	189	4	297
Sullivan	044	337	258	4	178
Amabel	045	68	99	4	54
Amabel	046	46	13	4	32
Albemarle	047	700	434	4	700
Albemarle	048	288	79	4	271
Albemarle	049	96	394	4	86

Table 2: Average Chemical Water Quality Data, June - August, 1986.

Township	Station Number	Free Ammonia (ppm)	Total Kjeldahl (ppm)	Nitrite (ppm)	Nitrate (ppm)	PHOSPHORUS		pH	Turbidity (FTU)	Conduct. (µmho/cm^3) @ 25°C	(Cl^-) (ppm)	Max. Temp (°C)
						Total (ppm)	Dissolved Reactive (ppm)					
Amabel	001	0.028	0.58	0.01	0.21	0.03	0.007	8.2	8.0	428	2.5	21.0
Amabel	002	0.007	0.55	0.01	0.10	0.02	0.005	8.0	1.5	439	2.3	19.0
Amabel	003	0.021	0.73	0.01	0.10	0.02	0.002	7.9	5.0	483	2.5	23.0
Amabel	004	0.010	0.55	0.01	0.10	0.04	0.009	8.1	5.5	464	6.5	22.0
Amabel	005	0.016	0.49	0.01	0.10	0.04	0.006	7.6	5.0	455	2.0	21.5
Amabel	006	0.012	0.61	0.01	0.10	0.04	0.010	8.1	2.0	388	4.6	19.5
Amabel	007	0.214	1.33	0.04	0.10	0.13	0.034	7.9	11.0	444	7.7	20.0
Amabel	008	0.014	0.55	0.01	0.15	0.05	0.011	8.1	4.5	524	6.4	27.0
Amabel	009	0.018	0.56	0.01	0.10	0.02	0.005	8.1	5.0	389	1.6	21.0
Amabel	010	0.017	0.53	0.01	0.10	0.06	0.006	8.1	4.5	377	2.2	22.0
Amabel	011	0.009	0.56	0.01	0.12	0.03	0.004	8.3	3.5	338	2.8	23.0
Amabel	012	0.033	0.58	0.01	0.10	0.01	0.001	8.5	5.0	303	2.1	27.0
Amabel	013	0.008	0.39	0.01	0.22	0.01	0.001	8.0	8.0	472	0.6	17.0
Amabel	014	0.019	0.51	0.01	0.10	0.02	0.002	8.4	9.5	437	2.3	23.0
Amabel	015	0.025	0.53	0.01	0.10	0.02	0.003	8.3	10.0	433	1.2	24.0
Amabel	016	0.024	0.40	0.01	0.24	0.01	0.001	8.2	16.5	503	1.3	23.0
Amabel	017											
Keppel	018											
Keppel	019											
Keppel	020	0.022	0.70	0.01	0.10	0.03	0.010	7.7	2.0	402	1.5	23.0
Keppel	021	0.123	0.79	0.01	0.10	0.07	0.018	7.7	17.5	609	2.3	23.0
Keppel	022	0.034	1.05	0.01	0.10	0.06	0.023	7.8	6.0	508	7.1	19.0
Arran	023	0.014	0.99	0.01	0.10	0.05	0.024	7.7	7.5	558	3.6	18.0
Amabel	024	0.022	0.65	0.01	0.10	0.03	0.002	8.2	10.0	430	1.4	24.0
Amabel	025	0.200	1.28	0.02	0.10	0.06	0.010	7.8	12.5	565	24.4	19.0
Amabel	026	0.123	1.43	0.02	0.10	0.07	0.013	8.1	4.0	525	17.5	20.0
Amabel	027	0.021	0.55	0.01	0.10	0.02	0.003	8.1	8.5	433	1.8	23.0
Amabel	028	0.103	1.65	0.02	0.12	0.14	0.013	7.7	62.5	816	31.3	20.0
Amabel	029	0.216	1.23	0.01	0.10	0.09	0.023	7.8	23.0	689	12.6	21.0
Arran	030	0.009	0.74	0.01	0.10	0.03	0.015	7.7	3.5	362	1.7	20.0
Arran	0)1	0.024	0.85	0.01	0.10	0.05	0.013	8.0	7.5	465	5.4	22.5
Arran	0)2	0.034	0.58	0.01	0.26	0.03	0.009	8.0	7.5	626	14.4	19.0
Arran	033	0.020	0.50	0.01	0.10	0.05	0.029	8.1	6.5	527	2.6	21.5
Arran	034	0.027	0.65	0.01	0.10	0.05	0.017	8.1	5.5	589	5.1	21.0
Arran	035	0.026	0.37	0.01	1.86	0.02	0.005	8.0	7.0	604	3.4	17.0
Arran	036	0.019	0.52	0.01	0.31	0.02	0.006	8.1	10.5	587	2.3	21.0
Arran	037	0.039	0.61	0.04	0.67	0.06	0.012	8.1	11.5	611	2.5	20.5
Derby	038	0.056	0.78	0.02	2.44	0.07	0.012	7.9	8.5	598	5.1	19.5
Arran	039	0.045	0.44	0.02	1.02	0.03	0.005	8.2	6.5	558	10.2	21.0
Sullivan	040	0.016	0.38	0.01	1.17	0.02	0.002	8.3	6.5	560	8.9	20.0
Sullivan	041	0.048	0.67	0.03	1.19	0.10	0.058	8.0	16.0	552	2.0	21.5
Sullivan	042	0.011	0.31	0.01	1.34	0.01	0.001	8.1	5.5	557	2.5	20.0
Sullivan	043	0.024	0.46	0.01	0.81	0.02	0.002	8.3	8.0	549	5.5	23.0
Sullivan	044	0.026	0.49	0.01	0.21	0.02	0.002	7.9	4.5	561	1.4	22.0
Amabel	045	0.007	0.30	0.01	1.90	0.02	0.003	7.5	19.0	583	0.6	17.0
Amabel	046	0.025	0.54	0.01	0.10	0.01	0.001	8.0	4.5	328	1.7	23.0
Albemarle	047	0.025	0.44	0.01	0.10	0.03	0.006	8.0	4.0	308	7.6	17.5
Albemarle	048	0.011	0.37	0.01	0.12	0.01	0.001	8.2	2.5	296	1.1	17.5
Amabel	049	0.012	0.31	0.02	2.20	0.01	0.002	7.4	25.0	668	1.0	13.5

When suspended material settles, the bottom sediments become a reservoir for fecal coliforms that may be resuspended by animal disturbance or stream flow.

5.1.2 Other Bacterial Parameters

The fecal coliform is composed of the bacteria types; *Escherichia coli* (*E. coli*) and *Klebsiella pneumoniae*. In fecal contamination by man or animals, *E. coli* will make up 90% of the total number of organisms in a sample. Since *Klebsiella* sp. can grow in a carbohydrate-rich environment such as pulp and paper waste waters, such a sample could give a false indication of fecal contamination. For this reason, *E. coli* bacteria is now considered the best indicator of fecal pollution (Palmateer, pers. comm.).

Another indicator of fecal pollution is *Pseudomonas aeruginosa* which tends to be a component of human metabolic waste and pathogenic to man and animals. Normal background levels of this bacterium were found throughout the watershed, except for station 028 in Allenford where it was tabulated in greater numbers on three occasions and at stations 007, 031 and 040 where it was observed once above normal background levels during the summer.

Some diseases are transmitted through fecal contamination of bathing water. Among these are ear infections, leptospirosis and swimmers itch (PLUARG, 1978) which was reported at Sauble Beach in August, 1986.

The source of bacterial contamination can be inferred through the examination of the ratio of fecal coliforms to fecal streptococcus. Contamination of primarily human origin will yield a ratio greater than 4. It has also been reported that a ratio of less than 0.7 indicates a non-human, animal source. Doran *et al* (1981) further define the analysis of fecal coliform and fecal streptococcus bacteria levels in describing domestic livestock sources (cattle, sheep, poultry) as yielding a ratio between 0.10 and 0.42.Wildlife sources such as chipmunks, squirrels, birds and mice were described as yielding a ratio between 0.001 and 0.04.

Figure 6 shows the average levels of fecal streptococci for the Sauble River watershed stations. Comparative analysis of averaged fecal coliform and fecal streptococci concentrations proved inconclusive though the data generally fell within the range of domestic livestock associated pollution.

5.1.3 Nutrients

Healthy streams depend upon good water quality with moderate amounts of food and nutrients. Nutrients required by plants are phosphorous, nitrogen, oxygen, carbon and trace amounts of other substances. The abundance of nutrients in a natural environment is related to the geology and physiography of the area. As carbon is readily available from the parent material of the region's soil type and because of the abundance of nitrogen in the atmosphere, phosphorous appears to be the limiting element which controls the growth of plants and algae (M.O.E., 1980).

While phosphorous concentrations above certain levels are known to stimulate plant growth, higher levels above 5 mg/L can prove toxic to plant life. The Ministry has set a guideline level of 0.03 mg/L for the prevention of excessive plant growth in rivers and streams. With one exception south of Tara, water analysis for the main stream (figure 7) shows average total phosphorous concentrations below the criteria. This probably reflects the contributions of cleaner groundwater to the main river channel.

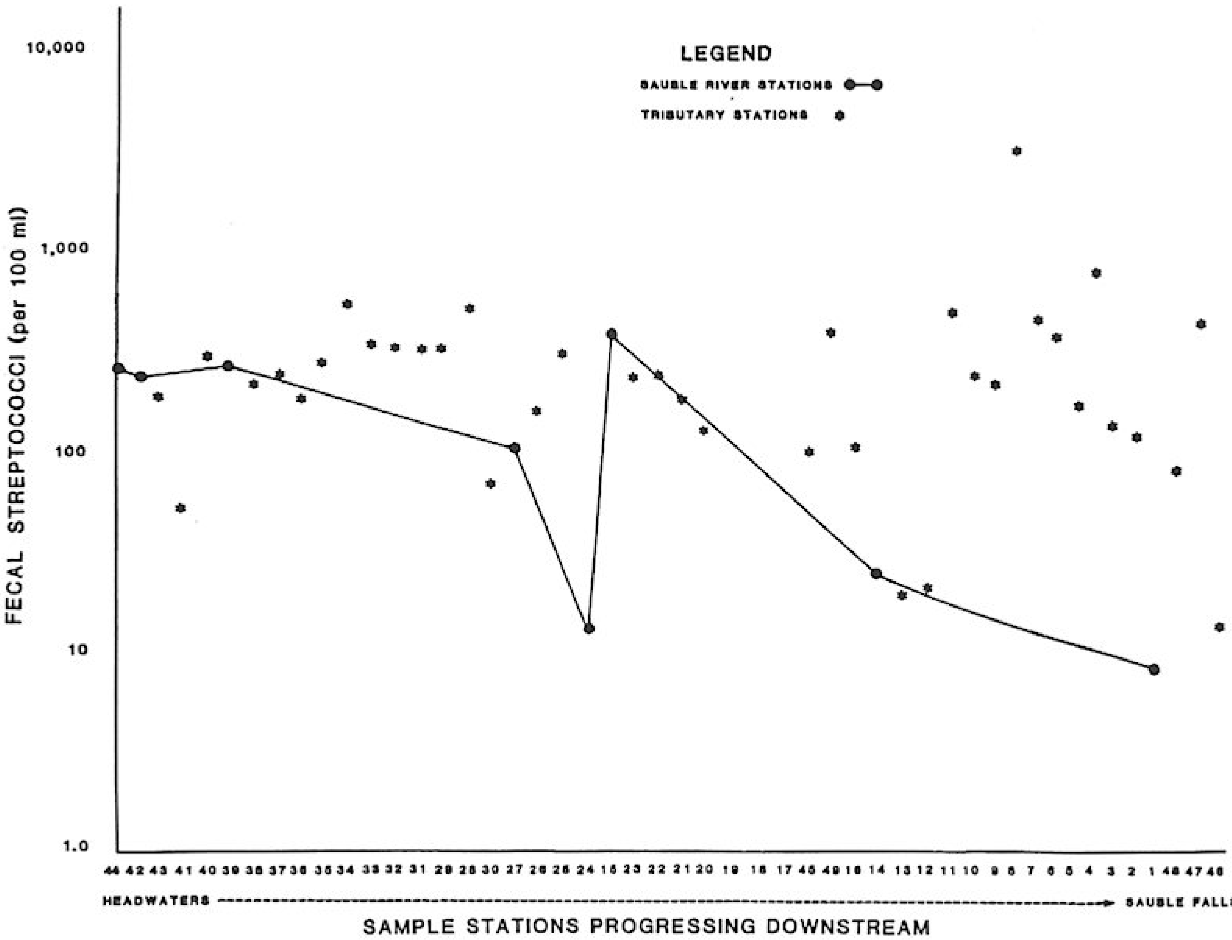

Figure 6: Average concentrations of Fecal Streptococci (per 100 ml) measured at Sauble River and tributary sampling stations, June - August, 1986.

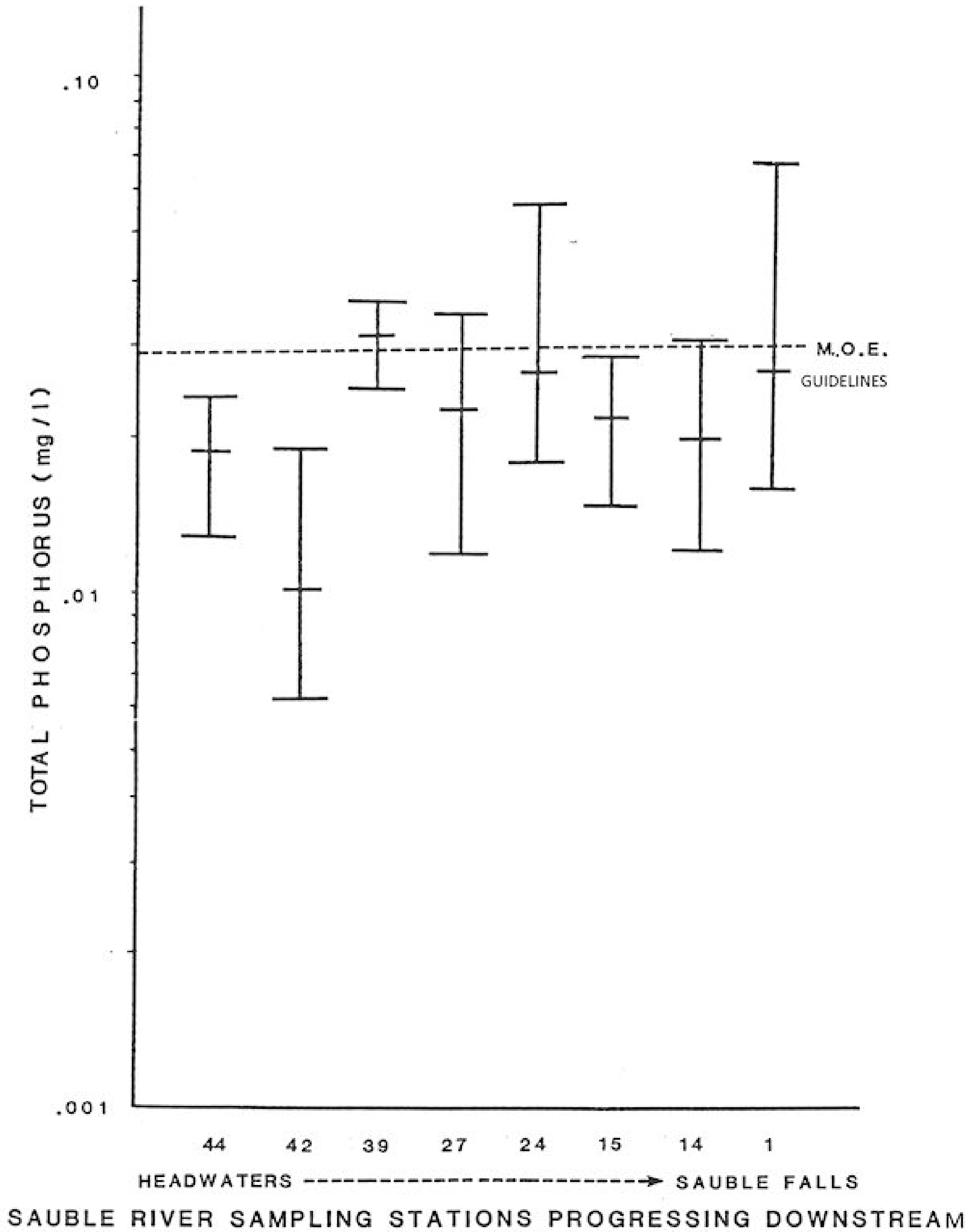

Figure 7: Average concentrations of Total Phosphorus (mg/L) measured at sampling stations along the Sauble River, June - August, 1986.

Sources of phosphorous include sediments, fertilizers, plant and animal decomposition and wetlands. Detailed analysis of phosphorous can recognize eight forms based on reactivity, particle size and ease of hydrolysis (Wetzel, 1975). Laboratory analysis for this study described total phosphorous which is a measure of all phosphorous compounds available and dissolved reactive, the type most readily utilized by aquatic plants.

Aquatic plants and algae have the ability to store phosphorous when excess quantities are available. This trait, known as luxurious uptake (M.O.E., 1980) makes seasonal phosphorous sinks of wetland areas. Though phosphorous is known to be released as vegetation dies back in the winter, wetlands are generally accepted as maintaining a net balance between phosphorous consumption and production.

Average phosphorous levels of the tributaries are higher than those of the main river (figure 8) with 62% of the stations above the M.O.E. criteria. The extreme high and low averages were found to be within the central study area. Station 028 located on a recently cleaned out drain in Allenford shows the highest results, probably because of the disturbance of bank and bottom material in the dredging activity. Station 007 was also notably high possibly due to over-fertilization of the golf course and barnyard contributions north of County Road 8. An extremely low average level was observed at station 013 which is predominately a groundwater sourced stream with a mostly forested drainage area.

As can be seen in Figure 8, a greater proportion of tributaries exceed the M.O.E. criteria in the watershed south of Highway 21, reflecting the intensity of agricultural land use and drainage systems.

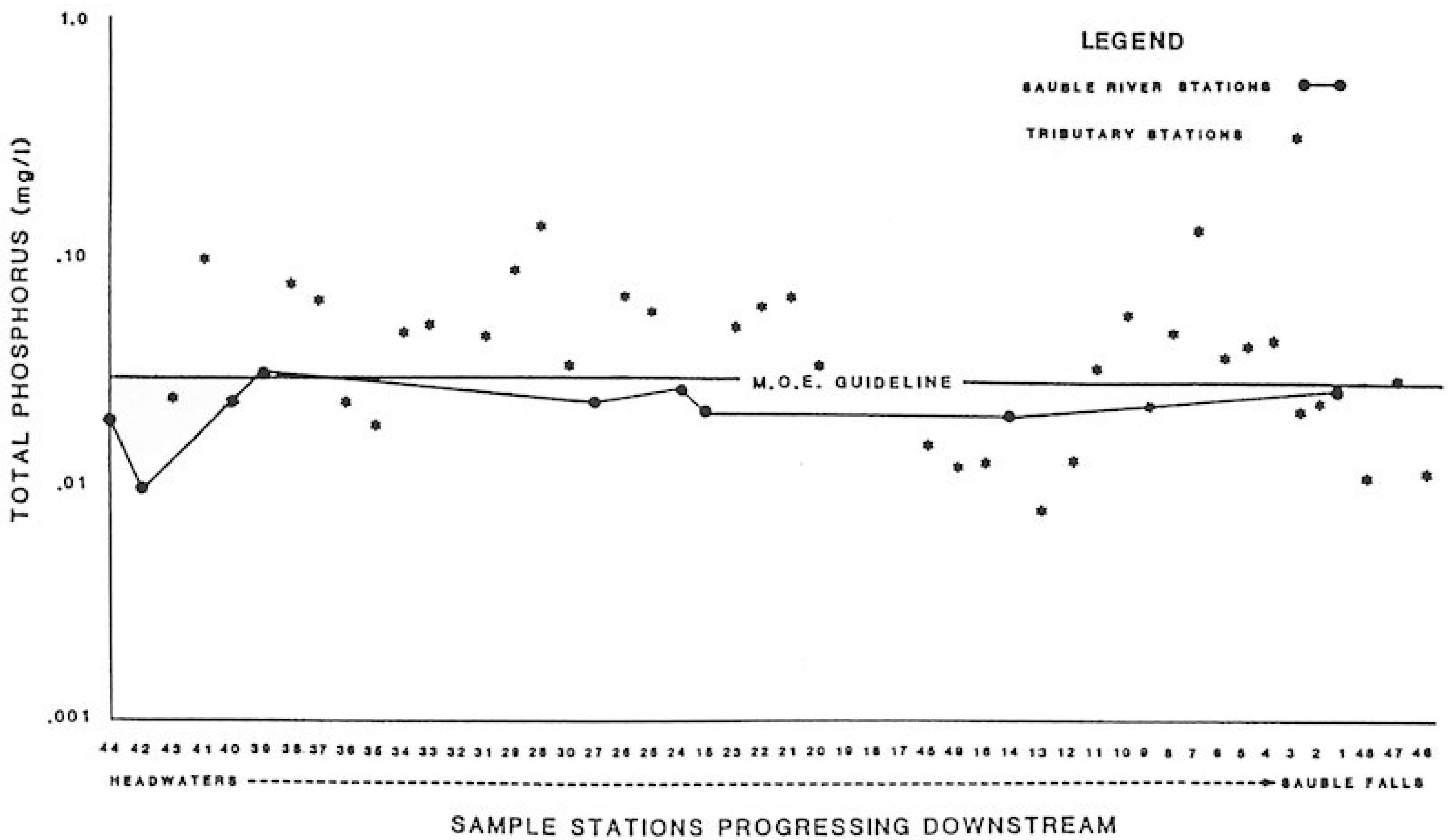

Figure 8: Average concentrations of Total Phosphorus (mg/L), measured at Sauble River and tributary sampling stations, June - August, 1986.

Nitrogen was evaluated for this study in four forms: free ammonia (NH_4^+), total kjeldahl, nitrite (NO_2^-) and nitrate (NO_3^-). Sources of nitrogen are through direct terrestrial runoff and from the atmosphere, with runoff considered the major component (Wetzel, 1975).

Figure 9 demonstrates the average nitrate analysis for stations sampled during low summer flow conditions. It is probable that the higher concentrations of nitrate shown in the headwaters of the river and at Park Head are a result of groundwater inputs from sedimentary rock formations.

5.2 Visual Survey

Field examination of streams within the initial study area was carried out on foot and by canoe to cover over 70 kilometres of watercourse. Signs of pollution were noted and probable sources documented where possible.

As there is very little subsurface drainage in the central study area, the vast majority of negative impacts to the streams were associated with livestock access.

Presented in this section is a group of streams from the central study area for which upstream-downstream water analysis was available. Complete records of mainstream and tributary observations are on file at the Grey Sauble Conservation Authority office.

5.2.1 Unnamed Stream, Amabel Township, Stations 009,010,011,012

This stream originates at the outflow of Gould Lake. At this point despite considerable cottaging, the fecal coliform level was just 39 (per 100 ml), well within the Ministry criteria for safe bathing water. A number of cattle access the stream just west of this point where it flows through a barnyard.

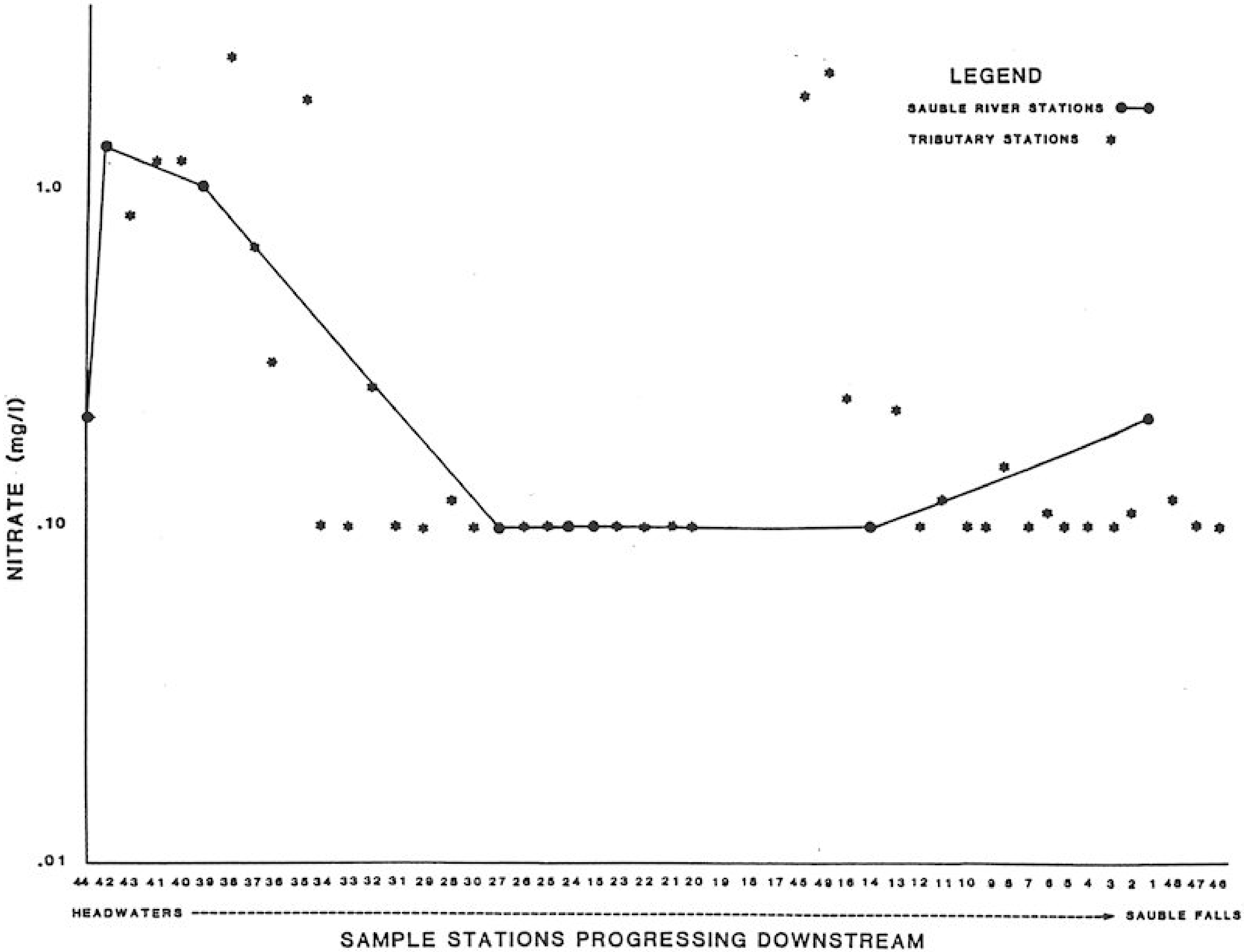

Figure 9: Average concentrations of Nitrate (mg/L) measured at Sauble River and tributary sampling stations, June - August, 1986.

Impact appears minimal at this point due to the small number of cattle.

As shown by figure 10, the stream proceeds on a 0.5% grade for 8.3 kilometres before reaching the Sauble River. At least four groups of beaver utilize the stream with minor to considerable flow restriction effects. An approximate total of 85 cattle have access to the stream at various locations through pasturing during the summer months.

Water quality data (Figure 10) shows a general increase in bacteria counts from source to confluence with levels consistently below 100 organisms per 100 ml water at the Gould Lake station to average levels well above 500 per 100 ml at the point of confluence. The most dramatic water quality change appears to occur in the section north of County Road 8, where there is also the most significant cattle access.

5.2.2 Unnamed Stream, Amabel Township Stations 007 & 008

The source of the watercourse was found to be in a wet forested area south of County Road 8. Flow from this point to the County Road is in a straight, steep sided ditch through a coniferous plantation. Considerable evidence of wildlife activity was noted in this area (Figure 11).

At sample site 008, high bacterial levels were noted during the early summer. An attempt to determine the source of contaminants was made through two special samples but analytical results were inconclusive. It appears there may be wildlife sources in the upper reaches of the stream in combination with runoff during wet weather from a barnyard located near the sample site.

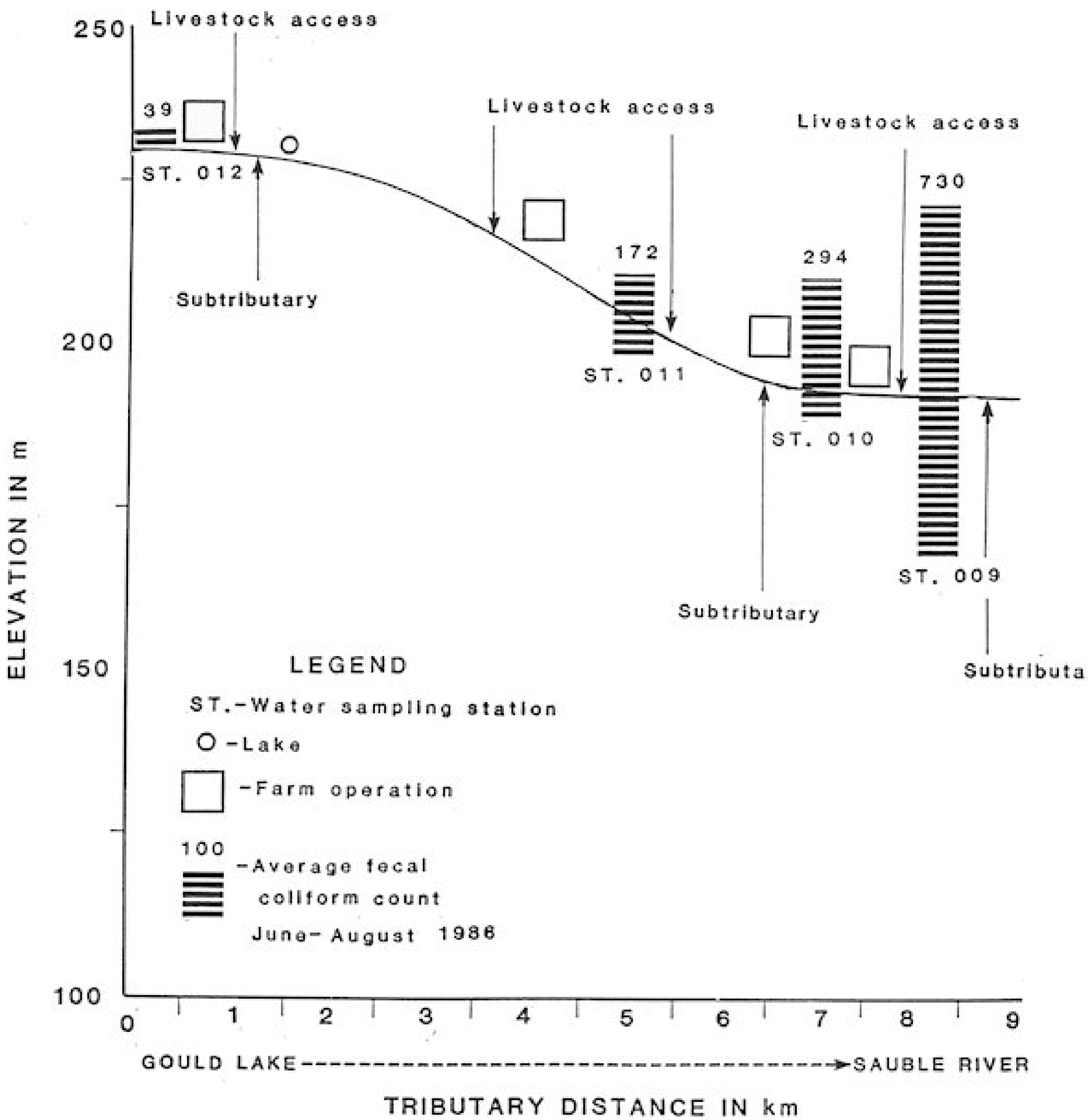

Figure 10: Gradient profile of unnamed stream in Amabel Township, sampling stations 009, 010, 011 and 012.

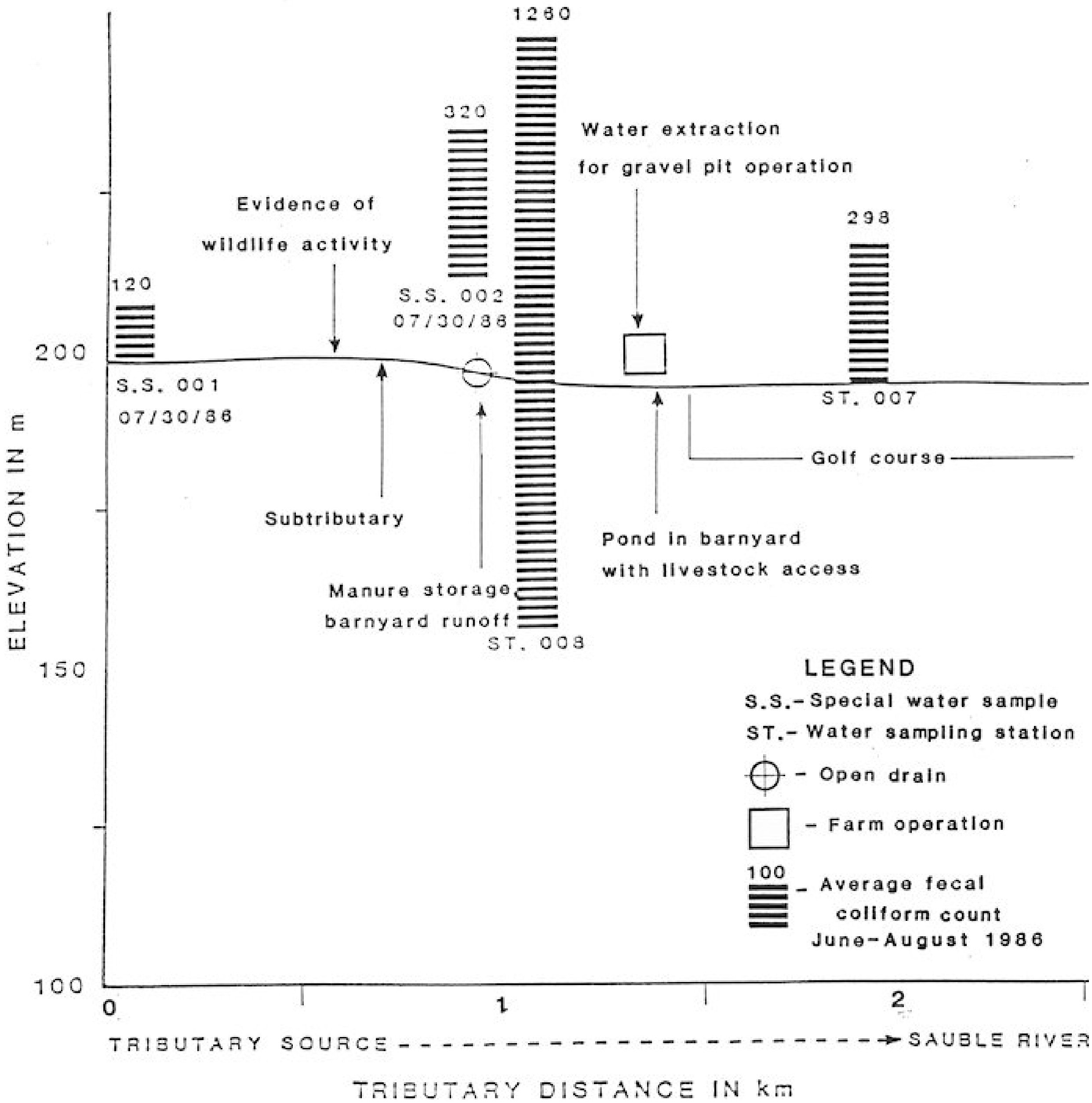

Figure 11: Gradient profile of unnamed stream in Amabel Township, sampling stations 007 and 008.

North of County Road 8, the stream meanders from the golf course to a neighbouring farm operation and back before flowing into the main river. Chemical water quality at station 007 seems to reflect the contribution of golf course fertilizers to the stream.

Severe degradation of the stream occurs on the neighbouring farm where an in-stream barnyard pond is utilized by various fowl and livestock. Sampling the downstream stations became impossible in the summer when the entire flow was consumed by the gravel and concrete business located on the same property.

5.2.3 Unnamed Stream, Amabel Township, Stations 003 & 004

This stream (Figure 12) flows year-round for an approximate distance of 5 kilometres. Sample stations were located on Lot 20, Conc. 10 and Lot 20, Conc. 11 of Amabel Township. In the 1962 Sauble Valley Conservation Report, it was described as a cold water stream with summer temperatures not exceeding 24°C. Our survey confirmed this with a high temperature of 22°C recorded in the lower portion of the stream.

From the spring source on Lot 18, Conc. 7, the stream flows through a series of artificial ponds in a large sand and gravel extractive operation with inevitable thermal degradation. South of the Concession road is another extractive operation that has avoided affecting the natural stream course by leaving a buffer zone along the channel. The stream does however, flow by a barnyard where sheep are being raised and a pack of hunting dogs are housed. The only other apparent point of water quality impact is further downstream where a small herd of about 20 cattle have access to 15 metres of the stream, the rest being protected by areas of shrub marsh or forest.

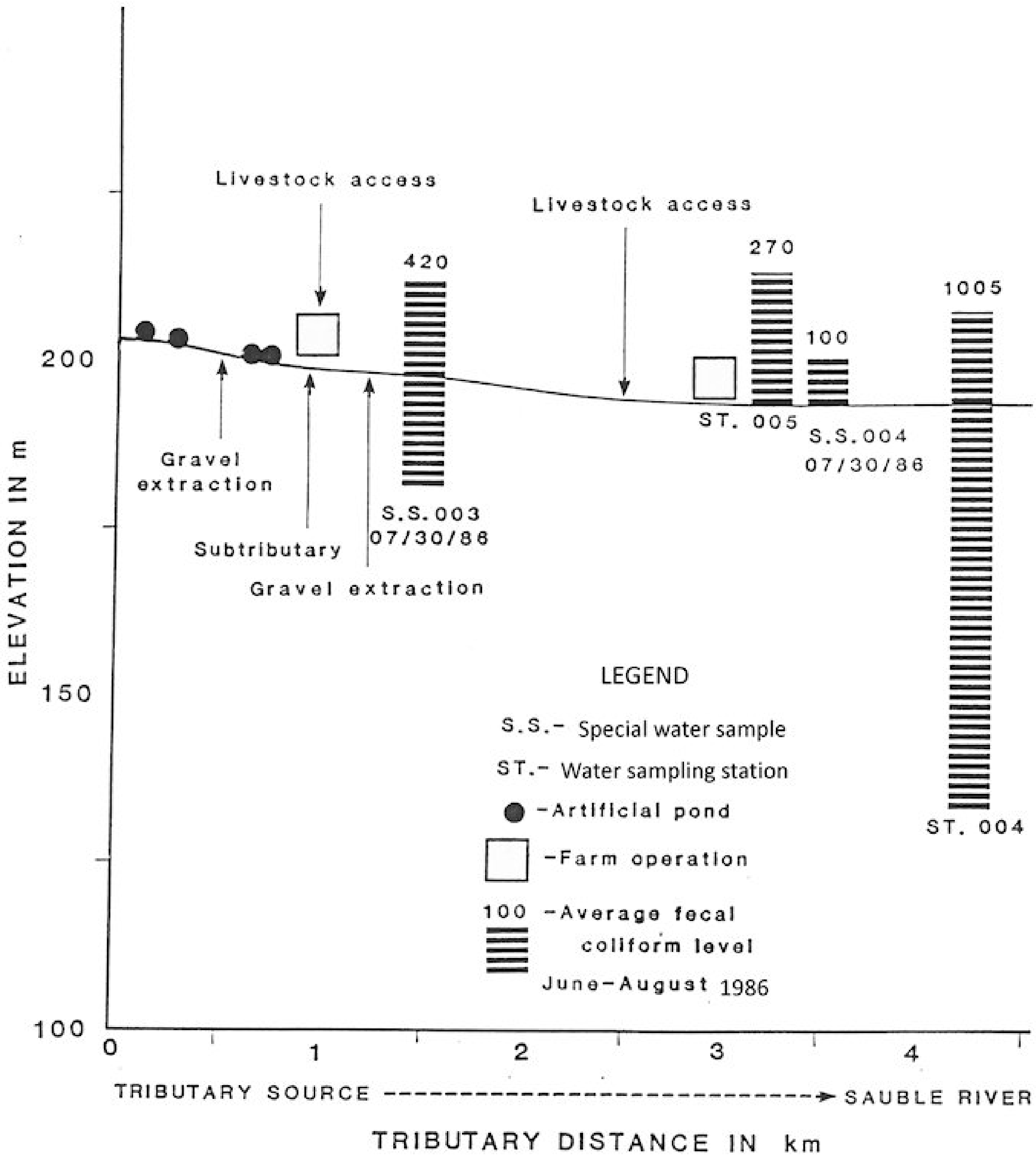

Figure 12: Gradient profile of unnamed stream in Amabel Township, sampling stations 004 and 005.

Though clear at the time of the field investigation, the entire stream seems to be periodically affected by beaver activity. Many local people blame the degradation of water courses on the beaver.

Average fecal coliform levels of the lower sampling station were much higher than those found upstream. The highest level occurred when a road crew removed a culvert blockage and backed-up water flushed through the system.

Longtime residents could remember catching brook trout in the stream but none had been observed in recent years. A small spring fed pool on a sub-tributary of the stream was found through the course of the survey to contain a remnant population of trout.

Special samples taken at two points on the stream did not reflect expected contributions by nearby land uses. This may have been due to the hot dry weather at the time of collection which would have limited runoff to the stream.

5.2.4 Unnamed Stream, Amabel Township, Stations 028 & 029

Stations 028 and 029 are on a very interesting unnamed stream flowing from the north into Allenford (Figure 13) fed by agricultural drains in the upper reaches and accessed by cattle for much of its length; this watercourse is a good example of negative human impacts.

When observed from Highway #21 in the early summer, the stream appeared to be in poor condition with barren, trampled banks and a channel choked with sediments, weed growth and algae bloom. Water analysis showed high counts of all bacteria types including *Pseudomonas*.

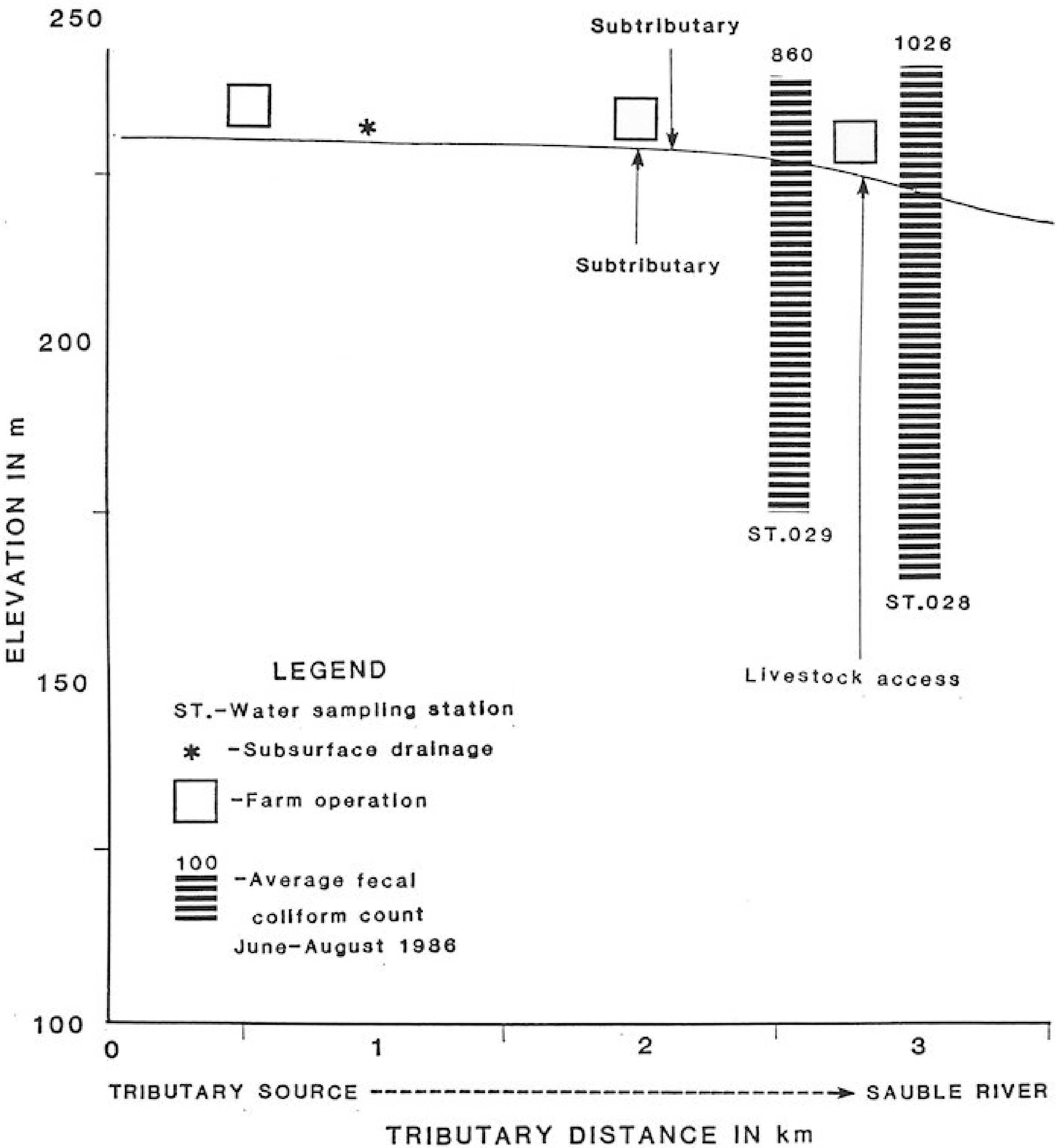

Figure 13: Gradient profile of unnamed stream in Amabel Township, sampling stations 028 and 029.

Later in the summer, the entire stream was dredged to improve drainage and the excavated material was piled along the banks in the accepted fashion. Subsequent water sampling proved the stream to be continually high in turbidity with expected high levels of nutrient contamination that accompanies the continual erosion of excavated material.

5.2.5 Unnamed Stream, Amabel Township, Stations 025 & 026

Extensive drain construction, subsurface tiling and bush clearing occurred in the upper reaches of the stream during the summer. These activities appeared to have little negative impact on water quality at station 026 probably due to the less erodible gravel materials in the excavations.

Downstream at station 025, cattle access seemed to have a significant effect on water quality with average fecal coliform levels increasing by five times those of station 026. Figure 14 illustrates the relative concentrations of bacteria at the two sample stations.

5.3 Quantity and Variation of Flow

Various watershed components and the amount of precipitation that occurs in the basin determine the flow characteristics of the river. The amount and seasonal distribution of flow is important as it determines the dilution and transport of pollutants. During runoff events when tributary flow is greatest, 80% or more of certain pollutants can be transported to the main stream (PLUARG, 1978) and sediment associated pollutants which have entered temporary sinks may be re-mobilized.

Since bacterial levels correlate with discharge (Bohn and Buckhouse, 1985), it may be useful to examine the discharge records for the Sauble River (Figure 15) when evaluating the results of the water sampling program.

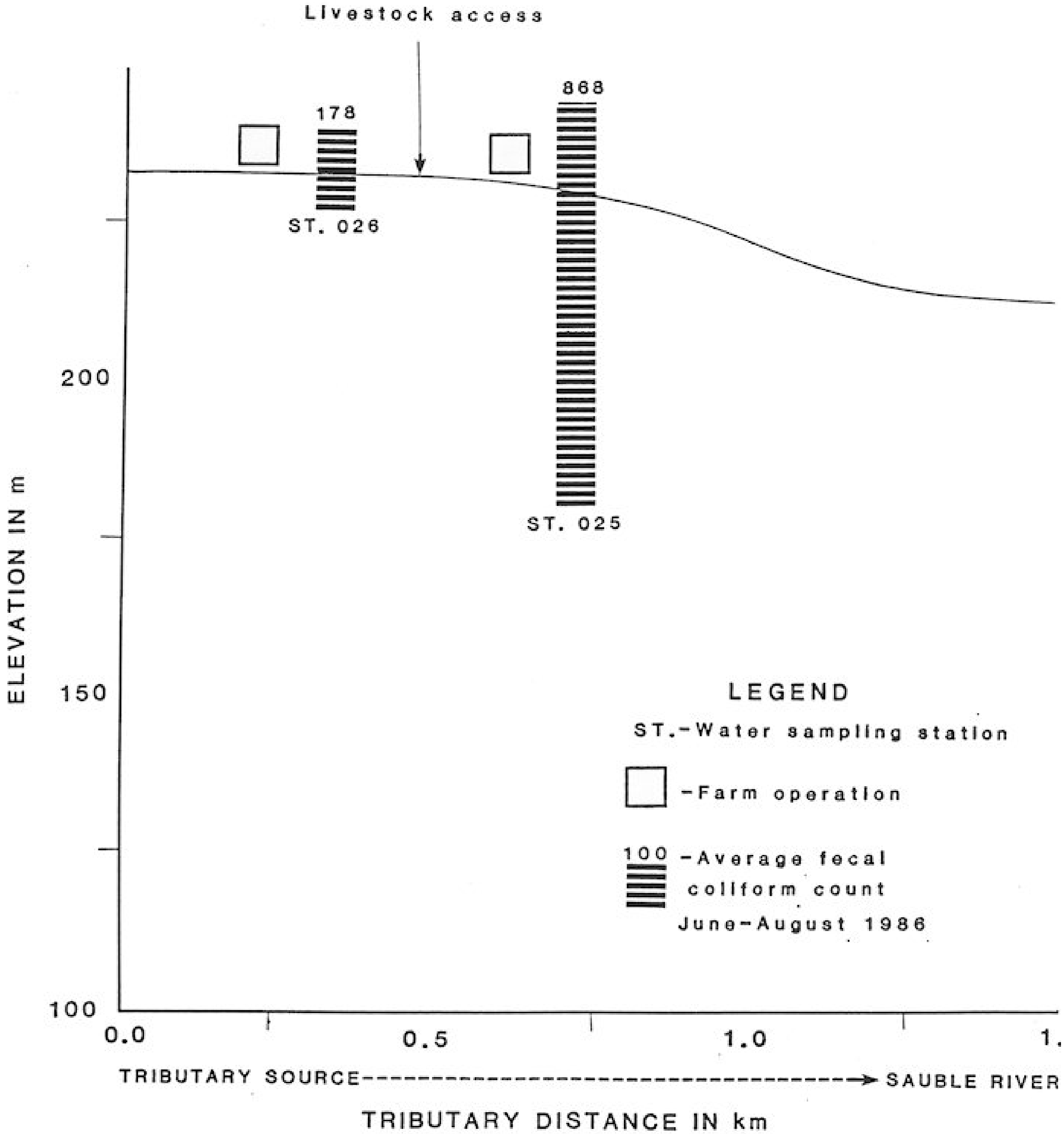

Figure 14: Gradient profile of unnamed stream in Amabel Township, sampling stations 025 and 026.

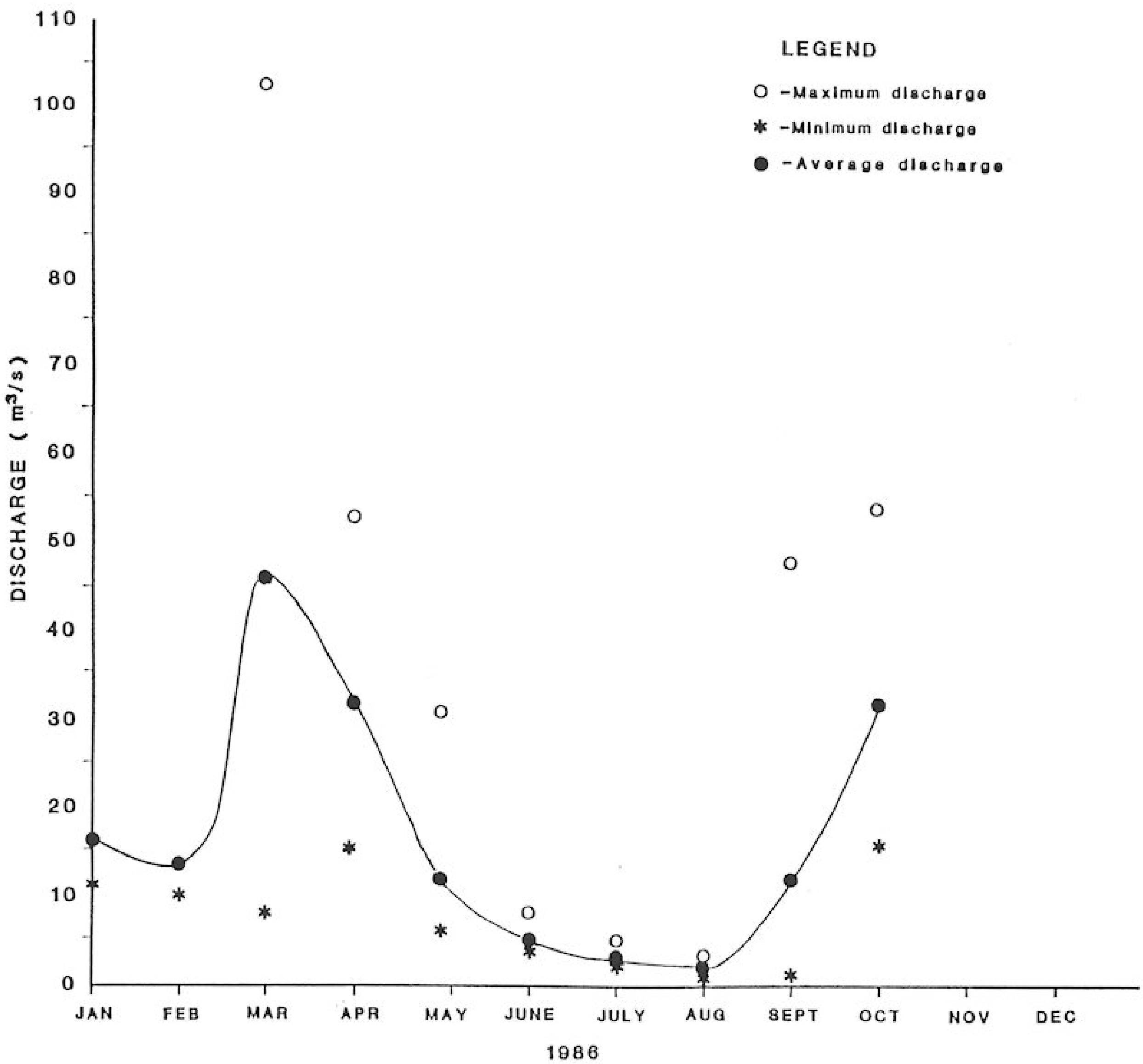

Figure 15: Monthly minimum, maximum and average discharge (m^3/sec) of the Sauble River, recorded at Sauble Falls, January - October, 1986.

Bacterial analysis of samples gathered during low flow periods of June through August reflect base flow conditions while more significant contaminant loadings probably occur during the spring and fall runoff periods. Figure 16 shows the correlation between rainfall and discharge for the 20 week sampling period.

5.4 Information and Education

A letter sent to Sauble watershed residents is included (Appendix A) in this report. It includes a description of the program's methods and goals with an offer of further information if required. Response to the letter was limited to a few reports of minor pollution problems.

Newspaper articles further publicized the project to raise consciousness of pollution issues in the area. Articles also appeared in both the Grey and the Bruce County Federation of Agriculture newspapers.

An ongoing information and education program was carried out through landowner contact prior to visual inspection of watercourses on private land. This contact increased awareness of conservation issues and improved relations with farmers.

Landowners were generally interested and concerned about water quality in the Sauble system. A wide range of perceptions were gained concerning sources of pollution and causes of stream degradation.

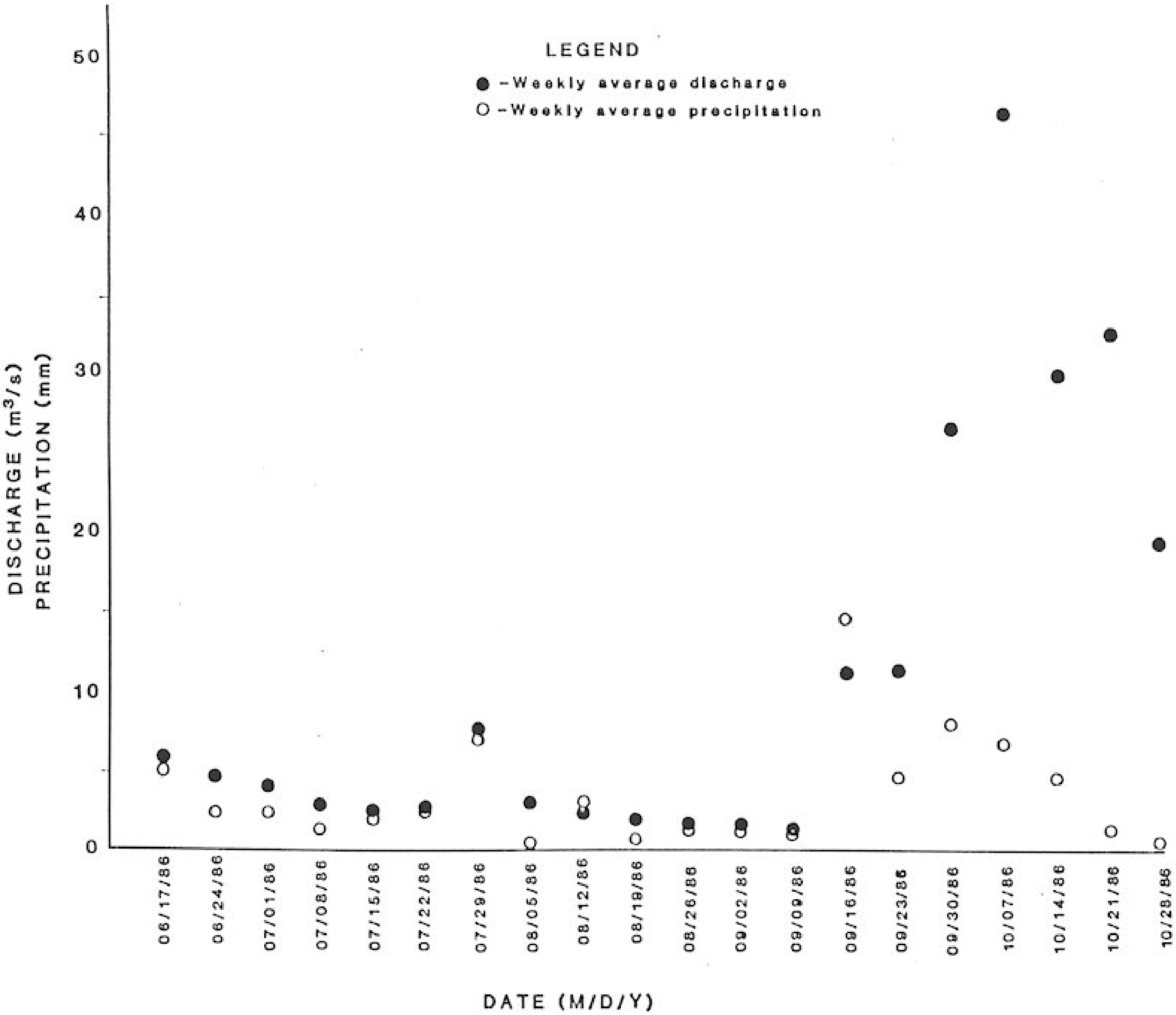

Figure 16: Weekly average precipitation (mm) and Sauble system discharge (m^3/sec), June - October, 1986.

It was apparent that while many landowners acknowledge the problems inherent with stream-side agricultural operations others did not attach any responsibility for water quality degradation with agriculture. Alternate concerns cited were mostly wildlife based with beaver activity being particularly objectionable.

Financial concerns were apparent in most cases with some conservation practices failing to meet cost/benefit requirements. Enhancement to the existing environmental protection grant systems may provide incentive for some landowners to improve conditions on their farms.

An extensive "Stream Conservation and You" theme display was constructed for use at Fall Fairs within the Sauble River watershed. Elements of the display focused on water quality of the river system, the Beaches Program and the promotion of manure management and erosion control technology. Manned by program staff, there was an automatic slide presentation, a display of current erosion control materials and devices and a free draw for a large Norway spruce tree. The display was very well received and attended with many requests for site-specific information on water quality and assistance available to landowners within the watershed.

6.0 CONCLUSIONS

The first year of the Beaches Impact Study on the Sauble River basin provided insight into the complex watershed mechanisms that are ultimately responsible for the delivery of water to the Great Lakes and the heavily utilized beaches thereon.

The water sampling program described in qualitative terms the contributions of most tributaries to the total river volume. In terms of fecal coliform bacteria loading, average summer levels well above Ministry bathing criteria were observed throughout the watershed. Of the five highest recorded fecal coliform levels, one was on a headwater tributary of Tara creek, another was on the Sauble River not far from this point, a third was on a tributary flowing through Allenford and two more were on streams converging with the Sauble River only 10 kilometres from Lake Huron. Open agricultural drains and unrestricted livestock access to watercourses appear to be the primary causes of the degraded water quality.

More intensive upstream-downstream sampling at selected sites in the central study area clearly illustrated the cumulative effect of pollutant loading on streams passing through areas of land use impact. Field surveys in study area no. 1 were utilized effectively to visually determine probable sources of contaminants. Linked to bacterial contamination of streams in the preliminary study area were open livestock access, runoff from barnyard and manure storage areas and in some places apparent wildlife and human contributions.

The information and education component of the study provided insight into the opinion of landowners within the watershed concerning the issues involved. From contacts with people in the field, it is apparent that in areas where negative water quality impacts are occurring there has been little incentive to improve the situation.

Many landowners acknowledged the problem of bacterial contamination in watercourses but considered the solutions to be too costly or their operations too small to be of concern. This response underlines the need for an enhancement to the existing OSCEPAP program.

A need for soil and water conservation education was apparent in the watershed. Some landowners fail to see small watercourses as part of a larger system where effects of abuse are accumulative and not necessarily localized.

Programs to enhance the visibility of the water pollution problem should be continued with increased media attention and participation in local events such as fall fairs. Public consciousness of watershed issues will make stream degradation less easy to ignore and increase participation in conservation projects.

7.0 RECOMMENDATIONS

1. Demonstration projects should be undertaken to publicize stream management concerns and to illustrate remedial techniques. Specifically, the stream originating in Forbes' gravel pit (west of Hepworth), the Allenford tributary and the western branch of Tara Creek would make excellent demonstration projects.

2. OSCEPAP funding should be increased and allocated within the watershed according to priority as determined through coordinated efforts by the Ministries of the Environment, Agriculture and Food and the Conservation Authority.

3. The field investigation of watercourses should be continued in the second and third watershed sections in conjunction with water analysis to document stream conditions and prioritize areas for future study.

4. Programs should be designed Co utilize resources of other groups where there can be an integration of goals i.e. Community Fisheries Involvement Programs and sportsmen's clubs can help to reduce bacterial pollution while improving streams for trout habitat.

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APPENDIX A

GREY SAUBLE
CONSERVATION AUTHORITY

June 1, 1986

Dear: Landowners on the Sauble River System

Re: Sauble Watershed Beaches Impact Study

This summer, the Grey Sauble Conservation Authority will begin the Sauble Watershed Beaches Impact Study as part of the Beaches Management Strategy to protect and upgrade water quality in the Sauble River. The Beaches Management Strategy was developed by the Ministry of the Environment in response to the problem of high bacteria levels with resulting beach closures in Southern Ontario. This effort has been made possible through funding by the Ministry of the Environment with support from the Ministry of Agriculture and Food.

Two staff members will be walking the Sauble River and its tributaries in order to collect information and locate potential sources of pollution. After any problems on the river have been identified, we will offer information and assistance to landowners wishing to take steps toward improving specific conditions on their land.

Since there are no known major individual contributors of pollution to the Sauble system, an improvement in water quality can only be made through the combined efforts of people living and working along the river. It is our intention to develop cost effective ways to control pollution, making use of funding and technical assistance available in the enhanced Ontario Soil Conservation and Environmental Protection Assistance Program (OSCEPAP) of the Ministry of Agriculture and Food and in the Conservation Services Program of the Authority.

.../2

The field work of this summer will provide enough information to enable us to direct assistance to areas where some good can be done. If you have any objections to our field staff walking along streams flowing through your property or if you would like more information about our project, please contact:

The Grey Sauble Conservation Authority
R. R. #4
Owen Sound, Ontario
N4K 5N6
519-376-3076

Sincerely,

Neils Munk
Project Supervisor

NM/kc

APPENDIX B

Farm waste said to be hurting beach

The Grey-Sauble Conservation Authority has received a $26,000 grant to study the Sauble watershed for sources of pollution. Researchers with the Authority say that manure and farm chemicals contribute to high bacteria levels In Lake Huron at Sauble Beach.

Sauble rivers flow through areas of high cattle production including areas such as Desboro,"Tara, Allenford and Hepworth.

A 1984 study of Allenford area showed that agricultural practices could be improved along the river but wasn't very specific about sites.

Apparently coliform bacteria levels at Sauble Beach have reached high levels in recent years and while the beach hasn't been closed to swimmers, it has come close, according to Ann Lennox of the Authority.

The study calls for two people to survey the whole river watershed and point out various sources including manure from feedlots and dumping waste. They will also look at areas where the river flows through barn yards or where animals are grazing near the river.

Farmers with pollution problems will be asked to clean up. It is also hoped the farmers will be able to take advantage of grants from the Ministry of Environment and Agriculture.

May 16, 1986

Farm waste hurts beach

By TIM ALGIE
Sun Times staff

Manure and farm chemicals in the Sauble River contribute to high bacteria levels in Lake Huron at Sauble Beach, researchers with the Conservation Authority say.

The Authority plans a nine-month study of the Sauble watershed to identify pollution sources using a $26,000 grant from the provincial Environment Ministry.

The Sauble flows. through areas of intense cattle production in Bruce County from Desboro through Tara, Allenford and Hepworth.

A 1984 study of the Allenford area indicated potential improvements in agricultural practices along the river, said Neils Munk, supervisor of the Sauble study.

"It concluded work could be done to improve the situation", Munk said, "but it wasn't very specific about ... sites."

Coliform bacteria levels at Sauble Beach have reached high levels in recent years, although the beach has not been closed by Bruce County public health officials.

"It has come close to being closed." said Ann Lennox of the authority.

Levels have been particularly high at the Sauble River mouth.

"The problem is quite apparent. We're going to try to stop it before it becomes too bad."

During the study, two people will survey the entire Sauble River watershed including branches which run north into the Rankin River system on the Bruce Peninsula.

Researchers will search out various pollution sources including manure from feedlots; farmers dumping waste; streams running through barnyards; animals grazing near the river, and spreading of manure and chemicals close to the water.

"We'll be taking water samples above and below (specific sites) to determine if it's making any contribution to pollution." said Lennox.

Farmers with pollution problems will be approached and asked to clean up.

"When we identify the situation, we hope farmers will take advantage of grants from the Ministry of the Environment and Agriculture," Lennox said.

"At this stage, it's mostly a research type of project," Munk said.

"Eventually when money" becomes available... we'll carry out some work."It should be emphasized that money mon is coming through the grant system. There isn't going to be any burden placed on the farming public.

"We acknowledge that times are tough enough on farms as it is", Monk said. ''Grants for soil conservation and erosion protection are presently under revision", Monk said.

Lennox said existing grants provide up to 85 per cent of capital costs in some cases.