CATFISH CREEK AND KETTLE CREEK CONSERVATION AUTHORITIES

1992 SUMMARY REPORT

Prepared by:

Margaret Steele
Water Quality Technician

MARCH 1993

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1. INTRODUCTION

The Kettle Creek Conservation Authority and the Catfish Creek Conservation Authority watersheds are located adjacent to each other on the north shore of Lake Erie (Figure 1). The major urban areas are St. Thomas in the Kettle Creek watershed and Aylmer in the Catfish Creek watershed.

Both watersheds empty into Lake Erie which is also where the two major beaches for the watersheds are located. There are also beaches at different conservation areas in the watersheds.

The two Conservation Authorities have entered into a joint Clean Up Rural Beaches Study beginning in 1992. This joint study focuses on surface water quality within the watersheds and is funded by the Ministry of the Environment under the Provincial Rural Beaches Program. The program began because of the increase in the number of beach closures due to high bacteria levels in the early 1980's. These elevated levels can cause minor skin, nose, ear, eye and throat infections as well as stomach ailments. A local steering committee directs the study and is made up of representatives from the Ministry of the Environment, Ontario Ministry of Agriculture and Food, Ministry of Natural Resources, Elgin-St. Thomas Health Unit, a Representative of the Farming Community, Drainage Superintendent, and both Conservation Authorities.

Both Conservation Authorities are concerned with the water quality in the watersheds and it was felt that a study to identify and prioritize the sources of pollution in the watersheds was needed. From this study, the measures needed to improve water quality could be identified. This report is the first year report of a two year study phase. A second report will be issued at the end of 1993.

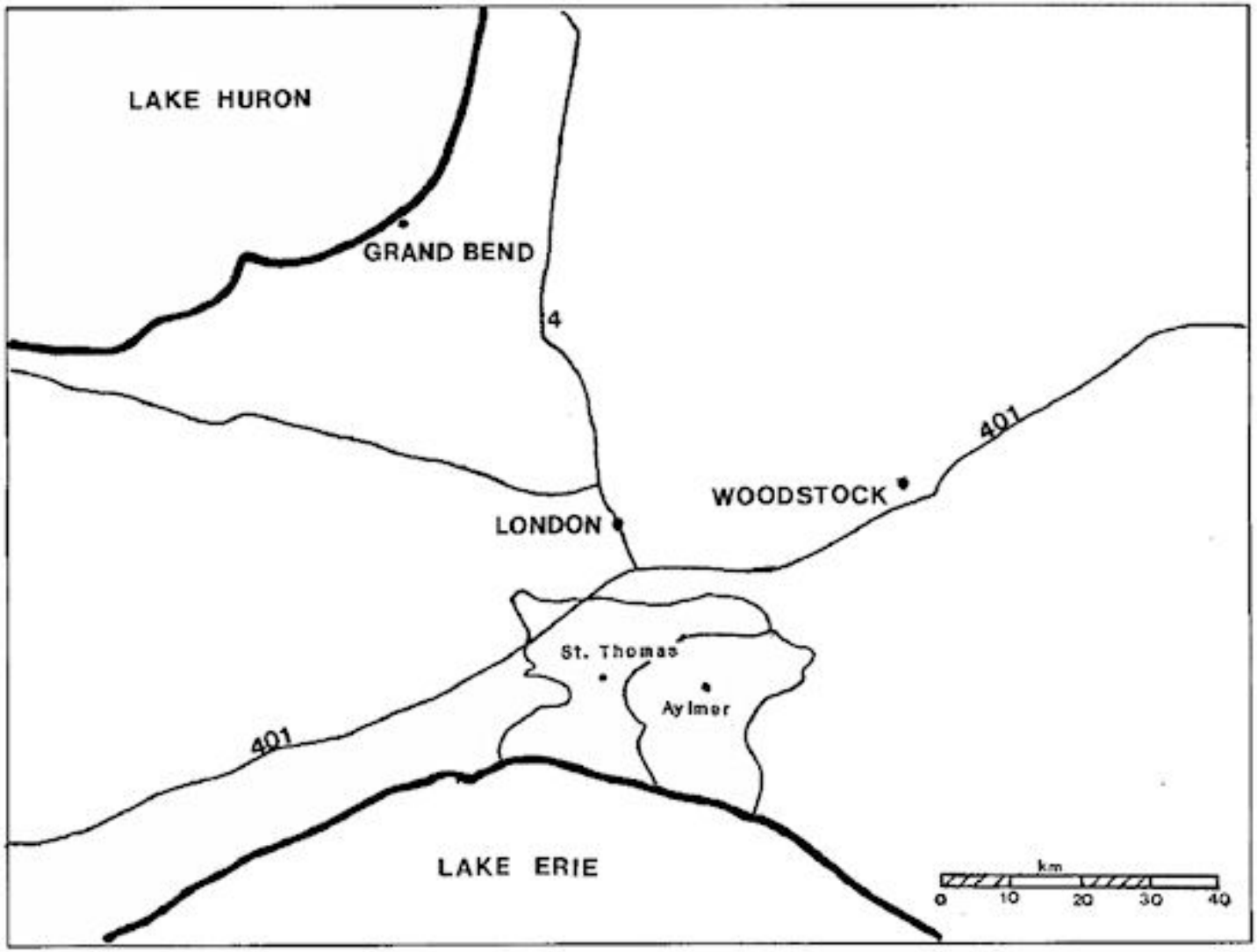

Figure 1: KCCA and CCCA

2. GOALS AND OBJECTIVES

The goal of the Clean Up Rural Beaches Program as set out by the Ministry of the Environment is for Conservation Authorities to be able to restore and maintain acceptable water quality in watersheds with rural beaches through the guidance of the CURB Plan. In order to do this a measurable improvement in water quality is necessary within the targeted watersheds.

During the 10 year program, $57 million will be allocated towards the CURB Program. Eight Authorities that are presently in the Implementation Stage have determined that it will take an estimated $65 million to implement effective measures within their Authorities. Therefore, it is clear that most Authorities will be underfunded (Hayman, 1992).

Because of this potential underfunding, it is necessary that the Conservation Authorities set realistic goals in determining how to best achieve improved water quality. The Kettle Creek and Catfish Creek Conservation Authorities would like to achieve measurable results with the least amount of funding through a systematic implementation of the program by priority areas in each Authority, on a subwatershed basis, to demonstrate improved downstream water quality and justify grant needs. The Kettle - Catfish CURB Plan includes the following goals and objectives for the study phase to facilitate this idea.

GOAL:

1. Confirm and establish the extent of faecal and phosphorus contamination by rural point/non-point sources in the Kettle and Catfish Creek watersheds and provide recommendations for implementation and remedial works.

OBJECTIVES:

1. A monitoring and data collection program throughout both watersheds to establish and isolate priority areas of faecal and phosphorus contributions.

2. Provide information and educational materials to the rural community on the goals of the CURB Program and how the community can participate.

3. Establish a criteria and rationale within the Study Phase to identify areas targeted for remedial action.

4. Provide recommendations within a Final Report, at the end of a two year Study Phase, which will identify projects in each watershed, directed toward reducing phosphorus and faecal loading and possibly other major sources of water degradation. The importance of selecting subwatersheds in each Authority for systematic prioritized funding, if warranted, will be emphasized.

3. STUDY AREA

The study area is outlined in Figure 2. A few of the smaller watersheds were not included in the study area because they did not impact on the beaches. These watersheds are on the east side of the Catfish Creek and impact more on Port Burwell than on Port Bruce because of the littoral drift of Lake Erie. The beaches are very important to the local economies of Port Stanley and Port Bruce. Both the beaches at Port Stanley and the beach at Port Bruce attract tourists in the summer. This tourist population is a major source of revenue for the villages.

Kettle Creek watershed

The Kettle Creek watershed is located in the area regulated by the Kettle Creek Conservation Authority and accounts for the majority of the land in the Authority. The watershed drains about 520 km^2 of land. The primary land use in the watershed is agricultural, with mixed farming predominate in the northern half of the watershed.

There are two beaches in Port Stanley, Little Beach and Main Beach. These beaches were closed for the first time in 1992, but there has always been some concern about water quality and the beaches are monitored closely every year. Garbage from the Kettle Creek has also been found on the beaches.

As well as the beaches of Port Stanley at the mouth of the Kettle Creek, there are other areas of concern as well. Dalewood Reservoir is located just north of the city of St. Thomas and is part of the Dalewood Conservation Area. Though the Reservoir has not been used for swimming since the 1970's, there is interest in improving the water quality and reopening the Reservoir. The Reservoir was closed because of the sediment coming downstream which degraded the water quality.

Catfish Creek watershed

The Catfish Creek watershed drains the 355 km^2 area regulated by the Catfish Creek Conservation Authority and accounts for 71 % of the area within the Authority. Here the primary land use is agriculture, with mixed farming in the northern half of the watershed and primarily cash cropping in the south.

The two important beaches within the Catfish watershed are Port Bruce Provincial Park and the Springwater Day Use Area Beach near Aylmer. The beach in Port Bruce is located along the lake shore and is used by many visitors and seasonal residents of trailer parks in the village. The beach at Springwater Conservation Area is used by both local residents and conservation area campers for many recreational activities.

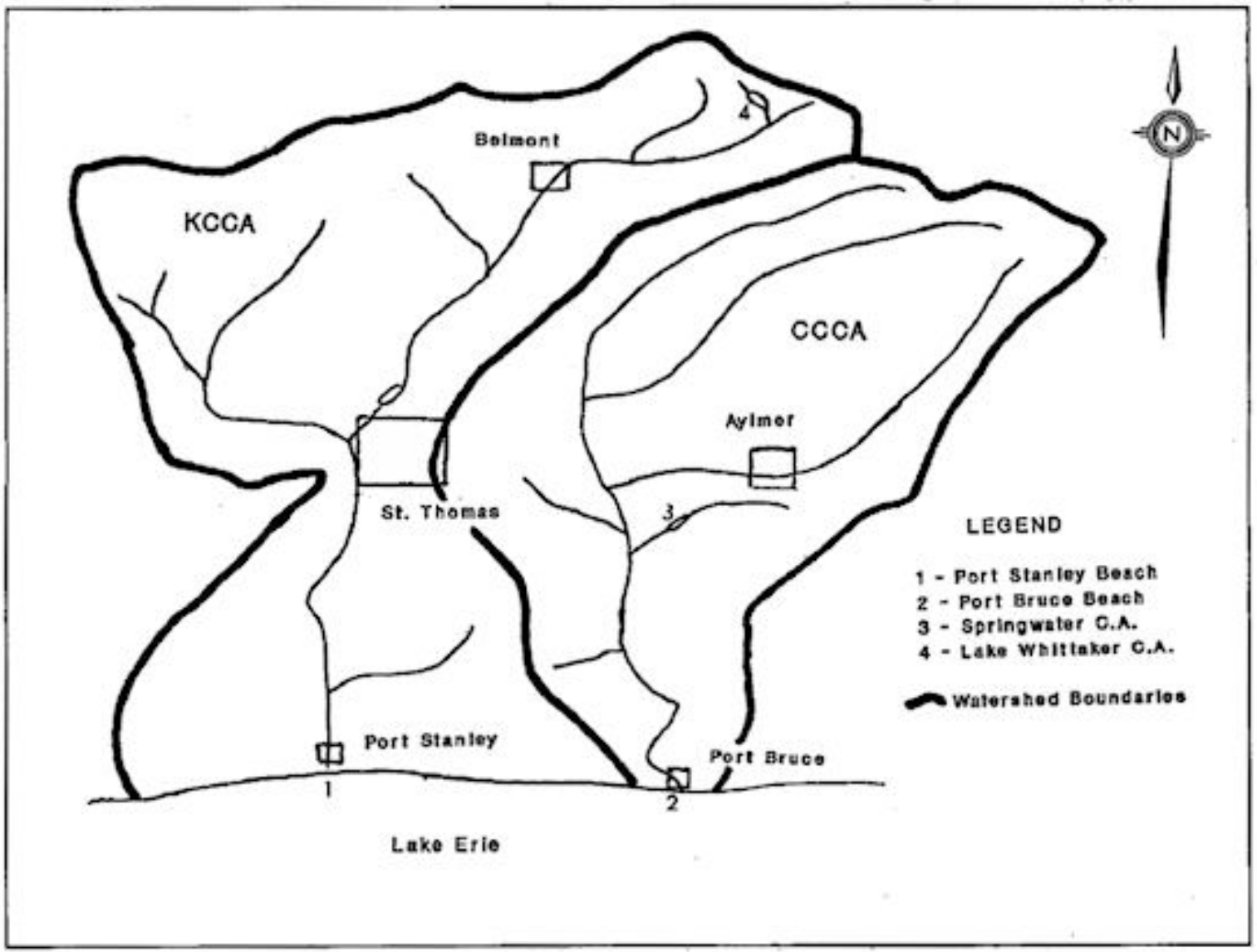

Figure 2: Study Area

4. WORK PROGRAM SUMMARY

4.1 Water Sampling

Water sampling was conducted to not only track rural water quality problems in the watersheds, but also to try to account for the urban influences within the watersheds. There are many small villages in the watersheds that could be impacting on the creeks because only St. Thomas, Port Stanley, Belmont and Aylmer have municipal treatment for their waste. The other villages are on septic systems, many of which are probably very old.

In order to compare water quality during wet and dry periods, the rainfall events were monitored and recorded so that the samples could be identified as either being taken during wet or dry weather.

There were seven weekly water sampling sites chosen in the Kettle Creek Conservation Authority. Figure 3 indicates these sites.

There were fourteen water sampling sites chosen for the Catfish Creek. Figure 4 indicates these sites. Sites A to G and sites H to N were sampled on alternate weeks.

Water samples were collected at each station from May to the end of October for bacterial analysis and from June to the end of October for chemical analysis, at the London Ministry of the Environment laboratory. A total of 525 bacterial samples and 462 chemical samples were analyzed for the following:

Bacterial:	Faecal Coliforms
	Faecal Streptococci
	Pseudomonas aeruginosa
	Escherichia coil (E. coli)
Chemical:	Suspended solids
	Nitrogen as free ammonia
	Nitrate and Nitrite
	Total Kjeldahl
	Total and dissolved Phosphorus
	pH
	Conductivity
	Chloride as Cl

Temperature and dissolved oxygen levels were also measured for each site at time of sampling.

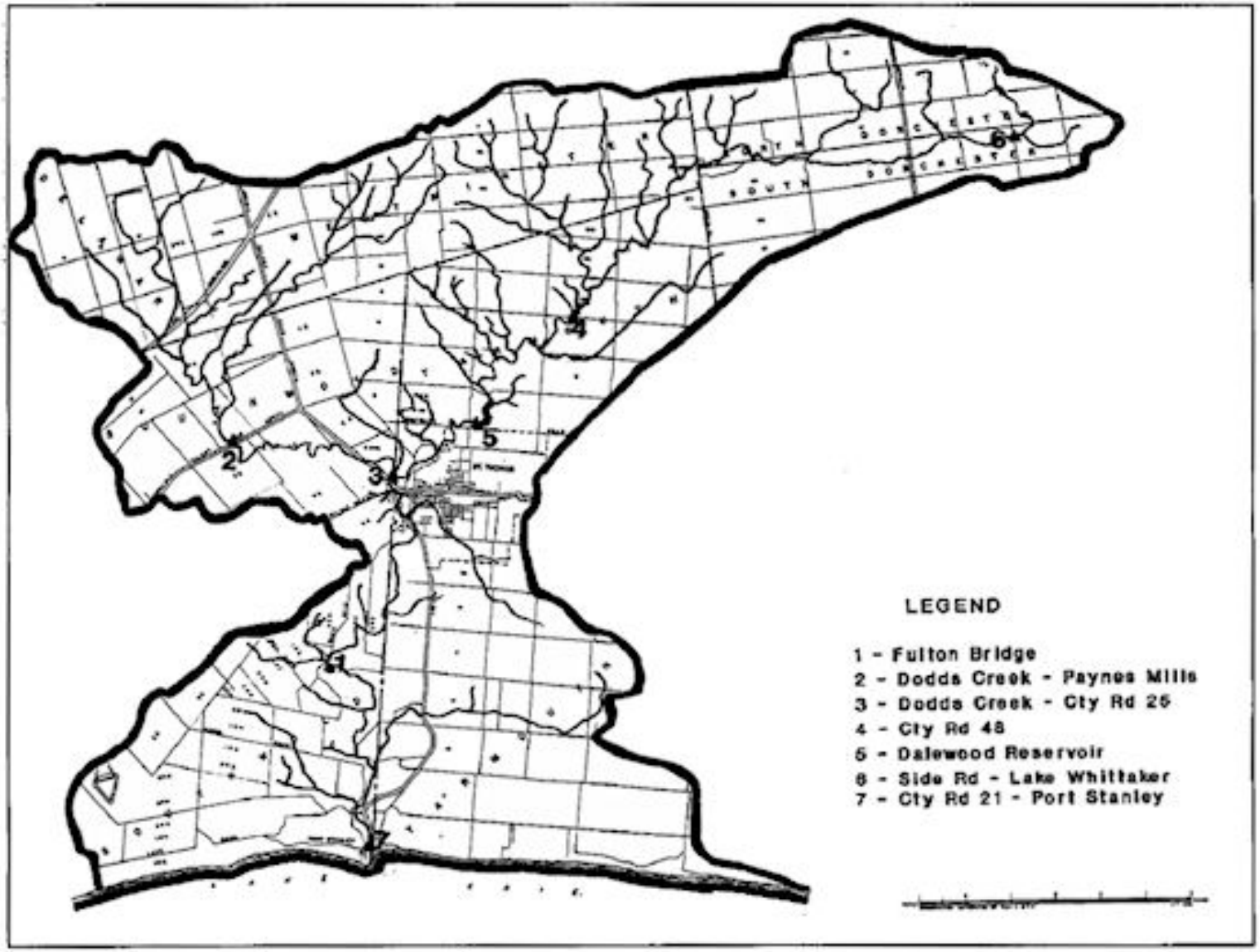

Figure 3: KCCA Sampling Sites

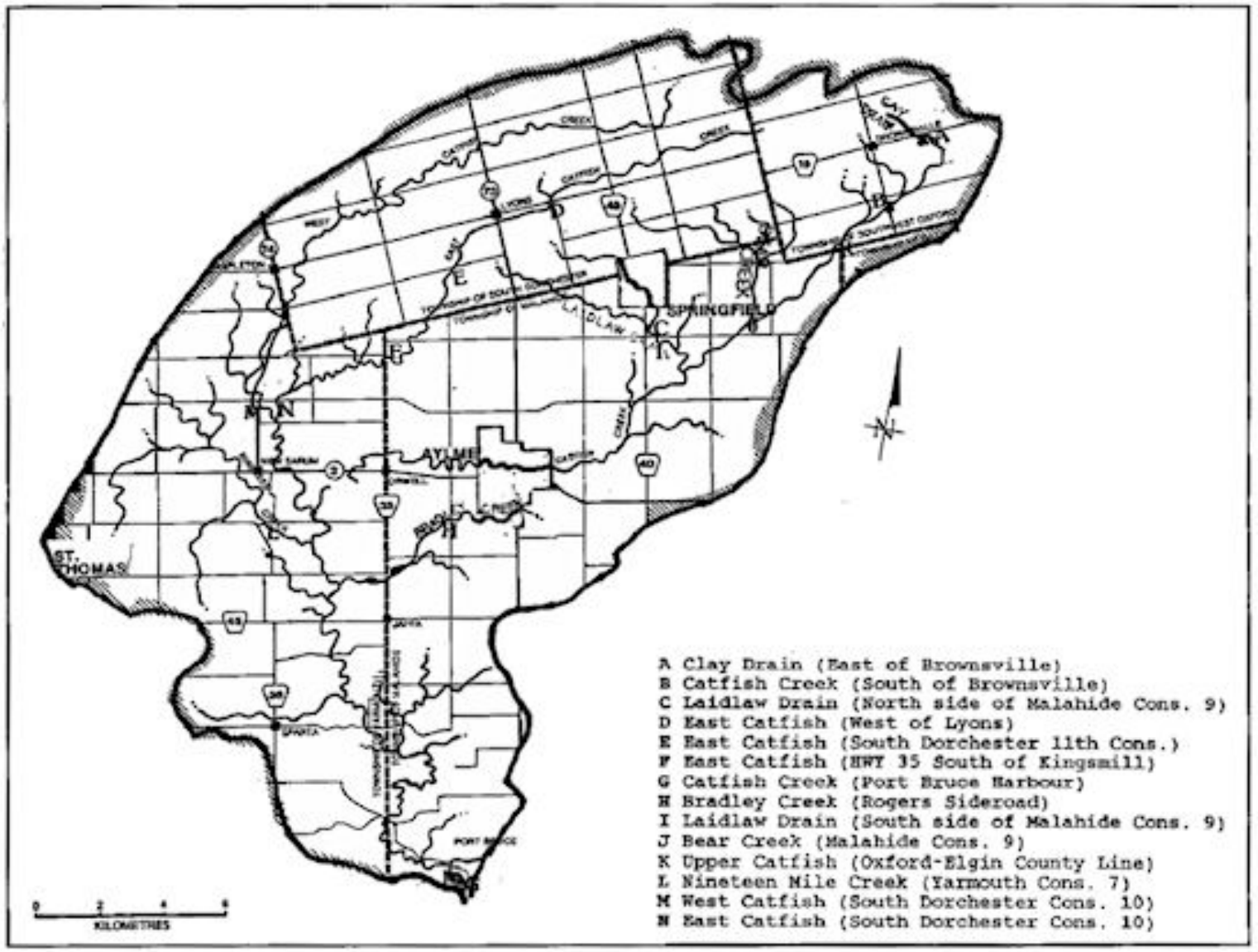

Figure 4: COCA Sampling Sites

Bacterial Indicators

Water that is polluted with human or animal waste can be a serious health hazard to both humans and livestock. Humans run the risk of nose, throat, ear and eye infections as well as stomach complaints. Livestock can be exposed to a number of diseases through poor water quality. Bacterial indicators indicate the presence of pathogenic organisms of human or animal origin and that soil and faecal contamination have occurred. These pathogens include bacteria, viruses and protozoa and are easily spread in water. The bacterial indicators for this study are:

i) Faecal Coliforms and Faecal Streptococci

Faecal Streptococci is generally found in the alimentary tract of warm blooded animals. They are indicative of sanitary waste and/or faecal contamination from warm blooded animals.

Faecal coliforms are natural inhabitants of the intestines of humans and animals. The Ministry of the Environment at one time used Faecal coliforms as the bacterial indicator for safe swimming water. Faecal coliforms are usually made up of 90% *E. coli* and 10% *Klebsiella* sp. Because *Klebsiella* can grow under various conditions, it is often not a true indicator of bacterial pollution. Because of this the Ministry of the Environment has changed the guidelines for safe recreational water so that the bacterial indicator is *E. coli*.

ii) *E. coli*

E. coli is the predominant species found in the large intestine and is most directly related to faecal pollution. *E. coli* is primarily an indicator organism for the presence of more virulent organisms.

The MOE guideline for *E. coli* is less than 100 per 100 ml for water to be safe for swimming.

iii) *Pseudomonas aeruginosa*

These organisms are primarily found in sewage. *Pseudomonas* is the major cause of earaches and skin infections.

Chemical Indicators

i) Suspended Solids

Suspended solids can transport significant quantities of organic and inorganic trace elements. They can originate from soil erosion, sewage treatment plant effluents, municipal storm drains, and industrial discharges.

ii) Nitrogen

a) Nitrogen as Free Ammonia

Ammonia nitrogen is found in fertilizers, cleaning solvents, livestock wastes, household wastewater and industrial discharges. It is rather short lived in surface waters, but can be toxic to freshwater aquatic life.

b) Nitrate and Nitrite

Nitrate is the end product of the stabilization of organic nitrogen which occurs primarily through aerobic processes. Nitrate is usually present in trace amounts in surface waters. However, high levels of nitrate will contribute to the eutrophication process.

Nitrite is the intermediate oxidation product of ammonia and is also an intermediate form in the denitrification process from nitrate to nitrogen gas. High concentrations of nitrite are indicative of the presence of industrial effluent.

Cattle, young animals and children can convert nitrate to nitrite and can develop methaemoglobinaemia (blue baby syndrome).

c) Total Kjeldahl Nitrogen

Total Kjeldahl Nitrogen (TKN) is a measure of the total nitrogenous matter present including nitrate and nitrite. The concentration of Total Kjeldahl Nitrogen minus the ammonia concentration gives a measure of the organic nitrogen present. Eutrophication may occur if TKN is found in excessive amounts. Sources of TKN include manure, sewage, industrial waste treatment effluent and normal biological activities.

iii) Total and Dissolved Phosphorus

Phosphorus is a primary nutrient for plant and animal life. Sources of phosphorus are untreated and treated sewage, industrial wastes, agricultural practices, and urban drainage. Excess phosphorus promotes excessive aquatic plant growth which, upon decay, depletes oxygen in lakes and streams. This can result in fish kills and the death of other aquatic life.

The MOE guideline for phosphorus is 0.03 mg/L to prevent excessive plant growth.

iv) pH

pH is an index of the acidity or alkalinity of the water. It is important in determining the appropriate treatment of water supplies. Both acidic and alkaline water may cause eye irritation, therefore the pH of recreational waters should be in the range of 6.5 to 8.5.

v) Conductivity

Conductivity provides a measurement of the electrolytic properties of water. It is an excellent indicator of water quality changes since it is relatively sensitive to variations in dissolved solids concentrations. A standard temperature of 25 degrees Celsius is used when presenting the results.

vi) Chlorides as Cl

The largest sources of chlorides are from domestic sewage effluent, municipal storm drains, road salting and industrial waste. The level of chlorides should not exceed 0.002 mg/L according to the Provincial Water Quality Objectives put out by the Ministry of the Environment.

vii) Temperature

The water temperature directly affects the solubility of gases and biological and chemical reaction rates.

viii) Dissolved Oxygen

Dissolved Oxygen originates either by direct interchange from the atmosphere or from photosynthesis of aquatic plants. The higher the level of dissolved oxygen in the water, the more satisfactory the conditions are for fish and other aquatic species.

4.2 Public Relations

The television commercial for the CURB Program prepared by the Ministry of the Environment raised much interest within the agricultural community in the watersheds. Information was sent on request to people interested in further information. As well, a few site visits were made to examine potential projects and to offer some suggestions on how to prepare for the Implementation Phase.

A display was created on the Curb Program and appeared at the Elgin County Plowing Match-Agrivision 1992. An information sheet for landowners on the Program was created and made available to the public at various public events. Presentations on the CURB Program were made at the Kettle Creek and the Catfish Creek Conservation Authority's Fall Tours. Articles on the CURB Program were published in the Annual Reports of both Authorities.

Two newspaper articles on the CURB Program appeared in the local papers informing the public about the program. The newspaper articles appear in Appendix C.

4.3 Hydrology

Hydrology studies for various tributaries in the watersheds were conducted in order to be able to calculate flow volumes and flow rates. This was done in order to be able to evaluate approximate bacterial loading from the different tributaries.

4.4 Window Survey

A window survey of the study area was conducted to identify the location of the different agricultural practices. This survey involved driving through the watersheds and visually identifying the different types of farms and homeowners. This information will be used to identify high priority areas in the watersheds and to assist in the distribution of the landowner surveys in year 2 of the study.

5. RESULTS

5.1 1992 Water Sampling Results

Bacteria

E. coli levels in the creeks rose and fell with rainfall events. However, for most sites levels during low rainfall periods remained above the MOE Provincial Water Quality Objective of 100 *E. coli*/100 ml. Dalewood Reservoir was the only site which consistently registered below the MOE guideline. Though the guidelines are set for swimming areas, it is clear that even with dilution the high bacteria numbers in the creeks are affecting the beaches downstream. The number of days the beaches were closed is proof of this. Figures 5 to 8 show the *E. coli* levels over the water sampling period from May to October.

On average the bacteria levels in the Catfish Creek watershed were higher than those in the Kettle Creek watershed. Though the graphs do not show it, rainfall levels really influence the numbers of bacteria in the water courses. There was usually a correlation between rainfall and *E. coli* Figure 6 shows the increase in bacteria at site 1 during high flow conditions (rain events) as compared to the base flow conditions. This increase is most likely due to overflow at the St. Thomas sewage treatment plant since on average the number of bacteria are not a lot higher during rain events for Dalewood Reservoir (Site 5) and Dodds Creek (Site 3).

Tables 1 and 2 show a comparison of the numbers of bacteria passing by the sampling station per second. This was calculated by multiplying the number of bacteria/100 ml by the streamflow in m^3/sec and by 10,000 (m^3 to 100 ml). In this way influxes of bacteria could be seen between sampling sites. Dodds Creek above Paynes Mills (Site 2) had the highest levels of bacteria in the Kettle Creek. During high flow West Catfish (Site M) had the highest levels of bacteria on average. The next highest tributaries were East Catfish (Site N), 19 Mile Creek (Site L), Laidlaw Drain (Site I), and Bear Creek (Site J). There was also a significant increase in bacteria between sites A and B (Table 2). The increase is probably due to non point source pollutants since it is evident during all sampling periods. Those sites missing from the tables did not have streamflow volumes.

For all graphs, the sites run from the headwaters to the mouth of the creeks with tributaries added in as they join the creek. As well, one graph shows levels during rain events (high flow) and another for normal events (base flow).

Faecal Coliform

Faecal coliform levels increased in levels from site to site downstream. There was a huge jump in high flow levels at site 4 (Fig 10) in the Kettle Creek watershed. For both watersheds, levels increased significantly during high flow events. Figures 9 to 12 show faecal coliform levels between May and October.

Pseudomonas aeruginosa

Figures 13 to 16 show *Pseudomonas* levels for both watersheds. There was a wide fluctuation in the levels of *Pseudomonas* measured in the Kettle Creek for each site, especially during high flow sampling. The Catfish samples show a wide fluctuation in levels between sites and shows the different contributions of each tributary.

Temperature

At all stations, water temperature gradually increased over the summer season. Temperatures began to drop again in mid September. The average temperatures ranged between 14 and 16 degrees Celsius. Summer highs were in the range of 20 to 25 degrees Celsius.

Figures 17 to 20 show temperature levels between May and October.

Dissolved Oxygen

Dissolved oxygen (DO) levels for most stations followed no distinct pattern, other than to reflect water temperature. When water temperature was high, dissolved oxygen levels were low and vice versa. Average levels ranged from 7.5 to 9 mg/L for the streams in the Catfish Creek watershed. Average numbers in the Kettle Creek watershed were about the same as those in the Catfish. DO levels were lowest in July and August between 2 and 6 mg/L. Figures 21 to 24 show the dissolved oxygen levels for both Creeks.

Suspended Solids

The level of suspended solids in the creeks is a function of rainfall and the types of land use around the creeks. Sampling dates where all numbers are high usually indicate rainfall within the last 12 to 24 hours. For most sites, suspended solids averaged between 50 and 100 mg/L unless there was a rainfall event in which case they jumped anywhere from 200 to 1000 mg/L. High levels of suspended solids means that bacteria can live longer in the water since the sunlight is blocked and cannot kill the bacteria below the water surface (MOE,1991). Figures 25 to 28 show the levels of suspended solids in the watersheds.

TABLE 1: Number of Bacteria per Second at each Sampling Station

KETTLE CREEK

DATE	SITE 1	SITE 2	SITE 3	SITE 4	SITE 6
JULY 2	3.29E+05	8.14E+05	2.68E+05	5.38E+04	2.20E+05
JULY 9	3.96E+06	9.61E+06	1.31E+06	1.57E+06	7.50E+06
JULY 16	0.41E+07	1.98E+07	1.22E+07	6.69E+07	
JULY 23	1.86E+07	3.35E+06	9.65E+05	1.04E+06	2.25E+07
JULY 30	4.71E+06	5.78E+05	5.55E+05	5.87E+05	2.42E+06
AUG 6	4.06E+06	5.78E+05	6.88E+04	6.11E+05	
AUG 13	1.90E+06	8.17E+04	4.60E+05	2.22E+04	
AUG 20	9.64E+05	8.30E+05	3.06E+05	3.35E+04	
AUG 27	1.58E+06	1.42E+05	2.94E+04	2.82E+04	
SEPT 3	1.66E+08	1.87E+06	2.09E+06	5.40E+05	1.02E+06
SEPT 17	9.09E+06	1.75E+06	4.82E+05	1.23E+06	2.60E+07
SEPT 24	3.12E+06	3.98E+05	6.17E+06	3.93E+06	
OCT 1	8.72E+05	5.32E+05	2.61E+05	4.17E+05	
OCT 8	7.54E+05	3.61E+05	3.05E+03	1.13E+05	
OCT 15	2.93E+07	1.06E+07	3.69E+06	7.54E+06	
OCT 29	7.75E+06	4.72E+05	5.08E+04	1.40E+05	
MIN	3.29E+05	1.42E+05	2.94E+04	2.22E+04	2.20E+05
MAX	1.66E+08	1.41E+07	1.98E+07	1.22E+07	6.69E+07
AVG	1.68E+07	2.88E+06	2.28E+06	1.87E+06	1.81E+07

Note: 0.00E+00 means that the data is not available.

TABLE 2: Numbers of Bacteria per Second at each Sampling Station

CATFISH CREEK

DATE	SITE A	SITE B	SITE C	SITE D	SITE F
JULY 9	6.70E+04	1.62E+05	3.96E+06	1.13E+06	1.40E+06
JULY 23	7.80E+05	3.83E+05	6.60E+05	2.98E+06	4.50E+06
AUG 6	0.00E+00	1.11E+05	7.70E+03	2.82E+04	2.70E+04
AUG 20	0.00E+00	1.13E+05	9.10E+03	4.40E+03	2.17E+04
SEPT 3	2.20E+04	6.81E+05	2.05E+05	2.64E+05	1.54E+05
SEPT 17	5.70E+04	3.23E+05	1.37E+05	3.05E+05	1.88E+05
OCT 1	7.04E+04	4.88E+05	6.54E+04	5.80E+04	1.37E+05
OCT 29	2.84E+04	1.02E+05	1.93E+05	4.42E+05	1.22E+05
MIN	2.20E+04	1.02E+05	7.70E+03	4.40E+03	2.17E+04
MAX	7.80E+05	6.81E+05	3.96E+06	2.98E+06	1.40E+06
AVG	1.71E+05	2.95E+05	6.55E+05	6.51E+05	8.19E+05

DATE	SITE H	SITE I	SITE J	SITE K	SITE M	SITE N	
JULY 2	2.65E+04	0.00E+00	2.08E+04	3.52E+04	1.41E+05	4.56E+03	
JULY 16	5.40E+05	5.85E+05	2.49E+06	2.39E+06	4.37E+06	4.72E+06	6.62E+06
JULY 30	8.42E+04	8.28E+04	3.94E+05	9.98E+05	1.94E+05	2.88E+05	6.44E+04
AUG 13	1.77E+05	1.88E+05	4.67E+05	1.27E+07	1.71E+05	1.67E+07	6.68E+06
AUG 27	5.64E+04	1.30E+04	5.42E+05	1.39E+05	5.00E+02	2.93E+04	1.65E+03
SEPT 24	2.10E+06	6.49E4-05	8.92E+05	3.15E+05	6.39E+05	4.38E+05	3.14E+06
OCT 8	4.96E+05	3.58E+04	7.74E+04	1.93E+05	0.00E+00	7.40E+03	3.25E+03
OCT 22	6.75E+05	4.25E+06	9.35E+05	5.78E+05	5.78E+06	2.63E+07	5.38E+06
MIN	2.65E+04	1.30E+04	2.08E+04	3.52E+04	5.00E+02	4.56E+03	1.65E+03
MAX	2.10E+06	4.25E+06	2.49E+06	1.27E+07	5.78E+06	2.63E+07	6.68E+06
AVG	5.19E+05	8.29E+05	7.27E+05	2.17E+06	1.61E+06	6.0E+06	3.13E+06

Note: 0.00E+00 means that the data is not available.

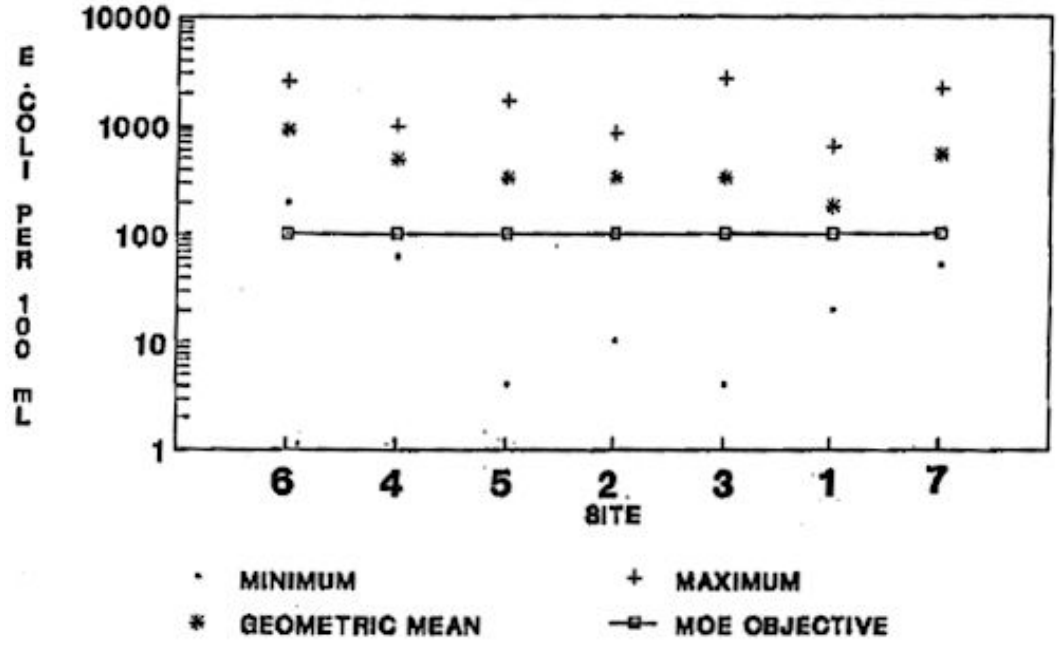

FIGURE 5: Kettle Creek - *E. Coli*, Base Flow

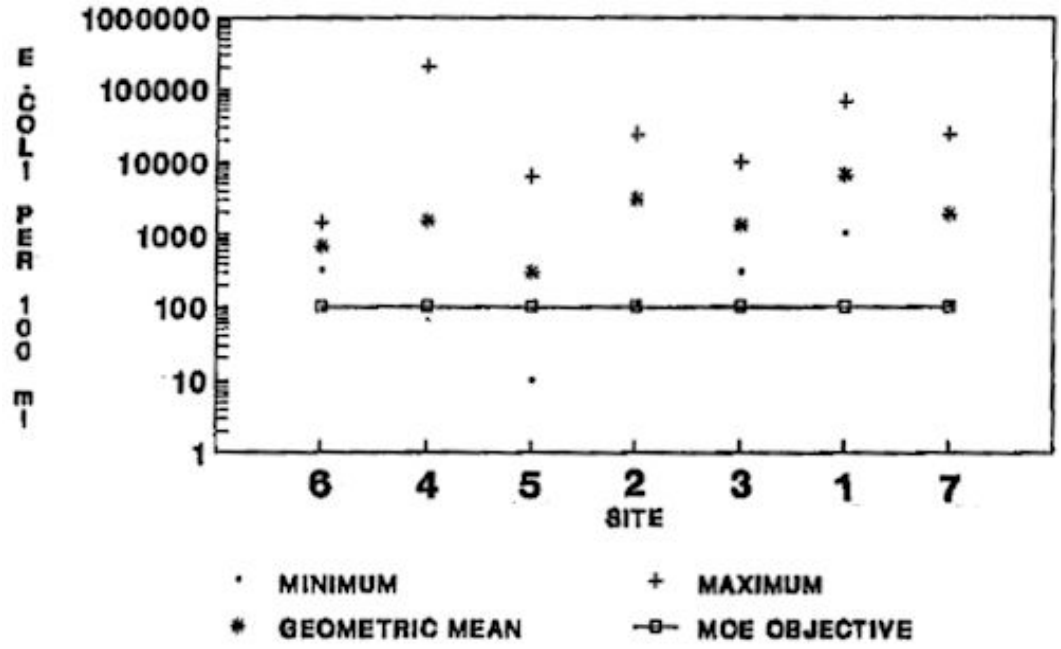

FIGURE 6: Kettle Creek - *E. Coli*, High Flow

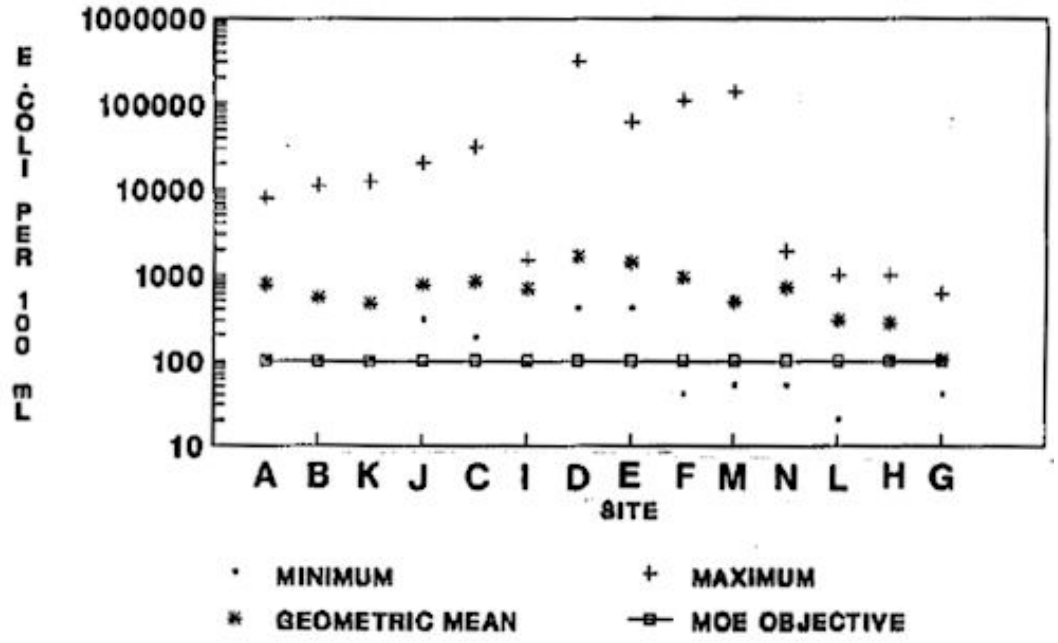

FIGURE 7: Catfish Creek - *E. Coli*, Base Flow

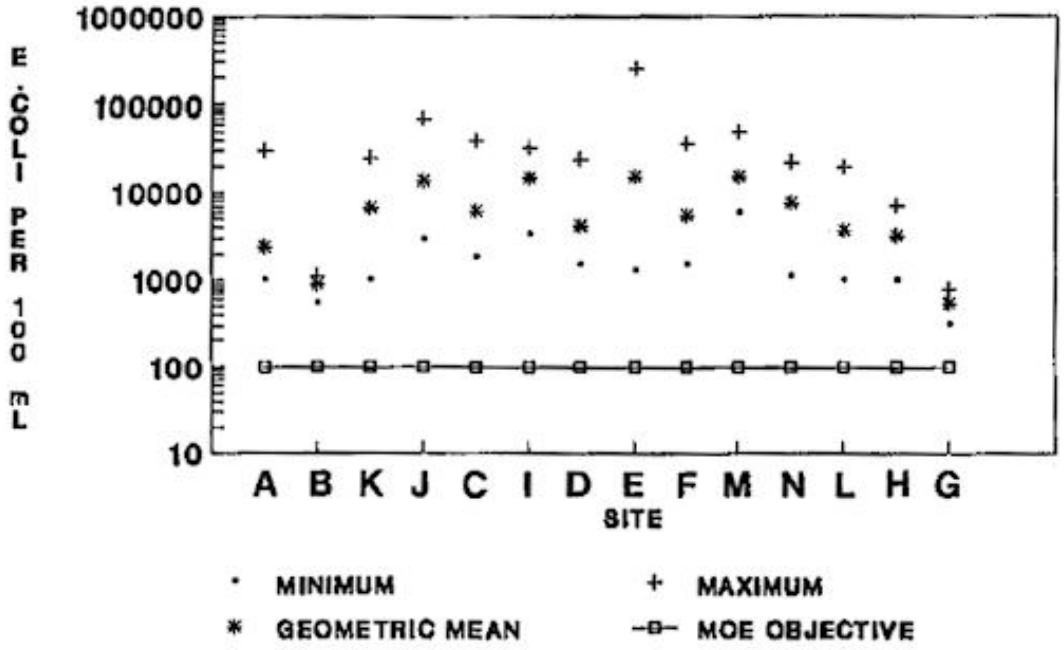

FIGURE 8: Catfish Creek - *E. Coli*, High Flow

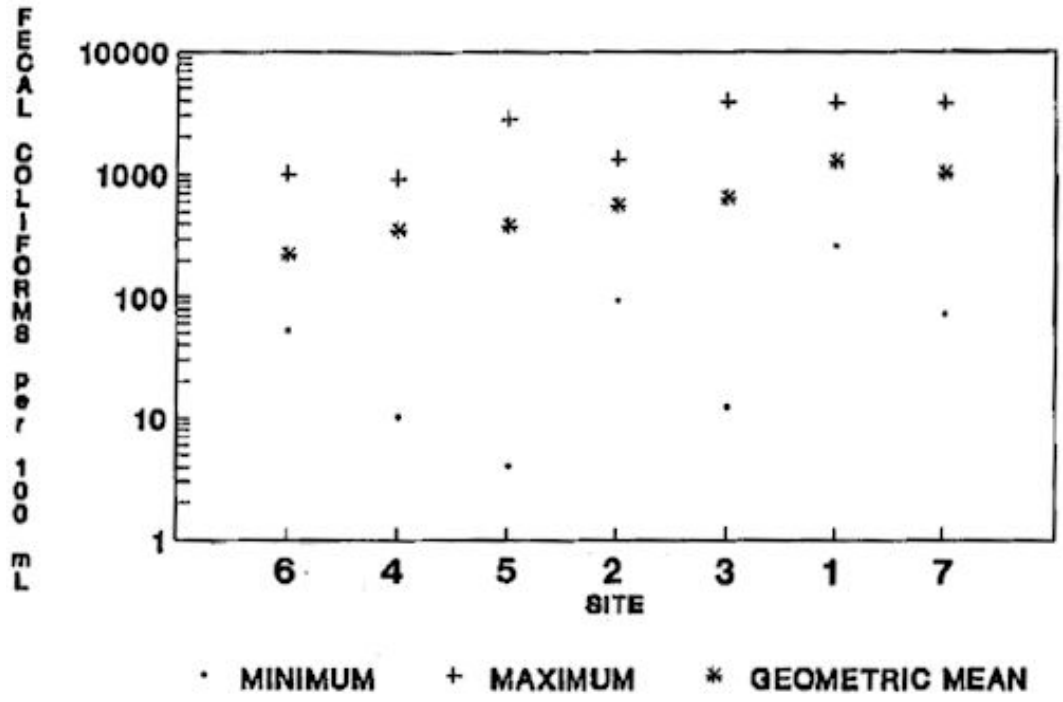

FIGURE 9: Kettle Creek - Fecal Coliform, Base Flow

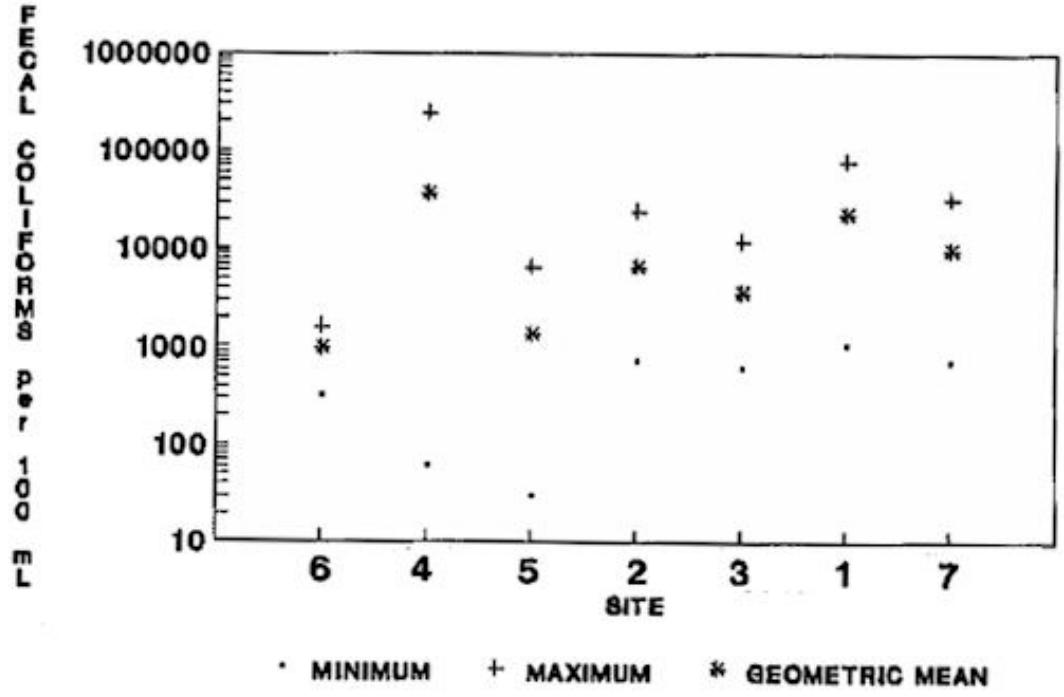

FIGURE 10: Kettle Creek - Fecal Coliform, High Flow

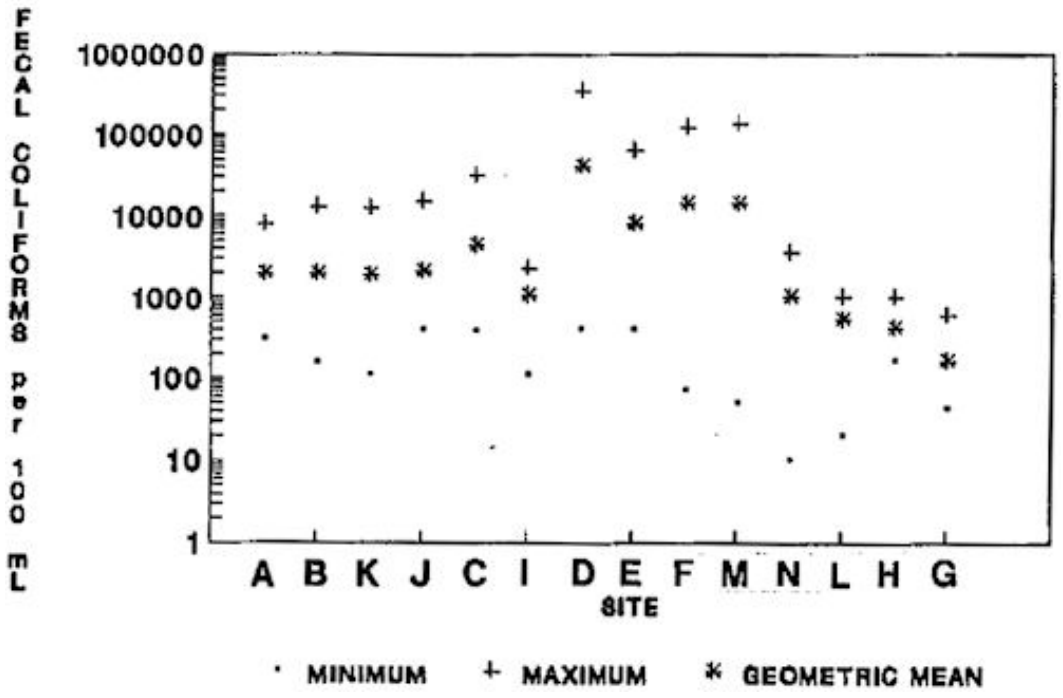

FIGURE 11: Catfish Creek - Fecal Coliform, Base Flow

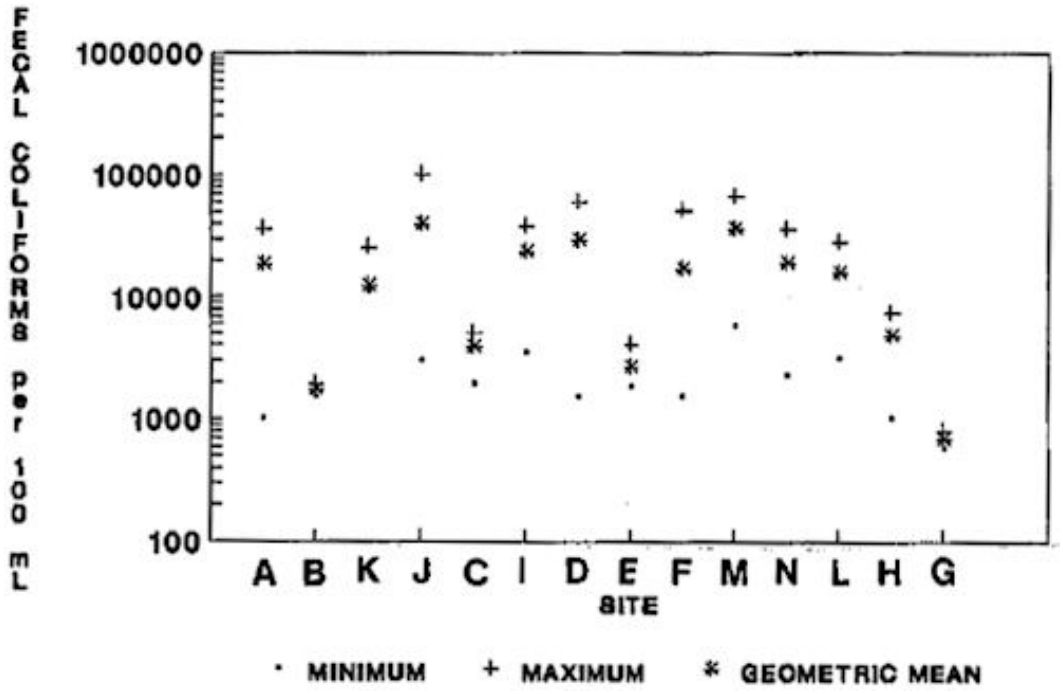

FIGURE 12: Catfish Creek - Fecal Coliform, High Flow

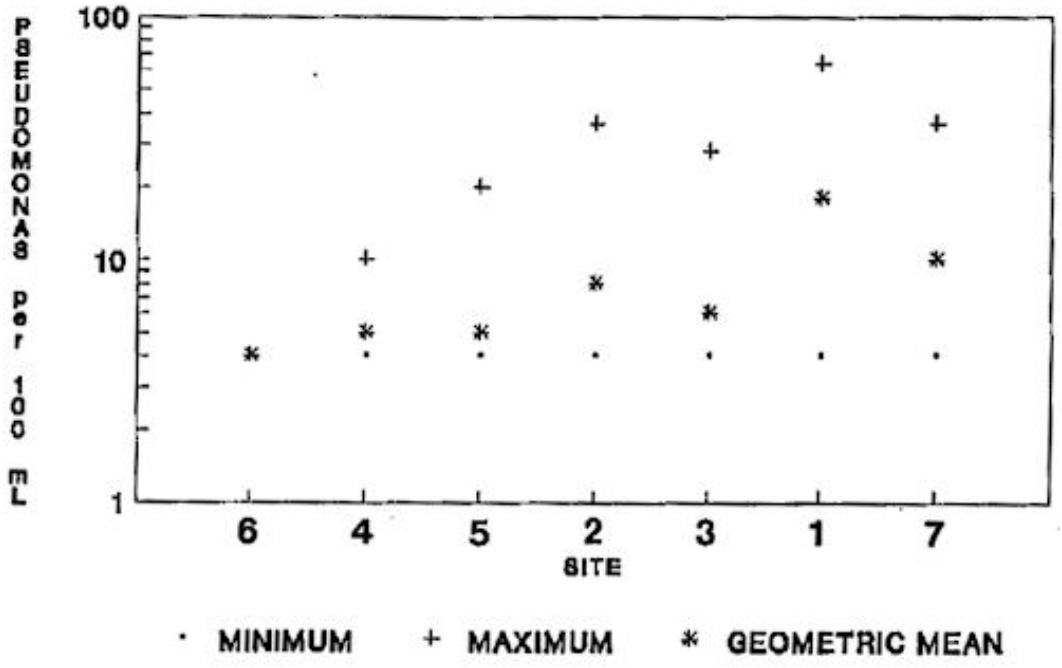

FIGURE 13: Kettle Creek - *Pseudomonas*, Base Flow

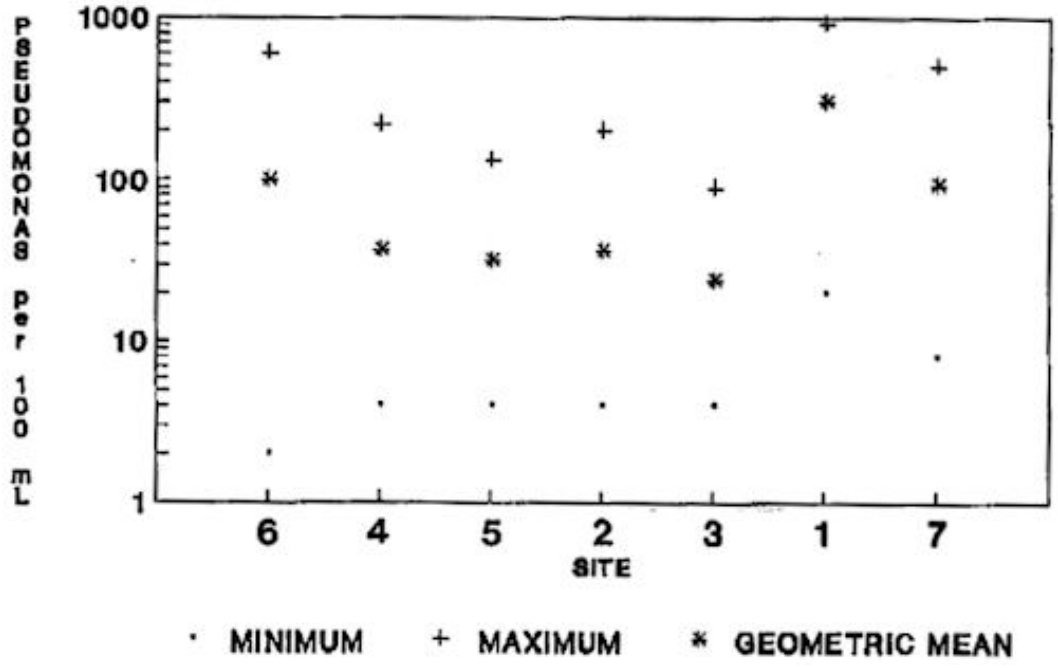

FIGURE 14: Kettle Creek - *Pseudomonas*, High Flow

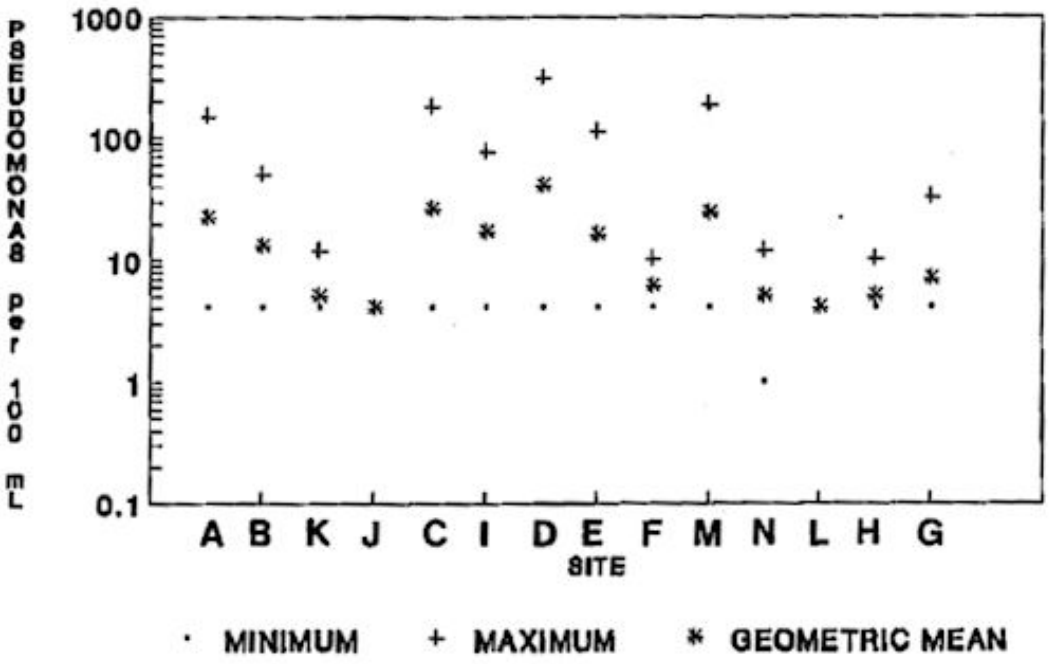

FIGURE 15: Catfish Creek -*Pseudomonas*, Base Flow

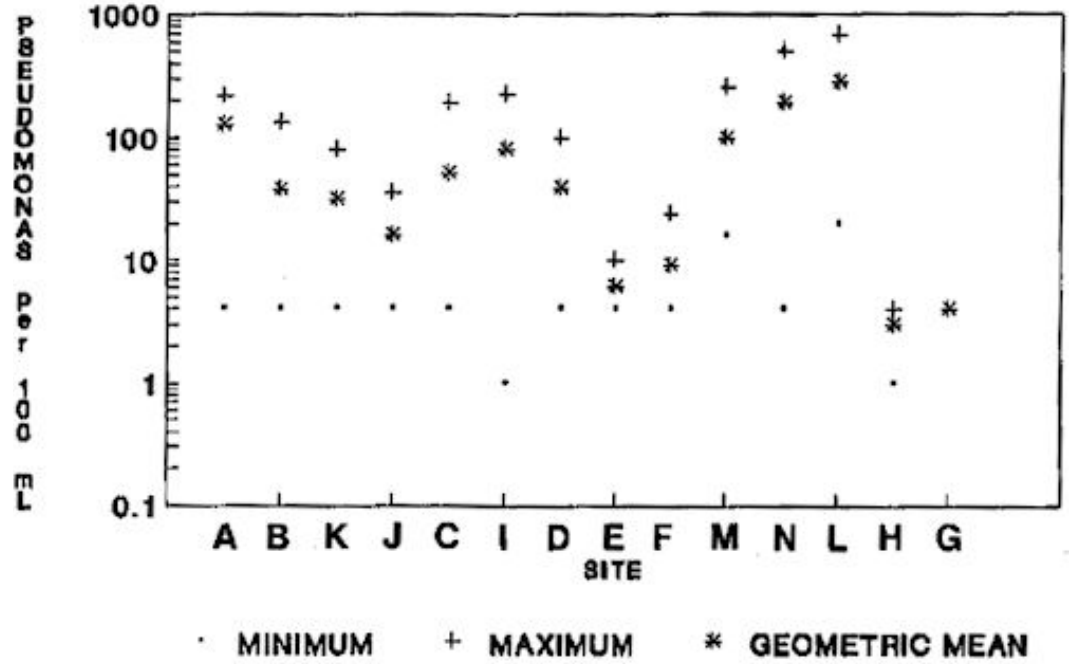

FIGURE 16: Catfish Creek -*Pseudomonas,* High Flow

pH

The water in the Catfish Creek is alkaline in nature. Except for one incident at site A, all data measures between 7.1 and 9.6. This means that the Catfish Creek falls within ideal ranges for recreational waters and also does not have the adverse effects on the fish habitat associated with the more acidic levels of pH, such as reduced spawning. Figures 31 and 32 show pH levels for Catfish Creek.

Kettle Creek was also alkaline in nature. pH levels ranged from 7.5 to 8.7. Figures 29 and 30 show pH levels for Kettle Creek.

Phosphorus

The Ministry of Environment's guideline for phosphorus is 0.03 mg/L in order to avoid excessive plant growth in rivers and streams (MOE, 1984). All sites in both the Kettle and Catfish watersheds were over the MOE guideline for phosphorus. In the Kettle watershed, phosphorus increased from the head waters to the mouth of the creek. The Catfish water sampling sites do not show a general increase as one moves downstream because of the number of tributaries sampled. Several tributaries, such as the East Catfish (Site N), Bear Creek (Site J) and Laidlaw Drain (Site I), were high in phosphorus. Figures 33 to 36 show phosphorus levels for Catfish and Kettle Creeks.

Nitrogen

For all sites in the Catfish watershed ammonia levels were usually below 0.35 mg/L. Total Kjeldahl Nitrogen ranged as high as 12 mg/L but was on average below 4 mg/L. Ammonia levels in the Kettle Creek watershed were consistently higher at the Dalewood Reservoir. Levels in other sites fluctuated over the summer but were usually very low.

There is no real trend in the level of nitrates and nitrites in the creeks. Each site has different levels at different times. Even maximum and minimum levels vary considerably. Both nitrates and nitrites or higher on average in the Catfish Creek then the Kettle. Average numbers range from 2.4 to 14 mg/L for nitrates and 0.07 to 0.28 mg/L for nitrites in the Catfish watershed. Average numbers range between 3.4 to 6.4 for nitrates and 0.07 to 0.14 for nitrites in the Kettle watershed.

Nitrogen levels for each site can be found in Appendix B.

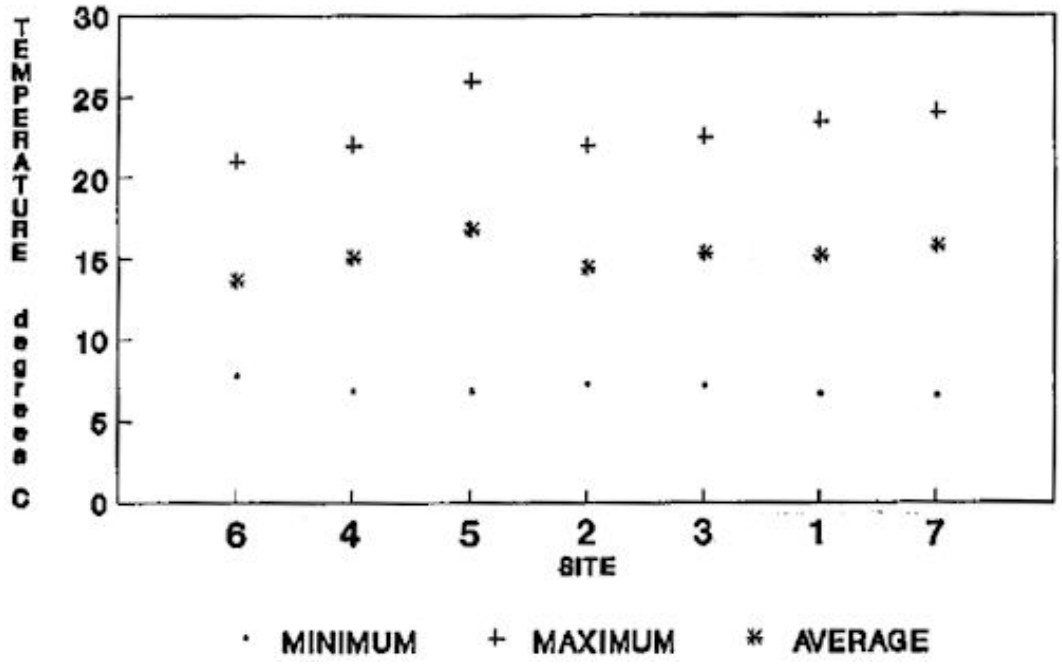

FIGURE 17: Kettle Creek - Temperature, Base Flow

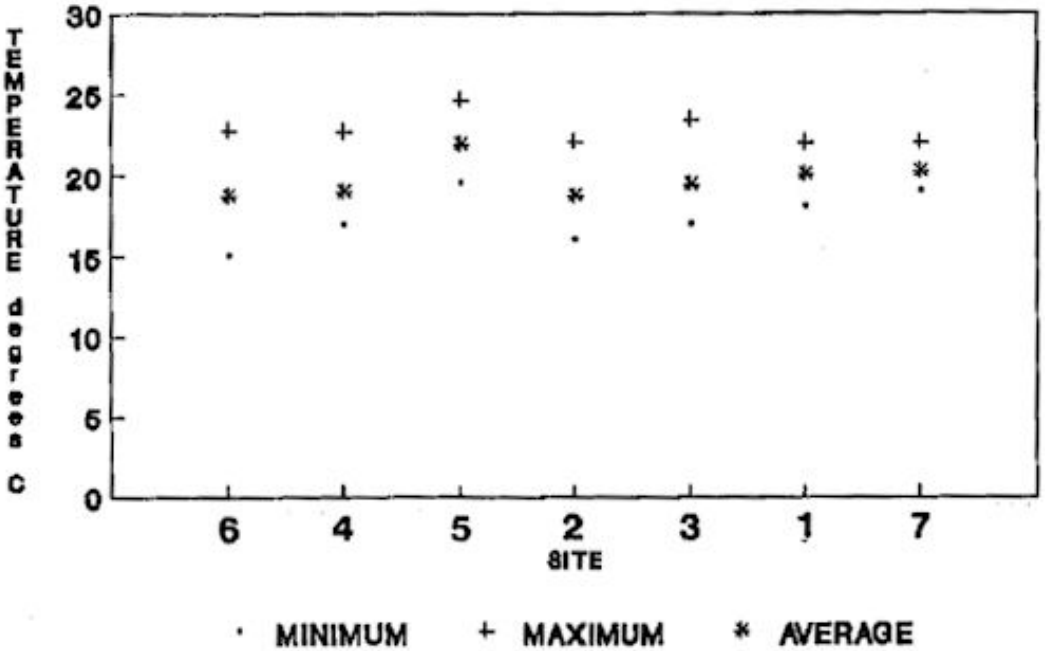

FIGURE 18: Kettle Creek - Temperature, High Flow

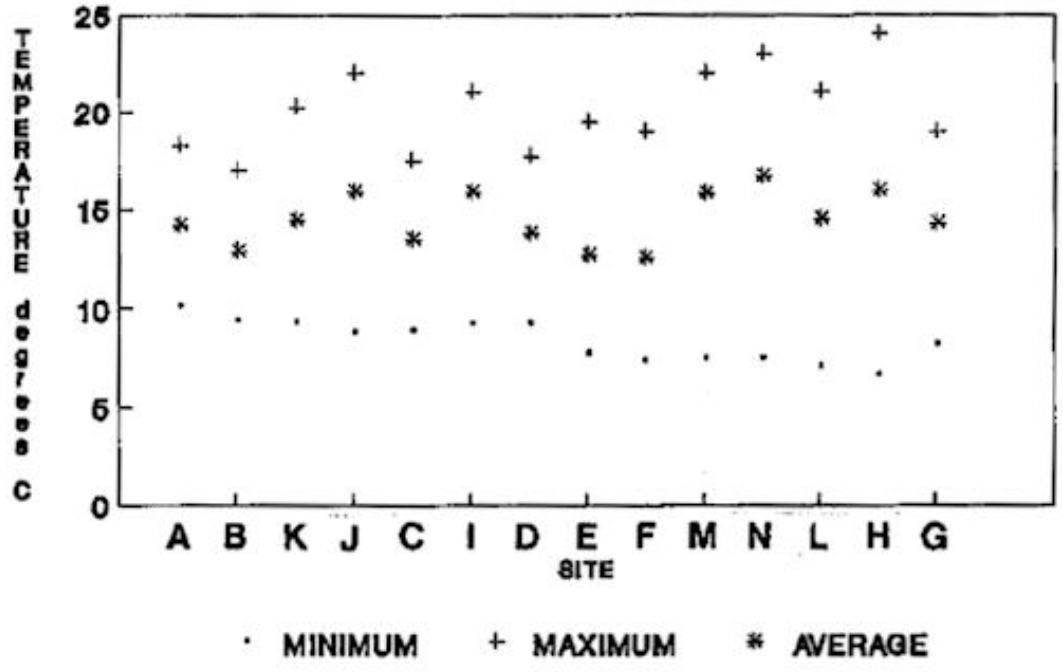

FIGURE 19: Catfish Creek - Temperature, Base Flow

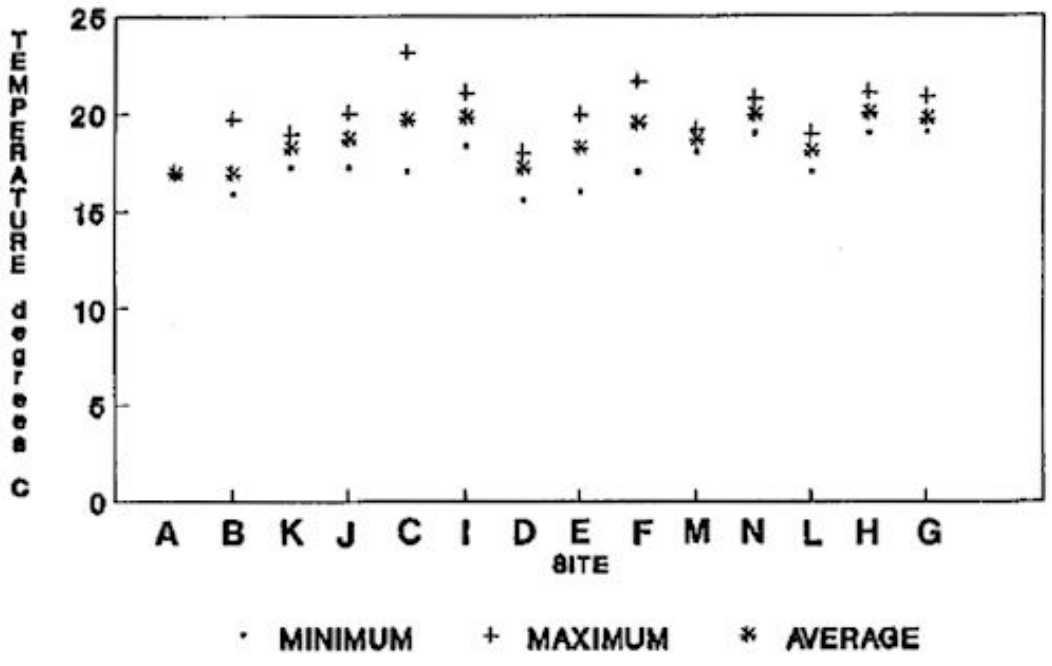

FIGURE 20: Catfish Creek - Temperature, High Flow

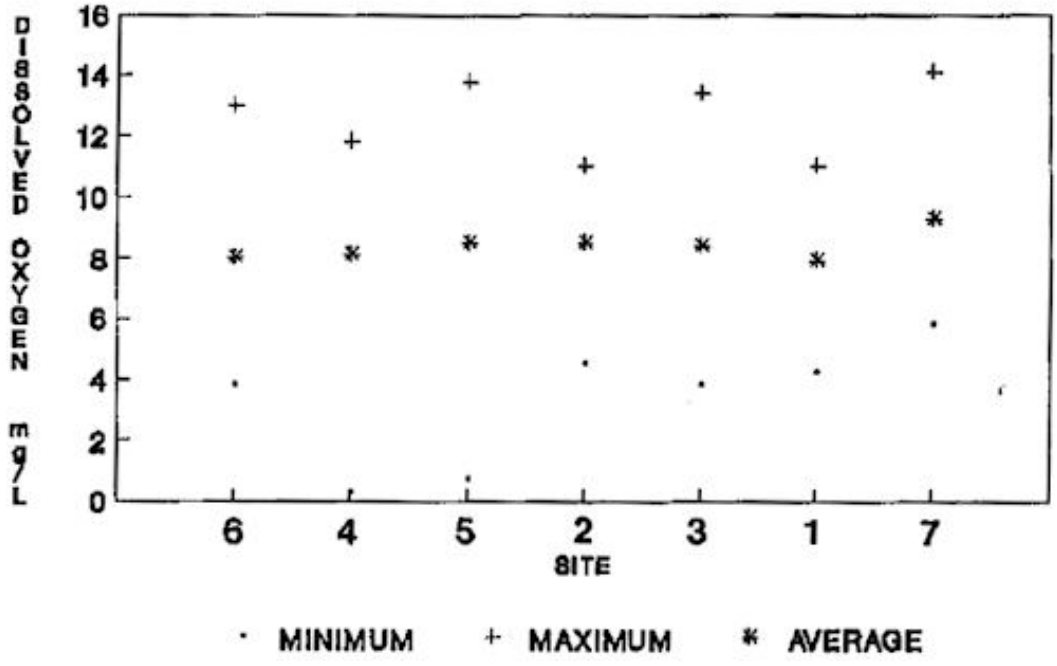

FIGURE 21: Kettle Creek - Dissolved Oxygen, Base Flow

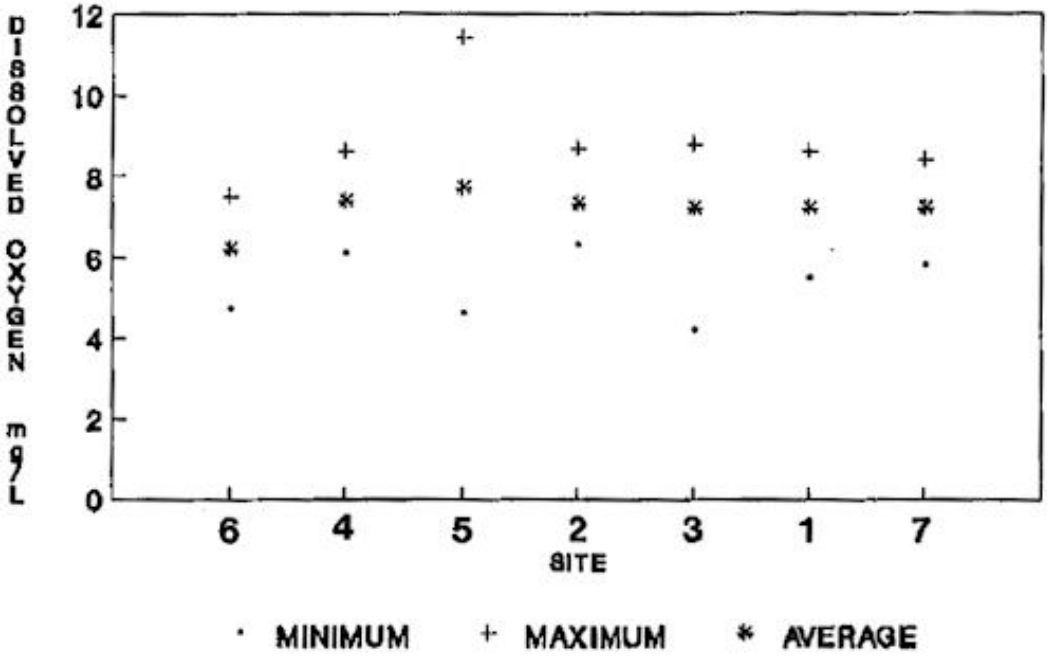

FIGURE 22: Kettle Creek - Dissolved Oxygen, High Flow

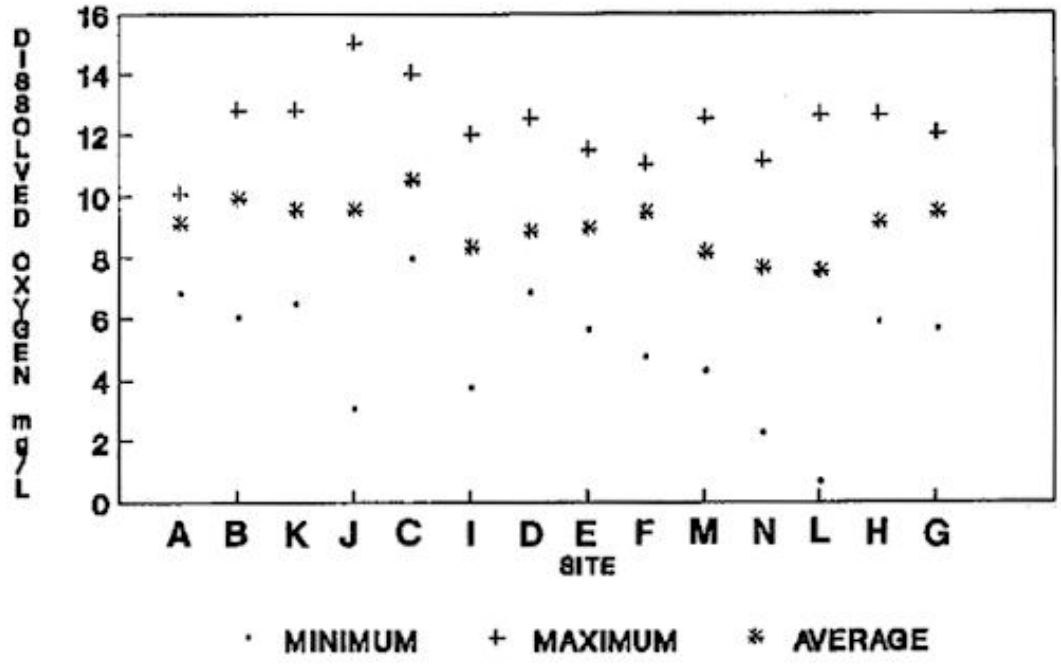

FIGURE 23: Catfish Creek - Dissolved Oxygen, Base Flow

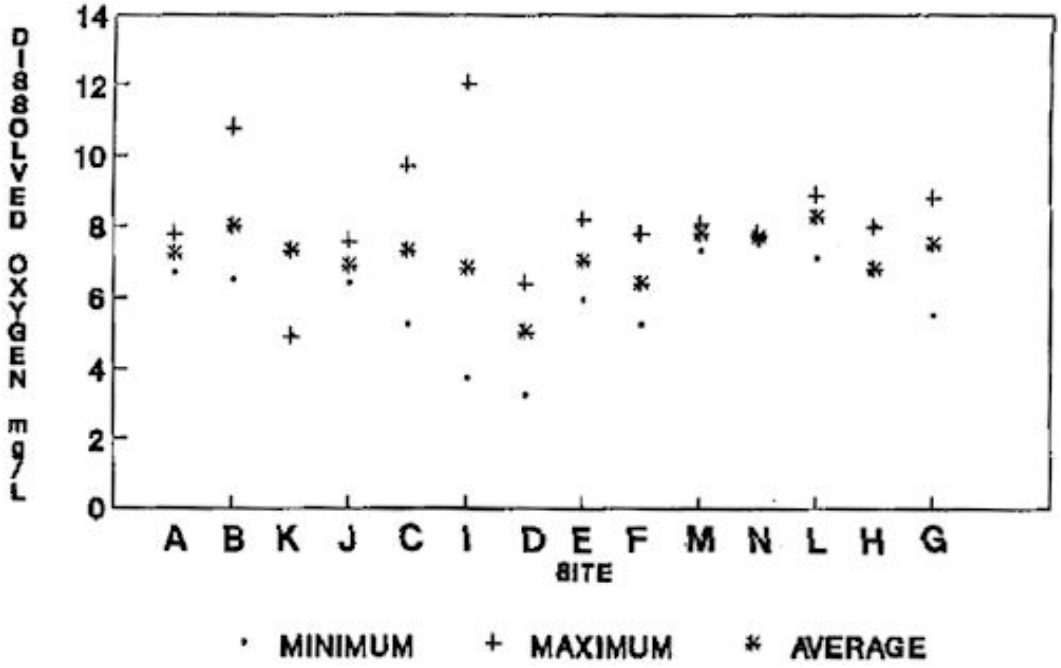

FIGURE 24: Catfish Creek - Dissolved Oxygen, High Flow

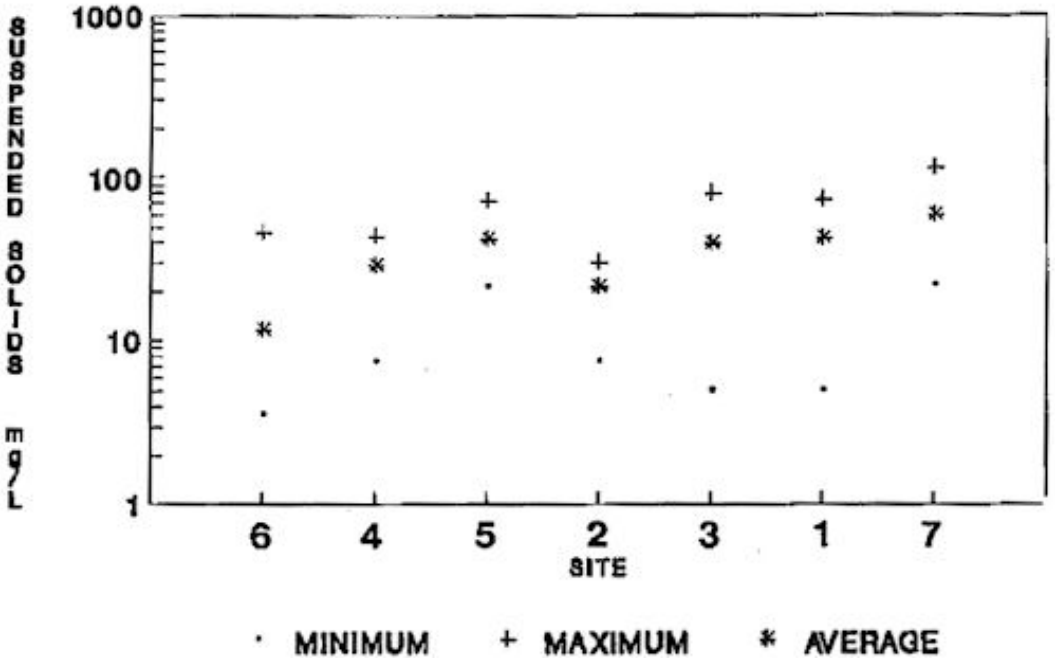

FIGURE 25: Kettle Creek - Suspended Solids, Base Flow

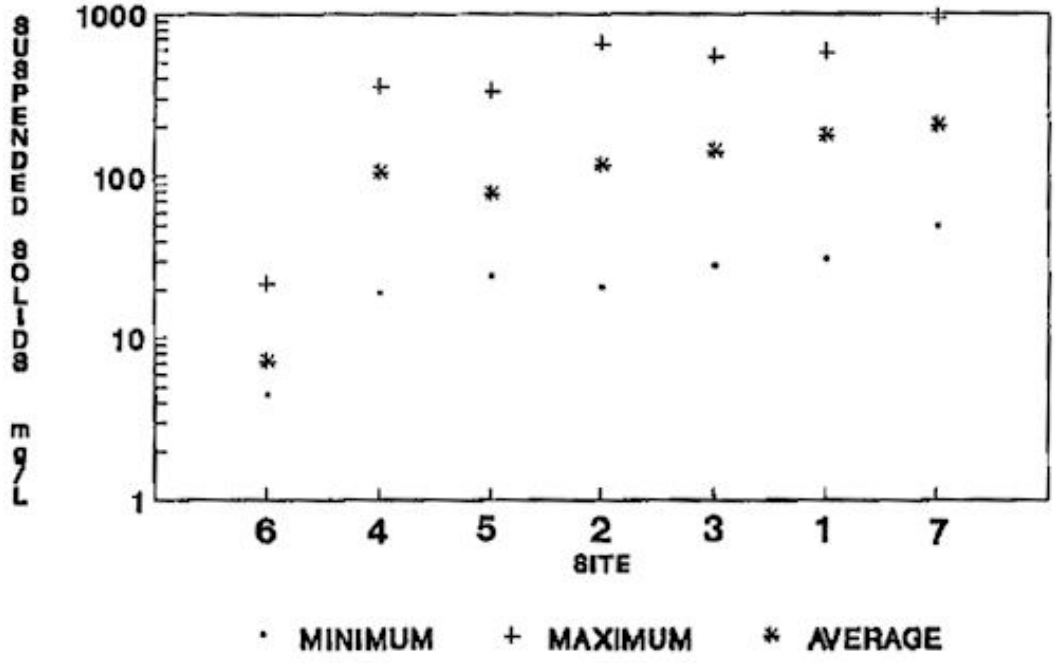

FIGURE 26: Kettle Creek - Suspended Solids, High Flow

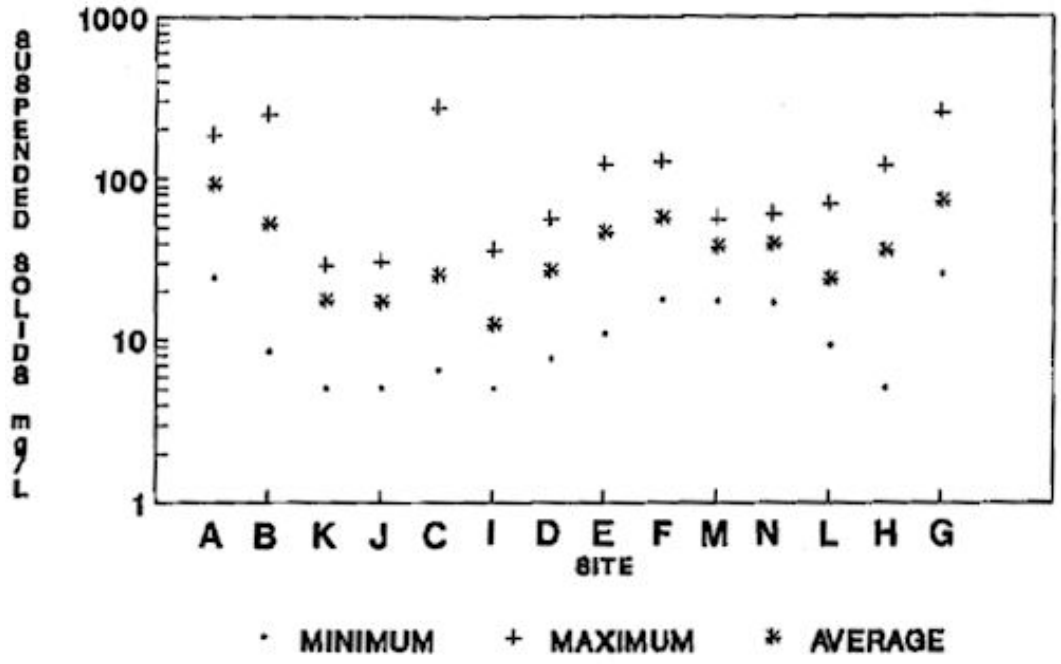

FIGURE 27: Catfish Creek - Suspended Solids, Base Flow

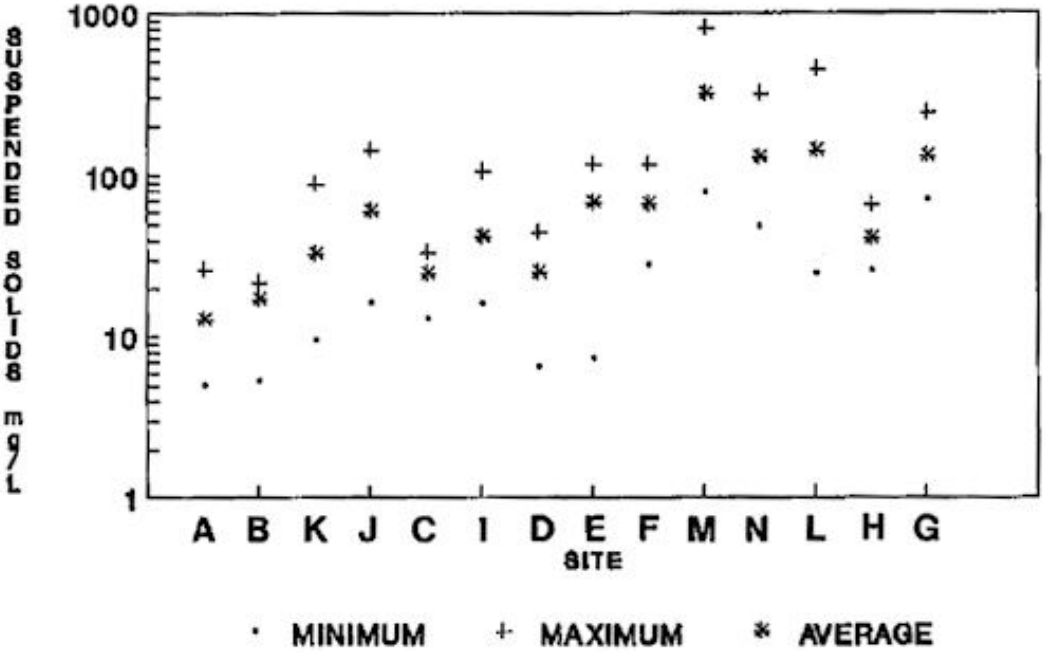

FIGURE 28: Catfish Creek - Suspended Solids, High Flow

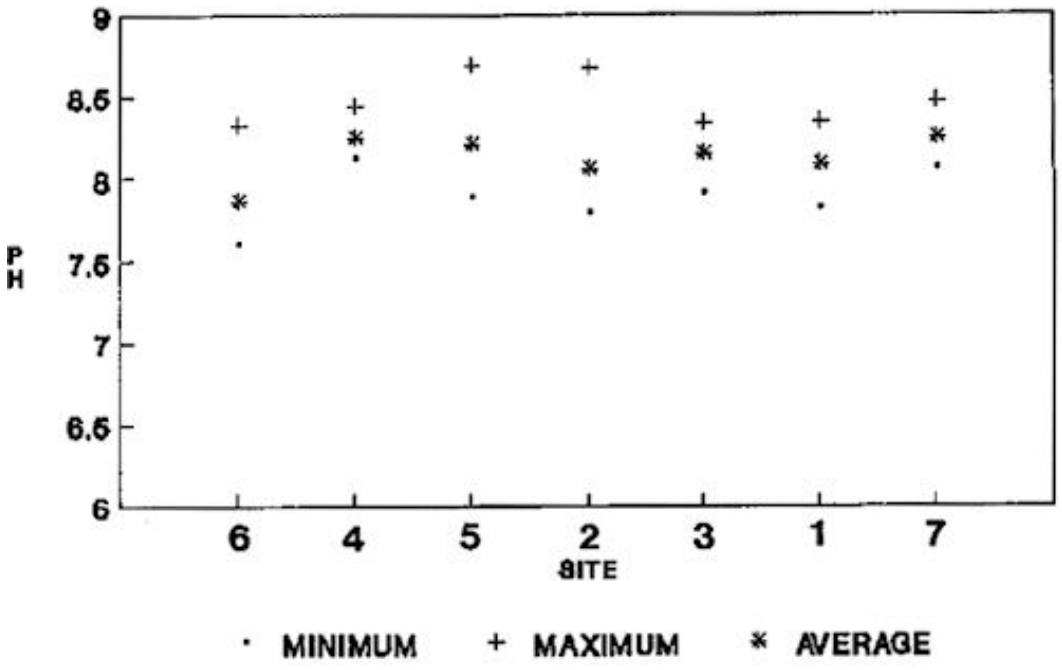

FIGURE 29: Kettle Creek - pH, Base Flow

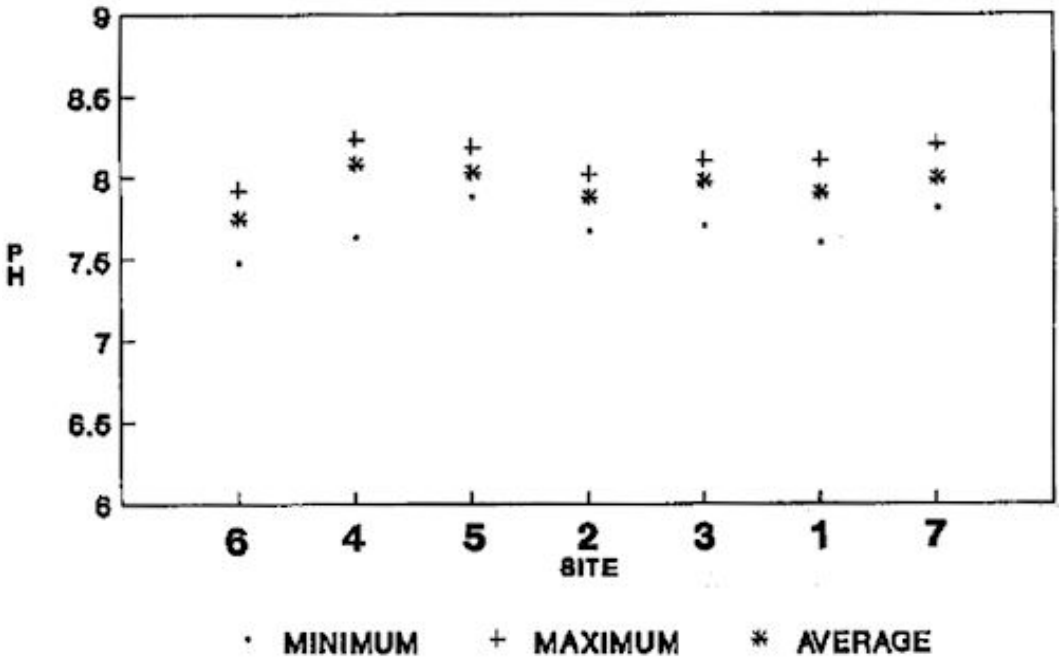

FIGURE 30: Kettle Creek - pH, High Flow

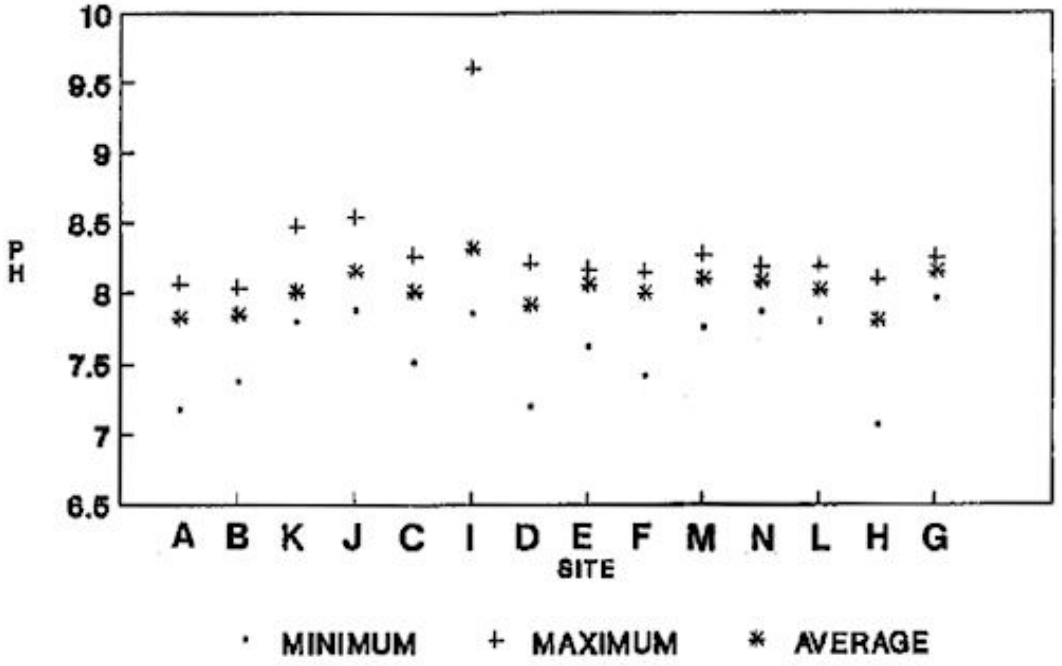

FIGURE 31: Catfish Creek - pH, Base Flow

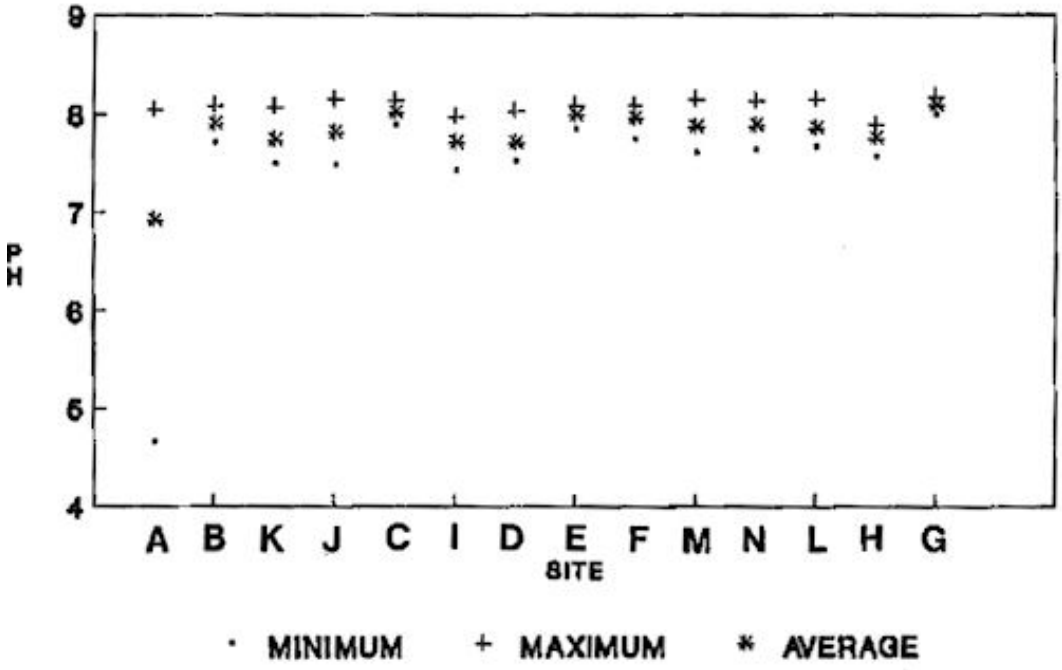

FIGURE 32: Catfish Creek - pH, High Flow

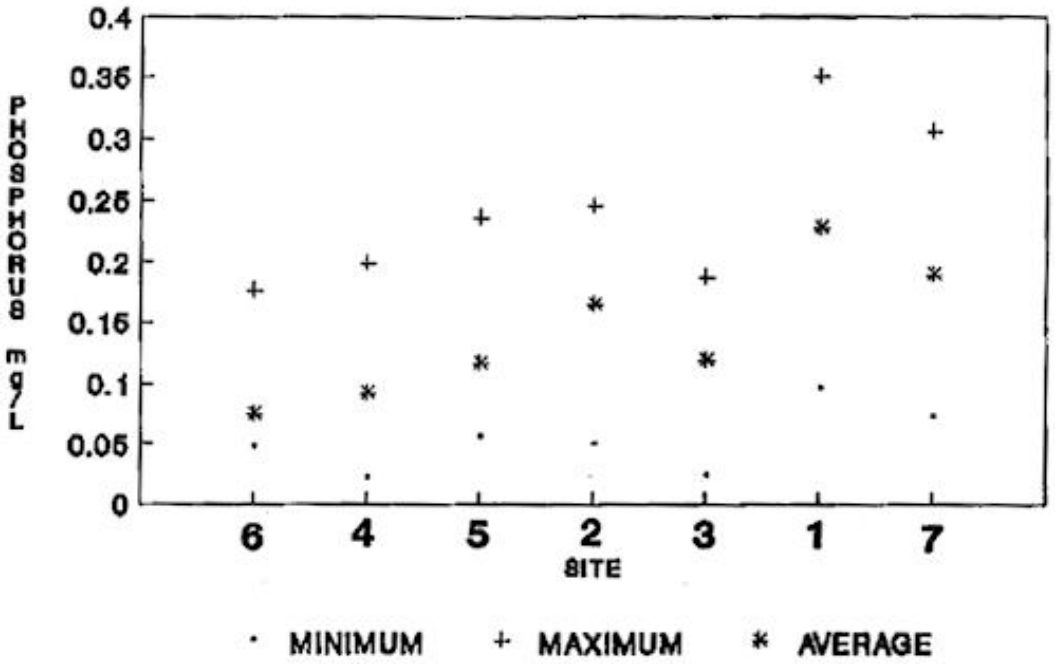

FIGURE 33: Kettle Creek - Phosphorus, Base Flow

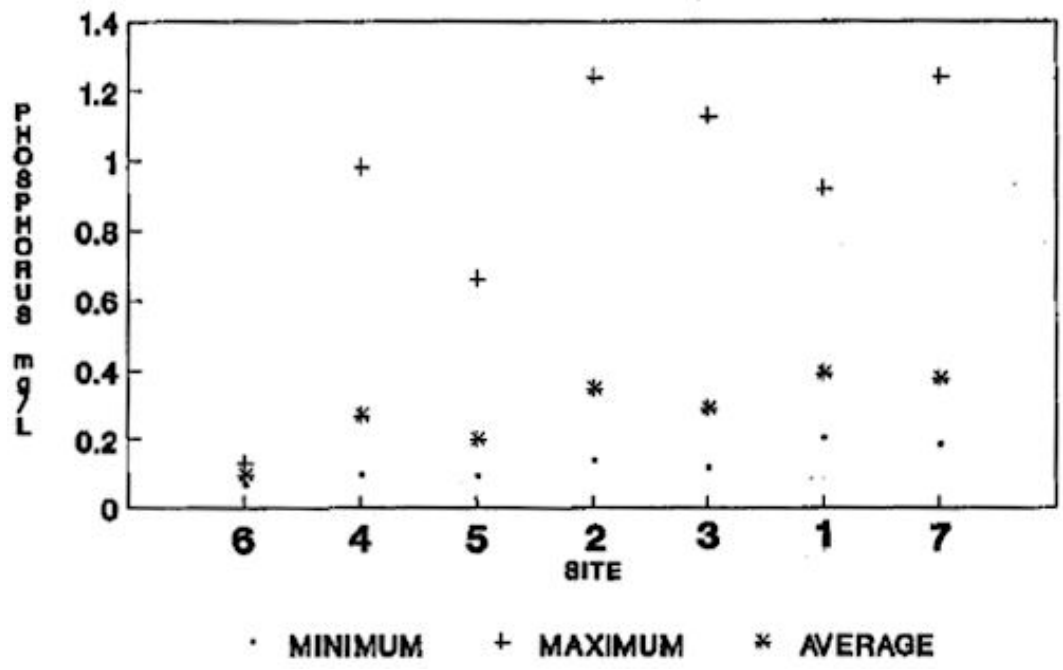

FIGURE 34: Kettle Creek - Phosphorus, High Flow

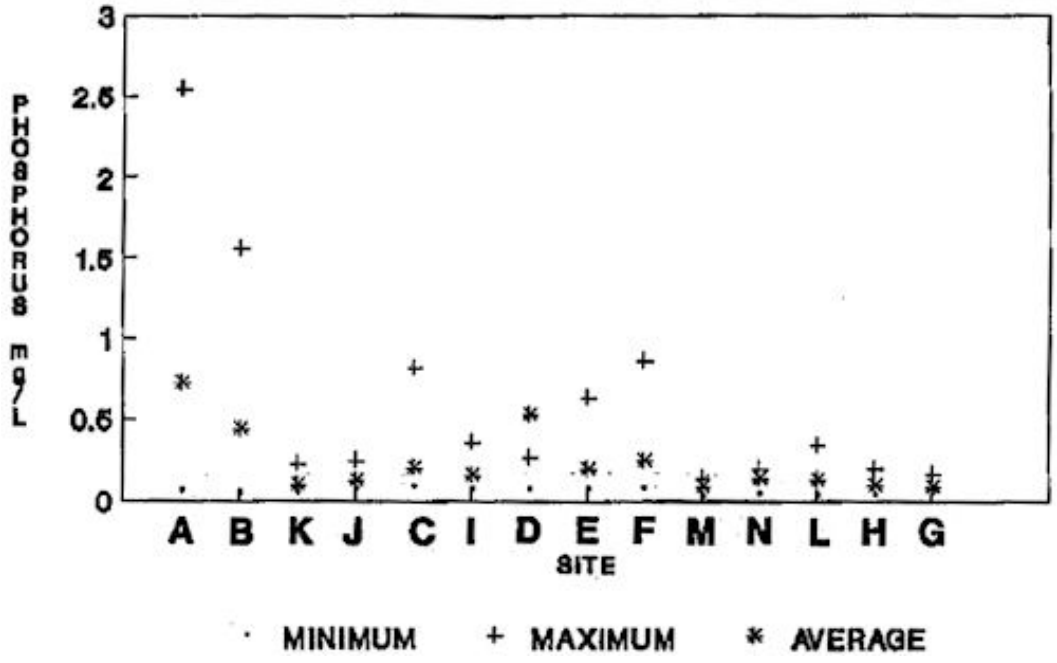

FIGURE 35: Catfish Creek - Phosphorus, Base Flow

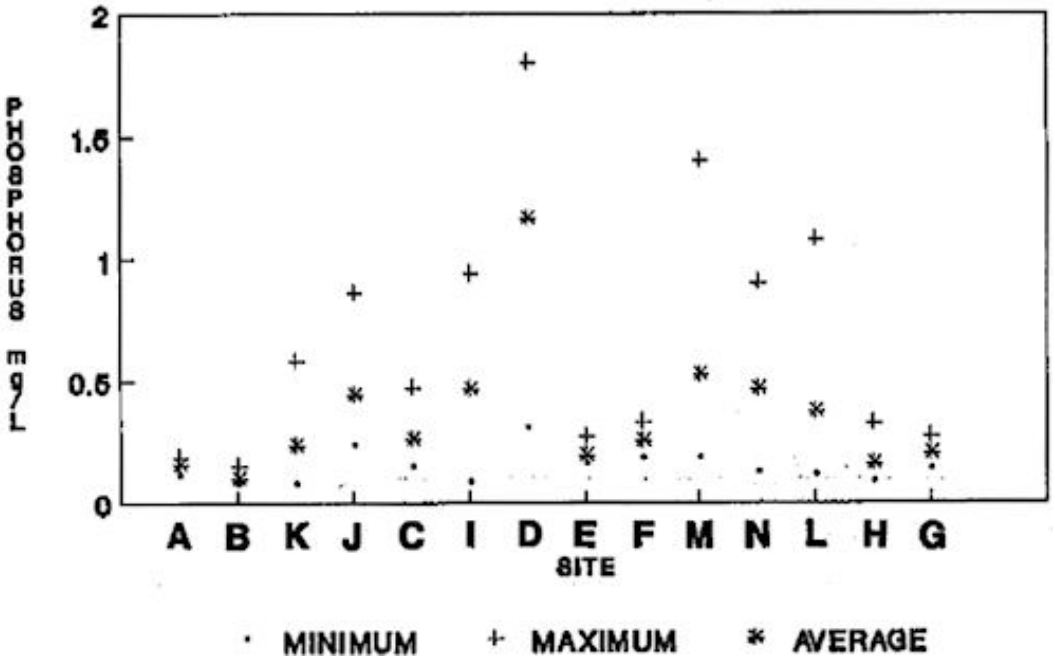

FIGURE 36: Catfish Creek - Phosphorus, High Flow

Chlorides

The level of chlorides fluctuates at each site in both watersheds. Site C had the highest levels of all the sites in the Catfish watershed. Sites 2 and 3 in the Kettle watershed had the highest level of chlorides. Data for chloride levels can be found in Appendix B.

5.2 Beach Closures

1992 was the first year in many years that the beaches have been closed. Unfortunately there are no water quality records for past years available from the Health Unit.

Table 3: Beach Postings for Elgin - St. Thomas Health Unit, 1992 Season (up to Aug 21, 1992)

Authority	Beach	Days Posted
Catfish Creek	Port Bruce Beach	5
Kettle Creek	Port Stanley-Little Beach	19
Kettle Creek	Port Stanley-Main Beach	7

5.3 Sewage Treatment Plants

There are several sewage treatment plants in the watersheds which have an impact on the water quality of the creeks. Information on the treatment plants was obtained from the Ministry of the Environment. There are sewage treatment plants in Aylmer, Belmont, the Ontario Police College, Port Stanley, and St. Thomas.

i) Aylmer

The Aylmer Sewage Treatment Plant has a capacity of 5232 m^3/day. The treatment plant consists of 3 pumping stations and a 4 celled lagoon system. The lagoon system is discharged in the spring and fall into Catfish Creek. Currently the plant serves roughly 6000 people. Table lists the flows for the last 3 years. Presently, the plant is operating below maximum capacity.

Table 4: Seasonal Flows for the last 3 calendar years at Aylmer.

	1989	1990	1991
Average Day Flow (m^3/day)	3747	3186	4234
Maximum Day Flow (m^3/day)	11334	8605	13760
% (Avg. Day / Rated Capacity)	71.6	60.9	81.0

During high flow conditions influent is delivered directly to Catfish Creek without treatment. Two of the pumping stations are in need of repair. Each station has been over capacity and spilled raw sewage directly into Bradley Creek on more than one occasion (Aylmer Express, 1992).

ii) Belmont

This facility consists of a main pumping station and a twin celled lagoon. The effluent is discharged in the spring and fall into the Kettle Creek. The plant has a capacity of 554 m^3/day and serves roughly 1300 people. Table lists the flows for the last 3 years and the capacity that the plant has been operating.

Table 5: Seasonal Flows for the last three calendar years at Belmont.

	1989	1990	1991
Average Day Flow (m^3/day)	414	612	452
Maximum Day Flow (m^3/day)	785	1751	1287
% (Avg. Day / Rated Capacity)	73.4	108.5	80.1

iii) Ontario Police College

The Ontario Police College has a sewage lagoon facility. The College is in the process of closing down the lagoon and building a pumping station to transfer the sewage to Aylmer. This additional sewage means that the Aylmer treatment plant will be at full capacity in 1999 instead of 2005, but the Police College system is currently failing to meet effluent discharge criteria, and has been for some time.

iv) Port Stanley

The lagoon consists of four cells and is discharged seasonally. The lagoon has a capacity of 1496 m^3/day and serves approximately 1900 persons. Table lists the flows for the last 3 years and the capacity that the plant has been operating at.

Table 6: Seasonal Flows for the last 3 years in Port Stanley.

	1989	1990	1991
Average Day Flow (m^3/day)	1159	1273	1182
Maximum Day Flow (m^3/day)	1950	3193	2026
% (Avg. Day / Rated Capacity)	77	87	79

v) St. Thomas

This facility consists of four separate activated sludge plants, three of which are operating. The plant has both primary and secondary treatment place. The treated effluent is discharged to the Kettle Creek. However, during high flow events raw sewage can flow directly into the Kettle Creek because many of the old sewage pipes are also storm sewers. The treatment plant services a population of approximately 30,000 people and the rated capacity is 27,276 m^3/day. Table lists the flows for the last 3 years and the capacity at which the plant has been operating.

Table 7: Flows for last 3 years.

	1989	1990	1991
Average Day Flow (m^3/day)	15,830	18,410	15,533
Maximum Day Flow (m^3/day)	31,650	51,999	51,870
% (Avg. Day / Rated Capacity)	58	67	57

6. CONCLUSIONS

1) 1991 water sampling results show that background levels of bacteria are above 100 organisms/100 mL in both watersheds. This means that major improvements are needed in manure management, milkhouse waste and septic upkeep in both watersheds.

2) Bacteria are introduced into the water from both point and non-point sources.

3) During rainfall events water sampling shows that St. Thomas has an impact on bacteria levels. This could be contributed to inadequate storage and improper storm sewer connections.

4) Dodds Creek (Site 2) subwatershed is a major source (18 %) of bacteria in the Kettle Creek watershed. There seems to be a point source polluter somewhere between Paynes Mills and County Rd 25 that contributes on an infrequent basis.

5) West Catfish (Site M) subwatershed is the greatest contributor of bacteria to the Catfish.

6) Bear Creek (Site J) subwatershed is the fifth largest contributor of bacteria to the Catfish Creek. Livestock access to the creek is a known contributor of bacteria in this watershed.

7) There are definite contributions between sites A and B on the Upper Catfish. This can be attributed to either livestock access or septic or milkhouse waste since rainfall events did not have an impact on bacteria numbers.

8) The large number of dairy farms in the watersheds contribute milkhouse washwater to the creeks. This is evident by the constant influx of phosphorus into the creeks even in the summer when fields are covered in crops and erosion is at its lowest.

7. RECOMMENDATIONS

1) To further define high priority areas in the watersheds through continued water quality monitoring and landowner surveys. Continued sampling will either prove or disprove this year's conclusions.

2) Some of the water sampling stations should be moved to new locations to better identify bacterial and phosphorus sources in the watershed.

3) A public information program should be continued in 1993 in order to keep the community informed on the progress of the study. Public information sessions can be held later in the year to announce the Implementation Phase of the Program. Press releases can be sent to the local papers to inform the public of any updates to the Study Phase.

4) A landowner survey should be done to give some in depth information on agricultural practices in the watershed. This will give much needed data for the CURB Model.

8. BIBLIOGRAPHY

Hayman, D. 1992. ACAO Southwest Chapter Staff Minutes, February.

HSP Inc., 1992. Proposal for Beaches Investigation in the Kettle Creek Watershed and the Catfish Creek Watershed.

Ministry of the Environment, 1984. Water Management: Goals, Objectives and Implementation Procedures of the Ministry of the Environment.

Ministry of the Environment, 1991. Water Quality Data, Ontario Lakes and Streams. Vol XX. Southwest Region.

Raisin Region Conservation Authority, 1990. St. Lawrence Beaches Study, Summary Report.

APPENDIX A
1992 WATER QUALITY DATA
BACTERIAL ANALYSIS

CURB WATER QUALITY DATA FOR THE CATFISH CREEK CA - 1992

SITE A- HWY 20 EAST BROWNSVILLE

DATE	TEMP DEGREES C	D.O.	BACTERIAL FAECAL COLIFORM	BACTERIAL FAECAL STREP	BACTERIAL PSEUD AERU	BACTERIAL E. COLI
05/14/92			400	68	4	400
05/28/92	15	10.1	1000	730	4	1000
06/11/92	14.1	9.9	1000	480	4	1000
06/25/92	18.3	9.4	2600	2100	12	100
07/09/92				1500	112	1000
07/23/92	17	7.8	36000	5800	220	30000
08/06/92			1000	100	10	1000
08/20/92	17	9.2	300	440	10	300
09/03/92	17	6.7	1000	1500	176	1000
09/17/92	16.7	7.1		520	4	1000
10/01/92	13.7	10	2200	70	4	2200
10/15/92	11.2	8.6	8000	80000	150	8000
10/29/92	10.1	6.8	700	100	4	400
MIN	10.1	6.7	300	68	4	100
MAX	18.3	10.1	36000	80000	220	30000
AVERAGE	15.01	8.56	4927	7185	55	3646
GEOMETRIC MEAN			4927	7185	55	3646

SITE B - HWY 10 SOUTH BROWNSVILLE

DATE	TEMP DEGREES C	D.O.	BACTERIAL FAECAL COLIFORM	BACTERIAL FAECAL STREP	BACTERIAL PSEUD. AERU	BACTERIAL E. COLI
05/14/92			156	140	12	136
05/28/92	13	10.2	272	300	4	216
06/11/92	13.3	11.9	400	600	4	400
06/25/92	16.9	12.8	1100	1300	10	1100
07/09/92	19.7	6.8		1500	136	1000
07/23/92	16	10.8	1900	2700	8	1100
08/06/92			900	400	4	800
08/20/92	17	10.2	300	400	4	300
09/03/92	16	6.5	1500	3100	4	1000
09/17/92	15.8	8		410	4	550
10/01/92	10.3	10.2	1000	170	28	1000
10/15/92	10.7	8	13100	54000	50	11400
10/29/92	9.4	6	300	1100	4	100
MIN	9	6	156	140	4	100
MAX	20	13	13100	54000	136	11400
AVERAGE	14	9	1903	5086	21	1469
GEOMETRIC MEAN			1903	5086	21	1469

SITE C - LAIDLAW DRAIN - N SIDE OF 9TH CON

DATE	TEMP DEGREES C	D.O.	BACTERIAL FAECAL COLIFORM	BACTERIAL FAECAL STREP	BACTERIAL PSEUD. AERU	BACTERIAL E. COLI
05/14/92			400	28	4	400
05/28/92	14	8.6	390	152	4	220
06/11/92	15.6	7.9	1000	1500	4	180
06/25/92	16.5	14	2200	700	4	1600
07/09/92	23.1	6.4		14400	192	40000
07/23/92	17	9.7	5000	5400	4	5000
08/06/92			1100	200	28	1100
08/20/92	17.5	9.2	700	800	4	700
09/03/92	19	5.2	4700	1800	4	4100
09/17/92	19.1	8	1900	470	4	1800
10/01/92	10.3	13.1	1800	500	4	600
10/15/92	11.6	9.2	31000	36000	180	31000
10/29/92	8.9	11.5	650	480	4	470
MIN	8.9	5.2	390	28	4	180
MAX	23.1	14.0	31000	36000	192	40000
AVERAGE	15.7	9.3	4237	4802	34	6705
GEOMETRIC MEAN			4237	4802	34	6705

SITE D - HWY 48 - WEST LYONS

DATE	TEMP DEGREES C	D.O.	BACTERIAL FAECAL COLIFORM	BACTERIAL FAECAL STREP	BACTERIAL PSEUD. AERU	BACTERIAL E. COLI
05/14/92			1000	130	4	840
05/28/92	16	8.2	610	140	4	450
06/11/92	17.7	7.4	1000	1500	4	1000
06/25/92	17.7	12.5	2500	1600	4	1200
07/09/92				61000	28	250000
07/23/92	15.5	5.4	60000	78000	100	60000
08/06/92			1000	1000	10	1000
08/20/92	15.5	7	8000	2900	20	4000
09/03/92	18	3.2	25000	36000	24	24000
09/17/92	18	6.4	1500	2100	4	1500
10/01/92	9.6	10.5	400	268	4	400
10/15/92	11	9.2	350000	182000	310	320000
10/29/92	9.2	6.8	2000	380	4	2000
MIN	9.2	3.2	400	130	4	400
MAX	18.0	12.5	350000	182000	310	320000
AVERAGE	14.8	7.7	37751	28232	40	51261
GEOMETRIC MEAN			37751	28232	40	51261

SITE E - S. DORCHESTER - 11TH CON RD

DATE	TEMP DEGREES C	D.O.	BACTERIAL FAECAL COLIFORM	BACTERIAL FAECAL STREP	BACTERIAL PSEUD. AERU	BACTERIAL E. COLI
05/14/92			400	28	4	400
05/28/92	12	11.5	400	40	4	400
06/11/92	19.5	7.3	850	180	4	600
06/25/92	14.2	9.7	3100	2900	4	3100
07/09/92	19.9	7.1		2700	4	4100
07/23/92	16	8.2	2100	3300	4	2000
08/06/92			1100	300	4	600
08/20/92	15	8.2	500	400	10	400
09/03/92	18	6.8	1800	1100	10	1300
09/17/92	18.8	5.9	4000	900	4	2800
10/01/92	9.9	10.9	1000	440	4	990
10/15/92	10.4	9	63000	102000	110	63000
10/29/92	7.7	5.6	1200	110	4	800
MIN	7.7	5.6	400	40	4	400
MAX	19.9	11.5	63000	102000	110	63000
AVERAGE	14.7	8.2	7186	9531	14	6674
GEOMETRIC MEAN			6588	9531	13	6161

SITE F- RD 35 KINGSMILL

DATE	TEMP DEGREES C	D.O.	BACTERIAL FAECAL COLIFORM	BACTERIAL FAECAL STREP	BACTERIAL PSEUD. AERU	BACTERIAL E. COLI
05/14/92			70	10	4	40
05/28/92	12	8	400	344	8	400
06/11/92			1900	1500	10	1900
06/25/92	16	10.1	1800	200	4	1800
07/09/92	21.6	5.5	51000	9000	24	36000
07/23/92	17	7.8	13600	8000	4	11000
08/06/92			500	500	4	500
08/20/92	19	8.6	700	1500	4	700
09/03/92	20	5.2	1800	1100	4	1600
09/17/92	19.3	7.2	1500	1000	4	1500
10/01/92	9.6	11	1200	220	4	700
10/15/92	11.1	9.1	120000	85000	10	110000
10/29/92	7.3	4.7	340	110	4	340
MIN	7.3	4.7	70	10	4	40
MAX	21.6	11.0	120000	85000	24	110000
AVERAGE	15.3	7.7	14985	8345	7	12806
GEOMETRIC MEAN			14985	8345	7	12806

SITE G - PORT BRUCE HARBOUR

DATE	TEMP DEGREES C	D.O.	BACTERIAL FAECAL COLIFORM	FAECAL STREP	PSEUD. AERU	E. COLI
05/14/92			110	30	32	110
05/28/92	16	5.6	44	16	4	44
06/11/92	18.7	9.8	130	60	4	90
06/25/92	16	10.1	100	100	4	100
07/09/92	20.8	5.5	570	2000	4	310
07/23/92	19	8.8	800	1000	4	800
08/06/92			70	150	4	40
08/20/92	19	9.4	100	100	4	100
09/03/92	19	7.3	700	480	4	700
09/17/92	19.8	8.4	670	560	4	530
10/01/92	12.3	8.9	600	140	4	600
10/15/92	10.2	10.3	270	110	4	270
10/29/92	8.1	12	70	50	4	40
MIN	8.1	5.5	44	16	4	40
MAX	20.8	12.0	800	2000	32	800
AVERAGE	16.3	8.7	326	369	6	287
GEOMETRIC MEAN			326	369	6	287

SITE H - BRADLEY CREEK

DATE	TEMP DEGREES C	D.O.	BACTERIAL FAECAL COLIFORM	FAECAL STREP	PSEUD. AERU	E. COLI
05/07/92			530	260	4	460
05/21/92	15		448	172	4	244
06/04/92	19.8	11.2	164	40	4	148
06/18/92	21	6	7300	9300	4	7200
07/02/92	19.8	12.6	190	220	4	170
07/16/92	20	6.4	1000	1600	4	1000
07/30/92	20	6.6	300	220	10	100
08/13/92			500	660	4	440
08/27/92	24	5.8	170	360	4	110
09/10/92	19	8	5800	22000	1	4400
09/24/92	11.1	10.4	1000	460	8	1000
10/08/92	11.4	8	610	460	8	610
10/22/92	6.6		320	240	4	270
MIN	6.6	5.8	164	40	1	100
MAX	24.0	12.6	7300	22000	10	7200
AVERAGE	17.1	8.3	1410	2769	5	1242
GEOMETRIC MEAN			1410	2769	5	1242

SITE I- LAIDLAW DRAIN

DATE	TEMP DEGREES C	D.O.	BACTERIAL FAECAL COLIFORM	FAECAL STREP	PSEUD. AERU	E. COLI
05/07/92			400	192	12	400
05/21/92	17		1000	136	4	1000
06/04/92	17.2	10.2	800	450	4	800
06/18/92	18.3	5.3	38000	15000	224	32000
07/02/92	21	7.6	110	500	4	90
07/16/92	21	7.2	3400	1800	16	3400
07/30/92	19	3.7	2300	560	20	900
08/13/92			1000	1500	76	1000
08/27/92	21	5.2	1300	1700	4	1300
09/10/92	20	7.8	29000	55000	1	28000
09/24/92	12.7	10.8	1000	200	4	620
10/08/92	10	12	560	80	4	560
10/22/92	9.2		2300	3300	40	1500
MIN	9.2	3.7	110	80	1	90
MAX	21.0	12.0	38000	55000	224	32000
AVERAGE	16.9	7.8	6244	6186	32	5505
GEOMETRIC MEAN			6244	6186	32	5505

SITE J - BEAR CREEK

DATE	TEMP DEGREES C	D.O.	BACTERIAL FAECAL COLIFORM	FAECAL STREP	PSEUD. AERU	E. COLI
05/07/92			400	116	4	400
05/21/92	15.5		400	132	4	400
06/04/92	15.8	9.3	400	396	4	400
06/18/92	17.2	6.4	12900	7400	8	12900
07/02/92	22	15	400	600	4	400
07/16/92	20	6.7	2900	2900	36	2900
07/30/92	19	3	1300	340	4	1300
08/13/92			1000	1500	4	1000
08/27/92	22	7.2	15000	16200	4	21000
09/10/92	19	7.6	100000	360000	4	70000
09/24/92	12.2	10.3	910	300	4	620
10/08/92	12	12	410	190	4	290
10/22/92	8.8		760	810	4	480
MIN	8.8	3.0	400	116	4	290
MAX	22.0	15.0	100000	360000	36	70000
AVERAGE	16.7	8.6	10522	30068	7	8622
GEOMETRIC MEAN			10522	30068	7	8622

SITE K - UPPER CATFISH

DATE	TEMP DEGREES C	D.O.	BACTERIAL FAECAL COLIFORM	BACTERIAL FAECAL STREP	BACTERIAL PSEUD. AERU	BACTERIAL E. COLI
05/07/92			108	600	4	108
05/21/92	14.5		268	112	4	184
06/04/92	12.8	10.2	400	384	4	400
06/18/92	17.2	4.9	25000	23000	8	25000
07/02/92	20.2	12.8	396	600	4	400
07/16/92	19	10.3	1000	1000	4	1000
07/30/92	17	6.4	1700	670	4	1700
08/13/92			12400	1400	12	12400
08/27/92	18	7.9	2200	13300	4	200
09/10/92	18.5	6.8	11000	76000	80	11000
09/24/92	12.5	9.7	280	290	4	280
10/08/92	10.7	10.2	580	210	4	580
10/22/92	9.3		260	620	4	190
MIN	9.3	4.9	108	112	4	108
MAX	20.2	12.8	25000	76000	80	25000
AVERAGE	15.4	8.8	4276	9091	11	4111
GEOMETRIC MEAN			4276	9091	11	4111

SITE L - NINETEEN MILE CREEK

DATE	TEMP DEGREES C	D.O.	BACTERIAL FAECAL COLIFORM	BACTERIAL FAECAL STREP	BACTERIAL PSEUD. AERU	BACTERIAL E. COLI
05/07/92			272	92	4	164
05/21/92	18.5		272	132	4	208
06/04/92	15.5	7	400	568	4	400
06/18/92	18.3	7.1		1500	144	1000
07/02/92	17.3	6.4	760	284	4	890
07/16/92	17	8.9	3100	3800	20	2500
07/30/92	17	7.6	1000	780	4	1000
08/13/92			1000	720	4	1000
08/27/92	21	0.6	20	50	4	20
09/10/92	19	8.8	28000	68000	680	20000
09/24/92	11.4	11	480	310	4	380
10/08/92	8.5	12.6	220	50	4	60
10/22/92	7		1000	1500	4	1000
MIN	7.0	0.6	20	50	4	20
MAX	21.0	12.6	28000	68000	680	20000
AVERAGE	15.5	7.8	3044	5984	68	2202
GEOMETRIC MEAN			3044	5984	68	2202

SITE M - WEST CATFISH

DATE	TEMP DEGREES C	D.O.	BACTERIAL FAECAL COLIFORM	BACTERIAL FAECAL STREP	BACTERIAL PSEUD AERU	BACTERIAL E. COLI
05/07/92			84	68	4	72
05/21/92	20		84	68	4	64
06/04/92	18.4	8.2	90	90	4	80
06/18/92	19.2	7.3		10300	16	12000
07/02/92	18.3	7.8	240	200	4	240
07/16/92	18	7.9	5800	5300	20	5800
07/30/92	18.5	4.2	1000	230	4	500
08/13/92			135000	240000	188	135000
08/27/92	22	4.6	860	2000	10	650
09/10/92	19	8.1	66000	71000	260	49000
09/24/92	11.7	11.1	1600	580	4	1600
10/08/92	10.3	12.5	50	60	4	50
10/22/92	7.5		3000	2800	12	2500
MIN	7.5	4.2	50	60	4	50
MAX	22.0	12.5	135000	240000	260	135000
AVERAGE	16.6	8.0	17817	25592	41	15966
GEOMETRIC MEAN			17817	26866	43	16296

SITE N - EAST CATFISH

DATE	TEMP DEGREES C	D.O.	BACTERIAL FAECAL COLIFORM	BACTERIAL FAECAL STREP	BACTERIAL PSEUD AERU	BACTERIAL E. COLI
05/07/92			10	200	4	90
05/21/92	20		160	40	1	150
06/04/92	19.4	7.2	580	160	4	490
06/18/92	20.7	7.7	2200	660	4	1100
07/02/92	22	7.2	1000	330	4	1000
07/16/92	20	7.5	18000	12000	60	18000
07/30/92	19.5	2.2	1000	170	4	700
08/13/92			3600	2400	4	1900
08/27/92	23	6.8	110	590	4	110
09/10/92	19	7.8	36000	40000	510	22000
09/24/92	11.6	11.1	1500	490	4	1300
10/08/92	10.5	10.8	150	20	4	50
10/22/92	7.5		2100	3400	12	1200
MIN	7.5	2.2	10	20	1	50
MAX	23.0	11.1	36000	40000	510	22000
AVERAGE	17.6	7.6	5108	4651	48	3699
GEOMETRIC MEAN			5108	4651	48	3699

CURB WATER QUALITY DATA FOR THE KETTLE CREEK CA - 1992

SITE # 1 - FULTON BRIDGE

DATE	TEMPERATURE DEGREES C	D.O.	BACTERIAL FAECAL COLIFORM	BACTERIAL FAECAL STREP	BACTERIAL PSEUD. AER	BACTERIAL E. COLI
05/07/92	8.0		1000	140	40	1000
05/14/92		8.2	440	10	4	190
05/21/92	20.0	10.2	316	20	8	264
05/28/92	17.0	8.2	280	16	4	280
06/04/92	19.1	8.6	580	50	8	350
06/11/92	19.5	4.2	740	110	8	560
06/18/92	21.4	6.2	78000	13100	600	66000
06/25/92	15.2	10.1	1100	200	20	700
07/02/92	20.0	9.0	460	550	4	210
07/09/92	19.1	7.3	1000	1000	400	1000
07/16/92	22.0	7.8	31000	3200	60	17000
07/23/92	18.0	7.4	3000	700	60	1600
07/30/92	19.5	6.2	3700	690	64	2300
08/06/92	17.0	8.2	2600	230	56	1600
08/13/92	20.0	5.5	1700	640	24	1700
08/20/92	17.0	9.2	600	700	20	500
08/27/92	23.5	6.1	2400	180	40	1500
09/03/92	20.0	6.9	38000	13000	330	26000
09/10/92	20.0	8.6	25000	66000	920	24000
09/17/92	19.3	8.0	1600	1000	20	1600
09/24/92	12.7	9.8	2100	1000	10	1400
10/01/92	11.3	11.0	400	130	4	370
10/08/92	11.0	10.7	250	80	4	240
10/15/92	11.2	9.5	730	380	8	580
10/22/92	6.6		3400	4100	20	2500
10/29/92	8.1	5.2	970	190	8	960
MIN	6.6	0.0	250	10	4	190
MAX	23.5	11.0	78000	66000	920	66000
AVERAGE	16.7	7.7	7745	4131	106	5939
GEOMETRIC			7745	4131	106	5939

SITE #2 - DODD'S CREEK AT PAYNE'S MILL

			- - - - - - - - BACTERIAL - - - - - - - - - - -			
DATE	TEMPERATURE	D.O.	FAECAL COLIFORM	FAECAL STREP	PSEUD. AER	E. COLI
05/07/92	9.0		90	60	4	60
05/14/92		8.7	440	10	4	190
05/21/92	21.0	11.0	112	76	4	108
05/28/92	16.0	10.0	148	108	4	148
06/04/92	19.0	8.6	160	130	4	160
06/11/92	19.5	6.5	220	120	4	250
06/18/92	22.1	6.3	12100	3500	16	12100
06/25/92	14.2	9.9	900	800	10	900
07/02/92	18.0	7.2	520	450	4	520
07/09/92	18.2	6.6		6900	20	23600
07/16/92	19.0	8.2	3600	2100	20	3500
07/23/92	17.0	8.2	1500	1200	12	1500
07/30/92	18.0	6.4	900	400	4	600
08/06/92	15.0	7.5	1000	800	4	1000
08/13/92	18.0	6.6	700	1500	4	100
08/20/92	16.0	9.2	900	480	4	900
08/27/92	22.0	6.0	410	380	4	210
09/03/92	16.0	6.4	2200	1500	10	1300
09/10/92	20.0	8.7	24000	65000	200	23000
09/17/92	19.6	7.4	1400	300	10	1400
09/24/92	12.3	10.1	1000	400	30	400
10/01/92	10.3	10.6	480	150	4	480
10/08/92	9.6	10.1	550	190	4	550
10/15/92	10.0	9.0	660	960	4	660
10/22/92	7.2		1300	2800	36	1000
10/29/92	8.2	4.5	180	90	4	140
MIN	7.2	4.5	90	10	4	60
MAX	22.1	11.0	24000	65000	200	23600
AVERAGE	15.8	8.1	2219	3477	16	2876
GEOMETRIC			2219	3477	16	2876

SITE #3 -DODD'S CREEK AT ST. THOMAS (HWY 25)

			BACTERIAL			
DATE	TEMPERATURE	D.O.	FAECAL COLIFORM	FAECAL STREP	PSEUD. AER	E. COLI
05/07/92	9.0		60	30	4	20
05/14/92		8.7	32	28	4	20
05/21/92	22.0	9.4	344	124	4	164
05/28/92	17.0	8.0	136	152	4	132
06/04/92	20.2	8.8	200	210	4	200
06/11/92	21.5	8.2	250	320	4	250
06/18/92	23.4	6.7	1200	1800	16	1200
06/25/92	15.0	10.9	400	320	10	100
07/02/92	20.6	8.0	500	360	4	270
07/09/92	20.1	6.6	1000	1120	4	1000
07/16/92	19.0	7.8	10000	3900	30	10000
07/23/92	17.0	8.5	1000	200	28	300
07/30/92	20.0	5.6	1200	240	4	500
08/06/92	19.0	7.1	300	120	4	100
08/13/92	20.0	4.2	1000	600	4	770
08/20/92	17.0	9.2	300	100	4	300
08/27/92	22.5	6.2	3800	470	4	200
09/03/92	17.0	6.8	1900	2100	10	1100
09/10/92	20.0	8.8	12000	49000	90	10000
09/17/92	19.0	7.8	600	400	10	300
09/24/92	12.3	10.1	1300	620	4	1300
10/01/92	10.5	10.9	190	80	4	180
10/08/92	10.2	13.4	12	24	4	4
10/15/92	9.8	6.5	192	288	4	192
10/22/92	7.1		2200	5400	28	1700
10/29/92	7.2	3.8	90	20	4	20
MIN	7.1	3.8	12	20	4	4
MAX	23.4	13.4	12000	49000	90	10000
AVERAGE	16.7	8.0	1546	2616	11	1166
GEOMETRIC MEAN			1546	2616	11	1166

SITE 4 - KETTLE CREEK AT COUNTY RD # 48 (BRIDGE)

			- - - - - - - - BACTERIAL - - - - - - - - - - -			
DATE	TEMPERATURE	D.O.	FAECAL COLIFORM	FAECAL STREP	PSEUD. AER	E. COLI
05/07/92	8.0		40	28	4	32
05/14/92		7.2	60	20	4	40
05/21/92	22.0	9.6	48	12	4	48
05/28/92	17.0	7.8	200	68	4	160
06/04/92	20.3	9.2	10	10	4	10
06/11/92	21.9	8.3	130	60	4	130
06/18/92	22.7	6.1		3300	4	1800
06/25/92	15.3	11.2	600	200	10	600
07/02/92	19.9	7.4	530	350	4	430
07/09/92	19.0	7.9	1000	1000	216	1000
07/16/92	19.0	6.6	6700	5700	40	5800
07/23/92	17.0	8.6	500	800	4	400
07/30/92	20.0	5.8	700	160	4	700
08/06/92	18.5	7.8	890	190	4	850
08/13/92	18.5	7.5	60	700	4	60
08/20/92	16.0	9.3	100	100	4	100
08/27/92	22.0	7.0	200	610	4	200
09/03/92	17.0	7.0	1000	1600	10	600
09/10/92	20.0	8.5	240000	310000	10	210000
09/17/92	19.0	7.3	1000	1000	10	1000
09/24/92	11.0	11.8	920	470	10	780
10/01/92	9.9	11.2	360	160	4	360
10/08/92	9.8	11.6	180	40	4	130
10/15/92	9.3	0.3	490	576	4	400
10/22/92	7.0		800	3100	8	600
10/29/92	6.8	4.0	70	110	4	40
MIN	6.8	0.3	0	10	4	10
MAX	22.7	11.8	240000	310000	216	210000
AVERAGE	16.3	7.9	9869	12706	15	8703
GEOMETRIC MEAN			10264	12706	15	8703

SITE #5 -KETTLE CREEK- DALEWOOD RESERVOIR

			- - - - - - - - BACTERIAL - - - - - - - - - - -			
DATE	TEMPERATURE	D.O.	FAECAL COLIFORM	FAECAL STREP	PSEUD. AER	E. COLI
05/07/92	9.0		20	20	4	10
05/14/92		6.4	80	20	4	80
05/21/92	21.0	13.4	4	4	4	4
05/28/92	19.0	10.8	10	10	4	10
06/04/92	23.0	13.8	50	40	4	50
06/11/92	25.9	10.3	10	10	4	10
06/18/92	24.6	6.0	130	140	12	120
06/25/92	17.2	8.0	10	10	4	10
07/02/92	22.2	6.8	60	96	4	16
07/09/92	22.8	5.8	100	370	32	100
07/16/92	22.0	6.5	1600	1000	60	1600
07/23/92	19.5	8.4	100	100	4	100
07/30/92	22.0	4.6	100	10	4	100
08/06/92	17.0	10.6	10	10	4	10
08/13/92	23.5	11.4	30	170	4	10
08/20/92	21.0	12.2	100	100	4	100
08/27/92	25.0	8.6	10	20	4	10
09/03/92	22.0	4.6	1500	1020	4	1100
09/10/92	20.0	9.0	6500	43000	130	6400
09/17/92	20.7	10.2	600	500	10	500
09/24/92	13.2	9.4	2800	1800	20	1800
10/01/92	12.6	9.6	400	30	4	340
10/08/92	12.9	0.7	60	8	4	60
10/15/92	10.7	2.6	250	108	4	250
10/22/92	6.8		2700	6100	8	2700
10/29/92	7.6		110	30	4	110
MIN	6.8	0.7	4	4	4	4
MAX	25.9	13.8	6500	43000	130	6400
AVERAGE	18.4	8.2	667	2105	13	600
GEOMETRIC MEAN			667	2105	13	600

SITE #6 -KETTLE CREEK - LAKE WHITTAKER

			- - - - - - - - BACTERIAL - - - - - - - - - - -			
DATE	TEMPERATURE	D.O.	FAECAL COLIFORM	FAECAL STREP	PSEUD. AER	E. COLI
05/07/92	8.0		52	8	4	24
05/14/92		3.8	80	360	4	20
05/21/92	21.0	7.8	120	64	4	108
05/28/92	16.0	10.8	64	40	4	52
06/04/92	17.0	13.0	210	390	4	210
06/11/92	17.6	11.0	190	350	4	170
06/18/92	19.7	5.8	1000	1500	36	1000
06/25/92	13.8	10.2	210	430	4	210
07/02/92	16.5	9.0	160	580	4	110
07/09/92	22.8	5.8	1000	1500	100	1000
07/16/92	22.0	6.5	310	470	4	310
07/23/92	17.0	7.0	1600	3500	2	800
07/30/92	17.0	6.6	200	360	4	200
08/06/92			340	400	4	230
08/13/92	15.0	7.5	1000	1000	16	1000
08/20/92	15.5	8.0	100	700	4	100
08/27/92	19.0	4.4	490	830	4	3.10
09/03/92	17.0	4.7	610	1500	24	340
09/10/92	19.0	7.0	1500	6100	600	1500
09/17/92	16.7	5.2	600	400	12	400
09/24/92	11.5	9.1	110	280	4	90
10/01/92	9.3	7.5	300	340	4	270
10/08/92	9.3	6.8	150	220	4	150
10/15/92	9.9	7.2	1000	1500	4	640
10/22/92	8.3		100	790	4	60
10/29/92	7.7	5.4	140	280	4	140
MIN	7.7	3.8	52	8	2	20
MAX	22.8	13.0	1600	6100	600	1500
AVERAGE	15.3	7.4	448	919	33	363
GEOMETRIC MEAN			448	919	33	363

SITE #7 -KETTLE CREEK - PORT STANLEY, BRIDGE AT COUNTY RD 21

DATE	TEMPERATURE	D.O.	BACTERIAL - - - - - - - -			
			FAECAL COLIFORM	FAECAL STREP	PSEUD. AER	E. COLI
05/07/92						
05/14/92						
05/21/92						
05/28/92						
06/04/92						
06/11/92	21.5	6.1	240	70	4	190
06/18/92	21.4	6.4		1400	8	2500
06/25/92	15.5	10.0	3100	100	12	2200
07/02/92	21.3	10.4	200	240	4	160
07/09/92	19.0	7.5	1900	5100	56	1400
07/16/92	22.0	7.5	28000	3500	80	24000
07/23/92	19.0	7.4	1900	200	40	1200
07/30/92	21.0	6.8	1200	290	12	1000
08/06/92	20.0	9.8	200	200	4	200
08/13/92	21.5	5.8	700	400	8	100
08/20/92	19.0	9.8	500	300	4	200
08/27/92	24.0	8.4	150	120	4	140
09/03/92	19.0	7.0	1200	2200	28	1000
09/10/92	20.0	8.4	33000	76000	500	18000
09/17/92	19.6	7.6	2300	700	20	1000
09/24/92	12.7	10.8	2400	1100	30	1700
10/01/92	11.8	10.0	640	150	8	540
10/08/92	11.7	14.1	70	30	4	50
10/15/92	10.5	9.5	630	390	4	630
10/22/92	6.5		3700	7700	36	2100
10/29/92	8.1	5.8	120	130	4	120
MIN	6.5	5.8	70	30	4	50
MAX	24.0	14.1	33000	76000	500	24000
AVERAGE	17.4	8.5	4108	4777	41	2782
GEOMETRIC MEAN			4108	4946	43	2797

APPENDIX B

1992 WATER QUALITY DATA

CHEMICAL ANALYSIS

SITE D - HWY 48 - WEST LYONS

DATE	Susp Solids	Nitrogen - Free Ammonia	Nitrogen - Total Kjeldahl	Nitrogen - Nitrite	Nitrogen - Nitrate	Phosphorus - Total	Phosphorus - Dissolved	pH	Cond. In	Chloride
06/11/92	7.6	0.027	1.41	0.28	4.7	0.183	0.112	8.06	558	34.5
06/25/92	16	0.152	1.02	0.23	11.6	0.137	0.09	8.2	682	32.3
07/09/92	44.1	1.4	7.7	0.15	14.8	1.8	0.96	7.53	667	31.4
07/23/92	34.2	1.4	7.2	0.7	17.3	1.8	1.07	7.52	771	39.7
08/06/92	18	0.004	1.23	0.93	10.7	0.365	0.27	7.83	814	42.4
08/20/92	12.3	0.07	0.76	0.09	15.6	0.137	0.064	7.93	896	54.6
09/03/92	15.4	0.6	1.6	0.33	2.7	0.75	0.63	7.76	795	44.8
09/17/92	6.5	0.042	0.9	0.29	6.4	0.305	0.22	8.03	773	31.1
10/01/92	33.9	0.068	0.73	0.13	10	0.195	0.138	8.1	760	29.8
10/15/92	56.2	0.5	8.52	0.86	6.7	2.62	0.81	7.19	521	30.1
10/29/92	42.8	0.004	0.6	0.04	13.3	0.074	0.033	8.09	770	28.5
MIN	6.5	0.004	0.60	0.04	2.7	0.074	0.033	7.19	521	28.5
MAX	56.2	1.400	8.52	0.93	17.3	2.62	1.070	8.2	896	54.6
AVERAGE	26.1	0.388	2.88	0.37	10.3	0.76	0.400	7.84	728	36.3

SITE E - S. DORCHESTER - 11TH CON RD

DATE	Susp Solids	Nitrogen - Free Ammonia	Nitrogen - Total Kjeldahl	Nitrogen - Nitrite	Nitrogen - Nitrate	Phosphorus - Total	Phosphorus - Dissolved	pH	Cond. In	Chloride
06/11/92	10.6	0.009	1.08	0.18	1.7	0.157	0.093	8.11	631	60.1
06/25/92	32.1	0.131	1.28	0.21	11.4	0.116	0.071	8.1	703	35.8
07/09/92	74.3	0.251	2.28	0.07	0.7	0.268	0.077	7.84	573	44.4
07/23/92	71.7	0.012	1.6	0.17	15.3	0.16	0.05	8.09	711	32
08/06/92	35.9	0.009	1.02	0.25	6.5	0.108	0.04	8.15	716	44.8
08/20/92	37.2	0.002	1.03	0.02	2	0.144	0.005	8.07	760	70.9
09/03/92	117	0.001	1.05	0.05	3.9	0.175	0.049	8.04	741	51
09/17/92	7.3	0.017	0.73	0.09	6.6	0.171	0.153	8.01	810	49.8
10/01/92	28.6	0.037	0.62	0.04	8.3	0.103	0.084	8.16	802	43.3
10/15/92	121	0.1	2.46	0.1	8.3	0.63	0.38	7.61	675	49.5
10/29/92	58.8	0.002	0.6	0.05	11.1	0.075	0.031	8.16	800	45.2
MIN	7.3	0.001	0.60	0.02	0.7	0.075	0.005	7.61	573	32.0
MAX	121.0	0.251	2.46	0.25	15.3	0.63	0.380	8.16	810	70.9
AVERAGE	58.4	0.056	1.27	0.11	7.4	0.20	0.094	8.02	729	46.7

SITE F - RD 35 KINGSMILL

DATE	Susp Solids	Nitrogen - Free Ammonia	Nitrogen - Total Kjeldahl	Nitrogen - Nitrite	Nitrogen - Nitrate	Phosphorus - Total	Phosphorus - Dissolved	pH	Cond. In	Chloride
06/11/92	124	0.006	1.5	0.11	0.8	0.305	0.05	8.02	586	65.6
06/25/92	17.2	0.124	0.84	0.29	12.5	0.103	0.06	8.13	732	50.1
07/09/92	116	0.049	2.05	0.21	2.6	0.33	0.057	7.73	477	46.2
07/23/92	27.9	0.02	0.91	0.32	15.1	0.189	0.093	8.09	767	46.8
08/06/92	18.3	0.031	1.02	0.26	5.4	0.112	0.064	8.07	795	72.2
08/20/92	23.4	0.033	1.22	0.03	0.8	0.158	0.082	B.07	847	92.9
09/03/92	75.3	0.032	1.36	0.08	1.8	0.32	0.145	7.96	793	75.7
09/17/92	42.8	0.008	1.04	0.07	6.4	0.18	0.09	8.04	783	45.4
10/01/92	24.3	0.068	0.72	0.04	7.2	0.11	0.062	8.12	792	43.5
10/15/92	127	0.3	3.92	0.1	9.8	0.86	0.47	7.4	707	63.9
10/29/92		0.026	0.62	0.04	9.6	0.082	0.038	8.14	789	73.9
MIN	17.2	0.008	0.62	0.03	0.8	0.082	0.038	7.4	477	43.5
MAX	127.0	0.300	3.92	0.32	15.1	0.86	0.470	8.14	847	92.9
AVERAGE	52.5	0.069	1.37	0.14	7.1	0.24	0.116	7.98	748	61.1

CURB WATER QUALITY DATA FOR THE CATFISH CREEK CA - 1992

SITE A - HWY 20 EAST BROWNSVILLE

DATE	Susp Solids	Nitrogen - Free Ammonia	Nitrogen - Total Kjeldahl	Nitrogen - Nitrite	Nitrogen - Nitrate	Phosphorus - Total	Phosphorus - Dissolved	pH	Cond. In	Chloride
06/11/92	24.6	0.001	0.76	0.16	14.5		0.046	8.06	859	63.5
06/25/92	160	0.097	1.9	0.24	12.3	0.335	0.096	7.96	964	90.4
07/09/92	5	0.027	0.7	0.2	30.3	0.188	0.135	8.04	1066	91.4
07/23/92	5	0.022	0.76	0.54	16.8	0.179	0.141	7.74	973	78.3
08/06/92	109	0.005	2.1	0.76	15.5	0.39	0.087	7.89	967	83.6
08/20/92	37.7	0.003	1.37	0.91	3	0.87	0.83	7.8	829	55.9
09/03/92	15.3	0.141	0.81	0.13	15.4	0.152	0.101	4.65	890	42.8
09/17/92	26.2	0.011	0.58	0.04	16.2	0.109	0.047	7.92	882	38.7
10/01/92	24.2	0.025	0.45	0.03	15.6	0.066	0.038	7.99	854	35.8
10/15/92	186	2.9	11.6	0.02	0.1	2.54	1.02	7.17	643	32
10/29/92		0.001	0.54	0.1	14.8	0.089	0.022	7.87	852	38
MIN	5.0	0.001	0.45	0.02	0.1	0.066	0.022	4.65	643	32.0
MAX	186.0	2.900	11.60	0.91	30.3	2.54	1.020	8.06	1066	91.4
AVERAGE	59.3	0.294	1.96	0.28	14.0	0.49	0.233	7.55	889	59.1

SITE B - HWY 10 SOUTH BROWNSVILLE

DATE	Susp Solids	Nitrogen - Free Ammonia	Nitrogen - Total Kjeldahl	Nitrogen - Nitrite	Nitrogen - Nitrate	Phosphorus - Total	Phosphorus - Dissolved	pH	Cond. In	Chloride
06/11/92	9.5	0.001	0.62	0.05	3.2	0.051	0.012	8.03	711	31.1
06/25/92	16.7	0.103	0.83	0.07	4.2	0.07	0.016	7.95	721	32.7
07/09/92	21.9	0.001	1.33	0.44	14	0.153	0.056	7.95	782	43.4
07/23/92	5.3	0.008	0.76	0.16	7.3	0.077	0.034	8.08	704	35.7
08/06/92	8.4	0.031	0.72	0.26	5.3	0.046	0.02	7.84	761	38.9
08/20/92	8.4	0.007	0.56	0.06	5.5	0.052	0.009	7.83	761	35.3
09/03/92	21.1	0.058	0.77	0.08	6.5	0.095	0.053	7.7	757	32.2
09/17/92	19.2	0.004	0.66	0.07	5.7	0.075	0.048	7.89	764	29.6
10/01/92	18.5	0.046	0.56	0.05	6.5	0.057	0.034	7.94	579	28.2
10/15/92	246	2.2	9.52	0.04	0.1	1.56	0.35	7.36	627	31.4
10/29/92		4.6	8.2	0.51	4.5	1.27	0.81	7.85	824	35
MIN	5.3	0.001	0.56	0.04	0.1	0.046	0.009	7.36	579	28.2
MAX	246.0	4.600	9.52	0.51	14.0	1.56	0.810	8.08	824	43.4
AVERAGE	37.5	0.642	2.23	0.16	5.7	0.32	0.131	7.86	726	34.0

SITE C - LAIDLAW DRAIN - N SIDE OF 9TH CON

DATE	Susp Solids	Nitrogen - Free Ammonia	Nitrogen - Total Kjeldahl	Nitrogen - Nitrite	Nitrogen - Nitrate	Phosphorus - Total	Phosphorus - Dissolved	pH	Cond. In	Chloride
06/11/92	20.9	0.05	1.3	0.01	0.1	0.092	0.012	7.93	1041	242
06/25/92	16.4	0.071	1.44	0.29	13.2	0.104	0.015	8.25	923	120
07/09/92	22	0.036	1.92	0.37	8.8	0.47	0.276	7.94	679	95.3
07/23/92	32.9	0.018	1.01	0.45	22.6	0.23	0.102	8.13	987	97.8
08/06/92	11.1	0.044	1.01	0.49	6.2	0.09	0.057	8.01	1099	169
08/20/92	6.5	0.002	0.71	0.16	6.2	0.102	0.003	8	1152	182
09/03/92	31.1	0.214	1.28	0.31	7.9	0.198	0.123	7.88	1029	120
09/17/92	12.9	0.01	0.71	0.17	8.8	0.147	0.111	8.12	985	82.3
10/01/92	19.9	0.042	0.67	0.08	10.5	0.118	0.09	8.15	920	85.7
10/15/92	273	0.1	3.54	0.09	6.9	0.82	0.3	7.5	592	48.8
10/29/92	42.8	0.114	0.62	0.07	13.3	0.107		8.18	894	70.8
MIN	6.5	0.002	0.62	0.01	0.1	0.09	0.003	7.5	592	48.8
MAX	273.0	0.214	3.54	0.49	22.6	0.82	0.300	8.25	1152	242.0
AVERAGE	44.5	0.064	1.29	0.23	9.5	0.23	0.109	8.01	936	119.4

SITE J - BEAR CREEK

DATE	Susp Solids	Nitrogen - Free Ammonia	Nitrogen - Total Kjeldahl	Nitrogen - Nitrite	Nitrogen - Nitrate	Phosphorus - Total	Phosphorus - Dissolved	pH	Cond. In	Chloride
06/04/92		0.103	0.77	0.2	7.3	0.092	0.054	8	688	32.9
06/18/92	16	0.182	1.18	0.39	2.8	0.235	0.076	7.7	604	17
07/02/92	30.8	0.031	0.83	0.2	2.4	0.139	0.049	8.53	592	19
07/16/92	44.1	0.008	1.82	0.45	31.1	0.43	0.131	8.14	998	74.3
07/30/92	18.3	0.028	0.73	0.16	5.8	0.071	0.028	8.2	770	35.7
08/13/92	35.8	0.002	0.89	0.15	6.3	0.235	0.095	7.96	723	34.8
08/27/92	27.1	0.024	1.03	0.25	3.1	0.245	0.125	7.86	666	25.4
09/10/92	141	0.3	2.76	0.19	8.5	0.86	0.48	7.47	501	22.6
09/24/92	5	0.013	0.64	0.11	7.7	0.13	0.075	7.99	792	31.6
10/08/92	12.9	0.015	0.61	0.1	4.7	0.09	0.059	8.27	699	26
10/22/92	7.9	0.038	0.66	0.04	8.9	0.103	0.034	8.13	784	31.9
MIN	5.0	0.002	0.61	0.04	2.4	0.071	0.028	7.47	501	17.0
MAX	141.0	0.300	2.76	0.45	31.1	0.86	0.480	8.53	998	74.3
AVERAGE	33.9	0.064	1.12	0.20	8.1	0.25	0.115	8.03	713	31.8

SITE K - UPPER CATFISH

DATE	Susp Solids	Nitrogen - Free Ammonia	Nitrogen - Total Kjeldahl	Nitrogen - Nitrite	Nitrogen - Nitrate	Phosphorus - Total	Phosphorus - Dissolved	pH	Cond. In	Chloride
06/04/92		0.07	0.69	0.08	3.9	0.052	0.023	7.9	726	33.9
06/18/92	19.5	0.184	1.34	0.31	2.6	0.164	0.053	7.51	565	46.6
07/02/92	17	0.056	0.79	0.19	3.8	0.068	0.031	8.47	691	32.6
07/16/92	13.9	0.001	0.85	0.34	17.1	0.13	0.046	8.07	796	42.5
07/30/92	17.2	0.036	0.78	0.37	6.9	0.232	0.177	8.14	716	36.2
08/13/92	9.4		0.91	0.09	5.9	0.074		7.87	795	35.6
08/27/92	18.5	0.073	1	0.12	3.6	0.09	0.039	7.78	704	29.8
09/10/92	88	0.2	1.18	0.14	4.4	0.58	0.3	7.49	406	16.6
09/24/92	5	0.02	0.86	0.05	6	0.072	0.033	7.84	793	30.6
10/08/92	17.3	0.02	0.73	0.07	4.6	0.062	0.037	7.92	761	30.6
10/22/92	28.6	0.028	0.76	0.03	7.5	0.073	0.019	7.99	780	28
MIN	5.0	0.001	0.73	0.03	2.6	0.062	0.019	7.49	406	16.6
MAX	88.0	0.200	1.34	0.37	17.1	0.58	0.300	8.47	796	46.6
AVERAGE	23.4	0.069	0.92	0.17	6.2	0.15	0.082	7.91	701	32.9

SITE L - NINETEEN MILE CREEK

DATE	Susp Solids	Nitrogen - Free Ammonia	Nitrogen - Total Kjeldahl	Nitrogen - Nitrite	Nitrogen - Nitrate	Phosphorus - Total	Phosphorus - Dissolved	pH	Cond. In	Chloride
06/04/92		0.114	0.81	0.22	4.6	0.135	0.101	7.95	785	91.6
06/18/92	25	0.062	0.83	0.04	0.1	0.11	0.03	7.75	703	123
07/02/92	9.1	0.097	0.53	0.12	1.1	0.032	0.015	7.89	654	98
07/16/92	24.4	0.004	1.06	0.25	14.8	0.116	0.011	7.85	826	39.8
07/30/92	18.7	0.054	0.86	0.09	5.1	0.118	0.072	8.03	709	68.9
08/13/92	84.1	0.008	0.77	0.02	5.6	0.174	0.006	8.15	782	71.9
08/27/92	68.7	0.007	2.25	0.01	0.3	0.34	0.051	7.78	981	107
09/10/92	441	0.2	2.47	0.18	4	1.08	0.37	7.66	317	16.9
09/24/92	17.1	0.011	0.68	0.1	5.5	0.131	0.052	8.18	743	39.4
10/08/92	11.2	0.005	0.52	0.02	3.5	0.041	0.022	8.08	794	73.6
10/22/92	14.8	0.011	0.73	0.03	6.5	0.124	0.063	8.18	736	48.8
MIN	9.1	0.004	0.52	0.01	0.1	0.032	0.006	7.66	317	16.9
MAX	441.0	0.200	2.47	0.25	14.8	1.08	0.370	8.18	981	123.0
AVERAGE	71.4	0.046	1.07	0.09	4.7	0.23	0.069	7.96	725	68.7

SITE G- PORT BRUCE HARBOUR

DATE	Susp Solids	Nitrogen - Free Ammonia	Nitrogen - Total Kjeldahl	Nitrogen - Nitrite	Nitrogen - Nitrate	Phosphorus - Total	Phosphorus - Dissolved	pH	Cond. In	Chloride
06/11/92	38.1	0.038	0.78	0.05	0.4	0.088	0.016	8.16	512	27.6
06/25/92	35.4	0.122	1.08	0.18	5.6	0.094	0.029	7.95	620	34.5
07/09/92	103	0.017	1.18	0.14	1.3	0.189	0.026	7.98	543	23.2
07/23/92	115	0.003	1.55	0.18	10.2	0.21	0.053	8.04	666	36.7
08/06/92	30.9	0.056	0.84	0.21	3	0.072	0.018	8.09	625	37.3
08/20/92	249	0.03	0.64	0.03	2.4	0.089	0.028	8.17	620	39.6
09/03/92	241	0.022	0.86	0.09	3.4	0.27	0.053	8.15	548	29.7
09/17/92	70	0.012	0.86	0.04	3.6	0.138	0.056	8.18	682	30.5
10/01/92	24.8	0.04	0.6	0.02	3.7	0.071	0.04	8.24	664	30.3
10/15/92	92.7	0.1	1.04	0.02	3.9	0.17	0.09	8.16	664	33.5
10/29/92	25.6	0.07	0.62	0.01	4.6	0.056	0.028	8.18	736	43.9
MIN	24.8	0.003	0.60	0.01	1.3	0.056	0.018	7.95	543	23.2
MAX	249.0	0.122	1.55	0.21	10.2	0.27	0.090	8.24	736	43.9
AVERAGE	98.7	0.047	0.93	0.09	4.2	0.14	0.042	8.11	637	33.9

SITE H - BRADLEY CREEK

DATE	Susp Solids	Nitrogen - Free Ammonia	Nitrogen - Total Kjeldahl	Nitrogen - Nitrite	Nitrogen - Nitrate	Phosphorus - Total	Phosphorus - Dissolved	pH	Cond. In	Chloride
06/04/92		0.102	0.98	0.06	2.3	0.078	0.005	7.84	554	27.8
06/18/92	45.3	0.081	1.27	0.09	1.7	0.139	0.006	7.56	485	27.7
07/02/92	22.7	0.066	1.05	0.13	0.9	0.08	0.021	7.89	448	27.4
07/16/92	25.2	0.075	1.38	0.4	4.7	0.084	0.003	7.81	528	19.6
07/30/92	29.7	0.136	1.1	0.5	1.8	0.098	0.008	7.85	631	24.9
08/13/92	26.1	0.057	1.11	0.28	1.8	0.089	0.005	7.9	613	25.9
08/27/92	23.3	0.233	1.23	0.12	1.8	0.105	0.055	7.81	625	27.2
09/10/92	65.8	0.2	1.17	0.07	1.7	0.32	0.1	7.72	403	14.4
09/24/92	5	0.043	0.8	0.05	3	0.05	0.007	7.05	639	24.7
10/08/92	118	0.147	1.3	0.01	3	0.205	0.021	8.02	644	29.2
10/22/92	14	0.041	0.72	0.02	4	0.037	0.001	8.09	640	20
MIN	5.0	0.041	0.72	0.01	0.9	0.037	0.001	7.05	403	14.4
MAX	118.0	0.233	1.38	0.50	4.7	0.32	0.100	8.09	644	29.2
AVERAGE	37.5	0.108	1.11	0.17	2.4	0.12	0.023	7.77	566	24.1

SITE I- LAIDLAW DRAIN

DATE	Susp Solids	Nitrogen - Free Ammonia	Nitrogen - Total Kjeldahl	Nitrogen - Nitrite	Nitrogen - Nitrate	Phosphorus - Total	Phosphorus - Dissolved	pH	Cond. In	Chloride
06/04/92		0.101	1.22	0.09	0.1	0.139	0.051	8.14	852	154
06/18/92	16.1	0.213	1.31	0.34	0.7	0.375	0.218	7.61	529	73.7
07/02/92	6.2	0.014	1.02	0.09	0.1	0.075	0.023	9.61	672	135
07/16/92	25.2	0.075	1.38	0.4	4.7	0.084	0.003	7.81	528	19.6
07/30/92	5	0.047	0.65	0.42	10.6	0.093	0.07	8.26	883	81.5
08/13/92	20.5		1.16	0.44	3.9		0.21	7.97	874	103
08/27/92	26.3	0.074	0.98	0.08	0.2	0.365	0.2	7.84	1128	193
09/10/92	105	0.2	2.92	0.14	15.1	0.94	0.6	7.42	610	36.1
09/24/92	5	0.038	0.71	0.08	10.9	0.139	0.09	8.1	802	47.1
10/08/92	14.7	0.061	0.65	0.18	3	0.136	0.107	8.18	934	108
10/22/92	17.4	0.046	0.84	0.04	11	0.151	0.093	8.1	768	44.7
MIN	5.0	0.014	0.65	0.04	0.1	0.075	0.003	7.42	528	19.6
MAX	105.0	0.213	2.92	0.44	15.1	0.94	0.600	9.61	1128	193.0
AVERAGE	24.1	0.085	1.16	0.22	6.0	0.26	0.161	8.09	773	84.2

SITE #5 -KETTLE CREEK- DALEWOOD RESERVOIR

DATE	Susp Solids	Nitrogen				Phosphorus		pH	Cond. In	Chloride
		Free Ammonia	Total Kjeldahl	Nitrite	Nitrate	Total	Dissolved			
06/04/92		0.255	1.34	0.01	0.1	0.136	0.038	8.69	461	40.4
06/11/92	21.1	0.077	1.27	0.01	0.1	0.113	0.013	8.62	501	36.6
06/18/92	43.2	0.057	1.42	0.02	0.1	0.174	0.014	7.99	516	36.6
06/25/92	22.1	0.337	1.30	0.11	1.8	0.100	0.035	8.09	539	34.7
07/02/92	71.4	0.157	1.68	0.29	3.5	0.154	0.032	8.26	550	33.1
07/09/92	39.0	0.321	1.84	0.17	2.6	0.148	0.032	7.95	561	33.6
07/16/92	47.7	0.031	1.75	0.34	6.1	0.150	0.027	8.00	557	33.2
07/23/92	50.8	0.090	1.56	0.24	12.2	0.140	0.027	8.06	620	34.6
07/30/92	36.5	0.222	1.55	0.22	6.4	0.110	0.019	8.09	585	35.2
08/06/92	28.6	0.104	1.10	0.34	4.3	0.082	0.029	8.22	559	38.9
08/13/92	28.8	0.130	1.11	0.09	1.8	0.091	0.005	8.08	523	38.5
08/20/92	32.6	0.173	1.16	0.05	0.2	0.099	0.015	8.28	484	38.7
08/27/92	23.7	0.181	1.07	0.01	0.1	0.106	0.051	7.89	450	38.9
09/03/92	54.3	0.287	1.44	0.09	5.4	0.116	0.025	7.99	677	34.1
09/10/92	334.0	0.200	1.93	0.16	3.0	0.660	0.190	7.87	380	18.9
09/17/92	24.1	0.150	1.28	0.04	4.2	0.102	0.021	8.18	643	27.3
09/24/92	67.0	0.021	1.30	0.08	4.4	0.235	0.089	8.09	612	25.8
10/01/92	51.3	0.158	1.02	0.10	4.5	0.104	0.032	8.25	720	30.8
10/08/92	43.4	0.043	0.96	0.06	2.6	0.062	0.012	8.08	630	32.2
10/15/92	29.5	0.102	1.10	0.07	1.4	0.076	0.030	8.25	637	39.4
10/22/92	46.4	0.048	1.26	0.06	4.9	0.194	0.069	8.00	608	27.5
10/29/92	64.4	0.047	0.76	0.03	5.1	0.055	0.026	8.18	734	34.7
MIN	21.1	0.021	0.76	0.01	0.1	0.055	0.005	7.87	380	18.9
MAX	334.0	0.337	1.93	0.34	12.2	0.660	0.190	8.69	734	40.4
AVERAGE	55.2	0.145	1.33	0.12	3.4	0.146	0.038	8.14	570	33.8

SITE #6 -KETTLE CREEK - LAKE WHITTAKER

DATE	Susp Solids	Nitrogen				Phosphorus		pH	Cond. In	Chloride
		Free Ammonia	Total Kjeldahl	Nitrite	Nitrate	Total	Dissolved			
06/04/92		0.025	0.93	0.05	5.0	0.050	0.022	8.23	703	31.9
06/11/92	3.5	0.005	0.90	0.04	4.3	0.052	0.021	8.32	699	33.0
06/18/92	4.9	0.029	1.13	0.16	6.5	0.116	0.060	7.86	700	50.7
06/25/92	7.7	0.074	0.97	0.09	5.1	0.068	0.034	8.09	660	30.3
07/02/92	6.3	0.027	0.81	0.17	5.2	0.064	0.028	8.21	704	31.1
07/09/92	5.0	0.037	1.11	0.20	8.8	0.100	0.067	7.92	759	45.8
07/16/92	5.0	0.016	1.23	0.14	5.0	0.090	0.061	7.74	595	29.4
07/23/92	5.0	0.029	1.14	0.19	5.0	0.131	0.090	7.50	628	38.0
07/30/92	5.0	0.034	0.98	0.14	3.8	0.058	0.040	7.77	609	27.4
08/06/92	5.0	0.013	0.88	0.27	3.2	0.065	0.036	7.77	611	29.8
08/13/92	4.4	0.013	0.91	0.07	4.1	0.088	0.055	7.88	704	38.1
08/20/92	6.1	0.001	1.00	0.05	2.9	0.068	0.040	7.80	592	29.2
08/27/92	7.0	0.049	1.03	0.07	2.6	0.088	0.070	7.61	587	27.9
09/03/92	4.6	0.013	0.96	0.07	3.2	0.078	0.053	7.78	636	37.3
09/10/92	21.7	0.100	1.09	0.06	1.9	0.090	0.010	7.47	473	20.7
09/17/92	6.1	0.019	1.02	0.13	5.0	0.068	0.044	7.80	736	31.6
09/24/92	5.0	0.019	0.87	0.03	2.8	0.047	0.020	7.81	593	26.0
10/01/92	9.3	0.054	0.88	0.06	4.7	0.055	0.029	7.76	681	29.7
10/08/92	13.8	0.024	0.74	0.10	3.7	0.073	0.038	7.70	684	30.8
10/15/92	17.4	0.016	1.20	0.05	3.8	0.128	0.060	7.71	645	37.4
10/22/92	45.6	0.031	1.32	0.04	6.2	0.176	0.028	7.60	726	28.5
10/29/92	17.6	0.017	0.93	0.03	4.0	0.049	0.013	7.67	669	30.5
MIN	3.5	0.001	0.74	0.03	1.9	0.047	0.010	7.47	473	20.7
MAX	45.6	0.100	1.32	0.27	8.8	0.176	0.090	8.32	759	50.7
AVERAGE	9.8	0.029	1.00	0.10	4.4	0.082	0.042	7.82	654	32.5

SITE #3 -DODD'S CREEK AT ST. THOMAS (HWY 25)

DATE	Susp Solids	Nitrogen - Free Ammonia	Nitrogen - Total Kjeldahl	Nitrogen - Nitrite	Nitrogen - Nitrate	Phosphorus - Total	Phosphorus - Dissolved	pH	Cond. In	Chloride
06/04/92		0.048	1.90	0.10	7.3	0.150	0.036	8.07	697	60.6
06/11/92	74.7	0.007	1.75	0.07	5.2	0.165	0.027	8.26	666	55.1
06/18/92	119.0	0.133	1.35	0.39	3.7	0.115	0.043	7.91	682	68.1
06/25/92	36.5	0.076	1.85	0.04	6.5	0.105	0.061	8.14	729	78.1
07/02/92	78.5	0.040	2.00	0.12	2.4	0.150	0.041	8.33	663	67.7
07/09/92	117.0	0.012	2.60	0.08	2.5	0.230	0.520	8.00	623	60.3
07/16/92	96.0	0.003	2.20	0.15	13.3	0.175	0.009	7.78	816	72.1
07/23/92	102.0	0.009	1.32	0.09	12.7	0.194	0.051	8.07	706	49.5
07/30/92	62.8	0.020	1.70	0.09	8.1	0.160	0.066	8.09	686	55.9
08/06/92	45.3	0.005	1.50	0.18	4.6	0.124	0.065	8.16	748	78.2
08/13/92	43.6	0.012	1.74	0.01	2.0	0.140	0.061	8.10	714	84.4
08/20/92	43.6	0.005	1.28	0.03	4.0	0.184	0.081	8.09	677	63.1
08/27/92	29.4	0.026	1.60	0.02	2.2	0.090	0.062	7.91	779	92.3
09/03/92	87.5	0.020	1.25	0.05	4.5	0.205	0.073	8.10	702	46.4
09/10/92	542.0	0.200	2.82	0.22	2.7	1.120	0.340	7.70	348	19.1
09/17/92	27.8	0.013	1.04	0.02	3.7	0.116	0.086	8.09	737	43.8
09/24/92	43.8	0.014	1.24	0.03	3.4	0.186	0.093	8.14	619	30.0
10/01/92	16.5	0.024	0.93	0.01	3.5	0.081	0.055	8.20	770	48.7
10/08/92	5.0	0.001	0.94	0.01	2.3	0.024	0.017	8.21	768	65.4
10/15/92	5.2	0.028	1.06	0.01	2.0	0.042	0.001	8.16	746	64.3
10/22/92	34.9	0.025	1.22	0.04	4.6	0.166	0.066	8.02	589	31.7
10/29/92	31.8	0.029	0.81	0.01	4.2	0.023	0.008	8.14	769	52.3
MIN	5.0	0.001	0.81	0.01	2.0	0.023	0.001	7.70	348	19.1
MAX	542.0	0.200	2.82	0.39	13.3	1.120	0.520	8.33	816	92.3
AVERAGE	78.2	0.034	1.55	0.08	4.8	0.179	0.085	8.08	692	58.5

SITE 4 - KETTLE CREEK AT COUNTY RD # 48 (BRIDGE)

DATE	Susp Solids	Nitrogen - Free Ammonia	Nitrogen - Total Kjeldahl	Nitrogen - Nitrite	Nitrogen - Nitrate	Phosphorus - Total	Phosphorus - Dissolved	pH	Cond. In	Chloride
06/04/92		0.061	1.74	0.14	0.9	0.198	0.032	8.13	589	30.7
06/11/92	37.4	0.002		0.06	0.6	0.120	0.016	8.33	595	34.2
06/18/92	55.5	0.062	1.07	0.09	0.1	0.165	0.030	8.02	525	30.4
06/25/92	24.4	0.060	0.98	0.09	6.9	0.084	0.029	8.31	654	35.5
07/02/92	38.4	0.039	0.84	0.16	1.1	0.104	0.031	8.43	567	33.2
07/09/92	155.0	0.005	1.74	0.15	3.1	0.334	0.104	8.02	542	31.1
07/16/92	105.0	0.004	1.85	0.15	9.3	0.265	0.072	8.15	741	43.9
07/23/92	54.2	0.008	1.14	0.09	9.1	0.142	0.048	8.15	697	35.9
07/30/92	38.2	0.018	1.20	0.09	7.5	0.110	0.050	8.25	719	36.1
08/06/92	43.0	0.006	0.84	0.21	3.7	0.108	0.043	8.23	689	45.0
08/13/92	44.8	0.013	0.84	0.02	1.8	0.121	0.033	8.23	629	42.5
08/20/92	31.7	0.001	0.66	0.02	1.4	0.100	0.019	8.20	684	50.5
08/27/92	37.5	0.016	0.66	0.02	0.4	0.079	0.041	8.12	619	45.1
09/03/92	50.7	0.017	1.00	0.04	5.3	0.108	0.036	8.17	724	36.4
09/10/92	351.0	0.200	2.58	0.18	2.3	0.980	0.320	7.63	369	22.2
09/17/92	18.9	0.011	0.91	0.01	4.0	0.093	0.056	8.17	714	30.8
09/24/92	24.3	0.007	0.79	0.03	6.1	0.103	0.048	8.23	725	28.5
10/01/92	29.1	0.013	0.67	0.01	4.2	0.043	0.026	8.26	733	31.8
10/08/92	7.4	0.012	0.90	0.01	1.6	0.044	0.015	8.26	698	57.3
10/15/92	7.9	0.013	0.76	0.01	2.1	0.059	0.008	8.26	705	45.4
10/22/92	16.6	0.012	0.79	0.02	6.5	0.099	0.045	8.16	689	28.9
10/29/92	41.6	0.004	0.56	0.01	5.1	0.021	0.008	8.20	745	35.1
MIN	7.4	0.001	0.56	0.01	0.1	0.021	0.008	7.63	369	22.2
MAX	351.0	0.200	2.58	0.21	9.3	0.980	0.320	8.43	745	57.3
AVERAGE	57.7	0.027	1.07	0.07	3.8	0.158	0.050	8.18	652	36.8

CURB WATER QUALITY DATA FOR THE KETTLE CREEK CA - 1992

SITE # 1 - FULTON BRIDGE

DATE	Susp Solids	Nitrogen - Free Ammonia	Nitrogen - Total Kjeldahl	Nitrogen - Nitrite	Nitrogen - Nitrate	Phosphorus - Total	Phosphorus - Dissolved	pH	Cond. In	Chloride
06/04/92		0.129	1.38	0.17	6.0	0.228	0.132	7.98	722	75.1
06/11/92	24.6	0.001	0.76	0.16	14.5		0.046	8.06	859	63.5
06/18/92	145.0	0.490	2.30	0.38	3.2	0.430	0.154	7.59	418	40.9
06/25/92	28.3	0.133	1.66	0.22	5.6	0.210	0.139	8.11	673	63.3
07/02/92	65.0	0.043	1.90	0.20	7.8	0.340	0.165	8.34	688	
07/09/92	104.0	0.018	1.95	0.48	3.5	0.320	0.123	7.79	493	44.1
07/16/92	194.0	0.004	2.40	0.22	11.3	0.355	0.048	7.67	653	49.7
07/23/92	145.0	0.010	1.85	0.13	11.8	0.210	0.096	8.03	684	50.6
07/30/92	72.5	0.024	1.35	0.09	7.2	0.235	0.113	8.03	613	48.0
08/06/92	47.1	0.016	1.20	0.24	6.4	0.210	0.102	7.99	717	72.5
08/13/92	51.8	0.002	1.24	0.25	5.3	0.295	0.177	8.04	708	70.5
08/20/92	56.9	0.009	1.06	0.03	4.5	0.275	0.220	7.90	635	62.1
08/27/92	53.9	0.028	1.40	0.07	5.1	0.350	0.200	7.82	642	67.2
09/03/92	168.0	0.014	1.60	0.12	6.4	0.400	0.109	8.04	656	44.8
09/10/92	578.0	0.100	2.60	0.13	3.9	0.920	0.180	7.90	474	26.7
09/17/92	30.5	0.122	1.00	0.04	5.3	0.200	0.138	8.10	701	42.3
09/24/92	66.1	0.021	1.30	0.05	4.0	0.234	0.104	8.17	613	31.2
10/01/92	16.0	0.033	0.79	0.03	6.0	0.200	0.160	8.21	760	49.0
10/08/92	5.0	0.006	0.75	0.03	6.0	0.148	0.098	8.11	726	57.0
10/15/92	28.6	0.028	1.35	0.04	5.1	0.250	1.580	8.08	704	53.2
10/22/92	42.2	0.039	1.14	0.04	5.2	0.170	0.068	8.11	623	32.0
10/29/92		0.017	0.72	0.03	6.1	0.095	0.057	8.16	761	50.7
MIN	5.0	0.001	0.72	0.03	3.2	0.095	0.046	7.59	418	26.7
MAX	578.0	0.490	2.60	0.48	14.5	0.920	1.580	8.34	859	75.1
AVERAGE	96.1	0.059	1.44	0.14	6.4	0.289	0.191	8.01	660	52.1

SITE #2 - DODD'S CREEK AT PAYNE'S MILL

DATE	Susp Solids	Nitrogen - Free Ammonia	Nitrogen - Total Kjeldahl	Nitrogen - Nitrite	Nitrogen - Nitrate	Phosphorus - Total	Phosphorus - Dissolved	pH	Cond. In	Chloride
06/04/92		0.067	2.80	0.14	5.5	0.180	0.102	8.67	65	24.0
06/11/92	24.0	0.004	2.40	0.07	1.9	0.180	0.102	8.16	643	74.7
06/18/92	28.9	0.069	1.50	0.17	2.5	0.260	0.145	7.75	605	70.0
06/25/92	16.0	0.065	2.16	0.06	2.7	0.148	0.108	7.95	610	65.0
07/02/92	21.9	0.063	2.50	0.14	2.1	0.240	0.171	8.05	609	67.0
07/09/92	59.4	0.024	3.50	0.11	2.7	0.370	0.213	7.79	633	72.9
07/16/92	60.6	0.005	1.60	0.10	12.9	0.166	0.047	7.97	814	69.4
07/23/92	41.2	0.006	1.52	0.15	9.5	0.173	0.083	7.88	713	62.5
07/30/92	30.2	0.017	1.85	0.11	7.7	0.130	0.072	8.01	728	57.0
08/06/92	20.8	0.006	2.10	0.20	3.2	0.162	0.111	7.92	703	90.4
08/13/92	20.3	0.021	2.35	0.02	2.2	0.250	0.189	7.92	707	94.0
08/20/92	24.3	0.001	1.60	0.04	3.3	0.235	0.133	7.96	709	75.6
08/27/92	22.9	0.030	1.20	0.07	1.2	0.245	0.102	7.79	583	55.5
09/03/92	48.1	0.021	1.08	0.07	4.2	0.136	0.054	8.01	722	44.0
09/10/92	648.0	0.200	3.18	0.19	2.7	1.240	0.290	7.66	335	20.4
09/17/92	26.9	0.024	1.44	0.06	3.0	0.172	0.132	7.98	741	55.0
09/24/92	30.1	0.015	1.12	0.03	3.4	0.154	0.079	8.07	633	32.8
10/01/92	30.0	0.022	1.19	0.02	2.9	0.159	0.114	8.12	757	59.8
10/08/92	7.4	0.009	0.70	0.02	2.8	0.049	0.037	8.00	774	47.3
10/15/92	14.8	0.052	0.96	0.01	1.9	0.236	0.063	8.02	706	67.1
10/22/92	20.9	0.021	1.14	0.03	4.6	0.128	0.054	7.97	619	33.8
10/29/92	14.6	0.017	0.94	0.01	3.8	0.054	0.032	8.14	746	57.4
MIN	7.4	0.001	0.70	0.01	1.2	0.049	0.032	7.66	65	20.4
MAX	648.0	0.200	3.50	0.20	12.9	1.240	0.290	8.67	814	94.0
AVERAGE	57.7	0.035	1.77	0.08	3.9	0.230	0.111	7.99	643	58.9

SITE M - WEST CATFISH

DATE	Susp Solids	Nitrogen - Free Ammonia	Nitrogen - Total Kjeldahl	Nitrogen - Nitrite	Nitrogen - Nitrate	Phosphorus - Total	Phosphorus - Dissolved	pH	Cond. In	Chloride
06/04/92		0.07	0.8	0.03	0.8	0.088	0.004	8.11	585	44.2
06/18/92	96.5	0.176	1.28	0.04	0.1	0.184	0.017	7.6	601	69.2
07/02/92	16.9	0.056	0.98	0.14	7	0.044	0.005	8.12	643	51.6
07/16/92	77	0.005	2.1	0.15	23.9	0.18	0.045	8.15	812	42.1
07/30/92	53.6	0.023	1.35	0.07	12.6	0.112	0.018	8.26	753	42.1
08/13/92	293	0.02	1.1	0.03	2.8	0.31	0.008	8.07	620	64
08/27/92	19.7	0.045	0.65	0.01	0.6	0.039	0.018	7.74	752	90.5
09/10/92	798	0.3	3.42	0.19	4.3	1.4	0.36	7.66	339	13.5
09/24/92	55.7	0.018	1	0.03	6.9	0.14	0.057	8.15	725	31.1
10/08/92	33.9	0.016	0.6	0.02	4.7	0.025	0.013	8.1	755	46
10/22/92	42.5	0.02	1.06	0.03	7.7	0.144	0.059	8.18	661	29
MIN	16.9	0.005	0.60	0.01	0.1	0.025	0.005	7.6	339	13.5
MAX	798.0	0.300	3.42	0.19	23.9	1.4	0.360	8.26	812	90.5
AVERAGE	148.7	0.068	1.35	0.07	7.1	0.26	0.060	8.00	666	47.9

SITE N - EAST CATFISH

DATE	Susp Solids	Nitrogen - Free Ammonia	Nitrogen - Total Kjeldahl	Nitrogen - Nitrite	Nitrogen - Nitrate	Phosphorus - Total	Phosphorus - Dissolved	pH	Cond. In	Chloride
06/04/92	78.3	0.084	1.55	0.07	1.7	0.205	0.014	8	558	57.3
06/18/92		0.029	2.08	0.03	1.9	0.254	0.017	7.84	494	53.2
07/02/92	43.1	0.081	1.75	0.16	7.5	0.135	0.008	8.15	532	42.9
07/16/92	77.9	0.003	3.1	0.4	27.1	0.565	0.357	7.91	844	53.9
07/30/92	48	0.02	1.5	0.12	11.8	0.145	0.066	8.18	741	48.6
08/13/92	47.7	0.007	1.04	0.05	3.6	0.126	0.015	8.13	663	55.5
08/27/92	59.2	0.112	1.36	0.06	1.1	0.132	0.032	7.85	633	69.4
09/10/92	314	0.2	2.64	0.18	6.7	0.9	0.32	7.63	432	25
09/24/92	32.3	0.013	0.8	0.04	8.4	0.149	0.077	8.13	731	34.9
10/08/92	16.8	0.026	0.66	0.03	5.8	0.048	0.019	8.1	686	43.4
10/22/92	33.2	0.018	1.1	0.03	8.9	0.17	0.085	8.08	671	34.2
MIN	16.8	0.003	0.66	0.03	1.1	0.048	0.008	7.63	432	25.0
MAX	314.0	0.200	3.10	0.40	27.1	0.9	0.357	8.18	844	69.4
AVERAGE	75.1	0.051	1.60	0.11	8.3	0.26	0.100	8.00	643	46.1

SITE #7 -KETTLE CREEK - PORT STANLEY, BRIDGE AT COUNTY RD 21

		- - - - - - - Nitrogen - - - - - - - -				- - Phosphorus - -				
DATE	Susp Solids	Free Ammonia	Total Kjeldahl	Nitrite	Nitrate	Total	Dissolved	pH	Cond. In	Chloride
06/11/92	41.6	0.004	0.64	0.10	3.5	0.090	0.067	8.22	647	57.7
06/18/92	80.6	0.052	1.42	0.10	5.4	0.254	0.092	7.94	640	61.2
06/25/92	79.4	0.107	1.35	0.17	4.6	0.215	0.110	8.13	648	54.2
07/02/92	114.0	0.061	1.60	0.20	4.1	0.254	0.059	8.46	642	59.1
07/09/92	189.0	0.024	1.80	0.17	5.8	0.425	0.112	7.86	599	52.8
07/16/92	113.0	0.018	1.95	0.38	13.4	0.235	0.037	7.80	655	42.7
07/23/92	123.0	0.012	1.60	0.12	10.9	0.235	0.061	8.06	684	46.5
07/30/92	82.7	0.028	1.60	0.12	7.5	0.220	0.074	8.24	673	51.0
08/06/92	53.8	0.011	1.30	0.32	4.6	0.210	0.094	8.33	673	61.3
08/13/92	85.5	0.008	1.26	0.03	4.3	0.224	0.076	8.20	665	55.6
08/20/92	69.7	0.013	1.16	0.03	3.1	0.226	0.092	8.17	642	60.4
08/27/92	78.9	0.028	1.50	0.07	4.1	0.306	0.157	8.26	672	62.1
09/03/92	65.7	0.026	1.05	0.08	5.0	0.180	0.077	8.13	648	39.1
09/10/92	930.0	0.200	2.94	0.15	2.1	1.240	0.170	7.83	389	24.7
09/17/92	49.0	0.015	0.42	0.03	4.4	0.200	0.126	8.12	669	40.5
09/24/92	81.6	0.023	1.35	0.05	3.7	0.295	0.114	8.16	590	30.6
10/01/92	31.1	0.033	0.71	0.03	6.1	0.167	0.116	8.25	728	44.4
10/08/92	25.0	0.030	0.79	0.05	5.0	0.131	0.062	8.44	693	52.9
10/15/92	21.5	0.033	0.73	0.01	3.5	0.092	0.030	8.20	670	47.1
10/22/92	48.3	0.029	1.10	0.05	5.0	0.182	0.067	8.06	629	31.9
10/29/92	26.2	0.053	0.70	0.02	4.9	0.072	0.031	8.15	749	47.7
MIN	21.5	0.004	0.42	0.01	2.1	0.072	0.030	7.80	389	24.7
MAX	930.0	0.200	2.94	0.38	13.4	1.240	0.170	8.46	749	62.1
AVERAGE	113.8	0.038	1.28	0.11	5.3	0.260	0.087	8.14	648	48.7

APPENDIX C

NEWSPAPER ARTICLES

CURB aims at water quality

Aylmer Express Nov 4/1992

Margaret Steele does not expect to solve all water pollution concerns in Elgin but she does expect to have a positive impact on the situation.

As co-ordinator of Clean Up Rural Beaches in Elgin, Mrs. Steele is conducting a five-year program with Catfish Creek and Kettle Creek conservation authorities. Its purpose is to reduce pollution concerns.

The CURB project is a province-wide program of the ministry of environment aimed at improving land management and reducing the impact of pollution on public beaches.

The province has committed $57 million to the project, staggered over a 10-year period.

A graduate of the University of Guelph, she holds a Bachelor of Science degree in Agriculture and specializes in resource management.

Her work began earlier this year and got off to a positive start because many local farmers were already aware of the program. This she said was a result of publicity for similar work in London area.

Voluntary participation by landowners is an important element of the CURB program, said Mrs. Steele. Landowners cannot be forced to participate. "I am sure there are some who should be participating but won't take part."

Concerns about drainage from septic systems, milk wash waste, manure storage are examined with the owner along with cattle access to streams. Possible solutions are suggested and financial assistance for improvements may be available.

"Cost of a manure storage facility can be $20,000 to $30,000 which is out of the reach of some people," she said.

Margaret Steele is working with two local conservation authorities to reduce water pollution in area creeks and streams. The CURB program is sponsored by the provincial government and will last for five years.

In working with the local community, site visits get property owners involved.

Mrs. Steele said on those visits, she travels with land downers to examine any areas of concern they have.

If a problem or potential problem is identified, no one is forced to take corrective action but Mrs. Steele will offer suggestions for solutions.

Water quality is an important consideration and Mrs Steele takes weekly samples from the creeks to determine levels of bacteria such as E coli and their possible source

The tests, she said, will provide an indication of what materials are getting into the water.

Several tests over the past 20-years have indicated a water quality problem in Simpson Drain, a tributary of Catfish Creek, after it passes through the village of Springfield.

CURB water quality tests further downstream will not be adversely affected by Simpson Drain pollution, she said.

At the same time, her project will have no impact on whether or not corrective measures are taken in the village.

"We are staying away from industrial and municipal problems," she said. "It would use up all the money just to do those projects."

"We will leave it for the government to look after the village. When we're finished with the CURB program, we'll have done our bit to clean up the creek."

For the first two years, the program will concentrate on studying and testing water quality and bacteria counts. A steering committee of local health, environmental, and conservation officials will study apparent problem areas and submit recommendations for funding to the ministry of environment.

Wet weather this summer has made her task more difficult. The increased run-off, she said, may have increased bacteria counts in the waterways.

"There is so much we don't know about bacteria and the way it travels but any information we can gather will be helpful," she said.

The eastern Ontario native said working in this area has been a learning experience.

Rivers in this area are "quite brown" compared to the waterways she is more familiar with. She suspected the colour difference was a result of different agricultural practices.

She refrained from comment on water quality saying the program was still in its first year and thus too early to assess accurately.

TJ - Mon June 15/92

Conservation areas working to clean up rural beaches

Goal to reduce bacteria content in watersheds

By TOM FROESE
Staff Reporter

Elgin County's two conservation authorities are working together to clean up the rural beaches in their watersheds.

Kettle Creek and Catfish Creek conservation authorities (KCCA and CCCA) are spening $40,000 to test the water at several rural beaches, and will then access provincial money to reduce bacteria content.

The province is making $57 million available over the next 10 years to clean up rural beaches.

The move is geared as a preventative measure to keep more beaches in Ontario from closing. Area beaches are not yet laden with as much bacteria as some others in the province, say officials, but water pollution is a growing concern.

Many beaches in the Toronto and London area have been closed recently due to high bacteria counts. In Elgin County the Dalewood reservoir, formerly used by swimmers wanting to cool off, has been closed for several years.

It's hoped it will eventually be reopened, said Margarget Steele, the CURB (Clean Up Rural Beaches) technician, Friday. She's been hired by the KCCA and CCCA to initiate the CURB program.

The conservation authorities are now testing for bacteria levels at 14 locations, focusing on beaches at Springwater, Dalewood, Lake Whittaker, Port Bruce, and Port Stanley.

By the summer of 1993 the conservation authorities are expected to know the trouble points, and will be able to access provincial money to give grants to farmers to stop sources of pollution such as manure runoff and milk house waste.

"It's completely voluntary. We're not out to get anyone," said Mrs. Steele.

She said she expects more people to become aware of the program in the next several months.

Farmers will be able to access a maxium of $10,000 for livestock access restriction, $12,000 for milkhouse storages, $5,000 for milkhouse washwater systems, and $2,000 for private sewage systems.

Kim Smale, general manager of the CCCA, said the rural beaches may also be getting polluted from urban sources. Industrial waste and sewer runoffs could be sources of pollution, he said.

But urbanites will have access money from other sources, not CURB, to stem any pollution from urban sources.

At a glance

THE ISSUE: Stemming the flow of pollution in rural beaches.

HOW: The province is making $57 million available over the next 10 years. Farmers can access money to stop pollution from such sources manure runoff and milkhouse waste. The program is volunary.

LOCAL AFFECT: Rural beaches in Springwater, Dalewood, Lake Whittaker, Port Stanley and Port Bruce are now being tested. It's hoped the Dalewood reservoir will eventually be re-opened for swimming.

APPENDIX D

LANDOWNER SURVEY

WATER QUALITY QUESTIONNAIRE

THIS QUESTIONNAIRE IS STRICTLY CONFIDENTIAL.

NAME: _____ DATE: _____
ADDRESS: _____ PHONE: _____
_____ TOWNSHIP: _____
_____ LOT/CON: _____
LOT SIZE: _____

SECTION 1: CROPS AND DRAINAGE

TOTAL FARM ACRES: _____

CROP	# OF ACRES	ACRES TILED	RANDOM(%)	SYSTEMATIC(%)
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

SECTION 2: TYPE OF ENTERPRISE

LIVESTOCK	NUMBER					
DAIRY	COWS _____	CALF _____	HEIFERS _____			
BEEF	COWS _____	CALF _____	SLAUGHTER STEERS _____			
SWINE	FARROWING _____	FEEDER _____				
POULTRY	BROILERS _____	LAYERS _____	BREEDERS _____			
HORSES	_____					
SHEEP	_____					
OTHER	_____					

CROPS CHECK CROPS WHERE MANURE IS USED AS FERTILIZER

Indicate liquid or solid manure.

_____ _____
_____ _____
_____ _____
_____ _____
_____ _____
_____ _____

SECTION 3: MANURE MANAGEMENT

SOLID MANURE

MANURE STORED: INSIDE ____ OUTSIDE ____ ON PAD _____
IN FEEDLOT ____ ON GROUND _____

PAD DIMENSIONS _____

A) HOW OFTEN IS PAD SCRAPED? _____

B) ARE THERE WALLS AROUND PAD? YES ____ NO _____

C) IS THERE RUNOFF CONTAINMENT YES ____ NO _____
IF YES, TYPE? POND _____ TANK _____ CAPACITY _____
DIMENSIONS _____
DAYS STORAGE: _____

D) HOW CLOSE IS THE NEAREST TILE OR OPEN DITCH? _____

LIQUID MANURE

COVERED TANK _____ OPEN TANK _____ EARTHEN PIT _____
DIMENSIONS _____
CAPACITY _____
DAYS STORAGE: _____

E) HOW CLOSE IS THE NEAREST OPEN DITCH OR CREEK? _____
_____

F) DO YOU SPREAD ON YOUR OWN PROPERTY OR ON NEIGHBOURS AS WELL?
_____

G) WHAT 2 SOURCES OF INFORMATION ARE THE MOST USEFUL TO YOU CONCERNING MANURE MANAGEMENT AND STORAGE?

DEMONSTRATIONS _____ EQUIPMENT DEALERS _____

FACT SHEETS _____ FARM NEWSPAPERS/MAGAZINES _____

OMAF CANADA PLAN INSURANCE _____

ONTARIO AGRICULTURAL CODE OF PRACTICE _____
OTHER _____

H) HOW FAR IS YOUR WELL FROM YOUR MANURE STORAGE? _____

SECTION 4: FEEDLOT/CEMENT YARD/EXERCISE YARD

NUMBER OF AND TYPE OF ANIMALS USING FEEDLOT/YARD? _____
_____
DIMENSIONS OF LOT/YARD: _____

IS THE YARD ROOFED? YES ____ NO _____
PAVED? YES _____ NO _____
EAVESTROUGHS? YES _____ NO _____
RETAINING WALLS? YES _____ NO _____
RUNOFF CONTAINMENT? YES _____ NO _____
IF YES, DESCRIBE: _____

DISTANCE TO NEAREST TILE OR OPEN DITCH: _____
NUMBER OF MONTHS IN USE: _____
HOURS PER DAY USED: _____
NUMBER OF CLEANOUTS PER YEAR: _____

SECTION 5: MANURE APPLICATION

TYPE OF APPLICATION _____

TIME OF APPLICATION SPRING _____ SUMMER _____
FALL _____ WINTER _____

A) HOW MANY ACRES ARE SPREAD WITH MANURE? _____

B) IS THE LAND TILLED BEFORE SPREADING? _____

C) ESTIMATE THE RATE OF APPLICATION:

_____ GAL/ACRE _____ TONS/ACRE

D) IS THE MANURE WORKED IN AFTERWARDS? YES ____ NO _____
IF YES, HOW SOON AFTERWARDS? _____

E) DO YOU HAVE YOUR SOIL TESTED? YES ____ NO ____
IF YES, HOW OFTEN? _____

F) TYPE OF SOIL: _____

G) DO YOU HAVE YOUR MANURE ANALYZED: YES ____ NO ____
IF YES, HOW OFTEN? _____

H) HOW MUCH VALUE DO YOU FEEL MANURE HAS IN YOUR OPERATION?
NO VALUE ____ MINOR VALUE _____ MODERATE VALUE _____
CONSIDERABLE VALUE ____ VERY GREAT VALUE ____
WHY? _____

SECTION 6: STORAGE IMPROVEMENTS

A) HAVE YOU CHANGED OR IMPROVED YOUR HANDLING OR STORAGE SYSTEM IN THE LAST 5 YEARS? YES ____ NO ____
IF YES, WHY DID YOU MAKE THE CHANGES? _____
_____

B) DO YOU FEEL OTHER IMPROVEMENTS ARE REQUIRED? YES ____ NO ____
EXPLAIN: _____
IF NO:

C) WOULD YOU BE INTERESTED IN IMPROVING OR CHANGING YOUR MANURE STORAGE SYSTEM?
IF YES, WHY? _____

IF NO, GIVE REASONS: ECONOMIC ____ NEAR RETIREMENT _____
OPERATION TOO SMALL ____ NOT REQUIRED ____
INSUFFICIENT ON FARM BENEFITS _____
OTHER _____

D) IF GRANTS WERE AVAILABLE WOULD YOU UPGRADE THE PRESENT MANURE STORAGE SYSTEM? YES ____ NO ____

SECTION 7: DAIRY

TYPE OF SYSTEM: PIPELINE ____ PARLOUR ____
WHAT HAPPENS TO THE WASH WATER?
SEPTIC TANK ____ HOLDING TANK _____ LAGOON ____
MANURE STORAGE SYSTEM ____ TILE DRAIN ____ TRENCH ____
OTHER: _____

SECTION 7B: VOLUME OF WASHWATER/MILKING

NO OF CYCLES PER DAY: _____
IS THE FIRST RINSE FED TO CALVES? YES ____ NO ____
IF NO, WHY NOT? _____

SECTION 8: LIVESTOCK ACCESS

DO LIVESTOCK WATER IN STREAM/DITCH? YES ____ NO ____
IS ACCESS TO STREAM UNLIMITED ____ LIMITED ____
IF LIMITED DESCRIBE: _____
LENGTH OF STREAMBANK ACCESSIBLE TO ANIMALS: _____
DAYS/YR PASTURED: _____ % OF DAY PASTURED: _____
ACREAGE OF PASTURE: _____

SECTION 9: EROSION CONTROL

A) DO YOU HAVE A BUFFER STRIP ALONG THE DITCH OR CREEK? YES ____ NO ____

B) DO YOU HAVE WINDBREAKS ON YOUR FARM? YES _____ NO _____

C) DO YOU HAVE ANY GRASSED WATERWAYS? YES _____ NO _____

D) WHAT PERCENTAGE OF THE NATURAL DRAINAGE PATHWAYS ARE UNDER GRASS?
_____

E) ARE YOUR FIELDS SUFFERING FROM SIGNIFICANT GULLY EROSION? YES ___Non ___

F) DO YOU PRACTICE CROP ROTATION? YES _____ NO _____

SECTION 10: SEPTIC SYSTEM

HOW MANY BEDROOMS DOES THE HOUSE HAVE? _____
AGE OF SYSTEM _____
HAS IT EVER BEEN INSPECTED? _____
HAVE YOU MADE ANY CHANGES TO YOUR SYSTEM SINCE YOU MOVED IN? _____
_____

HAVE YOU ALTERED YOUR WATER USE IN ANY WAY? (# OF PEOPLE, ADDED BATHROOM) _____

WHAT KIND OF WASTE ENTERS THE SEPTIC SYSTEM:
TOILET(S) ____ SINK(S) _____ DISHWASHER _____
SHOWER/BATHTUB(S) _____ LAUNDRY _____
OTHER _____

SYSTEM DESCRIPTION
SIZE OF TANK _____
SIZE OF WEEPING BED (NUMBER OF FEET) _____
SOIL TYPE AROUND BED _____
LOCATION OF WEEPING BED (PLEASE DRAW A MAP ON THE BACK SHOWING THE BED IN RELATION TO THE HOUSE)
HOW FAR AWAY IS THE WELL FROM THE SEPTIC SYSTEM? _____
WHAT IS THE DISTANCE TO AND ARE THERE ANY CONNECTIONS TO:
FIELD TILES _____
CREEKS, DRAINS _____

IF GRANTS WERE AVAILABLE WOULD YOU UPGRADE THE PRESENT SEPTIC SYSTEM?
TECHNICAL ASSISTANCE YES ____ NO ____
FINANCIAL ASSISTANCE YES ____ NO ____

SECTION 10B: HISTORY (MAINTENANCE)

HAVE YOU EVER HAD PROBLEM WITH BACKUPS, PONDING OF WATER, ETC?
_____
_____

IS SYSTEM IN NEED OF REPAIRS NOW? YES ____ NO ____
WHAT, IF ANYTHING, HAS BEEN REPAIRED? _____
_____

HOW OFTEN IS THE TANK PUMPED OUT? _____
WHEN WAS THE TANK LAST PUMPED OUT? _____
DO YOU REGULARLY HAVE YOUR WATER TESTED? YES ____ NO ____

ADDITIONAL COMMENTS: PLEASE GIVE YOUR COMMENTS ON THE FOLLOWING

ALGAL BLOOMS
FISH KILLS
SEDIMENTATION LOADING
OXYGEN DEPLETION
WATER QUALITY
NITROGEN