

***WATER QUALITY STUDY OF
THE BARGE CANAL***

Brockport to Montezuma Wildlife Refuge

2003

***Delta Laboratories, Inc.
Rochester, NY***

Prepared by:
Kenneth R. Applin, Ph.D.
KR Applin & Associates
8806 Route 256
Dansville, NY 14437

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Table of Contents

	<u>Page No.</u>
1.0 INTRODUCTION	1
2.0 SAMPLING AND ANALYSIS	2
3.0 RESULTS	3
3.1 Field Parameters	3
3.2 BOD ₅ , Nitrate, and Phosphorus	4
3.3 Chloride and Alkalinity	4
3.4 Metals	5
3.5 Coliform Bacteria	5
4.0 CONCLUSIONS	7
5.0 REFERENCES	8

List of Tables

	<u>Follows Page</u>
Table 1 Sample Locations	2
Table 2 Summary of Analytical Results for Phase 1 and Phase 2 Sampling	3

APPENDIX A Graphical Summary of Analytical Results
APPENDIX B Laboratory Analytical Data

2.0 SAMPLING AND ANALYSIS

The sample locations included in both the Phase 1 and 2 studies are listed in Table 1. The samples included in the Phase 1 study were collected on June 26, 2003. Those included in the Phase 2 study were collected on September 22, 2003. All samples were collected by personnel from Delta Laboratories, Inc. and delivered to Columbia Analytical Services, Inc., Rochester, New York, for laboratory analysis.

At each sampling location, field measurements of temperature, pH, specific conductance, dissolved oxygen (DO), and turbidity were performed prior to sample collection by Delta Laboratories personnel. Samples for laboratory analysis were collected as grab samples taken from the edge of the canal using a long-handled plastic scoop. The samples were collected in sample containers provided by Columbia Analytical Services and delivered to Columbia Analytical Services for laboratory analysis within 24 hours of collection.

Laboratory analyses of the samples were performed in accordance with methods established by the United States Environmental Protection Agency (USEPA). Each sample was analyzed for selected water quality indicator parameters including 5-day biological oxygen demand (BOD₅), total phosphorus, nitrate, chloride, alkalinity, total coliform bacteria, E. coli, and fecal coliform bacteria. The samples were also analyzed for six trace metals including cadmium, chromium, copper, lead, nickel, and zinc.

1.0 INTRODUCTION

This report provides the results of a water quality study performed during 2003 by Delta Laboratories, Inc. on sections of the Barge Canal extending west and east of the City of Rochester, New York. This study expands on a previous water quality study conducted during August 2001 by Delta Laboratories on a section of the canal bordering the south side of the City and extending from the Town of Chili to the Town of Pittsford (KR Applin and Associates, Dec. 2001).

The present study was conducted in two phases. Phase 1 was conducted during June 2003 and involved the collection of water samples at seven locations along a section of the canal beginning at Fairport, New York, and extending east to the Montezuma Wildlife Refuge, Seneca County. Phase 2 was conducted in September 2003 and involved the collection of seven samples starting at the boat launch east of Clover Street (Route 65) in the Town of Pittsford and extending west to Brockport, New York. Each sample was analyzed for a variety of water quality indicator parameters to evaluate overall water quality and to identify potential impacts to the canal.

Under 6 NYCRR, Chapter X, Article 5, Sect. 820.4, the Barge Canal is classified as a Class B surface water body. The best usages of Class B waters are defined as primary and secondary recreation and fishing (6 NYCRR, Chapter X, Part 701). Primary recreational activities include those activities (e.g., swimming) where there is direct human contact with the water. Secondary activities include activities such as fishing and boating where direct contact with the water is minimal and ingestion of the water is not probable. The New York State Department of Environmental Conservation (NYSDEC) provides limits on the concentrations of various water quality parameters that are required to maintain the quality of Class B waters (6 NYCRR, Ch. X, Part 703). Limits or standards are not provided for all of the parameters included in this study. However, where applicable, the standards were used to assess the overall water quality of the canal.

TABLE 1

Sample Locations

	PHASE 1 (6/26/03)	PHASE 2 (9/22/03)
1	Montezuma Refuge (Rt 89, Mays Point)	Pittsford (boat launch on Clover St.)
2	Clyde (boat launch)	Winton Rd.
3	Lyons (lock # 27)	Genesee Valley Park
4	Newark (brdge at NY Rt 88)	Lee Rd.
5	Palmyra (bridge at NY Rt 21)	Long Pond Rd.
6	Macedon (bridge at Rt 350)	Spencerport
7	Fairport (canal park at Rt 31F)	Brockport

3.0 RESULTS

The analytical results are summarized in Table 2 and also presented graphically in Appendix A for various groupings of the chemical parameters (i.e., field parameters, inorganic analytes, and bacteria counts). The sample results for both the Phase 1 and Phase 2 samples were plotted on each graph and ordered from west to east to examine possible spatial trends within the data. The field data forms, laboratory analytical results, and chain of custody records are provided in Appendix B. A discussion of the results is provided in the following sections.

3.1 Field Parameters

The field measurements of temperature, pH, DO, and turbidity were evaluated using the graph provided in Appendix A. As shown in the graph, the temperature measurements taken at both the Phase 1 and Phase 2 locations varied slightly around 25 °C. No significant change in temperature was observed between the Phase 1 and Phase 2 samples even though they were taken about three months apart.

The pH values of the Phase 1 samples varied slightly ranging from 9.04 at Lyons to 9.31 at Newark. Overall, these pHs are high relative to the values exhibited by most natural waters and exceed the Part 703 standard (pH must be between 6.5 and 8.5). By comparison, the pHs of the Phase 2 samples ranged from 6.67 at the Clover St. site to 7.79 at Brockport and are within the range of "normal" pHs. The higher readings obtained for the Phase 1 samples are not thought to be representative of the canal water and are likely the result of an error in the instrument calibration.

The dissolved oxygen (DO) readings follow a trend similar to that observed for pH. The DO values for the Phase 1 samples ranged from 8.9 mg/L at Lyons to 11.6 mg/L at the Montezuma site whereas those for the Phase 2 samples ranged from 5.09 mg/L at Genesee Valley Park to 6.10 at the Clover St. site. As with the pH measurements, the differences in the range

TABLE 2

Summary of Analytical Results for Phase 1 and Phase 2 Sampling

Phase 1

	Fairport	Macedon	Palmyra	Newark	Lyons	Clyde	Montezuma
pH	9.24	9.14	9.14	9.31	9.04	9.11	9.27
Sp.C. (mS/cm)	0.651	0.686	0.769	0.961	0.957	0.975	1.09
Temp (deg C)	24.8	24.3	25.0	26.1	24.0	24.9	24.3
Turbidity (NTU)	26	6	2	5	6	7	19
DO (mg/L)	10.13	10.04	9.77	11.33	8.90	9.95	11.60
Total Coliform (col/100ml)	130	127	487	127	293	133	133
E. Coli	pos	pos	pos	pos	pos	pos	pos
Fecal Coliform (MPN/100ml)*	40	90	400	70	170	40	80
BOD5 (mg/L)	<2.0	2.52	<2.0	2.31	<2.0	5.35	6.66
Chloride (mg/L)	52.4	64.0	72.1	92.0	76.0	70.7	85.0
Nitrate (mg/L)	0.793	<0.5	<0.5	<0.5	0.87	0.773	<0.5
Alkalinity (mg/L)	132	145	155	167	187	207	210
Phosphorus (mg/L)	0.0657	0.0746	0.0830	0.0899	0.1040	0.1430	0.1880
Cadmium (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chromium (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper (mg/L)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Lead (mg/L)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Nickel (mg/L)	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Zinc (mg/L)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

Phase 2

	Brockport	Spencerport	Long Pond Rd	Lee Rd	Gen. Val. Pk	Winton Rd	Clover St.
pH	7.79	7.60	7.78	7.65	7.18	6.70	6.67
Sp.C. (mS/cm)	0.471	0.436	0.438	0.429	0.476	0.464	0.472
Temp (deg C)	24.4	25.0	25.3	25.4	24.3	25.4	25.3
Turbidity (NTU)	10.9	5.8	4.9	5.0	9.5	7.7	10.0
DO (mg/L)	5.68	5.59	6.50	5.48	5.09	5.78	6.10
Total Coliform (col/100ml)	80	40	52	20	232	460	72
E. Coli	pos	pos	pos	pos	pos	pos	pos
Fecal Coliform (MPN/100ml)	2	2	2	2	4	8	2
BOD5 (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Chloride (mg/L)	34.5	29.8	31.1	30.1	39.3	37.6	36.8
Nitrate (mg/L)	0.0106	<0.01	<0.01	<0.01	0.0139	0.0117	0.0113
Alkalinity (mg/L)	110	108	104	118	124	124	122
Phosphorus (mg/L)	<0.05	<0.05	<0.05	0.0513	<0.05	<0.05	<0.05
Cadmium (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chromium (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper (mg/L)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Lead (mg/L)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Nickel (mg/L)	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Zinc (mg/L)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

* MPN = most probable number of fecal coliform forming units

of DO values measured at the Phase 1 and Phase 2 sites may be due to differences in the instrument calibration performed on the two sampling dates. Nonetheless, the DO readings of all the samples are above the Part 703 standard of 5.0 mg/L.

As shown on the graph in Appendix A, the turbidity of the samples varied considerably. Spikes in the turbidity readings occurred at the Fairport and Montezuma sites. However, significant variation in turbidity is expected due to changes in the suspended load of the water at various points along the canal. In addition, turbidity alone is not a reliable indicator of the presence of other chemical contaminants.

3.2 : BOD₅, Nitrate, and Phosphorus

The results for BOD₅, nitrate, and total phosphorus are plotted together on a graph in Appendix A. The BOD₅ results were less than 2.0 mg/L (i.e., not detected) in most of the samples. Detectable levels of BOD₅ were found in the samples from the Macedon, Newark, Clyde, and Montezuma sites, but these levels are not significantly elevated above the detection limit of 2.0 mg/L and do not indicate a possible impact to the canal waters at these locations.

Likewise, nitrate and total phosphorus were detected in several of the samples but at levels slightly above their detection limits.

3.3 Chloride and Alkalinity

The graph of the chloride and alkalinity results (Appendix A) show increasing levels of these analytes proceeding from the Brockport site easterly to the Montezuma site. The concentrations are within the range expected for natural waters. Thus, the increasing levels of these analytes are most likely due to natural causes such as a change in geologic materials along the canal route.

A comparison of the Phase 1 and 2 sampling locations to maps of the bedrock geology (Rickard and Fisher, 1970)

shows that in areas west of Rochester (i.e., Brockport to Spencerport) the canal flows over bedrock consisting of Lower Silurian sandstones and shales. From Spencerport east to the Montezuma site, the canal flows over bedrock dominated by Upper Silurian limestones and dolostones that occasionally contain interbedded salt deposits. Contact of the canal water with these carbonate-bearing limestones and dolostones would increase the alkalinity and chloride content of the canal water.

3.4 Metals

None of the samples collected at the Phase 1 and Phase 2 sites contained detectable levels of the six metals listed in Section 2.0 above.

3.5 Coliform Bacteria

The water quality standards for total and fecal coliform bacteria in surface water are provided in 6 NYCRR, Chapter X, Part 703. For Class B surface waters, the monthly median total coliform count from a minimum of five samples should not exceed 2,400 colonies per 100 milliliters (col/100ml). The monthly geometric mean of fecal coliform counts taken from a minimum of five samples should not exceed 200 col/100ml.

Although the bacteria counts obtained from this study were performed on single samples, the results were compared to the median- and mean-based standards for the purpose of identifying potential water quality impacts.

The results of the coliform bacteria analyses are listed in Table 2 and are shown graphically in Appendix A. None of the samples exceeded the monthly median standard of 2,400 col/100ml for total coliform. However, two of the Phase 1 samples (Palmyra and Lyons) and two of the Phase 2 samples (Genesee Valley Park and Winton Road) exceeded the mean monthly limit of 200 col/100ml for fecal coliform. The higher results in these samples relative to adjacent sampling sites may indicate possible point sources of contamination.

A comparison of the fecal coliform results for the Phase 1 and Phase 2 samples shows significantly higher counts in the Phase 1 samples, which were sampled in June. The Phase 2 samples were collected in September. In addition, a comparison on the total and fecal coliform results shows that a significant portion of the total coliform counts in the Phase 1 samples was due to fecal coliform. These results suggest that there may be a strong seasonal effect on the fecal coliform levels in the canal.

The coliform results also show that each of the samples tested positive for the presence of *E. coli* indicating possible recent contamination by fecal material.

4.0 CONCLUSIONS

The analytical results for the Phase 1 and Phase 2 Barge Canal samples indicate that the canal water is of generally good quality. The results for most of the water quality parameters analyzed as part of this study were within the range of naturally-occurring concentrations and within the limits established for Class B surface waters. The pH values of the Phase 1 samples exceeded the 6.5 to 8.5 range established for Class B waters, but the measurements are believed to be biased high due to a possible error in instrument calibration.

Spatial trends within the analytical results were observed for alkalinity and chloride, which exhibited gradually increasing concentrations from the western to the eastern sampling sites. These increases were attributed to changes in the bedrock geology.

The fecal coliform results exceeded the mean monthly limit for Class B waters (200 col/100ml) in two of the Phase 1 samples (Palmyra and Lyons) and two of the Phase 2 samples (Genesee Valley Park and Winton Road). The higher results in these samples relative to adjacent sampling sites may indicate possible point sources of contamination at or near these sampling locations. However, the total coliform bacteria counts at these locations were well below the monthly median standard of 2,400 col/100ml.

5.0 REFERENCES

KR Applin and Associates, 2001, Water Quality Study of the Erie Canal, Monroe County, New York: prepared for Delta Laboratories, Inc., Rochester, NY; 7 pp. and attachments.

6 NYCRR Chapter X, Part 701, Classifications – Surface Waters and Groundwaters: amended March 1998.

6 NYCRR Chapter X, Part 703, Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations: amended August 1999.

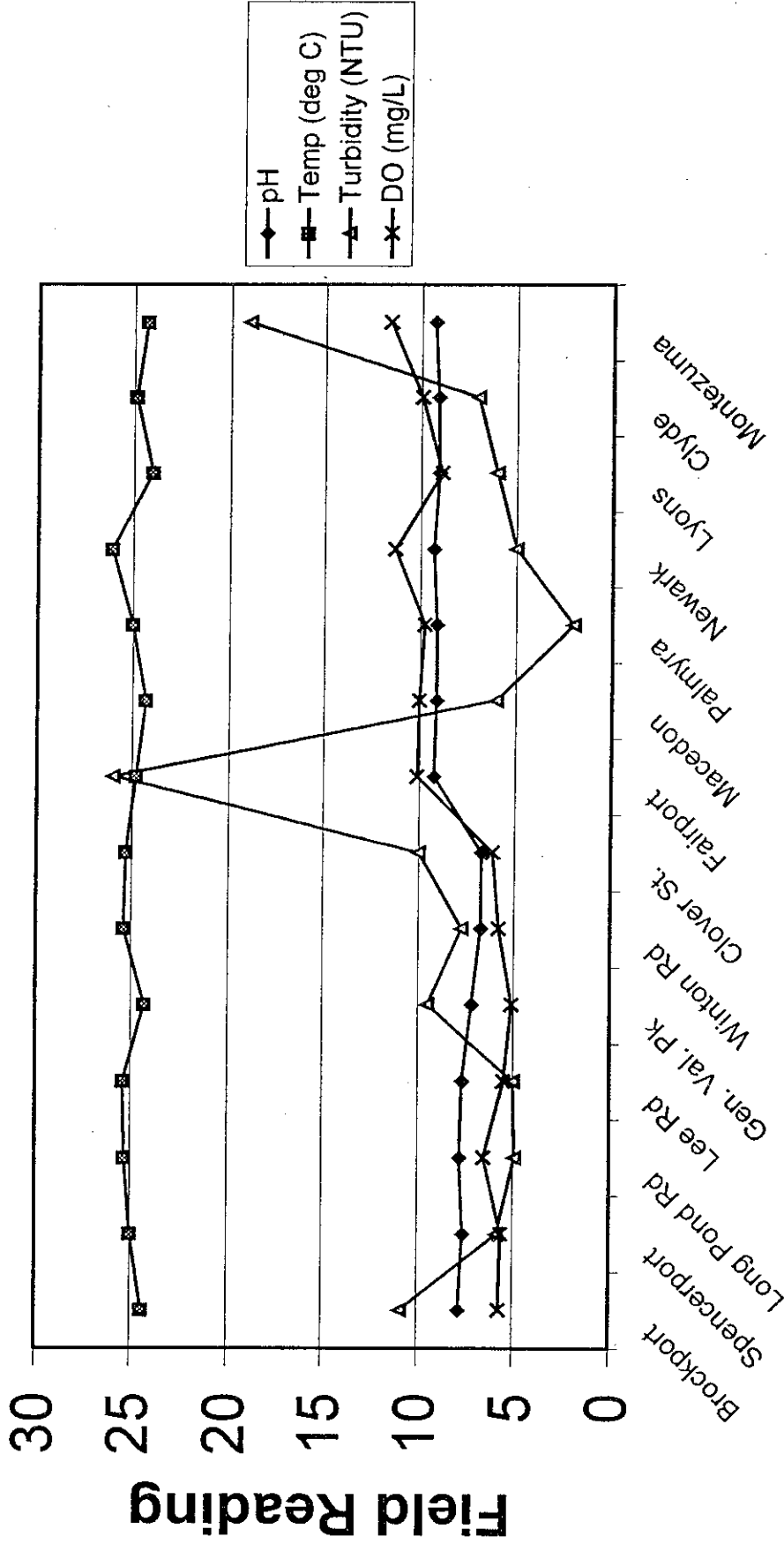
Rickard, L.V. and Fisher, D.W., 1970, Geologic map of New York – Finger Lakes Sheet: New York State Museum and Science Service, Map and Chart Series No. 15.

Rickard, L.V. and Fisher, D.W., 1970, Geologic map of New York – Niagara Sheet: New York State Museum and Science Service, Map and Chart Series No. 15.

Appendix A

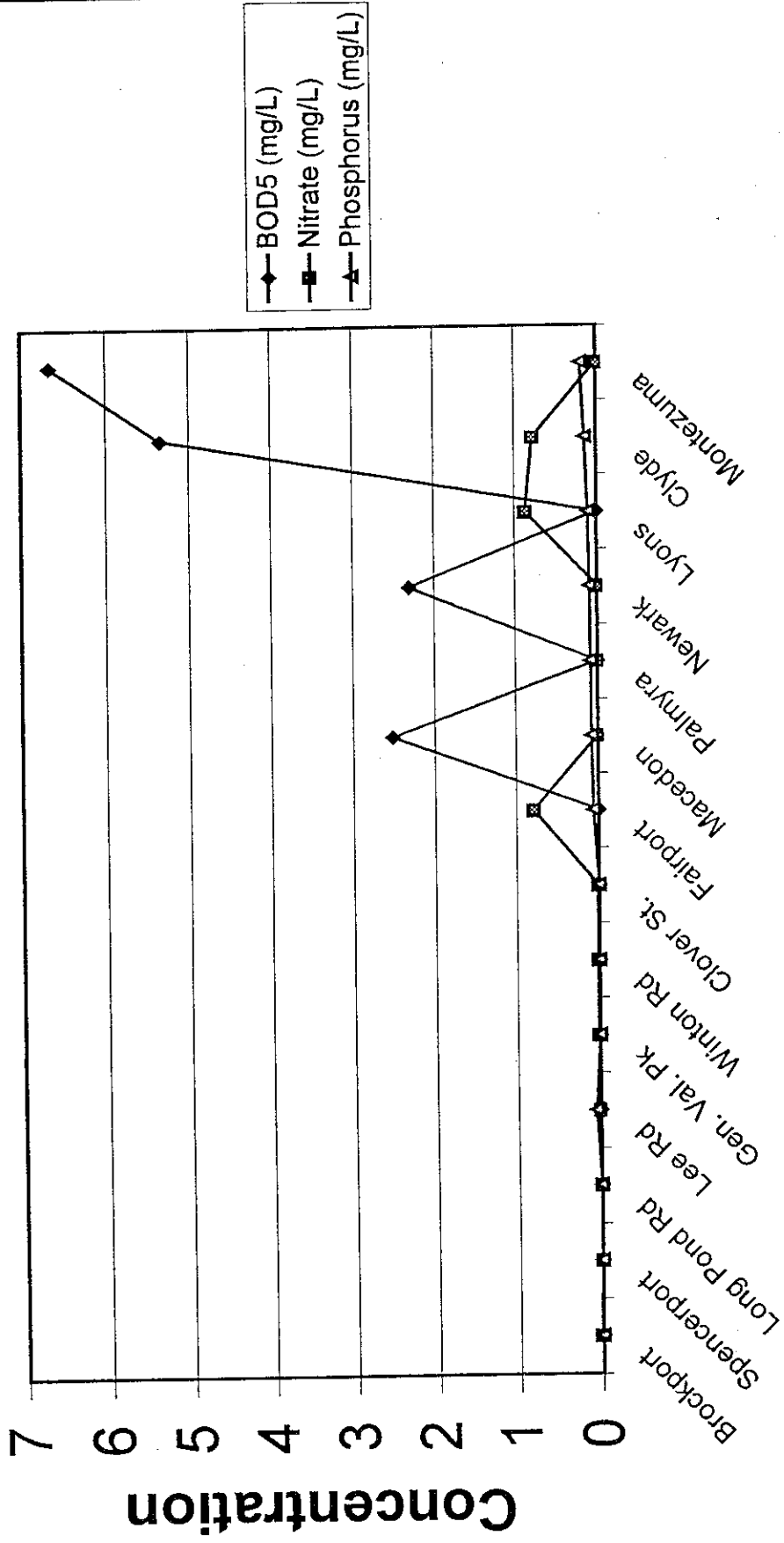
Graphical Summary of Analytical Results

Barge Canal Phases 1 & 2



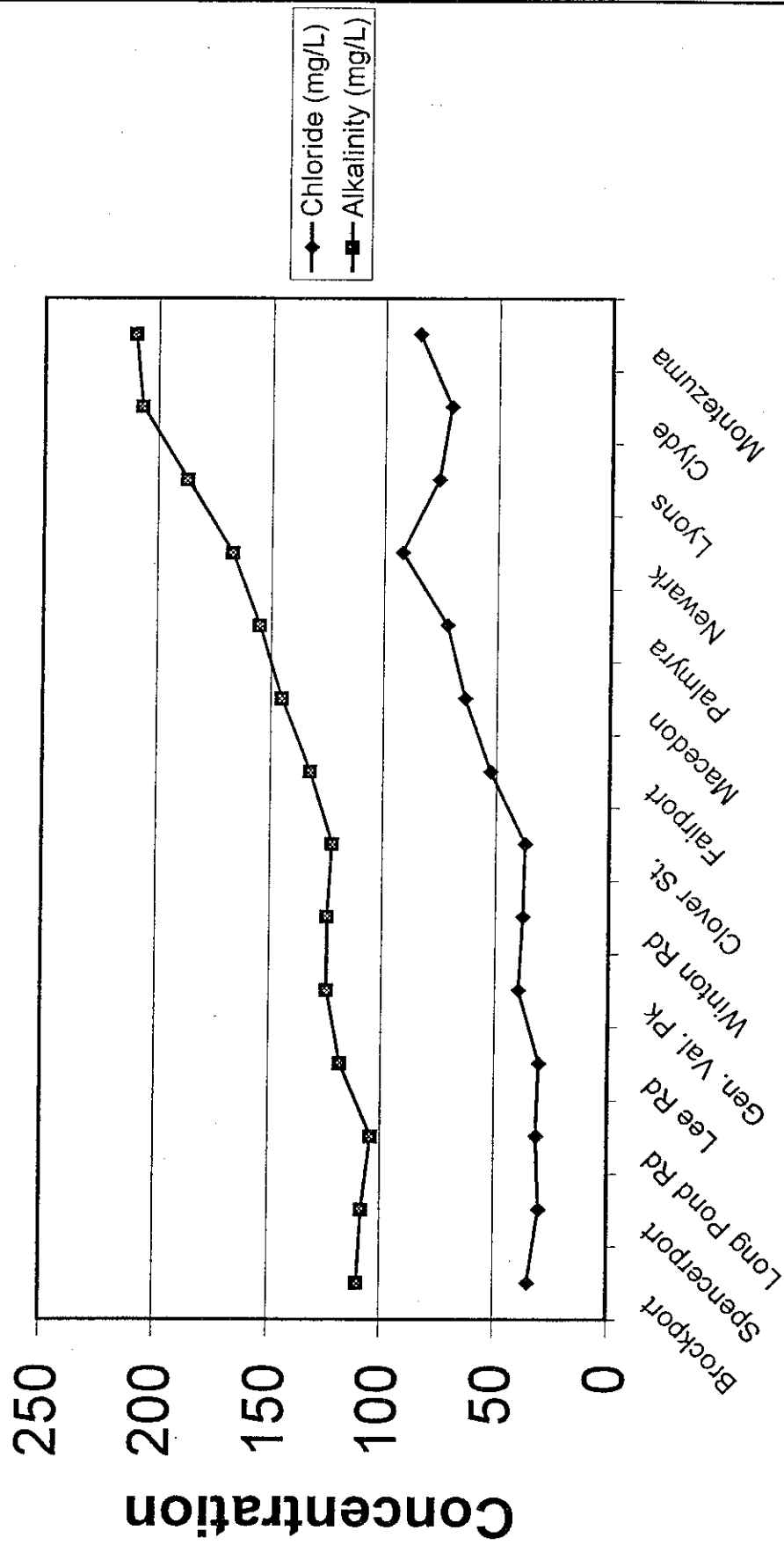
Sampling Location

Barge Canal Phases 1 & 2



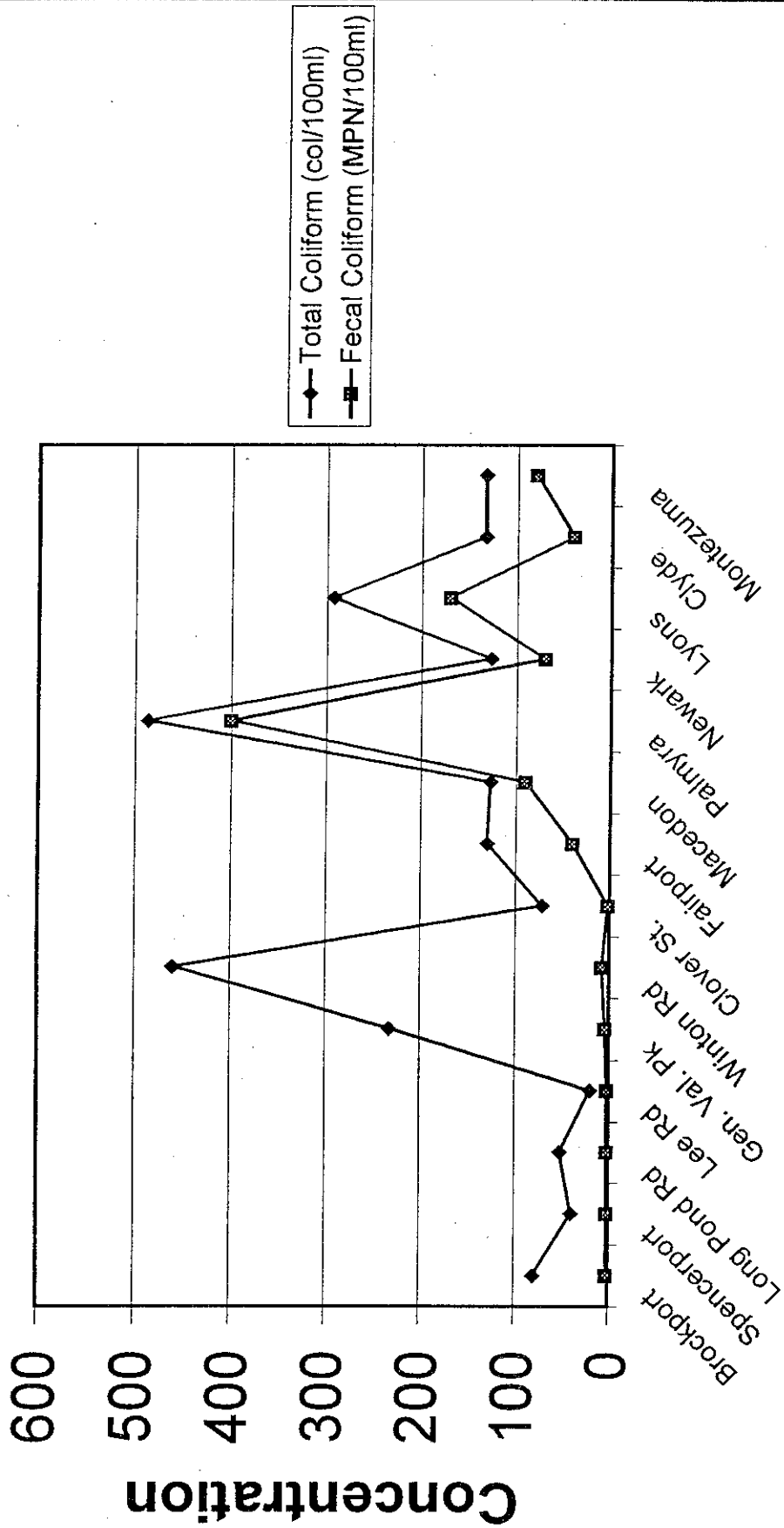
Sampling Location

Barge Canal Phases 1 & 2



Sampling Location

Barge Canal Phases 1 & 2



Sampling Location