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REPORT  
TO THE  
INTERNATIONAL JOINT COMMISSION  
ON THE  
NIAGARA RIVER

NIAGARA RIVER WATER QUALITY  
INVESTIGATIONS IN 1971

U.S. ENVIRONMENTAL PROTECTION AGENCY  
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION  
ONTARIO WATER RESOURCES COMMISSION

MARCH 1972

## NIAGARA RIVER WATER QUALITY

### INVESTIGATIONS IN 1971

This report on Niagara River Water Quality presents data for the 1971 water year (Oct. 1, 1970 to Sept. 30, 1971) collected by the Ontario Water Resources Commission, New York State Department of Environmental Conservation, the Buffalo Sewer Authority and the Environmental Protection Agency. Some additional data for prior years are included for comparison purposes.

The Ontario Water Resources Commission made five to seven surveys at eleven Niagara River ranges plus some additional sampling at Range Ni-34.3. Tables III and IV contain only OWRC data except for ranges 35.8, 35.2 and 19.0. OWRC also collected data for additional parameters which are not included in this report. Data presented in the remaining tables and for ranges 35.8, 35.2 and 19.0 were provided by the other cooperating agencies.

Buffalo River data is presented in Table I. Table II contains 1971 and some prior data at the source and the mouth of the Niagara for comparison purposes. Table V shows the phenol concentration present at various locations along the U.S. shore which indicate the influence of the major individual U.S. waste phenol discharges. Table VI contains coliform and phenol data for the ranges immediately upstream and downstream of the Buffalo sewage treatment plant discharge. It shows the immediate effect of this effluent on the coliform and phenol concentrations in the river.

The Buffalo Sewer Authority used the multiple tube dilution method for total and fecal coliform determinations. Except for Ohio Street, all of the Buffalo River coliform data, range 35.8 data in Table III and that in Table VI were provided by the Authority. The other coliform data presented were

determined by the membrane filter procedure.

#### BACTERIOLOGICAL QUALITY

The data indicates that the bacteriological quality of the rivers have remained relatively the same in recent years. The median coliform concentration in the water entering from Lake Erie is consistently below 100 per 100 milliliters. It is generally below a few hundred in the Canadian waters of the Upper River. It exceeds 1000 at all points and 2400 at most locations near the U.S. shore. The median concentration of fecal coliforms were less than 200/100 ml except at sampling points within 300 feet of the U.S. shore at ranges Ni 37.7, 35.8, 34.3 and 19.3.

Data presented in Table VI shows the effect of the Buffalo River extending out to 500 feet from the U. S. shore at range 35.7. The contribution of the Buffalo Sewer Authority plant is reflected by the data at range 34.3. Its combined effect with the Buffalo River apparently does not extend beyond 700 ft. from the U. S. shore at this location.

Other significant U.S. sources of bacteriological contamination to the Upper River include the Town of Tonawanda, Town of Grand Island, City of Tonawanda, City of North Tonawanda sewage treatment plant effluents, the discharge from Cayuga Creek immediately upstream of the City of Niagara Falls and storm water overflows from the municipal sewerage systems. Some storm water overflows are known to activate with relatively little precipitation. Sampling point locations were inadequate to pinpoint the effect on the river of the above individual communities.

The sewage treatment plants of Niagara Falls, New York and Ontario, and

Lewiston, New York, discharge effluent to the Lower River. The median coliform concentrations in this sector were found to be about the same as in previous years, approximately 2400 per 100 ml in all sectors of the River. Median fecal coliform concentrations were generally less than 200/100 ml at all sampling points in the Lower Niagara River.

#### PHENOL CONCENTRATIONS

The data shows a significant decrease of phenol in the Buffalo River since 1969. The average phenol concentration found at the Ohio Street Bridge in 1971 was 25 micrograms per milliliter as compared to 67 in 1969. This probably reflects reductions in phenol discharges by such Buffalo River Industries as Specialty Chemicals Division of Allied Chemical, Mobil Oil and Donner Hanna. This decrease is not clearly reflected by Niagara River data at near U. S. shore sampling points at range 34.3. OWRC data for 1969 and 1971 at these points were about the same. E.P.A. 1971 data were somewhat lower. The combined results tend to indicate some reduction.

There was a major change in the phenol data for the waters entering the Niagara in those areas of the Upper Niagara River normally beyond the influence of U.S. waste phenol discharges. The 1969 data generally showed zero phenol concentrations in these sectors. In 1971 the average values obtained generally ranged from 2 to 3 ug/l. There does not appear to be any logical explanation for an actual increase of phenol in these waters. The data may not be significant, but rather a further indication of possible limitations of the phenol sampling and analytical techniques at these very low concentrations. This question has previously surfaced as inconsistent as well as unexplainable results have occurred with some frequency in prior years.

The relatively high phenol concentration found at Goat Island Bridge Range 13.2, as shown in Table V, is surprising. This has consistently been relatively free of phenol in the past. The upstream phenol along the U.S. shore is normally diverted into the New York State power intake. Furthermore the phenol discharge from the Hooker Niagara Falls plant which might reach this area was reportedly discontinued in 1971.

Compared to 1969 data the 1971 results show a significantly higher phenol concentration in the Lower River. The 1969 OWRC data showed practically no phenol in the Lower River. In 1971 they found an average concentration of 4 to 6 ug/l throughout this sector. E.P.A. and New York State results for 1971 ranged from 2 to 4 ug/l. A reason for this increase is not currently available. At least one phenol discharge from the Hooker Niagara Falls plant was reportedly discontinued in early 1971. As far as is known there was no increase in other phenol discharges.

#### PHOSPHORUS CONCENTRATIONS

The phosphorus concentrations entering the Niagara from Lake Erie is apparently unchanged at 0.02 mg/l. A significant increase in phosphorus occurs immediately downstream of the Buffalo sewage treatment plant at the near shore sampling points. The location of the sampling ranges do not pinpoint the effect of the other municipal treatment plant effluents although their contribution is also significant.

It is interesting to note that OWRC data showed a reduction from 0.04 mg/l in 1969 to 0.03 mg/l in 1971 at the mouth of the river. The EPA results were the reverse. The variation is undoubtedly within the experimental error.

There actually may have been some reduction of phosphorus concentration in the water at the river mouth since 1969 inasmuch as the concentration of phosphorus permitted in detergents was limited to 8.7 percent in both Erie County on the U. S. side and in Canada subsequent to 1969. It appears that the sampling and analyses techniques are not sufficiently precise to identify the degree of reduction of phosphorus concentration that may have occurred in the river water.

The relatively clear indication of the influence of the Buffalo sewage treatment plant effluent in the Niagara River revealed by coliform determinations at ranges 35.7 and 34.3 suggest that these ranges also be sampled for phosphorus somewhat intensively in the future. It would serve to indicate any major future changes in phosphorus contributions from both the Buffalo River and the Buffalo sewage treatment plant.

#### OTHER PARAMETERS

Review of the data collected does not indicate any significant change in the quantity of nitrogen or other measured parameters in the Niagara River since 1969.

#### ESTHETIC CHARACTERISTICS

There were no any major changes in 1971 with respect to those outfalls which create localized discolorations of the river.

#### OIL SPILLS

The U. S. Coast Guard intensively patrolled the U. S. side of the Niagara River in 1971 for evidence of oil spills. Any occurrences discovered have been jointly investigated with New York State. Punitive action as well as

requiring measures to prevent similar future incidents have been taken in some instances. Although there has been no apparent decrease in the frequency of discovered spills, it is believed that there may have been a reduction in the actual number of spills which was masked by increased surveillance and improved reporting. During 1971 there were no reported or known major oil spills from Canadian sources.

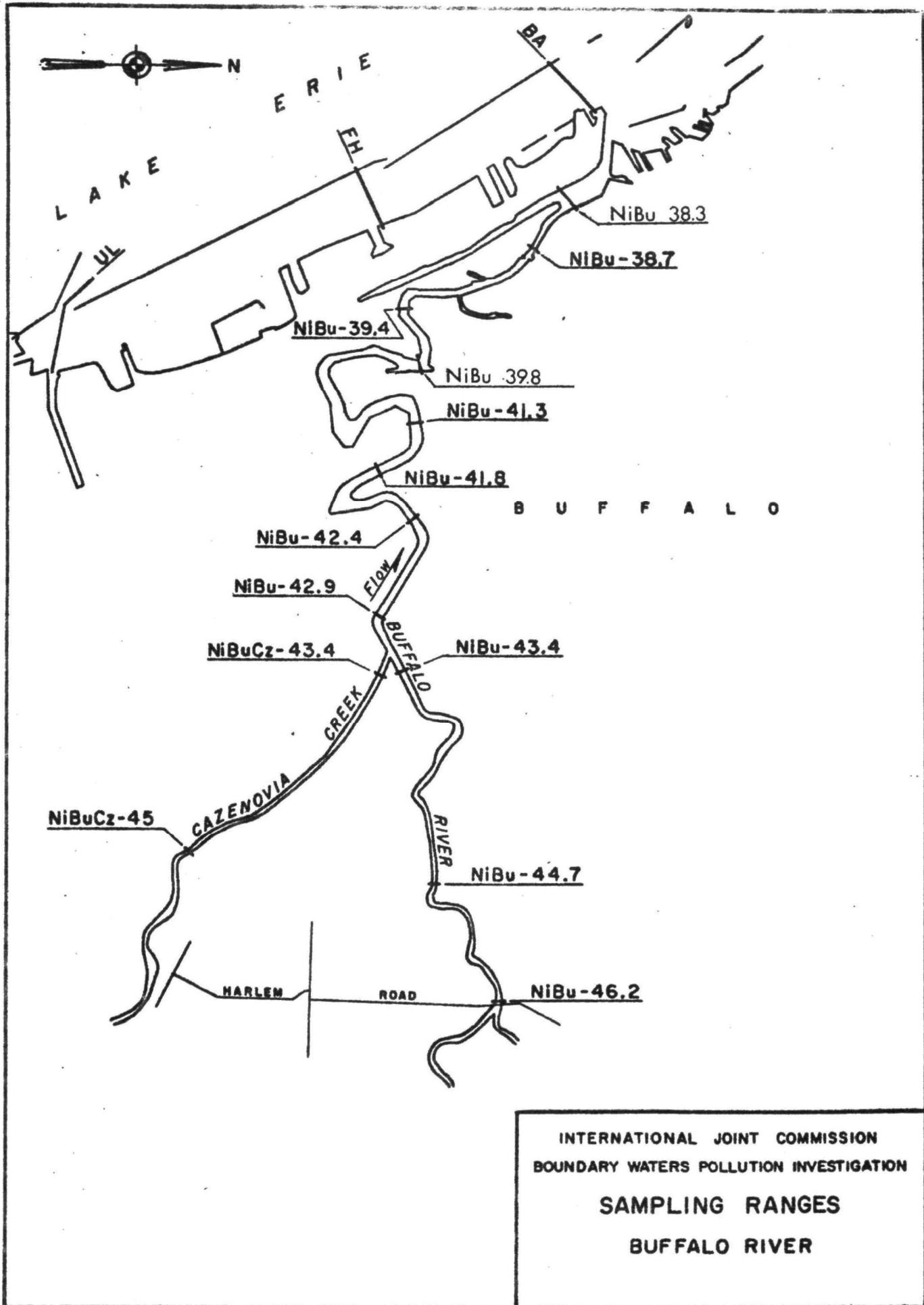


Figure 1

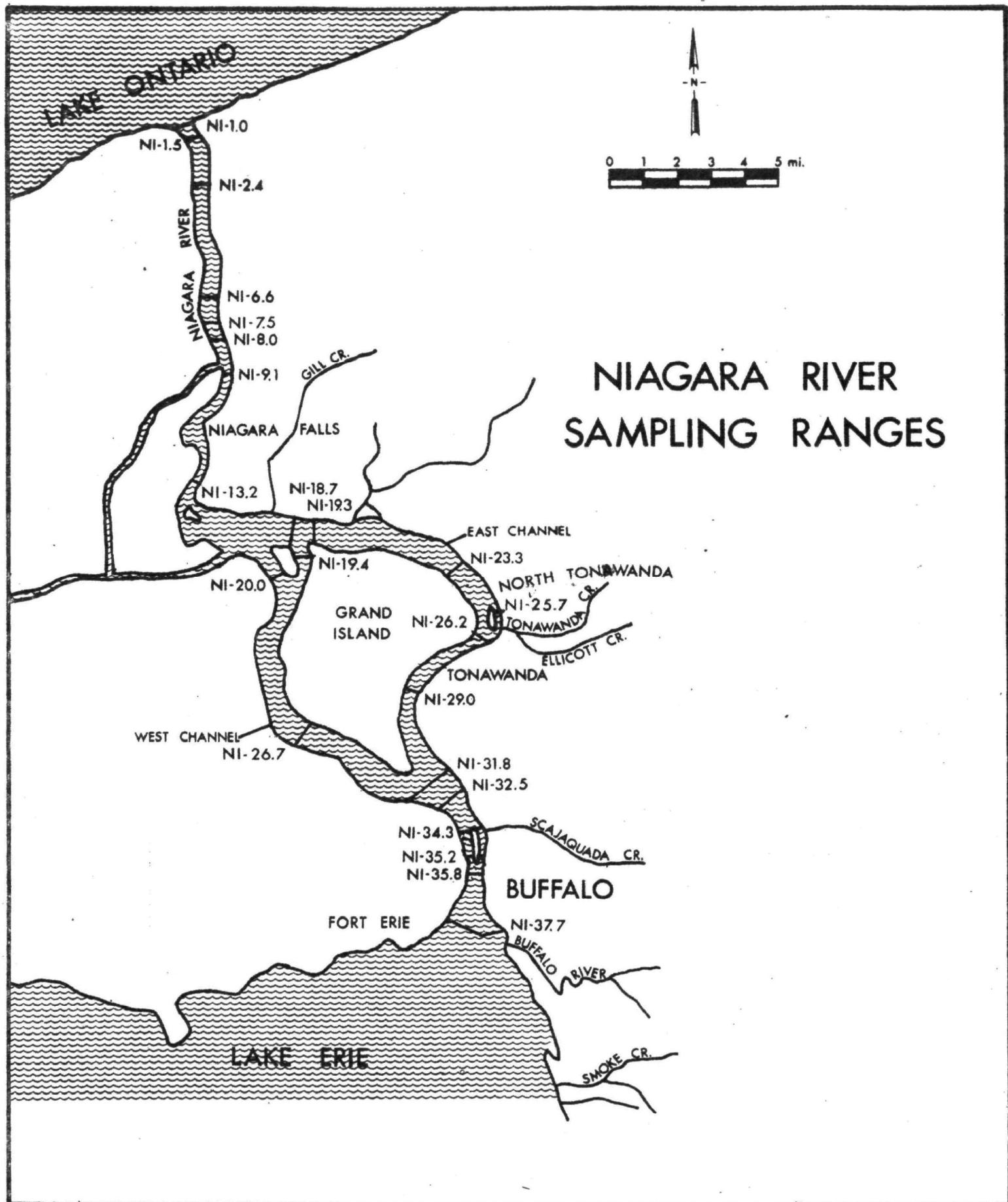


Figure 2

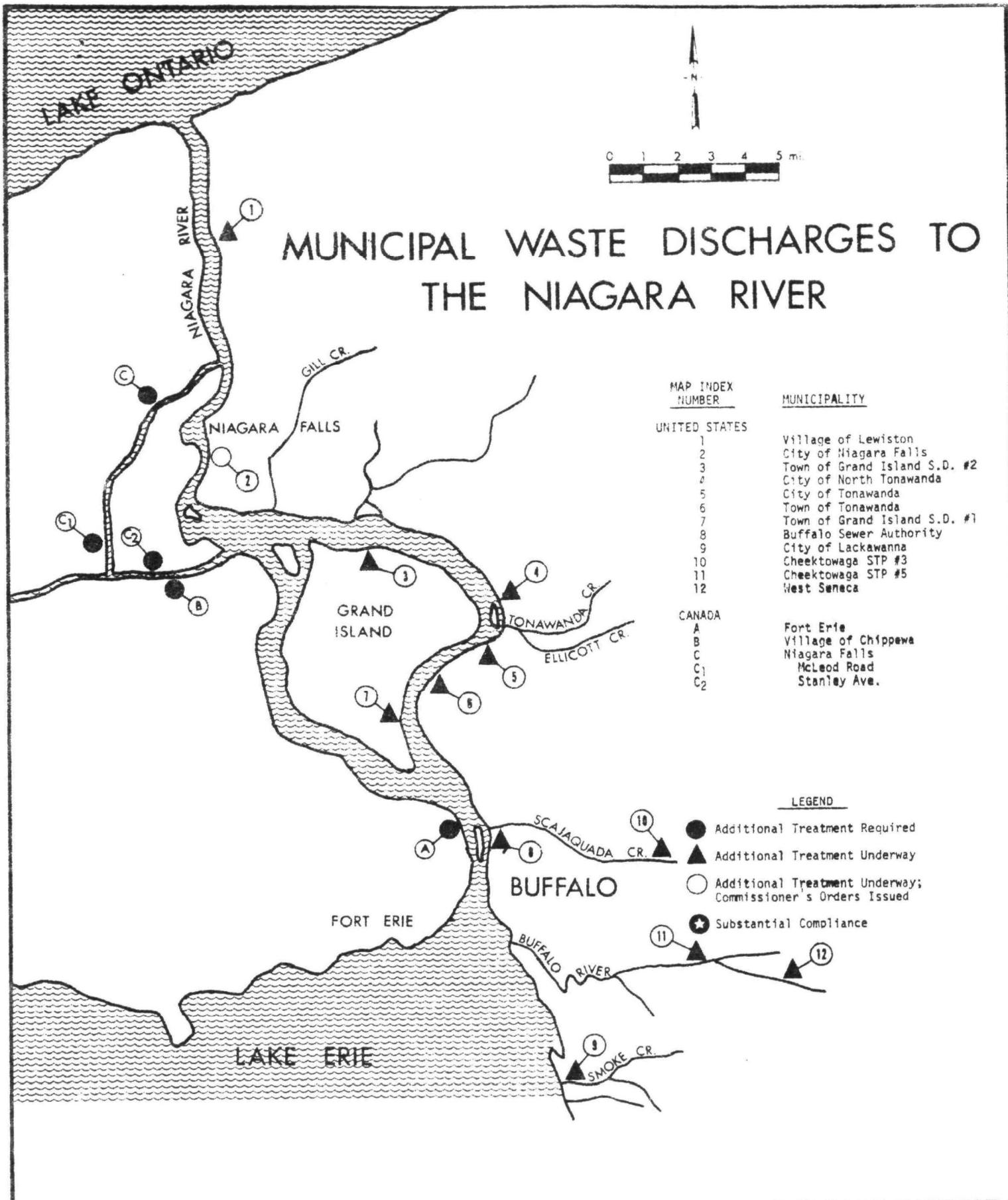


Figure 3

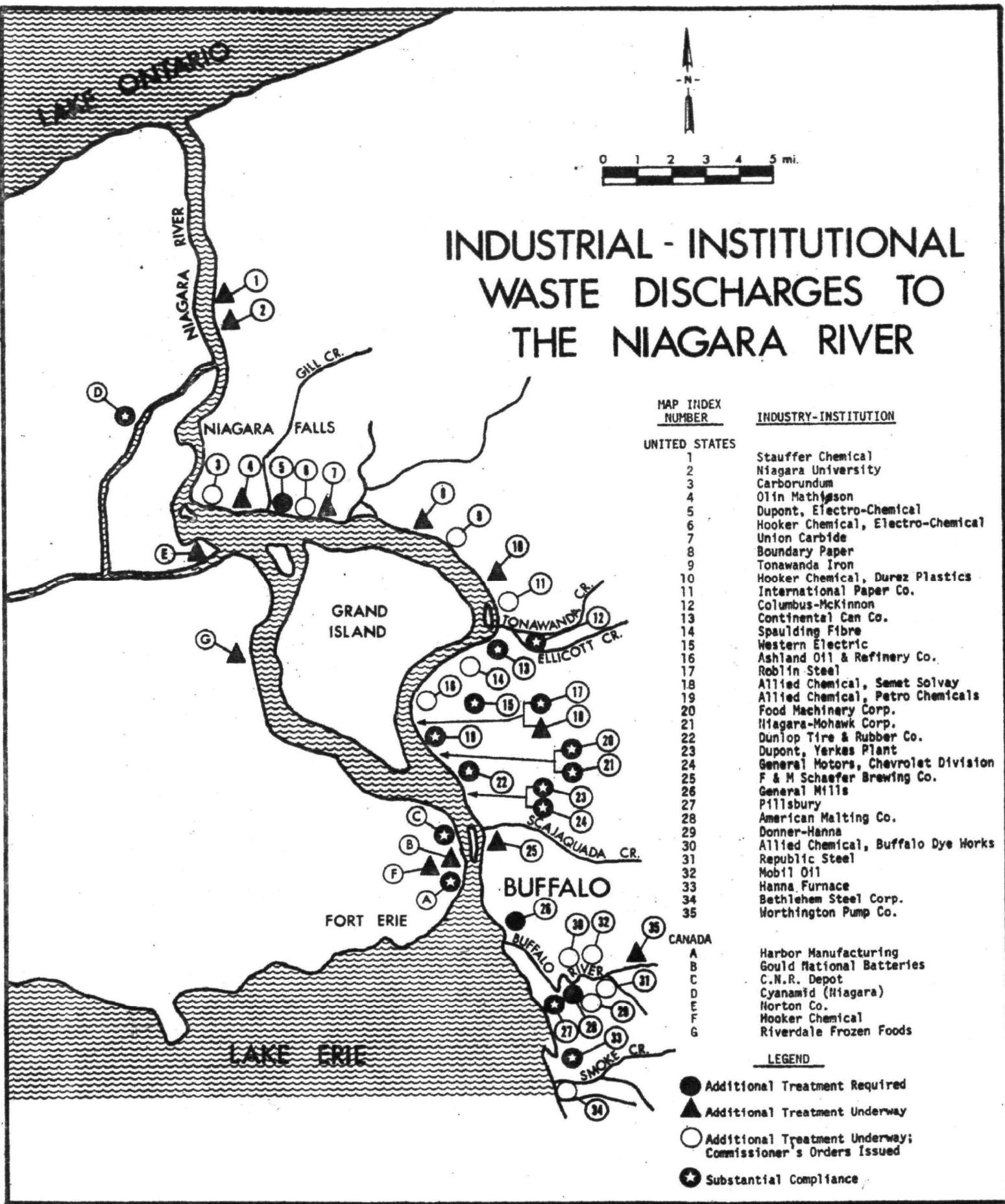


Figure 4

TABLE I  
SUMMARY OF ANALYTICAL RESULTS  
OCTOBER 1, 1970 to SEPTEMBER 30, 1971

Buffalo River and Tributaries

	Buffalo Creek At Bailey NiBu-43.4	Cazenovia Creek At Bailey NiBuCz-43.4	D&W R.R. Bridge NiBu-42.9	So. Park Bridge NiBu-42.4	Smith Street NiBu-41.4	BUFFALO RIVER			
						Hamburg Street NiBu-39.8	Ohio St. Bridge NiBu-39.1	Mich. Ave. Bridge NiBu-38.7	Skyway Bridge NiBu-38.3
<b>Coliform *</b>									
Median	48000	15000	144000	36000	175000	48000	33000	62500	240000
Maximum	240000	48000	1100000	110000	240000	1100000	240000	240000	240000
Minimum	9100	9100	3600	3600	9300	21000	690	2300	48000
No. of Samples	5	5	6	6	6	5	19	6	3
<b>Fecal Colif. *</b>									
Median	4300	2900	132000	9200	17500	15000	13000	4300	24000
Maximum	240000	24000	2400000	48000	110000	48000	110000	240000	48000
Minimum	2300	1500	2300	2300	1500	2300	910	910	2300
No. of Samples	5	4	6	6	6	5	6	6	3
<b>Phenol **</b>									
Average							25	6	
Maximum							92	10	
Minimum							2	2	
No. of Samples							13	8	
<b>Chloride</b>									
Average	49	58	52	56	65	63	52	50	49
Maximum	58	73	65	78	75	75	77	60	53
Minimum	38	48	25	28	53	53	27	40	43
No. of Samples	5	5	6	6	6	5	19	6	3
<b>Phosphorus</b>									
Average							0.18		
Maximum							0.28		
Minimum							0.13		
No. of Samples							13		

mg/l unless otherwise indicated

\* MPN/100 ml

\*\*ug/l

TABLE I  
SUMMARY OF ANALYTICAL RESULTS  
OCTOBER 1, 1970 to SEPTEMBER 30, 1971

Buffalo River and Tributaries

	Buffalo Creek At Bailey NiBu-43.4	Cazenovia Creek At Bailey NiBuCz-43.4	DL&W R.R. Bridge NiBu-42.9	So. Park Bridge NiBu-42.4	Smith Street NiBu-41.4	Hamburg Street NiBu-39.8	BUFFALO RIVER Ohio St. Bridge NiBu-39.4	Mich. Ave. Bridge NiBu-38.7	Skyway Bridge NiBu-38.1
<b>Total Nitrogen</b>									
Average							3.25		
Maximum							6.40		
Minimum							1.22		
No. of Samples							13		
<b>Total Solids</b>									
Average	288	266	367	287	317	301	326	293	266
Maximum	346	306	700	3512***	2980***	375	1030***	341	290
Minimum	222	190	270	194	243	234	254	255	237
No. of Samples	5	5	6	5	6	5	18	6	3
<b>Susp. Solids</b>									
Average	14	11	88	16	15	12	29	16	6
Maximum	27	22	442	31	23	21	149	32	7
Minimum	6	5	5	7	7	2	1	6	4
No. of Samples	5	5	6	6	6	5	19	6	3
<b>Turbidity (NTU)</b>									
Average									
Maximum									
Minimum									
No. of Samples									
<b>Iron</b>									
Average							1.6		
Maximum							3.6		
Minimum							0.2		
No. of Samples							13		

\*\*\* Atypical value. Not included in average  
mg/l unless otherwise indicated

\* MPV/100 ml  
\*\* uf/l

TABLE I  
SUMMARY OF ANALYTICAL RESULTS  
OCTOBER 1, 1970 to SEPTEMBER 30, 1971

Buffalo River and Tributaries

	Buffalo Creek At Bailey NiBu-43.4	Cazenovia Creek At Bailey NiBuCz-43.4	DL&W R.R. Bridge NiBu-42.9	So. Park Bridge NiBu-42.4	Smith Street NiBu-41.4	Hamburg Street NiBu-39.8	BUFFALO RIVER Ohio St. Bridge NiBu-39.4	Mich. Ave. Bridge NiBu-38.7	Skyway Bridge NiBu-38.6
<b>Sulfate</b>									
Average	58	53	64	69	71	68	56	56	51
Maximum	64	68	96	108	108	92	92	68	56
Minimum	40	32	44	48	44	48	27	44	48
No. of Samples	5	5	6	6	6	5	19	6	3
<b>pH (St. Units)</b>									
Average	7.4	7.5	7.4	7.4	7.3	7.5	6.9	7.4	7.7
Maximum	8.1	8.1	8.0	8.1	8.1	8.1	8.1	8.2	8.2
Minimum	6.9	6.9	6.8	6.7	6.8	7.3	6.1	6.7	7.4
No. of Samples	5	5	6	6	6	5	19	6	3
<b>Alkalinity</b>									
Average	136	116	125	119	119	114	109	116	111
Maximum	178	126	142	132	126	124	137	122	118
Minimum	116	102	116	108	110	100	90	108	108
No. of Samples	5	5	6	6	6	5	19	6	3
<b>Conductivity</b>									
Average							439		
Maximum							549		
Minimum							349		
No. of Samples							13		
<b>Temp.</b>									
Average	73	73	80	78	77	74	60	74	76
Maximum	82	82	86	82	82	78	79	80	79
Minimum	57	56	63	63	62	58	34	57	72
No. of Samples	5	5	6	6	6	5	19	6	2

**TABLE I**  
**SUMMARY OF ANALYTICAL RESULTS**  
**OCTOBER 1, 1970 to SEPTEMBER 30, 1971**

**Buffalo River and Tributaries**

	Buffalo Creek At Bailey NiBu-43.4	Cazenovia Creek At Bailey NiBuCz-43.4	DL&W R.R. Bridge NiBu-42.9	So. Park Bridge NiBu-42.4	Smith Street NiBu-41.4	Hamburg Street NiBu-39.8	BUFFALO RIVER Ohio St. Bridge NiBu-39.4	Mich. Ave. Bridge NiBu-38.7	Skyway Bridge NiBu-38.6
<b>DO.</b>									
Average	4.3	5.8	2.4	2.6	2.3	2.5	4.7	1.8	2.8
Maximum	8.9	11.8	6.9	4.4	8.2	7.5	12.0	2.5	3.1
Minimum	1.0	1.4	0.0	0.9	0.7	0.7	0.0	1.0	2.5
No. of Samples	4	5	6	6	6	5	20	6	3
<b>BOD</b>									
Average	3.1	4.9	3.9	2.5	7.8	3.9	3.8	2.1	0.9
Maximum	4.7	18.4	9.4	6.6	13.1	7.4	14.0	6.0	1.8
Minimum	1.5	0.1	1.5	0.8	0.8	1.7	0.6	0.3	0.4
No. of Samples	4	5	6	6	6	5	18	6	3
<b>COD.</b>									
Average			34	37	54	30	27		
Maximum			50	42	69	169	27		
Minimum			12	31	31	0	27		
No. of Samples			6	6	5	20	1		
<b>Cl. Demand</b>									
Average	10.8	1.4	3.7	1.8	4.1	2.4	1.8	1.2	0.5
Maximum	17.0	2.0	7.9	2.8	7.2	2.6	2.8	1.7	0.5
Minimum	0.5	0.5	0.5	0.5	1.4	2.2	0.5	0.5	0.5
No. of Samples	3	3	3	3	3	2	3	3	1

TABLE II  
SUMMARY OF NIAGARA RIVER DATA AT THE SOURCE AND MOUTH

	SOURCE				MOUTH			
	Buffalo Water Intake Mileage Index Ni 37.7 6500' from U.S. Shore				U.S. Coast Guard Dock Mileage Index Ni 1.0 Near U.S. Shore			
	<u>1948-9</u>	<u>1968-9</u>	<u>1969-70</u>	<u>1970-71</u>	<u>1948-9</u>	<u>1968-9</u>	<u>1969-70</u>	<u>1970-71</u>
<b>Coliform *</b>								
Median	4	3	5	3	2300	2100	-	220
Maximum	36	36	120	100	24000	2700	-	2700
Minimum	3	0	0	0	93	320	-	70
No. of Samples	31	33	52	52	65	7	-	14
<b>Phenol **</b>								
Average	1	0	-	-	2	1	-	2.2
Maximum	14	0	-	-	65	2	-	86 ***
Minimum	0	0	-	-	0	0	-	1
No. of Samples	31	4	-	-	62	4	-	22
<b>Chlorides</b>								
Average	21	28	28	27	20	27	28	27
Maximum	25	33	33	32	24	34	34	41
Minimum	17	22	23	22	18	23	24	25
No. of Samples	15	50	49	53	19	20	11	23
<b>Total Diss. Solids</b>								
Average	-	210	204	218	-	211	203	210
Maximum	-	240	252	293	-	289	239	252
Minimum	-	124	136	171	-	169	127	115
No. of Samples	-	39	49	53	-	15	11	25
<b>Total Solids</b>								
Average	-	219	222	245	-	227	206	226
Maximum	-	280	323	423	-	295	239	263
Minimum	-	183	157	190	-	174	129	195
No. of Samples	-	32	49	55	-	15	11	25

mg/l unless otherwise indicated

\* MPN/100 ml

\*\* ug/l

\*\*\*Atypical; not included in average

TABLE II (Cont'd.)  
SUMMARY OF NIAGARA RIVER DATA AT THE SOURCE AND MOUTH

	SOURCE				MOUTH			
	Buffalo Water Intake Mileage Index Ni 37.7 6500' from U.S. Shore				U.S. Coast Guard Dock Mileage Index Ni 1.0 Near U.S. Shore			
	<u>1948-9</u>	<u>1968-9</u>	<u>1969-70</u>	<u>1970-71</u>	<u>1948-9</u>	<u>1968-9</u>	<u>1969-70</u>	<u>1970-71</u>
<b>Sulfate</b>								
Average	-	25	27	27	-	28	23	23
Maximum	-	31	34	37	-	42	26	38
Minimum	-	20	19	18	-	19	17	13
No. of Samples	-	44	50	53	-	13	11	24
<b>pH Stand. Units</b>								
Average	8.1	8.2	8.2	8.1	8.2	8.2	8.3	7.9
Maximum	8.4	8.7	8.8	8.7	8.5	8.5	8.6	8.5
Minimum	7.4	7.9	7.4	7.5	7.7	8.0	7.9	7.6
No. of Samples	30	46	52	53	31	31	11	25
<b>Alkalinity</b>								
Average	92	87	92	93	94	98	91	95
Maximum	100	96	102	100	100	150	100	112
Minimum	84	80	74	80	84	78	83	70
No. of Samples	15	46	50	53	16	11	11	24
<b>Turbidity JTU</b>								
Average	5	5	4	8	5	5	3	6
Maximum	21	10	40	120	13	11	5	18
Minimum	1	1	1	1	1	3	1	1
No. of Samples	24	38	52	53	31	11	11	22
<b>D.O.</b>								
Average	10.5	11.3	11.2	10.7	11.7	10.5	11.1	11.4
Maximum	13.6	14.5	14.0	13.8	14.0	14.5	14.5	15.2
Minimum	7.5	8.0	7.6	7.7	10.4	8.3	8.7	7.6
No. of Samples	19	46	51	53	12	11	11	24

TABLE II (Cont'd.)  
SUMMARY OF NIAGARA RIVER DATA AT THE SOURCE AND MOUTH

	SOURCE				MOUTH			
	Buffalo Water Intake Mileage Index Ni 37.7 6500' from U.S. Shore				U.S. Coast Guard Dock Mileage Index Ni 1.0 Near U.S. Shore			
	<u>1948-9</u>	<u>1968-9</u>	<u>1969-70</u>	<u>1970-71</u>	<u>1948-9</u>	<u>1968-9</u>	<u>1969-70</u>	<u>1970-71</u>
<b>B.O.D.</b>								
Average	0.7	2.2	1.8	1.7	1.3	2.9	3.3	1.9
Maximum	1.7	6.0	6.3	6.7	2.0	6.8	5.2	5.6
Minimum	0.0	0.1	0.5	0.3	0.7	1.0	1.5	0.2
No. of Samples	17	45	52	53	11	15	10	24
<b>C.O.D.</b>								
Average	-	10.4	6.4	3.6	-	10.3	11.0	11.8
Maximum	-	42.0	16.0	18.4	-	18.6	17.7	21.7
Minimum	-	0.0	0.4	< 0.1	-	4.0	5.2	3.3
No. of Samples	-	40	52	53	-	15	12	22
<b>Phosphorus</b>								
Average	-	0.03	0.03	0.02	-	0.04	0.03	0.04
Maximum	-	0.07	0.06	0.24	-	0.09	0.05	0.06
Minimum	-	0.00	0.01	< 0.01	-	0.02	0.02	0.02
No. of Samples	-	42	51	53	-	20	11	9
<b>Total Nitrogen</b>								
Average	-	-	-	-	-	0.86	0.73	0.33
Maximum	-	-	-	-	-	1.47	1.51	1.20
Minimum	-	-	-	-	-	0.26	0.32	0.29
No. of Samples	-	-	-	-	-	15	12	20
<b>Iron</b>								
Average	-	-	-	-	-	0.21	0.24	0.18
Maximum	-	-	-	-	-	0.35	0.41	0.70
Minimum	-	-	-	-	-	0.04	0.11	0.02
No. of Samples	-	-	-	-	-	10	12	23

Upper Niagara River  
Range Ni 37.7

TABLE III

SUMMARY OF ANALYTICAL RESULTS  
 Oct. 1, 1970 to Sept. 30, 1971

	Feet From United States Shores									
	200	1000	2000	3500	5500	6,500	8500	10,000	11,500	
Coliform *										
Median	6000	500	40	10	60	35	25	32	30	
Maximum	13000	6600	540	50	170	70	110	120	50	
Minimum	5400	54	10	1	4	1	1	10	1	
No. of Samples	3	3	5	5	5	4	4	3	5	
Phenol **										
Average	9	9	3	3	3	3	2	3	2	
Maximum	12	25	6	6	6	8	6	6	6	
Minimum	2	0	0	0	0	0	0	0	0	
No. of Samples	3	4	4	4	4	4	4	3	4	
Chloride										
Average	34	30	26	25	25	25	25	25	25	
Maximum	51	39	28	26	26	26	26	26	26	
Minimum	28	26	24	24	24	23	23	24	24	
No. of Samples	4	5	5	5	5	5	5	4	5	
Phosphorus										
Average	0.08	0.06	0.03	0.05	0.02	0.02	0.02	0.02	0.04	
Maximum	0.16	0.16	0.05	0.06	0.02	0.05	0.02	0.04	0.10	
Minimum	0.04	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	
No. of Samples	4	5	5	5	5	5	5	4	4	
Total Nitrogen										
Average	0.77	0.50	0.37	0.34	0.33	0.33	0.40	0.34	0.36	
Maximum	2.00***	2.13***	0.49	0.50	0.52	0.48	0.71	0.49	0.58	
Minimum	0.61	0.29	0.26	0.23	0.25	0.22	0.23	0.21	0.23	
No. of Samples	3	4	4	4	4	4	4	3	4	

\*\*\* Atypical; not included in average

\*\* mg/l unless otherwise stated - \*MPN/100 ml

- \*\*ug/l

Upper Niagara River  
Peace Bridge Range Ni 35.8

TABLE III (Cont'd.)  
SUMMARY OF ANALYTICAL RESULTS  
Oct. 1, 1970 to Sept. 30, 1971

	Peace Bridge Range							
	100	200	300	400	500	700	1000	1400
Coliforms *								
Median	750		91		23	23	23	23
Maximum	24000		24000		2400	2400	2400	2400
Minimum	230		2.3		<2.3	<2.3	<2.3	3.6
No. of Samples	13		13		13	13	13	11
Fecal Colf. *								
Median	23		23		9.1	3.6	9.1	2.3
Maximum	11000		2400		2400	2400	2400	2400
Minimum	36		3.6		<2.3	<2.3	<2.3	<2.3
No. of Samples	13		13		13	13	13	11
Phenols **								
Average	1.3	1.7	1.1	0.7	1	1.7	1.3	1.2
Maximum	2.6	4	1.3	2.6	1.1	2.5	5.2	2.5
Minimum	0	1	1	0	1	1	0	0
No. of Samples	8	7	4	7	3	4	9	9

\* mg/l unless otherwise stated

\* MPN/100 ml

\*\* ug/l

TABLE III (Cont'd.)

SUMMARY OF ANALYTICAL RESULTS  
Oct. 1, 1970 to Sept. 30, 1971

Upper Niagara River  
Range Ni 35.2

Near U. S. Shore		
	1967-70	1970-71
<b>Coliform *</b>		
Maximum	114000	12000
Minimum	180	210
No. of Samples	16	14
<b>Phenol**</b>		
Average	8	2
Maximum	36	6
Minimum	1	< 1
No. of Samples	19	14
<b>Chloride</b>		
Average	27	28
Maximum	33	34
Minimum	23	23
No. of Samples	20	12
<b>Phosphorus</b>		
Average	0.28	0.05
Maximum	4.44	0.09
Minimum	0.01	0.02
No. of Samples	19	12
<b>Total Nitrogen</b>		
Average	0.40	0.64
Maximum	2.98	0.93
Minimum	0.44	0.20
No. of Samples	20	12

TABLE III (Cont'd.)

SUMMARY OF ANALYTICAL RESULTS  
Oct. 1, 1970 to Sept. 30, 1971

Upper Niagara River  
Range Ni. 35.2

Near U. S. Shore

	1967-70	1970-71
Total Solids		
Average	254	239
Maximum	373	337
Minimum	208	195
No. of Samples	20	14
Dissolved Solids		
Average	224	223
Maximum	324	321
Minimum	158	181
No. of Samples	20	14
Iron		
Average	0.65	0.43
Maximum	3.00	1.30
Minimum	0.07	0.12
No. of Samples	20	12
Sulfate		
Average	9.9	24.7
Maximum	14.0	36.0
Minimum	6.3	21.0
No. of Samples	20	12
pH Standard Units		
Average	7.5	7.7
Maximum	8.1	8.4
Minimum	7.1	7.3
No. of Samples	20	14

TABLE III (cont.d)

SUMMARY OF ANALYTICAL RESULTS  
Oct. 1, 1970 to Sept. 30, 1971

Upper Niagara River  
Range Ni. 35.2

		Near U. S. Shore	
		1967-70	1970-71
Conductivity			
Average	324	325	
Maximum	437	424	
Minimum	287	237	
No. of Samples	20	14	
Turbidity (JTU)			
Average	12	8	
Maximum	28	16	
Minimum	4	3	
No. of Samples	20	12	
Dissolved Oxygen			
Average	9.6	10.3	
Maximum	14.0	13.6	
Minimum	6.6	7.2	
No. of Samples	20	14	
B.O.D.			
Average			
Maximum	2.5	1.1	
Minimum	4.6	3.0	
No. of Samples	14	0.2	
	20	13	
C.O.D.			
Average	20.2	11.8	
Maximum	196.0	20.0	
Minimum	4.0	7.0	
No. of Samples	20	11	

TABLE III (cont'd.)

Upper Niagara River  
Range Ni. 34.3

SUMMARY ANALYTICAL RESULTS  
Oct. 1, 1970 to Sept. 30, 1971

	Feet From United States Shore							
	100	300	500	700	1000	1300	1600	1700
Coliform *								
Median	2700	350	70	6	33	190	64	20
Maximum	14000	25000	1500	2200	140	2300	540	270
Minimum	250	48	12	0	1	4	4	1
No. of Samples	10	11	11	4	10	5	11	4
Phenol **								
Average	7	6	3	1	2	1	3	2
Maximum	20	15	6	4	8	2	12	4
Minimum	0	0	0	0	0	0	0	0
No. of Samples	15	16	14	6	16	6	16	6
Chloride								
Average	28	27	26	25	25	25	25	25
Maximum	32	32	28	26	28	26	28	26
Minimum	24	25	24	24	24	24	23	24
No. of Samples	14	15	15	6	15	6	15	6
Phosphorus								
Average	0.06	0.06	0.03	0.02	0.02	0.02	0.02	0.02
Maximum	0.15	0.12	0.06	0.04	0.08	0.03	0.05	0.04
Minimum	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
No. of Samples	14	16	16	6	16	6	16	6
Total Nitrogen								
Average	0.63	0.57	0.44	0.36	0.40	0.34	0.42	0.38
Maximum	1.27	0.92	0.65	0.62	0.65	0.61	0.74	0.58
Minimum	0.30	0.28	0.28	0.21	0.25	0.21	0.19	0.21
No. of Samples	15	17	16	6	16	6	16	6

mg/l unless otherwise stated

\* MPN/100

\*\*ug/l

Upper Niagara River  
Range Ni. 32.5

TABLE III (cont'd.)

SUMMARY ANALYTICAL RESULTS  
Oct. 1, 1970 to Sept. 30, 1971

	Feet From United States Shore									
	400	700	1100	1400	1700	2500	3000	3500	4500	5500
Coliform *										
Median	1800	1550	610	144	108	205	156	50	140	226
Maximum	3700	8000	4700	258	170	2900	900	340	200	350
Minimum	460	580	128	80	1	36	0	0	4	8
No. of Samples	5	6	4	4	5	4	11	5	5	4
Phenol **										
Average	4	3	2	2	3	2	2	2	2	2
Maximum	6	7	4	4	6	6	8	6	4	4
Minimum	0	0	0	0	2	0	0	0	0	0
No. of Samples	6	6	5	5	6	6	11	6	6	6
Chloride										
Average	27	27	25	25	25	25	25	25	25	25
Maximum	30	31	28	27	27	26	30	26	26	26
Minimum	25	24	24	24	24	23	23	24	24	24
No. of Samples	6	6	5	5	6	6	11	6	6	6
Phosphorus										
Average	0.04	0.04	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02
Maximum	0.05	0.06	0.03	0.02	0.04	0.03	0.10	0.04	0.04	0.04
Minimum	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
No. of Samples	6	6	5	4	6	6	12	6	6	6
Total Nitrogen										
Average	0.49	0.52	0.41	0.37	0.33	0.35	0.34	0.36	0.36	0.38
Maximum	0.60	0.72	0.61	0.52	0.46	0.56	0.61	0.60	0.54	0.56
Minimum	0.33	0.36	0.21	0.21	0.20	0.20	0.13	0.20	0.19	0.26
No. of Samples	6	6	5	5	6	6	6	6	6	6

mg/l unless otherwise stated

\* MPN/100 ml

\*\*ug/l

Upper Niagara River  
Range 26.7

TABLE III (cont'd.)  
SUMMARY ANALYTICAL RESULTS  
Oct. 1, 1970 to Sept. 30, 1971

	Feet From United States Shore			
	300	800	1400	1900
Coliform *				
Median	12	14	4	844
Maximum	12	20	4	1280
Minimum	12	8	4	408
No. of Samples	1	2	1	2
Phenol **				
Average	0	1	0	0
Maximum	0	1	0	0
Minimum	0	0	0	0
No. of Samples	2	2	1	2
Chloride				
Average	27	27	26	26
Maximum	27	27	26	26
Minimum	26	26	26	26
No. of Samples	2	2	1	2
Phosphorus				
Average	0.03	0.03	0.03	0.03
Maximum	0.04	0.04	0.03	0.04
Minimum	0.02	0.02	0.03	0.02
No. of Samples	2	2	1	2
Total Nitrogen				
Average	0.45	0.40	0.41	0.45
Maximum	0.47	0.46	0.49	0.55
Minimum	0.42	0.34	0.32	0.34
No. of Samples	2	2	2	2

mg/l unless otherwise stated

\* MPN/100 ml

\*\*ug/l

Upper Niagara River  
Range 20.0

TABLE III (cont'd.)  
SUMMARY ANALYTICAL RESULTS  
Oct. 1, 1970 to Sept. 30, 1971

	Feet From United States Shore			
	300	800	1400	1900
Coliform *				
Median	130	54	270	660
Maximum	360	510	1900	2060
Minimum	12	8	36	12
No. of Samples	6	6	5	6
Phenol **				
Average	2	2	2	1
Maximum	6	6	8	4
Minimum	0	0	0	0
No. of Samples	6	6	6	6
Chloride				
Average	25	25	25	25
Maximum	26	26	26	26
Minimum	24	24	24	24
No. of Samples	6	6	6	6
Phosphorus				
Average	0.02	0.02	0.02	0.02
Maximum	0.04	0.03	0.02	0.03
Minimum	0.01	0.01	0.01	0.01
No. of Samples	6	6	6	6
Total Nitrogen				
Average	0.43	0.42	0.42	0.40
Maximum	0.71	0.61	0.61	0.58
Minimum	0.12	0.15	0.17	0.15
No. of Samples	6	6	6	6

mg/l unless otherwise stated

\* MPN/100 ml

\*\*ug/l

TABLE III (cont'd.)

Upper Niagara River  
Range 19.<sup>4</sup>

SUMMARY ANALYTICAL RESULTS  
Oct. 1, 1970 to Sept. 30, 1971

	Feet From United States Shore		
	700	1100	1400
Coliform *			
Median	100	60	232
Maximum	344	380	11000
Minimum	24	12	12
No. of Samples	6	5	5
Phenol **			
Average	3	3	1
Maximum	10	4	4
Minimum	0	0	0
No. of Samples	6	6	6
Chloride			
Average	26	25	25
Maximum	27	26	26
Minimum	24	23	24
No. of Samples	6	6	6
Phosphorus			
Average	0.02	0.02	0.02
Maximum	0.02	0.03	0.03
Minimum	0.01	0.01	0.01
No. of Samples	6	6	5
Total Nitrogen			
Average	0.39	0.42	0.40
Maximum	0.57	0.63	0.61
Minimum	0.23	0.18	0.20
No. of Samples	6	6	6

mg/l unless otherwise stated

\* MPN/100 ml

\*\*ug/l

Upper Niagara River  
Range 19.3

TABLE III (cont'd.)  
SUMMARY ANALYTICAL RESULTS  
Oct. 1, 1970 to Sept. 30, 1971

	Feet From United States Shore							
	300	600	900	1400	1900	2500	3000	3500
Coliform *								
Median	3500	3600	8200	620	376	90	210	237
Maximum	14000	14000	14200	8100	1400	158	1700	780
Minimum	270	640	880	40	56	10	32	36
No. of Samples	6	6	4	5	6	6	6	4
Phenol **								
Average	18	6	3	2	3	2	2	2
Maximum	30	15	10	4	10	6	6	4
Minimum	2	0	0	0	0	0	0	0
No. of Samples	5	6	6	6	6	6	6	5
Chloride								
Average	29	28	27	26	26	26	25	26
Maximum	36	32	29	28	27	28	27	28
Minimum	25	25	24	24	24	24	24	24
No. of Samples	6	6	6	6	6	6	6	5
Phosphorus								
Average	0.07	0.06	0.04	0.03	0.03	0.02	0.02	0.03
Maximum	0.09	0.08	0.05	0.05	0.04	0.03	0.03	0.04
Minimum	0.05	0.03	0.03	0.02	0.02	0.01	0.01	0.01
No. of Samples	6	6	6	6	6	6	6	6
Total Nitrogen								
Average	0.79	0.59	0.63	0.49	0.45	0.38	0.42	0.45
Maximum	1.10	0.77	0.92	0.69	0.64	0.52	0.55	0.61
Minimum	0.42	0.32	0.34	0.25	0.24	0.20	0.21	0.18
No. of Samples	6	6	6	6	6	6	6	5

mg/l unless otherwise stated

\* MPN/100 ml

\*\*ug/l

TABLE III (Cont'd.)

SUMMARY OF ANALYTICAL RESULTS  
Oct. 1, 1967 to Sept. 30, 1971

Upper Niagara River  
Range Ni. 19.0

Near U. S. Shore			
	1967-70	1970-71	
Coliform			
Maximum	42000		5300
Minimum	180		90
No. of Samples	24		14
Phenol			
Average	48		34
Maximum	210		160
Minimum	5		1
No. of Samples	24		13
Chloride			
Average	30		29
Maximum	37		36
Minimum	24		23
No. of Samples	28		12
Phosphorus			
Average	0.10		0.28
Maximum	0.33		0.14
Minimum	0.05		0.05
No. of Samples	28		12
Total Nitrogen			
Average	0.88		0.89
Maximum	2.64		1.18
Minimum	0.14		0.20
No. of Samples	28		12

mg/l unless otherwise stated

\* MPN/100 ml

\*\*ug/l

Lower Niagara River  
Range 6.8

TABLE IV  
SUMMARY ANALYTICAL RESULTS  
Oct. 1, 1970 to Sept. 30, 1971

	Feet From United States Shore				
	100	900	950	1000	1800
Coliform *					
Median		1400		750	1870
Maximum		4800		3800	4100
Minimum		310		440	600
No. of Samples		6		6	6
Phenol **					
Average		5		5	6
Maximum		6		6	15
Minimum		4		4	4
No. of Samples		7		7	7
Chloride					
Average		27		27	26
Maximum		28		28	28
Minimum		25		25	25
No. of Samples		7		7	7
Phosphorus					
Average		0.03		0.03	0.03
Maximum		0.07		0.04	0.04
Minimum		0.02		0.02	0.02
No. of Samples		7		7	7
Total Nitrogen					
Average		0.44		0.45	0.42
Maximum		0.59		0.83	0.56
Minimum		0.28		0.27	0.27
No. of Samples		7		7	7

mg/l unless otherwise stated

\* MPN/100 ml

\*\*ug/l

Lower Niagara River  
Range 2.4

TABLE IV (Cont'd.)  
SUMMARY ANALYTICAL RESULTS  
Oct. 1, 1970 to Sept. 30, 1971

	Feet From United States Shore								
	100	200	300	800	1300	1500	1600	1700	1800
Coliform *									
Median	1555			1400				1200	
Maximum	5000			9300				3200	
Minimum	900			700				90	
No. of Samples	4			5				4	
Phenol **									
Average	6			5				5	
Maximum	6			8				6	
Minimum	4			4				4	
No. of Samples	7			7				7	
Chloride									
Average	27			27				27	
Maximum	28			29				28	
Minimum	25			25				25	
No. of Samples	7			7				7	
Phosphorus									
Average	0.03			0.03				0.03	
Maximum	0.04			0.04				0.04	
Minimum	0.02			0.02				0.02	
No. of Samples	7			7				7	
Total Nitrogen									
Average	0.41			0.42				0.40	
Maximum	0.58			0.57				0.56	
Minimum	0.26			0.26				0.23	
No. of Samples	7			7				7	

mg/l unless otherwise stated

\* MPN/100 ml

\*\*ug/l

TABLE IV (Cont'd.)

Lower Niagara River  
Range 1.5

SUMMARY ANALYTICAL RESULTS  
Oct. 1, 1970 to Sept. 30, 1971

	Feet From United States Shore									
	50	100	200	300	400	500	900	1300	1400	1500
<b>Coliform *</b>										
Median	580	2900	2350	1300	2500	2600	1200		2800	
Maximum	2800	4400	6300	4600	4400	4400	8100		4500	
Minimum	56	500	500	1000	1600	1100	670		600	
No. of Samples	3	4	4	5	4	5	5		5	
<b>Phenol **</b>										
Average	6	6	6	8	5	5	4		5	
Maximum	12	10	10	20	6	8	6		8	
Minimum	2	4	4	4	4	4	2		4	
No. of Samples	4	7	7	7	7	7	7		7	
<b>Chloride</b>										
Average	26	27	27	27	27	26	26		27	
Maximum	27	28	28	28	28	28	28		28	
Minimum	25	25	25	25	24	25	25		25	
No. of Samples	4	7	7	7	7	7	7		7	
<b>Phosphorus</b>										
Average	0.02	0.03	0.03	0.03	0.03	0.03	0.03		0.03	
Maximum	0.03	0.04	0.04	0.04	0.06	0.04	0.04		0.04	
Minimum	0.02	0.02	0.02	0.02	0.02	0.02	0.02		0.02	
No. of Samples	4	7	7	7	7	7	7		7	
<b>Total Nitrogen</b>										
Average	0.37	0.42	0.43	0.42	0.44	0.47	0.42		0.38	
Maximum	0.51	0.54	0.60	0.68	0.60	0.66	0.66		0.52	
Minimum	0.27	0.25	0.26	0.26	0.32	0.26	0.19		0.25	
No. of Samples	4	7	7	7	7	7	7		7	

mg/l unless otherwise stated

\* MPN/100ml

\*\*ug/l

TABLE IV (Cont'd.)

SUMMARY ANALYTICAL RESULTS  
Oct. 1, 1970 to Sept. 30, 1971

Lower Niagara River  
Range Ni 1.0

	Feet From United States Shore							
	100	300	400	750	800	1200	1300	1400
Coliform *								
Median	2200		2200		2100	1200		2100
Maximum	3500		3000		5300	3700		6900
Minimum	1000		800		1400	190		370
No. of Samples	5		6		5	6		5
Phenol **								
Average	5		5		5	5		5
Maximum	8		7		6	7		10
Minimum	2		2		2	4		4
No. of Samples	7		7		7	7		5
Chloride								
Average	26		26		26	26		26
Maximum	28		28		28	28		28
Minimum	25		24		25	25		25
No. of Samples	7		7		7	6		5
Phosphorus								
Average	0.03		0.03		0.03	0.03		0.03
Maximum	0.04		0.05		0.04	0.04		0.04
Minimum	0.02		0.02		0.02	0.02		0.02
No. of Samples	7		7		7	7		5
Total Nitrogen								
Average	0.42		0.43		0.45	0.47		0.43
Maximum	0.59		0.61		0.63	0.55		0.66
Minimum	0.26		0.29		0.29	0.37		0.30
No. of Samples	7		7		7	7		5

mg/l unless otherwise stated

\* MPN/100 mg/l

\*\*ug/l

TABLE V  
SUMMARY OF PHENOL CONCENTRATIONS ALONG U.S. SHORE

**Buffalo and Niagara Rivers**  
**Sampling Location**

	River Mileage	Distance From U.S. Shore	Concentration ug/l
Buffalo River - Ohio St. Bridge	NiBu 39.4	Center of River	
Average			25
Maximum			92
Minimum			2
No. of Samples			13
Buffalo River - Mich. Ave. Bridge	NiBu 38.7	Center of River	
Average			6
Maximum			10
Minimum			2
No. of Samples			8
Niagara River - Peace Bridge	Ni <del>35.8</del> 35.8	100	
Average			1.3
Maximum			2.6
Minimum			0
No. of Samples			8
Niagara River - Int. R.R. Bridge	Ni 34.3	100	
Average			1.8
Maximum			4.1
Minimum			0
No. of Samples			9
Niagara River - T. of Ton. Water Plant	Ni <del>25.7</del> 31.7	10	
Average			2.3
Maximum			4.8
Minimum			0
No. of Samples			9

TABLE V (cont'd.)

## SUMMARY OF PHENOL CONCENTRATIONS ALONG U.S. SHORE

**Buffalo and Niagara Rivers**  
Sampling Location

	River Mileage	Distance From U.S. Shore	Concentration ug/l
Niagara River - So. Gr. Island Bridge	Ni 28.7	10	
Average			7.7
Maximum			19.0
Minimum			2.0
No. of Samples			9
Niagara River - Tonawanda Island Bridge	Ni 25.7	Center of Bridge	
Average			5.0
Maximum			8.9
Minimum			1.0
No. of Samples			8
Petit Drain (Durez Effluent)	Ni 25.0		
Average			102,000
Maximum			249,000
Minimum			20,000
No. of Samples			5
Niagara River - Wahakie Hotel	Ni 23.6	10	
Average			55
Maximum			139
Minimum			23
No. of Samples			9
Niagara River - Union Carbide Intake	Ni 19.0	10	
Average			34.2
Maximum			160
Minimum			0
No. of Samples			13

TABLE V (Cont'd)

## SUMMARY OF PHENOL CONCENTRATIONS ALONG U.S. SHORE

Buffalo and Niagara Rivers  
Sampling Location

	River Mileage	Distance From U.S. Shore	Concentration ug/l
Niagara River - PASNY Forebay	Ni 16.3	-	
Average			3.4
Maximum			8.3
Minimum			0
No. of Samples			9
Niagara River - Goat Island Bridge	Ni 15.4	10	
Average			7.2
Maximum			41
Minimum			0
No. of Samples			9
City of Niagara Falls Sewage Plant Effluent	Ni 13.2	-	
Average			820
Maximum			2800
Minimum			22
No. of Samples			8
Niagara River PASNY Upstream	Ni 9.1	10	
Average			3.9
Maximum			9.7
Minimum			0
No. of Samples			9
Niagara River - Lewiston Marina	Ni 7.5	10	
Average			3.1
Maximum			8.3
Minimum			0
No. of Samples			9

TABLE V (Cont'd.)

## SUMMARY OF PHENOL CONCENTRATIONS ALONG U.S. SHORE

Buffalo and Niagara Rivers  
Sampling Location

	River Mileage	Distance From U.S. Shore	Concentration ug/l
Niagara River - U.S. Coast Guard	Ni 1.0	10	
Average			3.9
Maximum			12.5
Minimum			1.0
No. of Samples			9
 Average			
Maximum			
Minimum			
No. of Samples			
 Average			
Maximum			
Minimum			
No. of Samples			
 Average			
Maximum			
Minimum			
No. of Samples			

TABLE VI

COMPARISON OF COLIFORMS, FECAL COLIFORMS, AND PHENOL  
AT PEACE BRIDGE (Ni-35.7) AND INTERNATIONAL BRIDGE (Ni-34.3) RANGES

<u>Parameter and Range</u>	<u>Feet from U.S. Shore</u>							
	100	300	500	700	1000	1400	1600	1700
<b>Coliform Ni-35.8</b>								
Median	750	91	23	23	23	23	23	23
Maximum	24000	24000	2400	2400	2400	2400	2400	2400
Minimum	230	< 2.3	< 2.3	< 2.3	< 2.3	< 2.3	< 3.6	
No. of Samples	13	13	13	13	13	13	11	
<b>Coliform Ni-34.3</b>								
Median	4300	2400	150	23		160		
Maximum	24000	24000	480	2400		2400		
Minimum	230	91	< 2.3	< 2.3		3.6		
No. of Samples	13	13	13	13		10		
<b>F. Coliform Ni-35.8</b>								
Median	23	23	9.1	3.6	9.1	2.3		
Maximum	11000	2400	2400	2400	2400	2400		
Minimum	36	3.6	< 2.3	< 2.3	< 2.3	< 2.3	< 2.3	
No. of Samples	13	13	13	13	13	11		
<b>F. Coliform Ni-34.3</b>								
Median	360	430	23	3.6		9.1		
Maximum	11000	24000	230	2300		2400		
Minimum	91	23	< 2.3	< 2.3		2.3		
No. of Samples	13	13	13	13		10		
<b>Phenol Ni-35.8</b>								
Average	1.3	1.1	1	1.7	1.3	1.2		
Maximum	4.4	1.3	1.1	2.5	5.2	2.5		
Minimum	0	1	1	1	0	0		
No. of Samples	9	4	3	4	9	9		
<b>Phenol Ni-34.3</b>								
Average	1.8	1.7	1.5	1.0	1.1	0.9	0.8	1.6
Maximum	4.1	4	3.6	4.0	4.0	4.0	3.6	5.4
Minimum	0	0	0	0	0	0	0	0
No. of Samples	9	9	9	9	9	9	9	9