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BCP - C

ENGINEERING INVESTIGATIONS AT INACTIVE HAZARDOUS WASTE SITES

PHASE I INVESTIGATION

CARBORUNDUM BUILDING 82, SITE NUMBER 932048B
CITY OF NIAGARA FALLS, NIAGARA COUNTY

September 1987

Prepared for:
New York State Department
of Environmental Conservation
50 Wolf Road, Albany, New York 12233
Thomas C. Jorling, Commissioner
Division of Solid and Hazardous Waste
Norman H. Nosenchuck, P.E., Director

Prepared by:
Ecology and Environment, Inc.

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1. EXECUTIVE SUMMARY

1.1 SITE BACKGROUND

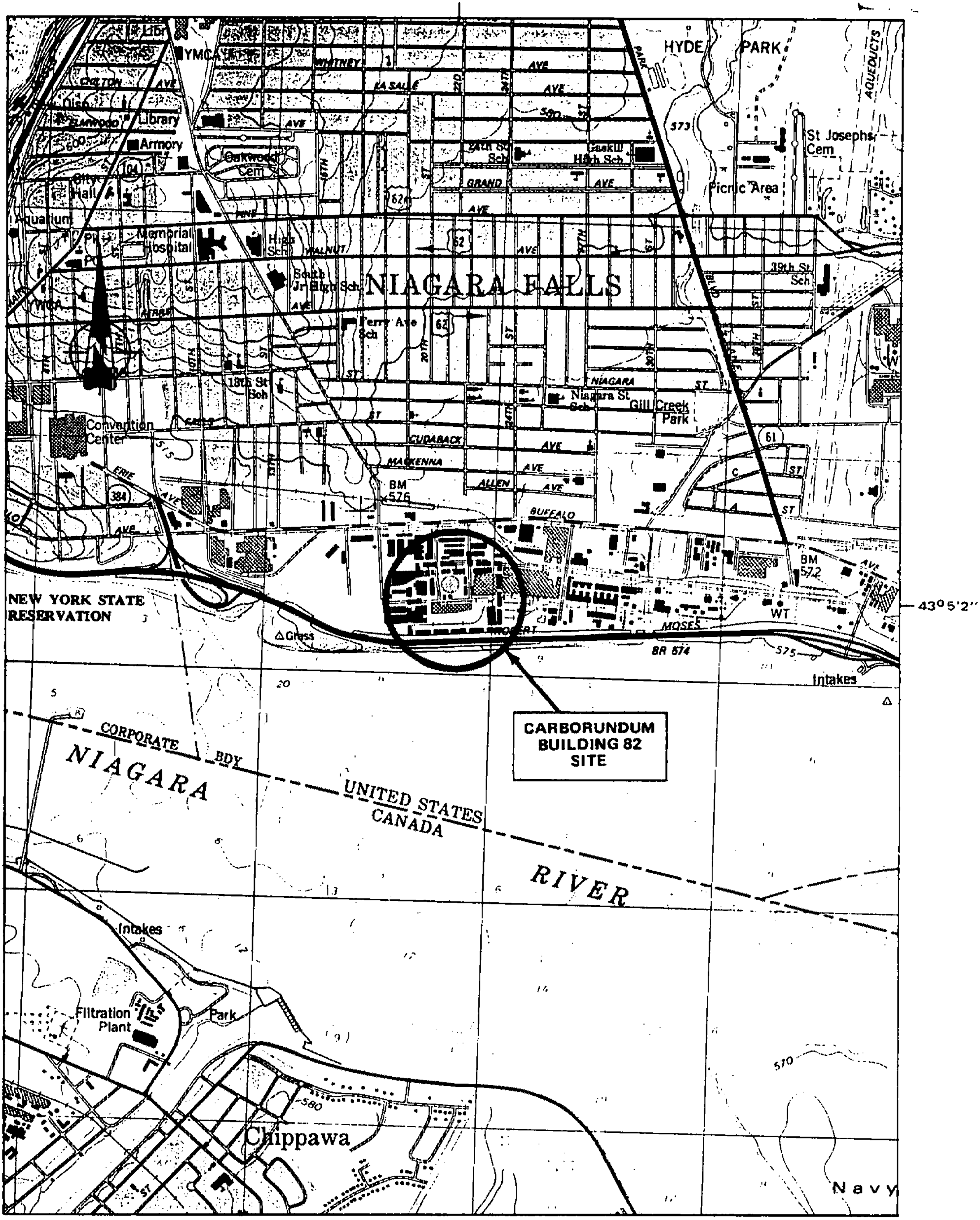
The Carborundum Building 82 site, now owned by Electro Minerals (U.S.), Inc., is approximately 40 acres in area. The site is located adjacent to the Robert Moses Parkway near the Niagara River in the City of Niagara Falls, Niagara County (see Figures 1-1 and 1-2). A portion of this facility was used by Carborundum for temporary storage of sand, fly ash, fire brick, dust collector fines, kiln furniture, wood, carborundum, grinding wheels, aluminum-silica shot, fiber, and metal scrap. It is unknown if any hazardous waste was stored or disposed in this area.

1.2 PHASE I EFFORTS

The site was visited on June 24, 1987, by Ecology and Environment, Inc., (E & E) personnel to conduct a physical inspection of the site in support of this investigation. Prior to the inspection, available state, federal, and municipal files were reviewed, and individuals having knowledge of the site were contacted. The site inspection consisted of a walk-over survey around the perimeter and an interview with the plant Environmental Health and Safety Manager.

1.3 ASSESSMENT

In general, the site was free of stored waste. No landfill activity was noted and the former storage area was graded with crushed stone. All formerly stored waste appeared to be removed.



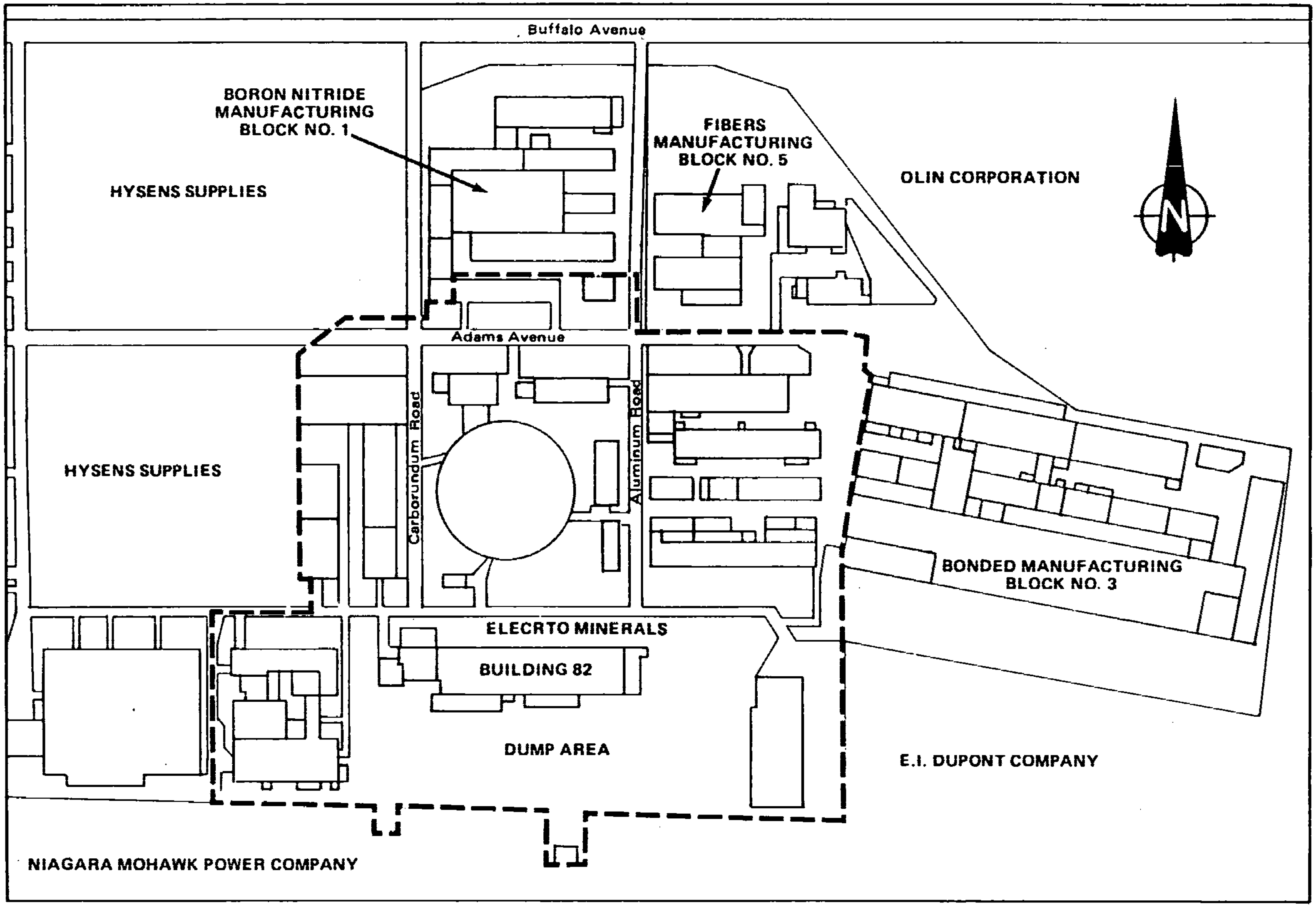
SOURCE: U.S.G.S. 7.5 Minute Series (Topographic) Quadrangle, Niagara Falls, N.Y.-Ont., 1980.

SCALE

0 ½ 1 MILE

0 .5 1 KILOMETER

Figure 1—1 LOCATION MAP



NOT TO SCALE

Figure 1—2 SITE MAP - CARBORUNDUM BUILDING 82

There is little site specific hydrogeologic information available for the Carborundum Building 82 site. There are no known wells on site, and no sampling has been conducted in the former disposal area. Further site investigation would need to be performed to determine if contaminants are present, including soil and groundwater sampling and analysis.

1.4 HAZARD RANKING SYSTEM SCORE

A preliminary application of the Hazard Ranking System (HRS) has been made to quantify the risk associated with this site. As the Phase I investigation is limited in scope, not all the information needed to fully evaluate the site is available. An HRS score was completed on the basis of the available data. Absence of necessary data may result in an unrealistically low HRS score.

Under the HRS, three numerical scores are computed to express the site's relative risk or damage to the population and the environment. The three scores are:

- S_M reflects the potential for harm to humans or the environment from migration of a hazardous substance away from the facility by routes involving groundwater, surface water, or air. It is a composite of separate scores for each of the three routes (S_{GW} = groundwater route score, S_{SW} = surface water route score, and S_A = air route score).

- S_{FE} reflects the potential for harm from substances that can explode or cause fires.

- S_{DC} reflects the potential for harm from direct contact with hazardous substances at the facility (i.e., no migration need be involved).

The preliminary HRS score was:

S_M = 0 (S_{GW} = 0; S_{SW} = 0; S_A = 0)
S_{FE} = not scored
S_{DC} = 0

2. PURPOSE

This Phase I investigation was conducted under contract to the New York State Department of Environmental Conservation (NYSDEC) Superfund Program. The purpose of this investigation was to provide a preliminary evaluation of the potential environmental or public health hazards associated with past disposal activities at the Carborundum Building 82 disposal site. This initial investigation consisted of a detailed file review of available information and a site inspection. This evaluation includes both a narrative description and preliminary HRS score. The investigation at this site focused on the portion of the site where miscellaneous wastes were reportedly stored during the 1970s and perhaps earlier. Based on this initial evaluation, a Phase II investigation is proposed to better assess the potential hazards posed by the industrial wastes disposed of on the site.

3. SCOPE OF WORK

The Phase I effort involved:

- The review of all available information from state, municipal, and private files;
- Interviews with individuals knowledgeable of the site; and
- A physical inspection of the site.

State files reviewed were maintained by the NYSDEC Region 9 in Buffalo, New York. County files reviewed were maintained by Niagara County Department of Health. Private files reviewed were maintained by Electro Minerals (U.S.), Inc., at their Buffalo Avenue, Niagara Falls, New York facility.

Mr. Ahmed Tayyebi at the NYSDEC Region 9 office in Buffalo, New York was contacted concerning information contained in the state file on this site. He referred E & E personnel to Mr. Michael Hopkins of Niagara County Health Department for information. Messrs. Peter Beuchi and Martin Doster from the Region 9 office of NYSDEC were also contacted, and they provided information regarding groundwater wells and soil borings in the vicinity of this site.

Mr. Michael Hopkins, Niagara County Health Department, was contacted in person on May 1, 1987 to discuss information maintained in the county files. Mr. Hopkins informed E & E personnel that the

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county had no direct involvement with the site since it was on industrial property away from drinking water or residential areas.

Ms. Patricia K. Haynes of Electro Minerals (U.S.), Inc., was contacted in person on June 24, 1987 to furnish background information and to accompany E & E personnel on a site inspection. She furnished E & E personnel with a site map, as well as background information on site history and ongoing processes at the site. Records of soil borings by Thomsen Associates from 1984 were also made available.

A site inspection was conducted by E & E personnel on June 24, 1987. No samples were collected by E & E although monitoring of air quality was performed using a HNu photoionizing organic vapor detector. Photographs were taken and are included in Appendix A. A physical inspection of the site and review of pertinent USGS 7.5-minute topographic maps were completed. A summary of agencies contacted, along with contact persons and addresses, is presented in Table 3-1.

Table 3-1

SOURCES CONTACTED FOR THE NYSDEC PHASE I
INVESTIGATION AT CARBORUNDUM BUILDING 82

New York State Department of Environmental Conservation,
Region 9
600 Delaware Avenue, Buffalo, New York 14202
Telephone Number: (716) 847-4585

- Division of Solid Hazardous Waste
  Contact: Lawrence Clare, Ahmed Tayyebi, Peter Beuchi, and Martin Doster
  Date Contacted: May 8, 1987
  Information: Groundwater use; analytical results.

- Division of Regulatory Affairs
  Contact: Paul Eismann
  Date Contacted: May 8, 1987, and June 2, 1987
  Information: Permits; wetlands information.

- Division of Environmental Enforcement
  Contact: Joann Gould
  Date Contacted: May 6, 1987
  Information: Enforcement actions.

- Division of Water
  Contact: Rebecca Anderson
  Date Contacted: June 2, 1987
  Information: Floodplain locations.

- Bureau of Wildlife
  Contact: James R. Snider
  Date Contacted: June 2, 1987
  Information: Critical habitat locations.

Niagara County Health Department
10th and East Falls Street, Niagara Falls, New York, 14302
Telephone Number: (716) 284-3128
Contact: Michael Hopkins
Dates Contacted: May 1, 1987, and May 5, 1987
Information: Groundwater usage.

Electro Minerals (U.S.), Inc.
Buffalo Avenue, Niagara Falls, New York 14302
Telephone Number: (716) 278-2563
Contact: Patricia K. Haynes
Date Contacted: June 24, 1987
Information: Site history; site maps; background information.

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4. SITE ASSESSMENT

4.1 SITE HISTORY

The Carborundum Building 82 waste storage area was used for the storage of sand, fly ash, fire brick, dust collector fines, kiln furniture, wood, grinding wheels, and other industrial scrap before transport to a proper disposal facility. This area is no longer used to store waste, and waste was transported from the site and disposed by Modern Disposal Services, Inc. in 1985. The site has been graded and covered with crushed stone. Some evidence of firebrick and sand was noted in the former storage area. No samples were taken from this area.

Electro Minerals (U.S.), Inc. was formerly owned by Carborundum Corporation, which, in turn, was owned by Standard Oil (SOHIO). Prior to being owned by SOHIO, Carborundum was owned by Kennecott Copper. Electro Minerals (U.S.), Inc., a subsidiary of Washington Mills Abrasives, manufactures abrasive grains from silicon carbide, premium aluminum oxide, graphite, and boric acid. Processes include crushing, sorting, bagging, and arc furnace processing. Waste streams generated include toluene, acetone, methanol, and sulfuric acid, used in grain rinsing, and spent lubricating oils, greases and degreasing agents, which are either recycled by Safety-Kleen, a subcontractor, or removed by SCA a few times each year. The sulfuric acid process was not in operation at the time of the inspection.

4.2 SITE TOPOGRAPHY

This site is located on the Ontario Plain approximately 1.75 miles east of the American Falls in the City of Niagara Falls, New York. The Falls represents the greatest topographic relief in the area, dropping approximately 210 feet from the Upper Niagara River to the Lower Gorge. The site is south of the Niagara Escarpment in an area of low relief which slopes toward the Niagara River located approximately 600 feet south of the site. Site elevation is approximately 570 feet above sea level. The site is not located in a floodplain and the nearest wetland is approximately 4.75 miles to the east. This site is located in the highly industrialized area in the southern portion of the City of Niagara Falls. This area contains several chemical industries.

4.3 SITE HYDROLOGY

4.3.1 Regional Geology and Hydrology

The geology of the Niagara Falls area is well understood because of its simplicity and because of the excellent exposures of bedrock along the Niagara River gorge and the Niagara escarpment.

The overburden in the Niagara Falls area is relatively thin. Three types of unconsolidated deposits are present. The lowermost is glacial till and regolith, an unsorted mixture of boulders, clay, and sand deposited by glaciers, which directly overlies the bedrock. This is covered by clays, silts, and fine sands of lacustrine origin. These are the surface soils throughout most of the region. In isolated spots, sand and gravel deposits are found above the lacustrine soils. These were deposited by glacial melt streams and by wave action of the larger ancestors of the Great Lakes.

The bedrock in the Niagara Falls area consists of nearly flat-lying sedimentary rocks, including dolomite, shale, limestone, and sandstone units. The several beds of bedrock slope southward approximately 30 feet per mile.

The entire region south of the Niagara escarpment, and extending almost to Erie County, is directly underlain by the Lockport Dolomite. The Clinton and Albion groups underlie the Lockport but crop out only along the escarpment and in the gorge of the Niagara River. These units are underlain by the Queenston shale. This unit is the uppermost bedrock unit under the plain north of the escarpment.

Groundwater in the Niagara Falls area occurs in both the unconsolidated deposits and in the bedrock. The bedrock, specifically the Lockport Dolomite, is, however, the principal source of groundwater in the Lockport area. Three types of bedrock openings contain groundwater: bedding joints, vertical joints, and solution cavities.

The bedding joints, which transmit most of the water in the Lockport, are fractures along prominent bedding planes which have been widened up to 1/8 inch by solution of the rocks. These joints extend several miles thus constituting effective water conduits.

The vertical joints are generally too short and sparse to account for significant groundwater storage and transmission, except in the top 10 to 25 feet of bedrock. Solution cavities, formed when gypsum is dissolved, are also not important components of the aquifer. Although they increase the storage capacity of the aquifer, they are isolated and do not contribute to groundwater transmission.

Two distinct sets of groundwater conditions exist in the Lockport Dolomite. The first is the upper 10 to 25 feet of the bedrock, which is highly fractured resulting in moderate permeabilities. In some areas in the region, a confining layer of clay above this zone can produce artesian groundwater conditions. The second class of groundwater conditions is found deeper in the bedrock, where at least seven different permeable zones have been identified. These zones are surrounded by impermeable bedrock, and it is not likely that they are hydraulically connected (Johnston 1964).

4.3.2 Site Hydrogeology

There are no groundwater wells on site, although some specific information on hydrogeology is available. Soil borings from 1984 (Thomsen Associates 1984) indicate the Lockport Dolomite is at a depth of 10 to 24 feet below ground level. Free standing water was encountered between 7 and 12 feet in several of the soil borings. Surface material consists of crushed stone, sand, slag, carbon, and cinder fill. Silts and clays underlie the fill material and overlie a fractured rock zone before competent bedrock is reached. Groundwater is most commonly encountered just above this fractured rock zone.

The silts and clays may impede downward flow of groundwater, but there is insufficient data to adequately assess hydraulic gradients and flow patterns at this site.

Groundwater flow is expected to be northeast toward an industrial pumping well located at the Olin Chemical plant, less than 0.5 mile away. This well is utilized to provide a source of water for a cooling process at a nearby chemical plant. However, some groundwater flow would also be expected to be south toward the Niagara River.

To determine more accurately the site hydrogeology, extensive subsurface investigations would have to be conducted, including installation of monitoring wells. This would provide more precise knowledge of groundwater gradients and flow patterns, and help to identify potential waste migration pathways.

For purposes of HRS scoring, the Lockport Dolomite is considered the aquifer of concern. This aquifer is expected to be encountered from 10 to 24 feet below land surface, and to be approximately 80 to 150 feet thick. A regolith zone is expected to be encountered before competent bedrock.

4.3.3 Hydraulic Connections

The Lockport can be divided into two zones on the basis of water-transmitting properties. The upper 10 to 25 feet of rock is a moderately permeable zone that contains relatively abundant bedding planes and vertical joints enlarged by dissolution of dolomite and abundant solution cavities left by dissolution of gypsum. These zones are more than likely hydraulically connected. The remainder of the formation contains low to moderately permeable bedding planes of which as many as seven may be major water-bearing zones that are surrounded by fine-grained crystalline dolomite. These zones are probably not hydraulically connected.

4.4 SITE CONTAMINATION

It has not been determined if hazardous waste has been disposed or stored at this site. It is known that hazardous materials were used for various processes at the facility, and that wastes were stored on site. The storage area was not lined, and any contaminants that may have been present could have migrated to the groundwater and eventually into the Niagara River. No sampling for hazardous wastes is known to have taken place in the former waste storage area. Air monitoring with a photo ionization detector was performed by E & E while on site, and no readings above background were noted.

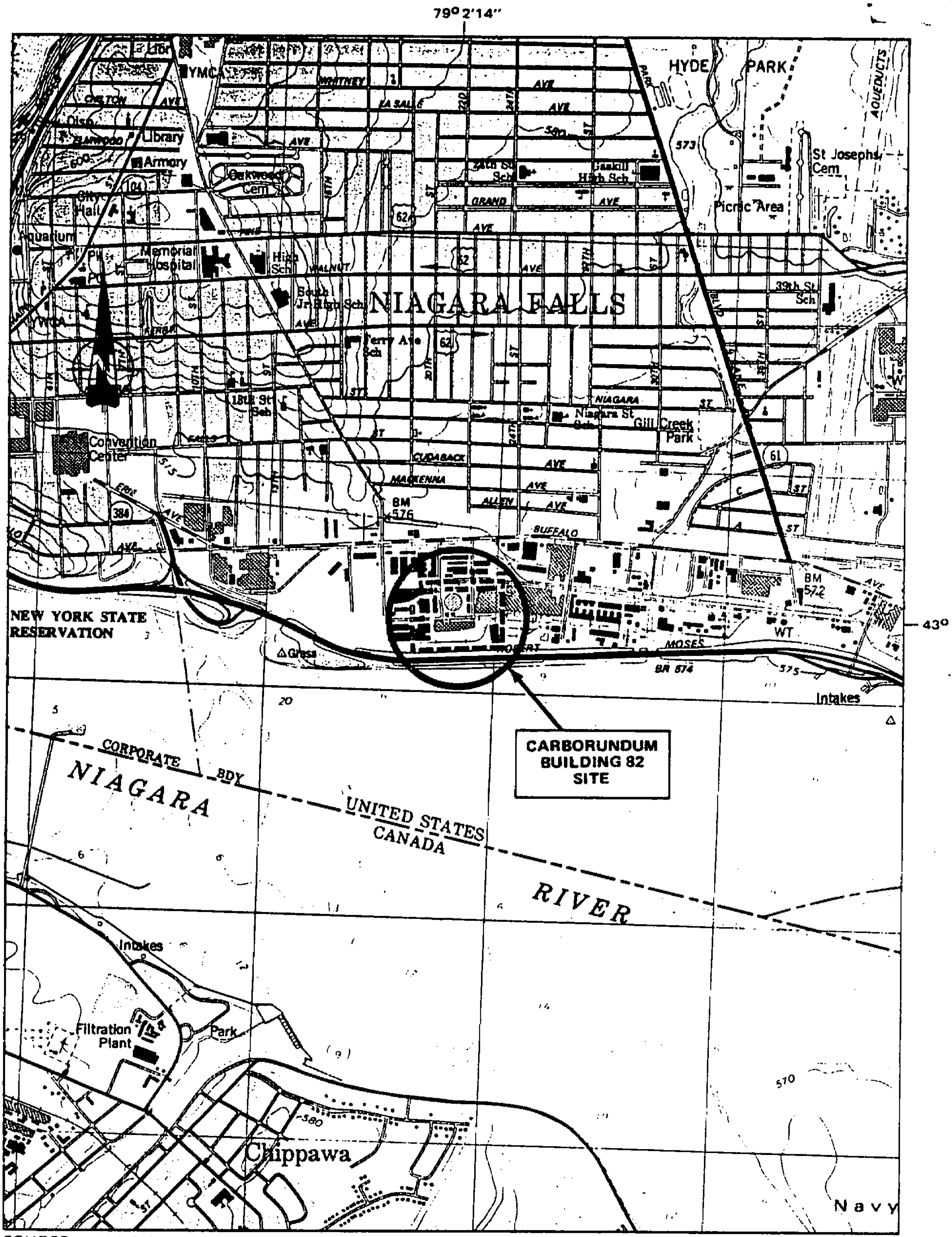
In November 1984, Earth Dimensions, Inc., collected split-spoon soil samples from five locations along Adams Avenue on the Electro Minerals (U.S.) property prior to the installation of the Adams Avenue storm sewer. Analysis of several of these samples indicated the presence of detectable levels of volatile organics, phenols, and total mercury (Advanced Environmental Systems, Inc. 1984). These results, although not attributable directly to the former storage area, show the potential for the presence of hazardous waste at the site. Soil analyses and a map showing sample location are presented in Appendix C to this report.

5. PRELIMINARY APPLICATION OF THE HAZARD RANKING SYSTEM

5.1 NARRATIVE SUMMARY

The Carborundum Building 82, now owned by Electro Minerals (U.S.), Inc., is located on an approximately 40-acre site in the City of Niagara Falls, Niagara County, New York (see Figure 5-1). A portion of this property was at one time used to temporarily store sand, fly ash, fire brick, dust collector fines, kiln furniture, wood, grinding wheels, fiber, aluminum-silica shot, and metal scrap prior to proper disposal. The property was used in this fashion for an unknown period of time ending in 1979. The waste was removed in 1985 and properly disposed, and the site was graded over with fill.

It has not been determined if hazardous wastes were stored at this site; however, the potential exists, since toluene, acetone, methanol, motor fuels, and lubricating oils are used on site.



SOURCE: U.S.G.S. 7.5 Minute Series (Topographic) Quadrangle, Niagara Falls, N.Y.-Ont., 1980.

SCALE

0 ½ 1 MILE

0 .5 1 KILOMETER

Figure 5—1 LOCATION MAP

FIGURE 1

HRS COVER SHEET

Facility Name: Electro Minerals (U.S.), Inc., formerly Carborundum Building 82

Location: Buffalo Avenue, Niagara Falls, New York

EPA Region: II

Person(s) in Charge of Facility: Patricia A. Haynes

Name of Reviewer: Dennis Sutton   Date: 7/15/87

General Description of the Facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action; etc.)

This property was formerly owned by Carborundum Corp., and a portion of the site was used for disposal of sand, fly ash, fire brick, dust collector fines, kiln furniture, wood, carborundum wheels, aluminum-silica shot, fiber and metal scrap. This waste was placed directly on the ground surface and has since been removed.

The site has been leveled and filled. No wells are known on site and the Niagara River is approximately 600 feet to the south.

Scores: S_M = 0 (S_{gw} = 0 S_{sw} = 0 S_a = 0)

S_{FE} = Not scored

S_{DC} = 0

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Ground Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
$\boxed{1}$ Observed Release	[✓ 0] 45	1	0	45	3.1
If observed release is given a score of 45, proceed to line $\boxed{4}$. If observed release is given a score of 0, proceed to line $\boxed{2}$.					
$\boxed{2}$ Route Characteristics					3.2
Depth to Aquifer of Concern	0 1 2 [✓ 3]	2	6	6	
Net Precipitation	0 [✓ 1] 2 3	1	1	3	
Permeability of the Unsaturated Zone	0 [✓ 1] 2 3	1	1	3	
Physical State	0 1 [✓ 2] 3	1	2	3	
	Total Route Characteristics Score		10	15	
$\boxed{3}$ Containment	0 1 2 [✓ 3]	1	3	3	3.3
$\boxed{4}$ Waste Characteristics					3.4
Toxicity/Persistence	[✓ 0] 3 6 9 12 15 18	1	0	18	
Hazardous Waste Quantity	[✓ 0] 1 2 3 4 5 6 7 8	1	0	8	
	Total Waste Characteristics Score		0	26	
$\boxed{5}$ Targets					3.5
Ground Water Use	0 [✓ 1] 2 3	3	3	9	
Distance to Nearest Well/Population Served	[✓ 0] 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
	Total Targets Score		3	49	
$\boxed{6}$ If line $\boxed{1}$ is 45, multiply $\boxed{1}$ x $\boxed{4}$ x $\boxed{5}$ If line $\boxed{1}$ is 0, multiply $\boxed{2}$ x $\boxed{3}$ x $\boxed{4}$ x $\boxed{5}$			0	57,330	
$\boxed{7}$ Divide line $\boxed{6}$ by 57,330 and multiply by 100		S_{gw} = 0			

FIGURE 2
GROUND WATER ROUTE WORK SHEET

Surface Water Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
$\boxed{1}$ Observed Release	[✓ 0] 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line $\boxed{4}$. If observed release is given a value of 0, proceed to line $\boxed{2}$.					
$\boxed{2}$ Route Characteristics					4.2
Facility Slope and Intervening Terrain	[✓ 0] 1 2 3	1	1	3	
1-yr. 24-hr. Rainfall	0 1 [✓ 2] 3	1	2	3	
Distance to Nearest Surface Water	0 1 2 [✓ 3]	2	6	6	
Physical State	0 1 [✓ 2] 3	1	2	3	
	Total Route Characteristics Score		11	15	
$\boxed{3}$ Containment	0 1 2 [✓ 3]	1	3	3	4.3
$\boxed{4}$ Waste Characteristics					4.4
Toxicity/Persistence	[✓ 0] 3 6 9 12 15 18	1	0	18	
Hazardous Waste Quantity	[✓ 0] 1 2 3 4 5 6 7 8	1	0	8	
	Total Waste Characteristics Score		0	26	
$\boxed{5}$ Targets					4.5
Surface Water Use	0 1 [✓ 2] 3	3	6	9	
Distance to a Sensitive Environment	[✓ 0] 1 2 3	2	0	6	
Population Served/Distance to Water Intake Downstream	[✓ 0] 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
	Total Targets Score		6	55	
$\boxed{6}$* If line $\boxed{1}$ is 45, multiply $\boxed{1}$ x $\boxed{4}$ x $\boxed{5}$ If line $\boxed{1}$ is 0, multiply $\boxed{2}$ x $\boxed{3}$ x $\boxed{4}$ x $\boxed{5}$			0	64,350	
$\boxed{7}$ Divide line $\boxed{6}$ by 64,350 and multiply by 100		S_{sw} =	0		

FIGURE 7
SURFACE WATER ROUTE WORK SHEET

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Air Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
$\boxed{1}$ Observed Release	[✓ 0] 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line $\boxed{1}$ is 0, the $S_a = 0$. Enter on line $\boxed{5}$. If line $\boxed{1}$ is 45, then proceed to line $\boxed{2}$.					
$\boxed{2}$ Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
Total Waste Characteristics Score				20	
$\boxed{3}$ Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
Total Targets Score				39	
$\boxed{4}$ Multiply $\boxed{1}$ x $\boxed{2}$ x $\boxed{3}$				35,100	
$\boxed{5}$ Divide line $\boxed{4}$ by 35,100 and multiply by 100		S_a =	0		

FIGURE 9
AIR ROUTE WORK SHEET

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	s	s^2
Groundwater Route Score (S_{gw})	0	0
Surface Water Route Score (S_{sw})	0	0
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$	▨	0
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$	▨	0
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$	▨	0

FIGURE 10
WORKSHEET FOR COMPUTING S_M

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Fire and Explosion Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
$\boxed{1}$ Containment	1 3	1		3	7.1
$\boxed{2}$ Waste Characteristics					7.2
Direct Evidence	0 3	1		3	
Ignitability	0 1 2 3	1		3	
Reactivity	0 1 2 3	1		3	
Incompatibility	0 1 2 3	1		3	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
$\boxed{3}$ Targets					7.3
Distance to Nearest Population	0 1 2 3 4 5	1		5	
Distance to Nearest Building	0 1 2 3	1		3	
Distance to Sensitive Environment	0 1 2 3	1		3	
Land Use	0 1 2 3	1		3	
Population Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Buildings Within 2-Mile Radius	0 1 2 3 4 5	1		5	
	Total Targets Score			24	
$\boxed{4}$ Multiply $\boxed{1}$ x $\boxed{2}$ x $\boxed{3}$				1,440	
$\boxed{5}$ Divide line $\boxed{4}$ by 1,440 and multiply by 100	S_{FE} =				

FIGURE 11
FIRE AND EXPLOSION WORK SHEET

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Direct Contact Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Incident	[✓ 0] 45	1	0	45	8.1
If line 1 is 45, proceed to line 4 If line 1 is 0, proceed to line 2					
2 Accessibility	[✓ 0] 1 2 3	1	0	3	8.2
3 Containment	[✓ 0] 15	1	0	15	8.3
4 Waste Characteristics Toxicity	0 [✓ 1] 2 3	5	1	15	8.4
5 Targets					8.5
Population Within a 1-Mile Radius	0 1 2 3 4 [✓ 5]	4	20	20	
Distance to a Critical Habitat	[✓ 0] 1 2 3.	4	0	12	
Total Targets Score			21	32	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			0	21,600	
7 Divide line 6 by 21,600 and multiply by 100		S_{DC} =	0		

FIGURE 12
DIRECT CONTACT WORK SHEET

DOCUMENTATION RECORDS
FOR
HAZARD RANKING SYSTEM

Instructions: As briefly as possible summarize the information you used to assign the score for each factor (e.g., "Waste quantity = 4,230 drums plus 800 cubic yards of sludges"). The source of information should be provided for each entry and should be a bibliographic-type reference. Include the location of the document.

Facility Name: Electro Minerals (U.S.), formerly Carborundum Building 82

Location: Buffalo Avenue, Niagara Falls, New York

Date Scored: 7/14/87

Person Scoring: D. Sutton

Primary Source(s) of Information (e.g., EPA region, state, FIT, etc.):

New York State Department of Environmental Conservation, Region 9, Buffalo, New York

Factors Not Scored Due to Insufficient Information:

Fire and explosion score was not computed as his site has not been declared a fire hazard by a fire marshal.

Comments or Qualifications:

It has not been determined if hazardous wastes were ever disposed or stored on site. Waste characteristics and waste quantity, if any, are unknown. Site was scored on the basis of available information.

GROUNDWATER ROUTE

1. OBSERVED RELEASE

Contaminants detected (3 maximum):

None observed

Rationale for attributing the contaminants to the facility:

NA

* * *

2. ROUTE CHARACTERISTICS

Depth to Aquifer of Concern

Name/description of aquifer(s) of concern:

Lockport Dolomite: massive- to thin-bedded dolomite with fracture zones and solution cavities
Ref. No. 3

Depth(s) from the ground surface to the highest seasonal level of the saturated zone [water table(s)] of the aquifer of concern:

Approximately 9 feet
Ref. No. 9

Depth from the ground surface to the lowest point of waste disposal/storage:

Unknown

Net Precipitation

Mean annual or seasonal precipitation (list months for seasonal):

31 in/yr
Ref. No. 1

Mean annual lake or seasonal evaporation (list months for seasonal):

27 in/yr
Ref. No. 1

Net precipitation (subtract the above figures):

4 in/yr
Ref. No. 1

Permeability of Unsaturated Zone

Soil type in unsaturated zone:

Silty clay, silty clay loam
Ref. No. 4

Permeability associated with soil type:

10^{-5} - 10^{-7} cm/sec
Ref. No. 1

Physical State

Physical state of substances at time of disposal (or at present time for generated gases):

Solid, unconsolidated and fine material (sand, dust collector fines)
Ref. Nos. 6, 7, 1

* * *

3. CONTAINMENT

Containment

Method(s) of waste or leachate containment evaluated:

None noted - waste material placed on land surface
Ref. Nos. 6, 7

Method with highest score:

Piles
No liner, piles uncovered
Ref. No. 1

4. WASTE CHARACTERISTICS

Toxicity and Persistence

Compound(s) evaluated:

None evaluated

Compound with highest score:

Unknown

Hazardous Waste Quantity

Total quantity of hazardous substances at the facility, excluding those with a containment score of 0 (give a reasonable estimate even if quantity is above maximum):

Unknown

Basis of estimating and/or computing waste quantity:

NA

* * *

5. TARGETS

Groundwater Use

Use(s) of aquifer(s) of concern within a 3-mile radius of the facility:

Industrial - non-contact cooling water
Ref. Nos. 11, 5

Distance to Nearest Well

Location of nearest well drawing from aquifer of concern or occupied building not served by a public water supply:

Located on Olin Chemical Plant property less than 1/2 mile away
Ref. Nos. 11, 5

Distance to above well or building:

4/10 mile
Ref. Nos. 11, 2, 5

Population Served by Groundwater Wells Within a 3-Mile Radius

Identified water-supply well(s) drawing from aquifer(s) of concern within a 3-mile radius and populations served by each:

NA

Computation of land area irrigated by supply well(s) drawing from aquifer(s) of concern within a 3-mile radius, and conversion to population (1.5 people per acre):

NA

Total population served by groundwater within a 3-mile radius:

NA

SURFACE WATER ROUTE

1. OBSERVED RELEASE

Contaminants detected in surface water at the facility or downhill from it (5 maximum):

None observed

Rationale for attributing the contaminants to the facility:

NA

* * *

2. ROUTE CHARACTERISTICS

Facility Slope and Intervening Terrain

Average slope of facility in percent:

0.1%
Ref. No. 2

Name/description of nearest downslope surface water:

Niagara River
Ref. No. 2

Average slope of terrain between facility and above-cited surface water body in percent:

0.1%
Ref. No. 2

Is the facility located either totally or partially in surface water?

No
Ref. No. 2

Is the facility completely surrounded by areas of higher elevation?

No
Ref. No. 2

1-Year 24-Hour Rainfall in Inches

2.5
Ref. No. 1

Distance to Nearest Downslope Surface Water

1/2 mile
Ref. No. 2

Physical State of Waste

Solid, unconsolidated and fine material (sand, dust collector fines)
Ref. Nos. 6, 7

* * *

3. CONTAINMENT

Containment

Method(s) of waste or leachate containment evaluated:

None evaluated

Method with highest score:

Piles
No liner, piles uncovered
Ref. Nos. 6, 7, 1

4. WASTE CHARACTERISTICS

Toxicity and Persistence

Compound(s) evaluated:

None evaluated

Compound with highest score:

NA

Hazardous Waste Quantity

Total quantity of hazardous substances at the facility, excluding those with a containment score of 0 (give a reasonable estimate even if quantity is above maximum):

No known hazardous waste on site

Basis of estimating and/or computing waste quantity:

NA

* * *

5. TARGETS

Surface Water Use

Use(s) of surface water within 3 miles downstream of the hazardous substance:

Commercial or industrial and recreational
Ref. Nos. 11, 2, 13

Is there tidal influence?

No
Ref. No. 2

Distance to a Sensitive Environment

Distance to 5-acre (minimum) coastal wetland, if 2 miles or less:

NA
Ref. No. 2

Distance to 5-acre (minimum) fresh-water wetland, if 1 mile or less:

NA
Ref. Nos. 2, 12

Distance to critical habitat of an endangered species or national wildlife refuge, if 1 mile or less:

NA
Ref. Nos. 2, 13

Population Served by Surface Water

Location(s) of water-supply intake(s) within 3 miles (free-flowing bodies) or 1 mile (static water bodies) downstream of the hazardous substance and population served by each intake:

NA
Ref. Nos. 10, 2

Computation of land area irrigated by above-cited intake(s) and conversion to population (1.5 people per acre):

NA

Total population served:

0
Ref. No. 10

Name/description of nearest of above water bodies:

NA

Distance to above-cited intakes, measured in stream miles:

NA

AIR ROUTE

1. OBSERVED RELEASE

Contaminants detected:

None observed

Date and location of detection of contaminants:

NA

Methods used to detect the contaminants:

NA

Rationale for attributing the contaminants to the site:

NA

* * *

2. WASTE CHARACTERISTICS

Reactivity and Incompatibility

Most reactive compound:

NA

Most incompatible pair of compounds:

NA

Toxicity

Most toxic compound:

NA

Hazardous Waste Quantity

Total quantity of hazardous waste:

NA

Basis of estimating and/or computing waste quantity:

NA

* * *

3. TARGETS

Population Within 4-Mile Radius

Circle radius used, give population, and indicate how determined:

0 to 4 mi [✓ 0 to 1 mi] 0 to 1/2 mi 0 to 1/4 mi

18,758
Ref. No. 8

Distance to a Sensitive Environment

Distance to 5-acre (minimum) coastal wetland, if 2 miles or less:

NA
Ref. No. 2

Distance to 5-acre (minimum) fresh-water wetland, if 1 mile or less:

NA
Ref. Nos. 2, 12

Distance to critical habitat of an endangered species, if 1 mile or less:

NA

Land Use

Distance to commercial/industrial area, if 1 mile or less:

100 feet
Ref. Nos. 2, 7

Distance to national or state park, forest, or wildlife reserve, if 2 miles or less:

1-1/8 miles
Ref. No. 2

Distance to residential area, if 2 miles or less:

2,500 feet
Ref. No. 2

Distance to agricultural land in production within past 5 years, if 1 mile or less:

NA
Ref. No. 2

Distance to prime agricultural land in production within past 5 years, if 2 miles or less:

NA
Ref. No. 2

Is a historic or landmark site (National Register of Historic Places and National Natural Landmarks) within the view of the site?

No
Ref. Nos. 2, 7

FIRE AND EXPLOSION

1. CONTAINMENT

Hazardous substances present:

Unknown

Type of containment, if applicable

Unknown

* * *

2. WASTE CHARACTERISTICS

Direct Evidence

Type of instrument and measurements:

NA

Ignitability

Compound used:

NA

Reactivity

Most reactive compound:

NA

Incompatibility

Most incompatible pair of compounds:

NA

Hazardous Waste Quantity

Total quantity of hazardous substances at the facility:

Unknown

Basis of estimating and/or computing waste quantity:

NA

* * *

3. TARGETS

Distance to Nearest Population

100 feet
Ref. No. 2

Distance to Nearest Building

100 feet
Ref. No. 2

Distance to a Sensitive Environment

Distance to wetlands:

NA
Ref. Nos. 2, 12

Distance to critical habitat:

NA
Ref. No. 13

Land Use

Distance to commercial/industrial area, if 1 mile or less:

100 feet
Ref. No. 2

Distance to national or state park, forest, or wildlife reserve, if 2 miles or less:

1-1/8 mile
Ref. No. 2

Distance to residential area, if 2 miles or less:

2,500 feet
Ref. No. 2

Distance to agricultural land in production within past 5 years, if 1 mile or less:

NA
Ref. No. 2

Distance to prime agricultural land in production within past 5 years, if 2 miles or less:

NA
Ref. No. 2

Is a historic or landmark site (National Register of Historic Places and National Natural Landmarks) within the view of the site?

No
Ref. No. 2

Population Within 2-Mile Radius

39,797
Ref. No. 8

Buildings Within 2-Mile Radius

17,710
Ref. No. 8

Draft

DIRECT CONTACT

1. OBSERVED INCIDENT

Date, location, and pertinent details of incident:

None observed

* * *

2. ACCESSIBILITY

Describe type of barrier(s):

Site is fenced
Plant facility guarded
Ref. Nos. 6, 7

* * *

3. CONTAINMENT

Type of containment, if applicable:

No containment - waste placed on land surface
Ref. No. 6, 7

* * *

4. WASTE CHARACTERISTICS

Toxicity

Compounds evaluated:

None evaluated

Compound with highest score:

NA

* * *

5. TARGETS

Population within one-mile radius

18,758
Ref. No. 8

Distance to critical habitat (of endangered species)

NA

Draft

REFERENCES

If the entire reference is not available for public review in the EPA regional files on this site, indicate where the reference may be found:

Reference Number	Description of the Reference
1	Barrett, K.W., S.S. Chang, S.A. Hans, A.M. Platt, 1982, Uncontrolled Hazardous Waste Site Ranking System; A Users Manual. Document location: Ecology and Environment, Inc., Buffalo, New York.
2	USGS 7.5 Minute Topographical Map, 1980, Niagara Falls, N.Y. quadrangle. Document location: Ecology and Environment, Inc., Buffalo, New York.
3	Johnson, Richard H., 1964, Groundwater in the Niagara Falls Area, New York, State of New York Conservation Department, Water Resource Commission, Bulletin GW-53. Document location: Ecology and Environment, Inc., Buffalo, New York.
4	Higgins, B.A., P.S. Puglia, R.P. Leonard, T.D. Yoakun, W.A. Wirtz, 1972, Soil Survey of Niagara County, New York, USDA Soil Conservation Service. Document location: Ecology and Environment, Inc., Buffalo, New York.
5	Koszaka, E.J., J.E. Paschal, Jr., T.S. Miller, P.B. Dvron, 1985, Preliminary Evaluation of Chemical Migration to Groundwater and the Niagara River from Selected Waste-Disposal Sites; EPA Bulletin. Document location: Ecology and Environment, Inc., Buffalo, New York.
6	Patricia K. Haynes, Manager, Environmental Health and Safety, Electro Minerals (U.S.), June 1987; personal communication. Document location: Ecology and Environment, Inc., Buffalo, New York.
7	Ecology and Environment, Inc., June 12, 1987, site inspection log book and photo log. Document location: Ecology and Environment, Inc., Buffalo, New York.
8	Graphical Exposure Modeling System, June 1987, Environmental Protection Agency, Office of Pesticides and Toxic Substances, Federal Plaza, New York, New York. Information location: Ecology and Environment, Inc., Buffalo, New York.
9	Miller, T.S., W.M. Kappel, 1987, The Effect of Niagara Power Project on Groundwater Flow in the Upper Part of the Lockport Dolomite, Niagara Falls Area, New York; USGS Survey Report 86-4130. Document location: Ecology and Environment, Inc., Buffalo, New York.
10	Hopkins, Michael, June 1987, Niagara County Health Department, Niagara Falls, New York, personal communication. Document location: Ecology and Environment, Inc., Buffalo, New York.
11	Beuchl, Peter, July 1987, New York State Department of Environmental Conservation, Region 9, Buffalo, New York, personal communication. Document location: Ecology and Environment, Inc., Buffalo, New York.
12	New York State Wetlands Maps, New York State Department of Environmental Conservation. Document location: Region 9, Buffalo, New York.
13	Snider, James, June 1987, Wildlife Biologist, New York State Department of Environmental Conservation, Region 9, Buffalo, New York; personal communication. Document location: Ecology and Environment, Inc., Buffalo, New York.
14	New York Atlas of Community Water System Sources, 1982, New York Department of Health, Division of Environmental Protection, Bureau of Public Water Supply Protection. Document location: Ecology and Environment, Buffalo, New York.
15	Murtagh, William, 1976, The National Register of Historic Places, U.S. Department of the Interior, National Park Service, Washington, D.C. Document location: Ecology and Environment, Inc., Buffalo, New York.

REFERENCE NO. 1

Draft

Uncontrolled Hazardous Waste Site Ranking System

A Users Manual

Kris W. Barrett
S. Steven Chang
Stuart A. Haus
Andrew M. Platt

August 1982

MTR-82W111

SPONSOR:
U.S. Environmental Protection Agency
CONTRACT NO.:
68-01-6278

The MITRE Corporation
Metrek Division
1820 Dolley Madison Boulevard
McLean, Virginia 22102

3 702 : - .36

Draft

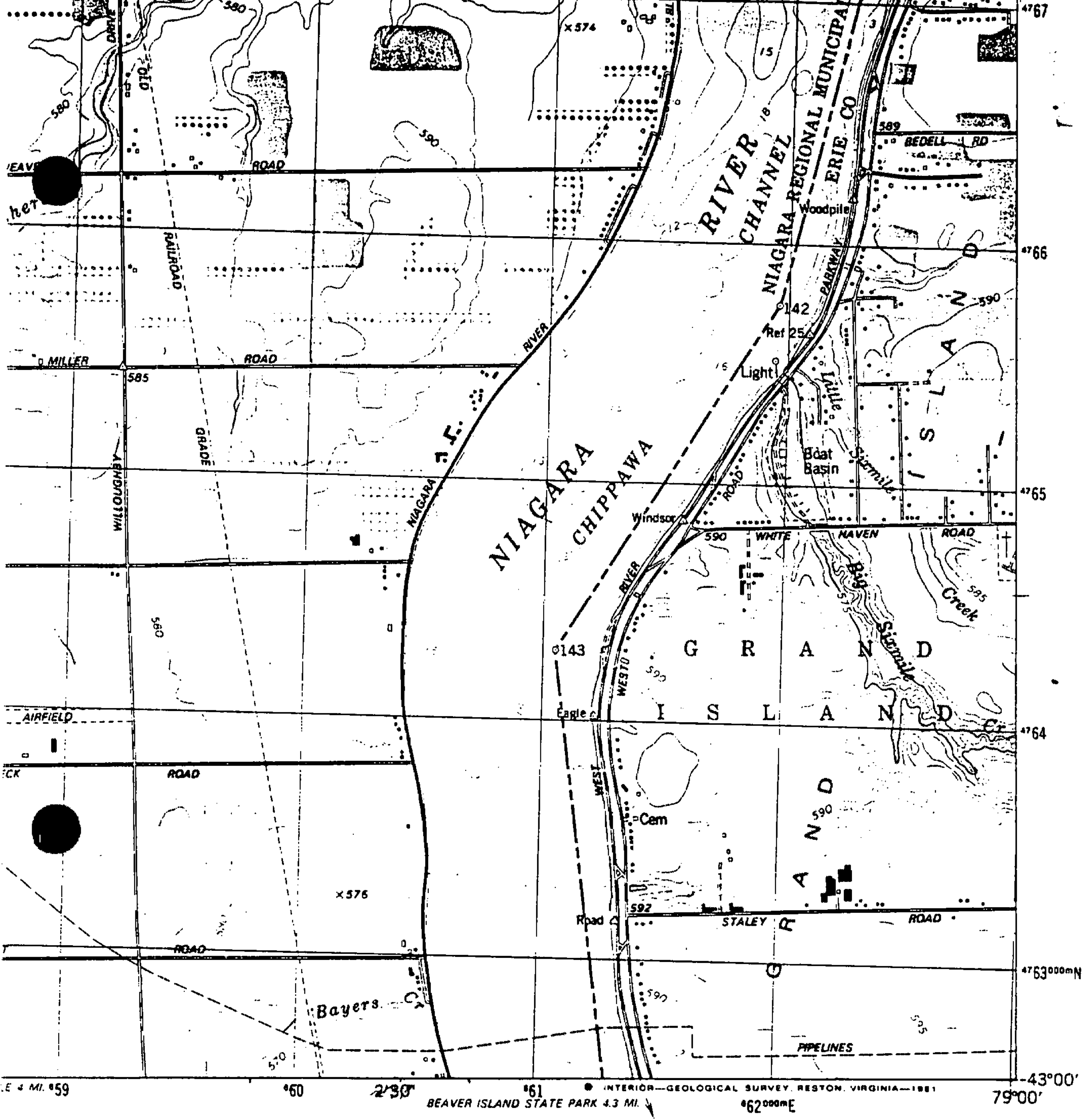
REFERENCE NO. 2

7	2.1336
8	2.4384
9	2.7432
10	3.0480

Draft

To convert feet to meters multiply by .3048

To convert meters to feet multiply by 3.2808



1 MILE

6000 7000 FEET

1 KILOMETER

FEET IN CANADA

R 568.6 FEET

NDARDS
IA 22092
BLE ON REQUEST

ROAD CLASSIFICATION

Primary highway, hard surface

Light-duty road, hard or improved surface

Secondary highway, hard surface

Unimproved road

Interstate Route U. S. Route State Route

NEW YORK

QUADRANGLE LOCATION

(BUFFALO NW)
5269 IV NW

NIAGARA FALLS, N. Y.–ONT.

SE/4 NIAGARA FALLS 15' QUADRANGLE
N4300–W7900/7.5

1980

DMA 5170 II SE–SERIES V821

REFERENCE NO. 3

Draft

Draft

GROUND WATER IN THE NIAGARA FALLS AREA, NEW YORK

With Emphasis on the Water-Bearing Characteristics of the Bedrock

BY
RICHARD H. JOHNSTON
GEOLOGIST
U.S. GEOLOGICAL SURVEY

RECEIVED
SEP 5 1985
ECOLOGY & ENVIRONMENT

STATE OF NEW YORK
CONSERVATION DEPARTMENT
WATER RESOURCES COMMISSION

BULLETIN GW-53
1964

because studies made on the Lockport may contribute to a better understanding of the occurrence of ground water in bedrock generally. The Queenston Shale and Clinton and Albion Groups are poor aquifers in comparison to the Lockport Dolomite, and less is known of their water-bearing characteristics.

LOCKPORT DOLOMITE

Character and extent

The Lockport Dolomite is the uppermost bedrock formation in about one-third of the Niagara Falls area. Its outcrop area extends from the Niagara escarpment on the north to the southern boundary of the area covered by this report except in two small areas that may be underlain by the Salina Group. (See plate 3.) One of these areas is in the vicinity of the hamlet of Nashville and the other is in the extreme southeast corner. Because of a lack of rock outcrops in these areas the position of the contact between the Lockport and the Salina cannot be accurately determined. However, the Salina Group is not discussed as a separate water-bearing unit in this report because at most only a few feet of it occurs in the area. Continuous exposures of the Lockport are found along the gorge of the Niagara River and along the Niagara escarpment. The formation is about 150 feet thick in the southern part of the area but has been eroded to a thickness of only about 20 feet along the escarpment (pl. 2). The excellent exposures at Niagara Falls (fig. 5), where the Lockport forms the lip of the Falls, are shown in many geology textbooks as a classic example of flat-lying sedimentary rocks. Throughout most of the remainder of the area, which is relatively flat, the Lockport is concealed by a thin cover of glacial deposits.

As its name implies, the Lockport Dolomite consists mainly of dolomite; however, the formation also includes thin beds of limestone and shaly dolomite near the base. The Lockport consists of five lithologic types which, from top to bottom, are:

(a) brownish-gray, coarse- to medium-grained dolomite, locally saccharoidal with thin intervals of curved bedding (algal structures).

(b) gray to dark-gray, fine-grained dolomite, containing abundant carbonaceous partings.

(c) tannish-gray, fine-grained dolomite.

(d) light-gray, coarse-grained limestone containing abundant crinoid fragments (Gasport Limestone Member).

(e) light-gray shaly dolomite, laminated in part (DeCew Limestone Member of Williams, 1919).

Fisher (1960) divides the Lockport Dolomite into six units based on fossils as well as rock types. An excellent discussion of the stratigraphy of the

Lockport, including measured sections in the Niagara Falls area, is given in the recent thesis by Zenger 1/.

The detailed breakdowns by Fisher and Zenger, although helpful for geologic mapping and correlating the Lockport with rocks of similar age elsewhere, are not necessary in descriptions of the water-bearing properties of the formation. For this purpose the Lockport is subdivided as follows (figure 5 and table 1): (1) upper and middle parts of the Lockport, and (2) lower part of the Lockport, including the Gasport Limestone Member and DeCew Limestone Member of Williams (1919).

Most of the beds in the Lockport are described as either "thick" (1 foot to 3 feet) or "thin" (1 inch to 1 foot). However, massive beds up to eight feet thick and very thin beds (1/4 to 1 inch) occur within the formation. The bedding is generally straight, but curved bedding occurs in some places in the upper part of the formation. The curved bedding is caused by dome-shaped algal structures called "stromatolites" (Zenger, p. 140). These reefs (bioherms), which occur as lens-like masses up to 50 feet across and 10 to 20 feet thick, contain no bedding.

Gypsum (calcium sulfate) is common in the Lockport, occurring chiefly as small irregularly shaped masses (commonly 1/2 to 5 inches in diameter) and as selenite. Sulfide minerals, particularly sphalerite (zinc sulfide), galena (lead sulfide), and pyrite (iron sulfide) occur as particles disseminated throughout the formation.

Water-bearing openings

Types.--Ground-water occurs in the Lockport Dolomite in three types of openings: (1) bedding joints which constitute at least seven important water-bearing zones, (2) vertical joints, and (3) small cavities from which gypsum has been dissolved. Of these, the bedding joints are the most important and transmit nearly all the water moving through the formation. The three types of openings were observed in the dewatered excavations for the conduits of the Niagara Power Project. (See the description of the power project in the introduction and the location of the conduits in figure 3.) The rock faces along the four-mile length of the conduits provided an unequaled opportunity to study water-bearing openings in the entire stratigraphic thickness of the Lockport and to observe the lateral extent of these openings for a few thousand feet. At the time the observations were made (July - August 1960), approximately one-third of the length of the conduits was available for inspection by the writer.

1/ Zenger, D. H., 1962, Stratigraphy of the Lockport Formation (Silurian) in New York State: Unpublished doctoral thesis, Cornell University.

The bedding joints, which transmit most of the water in the Lockport, are fractures along prominent bedding planes which have been widened very slightly by solution of the rock. These planar openings persist laterally for distances of at least 3 to 4 miles. The separation along individual bedding joints is small (less than 1/8 inch). However, their continuity makes them effective "conduits" for movement of ground water. The large water-transmitting capacity of the bedding joints was shown by the fact that they supplied nearly all the ground-water seepage entering the conduit excavations. The almost continuous lines of seepage from bedding joints was strikingly apparent in the conduits. Figure 7 shows seepage from two bedding joints.

The bedding joints transmitting ground water comprise at least seven distinct water-bearing zones within the Lockport. These water-bearing zones could be traced laterally for distances of 1 to 4 miles. Figure 8 shows the stratigraphic position and part of the lateral extent of the seven zones. The water-bearing zones have been numbered from 1 to 7 from bottom to top. The three sections shown in figure 8 were surveyed by transit and then correlated on the following basis: (1) lithologic similarities, (2) laterally tracing seepage from individual water-bearing zones, and (3) in the case of section A, the distance above the Rochester Shale as shown by core holes. The correlation of water-bearing zone 6 between sections A and B has been changed slightly from an earlier published version (Johnston, 1962, fig. 110.2).

A water-bearing zone may consist of a single open bedding joint (for example zone 4, section C, fig. 8) or it may consist of an interval of rock measuring up to one foot in thickness containing several open bedding joints (zone 7, section A, fig. 8). Where the water-bearing zone consists of several joints, the open joint transmitting most of the water at one locality may "pinch out" laterally and be replaced by another open joint within the same zone elsewhere. For example, at section B (fig. 8) most seepage from water-bearing zone 6 came from a joint at the top of a thin-bedded interval; however, at section A all seepage came from a joint at the bottom of the interval. The opening along one bedding joint thus becomes closed while a parallel opening along an adjacent bedding joint becomes open.

The water-bearing zones occur most commonly within intervals of the Lockport containing thin beds from 1/4 to about 4 inches thick which are directly overlain by thick or massive beds. The thin beds generally contain open vertical joints, and at the intersection of such vertical joints with open bedding joints ground-water seepage is greatest. At a few such points water was observed to squirt from the openings into the conduit excavations in much the same manner as it would from a broken water pipe. It seems likely that open joints occur most commonly in thin-bedded intervals because the greater structural rigidity of the overlying thick or massive beds permits the joints to remain open.

Water-bearing zones occur less commonly within thick-bedded intervals. In such cases all seepage occurs from one distinct bedding joint rather than from several joints. Seepage from zone 4 at section C (fig. 8) came from one prominent bedding joint within an interval of beds averaging one foot in thickness. This bedding joint is open about 1/16 to 1/8 inch locally and appears to transmit as much ground water as any water-bearing zone in the Lockport.

Figure 7.--Seepage from bedding joints in the Lockport Dolomite. View is of east wall of conduit number 1, looking south from Porter Rd. bridge. (Photograph by the Power Authority of the State of New York.)

Vertical joints, excluding those mentioned above which are associated with open bedding joints in thin-bedded intervals, are not important water-bearing openings in the Lockport, except within the top few feet of rock. Two prominent sets of vertical joints exist in the Niagara Falls area; one set oriented N. 65° E. and the other N. 30° W. These joints are fractures in the rock which must be widened by solution before they can become effective water-bearing openings. Such widening is apparent in outcrops of the Lockport. For example, open vertical joints are particularly prominent in the rock cliffs of the Niagara River Gorge and the Niagara escarpment. The width of these joints in many areas exceeds several inches. However, in fresh exposures of the Lockport, such as the conduit excavations, vertical joints are tight and often not apparent to the eye except in the upper few feet of the rock.

Cavities formed by solution of gypsum occur in the Lockport Dolomite. These cavities range in size from 1/16 inch or less to 5 inches but are generally less than one inch in size. The cavities are formed by the dissolving of gypsum by percolating ground water, and there is a complete range in the development of cavities from voids containing no gypsum to pin-point openings in gypsum nodules. The cavities are most abundant in the top 10 to 15 feet of rock but they also occur along water-bearing zones in the lower part of the rock (for example, water-bearing zone 3, section C, fig. 8). In the upper part of the rock, the abundance of cavities locally gives a vuggy appearance to the dolomite.

The cavities in the Lockport resulting from solution of gypsum increase the ability of the Lockport to store water (porosity) but probably have little effect on the water-transmitting ability of the formation. This is because the water-transmitting ability (or permeability) is dependent upon the size of the continuous openings rather than the size of isolated openings. Thus, the relatively thin but continuous bedding joints determine the permeability of the Lockport rather than the larger but isolated cavities resulting from solution of gypsum.

The character and interrelationships of the three types of water-bearing openings described above result in two distinct sets of ground-water conditions in the Lockport Dolomite: (1) a moderately permeable zone at the top of rock, generally 10 to 15 feet thick, characterized by both vertical and bedding joints that have been widened by solution and by gypsum cavities, and (2) the remainder of the formation consisting of seven permeable zones (composed of bedding joints) surrounded by essentially impermeable rock.

<u>Areal extent</u>.--Relatively little is known about the areal extent of the seven water-bearing zones in the Lockport Dolomite, except as observed in the conduits (fig. 8). Many of the individual bedding joints tend to "pinch out" laterally, and be replaced by adjacent joints in the same zone. Such "pinching out" of joints transmitting water was observed in the conduits. Observations in the conduits and data from wells suggest that a few of the zones may persist for tens of miles. The water-bearing zones of greatest areal extent are those which occur at distinct lithologic breaks in the formation. Zone 1, occurring at the base of the Lockport (fig. 8), is frequently reported to be a water-bearing zone by drillers throughout the area. Zone 2, which occurs at the contact between coarse-grained limestone (Gasport Member) and shaly dolomite (DeCew Limestone Member of Williams, 1919) is the source of most of the springs along the Niagara escarpment. Other water-bearing zones, not located at contacts between distinct lithologic units, probably tend to pinch out within a few miles. In summary, at any point in the area, a number of water-bearing zones parallel to bedding exist in the Lockport. All such zones, however, are not necessarily equivalent to the seven water-bearing zones observed in the conduit excavations at Niagara Falls.

It was also noted in the conduit excavations that there were places, even along the most prominent water-bearing zones, where no seepage was occurring. Many such places doubtless represent natural supports for the overlying rock because no extensive horizontal opening below the earth's surface can exist for any great distance. Little is known either about the nature or the size of these support areas or the distance between them. The available data suggest, however, that they encompass an area of at least a few square feet and are separated by a few tens of feet. It may be expected that with depth the size of the supports increases and the distance between them decreases.

The occurrence of ground water principally in zones parallel to bedding is probably characteristic of flat-lying Paleozoic carbonate rocks in many other places. This type of occurrence was reported by Trainer and Salvas (1962, p. 42) in the Beekmantown Dolomite near Massena, N. Y. They observed that "... The openings which are horizontal or gently dipping, and most of which are probably joints or other fractures parallel to the bedding of the rocks, are wider and more numerous than the steeply dipping openings." Although the Beekmantown Dolomite is of an older geologic age than the Lockport, certain similarities exist between the two formations: (1) both units consist of indurated Paleozoic dolomite and limestone; (2) both units are gently dipping, neither having been subjected to extensive folding and faulting which would result in the development of more prominent vertical joints or fractures associated with faulting; (3) both units were subjected to scouring by ice during glaciation within the last 10,000 to 15,000 years and thus, the extensive solution features common to limestones and dolomites in unglaciated areas have not had time to develop. It seems probable that any flat-lying carbonate rock, possessing the characteristics just stated, will contain ground water principally within joints parallel to bedding.

Origin of water-bearing openings.--The origin and the sequence of development of both the vertical joints and bedding joints are of considerable importance in developing an understanding of the occurrence of water in bedrock. Although it was not possible to investigate the origin or the development during this study, speculations based on fundamental principles of geology, especially regarding the origin of the bedding joints, may be worthwhile.

It is widely recognized that joints are formed by forces which tend to pull the rock apart (tension joints) or slide one part of the rock past an adjacent part (shear joints); see, for example, the discussion by Billings (1954, p. 115). The vertical joints were probably formed by a combination of tension and shear forces during or following the folding of the Appalachian Mountains about 200 million years ago. The bedding joints represent tension fractures that formed as a result of expansion of the rock in a vertical direction during more recent geologic time. The Lockport as recently as 200 million years ago was doubtless buried under thousands of feet of other rocks in the Niagara Falls area just as it is at the present time in the southern part of New York State. During the erosion of the overlying rocks the Lockport expanded vertically. The expansion caused fracturing to occur along bedding planes which are natural planes of weakness in the rock and which are approximately parallel to the land surface. Vertical joints, being at right angles to the land surface were little affected by the removal of the overlying rock.

The bedding joints may have been further expanded by stresses produced in the rock during the recession of the glaciers 10 to 15 thousand years ago. The melting of several thousand feet of ice was doubtless accompanied by an expansion of the rock. This expansion either resulted in an enlargement of existing bedding-plane openings or the formation of new openings along other bedding planes.

In recent geologic times, chemical solution of the rock has widened both the vertical and bedding joints. In the already well-developed openings along bedding joints, slight widening by solution has occurred to depths of 100 feet or more. Enlargement of vertical joints, in contrast, is generally restricted to the upper 10 to 15 feet of rock. Cavities formed by solution of gypsum exist where water moving along joints in the Lockport came into contact with gypsum. Gypsum is much more soluble than dolomite; thus, openings formed by the solution of gypsum are wider than other openings along joints. Water moving down vertical joints has dissolved the gypsum to a depth of about 15 feet leaving irregularly-shaped cavities, and water moving along bedding joints has dissolved gypsum to depths of at least 70 feet.

Water-bearing characteristics

Ground water exists in the Lockport Dolomite under artesian, semi-artesian, and unconfined conditions. Unconfined conditions occur where the water table is the upper surface of the zone of saturation within an aquifer. The water table in an unconfined aquifer moves freely upward as water is added to storage, or downward as water is taken from storage. In contrast, an artesian aquifer contains water which is confined by an overlying impermeable bed and which is under sufficient pressure to rise above the top of the aquifer. The level to which water in an artesian aquifer will rise forms an imaginary surface which is called a piezometric surface. Water levels in artesian aquifers change in response to pressure changes on the aquifer rather than to changes in the amount of water stored in the aquifer.

Both artesian and water-table conditions exist in the Lockport. However, artesian conditions predominate. Figure 9 illustrates the occurrence of both artesian and water-table conditions in the Lockport. The wells shown in the diagram are cased through the clay and silt, but are open holes in the bedrock. A packer is installed in each well which tapped water at two or more distinct levels. The packers make possible the measurement of two distinct water levels in each well; a water level above the packer reflecting conditions in the upper part of the rock and a water level below the packer reflecting conditions in the lower part of the rock.

In the upper part of the rock, either artesian or water-table conditions may exist locally. The clay and silt overlying the Lockport are less permeable than the rock and thus act as a confining bed. Artesian conditions exist where the water in the Lockport has sufficient head to rise above the bottom of the overlying clay and silt. In contrast, unconfined (or water-table) conditions exist where the water level occurs within the fractured upper part of the rock, as at well 309-901-5 in figure 9. Locally a "washed till" or dirty gravel zone occurs just above the top of rock. In these localities good connection probably exists between the bedrock and the overlying till or gravel, and the upper part of the rock and washed till zone together form a continuous semi-confined aquifer.

In the lower part of the rock, artesian conditions occur exclusively. The seven water-bearing zones in the Lockport are surrounded by essentially impermeable rock and therefore act as separate and distinct artesian aquifers. The hydraulic nature of the water-bearing zones was observed during the drilling of observation wells in the vicinity of the Niagara Power Project. These wells, whose locations are shown in plate 1, were drilled to observe the effects of the reservoir on ground-water levels in the area. The piezometric level for each successively lower water-bearing zone is lower than for the zone just above it in most of the wells. The reasons for this will be discussed in the section entitled "Ground-Water Movement and Discharge." During construction, the water level in the wells progressively declined in a steplike sequence as the wells were drilled deeper--that is, when a well had been drilled through the uppermost water-bearing zone, the water level in the well remained approximately at a constant level until the next lower zone was penetrated, at which time the water level abruptly declined to the piezometric level of the next lower zone. The difference between the piezometric levels of any two water-bearing zones is large, and in some places is comparable to the distance between zones. If no packer is installed in a well tapping two water-bearing zones, the upper zone will continue to drain into the well indefinitely. This condition exists in a few of the power project observation wells. In these wells the sides of the well remain wet from the level of the upper zone down to the water level in the well. The nature of the water-bearing zones as described above substantiates the reports by drillers and others of "finding water and losing it" in a well, or of wells with "water running in the top and out the bottom." These phenomena occur in some wells tapping two or more water-bearing zones in the Lockport Dolomite.

A well drilled into the Lockport may penetrate several water-bearing zones, but only one of the zones may be hydraulically effective at the site of the well. This is the case for wells 309-901-1, 3, and 5 shown in figure 9. These wells are open below the packers to zones 1, 2, and 3. However, because the water levels observed below the packers in these three wells apparently represents the piezometric surface of zone 3, zones 1 and 2 are not believed to contain effective openings at the sites of the wells. A well also may be drilled through the section occupied by several zones and not be open to any of them. For example, well 309-901-7 shown in figure 9, is apparently open only to the weathered zone at the top of rock.

Yield and specific capacity of wells

The yield of a well in the Lockport Dolomite depends mainly upon which water-bearing zone or zones are penetrated and the degree to which the bedding joints comprising the zones are open to the well. Near the top of rock, the number of open vertical joints and gypsum cavities penetrated may also be important. The average yield of 56 wells tapping the upper and middle parts of the Lockport (which includes water-bearing zones 4 through 7) is 31 gpm (gallons per minute). In contrast, 15 wells penetrating only the lower 40 feet of the Lockport (which includes water-bearing zones 1, 2, and 3) have an average yield of 7 gpm. The yields of individual wells range from less than 1 gpm to 110 gpm. (These figures do not include a few exceptionally high yield wells which obtain water by induced infiltration from the Niagara River and which are discussed in a following paragraph.) Wells tapping the same water-bearing zone may have different yields. For example, wells 309-901-3 and 309-901-5, which are 500 feet apart and tap water-bearing zones 1 through 4 (fig. 9) yielded 7 gpm and 39 gpm, respectively, before the packers were installed. The bedding joints comprising the water-bearing zones are thus more open at well -5 than at well -3.

Increases in yield during drilling in the Lockport Dolomite occur abruptly rather than gradually. As drilling proceeds through the rock, relatively little increase in the yield of a well will be observed until a water-bearing zone is tapped. At that time a marked increase in yield usually occurs. For example, during the drilling of well 308-901-7, the bailing rate abruptly increased from 12 to 50 gpm when water-bearing zone 5 was tapped. During the drilling of well 308-900-21, three distinct increases in yield were observed. The yield, which was 3 gpm at 17 feet (water-bearing zone 7), increased to 9 gpm at 22 feet (an open vertical? joint or solution cavity?) and abruptly increased to 30 gpm at 34 feet (water-bearing zone 6).

Wells in an area about a half mile wide adjacent to the Niagara River above the falls have substantially higher yields than wells elsewhere in the area. The higher yields in this area are caused by two conditions: (1) the Lockport Dolomite is thickest in the area, and (2) more importantly, conditions are favorable for the infiltration of water from the Niagara River. The greater thickness of the Lockport provides the maximum number of water-bearing zones to supply water to the wells. The Niagara River provides an unlimited source of recharge to the water-bearing zones.

Evidence that a substantial part of the water pumped is supplied by induced infiltration from the Niagara River is indicated by the high yields, which exceed 2,000 gpm at some wells, and the chemical character of the water. The chemical composition of the water in well 304-901-6 (which has been pumped at 2,100 gpm) is more similar to Niagara River water than "typical" ground water in the Lockport. (See the following discussion of the chemical character of water and figure 11.) Similar infiltration of Niagara River water into the bedrock at Tonawanda, N. Y., a few miles south of Niagara Falls, was described by Reck and Simmons (1952, p. 19-20).

Infiltration from the river can occur where pumping has lowered ground-water levels below river level to such an extent that a hydraulic gradient is created between the river and the wells. The amount of the infiltration depends on the gradient and the nature of the hydraulic connection between the river and Lockport. The hydraulic connection is controlled by the character of the river bottom. Throughout most of its length in the Niagara Falls area the bottom of the river is covered by a layer of unconsolidated deposits including both till and clay and silt. This layer was found to be from 10 to 20 feet thick in the vicinity of the Niagara Falls water-system intake. (See logs 304-900-i and -j in figure 19.) In the section of the river occupied by rapids, extending a half mile or more above the falls, the bottom has been scoured clean by the river. Where the layer of unconsolidated deposits is present its low permeability greatly retards infiltration. Where the layer is thin or absent infiltration can readily occur.

One of the most striking features in plate 2 is that all wells yielding more than 1,000 gpm are located in a narrow band that intercepts the river about two miles east of the falls. This band trends in a northeasterly direction roughly parallel to one of the two major directions of vertical jointing. Thus, the very high yields may be caused by a greater abundance of vertical joints within the band of high-yielding wells. Vertical joints provide avenues through which water could readily move from the river downward to the bedding joints comprising the water-bearing zones in the Lockport Dolomite.

Wells in the Lockport Dolomite are almost always adequate for domestic needs of a few gallons per minute. Supplies of 50 to 100 gpm, which are adequate for commercial uses and small public supplies, can be obtained in much of the area underlain by the upper part of the Lockport (pl. 2). Large supplies (over 1,000 gpm), as previously noted, are available only in a small area adjacent to the Niagara River.

Wells inadequate for domestic needs are occasionally reported. All wells that are perennially inadequate are located near the Niagara escarpment and therefore tap only the lowest and least permeable water-bearing zones (1, 2, and 3) in the Lockport. Throughout the area a few shallow wells that derive nearly all their water from a single water-bearing zone become inadequate during the summer and autumn of some dry years. Such is the case with well 308-853-1. This well is 27 feet deep and reportedly obtained over 50 gpm from a water-bearing zone 17 feet below land surface. During the drought in 1960, this zone was dewatered as the water table declined in the fall of the year, and the yield of the well quickly declined to less than 1 gpm. The inadequacy of some wells in the Lockport Dolomite can normally be overcome by deepening the well until it penetrates one or more lower water-bearing zones.

Information on the specific capacity of a well is more meaningful than a simple statement of yield. The specific capacity is the yield per unit drawdown, generally expressed as gallons per minute per foot of drawdown. For example, well 307-903-1 was pumped at 20 gpm with 54 feet of drawdown which indicates a specific capacity of 0.37 gpm per foot. The yield and the drawdown for a number of wells in the Lockport are shown in plates 2 and 3. These data must be used with care as they apply only so long as no part of the formation is dewatered.

As water-bearing zones in the Lockport are dewatered, the specific capacity declines. The decline in specific capacity caused by dewatering a water-bearing zone is shown by the data obtained during a pumping test on well 309-859-1. This well was pumped at 2.2 gpm with 5.0 feet of drawdown for 70 minutes--specific capacity of 0.44 gpm per foot. After 70 minutes, water-bearing zone 3 was partially dewatered and a drawdown of 8.2 feet was required to maintain the pumping rate of 2.2 gpm. This indicates a specific capacity of 0.27 gpm per foot. At the time the well was drilled, it was bailed at 3 gpm with a drawdown of about 60 feet. Thus, during the bailing the entire 42 feet of Lockport penetrated by the well was dewatered. The specific capacity of the well with the Lockport dewatered is 0.07 gpm per foot (3 gpm with 42 feet of drawdown) compared to 0.44 gpm per foot with no dewatering.

water from the Queenston are usually found in two areas--(1) in a band about two miles wide immediately north of the Niagara escarpment, and (2) in areas immediately adjacent to streams. Both these areas are believed to be places of ground-water discharge--that is, areas where ground water is moving upward from the Queenston to discharge naturally.

The origin of the salty water in the Queenston is unknown. In commenting on a similar occurrence of salty water in the bedrock in northern St. Lawrence County, N. Y., Trainer and Salvas (1962, p. 103) suggest three causes for the salty water in that area: (1) connate water, (2) the Champlain Sea, and (3) evaporite deposits. They conclude that the Champlain Sea, which covered the area about 10 or 20 thousand years ago, is the most likely source. This source is not applicable to the Niagara area, however, because the Champlain Sea did not extend into the area. Furthermore, it is unlikely that the salty water in the Niagara area is derived from evaporite beds because no such deposits are known to exist in the Queenston. Nor do any salt beds occur in the bedrock formations overlying the Queenston Shale (fig. 5) in the Niagara Falls area. The nearest salt beds occur about 40 miles to the southeast in the Salina Group which overlies the Lockport Dolomite. However, it is very improbable that salty water from the Salina beds has entered the Queenston Shale because (1) the salt beds themselves act as impermeable barriers to water moving downward from the Salina to the Queenston, and (2) it is more likely that salty water from the Salina would be discharged at points between the outcrop areas of the two formations.

Although direct evidence is lacking, the writer believes that the salty water in the Queenston Shale is most likely derived from connate water. The discharge of connate water begins as soon as a deeply buried bed is brought up into the zone of circulating ground water. The Queenston rocks were deposited as a sea-bottom clay about 350 million years ago, and have been deeply buried throughout most of the intervening time. During some thousands of years of Recent geologic time, connate water has been flushed from the upper several hundred feet of the Queenston. However, it is probable that flushing of the deeper part of the formation is continuing at present.

OCCURRENCE OF WATER IN UNCONSOLIDATED DEPOSITS

The unconsolidated deposits in the Niagara Falls area are not important sources of water. These deposits may be classified into two types based on their water-bearing properties: (1) coarse-grained materials of high permeability (sand and gravel), and (2) fine-grained materials of very low permeability (glacial till and lake deposits). The unconsolidated deposits in the Niagara Falls area are predominantly of the fine-grained type. However, the lack of sand and gravel deposits in the Niagara Falls area, other than a few deposits of very limited thickness and extent, has severely limited the development of large ground-water supplies in the area. Most large ground-water supplies in New York State are derived from sand and gravel deposits.

Table 2 shows selected chemical constituents from wells tapping unconsolidated deposits. Water from the different types of unconsolidated deposits is not easy to differentiate on the basis of quality because many wells tap more than one type of deposit. Thus, water samples from such wells are mixtures of water from two or more deposits. In general, water from the unconsolidated deposits is very hard, but not so highly mineralized as water from the bedrock. A complete analysis of water from well 312-859-1, which taps both till and lake deposits, is listed in table 9. This is a calcium bicarbonate water, very hard (568 ppm of total hardness) containing a moderately high chloride content (105 ppm). Water from the unconsolidated deposits generally has a wide range in chloride content. Those wells which yield water with a high chloride content are probably affected either by (1) local pollution, or by (2) upward discharge of saline water from the underlying bedrock.

SAND AND GRAVEL

Sand and gravel is found in small isolated hills and in a narrow "beach ridge" which crosses the area along an east-west line (pl. 3). The sand and gravel deposits are of limited areal extent, generally thin, and occur as topographic highs. The deposits commonly consist of two lithologic types: (1) fine-grained reddish-brown sand, and (2) coarse sand and pebbles with a matrix of fine to medium sand. The origin of both the beach ridge and small hills of sand and gravel is associated with glaciation in the Niagara Falls area. The small hills are kames, i.e. hills of sand and gravel formed originally against an ice front by deposition from sediment-laden melt-water streams. The long, narrow beach ridge is believed to represent a former shore line of glacial Lake Iroquois. This large lake, the predecessor of the present Lake Ontario, existed in the Niagara Falls area near the end of the Ice Age. The sand and gravel composing the beach ridge apparently was produced from pre-existing material by wave action at the shore which winnowed out most of the silt and clay originally contained in the glacial deposit.

Although the sand and gravel deposits in the Niagara Falls area are much more permeable than the other unconsolidated deposits or the bedrock, their occurrence as small topographic highs permits them to drain rapidly. As a result, ground water generally occurs only within a thin zone at the base of the sand and gravel. This is shown in the cross section of the beach ridge in figure 12. It can be seen that the water table is only a few feet above the base of the sand and gravel. Extensive pumping of any of the wells shown would quickly dewater the sand and gravel. In general, wells in the beach ridge and kames will yield only the small amounts of water required for domestic and small-farm needs.

Moderate supplies of ground water can be obtained from a sand and gravel deposit (probably a kame) just east of Lockport, N. Y. (pl. 3). This is the largest sand and gravel deposit in the area, measuring 1 1/2 by 3/4 miles in size. The thickness of the deposit is highly variable because of the hummocky nature of the land surface, but probably averages 60-70 feet. Some notion of the ability of this deposit to yield water is shown by the yield of 165 gpm pumped from a sand pit during excavation. One large-diameter supply well has been constructed in this deposit. This well (311-838-3) was reportedly pumped at a rate of 200 gpm for 24 hours in 1956.

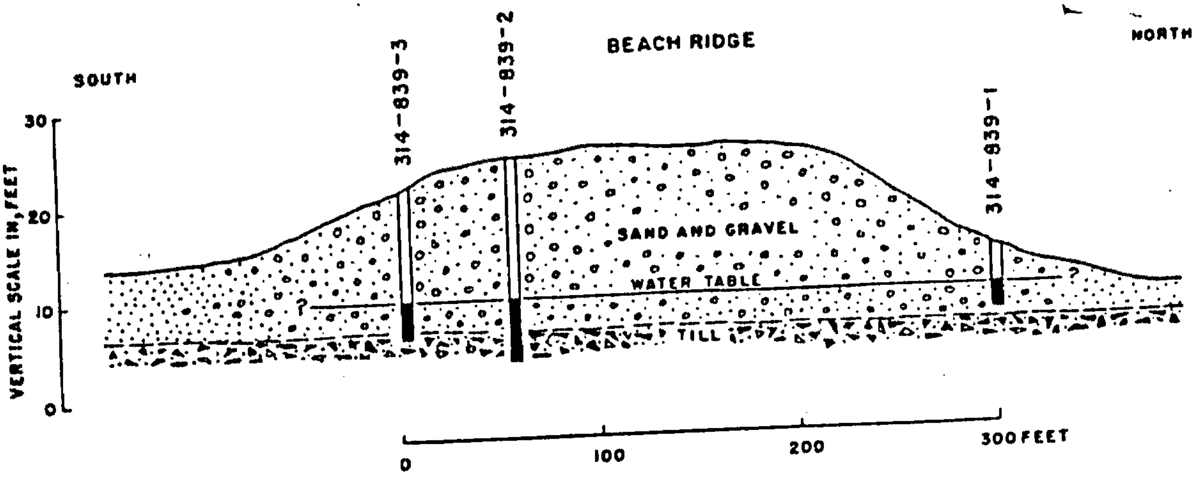


Figure 12.--Cross section of sand and gravel "beach ridge" through wells 314-839-1, -2, and -3.

LAKE DEPOSITS

Lake deposits consisting of silt, clay, and fine sand occur throughout the Niagara Falls area. These deposits are predominantly composed of laminated silt and clay which is characteristically dense and compact. Thin beds of fine sand (locally called quicksand) occur in the lake deposits. The clay, silt, and sand were deposited in lakes which existed in the area at the close of the Pleistocene Epoch (10,000 to 15,000 years ago). The lakes, which formed in the wake of the melting ice sheet, provided large bodies of quiet water for the slow accumulation of fine-grained deposits. Thus, the lake deposits are found at the surface nearly everywhere in the Niagara Falls area. The deposits are thinnest in the area south of the Niagara escarpment where they rarely exceed 20 feet in thickness. On the lake plain north of the escarpment the deposits average 30 to 40 feet in thickness; however, locally they vary from 0 to 90 feet in thickness. The greater thickness on the lake plain results from the persistence of a lake in this area (glacial Lake Iroquois) after the area south of the escarpment was above water.

The silt and clay have extremely low permeability and yield little water to wells. The thin beds of fine sand have comparatively greater permeability. Wells which tap only clay and silt will yield less than 100 gpd; those wells tapping sand beds yield more water and are usually adequate for domestic or very small agricultural needs. The lake deposits are utilized for water supplies only in the lake plain (north of the Niagara escarpment); to the south of the escarpment the deposits are too thin and are underlain by the much more permeable Lockport Dolomite.

The impermeable nature of the silt and clay was shown by a recovery test conducted on well 315-859-1. This well is believed to penetrate only clay and silt. After being pumped dry, the well required 4 1/2 months for the water level to rise to its static level 13 feet above the bottom. The permeability of the clay and silt, as calculated from the recovery data, was 0.04 gallons per day per square foot. The well was originally intended to provide water for a domestic supply, but was inadequate. In contrast, well 315-859-2, which is located about 500 feet to the south, provides an adequate domestic supply. This well undoubtedly penetrates a thin bed of sand.

GLACIAL TILL

A thin veneer of glacial till lies between the lake deposits described above and the bedrock throughout nearly all of the Niagara Falls area. The till is a mixture containing mostly sandy silt with boulders, pebbles, and some clay. The till was deposited directly by the ice sheet and is composed of rock which was quarried by the advancing ice, then ground up, and "plastered down" beneath the ice. The till cover in the Niagara Falls area is generally less than 10 feet thick. The greatest thickness of till (30 to 40 feet) is found in the moraines in the eastern part of the area. These features are the low ridges which trend approximately east-west located in the area southeast of Lockport and south of Medina (pl. 3). The moraines are composed of debris which was piled up in front of the advancing ice front. The moraines in the Niagara Falls area are believed to represent four minor readvances of the ice sheet during its retreat from the area (Kindle and Taylor, 1913, p. 10).

The poorly sorted nature of the till causes it to have very low permeability. An indication of the low permeability was obtained from a "slug" test on well 309-900-8. This well penetrates 7.5 feet of lake clay and silt and 1.5 feet of glacial till, and is cased through the lake deposits. The permeability of the till at this well was determined to be 23 gallons per day per square foot. This value for permeability may be too high because the well bottomed at the top of the Lockport Dolomite. Thus an open joint in the rock could have contributed to the yield of the well. However, the value for permeability may be representative of the "washed till-top of rock" aquifer tapped by many dug wells in the Niagara Falls area.

Yields adequate for domestic needs are obtained from till wells which tap: (1) sand lenses within the till, (2) the relatively permeable ("washed") zone at the top of rock, or (3) the sandy till making up the moraines. Wells which do not tap these more permeable horizons in the till are often inadequate to supply even domestic needs. Such inadequate wells yield less than 100 gpd.

separating Lake Erie from Lake Ontario. The winds are thus less moisture-laden than if they had passed over the lakes. Even those winds which may be moisture-laden (from evaporated lake water) may retain most of their moisture until they reach the more hilly areas east of Lake Ontario. The Niagara escarpment appears to have a local effect on the amount of precipitation also. As can be seen from the precipitation data given in table 5, Lewiston (elevation 320 feet), which is located below the escarpment, receives less precipitation than Lockport (elevation 520 feet), which is at the escarpment. Table 5 also shows that precipitation is fairly evenly distributed throughout the year. Within a given year, however, large variations from the average figures listed may occur. Note that the minimum monthly precipitation for each month during the 25-year period is between 1/2 and 1/20 the average precipitation for that month. However, the minimum annual precipitation (1941) is more than 1/2 the average annual precipitation. Average annual temperature is 48°F at Lewiston. The length of the growing season averages 160 days.

GROUND WATER

A part of the rain and snow falling on the Niagara Falls area seeps into the ground and continues downward to the water table to become ground water. The ground water is in constant, but generally very slow, movement from points of recharge to points of discharge. Ultimately all ground water in the area is discharged into Lake Ontario or the Niagara River either directly or via small tributary streams. The Niagara Falls area is, in effect, a peninsula-shaped catchment area in which the ground-water reservoir is being repeatedly replenished by precipitation, and constantly discharging to the surrounding surface-water bodies. This section of the report describes: (1) recharge to the unconsolidated deposits and the bedrock, (2) movement and discharge of ground water in the area, and (3) changes in storage in the ground-water reservoir as shown by water-level fluctuations.

RECHARGE

The source of nearly all the ground-water recharge in the Niagara Falls area is precipitation; however, a small amount of recharge also occurs in the area beneath and immediately adjacent to the Niagara Power Project reservoir by infiltration from the reservoir. Recharge of ground water means simply the addition of water (or quantity added) to the zone of saturation (Meinzer, 1923, p. 46). The rate and amount of recharge depends mainly upon the permeability of the soil, the amount of precipitation, and the soil-moisture condition at the time of precipitation. The rate of infiltration of water into the soil increases with increase of permeability. In the relatively small part of the Niagara Falls area underlain by sand and gravel, infiltration rates are greatest. However, throughout most of the area underlain by glacial till and lake clays and silts infiltration rates are low and surface runoff is high.

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Table 5.--Monthly precipitation at Lewiston and Lockport, N. Y., 1936-60
(Data from reports of U.S. Weather Bureau)

Month	Lewiston (1 mile north of; elevation 320 feet)		Lockport (2 miles northeast of; elevation 520 feet)	
	Average (inches)	Minimum (inches)	Average (inches)	Minimum (inches)
January	1.98	0.59 (1946)	2.38	0.67 (1946)
February	2.35	.54 (1947)	2.52	.85 (1947)
March	2.49	.63 (1958)	2.56	.71 (1958)
April	2.66	.83 (1946)	2.80	.91 (1946)
May	3.08	.71 (1941)	3.26	.94 (1936)
June	2.18	.66 (1953)	2.41	.33 (1953)
July	2.44	1.15 (1955)	2.70	.90 (1954)
August	2.57	.21 (1948)	2.97	.36 (1948)
September	2.97	.46 (1941)	2.92	.14 (1941)
October	2.55	.47 (1947)	2.85	.60 (1938)
November	2.33	.75 (1939)	2.62	.64 (1939)
December	2.02	.39 (1958)	2.39	.71 (1943)
Annual	29.62	17.64 (1941)	32.38	19.75 (1941)

The mechanism of recharge to the Lockport Dolomite is of primary concern in this report because this bedrock unit is by far the most important aquifer in the Niagara Falls area. As discussed previously, most ground water occurs in the Lockport within seven relatively permeable zones parallel to bedding which are separated by essentially impermeable rock. Recharge to these water-bearing zones occurs by one of two mechanisms: (1) downward movement of water through vertical joints or (2) recharge directly to the water-bearing zones at the outcrop of the bedding joints composing the zones.

Several lines of evidence suggest that recharge to the Lockport Dolomite occurs predominantly at the outcrop of the water-bearing zones. The lack of persistent open vertical joints in the Lockport as observed in the conduit excavations, suggests that vertical joints are not important avenues for downward movement of water. However, this is not conclusive evidence in itself because on an areal basis, many vertical joints, although apparently tight, might be able to transmit appreciable quantities of water when considered as a whole even though each joint singly might transmit a very small quantity of water. More conclusive evidence of a negligible movement of water along vertical joints is the occurrence of "dry" open bedding joints below the "wet" bedding joints comprising the water-bearing zones in the Lockport (fig. 8). This phenomenon could not occur if permeable vertical joints connected the "dry" and "wet" bedding joints. It seems probable that the "dry" bedding joints exist because they receive little or no recharge in their outcrop area. This lack of recharge would be particularly applicable to those bedding joints cropping out along the Niagara escarpment where there is very little opportunity for recharge.

The most important indication that recharge to the water-bearing zones of the Lockport Dolomite occurs at the outcrop of the zones, is the alignment of water levels approximately parallel to the dip of the zones themselves. This alignment of water level is shown for water-bearing zone 3 in figure 9.

The wells shown in the cross section are adjacent to the reservoir of the Niagara Power Project; however, the water levels shown were measured prior to flooding of the reservoir. If recharge to the water-bearing zones did occur throughout the area by downward movement through vertical joints, the gradient along the zones would steepen in the downdip direction rather than continue roughly parallel to the dip of the zones--that is, if it is assumed that there is no increase in transmissibility downdip. This steepening of the hydraulic gradient would be required in order to transmit the ever-increasing amounts of water supplied to the zone by the vertical joints. No such steepening of the gradient was observed.

In summary, it appears that recharge occurs principally at the outcrop of the water-bearing zones in the Lockport Dolomite and that water then moves down the dip of the zone with a relatively constant loss of head. Recharge is probably not limited to the actual line of outcrop of a zone, however, but occurs throughout the area where the zone is reached by the enlarged vertical joints that occur in the upper few feet of the rock.

Little is known about the recharge to the other bedrock formations underlying the Niagara Falls area. It is probable that a very small amount of water moves downward from the Lockport Dolomite into the Rochester Shale and the underlying bedrock units. As was pointed out in the preceding discussion, however, vertical openings even in the Lockport Dolomite appear to transmit relatively little water except in the upper few feet of the rock. Therefore, movement of water from the Lockport into the underlying formations probably occurs only along widely spaced major vertical joints. Some of the water in the deeper bedrock units in the Niagara Falls area may also be derived from recharge to these beds in the area to the south. Such water would move through the Niagara area toward the Niagara gorge and Lake Ontario, both of which are regional discharge areas.

GROUND-WATER MOVEMENT AND DISCHARGE

Ground water moves from points of high head to points of low head (or potential), in other words from points where the water table or piezometric surfaces are highest to points where they are lowest. The direction of ground-water movement in the upper few feet of bedrock and in the unconsolidated deposits (where water-table conditions exist) is shown by the configuration of the water table. The direction of movement in the remainder of the bedrock is shown by the configuration of the piezometric surfaces associated with each of the artesian water-bearing zones in the different bedrock formations.

As discussed previously, each of the seven water-bearing zones in the Lockport is a distinct artesian aquifer with an associated piezometric surface. To show in detail the ground-water movement in the Niagara Falls area, it would be necessary to construct a water-table map, and piezometric maps for each of the water-bearing zones. Such maps are not included in this report because water levels could be measured in relatively few wells and because of the difficulty of differentiating between water levels which represent the water table and water levels which represent the piezometric surfaces associated with each of the several water-bearing zones. In a few wells constructed with packers, such as shown in figure 9, it was possible to measure separate water levels associated with the water table and with distinct water-bearing zones. In wells not equipped with packers, which includes all domestic and industrial wells in the area, a measured water level is an average of the heads of the different water-bearing openings penetrated by the well. Such an average water level represents neither the water table nor the piezometric surface of a single water-bearing zone.

Nearly all water-level data that could be used in determining direction of ground-water movement were obtained from wells in the vicinity of the pumped-storage reservoir. These data show that in general the configuration of the water table follows the surface of the land, being highest under hills and in interstream tracts and lowest in stream valleys. The configuration of the piezometric surfaces associated with each water-bearing zone in the Lockport has little relationship to the land surface. The piezometric surfaces are approximately parallel to the slope of the water-bearing zones. The disparity in the configuration of the water table and the piezometric surfaces is shown in figure 9, which was previously referred to in the discussion of artesian and water-table conditions in the Lockport. As shown in the figure, the water table slopes from all directions toward Fish Creek, whereas the piezometric surface for water-bearing zone 3 slopes to the south away from the creek. Thus, ground-water movement in the upper fractured part of rock and in the overlying unconsolidated deposits is toward the creek, but movement along water-bearing zone 3 and, presumable in the other water-bearing zones, is to the south toward the upper Niagara River.

Figure 14 shows the inferred direction of ground-water movement in the upper water-bearing zones of the Lockport Dolomite. This figure is based on adequate data only in the vicinity of the reservoir. Because only a few scattered water-level observations are available for the area south of the reservoir, the flow lines in that area are based largely on the fundamental principles governing ground-water movement.

It may be observed in figure 14 that ground water in the Lockport Dolomite moves north toward the Niagara escarpment in a narrow area parallel to the escarpment. This northerly direction of ground-water movement is shown by (1) the location of springs near the base of the Lockport along the escarpment (pl. 1), and (2) the decline of water levels in wells in the direction of the escarpment. A divide in the water table and in the upper fractured part of the rock apparently exists at a distance of 1,000 to 2,000 feet south of the escarpment. The existence of this divide is shown by the reversal of hydraulic gradient in the area. The gradient is toward the escarpment in the area less than 1,000 feet south of the escarpment. However, a hydraulic gradient to the southeast (approximately parallel to the dip of the beds in the Lockport) was observed in wells located over 2,500 feet south of the escarpment.

Prior to the start of the investigation it was assumed that water in the Lockport Dolomite in the western part of the Niagara Falls area moved west to the gorge to discharge. It was observed very early in the study, however, that there was practically no evidence of seepage on the sides of the gorge. The lack of seepage could be explained by (1) assuming that the water moving toward the gorge was intercepted by enlarged vertical joints parallel to the gorge, or (2) assuming that there was little or no movement of water toward the gorge.

Because the city of Niagara Falls and the area along the gorge north of the city is supplied by the Niagara Falls municipal water system, very few wells suitable for water-level observations were found in the area. The only wells readily accessible for water-level measurements were in the vicinity of the power station and canal. The data from these wells indicate that water moves toward the gorge. The width of the area supplying water to the gorge, however, could not be determined. Indirect information relative to this problem was derived from the water-level measurements in the vicinity of the reservoir. It was found that if the slope of the piezometric surface for a specific water-bearing zone (for example, zone 3 in figure 9) was extended to the south, the pressure reached the level of the upper Niagara River a short distance south of the reservoir. This does not prove but certainly strongly suggests that under natural (pre-power project) conditions the water in the Lockport Dolomite turned west to discharge into the Niagara River gorge, roughly midway between the escarpment and the upper Niagara River (fig. 14). The absence of seepage on the sides of the gorge, therefore, is believed to be attributable to enlarged vertical joints parallel to the gorge.

Ground-water movement as it probably existed in 1962 may be summarized as follows: (1) water moves northward in a narrow area parallel to the Niagara escarpment, (2) water moves southward (downdip) in the area around the reservoir (which acts as a recharge mound and tends to deflect the water moving from the north), (3) water moves into the canal, conduits, and area of industrial pumping to discharge, and (4) water moves toward the gorge in the southwestern part of the area.

On the lake plain, north of the Niagara escarpment, ground water moves in a generally northward direction toward Lake Ontario. The water table is located within the lake deposits about 3 to 10 feet below the surface. The water table very nearly parallels the land surface and slopes regionally toward Lake Ontario with a gradient of 5 to 20 feet per mile. It also slopes toward the streams crossing the lake plain in a narrow area adjoining each stream. The direction of ground-water movement in the Lockport Dolomite in the eastern part of the Niagara Falls area is not known.

WATER-LEVEL FLUCTUATIONS

Fluctuations of ground-water levels reflect changes in the amount of water stored in an aquifer. A decline in water level shows a decrease in storage in the aquifer, and means simply that discharge from the aquifer is exceeding recharge. A rise in water level indicates the reverse situation--recharge is greater than discharge. In wells tapping unconfined aquifers, water-level fluctuations show changes in the position of the water table. In wells tapping artesian aquifers, water-level fluctuations show changes in artesian pressure.

Natural fluctuations

Water-level fluctuations of natural origin can be broadly classified as either short- or long-term fluctuations. The short-term fluctuations are produced mainly by changes in atmospheric pressure, ocean tides, and earth tides. Fluctuations due to atmospheric pressure and earth tides occur in the Niagara Falls area but are of relatively little importance in the description of the ground water. Such short-term fluctuations are observed only in wells tapping artesian aquifers. Long-term fluctuations are largely a product of climate, particularly precipitation and temperature. The long-term fluctuations in water levels show changes in the natural rate of recharge to an aquifer compared to its rate of discharge to springs and stream beds.

The most noticeable fluctuation of ground-water levels in the Niagara Falls area are seasonal fluctuations. In general, water levels in the area reach their peak during the spring of the year (March and April) because of the large amount of recharge provided by snow melt and precipitation. Water levels generally decline throughout the summer because most of the precipitation is lost by evaporation and the transpiration of plants. Such water loss is characteristic of the summer growing season. During other seasons substantial amounts of water pass through the soil zone and continue downward to the water table. Water levels generally reach their yearly lows near the end of the growing season during September or October. Thereafter, water levels begin to rise and this rise is more or less continuous through March or April. Because the amount of precipitation is normally evenly spaced throughout the year in the Niagara Falls area (table 4), seasonal fluctuations are more a product of air temperature than of precipitation. The air temperature controls whether precipitation falls as snow or rain, whether the ground is frozen at the time of precipitation, and the length of the growing season; all of these are factors that affect water levels.

Draft

SPRINGS

Springs are not widely utilized as ground-water supplies in the Niagara Falls area. Springs are common along the Niagara escarpment but rarely occur elsewhere in the area. (See plates 1 and 3.)

Most of the springs along the escarpment originate near the base of the Lockport Dolomite. The source is nearly always seepage from bedding joints at the contact between the DeCew Limestone Member of Williams (1919) and the Gasport Limestone Member of the Lockport (water-bearing zone 2 in fig. 8). The springs occur where vertical joints intersect the water-bearing zone. Enlargement of both vertical and bedding joints is common at the springs, and in some cases has proceeded to the point where small caves have developed.

Springs are uncommon along the cliffs of the Niagara River Gorge. This lack of springs probably results from the development of extensive open vertical joints parallel to the face of the gorge. These joints drain water readily from the Lockport Dolomite through the underlying rocks and talus to the river. (See figure 6.)

Notable exceptions to the lack of springs along the gorge are springs 309-902-2Sp and -3Sp which are located just south of the Niagara escarpment (pl. 1). These springs are located in caves developed by solution of the shaly dolomite of the DeCew Member of Williams (1919) of the Lockport. The source of the springs, like the source of most springs along the escarpment, are bedding joints at the contact between the DeCew and Gasport Members (water-bearing zone 2 in fig. 8). Extensive solution features, such as sink holes, exist in the area drained by these two springs. Fish Creek, which crosses the area, loses water as it flows across the bedrock, and apparently contributes a major part of the water discharging from the springs. Dye introduced into Fish Creek reappeared at the springs, 1,000 feet away, 38 minutes after introduction (personal communication from C. P. Benziger of Uhl, Hall & Rich). The yield of these springs is therefore highly variable; the yields varying from about 15 gpm during dry periods to reportedly thousands of gallons per minute following heavy rains or periods of melting snow. The water from springs 309-902-2Sp and -3Sp is polluted by nearby septic tanks as shown by the strong odor of sewage and the sudsy character of the water.

The yield of single springs in the Niagara Falls area ranges from about 2 to 30 gpm during the dry parts of the year. The yields of most springs increase following rains but not nearly so much as the increase noted for springs 309-902-2Sp and -3Sp in the discussion above. Spring 310-859-6Sp is the only spring in the area utilized as a water supply on a year-round basis. This spring provides an adequate domestic supply for a trailer court with eight families.

PRESENT UTILIZATION

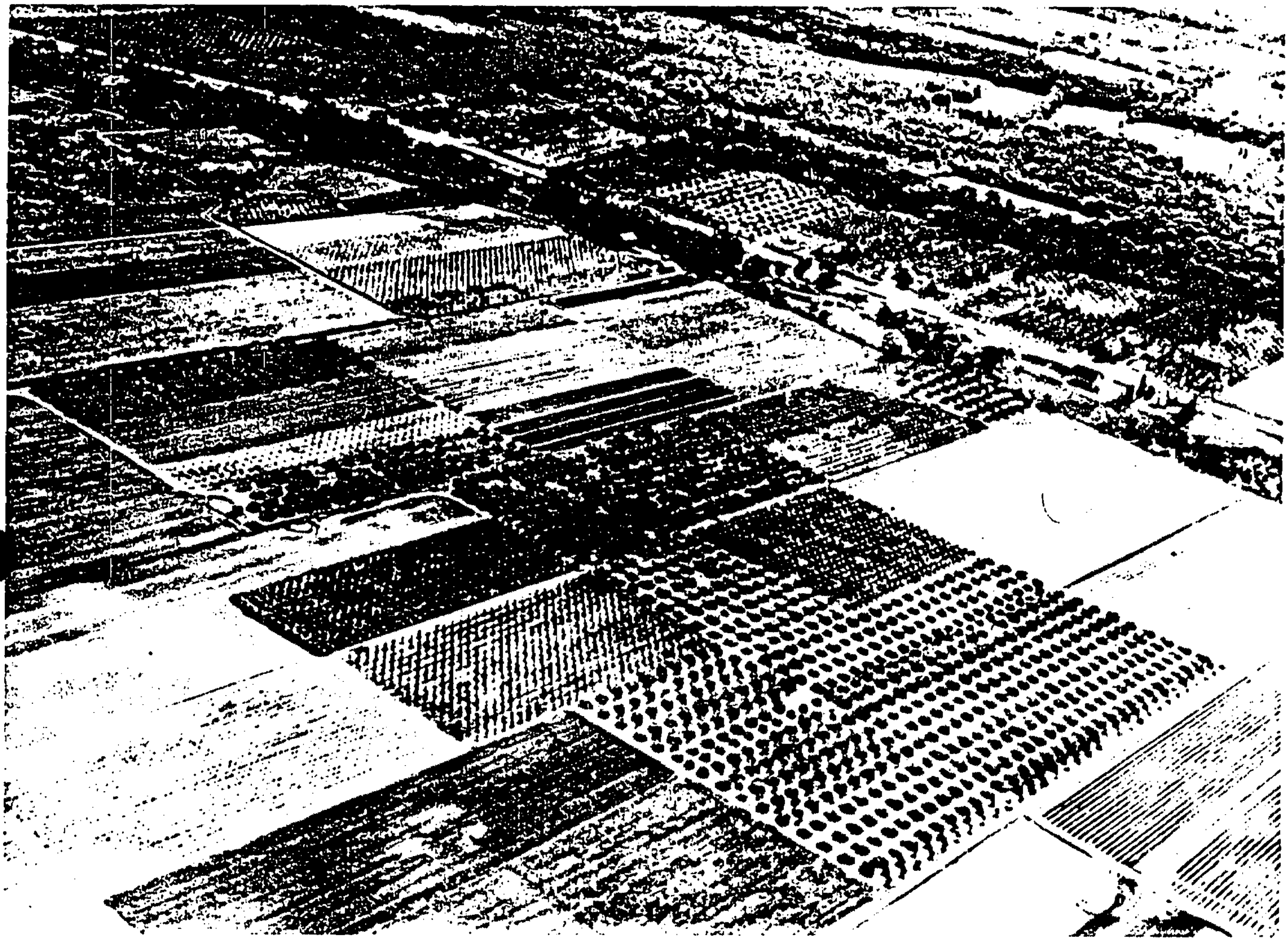
An estimated 10 mgd (million gallons per day) of ground water was obtained from wells in the Niagara Falls area during 1961-62. This figure contrasts with an estimated 60 mgd of water obtained from surface sources

REFERENCE NO. 4

Draft

SOIL SURVEY OF

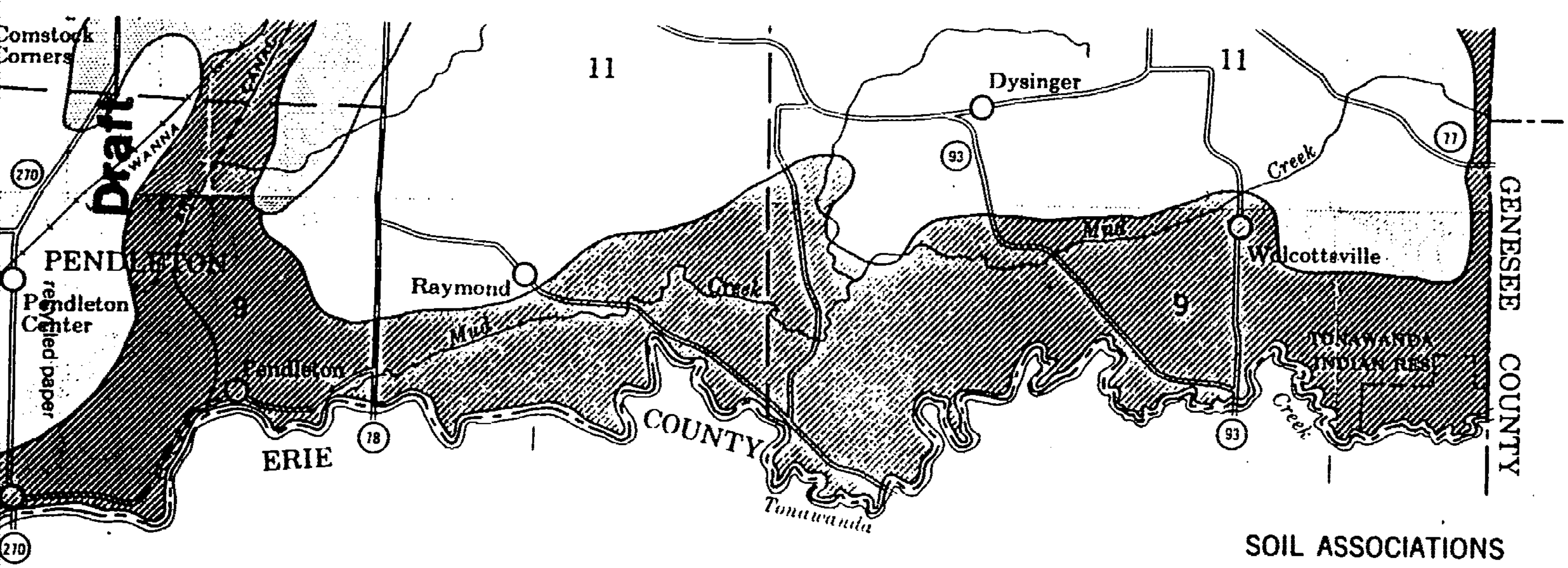
Niagara County, New York



NIAGARA COUNTY SOIL & WATER
CONSERVATION DISTRICT
FARM HOME CENTER 4487 LAKE AVE.
LOCKPORT, NEW YORK 14094

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Cornell University Agricultural Experiment Station

Issued October 1972



SOIL ASSOCIATIONS

AREAS DOMINATED BY SOILS FORMED IN GLACIAL TILL

1 Appleton-Hilton-Sun association: Deep, moderately well drained to very poorly drained soils having a medium-textured subsoil

2 Hilton-Ovid-Ontario association: Deep, well-drained to somewhat poorly drained soils having a medium-textured or moderately fine textured subsoil

3 Lockport-Ovid association: Moderately deep and deep, somewhat poorly drained soils having a fine textured or moderately fine textured subsoil

AREAS DOMINATED BY SOILS FORMED IN GRAVELLY GLACIAL OUTWASH OR IN BEACH AND BAR DEPOSITS

4 Howard-Arkport-Phelps association: Deep, somewhat excessively drained to moderately well drained soils having a medium-textured to moderately coarse textured subsoil, over gravel and sand

5 Otisville-Altmar-Fredon-Stafford association: Deep, excessively drained to poorly drained soils having a dominantly medium-textured to coarse-textured subsoil, over gravel and sand

AREAS DOMINATED BY SOILS FORMED IN LAKE-LAID SANDS

6 Minoa-Galen-Elnora association: Deep, somewhat poorly drained and moderately well drained soils having a medium-textured, moderately coarse textured, or coarse textured subsoil, over fine and very fine sand

7 Claverack-Cosad-Elnora association: Deep, moderately well drained and somewhat poorly drained soils having a coarse-textured subsoil, over clay or fine sand

AREAS DOMINATED BY SOILS FORMED IN LAKE-LAID SILTS AND VERY FINE SANDS

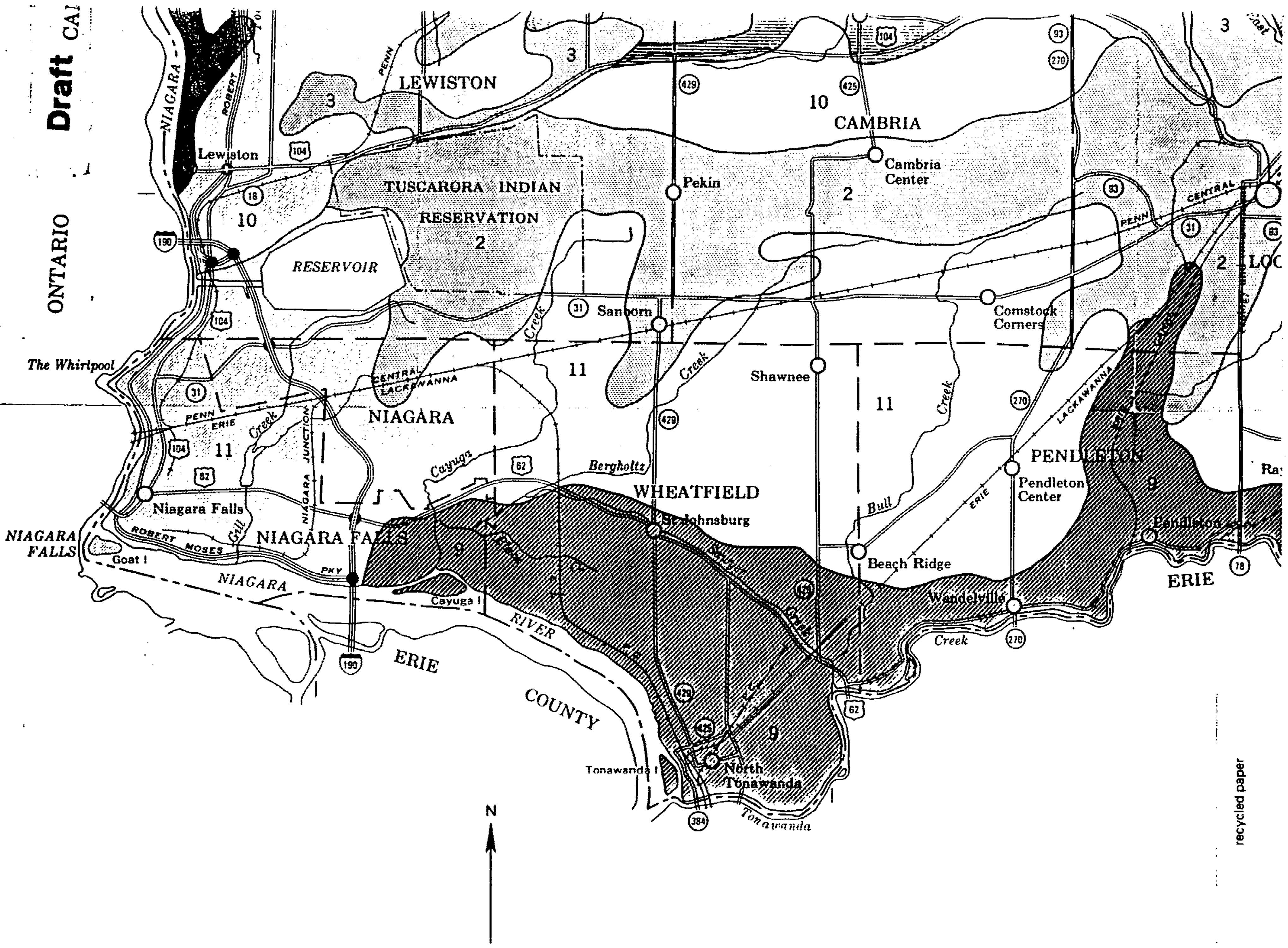
8 Niagara-Collamer association: Deep, somewhat poorly drained and moderately well drained soils having a medium-textured to moderately fine textured subsoil

9 Canandaigua-Raynham-Rhinebeck association: Deep, somewhat poorly drained to very poorly drained soils having a dominantly medium-textured to fine-textured subsoil

AREAS DOMINATED BY SOILS FORMED IN LAKE-LAID CLAYS AND SILTS

10 Rhinebeck-Ovid-Madalin association: Deep, somewhat poorly drained to very poorly drained soils having a fine textured or moderately fine textured subsoil that is dominantly brown or olive in color

11 Odessa-Lakemont-Ovid association: Deep, somewhat poorly drained to very poorly drained soils having a fine textured or moderately fine textured subsoil that is dominant[illegible]dish in color


Draft
ONTARIO
NIAGARA
ROBERT
Lewiston
LEWISTON
PENN
3
3
3
10
10
CAMBRIA
Cambria Center
Pekin
TUSCARORA INDIAN RESERVATION
2
2
2
RESERVOIR
Sanborn
Comstock Corners
LOC
CENTRAL
PENN
LACKAWANNA
The Whirlpool
Shawnee
11
11
11
NIAGARA
NIAGARA JUNCTION
PENN ERIE
Creek
Cayuga
Bergholtz
Bull
PENDLETON
Pendleton Center
WHEATFIELD
St Johnsburg
Niagara Falls
NIAGARA FALLS
NIAGARA FALLS
Goat I
ROBERT MOSES PKY
Gill
9
9
9
Beach Ridge
Wendelville
Pendleton
ERIE
Ra
Cayuga I
NIAGARA RIVER
ERIE COUNTY
Tonawanda I
North Tonawanda
Tonawanda
104
18
190
31
62
429
425
93
270
78
384
N

in the northwestern part of the county near the village of Youngstown. Three smaller areas also occur.

This association makes up about 15 percent of the county. About 32 percent of this is Rhinebeck soils, 10 percent is Ovid soils, and 9 percent is Madalin soils. The remaining 49 percent consists of minor soils.

The Rhinebeck soils are deep and are somewhat poorly drained. These soils typically have a silt loam surface layer, a silty clay or silty clay loam subsoil, and underlying material of varved silt and clay. They occupy the broad areas within the association and are slightly dissected by erosion in a few places, especially in areas that border Lake Ontario.

The Ovid soils occupy the slightly elevated areas where there has been some reworking of the fine-textured lake deposits and the glacial till or glacial beach deposits. The Ovid soils are deep and somewhat poorly drained. They typically have a silt loam surface layer and a silty clay loam subsoil and are underlain by loamy glacial till. Some coarse fragments are generally in and below the surface layer.

The Madalin soils occupy the more nearly level, more depressional areas within the broad, level lake plain. They are deep and poorly drained to very poorly drained. Madalin soils typically have a dark silt loam surface layer that is high in organic-matter content, a silty clay subsoil, and underlying material of varved silt and clay.

The minor soils are mainly of the Collamer, Hudson, and Niagara series. These soils are intermingled with the major soils in this association. The Collamer and Hudson soils occupy knolls or higher elevations and are intermingled with the Ovid soils. The Niagara soils are mainly nearly level.

This association has a medium value for farming. Much of it is idle or is cropland that is not used intensively. A fairly small acreage that is close to Lake Ontario is used intensively for fruit. The area near Youngstown is in community development, mostly for rural homes. The acreage in grapes is increasing, especially near the Model City area in the town of Lewiston.

Natural drainage is the principal concern in town and country planning and in farm development. The flatness of the area is the biggest factor to consider in planning artificial drainage. The soils in most of the association can be drained readily by installing adequate surface ditches. Tile lines help in draining some of the wet, coarser textured inclusions. The major need is group drainage projects that provide suitable outlets.

If drainage is adequate, this association has a good potential for apples, grapes, pears, and other fruit. Peaches and cherries normally are not suited. Some vegetables can be grown intensively, but maintaining soil tilth is difficult. Grain and hay crops are suited if drainage is adequate. The need for lime is generally small.

Natural drainage and slow permeability are the two most limiting factors for community development. Sanitary sewers and adequate surface drainage are needed. In many places the soils are unstable because they formed in deep lake deposits.

About 85 percent of the acreage is in open land. The forested areas consist mostly of scattered farm woodlots. Some of the idle land is reverting to ash, soft maple, and other native hardwoods. Openland wildlife is plentiful in many areas. Pheasants and rabbits are the most commonly hunted wildlife species, and there is a potential for wetland wildlife. Recreation in this association consists mostly of hunting, fishing, camping, and golfing. Scenic areas are confined mostly to the part of the association that borders the Niagara River and Lake Ontario.

11. Odessa-Lakemont-Ovid association

Deep, somewhat poorly drained to very poorly drained soils having a fine textured or moderately fine textured subsoil that is dominantly reddish in color

This is the largest soil association in Niagara County. It consists of level or nearly level soils on lake plains south of the limestone escarpment (fig. 5). There are two large areas that are dotted with small knolls and ridges of till. The largest area is west of the Barge Canal, and the other area is in the same topographical position as the larger area but is east of the Barge Canal.

This association makes up about 21 percent of the county. About 24 percent of this is Odessa soils, 14 percent is Lakemont soils, and 11 percent is Ovid soils. The remaining 51 percent consists of minor soils.

The Odessa soils are deep and somewhat poorly drained. They typically have a silty clay loam surface layer, a silty clay subsoil, and clay and silt underlying material. These soils are level and occupy the broad areas between the poorly drained, depressional areas and the slightly elevated till ridges.

The Lakemont soils are level to slightly depressional and are generally adjacent to the better drained Odessa soils. Lakemont soils typically have a silty clay loam surface layer, a silty clay subsoil, and underlying material of clay and silt. They have a darker surface layer than the Odessa soils and show more indications of wetness.

The Ovid soils are nearly level to gently undulating and are on till landscapes at slightly higher elevations above the lake plain. They are deep and somewhat poorly drained. Ovid soils typically have a silt loam surface layer, a silty clay loam subsoil, and underlying material of loamy glacial till.

The minor soils are mainly of the Churchville, Cayuga, Cazenovia, Fonda, and Hilton series. Also included are some areas of shallow muck. In many places the moderately well drained Hilton and Cazenovia soils occupy the higher parts of the knolls and

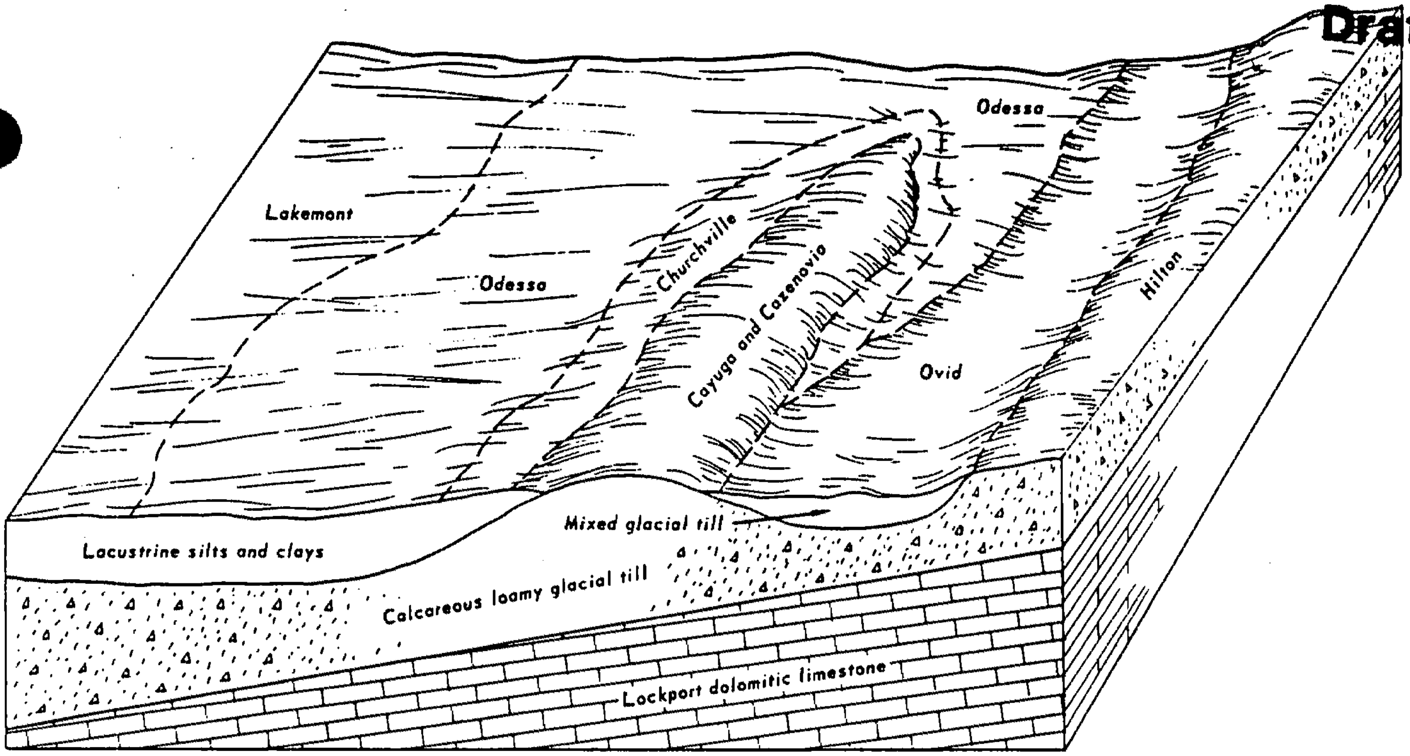


Figure 5.--Typical cross section of the Odessa-Lakemont-Ovid association.

till ridges that are scattered throughout the association. Around the fringes of these areas, where lacustrine clays overlap the till, are the somewhat poorly drained Churchville soils and the moderately well drained Cayuga soils. The very poorly drained Fonda soils and the shallow muck occupy some of the deeper depressions in the lake plain.

This association has a fairly low value for farming. Much of it is idle or cropland that is not intensively used. Communities are being rapidly developed in the western part of the association near Niagara Falls and in areas south of Lockport. The Conservation Needs Inventory for 1958 indicated that 58 percent of this association is cropland, 6 percent is pasture, 4 percent is forest, 14 percent is urban or built-up areas, and 18 percent is open land (6).

Natural drainage is the main concern in town and county planning and in agricultural development. The flatness of the area and the generally fine texture of the soils are the main factors to consider before installing artificial drainage. The biggest need is for group drainage projects that provide suitable outlets.

If adequately drained, the soils in this association have a good potential for grain and for dairy cattle and other livestock. The texture of the soils is generally too fine for most vegetable crops. If the soils are cultivated intensively, they are difficult to till because they crust, clod, and compact. Most fruit crops are damaged by frost in this association. The need for lime is small.

REFERENCE NO. 5

Environmental Protection
Agency

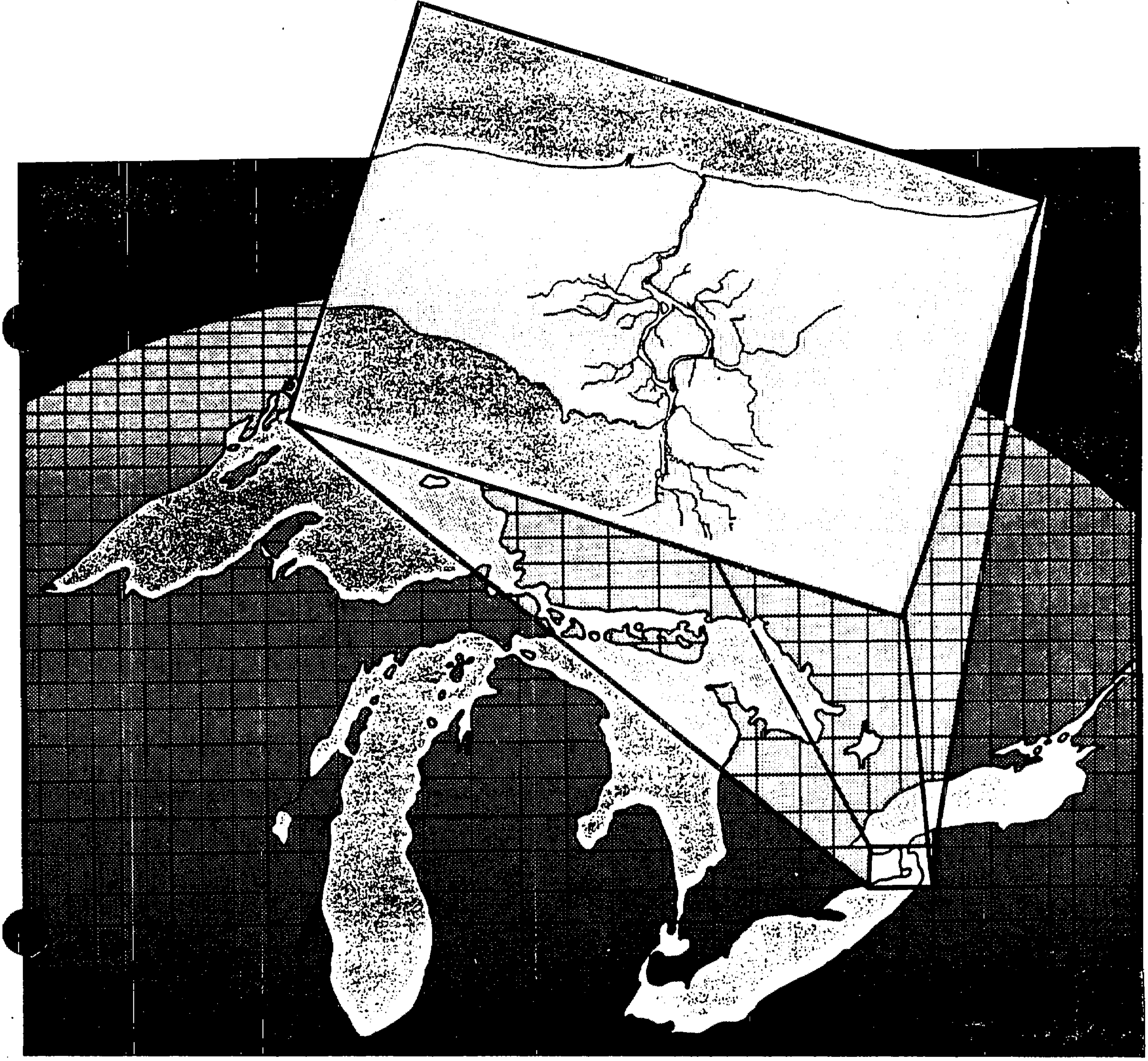
Program Office
536 South Clark Street
Chicago, Illinois 60605

March 1985

EPA

Draft

Preliminary Evaluation Of Chemical Migration To Groundwater and The Niagara River from Selected Waste-Disposal Sites



8. CARBORUNDUM, BUILDING 82 (Literature review) NYSDEC 932048-b

neral information and chemical-migration potential.--Building 82 is at arborundum's Buffalo Avenue Plant in Niagara Falls. The area south of Building 82 is used as a transfer point for general waste products, which include silicon dust and fibers. The waste is sent away for disposal. No geologic, hydrologic, or chemical information is available. The potential for contaminant migration is indeterminable.

9. CARBORUNDUM--ABRASIVE DIVISION (Literature review) NYSDEC 932007

General information and chemical-migration potential.--The Carborundum-Abrasive Division site, in the town of Wheatfield, was an open dump used during 1968-76 to dispose of 800 to 1,600 pounds of phenols and 400 tons of solidified resins, floor sweepings, and waste fillers, including calcium carbonate, clays, and animal glue. This site has been remediated through the installation of a clay cap, which was joined to the silty clay around the site. The potential for contaminant migration is indeterminable.

Geologic information.--The site consists of clay and silty fill underlain by a silty lacustrine clay, which is in turn underlain by a discontinuous layer of till. These units overlie bedrock of Lockport Dolomite. A geologic cross section is shown in figure C-4.

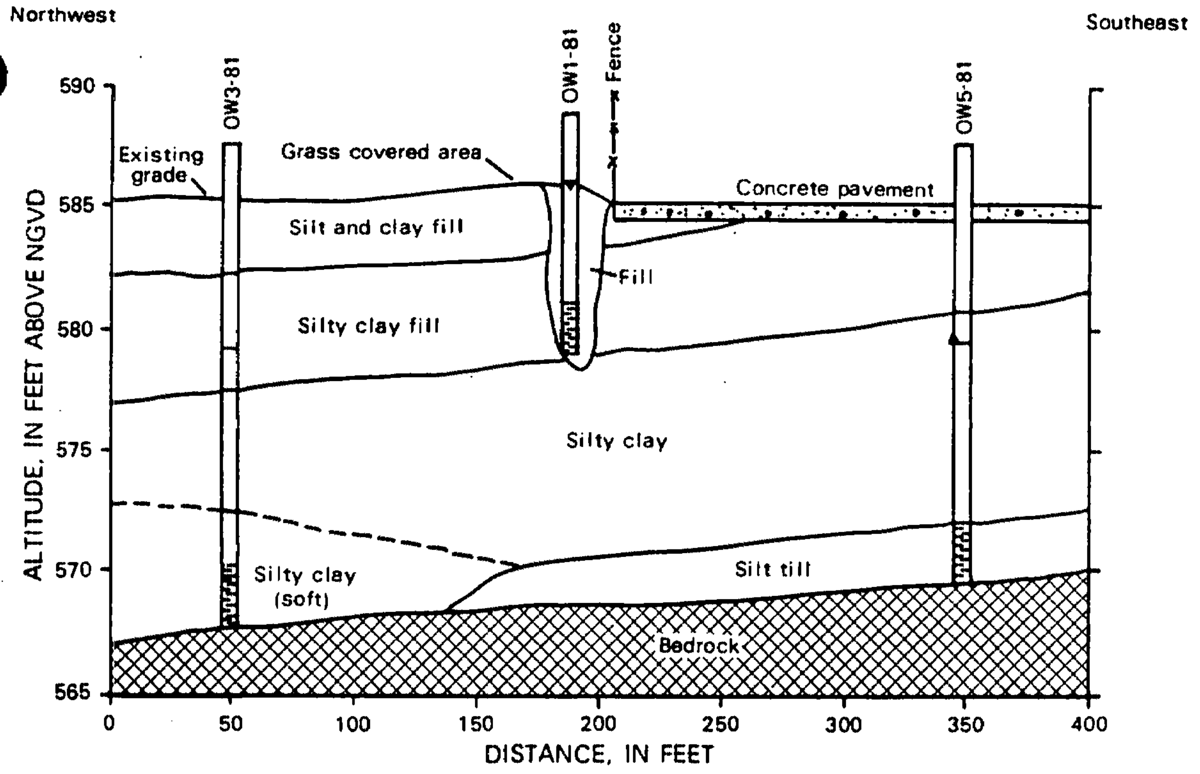


Figure C-4. Geologic cross section of formations underlying Carborundum-Abrasive Division, site 9, Wheatfield. (Modified from Conestoga-Rovers and Assoc., 1981.)

REFERENCE NO. 6

ELECTRO MINERALS (U.S.), INC.

Draft

Subsidiary of
Washington Mills Abrasive Co.

P.O. Box 423
Niagara Falls, NY 14302

July 8, 1987

Mr. D. Sutton
Ecology & Environment
195 Sugg Road
P.O. Box D
Buffalo, NY 14225

Dear Mr. Sutton:

I have made corrections to the attachment. I also included information on soil borings done in 1984 in the area behind B82. If you have any questions, please call me at (716)278-2563.

Yours truly,

ELECTRO MINERALS (U.S.), INC.

P.K. Haynes

P.K. Haynes
Manager
Environmental, Health & Safety

PKH:amb

Attachment

cc: R.R. Campbell N/A
G.J. Bush N/A

Draft

Former Waste Material That Prompted Action by the New York State Department of Environmental Conservation (NYSDEC):

- Metal and wood scrap and miscellaneous waste were stored behind Building 82
- All these wastes were removed in 1985 by Modern Disposal

Permits:

- EPA waste generator #: NYD001367481
- SPDES Permit: NYD001367 (for cooling water)
- Several air permits
- ~~Sanitary sewer permit (for neutralized sulfuric acid)~~

X Previous Sampling:

- 4 core samples taken during sewer installation on site along Adams Ave.
- NYSDEC has analytical results for these samples
- One sample had slightly elevated mercury

Addition 14 bores behind Bldg 82 (SEE ATTACHED)

Storage Tanks:

- Gasoline (underground), 8000 gallons for plant vehicles
- Diesel fuel (underground), 4000 gallons for plant vehicles
- Fuel oil (above ground), 20000 gallons, not currently used, has been cleaned by Elmwood Tank and Piping Corp.

Previous Enforcement Actions:

- Response to Engineered Materials Division Machine Shop
- Engineered materials is not part of Electro Minerals (U.S.) Inc.
- Machine stop formerly disposed of used cutting oils on ground
- Soil has been removed and site remediated

OCCURRED when site WAS OWNED by CARBORUNDUM - shop belonged to Bonded Abrasives division.

The above statements, with any qualifications or corrections added, are true to the best of my knowledge.

Signature

Date

Draft

ATTACHMENT 1

Name of Company:

Electro Minerals (U.S.) Inc.

Subsidary of:

Washington Mills Abrasives
20 North Main Street
North Grafton, MA

Owner of Parent Company:

Peter Williams

Previous Owners:

- Formerly owned by Carborundum
- Carborundum owned by Standard Oil (SOHIO)
- Carborundum formerly owned by Kennecott Copper

Field of Business:

Manufacture of abrasive grains ~~and grinding materials~~
Current Plant Operations (partial list):

- Crushing
- Sorting
- Bagging
- Arc Furnace Processing

Current Products and Comments:

Brown Aluminum oxide
- processes: crush, size, sort, bag

- Silicon Carbide
  - requires crushing and sorting processes
- Premium Aluminum Oxide
  - Manufactured from ~~brown~~ Refined aluminum oxide in an arc furnace crushing and sorting processes follow production
- Boron Carbide
  - Raw materials graphite and boric acid are fused in an arc furnace

Waste Streams

- Grain-rinsing solvents (toluene, acetone, methanol)
- Used lubricating oils, GREASES, DEGREASING AGENTS

Waste Treatments:

- Some solvents recycled by a contractor named Safety-Clean Kleen
- Other wastes are removed by SCA when 6-8 drums accumulate (this occurs a few times per year)

REFERENCE NO. 7

Rite in the Rain
WEATHERPROOF

MEMO

NOTEBOOK NO. 391

Electro-Metal
Formerly Carborundum Building 82
June 24 1987

a product of
J. L. DARLING CORPORATION
TACOMA, WASHINGTON 98421 U.S.A.

Electrominerals

Weather Sunny and very hot (90's) no wind

Arrive at Plant 9:00 AM June 24, 1987

Conduct interview with Patricia Hegney.

~~[illegible]~~ (JT) See notes following site inspection report

Commence visual site inspection at ~~[illegible]~~ JT 9:55

Photo 1 → Silicon Carbide pile at West of Bldg 83
Recycled eventually

Photo 2 → Alum. Oxide from settling pond
Settling pond for non-contact cooling water (does get some solids)
Have SPDES permit.

Photo 3 → Mixed product pile

Settling pond. ← Photo 4
removes solids before discharge to river.
Covered by SPDES.

10:10: Viewed area behind Bldg 82
Nothing above ground seen.
Some slag seen on ground
Otherwise sandy gravelly soil).
Some areas appeared dark.

Photo-5 → Former disposal area.

Disposal items removed in 85 by
Modern Disposal.

Elmwood tank clean #2 fuel oil tank
in Building 82.
Lots of unused equipment in Building 82

Photo 6 → H_2SO_4 tank.
Is neutralized with NaOH,
then sanitary sewer.
Have Sanitary permit.

Photo 7 → acid neutralizing tanks.
Discharges monitored in 3 spots.

6/24/87

Interview with Patricia Haynes
Manager Environmental Health & Safety

Name of Company:
Electrominerals (US) Incorporated
Subsidiary of Washington Mills Abrasives

Formerly owned by Carborundum
Carborundum bought by Kennecott Copper
Then " " Standard Oil (Sohio)
Then bought by Washington Mills Abrasives

Parent Co Washington Mills Abrasives
20 North Main Street
North Grafton, MA
Parent owner & CEO: Peter Williams

6/24/87

Jon [illegible] 6/24/87

Business:

Manufacture Grinding Materials
Abrasive Grains

Current operations: Crushing
Sorting
Bagging
Arc Furnace Processing

Products: Premium Aluminum Oxide
(from refined Aluminum) (use arc)
Graphite & Boric acid →
Boron Carbide (Fusing process)
Silicon Carbide

Current Wastes: Spent Solvents for grain rinsing
(toluene, acetone, methanol)
Used lubricating oils.
Disposed through SCA -- When
6-8 drums accumulate they call SCA.
Safety-Kleen does recycle solvents

Jon [illegible]
6/24/87

Jon [illegible] 6/24/87

Previous waste.
No buried on site.
--> Used to have junkyard behind Building 82
All removed in 1983 by Modern Disposal
Wastes were metal & wood scrap & misc. wastes.
Since 1980 followed RCRA regulations for
all material

Permits:
EPA Waste generator # NYD001367451
SPDES Permit NY001367
Numerous air Permits
Sanitary Sewer Permit

Sampling: 4 core samples during installation of Storm sewer on site. DEC has results. One sample high in mercury.

Jon [illegible] 6/24/87

6/24/87

Tanks:

Gasoline (UST) 8000 gal } for plant vehicles
Diesel (UST) 4000 gal }
Fuel oil (AGST) 20000 gal
↳ emptied & cleaned

6/24/87

REFERENCE NO. 8

Draft

GSC-TR8705

DRAFT

GRAPHICAL EXPOSURE MODELING SYSTEM

(GEMS)

USER'S GUIDE

VOLUME 1. CORE MANUAL

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF PESTICIDES AND TOXIC SUBSTANCES
EXPOSURE EVALUATION DIVISION
Task No. 3-2
Contract No. 68023970
Project Officer: Russell Kinerson
Task Manager: Loren Hall

Prepared by:

GENERAL SCIENCES CORPORATION
6100 Chevy Chase Drive, Suite 200
Laurel, Maryland 20707

Submitted: February, 1987

1. INTRODUCTION

The Graphical Exposure Modeling System (GEMS) is an interactive computer system developed by General Sciences Corporation under the auspices of the Modeling Section in the Exposure Evaluation Division (EED), Office of Toxic Substances (OTS) of the Environmental Protection Agency (EPA). It provides a simple interface to environmental modeling, physiochemical property estimation, statistical analysis, and graphic display capabilities, with data manipulation which supports all of these functions. An overview of the basic GEMS components is shown in Figure 1-1. The system is installed on the OTS VAX 11/780 computer in Research Triangle Park, North Carolina, and is accessible through dial-up lines.

GEMS is being developed to support integrated exposure analyses at OTS. Its purpose is to provide environmental researchers and analysts with a set of sophisticated tools to perform exposure assessments of toxic substances without requiring them to become familiar with most aspects of computer science or programming.

GEMS is designed under a unique concept which integrates the computerized tools of graphics, mapping, statistics, file management, and special functions such as modeling and physiochemical property estimation, under a user-oriented and simple-to-learn interface. GEMS prompts the user or provides a menu for each action to be performed. The following features provide users with great flexibility during the GEMS execution:

- HELP commands - When you are using the GEMS system, you may not always have a user's manual readily available and/or you may need to see the format and type of a command or an answer before you enter it. Various HELP commands are available in GEMS which provide such information.

- Recovering from errors - If you enter a command or a response incorrectly, the system issues an error message and reprompts you for the correct information.

- Built-in defaults for model execution - GEMS is designed to guide inexperienced users through the execution of selected models. Default responses are usually available when you cannot specify a choice or supply an input to a prompt during model execution.

- Data management of modeling results - Data generated from execution of the SESOIL, ISC, SWIP, or AT123D models may be stored automatically in GEMS. These data may be accessed or analyzed via GEMS' file management, graphics, and statistics operations.

The purpose of this document is to describe GEMS from the user's point of view. It is intended as a comprehensive guide to the use of GEMS for personnel who have no specialized knowledge of computer programming. However, a working knowledge of environmental modeling is necessary for complete and accurate use of the system.

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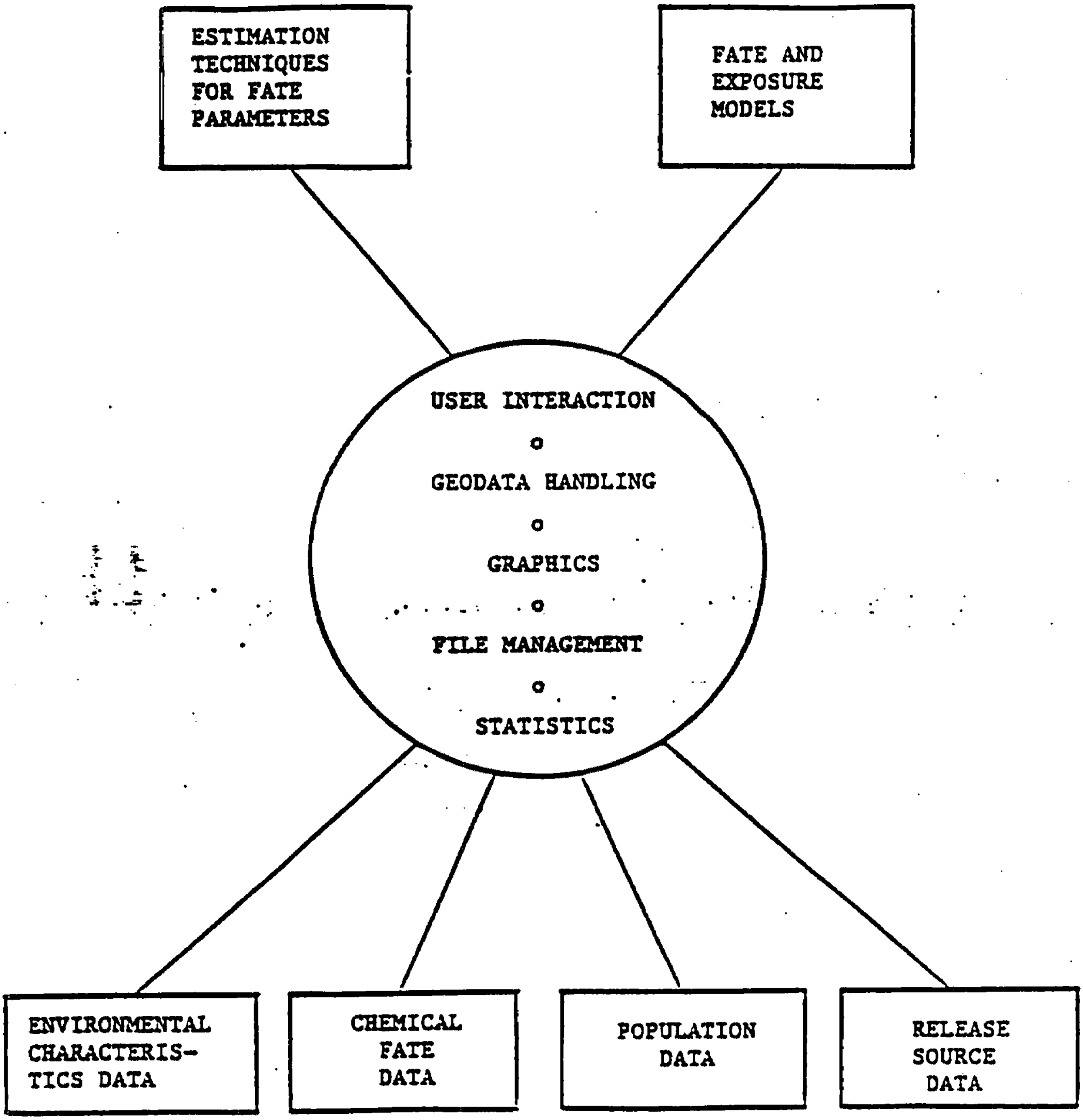

FIGURE 1-1. Components of the Graphical Exposure Modeling System (GEMS)

Since the last draft of the GEMS User's Guide, completed in June, 1984, the GEMS system has gone through a number of modifications and enhancements. It is no longer feasible to hold all sections in one single volume. This revised user's guide is designed in a modular fashion of six separate volumes described briefly below. In addition, GEMS has been adapted to function on an IBM PC/XT or AT. This prototype called PCGEMS has many of the same capabilities of the mainframe GEMS. These include environmental modeling procedures such as ENPART and AT123D as well as property estimation procedures such as CLOGP and AUTOCHEM. The prototype PCGEMS works in large part through interface with the OTS VAX 11/780 on which GEMS resides, a user's guide for PCGEMS will be available in the near future.

Volume 1: Core-Manual

This volume is a reference manual and introduction for first-time users. In addition to Section 1 - Introduction, a functional description of GEMS is presented in Section 2, a detailed guide to the use of the system is presented in Section 3, and summaries of the VAX operating environment and system and frequently used utilities are presented in Section 4. Two sample runs are given in the attachment to provide users with information in order to interact with the GEMS system, to generate a dataset, and subsequently, produce a map from the dataset.

Volume 2: Modeling

This volume consists of all GSC prepared user's manuals to GEMS models, grouped according to media. User's manuals are available for the following models: SESOIL, AT123D, SWIP, ENPART, TOX-SCREEN, INPUFF, and ISC/GAMS. A user's manual for EXAMS II model will be available later this year. Refer to Section 2.2 for further information.

Volume 3: Graphics and Geodata Handling

This volume contains two GEMS operations, Graphics and Geodata Handling. The Graphics operation contains a variety of graphics procedures which may be used to display results from modeling runs or from datasets. The Geodata Handling operation contains procedures that perform geographic data manipulation and generate maps of U.S. states or counties. Refer to Section 2.3 for further information.

Volume 4: Data Manipulation

This volume contains descriptions of GEMS system-installed datasets and two GEMS operations - File Management, and Utilities. Refer to Section 2.4 for further information.

Volume 5: Estimation

This volume consists of user's manuals for SFILES, FAP, CLOGP, and AUTOCHEM. These estimation programs may be used to provide estimated physiochemical properties for model input or for other environmental fate analyses. Refer to Section 2.5 for further information.

Volume 6: Statistics

This volume contains information on the GEMS Statistics operation which includes the Descriptive Statistics procedure and procedures to produce simple or multiple regression and contingency tables. Refer to Section 2.6 for further information.

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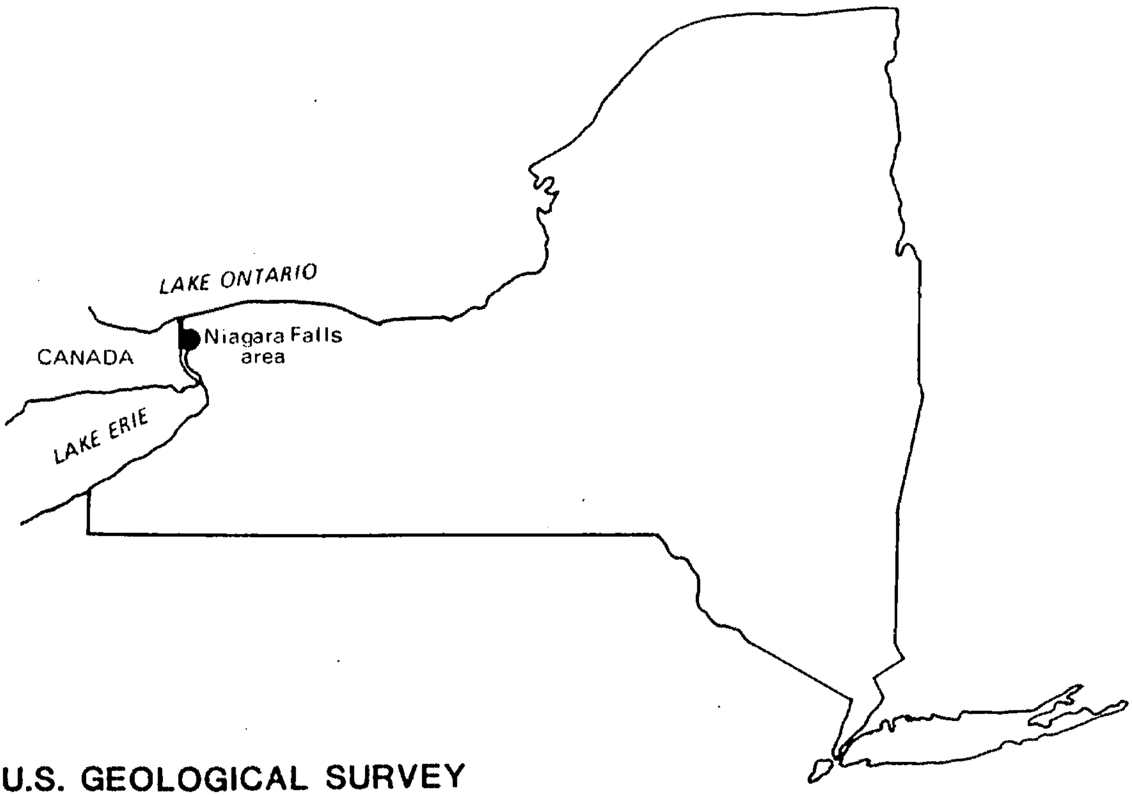
Effect of Niagara Power Project on Ground-Water Flow in the Upper Part of the Lockport Dolomite, Niagara Falls Area, New York



U.S. GEOLOGICAL SURVEY
Water-Resources Investigations
Report 86-4130

Prepared in cooperation with the
U.S. ENVIRONMENTAL PROTECTION AGENCY
NEW YORK STATE DEPARTMENT OF
ENVIRONMENTAL CONSERVATION

U.S. DEPARTMENT OF THE INTERIOR
MARCH 3, 1849

of studies by the New York State Department of Environmental Conservation, private consultants, and by the U.S. Geological Survey to describe ground-water conditions at many waste-disposal sites in the Niagara Falls area.

Acknowledgments

The New York Power Authority provided construction details of the power-project facilities, water-level data from the forebay canal and pumped-storage reservoir, and assistance in measuring water levels in NYPA wells in the vicinity of the pumped-storage reservoir. The New York State Department of Environmental Conservation coordinated the water-level measurements at industrial sites. Several industries, including Occidental Petroleum and E.I. Dupont De Nemours and Company, provided water-level data. The City of Niagara Falls provided construction details on many sewer and building projects and assisted in obtaining permits and permission to drill observation wells within the city.

GEOHYDROLOGY OF THE LOCKPORT DOLOMITE

Stratigraphy and Lithology

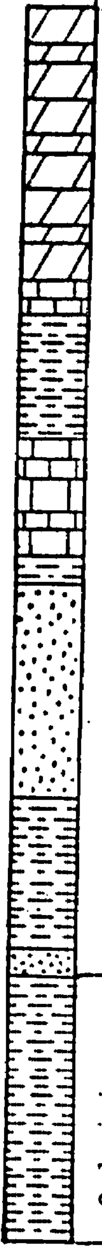
Unconsolidated glacial deposits of till and lacustrine silt and clay, generally 5 to 15 ft thick but ranging to 48 ft thick, overlie the 80- to 158-ft-thick Lockport Dolomite of Middle Silurian age within the Niagara Falls area (Tesmer, 1981). The thickest unconsolidated deposits (up to 48 ft) are in a shallow buried valley in the western part of the city (pl. 1B).

Underlying the Lockport Dolomite is a 27-ft-thick sequence of Middle Silurian shale, limestone, and dolomite in the lower part of the Clinton Group, which is underlain by a 113-ft-thick sequence of Lower Silurian sandstone and shale that is in turn underlain by 1,200-ft-thick Upper Ordovician shale. These rocks are exposed only in the Niagara River gorge and are shown in the stratigraphic column in figure 2. The strata are gently folded and dip slightly to the south-southwest at about 30 ft/mi (Fisher and Brett, 1981).

The Lockport Dolomite is a fine to coarse crystalline, thin to massive bedded dolomite, limestone, and shaly dolomite, with vugs containing gypsum (calcium sulfate) and calcite (calcium carbonate). Other minor minerals disseminated throughout the formation are sphalerite (zinc sulfide), pyrite (iron sulfide), and galena (lead sulfide) (Tesmer, 1981).

Hydraulic Conductivity

The Lockport can be divided into two zones on the basis of water-transmitting properties. The upper 10 to 25 ft of rock is a moderately permeable zone that contains relatively abundant bedding planes and vertical joints enlarged by dissolution of dolomite and abundant solution cavities left by dissolution of gypsum; the remainder of the formation contains low to moderately permeable bedding planes of which as many as seven may be major water-bearing zones that are surrounded by fine-grained crystalline dolomite of low permeability. Hydraulic-conductivity values obtained from model simulations and limited aquifer-test data (Maslia and Johnston, 1982) range from 5 to 15 ft/d in the upper part and from 1 to 2 ft/d in the lower part. Well yields commonly range from 10 to 100 gal/min.



System and series		Group	Formation	Thickness (feet)	Description
Silurian	Middle	Lockport	Lockport Dolomite	158	Dark-gray to brown, massive to thin-bedded dolomite locally containing algal reefs and small, irregularly shaped masses of gypsum. Near the base are light-gray coarse-grained limestone (Gasport Limestone Member, dark-gray shaley dolomite)
		Clinton	Rochester Shale	60	Dark-gray calcareous shale weathering light-gray to olive.
			Irondequoit Limestone	12	Light-gray to pinkish-white coarse-grained limestone.
			Reynales Limestone	10	White to yellowish-gray shaly limestone and dolomite.
			Neahga Shale	5	Greenish-gray soft fissile shale.
	Lower	Medina	Thorold Sandstone	8	Greenish-gray shaly sandstone.
			Grimsby Sandstone	45	Reddish-brown to greenish-gray cross-bedded sandstone interbedded with red to greenish-gray shale.
			Power Glen Shale	40	Gray to greenish-gray shale interbedded with light-gray sandstone.
			Whirlpool Sandstone	20	White, quartzitic sandstone
Ordovician	Upper	Richmond	Queenston Shale	1,200	Brick-red sandy to argillaceous shale.

Figure 2.--Stratigraphy of the Niagara Falls area. (Modified from Fisher, 1959.)

Ground Water

Occurrence

The Lockport Dolomite is the principal source of ground water in the Niagara Falls area. Although the effective primary porosity is negligible, significant ground-water movement occurs through secondary openings such as bedding joints (planes), vertical joints (fractures), and solution cavities, described below. The upper 25 ft of the Lockport has a greater potential for movement of ground water (and contaminants) than the deeper parts because it has more interconnected vertical and horizontal joints that have been widened by solutioning, which allows direct entry of contaminants from surface sources.

Bedding planes.--The bedding planes, which transmit most of the water in the Lockport (Johnston, 1964), are relatively continuous fracture planes parallel to the natural layering of the rock. These openings were caused by crustal movements and the expansion of the rock during removal of weight by erosion of overlying rock units and by retreat of the glaciers. Johnston (1964) identified seven water-bearing zones, which consist either of a single open-bedding plane or an interval of rock layers containing several open planes. The top 10 to 25 ft of rock may contain one or two significant bedding planes; these are probably connected by vertical joints, which are abundant in the upper part of the formation.

The lower part of the Lockport Dolomite contains fewer water-bearing bedding planes that are interconnected by vertical joints. These deeper water-bearing zones are underlain and overlain by essentially impermeable rock. Each water-bearing bedding plane can be considered a separate and distinct artesian aquifer (Johnston, 1964). The hydraulic head within each water-bearing zone is lower than that in the zone above it; this indicates a downward component of ground-water flow.

Vertical joints.--Vertical joints in the Lockport Dolomite are not significant water-bearing openings except (1) in the upper 10 to 25 ft of rock, (2) within about 200 ft of the Niagara River Gorge, and (3) in the vicinity of the buried conduits. Physical and chemical weathering have increased the number, continuity, and size of vertical fractures in the upper part of the Lockport. The major joints, oriented N 70°E to N 80°E, are generally straight, spaced 10 to 80 ft apart, and penetrate 10 to 25 ft (American Falls International Board, 1974). Intersecting the major joint set are less extensive high-angle joints that are confined to particular beds. Vertical joints become narrower, less numerous, and less connected with depth.

In addition to the major regional fractures, extensive tension-release fractures were formed near the gorge wall by the erosion and removal of the supporting rock mass in the gorge; openings up to 0.3 ft wide have been observed (American Falls International Board, 1974). Less developed tension-release joints and blasting-originated joints are common along the twin conduits. These fractures probably extend less than 100 ft from the trench walls.

Solution cavities.--Solution cavities are formed by the dissolution of gypsum pockets and stringers by percolating ground water. These cavities range in diameter from 1/16 in to 5 in; they are most abundant in the upper 10 to 15 ft of rock but occur also along water-bearing bedding zones throughout the Lockport. The solution cavities become less continuous with depth and therefore have little effect on the water-transmitting ability of the lower parts of the formation.

Recharge

Most of the recharge to the Lockport Dolomite results from infiltration of rainfall and snowmelt through the soil to the water table. Precipitation in the Niagara Falls area averages 30 in/yr and is fairly evenly distributed throughout the year (Dethier, 1966). Snow usually accumulates from mid-December to mid-March, during which time several thaws may reduce or entirely melt the snow pack. Seven 14-month hydrographs of U.S. Geological Survey wells installed in the upper part of the Lockport (fig. 3) and a 10-year hydrograph of a long-term observation well, Ni-69 (fig. 4) indicate that most recharge occurs from late fall through winter (November to April), when evapotranspiration is low. Generally, water levels fluctuate less than 6 ft annually.

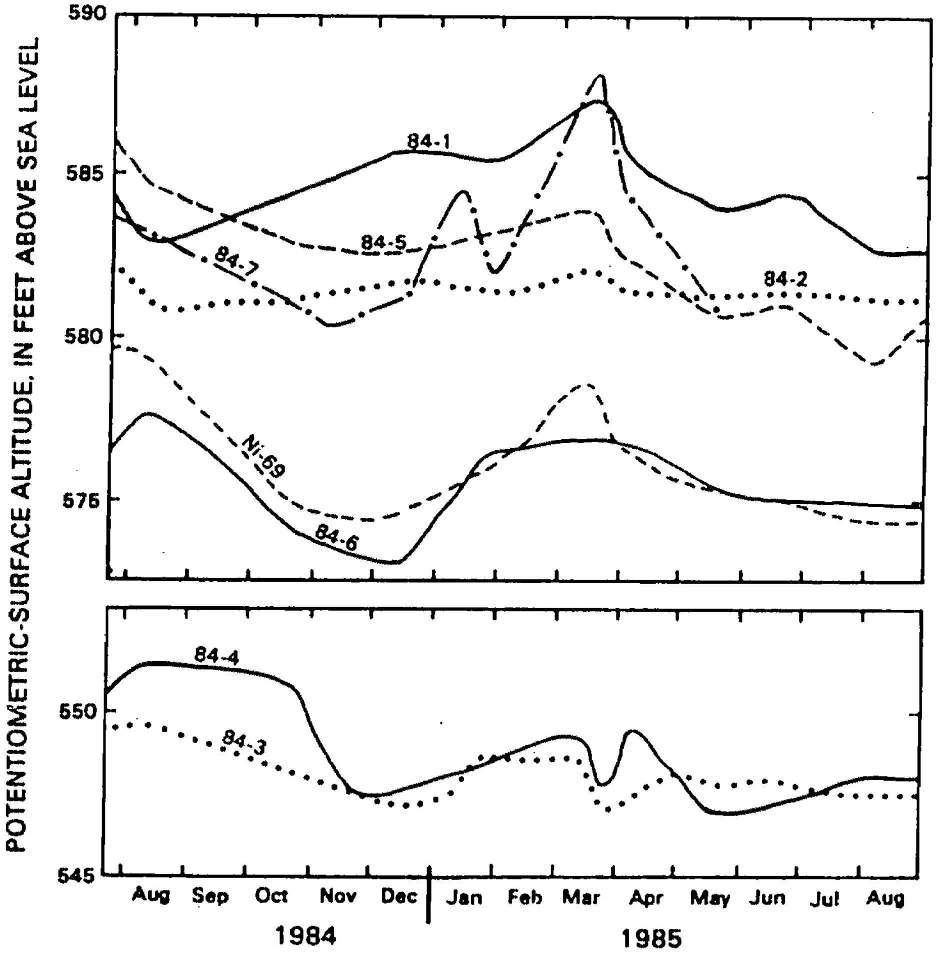


Figure 3.--Hydrographs of wells 84-1 through 84-7 in and near the City of Niagara Falls.

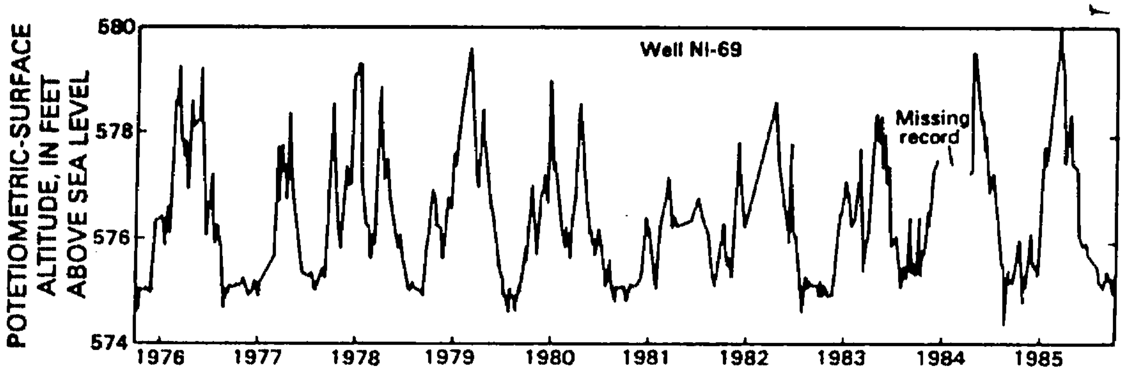


Figure 4.--Hydrograph of well Ni-69 in northern part of the city of Niagara Falls.

The rate and amount of recharge to a formation from precipitation depends on the permeability of the overlying lacustrine fine sand, silt, clay, and till, which in the Niagara Falls area is relatively low, with hydraulic conductivity ranging from 0.0014 to 0.27 ft/d. The average annual recharge from precipitation is estimated to be 5 to 6 in/yr (LaSala, 1967) but is probably greater in several small areas where the Lockport, whose hydraulic conductivity ranges from 5 to 15 ft/d, crops out at land surface.

Movement and Discharge

Before construction of Niagara Power project and Falls Street tunnel.--Little information is available on ground-water levels in the Niagara Falls area before 1960; therefore, interpretation of ground-water movement in the upper part of the Lockport Dolomite before that time is based largely on fundamental assumptions governing ground-water flow. These assumptions are that (1) ground-water divides coincide with topographic highs; thus the major divides in the region were at the Niagara Escarpment, north of the study area (fig. 1), and in the central part of the City of Niagara Falls (pl. 1A); (2) regional flow of ground water followed the south-southwestward slope of the land surface and the southwestward dip of major bedding planes, (3) local ground-water movement followed the configuration of the buried bedrock surface; and (4) ground water in the central and southern parts of the city discharged to the upper Niagara River, while water in the western part discharged to the lower Niagara River in the gorge. The general inferred directions of ground-water movement in the upper part of the Lockport Dolomite before any major construction or industrial pumping is shown in figure 5.

Effect of Falls Street tunnel.--In the early 1900's, the Falls Street tunnel was excavated through the upper part of the Lockport Dolomite from 56th Street to the Niagara gorge (fig. 6). This 3.5-mi-long unlined tunnel trends east-west and slopes 20 ft/mi beneath the southern part of the city approximately 0.65 mi north of the upper Niagara River (fig. 1). Runoff and ground water that drained into the tunnel flowed west with sewage to a treatment plant in the Niagara River gorge below the Falls.

The bottom of the Falls Street tunnel slopes westward from 549 ft above sea level at 56th Street to 533 ft at 27th Street (fig. 6), which places the tunnel at or above the altitude of the lowest part of the Niagara River channel in this reach. Thus, in the reach from 56th Street to 27th Street, water from the Niagara River (surface altitude about 560 ft) probably moves through the upper part of the Lockport northward toward the tunnel through the relatively permeable upper 15 to 20 ft of the Lockport. A shallow bedrock valley in this area (pl. 1B) may be a major zone of infiltration to the tunnel because the depth of weathering would be deepest under this channel. Ground water north and south of the tunnel probably drains into the tunnel also, but the size of the area affected by the tunnel is unknown.

The Falls Street tunnel from 24th Street west to the Niagara gorge is 25 ft or more below the relatively permeable upper zone of the Lockport. Thus, the tunnel in this area is overlain by less fractured, less permeable beds that limit downward flow. A study of ground-water infiltration into the tunnel (Camp, Dresser and McKee, 1982) found only minimal seepage to the Falls Street tunnel between 24th Street and the gorge. Although the amount of water that drained into the tunnel before construction of the conduits is unknown, the Falls Street tunnel east of 27th Street probably altered ground-water movement by creating a local ground-water low as water drained into the tunnel from the upper 25 ft of bedrock and possibly from the Niagara River.

During the 1930's and 1940's, several companies drilled and pumped water from an industrialized area within 2,000 ft of the Niagara River near Gill Creek (fig. 1); yields from these wells were as high as 1,800 gal/min. Johnston 1964) and Woodward-Clyde Consultants (1983) reported that most of the pumped water was induced recharge from the Niagara River that moves predominantly through the upper part of the Lockport Dolomite. The induced recharge from the Niagara River by industrial pumping and possibly some infiltration to the Falls Street tunnel are the only known changes in natural ground-water flow patterns in this part of the city before the construction of the Niagara Power Project.

HYDROLOGIC EFFECTS OF NIAGARA POWER PROJECT

The Niagara Power Project, constructed by New York Power Authority during 1958-62, has an electrical production capacity of 1,950,000 kw. Part of the flow of the upper Niagara River 2.5 mi above the Falls is diverted 4 mi north through the twin buried conduits to the L-shaped forebay canal, which is between the Robert Moses powerplant and the Lewiston powerplant (fig. 1). The conduits can divert 50,000 to 75,000 ft^3/s of water, which is at least 25 percent of the river's flow.

Table 1.--Flow of Niagara River over Horseshoe and American Falls.[1]

Season	Dates	Hours		Minimum flow over falls (ft^3/s)
Tourist season	Apr. 1 to Sept. 15	Day:	8:00 am to 10:00 pm	100,000
		Night:	10:00 pm to 8:00 am	50,000
	Sept. 1 to Oct. 31	Day:	8:00 am to 8:00 pm	100,000
		Night:	8:00 pm to 8:00 am	50,000
Non-tourist season	Nov. 1 to Mar. 30		12:00 am to 12:00 am	50,000

[1] The diverted water (average total flow of river, 204,000 ft^3/s, minus flow over falls) is divided between Canada and United States.

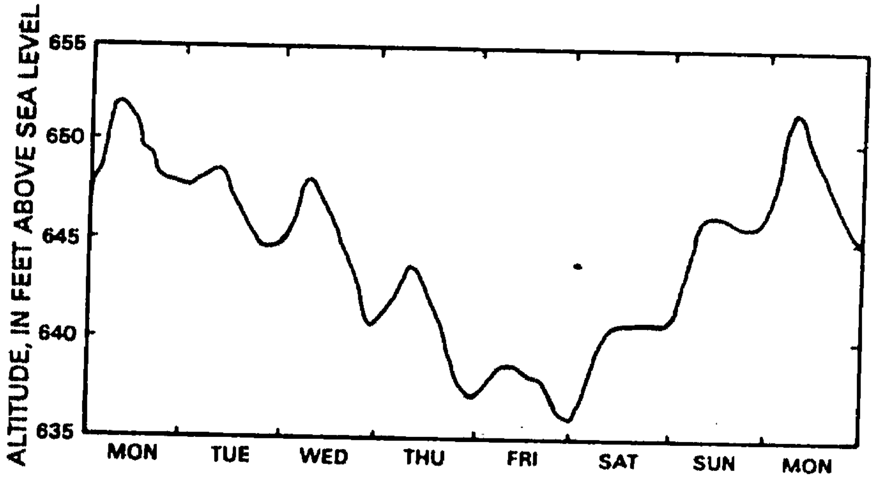


Figure 8.

Typical Lewiston Reservoir water levels during a weekly pumped-storage/release cycle.

Ground-Water Flow and Water Levels

Construction of the twin buried conduits, the forebay canal, and the pumped-storage reservoir has modified hydrologic conditions within the Niagara Falls area. The daily and seasonal regulation of water levels in the reservoir and forebay canal have changed the natural flow patterns and water levels in the upper part of the Lockport Dolomite. To determine the effect of the power project on ground-water movement, water levels in the upper part of the Lockport Dolomite were measured at 104 wells on October 23-24, 1984 and on March 26-27, 1985 (values are given in table 2, at end of report). The difference between water levels in October and those in March were relatively small (generally within 3 to 5 ft); therefore, only the water levels measured in March were used to construct a potentiometric-surface map (pl. 1A), which includes arrows showing the directions of ground-water flow.

Effect of Twin Buried Conduits

The twin buried conduits were constructed in two separate parallel bedrock trenches approximately 4 mi long. Each trench is 52 ft wide and penetrates 100 to 160 ft into the Lockport Dolomite; at the north end they penetrate the Lockport and upper part of the underlying Rochester Shale (fig. 9). The top of the conduits averages more than 40 ft below land surface. General construction details for the conduits are shown in figure 10.

Along the conduits are two dewatering stations--one at the intersection of the Falls Street tunnel at Royal Avenue, the other just south of the forebay canal (fig. 1). Each pumping station has direct access to water in both conduits and to water in the drain system that surrounds the conduits, which is in hydraulic contact with the surrounding bedrock. The pumping stations were designed to drain water from the bedrock surrounding each conduit through the drain system to reduce hydrostatic pressure, which could collapse the conduits should they need to be dewatered.

The drain system surrounding the conduits consists of formed, vertical 6-in-diameter drains placed every 10 ft along both sides of each conduit (fig. 11A), and two semicircular (2-ft radius) floor drains beneath the full length of the conduits at the bottom of each trench. The wall and floor drains are connected to continuous concrete-formed side drains in the lower corners of each bedrock trench (fig. 11A). All drains were formed into the concrete-conduit structure and are open to the bedrock walls and floor of conduit trenches but are not open directly to the river or forebay canal.

The only locations where water in the drain system can mix with water inside the conduits is at the two pumping stations. Each station has three sumps (fig. 11B)--a central sump connected to the conduit drain system that surrounds both conduits, and the two outer sumps, each of which is connected to the adjacent conduit. Both pumping stations have a pair of balancing weirs; one is near the Falls Street tunnel and operates at an altitude of 560 ft; the other is at the conduit outlet on the forebay canal and operates at an altitude of 550 ft. When the water level in the drain system exceeds the altitude of the balancing weir, water from the drains flows through the weir to the outer sumps and into the conduits, which discharge into the forebay canal.

Ground-water discharge into the backfill.--Backfill on top of the conduits was found to be relatively permeable where the Falls Street tunnel and conduits intersect (Koszalka and others, 1985, p. 56); however, no description of the backfill materials elsewhere along the conduits could be found. To determine whether the backfill is permeable elsewhere and forms a major pathway for ground-water movement, four wells were drilled during this study, three over the east conduit (wells 84-9, 84-10, and 84-11) and one over the west conduit (84-8, fig. 1). Drill cuttings indicated that the backfill consists of 2 to 5 ft of topsoil overlying 30 to 75 ft of shotrock (cobble- to boulder-size clasts of Lockport Dolomite that was blasted and removed during trench excavation), which overlies 5 to 15 ft of sandy, clayey silt fill of low permeability that overlies the conduits. The shotrock is permeable but unsaturated; only the lower part of the sandy, clayey silt was saturated. Water-level recorders installed on two wells in the sandy clayey silt (84-9 and 84-11, location shown in fig. 1) indicated that the water levels took several months to recover to a static level after the wells were pumped dry (fig. 12), which indicates that the sandy, clayey silt backfill has very low permeability and therefore transmits little ground water. Well 84-9 did not respond to fluctuations of water levels in the forebay canal, and water levels in well 84-11 fluctuated only when water levels in the forebay rose to altitudes greater than 560 ft, which occurred at the end of January and beginning of February 1985, when NYPA raised the water level in the forebay canal to clear a large accumulation of pack ice from the conduit intakes along the upper Niagara River. When this occurred, the water level in well 84-11 rose 10 ft to an altitude of 556.11 ft, then began a slow, steady decline (fig. 12). Water-level altitudes greater than 560 ft at well 84-11 would have caused the lower zone of the permeable shotrock fill to become saturated. Water probably entered the well relatively rapidly by leakage down the side of the casing, which could explain the rapid rise of the water level in the well; normally this should not have occurred because the well was installed in relatively impermeable sediment. Well 84-11 does not respond to water-level fluctuations in the bedrock or forebay canal below this altitude.

The relatively impermeable, sandy, clayey silt in the saturated part of the backfill prevents significant ground-water movement in the backfill. An exception may be at the intersection of the Falls Street tunnel and the conduits, where more permeable backfill was found. The method of backfilling there may have been different from that used elsewhere along the conduits because the conduits dip where they pass under the Falls Street sewer (fig. 9).

Ground-water discharge into drains surrounding the conduits.--The drain system that surrounds the conduits has lowered ground-water levels near the conduit trenches, which causes ground water in the Lockport Dolomite to flow toward the conduits (pl. 1A). Ground water within 0.5 mi of the conduits that previously flowed southward now flows toward the conduits and discharges into the drain system. To determine the direction of flow in the drains, water levels were measured in the central chamber in the pumping stations and in several NYPA open-hole wells installed in the bedrock 5 to 10 ft from the vertical wall drains. Because the drain system is in direct hydraulic contact

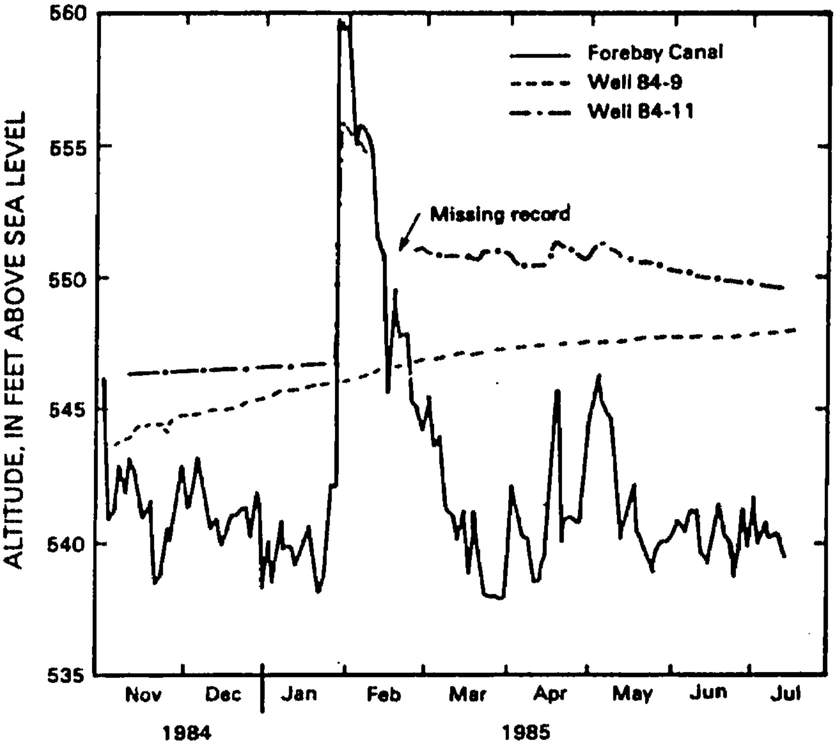


Figure 12.

Average daily water-level fluctuations in the forebay canal and recovery of water levels in wells 84-9 and 84-11 (installed in backfill atop conduits) after evacuation of water from the casing, November 1984 through July 1986.

with ground water in the Lockport Dolomite, the hydraulic heads measured in the NYPA wells are the same or nearly the same as water levels in the drains that surround the conduits (fig. 10). Water levels in wells adjacent to the conduits indicate that, most of the time, water from the vicinity of the forebay canal that enters the drains flows southward to where the Falls Street tunnel crosses the conduits (pl. 1A), whereas water from the upper Niagara River that enters the drains flows northward to the tunnel. The drain system acts as the path of least resistance to ground-water flow in and near the conduit trenches.

The major discharge point for water in the conduit drains is the Falls Street tunnel where it crosses the conduits (fig. 9). The method of construction at the conduit/tunnel intersection probably created this discharge zone. During construction of the conduit trenches, a 400-ft section of the Falls Street tunnel was rebuilt with precast concrete pipe sections, and the conduit trenches were then excavated beneath the Falls Street pipeline. After backfill was placed over the conduits and around the Falls Street tunnel pipe section, ground-water levels in the backfill fluctuated at or above the top of the rebuilt section of the Falls Street tunnel (fig. 13). Apparently the seals between the concrete pipe sections failed, and water from the drains began to leak into the Falls Street tunnel.

In 1982, the Falls Street tunnel was inspected for ground-water infiltration, and a large amount of inflow, estimated at approximately 6 Mgal/d, was found to leak into the Falls Street tunnel through joints in the concrete pipe where the tunnel passes over the conduits (Camp, Dresser and McKee, 1982). Most of this leakage is probably water from the conduit drain system, which drains ground water from 0.5 mi on both sides of the 4-mi-long trenches. The Lockport Dolomite is too impermeable to supply the quantity of water that

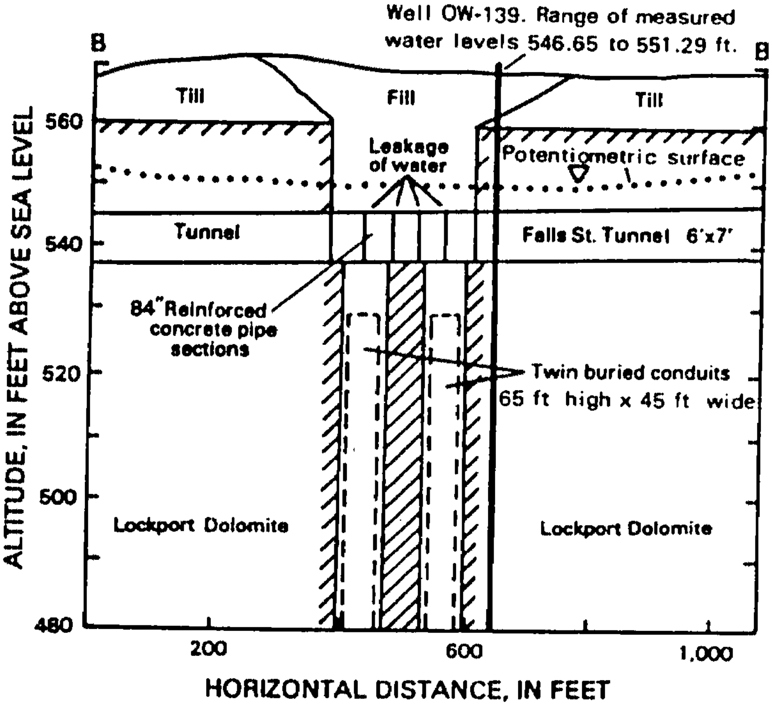


Figure 13.

Vertical section of intersection of twin buried conduits and the reconstructed Falls Street tunnel. (Location is shown in fig. 1.)

leaks into the tunnel. Estimation of how much water enters the Falls Street tunnel from either the north (powerplant) or south (river) side of the tunnel was beyond the scope of this project, however.

Effect of Forebay Canal

The forebay canal is an L-shaped excavation that penetrates the Lockport Dolomite and upper part of the Rochester Shale at the north end (outlet) of the twin conduits (fig. 1). It is 4,000 ft long, 500 ft wide, and 110 ft deep. The walls and floor are unlined. Water that enters the forebay canal from the conduits is routed to the Robert Moses powerplant, and some is pumped up to the Lewiston Reservoir, depending on the daily power-demand schedule.

The daily range of water-level fluctuations in the canal is dependent on the seasonal diversion schedule, the demand for power generation, and the flow of the Niagara River. During the summer and early fall, when the flow in the Niagara River is generally lower, daily fluctuations in the canal are greatest, as much as 25 ft. The water level in the forebay canal is increased by the release of water from the Lewiston Reservoir, which supplements the flow entering from the conduits. This combined flow into the forebay canal increases the hydraulic head in the canal to drive the Robert Moses powerplant turbines more efficiently. During high-flow periods (generally during spring) or when allowable diversions from the Niagara River are higher (table 1), daily water-level fluctuations in the forebay are less, usually ranging from 5 to 10 ft even during peak power-demand periods (fig. 7).

Ground-water discharge into the forebay canal.--The walls and floor of the forebay canal consist of bedrock. Observations of ground-water seepage from bedding planes in the forebay canal walls to the forebay canal (Lockport Dolomite) and higher water levels in nearby wells than in the forebay (pl. 1A and table 2) indicate that ground water generally discharges into the forebay canal. Little, if any, water enters the forebay canal from the underlying Rochester Shale, which has low permeability.

Effects of water-level fluctuations in the forebay canal.--The daily water-level fluctuations in the forebay canal, which can range to as much as 25 ft (fig. 7), cause instantaneous water-level fluctuations in wells along the conduits to as least 3.4 mi south of the forebay canal. The water-level fluctuations in the forebay canal also cause hydraulic-pressure changes in the drain system that surrounds the conduits. Instantaneous head responses in wells adjacent to the twin conduits to water-level fluctuations in the forebay canal suggest a direct hydraulic connection between the forebay canal and the drains. Water probably moves from the canal to the drains through gently southward dipping water-bearing bedding planes that are exposed in the walls of the forebay canal and is intercepted by the drain system that surrounds the conduits.

Water levels were recorded at four NYPA observation wells adjacent to the conduits at various distances south of the forebay canal; well OW-167 is at the outlet of the conduits, and wells OW-162, OW-152, and OW-139 are 0.8, 2.2,

REFERENCE NO. 10

Draft

ecology and environment, inc.

195 SUGG ROAD, P.O. BOX D, BUFFALO, NEW YORK 14225, TEL. 716-632-4491, TELEX 91-9183

International Specialists in the Environment

October 2, 1987

Mr. Michael Hopkins
Niagara County Department
of Health
10th and East Falls Street
Niagara Falls, New York 14302

Dear Mr. Hopkins:

On several occasions during the course of the Phase 1 investigations, E & E has contacted the Niagara County Department of Health to obtain information in regard to various characteristics of the sites under investigation. The DEC requires that all information contained in Phase 1 reports be fully documented. We ask you to review the information your department has provided, as presented in this letter, and sign this document to acknowledge that you have provided this information and that it (with any corrections or qualifications) is correct to the best of your knowledge.

<u>Ross Steel</u>

1) No hazardous waste is expected to be on site.
2) Groundwater is not used for irrigation within a 3-mile radius of the site.
3) Surface water within 3 miles of this site is used for commercial, industrial, and recreational purposes.
4) The drinking water intakes are upstream of site.

<u>Dussault Foundry</u>

1) There is no use of groundwater within 3 miles of site.
2) The surface water within 3 miles downstream of site is used for recreation (Erie Canal).

<u>Town of Lockport Landfill</u>

1) There is no use of groundwater within 3 miles of site.
2) The Erie Canal (surface water) is used for recreation near this site.
3) The drinking water intakes are located in the Niagara River located upstream of this site.

SKW Landfill

1) The drinking water surface intakes are located upstream of this site.
2) Groundwater is used within a 3 mile radius of this site for drinking water.
3) The surface water downstream (Niagara River) is used for recreation (Maid of Mist, fishing).

Diamond Shamrock

1) There is no groundwater used within a 3 mile radius of this site.

Roblin Street

1) There is no use of groundwater within a 3 mile radius of this site, drinking or irrigation.

Electro Minerals U. S. (formerly Carborundum Bldg. 82)

1) The water supply intakes are located upstream of this site.

Frontier Bronze

1) There is no suspected hazardous waste disposal present at this site.
2) Groundwater for drinking purposes is used by a neighborhood approximately 2.5 miles to the NW, at the intersection of Pennsylvania and Witmer Road. Two families, roughly 8 people, use groundwater for drinking purposes.

Walmore Road

1) The well on site is used for irrigation.
2) Approximately 1 acre of area is irrigated by this groundwater well.
3) There is no use of surface water 3 miles downstream of this site.

New York Power Authority Road Site

1) Hazardous waste is not suspected to be disposed of on site.
2) There is no land irrigated with groundwater within 3 miles of site.

I would also like you to confirm the fact that no fire official has declared any of the following sites a fire or explosion hazard:

- o SKW Alloys Landfill - Witmer Road, Town of Niagara.
- o Dussault Foundry - Washburn Street, Lockport.
- o Frontier Bronze - New Road, City of Niagara Falls.
- o Staufer Chemical, North Love Canal - Town of Lewiston.

Draft

- Electro Minerals, U.S., Inc., (formerly Carobrundum Bldg. #82), Buffalo Avenue, City of Niagara Falls.
- Ross Steel Co. - Pine Avenue, Niagara Falls (now the site of the New York Power Authority water intake conduit right-of-way).
- Roblin Steel Company - Oliver Street, North Tonawanda.
- LaSalle Expressway - specifically near Love Canal.
- Diamond Shamrock, now Occidental Petroleum Corp., Ohio Street, Lockport, New York.
- Town of Lockport Landfill - East Canal Street, Lockport, New York.
- Power Authority Road Site - New Road, Lewiston, New York (across from Hyde Park Landfill).
- 64 Street South (owned by Russo Chevrolet) - 64th and Niagara Falls Blvd., Niagara Falls.
- Walmore Road, 6373 Walmore Road, Town of Wheatfield, New York.

I certify that I provided the above information to Ecology and Environment, Inc., and it is correct to the best of my knowledge.

Signature

Date

Please find maps enclosed to assist you in locating these sites. If you have any questions regarding the above, please contact me at 633-9881.

Thank you very much for your time and assistance in our ongoing investigations.

Sincerely,

Dennis Sutton

oio

REFERENCE NO. 11

New York State Department of Environmental Conservation
600 Delaware Avenue, Buffalo, N.Y. 14202-1073

Draft

Thomas C. Jorling
Commissioner

July 30, 1987

Mr. Dennis Sutton
Ecology & Environment, Inc.
195 Sugg Road
Buffalo, New York 14226

Dear Mr. Sutton:

Referencing your letter of July 22, the attachments furnish information relative to the location, construction, and operation of the process cooling water well installation located on the Olin Buffalo Ave. Plantsite. Sources are as follows:

Attachment 1	Engineering Report Olin Corporation Niagara Falls, N.Y. April 15, 1983
Attachment 2	Draft Remedial Action Program Dupont Niagara Plant Niagara Falls, N.Y. June 27, 1986
Attachment 3	Olin Transmittal letter Re: SPDES Report for June 1987

Note that pumping rate has been reduced from approximately 3500 gpm to 670 gpm due to product line changes and engineered modifications made to Olin's cooling load.

No draw down information is available.

Sincerely,

Peter J. Buechi, P.E.
Regional Engineer for
Solid and Hazardous Waste

Attach.

C. Water Supply and Receiving Water

1. Water Supply

The Niagara Falls plant operates with three (3) sources of water supply. Since the primary use of water is for cooling and the heat load and temperature of the Niagara River water vary with the seasons, there is a seasonal variation in consumption figures:

Source	Flow (mgd)	
	Winter	Summer
Niagara River	2.02-2.95 2.48 avg.	2.88-4.90 3.89 avg.
Well Water	2.88-3.74 3.31 avg.	3.74-5.18 4.46 avg.
City Water (City of Niagara Falls)	0.43	0.43

2. Water Quality Requirements

Among the several uses of raw water at the Niagara Falls plant (e.g., boiler feed water, product, cooling, etc.), cooling is by far the major usage of river and well water.

As noted previously, the plant can use in excess of 8 million gallons of water per day in the summer months. Ninety percent of this is for cooling purposes, mainly in "once-through" systems. In once-through systems, the initial temperature is of considerable importance. Generally, the lower the initial temperature of such a water, the more desirable it is as cooling water. Of similar importance is the consistency of temperature and the Olin process wells produce a supply at 53-55°F, summer and winter. The real value of the wells lies in the combination of low temperature and high volume.

> Wells in an area about a half mile wide adjacent to the Niagara River above the falls have substantially higher yields than wells elsewhere in the area. The higher yields in this area are caused by two conditions: (1) the Lockport Dolomite is thickest in the area, and (2) more importantly, conditions are favorable for the infiltration of water from the Niagara River. The greatest thickness of the Lockport provides the maximum number of water-bearing zones to supply water to the wells. The Niagara River provides an unlimited source of recharge to the water-bearing zones.

3. Description of Production Wells

The Mathieson Chemical Company originally had one well at the Plant 1 site. The well was 18 inches in diameter, 125 feet deep, and was originally drilled in 1937. In a search for additional water in 1947, two additional wells were drilled approximately 50 feet west of the original No. 1 well. Also at this time, an 8 inch diameter test well was drilled between the two new wells (Number 2 and 3). Wells 2 and 3 (the wells in use at present) are 24 inches in diameter and 125 feet deep. In approximately this time period (1947), Olin discontinued use of the No. 1 well and later sold the property where the well was located to E. I. DuPont de Nemours Company. Plant records indicate that DuPont also had several wells on their property ranging in diameter from 6 to 24 inches in diameter and all approximately 125 feet deep. Field investigations carried out in 1948 concluded that "all the accessible DuPont and Mathieson operating and observation wells are cross connected either directly or indirectly" in the aquifer. Reports at the time also noted the consistent recording of crevices and broken limestone at the 45-50 foot level. This was a major water bearing layer.

Repair and remedial work was performed on Olin wells 2 and 3 in late 1978. This included plugging the 8 inch test well with concrete to a depth of 38 feet and relining the two production wells with new steel casings. The casings were 16 inches in diameter and were grouted in place from the 38 foot level to the surface. Any contamination reaching the wells must be entering from below the 38 foot level.

> Evidence that a substantial part of the water pumped is supplied by induced infiltration from the Niagara River is indicated by the high yields, which exceed 2000 gpm at some wells, and the chemical character of the water. The chemical composition of the water in well 304-901-6 (Olin) (which has been pumped at 2100 gpm) is more similar to Niagara River water than "typical" groundwater in the Lockport.[2]

The Niagara River water is returned via "clear water" sewers to the river after use. Important considerations with this supply are screening of debris, prevention of growth of aquatic organisms, fouling of conduits and heat exchangers. The major problem is lack of consistency in temperature. River water can actually be too cold in the winter months. Treatments for prevention of slime and scale must be inexpensive on a once-through system and substances cannot be added which would prove deleterious to its further uses or be in contravention of water quality or discharge standards.

In short, cooling waters should have appropriate initial temperatures and should not deposit scale, be corrosive, or encourage the growth of slimes. Among the constituents of natural water that may prove detrimental to its use for cooling purposes are hardness, suspended solids, dissolved gases, acids, and oil and slime-forming organisms. One of the most definitive lists of quality requirements for cooling waters gives the following recommended limiting concentrations:

Turbidity	50 mg/l
Hardness	50 mg/l
Iron	0.5 mg/l
Manganese	0.5 mg/l
Iron and manganese	0.5 mg/l

The Olin process wells provide a source of supply which is slightly harder than desired but in all other respects, is an ideal cooling water supply. No raw water treatment has been required for control (chemical addition or filtration) and the temperature is a uniform 53-55°F.

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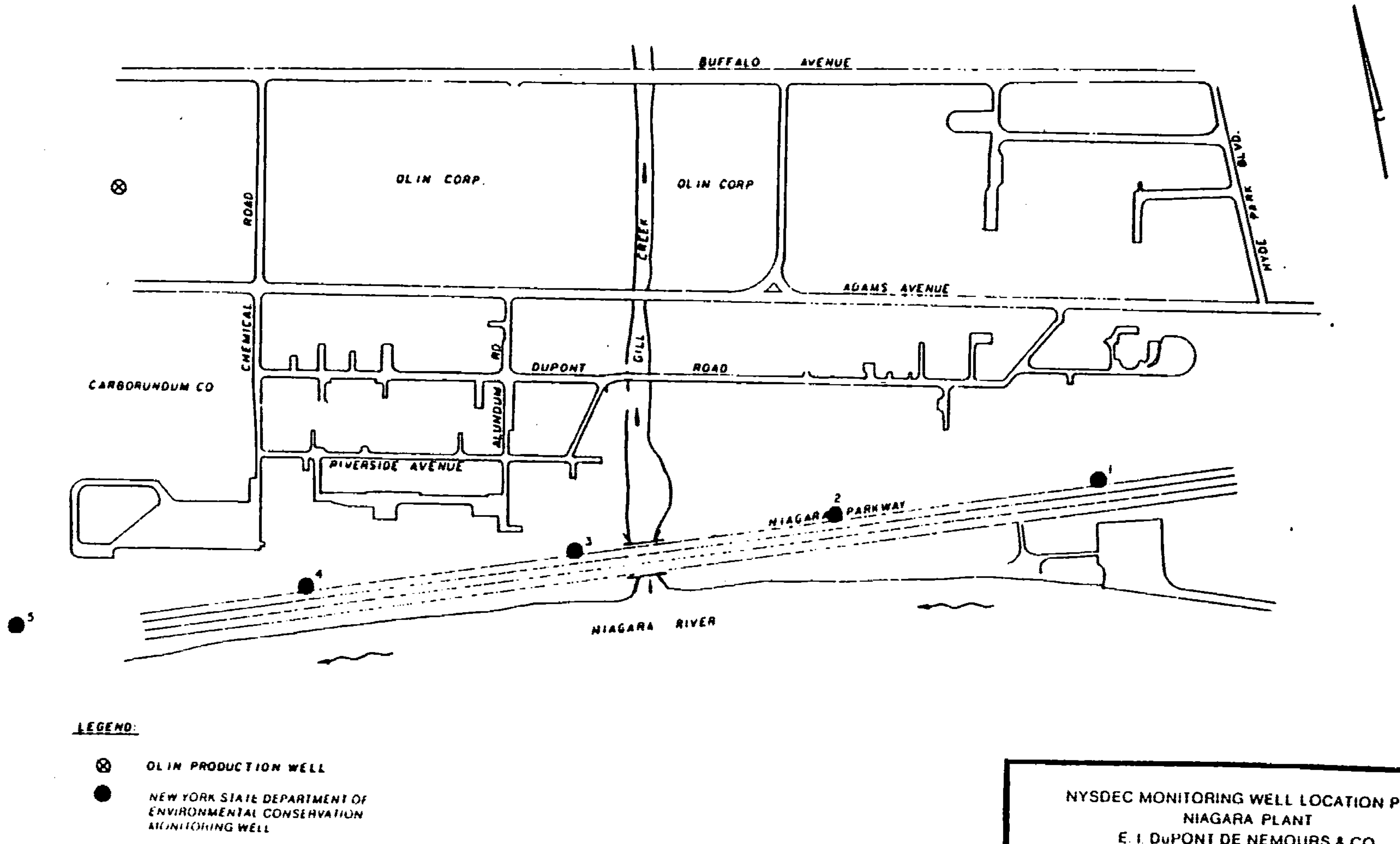
[2] Johnston, Groundwater in the Niagara Falls Area, New York, NYS Conservation Department, Bulletin GS-53, (1964) p. 30.

ATTACHMENT 2



NYSDEC MONITORING WELL LOCATION PLAN
NIAGARA PLANT
E. I. DuPONT DE NEMOURS & CO.

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

DRAWN BY: T. P.
CHECKED: D W B
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DATE: 6/[illegible]
JOB: 83C[illegible]8-8

PLATE 3

ATTACHMENT 3

Draft

Olin CHEMICALS
NIAGARA FALLS PLANT. P.O. BOX 748. NIAGARA FALLS. NY 14302

July 24, 1987

Mr. Colby Tucker
Chief, Source Surveillance Section
Bureau of Wastewater Facility Operation
Division of Water - Room 320
50 Wolf Road
Albany, NY 12233-3506

Dear Mr. Tucker:

Re: Olin Corporation
Niagara Falls Plant
Permit No. NYD001635

The following comments concern Olin's Niagara Falls facility SPDES discharge monitoring report for June 1-30, 1987 reporting period:

1. All monitoring data are reported on preprinted 3320-1 forms as supplied by NYSDEC.
2. It should be noted that extra mercury sampling was conducted as an aid in better controlling our mercury discharge.
3. Credit is taken for the contribution of background total suspended solids found in the incoming river supply as sampled at Olin's river water pump house No. 16. All other reported values are gross with respect to our Niagara River intake as per revised SPDES Permit Conditions effective 6/1/87.
4. Volatile organics concentrations in samples collected from outfalls 004, 005, and the river water supply during June 10-11 are included as attachment A. Attachment B lists GC/MS detection limits for volatile organic compounds in effluent samples. Mass discharges for chloroform and trans-1,2-dichloroethylene are included in Attachment A.
5. The total average well water flow for 30 operating days during June is estimated to be 0.961 MGD based upon orifice meter integrator readings. The south well operated during the entire month of June.

Very truly yours,

OLIN CORPORATION

M L Norsworthy

M. L. Norsworthy
Plant Manager

AFK/MLN/dmh

Attachments

Draft

REFERENCE NO. 12

Freshwater Wetlands Classification Sheet

Draft

December 5, 1984

Niagara County
Map 13 of 18
Niagara Falls Quadrangle

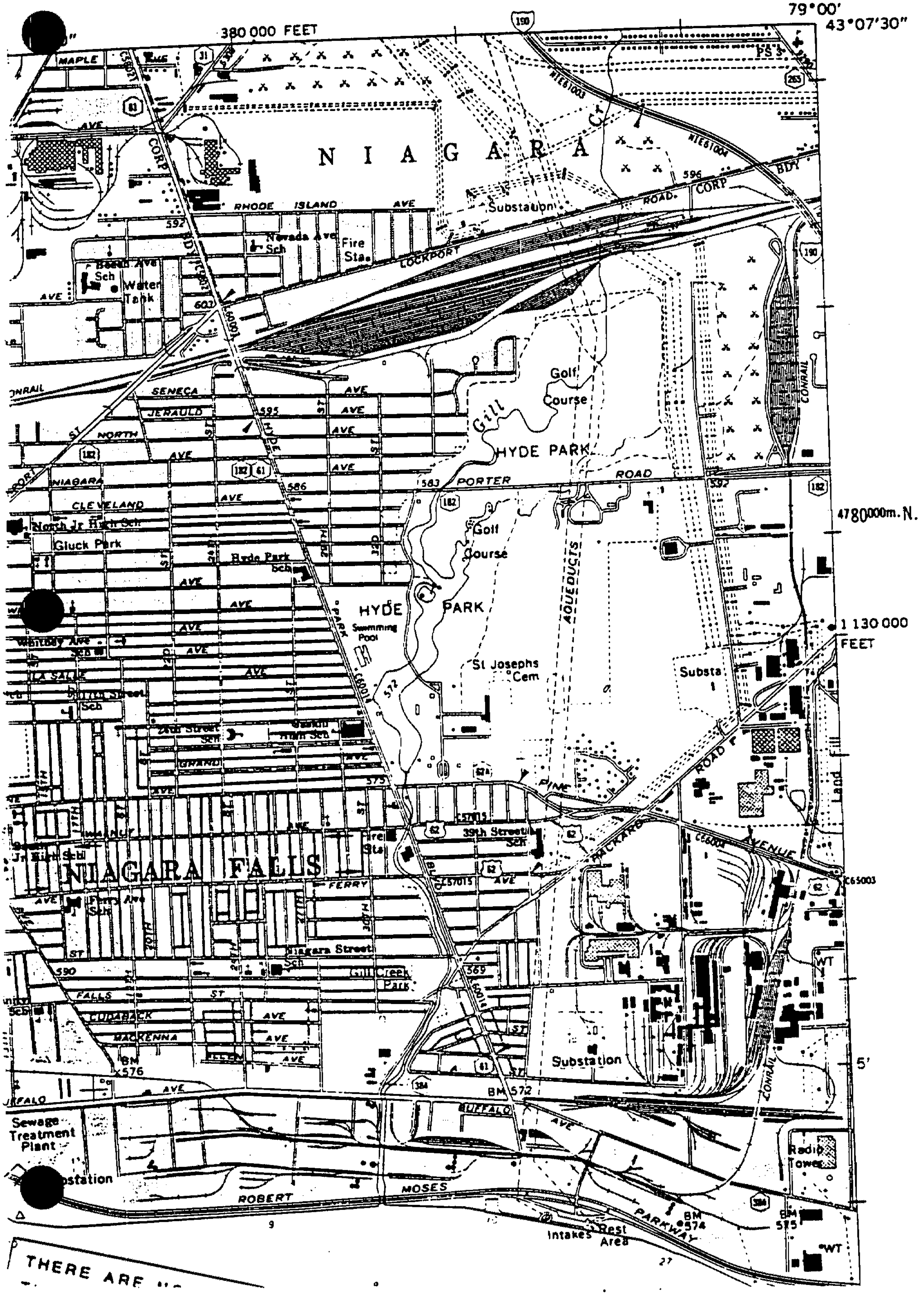
Wetlands Identification Code	Municipality	Classification

There are no wetlands in Niagara County on the Niagara Falls Quadrangle.

430790 DP

Draft

NIAGARA FALLS QUADRANGLE
ONTARIO–NEW YORK
7.5 MINUTE SERIES PLANIMETRIC
SE/4 NIAGARA FALLS 15' QUADRANGLE



THERE ARE N

REFERENCE NO. 13

Draft

CONTACT REPORT

AGENCY : New York State Department of Environmental Conservation, Region 9

ADDRESS : 600 Delaware Ave., Buffalo, NY 14202

PHONE : (716)847-4550

PERSON CONTACTED : James Snider, Senior Wildlife Biologist

TO : Jon Sundquist

DATE : June 2, 1987

SUBJECT : Critical Wildlife habitats near potential hazardous waste sites in Niagara County

In preparation of Phase 1 reports on potential hazardous waste sites in New York for the NYSDEC, information about nearby critical wildlife habitats is necessary. The following information is provided by Mr. James Snider of the Bureau of Wildlife, NYSDEC Region 9.

Except for the seasonal appearance of migratory birds, including, possibly the bald eagle, there are no critical habitats of endangered species within 2 miles of the suspected waste sites listed below:

- SKW Alloys
  Witmer Road at Maryland Ave.
  Niagara Falls, NY
- Dussault Foundries
  2 Washburn Street
  Lockport, NY
- North Love Canal
  Near Cleghorn Drive
  Lewiston, NY
- Carborundum Building 82
  Buffalo Ave.
  Niagara Falls, NY
- Ross Steel Company
  4237 Pine Ave.
  Niagara Falls, NY
- Frontier Bronze
  4870 Packard Rd.
  Niagara Falls, NY
- Roblin Steel
  101 East Ave.
  N. Tonawanda, NY

Draft

- LaSalle Expressway
  Niagara Falls, NY
- Diamond Shamrock
  Ohio Ave.
  Lockport, NY
- Town of Lockport Landfill
  Canal Road
  Lockport, NY
- Power Authority Road
  Lewiston, NY
- 64th Street South
  Chevy Place
  Niagara Falls, NY
- Walmore Road
  Walmore Rd., 0.5 miles south of Lockport Road
  Wheatfield, NY

James R.
Signature

July 27, 1987
Date

REFERENCE NO. 14

Draft

New York State Atlas of
Community Water System Sources
1982

NEW YORK STATE DEPARTMENT OF HEALTH
DIVISION OF ENVIRONMENTAL PROTECTION
BUREAU OF PUBLIC WATER SUPPLY PROTECTION

Draft

ERIE COUNTY

ID NO	COMMUNITY WATER SYSTEM	POPULATION	SOURCE
	Municipal Community		
	Akron Village (See No 1 Wyoming Co, Page 10)	3640	
1	Aiden Village	3460	Wells
2	Angola Village	8500	Lake Erie
3	Buffalo City Division of Water	357870	Lake Erie
4	Caffee Water Company	210	Wells
5	Collins Water District #3	704	Wells
6	Collins Water Districts #1 and #2	1384	Wells
7	Erie County Water Authority (Sturgeon Point Intake)	375000	Lake Erie
8	Erie County Water Authority (Van DeWater Intake)	NA	Niagara River - East Branch
9	Grand Island Water District #2	9390	Niagara River
10	Holland Water District	1670	Wells
11	Lawtons Water Company	138	Wells
12	Lockport City (Niagara Co)		Niagara River - East Branch
13	Niagara County Water District (Niagara Co)		Niagara River - West Branch
14	Niagara Falls City (Niagara Co)		Niagara River - West Branch
15	North Collins Village	1500	Wells
16	North Tonawanda City (Niagara Co)		Niagara River - West Branch
17	Orchard Park Village	3671	Pipe Creek Reservoir
18	Springville Village	4169	Wells
19	Tonawanda City	18538	Niagara River - East Branch
20	Tonawanda Water District #1	91269	Niagara River
21	Wanakah Water Company	10750	Lake Erie
	Non-Municipal Community		
22	Aurora Mobile Park	125	Wells
23	Bush Gardens Mobile Home Park	270	Wells
24	Circle B Trailer Court	50	Wells
25	Circle Court Mobile Park	125	Wells
26	Creekside Mobile Home Park	120	Wells
27	Donnelly's Mobile Home Court	99	Wells
28	Gowanda State Hospital	NA	Clear Lake
29	Hillside Estates	160	Wells
30	Hunters Creek Mobile Home Park	150	Wells
31	Knox Apartments	NA	Wells
32	Maple Grove Trailer Court	72	Wells
33	Millgrove Mobile Park	100	Wells
34	Perkins Trailer Park	75	Wells
35	Quarry Hill Estates	400	Wells
36	Springville Mobile Park	114	Wells
37	Springwood Mobile Village	132	Wells
38	Taylors Grove Trailer Park	39	Wells
39	Valley View Mobile Court	42	Wells
40	Villager Apartments	NA	Wells

NIAGARA COUNTY

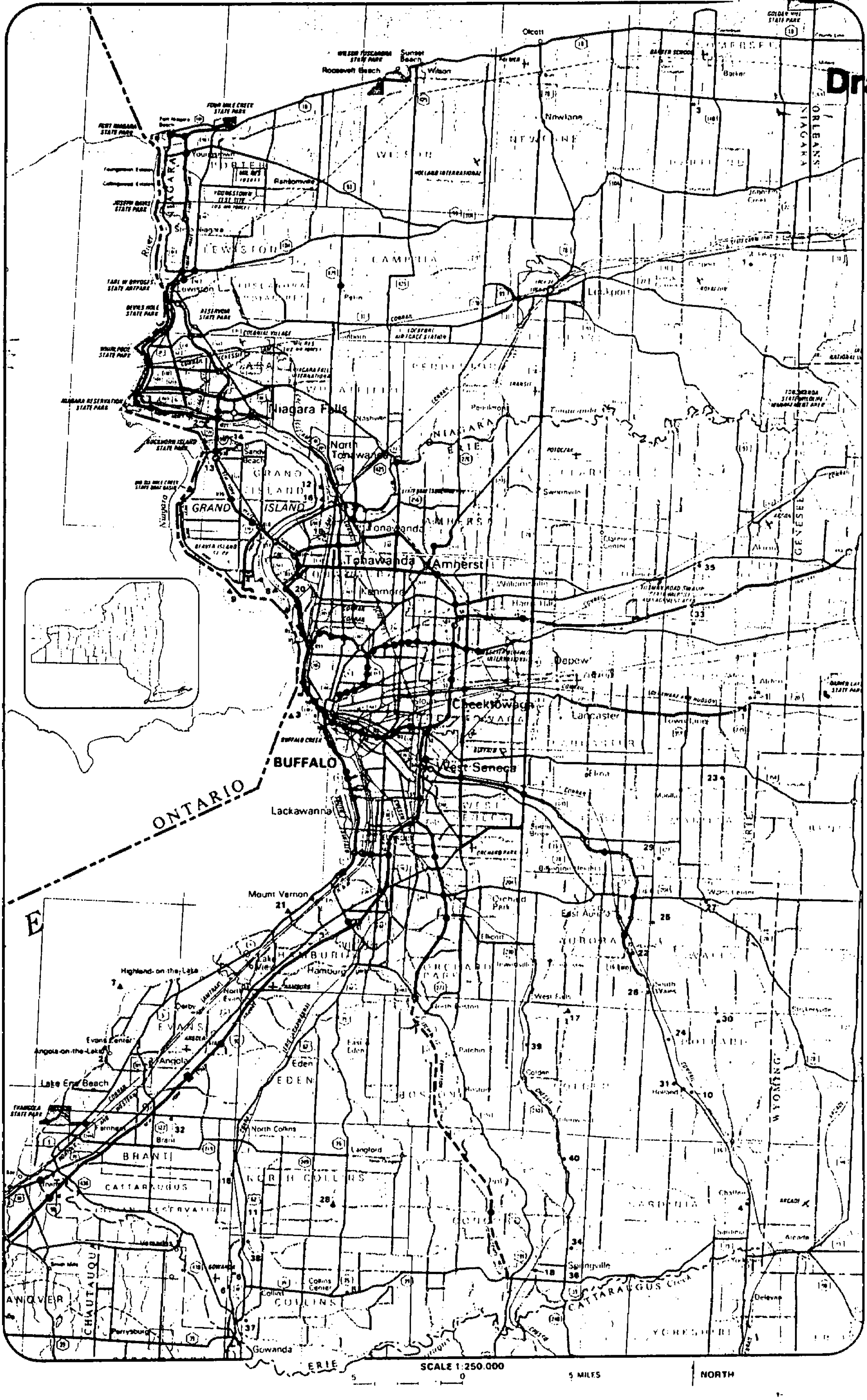
ID NO	COMMUNITY WATER SYSTEM	POPULATION	SOURCE
	Municipal Community		
	Lockport City (See No 12, Erie Co)	25000	
1	Middleport Village	2000	Wells (Springs)
	Niagara County Water District (See No 13, Erie Co)	48	
2	Niagara Falls City (See also No 14 Erie Co)	77384	Niagara River - East Bra
	North Tonawanda City (See No 16 Erie Co)	36000	
	Non-Municipal Community		
3	Country Estates Mobile Village	28	Wells

Draft

Draft

LOCATION OF COMMUNITY WATER SYSTEM SOURCES-1982

ERIE and NIAGARA COUNTIES



REFERENCE NO. 15

The
National Register
of Historic Places

1976

Irene Lewishon to carry forward their work in drama and dance with local children. *Multiple public/private:* NHL.

NIAGARA COUNTY

Lewiston. **FRONTIER HOUSE,** 460 Center St., 1824–1826. Stone, 3 1/2 stories, rectangular; gabled roof with stepped gables, paired chimneys, and balustrade; off-center and center entrances, full-width front porch with hipped roof, regular fenestration, oval windows in gables; N kitchen wings. Federal elements. Built as a tavern for Joshua Fairbanks and Benjamin and Samuel Barton, local prominent businessmen. *Private.*

Lewiston. **LEWISTON MOUND,** Lewiston State Park, Hopewellian affinities (c. 160). Oval burial mound. Partially investigated. *County.*

Lewiston vicinity. **LEWISTON PORTAGE LANDING SITE,** Prehistoric–19th C.. Gently sloping ravine leading from river remains of path used by travelers to avoid Niagara Falls. Archeological explorations yielded artifacts from Indian to British occupation, indicating this was a heavily used access point to a vital overland route. *State.*

Lockport. **LOWERTOWN HISTORIC DISTRICT,** Roughly bounded by Erie Canal and New York Central RR., 19th–20th C.. Primarily residential district, with some religious and commercial buildings and warehouses; facing the canal are 2 1/2-story brick and stone residences with Greek Revival and Italianate elements built in the 1830's; off the canal are 1–2-story frame structures with additions and modern siding built mid-19th C. and some stone structures: notable are the Gothic Revival former Christ Episcopal Church (1854) and the Italianate Vine Street School (1864). Systematic development of the village began after canal opened; district was Lockport's social, commercial, and industrial center, 1830's–1860's. *Multiple public/private:* HABS.

Lockport. **MOORE, BENJAMIN C., MILL (LOCKPORT CITY HALL; HOLLY WATER WORKS)** , Pine St. on the Erie Canal, 1864. Coursed rubble, 2 1/2 stories over basement on sloping site, trapezoidal shape, hipped roof sections with cross gables, interior chimney; front center entrance with transom and pediment on pilasters, triple round arched windows in gables, rock-faced stone lintels and sills, ashlar quoins; interior altered; rear 2-story addition 1893. Built as a flour mill, converted c. 1885 to a water pumping plant; adapted as city hall 1893; one of few survivors of 25 industrial buildings once clustered along this section of Erie Canal. *Municipal.*

Niagara Falls. **DEVEAUX SCHOOL COMPLEX,** 2900 Lewiston Rd., 1855–1888. Educational complex; contains 3 connected structures–Van Rensselaer Hall (1855–1857), Patterson Hall (1866), and Munro Hall (1888); and outbuildings–barn, shed, and gymnasium. Gothic Revival elements. Founded by Judge Samuel DeVeaux as an Episcopal school for poor and orphaned boys; later became a prominent preparatory school; closed, 1971. *Private.*

Niagara Falls. **NIAGARA FALLS PUBLIC LIBRARY,** 1022 Main St., 1902–1904, E. E. Joralemon, architect. Stone, yellow brick; 1 story, rectangular with semielliptical rear bow, flat roof with parapet, slightly projecting center entrance bay with pedimented double doorway, pedimented windows, string courses; fine interior detail intact. Neo-Classical Revival elements. One of many public libraries endowed by Andrew Carnegie. *Public.*

Niagara Falls. **NIAGARA RESERVATION,** 1885. Includes the falls, Goat Island and other islets, paths, and an observation tower. In establishing a reservation of over 400 acres, New York became the first state to use eminent domain powers to acquire land for aesthetic purposes. *State:* NHL.

Niagara Falls. **SHREDDED WHEAT OFFICE BUILDING,** 430 Buffalo Ave., 1900. Steel frame, brick; 5 stories, rectangular, flat roof, center entrance, 5 paired window bays, segmental arched basement windows, wide parapet; interior featured 4th-floor auditorium and 5th-floor cafeteria; doubled glazed windows. Commercial style. Administrative office building of original Shredded Wheat factory complex, developed by Henry D. Perky. *Private.*

Niagara Falls. **U.S. CUSTOMHOUSE,** 2245 Whirlpool St., 1863. Stone, 2 1/2 stories, square, hipped roof, arched window and door openings on W facade; built into railroad embankment, S side opens onto railroad tracks; renovated, 1928. Continues to serve as customs office for trains from Canada. *Private:* HABS.

Niagara Falls. **WHITNEY MANSION,** 335 Buffalo Ave., 1849–1851. Limestone, 2 1/2 stories, L-shaped, intersecting gabled roof sections; original section has off-center entrance with full-width Ionic portico; 19th C. side addition has front bay window and gabled dormer with 3 round arched windows. Greek Revival. Built according to 1830's design by Solon Whitney, son of Gen. Parkhurst Whitney, village founder and prominent hotel and tavern owner. *Private.*

Youngstown vicinity. **OLD FORT NIAGARA,** N of Youngstown on NY 18, 1678. Complex of stone buildings bounded by stone walls, earthworks, and a moat; restored. Original fort built in 1678; altered 1725–1726 and 1750–1759. Held alternately by French, British, and Americans in struggle for control of continent; strategically located in commanding the Great Lakes from Lake Erie to Ontario and in covering approaches to western NY. *State:* NHL.

ONEIDA COUNTY

Boonville. **ERWIN LIBRARY AND PRATT HOUSE,** 104 and 106 Schuyler St., 1890, C. L. Vivian (Erwin Library); 1875, J. B. Lathrop (Pratt House). Erwin Library: limestone, 1 story, gabled and hipped roofs; square tower with pyramidal roof contains recessed arched entrance. Romanesque. Pratt House: brick, 3 stories, mansard roof with dormers and central tower crowned with iron cresting and spire, ornate bracketed cornices and metal lintels; original interior wall coverings, fixtures, and woodwork. Second Empire. *Private.*

Boonville. **FIVE LOCK COMBINE AND LOCKS 37 AND 38, BLACK RIVER CANAL (BOONVILLE GORGE PARK)** , NY 46, 19th–20th C.. Section of the abandoned Black River Canal (built mid-19th C.) running through rugged terrain of Boonville Gorge; contains locks 37 and 38 and a 5-lock combine (locks 39–43); canal was 42' deep; locks, 90' by 15', which accommodate 70-ton boats, were built 1895–early 1900's. Canal built to connect Black River Valley to Erie Canal provided water supply for Erie Canal, allowed expansion of valley's lumbering industry, and fostered growth of towns. *State/county:* HAER.

Clinton. **HAMILTON COLLEGE CHAPEL,** Hamilton College campus, 1827, Philip Hooker, architect. Coursed rubble, 3 stories, rectangular, low pitched roof, interior chimney, modillion cornice, front and rear parapet; front slightly projecting 4-story clock tower with 3-stage frame belfry–2 stories, each with columns and entablature, surmounted by octagonal cupola; front center double-door entrance with round arched window above, flanked by tall round arched windows, blind decorative frame panels; limestone ashlar quoins, lintels, and sills; side elevations with 3 tiers of windows; apse added 1897; interior altered. Federal. Multipurpose classroom and chapel building designed by Philip Hooker; unusual 3-story interior plan attributed to John H. Lothrop, a trustee. *Private.*

Clinton. **ROOT, ELIHU, HOUSE,** 101 College Hill Rd., 1817. Frame, clapboarding; 2 stories, irregular shape, gabled roof, interior chimneys, pedimented arched portico, off-center entrance with semielliptical fanlight and side lights, 2-story pilasters dividing bays in flush-sided main facade, pedimented rear porch; side additions; restored, 1900's. Federal. Home of Elihu Root, U.S. Secretary of War largely credited with conceptual foundation for 20th C. development of American Army, Secretary of State, U.S. senator, and winner of 1912 Nobel Peace Prize. *Private; not accessible to the public:* NHL.

Rome. **ARSENAL HOUSE,** 514 W Dominick St., c. 1813–1814. Brick, 2 1/2 stories, rectangular, gabled roof, pairs of bridged interior end chimneys above single gable steps, central pedimented gable with elliptical window, 2 vertical elliptical windows in gabled ends between chimneys, stone sills and lintels; later front porch with large modillion blocks, chamfered

Irene Lewishon to carry forward their work in drama and dance with local children. *Multiple public/private:* NHL.

[illegible]ARA COUNTY

Lewiston. **FRONTIER HOUSE**, 460 Center St., 1824–1826. Stone, 3 1/2 stories, rectangular; gabled roof with stepped gables, paired chimneys, and balustrade; off-center and center entrances, full-width front porch with hipped roof, regular fenestration, oval windows in gables; N kitchen wings. Federal elements. Built as a tavern for Joshua Fairbanks and Benjamin and Samuel Barton, local prominent businessmen. *Private.*

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Lewiston vicinity. **LEWISTON PORTAGE LANDING SITE**, Prehistoric–19th C.. Gently sloping ravine leading from river remains of path used by travelers to avoid Niagara Falls. Archeological explorations yielded artifacts from Indian to British occupation, indicating this was a heavily used access point to a vital overland route. *State.*

Lockport. **LOWERTOWN HISTORIC DISTRICT**, Roughly bounded by Erie Canal and New York Central RR., 19th–20th C.. Primarily residential district, with some religious and commercial buildings and warehouses; facing the canal are 2 1/2-story brick and stone residences with Greek Revival and Italianate ele[illegible]s built in the 1830's; off the canal are 1–2-[illegible] frame structures with additions and modern siding built mid-19th C. and some stone structures: notable are the Gothic Revival former Christ Episcopal Church (1854) and the Italianate Vine Street School (1864). Systematic development of the village began after canal opened; district was Lockport's social, commercial, and industrial center, 1830's–1860's. *Multiple public/private:* HABS.

Lockport. **MOORE, BENJAMIN C., MILL (LOCKPORT CITY HALL; HOLLY WATER WORKS)** , Pine St. on the Erie Canal, 1864. Coursed rubble, 2 1/2 stories over basement on sloping site, trapezoidal shape, hipped roof sections with cross gables, interior chimney; front center entrance with transom and pediment on pilasters, triple round arched windows in gables, rock-faced stone lintels and sills, ashlar quoins; interior altered; rear 2-story addition 1893. Built as a flour mill, converted c. 1885 to a water pumping plant; adapted as city hall 1893; one of few survivors of 25 industrial buildings once clustered along this section of Erie Canal. *Municipal.*

Niagara Falls. **DEVEAUX SCHOOL COMPLEX**, 2900 Lewiston Rd., 1855–1888. Educational complex; contains 3 connected structures–Van Rensselaer Hall (1855–1857), Patterson Hall (1866), and Munro Hall (1888); and outbuildings–barn, shed, and gymnasium. Gothic Revival elements. Founded by Judge Samuel DeVeaux as an Episcopal school for poor and orphaned boys; later became a prominent preparatory school; closed, 1971. *Private.*

Niagara Falls. **NIAGARA FALLS PUBLIC LIBRARY**, 1022 Main St., 1902–1904, E. E. Joralemon, architect. Stone, yellow brick; 1 story, rectangular with semielliptical rear bow, flat roof with parapet, slightly projecting center entrance bay with pedimented double doorway, pedimented windows, string courses; fine interior detail intact. Neo-Classical Revival elements. One of many public libraries endowed by Andrew Carnegie. *Public.*

Niagara Falls. **NIAGARA RESERVATION**, 1885. Includes the falls, Goat Island and other islets, paths, and an observation tower. In establishing a reservation of over 400 acres, New York became the first state to use eminent domain powers to acquire land for aesthetic purposes. *State:* NHL.

Niagara Falls. **SHREDDED WHEAT OFFICE BUILDING**, 430 Buffalo Ave., 1900. Steel frame, brick; 5 stories, rectangular, flat roof, center entrance, 5 paired window bays, segmental arched basement windows, wide parapet; interior featured 4th-floor auditorium and 5th-floor cafeteria; doubled glazed windows. Commercial style. Administrative office building of original Shredded Wheat factory complex, developed by Henry D. Perky. *Private.*

Niagara Falls. **U.S. CUSTOMHOUSE**, 2245 Whirlpool St., 1863. Stone, 2 1/2 stories, square, hipped roof, arched window and door openings on W facade; built into railroad embankment, S side opens onto railroad tracks; renovated, 1928. Continues to serve as customs office for trains from Canada. *Private:* HABS.

Niagara Falls. **WHITNEY MANSION**, 335 Buffalo Ave., 1849–1851. Limestone, 2 1/2 stories, L-shaped, intersecting gabled roof sections; original section has off-center entrance with full-width Ionic portico; 19th C. side addition has front bay window and gabled dormer with 3 round arched windows. Greek Revival. Built according to 1830's design by Solon Whitney, son of Gen. Parkhurst Whitney, village founder and prominent hotel and tavern owner. *Private.*

Youngstown vicinity. **OLD FORT NIAGARA**, N of Youngstown on NY 18, 1678. Complex of stone buildings bounded by stone walls, earthworks, and a moat; restored. Original fort built in 1678; altered 1725–1726 and 1750–1759. Held alternately by French, British, and Americans in struggle for control of continent; strategically located in commanding the Great Lakes from Lake Erie to Ontario and in covering approaches to western NY. *State:* NHL.

ONEIDA COUNTY

Boonville. **ERWIN LIBRARY ~~AND~~ PRATT HOUSE**, 104 and 106 Schuyler St., 1890, C. L. Vivian (Erwin Library); 1875, J. B. Lathrop (Pratt House). Erwin Library: limestone, 1 story, gabled and hipped roofs; square tower with pyramidal roof contains recessed arched entrance. Romanesque. Pratt House: brick, 3 stories, mansard roof with dormers and central tower crowned with iron cresting and spire, ornate bracketed cornices and metal lintels; original interior wall coverings, fixtures, and woodwork. Second Empire. *Private.*

Boonville. **FIVE LOCK COMBINE AND LOCKS 37 AND 38, BLACK RIVER CANAL (BOONVILLE GORGE PARK)** , NY 46, 19th–20th C.. Section of the abandoned Black River Canal (built mid-19th C.) running through rugged terrain of Boonville Gorge; contains locks 37 and 38 and a 5-lock combine (locks 39–43); canal was 42' deep; locks, 90' by 15', which accommodate 70-ton boats, were built 1895–early 1900's. Canal built to connect Black River Valley to Erie Canal provided water supply for Erie Canal, allowed expansion of valley's lumbering industry, and fostered growth of towns. *State/county:* HAER.

Clinton. **HAMILTON COLLEGE CHAPEL**, Hamilton College campus, 1827, Philip Hooker, architect. Coursed rubble, 3 stories, rectangular, low pitched roof, interior chimney, modillion cornice, front and rear parapet; front slightly projecting 4-story clock tower with 3-stage frame belfry – 2 stories, each with columns and entablature, surmounted by octagonal cupola; front center double-door entrance with round arched window above, flanked by tall round arched windows, blind decorative frame panels; limestone ashlar quoins, lintels, and sills; side elevations with 3 tiers of windows; apse added 1897; interior altered. Federal. Multipurpose classroom and chapel building designed by Philip Hooker; unusual 3-story interior plan attributed to John H. Lothrop, a trustee. *Private.*

Clinton. **ROOT, ELIHU, HOUSE**, 101 College Hill Rd., 1817. Frame, clapboarding; 2 stories, irregular shape, gabled roof, interior chimneys, pedimented arched portico, off-center entrance with semielliptical fanlight and side lights, 2-story pilasters dividing bays in flush-sided main facade, pedimented rear porch; side additions; restored, 1900's. Federal. Home of Elihu Root, U.S. Secretary of War largely credited with conceptual foundation for 20th C. development of American Army, Secretary of State, U.S. senator, and winner of 1912 Nobel Peace Prize. *Private; not accessible to the public:* NHL.

Rome. **ARSENAL HOUSE**, 514 W. Dominick St., c. 1813–1814. Brick, 2 1/2 stories, rectangular, gabled roof, pairs of bridged interior end chimneys above single gable steps, central pedimented gable with elliptical window, 2 vertical elliptical windows in gabled ends between chimneys, stone sills and lintels; later front porch with large modillion blocks, chamfered

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EPA

POTENTIAL HAZARDOUS WASTE SITE SITE INSPECTION REPORT

PART 1 - SITE LOCATION AND INSPECTION INFORMATION

I. IDENTIFICATION	
01 State NY	02 Site Number 932048B

II. SITE NAME AND LOCATION

01 Site Name (Legal, common, or descriptive name of site) Carborundum Building 82	02 Street, Route No., or Specific Location Identifier Buffalo Avenue				
03 City Niagara Falls	04 State NY	05 Zip Code 14302	06 County Niagara	07 County Code	08 Cong. Dist.

09 Coordinates Latitude 4 3° 0 5' 0 2".	Longitude 0 7 9° 0 2' 1 4".	10 Type of Ownership (Check one) [X] A. Private [ ] B. Federal ______ [ ] C. State [ ] D. County [ ] E. Municipal [ ] F. Other ______ [ ] G. Unknown

III. INSPECTION INFORMATION

01 Date of Inspection 6 / 24 / 87 Month Day Year	02 Site Status [X] Active [ ] Inactive	03 Years of Operation _____ | 1979 Beginning Year Ending Year [ ] Unknown

04 Agency Performing Inspection (Check all that apply)

[ ] A. EPA [ ] B. EPA Contractor ______ (Name of Firm) [ ] C. Municipal [ ] D. Municipal Contractor ______ (Name of Firm)

[ ] E. State [X] F. State Contractor E & E, Inc. (Name of Firm) [ ] G. Other ______ (Specify)

05 Chief Inspector Dennis Sutton	06 Title Geologist	07 Organization Ecology & Environment	08 Telephone No. (716) 633-9881
09 Other Inspectors Jon Sundquist	10 Title Chemical Engineer	11 Organization Ecology & Environment	12 Telephone No. (716) 633-9881
			( )
			( )
			( )
			( )

13 Site Representatives Interviewed Patricia K. Haynes	14 Title Health & Safety Manager	15 Address Buffalo Ave., N.F., N.Y.	16 Telephone No. (716) 278-2563
			( )
			( )
			( )
			( )

17 Access Gained By (Check one) [X] Permission [ ] Warrant	18 Time of Inspection 0930	19 Weather Conditions Sunny and warm (80's F), winds 0-5 mph

IV. INFORMATION AVAILABLE FROM

01 Contact Walter E. Demick	02 Of (Agency/Organization) NYSDEC			03 Telephone No. (518) 457-9538
04 Person Responsible for Site Inspection Form Michael Hanchak	05 Agency	06 Organization E & E	07 Telephone No. (716) 633-9881	08 Date 7 / 10 / 87 Month Day Year

EPA Form 2070-13 (7-81)

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POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

PART 2 - WASTE INFORMATION

I. IDENTIFICATI

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01 State: NY
02 Site Number: 932048B

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 Physical States (Check all that apply)

[X] A. Solid
[X] B. Powder, Fines
[ ] C. Sludge
[ ] D. Other Trash (Specify)
[ ] E. Slurry
[ ] F. Liquid
[ ] G. Gas

02 Waste Quantity at Site (Measure of waste quantities must be independent)

Tons Unknown
Cubic Yards
No. of Drums

03 Waste Characteristics (Check all that apply)

[ ] A. Toxic
[ ] B. Corrosive
[ ] C. Radioactive
[ ] D. Persistent
[ ] E. Soluble
[ ] F. Infectious
[ ] G. Flammable
[ ] H. Ignitable
[ ] I. Highly volatile
[ ] J. Explosive
[ ] K. Reactive
[ ] L. Incompatible
[ ] M. Not applicable

III. WASTE TYPE

Category	Substance Name	01 Gross Amount	02 Unit of Measure	03 Comments
SLU	Sludge			Temporary storage area for sand, fly ash, fire brick, dust collector fines, kiln furniture, wood, grinding wheels, aluminum-silica shot, fiber and metal scrap. No waste has been landfilled. The area is not now in use, and it is not known if hazardous materials were stored onsite.
OLW	Oily waste			
SOL	Solvents			
PSD	Pesticides			
OCC	Other organic chemicals			
IOC	Inorganic chemicals			
ACD	Acids			
BAS	Bases			
MES	Heavy Metals	Unknown		

IV. HAZARDOUS SUBSTANCES (See Appendix for most frequently cited CAS Numbers)

01 Category	02 Substance Name	03 CAS Number	04 Storage/Disposal Method	05 Concentration	06 Measure of Concentration
	Toluene		Disposed of through		
	Acetone		SCA or recycled		
	Methanol		through Safety Kleen		
	Lubricating oils				

V. FEEDSTOCKS (See Appendix for CAS Numbers)

Category	01 Feedstock Name	02 CAS Number	Category	01 Feedstock Name	02 CAS Number
FDS			FDS		
FDS			FDS		
FDS			FDS		
FDS			FDS		

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

New York State DEC files, Region 9, Buffalo, New York
Ecology and Environment Site Inspection, June 1987

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POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION	
01 State NY	02 Site Number 932048B

II. HAZARDOUS CONDITIONS AND INCIDENTS

01 [ ] A. Groundwater Contamination 02 [ ] Observed (Date __________) [X] Potential [ ] Alleged
03 Population Potentially Affected Unknown 04 Narrative Description:

There is potential for contamination - site is not lined, it is not known if hazardous waste was stored on site.

01 [ ] B. Surface Water Contamination 02 [ ] Observed (Date __________) [X] Potential [ ] Alleged
03 Population Potentially Affected Unknown 04 Narrative Description:

Potential for surface water is present, site is approximately 600 feet from the Niagara River.

01 [ ] C. Contamination of Air 02 [ ] Observed (Date __________) [X] Potential [ ] Alleged
03 Population Potentially Affected Unknown 04 Narrative Description:

01 [ ] D. Fire/Explosive Conditions 02 [ ] Observed (Date __________) [X] Potential [ ] Alleged
03 Population Potentially Affected Unknown 04 Narrative Description:

Waste no longer present in storage area.

01 [ ] E. Direct Contact 02 [ ] Observed (Date __________) [ ] Potential [ ] Alleged
03 Population Potentially Affected Unknown 04 Narrative Description:

Potential for direct contact is low - waste is removed and site is graded over with fill.

01 [ ] F. Contamination of Soil 02 [ ] Observed (Date __________) [X] Potential [ ] Alleged
03 Area Potentially Affected Unknown (Acres) 04 Narrative Description:

Potential for soil contamination is higher - waste was placed directly on ground surface.

01 [ ] G. Drinking Water Contamination 02 [ ] Observed (Date __________) [ ] Potential [ ] Alleged
03 Population Potentially Affected Unknown 04 Narrative Description:

Potential is low - water intake for Niagara Falls is located upstream in the Niagara River.

01 [ ] H. Worker Exposure/Injury 02 [ ] Observed (Date __________) [X] Potential [ ] Alleged
03 Workers Potentially Affected Unknown 04 Narrative Description:

Potential for worker exposure is low - waste has been removed and site graded over with fill.

01 [ ] I. Population Exposure/Injury 02 [ ] Observed (Date __________) [ ] Potential [ ] Alleged
03 Population Potentially Affected Unknown 04 Narrative Description:

Potential is low - waste has been removed and site graded over with fill.

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POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION	
01 State NY	02 Site Number 932048B

II. HAZARDOUS CONDITIONS AND INCIDENTS (Cont.)

01 [X] J. Damage to Flora 02 [ ] Observed (Date 6/87) [ ] Potential [X] Alleged
04 Narrative Description:

All flora in former waste storage area has been destroyed.

01 [X] K. Damage to Fauna 02 [ ] Observed (Date ____) [X] Potential [ ] Alleged
04 Narrative Description:

Potential for damage to fauna is low - area is fenced, there is no vegetation, and waste has been removed.

01 [X] L. Contamination of Food Chain 02 [ ] Observed (Date ____) [X] Potential [ ] Alleged
04 Narrative Description:

Potential is low - no agriculture in area - population is advised not to eat fish or drink untreated water downstream from site.

01 [X] M. Unstable Containment of Wastes (Spills/Runoff/Standing liquids, Leaking drums) 02 [ ] Observed (Date ____) [X] Potential [ ] Alleged
03 Population Potentially Affected ____ 04 Narrative Description:

Potential is low - waste has been removed and site is covered with fill.

01 [X] N. Damage to Offsite Property 02 [ ] Observed (Date ____) [X] Potential [ ] Alleged
04 Narrative Description:

Potential is low - waste is removed from site.

01 [ ] O. Contamination of Sewers, Storm Drains, WWTPs 02 [ ] Observed (Date ____) [ ] Potential [ ] Alleged
04 Narrative Description:

Unknown - potential appears to be low - waste has been removed from site.

01 [ ] P. Illegal/Unauthorized Dumping 02 [ ] Observed (Date ____) [ ] Potential [ ] Alleged
04 Narrative Description:

No potential - site is fenced, grounds are guarded.

05 Description of Any Other Known, Potential, or Alleged Hazards

III. TOTAL POPULATION POTENTIALLY AFFECTED Unknown

IV. COMMENTS

It has not been determined if any hazardous wastes had been disposed or stored on site. Further investigation will be needed to assess site conditions.

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

New York State DEC Region 9 files, Buffalo, New York
Electro Minerals (U.S.), Inc. files, Niagara Falls, New York

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POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

PART 4 - PERMIT AND DESCRIPTIVE INFORMATION

I. IDENTIFICATION	
01 State NY	02 Site Number 932048B

II. PERMIT INFORMATION

01 Type of Permit Issued (Check all that apply)	02 Permit Number	03 Date Issued	04 Expiration Date	05 Comments
[ ] A. NPDES				
[ ] B. UIC				
[ ] C. AIR				
[ ] D. RCRA				
[ ] E. RCRA Interim Status				
[ ] F. SPCC Plan				
[ ] G. State (Specify)				
[ ] H. Local (Specify)				
[X] I. Other (Specify)	SPDES NY D001367481			For cooling water discharge
[ ] J. None				

III. SITE DESCRIPTION

01 Storage Disposal (Check all that apply)	02 Amount	03 Unit of Measure	04 Treatment (Check all that apply)	05 Other
[ ] A. Surface Impoundment			[ ] A. Incineration	[X] A. Buildings On Site
[ ] B. Piles			[ ] B. Underground Injection	
[ ] C. Drums, Above Ground			[ ] C. Chemical/Physical	
[ ] D. Tank, Above Ground			[ ] D. Biological	
[ ] E. Tank, Below Ground			[ ] E. Waste Oil Processing	
[ ] F. Landfill			[X] F. Solvent Recovery	06 Area of Site
[ ] G. Landfarm			[X] G. Other Recycling Recovery	
[X] H. Open Dump	Unknown		[ ] H. Other ______ (Specify)	40 Acres
[ ] I. Other ______ (Specify)				

07 Comments

It is unknown if hazardous waste was ever stored on site.

IV. CONTAINMENT

01 Containment of Wastes (Check one)

[ ] A. Adequate, Secure [ ] B. Moderate [X] C. Inadequate, Poor [ ] D. Insecure, Unsound, Dangerous

02 Description of Drums, Diking, Liners, Barriers, etc.

No liners in use.

V. ACCESSIBILITY

01 Waste Easily Accessible: [ ] Yes [X] No

02 Comments:

Site is fenced and guarded, waste has been removed.

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

New York State DEC files, Region 9, Buffalo, New York
Ecology & Environment Site Inspection Log Book, Buffalo, New York

POTENTIAL HAZARDOUS WASTE SITE SITE INSPECTION REPORT

PART 5 - WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATIO **Draft**

01 State NY	02 Site Number 932048B

II. DRINKING WATER SUPPLY

01 Type of Drinking Supply (Check as applicable)	Surface	Well	02 Status: Endangered	Affected	Monitored	03 Distance to Site
Community	A. [X]	B. [ ]	A. [ ]	B. [ ]	C. [X]	A 2 (mi)
Non-community	D. [ ]	D. [ ]	D. [ ]	E. [ ]	F. [ ]	B ______ (mi)

III. GROUNDWATER

01 Groundwater Use in Vicinity (Check one)

- [ ] A. Only Source for Drinking
- [ ] B. Drinking (Other sources available) Commercial, Industrial, Irrigation (No other water sources available)
- [X] C. Commercial, Industrial, Irrigation (Limited other sources available)
- [ ] D. Not Used, Unuseable

02 Population Served by Groundwater 0

03 Distance to Nearest Drinking Water well >3 (mi)

04 Depth to Groundwater	05 Direction of Groundwater Flow	06 Depth to Aquifer of Concern	07 Potential Yield of Aquifer	08 Sole Source Aquifer
9 (ft)	SW	9 (ft)	Unknown (gpd)	[ ] Yes [X] No

09 Description of Wells (including usage, depth, and location relative to population and buildings)

A well drawing water from the aquifer of concern is used for non-contact cooling processes. This well is located approximately 4/10 mile to the northeast on the Olin Corp. property.

10 Recharge Area

[X] Yes
[ ] No

Comments: Bedrock aquifer can be recharged by precipitation seeping through soil

11 Discharge Area

[ ] Yes
[X] No

Comments:

IV. SURFACE WATER

01 Surface Water (Check one)

- [ ] A. Reservoir Recreation Drinking Water Source
- [ ] B. Irrigation Economically Important Resources
- [ ] C. Commercial, Industrial
- [X] D. Not Currently Used

02 Affected/Potentially Affected Bodies of Water

Name:	Affected	Distance to Site
Niagara River	[ ]	600 ft. (mi)
Lake Ontario	[ ]	14 (mi)
	[ ]	(mi)

V. DEMOGRAPHIC AND PROPERTY INFORMATION

01 Total Population Within

One (1) Mile of Site	Two (2) Miles of Site	Three (3) Miles of Site
A. 18,758 No. of Persons	B. 39,797 No. of Persons	C. 58,663 No. of Persons

02 Distance to Nearest Population 0.25 (mi)

03 Number of Buildings Within Two (2) Miles of Site 17,710

04 Distance to Nearest Off-Site Building 100 ft. (mi)

05 Population Within Vicinity of Site (Provide narrative description of nature of population within vicinity of site, e.g., rural, village, densely populated urban area)

This site is in a highly industrialized area. A densely populated urban area is located within a 1/2-mile radius of this site.

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POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

PART 5 - WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATION

01 State	02 Site Number
NY	932048B

VI. ENVIRONMENTAL INFORMATION

01 Permeability of Unsaturated Zone (Check one)

☐ A. 10^{-6} - 10^{-8} cm/sec ☒ B. 10^{-4} - 10^{-6} cm/sec ☐ C. 10^{-4} - 10^{-3} cm/sec ☐ D. Greater Than 10^{-3} cm/sec

02 Permeability of Bedrock (Check one)

☐ A. Impermeable (Less than 10^{-6} cm/sec) ☐ B. Relatively Impermeable (10^{-4} - 10^{-6} cm/sec) ☒ C. Relatively Permeable (10^{-2} - 10^{-4} cm/sec) ☐ D. Very Permeable (Greater than 10^{-2} cm/sec)

03 Depth to Bedrock: 9 (ft)

04 Depth of Contaminated Soil Zone: Unknown (ft)

05 Soil pH: 5.6 - 7.6

06 Net Precipitation: 4 (in)

07 One Year 24-Hour Rainfall: 2.5 (in)

08 Slope

Site Slope: 0.1 %

Direction of Site Slope: SW

Terrain Average Slope: 0.1 %

09 Flood Potential

Site is in NA Year Floodplain

10 ☐ Site is on Barrier Island, Coastal High Hazard Area, Riverine Floodway

11 Distance to Wetlands (5 acre minimum)

ESTUARINE	OTHER
A. NA (mi)	B. 3.5 (mi)

12 Distance to Critical Habitat (of Endangered Species)

NA (mi)

Endangered Species: NA

13 Land Use in Vicinity

Distance to:

COMMERCIAL/INDUSTRIAL	RESIDENTIAL AREAS, NATIONAL/STATE PARKS, FORESTS, OR WILDLIFE RESERVES	AGRICULTURAL LANDS PRIME AG LAND	AGRICULTURAL LANDS AG LAND
A. 0 (mi)	B. 1,500 feet (mi)	C. 1.5 (mi)	D. 1.5 (mi)

14 Description of Site in Relation to Surrounding Topography

This site is located 1-3/4 miles east of the American Falls in the City of Niagara Falls, New York; Niagara Co. It is 600 feet north of the Niagara River in a highly industrialized southern section of the city. This area is characterized by numerous chemical plant facilities. Residential areas are located approximately 1,500 feet to the north of the site.

VII. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

USGS 7-1/2 minute topographic map, Niagara Falls quadrangle
Graphical Exposure Modeling System, USEPA, Federal Plaza, New York, New York
Groundwater in the Niagara Falls Area, New York - Johnston, 1964
Uncontrolled Hazardous Waste Site Ron King System; A Users Manual
Soil Survey of Niagara County, New York, 1972, USDA Soil Conservation Service

Draft

POTENTIAL HAZARDOUS WASTE SITE SITE INSPECTION REPORT

PART 6 - SAMPLE AND FIELD INFORMATION

I. IDENTIFICATION	
01 State NY	02 Site Number 932048B

II. SAMPLES TAKEN

Sample Type	01 Number of Samples Taken	02 Samples Sent to	03 Estimated Date Results Available
Groundwater			
Surface Water			
Waste			
Air			
Runoff			
Spill			
Soil			
Vegetation			
Other			

III. FIELD MEASUREMENTS TAKEN

01 Type	02 Comments
HnU Air Monitoring	No readings above background noted

IV. PHOTOGRAPHS AND MAPS

01 Type [X] Ground [ ] Aerial

02 In Custody of Michael Hanchak, Ecology & Environment, Inc.
(Name of organization or individual)

03 Maps
[X] Yes
[ ] No

04 Location of Maps
Electro Minerals (U.S.), Inc.

V. OTHER FIELD DATA COLLECTED (Provide narrative description of sampling activities)

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

New York State DEC files, Region 9, Buffalo, New York
USEPA files, Region II, Federal Plaza, New York, New York

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

PART 7 - OWNER INFORMATION

I. IDENTIFICATION **Draft**

01 State
NY

02 Site Number
9320488

II. CURRENT OWNER(S)

01 Name
Electro Minerals (U.S.), Inc.
02 D+B Number
03 Street Address (P.O. Box, RFD #, etc.)
Buffalo Avenue
04 SIC Code
05 City
Niagara Falls
06 State
NY
07 Zip Code
14302

01 Name
02 D+B Number
03 Street Address (P.O. Box, RFD #, etc.)
04 SIC Code
05 City
06 State
07 Zip Code

01 Name
02 D+B Number
03 Street Address (P.O. Box, RFD #, etc.)
04 SIC Code
05 City
06 State
07 Zip Code

01 Name
02 D+B Number
3 Street Address (P.O. Box, RFD #, etc.)
04 SIC Code
05 City
06 State
07 Zip Code

PARENT COMPANY (If applicable)

08 Name
Washington Mills Abrasives
09 D+B Number
10 Street Address (P.O. Box, RFD #, etc.)
200 North Main Street
11 SIC Code
12 City
North Grafton
13 State
MA
14 Zip Code

08 Name
09 D+B Number
10 Street Address (P.O. Box, RFD #, etc.)
11 SIC Code
12 City
13 State
14 Zip Code

08 Name
09 D+B Number
10 Street Address (P.O. Box, RFD #, etc.)
11 SIC Code
12 City
13 State
14 Zip Code

08 Name
09 D+B Number
10 Street Address (P.O. Box, RFD #, etc.)
11 SIC Code
12 City
13 State
14 Zip Code

III. PREVIOUS OWNER(S) (List most recent first)

01 Name
Carborundum Corp.
02 D+B Number
03 Street Address (P.O. Box, RFD #, etc.)
Buffalo Avenue
04 SIC Code
05 City
Niagara Falls
06 State
NY
07 Zip Code
14302

01 Name
02 D+B Number
03 Street Address (P.O. Box, RFD #, etc.)
04 SIC Code
05 City
06 State
07 Zip Code

01 Name
02 D+B Number
03 Street Address (P.O. Box, RFD #, etc.)
04 SIC Code
05 City
06 State
07 Zip Code

IV. REALTY OWNER(S) (If applicable, list most recent first)

01 Name
02 D+B Number
03 Street Address (P.O. Box, RFD #, etc.)
04 SIC Code
05 City
06 State
07 Zip Code

01 Name
02 D+B Number
03 Street Address (P.O. Box, RFD #, etc.)
04 SIC Code
05 City
06 State
07 Zip Code

01 Name
02 D+B Number
03 Street Address (P.O. Box, RFD #, etc.)
04 SIC Code
05 City
06 State
07 Zip Code

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Electro Minerals (U.S.), Inc., Niagara Falls, New York

Draft

POTENTIAL HAZARDOUS WASTE SITE SITE INSPECTION REPORT

PART 8 - OPERATOR INFORMATION

I. IDENTIFICATION	
01 State NY	02 Site Number 932048B

II. CURRENT OPERATOR (Provide if different from owner)			OPERATOR'S PARENT COMPANY (If applicable)		
01 Name Electro Minerals (U.S.), Inc.		02 D+B Number	10 Name Washington Mills Abrasives		11 D+B Number
03 Street Address (P.O. Box, RFD #, etc.) Buffalo Avenue		04 SIC Code	12 Street Address (P.O. Box, RFD #, etc.) 200 North Main Street		13 SIC Code
05 City Niagara Falls	06 State NY	07 Zip Code 14302	14 City North Grafton	15 State MA	16 Zip Code
08 Years of Operation 2	09 Name of Owner				
III. PREVIOUS OPERATOR(s) (List most recent first; provide only if different from owner)			PREVIOUS OPERATORS' PARENT COMPANIES (If applicable)		
01 Name Carborundum Corp.		02 D+B Number	10 Name Standard Oil of Ohio		11 D+B Number
03 Street Address (P.O. Box, RFD #, etc.) Buffalo Avenue		04 SIC Code	12 Street Address (P.O. Box, RFD #, etc.)		13 SIC Code
05 City Niagara Falls	06 State NY	07 Zip Code	14 City Cleveland	15 State OH	16 Zip Code
08 Years of Operation	09 Name of Owner During This Period				
01 Name		02 D+B Number	10 Name		11 D+B Number
03 Street Address (P.O. Box, RFD #, etc.)		04 SIC Code	12 Street Address (P.O. Box, RFD #, etc.)		13 SIC Code
05 City	06 State	07 Zip Code	14 City	15 State	16 Zip Code
08 Years of Operation	09 Name of Owner During This Period				
01 Name		02 D+B Number	10 Name		11 D+B Number
03 Street Address (P.O. Box, RFD #, etc.)		04 SIC Code	12 Street Address (P.O. Box, RFD #, etc.)		13 SIC Code
05 City	06 State	07 Zip Code	14 City	15 State	16 Zip Code
08 Years of Operation	09 Name of Owner During This Period				

IV. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Electro Minerals (U.S.), Inc. files, Niagara Falls, New York

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

PART 9 - GENERATOR/TRANSPORTER INFORMATION

I. IDENTIFICATI **Draft**

01 State: NY
02 Site Number: 932048B

II. ON-SITE GENERATOR

01 Name: Electro Minerals (U.S.), Inc.
02 D+B Number:
03 Street Address (P.O. Box, RFD #, etc.): Buffalo Avenue
04 SIC Code:
05 City: Niagara Falls
06 State: NY
07 Zip Code: 14320

III. OFF-SITE GENERATOR(S)

01 Name	01 Name
02 D+B Number	02 D+B Number
03 Street Address (P.O. Box, RFD #, etc.)	03 Street Address (P.O. Box, RFD #, etc.)
04 SIC Code	04 SIC Code
05 City	05 City
06 State	06 State
07 Zip Code	07 Zip Code
01 Name	01 Name
02 D+B Number	02 D+B Number
03 Street Address (P.O. Box, RFD #, etc.)	03 Street Address (P.O. Box, RFD #, etc.)
04 SIC Code	04 SIC Code
05 City	05 City
06 State	06 State
07 Zip Code	07 Zip Code

IV. TRANSPORTER(S)

01 Name Modern Disposal Services, Inc.	01 Name
02 D+B Number	02 D+B Number
03 Street Address (P.O. Box, RFD #, etc.) Model City Road	03 Street Address (P.O. Box, RFD #, etc.)
04 SIC Code	04 SIC Code
05 City Lewiston	05 City
06 State NY	06 State
07 Zip Code 14092	07 Zip Code
01 Name	01 Name
02 D+B Number	02 D+B Number
03 Street Address (P.O. Box, RFD #, etc.)	03 Street Address (P.O. Box, RFD #, etc.)
04 SIC Code	04 SIC Code
05 City	05 City
06 State	06 State
07 Zip Code	07 Zip Code

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Electro Minerals (U.S.), Inc. files, Niagara Falls, New York

Draft

POTENTIAL HAZARDOUS WASTE SITE SITE INSPECTION REPORT

PART 10 - PAST RESPONSE ACTIVITIES

I. IDENTIFICATION

01 State	02 Site Number
NY	932048B

II. PAST RESPONSE ACTIVITIES

01 [ ] A. Water Supply Closed 02 Date ______ 03 Agency ______
04 Description:

01 [ ] B. Temporary Water Supply Provided 02 Date ______ 03 Agency ______
04 Description:

01 [ ] C. Permanent Water Supply Provided 02 Date ______ 03 Agency ______
04 Description:

01 [ ] D. Spilled Material Removed 02 Date unknown 03 Agency ______
04 Description:

01 [ ] E. Contaminated Soil Removed 02 Date unknown 03 Agency ______
04 Description:

01 [ ] F. Waste Repackaged 02 Date ______ 03 Agency ______
04 Description:

01 [X] G. Waste Disposed Elsewhere 02 Date 1985 03 Agency ______
04 Description:
Waste storage area cleaned up and transported by Modern Disposal.

01 [ ] H. On Site Burial 02 Date ______ 03 Agency ______
04 Description:

01 [ ] I. In Situ Chemical Treatment 02 Date ______ 03 Agency ______
04 Description:

01 [ ] J. In Situ Biological Treatment 02 Date ______ 03 Agency ______
04 Description:

01 [ ] K. In Situ Physical Treatment 02 Date ______ 03 Agency ______
04 Description:

01 [ ] L. Encapsulation 02 Date ______ 03 Agency ______
04 Description:

01 [ ] M. Emergency Waste Treatment 02 Date ______ 03 Agency ______
04 Description:

01 [ ] N. Cutoff Walls 02 Date ______ 03 Agency ______
04 Description:

01 [ ] O. Emergency Diking/Surface Water Diversion 02 Date ______ 03 Agency ______
04 Description:

01 [ ] P. Cutoff Trenches/Sump 02 Date ______ 03 Agency ______
04 Description:

01 [ ] Q. Subsurface Cutoff Wall 02 Date ______ 03 Agency ______
04 Description:

Draft

POTENTIAL HAZARDOUS WASTE SITE SITE INSPECTION REPORT

PART 10 - PAST RESPONSE ACTIVITIES

I. IDENTIFICATION	
01 State NY	02 Site Number 932048B

II. PAST RESPONSE ACTIVITIES (Cont.)

01 [ ] R. Barrier Walls Constructed 02 Date ______ 03 Agency ______
04 Description:

01 [ ] S. Capping/Covering 02 Date ______ 03 Agency ______
04 Description:

01 [ ] T. Bulk Tankage Repaired 02 Date ______ 03 Agency ______
04 Description:

01 [ ] U. Grout Curtain Constructed 02 Date ______ 03 Agency ______
04 Description:

01 [ ] V. Bottom Sealed 02 Date ______ 03 Agency ______
04 Description:

01 [ ] W. Gas Control 02 Date ______ 03 Agency ______
04 Description:

01 [ ] X. Fire Control 02 Date ______ 03 Agency ______
04 Description:

01 [ ] Y. Leachate Treatment 02 Date ______ 03 Agency ______
04 Description:

01 [ ] Z. Area Evacuated 02 Date ______ 03 Agency ______
04 Description:

01 [X] 1. Access to Site Restricted 02 Date 1987 03 Agency ______
04 Description:
Site is fenced and grounds guarded

01 [ ] 2. Population Relocated 02 Date ______ 03 Agency ______
04 Description:

01 [ ] 3. Other Remedial Activities 02 Date ______ 03 Agency ______
04 Description:

III. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Ecology and Environment site inspection, 6/87

Draft

POTENTIAL HAZARDOUS WASTE SITE SITE INSPECTION REPORT

PART 11 - ENFORCEMENT INFORMATION

I. IDENTIFICATION	
01 State NY	02 Site Number 932048B

II. ENFORCEMENT INFORMATION

01 Past Regulatory/Enforcement Action [ ] Yes [X] No

02 Description of Federal, State, Local Regulatory/Enforcement Action

III. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

D1649

6. ASSESSMENT OF DATA ADEQUACY AND RECOMMENDATIONS

After assessing the information gathered for this site and applying it to an HRS worksheet, it was determined that the existing information is not adequate to accurately score the site, and that further investigations are necessary to determine a proper HRS score.

Since no sampling of any kind from the disposal area is known to have taken place, E & E recommends a screening program consisting of several soil samples collected at a depth of 2 feet from the disposal area and analyzed for priority pollutants and hazardous waste characteristics of ignitability, reactivity, corrosivity, and EP Toxicity. These data can be used to compute a more accurate HRS score.

Draft

7. REFERENCES

Johnston, R.H. (1964), Groundwater in the Niagara Falls Area, New York, State of New York Conservation Department, Water Resources Commission, Bulletin GW-53.

Higgins, B.A., P.S. Puglia, R.P. Leonard, T.D. Yoakum, W.A. Witz (1972), Soil Survey of Niagara County, New York, USDA Soil Conservation Service.

Advanced Environmental Systems, Inc., Investigation Prior to the Installation of the Adams Avenue Storm Sewer Analysis of Soil Samples Collected December 7, 1984, report prepared for SOHIO Electrominerals Company, December 7, 1984.

Thomsen Associates, Proposed SIC Facility, SOHIO Electro Minerals Company, Niagara Falls, New York, August 13, 1984.

Draft

APPENDIX A

PHOTOGRAPHIC RECORD

Draft

ecology and environment, inc.

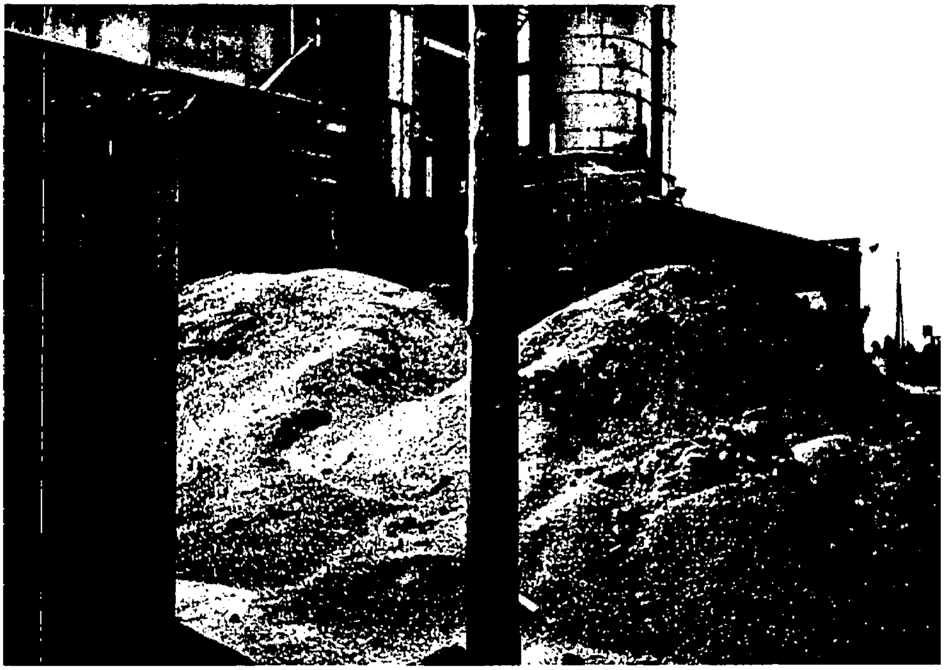
PHOTOGRAPHIC RECORD

Client: NYSDEC

E & E Job No.: ND2031

Camera: Make ANSCO

SN:



Photographer: J. Sundquist

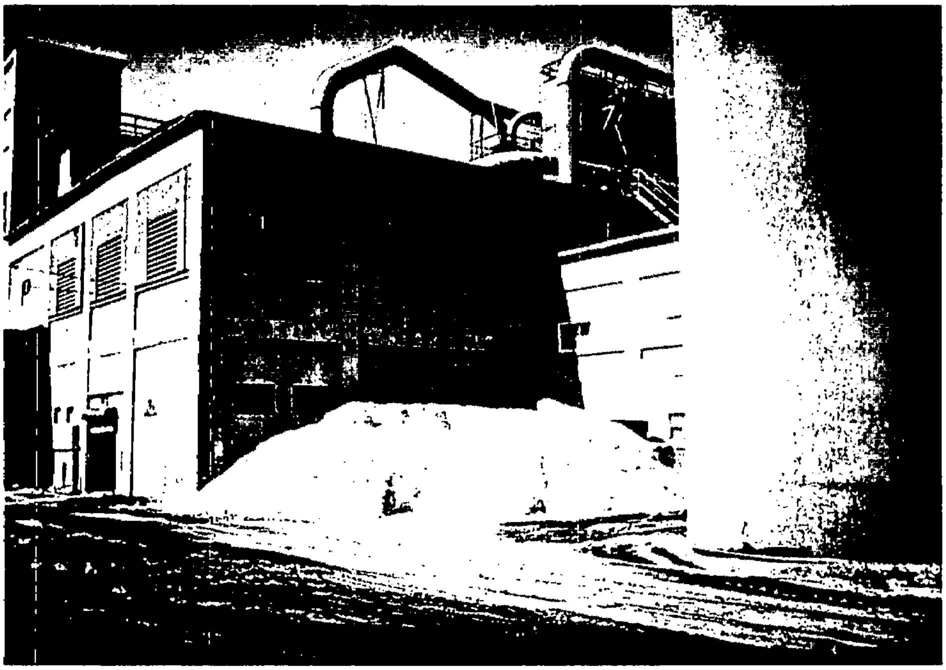
Date/Time: 6/24/87 09:55

Lens: Type:

SN:

Frame No.: 1

Comments*: Silicon carbide pile at west end of Building 83, for eventual recycling. Electro Minerals (U.S.) Inc.



Photographer: J. Sundquist

Date/Time: 6/24/87 10:00

Lens: Type:

SN:

Frame No.: 2

Comments*: Aluminum oxide from settling ponds on west side of Building 86.

*Comments to include location

ecology and environment, inc.

PHOTOGRAPHIC RECORD

Client: NYSDEC

E & E Job No.: ND2031

Camera: Make ANSCO

SN:

Photographer: J. Sundquist

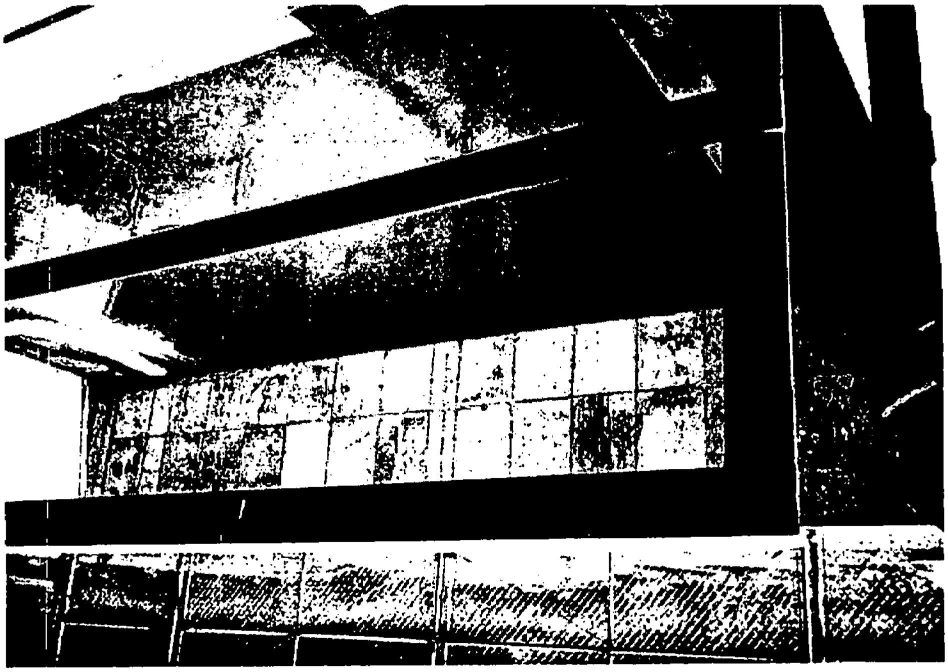
Date/Time: 6/24/87 10:05

Lens: Type:

SN:

Frame No.: 3

Comments*: Mixed pile of aluminum oxide and silica carbide near west end of Buildings 86 and 84. Note rainwater runoff.



Photographer: J. Sundquist

Date/Time: 6/24/87 10:10

Lens: Type:

SN:

Frame No.: 4

Comments*: Settling pond which removes solids from non-contact cooling water before discharge to Niagara River.

*Comments to include location

Draft

ecology and environment, inc.

PHOTOGRAPHIC RECORD

Client: NYSDEC E & E Job No.: ND2031

Camera: Make ANSCO SN:

Photographer: J. Sundquist

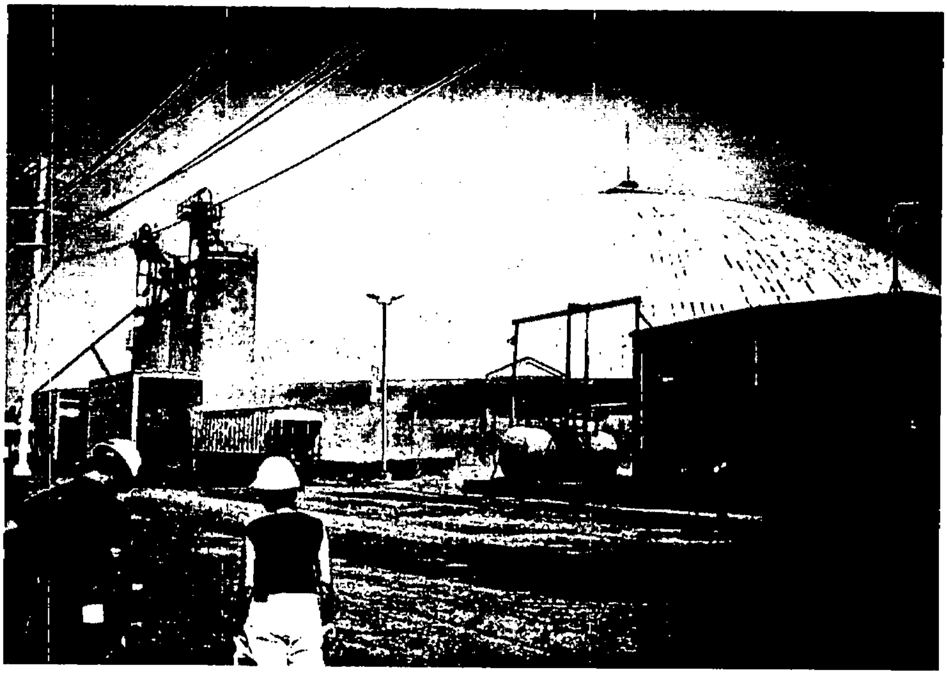
Date/Time: 6/24/87 10:15

Lens: Type:

SN:

Frame No.: 5

Comments*: Former waste storage area looking east toward Building 86. Trash has been removed, area is covered with fill.



Photographer: J. Sundquist

Date/Time: 6/24/87 10:20

Lens: Type:

SN:

Frame No.: 6

Comments*: Photo showing H_2SO_4 acid tank not in use at this time. Grain processing plant is in background.

*Comments to include location

Draft

ecology and environment, inc.

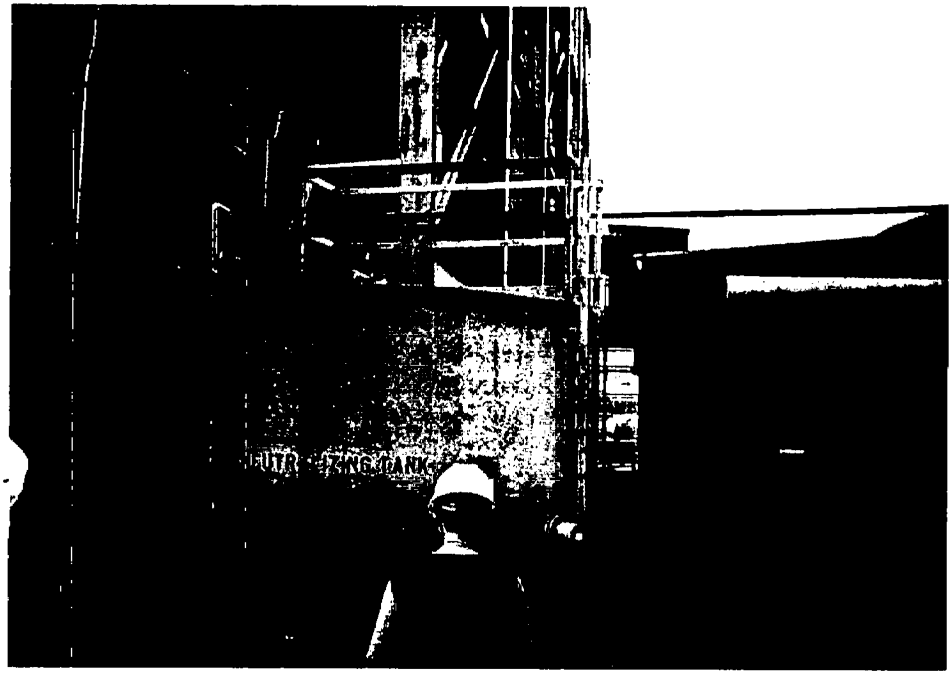
PHOTOGRAPHIC RECORD

Client: NYSDEC

E & E Job No.: ND2031

Camera: Make ANSCO

SN:



Photographer: J. Sundquist

Date/Time: 6/24/87 10:25

Lens: Type:

SN:

Frame No.: 7

Comments*: Acid neutralizing tank near grain processing plant, not in use at this time.

Photographer:

Date/Time:

Lens: Type:

SN:

Frame No.:

Comments*:

*Comments to include location

Draft

APPENDIX B

UPDATED INACTIVE HAZARDOUS WASTE DISPOSAL AREA REGISTRY FORM

47-15-11 (10/83)

Draft

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

DIVISION OF SOLID AND HAZARDOUS WASTE

INACTIVE HAZARDOUS WASTE DISPOSAL SITE REPORT

Priority Code: ______ Site Code: 932048B

Name of Site: Carborundum Building 82 Region: 9

Street Address: Buffalo Avenue

Town/City: Niagara Falls County: Niagara

Name of Current Owner of Site: Electro Minerals (U.S.), Inc.

Address of Current Owner of Site: Buffalo Avenue, Niagara Falls

Type of Site: [X] Open Dump [ ] Structure [ ] Lagoon

[X] Landfill [ ] Treatment Pond

Estimated Size: 7 acre(s)

Site Description:

Temporary storage area for sand, fly ash, fire brick, dust collector fines, kiln furniture, wood, carborundum wheels, aluminum-silica shot, and fibre prior to disposal at an approved offsite facility.

Hazardous Waste Disposed: [ ] Confirmed [X] Suspected

Type and Quantity of Hazardous Wastes Disposed:

Type	Quantity (Pounds, Drums, Tons, Gallons)
Unknown	

D1649

Page 1 of 2

Draft

Time Period Site was Used for Hazardous Waste Disposal:

Unknown, 19__ To ____, 19 79

Owner(s) During Period of Use: Carborundum Corp. (SOHIO)

Site Operator During Period of Use: Carborundum Corp.

Address of Site Operator: Buffalo Avenue, Niagara Falls

Analytical Data Available: ☐ Air ☐ Surface Water ☐ Groundwater
☐ Soil ☐ Sediment ☒ None

Contravention of Standards: ☐ Groundwater ☐ Drinking Water
☐ Surface Water ☐ Air

Soil Type: Silts, clays

Depth to Groundwater Table: Approx. 10 feet

Legal Action: Type: none ☐ State ☐ Federal

Status: ☐ In Progress ☐ Completed

Remedial Action: ☐ Proposed ☐ Under Design
☐ In Progress ☐ Completed

Nature of Action: Stored wastes were removed to approved landfill in 1975.

Assessment of Environmental Problems:

Unknown

Assessment of Health Problems:

Unknown

Person(s) Completing This Form:

NEW YORK STATE DEPARTMENT OF
ENVIRONMENTAL CONSERVATION

Name:
Title:
Name:
Title:
Date:

NEW YORK STATE DEPARTMENT OF HEALTH

Name:
Title:
Name:
Title:
Date:

APPENDIX C

PHOTOCOPIED REFERENCES

Draft

INVESTIGATION PRIOR TO THE INSTALLATION OF THE ADAMS AVENUE STORM SEWER ANALYSIS OF SOIL SAMPLES COLLECTED DECEMBER 7, 1984

Report Prepared For

SOHIO ELECTRO MINERALS COMPANY

By

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

Prepared by:

Susan M Cerquetti
Susan M. Cerquetti
GC Division

David P. Mix
David P. Mix
Metals Division

Kathleen A. Martin
Kathleen A. Martin
Wet Chemistry Division

W. Joseph McDougall, for
Leonard Borzynski
Technical Evaluation

December 7, 1984
AES Job ANY

Draft

SCOPE OF WORK

Six (6) soil samples were analyzed for parameters required by the New York State Department of Environmental Conservation, Region 9.

COLLECTION OF SAMPLES

On Friday, November 23, 1984, Earth Dimension, Inc. collected split spoon soil samples from five locations along Adams Avenue. Mr. Donald Owens, Soil Scientist, delivered the samples directly to the AES Laboratory.

ANALYTICAL METHODOLGY REFERENCE LIST

Analyses were performed in accordance with some of the methods in the references listed below and as specified in the Laboratory Report.

1. EPA 600/D-80-021, "Guidelines Establishing Test Procedures for the Analysis of Pollutants; Proposed Regulations", Federal Register 44(233), December 3, 1979.
2. EPA 600/D-80-022, "Guidelines Establishing Test Procedures for the Analysis of Pollutants; Proposed Regulations, Correction", Federal Register 44(244), December 18, 1979.
3. EPA 600/4-79-020, "Methods for Chemical Analysis of Water and Wastes", (1983)
4. EPA 600/4-79-057, "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater", (1982)
5. EPA-SW-846, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", second edition (1982)
6. "Standard Methods for the Examination of Water and Wastewater", 15th Edition, (1980)
7. New York State Institute of Toxicology Analytical Handbook, October 1982
8. NIOSH Manual of Analytical Methods, second edition 1977
9. "The Analysis of Polychlorinated Biphenyls in Transformer Fluid and Waste Oil", EPA Environmental Monitoring and Support Laboratory, draft, June 24, 1980
10. "Interim Methods for the Sampling and Analysis of Priority Pollutants in Sediments and Fish Tissue", EPA 600/4-81-055, January 7, 1983.

Draft

ADVANCED ENVIRONMENTAL SYSTEMS, INC.
LABORATORY REPORT

TYPE OF ANALYSIS: VOLATILE ORGANICS/THO SCAN
UNITS OF MEASURE: MILLIGRAMS/KILOGRAM, OR PPM **
CLIENT:SOHIO A.E.S. JOB CODE (ANY)

ANALYSIS	METHOD	REF	SAMPLE IDENTIFICATION				
			A0 BH #1 11/23/84	A1 BH #2 11/23/84	A2 BH #3 11/23/84	A3 BH #4 11/23/84	A4 BH #5 11/23/84
VINYL CHLORIDE	5030	5	<0.06	<0.06	<0.06	<0.06	<0.06
METHYLENE CHLORIDE	5030	5	<0.02	<0.02	<0.02	<0.02	<0.02
1,1 - DICHLOROETHYLENE	5030	5	<0.04	<0.04	<0.04	<0.04	<0.04
TRANS-1,2-DICHLOROETHYLENE	5030	5	<0.04	<0.04	<0.04	<0.04	<0.04
CHLOROFORM	5030	5	<0.04	<0.04	0.05	<0.04	<0.04
1,1,1-TRICHLOROETHANE	5030	5	<0.04	<0.04	<0.04	<0.04	<0.04
CARBON TETRACHLORIDE	5030	5	<0.10	<0.10	0.51	0.18	<0.10
BROMODICHLOROMETHANE	5030	5	<0.06	<0.06	<0.06	<0.06	<0.06
TRANS-1,3-DICHLOROPROPENE	5030	5	<0.04	<0.04	<0.04	<0.04	<0.04
TRICHOROETHYLENE	5030	5	<0.03	0.18	<0.03	<0.03	<0.03
CIS-1,3-DICHLOROPROPENE	5030	5	<0.05	<0.05	<0.05	<0.05	<0.05
1,1,2-TRICHLOROETHANE	5030	5	<0.05	<0.05	<0.05	<0.05	<0.05
DIBROMOCHLOROMETHANE	5030	5	<0.08	<0.08	<0.08	<0.08	<0.08
BROMOFORM	5030	5	<0.26	<0.26	<0.26	<0.26	<0.26
TETRACHLOROETHYLENE	5030	5	<0.03	0.11	0.04	<0.03	<0.03
1,2,2-TETRACHLOROETHANE	5030	5	<0.10	<0.10	<0.10	<0.10	<0.10
DICHLOROBENZENES(ISOMERS)	5030	5	<0.07	<0.07	<0.07	<0.07	<0.07
THO SCAN	*	7	<0.22	<0.22	<0.23	<0.25	<0.20

*SAMPLE WAS EXTRACTED ACCORDING TO "MODIFIED NIELSON-KRYGER STEAM DISTILLATION" AND ANALYZED ACCORDING TO "TOTAL CHLORINATED HYDROCARBONS"

** Reported on dry weight basis

Draft

ADVANCED ENV[illegible]NMENTAL SYSTEMS, INC.
LABORATORY REPORT

TYPE OF ANALYSIS: VOLATILE ORGANICS/THO SCAN
UNITS OF MEASURE: MILLIGRAMS/KILOGRAM, OR PPM
CLIENT:SOHIO A.E.S. JOB CODE (ANY)

ANALYSIS	METHOD	REF	SAMPLE IDENTIFICATION
			A5 FIELD DUP. 11/23/84
VINYL CHLORIDE	5030	5	<0.06
METHYLENE CHLORIDE	5030	5	<0.02
1,1 - DICHLOROETHYLENE	5030	5	<0.04
TRANS-1,2-DICHLOROETHYLENE	5030	5	<0.04
CHLOROFORM	5030	5	0.08
1,1,1-TRICHLOROETHANE	5030	5	<0.04
CARBON TETRACHLORIDE	5030	5	0.11
BROMODICHLOROMETHANE	5030	5	<0.06
TRANS-1,3-DICHLOROPROPENE	5030	5	<0.04
TRICHOROETHYLENE	5030	5	<0.03
CIS-1,3-DICHLOROPROPENE	5030	5	<0.05
1,1,2-TRICHLOROETHANE	5030	5	<0.05
DIBROMOCHLOROMETHANE	5030	5	<0.08
BROMOFORM	5030	5	<0.26
TETRACHLOROETHYLENE	5030	5	0.04
,1,2,2-TETRACHLOROETHANE	5030	5	<0.10
DICHLOROBENZENES(ISOMERS)	5030	5	<0.07
THO SCAN	*	7	<0.23

Draft

ADVANCED ENVI[illegible]NMENTAL SYSTEMS, INC.
LABORATORY REPORT

TYPE OF ANALYSIS:RESULTS - WET CHEMISTY
UNITS OF MEASURE: MILLIGRAMS/LITER, ORPPM
CLIENT:SOHIO A.E.S. JOB CODE (ANY)

ANALYSIS	METHOD	REF	SAMPLE IDENTIFICATION				
			A0	A1	A2	A3	A4
			BH #1	BH #2	BH #3	BH #4	BH #5
			11/23/84	11/23/84	11/23/84	11/23/84	11/23/84
PHENOLS	420.1	3	2.6	0.98	< 0.01	< 0.01	1.0
PERCENT SOLIDS*	160.3	3	87.1	91.7	91.5	87.4	91.4

* REPORTED ON A DRY
WEIGHT BASIS

Draft

ADVANCED ENVIRONMENTAL SYSTEMS, INC.
LABORATORY REPORT

TYPE OF ANALYSIS: RESULTS - WET CHEMISTRY
UNITS OF MEASURE: MILLIGRAMS/LITER, OR PPM
CLIENT:SOHIO A.E.S. JOB CODE (ANY)

ANALYSIS	METHOD	REF	SAMPLE IDENTIFICATION
			A5 FIELD DUP. 11/23/84
PHENOLS	420.1	3	< 0.01
PERCENT SOLIDS*	160.3	3	86.8

* REPORTED ON A DRY WEIGHT BASIS

Draft

ADVANCED ENVIRONMENTAL SYSTEMS, INC.
LABORATORY REPORT

TYPE OF ANALYSIS: RESULTS - METALS
UNITS OF MEASURE: MILLIGRAMS/KILOGRAM,DRY WT.
CLIENT:SOHIO A.E.S. JOB CODE (ANY)

ANALYSIS	METHOD	REF	SAMPLE IDENTIFICATION				
			A0	A1	A2	A3	A4
			BH #1	BH #2	BH #3	BH #4	BH #5
			11/23/84	11/23/84	11/23/84	11/23/84	11/23/84
TOTAL MERCURY (IN TRIPLE)	7471	5					
ALIQUOT #1			1.4	<0.5	1.5	<0.5	<0.5
ALIQUOT #2			1.0	<0.5	1.9	<0.5	<0.5
ALIQUOT #3			1.4	<0.5	1.7	<0.5	<0.5
AVERAGE			1.3	<0.5	1.7	<0.5	<0.5

===========

TYPE OF ANALYSIS: RESULTS - METALS
UNITS OF MEASURE: MILLIGRAMS/KILOGRAM,DRY WT.
A.E.S[illegible]OB CODE (ANY)
CLIENT:SOHIO

ANALYSIS	METHOD	REF	SAMPLE IDENTIFICATION A5 FIELD DUP. 11/23/84
MERCURY (IN TRIPLE)	7471	5	
JOT #1			<0.5
JOT #2			<0.5
UOT #3			<0.5

ADVANCED ENVIRONMENTAL SYSTEMS, INC.
LABORATORY REPORT

TYPE OF ANALYSIS:VOLATILE ORGANICS/THO SCAN
UNITS OF MEASURE:MILLIGRAMS/KILOGRAM, PPM
CLIENT: SOHIO A.E.S. JOB CODE (ANY)

ANALYSIS	SAMPLE	ORIGINAL CONC.	DUPL. CONC.	AVERAGE CONC.	RANGE	REL. % * DIFF.
VINYL CHLORIDE	A0	<0.06	<0.06	NA**	NA	NA
METHYLENE CHLORIDE	A0	<0.02	<0.02	NA	NA	NA
1,1-DICHLOROETHYLENE	A0	<0.04	<0.04	NA	NA	NA
TRANS-1,2-DICHLOROETHYLENE	A0	<0.04	<0.04	NA	NA	NA
CHLOROFORM	A0	<0.04	<0.04	NA	NA	NA
1,1,1-TRICHLOROETHANE	A0	<0.04	<0.04	NA	NA	NA
CARBON TETRACHLORIDE	A0	<0.10	<0.10	NA	NA	NA
BROMODICHLOROMETHANE	A0	<0.06	<0.06	NA	NA	NA
TRANS-1,3-DICHLOROPROPENE	A0	<0.04	<0.04	NA	NA	NA
TRICHLOROETHYLENE	A0	<0.03	<0.03	NA	NA	NA
CIS-1,3-DICHLOROPROPENE	A0	<0.05	<0.05	NA	NA	NA
1,1,2-TRICHLOROETHANE	A0	<0.05	<0.05	NA	NA	NA
DIBROMOCHLOROMETHANE	A0	<0.08	<0.08	NA	NA	NA
BROMOFORM	A0	<0.26	<0.26	NA	NA	NA
TETRACHLOROETHYLENE	A0	<0.03	<0.03	NA	NA	NA
1,1,2,2-TETRACHLOROETHANE	A0	<0.10	<0.10	NA	NA	NA
CHLOROBENZENES (ALL ISOMERS)	A0	<0.07	<0.07	NA	NA	NA
THO SCAN	A0	<0.22	<0.22	NA	NA	NA

* RELATIVE % DIFFERENCE
RANGE/AVERAGE X 100
**NA - NOT APPLICABLE

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ADVANCED ENVIRONMENTAL SYSTEMS, INC.
LABORATORY REPORT

TYPE OF ANALYSIS:VOLATILE ORGANICS/THO SCAN
UNITS OF MEASURE:MICROGRAMS/LITER, PPB
CLIENT: SOHIO A.E.S. JOB CODE (ANY)

ANALYSIS	TYPE	ORIGINAL CONC.	ADDED CONC.	EXPECTED CONC.	REPORTED CONC.	PERCENT RECOVERY	95% CONFIDENCE INTERVAL
LINDANE	R. SPK	997	NONE	997	837	84.0	285-168
VINYL CHLORIDE	A0	<3.10	18.39	18.39	15.67	85.2	9.8-25.
1,1-DICHLOROETHYLENE	A0	<1.80	13.81	13.81	12.72	92.1	11.2-18.
CHLOROFORM	A0	<1.82	13.83	13.83	16.36	118.3	11.3-18.
TRICHLORETHYLENE	A0	<1.37	12.52	12.52	12.28	98.1	9.3-14.
TETRACHLOROETHYLENE	A0	<1.66	11.80	11.80	13.15	111.4	8.0-14.

ADVANCED ENVIRONMENTAL SYSTEMS, INC.
LABORATORY REPORT

TYPE OF ANALYSIS: TEST CONTROLS - WET CHEMISTRY
UNITS OF MEASURE: MILLIGRAMS/KILOGRAM, OR PPM
CLIENT: SOHIO A.E.S. JOB CODE (ANY)

ANALYSIS	TYPE	ORIGINAL CONC.	ADDED CONC.	EXPECTED CONC.	REPORTED CONC.	PERCENT RECOVERY	95% CONFIDENC INTERVAL
PHENOLS	A2-SPK	<0.01	50	50	45.3	90.6	NOT APPLICAB

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ADVANCED ENVIRONMENTAL SYSTEMS, INC.
LABORATORY REPORT

TYPE OF ANALYSIS: TEST CONTROLS - METALS
UNITS OF MEASURE: MICROGRAMS/LITER, OR PPB
CLIENT: SOHIO A.E.S. JOB CODE (ANY)

ANALYSIS	TYPE	ORIGINAL CONC.	ADDED CONC.	EXPECTED CONC.	REPORTED CONC.	PERCENT RECOVERY	95% CONFIDENC INTERVAL
MERCURY	EPA	8.7	NONE	8.7	9.8	112.6	5.9-11.
MERCURY	A0-SPK	2.7	10.0	12.7	14.1	111.0	NO
MERCURY	A1-SPK	<1.0	10.0	10.0	11.4	114.0	NO
MERCURY	A2-SPK	3.3	10.0	13.3	14.1	106.0	NO
MERCURY	A3-SPK	<1.0	10.0	10.0	10.2	102.0	NO
MERCURY	A4-SPK	<1.0	10.0	10.0	9.2	92.0	NO
MERCURY	A5-SPK	<1.0	10.0	10.0	9.6	96.0	NO

NOTE: CONCENTRATIONS ARE REPORTED IN PPB, AS PRESENT IN LIQUID DIGESTED SAMPLES DURING ANALYSIS

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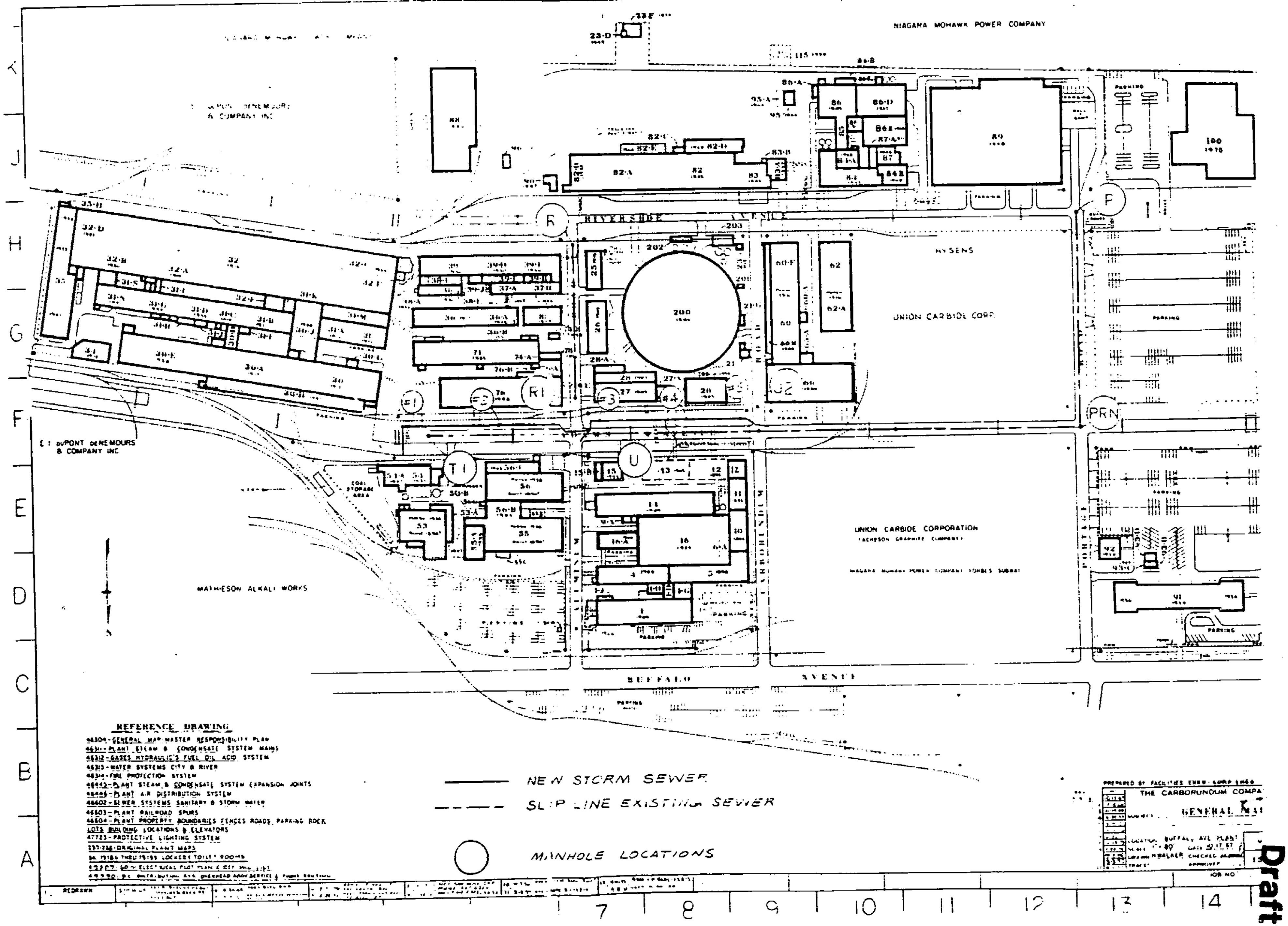
ADVANCED ENVIRONMENTAL SYSTEMS, INC.
LABORATORY REPORT

TYPE OF ANALYSIS: DUPLICATE-WET CHEMISTRY
UNITS OF MEASURE: MILLIGRAMS/KILOGRAM, OR PPM
CLIENT: SOHIO A.E.S. JOB CODE (ANY)

ANALYSIS	SAMPLE	ORIGINAL CONC.	DUPL. CONC.	AVERAGE CONC.	RANGE	REL. % * DIFF.
PHENOLS	A2	<0.01	<0.01	NA	NA	NA

* RELATIVE % DIFFERENCE
RANGE/AVERAGE X 100


NIAGARA MOHAWK POWER COMPANY
E I duPONT deNEMOURS & COMPANY INC
E I duPONT deNEMOURS & COMPANY INC
MATHIESON ALKALI WORKS
RIVERSIDE AVENUE
BUFFALO AVENUE
HYSENS
UNION CARBIDE CORP.
UNION CARBIDE CORPORATION
(ACHESON GRAPHITE COMPANY)
NIAGARA MOHAWK POWER COMPANY FORBES SUBWAY
COAL STORAGE AREA
PARKING
200
89
100
82-A
82
32
30-A
30
71
16
1
91
62
62-A
60
60-F
R
R1
T1
U
P
PRN
U2
#1
#2
#3
#4
NEW STORM SEWER
SLIP LINE EXISTING SEWER
MANHOLE LOCATIONS
REFERENCE DRAWING
46304-GENERAL MAP-MASTER RESPONSIBILITY PLAN
46311-PLANT STEAM & CONDENSATE SYSTEM MAINS
46312-GASES HYDRAULIC'S FUEL OIL ACID SYSTEM
46313-WATER SYSTEMS CITY & RIVER
46314-FIRE PROTECTION SYSTEM
46443-PLANT STEAM & CONDENSATE SYSTEM EXPANSION JOINTS
46495-PLANT AIR DISTRIBUTION SYSTEM
46602-SEWER SYSTEMS SANITARY & STORM WATER
46603-PLANT RAILROAD SPURS
46604-PLANT PROPERTY BOUNDARIES FENCES ROADS PARKING ROCK LOTS BUILDING LOCATIONS & ELEVATORS
47723-PROTECTIVE LIGHTING SYSTEM
237-238-ORIGINAL PLANT MAPS
REDRAWN
PREPARED BY FACILITIES ENGR. CORP ENGG
THE CARBORUNDUM COMPA
GENERAL MA
LOCATION BUFFALO AVE PLANT
DATE 10.17.67
DRAWN H.BALKER
CHECKED
APPROVED
JOB NO
A
B
C
D
E
F
G
H
J
K
7
8
9
10
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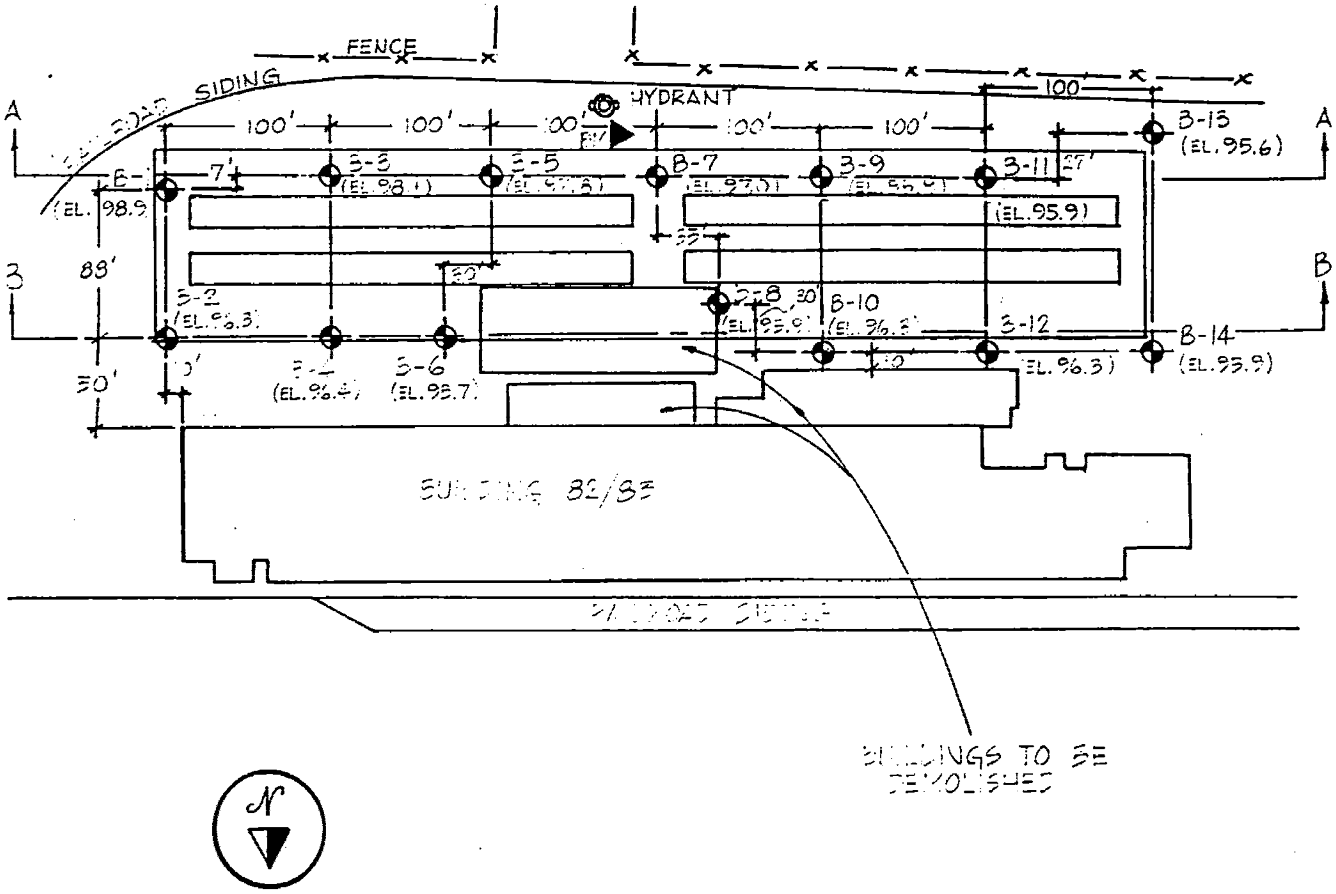
14

Draft



LEGEND

⊕ B-1 BORING DESIGNATION
(EL.) SURFACE ELEVATION

▲ BM BENCHMARK

NOTES:

1.) BENCHMARK IS NORTH BONNET NUT OF HYDRANT NEAR FENCE LINE SOUTH OF PROPOSED FURNACE BLDG. W/ASSUMED ELEV. OF 100.0 FEET.

2.) PROFILE OF SECTION A-A IS SHOWN ON DRAWING № 3 AND THE PROFILE OF SECTION B-B IS SHOWN ON DRAWING № 4.

EMPIRE
SOILS INVESTIGATIONS INC

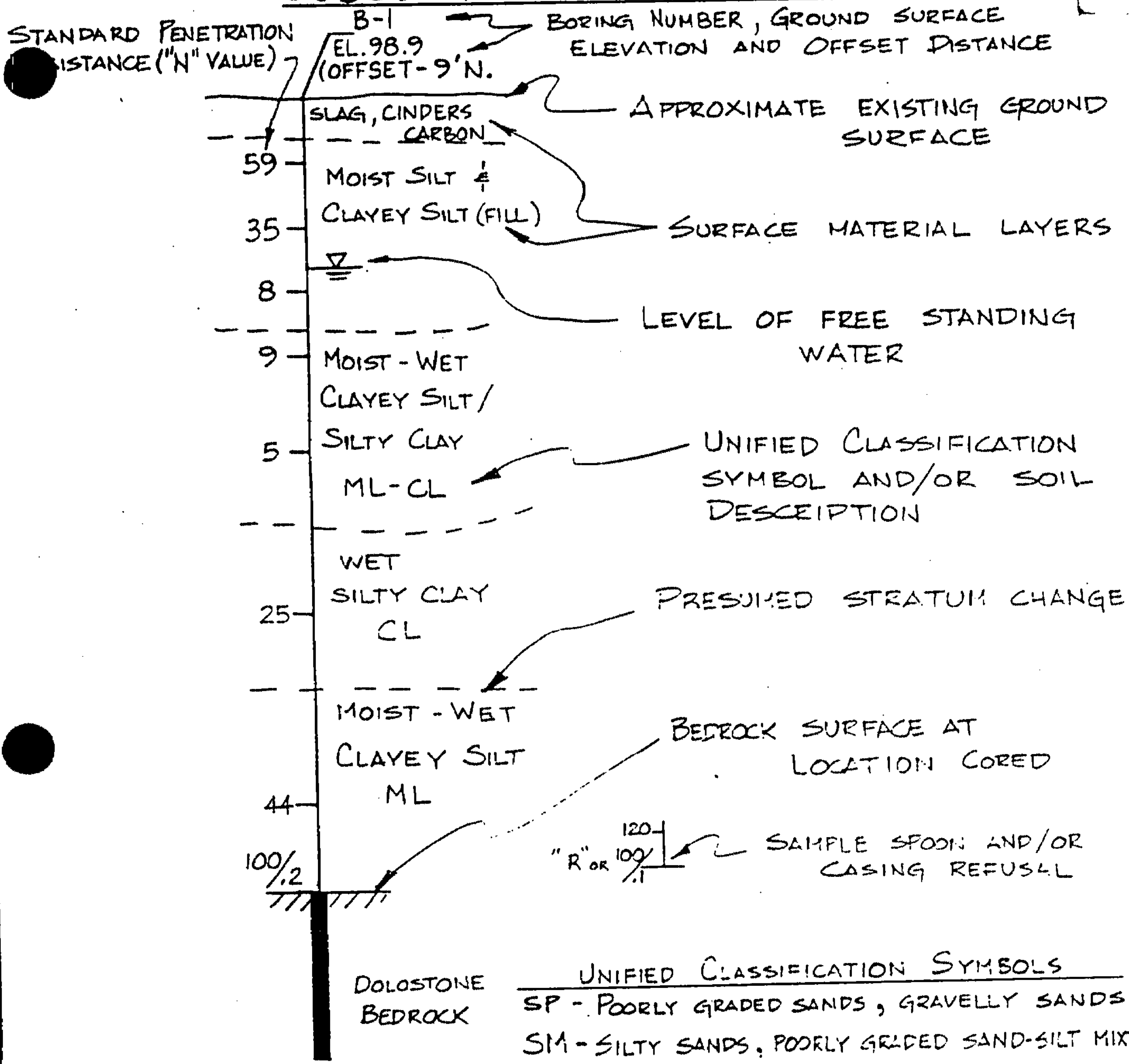
SUBSURFACE INVESTIGATION PLAN

PROPOSED SIC FACILITY
SOHIO ELECTRO MINERALS COMPANY
NIAGARA FALLS, NEW YORK

DR.BY: AJK / DLP	SCALE: 1" = 80'	PROJ. NO. BTA-84-
CK'D.BY: DJF	DATE: 5-8-84	DRWG.NO. 1

FORM E-2

SUBSURFACE PROFILE LEGEND



UNIFIED CLASSIFICATION SYMBOLS

SP - POORLY GRADED SANDS, GRAVELLY SANDS.

SM - SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES.

ML - INORGANIC SILTS AND VERY FINE SAND, SILTY OR CLAYEY FINE SANDS, CLAYEY SILTS OF LOW PLASTICITY.

CL - INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS.

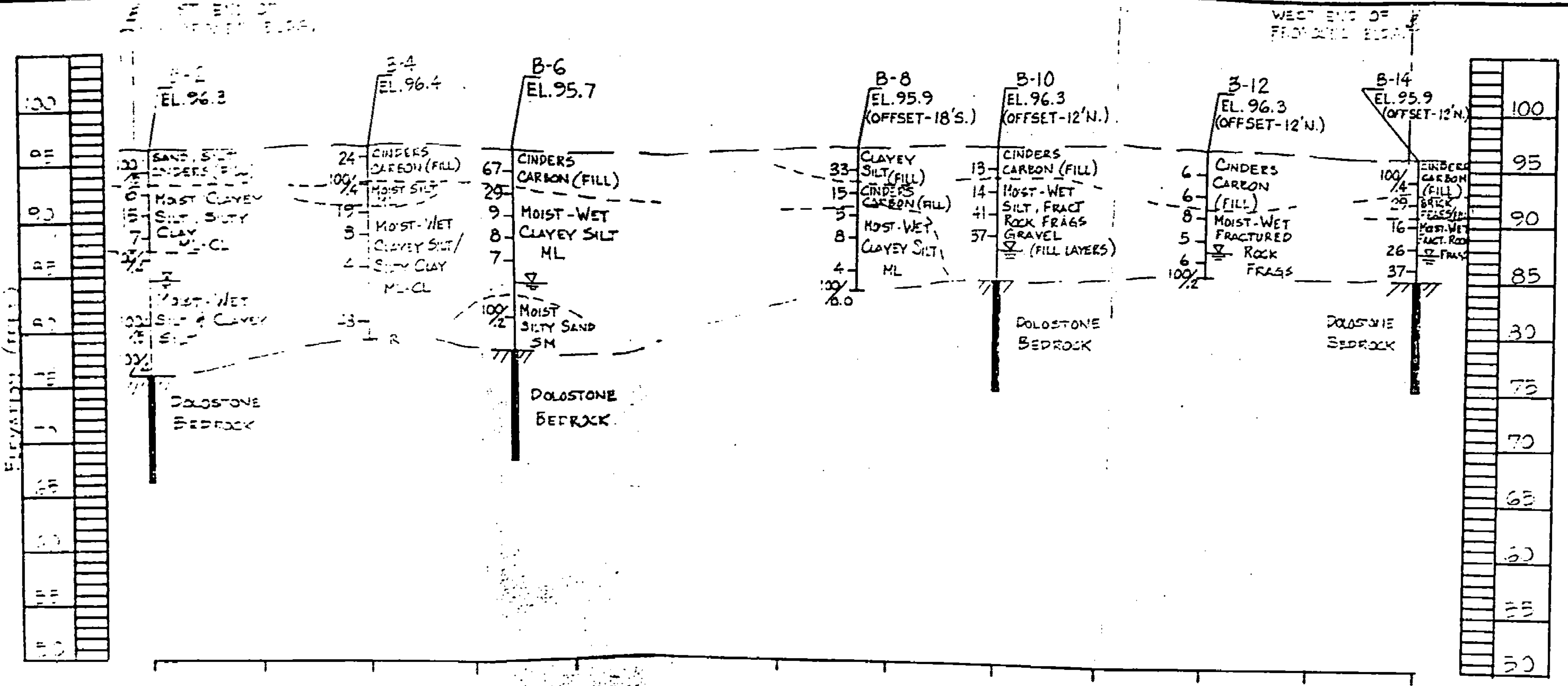
NOTE:

SUBSURFACE PROFILES ARE SHOWN ON DRAWINGS Nº 3 AND 4.

THOMSEN ASSOCIATES
CONSULTING GEOTECHNICAL ENGINEERS & GEOLOGISTS
Groton • Buffalo • Rochester • Syracuse • Albany
New York • Woodbridge • Harrisburg • Washington

PROPOSED SiC FACILITY
SOHIO ELECTRO MINERALS COMPANY
NIAGARA FALLS, NEW YORK

DR. BY: DLP	SCALE: No SCALE	PROJ. NO. BTA - 84-44
CK'D. BY: JD	DATE: 8-13-84	DRWG. NO. 2



B-B

NOTES:

1. A LEGEND OF TERMS AND SYMBOLS USED TO PREPARE THIS PROFILE IS PRESENTED ON DRAWING No 2.
2. THE LOCATION OF PROFILE B-B IS SHOWN ON DRAWING No 1.

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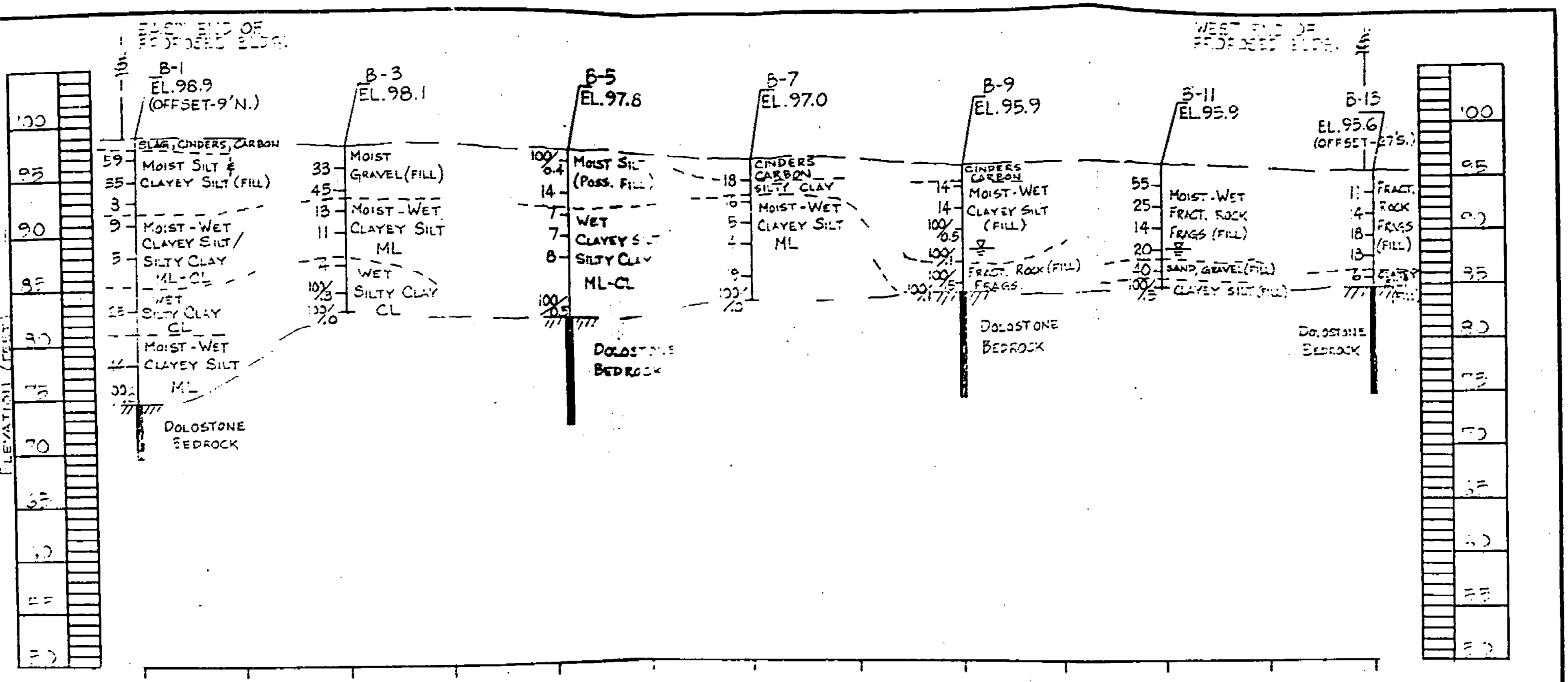
PROPOSED SiC FACILITY
SOHIO ELECTRO MINERALS COMPANY
NIAGARA FALLS, NEW YORK

DR.BY: DLP	SCALE: AS NOTED	PROJ. NO. BTA-84-44
CK'D BY: JD	DATE: 8-15-84	DRWG.NO. 4



SE[illegible]

SCA[illegible]

NOTES :

1.) A LEGEND OF TERMS AND SYMBOLS USED TO PREPARE THIS PROFILE IS PRESENTED ON DRAWING Nº 2.

2.) THE LOCATION OF PROFILE A-A IS SHOWN ON DRAWING Nº 1

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PROPOSED SiC FACILITY
SOHIO ELECTRO MINERALS COMPANY
NIAGARA FALLS , NEW YORK

DR.BY: DLP
SCALE: AS NOTED
PROJ. NO. BTA-84-44
CK'D.BY: [illegible]
DATE: 8-15-84
DRWG.NO. 3