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Special Study Report

ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION

PHASE I

City of Niagara Falls, New York

JUNE 1989

Project: 0337-19-1

MALCOLM PIRNIE

ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

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ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION

CITY OF NIAGARA FALLS
NEW YORK

MAY 1989

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EXECUTIVE SUMMARY

GENERAL

The City of Niagara Falls retained Malcolm Pirnie, Inc. to conduct a preliminary site investigation of six (6) potential sites within the City limits to assess their suitability as locations for an alternate water treatment plant (WTP) facility. These include the Porter Road, Fifty-sixth Street, Chevy Place, Janik, Buffalo Avenue, and East Area Sites. These investigations were conducted in April-May 1989, in accordance with a scope of work jointly developed by the City and Malcolm Pirnie, Inc. This report presents the findings of the Preliminary Site Investigation. The elements of the Preliminary Site Investigation addressed herein include:

(1) Discussion of the regional geology, hydrogeology, and geochemistry;

(2) Discussion of Site specific geology, hydrogeology and geochemistry for the Porter Road Site, Fifty-sixth Street Site, Chevy Place Site, Janik Site, Buffalo Avenue Site, and East Area Site; and

(3) Recommendations for additional investigation.

REGIONAL GEOLOGY, HYDROGEOLOGY AND GEOCHEMISTRY

Geology

The Niagara Falls Area is underlain by a layer of unconsolidated geologic materials (alluvium, lacustrine deposits, and till) of variable thickness and bedrock (stratified Paleozoic sedimentary rocks). Fill of variable composition is present locally at surface.

Alluvium generally consists of sand, silt, and gravel deposits. Glaciolacustrine deposits underlie the alluvium and consist of silt, clay, and sand. A layer of silty clay to sandy till underlies the glaciolacustrine deposits. The bedrock beneath the area consists of dolostone of the Middle Silurian Lockport Group.

Hydrogeology

Three (3) hydrostratigraphic units are defined in the Niagara Falls Area. These include: a shallow water-bearing zone, overburden aquitard, and bedrock aquifer. The shallow water-bearing zone encompasses the fill/alluvium deposits. The direction and rate of shallow ground water flow is influenced by the permeability/porosity of the hydrostratigraphic unit, topography, land use, and drainage. The shallow water-bearing zone is underlain by a clay-rich confining layer (overburden aquitard). The bedrock aquifer is predominantly located in the upper 10 to 15 feet of the Lockport Group and has a ground water flow direction southwest towards the Niagara River.

Geochemistry

Ground water is not extensively utilized in the Niagara Falls Area due to the low water-bearing characteristics in the overburden and the generally poor water quality in the Lockport Group. Both the overburden and bedrock aquifers are locally contaminated with the contamination attributed to previous land use activities in the Niagara Falls Area. In addition, ground water in the bedrock is described as brine, saline, and containing naturally occurring volatile organics, such as BTX.

PORTER ROAD SITE

The Site is underlain by between 5.0 to greater than 47.0 feet of fill which appears to consist mainly of "clean" fill associated with past New York Power Authority (NYPA) excavation activity in the area. A maintenance garage for the City-owned golf course is, however present on-site and has been used for the storage of oil, gas, fertilizers, and possibly other lawn care products. No records of any previous environmental sampling events are available for this site.

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FIFTY-SIXTH STREET SITE

The City owns only 1.3 acres (13 lots) of the 17.6-acre (129 lots) Site. The Site is underlain by up to 2.0 feet of fill of unknown origin and is thus considered "suspect". PAHs, toluene, and trace inorganics have been detected in soil samples in and adjacent to the Site and phthalates, carbon disulfide, 2-chlorophenol, and trace inorganics have been detected in ground water samples in and adjacent to the Site.

CHEVY PLACE SITE

The Site is underlain by between 1.0 to 7.0 feet of fill which is "suspect" in that its deposition was associated with past municipal landfilling activity. PAHs, toluene, and trace inorganics have been detected in soil samples in and adjacent to the Site and carbon disulfide and trace inorganics have been detected in ground water samples.

JANIK SITE

Located immediately south of the Chevy Place Site, the Janik Site is underlain by between 1.0 to 2.0 feet of fill which appears to consist mainly of "clean" fill associated with past urban renewal project demolition. However, it should be noted that no previous sampling events were conducted on the Site proper.

BUFFALO AVENUE SITE

The Buffalo Avenue Site (formerly PASNY Site) is underlain by up to 20.0 feet of fill (the northwestern portion of the Site contains no fill materials) which appears to consist primarily of "clean" fill associated with past NYPA excavation activity with lesser quantities of municipal waste. Trace amounts of PAHs, chlorinated hydrocarbons, and inorganics have been detected in soil samples from the Site and trace phthalate esters and inorganics have been detected in ground water samples.

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RECOMMENDATIONS

Considering the "suspect" origin of the fill material and the presence of contaminants, the Fifty-sixth Street, Chevy Place, and East Area Sites should not be considered for additional study. However, considering the "clean" origin of the fill material and the likelihood that encountering contaminants in the fill is considered to be low, the Porter Road and Janik Sites and the northwestern portion of the Buffalo Avenue Site should be considered for additional study.

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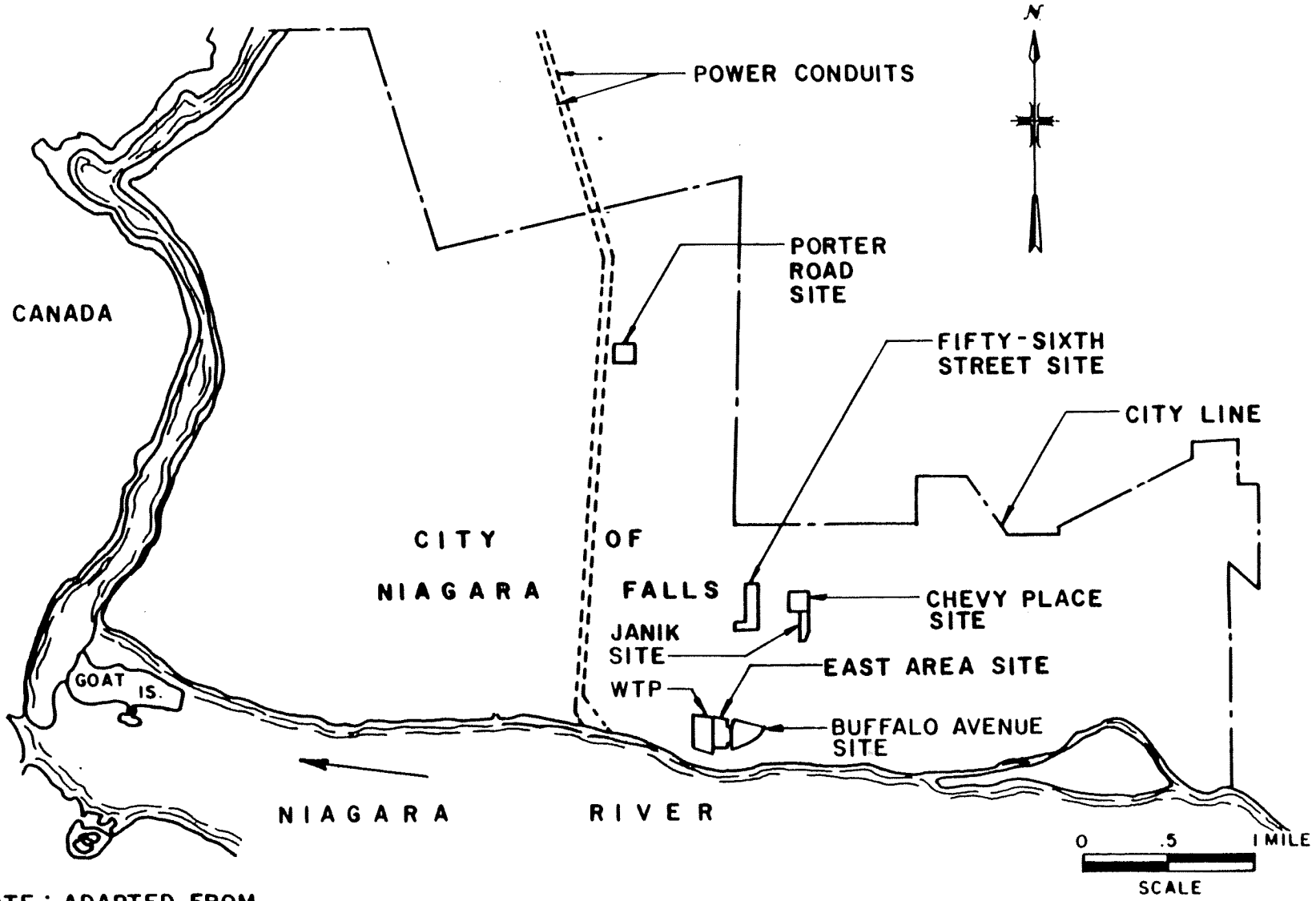
1.0 INTRODUCTION

Malcolm Pirnie, Inc. was retained by the City of Niagara Falls to conduct a preliminary site investigation of six (6) potential sites for an alternate water treatment plant (WTP) facility within the City limits. Figure 1-1 shows the locations of the six sites. These include: the 5.7 acre Porter Road Site, the 17.6 acre Fifty-sixth Street Site, the 9.2 acre Chevy Place Site, the 4.9 acre Janik Site, the 30.0 acre Buffalo Avenue (NYPA) Site (formerly PASNY Site), and the 8.5 acre East Area Site.

This preliminary site investigation involved a detailed review/ assessment of available reports and other existing documentation for the six sites obtained from the City of Niagara Falls, NYSDEC, and Niagara County Department of Health (NCDOH) files. This report summarizes available information on property ownership, history, geology, hydrogeology, and environmental sampling results.

FIGURE 1-1



NOTE: ADAPTED FROM MULLER, 1975

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NIAGARA FALLS, NEW YORK
CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION

ALTERNATE WTP SITES MAP

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2.0 REGIONAL GEOLOGY, HYDROGEOLOGY AND GEOCHEMISTRY

2.1 REGIONAL GEOLOGY

The surficial geology of the Niagara Falls Area has been described by Muller (1975). The surficial materials can be classified into three units based upon depositional environments. These include alluvium, lacustrine deposits, and till. The bedrock geology of the Area has been described by Fisher and Liberty (1981) and includes a thick succession of stratified Paleozoic sedimentary rocks which form the northern flank of the Alleghany Basin. Table 2-1 summarizes the geology of the Niagara Falls Area.

2.1.1 Alluvium

The recent alluvium includes sand, silt, and gravel deposited along modern river and stream courses. These deposits are thin and of limited lateral extent and normally lie unconformably above the underlying lacustrine deposits or till.

2.1.2 Lacustrine Deposits

The lacustrine deposits are comprised of silt, clay, and sand sediments formed in predecessors of the existing lakes in the area. The ancestral lakes include, from youngest to oldest, Lake Tonawanda (>500 years before present), Lake Iroquois, Lake Warren, and Lake Whittlesey. At Niagara Falls, the surficial sediments were formed in glacial Lake Tonawanda (Figure 2-1). These sediments are generally thin and thicken only at the strand lines associated with the remnant shores of the lake.

2.1.3 Till

Sediments of glacial origin (till) overlie bedrock in much of the Niagara Falls Area. An extensive ground moraine comprised of a thin silty clay to sandy till occupies much of the area. The ground moraine is normally marked by end moraines composed of materials of similar texture as well as sand and gravel deposits formed in ice-marginal positions or as outwash. In general, the till is thin and lies unconformably atop Paleozoic bedrock.

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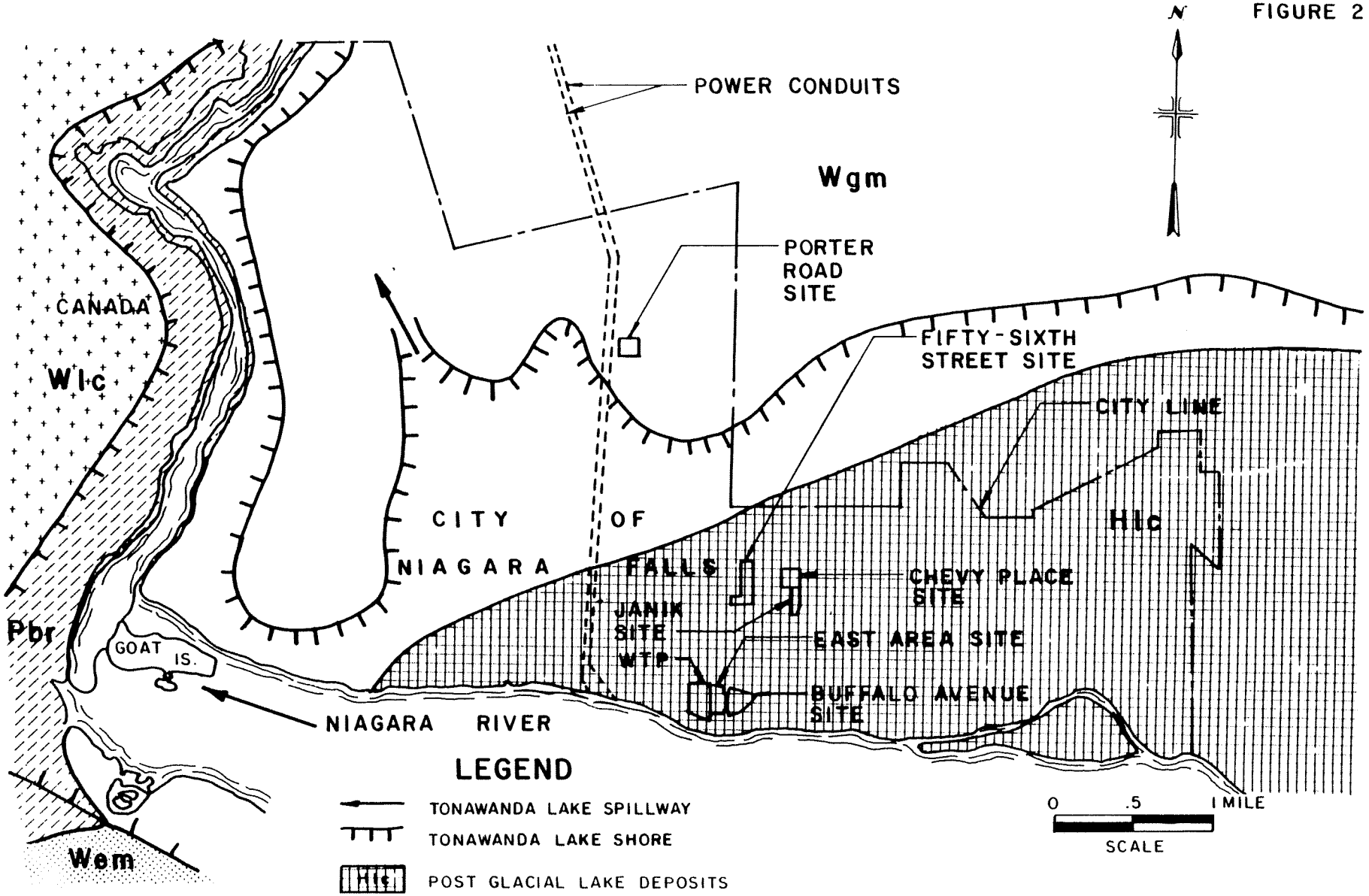
TABLE 2-1

CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION

GEOLOGY OF NIAGARA FALLS AREA SUMMARY

Unit Ages	Regional Units
Recent	Alluvium (limited laterally)
Wisconsinan	Lacustrine Deposits Till
Middle Silurian	Lockport Group Oak Orchard Formation Eramosa Formation Goat Island Formation Gasport Formation
	Clinton Group Decew Formation Rochester Formation Irondequoite Formation Reynales Formation Neahga Formation Thorold Formation
Lower Silurian	Medina Group Grimsby Formation Power Glen Formation Whirlpool Formation
Upper Ordovician	Queenston Formation

FIGURE 2-1



NOTE: ADAPTED FROM MULLER, 1975

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NIAGARA FALLS, NEW YORK
CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION

SURFICIAL GEOLOGY OF THE NIAGARA FALLS AREA

2.1.4 Bedrock

The bedrock stratigraphic succession beneath the Niagara Falls Area consists of rock ranging in age from Middle Silurian to Upper Ordovician. The principal bedrock unit exposed in the Area is the Lockport Group, which is composed of four distinct dolostone formations. This group dips toward the southeast at a slope of approximately 40 feet per mile and its exposure is controlled by lacustrine and glacial erosion.

2.2 REGIONAL HYDROGEOLOGY

The regional hydrogeology of the Niagara Falls Area has been described by Johnston (1964), Miller and Kappel (1987), and Yager and Kappel (1987).

2.2.1 Hydrostratigraphic Units

Hydrostratigraphic units are sequences of geologic materials that possess similar hydrogeologic properties including hydraulic conductivity, storage, and porosity. The hydrostratigraphy of the Niagara Falls Area is summarized in Table 2-2. The major hydrostratigraphic units are:

1. an unconfined, shallow water-bearing zone;
2. a confining unit (aquitard); and
3. a bedrock aquifier.

The shallow water-bearing zone consists of fill material (where present), hydraulically connected with an underlying layer of alluvial silt, sand, and gravel. The zone reaches its maximum thickness in the sand and gravel deposits of the remnant beach strands and has a variable thickness, in general, due to topography.

The overburden aquitard is comprised of very low permeable lacustrine deposits and an underlying layer of till. The thin beds of fine sand found in these deposits and a "washed zone" at the top of bedrock (a zone of high transmissivity between the bottom of till and upper bedrock fractures) have a comparatively greater permeability.

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TABLE 2-2

CITY OF NIAGARA FALLS ALTERNATE WATER
TREATMENT PLANT SITE INVESTIGATION

CORRELATION OF GEOLOGIC AND HYDROGEOLOGIC UNITS

	Geologic Unit	Hydrostratigrahic Unit
Fill:	construction debris, industrial waste, sand, silt, gravel, etc. (where present)	Shallow Unconfined Water-Bearing Zone
Alluvium:	sand, silt, and gravel	
Lacustrine:	silt, clay, and sand	Aquitard
Till:	clay, silt, sand, and gravel	
Bedrock:	dolostone	Bedrock Aquifer

The bedrock aquifier, which underlies the surficial deposits at depth, is principally composed of water-bearing zones parallel to bedding which are much more permeable than the surrounding rock. Vertical joints and small cavities (vugs) formed by solution of gypsum yield small amounts of water, particularly in the upper 10 to 15 feet of the Lockport Group.

2.2.2 Ground Water Flow

Ground water flow through the shallow overburden is variable in direction due to the influence of topography, land use, and drainage. The vertical component of flow under the Niagara Falls Area is in a downward direction.

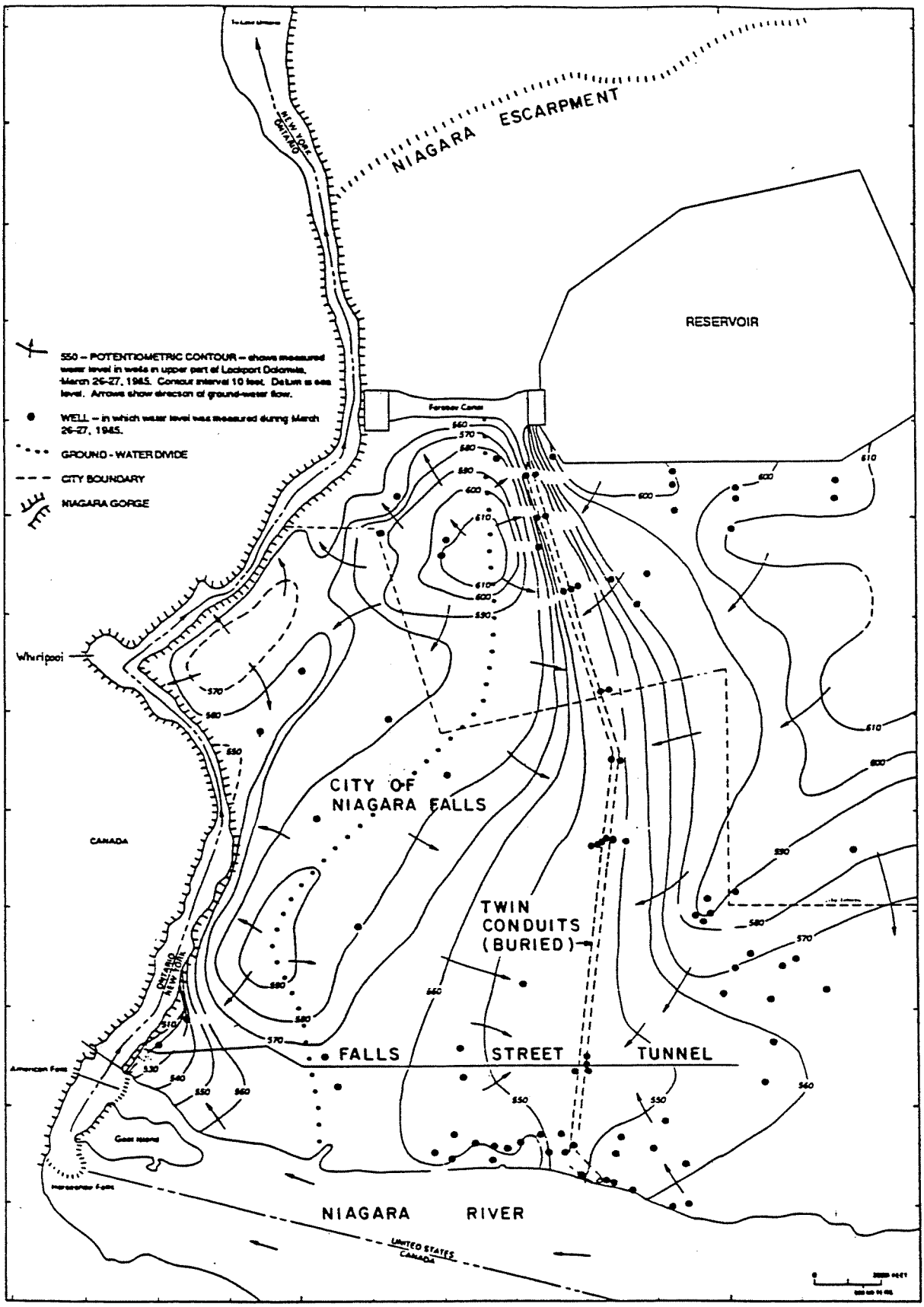
Regionally, ground water flow through the upper bedrock is to the southwest towards the Niagara River. Manmade structures have locally altered ground water flow direction in the bedrock. As illustrated in Figure 2-2, the Niagara Power Project reservoir acts as a source of recharge to the Lockport Group. The NYPA buried conduit system, which carries water from the Niagara River to the power plant, acts as a line sink for ground water discharge. Ground water also discharges to the Falls Street tunnel, which crosses the conduit system. In addition, industrial pumping west of the conduit intakes induces recharge from the Niagara River (Yager and Kappel, 1987).

2.3 REGIONAL GEOCHEMISTRY

Ground water is not extensively utilized in the Niagara Falls Area due to the low water-bearing characteristics in the overburden (see Section 2.2) and the generally poor water quality in the Lockport dolostone.

Johnston (1964) described the chemical character of ground water in the Lockport dolostone as very hard and moderately to highly mineralized. The calcium-bicarbonate content averages 960 ppm and would require softening before the water could be used for many purposes. Hydrogen sulfide, locally termed "sulfur water" or "black water," is

FIGURE 2-2



NOTE: ADAPTED FROM YAGER AND KAPPEL, 1987

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CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION
POTENTIOMETRIC MAP OF UPPER LOCKPORT GROUP

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found in numerous wells in the Lockport Group. In addition, Johnston (1964) describes ground water at depth in the Lockport Group as brine (having a total dissolved solids content of more than 35,000 ppm) and saline (having a total dissolved solids content of more than 2,000 ppm) in the lower and middle sections of the Lockport Group, respectively.

Numerous hazardous waste disposal sites, both active and inactive, are located in the Niagara Falls Area. Some examples include the S-Area and Hyde Park Landfills, owned and operated by Occidental Chemical Corporation (OCC), NECCO Park, owned and operated by E.I. DuPont deNemours & Company, Inc., and CECOS, operated by BFI, Inc. The inactive landfills are known sources of contamination in the overburden and the bedrock underlying the City, and surrounding area, and contribute to the regionally poor water quality. Contaminants from these landfills include volatile organics, semi-volatile organics, pesticides/PCBs, and inorganics.

The presence of naturally occurring volatile organics was detected by Novakowski and Lapcevic (1987) and Slaine and Baker (1989) in Paleozoic bedrock in the Niagara Falls Area. Gas Chromatography (GC) and other analytical methods indicate the presence of low concentrations of organic compounds, including Benzene, Toluene, and Xylene (BTX) in the Lockport and Upper Clinton (Decew and Rochester) Groups, and Benzene in the Rochester Group.

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3.0 PRELIMINARY SITE INVESTIGATION

3.1 PORTER ROAD SITE

3.1.1 Location and Ownership

The Porter Road Site which is located south of Porter Road and east of the entrance to the Municipal Golf Course is approximately 5.7 acres in size (Figure 3-1). The City of Niagara Falls owns approximately 5.0 acres of the Site and the Knights Club of Niagara Falls has a 0.7 acre easement through the center.

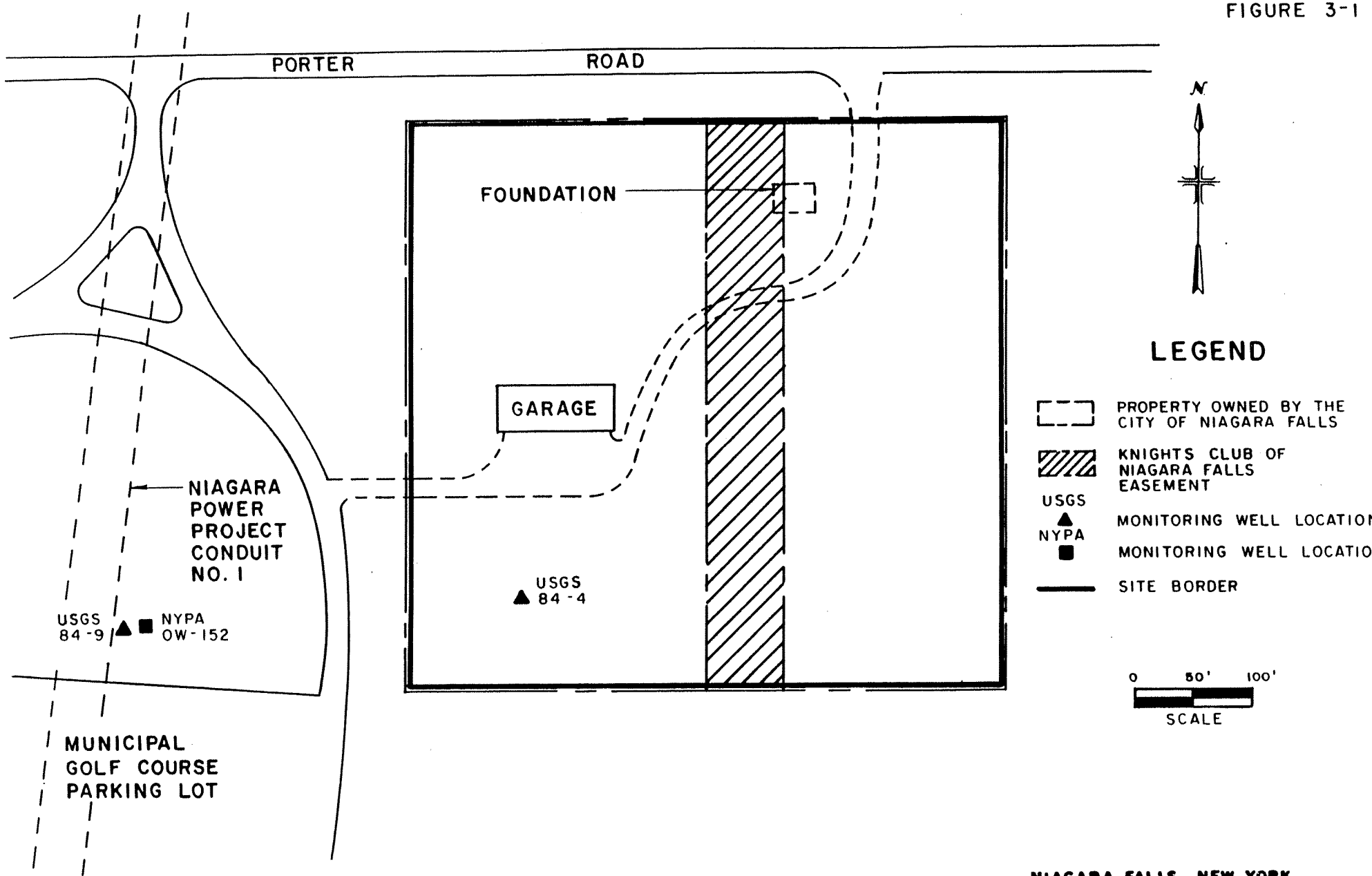
3.1.2 History

The Site is believed to have been a vacant lot prior to 1958. It is apparent from U.S. Department of Agriculture (USDA) 1958 aerial photographs (ARE-1U-22 and ARE-3V-82) that the Porter Road Site and surrounding area were used for the disposal of rock spoils and clean fill from the Niagara Power Project conduit excavations. A 1966 USDA photograph (ARE-2GG-S2) shows that excavation had ceased in the area and that development of the Municipal Golf Course had commenced. The metal garage located on the Site was built by the New York Power Authority (NYPA) after 1962 and the foundation illustrated in Figure 3-1 was a former caddy shack, which was demolished in 1988.

The U.S. Geological Survey (USGS) installed two (2) monitoring wells in the vicinity of the Porter Road Site in 1984 (Figure 3-1) in order to define the effects of the Niagara Power Project on ground water flow.

Recent site inspection indicates that the surface is relatively flat and grades gently to the west and south. The Site consists of open areas with small groves of conifers at the northwest and northeast corners and a cover of grass throughout. The southern third of the Site and south of the unpaved road are topographically low and are susceptible to ponding. A maintenance garage for the City-owned golf course is, however present on Site and has been used for the storage of oil, gas, fertilizers, and possibly other lawn care products. The Municipal Golf Course is located to the north and west, Saint James Methodist Episcopal Church property to the east, and property owned by the Knights

FIGURE 3-1



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NIAGARA FALLS, NEW YORK
CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION
PORTER ROAD SITE MAP

of Columbus Club of Niagara Falls and Niagara Mohawk Power Corporation to the south. Niagara Power Project conduits 1 and 2 underlie the golf course parking lot to the west of the Site.

3.1.3 Geology

The locations of NYPA (OW-152) and USGS (84-4 and 84-9) wells are shown in Figure 3-1. Appendix A-1 (Exhibit Number A.1-1) contains the logs for the USGS wells; no geologic log is available for OW-152. The stratigraphy encountered in well 84-4, with the exception of fill, corresponds with the regional geology of the Niagara Falls Area (Table 3-1). Well 84-9 is located in the excavation for conduit number 1, therefore, its stratigraphy is composed entirely of fill.

The fill encountered in well 84-4 is described as a zone of shot-rock overlying a zone of clay. Shot-rock is defined by Miller and Kappel (1987) as cobble to boulder sized clasts of Lockport dolostone that were blasted and removed during trench excavation. The shot-rock is commonly mixed with poorly sorted silt and clay. The thickness of the fill in wells 84-4 and 84-9 is 5.0 feet and greater than 47.0 feet, respectively.

The native stratigraphic units underlying the shot-rock/clay fill of well 84-4 include: lacustrine clay, which is 20.0 feet thick; till, which is 4.0 feet thick; and Lockport dolostone.

3.1.4 Hydrogeology

The Miller and Kappel Report (1987) identifies ground water characteristics in the area adjacent to the Niagara Power Project reservoir and buried conduit system, which encompasses the Porter Road Site. This report specifically addresses the bedrock aquifer, which is the principal aquifer of the region (see Section 2.2).

The upper shot-rock zone of the fill is described as permeable but unsaturated. The lower clay zone is saturated and forms the shallow unconfined water-bearing zone.

The lacustrine clay and till underlying the fill at the Porter Road Site, and surrounding area, have relatively low permeability with hydraulic conductivity values ranging from 0.0014 to 0.27 ft/day (Miller

TABLE 3-1
ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION
STRATIGRAPHIC SUMMARY

BOREHOLE NO.	LOCATION	SURFACE ELEV.	ALLUVIUM DEPTH	ALLUVIUM ELEV.	CLAY DEPTH	CLAY ELEV.	TILL DEPTH	TILL ELEV.	BEDROCK DEPTH	BEDROCK ELEV.
		(ft AMSL)	(ft BGS)	(ft AMSL)	(FT. BGS)	(ft AMSL)	(FT. BGS)	(ft AMSL)	(FT. BGS)	(ft AMSL)
84-4	C-NF GOLF COURSE	586.66			5.0	581.66	25.0	561.66	29.0	557.66
84-9	C-NF GOLF COURSE	590.45								
OW152	C-NF GOLF COURSE	586.83	.....		NO GEOLOGIC	LOG	.....		26.0	
MW1	PINE AVE AND CHEVY PL	571.50	3.0	568.50	6.0	565.50	17.0	554.50	21.0	550.50
MW4	56TH ST AND GIRARD AVE	571.74	1.5	570.24	6.5	565.24	19.0	552.74	25.15	546.59
MW5	61ST ST AND GIRARD AVE	573.25	2.0	571.25	13.9	559.35	27.2	546.05	29.05	544.20
MW6	GIRARD AVE AND CHEVY PL	571.94	1.0	570.94	5.5	566.44	18.5	553.44	24.7	547.24
NFB-9	61ST AND PINE AVE	572.78			7.0	565.78	16.5	556.28	18.0	554.78
NFB-10	60TH ST AND GIRARD AVE	571.60			1.0	570.60	19.0	552.60	21.0	550.60

BOREHOLE NO.	BOTTOM DEPTH	BOTTOM ELEV.	THICKNESSES			
			FILL	ALLUVIUM	CLAY	TILL
	(FT. BGS)	(ft AMSL)	(ft)	(ft)	(ft)	(ft)
84-4	46.04	540.62	5.0		20.0	4.0
84-9	47.0	543.45	>47.0			
OW152	111.6					
MW1	70.0	501.50	3.0	3.0	11.0	4.0
MW4	81.55	490.19	1.5	5.0	12.5	6.15
MW5			2.0	11.9	13.3	1.85
MW6			1.0	4.5	13.0	6.2
NFB-9	24.0	548.78	7.0		9.5	1.5
NFB-10	25.0	546.60		1.0	18.0	2.0

and Kappel, 1987). The native clay/till, therefore, acts as a confining layer (aquitard) between the shallow unconfined water-bearing zone and the bedrock aquifer (Table 3-2).

The following text is from the Miller and Kappel Report (1987):

> "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 dolostone and abundant solution cavities left by dissolution of gypsum; the remainder of the group 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 dolostone 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/day in the upper part and from 1 to 2 ft/day in the lower part. Well yields commonly range from 10 to 100 gal/min."

No data is available concerning horizontal ground water flow directions in the shallow water-bearing zone. Based on surface topography and the presence of a north-south trending intermittent stream located west of the Porter Road Site, flow is likely in a westerly direction. The vertical component of flow under the Site is likely downward.

According to Miller and Kappel (1987), ground water flow within about 0.5 mile of both sides of the buried conduits is towards the conduits with discharge into the conduit drain system. Drainage water flows southward and discharges into the Falls Street tunnel (see Figure 2-2).

3.1.5 Results of Previous Sampling

Soil and ground water chemistry at the Porter Road Site is unknown. No records of any previous sampling events at the Site were found during this investigation.

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TABLE 3-2

CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION

PORTER ROAD SITE

CORRELATION OF GEOLOGIC AND HYDROGEOLOGIC UNITS

Geologic Unit		Hydrostratigrahic Unit
Fill:	Shot-Rock Zone Clay Zone	Shallow Unconfined Water-Bearing Zone
Lacustrine Clay and Till		Aquitard
Upper Water-Bearing Zone (Upper 10-25 ft of rock)		Bedrock Aquifer
Lower Water-Bearing Zone (Lower 25-158 ft of rock)		

3.2 FIFTY-SIXTH STREET SITE

3.2.1 Location and Ownership

The Fifty-sixth Street Site, approximately 17.6 acres in size, is located between Fifty-sixth and Fifty-ninth Streets and between Charles and Kies Avenues, excluding the property currently occupied by the Niagara Mohawk Power Corporation transmission lines (Figure 3-2). The City of Niagara Falls currently owns approximately 1.3 acres (13 lots) of the 129 lot Site. Table 3-3 lists the properties which are owned by the City. The remaining properties are privately owned.

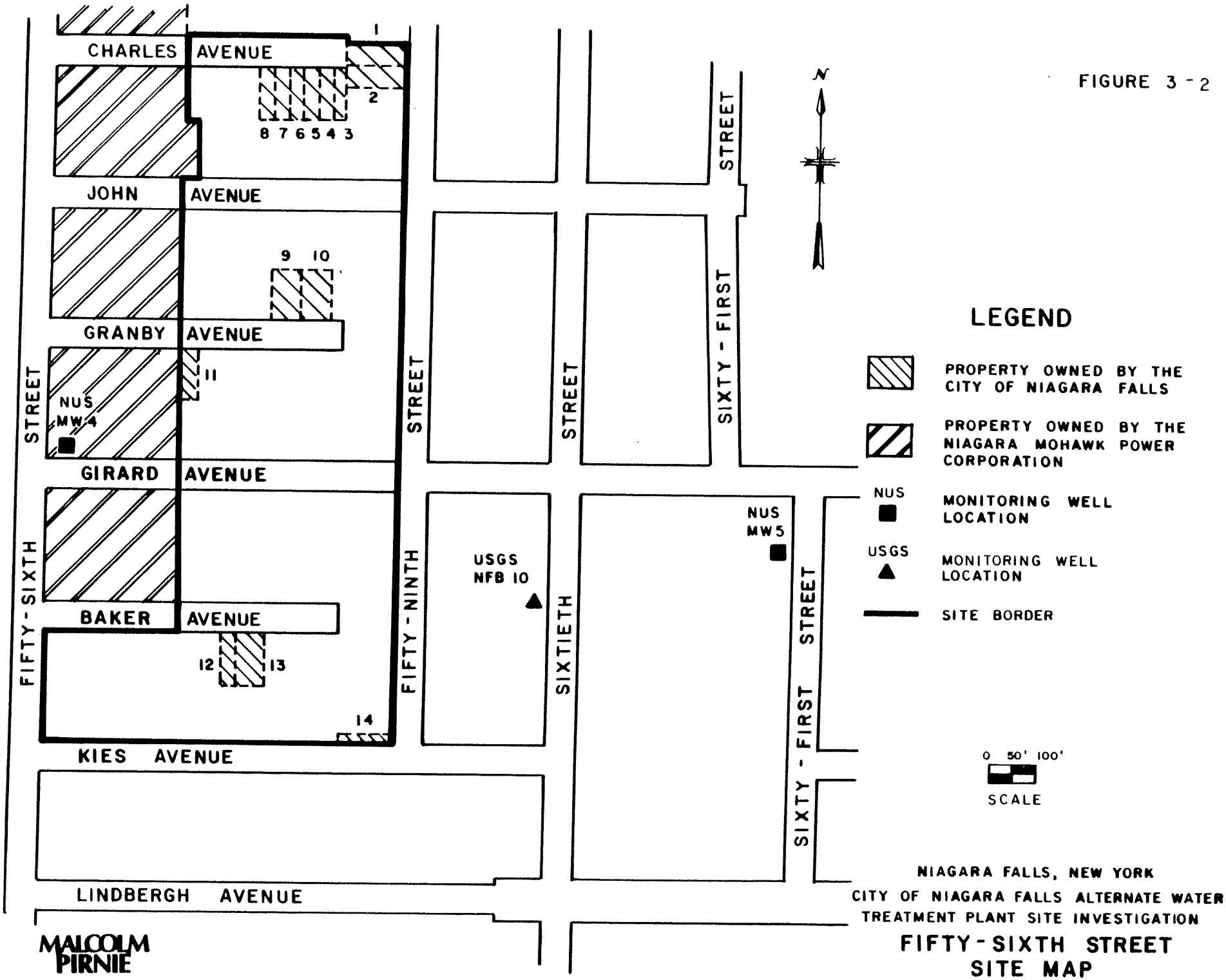
3.2.2 History

According to the Assessor's Office of the City of Niagara Falls, 12 of the 14 properties owned by the City on the Fifty-sixth Street Site have always been vacant lots. Structures were present on lots 9 and 10 during 1956 but appear to have been demolished between 1956 and 1970.

In 1985, NUS Corporation conducted a site investigation of a potentially hazardous site located within the Fifty-sixth Street Site between lots 13 and 14 (USEPA Technical Directive Document No. 02-8506-04). This site, designated by NUS (1985a) as the Fifty-ninth Street Site, is approximately 93 x 100 feet in size (Figure 3-3). According to area residents, a large hole was excavated in this area between 1978 and 1980. An unknown amount of sludge was allegedly dumped into the excavation along with an undetermined number of drums. After complaints concerning the alleged dumping of the materials were made to local authorities, residents observed the removal of sludge and drums from the Site. Construction debris and other fill was then used to fill the excavation. The analytical results for soil samples collected by NUS at the Fifty-ninth Street Site are presented in Section 3.3.5.

In 1982, the USGS installed two (2) bedrock monitoring wells in the LaSalle Area of Niagara Falls, which encompasses the Fifty-sixth Street Site (Miller and Kappel, 1987). In 1986, NUS conducted a hydrogeologic investigation (as requested by the USEPA) of the LaSalle Area, which involved the installation of six (6) clusters of overburden and bedrock

FIGURE 3 - 2



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CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION

FIFTY-SIXTH STREET SITE MAP

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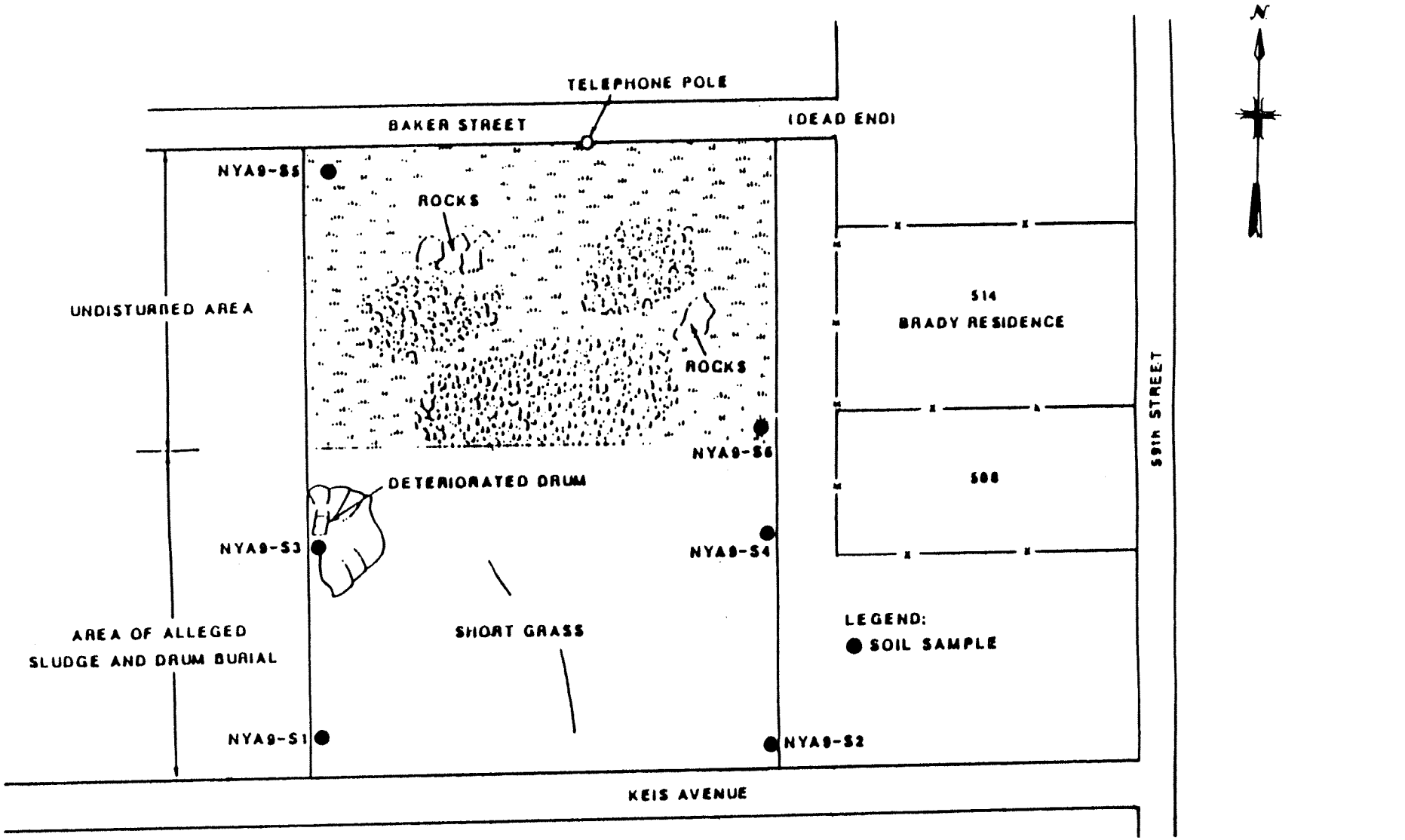
TABLE 3-3

CITY OF NIAGARA FALLS ALTERNATE WATER
TREATMENT PLANT SITE INVESTIGATION

CITY OF NIAGARA FALLS FIFTY-SIXTH STREET SITE PROPERTIES

Map No.	Property Designation	Address
1	160.40-1-11	722 59th Street
2	160.40-1-12	769 59th Street
3	160.40-1-10	5657 Charles Avenue
4	160.40-1-9	5655 Charles Avenue
5	160.40-1-8	5653 Charles Avenue
6	160.40-1-7	5649 Charles Avenue
7	160.40-1-6	5647 Charles Avenue
8	160.40-1-5	5643 Charles Avenue
9	160.40-1-24	5650 Granby Avenue
10	160.40-1-23	5656 Granby Avenue
11	160.48-1-1	5629 Granby Avenue
12	160.48-1-52	5637 Baker Avenue
13	160.48-1-53	5641 Baker Avenue
14	160.48-1-27	59th Street

FIGURE 3-3



NOTE: FROM NUS, 1985 a

NIAGARA FALLS, NEW YORK
CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION
SAMPLE LOCATION MAP
59 TH STREET SITE

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monitoring wells. NUS collected soil and ground water samples from these well and ground water samples from the USGS wells in 1986 and 1987. The analytical results are presented in Section 3.2.5.

Recent site inspection indicates that several privately owned residences are maintained on the Fifty-sixth Street Site. The City owned property on the Site consists mostly of open areas with a cover of grass and scrub vegetation. Some lots are topographic lows and appear to be susceptible to ponding. The area surrounding the Site is highly industrialized although residential communities border to the east and south.

3.2.3 Geology

Figure 3-2 presents the locations of NUS (MW-4 and MW-5) and USGS (NFB-10) wells located nearest to the Fifty-sixth Street Site. The logs for these wells are presented in Appendix A.1 (Exhibit Numbers A.1-2 and A.1-3) and the stratigraphy is summarized in Table 3-1. The stratigraphy encountered in MW-4, MW-5 and NFB-10, with the exception of fill in the NUS wells, corresponds with the regional geology of the Niagara Falls Area (Table 3-1).

The fill encountered in NUS wells MW-4 and MW-5 is described as loose dark brown to black silt, with cinders and other miscellaneous fill and organic debris. Moisture conditions within the fill vary from dry to damp. The thickness of the fill varies across the area from 0 (NFB-10) to 2.0 (MW-5) feet and averages 1.2 feet.

The native stratigraphic units underlying the fill include: alluvium, which is 1.0 (NFB-10) to 11.9 (MW-5) feet thick and averages 6.0 feet; lacustrine clay, which is 12.5 (MW-4) to 18.0 (NFB-10) feet thick and averages 14.6 feet; till, which is 1.9 (MW-5) to 6.2 (MW-4) feet thick and averages 3.3 feet; and Lockport dolostone.

3.2.4 Hydrogeology

NUS (1986b) has identified four hydrostratigraphic units or zones (referred to as "A", "B", "C" and "D") in the LaSalle Area (Table 3-4). These units are consistent with the regional hydrogeology described in Section 2.2 with the exception of the inclusion of two bedrock zones ("C" and "D"). Well completion information and previous recorded water levels are presented in Table 3-5.

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TABLE 3-4

CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION

LaSALLE AREA

CORRELATION OF GEOLOGIC AND HYDROGEOLOGIC UNITS

Geologic Unit	Hydrostratigraphic Unit	Type
Fill, Aluvium, and Lacustrine Clay	Shallow Unconfined Water-Bearing Zone	"A"
Lacustrine Clay and Till	Aquitard	"B"
Upper Water-Bearing Fracture (1st encountered)	Bedrock Aquifer	"C"
Lower Water-Bearing Fracture (2nd encountered)		"D"

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TABLE 3-5

CITY OF NIAGARA FALLS ALTERNATE WATER
TREATMENT PLANT SITE INVESTIGATION

LaSALLE AREA

WATER LEVELS AND WELL DESCRIPTIONS

Well No.	Material Screened or *Open Hole In Material	Screened Depth or Open Hole (Ft BGS)	Water Level (Ft BGS)	Water Level (Date)
MW-1A	Clay	8.0 - 13.0	0.4	05/13/86
MW-1B	Till	17.5 - 22.5	6.0	05/14/86
MW-1C	*Upper bedrock fracture zone	30.0 - 33.0	7.6	05/14/86
MW-1D	*Lower bedrock fracture zone	61.0 - 71.0	6.6	05/14/86
MW-4A	Alluvium/Clay	5.5 - 10.5	4.7	05/12/86
MW-4B	Till	21.0 - 26.0	20.2	05/12/86
MW-4C	*Upper bedrock fracture zone	30.0 - 35.0	20.7	05/12/86
MW-4D	*Lower bedrock fracture zone	71.5 - 82.0	14.7	05/12/86
MW-5A	Alluvium	5.0 - 10.0	5.0	05/13/86
MW-5B	Clay/Till/Upper bedrock	25.0 - 34.5	11.0	05/13/86
MW-5C	*Upper bedrock fracture zone	35.0 - 48.0	10.5	05/13/86
MW-5D	*Lower bedrock fracture zone	72.0 - 92.0	10.5	05/13/86
MW-6A	Alluvium/Clay	4.5 - 9.5	2.9	05/14/86
MW-6B	Till/Upper bedrock	22.5 - 27.5	10.9	05/14/86
MW-6C	*Upper bedrock fracture zone	33.0 - 44.0	10.5	05/14/86
MW-6D	*Lower bedrock fracture zone	44.0 - 61.0	9.7	05/14/86
NFB-9	Upper bedrock	22.0 - 24.0	12.8	05/13/86
NFB-10	Upper bedrock	23.0 - 25.0	10.3	05/13/86

AFTER NUS, 1986b

Isopotential/potentiometric surfaces of the "A", "B", "C", and "D" wells, as observed in May 1986, are illustrated in Figures 3-4 through 3-7, respectively and are summarized in Figure 3-8. As shown in Figure 3-8, the shallow ground water flow direction is northwesterly under the LaSalle Area. Ground water flow in the confining clay/till (aquitard) is toward the southwest. The observed hydraulic gradients across the aquitard indicates there is a downward component of the flow in the LaSalle Area.

NUS (1986b) reported that the John Avenue sewer, a 42-inch diameter sanitary and storm sewer that bisects the LaSalle Area at an elevation of +550 feet above mean sea level (AMSL), may act as a significant ground water sink. Shallow ground water flow may be diverted towards the sewer excavation and, thus, channeled in a western downgradient direction. This possible sink would have the effect of limiting shallow ground water flow and any contaminant movement in a northwestward direction beyond John Avenue.

According to NUS (1986b), the similar flow directions of the "B" and "C" wells is most probably due to hydraulic connection between the two zones. This conclusion is supported by the apparent densely fractured and highly vugged nature of the upper 10 to 15 feet of bedrock ("C" zone).

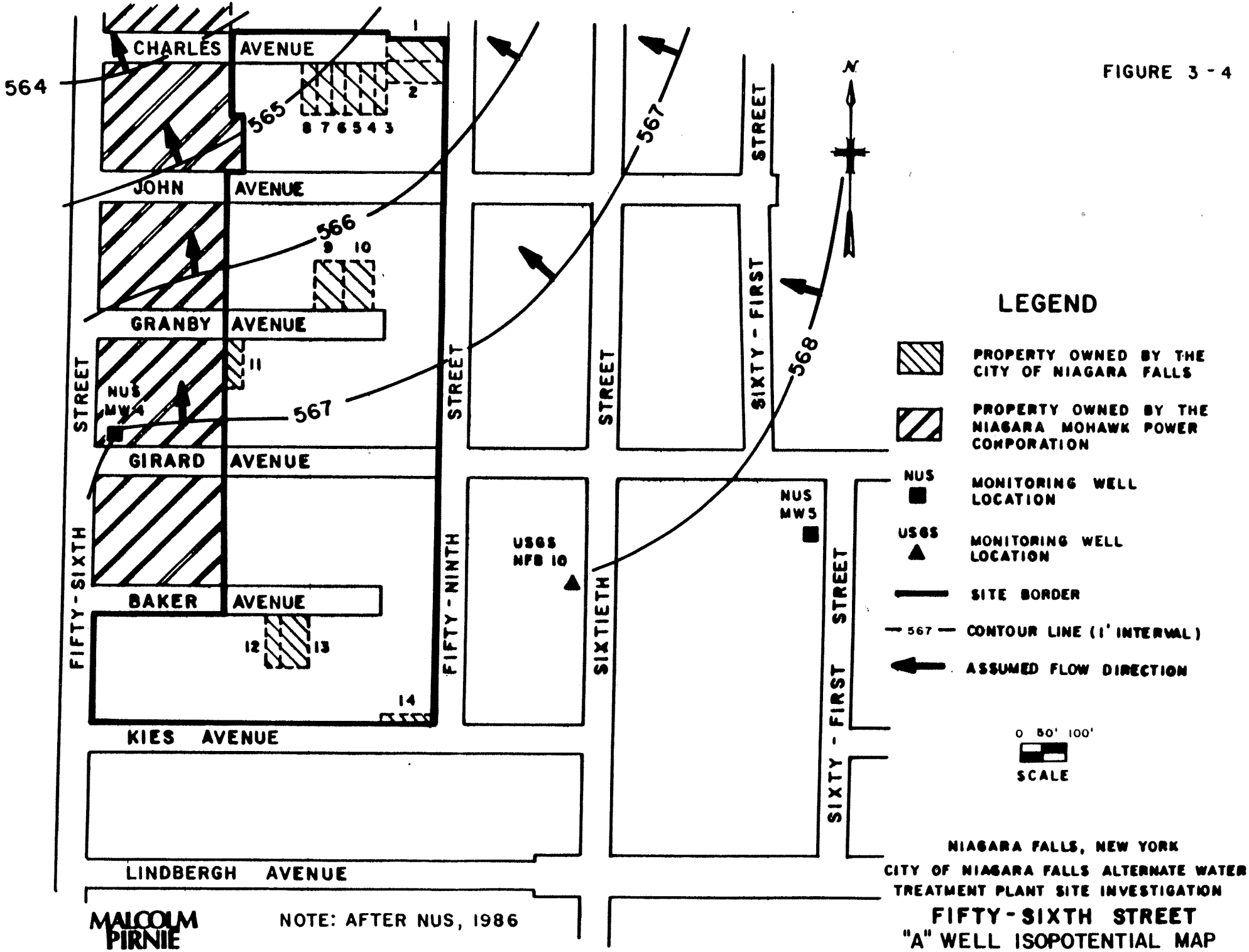
The more westerly flow of ground water in the "D" zone in the LaSalle Area suggests the hydrologic isolation of the lower fracture zone from the upper fracture zone. The westerly component of flow may, in part, be attributed to influence of the Niagara Power Project conduits (see Figure 2-2).

3.2.5 Results of Previous Sampling

3.2.5.1 Soil Results

Six (6) soil samples (see Figure 3-3 for sample locations) were collected and analyzed by NUS from the Fifty-ninth Street Site on 07/17/85. The soil samples were collected at depths of 12 to 19 inches below grade, with the exception of NYA9-S3, which was collected at a depth of 0 to 3 inches. Appendix A.2 (Exhibit Numbers A.2-1 and A.2-2)

FIGURE 3 - 4



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NOTE: AFTER NUS, 1986

NIAGARA FALLS, NEW YORK
CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION

FIFTY-SIXTH STREET
"A" WELL ISOPOTENTIAL MAP
(5-12-86)

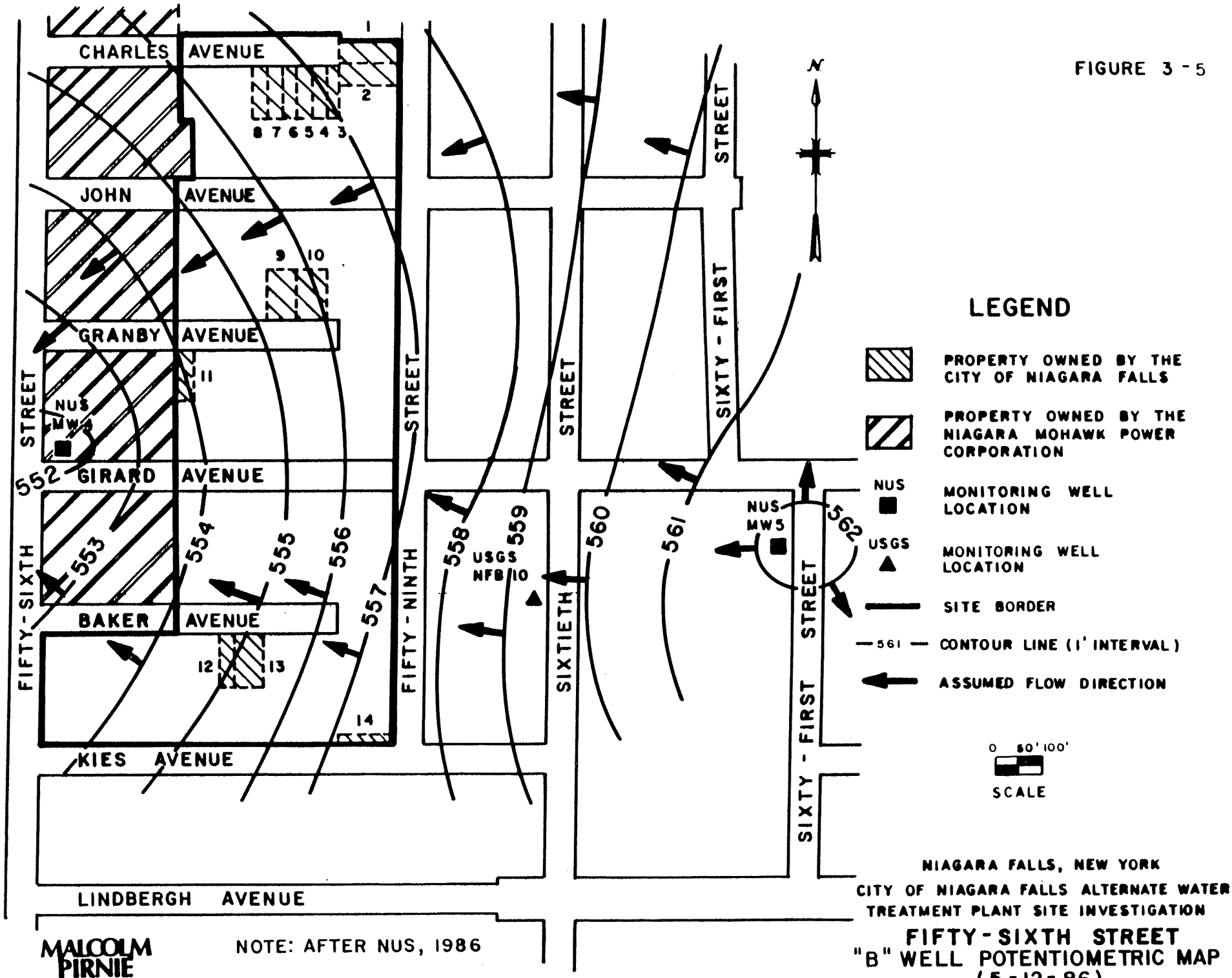

FIGURE 3-5

NIAGARA FALLS, NEW YORK
CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION

FIFTY-SIXTH STREET "B" WELL POTENTIOMETRIC MAP (5-12-86)

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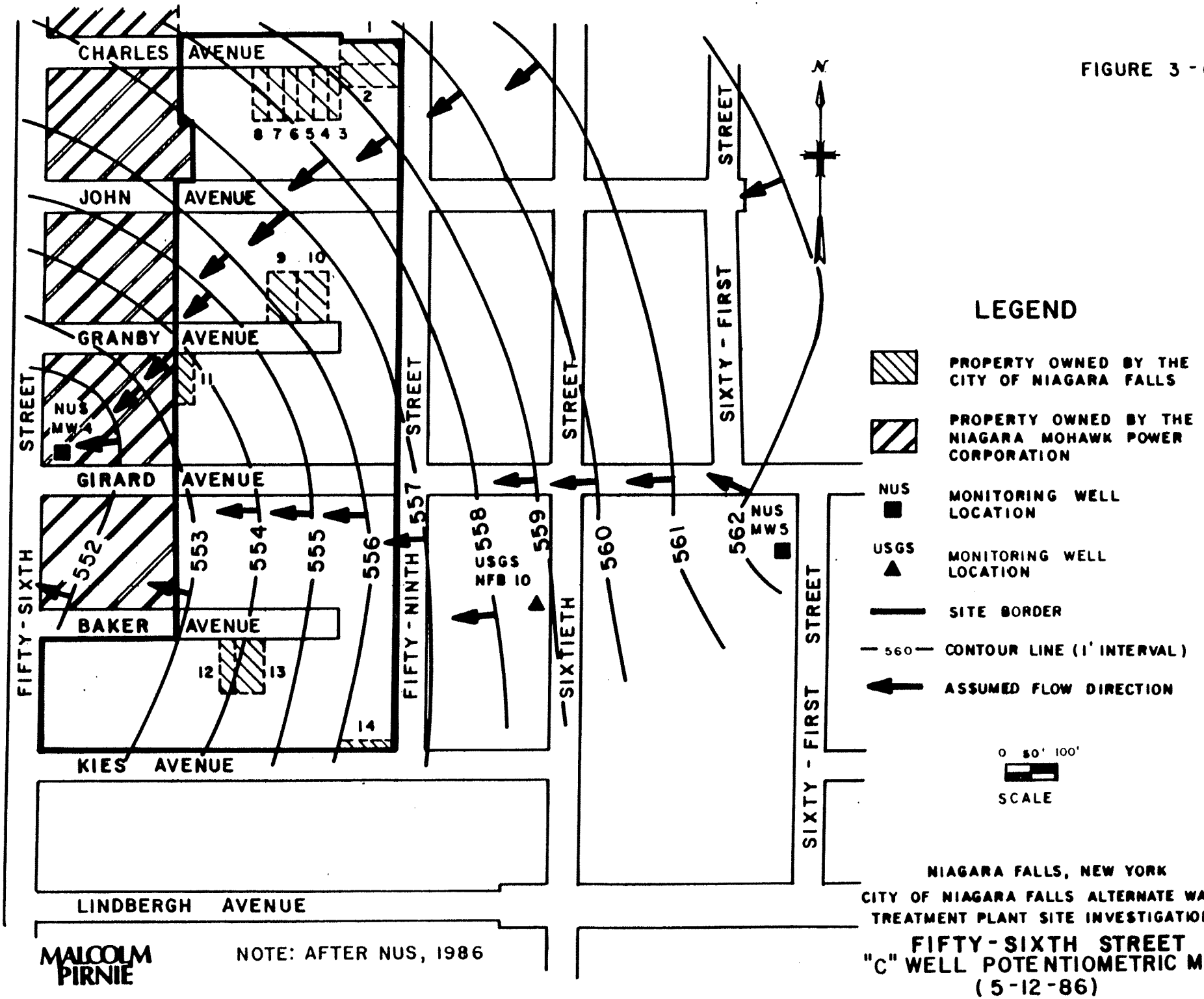
NOTE: AFTER NUS, 1986


CHARLES AVENUE
JOHN AVENUE
GRANBY AVENUE
GIRARD AVENUE
BAKER AVENUE
KIES AVENUE
LINDBERGH AVENUE
FIFTY-SIXTH STREET
FIFTY-NINTH STREET
SIXTIETH STREET
SIXTY-FIRST STREET
NUS MW4
NUS MW5
USGS NFB 10
552
553
554
555
556
557
558
559
560
561
562
N
LEGEND
PROPERTY OWNED BY THE CITY OF NIAGARA FALLS
PROPERTY OWNED BY THE NIAGARA MOHAWK POWER CORPORATION
NUS MONITORING WELL LOCATION
USGS MONITORING WELL LOCATION
SITE BORDER
560 CONTOUR LINE (1' INTERVAL)
ASSUMED FLOW DIRECTION
0 50' 100'
SCALE
NOTE: AFTER NUS, 1986
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NIAGARA FALLS, NEW YORK
CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION
FIFTY-SIXTH STREET
"C" WELL POTENTIOMETRIC MAP
(5-12-86)

FIGURE 3-6

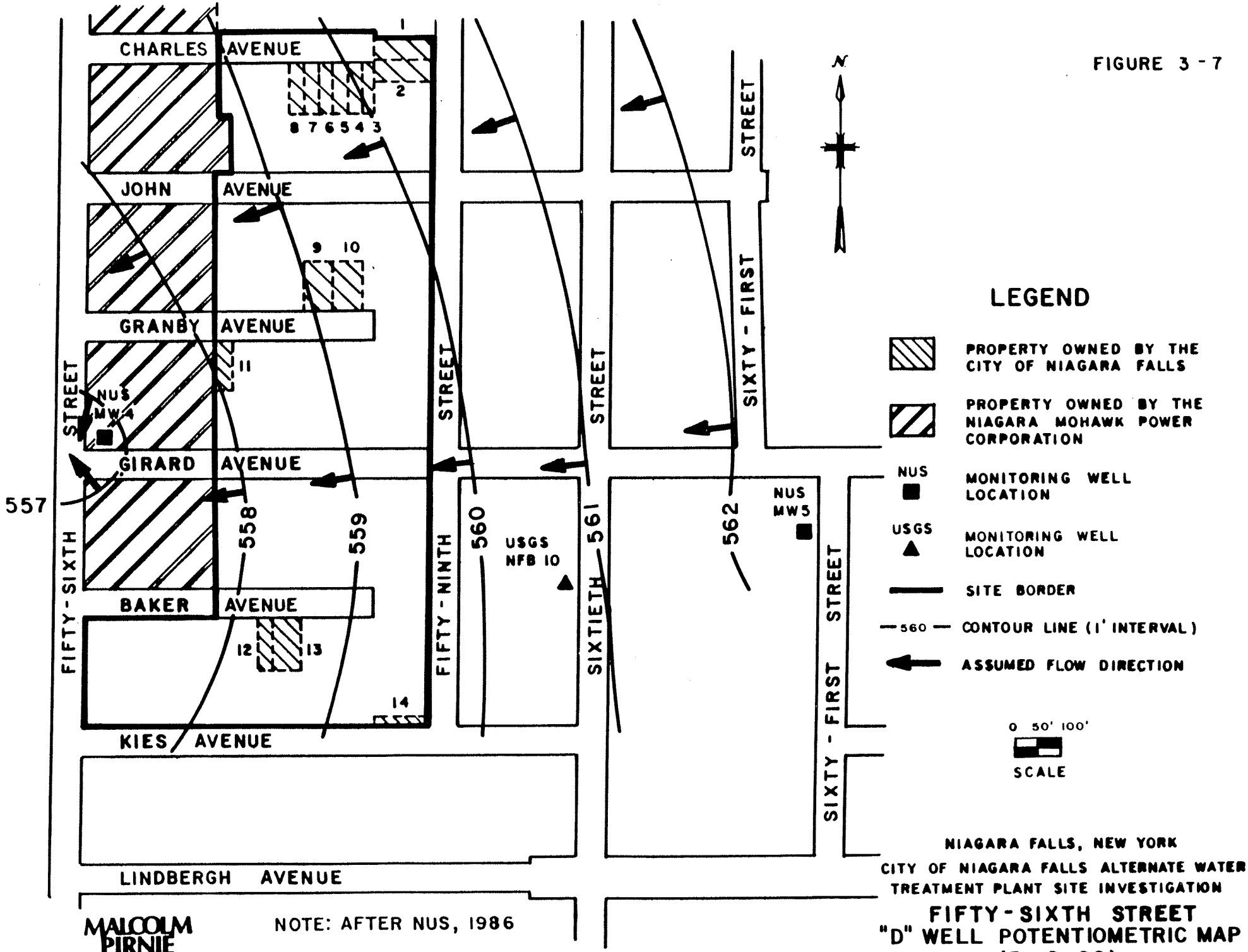

FIGURE 3-7

NOTE: AFTER NUS, 1986

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NIAGARA FALLS, NEW YORK
CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION

FIFTY-SIXTH STREET "D" WELL POTENTIOMETRIC MAP (5-12-86)

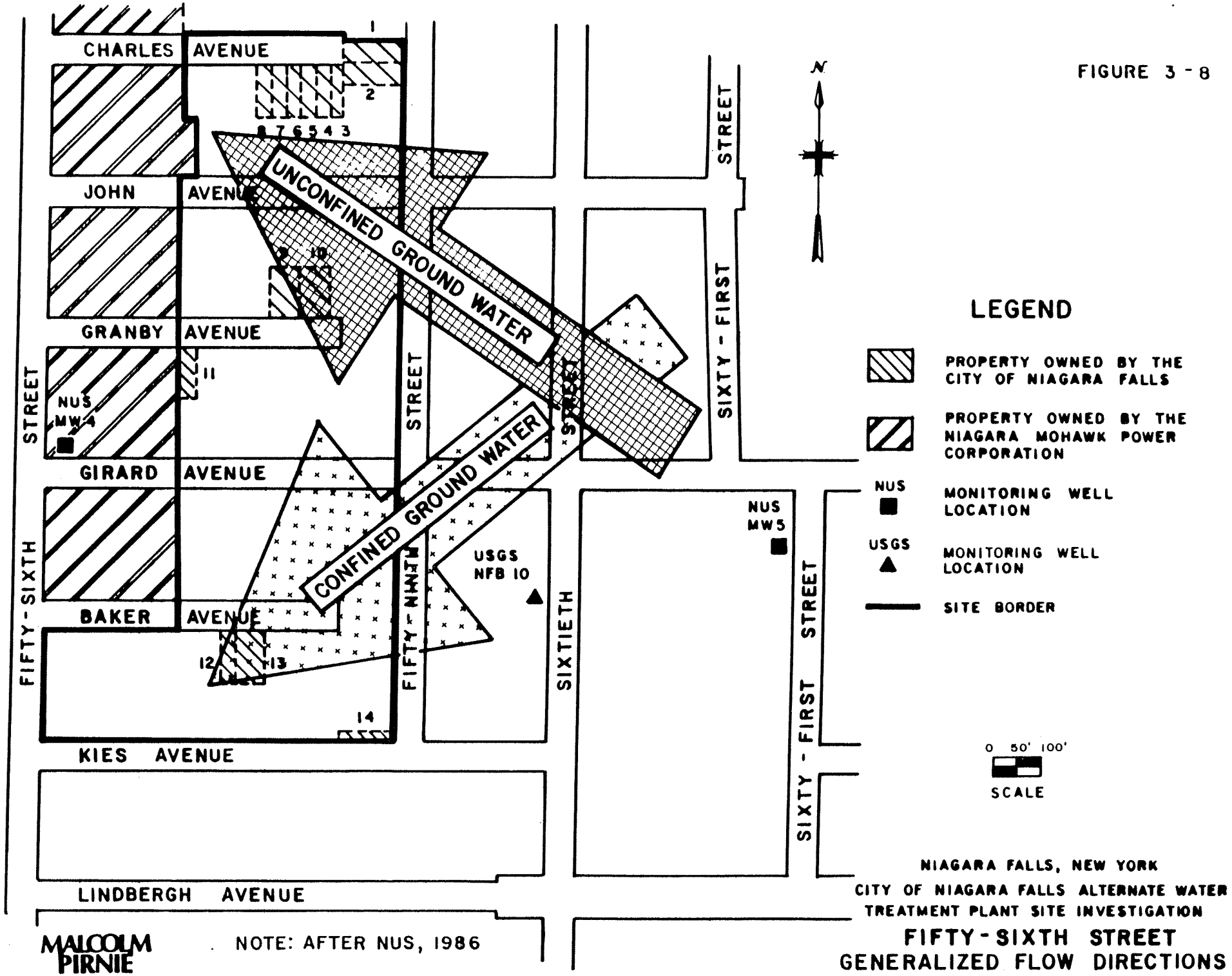

FIGURE 3 - 8

NOTE: AFTER NUS, 1986

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NIAGARA FALLS, NEW YORK
CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION

FIFTY-SIXTH STREET GENERALIZED FLOW DIRECTIONS

contains the analytical results and Table 3-6 summarizes the organic compounds detected in the shallow soil samples. Detected organics include polynuclear aromatic hydrocarbons (PAHs), phthalates and PCBs (Aroclon-1254). Acetone detected in well NYA9-S4 as well as its blank, is likely attributed to laboratory contamination. Elevated inorganics (metals) include barium, cadmium, chromium, lead, mercury and zinc.

Soil samples were also collected between 10/30/85 and 05/08/86 during installation of the six (6) NUS monitoring well clusters (NUS, 1986a) in the LaSalle area. The analytical results are presented in Appendix A.2 (Exhibit Number A.2-3). Table 3-7 summarizes the organics present in the soil samples and indicates that toluene is the predominant organic compound present at the Fifty-sixth Street Site. The compound 2-Butanone is also detected in the soil at the Site. Methylene chloride and acetone were detected in several soil samples as well as their blanks and/or rinsates; these are common laboratory contaminants suggesting their presence is related to possible/probable laboratory contamination. Of the inorganics analyzed (not summarized in Table 3-7), only lead was slightly elevated in the soil samples.

3.2.5.2 Ground Water Results

Two (2) rounds of ground water samples were collected from the NUS and USGS wells in the LaSalle Area. Exhibits A.2-4 and A.2-5 of Appendix A.2 contain the analytical results of the first (May 1986) and second (January 1987) rounds, respectively. A summary of the organics present in the ground water sampled from the wells at the Fifty-sixth Street Site (MW-4, MW-5, and NFB-10), Chevy Place Site (MW-1, MW-6, and NFB-9), and Janik Site (MW-5 and MW-6) is presented in Table 3-8. Acetone is suspected to have been present as a result of sampling equipment decontamination taking place in sub-freezing air temperatures, thus precluding evaporation of acetone from the equipment before sampling. Elevated inorganics in the ground water (not summarized in Table 3-8) include chromium, iron, lead, magnesium and manganese.

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TABLE 3-6

CITY OF NIAGARA FALLS ALTERNATE WATER
TREATMENT PLANT SITE INVESTIGATION

FIFTH-NINTH STREET SITE

SUMMARY OF ORGANICS PRESENT IN SOIL SAMPLES

Compound (ug/kg)	SAMPLE NYA9-S__ 1	2	3	4	5	6
Acetone				1000		
Naphthalene			900			
2-Methylnaphthalene			510			
Phenanthrene			1400			360
Fluoranthene			930			410
Pyrene			1300	770		590
Butylbenzylphthalate			7500			
Benzo (a) Anthrocene			610			
Bis (2-Ethylhexyl) Phthalate			1900			850
Chrysene			900			380
Benzo (b) Fluoranthene			1100			
Benzo (a) Pyrene			670			330
Indero (1,2,3-cd) Pyrene						350
Benzo (ghi) Perylene						420
1,2-Diphenyl Hydrazine			560			
Aroclor-1254	400	380	2700	720		520

FROM NUS, 1985a

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TABLE 3-7

CITY OF NIAGARA FALLS ALTERNATE WATER
TREATMENT PLANT SITE INVESTIGATION

LaSALLE AREA

SUMMARY OF ORGANICS PRESENT IN SOIL SAMPLES

Compound (ug/kg)	1				4				5				6			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Methylene Chloride												508				
Acetone		30													430	
2-Butanone												31				
Toluene	20		7.5	11	85		21	44	33	13	18	20				6

FROM NUS, 1986a

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TABLE 3-8

CITY OF NIAGARA FALLS ALTERNATIVE WATER
TREATMENT PLANT SITE INVESTIGATION

LaSALLE AREA

SUMMARY OF ORGANICS PRESENT IN GROUND WATER SAMPLES (1987)

Compound (ug/L)	SAMPLE MW-__-__																SAMPLE NFB-__	
	1				4				5				6					
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	9	10
Acetone	580	340	3200													63000	58000	7900
Carbon Disulfide										7				22				
2-Chlorophenol									15									
Bis (2-Ethylhexyl) Phthalate									65	15								
Endosulfan Sulfate			0.12															
Total Organic Halogens		23	124	8.9	40			11		80	52	15		107	9.2	20	54	239
Ammonia Nitrogen	0.16	10	12	2.5		0.65		2.5		7.3	1.7	1.4		8.9	1.5	0.45	8.8	14
Chloride	99	1350	1630	418	40	73		376	31	776	641	67	23	729	1090	398	1760	1240
Phenolics			0.01															
Sulfate	119		1400	1160	108			835	62	888	1260	57	71	832	1510	1330	333	1050
Total Organic Carbon	4.7	3.9	7.6	6.7	3.8			4.4	6.5	5.8	6.1	44	3.2	4.1	2.8	4.5	6.8	6.1

FROM NUS, 1987

3.3 CHEVY PLACE SITE

3.3.1 Location and Ownership

The Chevy Place Site was acquired by Richard S. Massaro in 1988. This site, which is located between Chevy Place and 100 feet east of Sixty-first Street and between Girard Avenue and a line extending parallel with John Avenue, is approximately 9.2 acres in size (Figure 3-9).

3.3.2 History

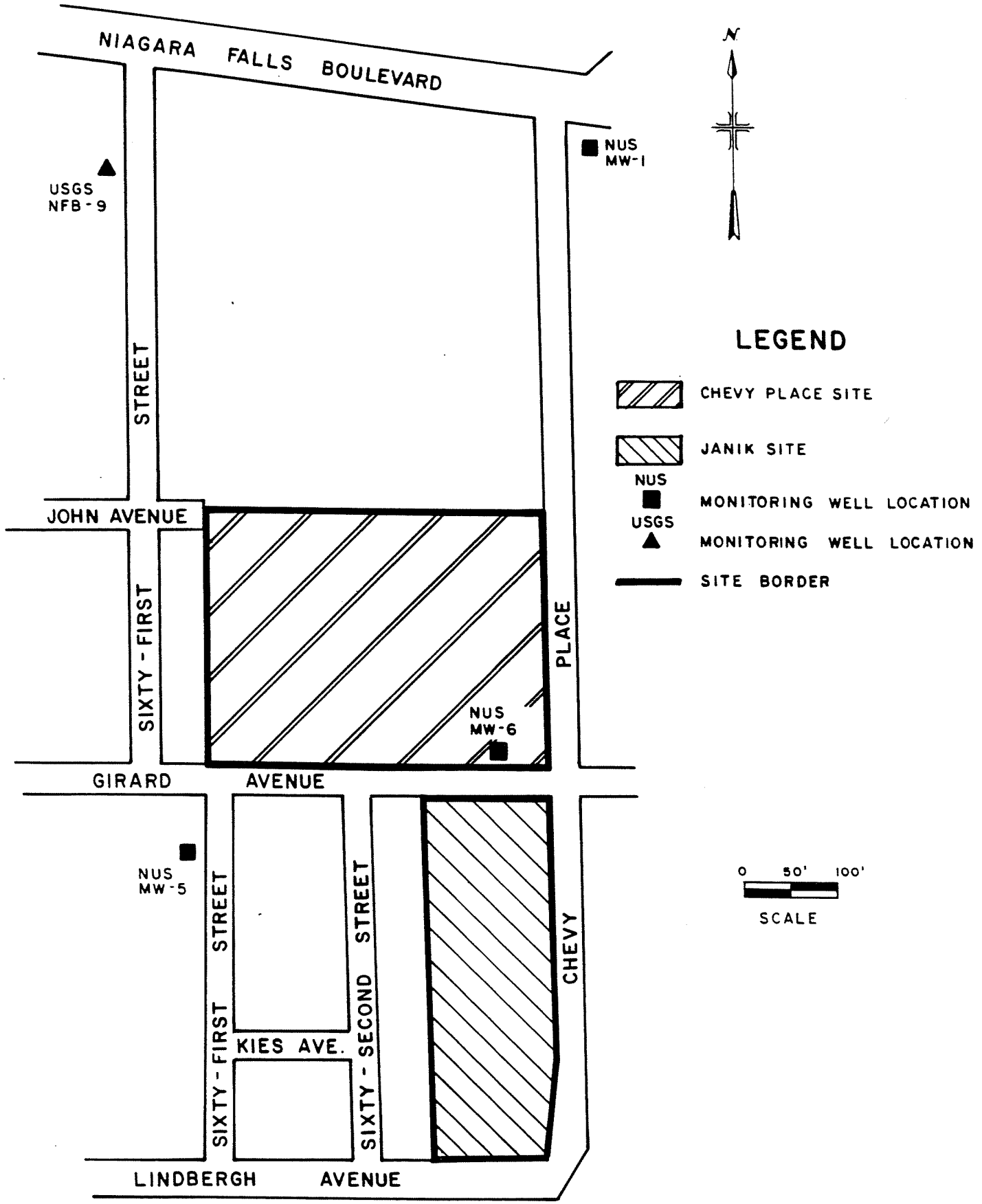
This Site is believed to have been farmland prior to about 1950. A 1935 USGS topographic map indicates that the area drained to the north at that time and that a swale cut through the central portion of the Site which directed drainage via a perennial stream to Cayuga Creek.

The City of Niagara Falls operated a municipal landfill on the Site during the 1950s and early 1960s. Domestic and commercial wastes are suspected to be the principal fill, although the disposal of industrial wastes is a possibility. Based on a review of 1958 USDA aerial photography (ARE-3U-85), the area north of the Site appears disturbed suggesting landfilling activities. A 1966 photograph (ARE-2GG-53) shows the Chevy Place Site to be leveled and grassed.

In 1985, NUS Corporation conducted a site inspection of the municipal landfill which encompasses a portion of the Chevy Place Site (USEPA Technical Directive Document No. 02-8505-07). This landfill, designated by NUS (1985b) as the Sixty-fourth Street Dump - South, is approximately 10 acres in size (Figure 3-10). There are several areas where garbage, ash, construction debris, and furnace slag are exposed at the surface. The results of chemical analyses for 25 soil samples collected by NUS at the dump are presented in Section 3.3.5.

In 1986, NUS conducted a hydrogeologic investigation of the LaSalle Area, which encompasses the Chevy Place Site (see Section 3.2.2). Soil and ground water samples were collected and the analytical results are presented in Section 3.3.5.

FIGURE 3-9



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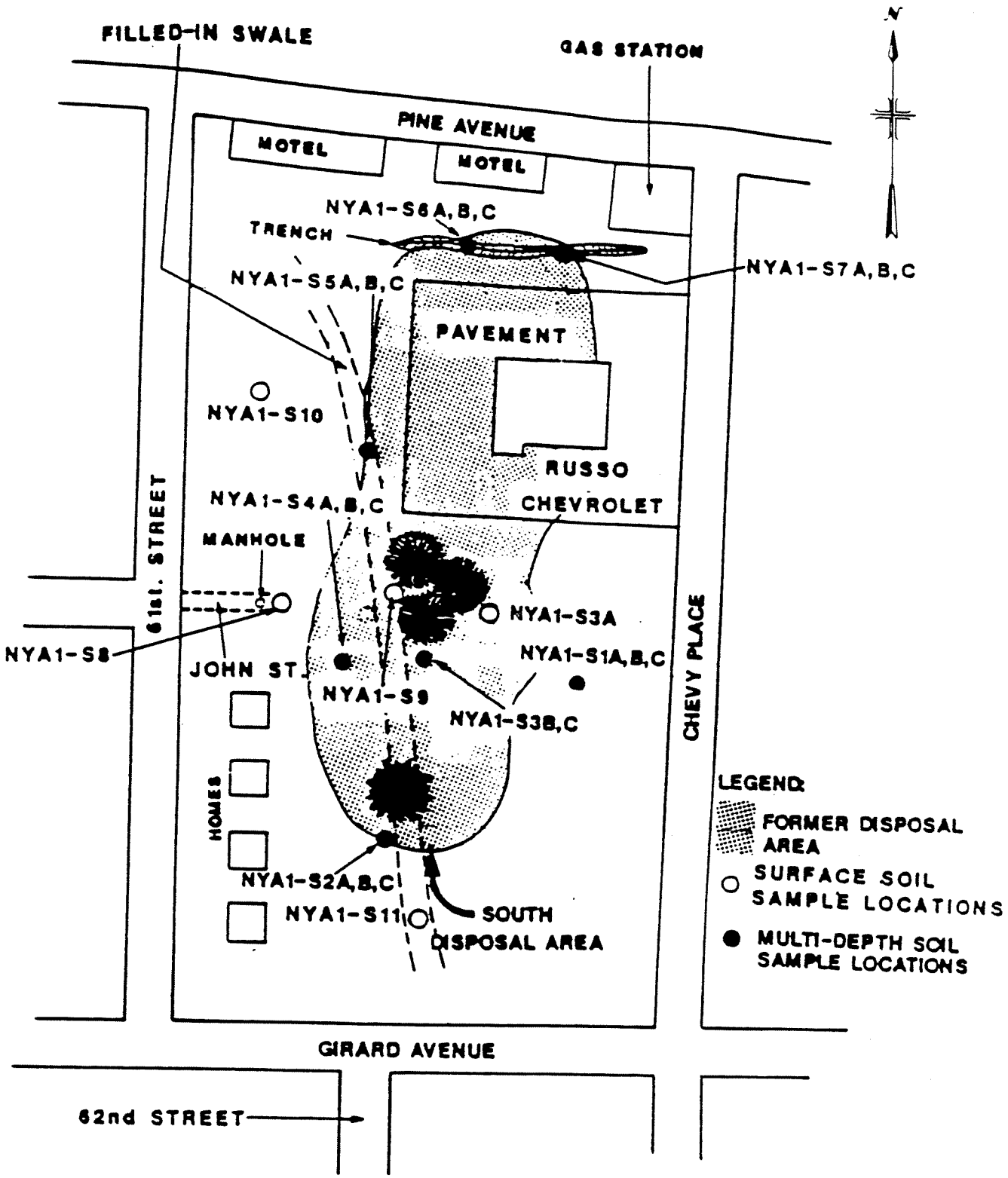
NIAGARA FALLS, NEW YORK
CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION
CHEVY PLACE AND JANIK SITE MAP

FIGURE 3-10



NOTE: FROM NUS, 1985b

NIAGARA FALLS, NEW YORK
CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION

64TH STREET DUMP - SOUTH
SAMPLE LOCATION MAP

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Recent site inspection indicates the presence of four (4) private residences east of Sixty-first Street bordering on the Site. The Site consists mostly of open areas with a cover of grass and scrub vegetation and is rough graded, with some depressions and mounding. The Chevy Place Site is bordered on the south (excluding the Janik Site) and west by a residential neighborhood. To the north and east are a highly developed commercial/industrial area and the Interstate 190 embankment.

3.3.3 Geology

Figure 3-9 illustrates the NUS (MW-1 and MW-6) and USGS (NFB-9) wells located nearest to the Chevy Place Site. Appendix A.1 (Exhibit Numbers A.1-2 and A.1-3) contains the logs for these wells. Since MW-6 is located near the southern border of the Site and the other monitoring wells lie to the north, it is assumed that the stratigraphy is continuous under the Site between the well locations. The stratigraphy encountered in MW-1, MW-6, and NFB-9, with the exception of fill in all three (3) wells, corresponds with the regional geology of the Niagara Falls Area (Table 3-1).

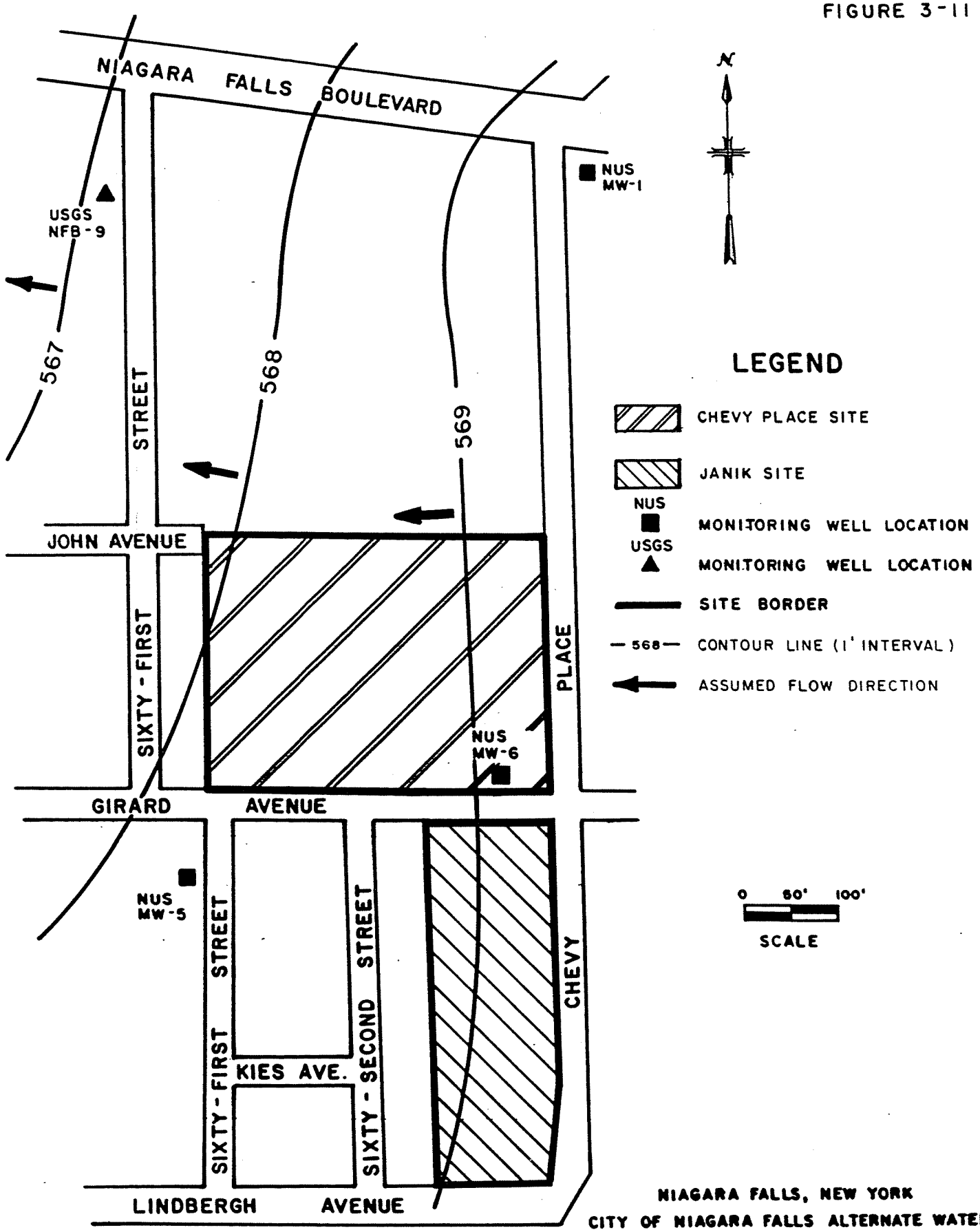
The fill encountered in NUS wells MW-1 and MW-6 is described as loose to medium dense, tan to yellow-brown to dark brown sand and silt, as well as miscellaneous fill and organic debris. The fill in NFB-9 is described as gravelly silt with bricks and oily, black chemical stains. Moisture conditions within the fill vary from dry to moist. The thickness of the fill varies across the area from 1.0 (MW-6) to 7.0 (NFB-9) feet and averages 4.0 feet.

The native stratigraphic units underlying the fill include: alluvium, which is 0 (NFB-9) to 4.5 (MW-6) feet thick and averages 2.5 feet; lacustrine clay, which is 9.5 (NFB-9) to 13.0 (MW-6) feet thick and averages 11.2 feet; till, which is 1.5 (NFB-9) to 6.2 (MW-6) feet thick and averages 3.9 feet; and Lockport dolostone.

3.3.4 Hydrogeology

The hydrogeology of the Chevy Place Site is similar to that of the Fifty-sixth Street Site (see Section 3.2.4). Figures 3-11 through 3-14 illustrate the isopotential/potentiometric surfaces of the "A", "B",

FIGURE 3-11



NOTE: AFTER NUS, 1986

NIAGARA FALLS, NEW YORK
CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION
CHEVY PLACE/JANIK SITES
"A" WELL ISOPOTENTIAL MAP
(5-12-86)

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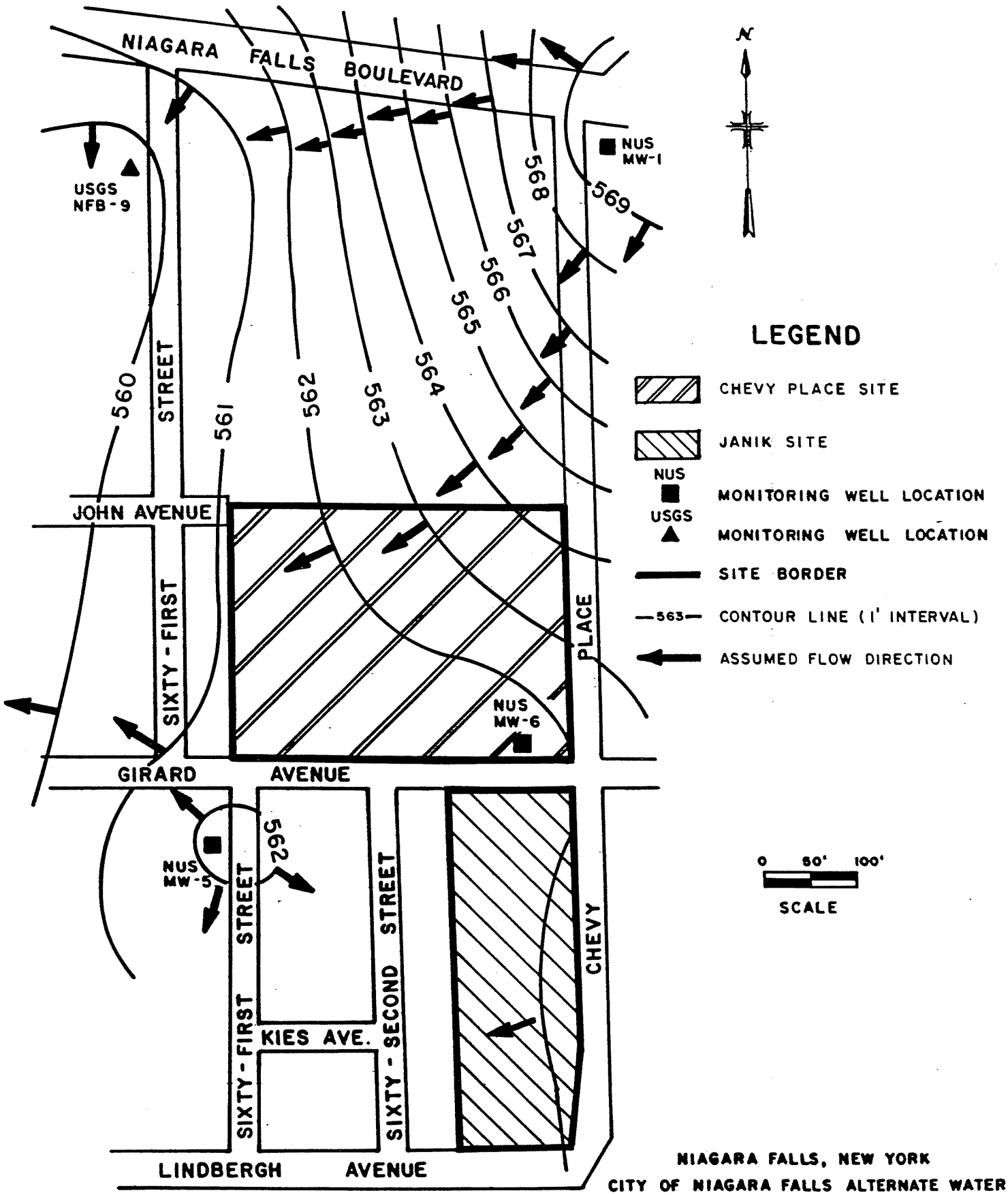
FIGURE 3-12



NOTE: AFTER NUS, 1986

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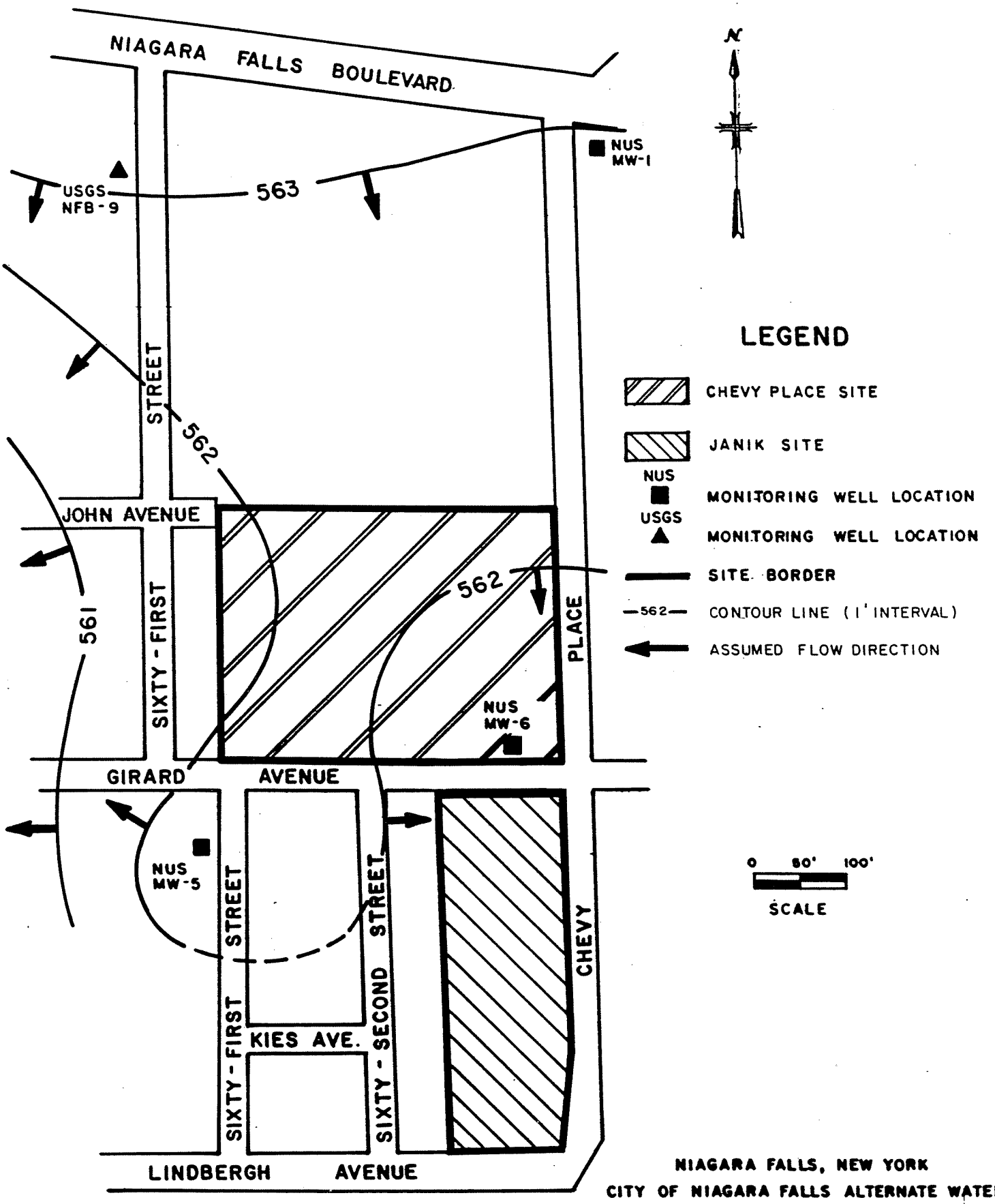
NIAGARA FALLS, NEW YORK
CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION
CHEVY PLACE/JANIK SITES
"B" WELL POTENTIOMETRIC MAP
(5-12-86)

FIGURE 3-13



NOTE: AFTER NUS, 1986

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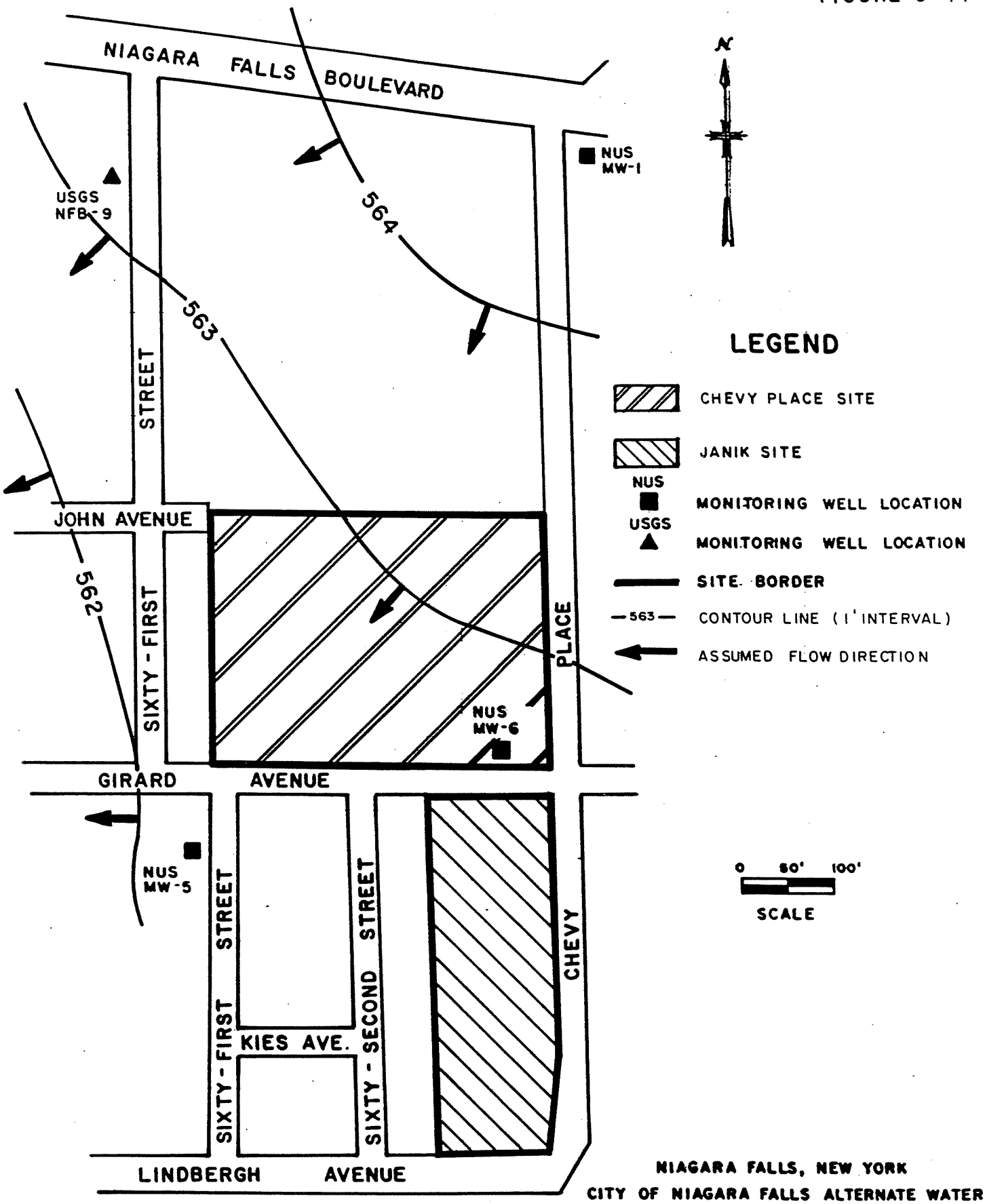
NIAGARA FALLS, NEW YORK
CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION
CHEVY PLACE/JANIK SITES
"C" WELL POTENTIOMETRIC MAP
(5-12-86)

FIGURE 3-14



NOTE: AFTER NUS, 1986

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NIAGARA FALLS, NEW YORK
CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION
CHEVY PLACE/JANIK SITES
"D" WELL POTENTIOMETRIC MAP
(5-12-86)

"C", and "D" wells, as observed in May 1986, and Figure 3-15 shows that shallow ground water flow is to the northwest and that ground water flow beneath the confining clay/till (aquitard) is to the southwest. The vertical component of flow under the Site is in a downward direction.

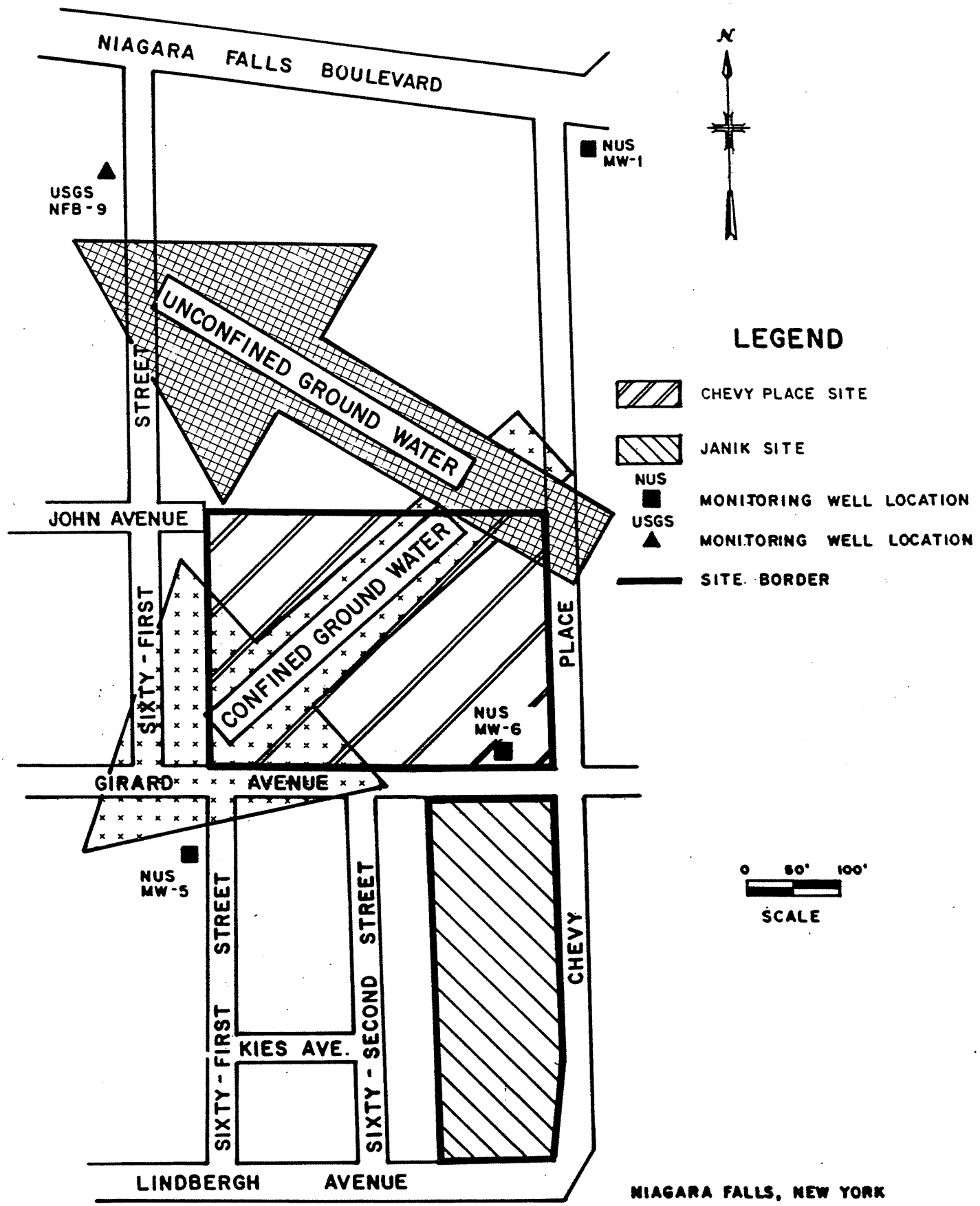
3.3.5 Results of Previous Sampling

3.3.5.1 Soil Results

A total of 25 soil samples (see Figure 3-10 for sample locations) were collected by NUS and analyzed from the Sixty-fourth Street Dump - South between 06/10/85 and 06/11/85. Eleven (11) samples were collected at the surface, seven (7) at depths of 1 to 2 feet, and seven (7) at depths of 5 to 6.5 feet. Appendix A.2 (Exhibit Numbers A.2-6 and A.2-7) contains the analytical results and Table 3-9 summarizes the organics present in the shallow soil samples. Organic compounds detected in the soils include PAHs, phthalates, trichloroethene and endosulfan sulfate. Methylene chloride and acetone, which were detected in several soil samples as well as their blanks and/or rinsates, are indicative of possible/probable laboratory contamination. Elevated inorganics in the soil samples (not summarized in Table 3-9) include chromium (one sample) and zinc (one sample).

Additional soil samples were collected by NUS from the LaSalle Area between 10/30/85 and 05/08/86. Appendix A.2 (Exhibit Number A.2-3) contains the analytical results and Table 3-7 summarizes the organics present in the soil samples and indicates that toluene is the predominant organic compound present at the Chevy Place Site. Acetone was again detected in two (2) soil samples as well as their blanks and/or rinsates, indicating possible/probable laboratory contamination. Inorganic (metals) concentrations show considerable variability as would be expected considering past disposal practices, but are generally below levels of significant concern.

FIGURE 3-15



NOTE: AFTER NUS, 1986

NIAGARA FALLS, NEW YORK
CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION
CHEVY PLACE/JANIK SITES
GENERALIZED FLOW DIRECTIONS

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TABLE 3-9
SIXTY-FOURTH STREET DUMP-SOUTH
SUMMARY OF ORGANICS PRESENT IN SOIL SAMPLES

SAMPLE NYA1-S__

COMPOUND	1			2			3			4		
(ug/kg)	A	B	C	A	B	C	A	B	C	A	B	C
Methylene Chloride	50	38	29	82	32	30	40	38	69	48	36	25
Phenanthrene	1100			1200			1400	590	1400	1200		
Anthracene									410			
Fluoranthene	1300	390		1700			1800	610	1800	1900		
Pyrene	1300	410		1900			1600	760	1800	1300		
Benzo (a) Anthracene	850			910			1100	390	1100	1000		
Bis (2-Ethylhexyl) Phthalate									2500			
Chrysene	980			1000			1200	450	1200	1100		
Benzo (b) Fluoranthene	1000			1400			1600	570	1500	970		
Benzo (k) Fluoranthene	830			1000			1100	380	1400	790		
Benzo (a) Pyrene				1200			1200	410	1300	990		
Indeno (1,2,3-cd) Pyrene				840			810		910	400		
Benzo (ghi) Perylene				740						420		
Acetone												29
Naphthalene												
Acenapthene												
Dibenzo (a,h) Anthracene												
Alpha-BHC												
Beta-BHC												
Trichloroethene												
Endosulfan Sulfate												

FROM NUS, 1985b

TABLE 3-9
SIXTY-FOURTH STREET DUMP-SOUTH
SUMMARY OF ORGANICS PRESENT IN SOIL SAMPLES

	SAMPLE NYA1-S__												
COMPOUND	5			6			7			8	9	10	11
(ug/kg)	A	B	C	A	B	C	A	B	C				
Methylene Chloride	44	63	60	60	35		67	37		28		34	26
Phenanthrene	2600	2100	590	400			36000	1300	410	920	550	3600	1300
Anthracene	660	490										820	410
Fluoranthene	3500	2600	570	670			50000	1900	480	1300	660	4600	2200
Pyrene	2800	2200	480	730			61000	1700		1000	610	4300	3000
Benzo (a) Anthracene	2400							670		680	460	2900	1400
Bis (2-Ethylhexyl) Phthalate	490	2300	510									1800	1000
Chrysene	2700	1600		410				750		710	520	2900	1500
Benzo (b) Fluoranthene	3000	2300	510					860		670	570	3300	
Benzo (k) Fluoranthene	2600	1600		550			26000	680		680	450	2800	
Benzo (a) Pyrene	2900	1900		460				670		690	500	3200	1600
Indeno (1,2,3-cd) Pyrene	1200	830		400							440	1600	
Benzo (ghi) Perylene	1200											1700	
Acetone	17				100		12			290			
Naphthalene	400											450	
Acenapthene	490											530	
Dibenzo (a,h) Anthracene	400										400	560	
Alpha-BHC	23			34		13				110			
Beta-BHC	330			40		1							
Trichloroethene								6.9					
Endosulfan Sulfate													180

FROM NUS, 1985b

3.3.5.2 Ground Water Results

NUS collected ground water samples from wells completed in the vicinity of the Chevy Place Site in January 1987. Exhibit Number A.2-5 of Appendix A.2 contains the analytical results and Table 3-8 summarizes the organics present in the ground water samples. Acetone detected in the samples is suspected to have been present as a result of sampling equipment decontamination taking place in sub-freezing air temperatures, thus precluding evaporation of acetone from the equipment before sampling. Elevated concentrations of inorganics (metals) (not summarized in Table 3-8) include arsenic, barium, chromium, iron, lead, magnesium, manganese and zinc.

3.4 JANIK SITE

3.4.1 Location and Ownership

The Janik Site was acquired by Walter J. Janik on 05/23/56. The site, which is located between Chevy Place and 110 feet east of Sixty-second Street and between Girard and Lindbergh Avenues (see Figure 3-9), is approximately 4.9 acres in size. North of Girard Avenue is the Chevy Place Site.

3.4.2 History

This Site is believed to have been farmland prior to about 1950. A 1935 USGS topographic map indicates that the area drained to the north at that time and that a swale through the center of the Site supported a perennial stream eventually entering Cayuga Creek.

According to Mr. Janik (pers. comm., 1989), the topsoil had been removed from his property before he purchased it in 1956. In the late 1960s and early 1970s, Mr. Janik allowed the City to dump clean demolition debris (concrete, brick, and asphalt rubble) from urban renewal projects on his property to fill in low lying areas. He reported that "There was no disposal of Hooker (OCC) wastes on this property."

In 1986, NUS conducted a hydrogeologic investigation of the LaSalle Area, which encompasses the Janik Site (see Section 3.2.2). Soil and ground water samples were collected and the analytical results are presented in Section 3.4.5.

Recent Site inspection indicates that the northern half of the Site consists mostly of open areas with a cover of grass and scrub vegetation and that several groves of deciduous trees are present on the southern half. In addition, the Site is rough graded with much of the property below the level of the street. There are several areas where demolition debris is exposed at the surface and where shallow pits are present. The Site is bordered on the south and west by a residential neighborhood. To the north is the Chevy Place Site and a highly developed commercial/industrial area and to the east is the Interstate 190 embankment.

3.4.3 Geology

Figure 3-9 illustrates the NUS (MW-5 and MW-6) wells located nearest to the Janik Site. Appendix A.1 (Exhibit Number A.1-3) contains the logs for these wells. Since MW-6 is located north of the Site and MW-5 lies to the west, it is assumed that the stratigraphy is continuous under the Site between the well locations. The stratigraphy encountered in MW-5 and MW-6, with the exception of fill in both wells, corresponds with the regional geology of the Niagara Falls Area (Table 3-1).

The fill encountered in NUS wells MW-5 and MW-6 is described as loose to medium dense, brown to yellow-brown sand and silt, as well as miscellaneous fill and organic debris. Moisture conditions within the fill vary from dry to wet. The thickness of the fill varies from 1.0 (MW-6) to 2.0 (MW-5) feet and averages 1.5 feet.

The native stratigraphy underlying the fill includes: alluvium, which is 4.9 (MW-6) to 11.9 (MW-5) feet thick and averages 8.2 feet; lacustrine clay, which is approximately 13.0 feet thick; till, which is 1.9 (MW-5) to 6.2 (MW-6) feet thick and averages 4.0 feet; and Lockport dolostone.

3.4.4 Hydrogeology

The hydrogeology of the Janik Site is similar to that of the Chevy Place Site (see Section 3.3.4).

3.4.5 Results of Previous Sampling

3.4.5.1 Soil Results

As indicated in Section 3.2.5.1, NUS collected soil samples from the LaSalle Area between 10/30/85 and 05/08/86. Appendix A.2 (Exhibit Number A.2-3) contains the analytical results and Table 3-7 summarizes the organics present in the soil samples. Discussion of the analytical results for surrounding areas are presented in Sections 3.2.5.1 and 3.3.5.1.

3.4.5.2 Ground Water Results

Again as indicated in Section 3.2.5.2, NUS collected ground water samples from wells bordering the Janik Site in January 1987. Exhibit A.2-5 of Appendix A.2 contains the analytical results. The organics present in the ground water samples are summarized in Table 3-8. See Sections 3.2.5.2 and 3.3.5.2 for a discussion of the analytical results.

3.5 BUFFALO AVENUE (NYPA) SITE

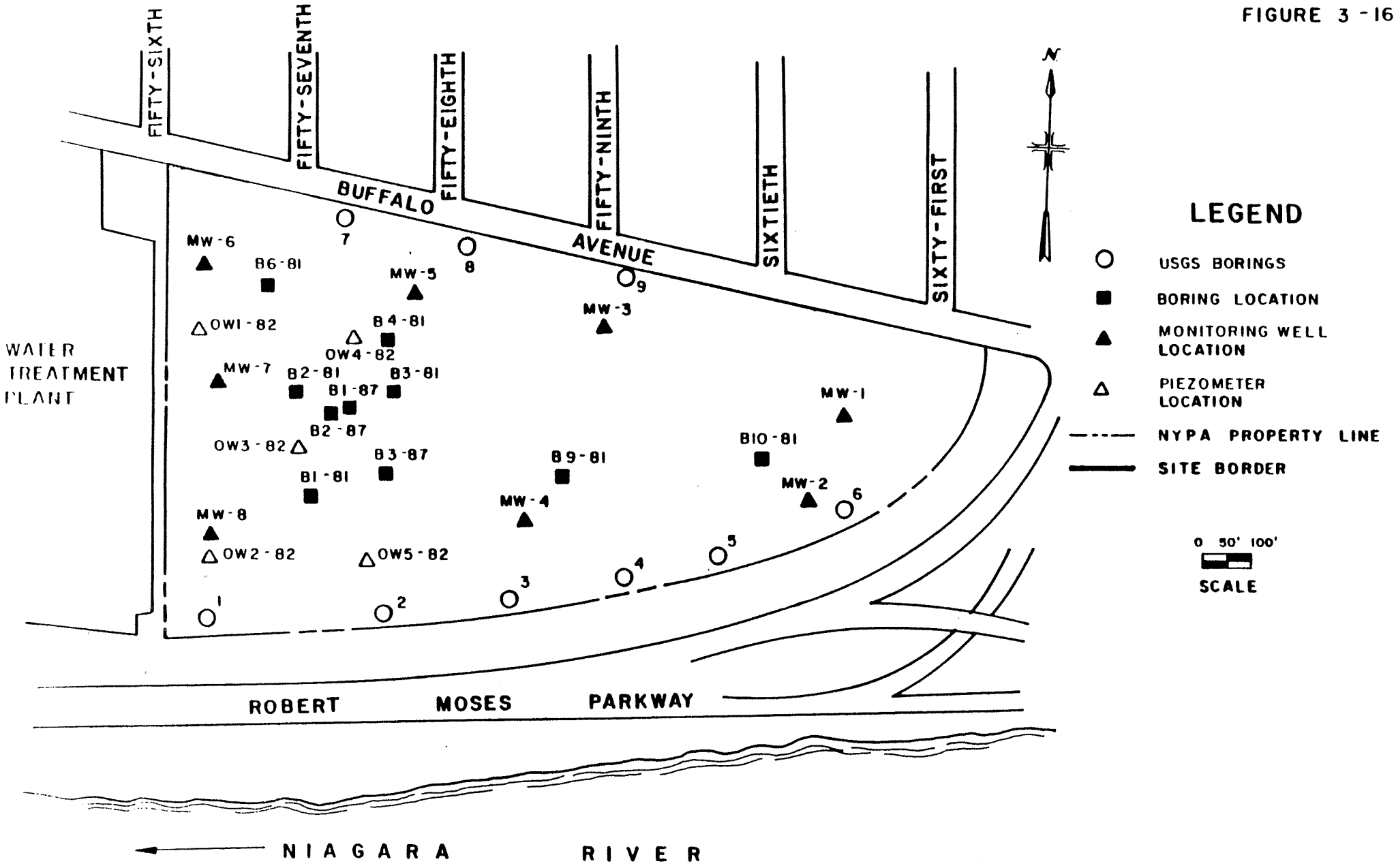
3.5.1 Location and Ownership

The Buffalo Avenue Site (NYSDEC No. 932080) is located between Buffalo Avenue and the Robert Moses Parkway from Fifty-sixth Street to beyond Sixty-first Street (Figure 3-16). The 30-acre property was acquired by the NYPA in 1958 and is bordered on the west by the East Area Site owned by the City of Niagara Falls (see Section 3.5.1).

3.5.2 History

According to the NCDOH, the site was originally a wetland area. A comparison of 1927 and 1980 City of Niagara Falls maps reveals that the shoreline has been extended as far as 700 feet into the Niagara River

FIGURE 3 - 16



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NIAGARA FALLS, NEW YORK
CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION
BUFFALO AVENUE SITE MAP

during that period of time. This extension is the result of three (3) operations:

1) disposal of refuse, incinerator residue, and noncombustibles by the City of Niagara Falls from the 1930s to the 1950s;

2) disposal of clean dredged material from the construction of the Niagara River Ice Canal by the NYPA; and

3) disposal of clean fill from the Niagara Power Project conduit excavations by the NYPA from 1958 to 1963.

The first operation extended the shoreline to just north of the Parkway and the second and third operations extended the shoreline to its present position. USDA aerial photographs taken in 1958 (ARE-3U-85) and 1966 (ARE-2GG-53) verify the extent of the Buffalo Avenue Site prior to the Parkway construction and that the Parkway was in place by 1966, respectively. However, all disposal activities are believed to have ceased prior to 1963.

Originally, the Buffalo Avenue Site was assembled from mostly residential subparcels sometime after 1946, which included privately owned homes along Buffalo Avenue and various residential businesses, such as a bowling alley, motel, hotel, and marina (Dames & Moore, 1988). All structures on the Site were demolished after 1958.

Four (4) drilling investigations have been conducted on the Buffalo Avenue Site since 1981. Seven (7) boreholes were installed by Pittsburgh Testing Laboratories (PTL) on behalf of Hysen Supplies, Inc. as part of a foundation related soil investigation in mid-1981. In 1982, Conestoga-Rovers & Associates, Ltd. (CRA) was contracted by OCC to install five (5) piezometers on the Site in order to determine ground water levels in the overburden material. In the summers of 1982 and 1983, the USGS completed nine (9) soil borings on the Buffalo Avenue Site as part of a sampling program of inactive hazardous waste disposal sites adjacent to the Niagara River. In late 1987, Dames & Moore conducted a Phase II investigation (as requested by the NYPA) of the Site, which included the installation of eight (8) clusters of overburden and bedrock wells, the completion of three (3) soil borings, a seismic survey, and a soil and ground water sampling and analysis program (Dames & Moore, 1988).

Recent Site inspection indicates that the surface is relatively flat with an elevated area in the center and a lower lying area near the southwest corner, which may represent an embankment in the Niagara River which has been filled. A few scattered shallow depressions are located near Buffalo Avenue and may represent differential settlement of soil associated with the filling of residential foundations. The Robert Moses Parkway is located to the south and east, the WTP to the west, and a residential neighborhood to the north.

3.5.3 Geology

Figure 3-16 shows the locations of wells, soil borings, and piezometers completed at the Buffalo Avenue Site. These are identified as follows:

- PTL (B1-81 through B4-81, B6-81, B9-81, and B10-81);
- CRA/OCC (OW1-82 through OW5-82);
- USGS (1 through 9);
- Dames & Moore (MW-1 through MW-8 and B1-87 through B3-87)

Appendix A.1 (Exhibit Numbers A.1-4 through A.1-7) contains the logs for these boreholes and the stratigraphy is summarized in Table 3-10. The stratigraphy encountered at the NYPA Site, with the exception of fill corresponds with the regional geology of the Niagara Falls Area.

The fill encountered at the Buffalo Avenue Site is described as brown to black silty sand with clay and gravel, as well as demolition debris, incinerator waste, cinders, fly ash, slag, carbon waste, shot-rock, and organic debris. Moisture conditions within the fill vary from dry to wet. The thickness of the fill varies across the area from 0 to 20.0 (MW-4) feet and averages 9.5 feet (Figure 3-17). The thickest fill is located at the south-central portion of the site. The fill thins to extinction near Buffalo Avenue.

The native stratigraphic units underlying the fill include: alluvium, which is 0 to 13.0 (MW-8) feet thick and averages 5.9 feet; lacustrine clay, which is 0 to 19.5 (MW-6) feet thick and averages 12.1 feet; till, which is 2.8 (OW2-82) to 14.5 (MW-4) feet thick and averages 9.0 feet; and Lockport dolostone.

TABLE 3-10
ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION
BUFFALO AVENUE SITE
STRATIGRAPHIC SUMMARY TABLE

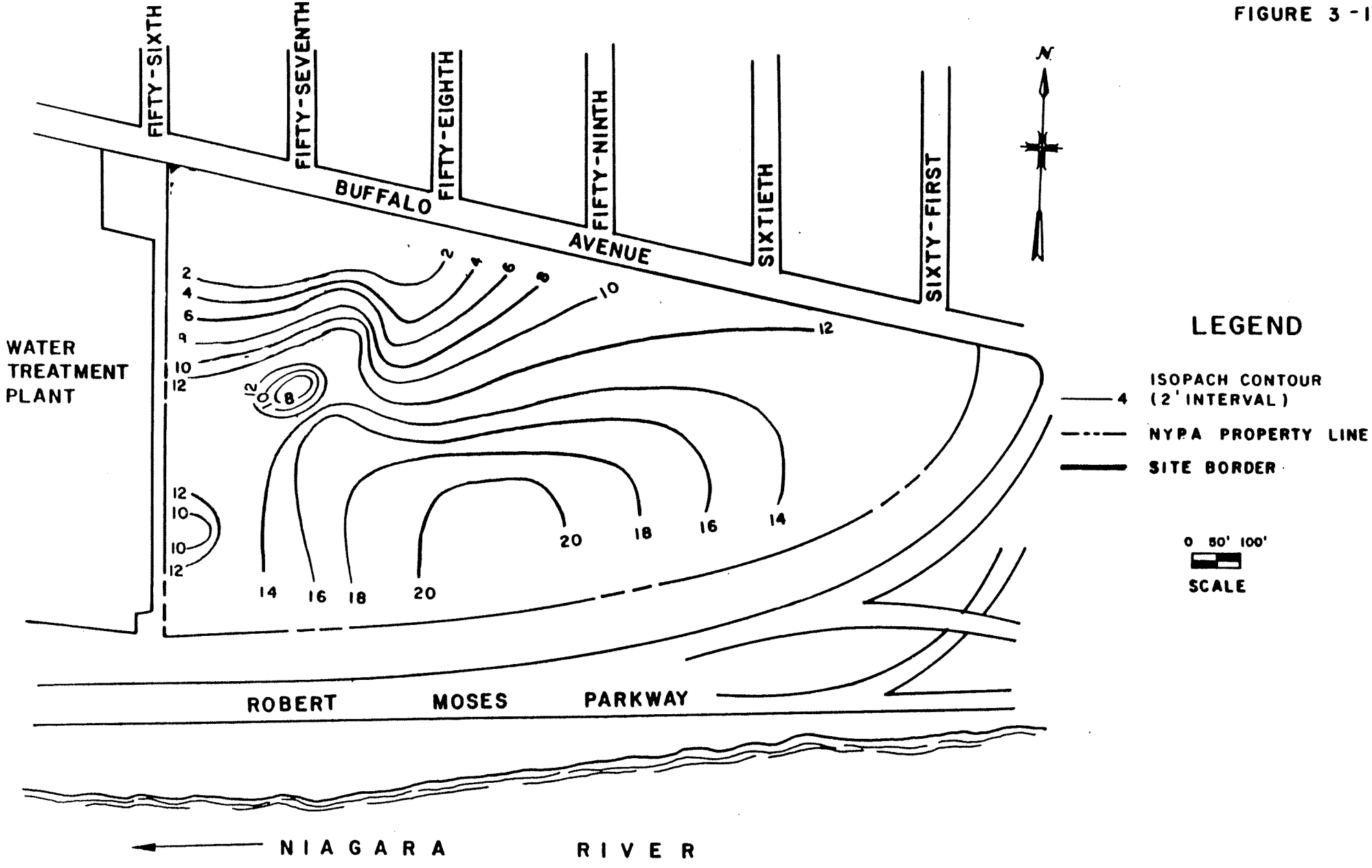
BOREHOLE NO.	SURFACE ELEV.	ALLUVIUM DEPTH	ALLUVIUM ELEV.	CLAY DEPTH	CLAY ELEV.	TILL DEPTH	TILL ELEV.
	(ft AMSL)	(ft BGS)	(ft AMSL)	(ft BGS)	(ft AMSL)	(ft BGS)	(ft AMSL)
B1-81	NA			17.1		33.9	
B2-81	NA	6.2		11.4		28.6	
B3-81	NA	10.1		11.5		28.6	
B4-81	NA	4.9		8.2		27.2	
B6-81	NA	1.7		6.1			
B9-81	NA			17.5		33.6	
B10-81	NA			14.1		23.9	
OW1-82	572.0	6.0	566.0	10.0	562.0	28.0	544.0
OW2-82	570.2	12.2	558.0	24.0	546.2	31.2	539.0
OW3-82	575.8	16.8	559.0	26.0	549.8	31.8	544.0
OW4-82	573.8			12.0	561.8	26.8	547.0
OW5-82	574.2	18.2	556.0			28.0	546.2
1	NA			11.5			
2	NA	2.0					
3	NA	2.5					
4	NA			4.0			
5	NA			0.0			
6	NA			8.0			
7	NA			3.5			
8	NA			0.0			
9	NA			0.0			
MW-1D	574.12			12.0	562.12	22.0	552.12
MW-1S	574.14			13.0	561.14		
MW-2D	573.24	12.0	561.24	20.5	552.74	21.0	552.24
MW-2S	No Geologic Log						
MW-3D	576.17			8.0	568.17	24.0	552.17
MW-3S	576.44			12.0	564.44		
MW-4D	580.15	20.0	560.15	24.0	556.15	30.5	549.65
MW-4S	579.95	20.0	559.95	26.5	553.45		
MW-5D	574.52	2.0	572.52	8.5	566.02	22.0	552.52
MW-5S	574.76	2.0	572.76	9.0	565.76		
MW-6D	573.76	0.0	573.76	8.0	565.76	27.5	546.26
MW-6S	573.41	0.0	573.41	7.5	565.76		
MW-7D	573.03	11.5	561.53	12.0	561.03	28.0	545.03
MW-7S	573.52			12.0	561.52		
MW-8D	570.21	9.0	561.21	22.0	548.21	29.0	541.21
MW-8S	570.16	9.0	561.16	21.5	548.66		
B1-87	579.06						
B2-87	578.82			16.1	562.32		
B3-87	579.90	18.0	561.90				

NA - Surface Elevation not Available

TABLE 3-10
ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION
BUFFALO AVENUE SITE
STRATIGRAPHIC SUMMARY TABLE

BOREHOLE NO.	BEDROCK DEPTH	BEDROCK ELEV.	BOTTOM DEPTH	BOTTOM ELEV.	THICKNESSES			
					FILL	ALLUVIUM	CLAY	TILL
	(ft BGS)	(ft AMSL)	(ft BGS)	(ft AMSL)	(ft)	(ft)	(ft)	(ft)
B1-81	40.9		45.9		17.1		16.8	7.0
B2-81			36.8		6.2	5.2	17.2	8.2
B3-81			34.0		10.1	1.4	17.1	5.4
B4-81			33.0		4.9	3.3	19.0	5.8
B6-81			25.0		1.7	4.4	18.9	
B9-81			36.4		17.5		16.1	2.8
B10-81			36.4		14.1		9.8	12.5
OW1-82	36.1	535.9	36.1	535.9	6.0	4.0	18.0	8.1
OW2-82	34	536.2	34.0	536.2	12.2	11.8	7.2	2.8
OW3-82	39.2	536.6	39.2	536.6	16.8	9.2	5.8	7.4
OW4-82	33.3	540.5	33.3	540.5	12.0		14.8	6.5
OW5-82	35.7	538.5	35.7	538.5	18.2	9.8	0.0	7.7
1			26.5		11.5		15.0	
2			2.0		2.0			
3			2.5		2.5			
4			6.7		4.0		2.7	
5			4.0		0.0	0.0	4.0	
6			15.0		8.0		7.0	
7			9.0		3.5		5.5	
8			4.0		0.0	0.0	4.0	
9			7.0		0.0	0.0	7.0	
MW-1D	34.5	539.62	44.5	529.62	12.0		10.0	12.5
MW-1S			14.0	560.14	13.0		1.0	
MW-2D	35.4	537.84	44.5	528.74	12.0	8.5	0.5	14.4
MW-2S								
MW-3D	34.0	542.17	43.0	533.17	8.0		16.0	10.0
MW-3S			14.0	562.44	12.0		2.0	
MW-4D	45.0	535.15	56.0	524.15	20.0	4.0	6.5	14.5
MW-4S			28.0	551.95	20.0	6.5	1.5	
MW-5D	36.0	538.52	42.0	532.52	2.0	6.5	13.5	14.0
MW-5S			10.0	564.76	2.0	7.0	1.0	
MW-6D	35.1	538.66	43.5	530.26	0.0	8.0	19.5	7.6
MW-6S			12.0	561.41	0.0	7.5	4.5	
MW-7D	37.0	536.03	45.0	528.03	11.5	0.5	16.0	9.0
MW-7S			14.0	559.52	12.0		2.0	
MW-8D	33.0	537.21	45.5	524.71	9.0	13.0	7.0	4.0
MW-8S			22.0	548.16	9.0	12.5	0.5	
B1-87			11.5	567.56	11.5			
B2-87			18.0	560.82	16.5			
B3-87			20.0	559.90	18.0	2.0		

FIGURE 3 - 17



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7A

NIAGARA FALLS, NEW YORK
CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION
BUFFALO AVENUE SITE MAP
FILL ISOPACH MAP

3.5.4 Hydrogeology

The Dames & Moore Report (1988) identifies the same hydrostratigraphic units at the Buffalo Avenue Site as are described regionally in Section 2.2. These include a shallow unconfined water-bearing zone, an aquitard, and a bedrock aquifer. Table 3-11 presents the water levels and well descriptions of the CRA/OCC piezometers and Dames & Moore wells.

The shallow unconfined water-bearing zone, or shallow aquifer, is composed of fill and alluvium (Table 3-11), which thicken southward towards the Niagara River. Figure 3-18 illustrates the isopotential surface of the shallow aquifer (from Dames & Moore, 1988) and reveals that the direction of shallow ground water flow is to the south and southeast. Recharge of the shallow aquifer is by precipitation and surface run-off onto and adjacent to the Site.

The lacustrine clay and till underlying the fill and alluvium at the Buffalo Avenue Site, and surrounding area, have relatively low permeability and act as an effective barrier between the shallow aquifer and the underlying bedrock aquifer. In addition, the slope of the clay surface is southward towards the River (Dames & Moore, 1988).

According to Dames & Moore (1988), the flow direction in the bedrock aquifer (the upper 10 to 15 feet of the Lockport dolostone) is to the west and southwest (Figure 3-19) via secondary permeability, i.e., through fractures and vugs.

3.5.5 Results of Previous Sampling

3.5.5.1 Soil Results

Seven (7) soil samples (see Figure 3-16 for sample locations) were collected by PTL and analyzed by Advanced Environmental Systems, Inc. (AES) from the Buffalo Avenue Site in mid-1981. The soil samples were collected at unknown depths. Appendix A.2 (Exhibit Number A.2-8) contains the analytical results and Table 3-12 summarizes the organics present in the soil samples (sample depth concentrations for trichlorobenzenes, C-46, C-56 and tetrachlorobenzene compound have been averaged

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TABLE 3-11

CITY OF NIAGARA FALLS ALTERNATE WATER
TREATMENT PLANT SITE INVESTIGATION

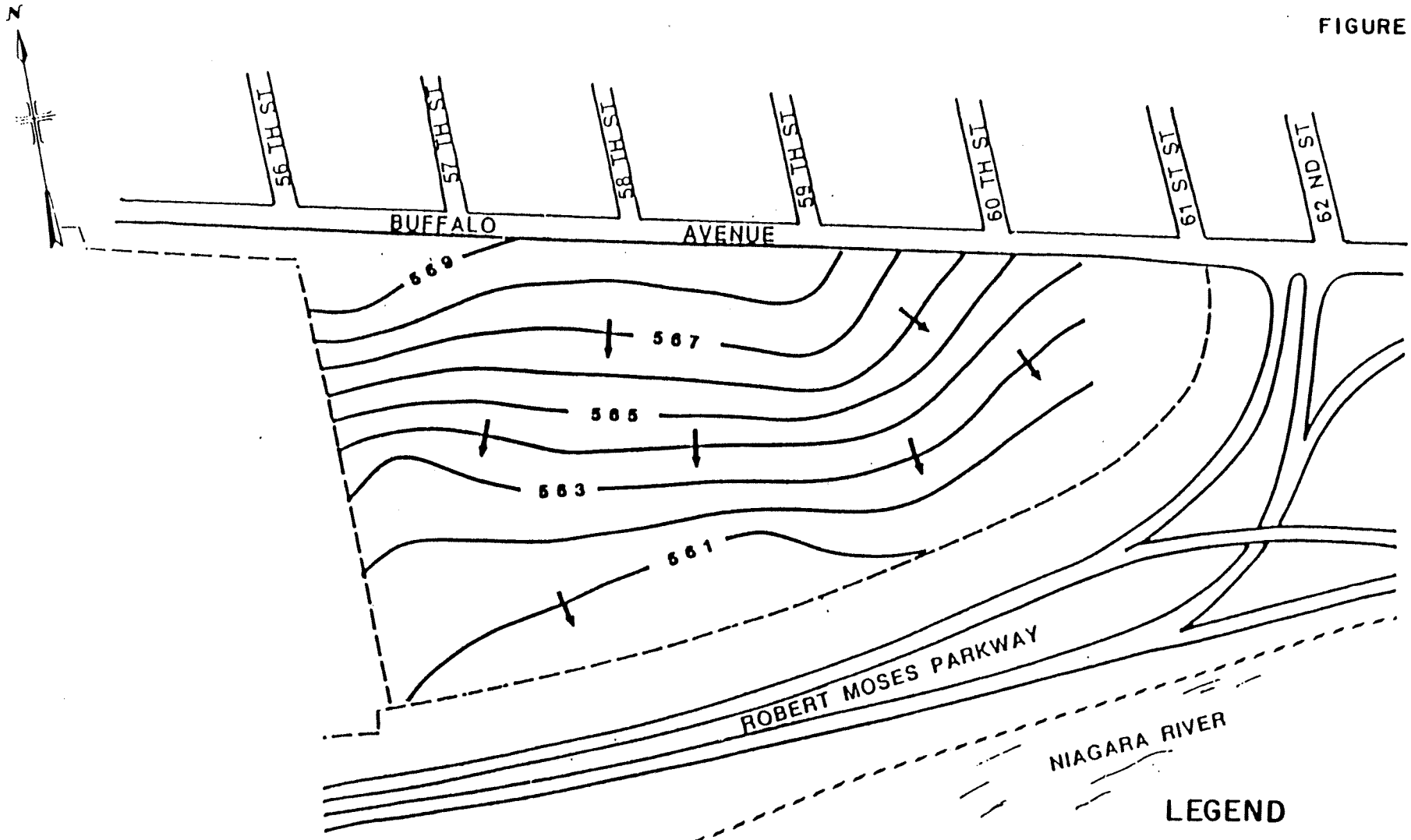
BUFFALO AVENUE SITE

WATER LEVELS AND WELL DESCRIPTIONS

Borehole No.	Material Screened	Screened Depth (Ft BGS)	Water Level (Ft BGS)	Water Level (Date)
*OW1-82	Fill/Alluvium	4.9 - 9.9	6.7	08/05/82
OW2-82	Alluvium	18.9 - 23.9	7.9	08/05/82
OW3-82	Alluvium	20.8 - 25.8	13.5	08/05/82
OW4-82	Fill	6.5 - 11.5	8.7	08/05/82
OW5-82	Alluvium	23.4 - 28.4	12.1	08/05/82
**MW-1D	Bedrock	33.5 - 43.5	14.3	12/09/87
MW-1S	Fill	6.5 - 12.5	11.8	12/09/87
MW-2D	Till/Bedrock	32.0 - 42.0	13.6	12/09/87
MW-2S	Fill/Alluvium	11.0 - 22.0	11.9	12/09/87
MW-3D	Bedrock	35.0 - 42.0	16.6	12/09/87
MW-3S	Fill	5.0 - 12.0	8.5	12/09/87
MW-4D	Bedrock	45.0 - 55.0	21.3	12/09/87
MW-4S	Fill/Alluvium	16.0 - 26.0	19.7	12/09/87
MW-5D	Bedrock	31.0 - 41.0	15.4	12/09/87
MW-5S	Alluvium	4.0 - 9.0	7.1	12/09/87
MW-6D	Till/Bedrock	32.0 - 42.0	14.8	12/09/87
MW-6S	Alluvium	4.0 - 8.0	4.2	12/09/87
MW-7D	Till/Bedrock	34.0 - 44.0	14.2	12/09/87
MW-7S	Fill	5.0 - 12.0	10.7	12/09/87
MW-8D	Bedrock	35.0 - 45.0	11.0	12/09/87
MW-8S	Alluvium	11.0 - 21.0	8.8	12/09/87

* After CRA, 1982
** After Dames & Moore, 1988

FIGURE 3-18



NOTE : FROM DAMES & MOORE, 1988

0 100 200 300

SCALE

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LEGEND

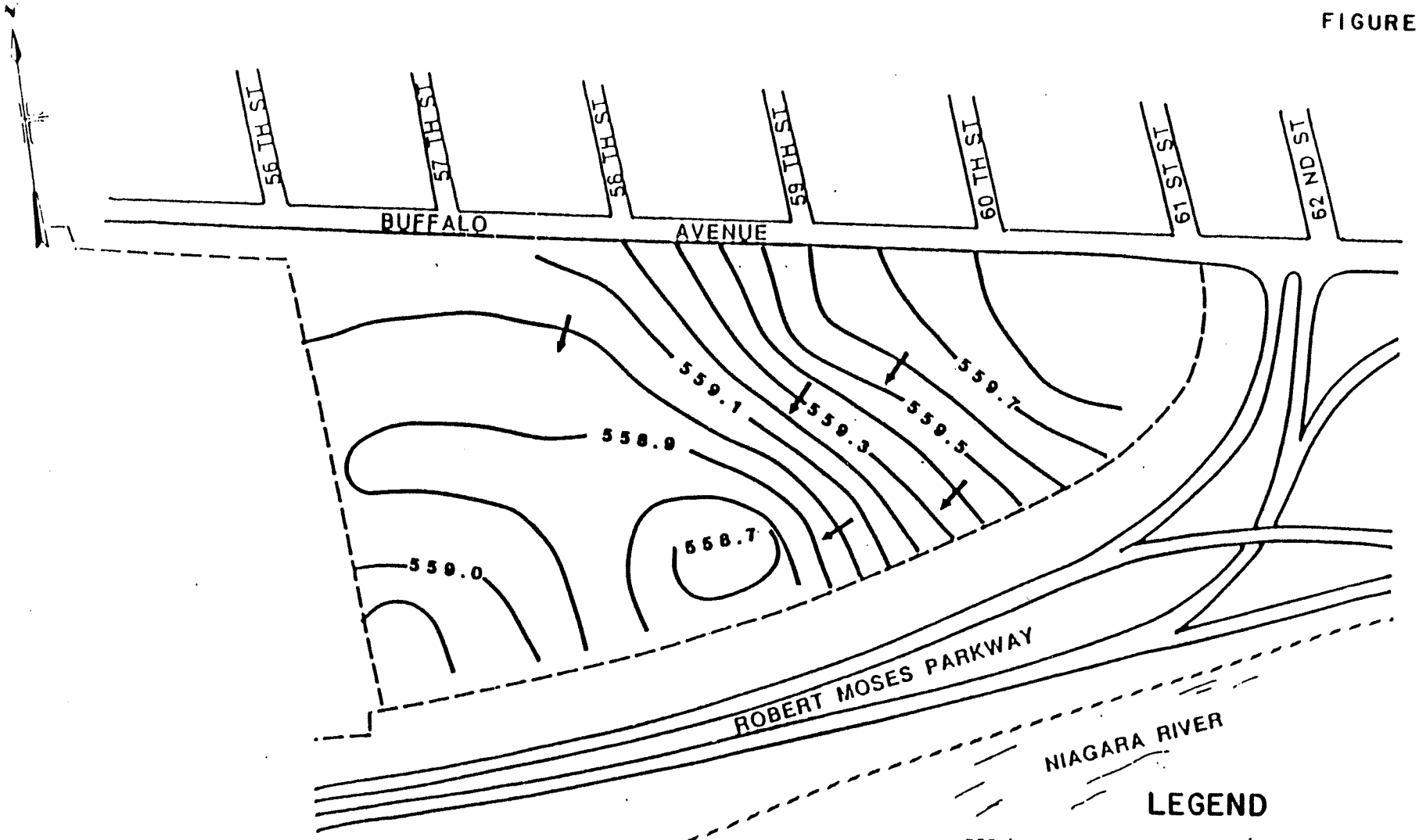
—565— CONTOUR LINE (1' INTERVAL)

GROUND WATER FLOW DIRECTION

NIAGARA FALLS, NEW YORK
CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION

BUFFALO AVENUE ISOPOTENTIAL MAP
(12-9-87)

FIGURE 3-19



NOTE: FROM DAMES & MOORE, 1988

0 100 200 300

SCALE

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LEGEND

—559.1— CONTOUR LINE (1' INTERVAL)

GROUND WATER FLOW DIRECTION

NIAGARA FALLS, NEW YORK
CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION

BUFFALO AVENUE SITE POTENTIOMETRIC MAP
(12-9-87)

TABLE 3-12

BUFFALO AVENUE SITE

SUMMARY OF ORGANICS PRESENT IN SOIL SAMPLES

COMPOUND (mg/kg)	AES B-___-81							USGS	
	1	2	3	4	6	9	10	1	2
Trichlorobenzene Total	149	46	177	42	563	154	30		
Tetrachlorobenzene Total	64	95	76	122	626	66	21		
Hexachlorobutadiene	47	26	48	24	3	30	2		
Phenanthrene								4200	
Fluoranthene								3800	
Pyrene								3500	
Benzo (a) Anthracene								1600	
Chrysene								2600	
Benzo (b) Fluoranthene								750	
Benzo (a) Pyrane								1400	
2,6-Dimethyl-2,5-Heptadien-4-one								3100	
4,5,7-Trimethylinden								360	
4,4-DDT									25
Methylene Chloride									
Acetone									
Benzene									
2-Butanone									
Vinyl Acetate									
1,1-Dichloroethane									
1,1,1-Trichloroethane									
Trichloroethane									
Bromomethane									
Trans-1,2-Dichlorethene									
Anthracene									
Benzo (k) Fluoranthene									
Indeno (1,2,3-cd) Pyrene									
Dibenzo (a,h) Anthracene									
Benzo (g,h,i) Perylene									
Naphthalene									
2-Methylnaphthalene									
Acenaphthene									
Dibenzofuran									
Fluorene									
Toluene									
Bis (2-Ethylhexyl) Phthalate									
Dieldrin									
Endrin									
4-4'-DDD									
Alpha-BHC									
Total Xylenes									
2-Hexanone									
Di-n-Butylphthalate									
Tetrachloroethene									
Styrene									
Carbon Disulfide									
Chloroform									
Chlorobenzene									
Phenol									
1,4-Dichlorobenzene									
Di-n-Octyl Phthalate									

TABLE 3-12

BUFFALO AVENUE SITE

SUMMARY OF ORGANICS PRESENT IN SOIL SAMPLES

COMPOUND (mg/kg)	DAMES & MOORE MW-__ 1	2	3	4	5	6	7	8
Trichlorobenzene Total								
Tetrachlorobenzene Total								
Hexachlorobutadiene								
Phenanthrene	3800	3900		51			5223	170
Fluoranthene	18000	6800					4160	320
Pyrene	26000	5300					4503	68
Benzo (a) Anthracene	18000	2300					4550	141
Chrysene	41000	2400					3013	180
Benzo (b) Fluoranthene	38000	2000					2405	140
Benzo (a) Pyrane	19000	1295					3400	91
2,6-Dimethyl-2,5-Heptadien-4-one								
4,5,7-Trimethylinden								
4,4-DDT								
Methylene Chloride	81	18	34	8	8	31	84	118
Acetone	114	88	44	32	61	79	31	17
Benzene	4		1	73	143		1	2
2-Butanone	47			2	5	2		2
Vinyl Acetate						5	9	4
1,1-Dichloroethane								
1,1,1-Trichloroethane	2.1			1	5			
Trichloroethane				2	11			
Bromomethane								
Trans-1,2-Dichlorethene								
Anthracene	580	1800					3500	
Benzo (k) Fluoranthene	44000	1300					1600	
Indeno (1,2,3-cd) Pyrene	3000	870					2150	
Dibenzo (a,h) Anthracene	1800	260					775	
Benzo (g,h,i) Perylene	4000	820					2150	
Naphthalene	190	430					1245	
2-Methylnaphthalene		130					385	
Acenaphthene		590					1290	
Dibenzofuran		280					1100	
Fluorene		510					1350	
Toluene			1			6	2	
Bis (2-Ethylhexyl) Phthalate			1200				683	649
Dieldrin			2			300		9
Endrin			2					292
4-4'-DDD			1					
Alpha-BHC			9			3		
Total Xylenes				8				
2-Hexanone				8				
Di-n-Butylphthalate				1162			490	14099
Tetrachloroethene						9		
Styrene						5		
Carbon Disulfide						5	6	
Chloroform							1	
Chlorobenzene							81	
Phenol							79	
1,4-Dichlorobenzene							101	
Di-n-Octyl Phthalate							185	

for the boreholes). In addition, soil sample depth information was unobtainable during this investigation. Since AES (1981) conducted their analysis using GC-EC (Electron Capture) rather than GC-MS (Mass Spectroscopy), and since GC-EC lacks two column confirmation of a target compound, the quality of this information is suspect. However, AES (1981) concluded that except for B-9-81, the concentration trend appears to decrease with increasing depth below the surface. Inorganics were not analyzed by AES.

Soil samples were also collected between 06/25/82 and 05/28/83 during the completion of the nine (9) soil borings conducted by the USGS. Appendix A.2 (Exhibit Number A.2-9) contains the analytical results and Table 3-11 summarizes the organics that were detected. Organic compounds were detected in soil borings 1 and 2. Only PAHs, 4,4-DDT, and various non-priority pollutants are identified in the analysis results.

Dames & Moore (1988) conducted a soil sampling analysis program during a Phase II investigation of the Buffalo Avenue Site. Appendix A.2 (Exhibit Number A.2-10) contains the analytical results and Table 3-12 summarizes the organics present (sample depth concentrations for each compound have been averaged for the wells). The quality of this information is suspect by the NYSDEC, therefore resampling may be required. Organic compounds detected in the soils include aromatic hydrocarbons, chlorinated aromatics, halogenated ethanes, PAHs, phthalates, and pesticides and metabolites. Acetone and methylene chloride were detected in the soil samples as well as some of the blanks, thus indicating possible/ probable laboratory contamination. Elevated concentrations of inorganics (metals) include arsenic, chromium, copper, lead, and zinc.

3.5.5.2 Ground Water Results

Ground water samples were collected and analyzed by Dames & Moore in late 1987. Appendix A.2 (Exhibit Number A.2-11) contains the analytical results and Table 3-13 summarizes the organics detected in ground water samples collected from both the shallow and deep wells. Organic compounds detected in the ground water include: aromatic hydrocarbons,

TABLE 3-13

CITY OF NIAGARA FALLS ALTERNATE WATER
TREATMENT PLANT SITE INVESTIGATION

BUFFALO AVENUE SITE

SUMMARY OF ORGANICS PRESENT IN GROUND WATER

Compound (ug/L)	SAMPLE MW-1		SAMPLE MW-2		SAMPLE MW-3		SAMPLE MW-4		SAMPLE MW-5		SAMPLE MW-6		SAMPLE MW-7		SAMPLE MW-8	
	D	S	D	S	D	S	D	S	D	S	D	S	D	S	D	S
Methylene Chloride	20	26		26	87	400	77	78	15	92		44		13	25	22
Acetone	11	12	21	15				59		130	11		46	9.3	22	10
Benzene	2.8	1.1		1.5							1.5		1.5	1.7	1.2	
Phenanthrene						14										
1,1,1-Trichloroethane					3.2											
Trichloroethane				1.4									1.2			
Bis (2-Ethylhexyl) Phthalate		150	26	270	16	1300	54	29	15		65	2700	95	2200	74	410
Di-n-Butylphthalate	16								33		25					
Di-n-Octyl Phthalate	20							33								
Daphthalene						29										
Aldrin						0.01								1.67		
Endosulfan I					0.05							0.01		4.38		
Endosulfan Sulfate					0.03											
Delta-BHC														2.76		
Heptachlor Epoxide											1.8			0.12		
Benzoic Acid														1200		

FROM DAMES & MOORE, 1988

halogenated ethanes, phthalates, and pesticides and metabolites. Elevated concentrations of inorganics (not summarized in Table 3-13) include arsenic, barium, cadmium, chromium, iron, lead, magnesium, manganese, selenium, silver and zinc.

3.6 EAST AREA SITE

3.6.1 Location and Ownership

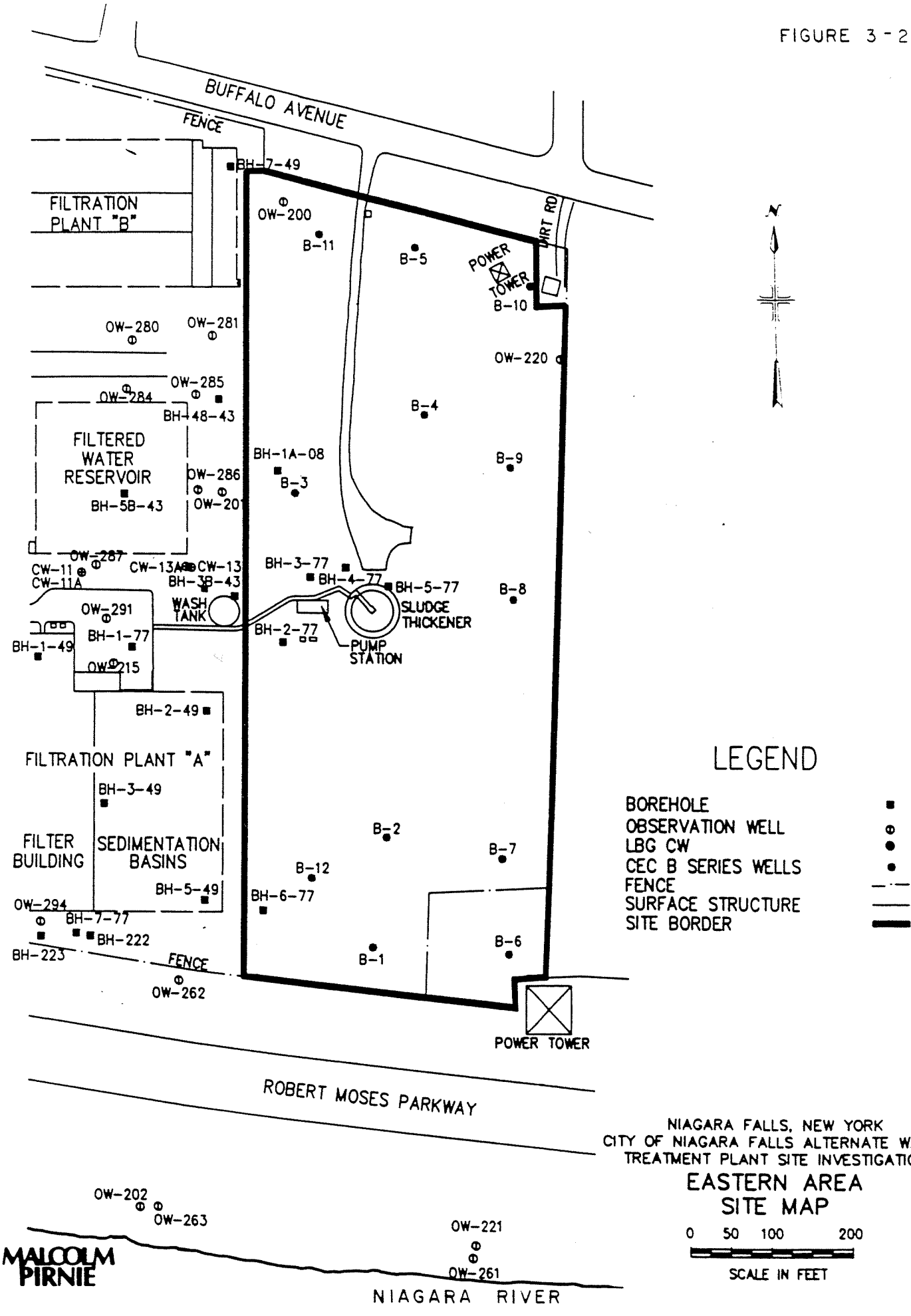
The East Area Site, approximately 8.5 acres in size, is located along the eastern side of the Water Treatment Plant (WTP) (Figure 3-20). The Site is owned by the City of Niagara Falls.

3.6.2 History

According to the NCDOH, the East Area Site was originally a wetland area. Circa 1915 to 1985 site plans for the WTP reveal that the shoreline at the Site has extended as far as 1,000 feet into the Niagara River during that period of time (MPI, 1989). The landfilling operations resulting in this extension are discussed in Section 3.5.2. Construction at the WTP commenced in 1908 with Filtration Plant "B", which is located outside the northwest corner of the East Area Site. The following text is from the Gannett Fleming Water Resources Engineers, Inc. (GFWRE) Report (1986):

> "Informal discussions with WTP personnel indicate that the area northeast of Filtration Plant "A" was utilized as a dump for a variety of wastes from household, commercial, and chemical plant sources from approximately 1920 to 1945. During 1979, an excavation was made just south of the Wash Tank (see Figure 3-20). It contained rusted and compacted 55-gallon drums, cylinders, and other metal material including remains of other drums and 'tar-like' substances (Legette, Brashears & Graham - LBG, 1979). Aerial photos from the 1950s show pipe and similar-looking materials being stored just east of the Filtered Water Reservoir. The materials were piled in rows extending from north to south along the reservoir's entire length."

FIGURE 3-20



NIAGARA FALLS, NEW YORK
CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION

EASTERN AREA SITE MAP

0 50 100 200

SCALE IN FEET

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Boreholes completed in the WTP and along the Niagara River adjacent to the East Area Site include: three (3) test borings in 1943, five (5) test borings in 1949, two (2) test borings in 1977, four (4) wells installed by LBG in 1979, and fifteen (15) wells and two (2) borings installed by CRA/OCC in 1987.

Boreholes completed in the East Area Site include: one (1) test boring in 1908, five (5) test borings in 1977, twelve (12) wells installed by Clayton Environmental Consultants, Inc. (CEC) in 1982, and two (2) wells installed by CRA/OCC in 1987.

Ground water and/or soil sampling programs have been completed at the East Area Site by CEC in 1982 and 1983, USEPA in 1983, Arthur D. Little, Inc. (ADL) and CRA/OCC in mid-1983, and CRA/OCC in 1987. In addition, CRA/OCC analyzed soil samples during their test boring/monitoring well installations of 1987.

The East Area Site is relatively flat with noticeable lower lying areas east of the Filtered Water Reservoir and near the southeast corner of the Site. The Site is bordered on the north by a residential neighborhood, on the west by the WTP, on the east by the Buffalo Avenue Site, and on the south by the Robert Moses Parkway.

3.6.3 Geology

Figure 3-20 presents the locations of geotechnical test borings and wells installed by LBG, CEC, and CRA/OCC. Appendix A.1 (Exhibit Numbers A.1-8 through A.1-11) contains the logs for the borings and wells completed after 1976. The stratigraphy encountered in borings/wells at the East Area Site is summarized in Table 3-14.

The fill encountered in boring at the East Area Site, and adjacent WTP property, is described as brown to black silty sand with clay and gravel, as well as demolition debris, cinders, fly ash, slag, rusted metal, paper, tar, rubber, and organic debris. In addition, "tar-like" substances were present in well OW-262 and chemical odors were noted in CW-13, CW-13A, B-2, B-7, and OW-294 west of the Site in the WTP. Shot-rock was encountered in wells OW-202, OW-221, OW-261, and OW-263 along

TABLE 3-14

ALTERNATE TREATMENT PLANT INVESTIGATION

EAST AREA SITE

STRATIGRAPHIC SUMMARY TABLE

BOREHOLE NO.	SURFACE ELEV.	ALLUVIUM DEPTH	ALLUVIUM ELEV.	CLAY DEPTH	CLAY ELEV.	TILL DEPTH	TILL ELEV.
	(ft AMSL)	(ft BGS)	(ft AMSL)	(ft BGS)	(ft AMSL)	(ft BGS)	(ft AMSL)
BH-1A-08	568.9			4.5	564.4	29.5	539.4
* BH-3B-43	569.8	0.0	569.8	13.0	556.8	31.0	538.8
* BH-4B-43	569.3	0.0	569.3	8.0	561.3		
* BH-5B-43	568.3	5.0	563.3	7.0	561.3	29.0	539.3
* BH-1-49	569.7			9.0	560.7		
* BH-2-49	568.7			11.0	557.7		
* BH-3-49	570.6	10.0	560.6	16.0	554.6	27.9	542.7
* BH-5-49	570.6	10.0	560.6	20.0	550.6	29.9	540.7
* BH-7-49	571.8			0.0	571.8	26.5	543.3
* BH-1-77	574.9			17.0	557.9		
BH-2-77	569.9	9.0	560.9	17.5	552.4		
BH-3-77	568.8	3.5	565.3	9.5	559.3	29.5	539.3
BH-4-77	568.6	7.0	561.6	7.5	561.1	29.0	539.6
BH-5-77	569.2	6.5	562.7	8.5	560.7		540.2
BH-6-77	573.9	16.0	557.9				
* BH-7-77	575.9	18.0	557.9			33.0	542.9
* CW-11	574.6	18.5	556.1	25.5	549.1		
* CW-11A	574.6	18.5	556.1	25.5	549.1		
* CW-13	573.7			16.5	557.2	33.0	540.7
* CW-13A	573.7						
B-1	572.6	7.0	565.6			35.5	537.1
B-2	573.4	12.0	561.4				
B-3	569.2			9.0	560.2	29.5	539.7
B-4	570.4			8.0	562.4	30.0	540.4
B-5	572.7	0.0	572.7	8.0	564.7		
B-6	571.5	12.0	559.5				
B-7	572.9	15.0	557.9	22.0	550.9	33.5	539.4
B-8	571.0			8.0	563.0	31.0	540.0
B-9	568.9			8.0	563.9		
B-10	573.2			0.0	573.2	30.0	543.2
B-11	572.2	0.0	572.2	8.0	564.2		
B-12	573.4	16.0	557.4	30.0	543.4	33.0	540.4
OW-200	572.8	3.0	569.8	8.0	564.8	26.0	564.8
* OW-201	568.9			7.0	561.9	28.5	540.4
* OW-202	571.5	20.0	551.5			26.5	545.0
* OW-215	575.1	17.0	558.1	19.0	556.1	30.5	544.6
OW-220	572.4	1.0	571.4	8.0	564.4	30.0	542.4
* OW-221	570.4	20.0	550.4			28.0	542.4
* OW-261	569.5	20.0	549.5			28.0	541.5
* OW-262	574.5	17.5	557.0			32.5	542.0
* OW-263	571.0	20.0	551.0				
* OW-280	569.9	2.0	567.9	8.0	561.9	28.0	541.9
* OW-281	570.3			4.0	566.3	25.5	544.8
* OW-284	569.6			6.0	563.6	29.0	540.6
* OW-285	569.8			7.0	562.8	27.5	542.3
* OW-286	570.7	5.5	565.2	7.0	563.7	28.0	542.7
* OW-287	574.2	18.0	556.2	20.5	553.7	34.0	540.2
* OW-291	574.4	14.0	560.4	20.0	554.4	34.0	540.4
* OW-294	574.6	20.0	554.6			32.0	542.6
* BH-222	575.2	18.0	557.2				
* BH-223	574.8	18.0	556.8				

* BOREHOLES COMPLETED IN THE WTP AND ALONG THE NIAGARA RIVER.

TABLE 3-14

ALTERNATE TREATMENT PLANT INVESTIGATION

EAST AREA SITE

STRATIGRAPHIC SUMMARY TABLE

BOREHOLE NO.	BEDROCK DEPTH	BEDROCK ELEV.	BOTTOM DEPTH	BOTTOM ELEV.	THICKNESSES			
					FILL	ALLUVIUM	CLAY	TILL
	(ft BGS)	(ft AMSL)	(ft BGS)	(ft AMSL)	(ft)	(ft)	(ft)	(ft)
BH-1A-08	31.5	537.4	35.5	533.4	4.5		25.0	2.0
* BH-3B-43	32.0	537.8	33.0	536.8	0.0	13.0	18.0	1.0
* BH-4B-43	29.0	540.3	30.5	538.8	0.0	8.0	21.0	
* BH-5B-43	30.0	538.3	31.5	536.8	5.0	2.0	22.0	1.0
* BH-1-49	29.0	540.7	31.0	538.7	9.0		20.0	
* BH-2-49	30.0	538.7	32.0	536.7	11.0		19.0	
* BH-3-49	31.9	538.7	32.0	536.7	10.0	6.0	11.9	4.0
* BH-5-49	33.0	537.6	43.0	527.6	10.0	10.0	9.9	3.1
* BH-7-49	28.5	543.3	34.0	537.8	0.0	0.0	26.5	2.0
* BH-1-77			37.0	537.9	17.0		27.0	
BH-2-77			20.0	549.9	9.0	8.5	2.5	
BH-3-77			33.0	535.8	3.5	6.0	10.5	3.5
BH-4-77			33.5	535.1	7.0	0.5	21.5	4.5
BH-5-77			34.0	535.2	6.5	2.0	20.5	5.0
BH-6-77			30.0	543.9	16.0	14.0		
* BH-7-77			35.0	540.9	18.0	15.0		2.0
* CW-11	36.0	538.6	41.0	533.6	18.5	7.0	10.5	
* CW-11A			34.5	540.1	18.5	7.0	9.0	
* CW-13	36.0	537.7	41.0	532.7	16.5		16.5	3.0
* CW-13A								
B-1	38.5	534.1	38.5	534.1	7.0	28.5		3.0
B-2			24.0	549.4	12.0	12.0		
B-3	32.6	536.6	32.6	536.6	9.0		20.5	3.1
B-4	34.5	535.9	34.5	535.9	8.0		22.0	4.5
B-5			12.0	560.7	0.0	8.0	4.0	
B-6			22.0	549.5	12.0	10.0		
B-7	39.5	533.4	39.5	533.4	15.0	7.0	11.5	6.0
B-8	37.0	534.0	37.0	534.0	8.0		24.0	6.0
B-9			12.0	556.9	8.0		4.0	
B-10	34.0	539.2	34.0	539.2	0.0	0.0	30.0	4.0
B-11			12.0	560.2	0.0	8.0	4.0	
B-12	39.0	534.4	39.0	534.4	16.0	14.0	3.0	6.0
OW-200	29.0	543.8	204.3	368.5	3.0	5.0	18.0	3.0
* OW-201	29.5	539.4	205.8	363.1	7.0		21.5	1.0
* OW-202	37.0	534.5	206.8	364.7	20.0	6.5		10.5
* OW-215	37.0	538.1	206.0	369.1	17.0	2.0	11.5	6.5
OW-220	30.1	542.3	61.1	511.3	1.0	7.0	22.0	0.1
* OW-221	31.5	538.9	63.3	507.1	20.0	8.0		3.5
* OW-261			31.5	538.0	20.0	8.0		3.5
* OW-262			34.2	540.3	17.5	15.0		1.5
* OW-263			26.0	545.0	20.0	6.0		
* OW-280			29.9	540.0	2.0	6.0	20.0	1.9
* OW-281			28.9	541.4	4.0		21.5	3.4
* OW-284			29.9	539.7	6.0		23.0	1.0
* OW-285	28.5	541.3	28.5	541.3	7.0		20.5	1.0
* OW-286			31.0	539.7	5.5	2.2	21.0	3.0
* OW-287	36.0	538.2	36.1	538.1	18.0	2.5	13.5	2.0
* OW-291			36.3	538.1	14.0	6.0	14.0	2.5
* OW-294			36.2	538.4	20.0	12.0		4.0
* BH-222			20.0	555.2	18.0	2.0		
* BH-223			20.0	554.8	18.0	2.0		

* BOREHOLES COMPLETED IN THE WTP AND ALONG THE NIAGARA RIVER.

the Niagara River. Moisture conditions within the fill vary from dry to wet. The thickness of the fill varies across the area from 0 to 20.0 (OW-202) feet and averages 10.3 feet with the fill thickening from north to south across the site.

The native stratigraphic units underlying the fill include: alluvium, which is 0 to 28.5 (B-1) feet thick and averages 7.4 feet; lacustrine clay, which is 0 to 30.0 (B-10) feet thick and averages 18.4 feet; till, which is 0.1 (OW-220) to 10.5 (OW-202) feet thick and averages 3.5 feet; and Lockport dolostone. Wells OW-200, OW-201, OW-202, and OW-215 were completed in the Rochester shale.

3.6.4 Hydrogeology

The hydrostratigraphic units present at the East Area Site include a shallow unconfined water-bearing zone, an aquitard, and a bedrock aquifer. Current status of the test borings/monitoring wells completed in the East Area Site, and adjacent WTP as determined from available reports is summarized in Table 3-15.

The shallow unconfined water-bearing zone, or shallow aquifer, is composed of fill and alluvium which thicken southward towards the Niagara River. Shallow ground water flow is towards the south. The shallow aquifer is primarily recharged by precipitation.

The lacustrine clay and till underlying the fill and alluvium at the East Area Site, and adjacent WTP, have relatively low permeability and together act as an aquitard between the shallow aquifer and the underlying bedrock aquifer effectively retarding the downward movement of ground water and any contaminants. The clay/till is absent or relatively thin along the south border of the Site.

Ground water flow in the underlying bedrock aquifer (the upper 10 to 15 feet of the Lockport Group) is primarily through fractures and bedding plane openings in the upper Lockport. Flow in the bedrock is in a northwesterly direction away from the Niagara River. The direction of flow appears to be strongly influenced by the Niagara Power Project intake structure.

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TABLE 3-15

CITY OF NIAGARA FALLS ALTERNATE WATER TREATMENT PLANT SITE INVESTIGATION

EAST AREA SITE AND ADJACENT WTP

WELL DESCRIPTIONS

Borehole No.	Material Screened	Screened Depth
*CW-11	Bedrock	36.0 - 41.0
*CW-11A	Fill/Alluvium/Clay	11.0 - 26.0
*CW-13	Till/Bedrock	35.5 - 40.5
*CW-13A	Fill	1.5 - 16.5
B-1	Alluvium	29.0 - 34.0
B-2	Alluvium	19.0 - 24.0
B-3	Clay/Till	26.5 - 31.5
B-4	Clay/Till	29.0 - 34.0
B-5	Alluvium	5.0 - 10.0
B-6	Alluvium	17.0 - 22.0
B-7	Clay/Till	31.5 - 36.5
B-8	Clay/Till	29.0 - 34.0
B-9	Fill/Clay	7.0 - 12.0
B-10	Clay/Till	28.0 - 33.0
B-11	Alluvium/Clay	5.0 - 10.0
B-12	Alluvium/Clay/Till	31.0 - 36.0
OW-200	Bedrock	Grouted
*OW-201	Bedrock	Grouted
*OW-202	Bedrock	127.0 - 206.8
*OW-215	Bedrock	154.0 - 171.0
OW-220	Bedrock	31.0 - 61.1
*OW-221	Bedrock	33.3 - 63.3
*OW-261	Alluvium	22.8 - 27.8
*OW-262	Alluvium	27.4 - 32.4
*OW-263	Alluvium	21.0 - 26.0
*OW-280	Alluvium/Clay	4.1 - 9.1
*OW-281	Clay	4.0 - 9.0
*OW-284	Fill/Alluvium/Clay	4.0 - 9.0
*OW-285	Fill/Alluvium/Clay	5.3 - 10.3
*OW-286	Fill/Alluvium/Clay	6.2 - 11.2
*OW-287	Fill/Alluvium	9.8 - 20.8
*OW-291	Fill/Alluvium/Clay	8.3 - 20.5
*OW-294	Alluvium	25.0 - 30.0

* Boreholes completed in the WTP and along the Niagara River.

3.6.5 Results of Previous Sampling

3.6.5.1 Soil Results

A total of 12 soil samples (see Figure 3-20 for sample locations) were collected by CEC and analyzed from the East Area Site. Appendix A.2 (Exhibit Number A.2-13) contains the sample depths and analytical results and Table 3-16 summarizes the organics present in the soil samples. The soil samples were not analyzed for inorganic constituents.

Eight (8) soil samples (see Figure 3-20 for sample locations) were collected by CRA/OCC during the test boring/monitoring well installations in the WTP property immediately to the west of the East Area Site. Appendix A.2 (Exhibit Number A.2-14) contains the sample depths and analytical results and Table 3-16 summarizes the organics present in the soil samples. Organic compounds detected in the samples include chlorinated aromatics and halogenated ethanes and other aliphatics. Again, the soil samples were not analyzed for inorganic constituents.

3.6.5.2 Ground Water Results

Appendix A.2 contains the analytical results of the ground water samples collected in 1983 during the CEC, EPA, and ADL programs (Exhibit Numbers A.2-15 and A.2-16) and in 1987 during the CRA/OCC program (Exhibit Numbers A.2-12 and A.2-17). A summary of the organics present in the ground water sampled in 1983 and 1987 is presented in Table 3-17. Organic compounds detected in the ground water include aromatic hydrocarbons, chlorinated aromatics, phthalates, PAHs, and pesticides. Elevated concentrations of inorganics in ground water (not summarized in Table 3-17) include arsenic, cadmium, chromium, copper, lead, mercury, thallium and zinc.

TABLE 3-16

CITY OF NIAGARA FALLS ALTERNATE WATER
TREATMENT PLANT SITE INVESTIGATION

EAST AREA SITE

SUMMARY OF ORGANICS PRESENT IN SOIL SAMPLES

Compound (ug/kg)	CEC (1983) B-2 15'-17'	B-3 20'-22'	B-6 20'-22'	B-7 30'-32'	B-8 5'-7'	B-8 10'-12'	B-9 10'-12'	B-10 25'-27'	B-11 5'-7'	B-12 30'-32'
Bis (2-ethylhexyl) Phthalate	0.6	0.5	0.7	0.9		1	1	0.6	1	0.9
Dioctylphthalate	0.3									
Tetrachloroethane					72					

WTP ADJACENT TO EAST AREA SITE
SUMMARY OF ORGANICS PRESENT IN SOIL SAMPLES

Compound (ug/kg)	CRA/OCC (1987 OW/BHR/BHW-__*) 280	281	284	285	287	291	294 12'-30'	294 30'-32'
Chlorobenzene				24	39	33	18	
Trichlorobenzene, Total						1400	333	
Tetrachlorobenzene, Total						1190	5360	158
Hexachlorobenzene	410			128	1000	463	8450	267
Octachlorocyclopentene							971	
Hexachlorocyclodecane, Total							13200	291
Perchloropentacyclodecane							633	
Total Organic Carbon					59000		46000	
Total Organic Halogen					300	200	25000	100

*OW = Observation Well
BHR = Borehole Resampled
BHW = Borehole Well (Borehole Adjacent to OW)

TABLE 3-17
EAST AREA SITE
SUMMARY OF ORGANICS PRESENT IN GROUND WATER SAMPLES

COMPOUND	B-1		B-2		B-3			B-4	B-5		B-6	
(ug/L)	CEC	EPA	CEC	EPA	CEC	EPA	ADL	EPA	CEC	EPA	CEC	ADL
Benzene		11	11		16				100			
Bis (2-Ethylhexyl) Phthalate		30			100	60		300	43	30		
Di-N-Butyl Phthalate							15					12
Methylene Chloride									12	18		
Phenol	20		10		20				20		10	
Vinyl Chloride											12	18
Endosulfan												
Heptachlor Epoxide									0.07			
Alpha-BHC			0.05						0.07			
Hexane		76		68								
2-Methylpantane		24		17								
4-Hydroxyl-4-Methyl-2-Pentanone												
Hexanoic Acid												
Octanoic Acid						100						
Caprolactam												
Chlorobenzenes												
Trichlorobenzene, Total												
Tetrachlorobenzenes, Total												
Total Organic Carbon	40600		74600		58800				110000		16200	
Total Organic Haglogen	81		139		21				38		63	

TABLE 3-17
EAST AREA SITE
SUMMARY OF ORGANICS PRESENT IN GROUND WATER SAMPLES

COMPOUND	B-7			B-8			B-9	B-10		B-11		B-12
(ug/L)	CEC	EPA	ADL	CEC	EPA	ADL	CEC	CEC	EPA	CEC	EPA	CEC
Benzene							29					
Bis (2-Ethylhexyl) Phthalate	33	100		310	200				100	70	30	
Di-N-Butyl Phthalate			11			15						
Methylene Chloride												
Phenol	10		75	40			40	10		10		10
Vinyl Chloride												
Endosulfan							0.29					
Heptachlor Epoxide												
Alpha-BHC												
Hexane												
2-Methylpantane												
4-Hydroxyl-4-Methyl-2-Pentanone					200							
Hexanoic Acid		70										
Octanoic Acid		400										
Caprolactam		800										
Chlorobenzenes												
Trichlorobenzene, Total												
Tetrachlorobenzenes, Total												
Total Organic Carbon	36400			65200			203000	10300		41800		10600
Total Organic Haglogen	27			16			37	25		30		493

TABLE 3-17

WTP ADJACENT TO EAST AREA SITE

SUMMARY OF ORGANICS PRESENT IN GROUND WATER SAMPLES

COMPOUND	CW-__		SAMPLE OW-__						
(ug/L)	11A	13A	261	263	280	284	286	287	291
Benzene									
Bis (2-Ethylhexyl) Phthalate									
Di-N-Butyl Phthalate									
Methylene Chloride									
Phenol									
Vinyl Chloride									
Endosulfan									
Heptachlor Epoxide									
Alpha-BHC									
Hexane									
2-Methylpantane									
4-Hydroxyl-4-Methyl-2-Pentanone									
Hexanoic Acid									
Octanoic Acid									
Caprolactam									
Chlorobenzenes									11
Trichlorobenzene, Total							34		180
Tetrachlorobenzenes, Total								10	47
Total Organic Carbon						24000			
Total Organic Haglogen	100	1900	300	600	100		300	100	700

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4.0 SUMMARY

4.1 PORTER ROAD SITE

The geology of the Porter Road Site includes approximately 5.0 to greater than 47.0 feet of clean fill, approximately 24.0 feet of confining clay/till, and dolostone bedrock.

Vertical ground water flow beneath the Site is in a downward direction. Horizontal ground water flow in the shallow water-bearing zone above the clay/till aquitard is likely in a westerly direction. The deeper ground water flow (beneath the aquitard) is also in a westerly direction towards the Niagara Power Project conduits.

The ground water and fill present at the Site has not been sampled to date.

4.2 FIFTY-SIXTH STREET SITE

The geology of the Fifty-sixth Street Site includes approximately 1.2 feet of fill, which is described as silt, cinders, and organic debris, 6.0 feet of alluvium, approximately 18.0 feet of confining clay/till, and dolostone bedrock.

Vertical ground water flow beneath the Site is in a downward direction. Horizontal ground water flow in the shallow water-bearing zone above the clay/till aquitard is in a northwesterly direction. The John Avenue sewer may act as a significant ground water sink, restricting shallow ground water and any contaminant flow in a northwestern direction beyond John Avenue. Ground water flow beneath the aquitard is in a westerly direction. The Niagara Power Project conduits may be responsible for the westerly flow of ground water in the bedrock.

According to NUS (1985a), the soil analytical data from the Fifty-ninth Street Site indicates that the highest concentration of contaminants detected were present in NYA9-S3, which was the most shallow sampling location. Organic compounds detected at the Site include polynuclear aromatic hydrocarbons (PAHs), phthalates, and PCBs (Arochlor-1254).

During the 1985 to 1986 NUS investigation of the LaSalle Area, toluene and 2-butanone (methyl ethyl ketone) were the only organic compounds detected in soil samples taken from the Fifty-sixth Street Site.

Based on the ground water analytical data from the NUS January 1987 sampling event at the Fifty-sixth Street Site, contaminants detected at well cluster MW-5 include 2-chlorophenol, carbon disulfide and bis (2-ethylhexyl) phthalate.

4.3 CHEVY PLACE SITE

The geology of the Chevy Place Site includes approximately 4.0 feet of fill, which is described as having black chemical stains in the NFB-9 well log, 2.5 feet of alluvium, approximately 15.0 feet of confining clay/till, and dolostone bedrock. The hydrogeologic conclusions for the Site are identical to those for the Fifty-sixth Street Site (see Section 3.2.6).

According to NUS (1985b), the soil analytical data from the Sixty-fourth Street Dump - South indicates that most contaminants detected were present in the surface soil (0 to 3-inches deep). Organic compounds detected at the dump include PAHs, phthalates, trichloroethene and endosulfan sulfate.

During the 1985 to 1986 NUS investigation of the LaSalle Area, toluene was the only organic compound detected in soil samples taken from the Chevy Place Site.

According to NUS (1987), the ground water analytical data from the January 1987 sampling event at the Chevy Place Site indicates that most contaminants detected were present in well cluster MW-1. Organic compounds detected at the site include PCBs (endosulfan sulfate) and phenolics.

4.4 JANIK SITE

The geology of the Janik Site includes approximately 1.5 feet of clean fill, 8.2 feet of alluvium, approximately 17.0 feet of confining clay/till, and dolostone bedrock. The hydrogeologic conclusions for the Site are identical to those for the Chevy Place Site (see Section 3.3.4).

During the 1985 to 1986 NUS investigation of the LaSalle Area, toluene and 2-butanone were the only organic compounds detected in soil samples taken from a well (MW-5) adjacent to the Janik Site.

Based on the ground water analytical data from the NUS January 1987 sampling event, both well clusters (MW-5 and MW-6) adjacent to the Janik Site contain detectable concentrations of organic and inorganic compounds. Organic compounds detected adjacent to the site include phenols (2-chlorophenol), phthalates, and carbon disulfide.

4.5 BUFFALO AVENUE (NYPA) SITE

The geology of the Buffalo Avenue Site (NYPA Site) includes approximately 9.5 feet of clean fill, 5.9 feet of alluvium, approximately 21.0 feet of confining clay/till, and dolostone bedrock. Fill is absent in the northwest corner and thickest in the south-central portion of the Site.

Vertical ground water flow beneath the Site is in a downward direction. Horizontal ground water flow in the shallow water-bearing zone above the clay/till aquitard is in a southerly to southeasterly direction. Ground water flow beneath the aquitard is in a westerly to southwesterly direction.

Organic compounds detected in soils during the AES sampling event include trichlorobenzenes, C-46, C-56 and tetrachlorobenzene. The USGS detected only PAHs, 4,4-DDT, and various non-priority pollutants during their analysis of soils from the Buffalo Avenue Site.

According to Dames & Moore (1988), the soil sample analytical data from the Buffalo Avenue Site indicates that most contaminants detected were present in wells MW-1, MW-2, MW-7, and MW-8. Organic compounds detected in the soils include aromatic hydrocarbons, chlorinated aromatics, halogenated ethanes, PAHs, phthalates, and pesticides and metabolites.

According to Dames & Moore (1988), organic compounds detected in the ground water include aromatic hydrocarbons, halogenated ethanes, phthalates, and pesticides and metabolites.

4.6 EAST AREA SITE

The geology of the East Area Site includes: approximately 10.3 feet of fill, which is described as containing "tar-like" substances at certain locations; 7.4 feet of alluvium; approximately 21.9 feet of confining clay/till, which thins to 3.0 feet at B-1; and dolostone and shale bedrock.

Vertical ground water flow beneath the Site is in a downward direction. Horizontal ground water flow in the shallow water-bearing zone above the clay/till aquitard is in a southerly direction towards the Niagara Power Project intake structures.

According to CEC (1983), the soil analytical data from the test borings in the East Area Site indicate the presence of low levels of phthalates (bis (2-ethylhexyl) phthalate). Organic compounds detected in soils during the CRA/OCC sampling event include chlorinated aromatics, halogenated ethanes, and other aliphatics.

Organic compounds detected in the ground water include aromatic hydrocarbons, chlorinated aromatics, phthalates, PAHs, and pesticides.

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5.0 CONCLUSIONS AND RECOMMENDATIONS

Table 5-1 summarizes the reviewed/assessed reports and documents pertaining to the six (6) potential sites for an alternate WTP. This includes: acreage, fill material, any documented contamination identified during test boring/monitoring well installations, fill thickness, and prevalent chemical compounds detected in soil and ground water samples at each of the sites.

Porter Road Site

The Site is underlain by between 5.0 to greater than 47.0 feet of fill which appears to consist mainly of "clean" fill associated with past NYPA excavation activity. However, a maintenance garage has been used for the storage of oil, gas, fertilizers, and possibly other lawn care products, which may be a potential source for contamination. In addition, it should be noted that no records of any previous sampling events were found during this investigation. Considering the origin of the fill material, the likelihood of encountering contaminants in the fill is considered to be low, with possibly only a "hot spot" cleanup required. It is therefore recommended that the Site be considered for additional study.

Fifty-sixth Street Site

The City owns only 1.3 acres (13 lots) of the 17.6-acre (129 lots) Site. The Site is underlain by up to 2.0 feet of fill of unknown origin and is thus considered "suspect". PAHs, toluene, and trace inorganics have been detected in soil samples in and adjacent to the Site and phthalates, carbon disulfide, 2-chlorophenol, and trace inorganics have been detected in ground water samples in and adjacent to the Site. It is recommended that the Site not be considered further for additional study in light of the availability of more suitable sites.

TABLE 5-1

CITY OF NIAGARA FALLS ALTERNATE WATER
TREATMENT PLANT SITE INVESTIGATION

SUMMARY TABLE

SITE NAME	ACRES	FILL MATERIAL	DOCUMENTED CONTAMINATION	FILL THICKNESS	PREVALENT CHEMICAL COMPOUNDS IN SOIL	PREVALENT CHEMICAL COMPOUNDS IN GROUND WATER	RECOMMENDED FOR FURTHER INVESTIGATION
Porter Road Site	5.7	Shot-rock & clay	-	5′ - 47′	-	-	Yes
Fifty-sixth Street Site	17.6	Silt, cinders, & organic debris	-	0 - 2′	PAHs & trace inorganics (59th St.); Toluene & trace inorganics (E & W of 56th St.)	Phthalates, carbon disulfide, 2-chlorophenol, (E of Site), & trace inorganics	No
Chevy Place Site	9.2	Sand, silt, misc. fill, & organic debris	Oily, black chemical stains (NFB-9 NW of Site)	1′ - 7′	PAHs & trace inorganics (64th St.); Toluene & trace inorganics (Chevy Place)	Carbon disulfide & trace inorganics	No
Janik Site	4.9	Sand, silt, misc. fill, & organic debris	-	1′ - 2′	Toluene, trace inorganics (N & W of Site), and 2-butanone (W of Site)	Carbon disulfide & trace inorganics (N of Site)	Yes
Buffalo Avenue (NYPA) Site	30.0	Sand, silt, cinders, incinerator waste, fly ash, shot-rock, & organic debris	-	0 - 20′	PAHs, chlorinated hydorcarbons, & trace inorganics	Phthalate esters & trace inorganics	Yes
East Area Site	8.5	Sand, silt, cinders, demolition debris, fly ash, & organic debris	Chemical odors (B-2 & B-7); chemical odors (CW-13 & OW-294) & tar-like material (OW-262) W of Site	0 - 20′	Chlorinated hydrocarbons	Phthalates, phenols, trac volatiles, trace pesticides, & trace inorganics	No

Chevy Place Site

The Site is underlain by between 1.0 to 7.0 feet of fill which is "suspect" in that its deposition was associated with past municipal landfilling activity. PAHs, toluene, and trace inorganics have been detected in soil samples in and adjacent to the Site and carbon disulfide and trace inorganics have been detected in ground water samples. Considering the origin of the fill material and the presence of contaminants, it is recommended that the Site not be considered for additional study.

Janik Site

The Site is underlain by between 1.0 to 2.0 feet of fill which appears to consist mainly of "clean" fill associated with past urban renewal project demolition. However, it should be noted that no previous sampling events were conducted on the Site proper. Considering the origin of the fill material, the likelihood of encountering contaminants in the fill is considered to be low. It is therefore recommended that the Site be considered for additional study.

Buffalo Avenue (NYPA) Site

The Site is underlain by up to 20.0 feet of fill which appears to consist primarily of "clean" fill associated with past NYPA excavation activity with lesser quantities of municipal waste. Trace amounts of PAHs, chlorinated hydrocarbons, and inorganics have been detected in soil samples from the Site and trace phthalate esters and inorganics have been detected in ground water samples. Considering the origin and the thickness of the fill material, and the likelihood that the municipal disposal occurred largely over the southern portion of the Site, it is recommended that the northwestern portion of the Site be considered for additional study.

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East Area Site

The Site is underlain by up to 20.0 feet of fill which appears to consist of "clean" fill associated with past NYPA excavation activity and "suspect" fill associated with various undocumented landfilling activities. Documented contamination at the Site includes chemical odors noted during monitoring well installation (B-2 and B-7). Chlorinated hydrocarbons have been detected in soil samples from the Site and phthalates, phenols, trace volatiles, trace pesticides, and trace inorganics have been detected in ground water samples. The Site should not be considered for additional study in light of more suitable sites.

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