Site # 2016

ENGINEERING INVESTIGATIONS AT INACTIVE HAZARDOUS WASTE SITES

PHASE II INVESTIGATION
Emerson Street Landfill Site No. 828023
Rochester Monroe County
DATE: February, 1990
Volume 1

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DIVISION OF HAZARDOUS
WASTE REMEDIATION

Prepared for:

New York State Department of Environmental Conservation

50 Wolf Road, Albany, New York 12233
Thomas C. Jorling, *Commissioner*

Division of Hazardous Waste Remediation
Michael J. O'Toole, Jr. P.E., *Director*

BY:

Recra Environmental, Inc.
and
Lawler, Matusky, & Skelly Engineers

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RECRA ENVIRONMENTAL, INC.

Chemical Waste Analysis, Prevention and Control

ENGINEERING INVESTIGATIONS AT INACTIVE HAZARDOUS WASTE SITES

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City of Rochester — Monroe County

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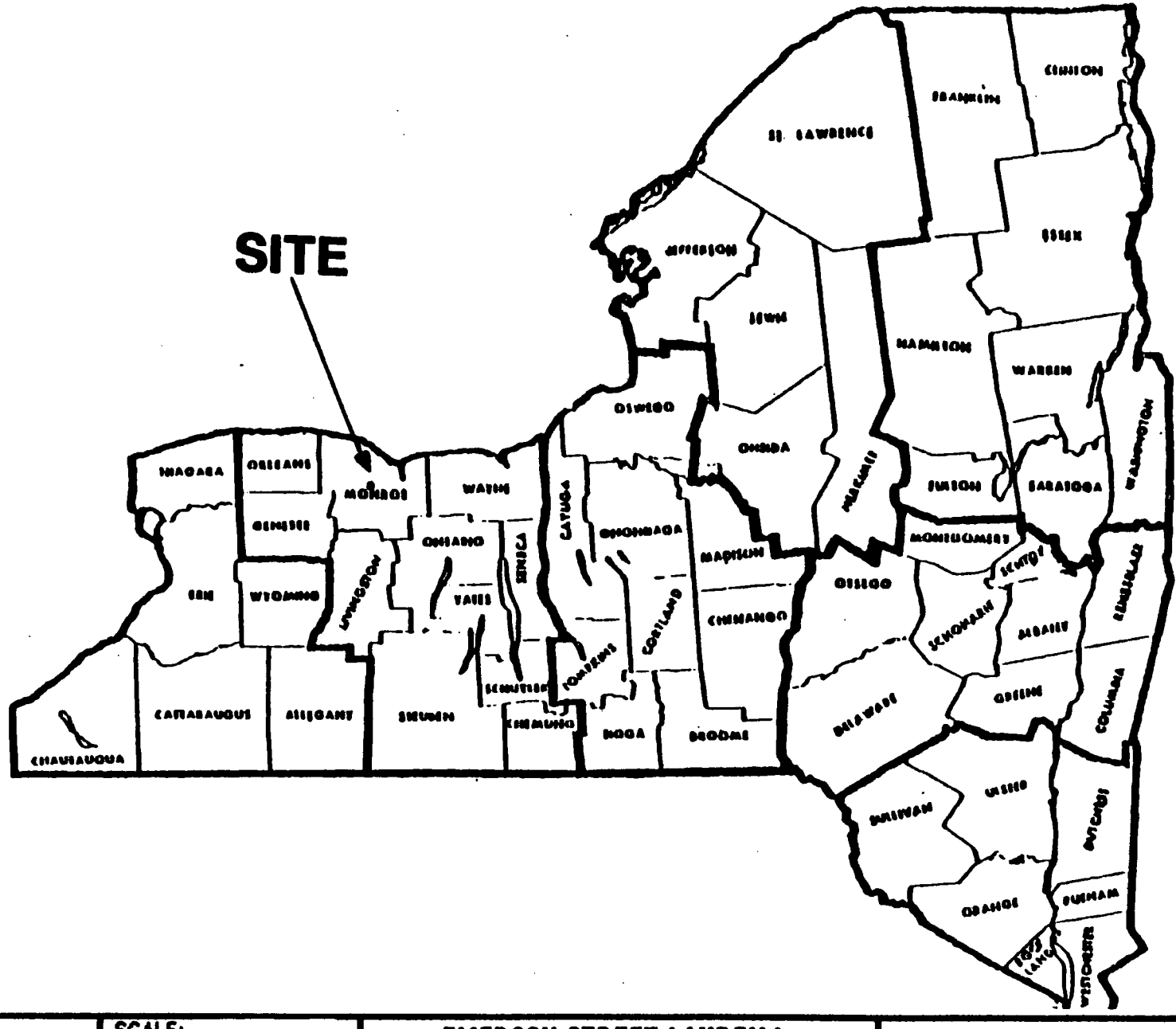
1.0 EXECUTIVE SUMMARY

The Emerson Street Landfill is an approximate 230 acre inactive landfill located within a commercial and residential area in the northwest portion of the City of Rochester, Monroe County, New York (Figures 1 and 2). It is roughly bounded by Lexington Avenue on the north, Lee Road to the west, a railroad right-of-way along the south, and Colfax Street to the northeast (Figure 3). The site was operated by the City of Rochester from around 1930 to 1971, primarily for the land disposal of municipal refuse. Allegations and correspondence have been documented regarding the disposal of radioactive wastes from the University of Rochester, Eastman Kodak Company, and the Minnesota Mining and Manufacturing Company (3M). These wastes have been alleged to contain uranium, thorium, and beryllium. Additionally, commercial and industrial waste disposal has been reported, some of which contained free liquids.

The landfilling activity began in areas south of Emerson Street and progressively expanded northward with time. Prior to landfilling, the area was relatively flat with shallow groundwater levels. Natural soil deposits which are characteristic of poorly drained areas have been observed historically (i.e., prior to landfilling) and presently. A New York State Class II wetland is located approximately 100 feet east of the landfill boundary. The New York State Barge Canal is situated approximately 500 feet southwest of the site.



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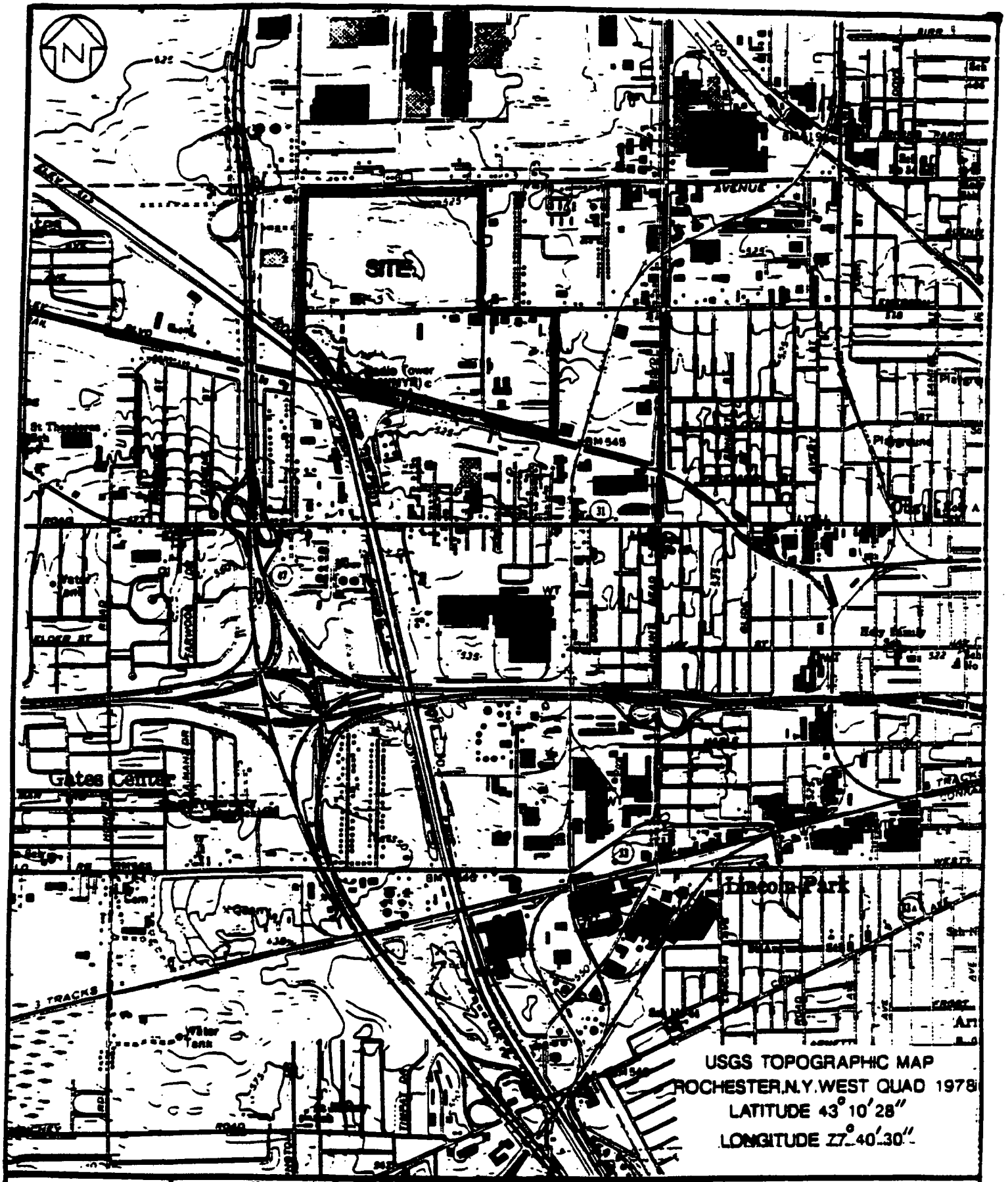
SCALE:		
	BY	DATE
DWN.	PCB	2/3/89
CKD.	JRS	2/8/89
APPVD.		
REV.		

EMERSON STREET LANDFILL
NYSDEC SUPERFUND
PHASE II INVESTIGATION
SITE NO. 828023

SITE LOCATION

PROJECT NO: 8C1301A | DRAWING NO. PB.00238 | FIGURE 1 | A



RECRA ENVIRONMENTAL INC.	Scale: 1"=2000'		EMERSON STREET LANDFILL N.Y.S. SUPERFUND PHASE II INVESTIGATION SITE No.828023	VICINITY MAP
		By	Date	
	Dwn.	JTB	1/89	
	Ckd.	JRS	2/89	
	Ap'vd.			
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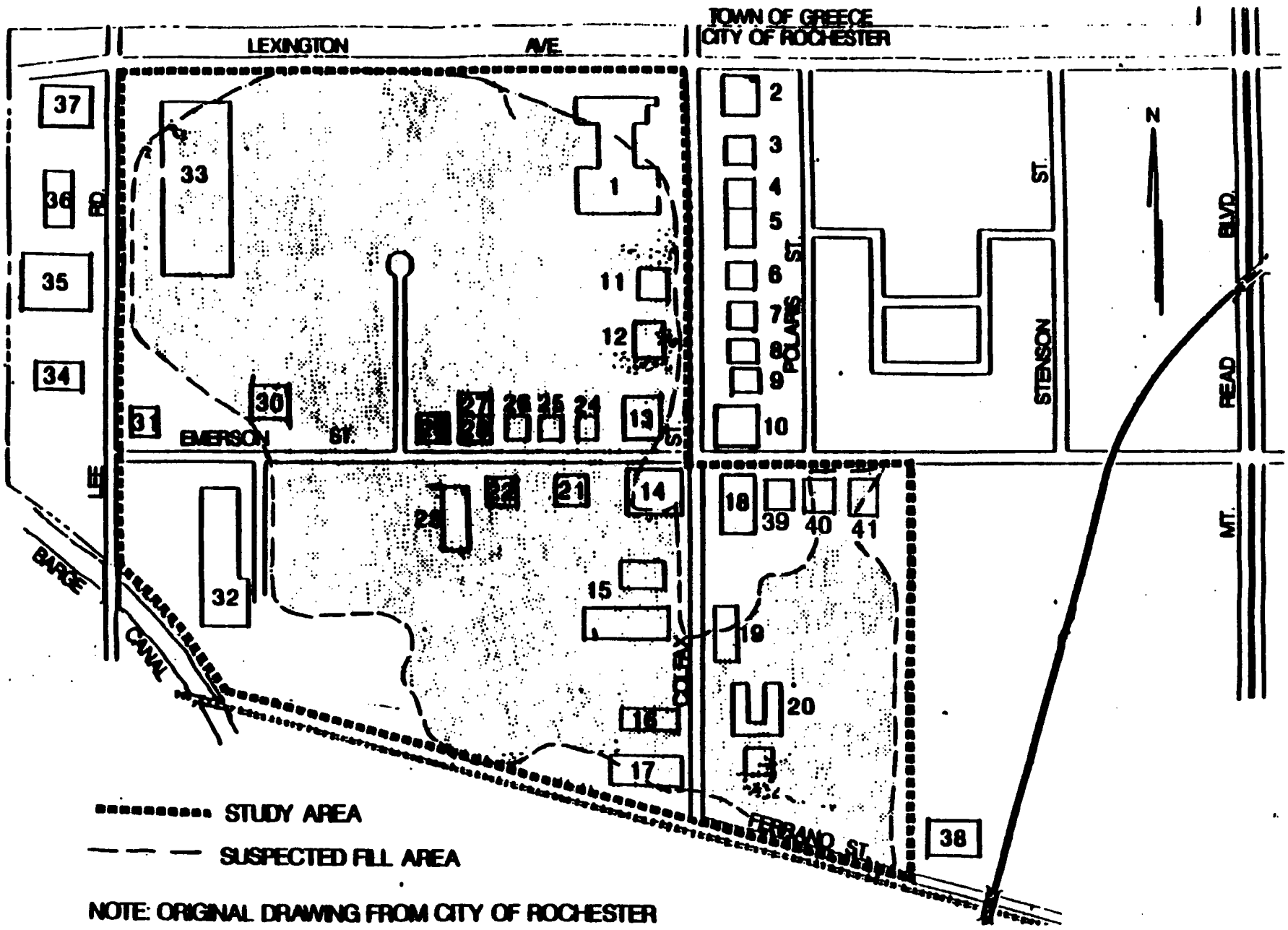
			Project No. 8C1301	A FIGURE 2



NOTE: ORIGINAL DRAWING FROM CITY OF ROCHESTER

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SCALE: 1"=200'		
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DWN.	KYC	1/5/88
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APPVD.	RES	2/8/89
REV.	RES	8/89

EMERSON STREET LANDFILL
NYS SUPERFUND
PHASE II
SITE NO. 828023

PROJECT NO: 8C1301A

A

SITE SKETCH

FIGURE 3

FIGURE 3

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION

FACILITIES LOCATED ON SITE SKETCH

Map #	Facility Name	Address
1	Edison Technical High School	655 Colfax St.
2	Bartolomeo Funeral Home	1425 Lexington Ave.
3	Accu-Dyne Co.	700 Colfax St.
4	Kurz & Zobel	688 Colfax St.
5	Q-Mac, Inc.	686 Colfax St.
6	vacant	Colfax St.
7	Bruening Bearings, Inc.	600 Colfax St.
8	Acro Industries	554 Colfax St.
9	Peko Precision Products, Inc.	500 Colfax St.
10	Peko Precision Products, Inc.	1400 Emerson St.
11	National School Bus Service	575 Colfax St.
12	Cannon Industries	545 Colfax St.
13	Batty & Hout	1444 Colfax St.
14	Federal Stamping	1455 Emerson St.
15	Di Carolis Truck Rental	333 Colfax St.
16	Howard & Bowen, Co.	305 Colfax St.
17	Browning Ferris Corp. (BFI)	145 Colfax St.
18	CME Construction Co., Inc.	1425 Emerson St.
19	City Rochester Forestry Dept.	330 Colfax St.
20	City Rochester Refuse Dept.	210 Colfax St.
21	Printing Methods, Inc.	1525 Emerson St.
22	Abrasive Tool Corp.	1555 Emerson St.
23	Yellow Freight	1575 Emerson St.
24	Dooley Equipment Corp.	1550 Emerson St.
25	Eberhardt Enterprise	1560 Emerson St.
26	Imaging Systems Inc.	1570 Emerson St.
27	Intercom Associates, Inc.	1580 Emerson St.
28	Delta Computer, Inc.	1580 Emerson St.
29	Almac Plastics	1640 Emerson St.
30	Raymond LeChase, Inc.	1740 Emerson St.
31	E.G. Sackett Co., Inc.	454 Lee Road
32	Monroe County Resource Recovery	1845 Emerson St.
33	Rochester Products	500 Lee Road
34	NyLo Mold	515 Lee Road
35	CVC Products, Inc.	525 Lee Road
36	Public Store Management, Inc.	605 Lee Road
37	Racquetball World	687 Lee Road
38	Genesee Brewery	Ferrano St.
39	Uniweld, Inc.	1385 Emerson St.
40	Alton Tool Co., Inc.	1355 Emerson St.
41	Emerson Loop Associates	1335 Emerson St.

During latter periods of operation, the landfill became a source of public criticism and controversy. Complaints of odors, fires, ponding, and rodent infestation have been documented. In 1971, the site was cited for violation of Part 19 of the New York State Sanitary Code which deals with the operation of refuse disposal areas, and Article V - Air Pollution Control Regulations of the Monroe County Sanitary Code, which prohibits open burning of refuse.

The landfill was purchased by the New York State Urban Development Corporation in 1970. This agency initiated a development plan for the area which included the construction of an extensive storm sewer network. The City of Rochester Economic Development Administration has been offering financial incentives since then to entice industry into the area. The landfill was officially closed in October, 1971. Parcels of land have been sold to numerous businesses and the site is currently a large industrial park with few vacant parcels of land remaining. The Edison Technical High School is located on the site along Lexington Avenue and Colfax Street.

The site was listed in the registry of Inactive Hazardous Waste Disposal Sites in New York State by the New York State Department of Environmental Conservation (NYSDEC). A Phase I investigation had been conducted by Recra Research, Inc. in 1983. Geotechnical engineering and environmental studies, including the drilling of at least 201 test borings, have been conducted at the site by others. Elevated combustible gas measurements were documented by Rochester Drilling Company, Inc. (Rochester Drilling) in 1980. Analysis of a composite fill sample collected by Rochester Drilling revealed elevated levels of cyanide, phenol, arsenic, cadmium, copper, lead, mercury, and zinc, along with detectable levels of methylene

chloride, trichloroethene, tetrachloroethene, benzene, toluene, ethylbenzene, total xylenes, and PCB's (Aroclor 1254). Sampling and analysis by the New York State Department of Health in 1987 identified the presence of low level organic and inorganic compounds from the area immediately west of Edison Technical High School.

The significant results and conclusions based on the activities conducted during the Phase II investigation are discussed in detain in subsequent sections fo this report. An abbreviated outline of the findings is as follows:

Drilling activities around the landfill perimeter, as well as previous investigations, have revealed the presence of fill, soil, and dolomite bedrock existing in variable thicknesses and at irregular depths beneath the surface. The fill thickness was found to be up to 16.5 feet directly overlying bedrock and up to 20 feet directly over glacial till/recent deposits.

Groundwater was observed to occur under water table conditions. The top of the water table was variable across the site and was found in both the unconsolidated material and bedrock. Well GW-3 represented the highest relative groundwater elevation. It appears that mounding and a radial flow pattern may be present beneath the site.

Chemical analytical testing of groundwater, surface water and sediments has revealed the presence of low levels of volatile organic, semi-volatile organic, and pesticide compounds. Inorganic contamination in contravention of existing NYSDEC water quality standards (6NYCRR 701,703.5) has been identified in both the groundwater and

surface waters.

Sediments and ash residue samples were found to contain a variety of inorganic constituents above documented concentrations in non-contaminated soils from similar environments.

A radiological survey within the site identified three areas south of Emerson Street with radiation levels above background conditions.

Monitoring for combustible gases during the advancement of test borings revealed elevated explosivity levels at two locations. This is interpreted as probable methane gas generation within the landfill.

The results of this investigation and previous studies were used to calculate a HRS score based upon the United States Environmental Protection Agency, July, 1982 Users Manual (HW-10). Three scores were calculated for the site: the Sm score, the S_{FE} score and the S_{DC} score. The Sm score reflects the potential for impacting human health and the environment due to migration of hazardous substances away from the facility. It is a composite of scores for groundwater (S_{gw}), surface water (S_{sw}) and air (S_a) transport routes. The S_{FE} score reflects the potential for harm from fires or explosions, and the S_{DC} score reflects the potential harm from direct contact with hazardous substances.

The HRS scores for the Emerson Street Landfill site have been calculated as follows:

$S_m = 6.09$

$S_{gw} = 7.46$

$S_{sw} = 7.44$

$S_a = 0.00$

$S_{FE} = 0.00$

$S_{DC} = 50.00$

Based on the assessment of all data generated from the Phase II investigation, the need for additional data pertinent to evaluating the site has been identified. Recommendations for obtaining this data are:

Install piezometers in a systematic network throughout the site. At points of shallow groundwater, piezometers should be installed. The network will provide an expanded geohydrologic data base whereby static pressure heads in the groundwater system can be evaluated laterally.

Collect soil and/or fill samples and perform gamma spectrographic analysis from the area of alleged radioactive waste disposal south of Emerson Street. This is needed to develop a horizontal and vertical profile of source materials and to clearly establish the disposal option required.

Collect fill samples and analyze for total PCB concentrations. The need for this is based on the finding of 14 parts per million of total PCB's in a 1985 composite fill sample.

Collect and analyze additional surface water, sediment and storm sewer samples to better define background contaminant concentrations and further define source locations.

2.0 PURPOSE

The purpose of this Phase II Site Investigation is to address specific concerns regarding past waste disposal practices at the Emerson Street Landfill Site and to provide additional information for scoring the site utilizing the Hazard Ranking System (HRS). The HRS is the standard numeric ranking system adopted by NYSDEC for state inactive hazardous waste sites. A preliminary HRS score of the site was obtained through a Phase I investigation conducted by Recra Research, Inc., in 1983, and this Phase II investigation is intended to fill data gaps and substantiate previous findings for a final HRS score.

The objectives of the Phase II investigation are:

- Provide a preliminary geologic and hydrogeologic site assessment.
- Identify and evaluate the presence and nature of contamination.
- Based on conclusions formulated by accomplishing the objectives identified above evaluate the environmental significance and potential impact on public health.
- Provide additional information for scoring the site utilizing the 1982 Mitre Model Hazard Ranking System (HRS).
- Prepare a report document in accordance with NYSDEC's Phase II report format.

3.0 SCOPE OF WORK

The scope of work for the Emerson Street Landfill Phase II Investigation has been defined in a workplan prepared by Recra Environmental, Inc. (Recra) in association with Lawler, Matusky and Skelly Engineers (Ref. 1). Included in the workplan were the data collection requirements and procedures identified to fulfill the investigation's objectives. These data collection activities had included the following tasks:

- Literature Review
- Public Meeting
- Site Reconnaissance
- Geophysical Investigation
- Radiological Survey
- Subsurface Investigation
- Monitoring Well Installation
- Permeability Testing
- Sampling and Analysis
- Drum Material Handling
- Surveying

Details of the specific procedures used in performing each work task are presented in the following sections.

3.1 Literature Review

Prior to initiating field work, a literature review was performed to review available data pertinent to the site. During this process, the Phase I report was examined for completeness and information gathered prior to its development was verified. New data was examined that had been generated

after the completion of the Phase I report. The literature review included examination of site sketches, county and city records, aerial photographs, utility maps (water and sewer) and correspondence between state and local agencies. For the Emerson Street Landfill site, the primary sources of information used were: the City of Rochester Department of Environmental Services, Monroe County Environmental Management Council, Monroe County Department of Health, Monroe County Department of Pure Waters, Monroe County Resource Recovery Facility, and NYSDEC Region 8 Office, Avon, New York. The information developed from this review was used primarily to assist in making adjustments to the proposed monitoring well and sample point locations, verify fill depths, define groundwater elevations, determine bedrock surface, and identify property ownership.

3.2 Public Meeting

A public meeting was held at the Edison Technical High School on June 14, 1988, to discuss the proposed Phase II investigation of the Emerson Street Landfill. The meeting was held under the auspices of the NYSDEC. At this meeting, Recra and NYSDEC discussed with property owners and the general public the investigation tasks proposed for the site investigation and the proposed project schedule.

3.3 Site Reconnaissance

On July 11 to 13, 1988, Recra conducted a site reconnaissance prior to the commencement of drilling and/or sampling activities. During this time, information pertinent to performing a drilling program was obtained. This included locating accessible water, evaluating site accessibility, communicating with property owners whose property was being considered for

drilling locations, and noting overall conditions at the site. Concurrent with the site reconnaissance, Recra performed air monitoring using an HNu photoionization detector. The air monitoring levels were taken in the zone of breathing, normally 4 to 6 feet above ground surface. This monitoring was conducted around the entire perimeter of the site to detect the presence of volatile contaminants. Specifically, upwind and downwind locations were monitored and wind directions were noted.

Based on these observations and air monitoring results, Recra developed and submitted to NYSDEC a site specific Health and Safety Plan which identified the responsibilities of authorized personnel, criteria for medical surveillance, requirements for training, establishment of reduction zones, specifics for a protection program requiring a minimum level D personnel protective equipment, decontamination procedures, monitoring requirements, action levels, and emergency information.

3.4 Geophysical Investigation

3.4.1 Introduction

On July 11 to 13, 1988, a geophysical survey using a terrain conductivity technique was conducted by Dunn Geoscience Corporation as a subcontractor to Recra. This survey was performed in an attempt to define the limits of fill material, to characterize the electrical conductivity of the site, and to determine the possible presence of conductive groundwater contaminant plumes. On July 28 and 29, 1988, a magnetometer survey was performed at each proposed drilling location. This was performed in an attempt to detect any metallic objects of appreciable size in the areas of proposed drilling activities. The geophysical information obtained was used to

minimize the number of drill sites, assist in determining the location of monitoring wells, and reduce the risk associated with drilling into unknown terrain and waste.

3.4.2 Methodologies

The terrain conductivity survey was performed utilizing a Geonics Model EM-31 DL terrain conductivity meter to measure the subsurface conductivity characteristics. The EM-31 can measure the subsurface conductivity to an average depth of approximately 6 meters (18 feet). It measures the apparent conductivity of the ground in millimhos per meter and has a noise level of <0.1 millimho per meter. An EM-31 terrain conductivity survey is valuable for obtaining initial information in areas which consist of unknown materials and can also support other geophysical investigations that present common objectives. The instrument is generally sensitive to underground conductors (i.e., metallic objects, large pipes, buried drums, etc.) and can also reflect lateral changes in the conductivity of materials in the subsurface. In some cases, contaminated groundwater can also be identified using geophysical techniques. Groundwater contamination as detected by the EM-31 is based upon the presence of electrolytes in solution; primarily the presence of chloride ions. Although such electrolytes are commonly not of primary concern, they are frequently transported with other constituents such as organic chemical compounds, of which few are conductive.

Prior to data collection, traverses were selected to encompass the perimeter of the suspected fill area. Base stations were established at each turning point with a 200 ft. tape measure. After calibrating the instru-

ment, readings were taken at 20 foot centers, both parallel and perpendicular to the direction of travel, where possible. The 200 foot tape was extended along the path of each traverse to insure accurate station location. All readings were taken with the instrument in the "operational" mode which measures the quadrature-phase component of an induced magnetic field. This component is linearly related to actual ground conductivity.

The magnetometer survey was performed at each proposed drilling location using an EG&G Geometrics, Inc. Model G-846 proton magnetometer. This instrument measures spatial variations of perturbations in the earth's magnetic field caused by the presence of ferrous materials. Total magnetic field intensity readings (in gamma's) were recorded in a 40 foot by 40 foot cross pattern centered at each proposed location.

3.4.3 Field Survey

A total of thirteen (13) traverses were completed using the terrain conductivity technique. Seven (7) were completed parallel to existing roads and six (6) were performed through wooded areas or open fields. The total length of terrain conductivity survey lines completed at the site was approximately 16,285 linear feet. An initial base station was located on the southeast corner of the intersection of Lexington Avenue and Lee Road. Subsequent base stations or turning points were situated throughout the site as depicted on Drawing No. 2 (Appendix A). Turning points and base stations were tied into two existing structures, where possible. Traverses through fields and wooded areas were marked by attaching red surveyors tape to tree limbs and trunks at approximate 150 foot intervals. The length of the individual profiles varied.

The magnetometer survey was performed at eleven (11) proposed drilling locations. Measurements were taken at radial distances of 10 and 20 feet.

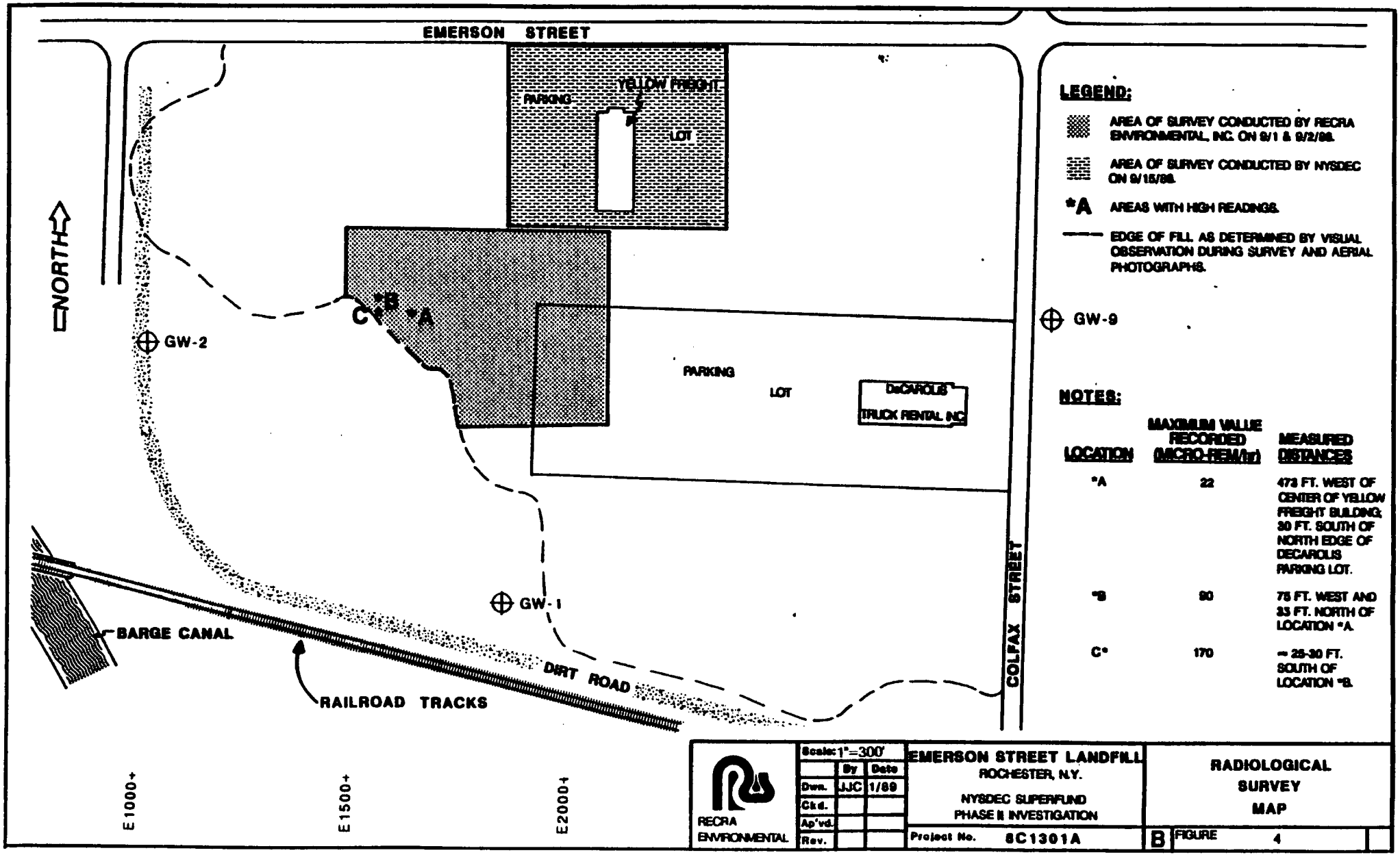
A report of the geophysical survey methodologies, techniques, and results is presented in Appendix B (Dunn Geoscience Report).

3.5 Radiological Survey

A radiological survey was conducted by Recra on September 1 and 2, 1988 in an area of alleged disposal of radioactive wastes (Ref. 2). The instruments utilized were a Ludlum Model 19 Micro R meter (i.e., NaI scintillation meter) and a G.E. Smith and Associates GS500P Geiger Counter. These two instruments were intended to complement each other as the Micro R meter measures gamma radiation and the geiger counter measures gamma and beta radiation. The Micro R meter is a more sensitive instrument and measures radiation in microrems per hour, whereas the geiger counter measures radiation in millirems per hour.

Traverses were conducted over the suspected disposal area in a north-south manner and were spaced from 6 to 10 feet apart. Each meter was read continuously along the traverses and readings twice that of background were noted. The survey area is depicted on Figure 4. Field data is provided in Appendix C.

An additional radiological survey was conducted by NYSDEC on September 15, 1988 over a parking lot on property owned by the Yellow Freight Company. The survey was conducted adjacent to the northeast portion of the initial disposal survey. Field notes are presented in Appendix C.


EMERSON STREET
NORTH
PARKING
YELLOW FREIGHT
LOT
GW-2
C* *B *A
PARKING
LOT
DeCAROLIS
TRUCK RENTAL INC
GW-9
GW-1
BARGE CANAL
DIRT ROAD
RAILROAD TRACKS
COLFAX STREET
E1000+
E1500+
E2000+
LEGEND:
AREA OF SURVEY CONDUCTED BY RECRA ENVIRONMENTAL, INC. ON 9/1 & 9/2/88.
AREA OF SURVEY CONDUCTED BY NYSDEC ON 9/15/88.
*A AREAS WITH HIGH READINGS.
EDGE OF FILL AS DETERMINED BY VISUAL OBSERVATION DURING SURVEY AND AERIAL PHOTOGRAPHS.
NOTES:
LOCATION | MAXIMUM VALUE RECORDED (MICRO-REM/hr) | MEASURED DISTANCES
*A | 22 | 473 FT. WEST OF CENTER OF YELLOW FREIGHT BUILDING; 30 FT. SOUTH OF NORTH EDGE OF DECAROLIS PARKING LOT.
*B | 90 | 75 FT. WEST AND 33 FT. NORTH OF LOCATION *A.
C* | 170 | ≈ 25-30 FT. SOUTH OF LOCATION *B.
RECRA ENVIRONMENTAL
Scale: 1"=300'
By Date
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EMERSON STREET LANDFILL
ROCHESTER, N.Y.
NYSDEC SUPERFUND
PHASE II INVESTIGATION
Project No. 8C1301A
RADIOLOGICAL SURVEY MAP
B FIGURE 4

A survey with these same instruments was conducted by Recra over each proposed boring location on July 28 and 29, 1988. Traverses were conducted on the survey patterns established for the magnetometer measurements. Readings were taken continuously over each proposed location and average values were documented for each 6 foot distance.

Continuous monitoring with the Micro R meter and geiger counter was performed by Recra during drilling and sampling activities. All auger cuttings and split spoon samples were monitoring, as well as well development water and sediment and water samples that were collected.

3.6 Subsurface Investigation

Twelve (12) test borings were drilled during the period August 2 to September 2, 1988 by American Auger and Ditching Company of West Monroe, New York. All work was conducted with field supervision by a Recra geologist. Each boring location was selected by Recra and approved by NYSDEC based upon review of the geophysical survey data, historical landfilling operations, existing subsurface utility information, and physical obstructions. All boring locations are depicted on Drawing 1 (Appendix A). Each boring was designed to penetrate the top 10 feet of the zone of saturation.

Test borings were advanced with 4 ¼-inch inside diameter (I.D.) hollow stem auger driven by a CME-55 truck mounted drill rig. Soil samples were collected with a two (2) inch outside diameter (O.D.) split barrel sampler advanced in accordance with the standard penetration test procedure (ASTM D-1586). Where possible, samples were collected continuously in the zone of saturation. All samples were monitored for the presence of volatile or explosive gases and radiation immediately after the sample barrel was

opened by using a photoionization detector, compustible gas and oxygen alarm, geiger counter, and NaI Scintillation meter. Each sample was visually described in the field by the geologist and placed in a labeled, screw cap glass jar.

Borings were advanced with NX size diamond core drilling methods where bedrock was encountered. Rock core samples were obtained in accordance with the standard procedure for diamond core drilling (ASTM D-2113). All samples were visually described by the field geologist.

Drilling and stratigraphic information specific to each boring is presented on subsurface logs in Appendix D.

As a safety precaution, each area where a boring was to be advanced was divided into three discrete zones. These divisions included the exclusion or work zone, the contamination reduction zone (CRZ) and the support or safe zone.

The support zone was set up in an area believed to be free of contamination and removed from the active drilling operation. This zone contained a vehicle equipped with supplies, site specific work plans, health and safety information and first aid supplies. In the support zone, personnel donned protective clothing and activated monitoring equipment.

The CRZ served as a buffer zone between the support and exclusion zones. Personnel removed protective clothing and decontaminated equipment during passage through the CRZ after exit from the exclusion zone on their way to the support zone.

The exclusion zone included the areas which were considered potentially contaminated and where actual drilling activities took place. The border of this zone was marked with plastic snow fencing, which was staked and secured in an effort to inhibit public access to the work area. No personnel were allowed to pass into this zone without the designated, proper level of protection.

3.7 Monitoring Well Installation

3.7.1 Well Construction

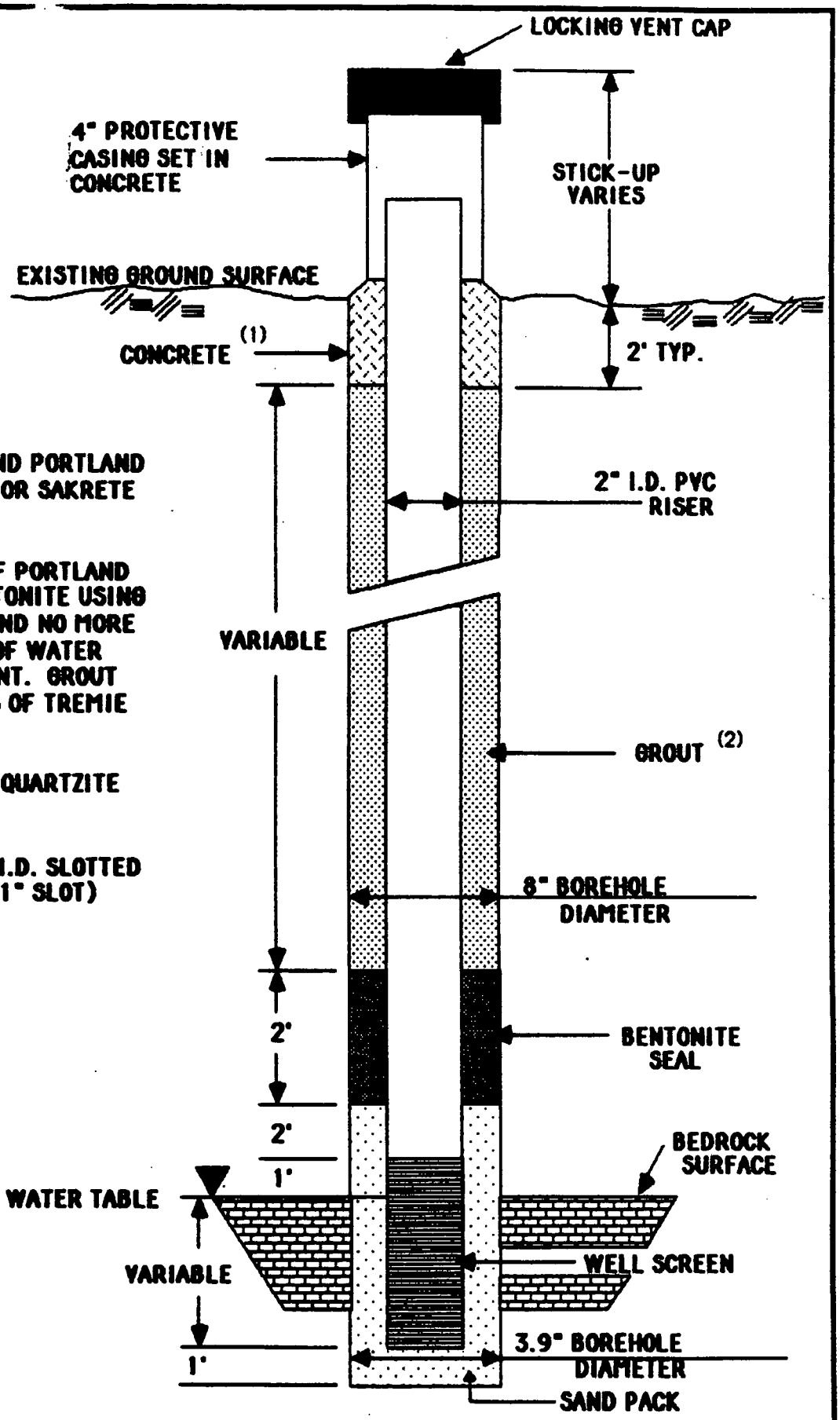
A total of twelve (12) monitoring wells were installed from August 2 to September 2, 1988. These wells were installed either partially or entirely in the bedrock to depths ranging from 11 to 28 feet, as dictated by the occurrence of a water bearing zone. Decisions for specific constructions were made after a review of the test boring data in the field by Recra in concurrence with the NYSDEC. Regardless of where the well was positioned, two basic construction schemes were utilized. These were a screened monitoring well or an open hole bedrock monitoring well. Individual well construction details are presented in Appendix D of this report.

The screened monitoring wells were constructed with 5 to 15 foot long, 2 inch I.D., threaded flush jointed, Schedule 40 PVC, 0.010 inch well screen and equivalent riser casing. Well screens were installed with the top of the screen located one foot or more above the encountered water table to allow for seasonal fluctuations in groundwater elevations. All installations of this type included a washed and graded sand pack surrounding the well screen and extending approximately two feet above the screen top. A two foot thick bentonite seal was placed above the sand pack and the

remaining annulus was filled, via tremie, with cement/bentonite grout to within two feet of the ground surface. A four inch diameter steel casing with locking cap was placed over each well and cemented in place. Typical monitoring wells of this type are illustrated in Figures 5 and 6.

At most locations where the overburden type well was installed, the well screen was placed partially in the bedrock and above to monitor a basal gravel/weathered bedrock zone. At these locations, the NX core hole was enlarged to 3-7/8 inches to facilitate installation of the 2-inch well screen and sandpack. At two locations, GW-1 and GW-9, overburden type wells were installed entirely within the bedrock. At two other locations, GW-10 and GW-8, well couplets were installed. At these two locations a distinct water bearing zone was identified a few feet above the bedrock surface. Shallow screened wells were installed to monitor this zone and the interface with the top of bedrock (Figure 5). Secondary deeper bedrock wells were then installed to monitor transmissive zones at least 6 to 7 feet below the rock surface (Figure 7).

Bedrock monitoring wells were installed by removing the hollow stem augers and driving seven inch casing down to the bedrock surface. Upon refusal on this surface, an NX-core barrel was advanced at least five feet into the bedrock. The open rock hole created by NX core drilling was enlarged to 4½ inches by rotary drilling with a tricone bit. This enabled the installation of three inch I.D. Schedule 40 PVC casing into the bedrock. Potable water was used and recycled as the drilling fluid during the rotary drilling procedure. The PVC casing was permanently grouted in place with a cement and bentonite mixture. After the grout had cured for at least 16 to 18 hours, an NX core barrel was advanced until saturated transmissive zones



NOTES:

(1) CONCRETE:SAND AND PORTLAND CEMENT MIXTURE OR SAKRETE PREPACKED MIX

(2) GROUT:MIXTURE OF PORTLAND CEMENT AND BENTONITE USING 10% BENTONITE AND NO MORE THAN 7 GALLONS OF WATER PER BAG OF CEMENT. GROUT PLACED BY MEANS OF TREMIE GROUTING

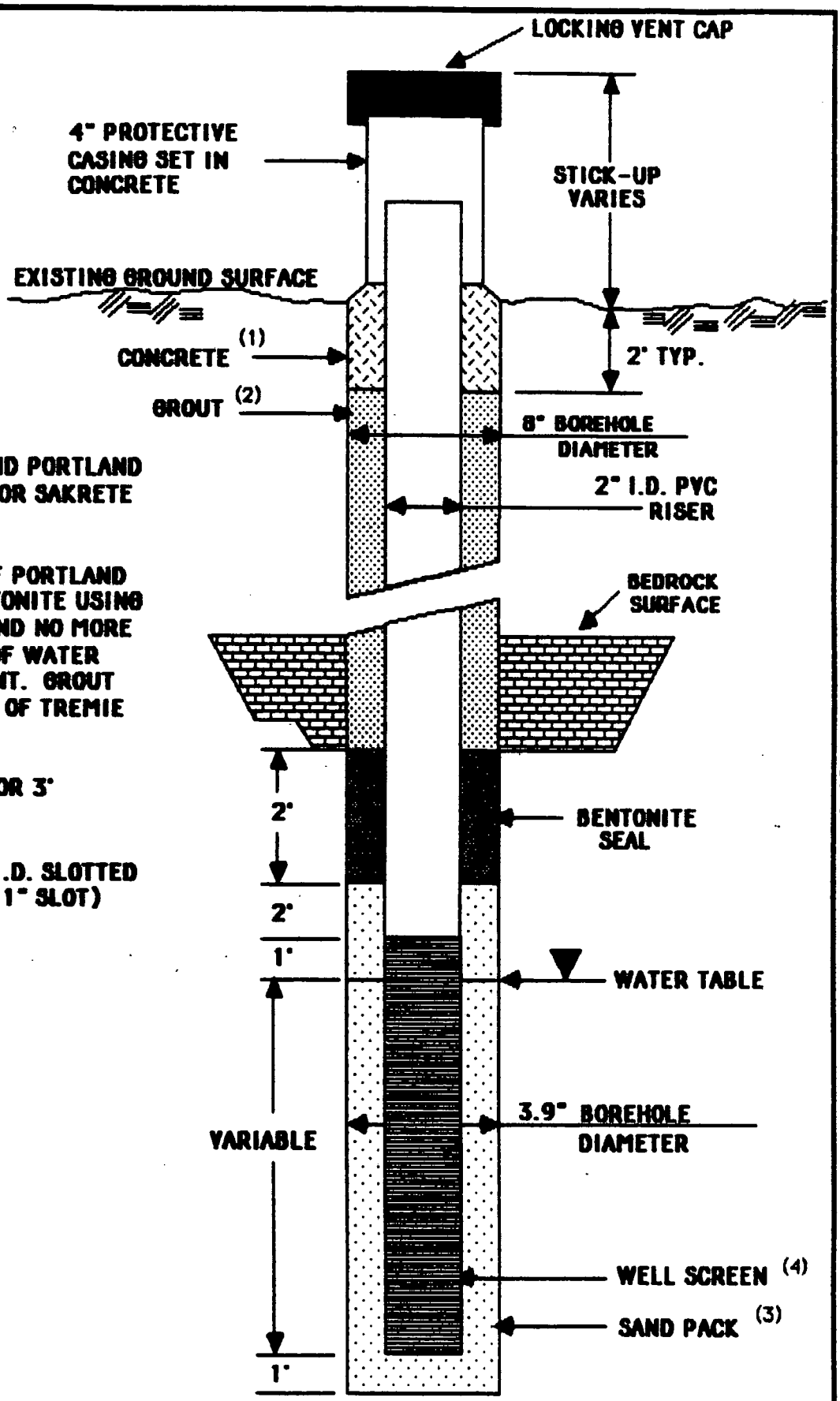
(3) SAND PACK: NO. 2 QUARTZITE SAND

(4) WELL SCREEN: 2" I.D. SLOTTED SCH. 40 PVC (0.01" SLOT)

PB.00239

RECRA ENVIRONMENTAL INC	SCALE: NTS		EMERSON ST. LANDFILL NYSDEC SUPERFUND PHASE II INVESTIGATION SITE NO. 828023	TYPICAL OVERBURDEN/BEDROCK INTERFACE MONITORING WELL
		BY / DATE		
	DWN.	PCB 2/3/89		
	CKD.	JRS 2/5/89		
	APPVD.	RES 8/89		
	REV.		PROJECT NO. 8C1301A	FIGURE 5 A

3-11



NOTES:

(1) CONCRETE:SAND AND PORTLAND CEMENT MIXTURE OR SAKRETE PREPACKED MIX

(2) GROUT:MIXTURE OF PORTLAND CEMENT AND BENTONITE USING 10% BENTONITE AND NO MORE THAN 7 GALLONS OF WATER PER BAG OF CEMENT. GROUT PLACED BY MEANS OF TREMIE GROUTING

(3) SAND PACK: NO. 2 OR 3' QUARTZITE SAND

(4) WELL SCREEN: 2" I.D. SLOTTED SCH. 40 PVC (0.01" SLOT)

P8.00239A

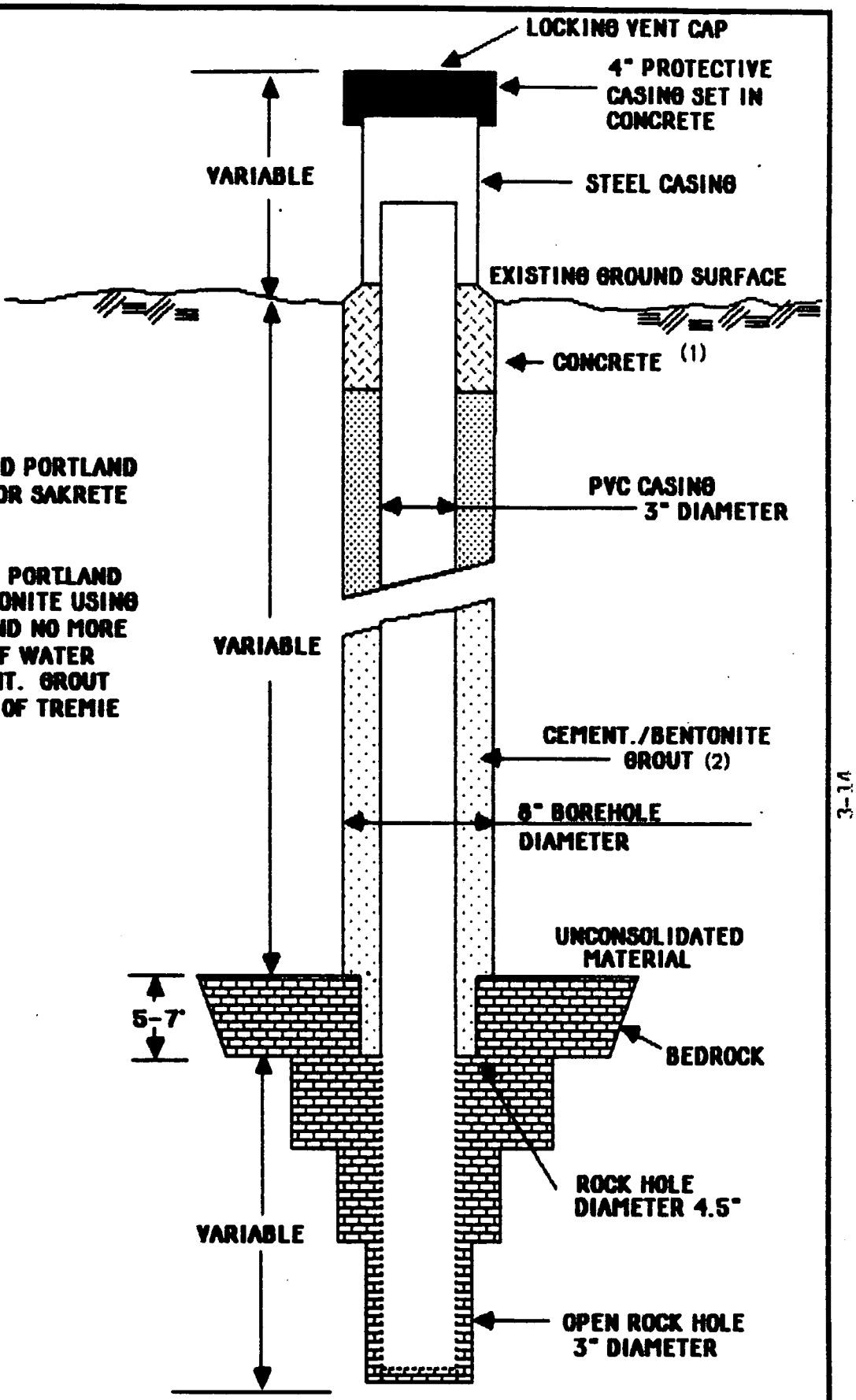
RECRA ENVIRONMENTAL, INC.	SCALE: NTS		EMERSON ST. LANDFILL NYSDEC SUPERFUND PHASE II INVESTIGATION SITE NO. 828023	TYPICAL SCREENED WELL CONSTRUCTED IN BEDROCK
		BY / DATE		
	DWN.	PCB 2/3/89		
	CKD.	JRS 2/1/89		
	APPVD.	RES 8/89		
	REV.		PROJECT NO. 8C1301A	A FIGURE 6

within the rock were encountered. The open NX core hole thereafter served as the intake for the well. Typical well construction details for bedrock wells are presented on Figure 7.

3.7.2 Well Development

Well development was initiated at least 24 hours subsequent to the completion of grouting. Well development was performed to correct any clogging of the water-bearing formation which may have occurred as a side effect of the drilling and to remove drilling water from the water table such that each well would yield water which was representative of the in situ conditions. Each well was initially evacuated with a suction lift pump located on the drill rig. In some cases where the evacuation rate exceeded the yield of the well, further development was performed by surging and evacuation with pre-cleaned, dedicated PVC bailers. Prior to each well development, the static water level was recorded using an electric level sounder and engineer's ruler. The well bottom was measured using a fiberglass tape.

The development process was continued until a turbidity measurement of less than 50 Nephelometric Turbidity Units (NTU) was obtained and measurements of pH and specific conductance had stabilized. For wells where the water did not show signs of clearing up, potable water was alternately pumped into each well and withdrawn as an attempt to remove the fines in close proximity to the well screen. Where unsuccessful, additional development efforts were performed by surging, bailing, or suction lift pumping imme-



NOTES:

(1) CONCRETE:SAND AND PORTLAND CEMENT MIXTURE OR SAKRETE PREPACKED MIX

(2) GROUT:MIXTURE OF PORTLAND CEMENT AND BENTONITE USING 10% BENTONITE AND NO MORE THAN 7 GALLONS OF WATER PER BAG OF CEMENT. GROUT PLACED BY MEANS OF TREMIE GROUTING

PB.002398

RECRA ENVIRONMENTAL, INC.	SCALE: NTS		EMERSON ST. LANDFILL NYSDEC SUPERFUND PHASE II INVESTIGATION SITE NO. 828023	TYPICAL BEDROCK MONITORING WELL
		BY / DATE		
	DWN.	PCB 2/3/89		
	CKD.	JRS 2/11/89		
	APPVD.	RES 3/89		
	REV.		PROJECT NO. 8C1301A	A FIGURE 7

3-14

diately before sampling. Static water level measurements were made following well development. Tabulated well development data is presented in Appendix E.

3.7.3 Permeability Testing

In situ permeability testing of the newly installed monitoring wells was conducted by Recra on November 10 to 11, and 14 to 15, 1988. Initial static water level measurements were made in each well followed by the injection of a weighted slug of a specific volume. An instantaneous head displacement associated with the slug volume was created and the subsequent decline in water level was measured with an electric water level sounder. Once head conditions reached a static state or attained 10% of the initial displacement, the slug was removed. The subsequent rise in water level was then measured with an electric water level sounder.

Data analysis involved the determination of the coefficient of permeability. The analysis performed utilized a technique provided by Harry R. Cedergren in Seepage, Drainage and Flow Nets, 2nd Edition, whereby the log of the head ratio (dependent variable) is plotted with respect to elapsed time (independent variable). Data points for the permeability determination were then obtained from a linearization of this plot and utilized in an appropriate equation.

This testing provided data on the permeability of the materials at the top of the water table. These values were subsequently extrapolated to approximate permeability in the unsaturated zone as required in scoring under the HRS. All data and calculations are presented in Appendix F.

3.8 Sampling and Analysis

3.8.1 Groundwater Samples

Following the equilibration of water levels within the newly installed wells, water elevations were measured to determine the water table surface. Measurements were taken on November 9 and December 16, 1988.

Representative groundwater samples were collected by Recra on September 20 to 23, 1988. Prior to sample collection, all wells were purged of their standing water. Low yield wells were evacuated to dryness. For moderate to high yield wells, a volume of three (3) times the borehole contents were removed.

Evacuation of water from the wells and sample collection was accomplished with dedicated PVC bailers or with an ISCO Model 1580 peristaltic pump. Dedicated low-density polyethylene tubing was used when pumping was employed. Samples for volatile organic analyses were collected utilizing the dedicated PVC bailers.

Resampling of wells GW-3,4,5,7,9,10S and 10D was performed on April 25, 1989. Samples collected at this time were analyzed only for semi-volatile organic compounds. The resampling was necessary as the original analysis of these compounds for the specified wells was found to be non-compliant with NYSDEC Contract laboratory Protocol. The wells were evacuated and sampled with dedicated PVC bailers or with an ISCO Model 1580 peristaltic pump. Dedicated low-density polyethylene tubing was used when pumping was employed.

Upon collection of each sample, field pH, temperature, specific conductance, radiation, and turbidity measurements were recorded. Each sample was placed in an appropriate pre-cleaned bottle or septa vial, labeled, chilled and returned daily to the Recra Environmental, Inc. laboratories in Tonawanda, New York for analysis. Chain of Custody Records were maintained by authorized sampling personnel from the point of collection to delivery at the laboratory. Specific sample collection data is presented in Appendix G.

3.8.2 Surface/Storm Water Samples

Surface water and storm water samples were collected during September 23 to 28, 1988, to aid an evaluation of possible contaminant migration through gravel beds for utilities, storm drains, building sumps, and via the surface water route. The final selection of these sampling locations was made after the literature review and in conjunction with NYSDEC recommendations and approval. All locations are presented on Drawing No. 1 (Appendix A).

Surface water samples were obtained using pre-cleaned PVC bailers or by directly collecting the sample into the sample containers. At the time of collection, samples were analyzed for pH, specific conductance, temperature and radiation. The samples were then chilled and returned daily to the Recra Environmental, Inc. laboratories for analysis. Chain of Custody Records were maintained as described above. Specific sample collection data is presented in Appendix G.

3.8.3 Sediment Samples

Sediment samples were collected on November 28, 1988, in a wetland area, near each surface water sample and in the bottom of two intermittent streams located on Drawing No. 1. These were collected to aid evaluation of possible contaminant migration via the surface water route. A sample of ash was also collected from the City of Rochester incinerator.

Sediment samples were collected by utilizing a pre-cleaned hand trowel or hand auger. Samples were collected from the upper 1 to 2 feet of soil and placed in pre-cleaned glass sampling containers. Upon collection, the samples were tested for radiation, chilled, and returned daily to the Recra Environmental, Inc. laboratories in Tonawanda, New York for analysis. Chain of Custody Records were maintained; specific sample collection data is presented in Appendix G.

3.8.4 Chemical Analytical Methods

Samples collected during this Phase II investigation for chemical analysis were evaluated for the parameters listed in Table 3-1 and Table 3-2.

All samples were analyzed at Recra Environmental, Inc. laboratories. The aqueous matrix samples were analyzed utilizing the 1987 New York State Contract Laboratory Protocol (CLP) for organic parameters. For the inorganics, the 1986 New York State CLP was followed. All solid matrix samples were analyzed in accordance with the 1987 New York State CLP.

TABLE 3-1

CHEMICAL ANALYTICAL TEST METHODS
ORGANIC COMPOUNDS
EMERSON STREET LANDFILL
#828023

Contract Laboratory Protocol (CLP)
Target Compound List (TCL) and
Contract Required Quantification Limits (CRQL)*

Constituents	CAS Number	Quantitation Limits ** Water (ug/L)	Low Soil/Sediment(a) (ug/Kg)
1. Chloromethane	74-87-3	10	10
2. Bromomethane	74-83-3	10	10
3. Vinyl Chloride	75-01-4	10	10
4. Chloroethane	75-00-3	10	10
5. Methylene Chloride	75-09-2	5	5
6. Acetone	67-64-1	10	10
7. Carbon Disulfide	75-15-0	5	5
8. 1,1-Dichloroethene	75-35-4	5	5
9. 1,1-Dichloroethane	75-34-3	5	5
10. 1,2-Dichloroethene (total)	540-59-0	5	5
11. Chloroform	67-66-3	5	5
12. 1,2-Dichloroethane	107-06-2	5	5
13. 2-Butanone	78-93-3	10	10
14. 1,1,1-Trichloroethane	71-55-6	5	5
15. Carbon Tetrachloride	56-23-5	5	5
16. Vinyl Acetate	108-05-4	10	10
17. Bromodichloromethane	75-27-4	5	5
18. 1,2-Dichloropropane	78-87-5	5	5
19. cis-1,3-Dichloropropene	10061-01-5	5	5
20. Trichloroethene	79-01-6	5	5
21. Dibromochloromethane	124-48-1	5	5
22. 1,1,2-Trichloroethane	79-00-5	5	5
23. Benzene	71-43-2	5	5
24. trans-1,3-Dichloropropene	10061-02-6	5	5
25. Bromoform	75-25-2	5	5
26. 4-methyl-2-pentanone	108-10-1	10	10
27. 2-Hexanone	591-78-6	10	10
28. Tetrachloroethene	127-18-4	5	5
29. Toluene	108-88-3	5	5
30. 1,1,2,2-Tetrachloroethane	79-34-5	5	5

(a) Medium Soil/Sediment Contract Required Quantitation Limits (CRQL) for Volatile TCL Compounds are 125 times the individual Low Soil/Sediment CRQL.

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

TABLE 3-1
(continued)

CHEMICAL ANALYTICAL TEST METHODS
ORGANIC COMPOUNDS
EMERSON STREET LANDFILL
#828023

Contract Laboratory Protocol (CLP)
Target Compound List (TCL) and
Contract Required Quantification Limits (CRQL)*

Constituents	CAS Number	Quantitation Limits ** Water (ug/L)	Low Soil/Sediment(a) (ug/Kg)
31. Chlorobenzene	108-90-7	5	5
32. Ethyl Benzene	100-41-4	5	5
33. Styrene	100-42-5	5	5
34. Xylenes (total)	1330-20-7	5	5
35. Phenol	108-95-2	10	330
36. bis(2-Chloroethyl)ether	111-44-4	10	330
37. 2-Chlorphenol	95-57-8	10	330
38. 1,3-Dichlorobenzene	541-73-1	10	330
39. 1,4-Dichlorobenzene	106-46-7	10	330
40. Benzyl alcohol	100-51-6	10	330
41. 1,2-Dichlorobenzene	95-50-1	10	330
42. 2-Methylphenol	95-48-7	10	330
43. bis(2-Chloroisopropyl)ether	108-60-1	10	330
44. 4-Methylphenol	106-44-5	10	330
45. N-Nitroso-di-n-dipropylamine	621-64-7	10	330
46. Hexachloroethane	67-72-1	10	330
47. Nitrobenzene	98-95-3	10	330
48. Isophorone	78-59-1	10	330
49. 2-Nitrophenol	88-75-5	10	330
50. 2,4-Dimethylphenol	105-67-9	10	330
51. Benzoic acid	65-85-0	50	1600
52. bis(2-Chloroethoxy)methane	111-91-1	10	330
53. 2,4-Dichlorophenol	120-83-2	10	330
54. 1,2,4-Trichlorobenzene	120-82-1	10	330
55. Naphthalene	91-20-3	10	330
56. 4-Chloroaniline	106-47-8	10	330
57. Hexachlorobutadiene	87-68-3	10	330
58. 4-Chloro-3-methylphenol (para-chloro-meta-cresol)	59-50-7	10	330

(a) Medium Soil/Sediment Contract Required Quantitation Limits (CRQL) for Volatile TCL Compounds are 125 times the individual Low Soil/Sediment CRQL.

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

TABLE 3-1
(continued)

CHEMICAL ANALYTICAL TEST METHODS
ORGANIC COMPOUNDS
EMERSON STREET LANDFILL
#828023

Contract Laboratory Protocol (CLP)
Target Compound List (TCL) and
Contract Required Quantification Limits (CRQL)*

Constituents	CAS Number	Quantitation Limits ** Water (ug/L)	Low Soil/Sediment(a) (ug/Kg)
59. 2-Methylnaphthalene	91-57-6	10	330
60. Hexachlorocyclopentadiene	77-47-4	10	330
61. 2,4,6-Trichlorophenol	88-06-2	10	330
62. 2,4,5-Trichlorophenol	95-95-4	50	1600
63. 2-Chloronaphthalene	91-58-7	10	330
64. 2-Nitroaniline	88-74-4	50	1600
65. Dimethylphthalate	131-11-3	10	330
66. Acenaphthylene	208-96-8	10	330
67. 2,6-Dinitrotoluene	606-20-2	10	330
68. 3-Nitroaniline	99-09-2	50	1600
69. Acenaphthene	83-32-9	10	330
70. 2,4-Dinitrophenol	51-28-5	50	1600
71. 4-Nitrophenol	100-02-7	50	1600
72. Dibenzofuran	132-64-9	10	330
73. 2,4-Dinitrotoluene	121-14-2	10	330
74. Diethylphthalate	84-66-2	10	330
75. 4-Chlorophenyl-phenylether	7005-72-3	10	330
76. Fluorene	86-73-7	10	330
77. 4-Nitroaniline	100-01-6	50	1600
78. 4,6-Dinitro-2-methylphenol	534-52-1	50	1600
79. N-nitrosodiphenylamine	86-30-6	10	330
80. 4-Bromophenyl-phenylether	101-55-3	10	330
81. Hexachlorobenzene	118-74-1	10	330
82. Pentachlorophenol	87-86-5	50	1600
83. Phenanthrene	85-01-8	10	330
84. Anthracene	120-12-7	10	330
85. Di-n-butylphthalate	84-74-2	10	330
86. Fluoranthene	206-44-0	10	330
87. Pyrene	129-00-0	10	330

(a) Medium Soil/Sediment Contract Required Quantitation Limits (CRQL) for Volatile TCL Compounds are 125 times the individual Low Soil/Sediment CRQL.

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

TABLE 3-1
(continued)

CHEMICAL ANALYTICAL TEST METHODS
ORGANIC COMPOUNDS
EMERSON STREET LANDFILL
#828023

Contract Laboratory Protocol (CLP)
Target Compound List (TCL) and
Contract Required Quantification Limits (CRQL)*

Constituents	CAS Number	Quantitation Limits ** Water (ug/L)	Low Soil/Sediment(a) (ug/Kg)
88. Butylbenzylphthalate	85-68-7	10	330
89. 3,3'-Dichlorobenzidine	91-94-1	20	660
90. Benzo(a)anthracene	56-55-3	10	330
91. Chrysene	218-01-9	10	330
92. bis(2-Ethylhexyl)phthalate	117-81-1	10	330
93. Di-n-octylphthalate	117-84-0	10	330
94. Benzo(b)fluoranthene	205-99-2	10	330
95. Benzo(k)fluoranthene	207-08-9	10	330
96. Benzo(a)pyrene	50-32-8	10	330
97. Indeno(1,2,3-cd)pyrene	193-39-5	10	330
98. Dibenz(a,h)anthracene	53-70-3	10	330
99. Benzo(g,h,i)perylene	191-24-2	10	330
100. alpha-BHC	319-84-6	0.05	8
101. beta-BHC	319-85-7	0.05	8
102. delta-BHC	319-86-8	0.05	8
103. gamma-BHC (Lindane)	58-89-9	0.05	8
104. Heptachlor	76-44-8	0.05	8
105. Aldrin	309-00-2	0.05	8
106. Heptachlor epoxide	1024-57-3	0.05	8
107. Endosulfan I	959-98-8	0.05	8
108. Dieldrin	60-57-1	0.10	16
109. 4,4'-DDE	72-55-9	0.10	16
110. Endrin	72-20-8	0.10	16
111. Endosulfan II	33213-65-9	0.10	16
112. 4,4'-DDD	72-54-8	0.10	16
113. Endosulfan sulfate	1031-07-8	0.10	16
114. 4,4'-DDT	50-29-3	0.10	16
115. Methoxychlor	72-43-5	0.5	80
116. Endrin ketone	53494-70-5	0.10	16

(a) Medium Soil/Sediment Contract Required Quantitation Limits (CRQL) for Volatile TCL Compounds are 125 times the individual Low Soil/Sediment CRQL.

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

TABLE 3-1
(continued)

CHEMICAL ANALYTICAL TEST METHODS
ORGANIC COMPOUNDS
EMERSON STREET LANDFILL
#828023

Contract Laboratory Protocol (CLP)
Target Compound List (TCL) and
Contract Required Quantification Limits (CRQL)*

Constituents	CAS Number	Quantitation Limits ** Water (ug/L)	Low Soil/Sediment(a) (ug/Kg)
117. alpha-Chlordane	5103-71-9	0.5	80
118. gamma-Chlordane	5103-74-2	0.5	80
119. Toxaphene	8001-35-2	1.0	160
120. Aroclor-1016	12674-11-2	0.5	80
121. Aroclor-1221	11104-28-2	0.5	80
122. Aroclor-1232	11141-16-5	0.5	80
123. Aroclor-1242	53469-21-9	0.5	80
124. Aroclor-1248	12672-29-6	0.5	80
125. Aroclor-1254	11097-69-1	1.0	160
126. Aroclor-1260	11096-82-5	1.0	160

(a) Medium Soil/Sediment Contract Required Quantitation Limits (CRQL) for Volatile TCL Compounds are 125 times the individual Low Soil/Sediment CRQL.

* Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

** Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

TABLE 3-2

CHEMICAL ANALYTICAL TEST METHODS
INORGANIC COMPOUNDS
EMERSON STREET LANDFILL
#828023

ELEMENT	CONTRACT REQUIRED DETECTION LEVEL (ug/l)
Aluminum	200
Antimony	60
Arsenic	10
Barium	200
Beryllium	5
Cadmium	5
Calcium	5000
Chromium	10
Cobalt	50
Copper	25
Iron	100
Lead	5
Magnesium	5000
Manganese	15
Mercury	0.2
Nickel	40
Potassium	5000
Selenium	5
Silver	10
Sodium	5000
Thallium	10
Vanadium	50
Zinc	20
Cyanide	10

3.8.5 Geotechnical Test Methods

Soil samples selected for geotechnical evaluation were prepared and tested in accordance with procedures from the American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Section 4 Construction, Volume 04.08 Soil and Rock; Building Stones, C-1988. The following standard test methods were utilized in whole or in part for select split spoon samples collected during boring advancement:

- moisture content (ASTM D-2216)
- grain size analysis (ASTM D-422)
- hydrometer analysis if 20% of the sample was less than a No. 200 sieve size.

All geotechnical evaluations were performed by Buffalo Drilling Company, Inc. located in Buffalo, New York. A report of these evaluations is presented in Appendix D.

3.8.6 Quality Assurance Program

The Quality Assurance Program implemented for this investigation utilized quality control procedures initiated at the time of drilling, continuing through with the sampling and into the actual analysis.

Prior to initiating drilling activities, the drill rig, augers, rods, appurtenant equipment, well pipe and screens were steam cleaned. This cleaning procedure was also used between each boring and prior to leaving the site. During the drilling and cleaning processes, any unnecessary direct contact between equipment and the ground surface was avoided by employing wooden pallets and plastic sheeting.

The split barrel samplers used for collecting soil samples during the advancement of test borings were steam cleaned prior to each use or cleaned by the following procedure:

- o initially cleaned of all foreign matter.
- o washed with a detergent and water mixture.
- o rinsed with deionized water.
- o allowed to air dry.

In the event that the borehole or monitoring well had to be left unattended prior to completion, it was properly secured to ensure its integrity.

Once the well was installed, its integrity was upheld by making sure that only dedicated tubing and pre-cleaned bailers were used for development and sampling. Also, any other equipment such as slugs and measuring devices were cleaned prior to and after each use by washing and rinsing with deionized water.

All samples were collected into pre-cleaned containers and delivered by Recra Environmental, Inc. personnel under chain of custody procedures. Copies of these documents are included in Appendix I.

Trip blanks were maintained for each day of sampling. These blanks consisted of two (2) 40 ml vials with Teflon septa caps which were filled with volatile-free water at the laboratory and transported to and from the site in sample coolers. Each was analyzed for HSL volatile organics. Field blanks were collected on September 20 and 21, 1988. Each was collected in the field as a PVC bailer or polyethylene tubing rinsate sample. Each blank sample was analyzed for the complete suite of parameters itemized in

Tables 3-1 and 3-2.

The quality assurance measures followed by the laboratory included those outlined in the 1986 and 1987 New York State Contract Laboratory Protocol. The laboratory QA/QC program is further discussed in Appendix I.

3.9 Drum Material Handling/Sampling

All auger cuttings, drilling fluid, and groundwater from well development and purging was placed into 17-H steel drums. Efforts were made to keep solids and aqueous material in separate drums. Miscellaneous materials, such as disposable suits and other refuse, was also contained in separate drums.

When a drum was full, it was labeled, secured and transported by the drilling contractor to a secured trailer located at Browning-Ferris Industries, Inc. at 145 Colfax Street. The trailer was situated inside a fence that was locked at the end of each day.

On September 27 to 28, 1988, the drums were sampled by Recra personnel. Composite samples were collected from each set of ten (10) drums containing aqueous material. A total of seven (7) composite samples were taken from sixty-four (64) drums. Two (2) soil composite samples were collected from the drums containing auger cuttings. One (1) composite was made up of three drums, the other was made up of two drums.

The drums containing the aqueous material were sampled by removing a sample from the drums with an ISCO peristaltic pump. The sample from each drum making up a particular composite was placed into a 2½ gallon glass jar. Once sampling was complete, the material in the jar was homogenized by

stirring and then poured into the appropriate sample containers. The drums containing auger cuttings were sampled by removing a sample from each drum with a hand auger. The material from the drums making up each composite was then mixed together and placed into appropriate sample containers.

The aqueous and solid materials from the drums were analyzed to determine if they exhibited the characteristics of a hazardous waste. As defined by NYSDEC, the particular tests included: ignitability, reactivity, EP toxicity, total PCB analysis, total available cyanide, and total available sulfide. Results of these tests are presented in Appendix I.

3.10 Surveying

A Leitz SDM3F Total Station, transit mounted Electronic Distance Measuring (EDM) System and Zeiss N-12 differential level and level rod were used to determine street layouts and monitoring well locations and elevations. A bench mark used for this survey was located at the northwest corner of a concrete base for light control box at the northeast corner of Colfax and Emerson Street. A relative starting elevation of 100.00 was designated for this benchmark. All field surveying, calculations, and drawing generation were performed by Edward O. Watts and Associates of Buffalo, New York under subcontract to Recra.

4.0 SITE ASSESSMENT

4.1 Site History

Land disposal of municipal refuse at the Emerson Street Site began around 1930 in an area south of Emerson Street. At some time between the years 1947 and 1954, Mr. Richard Guck, a maintenance worker at the University of Rochester, allegedly delivered radioactive animal cages and inhalation equipment to the dump (Ref. 1). These materials were used in a variety of studies on the toxicology of uranium and thorium compounds in behalf of the U.S. Army Corps of Engineers under the Manhattan Project and later under the Atomic Energy Commission. Beryllium was reported to be another material used during this experimentation (Ref. 2). Aerial photographs of this site, taken during 1955 and 1958, showed that major dumping activities were taking place in the southern disposal area (Ref. 3). By 1961, major dumping had extended north of Emerson Street, as well as into the woods and marshland in the western portion of the southern area (Ref. 3).

The Emerson Street dump had a long standing reputation for being a poorly operated facility. Local newspaper articles are available which document the conditions at the site (Ref. 4). Most complaints were registered about the open burning of the refuse. One article, which appeared in the Rochester Times - Union during November of 1964, has an accompanying picture showing several drums within the burning solid waste. At some time between the years 1962 and 1965, Mr. Stan Hanna, a waste hauler for Dugan Brothers Refuse Removers, allegedly hauled radioactive wastes from Eastman Kodak and chemical wastes from Schagel. Mr. Hanna also hauled industrial, commercial and municipal wastes to the dump (Ref. 5). In addition, the Minnesota Mining and Manufacturing Company (3M) from St. Paul, Minnesota,

made arrangements during 1963 to dispose of thoriated glass wastes at the dump (Ref. 6).

An exploration of the subsurface conditions within the landfill area was made by Ebasco, Inc. in 1964 (Ref. 7). As a result of this study, it was determined that the average depth of refuse in the older part of the dump south of Emerson Street was 10 feet. North of Emerson Street, the refuse was found to be as deep as 20 feet. The area southeast of the Colfax-Emerson Street intersection was reported as being used primarily for the disposal of hard fill.

In 1966 aerial photographs, dumping had appeared to have ceased in the southern disposal area, but had expanded in the northern area (Ref. 3). A 1970 comprehensive solid waste study of Monroe County indicated that in 1966 slightly more than 202 thousand tons of refuse was incinerated by the City of Rochester (Ref. 8).

Complaints to the city about odors emanating from the dump prompted the Department of Public Works to take action during 1967. Chlorine powder was spread along the banks of the stream which ran northeasterly from the site to help control odors. The frequent outbreak of smoldering fires was a problem. In July, 1968, a week-long fire during an "atmospheric inversion" resulted in a layer of smoke and fumes lingering over the city (Ref. 9). Rodent infestation also became a major problem during this period. An extensive baiting program was undertaken by the city in 1970 to help control pest populations at the site (Ref. 10).

During the late 1960's and early 1970's, the Emerson Street dump constantly violated Part 19 of the New York State Sanitary Code, which deals with the criteria for operation of refuse disposal areas, and Article V - Air Pollution Control Regulations of the Monroe County Sanitary Code that prohibits open burning of refuse (Ref. 10). In 1970, the City had phased out the eastern portion of the northern disposal area of the landfill, with approximately one-third of the site being covered with two feet of soil. Other problems included exposed refuse throughout large areas of the site and ponded water in both the southeast corner and along the west side of the site (Ref. 10). The City of Rochester Bureau of Engineering had little success trying to drain the landfill site to keep it from flooding during wet periods. Late 1971, the Monroe County Health Department requested that the NYSDEC institute legal action against the City of Rochester in an effort to correct the situation (Ref. 10). By this point in time, the landfill had expanded to nearly its full size. The landfill was officially closed in October, 1971 (Ref. 11).

The New York State Urban Development Corporation purchased the landfill site from the City of Rochester during 1970. This agency developed a drainage plan for the area, including the construction of storm sewers, as a part of an extensive development plan for the site. The City of Rochester Economic Development Administration has been offering financial incentives since then to entice industry into the area. Such incentives include tax deferral, low interest rate financial plans and reduced land costs. Parcels of land have been sold to numerous businesses and the entire site is currently a large industrial park with few vacant parcels of land remaining. In addition, a large high school complex has been built by

the City on the site. Property owners, businesses and their addresses, located on or near the site are shown on Drawing Number 1.

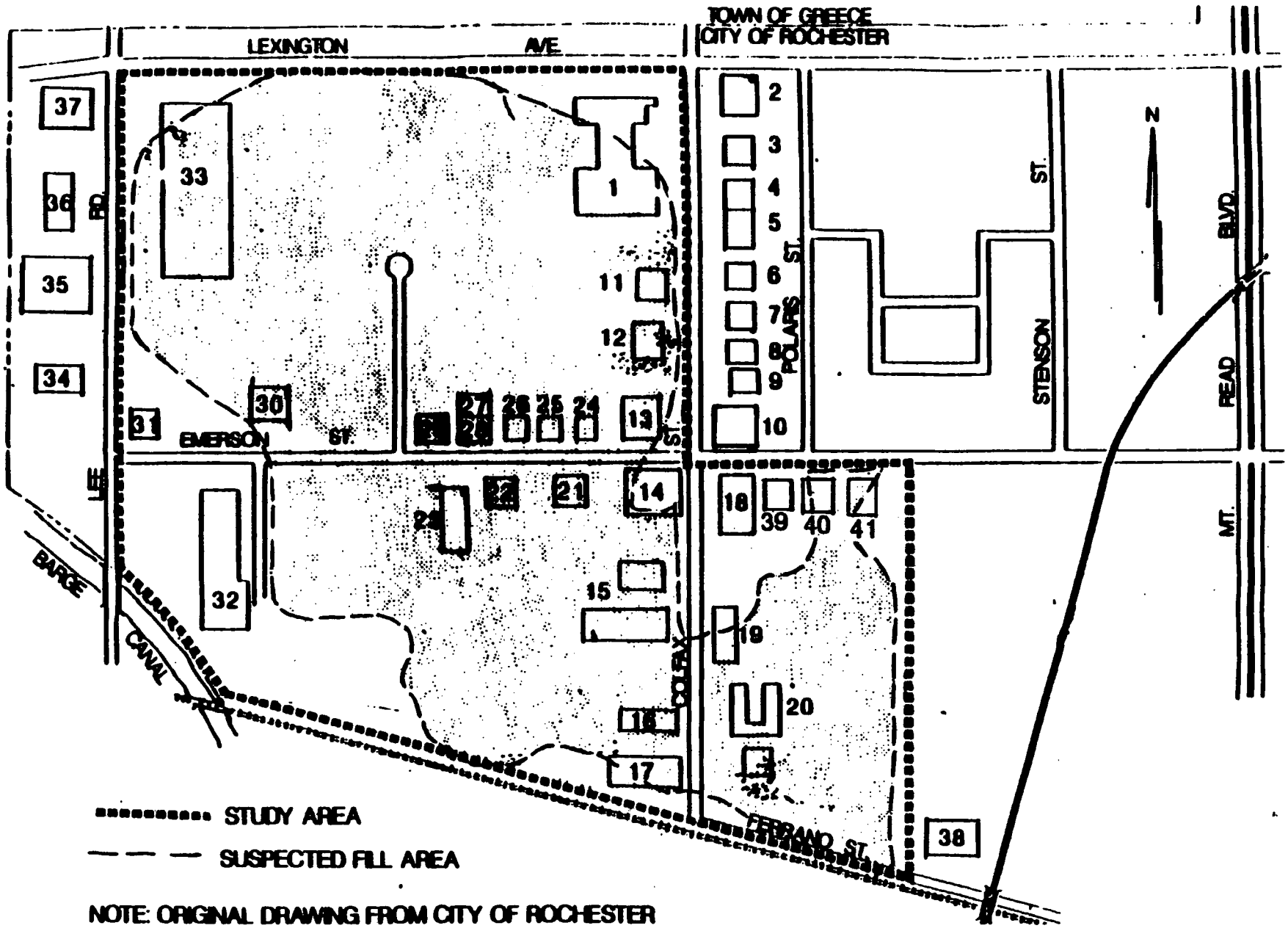
4.2 Site Area Characteristics

4.2.1 Environmental Setting

The Emerson Street Landfill occupies approximately 230 acres within a commercial and residential area in the northwest portion of the City of Rochester, Monroe County, New York. It is roughly bounded by Lexington Avenue on the north, Lee Road to the west, a railroad right-of-way along the south, and Colfax Street to the northeast. Approximate landfill boundaries are delineated in Figure 8 and Drawing No. 3. Presently, the site is highly developed, with numerous buildings and subsurface utilities having been constructed on the site since the landfill was closed. These buildings generally house commercial and industrial operations. The Edison Technical High School is located along Lexington Avenue and Colfax Street (Figure 8).

A wetland boundary map of the site issued by the City of Rochester Department of Environmental Services in July, 1985, indicates that the landfill lies within approximately 100 feet of a New York State Class II wetland designated as RH-18-II (Ref. 12). This wetland is approximately 15.4 acres in area and is situated south and east of the site (Ref. 12).

Mean annual precipitation recorded at the Rochester, Monroe County Airport is 32.67 inches (Ref. 13). The local mean annual lake evaporation interpreted from the United States Department of Commerce is 26.0 inches (Ref. 14), allowing for a net annual precipitation surplus (excluding



RECRA ENVIRONMENTAL, INC.	SCALE: 1"=200'	EMERSON STREET LANDFILL NYS SUPERFUND PHASE II SITE NO. 828023	SITE SKETCH
	DWN. KYC 1/5/88		
	CKD. JRS 2/4/89		
	APPVD. RES 2/8/89		
	REV. RES 8/89	PROJECT NO: 8C1301A	A FIGURE 8

transpiration) of 6.67 inches. The one-year, 24-hour rainfall is estimated at 2.1 inches (Ref. 15). The climate during the period of the present investigation, especially prior to sampling was unusually dry, as evidenced by dry storm lines, and may not be representative of the above listed data.

The New York State Barge Canal is located approximately 400 feet southwest of the site and is further discussed in the following section. No critical habitat of an endangered species or national wildlife refuge is located within two miles of the site.

4.2.2 Topography and Drainage

The site lies in a relatively low lying geographic province known as the Erie-Ontario Lowland which extends from Lake Ontario southward to the Appalachian Plateau. The topography of the surrounding area has been characterized as gently rolling. The northern portion of the landfill exists as the highest land in the immediate area, with ground surface elevations in excess of 550 feet above mean sea level (Ref. 16). The land surface has been graded and gently slopes at less than 3 percent radially outward from this maximum point. Some undeveloped land exists in the southern portion of the site. Although this area gently slopes to the south, local irregularities in the form of elevated fill, depressions, and drainage swales are present.

Prior to landfilling, the area was a wetland with several streams recharging and draining it. At present, nearly all surface water runoff is collected and transmitted through a storm drain network which was constructed within and around the site. Through this network, surface runoff is channeled to the south and west, emptying into the barge canal, and to the east

to the Genesee River (Drawing No. 5). Undeveloped land in the southern portion of the site exhibits small swales which drain surface runoff toward the barge canal.

The canal is a nearly stagnant body of water which is hydraulically connected to the Genesee River approximately 4.5 canal miles southeast of the site. The water level in the canal is maintained at variable seasonal levels.

4.2.3 Surface Water Usage

Potable water for domestic consumption is obtained from the Monroe County Water Authority intake located on Lake Ontario, approximately 7 miles north of the site (Ref. 17). There is no reported use of water taken from the barge canal for industrial purposes.

4.3 Geophysical Data Evaluation

The geophysical studies for this investigation were conducted primarily to aid in the placement of borings and monitoring wells. The intent was to avoid drilling through fill material and to attempt to locate monitoring wells to determine the presence of possible contaminant plumes. Thirteen (13) terrain conductivity profiles and magnetometer surveys over eleven (11) points were completed for this investigation.

The results of the survey along Profile 1 revealed a very conductive area across the entire profile. Background readings varied from 60-100 millimhos/meter and probably represent an entire zone of possible contamination that may extend beyond the edges of the profile.

The results of the Colfax St. Survey (Profile 2) revealed variable background readings of 80-130 millimhos/meter and probably represent fill material. A strong "zero" anomaly was apparent along a portion of the profile. This was believed to be the result of buried metal utilities. A strong positive anomaly was noted between locations 1400S, 2820E and 1520S, 2820E. This location could represent a potential area of contamination.

The results of the survey along Profile 3 indicated background values of 40-60 millimhos/meter. Although the subsurface of this profile is interpreted to be less disturbed than profiles 1 and 2, an anomaly was observed which may represent a zone of contamination.

Background values observed during the survey along Profile 4 ranged from 40 to 80 millimhos/meter. These values were interpreted to most likely represent fill material. Some isolated high spikes are due to railroad tracks, storm sewers, and fire hydrants.

The results of the survey along Profiles 5 and 6 revealed no values which were interpreted to be indicative of subsurface fill material.

The results of the survey along Profiles 7 and 8 indicated a number of strong positive anomalies and frequent areas of "zero" readings. These findings along with the observance of empty steel drums and automotive debris on the surface led to the interpretation that moderate to large amounts of buried metallic debris are located below grade in these areas.

During the survey along Profile 9, a large anomaly was observed between locations 3200S, 1930E and 3200S, 2570E. A water main in this area and a radio transmitter tower both contributed background noise but are not

capable of causing an anomaly of this magnitude. This anomaly is interpreted to possibly represent a zone of contamination and/or an area of deeply buried metallic debris.

The survey along Profile 10 revealed two areas of anomalous values. One anomaly was observed between locations 2910S, 4010E and 2690S, 4010E. It is possible that this condition is in part due to a steel shelled building and the sub-base of the parking area directly beneath the profile. Another anomaly was observed across a filled area between locations 2440S, 4010E and 2000S, 4010E. Three peaks were also observed across this location and are interpreted as representing buried metallic debris and/or chemical contamination.

Profile 11 was conducted east of Profile 10 on the edge of the filled area. An anomaly was found that extended from 2400S, 4090E to 2180S, 4090E. This area was interpreted to represent buried metallic debris and/or chemical contamination migrating towards a wetland area.

Values of terrain conductivity observed along Profile 12 were interpreted as representing natural soil conditions. Slight changes in the values are most likely due to changes in soil composition and soil moisture content.

An anomaly was observed along Profile 13 between location 4010E, 2020S and 3970E, 2020S. This area was interpreted as possibly representing buried debris and/or chemical contamination.

Areas of suspected or possible contamination identified by the conductivity survey may exist at the locations listed on Table 4-1. Elevated background values attributed to urban development may have been sufficient at some locations to mask areas that may have been contaminated.

If non-conductive contaminants were present without sufficient quantities of electrolytes also present, they would not produce anomalous recordings. Areas of this nature may exist at this site.

Anticipated background magnetic values for the Rochester, New York area are 55,000-56,000 gammas (Appendix B). Measurements recorded at each proposed drilling location were at or moderately above these anticipated values. The measured values were interpreted to represent the presence of small buried metallic debris or utilities within the vicinity of the survey. All proposed locations were judged to be acceptable for the placement of borings and were not re-located to any substantial extent.

4.4 Radiological Survey Data Evaluation

The initial phase of the radiological survey consisted of measurements taken at each proposed boring location and did not yield values in excess of the anticipated background condition of 0.01 to 0.02 millirem per hour (NIOSH 1989).

A survey over the area of alleged disposal of radioactive wastes was conducted with an estabished background condition of 0.0075 millirem per hour as determined by the initial survey efforts. Readings which were greater than or equal to twice this background level were recorded at three locations (Figure 4). At two of the locations, elevated levels were found to

TABLE 4-1

AREAS OF SUSPECTED CONTAMINATION
IDENTIFIED BY TERRAIN CONDUCTIVITY SURVEY

EMERSON STREET LANDFILL
#828023

AREA OF "SUSPECTED FILL MATERIAL"		BACKGROUND VALUES (milliohms/meter)	COMMENTS
Profile	Coordinate Locations		
1	0S,0E to 0S 2820E	60-100	Lexington Avenue
2	1400S,2820E to 1520S,2820E	80-130	Colfax Street.
3	190S,0E to 410S,0E	40-60	Lee Street.
4**	0E, 1855S to 800E, 1855S	40-80	North of Emerson St.
9	3200S,1930E to 3200S,2570E	-	Ferrano Street.
10	2690S,4010E to 2910S,4010E	-	Fill area east of the City of Rochester Solid Waste Facility.
10	2000S, 4010E to 2440S,4010E	-	As above.
11	2180S,4090E to 2400S,4090E	-	As above, east of profile 10.
13	4010E,2020S to 3970E,2020S	-	Fill area north of the City of Rochester Solid Waste Facility.

* Refer to Drawing No. 2, Appendix A
** No Suspected Fill Material along this profile.

occur at the surface openings of animal burrows and from the associated excavated material. This material consisted of incinerator ash and glass. All areas of elevated radioactivity were situated near the landfill boundary. Additional surveying 50 to 100 feet west of this boundary on non-filled areas did not reveal radiation levels above background.

The New York State Department of Environmental Conservation conducted a supplemental survey over the Yellow Freight property located north of the Recra study. No measurements above background were observed (Appendix C).

As a result of the findings during the radiological survey, ten soil samples were collected on January 23, 1989 from the areas of concern and subjected to radionuclide analysis.

Two of the samples, Rad-1 and 2, were collected from the bottom of the City of Rochester incinerator stack. Samples Rad-3 and Rad-4 were collected from two burn pits located near the incinerator building. Samples Rad-5,6 and 7 were obtained within the "warm area" as determined by the previously described radiological survey. Rad-8 and 9 were collected from what appears to be a drainage area just off the apparent edge of the fill adjacent to the warm area. The final sample, Rad-10, was collected from the drummed auger cuttings collected while drilling at GW-2. A sketch of the approximate sample locations is present in Appendix C.

Subsequent to screening studies, only one of the ten samples was determined to have significant activity above background. The sample (RAD-5) was then subjected to further detailed analysis as indicated in the laboratory report (Appendix C).

Results of the detailed analysis revealed that sample RAD-5 contains approximately 100 times the normal background levels of Thorium-232. This condition relates to radioactivity levels in excess of 6 times background. Comparison of these results with the New York State DEC standards of part 30 is not possible given that no established criteria are listed for concentrations of radionuclides in soil but only in air and water.

Review of these results by the NYSDEC Bureau of Radiation concluded that off-site releases of Thorium 232 Series Radionuclides are unlikely. It was also suggested that additional soil samples would be necessary for confirmation purposes. The NYSDOH Bureau of Environmental Radiation Protection concurred (see Appendix C).

4.5 Site Hydrogeology

4.5.1 Geology

The Emerson Street Landfill site is located in the Erie-Ontario Lake Plain region of western New York. The geology underlying the site consists of Late Wisconsinan unconsolidated glacial deposits overlying Silurian dolomite and shale of the Clinton Group. Recent alluvial and swamp deposits occur in localized wetland and drainage areas.

Unconsolidated glacial deposits mapped by Muller and Cadwell (1986) are identified as lacustrine silt and clay and till (Ref. 18). The lacustrine deposits are described as "generally laminated clay and silt deposited in proglacial lakes, generally calcareous, ... thickness variable." The till deposits are described as "variable texture (i.e. clay, silt-clay, boulder

clay), usually poorly sorted, ... generally calcareous, ... thickness variable." The principal overburden soils identified in 1966 within the boundaries of this site by the United States Department of Agriculture Soil Conservation Service (USDA) were muck, Brockport silt loam, and Colwood loam (Ref. 19). These soils are generally associated with wet areas, especially the muck soils which were the most extensive type on the site. The Brockport soils were found on elevated areas of poorly drained soils, while the Colwood soils were found along drainageways. These soils are classified into associations dominated by soils formed in glacial till (Ref. 19).

The uppermost bedrock units underlying the site are interpreted to be the Lockport Dolomite and Rochester Shale. The Lockport is described locally (Scherzer, 1983 and H&A of New York, 1981) as "a light to medium gray, fine to medium grained, thin to medium bedded siliceous dolomite" (Ref. 20,21). It is composed of three members. The uppermost member is the Oak Orchard Dolomite. Underlying it are the Penfield Dolomite and a basal Decew Dolomite (Ref. 20). The Decew Dolomite is mapped by Rickard and Fisher as a surficial rock in this area (Ref. 22). Its maximum thickness is reported to be 22 feet. Pits and vugs occur throughout the Lockport. Trace amounts of gypsum nodules are noted in the Decew Dolomite (Ref. 20).

The Rochester Shale is present below the Lockport (Decew Member). The Rochester is a light to dark gray, fine-grained, fossiliferous, dolomitic mudstone with interbeds of limestone and dolomite. The contact between the Lockport and the Rochester is reported to be gradational in the Rochester area (Ref. 21).

H and A of New York (1981) have reported the surficial bedrock encountered in a boring drilled at the southwest corner of Mount Read Boulevard and Lexington Avenue (boring B602) as being the Rochester Shale (elevation 520.8 feet, Rochester, New City Datum) (Ref. 21). A boring (B503) drilled at the northwest corner of Mount Read Boulevard and Ferrano Street had encountered a 29 foot thickness of the Lockport at elevation 521.5 feet (Rochester New City Datum) and elevation 492.5 ft. where the transition to the Rochester Shale formation was interpreted.

The regional dip of these strata is approximated at 50 feet per mile in a SSE direction (S15°E) with a strike of N75°E (Ref. 20).

Zones of stratigraphic displacement have been documented by H and A of New York (1981) and Scherzer (1983) within the local area (Ref. 20,21). One such structural zone is identified within a Rochester Shale exposure in the Barge Canal just north of Lyell Avenue. It is classified as a faulted anticlinal flexure with a somewhat broader synclinal warp to the north. It trends approximately N70°W and is locally exposed for 2000 feet. The north side of the small anticline has a dip which is steeper than and reverse to the regional trend. Both the anticlinal and synclinal flexures were reported to show an increased concentration of jointing and small faults near their axial centers. The general dip of the strata (5°) is locally steeper than the regional trend (0.5°).

A similar NW trending flexure is also reported from excavations dug during the construction of the Monroe County Resource Recovery Facility at the southeast corner of Emerson Street and Lee Road (Ref. 20,21). It is suggested by Scherzer (1983) that this feature may be part of the adjacent

canal structural zone.

These structures and others within the City of Rochester are interpreted by H and A of New York (1981) and Scherzer (1983) to be unrelated to simple shallow glacial deformation, but are narrow "wrinkle-like" compressional features super-imposed on the regional dip of the rocks. These structural offset zones typically include gentle warping, minor faulting and increased joint frequency.

Continuous and discontinuous joints have been observed in both bedrock units (Ref. 20,21). Continuous joints have been classified as those which extend from 3 feet to more than 40 feet. These joints are reported to be essentially vertical. Locally, two dominant joint sets are present and trend N71°E and N16°W, with subordinate sets trending essentially N45°E and N45°W. These are interpreted to have originated from both relict principal tectonic stresses and variable principal stresses due to topography, unloading, and present tectonic conditions (Ref. 20,21).

Test borings for subsurface investigations at the site have been drilled by EBS Management Consultants in 1964, Empire Soils Investigations, Inc. in 1979, Rochester Drilling Company, Inc. in 1980 and 1981 and American Auger and Ditching Company, Inc. in 1988 (Ref. 7, 23, 24, and Appendix E). The conditions and evaluations presented herein are based upon the subsurface logs and profiles developed from 213 borings drilled for these investigations.

Unconsolidated material was heterogeneous throughout the site, and consisted of the following general types as categorized for this study:

- organic topsoil
- reworked soil
- fill (rubbish and ash)
- glacial till/lacustrine deposits
- basal gravel.

The general character and range of thicknesses of these materials across the site are displayed on Figure 9. Four typical sequences were identified from the boring data and are summarized as follows:

1. Municipal rubbish and ash (up to 16.5 feet) directly over dolomite bedrock.

2. Municipal rubbish and ash (up to 20 feet) directly over glacial till/recent deposits (at variable thicknesses of 0.5 to 10.5 feet), thence dolomite bedrock.

3. Reworked soils (up to 10 feet) directly over glacial till/recent deposits (at variable thicknesses of 1 to 8.5 feet), thence dolomite bedrock.

4. Glacial till/ recent deposits (up to 16.5 feet) directly over dolomite bedrock.

Reworked soils are characterized as those soil materials which possess different structural or compositional characteristics from the glacial till and recent soil deposits as identified by the USDA and from split-barrel samples collected during the Phase II investigation. These soils have appeared to be primarily earthen fill and redistributed soil from construction activity.

	COLUMNAR SECTION	APPROXIMATE RANGE OF THICKNESS IN FEET	CHARACTER
TOPSOIL		0-2	Organic silt and sand.
REWORKED SOIL		0-10	Silt and sand, some gravel, some clay.
FILL		0-20	Solid municipal waste, fly ash, demolition debris.
RECENT DEPOSITS AND GLACIAL TILL		0-16	Silt and sand, some gravel, dense
BASAL GRAVEL, WEATHERED ROCK ZONE		0-2	Dolomite gravel
BEDROCK		≥22	Light to dark grey, fine textured dolomite, fractured.

PB.00240

RECRA ENVIRONMENTAL, INC.

SCALE: NTS		
	BY	DATE
DWN.	PCB	2/3/89
CKD.	RES	2/89
APPVD.		
REV.		

EMERSON ST. LANDFILL
NYSDEC SUPERFUND
PHASE II INVESTIGATION
SITE NO. 828023

PROJECT NO. 8C1301A

GENERAL COLUMNAR SECTION

A

FIGURE 9

A basal gravel and weathered bedrock zone was identified in four borings drilled for the Phase II investigation (GW-4, GW-5, GW-6, and GW-7). Four borings drilled south of Emerson Street by Empire Soils Investigations are herein interpreted to indicate the presence of the basal gravel and weathered bedrock zone in this area (Ref. 23). However, based upon all available data, this zone is not continuous across the site.

Geotechnical testing of select soil samples from within the unsaturated and saturated zones indicate that the greatest proportion of particles were silt, followed by sand, clay and gravel (Appendix D).

Rock core samples collected during the Phase II investigation were light to medium gray, fine textured dolomite. Horizontal and vertical fractures were common at most locations. Rock cores from borings GW-5 and GW-6 were interpreted to be the Gates Member of the Rochester Shale. All other borings are interpreted to have penetrated the Decew Member of the Lockport Dolomite and possibly encountered the gradational contact between the Lockport (Decew Member) and the Rochester (Gates Member).

A bedrock surface contour map has been developed for the site from borings drilled by Ebasco (1964) and American Auger and Ditching (1988) (Drawing No. 4). All borings drilled by Ebasco were completed at auger drilling refusal. For this Phase II investigation, these refusal levels were interpreted to be analogous with the rock surface. Correlation between elevation datum used for the Ebasco borings and the American Auger and Ditching borings have been determined by comparing the rock surface elevations from adjacent borings. From this process, it was determined that an approximate elevation of 520 feet from the Ebasco report

corresponds to the 90 foot contour used for the American Auger borings (Drawing No. 4).

The contours show that the rock surface elevation decreases in the north central and southeastern sections of the site. A northwest trending ridge is situated in the general area south of Emerson Street, east of Colfax Street and Lee Road. This feature may be analogous to the northwest trending flexture reported by Scherzer (1983) (Ref. 20). Borings drilled by Ebasco along Emerson Street, midway between Colfax and Lee, exhibit lower relative rock surface elevations in a localized area. Test pits excavated south of Emerson Street and east of Colfax Street showed the weathered bedrock surface to exist as shallow as 1.5 feet below ground surface (Ref. 25).

4.5.2 Hydrogeology

Groundwater in the Erie-Ontario Lowland province is reported to occur primarily under water table conditions and generally slopes towards Lake Ontario in the north and locally toward Irondequoit Bay, the Genesee River, or the Barge Canal (Ref. 26). At the Emerson Street Landfill site, groundwater was assumed to be transmitted through the overburden material and through the bedding planes and joints of the Lockport Dolomite.

During the advancement of test borings for this study, groundwater was observed to occur under unconfined or water table conditions. The surface of this zone was present in both the unconsolidated materials and in the underlying bedrock. Water level measurements were collected on November 9 and December 16, 1988 and May 12, 1989. These levels, when related to a standard elevation datum, indicate that the water table sur-

face is variable across the site. Drawing No. 5 depicts the plotted water table surface elevations from these data. Tabulated water surface elevation data are presented on Table 4-2.

The water bearing medium (i.e., fill, soil, or bedrock) possesses heterogeneous anistropic hydraulic properties. Anisotropy, in this sense, is the condition where the properties (vis. hydraulic conductivity) of the medium vary directionally from a point. Heterogeneity relates to the properties or conditions which vary from point to point in the medium. This hydrogeologic characterization is borne out of the observation that the particle size distribution, degree of compaction, and fracture density and orientation vary both vertically and horizontally across the site. In situ hydraulic conductivity testing performed in each monitoring well indicates a variation across the site of four (4) orders of magnitude. These range from 3×10^{-2} centimeters per second (cm/sec) at GW-2 to 3×10^{-6} cm/sec at GW-1 (Table 4-3). As a result, groundwater equipotential lines and flow lines throughout the site may exhibit complex and irregular configurations which will vary temporarily.

Piezometers, observation wells or monitoring wells were not constructed within the main body of the landfill. The hydraulic head measurements recorded from the existing monitoring well network, coupled with a lack of data from within the interior portions of the site, do not permit the construction of approximate water table surface contours or horizontal flow directions.

TABLE 4-2

WATER LEVEL MEASUREMENT DATA
EMERSON STREET LANDFILL
SITE NO. 828023

LOCATION	BEDROCK SURFACE		WATER TABLE SURFACE					
			11/9/88		12/16/88		5/12/89	
	DEPTH FROM GROUND SURFACE (ft.)	ELEVATION (ft.)*	DEPTH FROM GROUND SURFACE (ft.)	ELEVATION (ft.)*	DEPTH FROM GROUND SURFACE (ft.)	ELEVATION (ft.)*	DEPTH FROM GROUND SURFACE (ft.)	ELEVATION (ft.)*
GW-1	10.0	92.7	20.43	82.27	24.85	77.85	12.34	90.36
GW-2	7.5	90.7	21.02	77.18	23.21	74.99	18.45	79.75
GW-3	13.2	96.0	3.79	105.41	3.82	105.38	0.52	108.68
GW-4	10.0	97.9	7.66	100.24	8.48	99.42	4.75	103.15
GW-5	10.0	86.2	8.67	87.53	9.18	87.02	6.54	89.66
GW-6	9.0	90.3	14.63	84.67	15.11	84.19	12.21	87.09
GW-7	10.0	90.6	12.53	88.07	12.58	88.02	10.31	90.29
GW-8S	7.0	89.0	3.49	92.51	3.76	92.24	0.08	96.08
GW-8D	7.0	89.5	6.98	89.52	4.25	92.25	0.50	96.00
GW-9	5.0	95.2	15.68	84.52	16.09	84.11	15.55	84.65
GW-10S	8.0	91.1	2.18	96.92	2.42	96.68	0.06	99.04
GW-10D	8.0	91.3	2.80	96.50	2.85	96.45	0.43	98.87

* Ref: Edward O. Watts and Associates, Drawing No. EJ121188, 12/20/88.

TABLE 4-3

SUMMARY OF HYDRAULIC CONDUCTIVITY DATA
EMERSON STREET LANDFILL
#828023

WELL NO.	TEST METHOD	CALCULATED HYDRAULIC CONDUCTIVITY, K (cm/sec)
GW-1	Rising Head	K = 3 x 10-6
	Falling Head	K = 2 x 10-5
GW-2	Rising Head	K = 3 x 10-2
	Falling Head	K = 3 x 10-2
GW-3	Rising Head	K = 2 x 10-5
	Falling Head	K = 5 x 10-5
GW-4	Rising Head	K = 3 x 10-3
	Falling Head	K = 4 x 10-3
GW-5	Rising Head	K = 2 x 10-3
	Falling Head	K = 4 x 10-3
GW-6	Rising Head	K = 8 x 10-3
	Falling Head	K = 7 x 10-3
GW-7	Rising Head	K = 3 x 10-3
	Falling Head	K = 3 x 10-3
GW-8D	Rising Head	K = 5 x 10-4
	Falling Head	K = 1 x 10-4
GW-8S	Rising Head	K = 2 x 10-4
	Falling Head	K = 2 x 10-4
GW-9	Rising Head	K = 7 x 10-5
	Falling Head	K = 1 x 10-5
GW-10D	Rising Head	K = 7 x 10-4
	Falling Head	K = 4 x 10-4
GW-10S	Rising Head	K = 5 x 10-4
	Falling Head	K = 4 x 10-4

For the purposes of HRS scoring only, monitoring well GW-3 was considered to be an upgradient or background groundwater monitoring location. This was based upon the following observations:

- well GW-3 had the highest relative hydraulic head measurements.
- the chemical analytical data, discussed subsequently in the text, supports this hypothesis.

The possibility does exist, however, that groundwater mounding conditions are present within the landfill body. If so, water would be expected to flow radially from the landfill. In addition, the interception of ground water flow by the storm sewer network may play a significant role.

Water elevation measurements have indicated that the water table surface was lower on December 16, 1988 than on November 9, 1988 at all well locations except GW-8D. These measurement episodes coincide with a lowering of the Barge Canal water level during this period. Head differences varied from a maximum of 4.42 feet at GW-1 to a minimum of 0.03 feet at GW-3. The largest relative head differences were observed at wells GW-1 and GW-2. These wells are located in close proximity to storm sewer lines constructed in the bedrock, suggesting possible direct hydraulic connections with the canal at these locations (Drawing No. 5).

The urban development of the site has resulted in the construction of highly impermeable asphalt and concrete roadways and parking lots along with various commercial structures (i.e., buildings). Surface water runoff from these areas and the surrounding graded landfill is channeled primarily through an extensive storm drain network constructed throughout the site. The relative location and slope of this network is depicted in plan view on

Drawing No. 5. At various portions of the site, the excavations for construction of these storm sewers were dug into the underlying bedrock.

4.6 Analytical Results

4.6.1 Previous Sampling and Analysis

In December of 1980, Erdman, Anthony and Associates contracted Rochester Drilling Co., Inc. to drill 16 borings north of Emerson Street and west of Colfax Street for determining bedrock elevations. The borings were also monitored for combustible gases. In nine of these holes, combustible gas concentrations were above the upper explosive limit and four other holes had concentrations from 5 to 70 percent of the lower explosive limit. These readings were attributed to methane gas generated from the buried waste material (Ref. 24).

In April of 1981, a water sample was taken from a basement sump in the Emerson Heights Subdivision by the Monroe County Department of Health. Analytical test results indicated that there was no organic or metals contamination of the groundwater above normal concentrations (Ref. 27), although it should be noted that only a very limited analysis was conducted on this sample with no priority pollutant organic or metal analyses performed.

On March 22, 1984, the Monroe County Department of Health responded to odor complaints within the Edison Technical High School. Hydrogen sulfide was detected permeating throughout the building (Ref. 28). The source of the emissions was found to be the building's elevator shaft. Laboratory analysis of a liquid sample collected from the shaft at this time was reported

as providing evidence of "significant" leachate contamination (Ref. 28). In August of 1984, futher air monitoring for hydrogen sulfide and methane was conducted in the school, yielding negative results.

In August of 1985, eight test borings were advanced to refusal along the south side of Emerson Street, east of and adjacent to the Monroe County Resource Recovery Facility. The work was performed by Rochester Drilling Co., Inc. for S.H. Caruso and Sons, Inc. Samples of the fill material encountered were composited to form one sample for chemical analysis. The analysis showed elevated levels of some metals and organic compounds. A summary of the compounds detected is presented in Table 4-4. A complete report of this analysis can be found in Appendix H (Ref. 30) of this report.

On August 5, 1987, the New York State Department of Health collected a water sample from the sump in the shaft of elevator number 3 at the Edison Technical High School. The test results showed the presence of lubricating oil in the water sample. This oil may have interfered with the detection of other compounds. The presence of the oil was interpreted as coming from the mechanical equipment associated with the elevator or the sump pump. A list of these results is presented in Appendix H (Ref. 29).

The New York State Department of Health collected eight surface soil samples from the areas of the athletic fields on the school grounds on August 26, 1987. Subsequent analysis indicated positive results for several organic and inorganic compounds. Specifically, these included several insecticide and herbicide compounds, polynuclear aromatic hydrocarbons, along with some additional organics and metals. By comparing these

TABLE 4-4

SUMMARY OF COMPOUNDS DETECTED IN
WASTE/FILL COMPOSITE SAMPLE
(8/9/85)

EMERSON STREET LANDFILL
#828023

CONTAMINANTS	Wet Weight (ug/g)	Dry Weight (ug/g)	Wet Weight (ug/Kg)	mg/Kg
Inorganics				
Cyanide, total	0.94			
Phenol, total	0.20			
Arsenic		32		
Cadmium		4.4		
Chromium, total		95		
Copper		1300		
Lead		2000		
Mercury		1.1		
Nickel		83		
Selenium		0.32		
Silver		14		
Zinc		1700		
Volatile Halogenated Organics				
Methylene Chloride			320	
Trichloroethene			120	
Tetrachloroethene			15	
Volatile Aromatics				
Benzene			6.7	
Toluene			67	
Ethylbenzene			19	
p-Xylene			22	
m-Xylene			78	
o-Xylene			65	
Pesticides/PCB's				
PCB 1254				14

results to "background" concentrations of chemicals found in natural soils or urban environments, the Department of Health determined that there was no immediate cause for concern regarding impact to the health of the individuals using the Edison School athletic fields. A more detailed description of the data and their health assessment rationale can be found in Appendix H (Ref. 31).

4.6.2 Phase II Air Analytical Data

As part of the Phase II investigation, the site perimeter was initially screened for airborne organic contaminants with a photoionization analyzer (HNu). All readings were negative. Monitoring with a HNu and a combustible gas indicator (CGI) was conducted during the advancement of test borings. During the drilling of GW-4 and 5, combustible gas readings as high as 100 percent of the lower explosive limit were detected. The readings, which approached 100 percent, were obtained upon the initial penetration of the upper two feet of soil. Readings were only observed when the probe was placed directly in the borehole. The readings dropped off to zero below 2 to 3 feet at GW-4 and GW-5. Readings of only 1 to 2 ppm above background were obtained with the photoionizer during drilling. Methane gas will be detected by a combustible gas indicator (lower explosive limit) and not by a photoionization detector. The field crew suspected the gas encountered was methane.

Due to reports of alleged disposal of radioactive materials at this site, in an area south of Emerson Street and West of Colfax, a survey in the reported disposal area was conducted with a geiger counter and NaI scintillation meter (micro R meter). Readings ranging from 22 to 170

microrems/hour were observed at three localized spots in the south central part of the site. Background values were observed to be 7.5 microrems/hour. Since these readings were obtained with a NaI scintillation meter (micro R meter), it is inferred that the low level of radiation is originating from a gamma source.

4.6.3 Phase II Sediment Analytical Data

Upon collection in the field, all samples were screened for radiation. Sediment sample 4, which was collected from inside the City of Rochester incinerator, yielded readings of 40-60 microrems/hour, approximately 5 to 8 times the established background level.

Chemical analytical testing of the sediment samples revealed trace levels of some volatile organics and pesticides. A somewhat larger variety of semi-volatile organic compounds were detected. Up to 14 compounds were detected in sediment samples 1, 2 and 5. In all but one case the values reported were below the quantification limit (although not the contract required detection limit) and were therefore estimated values. When combined, the 14 semi-volatile compounds in SED-5 comprise an estimated total of 71.7 parts per million. Although this appears to be a significant concentration, these polynuclear aromatic hydrocarbons were detected at very low concentrations. These types of compounds are commonly occurring in soils and their presence is not a cause for concern. Laboratory, as well as trip and field blanks, illustrated the presence of trace levels (generally less than the quantification limits) of select solvent materials. Sediment sample 4 was found to have a concentration of 14 ppm of phenol. A summary of the organic compounds found in the sediment

samples is provided in Table 4-5.

Sediment samples collected and analyzed for Hazardous Substance List (HSL) inorganic compounds displayed variable concentrations. Of these, the highest relative metals conentrations were detected from a City of Rochester ash sample (SED-4). This would seem likely as the incinerating process destroys most organic compounds, thereby producing a substance with a concentrated inorganic content. The ash may also have contributed to elevated inorganics concentrations at other parts of the landfill since it was disposed of around the incinerator property, as well as other portions of the site.

Elevated levels of cadmium, cyanide, lead, mercury, and zinc were detected from wetlands RH-18-II samples SED-2 and/or SED-3. Cadmium, cyanide, lead, magnesium, mercury, and zinc were detected in drainage swale sediments from the south central section of the site (SED-1). Detectable levels of cyanide were present in all samples. Mercury was present in all samples except SED-5. A summary of the inorganic compounds found in the sediment samples is provided in Table 4-6.

On December 9, 1988, a sample was collected from soils excavated at the City of Rochester Forestry Building on Colfax St. The sample was collected by NYSDEC Region 8 staff and submitted for volatile organic analysis. As a result of this analysis, four volatile organic compounds were found to be present in the soil. Toluene, 1,2-dichloropropane and 1,1-dichloroethane were found at concentrations of 7,6 and 13 ug/kg, respectively. Methylene chloride was found at a concentration of 420 ug/kg. This prompted DEC officials to instruct the City of Rochester that the drummed soils must be

TABLE 4-5

SUMMARY OF ORGANIC COMPOUNDS DETECTED IN SEDIMENTS SAMPLES
(ug/Kg)
EMERSON STREET LANDFILL
#828023

COMPOUND	SEDIMENT SAMPLE NUMBER					
	SED 1	SED 1 RE	SED 2	SED 3	SED 4*	SED 5
Volatile Organics						
Methylene Chloride	8B	6BJ	18BJ	6BJ	4BJ	6B
Acetone	9BJ		75B	48B	8BJ	15B
Toluene	0.1BJ		96B	53B		3BJ
Chlorobenzene	0.6BJ				0.5BJ	
Benzene		0.2J				
Semi-Volatile Organics						
Phenanthrene	320J					1400J
Fluoranthrene	430J					2900J
Pyrene	380J					2600J
Butylbenzylphthalate	180J					
Benzo(a)anthracene	240J		160J			2800J
bis-(2-Ethylhexyl)phthalate	440J		1400J		680J	350J
Chrysene	310J					4100J
Benzo(b)fluoranthene	230J		180J			4800J
Benzo(k)fluoranthene	130J					3500J
Benzo(a)pyrene	190J		230J			3600J
Phenol			3300J	6800J	14000	
Benzaldehyde Derivative			23000J	3000J		
Dibenzofuran						49J
Di-n-butylphthalate						3300J
Indeno(1,2,3-cd)pyrene						37000
Dibenz(a,h)anthracene						1100J
Benzo(g,h,i)perylene						4200J
Pesticides/PCB's						
Alpha-chlordane	9.1J					
Gamma-chlordane	9.1J		25J			
4,4'-DDE			170	120	120	
4,4'-DDD						7.1J

B = Analyte was found in the associated blank as well as in the sample.
J = Indicates an estimated value.
* = Ash Sample collected from City of Rochester Incinerator Building.

TABLE 4-6

SUMMARY OF INORGANIC COMPOUNDS DETECTED IN SEDIMENT SAMPLES
(mg/Kg)
EMERSON STREET LANDFILL
#828023

ELEMENT	SEDIMENT SAMPLE NUMBER						REPORTED RANGE OF CONCENTRATIONS IN NON-CONTAMINATED SOILS (ppm)(1)(2)(3)
	SED-1	SED-1-DUP	SED-2	SED-3	SED-4*	SED-5	
Aluminum	6,870	7,660	11,700	11,300	25,600	8,058	150,000-600,000
Antimony					18.0		0.1-10
Arsenic	4.3	4.4	9.4	3.3	51.8	6.75	<40
Barium	157	163	245	121	378	75.7	1-1,000
Beryllium					0.83		<1
Cadmium	3.3	2.9	1.8		417		<1
Calcium	37,600	42,700	14,200	10,200	61,400	7,750	0-10,000
Chromium	20.4	27.6	24.2	13.7	139	61.8	trace-250
Cobalt	9.2	6.9			18.0		0.1-13
Copper	139	118	111	54.1	952	82.8	10-80
Cyanide	0.88	0.79	3.6	1.2	0.83	0.62	
Iron	17,200	20,700	45,000	9,960	8,790	12,700	10,000-100,000
Lead	278	218	263	37.1	23,000	39.6	2-200
Magnesium	8,820	9,080	2,490	2,108	13,700	2,530	600-6,000
Manganese	294	355	298	114	1,270	221	20-3,000
Mercury	0.25	0.41	0.33	0.18	0.37		<.01
Nickel	31.6	30.4	24.9	15.6	98.3	12.1	3-1,000
Potassium	1,180	1,230	1,520	799	38,900	706	400-30,000
Selenium					2.6		1-10
Silver	3.8	2.9	9.6		1.1		15-50
Sodium	660	690			41,550		750-7,500
Vanadium	21.1	30.4	24.9	25.4	55.4	13.8	5-140
Zinc	595	578	462	107	24,400	113	10-300

(1) Design of Land Treatment Systems, Overcash and Pal (1979).
(2) Applied Soil Trace Elements, Davies (1980).
(3) Design of Land Treatment Systems, Overcash and Pal (1979).
* Ash Sample Collected from City of Rochester Incinerator Building

properly disposed of as a hazardous waste. A complete laboratory report of this analysis is included in Reference 32.

4.6.4 Phase II Groundwater Analytical Data

Well GW-3 was identified as a source of background groundwater quality for this investigation. Water quality analysis of GW-3 indicated no volatile organic contamination and the presence of one semi-volatile organic compound (bis(2-ethylhexyl)phthalate) which was also found in a field blank.

Trace levels of volatile organic compounds were identified in seven of the monitoring wells. In many cases, the concentrations were measured at levels below quantification limits and were estimated. Methylene chloride and toluene were found to be present in trip blanks for September 22, 26 and 28 samplings at levels of 9 ug/l to 11 ug/l and 0.6 ug/l to 0.8 ug/l, respectively. Wells GW-7 and GW-9 showed the highest relative concentration of volatile organics. Both wells exhibited vinyl chloride and trichloroethene concentrations which were above NYSDEC quality standards for groundwater (Ref. 33). In addition, these wells also had elevated levels of 1,2-dichloroethene. GW-9 also was found to contain levels of 1,1-dichloroethane and 1,1-dichloroethene.

Trace levels of some semi-volatile organic compounds were identified in each of the wells installed as part of the Phase II investigation. In most cases, the reported values were estimated in that they were below quantification limits. Two of these di-n-butylphthalate and bis(2-ethylhexyl) phthalate were also present in some of the blanks. The semi-volatile results for wells GW-3,4,5,7,9,10S and 10D are for samples collected on

April 25, 1989. The results of the analyses for the September 1988 samples were determined to be non-compliant with NYSDEC Contract Laboratory Protocol. A complete list of the organic compounds detected in the groundwater is given in Table 4-7.

Groundwater samples collected and analyzed for HSL inorganic compounds indicated that all of the monitoring wells exhibited some metals in varying concentrations. Of these, more elevated concentrations appear to be directly attributable to calcium carbonate, magnesium bicarbonate, sodium bicarbonate, and calcium sulfate dissociation of the bedrock underlying the site. Some low levels of less common inorganic species were found, but the reported concentrations were primarily below NYSDEC quality standards for GA waters (6NYCRR 703.5) and, in many cases, were below the contract required quantitation limits. Each of the wells did exhibit iron concentrations that were greater than NYSDEC quality standard levels. Also, 6 wells had manganese levels which also exceeded quality standards. Groundwater inorganic data and applicable standards are presented in Tables 4-8 and 4-9.

4.6.5 Phase II Surface Water Analytical Data

Few volatile organic compounds were detected in the surface water samples. Traces of toluene, methylene chloride, and carbon disulfide were detected in some samples and also in the blanks. Surface sample SW-1 had an estimated concentration of 2 ug/l of 1,2-dichloroethane. Sample SW-5 had an estimated concentration of 4 ug/l of 1,1,1-trichloroethane.

TABLE 4-7

SUMMARY OF ORGANIC COMPOUNDS DETECTED
IN GROUNDWATER SAMPLES
(ug/l)
EMERSON STREET LANDFILL
#828023

COMPOUND	WELL NUMBER												
Volatile Organics	GW1	GW2	GW2 (RE)	GW3	GW4	GW5	GW6	GW7	GW8D	GW8S	GW9	GW10D	GW10S
Methylene Chloride		9B	9B						7B	9B			
Acetone		88	84										
Benzene		5	5		4J								
Toluene		2BJ	2BJ						0.6BJ	0.7BJ		0.8J	
Total Xylenes		4J	3J		2J								
Chloroethane					6J								
1,1-Dichloroethane					4J						7		
Chlorobenzene					0.8J								
Vinyl Chloride								17			22		
1,2-Dichloroethane (Tot.)								190			190		
Trichloroethene								90			35		
1,1-Dichloroethene											11		
Semi-Volatile Organics													
Di-n-butylphthalate	4J	2J					4J		1J	1J			
Butylbenzylphthalate	1J									0.2J			
bis(2-ethylhexyl)phthalate	21	14		3J			25		12	10	7BJ	3J	4J
1,4-Dichlorobenzene													
Diethylphthalate							0.6J						
Di-n-octyl phthalate										0.09J			
Pyrene													

B = Analyte was found in the associated blank as well as in the sample.
J = Indicates an estimated value.

TABLE 4-8

SUMMARY OF INORGANIC COMPOUNDS DETECTED
IN GROUNDWATER SAMPLES
(ug/l)
EMERSON STREET LANDFILL
#828023

COMPOUND	WELL NUMBER						
	GW1	GW2	GW3	GW4	DUP GW4	GW5	GW6
Aluminum	760	230	1,200	1,000	840	820	290
Arsenic			11.2	12.7	13.6	9.3	
Barium			[68]	264	254	[121]	[107]
Beryllium							
Cadmium							
Calcium	284,000	172,000	163,000	211,000	223,000	139,000	170,000
Chromium				[8.0]			
Cobalt							
Copper		[13]					[6.0]
Iron	1,300	333	910	16,400	16,600	1,350	630
Lead							
Magnesium	97,500	58,600	125,000	69,900	71,800	64,000	68,900
Manganese	322	51	311	411	403	39	160
Nickel							
Potassium	4,740	19,400	9,700	13,600	13,700	8,500	22,400
Silver		30		19	13		5.0
Sodium	78,900	266,000	420,000	510,000	580,000	205,000	383,000
Zinc	45	[17]			[17]		[10]

[] - Result is a value greater than or equal to the instrument detection limit but less than the contract required detection limit.

TABLE 4-8
(continued)

SUMMARY OF INORGANIC COMPOUNDS DETECTED
IN GROUNDWATER SAMPLES
(ug/l)
EMERSON STREET LANDFILL
#828023

COMPOUND	WELL NUMBER					
	GW7	GW8D	GW8S	GW9	GW10D	GW10S
Aluminum	1,000	940	1,380	2,570	1,080	1,120
Arsenic			5.1			
Barium	[173]	471	445		[103]	[110]
Beryllium	5.0					
Cadmium			5.0			
Calcium	104,000	332,000	314,000	301,000	318,000	165,000
Chromium	[6.0]	24		[6.0]		
Cobalt		30				
Copper		[11]	[14]		[5.0]	
Iron	3,950	1,820	2,270	1,410	780	760
Lead			5.0			
Magnesium	46,000	102,000	99,500	91,000	110,000	66,600
Manganese	314	76	417	96	100	739
Nickel	[30]					
Potassium	9,410	14,000	11,200	23,300	17,400	7,010
Silver			10			
Sodium	124,000	243,000	209,000	320,000	500,000	530,000
Zinc	107	[18]	[18]	[13]		30

[] - Result is a value greater than or equal to the instrument detection limit but less than the contract required detection limit.

TABLE 4-9

NEW YORK STATE QUALITY STANDARDS
FOR CLASS GA GROUNDWATERS
(ug/l)

EMERSON STREET LANDFILL
#828023

COMPOUND	NYSDEC STANDARD (1)
Arsenic	25
Barium	1,000
Cadmium	10
Copper	1,000
Cyanide	200
Iron	300
Lead	25
Manganese	300
Mercury	2
Selenium	20
Silver	50
Zinc	5,000
Vinyl Chloride	5.0
Trichloroethene	10

(1) NYSDEC (1984) "Classes and Quality Standards for Ground Waters," 6NYCRR 703.5.

Each of the eight surface water samples exhibited low levels of three semi-volatile organic compounds (di-n-butylphthalate, bis(2-ethylhexyl)phthalate, and butylbenzylphthalate). Two of these (di-n-butylphthalate and bis(2-ethylhexyl)phthalate) were detected in the blanks. Sample SW-1 exhibited bis(2-ethylhexyl)phthalate at a concentration which exceeded quality standards (6NYCRR 701) established by the NYSDEC.

Pesticide compounds (gamma chlordane and 4,4'-DDT) were detected in two of the surface water samples. Sample SW-1 had an estimated concentration of 0.95 ug/l of 4,4'-DDT which exceeded NYSDEC quality standards (6NYCRR 701). The organic compounds detected in surface water samples are presented in Table 4-10.

A large variety of inorganic compounds were found in the surface water samples. Sample SW-2 displayed the highest number of these inorganics which were in contravention of NYSDEC quality standards (6NYCRR, Appendix 31, Part 701). NYSDEC quality standards for aluminum, iron and zinc were exceeded in all of the samples. A number of other compounds were found to exist in elevated levels at various sample locations. A list of the inorganic compounds detected and applicable standards can be found in Table 4-11.

TABLE 4-10

SUMMARY OF ORGANIC COMPOUNDS DETECTED
IN SURFACE WATER SAMPLES
(ug/l)

EMERSON STREET LANDFILL
#828023

COMPOUND	SURFACE SAMPLE LOCATION							
	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8
Volatile Organics								
Methylene Chloride		13B	13B	12B	10B	9B	12B	12B
Toluene		0.5BJ	0.6BJ		0.5BJ			
1,1,1-Trichloroethane					4J			
Carbon Disulfide							3BJ	3BJ
1,2-Dichloroethene (tot.)	2J							
Semi-Volatile Organics								
Di-n-butylphthalate	4J	2BJ	2BJ	2BJ	3BJ	1BJ	2BJ	1BJ
bis(2-ethylhexyl)phthalate	18	23B	7BJ	5BJ	28B	6BJ	9BJ	4BJ
Butylbenzylphthalate		2J	1J	1J	1J		1J	
Diethyl methyl benzamide		19J						
Pesticides/PCB's								
Gamma-chlordane	0.12J							
4,4'-DDT								0.95

B = Analyte was found in the associated blank as well as in the sample.

J = Indicates an estimated value.

Note: See Drawing Number 5 for Sample Locations

TABLE 4-11

SUMMARY OF INORGANIC COMPOUNDS DETECTED
IN SURFACE WATER SAMPLES
(ug/l)
EMERSON STREET LANDFILL
#828023

ELEMENT	SURFACE SAMPLE LOCATION SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8	FIELD BLANK	NYSDEC QUALITY STANDARDS FOR SURFACE WATERS (ug/l)
Aluminum	500	343,000	15,900	1,050	6,940	2,230	14,000	11,800		100 (1)(2)(3)(4)
Arsenic		207	13.8		5.4		12.4	18.5		360 (5)*
Barium	60	3,190	230	490	170	160	180	330		1,000 (1)(2)
Beryllium		19		5.0						1,100 (1)(2)(3)(4)**
Cadmium		7.0	6.0		7.0		15			10 (1)
Calcium	53,900	7,580,000	842,000	238,000	75,900	27,000	31,500	9,700	260	
Chromium		406	14	41	30	24	55	54		50 (1)(2)
Cobalt		289								5 (1)(2)(3)(4)
Copper	10	820	110	258	141	64	110	284		200 (1)(2)
Iron	1,080	669,000	59,500	50,400	35,600	9,320	46,800	44,200		300 (5)
Lead	10.5	715	48.1	63	68.8	24.1	85.3	158		50 (1)(2)
Magnesium	11,000	555,000	115,000	64,200	28,000	57,800	22,100	22,200		35,000 (1)(2)
Manganese	44	12,570	3,340	772	465	199	547	1,830		300 (1)(2)
Mercury		2.4								2 (1)(2)
Nickel		840	30		80		50	60		
Potassium	3,290	20,900	13,400	38,200	57,800	9,830	80,600	21,200		
Silver		32	5.0	19		6.0	9.0	6.0		0.1 (1)(2)(3)(4)
Sodium	20,000	71,000	57,000	960,000	240,000	175,000	31,000	48,000		
Vanadium		582	52				50			190 (5)**
Zinc	37	3,540	281	964	571	311	1,020	4,150		30 (3)(4)

NYSDEC (1985) "Ambient Water Quality Standards", 6NYCRR Appendix 31, Part 701 (Ref. 39)
(1)-Class AA Water
(2)-Class A Water
(3)-Class B Water
(4)-Class C Water
(5)-Class D Water
* - Dissolved Form
** - Acid Soluble
Note: See Drawing Number 5 for Sample Locations

On January 10, 1989, two additional surface water samples were collected by the NYSDEC Region 8 staff. The samples were collected from 2 storm sewer outfalls along the Barge Canal. Sample 301 was collected from the Lee Road outfall and sample 501 from the Ferrano Street outfall.

The only volatile organic compound found in either sample was acetone. Sample 501 yielded an acetone concentration of 8 ug/l.

A small number of semi-volatile organic compounds were detected in both samples. Surface water sample 301 was found to contain phenanthrene, fluoranthene, and pyrene at concentrations ranging from 5 to 6 ug/l. Sample 501 contained those three compounds and also benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(a)pyrene. These compounds existed at concentrations ranging from 10-28 ug/l. In addition to these, Sample 501 yielded 21 unknown aliphatic hydrocarbon compounds with concentrations ranging from 16 to 70 ug/l.

No pesticide or PCB compounds were detected in the surface water samples collected from the storm sewer outfalls.

Of the inorganic compounds analyzed for, the following were found in both samples at concentrations above NYSDEC quality standards (6NYCRR 701): aluminum, iron, lead, magnesium, manganese, and zinc. In addition to these, surface water sample 501 contained cadmium and chromium at concentrations which exceeded these standards. The complete laboratory report for the analysis of these samples is located in Reference 34.

4.6.6 Phase II Drum Analytical Data

Composite samples of the drummed auger cuttings and water generated during drilling, development and sampling were analyzed to determine if the materials exhibited the characteristics of a hazardous waste, as defined by NYSDEC. Specifically, the tests conducted on the soil and water samples included: ignitability, reactivity, EP toxicity, total PCB's, total available cyanide and total available sulfide. All of the analyses performed indicated that the drummed materials did not exhibit any of the properties of a hazardous waste and did not contain PCB's. The analytical report is presented in Appendix I.

4.7 Possible Sources of Detected Compounds

A potential source of the inorganic compounds detected in groundwater surface water, and sediment samples appears to be the ash material generated by the City of Rochester incinerator. This ash material was distributed around the incinerator property and throughout large portions of the site. Boring logs from test borings south of Emerson Street and East of Resource Recovery Facility indicate frequent quantities of ash and cinder material (Ref. 23). Borings drilled south of Edison Tech. and west of Colfax St. also indicated a presence of cinder material.

A sample of the ash material was collected from the incinerator building. As a result of the analysis this material was found to contain concentrations of the following compounds above those found in common soils: arsenic, cadmium, calcium, cobalt, copper, lead, magnesium, mercury, potassium, sodium, and zinc. The concentrations of all but three inorganic compounds (cyanide, iron, silver) were higher in the ash sample than in the

soil samples collected throughout the site. The concentrations found in the ash sample were up to 60 times greater.

The ash sample also contained 14,000 UG/KG of phenol which may account for the detection of phenol in samples SED-2 and SED-3.

Soils excavated near the City of Rochester Forestry building were analyzed for disposal purposes. This analysis which was performed by Versar, Inc. laboratories using EPA methodology, indicated the presence of toluene, 1,2-dichloropropane and 1,1-dichloroethane. Methylene chloride was found at a concentration of 420 UG/KG. Based on these findings, the DEC required that the soils be disposed of as hazardous waste. The presence of these compounds indicates the possibility that waste material containing them may have been disposed of near the forestry building or that they may have migrated from a source in this vicinity.

Test pits excavated just west of Colfax St. and 400 to 500 feet south of Emerson St. revealed the presence of fill material including asphalt and material described as vitreous tar solids. Some soils were also found to have a violet-shaded tint.

Monitoring well GW-9 is located about 100 feet from these test borings. Laboratory analysis of groundwater samples collected from GW-9 indicated the presence of some volatile organic compounds. The source may be associated with this fill material or from the same source responsible for the contamination found in the soils near the forestry building.

A composite fill sample was collected from borings south of Emerson St. and east of the Resource Recovery Facility. Laboratory analysis of the sample by General Testing, Inc. revealed elevated concentrations of cadmium, total chromium, copper, lead and zinc. Several organic compounds were also detected. These included: methylene chloride, trichloroethene, tetrachloroethane, benzene, toluene, ethylbenzene, xylenes and a PCB compound (Ref. 30). It appears that the fill material deposited in this area could be a potential source for contaminants found at the site.

Other potential sources of the predominantly low levels of organic compounds detected across the site may be from the large quantities of sanitary wastes deposited at the landfill. The reported dumping of some industrial wastes at the site also indicates a possible source of some contaminants.

4.8 Recommendations

The Phase II Investigation for the Emerson Street Landfill was conducted as a combined field and laboratory study. Assessment of all data generated from this investigation has permitted identification of additional data pertinent to evaluating the site. Our recommendations for obtaining this data are:

- Install piezometers in a systematic network throughout the site. At points of shallow groundwater, piezometers should be installed. The network will provide an expanded geohydrologic data base whereby static pressure heads in the groundwater system can be evaluated laterally. The presence of pearched or unconnected water-bearing zones may exist in

localized portions of the unconsolidated materials or within the underlying dolomite bedrock. Additionally, elevated (mounded) groundwater levels within the landfill body may be present.

- Collect soil and/or fill samples and perform gamma spectrographic analysis from the area of alleged radioactive waste disposal south of Emerson Street. Sampling should be conducted to allow for vertical and horizontal profiling of the radioactive levels and source materials in this area.

- Collect fill samples and analyze for total PCB concentrations. The sampling and analysis should be conducted to supplement the greater than SARA PCB clean-up levels (14 mg/Kg PCB concentration) identified in a composite sample collected by Rochester Drilling Co., Inc. in 1985.

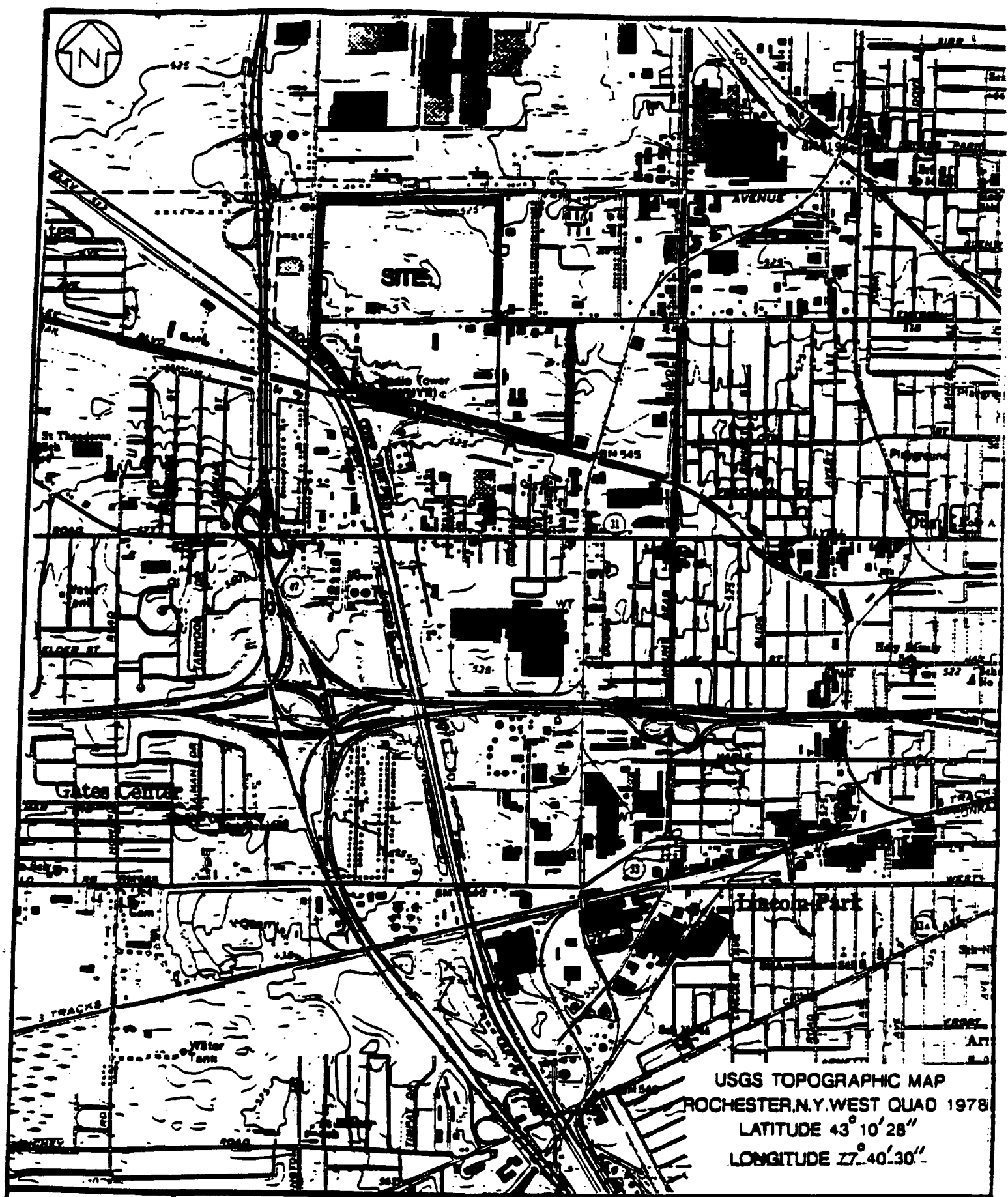
- Collect additional surface water sediment and storm sewer samples and analyze for HSL list compounds to determine background contaminant concentrations and further define the source and locations of these contaminants.

5.0 FINAL HAZARD RANKING SYSTEM

5.1 Narrative

The Emerson Street Landfill covers approximately 230 acres in a commercial and residential area of the City of Rochester, Monroe County, New York. The City of Rochester operated the landfill from 1930 to 1971. Disposal of approximately 3 million cubic yards of municipal, demolition, and industrial wastes have been documented. Of these, low level radioactive waste containing uranium, thorium and beryllium have been reported. In 1970, the New York State Urban Development Corporation purchased the landfill from the City of Rochester. This agency then commenced to develop the site into an industrial park. Parcels of land were sold to a variety of businesses.

Analytical data generated as part of the Phase II Investigation indicated that contamination of the groundwater, surface water, and sediments has occurred. The landfill is situated on a shallow unconfined water bearing zone in unconsolidated soil, fill and dolomite bedrock. Historical groundwater use has been identified within the area. The New York State Barge Canal is located 500 feet southwest of the landfill. Surface water usage for domestic or industrial purposes has not been documented.



RECRA ENVIRONMENTAL INC.

Scale: 1"=2000'		
	By	Date
Dwn.	JTB	1/89
Ckd.	JRS	2/89
Ap'vd.		
Rev.		

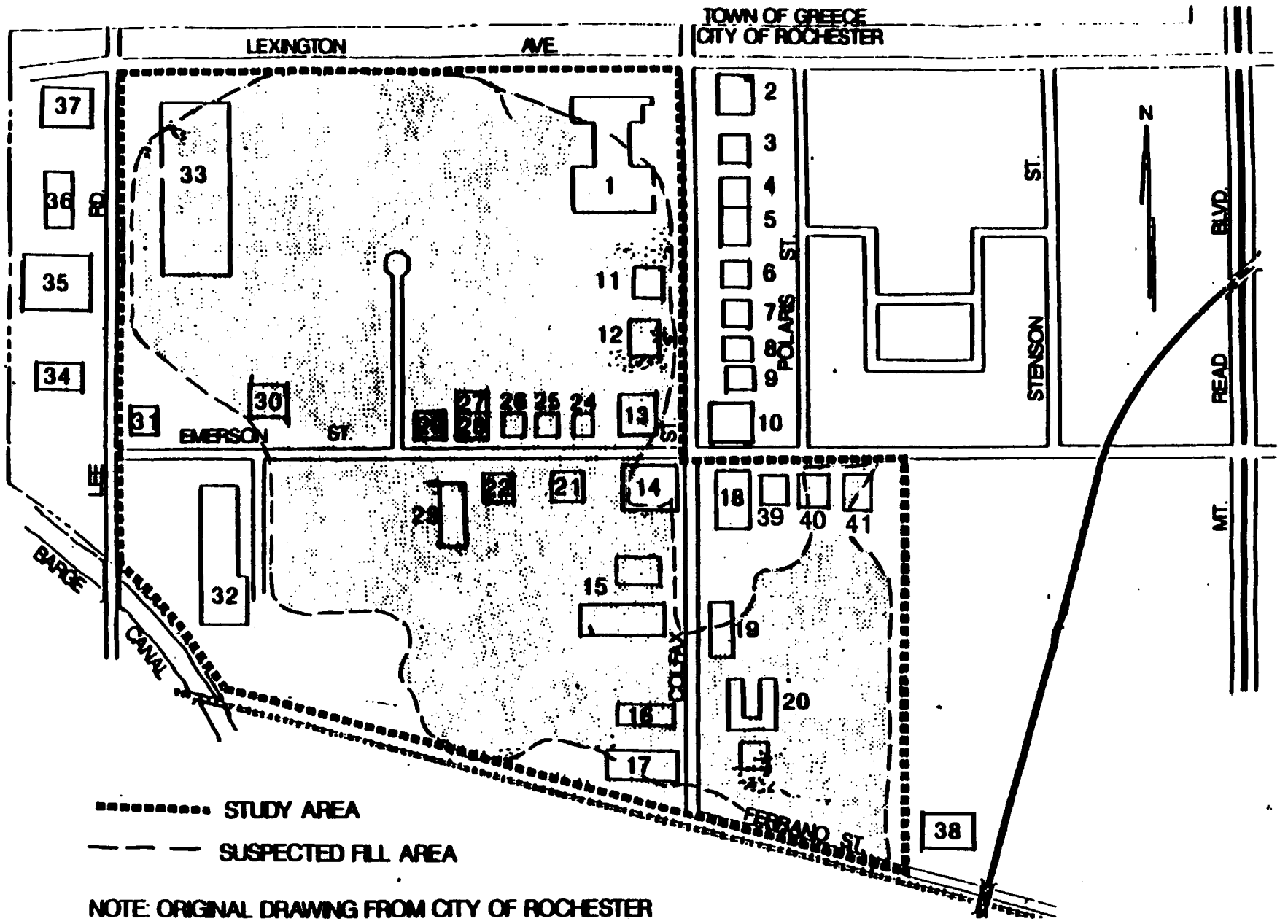
EMERSON STREET LANDFILL
N.Y.S. SUPERFUND
PHASE II INVESTIGATION
SITE No.828023

VICINITY MAP

Project No. 8C1301

A

FIGURE 2



NOTE: ORIGINAL DRAWING FROM CITY OF ROCHESTER

RECRA ENVIRONMENTAL, INC.

SCALE:	1"=200'	
	BY	DATE
DWN.	KYC	1/5/88
CKD.	JRS	2/4/89
APPVD.	RES	2/8/89
REV.	RES	8/89

EMERSON STREET LANDFILL
NYS SUPERFUND
PHASE II
SITE NO. 828023

PROJECT NO: 8C1301A

A

SITE SKETCH

FIGURE 3

FIGURE 3

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION

FACILITIES LOCATED ON SITE SKETCH

Map #	Facility Name	Address
1	Edison Technical High School	655 Colfax St.
2	Bartolomeo Funeral Home	1425 Lexington Ave.
3	Accu-Dyne Co.	700 Colfax St.
4	Kurz & Zobel	688 Colfax St.
5	Q-Mac, Inc.	686 Colfax St.
6	vacant	Colfax St.
7	Bruening Bearings, Inc.	600 Colfax St.
8	Acro Industries	554 Colfax St.
9	Peko Precision Products, Inc.	500 Colfax St.
10	Peko Precision Products, Inc.	1400 Emerson St.
11	National School Bus Service	575 Colfax St.
12	Cannon Industries	545 Colfax St.
13	Batty & Hout	1444 Colfax St.
14	Federal Stamping	1455 Emerson St.
15	Di Carolis Truck Rental	333 Colfax St.
16	Howard & Bowen, Co.	305 Colfax St.
17	Browning Ferris Corp. (BFI)	145 Colfax St.
18	CME Construction Co., Inc.	1425 Emerson St.
19	City Rochester Forestry Dept.	330 Colfax St.
20	City Rochester Refuse Dept.	210 Colfax St.
21	Printing Methods, Inc.	1525 Emerson St.
22	Abrasive Tool Corp.	1555 Emerson St.
23	Yellow Freight	1575 Emerson St.
24	Dooley Equipment Corp.	1550 Emerson St.
25	Eberhardt Enterprise	1560 Emerson St.
26	Imaging Systems Inc.	1570 Emerson St.
27	Intercom Associates, Inc.	1580 Emerson St.
28	Delta Computer, Inc.	1580 Emerson St.
29	Almac Plastics	1640 Emerson St.
30	Raymond LeChase, Inc.	1740 Emerson St.
31	E.G. Sackett Co., Inc.	454 Lee Road
32	Monroe County Resource Recovery	1845 Emerson St.
33	Rochester Products	500 Lee Road
34	NyLo Mold	515 Lee Road
35	CVC Products, Inc.	525 Lee Road
36	Public Store Management, Inc.	605 Lee Road
37	Racquetball World	687 Lee Road
38	Genesee Brewery	Ferrano St.
39	Uniweld, Inc.	1385 Emerson St.
40	Alton Tool Co., Inc.	1355 Emerson St.
41	Emerson Loop Associates	1335 Emerson St.

5.2 HRS Worksheets

Facility name: Emerson Street Landfill

Location: City of Rochester, Monroe County, New York

EPA Region: 2

Person(s) in charge of the facility: Various Owners

Name of Reviewer: James R. Stachowski **Date:** 2/1/89

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

230 acre landfill located in a commercial and residential section of the City of Rochester. Documented disposal of municipal refuse, demolition debris, industrial waste, and low level radioactive waste. Observed contamination of groundwater, surface water, and sediment. Some elevated radioactivity in southern portion of site.

Scores: S_M = 6.09 (S_{gw} = 7.46 S_{sw} = 7.44 S_a = 0.00)

S_{FE} = 0.00

S_{DC} = 50.00

FIGURE 1

HRS COVER SHEET

Ground Water Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release	0 45	1	45	45	3.1
If observed release is given a score of 45, proceed to line 4 If observed release is given a score of 0, proceed to line 2					
2 Route Characteristics					3.2
Depth to Aquifer of Concern	0 1 2 3	2	6	6	
Net Precipitation	0 1 2 3	1	2	3	
Permeability of the Unsaturated Zone	0 1 2 3	1	2	3	
Physical State	0 1 2 3	1	3	3	
	Total Route Characteristics Score		13	15	
3 Containment	0 1 2 3	1	3	3	3.3
4 Waste Characteristics					3.4
Toxicity/Persistence	0 3 6 9 12 15 18	1	18	18	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1	1	8	
	Total Waste Characteristics Score		19	26	
5 Targets					3.5
Ground Water Use	0 1 2 3	3	3	9	
Distance to Nearest Well/Population Served	0 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
	Total Targets Score		3	49	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			4,275	57,330	
7 Divide line 6 by 57,330 and multiply by 100		S_{gw} =	7.46		

FIGURE 2
GROUND WATER ROUTE WORK SHEET

Surface Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	4.1
If observed release is given a score of 45, proceed to line 4 If observed release is given a score of 0, proceed to line 2					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain	0 1 2 (3)	1	3	3	
1-yr. 24-hr. Rainfall	0 1 (2) 3	1	2	3	
Distance to Nearest Surface Water	0 1 2 (3)	2	6	6	
Physical State	0 1 2 (3)	1	3	3	
	Total Route Characteristics Score		14	15	
3 Containment	0 1 2 (3)	1	3	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 (1) 2 3 4 5 6 7 8	1	1	8	
	Total Waste Characteristics Score		19	26	
5 Targets					4.5
Surface Water Use	(0) 1 2 3	3	0	9	
Distance to a Sensitive Environment	0 1 2 (3)	2	6	6	
Population Served/ Distance to Water Intake Downstream	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
	Total Targets Score		6	55	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			4,788	64,350	
7 Divide line 6 by 64,350 and multiply by 100		S_{sw} =	7.44		

FIGURE 7
SURFACE WATER ROUTE WORK SHEET

Air Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release	0 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line 1 is 0, the S_a = 0. Enter on line 5.					
If line 1 is 45, then proceed to line 2.					
2 Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1	0	3	
Toxicity	0 1 2 3	3	0	9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1	8	8	
Total Waste Characteristics Score			8	20	
3 Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1	24	30	
Distance to Sensitive Environment	0 1 2 3	2	6	6	
Land Use	0 1 2 3	1	3	3	
Total Targets Score			33	39	
4 Multiply 1 x 2 x 3			11,880	35,100	
5 Divide line 4 by 35,100 and multiply by 100		S_a =	0		

FIGURE 9
AIR ROUTE WORK SHEET

	S	S^2
Groundwater Route Score (S_{gw})	7.46	55.65
Surface Water Route Score (S_{sw})	7.44	55.35
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		111
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		10.54
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$		6.09

FIGURE 10
WORKSHEET FOR COMPUTING S_M

Fire and Explosion Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Containment	1 3	1	0	3	7.1
2 Waste Characteristics					7.2
Direct Evidence	(0) 3	1	0	3	
Ignitability	0 1 2 (3)	1	3	3	
Reactivity	(0) 1 2 3	1	0	3	
Incompatibility	(0) 1 2 3	1	0	3	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 (8)	1	8	8	
	Total Waste Characteristics Score		11	20	
3 Targets					7.3
Distance to Nearest Population	0 1 2 3 4 (5)	1	5	5	
Distance to Nearest Building	0 1 2 (3)	1	3	3	
Distance to Sensitive Environment	0 1 2 (3)	1	3	3	
Land Use	0 1 2 (3)	1	3	3	
Population Within 2-Mile Radius	0 1 2 3 4 (5)	1	5	5	
Buildings Within 2-Mile Radius	0 1 2 3 (4) 5	1	4	5	
	Total Targets Score		23	24	
4 Multiply 1 x 2 x 3			0	1,440	
5 Divide line 4 by 1,440 and multiply by 100		S_{FE} =	0		

FIGURE 11
FIRE AND EXPLOSION WORK SHEET

Direct Contact Work Sheet

Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Incident	0 45	1	0	45	8.1
If observed release is given a score of 45, proceed to line 4 If observed release is given a score of 0, proceed to line 2					
2 Accessibility	0 1 2 3	1	3	3	8.2
3 Containment	0 15	1	15	15	8.3
4 Waste Characteristics Toxicity	0 1 2 3	5	15	15	8.4
5 Targets					8.5
Population Within a 1-Mile Radius	0 1 2 3 4 5	4	16	20	
Distance to a Critical Habitat	0 1 2 3	4	0	12	
Total Targets Score			16	32	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			10,800	21,600	
7 Divide line 6 by 21,600 and multiply by 100	S_{DC} =		50.00		

FIGURE 12
DIRECT CONTACT WORK SHEET

DOCUMENTATION RECORDS
FOR
HAZARD RANKING SYSTEM

INSTRUCTIONS. The purpose of these records is to provide a convenient way to prepare an auditable record of the data and documentation used to apply the Hazard Ranking System to a given facility. As briefly as possible summarize the information you used to assign the score for each factor (e.g., "Waste quantity = 4,230 drums plus 800 cubic yards of sludges"). The source of information should be provided for each entry and should be a bibliographic-type reference that will make the document used for a given data point easier to find. Include the location of the document and consider appending a copy of the relevant page(s) for ease in review.

FACILITY NAME: Emerson Street Landfill

LOCATION: City of Rochester, Monroe County, New York

SCORING COMPLETED ON: February 1989

SCORING PERFORMED BY: James R. Stachowski

GROUND WATER ROUTE

1 OBSERVED RELEASE

Contaminants detected (5 maximum):

1,2-Dichloroethane (total); vinyl chloride; Trichloroethene; Chromium; Benzene

Rationale for attributing the contaminants to the facility:

Recra Environmental, Inc. Phase II Investigation, 1989

Compound	Upgradient Well GW-3	Downgradient Wells GW-7	GW-9	GW-8D
1,2-Dichloroethane(tot.)	Not Detected	190 ug/l	190 ug/l	
Vinyl Chloride	Not Detected	17 ug/l	22 ug/l	
Trichloroethene	Not Detected	90 ug/l	35 ug/l	
Chromium	Not Detected	6.0 ug/l	6.0 ug/l	24 ug/l

* * *

2 ROUTE CHARACTERISTICS

Depth to Aquifer of Concern

Name/description of aquifer(s) of concern:

Groundwater in either bedrock or in the upper weathered zone at the bedrock surface. Saturated overburden zones are hydraulically connected to water in the bedrock.

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

3.9 feet

Ref: Recra Environmental, Inc. Phase II Investigation, 1989

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

Approximately 20 feet

Ref: EBS Management Consultants Incorporated, 1969 (Ref. 7)

Net Precipitation

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

Mean annual precipitation of 32-67 inches.

Ref: Ruffner, J.A. and Bair, F.E. Weather of U.S. Cities, Gale Research Co., Detroit Michigan (Ref. 13)

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

Mean annual lake evaporation of 26.0 inches.

Ref: U.S. Dept. of Commerce Technical Paper No. 40, "Rainfall Frequency Atlas of the U.S." (Ref. 14)

Net precipitation (subtract the above figures):

6.67 inches.

Permeability of Unsaturated Zone

Soil type in unsaturated zone:

Clayey SILT and SAND, miscellaneous FILL, topsoil.

Ref: Recra Environmental, Inc. Phase II Investigation 1989.

Permeability associated with soil type:

10^{-3} to 10^{-5} cm/sec.

Ref: Davis S.N., Porosity and Permeability of Natural Materials in Flow-Through Porous Media, R.J.M. DeWest ed., Academic Press, New York, 1969.
Freeze, R.A. and J.A. Cherry, Groundwater, Prentice-Hall, Inc., New York, 1979. (Ref. 35)

Physical State

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

Solid, unconsolidated (Ref. 1,5,6)
Liquid (Ref. 5)

* * *

3 CONTAINMENT

Containment

Method(s) of waste or leachate containment evaluated:

Landfill, no liner, ponded water.
Ref: Recra Environmental, Inc. Phase II Investigation 1989

Method with highest score:

Landfill as described above.

4 WASTE CHARACTERISTICS

Toxicity and Persistence

Compound(s) evaluated:

Acetone, Benzene, Toluene, Total Xylenes, Chloroethane, 1,1-Dichloroethane, Chlorobenzene, Vinyl Chloride, 1,2-Dichloroethene, Trichloroethene, 1,1-Dichloroethene, Di-n-butylphthalate, Butylbenzylphthalate, bis(2-Ethylhexyl)phthalate, 1,4-Dichlorobenzene, Diethylphthalate, Di-n-octylphthalate, Chromium, Copper, Iron, Silver, Beryllium, Barium, Cadmium, Cobalt, Lead, Nickel, Zinc
Ref: Appendix I, Recra Environmental, Inc., Laboratory Chemical Analysis Report.

Compound with highest score:

Lead, Nickel, Chromium, Iron, Beryllium, Barium, Cadmium, Mercury, Di-n-butylphthalate, Diethylphthalate, Di-n-octylphthalate

Hazardous Waste Quantity

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

1-10 tons

Basis of estimating and/or computing waste quantity:

Various volatile organic compounds are leaching from the landfill. However, it cannot be clearly documented that hazardous substances are characteristic of the entire landfill. Therefore, the lowest non-zero quantity score is used.

Ref: Recra Environmental, Inc. Phase II Investigation 1989

* * *

5 TARGETS

Ground Water Use

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

No current uses documented. Former residents indicated groundwater was used until the early to mid 1960s when public water was supplied. The landfill was active when groundwater was being used.

Assigned score = 1 (Ref. 36)

Distance to Nearest Well

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

No wells are documented to presently be drawing from aquifer of concern. A survey of some former residents indicates some wells were used but there is no documentation that suggests their use was discontinued because of the landfill.

(Ref. 36)

Distance to above well or building:
N/A

Population Served by Ground Water Wells Within a 3-Mile Radius

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

No wells are documented to be currently drawing from aquifer of concern.

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

Zero acres irrigated.

Ref: USGS Topographic Map, Rochester, NY West Quadrangle, 1978 (Ref. 16)

Total population served by ground water within a 3-mile radius:

Zero as indicated above.

SURFACE WATER ROUTE

1 OBSERVED RELEASE

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

No release observed

Rationale for attributing the contaminants to the facility:

* * *

2 ROUTE CHARACTERISTICS

Facility Slope and Intervening Terrain

Average slope of facility in percent:

0 to 3%

Ref: USGS Topographic Map, Rochester, NY West Quadrangle, 1978. (Ref. 16)

Name/description of nearest downslope surface water:

NYS Barge Canal (nearly stagnant fresh water).
NYS Class II Wetland RH-18-II.

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

0 to 3%

Ref: USGS Topographic Map, Rochester NY West Quadrangle, 1978 (Ref. 16)

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

The facility is located partially in surface water, based upon the presence of contamination detected in samples SW-2 and SW-3 located in wetland RH-18-II.

Ref: Recra Environmental, Inc. Phase II Investigation, 1989.

Is the facility completely surrounded by areas of higher elevation?

The facility is not completely surrounded by areas of higher elevation.

Ref: USGS Topographic Map, Rochester, NY West Quadrangle 1978 (Ref. 15)

1-Year 24-Hour Rainfall in Inches

2.12 inches.

Ref: U.S. Dept. of Commerce Technical Paper No. 40 (Ref. 15)

Distance to Nearest Downslope Surface Water

850 feet to NYS Barge Canal along storm sewer network.

Physical State of Waste

Solid, unconsolidated (Ref. 1,5,6)
Liquid (Ref. 5)

* * *

3 CONTAINMENT

Containment

Method(s) of waste or leachate containment evaluated:

Landfill covered, wastes unconsolidated and diversion or containment system absent.

Method with highest score:

Landfill as described above.

4 WASTE CHARACTERISTICS

Toxicity and Persistence

Compound(s) evaluated

1,1,1-Trichloroethane, Carbon Disulfide, Di-n-butylphthalate, bis(2-Ethylhexyl)phthalate, Butylbenzylphthalate, Gamma-chlordane, 4,4'-DDT, Chromium, Zinc, Beryllium, Barium, Lead, Nickel, Mercury, Cobalt, Calcium, Copper

Ref: Recra Environmental, Inc. Phase II Investigation 1989

Compound with highest score:

Di-n-butylphthalate, Gamma-chlordane, 4,4'-DDT, Mercury, Lead, Barium, Beryllium

Hazardous Waste Quantity

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

1-10 tons

Basis of estimating and/or computing waste quantity:

Various volatile organic compounds are leaching from the landfill. However, it cannot be clearly documented that hazardous substances are characteristic of the entire landfill. Therefore, the lowest non-zero quantity score is used.

Ref: Recra Environmental, Inc. Phase II Investigation 1989.

* * *

5 TARGETS

Surface Water Use

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

Not currently used within 3 miles.

Ref: NYSDOH New York State Atlas of Community Water System Sources, 1982 (Ref. 17)

Is there tidal influence?

There is no tidal influence.

Distance to a Sensitive Environment

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

There is no coastal wetland within 2 miles of the facility.
Ref: USGS 7.5 minute Topographic Map of the Rochester, NY West Quadrangle, 1978.

(Ref. 16)

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

Hazardous substances present in NYS Class II Wetland RH-18-II.

Ref: Recra Environmental, Inc. Phase II Investigation, 1989.

(Ref. 12)

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

There are no critical habitats of an endangered species or national wildlife refuge within 1 mile of the facility. Site located in urban area.
Ref: USGS 7.5 minute Topographic Map of the Rochester, NY West Quadrangle, 1978.

(Ref. 16)

Population Served by Surface Water

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

There is no water supply intake located within 3 miles of the facility.

Ref: NYSDOH New York State Atlas of Community Water System Sources, 1982 (Ref. 17)

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

Zero acres and zero people within 3 miles.

Ref: USGS Topographic Map, Rochester, NY, West Quadrangle 1978. (Ref. 16)

Total population served:

Zero

Name/description of nearest of above water bodies:

Lake Ontario

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

Straight line distance to the Monroe County Water Authority intake on Lake Ontario is approximately 7 miles. Genesee River discharges into Lake Ontario at greater distance.

Ref: NYSDOH Atlas of Community Water System Sources, 1982 (Ref. 17)

1 OBSERVED RELEASE

Contaminants detected:

Based on Phase II field investigation, no release can be scored.

Date and location of detection of contaminants:

Methods used to detect the contaminants:

Rationale for attributing the contaminants to the site:

* * *

2 WASTE CHARACTERISTICS

Reactivity and Incompatibility

Most reactive compound:

None identified with NFPA level above zero.

Ref: National Fire Protection Association, 1976 (Ref. 37)

Most incompatible pair of compounds:

None identified.

Ref: Recra Environmental, Inc. Phase II Investigation, 1989, and California Department of Health, "Hazardous Waste Management Law, Regulations, and Guidelines for Handling of Hazardous Waste" (Ref. 38)

Toxicity

Most toxic compound:

No toxicity values reported for thorium and uranium in Sax, 1984. Both thorium and uranium are radioactive. Assign value of zero.

Hazardous Waste Quantity

Total quantity of hazardous waste:

1-10 tons

Basis of estimating and/or computing waste quantity:

Various volatile organic compounds are leaching from the landfill. However, it cannot be clearly documented that hazardous substances are characteristic of the entire landfill. Therefore, the lowest non-zero quantity score is used.

Ref: Recra Environmental, Inc. Phase II Investigation 1989.

* * *

3 TARGETS

Population Within 4-Mile Radius

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

0 to 4 mi 0 to 1 mi 0 to 1/2 mi 0 to 1/4 mi

3,001 to 10,000 people. Estimated from building count on USGS Topographic Map, Rochester, NY West Quadrangle, 1978

(Ref. 16)

Distance to a Sensitive Environment

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

Not applicable.

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

Facility located on NYS Class II Wetland RH-18-II.

Ref: Recra Environmental, Inc.. Phase II Investigation, 1989.

(Ref. 12)

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

No critical habitat of an endangered species are located within one mile of the facility.

(Ref. 16)

Land Use

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

A commercial/industrial area is situated directly on the facility. Score at less than ¼ mile.

(Ref. 16)

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

No national or state park, forest, or wildlife reserve have been identified within 2 miles of the facility.

(Ref. 16)

Distance to residential area, if 2 miles or less:

Residential areas are located within ¼ to 1 mile of the facility.

Ref: USGS Topgraphic Map, Rochester, NY, West Quadrangle 1978.

(Ref. 16)

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

None identified within 1 mile. (Ref. 16)

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

None identified within 2 miles. (Ref. 16)

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

No historic or landmark site is located within view of the facility.

1 CONTAINMENT

Hazardous substances present:

None identified.

Type of containment, if applicable:

Fire Marshall has not certified a fire threat nor do field measurements suggest such.

* * *

2 WASTE CHARACTERISTICS

Direct Evidence

Type of instrument and measurements:

No direct evidence.

Ignitability

Compound used:

Ethyl benzene, Toluene, Xylene, Benzene

Ref: National Fire Protection Association, National Fire Codes, Vol. 13, No. 49, 1977.

(Ref. 37)

Reactivity

Most reactive compound:

None identified with NFPA level above zero.

(Ref. 37)

Incompatibility

Most incompatible pair of compounds:

No incompatible substances are present.

(Ref. 38)

* * *

Hazardous Waste Quantity

Total quantity of hazardous substances at the facility:

1-10 tons

Basis of estimating and/or computing waste quantity:

Various volatile organic compounds are leaching from the landfill. However, it cannot be clearly documented that hazardous substances are characteristic of the entire landfill. Therefore, the lowest non-zero quantity score is used.

Ref: Recra Environmental, Inc. Phase II Investigation 1989.

* * *

3 TARGETS

Distance to Nearest Population

Buildings with one or more persons are located directly on-site, score 0-50 feet.
Ref: Recra Environmental, Inc. Phase II Investigation 1989.

Distance to Nearest Building

Directly on-site, score 0-50 feet.
Ref: Recra Environmental, Inc. Phase II Investigation 1989.

Distance to Sensitive Environment

Distance to wetlands:

NYS Class II Wetland RH-18-II is located within 100 feet of the fill boundary (i.e. hazardous substance).

(Ref. 12)

Distance to critical habitat:

No critical habitats have been identified within ½ mile of the fill boundary (i.e. hazardous substance).

Land Use

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

Less than ¼ mile.

(Ref. 16)

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

None identified within 2 miles. (Ref. 16)

Distance to residential area, if 2 miles or less:

¼ to 1 mile.

Ref: USGS Topographic Map, Rochester, NY West Quadrangle 1978 (Ref. 16)

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

None identified within 1 mile. (Ref. 16)

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

None identified within 2 miles. (Ref. 16)

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

None located within view of the site.

Population Within 2-Mile Radius

>10,000 people within a 2 mile radius.

Ref: USGS Topographic Map, Rochester, NY, West Quadrangle 1978

(Ref. 16)

Buildings Within 2-Mile Radius

1,609

Ref: USGS Topographic Map, Rochester, NY West Quadrangle 1978

(Ref. 16)

DIRECT CONTACT

1 OBSERVED INCIDENT

Date, location, and pertinent details of incident:

No observed incidents.

* * *

2 ACCESSIBILITY

Describe type of barrier(s):

Barriers do not completely surround the facility.

Ref: Recra Environmental, Inc. Phase II Investigation 1989

* * *

3 CONTAINMENT

Type of containment, if applicable:

Landfill with less than 2 feet of cover.

* * *

4 WASTE CHARACTERISTICS

<u>Toxicity</u>

Compounds evaluated:

Acetone, Benzene, Toluene, Total Xylenes, Chloroethane, 1,1-Dichloroethane, Chlorobenzene, Vinyl Chloride, 1,2-Dichloroethene, Trichloroethene, 1,1-Dichloroethene, Di-n-butylphthalate, Butylbenzylphthalate, bis(2-Ethylhexyl)phthalate, 1,4-Dichlorobenzene, Diethylphthalate, Di-n-octylphthalate, Chromium, Copper, Iron, Silver, Beryllium, Barium, Cadmium, Cobalt, Lead, Nickel, Zinc

Ref: Recra Environmental, Inc. Phase II Investigation 1989

Compound with highest score:

Di-n-butylphthalate (18)
Diethylphthalate (18)
Di-n-octylphthalate (18)

* * *

5 TARGETS

Population within one-mile radius

3,001 - 10,000

Ref: USGS Topographic Map, Rochester, NY West Quadrangle, 1978 (Ref. 16)

Distance to critical habitat (of endangered species)

No critical habitat (of endangered species) identified within 1 mile of the facility.

5.4 EPA Site Inspection Report

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 1 - SITE LOCATION AND INSPECTION INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
NY	828023

II. SITE NAME AND LOCATION

01 SITE NAME (Legal, common, or descriptive name of site)	02 STREET, ROUTE NO., OR SPECIFIC LOCATION IDENTIFIER
Emerson Street Landfill	Surrounding Emerson Street near Lee Road

03 CITY	04 STATE	05 ZIP CODE	06 COUNTY	07 COUNTY CODE	08 CONG DIST
Rochester	NY	14606	Monroe		32

09 COORDINATES — LATITUDE: 43 10 40.0 — LONGITUDE: 077 40 27.0

10 TYPE OF OWNERSHIP (Check one): ☐ A. PRIVATE ☐ B. FEDERAL ☐ C. STATE ☐ D. COUNTY ☒ E. MUNICIPAL ☐ F. OTHER ☐ G. UNKNOWN

III. INSPECTION INFORMATION

01 DATE OF INSPECTION: 7 / 11 / 88 (MONTH DAY YEAR)

02 SITE STATUS: ☐ ACTIVE ☒ INACTIVE

03 YEARS OF OPERATION: 1930 (BEGINNING YEAR) / 1971 (ENDING YEAR) ___ UNKNOWN

04 AGENCY PERFORMING INSPECTION (Check all that apply): ☐ A. EPA ☐ B. EPA CONTRACTOR ___ ☐ C. MUNICIPAL ☐ D. MUNICIPAL CONTRACTOR ___ ☐ E. STATE ☒ F. STATE CONTRACTOR Recra Env., Inc. ☐ G. OTHER ___

05 CHIEF INSPECTOR	06 TITLE	07 ORGANIZATION	08 TELEPHONE NO.
James R. Stachowski	Project Manager	Recra	(716) 691-2600
09 OTHER INSPECTORS	10 TITLE	11 ORGANIZATION	12 TELEPHONE NO.
Robert E. Steiner	Staff Geologist	Recra	(716) 691-2600
			( )
			( )
			( )
			( )

13 SITE REPRESENTATIVES INTERVIEWED	14 TITLE	15 ADDRESS	16 TELEPHONE NO.
Ed Harding	Asst. Solid Waste Engineer	Monroe County Resource Recovery Facility	(716) 254-4000
John A. Swanson	Sanitary Engineer	New York State Dept. of Environmental Conservation	(716) 226-2466
			( )
			( )
			( )
			( )

17 ACCESS GAINED BY (Check one)	18 TIME OF INSPECTION	19 WEATHER CONDITIONS
☒ PERMISSION ☐ WARRANT	09:00 - 12:00	Sunny, mild, 70°F

IV. INFORMATION AVAILABLE FROM

01 CONTACT	02 OF (Agency/Organization)	03 TELEPHONE NO.
Marsden Chen, P.E.	NYS Dept. of Environmental Conservation	518-457-0639

04 PERSON RESPONSIBLE FOR SITE INSPECTION FORM	05 AGENCY	06 ORGANIZATION	07 TELEPHONE NO.	08 DATE
Robert E. Steiner II		Recra	(716) 691-2600	1 / 27 / 89 (MONTH DAY YEAR)

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 2 - WASTE INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	878023

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 PHYSICAL STATES (Check all that apply)

- X A SOLID
- B. POWDER, FINES
- C SLUDGE
- D OTHER _____ (Specify)
- E SLURRY
- X LIQUID
- G GAS

02 WASTE QUANTITY AT SITE (Measures of waste quantities must be independent)

TONS _____

CUBIC YARDS ~3.07x10^6 yds^3

NO OF DRUMS _____

03 WASTE CHARACTERISTICS (Check all that apply)

- X A TOXIC
- B CORROSIVE
- X C RADIOACTIVE
- X D PERSISTENT
- E SOLUBLE
- F INFECTIOUS
- G FLAMMABLE
- H IGNITABLE
- I HIGHLY VOLATILE
- J EXPLOSIVE
- X K REACTIVE
- L INCOMPATIBLE
- M NOT APPLICABLE

III. WASTE TYPE

CATEGORY	SUBSTANCE NAME	01 GROSS AMOUNT	02 UNIT OF MEASURE	03 COMMENTS
SLU	SLUDGE			
OLW	OILY WASTE			
SOL	SOLVENTS			
PSD	PESTICIDES			
OCC	OTHER ORGANIC CHEMICALS			
IOC	INORGANIC CHEMICALS			
ACD	ACIDS			
BAS	BASES			
MES	HEAVY METALS			

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

01 CATEGORY	02 SUBSTANCE NAME	03 CAS NUMBER	04 STORAGE/DISPOSAL METHOD	05 CONCENTRATION	06 MEASURE OF CONCENTRATION
IOC	Arsenic	7440-38-2	Landfilled	32	µg/g
IOC	Cadmium	7440-43-9	" "	4.4	µg/g
IOC	Chromium, total	7440-47-3	" "	95	µg/g
IOC	Copper	7440-50-8	" "	1300	µg/g
IOC	Lead	7439-92-1	" "	2000	µg/g
IOC	Mercury	7439-97-6	" "	1.1	µg/g
IOC	Nickel	7440-02-0	" "	83	µg/g
IOC	Zinc	7440-66-6	" "	1700	µg/g
IOC	Silver	7440-22-4	" "	14	µg/g
SOL	Methylene Chloride	75-09-2	" "	320	µg/kg
SOL	Trichloroethene	79-01-6	" "	120	µg/kg
SOL	Tetrachloroethene	127-18-4	" "	15	µg/kg
OCC	Benzene	71-43-2	" "	6.7	µg/kg
OCC	Toluene	108-88-3	" "	67	µg/kg
OCC	Ethylbenzene	100-41-4	" "	19	µg/kg
PSD	PCB/254	11097-69-1	" "	14	mg/kg

V. FEEDSTOCKS (See Appendix for CAS Numbers)

CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER	CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER
FDS			FDS		
FDS			FDS		
FDS			FDS		
FDS			FDS		

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

General Testing Corporation laboratory report for Rochester Drilling Company, Job No. R51506, Date 10/16/85.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	828023

II. HAZARDOUS CONDITIONS AND INCIDENTS

01 [X] A. GROUNDWATER CONTAMINATION
03 POPULATION POTENTIALLY AFFECTED: 112
02 [ ] OBSERVED (DATE: 9/20-23/88) [X] POTENTIAL [ ] ALLEGED
04 NARRATIVE DESCRIPTION

Phase II Investigation revealed traces of organic and elevated levels of some inorganic compounds in groundwater. Historic groundwater use as either a primary or secondary source has been documented.

01 [X] B. SURFACE WATER CONTAMINATION
03 POPULATION POTENTIALLY AFFECTED: 0
02 [ ] OBSERVED (DATE: 9/20-23/88) [X] POTENTIAL [ ] ALLEGED
04 NARRATIVE DESCRIPTION

Phase II Investigation revealed traces of organics and some elevated levels of inorganic compounds in surface water samples. Surface water primarily drains into the Barge Canal and no intakes are known to exist there.

01 [X] C. CONTAMINATION OF AIR
03 POPULATION POTENTIALLY AFFECTED: 0
02 [ ] OBSERVED (DATE: 9/1/88) [X] POTENTIAL [ ] ALLEGED
04 NARRATIVE DESCRIPTION

Radiation readings of 22-170 micro rems/hr. in area of alleged disposal of radioactive wastes. Detected 1-2' from ground surface.

01 [X] D. FIRE/EXPLOSIVE CONDITIONS
03 POPULATION POTENTIALLY AFFECTED: 0
02 [ ] OBSERVED (DATE: 8/9/88) [ ] POTENTIAL [ ] ALLEGED
04 NARRATIVE DESCRIPTION

Explosive gas reading of u p to 100% LEL during drilling operations at GW-4 & 5.

01 [ ] E. DIRECT CONTACT
03 POPULATION POTENTIALLY AFFECTED:
02 [ ] OBSERVED (DATE: N/A) [ ] POTENTIAL [ ] ALLEGED
04 NARRATIVE DESCRIPTION

None documented.

01 [X] F. CONTAMINATION OF SOIL
03 AREA POTENTIALLY AFFECTED: 230 (Acres)
02 [ ] OBSERVED (DATE: 11/28/88) [X] POTENTIAL [ ] ALLEGED
04 NARRATIVE DESCRIPTION

Phase II Investigation showed some organic compounds to be present in soils around the site. Also, Radiological survey indicated radioactive contamination.

01 [ ] G. DRINKING WATER CONTAMINATION
03 POPULATION POTENTIALLY AFFECTED:
02 [ ] OBSERVED (DATE: N/A) [ ] POTENTIAL [ ] ALLEGED
04 NARRATIVE DESCRIPTION

None documented.

01 [ ] H. WORKER EXPOSURE/INJURY
03 WORKERS POTENTIALLY AFFECTED:
02 [ ] OBSERVED (DATE: N/A) [ ] POTENTIAL [ ] ALLEGED
04 NARRATIVE DESCRIPTION

None documented.

01 [ ] I. POPULATION EXPOSURE/INJURY
03 POPULATION POTENTIALLY AFFECTED:
02 [ ] OBSERVED (DATE: N/A) [ ] POTENTIAL [ ] ALLEGED
04 NARRATIVE DESCRIPTION

None documented.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	828023

II. HAZARDOUS CONDITIONS AND INCIDENTS Continued

01 ☐ J. DAMAGE TO FLORA — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

Unknown

01 ☐ K. DAMAGE TO FAUNA — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION (Include names(s) of species)

Unknown

01 ☐ L. CONTAMINATION OF FOOD CHAIN — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

Unknown

01 ☒ M. UNSTABLE CONTAINMENT OF WASTES (Spills/Runoff/Standing liquids, Leaking drums) — 02 ☐ OBSERVED (DATE: _____) ☒ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: _____ 04 NARRATIVE DESCRIPTION

Unlined Landfill

01 ☒ N. DAMAGE TO OFFSITE PROPERTY — 02 ☒ OBSERVED (DATE: 9/20-23/88) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

Contamination in basement sumps and in wetlands.

01 ☒ O. CONTAMINATION OF SEWERS, STORM DRAINS, WWTPs — 02 ☒ OBSERVED (DATE: 9/23-28/88) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

Di-n-Butylphthalate and bis (2-Ethylhexyl)phthalate detected from samples collected during 9/23 - 28/88.

01 ☒ P. ILLEGAL/UNAUTHORIZED DUMPING — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☒ ALLEGED
04 NARRATIVE DESCRIPTION

A DEC, 1970, Times Union article indicated the City of Rochester Department of Public Works took steps to stop illegal dumping. These steps included posting signs and patrolling the area.

05 DESCRIPTION OF ANY OTHER KNOWN, POTENTIAL, OR ALLEGED HAZARDS

Potential for radiation, also reports indicate that some industrial chemical wastes were transported to the site.

III. TOTAL POPULATION POTENTIALLY AFFECTED: 3,001 to 10,000

IV. COMMENTS

Population potentially affected estimated by by building count in area at radial distance of 1 mile from center of landfull.

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

1. Recra Environmental, Inc. Phase II Investigation, 1989.
2. Refs. 2,4.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION
PART 4 - PERMIT AND DESCRIPTIVE INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
NY	828023

II. PERMIT INFORMATION

01 TYPE OF PERMIT ISSUED (Check all that apply)	02 PERMIT NUMBER	03 DATE ISSUED	04 EXPIRATION DATE	05 COMMENTS
☐ A. NPDES				
☐ B. UIC				
☐ C. AIR				
☐ D. RCRA				
☐ E. RCRA INTERIM STATUS				
☐ F. SPCC PLAN				
☐ G. STATE (Specify)				
☐ H. LOCAL (Specify)				
☐ I. OTHER (Specify)				
☒ J. NONE				

III. SITE DESCRIPTION

01 STORAGE/DISPOSAL (Check all that apply)	02 AMOUNT	03 UNIT OF MEASURE
☐ A. SURFACE IMPOUNDMENT		
☐ B. PILES		
☐ C. DRUMS, ABOVE GROUND		
☐ D. TANK, ABOVE GROUND		
☐ E. TANK, BELOW GROUND		
☐ F. LANDFILL	3×10^6	yd.^{3}
☐ G. LANDFARM		
☐ H. OPEN DUMP		
☐ I. OTHER (Specify)		

04 TREATMENT (Check all that apply)

- ☒ A. INCENERATION
- ☐ B. UNDERGROUND INJECTION
- ☐ C. CHEMICAL/PHYSICAL
- ☐ D. BIOLOGICAL
- ☐ E. WASTE OIL PROCESSING
- ☐ F. SOLVENT RECOVERY
- ☐ G. OTHER RECYCLING/RECOVERY
- ☐ H. OTHER (Specify)

05 OTHER

- ☒ A. BUILDINGS ON SITE

06 AREA OF SITE: 230 (Acres)

07 COMMENTS

IV. CONTAINMENT

01 CONTAINMENT OF WASTES (Check one)

☐ A. ADEQUATE, SECURE ☐ B. MODERATE ☒ C. INADEQUATE, POOR ☐ D. INSECURE, UNSOUND, DANGEROUS

02 DESCRIPTION OF DRUMS, DIKING, LINERS, BARRIERS, ETC.

Some empty drums were seen during site inspection. Landfill was operated with no liner. Majority of the site is currently covered with topsoil.

V. ACCESSIBILITY

01 WASTE EASILY ACCESSIBLE: ☒ YES ☐ NO

02 COMMENTS

Some debris can be seen on ground surface; most waste has been covered.

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

Phase I report and Phase II site inspection, Recra Research, Inc. and Recra Environmental, Inc.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 5 - WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
NY	828023

II. DRINKING WATER SUPPLY

01 TYPE OF DRINKING SUPPLY (Check as applicable)	SURFACE	WELL	02 STATUS: ENDANGERED	AFFECTED	MONITORED	03 DISTANCE TO SITE
COMMUNITY	A. X	B. ☐	A. ☐	B. ☐	C. ☐	A. 7 (mi)
NON-COMMUNITY	C. ☐	D. ☐	D. ☐	E. ☐	F. ☐	B. ____ (mi)

III. GROUNDWATER

01 GROUNDWATER USE IN VICINITY (Check one)

☐ A. ONLY SOURCE FOR DRINKING ☐ B. DRINKING (Other sources available) COMMERCIAL, INDUSTRIAL, IRRIGATION (No other water sources available) ☐ C. COMMERCIAL, INDUSTRIAL, IRRIGATION (Limited other sources available) X D. NOT USED, UNUSEABLE (currently)

02 POPULATION SERVED BY GROUND WATER Currently zero.

03 DISTANCE TO NEAREST DRINKING WATER WELL Historically estimated at 800-1000ft.

04 DEPTH TO GROUNDWATER	05 DIRECTION OF GROUNDWATER FLOW	06 DEPTH TO AQUIFER OF CONCERN	07 POTENTIAL YIELD OF AQUIFER	08 SOLE SOURCE AQUIFER
3.9 (m)	Regional is to North	4-25 (m)	unknown (gpd)	☐ YES X NO

09 DESCRIPTION OF WELLS (Including usage, depth, and location relative to population and buildings)

House-hold supply wells used through the 1960's located north of the landfill.

10 RECHARGE AREA		11 DISCHARGE AREA	
☐ YES ☐ NO	COMMENTS: Unable to determine	☐ YES ☐ NO	COMMENTS: Unable to determine

IV. SURFACE WATER

01 SURFACE WATER USE (Check one)

☐ A. RESERVOIR, RECREATION DRINKING WATER SOURCE ☐ B. IRRIGATION, ECONOMICALLY IMPORTANT RESOURCES ☐ C. COMMERCIAL, INDUSTRIAL X D. NOT CURRENTLY USED

02 AFFECTED/POTENTIALLY AFFECTED BODIES OF WATER

NAME:	AFFECTED	DISTANCE TO SITE
N.Y.S. Barge Canal	☐	.01 (mi)
Genesee River	☐	4 (mi)
Lake Ontario	☐	7 (mi)

V. DEMOGRAPHIC AND PROPERTY INFORMATION

01 TOTAL POPULATION WITHIN

ONE (1) MILE OF SITE	TWO (2) MILES OF SITE	THREE (3) MILES OF SITE
A. 3,001-10,000 (NO. OF PERSONS)	B. >10,000 (NO. OF PERSONS)	C. >10,000 (NO. OF PERSONS)

02 DISTANCE TO NEAREST POPULATION: 0 (mi)

03 NUMBER OF BUILDINGS WITHIN TWO (2) MILES OF SITE: 1609

04 DISTANCE TO NEAREST OFF-SITE BUILDING: 50' (mi)

05 POPULATION WITHIN VICINITY OF SITE (Provide narrative description of nature of population within vicinity of site, e.g., rural, village, density, occupied urban area)

Highly developed commercial, residential area.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 5 - WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATION
01 STATE: NY
02 SITE NUMBER: 828023

VI. ENVIRONMENTAL INFORMATION

01 PERMEABILITY OF UNSATURATED ZONE (Check one)

☐ A. $10^{-6} - 10^{-8}$ cm/sec ☐ B. $10^{-4} - 10^{-6}$ cm/sec ☒ C. $10^{-4} - 10^{-3}$ cm/sec ☐ D. GREATER THAN 10^{-3} cm/sec

02 PERMEABILITY OF BEDROCK (Check one)

☐ A. IMPERMEABLE (Less than 10^{-6} cm/sec) ☐ B. RELATIVELY IMPERMEABLE ($10^{-4} - 10^{-6}$ cm/sec) ☒ C. RELATIVELY PERMEABLE ($10^{-2} - 10^{-4}$ cm/sec) ☐ D. VERY PERMEABLE (Greater than 10^{-2} cm/sec)

03 DEPTH TO BEDROCK	04 DEPTH OF CONTAMINATED SOIL ZONE	05 SOIL pH
≥ 3 (ft)	0 to 20 (ft)	7.8

06 NET PRECIPITATION	07 ONE YEAR 24 HOUR RAINFALL	08 SLOPE: SITE SLOPE	DIRECTION OF SITE SLOPE	TERRAIN AVERAGE SLOPE
6.67 (in)	2.12 (in)	0-3 %	radial from center	0-3 %

09 FLOOD POTENTIAL: SITE IS IN N/A YEAR FLOODPLAIN

10: N/A ☐ SITE IS ON BARRIER ISLAND, COASTAL HIGH HAZARD AREA, RIVERINE FLOODWAY

11 DISTANCE TO WETLANDS (5 acre minimum)

ESTUARINE: A. N/A (mi)
OTHER: B. 0 (mi)

12 DISTANCE TO CRITICAL HABITAT (of endangered species): N/A (mi)

ENDANGERED SPECIES: N/A

13 LAND USE IN VICINITY

DISTANCE TO:

COMMERCIAL/INDUSTRIAL	RESIDENTIAL AREAS; NATIONAL/STATE PARKS, FORESTS, OR WILDLIFE RESERVES	AGRICULTURAL LANDS: PRIME AG LAND	AGRICULTURAL LANDS: AG LAND
A. 0 (mi)	B. 1/4 to 1 (mi)	C. N/A (mi)	D. N/A (mi)

14 DESCRIPTION OF SITE IN RELATION TO SURROUNDING TOPOGRAPHY

Some areas are elevated 5 to 10 ft. from landfilling operations. North central portion of landfill exists as highest ground in the area with an elevation in excess of 550 feet above mean sea level.

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

1. Uncontrolled Hazardous Waste Site Ranking System, A Users Manual, July 16, 1982.
2. Recra Environmental, Inc., Phase II Investigation, 1989.
3. USGS Topographic Map, Rochester, NY West Quadrangle, 1978.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 6 - SAMPLE AND FIELD INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
NY	828023

II. SAMPLES TAKEN

SAMPLE TYPE	01 NUMBER OF SAMPLES TAKEN	02 SAMPLES SENT TO	03 ESTIMATED DATE RESULTS AVAILABLE
GROUNDWATER	12+	Recra Environmental, Inc.	Presently
SURFACE WATER	8	Recra Environmental, Inc.	Presently
WASTE	1	General Testing, Inc.	Presently
AIR			
RUNOFF			
SPILL			
SOIL (SED)	15	5 to Recra, 10 to ENSA for Gamma Spec.	Presently
VEGETATION			
OTHER Soil and Liquid Drums	9	Recra Environmental, Inc.	Presently

III. FIELD MEASUREMENTS TAKEN

01 TYPE	02 COMMENTS
Air Monitoring	Initial survey yielded 0 ppm volatiles; during drilling explosive gas readings up to 100% LEL were obtained.
Groundwater	pH=6.68 - 7.48 Specific Conductance=1000-3600 µmhos/cm
Surface Water	pH=7.10 - 8.64 Specific Conductance=360-5100 µmhos/cm
Radiological	22-170 microrems/hr. in three spots during survey

IV. PHOTOGRAPHS AND MAPS

01 TYPE ☐ GROUND ☒ AERIAL

02 IN CUSTODY OF Recra Environmental, Inc.
(Name of organization or individual)

03 MAPS ☒ YES ☐ NO

04 LOCATION OF MAPS Recra Environmental, Inc. - Phase II Investigation Report, 1989.

V. OTHER FIELD DATA COLLECTED (Provide narrative description)

Descriptions of surficial soils and bedrock.
Turbidity of well water during development and sampling.
Permeability test data.
Terrain conductivity and magnetometer survey of well locations.
Radiological survey data.

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

Recra Environmental, Inc. Phase II Investigation Report, 1989.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 7 - OWNER INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	828023

II. CURRENT OWNER(S)

01 NAME	02 D+B NUMBER	08 NAME	09 D+B NUMBER
See V below			
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	10 STREET ADDRESS (P.O. Box, RFD #, etc.)	11 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	12 CITY	13 STATE / 14 ZIP CODE
01 NAME	02 D+B NUMBER	08 NAME	09 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	10 STREET ADDRESS (P.O. Box, RFD #, etc.)	11 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	12 CITY	13 STATE / 14 ZIP CODE
01 NAME	02 D+B NUMBER	08 NAME	09 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	10 STREET ADDRESS (P.O. Box, RFD #, etc.)	11 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	12 CITY	13 STATE / 14 ZIP CODE
01 NAME	02 D+B NUMBER	08 NAME	09 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	10 STREET ADDRESS (P.O. Box, RFD #, etc.)	11 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	12 CITY	13 STATE / 14 ZIP CODE

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

01 NAME	02 D+B NUMBER
City of Rochester	
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
30 Chruch Street	
05 CITY / 06 STATE	07 ZIP CODE
Rochester / NY	14614
01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY / 06 STATE	07 ZIP CODE
01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY / 06 STATE	07 ZIP CODE

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

01 NAME	02 D+B NUMBER
NYS Urban Development Corp.	
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
183 E. Main Street	
05 CITY / 06 STATE	07 ZIP CODE
Rochester / NY	14604
01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY / 06 STATE	07 ZIP CODE
01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY / 06 STATE	07 ZIP CODE

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

A complete list of businesses is given in the Phase II report.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 8 - OPERATOR INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	828023

II. CURRENT OPERATOR (Provide if different from owner)

01 NAME	02 D+B NUMBER
None	

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE

08 YEARS OF OPERATION	09 NAME OF OWNER

OPERATOR'S PARENT COMPANY (If applicable)

10 NAME	11 D+B NUMBER

12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE

14 CITY	15 STATE	16 ZIP CODE

III. PREVIOUS OPERATOR(S) (List most recent first; provide only if different from owner)

01 NAME	02 D+B NUMBER
City of Rochester	

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
30 Church Street	

05 CITY	06 STATE	07 ZIP CODE
Rochester	NY	14614

08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD

PREVIOUS OPERATORS' PARENT COMPANIES (If applicable)

10 NAME	11 D+B NUMBER

12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE

14 CITY	15 STATE	16 ZIP CODE

01 NAME	02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE

08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD

10 NAME	11 D+B NUMBER

12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE

14 CITY	15 STATE	16 ZIP CODE

01 NAME	02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE

08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD

10 NAME	11 D+B NUMBER

12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE

14 CITY	15 STATE	16 ZIP CODE

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

Recra Environmental, Inc. Phase I Investigation Report, 1983.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 9 - GENERATOR/TRANSPORTER INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	828023

II. ON-SITE GENERATOR

01 NAME	02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE

III. OFF-SITE GENERATOR(S)

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
Eastman-Kodak Co.		City of Rochester	
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	**04 SIC CODE**	**03 STREET ADDRESS (P.O. Box, RFD #, etc.)**	**04 SIC CODE**
343 State Street		30 Church street	
05 CITY / 06 STATE / 07 ZIP CODE		**05 CITY / 06 STATE / 07 ZIP CODE**	
Rochester / NY / 14650		Rochester / NY / 14614	
01 NAME	**02 D+B NUMBER**	**01 NAME**	**02 D+B NUMBER**
University of Rochester		3M Co.	
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	**04 SIC CODE**	**03 STREET ADDRESS (P.O. Box, RFD #, etc.)**	**04 SIC CODE**
300 East River Road		2501 Hudson Road	
05 CITY / 06 STATE / 07 ZIP CODE		**05 CITY / 06 STATE / 07 ZIP CODE**	
Rochester / NY / 14623		St. Paul / MN / 55119	

IV. TRANSPORTER(S)

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
Mr. Guck			
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	**04 SIC CODE**	**03 STREET ADDRESS (P.O. Box, RFD #, etc.)**	**04 SIC CODE**
374 South Road			
05 CITY / 06 STATE / 07 ZIP CODE		**05 CITY / 06 STATE / 07 ZIP CODE**	
Rochester / NY			
01 NAME	**02 D+B NUMBER**	**01 NAME**	**02 D+B NUMBER**
Stan Hanna			
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	**04 SIC CODE**	**03 STREET ADDRESS (P.O. Box, RFD #, etc.)**	**04 SIC CODE**
1380 E. River Road			
05 CITY / 06 STATE / 07 ZIP CODE		**05 CITY / 06 STATE / 07 ZIP CODE**	
Brighton / NY / 14618			

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

Recra Environmental, Inc. Phase I Investigation Report.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 10 - PAST RESPONSE ACTIVITIES

I. IDENTIFICATION
01 STATE: NY
02 SITE NUMBER: 828023

II. PAST RESPONSE ACTIVITIES

01 ☐ A. WATER SUPPLY CLOSED — 02 DATE ____ — 03 AGENCY ____
04 DESCRIPTION
No

01 ☐ B. TEMPORARY WATER SUPPLY PROVIDED — 02 DATE ____ — 03 AGENCY ____
04 DESCRIPTION
No

01 ☐ C. PERMANENT WATER SUPPLY PROVIDED — 02 DATE ____ — 03 AGENCY ____
04 DESCRIPTION
No

01 ☐ D. SPILLED MATERIAL REMOVED — 02 DATE ____ — 03 AGENCY ____
04 DESCRIPTION
Unknown

01 ☐ E. CONTAMINATED SOIL REMOVED — 02 DATE ____ — 03 AGENCY ____
04 DESCRIPTION
Unknown

01 ☐ F. WASTE REPACKAGED — 02 DATE ____ — 03 AGENCY ____
04 DESCRIPTION
Unknown

01 ☒ G. WASTE DISPOSED ELSEWHERE — 02 DATE 1977 — 03 AGENCY ____
04 DESCRIPTION
Waste was shipped to other city landfills to construct Rochester Products facility.

01 ☒ H. ON SITE BURIAL — 02 DATE 1930's to 1970 — 03 AGENCY ____
04 DESCRIPTION
Wastes were buried on site.

01 ☒ I. IN SITU CHEMICAL TREATMENT — 02 DATE ____ — 03 AGENCY ____
04 DESCRIPTION
Lime was spread on drainage ditches to control odor.

01 ☐ J. IN SITU BIOLOGICAL TREATMENT — 02 DATE ____ — 03 AGENCY ____
04 DESCRIPTION
None

01 ☐ K. IN SITU PHYSICAL TREATMENT — 02 DATE ____ — 03 AGENCY ____
04 DESCRIPTION
None

01 ☐ L. ENCAPSULATION — 02 DATE ____ — 03 AGENCY ____
04 DESCRIPTION

01 ☐ M. EMERGENCY WASTE TREATMENT — 02 DATE ____ — 03 AGENCY ____
04 DESCRIPTION
Unknown

01 ☐ N. CUTOFF WALLS — 02 DATE ____ — 03 AGENCY ____
04 DESCRIPTION
None

01 ☐ O. EMERGENCY DIKING/SURFACE WATER DIVERSION — 02 DATE ____ — 03 AGENCY ____
04 DESCRIPTION
None

01 ☐ P. CUTOFF TRENCHES/SUMP — 02 DATE ____ — 03 AGENCY ____
04 DESCRIPTION
None

01 ☐ Q. SUBSURFACE CUTOFF WALL — 02 DATE ____ — 03 AGENCY ____
04 DESCRIPTION
None

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 10 - PAST RESPONSE ACTIVITIES

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	828023

II PAST RESPONSE ACTIVITIES (Continued)

01 ☐ R. BARRIER WALLS CONSTRUCTED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
None

01 ☒ S. CAPPING/COVERING — 02 DATE Post 1971 — 03 AGENCY _____
04 DESCRIPTION
Covered with clay and topsoil.

01 ☐ T. BULK TANKAGE REPAIRED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
None

01 ☐ U. GROUT CURTAIN CONSTRUCTED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
None

01 ☐ V. BOTTOM SEALED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
None

01 ☐ W. GAS CONTROL — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
None

01 ☒ X. FIRE CONTROL — 02 DATE 1960's — 03 AGENCY _____
04 DESCRIPTION
A fire department was located at the site to control fires.

01 ☐ Y. LEACHATE TREATMENT — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
None

01 ☐ Z. AREA EVACUATED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
None

01 ☐ 1. ACCESS TO SITE RESTRICTED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
None

01 ☐ 2. POPULATION RELOCATED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
None

01 ☐ 3. OTHER REMEDIAL ACTIVITIES — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION

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

Recra Research, Inc. Phase I Investigation.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 11 - ENFORCEMENT INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	828023

II. ENFORCEMENT INFORMATION

01 PAST REGULATORY ENFORCEMENT ACTION ☐ YES ☐ NO

02 DESCRIPTION OF FEDERAL, STATE, LOCAL REGULATORY ENFORCEMENT ACTION

Violations of New York State Sanitary Code, Part 19 and Monroe County Sanitary Code, Article V - Air Pollution Control Regulations. Cited by the Monroe County Department of Health, 1971.

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

Recra Research, Inc. Phase I Report Ref. 11 Dwayne Day, MCHD, Memo to Wendell Ames, 8/9/71.

1/D10390.19

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF SOLID AND HAZARDOUS WASTE
INACTIVE HAZARDOUS WASTE DISPOSAL SITE REPORT

CLASSIFICATION CODE: 2a REGION: 8 SITE CODE: 828023

NAME OF SITE: Emerson Street Dump
STREET ADDRESS: Emerson Street
TOWN/CITY: Rochester COUNTY: Monroe ZIP: 14606

SITE TYPE: Open Dump X Structure _ Lagoon _ Landfill X Treatment Pond _
ESTIMATED SIZE: 230 Acres

SITE OWNER/OPERATOR INFORMATION:
CURRENT OWNER NAME: Multiple owner site
CURRENT OWNER ADDRESS: Emerson Street, Lee Road, Colfax Street, Lexington Ave.
OWNER(S) DURING USE: City of Rochester
OPERATOR DURING USE: City of Rochester
OPERATOR ADDRESS Rochester, New York
PERIOD ASSOCIATED WITH HAZARDOUS WASTE: From 1930's To 1971

SITE DESCRIPTION:

Lat. 43°10'4" N Long. 77°40'27" W (midpoint)

Flat topography - residential/commercial/industrial area.

Nearest water body - Barge Canal approximately 500 feet southwest.

This is an inactive landfill operated from 1930-1971 by the City of Rochester. During operation, fire, odor and leachate problems have been documented. Reports have been obtained indicating that some hazardous and radioactive wastes were taken to the landfill. The site has been developed into a commercial and industrial park by the New York State Urban Development Corporation. Numerous buildings, including the Edison Technical High School, are situated on the landfill.

A phase II study of the site has been completed in 1989. Results of this study indicate that inorganic contamination and low level organic and radioactive contamination exist within the groundwater, surface water and sediments.

HAZARDOUS WASTE DISPOSED: Confirmed X Suspected _

TYPE	QUANTITY (units)
Organic wastes	unknown
Lead wastes	unknown
Radioactive wastes	unknown
Other inorganic wastes	unknown

SITE CODE: 828023

ANALYTICAL DATA AVAILABLE:

Air X Surface Water X Groundwater X Soil X Sediment X None _

CONTRAVENTION OF STANDARDS:

Groundwater X Drinking Water _ Surface Water X Air _

LEGAL ACTION:

TYPE: None State _ Federal _
STATUS: In Progress _ Completed _

REMEDIAL ACTION:

Proposed Under Design _ In Progress _ Completed _
NATURE OF ACTION: _____

GEOTECHNICAL INFORMATION:
SOIL TYPE: Silt and gravel with some sand and clay
GROUNDWATER DEPTH: from 3.5 to 24.5 feet

ASSESSMENT OF ENVIRONMENTAL PROBLEMS:

Inorganic contamination and low level organic and radioactive contamination exist within the groundwater, surface water and sediments. Public exposure is possible due to the commercial development of the site.

ASSESSMENT OF HEALTH PROBLEMS:

Medium	Contaminants Available	Migration Potential	Potentially Exposed Population	Need For Investigation
Air				
Surface Soil				
Groundwater				
Surface Water				

Health Department Site Inspection Date: _____

Municipal Waste ID: _____

ICS ID: _____

SPEDES ID: _____

APPENDIX A

RECRA ENVIRONMENTAL, INC.

DRAWINGS

EMERSON STREET LANDFILL

#828023

I.D. NO.	ELEV. STL. CASING	ELEV. PVC CASING	GRADE ELEV.	NORTH COORD.	EAST COORD.
GW-1	104.40	104.27	102.7	921.87	1868.69
GW-2	98.35	98.23	98.2	1503.02	1026.28
GW-3	111.30	111.22	109.2	2511.16	398.75
GW-4	109.57	109.48	107.9	3918.97	279.53
GW-5	98.20	98.07	96.2	4116.05	1649.23
GW-6	101.13	101.02	99.3	3291.12	3031.11
GW-7	100.69	100.54	100.6	2720.10	3037.33
GW-8S	97.79	97.66	96.0	482.65	4139.87
GW-8D	98.44	98.27	96.5	481.45	4128.56
GW-9	101.80	101.80	100.2	1564.13	3122.55
GW-10S	101.14	100.95	99.1	1039.68	4233.31
GW-10D	101.47	101.39	99.3	1043.55	4239.10
SW-1	—	—	99.1	830.96	1902.33
SW-2	—	—	—	1502.00	4156.00
SW-3	—	—	—	1465.00	4391.00
SW-4	—	—	—	3605.00	3330.00
SW-5	—	—	103.5	3552.22	96.00
SW-6	—	—	104.7	4003.47	96.00
SW-7	—	—	98.1	4012.28	2524.41
SW-8	—	—	99.4	2461.84	3220.77
SD-1	—	—	95.2	505.38	4080.40
SD-2	—	—	—	1502.00	4156.00
SD-3	—	—	—	1465.00	4391.00
SD-4	—	—	—	605.00	3330.00
SD-5	—	—	93.4	953.11	1909.34

LEGEND:

PROPERTY BOUNDARY.

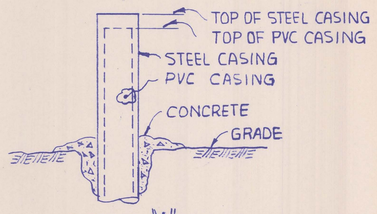
APPROXIMATE CURRENT BOUNDARY OF FILL MATERIAL.

RADIOLOGICAL SURVEY CONDUCTED BY RECRA.

RADIOLOGICAL SURVEY CONDUCTED BY NYSDEC.

NOTES:

1. COORDINATES ABRITRARILY ASSUMED NORTH 500.00 AND EAST 4000.00 AT P.K. NAIL "B".
2. BENCH MARK, N.W. CORNER OF CONCRETE BASE FOR LIGHT CONTROL BOX AT N.E. CORNER OF COLFAX AND EMERSON ST., ASSUMED 100.00.
3. WELL CASING DESIGN PER DETAIL "A".
4. FIELD MEASUREMENTS FOR SW-2, SW-3 SW-4, SW-5 SW-6 AND SD-2, SD-3 AND SD-4 PROVIDED BY RECRA ENVIRONMENTAL, INC.
5. PROPERTY LOCATIONS AND DIMENSIONS WERE NOT FIELD SURVEYED BUT DERIVED FROM TAX MAPS PROVIDED BY THE CITY OF ROCHESTER.
6. CURRENT BOUNDARY OF FILL MATERIAL ESTIMATED FROM BORING LOGS, FIELD OBSERVATIONS AND AERIAL PHOTOS.
7. BUILDINGS ARE NOT TO SCALE BUT ESTIMATED FROM AERIAL PHOTOGRAPHS AND FIELD OBSERVATIONS.



DETAIL "A"

NOT TO SCALE

F.B. # E-101, P10-25

REVISED BY RECRA ENVIRONMENTAL, INC. 1/89

SCALE: 1" = 200'			EMERSON STREET LANDFILL
	BY	DATE	CURRENT SITE USAGE MAP
DWN.	EOW	12-11-88	EDWARD O. WATTS & ASSOCIATES
REV.	EOW	12-20-88	BUFFALO NEW YORK

EOW DWG. NO. EJ121188

DWG. NO. 1

LEGEND:

REFER TO DRAWING NO. 1 FOR GENERAL LEGEND.

— TERRAIN CONDUCTIVITY PROFILE LINE.

● DENOTES STARTING, TURNING, OR ENDING POINT OF A PROFILE LINE.

NOTES:

1. REFER TO DRAWING NO. 1 FOR GENERAL NOTES.
2. FOR DETAILED INFORMATION PERTAINING TO TERRAIN CONDUCTIVITY STUDY, SEE APPENDIX B.
3. ACTUAL TRAVERSE OF STUDY WAS CONDUCTED CLOSER TO ROADWAYS AND PARALLEL TO SIDEWALKS (WHERE APPLICABLE).
4. COORDINATE SYSTEM BASED ON A 0 SOUTH 0 EAST ARBITRARY STARTING POINT SET AT THE SOUTHEAST CORNER OF LEE ROAD AND LEXINGTON AVENUE INTERSECTION.
5. SINCE NO BEARINGS WERE MAINTAINED DURING THE FIELD SURVEY, PROFILE LOCATIONS ARE ESTIMATED BASED ON FIELD MEASUREMENTS.

NOTE: BASE MAP DEVELOPED FROM DRAWING #EJ121188 OF EDWARD O. WATTS & ASSOCIATES

Rev	Date	By	Description	Ckd	Date	App	Date	Rev	Date	By	Description	Ckd	Date	App	Date	Rev	Date	By	Description	Ckd	Date	App	Date

RECRA ENVIRONMENTAL, INC.
AMHERST, NEW YORK

Scale:	1"=200'	
	By:	Date
Dwn.	JJC	12/88
Ckd.		
App.		
App.		

EMERSON STREET LANDFILL
ROCHESTER, N.Y.
NYSDEC SUPERFUND
PHASE II INVESTIGATION

Project No. 8C1301A

TERRAIN CONDUCTIVITY SURVEY LOCATIONS

D DWG. NO. 2

BRUNING 61160

LEGEND:

REFER TO DRAWING NO. 1 FOR GENERAL LEGEND.

1970 EXTENT OF FILL.

1970 INTERMITTENT WATER AND VEGETATION.

—·←·— DRAINAGE AREA AND FLOW DIRECTION.

1970 STANDING WATER.

NOTES:

1. REFER TO DRAWING NO. 1 FOR GENERAL NOTES.
2. EXTENT OF FILL LIMITS WERE APPROXIMATED USING AERIAL PHOTOGRAPHS FROM THE CITY OF ROCHESTER AND SITE SKETCH BY MONROE COUNTY ENVIRONMENTAL MANAGEMENT COUNCIL.

NOTE: BASE MAP DEVELOPED FROM DRAWING #EJ121188 OF EDWARD O. WATTS & ASSOCIATES

Rev	Date	By	Description	Ckd	Date	App	Date	Rev	Date	By	Description	Ckd	Date	App	Date	Rev	Date	By	Description	Ckd	Date	App	Date

RECRA ENVIRONMENTAL, INC.
AMHERST, NEW YORK

	By:	Date
Scale: 1"=200'		
Dwn.	JJC	12/88
Ckd.		
App.		
App.		

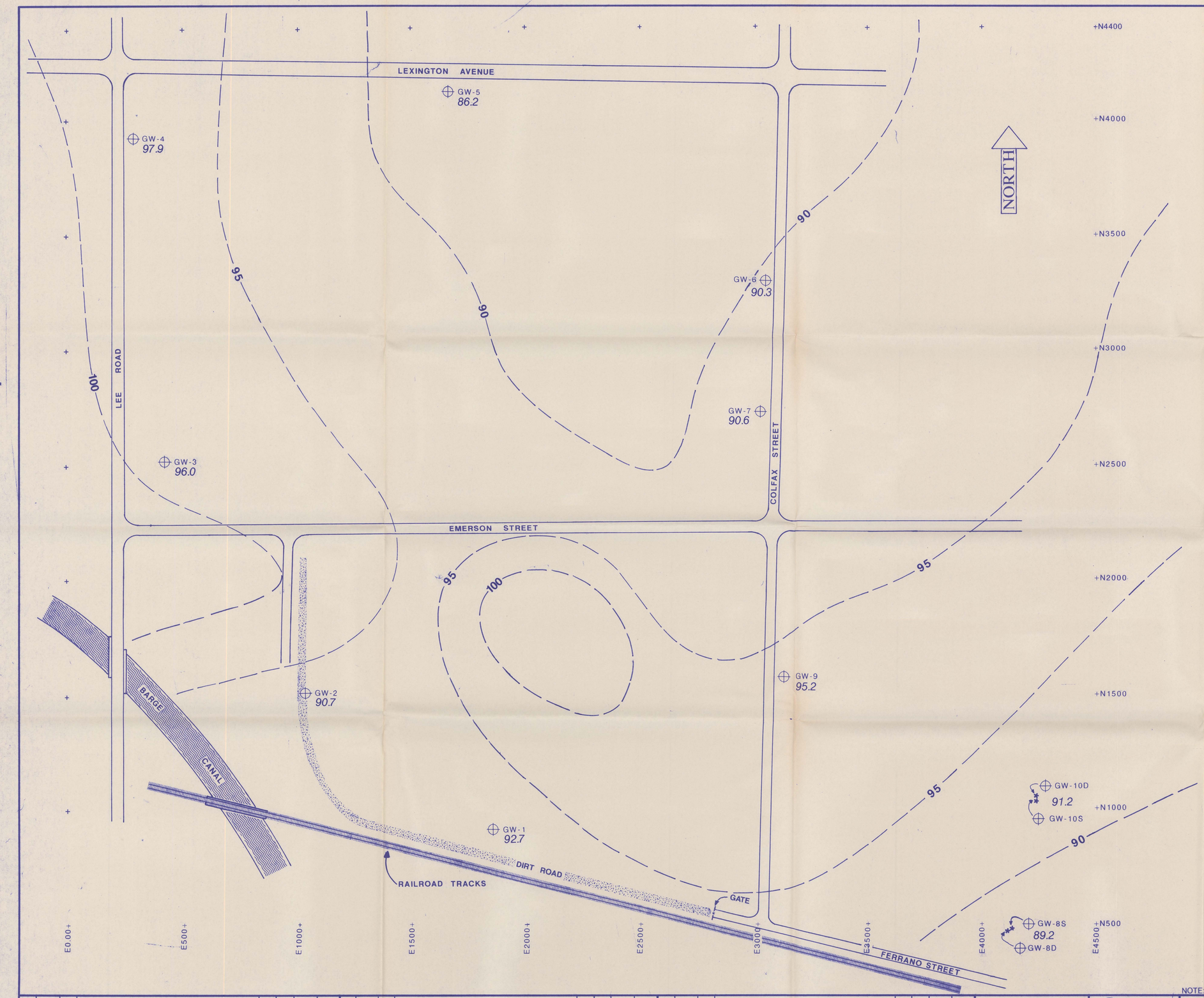
EMERSON STREET LANDFILL
ROCHESTER, N.Y.
NYSDEC SUPERFUND
PHASE II INVESTIGATION

Project No. 8C1301A

FILL PROGRESSION MAP

D DWG. NO. 3

DRAWING 61160



LEGEND:

REFER TO DRAWING NO. 1 FOR GENERAL LEGEND.

—95— ESTIMATED TOP OF BEDROCK CONTOUR LINE.

95.2 APPROXIMATE TOP OF BEDROCK ELEVATION.

NOTES:

1. SEE DRAWING NO. 1 FOR GENERAL NOTES.
2. TOP OF BEDROCK CONTOURS WERE DEVELOPED USING LINEAR INTERPOLATION OF TOP OF BEDROCK ELEVATIONS OBTAINED AT WIDELY SPACED LOCATIONS.
3. THESE CONTOUR LINES ARE SHOWN TO ILLUSTRATE GENERAL TOP OF BEDROCK PATTERNS FOR THE CONTEXT OF THIS REPORT. THEY ARE APPROXIMATE AND ACTUAL ELEVATIONS ARE EXPECTED TO VARY FROM THE CONTOURS SHOWN.
4. SOME OF THE DATA USED TO DEVELOP THE CONTOURS SHOWN WERE COLLECTED BY EBASCO AND EBS MANAGEMENT CONSULTANTS INCORPORATED FOR PREVIOUS STUDIES OF THIS AREA. THE ACCURACY OF THE INTERPRETATIONS MADE IS DEPENDENT ON THE ACCURACY OF THE DATA USED.

NOTE: BASE MAP DEVELOPED FROM DRAWING #EJ121188 OF EDWARD O. WATTS & ASSOCIATES

Rev	Date	By	Description	Ckd	Date	App	Date

RECRA ENVIRONMENTAL, INC. AMHERST, NEW YORK

Scale:	1"=200'	
	By:	Date
Dwn.	JJC	12/88
Ckd.		
App.		
App.		

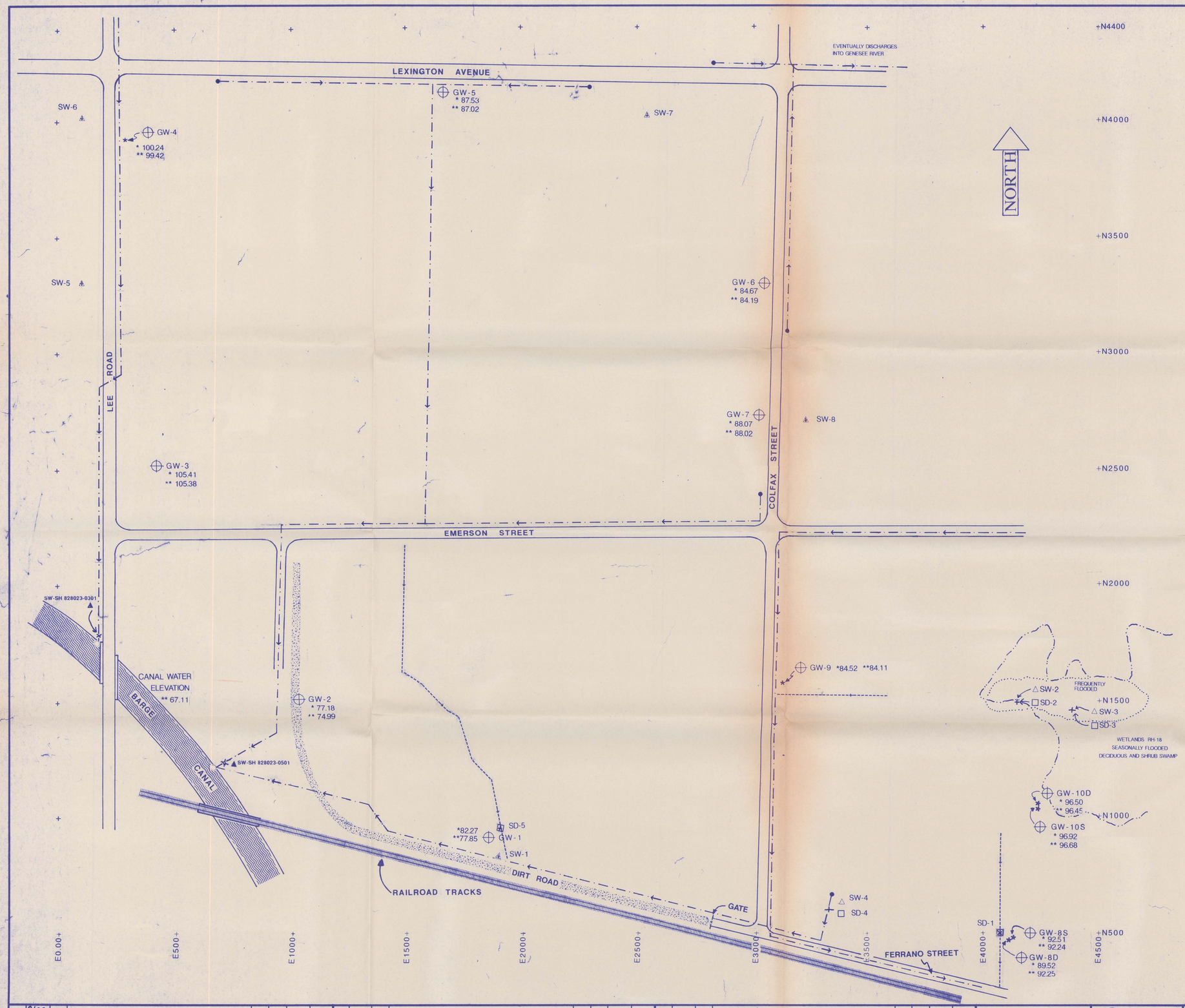
EMERSON STREET LANDFILL
ROCHESTER, N.Y.
NYSDEC SUPERFUND PHASE II INVESTIGATION

Project No. 8C1301A

ESTIMATED TOP OF BEDROCK CONTOUR MAP

D DWG. NO. 4

BRUNING 61180



LEGEND:

- ▲SW SURFACE WATER SAMPLE COLLECTED BY NYSDEC
- ⊕GW GROUNDWATER MONITORING WELL LOCATION.
- △SW SURFACE WATER SAMPLE LOCATION.
- □SD SOIL SAMPLE LOCATION.
- ----- APPROXIMATE LOCATIONS OF INTERMITTENT DRAINAGE FEATURES
- —·—·— APPROXIMATE BORDER OF WETLANDS
- ····· FREQUENTLY FLOODED PORTION OF WETLANDS
- * WATER ELEVATION TAKEN ON 11/9/88.
- ** WATER ELEVATION TAKEN ON 12/16/88.
- ●—→ APPROXIMATE LOCATION OF STORM DRAIN NETWORK AND FLOW DIRECTION.
- —○ STORM DRAIN OUTFALL.

NOTES:

1. REFER TO DRAWING NO. 1 FOR GENERAL NOTES.
2. FLUCTUATIONS IN GROUNDWATER ELEVATIONS, DIRECTIONS AND FLOW RATES MAY OCCUR DUE TO VARIATIONS IN SURFACE WATER ELEVATION (CANAL WATER ELEVATION), PRECIPITATION, PUMPING RATES, BAROMETRIC PRESSURE AND OTHER FACTORS FROM THE TIME THE MEASUREMENTS WERE TAKEN.
3. SD-4 COLLECTED INSIDE STACK OF CITY OF ROCHESTER INCINERATOR.
4. SW-4 COLLECTED FROM SUMP IN BASEMENT OF INCINERATOR BUILDING.
5. SW-5 COLLECTED FROM NON-PROCESS CONTAINMENT PIT ON 1ST FLOOR OF CVC PRODUCTS
6. SW-6 COLLECTED AT ROCHESTER FITNESS CLUB.
7. SW-7 COLLECTED FROM BELOW GRADE WATER MAIN VALVE BOX ON EDISON TECH. PROPERTY.
8. SW-8 COLLECTED FROM SUMP BELOW A ROCHESTER G&E TRANSFORMER AT PEKO PRECISION PRODUCTS
9. INTERMITTENT DRAINAGE FEATURE LOCATIONS BASED ON AERIAL PHOTOS AND FIELD OBSERVATIONS.
10. BORDER OF WETLANDS APPROXIMATED FROM CITY OF ROCHESTER WETLANDS BOUNDARY MAP #3650-021-70000-971-13-D

NOTE: BASE MAP DEVELOPED FROM DRAWING #EJ121188 OF EDWARD O. WATTS & ASSOCIATES

Rev.	Date	By	Description	Ckd	Date	App	Date
	8/89	RES	JW + SD sample locations, Wetland + Drainage				

RECRA ENVIRONMENTAL, INC. AMHERST, NEW YORK

Scale: 1"=200'
Dwn. JJC 12/88
Ckd.
App.
App.

EMERSON STREET LANDFILL
ROCHESTER, N.Y.
NYSDEC SUPERFUND PHASE II INVESTIGATION

Project No. 8C1301A

MONITORING WELL AND SAMPLING LOCATIONS, SURFACE WATER DRAINAGE AND GROUNDWATER ELEVATION MAP

D DWG. NO. 5

BRUNING 61160

PROPERTY OWNER KEY
DRAWING NUMBER 1
EMERSON STREET LANDFILL
#828023

Parcel Number	Monroe County Real Property Tax I.D. Number	Owner Address (Occupant)
1	104.26-15.1	Robert and John Nuccitelli (Raquetball World) 687 Lee Road
2	104.26-16.2	Robert and John Nuccitelli 651 Lee Road
3	104.26-17.1	Public Storage 605 Lee Road
4	104.27-38.1	Eastman Kodak Company 1635 Lexington Ave.
5	104.28-26	Philip P. Perotto (Bartolomeo Funeral Home) 1425 Lexington Ave.
6	104.28-27	Andrew/Visca Mastrodonato (Accu-Dyne Co.) 700 Colfax St.
7	104.28-28	City of Rochester (Edison Technical High School) 1501 Lexington Ave.
8	104.34-1.1	*COMIDA-CVC Products 525 Lee Rd.
9	104.34-11.1	*COMIDA (Nylo Mold) 515 Lee Rd.
10	104.35-2.1	NYS Urban Development Corp. (Rochester Products) 500 Lee Rd.
11	104.35-18.2	Eastman Kodak Company 1660 Emerson St.
12	104.36-1	Michael and Michael J. Zobel (Q-Mac, Inc.) 686 Colfax St.
13	104.36-2.1	Bruening Bearing Inc. 604-622 Colfax St.
14	104.36-2.2	Joseph H. and Gefell J. Noto 594-600 Colfax St.
15	104.36-3	*COMIDA-Acro Tool & Die 554 Colfax St.

*COMIDA-County of Monroe Industrial Development Agency

PROPERTY OWNER KEY (cont'd)

Parcel Number	Monroe County Real Property Tax I.D. Number	Owner Address (Occupant)
16	104.36-4	Peko Precision Products 530 Colfax St.
17	104.36-17.1	Cannon Industries, Inc. 535 Colfax St.
18	104.36-23.1	NYS Urban Development Corp. 60 McCrackanville
19	104.35-39.1	*COMIDA Golden Arrow Company 575 Colfax St.
20	104.42-2	Gerald J. Leva (E. G. Sackett Co., Inc.) 454 Lee Rd.
21	104.42-3.1	Rochester Gas & Electric Corp. 1845 Emerson St.
22	104.43-4	Raymond Lechase and Company 1740 Emerson St.
23	104.43-6.3	COMIDA-Almac Plastics 1640E Emerson St.
24	104.43-12.1	NYS Urban Development Corp. 1647 Emerson St.
25	104.43-29	Rochester Gas & Electric Corp. 1727-1755 Emerson St.
26	104.43-32.1	NYS Urban Development Corp. 1699 Emerson St.
27	104.43-32.2	NYS Urban Development Corp. 1759 Emerson St.
28	104.43-34.1	County of Monroe 1769 Emerson St.
29	104.44-1.1	David and Marsailles Marx (Intercom Assoc., Inc.) 1580 Emerson St.
30	104.44-2.1	Davis and Marsailles Marx (Imaging Systems, Inc.) 1570 Emerson St.

*COMIDA-County of Monroe Industrial Development Agency

PROPERTY OWNER KEY (cont'd)

Parcel Number	Monroe County Real Property Tax I.D. Number	Owner Address (Occupant)
31	104.44-8.1	1444 Emerson Associates 1444 Emerson St.
32	104.44-13	John Oliveri/Peko Precision 1400 Emerson St.
33	104.44-14	1425 Emerson St., Inc. (CME Construction Co., Inc.) 1425 Emerson St.
34	104.44-16.3	Federal Stampings, Inc. 1455 Emerson St.
35	104.44-17	*COMIDA-DeCarolis Trucking 395 Colfax St.
36	104.44-18	Printing Methods Inc. 1525 Emerson St.
37	104.44-19	Gerald B. Hanna (Abrasive Tool Corp.) 1555 Emerson St.
38	104.44-20	Yellow Freight Systems 1575 Emerson St.
39	104.44-25.1	Peter Eberhardt 1560 Emerson St.
40	104.44-26.1	James Jr. and Boegne Dooley 1520 Emerson St.
41	104.51-2.1	County of Monroe Emerson St.
42	104.51-4.1	NYS Urban Development Corp. 560 Ferrano St.
43	104.51-4.3	Eastman Kodak Co. 1667 Emerson St.
44	104.51-5.1	City of Rochester 600 Ferrano St.
45	104.52-1.1	Paul DeCarolis 361 Colfax St.
46	104.52-2	Paul DeCarolis 331-333 Colfax St.

*COMIDA-County of Monroe Industrial Development Agency

PROPERTY OWNER KEY (cont'd)

Parcel Number	Monroe County Real Property Tax I.D. Number	Owner Address (Occupant)
47	104.52-3	Paul DeCarolis 327 Colfax St.
48	104.52-4.1	HBT Corporation Liquid Trust 225 Colfax St.
49	104.52-4.2	Sheldon L. Gleason (Howard & Bowen, Co.) 305 Colfax St.
50	104.52-5.2	Browning Ferris Industries 145 Colfax St.
51	104.52-5.2	Bernard and William Hurvitx 400 Ferrano St.
52	104.52-6	Atlantic Ventures of Rochester 480 Ferrano St.
53	104.59-1.1	State of New York 1850 Lyell Ave.
54	105.37-19	*COMIDA-MICRO Instruments 1185-1231 Emerson St.
55	105.37-20	Frederick and Benedict Mertz 1255 Emerson St.
56	105.37-21	Precision Grinding & Machining 1275 Emerson St.
57	105.37-22	City of Rochester 1181 Emerson St.
58	105.37-23	City of Rochester 1345 Emerson St.
59	105.37-24	*COMIDA-Precision Grinding & Mfg. 1305 Emerson St.
60	105.37-25	Emerson Loop Associates 1335 Emerson St.
61	105.37-26	Andrew and George Chornobil (Alton Tool Co.,Inc.) 1355 Emerson St.
62	105.37-27	Uniweld Incorporated 1385 Emerson St.
63	105.37.28	City of Rochester Emerson St.

*COMIDA-County of Monroe Industrial Development Agency

PROPERTY OWNER KEY (cont'd)

Parcel Number	Monroe County Real Property Tax I.D. Number	Owner Address
64	105.37.30	*COMIDA-MICRO Instruments 1179 Emerson St.
65	105.45-1	City of Rochester 110-210 Colfax St.
66	105.45-2	The Genesee Brewing Co. Lyell Ave.
67	105.53-1	The Genesee Brewing Co. 805 Mt. Read Blvd.

*COMIDA-County of Monroe Industrial Development Agency

APPENDIX B

DUNN GEOSCIENCE CORPORATION

TERRAIN CONDUCTIVITY SURVEY REPORT

MAGNETOMETER SURVEY REPORT

EMERSON STREET LANDFILL

#828023

GEOSCIENCE CORP.

496 COMMERCE DRIVE •
AMHERST, NY 14150
(716)691-3866

July 22, 1988

Dr. Roger A. Clark
RECRA ENVIRONMENTAL, INC.
10 Hazelwood Drive
Suite No. 106
Amherst, NY 14150

Dear Dr. Clark:

Enclosed are the results of the EM-31 terrain conductivity survey for the Emerson Street Landfill, Rochester, New York. These results include a discussion of methods used, results, conclusions, raw data and plotted data.

If there are any questions or comments please feel free to contact me.

Sincerely,

Thomas E. Jordan

Thomas E. Jordan
Geologist

TEJ/mtd
enc.

7/22/88

EMERSON STREET LANDFILL

ROCHESTER, NEW YORK

1.0 INTRODUCTION

A terrain conductivity survey was completed around the perimeter of the Emerson Street Landfill in the City of Rochester, New York on July 11-13, 1988. The method of investigation utilized a Geonics Model EM-31 DL terrain conductivity meter (TC) to measure the subsurface conductivity characteristics. The TC method is a fast, environmentally non-disruptive technique for determining subsurface conditions. This method is an indirect and interpretive method that should be verified by more direct methods of investigation.

A total of 13 profiles were completed; seven completed parallel to existing roads and six traverses completed through wooded areas or open fields. A total of approximately 16,285 linear feet of terrain conductivity survey lines was completed at the site.

2.0 PURPOSE

The purpose of this investigation was to help define limits of fill material, to better characterize the site and to possibly determine the presence of contaminants.

3.0 METHODS

Prior to the data collection, base stations were established with a 200 foot tape measure. Base stations were tied into two existing structures (ie. manhole covers, telephone poles, etc.) and recorded for reproduction purposes.

The initial base station was located on the southeast corner of the intersection of Lexington Avenue and Lee Road. The length of the individual profiles varied. Subsequent base stations and turning points for the investigation were situated along the streets surrounding the site unless otherwise noted. Turning points and base stations were tied into two existing structures where possible. Traverses through fields and wooded areas were marked by attaching red surveyors tape to tree limbs and trunks at approximately 150 feet intervals.

Prior to each days activity of data collection with the EM-31 DL TC meter, the instrument was calibrated. After calibration processes were completed, a 200 foot tape measure was extended along the path of the traverse to insure accurate station location with the

instrument. There were many areas along each traverse for potential interference from utilities, fences, sewers, etc. Care was taken to choose traverses where a minimum of interference would be encountered. Readings were taken with the EM-31 DL TC at 20 foot centers unless otherwise noted. All readings were taken with the instrument in the "operational" mode which measures the quadrature-phase component of the induced magnetic field. This component is linearly related to actual ground conductivity. Readings were taken with the instrument both parallel and perpendicular to the direction of travel unless otherwise noted. This method was incorporated to test the laterial variance in conductivity at each station.

The EM-31 DC TC meter is equipped with a transmitter coil and a receiver coil spaced 3.67 meters apart. The transmitter coil is energized with an alternating current at an audio frequency producing a time varying primary magnetic field (McNeill, 1980). The magnetic field induces small currents in the ground which produces a secondary magnetic field. The ratio of the primary field to the secondary field is linearly proportional to the ground conductivity. The effective depth of investigation of the instrument is six meters.

Ground water contamination as detected by the EM-31 is based on the presence of electrolytes in solution; primarily the presence of

chloride ions. Typically the electrolytes that cause the instrument to respond are not of primary concern. Electrolytes are generally common travelers with chemicals that are of concern such as organic chemicals, of which few are conductive. If relatively non-conductive/low conductive contaminants are present in the soil and ground water of the Emerson Street site without sufficient amounts of detectable electrolytes present, these zones of contamination would go undetected by the above method.

3.1 Terrain Conductivity Profiles

3.1.1 Lexington Avenue (Profile 1)

This profile was located approximately 6-10 feet south of Lexington Avenue between Lee Street and Colfax Street. The results of the Lexington Avenue survey revealed a very conductive area across the entire profile. Background readings varied from 60-100 millimhos/meter and probably represent fill material. Two anomalies were apparent at 0S, 1860E, to 0S, 2080E and 0S, 2560E to OS, 2760. The western anomaly is attributed to the presence of a reinforced concrete wall located near the traverse. The eastern most anomaly had no surface expression of a buried utility; but because of its location near the Southwest corner of the intersection of Lexington Avenue and Colfax Street, buried utilities would be anticipated. A zero reading at location 0S, 2760E probably reflects the presence of a buried pipeline. This profile due to its very conductive nature may represent an entire zone of possible contamination that may

extend beyond the edges of the profile. It may also represent an area of large amounts of residual road salt present in the soil.

3.1.2 Colfax St. (Profile 2)

This profile was located approximately 8-10 feet west of Colfax Street between Lexington Street and Emerson Street. The results of the Colfax Street survey revealed highly variable background readings of 80-130A and probably represent fill material. A strong "zero" anomaly was apparent between OS, 2820E and 880S, 2820E. This is believed to be due to buried metal utilities. A strong positive anomaly was noted between locations 1400S, 2820E and 1520S, 2820E. This anomaly may represent a potential area of contamination.

3.1.3 Lee Street (Profile 3)

This profile was located approximately ten feet east of Lee Street between Lexington and Emerson Street. The results of the Lee Street survey revealed background values of 40-60 millimhos. The singular low and singular high values that appear as spikes in the profile represent buried utilities, sewers, etc. An anomaly was observed between locations 190S, OE and 410S, OE. This anomaly may represent a zone of contamination. The subsurface of this profile appears less disturbed than profiles 1 and 2.

3.1.4 Emerson Street-West (Profile 4)

This profile was located approximately 6-8 feet north of Emerson

Street starting at the intersection of Lee Street and Emerson. A fence was present approximately 20 feet north of the traverse, starting at location 1855S, 120E and continuing east for the length of the profile. Background values were approximately 40-80 millimhos/meter and probably represent fill material. A strong high spike was realized at location 1855S, 740E. This spike value is due to the presence of railroad tracks that cross Emerson Street and trend approximately north-south. Spike values of a lesser magnitude of this profile have been correlated to the presence of storm sewers, manholes, steel light poles and fire hydrants.

3.1.5 Emerson Street-East (Profile 5)

This profile was located approximately 6-8 feet south of Emerson Street starting at the intersection of Emerson Street and Colfax, Southwest corner. Background values of 45-60 millimhos/meter across this profile. A low-value anomaly at location 1960S, 2900E probably reflects a buried metal utility (e.g. water main). An anomaly was observed between locations 1960S, 3700E and 1960S, 3840E. This anomaly is believed to be due to over-head power lines that crossed over Emerson Street between these locations.

3.1.6 West Road (Profile 6)

This profile was located approximately 20 feet east, of West Road, east of the Recovery Facility. An anomaly from railroad tracks along the north of the profile was observed from location 1855S, 790E to 2110S, 790E.

From location 2110S, 790E to 2570S, 790E low readings of conductivity were observed. These readings reflect natural soil conditions with the small conductivity changes due to slight changes of the natural soil composition and/or changes in soil moisture content.

3.1.7 Resource Recovery Facility-Wooded Area (Profile 7)

This profile was completed through the wooded area to the east of the Resource Recovery Facility. The results of this profile revealed areas of buried metallic debris at location 2570S, 890E to 2570S, 1090E, 2570S, 1150E, and the vicinity of 270S, 1190E. Railroad tracks were present at 2750S, 810E to 2570S, 830E and created a "zero" reading with the instrument. Surface metal debris was observed along this traverse and this debris consisted of empty steel drums and automotive debris. It is believed that similar metallic debris is located within the subsurface material.

3.1.8 Resource Recovery Facility-North (Profile 8)

This profile was located in the wooded area Southeast of the facility, trending south. The Resource Recovery Facility (South) traverse was conducted through the wooded area to the southeast of the facility. Frequent areas of "zero" readings suggest that moderate to large amounts of buried metallic debris are located below grade along this traverse. Surface metallic debris was not observed in the wooded area along the traverse. Abandoned

automotives and other surface metallic debris was observed to the east of the traverse in the field area south of the woods and north of the railroad tracks. It is believed that the subsurface contains similar metallic debris as that of Profile 7.

3.1.9 Ferrano Street (Profile 9)

This profile was located from the unpaved portion of road to the west in the vicinity of the Genessee Brewery to the east. A large anomaly was observed between locations 3200S, 1930E and 3200S, 2570E. A 24" water main runs parallel to the road and a radio transmitter tower was located approximately 500 feet north of this profile, both contributing to background noise but neither causing an anomaly of this magnitude. This anomaly may represent a zone of contamination and/or an area of deeply buried metallic debris.

3.1.10 Solid Waste Facility-North (Profile 10)

This profile was located from the Ferrano Street turning point, north into the second wooded area. The south end of the profile exhibited large amounts of construction and demolition material at the surface which from the relatively low readings may extend to below the surface. A metal drum was apparent at the surface near location 2290S, 4010E. An anomaly was present between locations 2910S, 4010E and 2690S 4010R and may be partially due to the presence of a steel shelled building approximately 75 feet west of the profile and partially due to the sub-base of the parking area

directly beneath the profile. An anomaly was present across the filled area between locations 2440S, 4010E and 2000S, 4010E. Three peaks were observed across this location and may be due to buried metallic debris and/or chemical contamination.

3.1.11 Solid Waste Facility-Northeast (Profile 11)

Profile 11 was completed approximately 80 feet east of this profile, and approximately 50 feet east of the filled area. A peak of 120 millimhos was observed at location 2340S, 4090E and was part of an anomaly that extends from 2400S, 4090E and 2180S, 4090E. This anomaly may represent buried metallic debris and/or chemical contamination migrating from the filled area, east to a wet lands area.

3.1.12 Emerson Street-Parking Lot (Profile 12)

The Emerson Street Parking Lot profile is actually the northern extension of the previously discussed Solid Waste Facility-North profile. Locations were based upon the turning point located at Emerson Street and differ from location points of the previously mentioned profile due to a north-south measuring error along Ferrano Street. This error can be corrected once a base map is generated.

Terrain conductivity readings reflected natural soil conditions along this profile. Slight changes are due to soil composition changes and changes in soil moisture content. A zero reading

was observed at location 2360S, 4060E and probably reflects a buried steel pipeline.

3.1.13 Solid Waste Facility-East (Profile 13)

This profile was located along the northern boundary of the fill trending east-west. An anomaly was observed between location 4010E, 2020S and 3970E, 2020S. This anomaly may represent buried metallic debris and/or chemical contamination. The remainder of the profile reflects values representative of clay or fill deposits.

4.0 LIMITATIONS

Geophysical exploration is an established method for nondestructively investigating the subsurface. However, because it is an indirect method of subsurface investigation it is subject to inherent limitations and ambiguities. Search targets such as stratigraphy, the water table, disturbed areas, soil or ground water contamination, buried tanks, drums, transformers, and conduits are detectable only if they produce recognizable anomalies or patterns against the background geophysical data. Natural and cultural features such as major soils changes, topography, site boundaries, pavement, fences, buildings, surface and buried extraneous debris, vehicles, and heterogeneous fill, may exhibit significant anomalies depending upon the geophysical technique being used.

The reliability of the interpretation of the observed anomalies and the probability of success in finding search targets is greatly enhanced by the use of additional correlative data, such as onsite observations, borings, or test pits, and by the use of supplementary methods. On the basis of the consistent and supporting results of the different techniques employed, the principal objectives of the geophysical surveys have been achieved insofar as possible. The data generated during these surveys are a potentially useful source of information and should be consulted prior to conducting any additional subsurface investigation.

5.0 CONCLUSIONS

- Areas of suspected or possible contamination migration exist along the entire length of Lexington Avenue (Profile 1), Colfax Street (Profile 2) between location 960S, 280E and 1700S, 2820E; Ferrano Street (Profile 9) between location 3200S, 1930E and 3200S, 2,750 the filled area and east of the filled area of the City of Rochester Solid Waste Facility (Profile 10 & Profile 11) between profile location 2440S, 4010E and 2000S, 4010E, profile location 2400S, 4090E to 2180S, 4090E and profile location 2020S, 3970E and 2020S, 4010E.
- Two areas along the forested traverses east and southeast of the Resource Facility exhibited large amounts of suspected near surface metallic debris. If chemical contamination was present it was masked by the response produced from the metallic debris.

- A small anomaly along Lee Street between location 190S, OE and 410S, OE may represent an area of slight contamination or contaminant migration.
- Background values due to the urban development of the site was sufficient at some locations to mask areas that may have been contaminated. If non-conductive contaminants were present without sufficient quantities of electrolytes also present they would not produce an anomalous recording. Areas of this nature may exist at this site.

APPENDIX A

APPENDIX B

EMERSON STREET LANDFILL
LEXINGTON AVENUE
PROFILE 1

LOCATION	PARALLEL	PERPENDICULAR
0 E 0S	81.5	66
20 E 0S	59	54
40 E 0S	130	55.5
60 E 0S	57	0
80 E 0S	58	0
100 E 0S	100	35.5
120 E 0S	82	57.5
140 E 0S	65.5	44
160 E 0S	68	48.5
180 E 0S	70	50.5
200 E 0S	67	48
220 E 0S	70.5	57
240 E 0S	82	67
260 E 0S	91.5	74
280 E 0S	54	66
300 E 0S	84.5	66
320 E 0S	76	58
340 E 0S	77	60
360 E 0S	66	40
380 E 0S	81	59.5
400 E 0S	74	56.5
420 E 0S	74	61.5
440 E 0S	74.5	67
460 E 0S	92	78
480 E 0S	102	81.5
500 E 0S	95	77.5
520 E 0S	80.5	60
540 E 0S	88	71
560 E 0S	101	72
580 E 0S	120	94
600 E 0S	152	98
620 E 0S	119	110
640 E 0S	89.5	90.5
660 E 0S	100	67
680 E 0S	95.5	65
700 E 0S	102	43
720 E 0S	94	68
740 E 0S	69	42
760 E 0S	72	50.5
780 E 0S	73.5	52.5
800 E 0S	48	60
820 E 0S	86	76
840 E 0S	85	72.5
860 E 0S	73	59.5
880 E 0S	65	55
900 E 0S	68	56.5
920 E 0S	65.5	56
940 E 0S	71	59.5
960 E 0S	71.5	59

980	E	0S	84.5	68
1000	E	0S	80	70
1020	E	0S	60.5	54
1040	E	0S	89	72
1060	E	0S	90	90
1080	E	0S	92.5	80.5
1100	E	0S	78	66
1120	E	0S	84	70
1140	E	0S	98	78
1160	E	0S	93	74
1180	E	0S	92	70.5
1200	E	0S	74	50.5
1220	E	0S	70	46
1240	E	0S	82	57
1260	E	0S	88	64
1280	E	0S	90	70.5
1300	E	0S	62.5	64
1320	E	0S	92.5	72
1340	E	0S	62.5	75
1360	E	0S	89.5	76
1380	E	0S	78	64
1400	E	0S	65.5	57
1420	E	0S	58	52
1440	E	0S	58	49
1460	E	0S	69.5	59
1480	E	0S	75.5	N/A
1500	E	0S	89.5	N/A
1520	E	0S	82	N/A
1540	E	0S	78	N/A
1560	E	0S	80.5	N/A
1580	E	0S	92	N/A
1600	E	0S	76	N/A
1620	E	0S	82.5	N/A
1640	E	0S	116	N/A
1660	E	0S	142	N/A
1680	E	0S	140	N/A
1700	E	0S	98	N/A
1720	E	0S	109	N/A
1740	E	0S	112	N/A
1760	E	0S	110	N/A
1780	E	0S	122	N/A
1800	E	0S	132	N/A
1820	E	0S	155	N/A
1840	E	0S	148	N/A
1860	E	0S	152	N/A
1880	E	0S	199	N/A
1900	E	0S	224	N/A
1920	E	0S	300	N/A
1940	E	0S	305	N/A
1960	E	0S	320	N/A
1980	E	0S	289	N/A
2000	E	0S	312	N/A
2020	E	0S	295	N/A
2040	E	0S	274	N/A
2060	E	0S	149	N/A
2080	E	0S	105	N/A

2100	E	OS	142	N/A
2120	E	OS	160	N/A
2140	E	OS	138	N/A
2160	E	OS	110	N/A
2180	E	OS	86	N/A
2200	E	OS	98	N/A
2220	E	OS	94	N/A
2240	E	OS	62	N/A
2260	E	OS	93	N/A
2280	E	OS	79.9	N/A
2300	E	OS	86	N/A
2320	E	OS	85	N/A
2340	E	OS	86	N/A
2360	E	OS	63	N/A
2380	E	OS	93	N/A
2400	E	OS	98	N/A
2420	E	OS	110	N/A
2440	E	OS	105	N/A
2460	E	OS	92	N/A
2480	E	OS	82	N/A
2500	E	OS	87.5	N/A
2520	E	OS	72	N/A
2540	E	OS	97	N/A
2560	E	OS	71	N/A
2580	E	OS	96	N/A
2600	E	OS	158	N/A
2620	E	OS	200	N/A
2640	E	OS	230	N/A
2660	E	OS	232	N/A
2680	E	OS	260	N/A
2700	E	OS	300	N/A
2720	E	OS	260	N/A
2740	E	OS	245	N/A
2760	E	OS	0	N/A
2780	E	OS	33	N/A
2800	E	OS	92	N/A
2820	E	OS	124	N/A

EMERSON STREET LANDFILL
COLFAX STREET
PROFILE 2

LOCATION	PARALLEL	PERPENDICULAR	AVERAGE
0 S 2820 E	124	N/A	124
20 S 2820 E	70	110	90
40 S 2820 E	90	100	95
60 S 2820 E	80	76	78
80 S 2820 E	80	70	75
100 S 2820 E	89	56	72.5
120 S 2820 E	92	38	65
140 S 2820 E	93	24	58.5
160 S 2820 E	96	0	48
180 S 2820 E	94	0	47
200 S 2820 E	60	0	30
220 S 2820 E	46	0	23
240 S 2820 E	20	0	10
260 S 2820 E	8	0	4
280 S 2820 E	0	0	0
300 S 2820 E	20	18	19
320 S 2820 E	12	25	18.5
340 S 2820 E	0	11	5.5
360 S 2820 E	0	0	0
380 S 2820 E	0	4	2
400 S 2820 E	0	15	7.5
420 S 2820 E	0	0	0
440 S 2820 E	0	20	10
460 S 2820 E	0	0	0
480 S 2820 E	0	23	11.5
500 S 2820 E	0	30	15
520 S 2820 E	0	14	7
540 S 2820 E	0	8	4
560 S 2820 E	0	28	14
580 S 2820 E	0	8	4
600 S 2820 E	0	24	12
620 S 2820 E	0	40	20
640 S 2820 S	0	62	31
660 S 2820 E	8.5	26	17.25
680 S 2820 E	20	16	18
700 S 2820 E	10	15	12.5
720 S 2820 E	0	18	9
740 S 2820 E	18	25	21.5
760 S 2820 E	32	23	27.5
780 S 2820 E	0	54	27
800 S 2820 E	0	78	39
820 S 2820 E	0	24	12
840 S 2820 E	0	8	4
860 S 2820 E	0	24	12
880 S 2820 E	25	18	21.5
900 S 2820 E	105	130	117.5
920 S 2820 E	110	35	72.5
940 S 2820 E	74	24	49
960 S 2820 E	65	36	50.5
980 S 2820 E	120	15	67.5
1000 S 2820 E	120	10	65
1020 S 2820 E	130	19	74.5

1040	S	2820	E	120	18	69
1060	S	2820	E	115	0	57.5
1080	S	2820	E	120	12	66
1100	S	2820	E	120	13	66.5
1120	S	2820	E	130	10	70
1140	S	2820	E	115	0	57.5
1160	S	2820	E	110	0	55
1180	S	2820	E	100	0	50
1200	S	2820	E	135	0	67.5
1220	S	2820	E	150	0	75
1240	S	2820	E	170	0	85
1260	S	2820	E	135	22	78.5
1280	S	2820	E	80	5	42.5
1300	S	2820	E	120	3	61.5
1320	S	2820	E	145	20.5	82.75
1340	S	2820	E	120	16	68
1360	S	2820	E	150	32	91
1380	S	2820	E	165	56	110.5
1400	S	2820	E	180	90	135
1420	S	2820	E	205	69	137
1440	S	2820	E	180	56	118
1460	S	2820	E	190	64	127
1480	S	2820	E	195	47	121
1500	S	2820	E	185	62	123.5
1520	S	2820	E	185	75	130
1540	S	2820	E	160	62	111
1560	S	2820	E	135	48	91.5
1580	S	2820	E	115	21	68
1600	S	2820	E	108	34	71
1620	S	2820	E	92	34	63
1640	S	2820	E	66	21	43.5
1660	S	2820	E	58	1	29.5
1680	S	2820	E	40	44	42
1700	S	2820	E	26	43	34.5
1720	S	2820	E	32	3	17.5
1740	S	2820	E	70	0	35
1760	S	2820	E	26	0	13
1780	S	2820	E	40	17	28.5
1800	S	2820	E	49	12	30.5
1820	S	2820	E	68	20	44
1840	S	2820	E	38	0	19
1860	S	2820	E	34	14	24
1880	S	2820	E			
1900	S	2820	E			
1920	S	2820	E			
1940	S	2820	E			
1960	S	2820	E	34	26	30

EMERSON STREET LANDFILL
LEE STREET
PROFILE 3

LOCATION	PARALLEL	PERPENDICULAR	AVERAGE
0 S 0 E			
20 S 0 E	42	32	37
40 S 0 E	40	33	36.5
60 S 0 E	36	29	32.5
80 S 0 E	34	26.5	30.25
100 S 0 E	36.5	29.5	33
120 S 0 E	39	32	35.5
140 S 0 E	40	32.5	36.25
160 S 0 E	42	34	38
180 S 0 E	42.5	38	40.25
200 S 0 E	44	36	40
220 S 0 E	54	42	48
240 S 0 E	58	44.5	51.25
260 S 0 E	56.5	46	51.25
280 S 0 E	55	48.5	51.75
300 S 0 E	60	48.5	54.25
320 S 0 E	61	51	56
340 S 0 E	56	52	54
360 S 0 E	57	53	55
380 S 0 E	56.5	52	54.25
400 S 0 E	52.5	48	50.25
420 S 0 E	48	41.5	44.75
440 S 0 E	42	39.5	40.75
460 S 0 E	41	38	39.5
480 S 0 E	40.5	36	38.25
500 S 0 E	41.5	39	40.25
520 S 0 E	43.5	42	42.75
540 S 0 E	44	41	42.5
560 S 0 E	38	38	38
580 S 0 E	42	38	40
600 S 0 E	42.5	38	40.25
620 S 0 E	40	36	38
640 S 0 E	40.5	35	37.75
660 S 0 E	42	36	39
680 S 0 E	40.5	35	37.75
700 S 0 E	43	35	39
720 S 0 E	43	35.5	39.25
740 S 0 E	53.5	44	48.75
760 S 0 E	48	44	46
780 S 0 E	46.5	38	42.25
800 S 0 E	41	90	65.5
820 S 0 E	55	54	54.5
840 S 0 E	0	69	34.5
860 S 0 E	44	21.5	32.75
880 S 0 E	43.5	13	28.25
900 S 0 E	37.5	28	32.75
920 S 0 E	41.5	32	36.75
940 S 0 E	48	40.5	44.25
960 S 0 E	45	51	48
980 S 0 E	50.5	48	49.25
1000 S 0 E	17.5	44	30.75

1020	S	0	E	70	54	62
1040	S	0	E	53	0	26.5
1060	S	0	E	90	80	85
1080	S	0	E	73.5	58	65.75
1100	S	0	E	56	44	50
1120	S	0	E	54.5	27	40.75
1140	S	0	E	57	41	49
1160	S	0	E	56	49	52.5
1180	S	0	E	55	51	53
1200	S	0	E	56	64	60
1220	S	0	E	57	66	61.5
1240	S	0	E	56	64	60
1260	S	0	E	54	58	56
1280	S	0	E	50.5	36	43.25
1300	S	0	E	51	41	46
1320	S	0	E	56	16	36
1340	S	0	E	58	19.5	38.75
1360	S	0	E	56	0	28
1380	S	0	E	77	35	56
1400	S	0	E	64.5	26	45.25
1420	S	0	E	52	40.5	46.25
1440	S	0	E	53	24.5	38.75
1460	S	0	E	59.5	43	51.25
1480	S	0	E	59.5	62	60.75
1500	S	0	E	56	72	64
1520	S	0	E	44	69.5	56.75
1540	S	0	E	60	63.5	61.75
1560	S	0	E	62.5	85	73.75
1580	S	0	E	60	81	70.5
1600	S	0	E	49.5	54.5	52
1620	S	0	E	66	40	53
1640	S	0	E	56	50.5	53.25
1660	S	0	E	59	52	55.5
1680	S	0	E	44	33	38.5
1700	S	0	E	79	62	70.5
1720	S	0	E	92	46	69
1740	S	0	E	98	92	95
1760	S	0	E	143	142	142.5
1780	S	0	E	48	96	72
1800	S	0	E	61	41.5	51.25
1820	S	0	E	62	46	54
1840	S	0	E	12	10	11

EMERSON STREET LANDFILL
EMERSON STREET (WEST)
PROFILE 4

LOCATION	PARALLEL	PERPENDICULAR
0 E 1855 S	74	0.9
20 E 1855 S	30	8
40 E 1855 S	18	10.5
60 E 1855 S	39	0
80 E 1855 S	44	0
100 E 1855 S	43	0
120 E 1855 S	50	N/A
140 E 1855 S	74	N/A
160 E 1855 S	59	N/A
180 E 1855 S	90	N/A
200 E 1855 S	94	N/A
220 E 1855 S	102	N/A
240 E 1855 S	106	N/A
260 E 1855 S		N/A
280 E 1855 S	100	N/A
300 E 1855 S	101	N/A
320 E 1855 S	105	N/A
340 E 1855 S	105	N/A
360 E 1855 S	89.5	N/A
380 E 1855 S	58	N/A
400 E 1855 S	94	N/A
420 E 1855 S	81	N/A
440 E 1855 S	74	N/A
460 E 1855 S	55	N/A
480 E 1855 S	68	N/A
500 E 1855 S	70.5	N/A
520 E 1855 S	81	N/A
540 E 1855 S	89	N/A
560 E 1855 S	94	N/A
580 E 1855 S	86	N/A
600 E 1855 S	79	N/A
620 E 1855 S	80	N/A
640 E 1855 S	98	N/A
660 E 1855 S	108	N/A
680 E 1855 S	66.5	N/A
700 E 1855 S	66.5	N/A
720 E 1855 S	42.5	N/A
740 E 1855 S	306	N/A
760 E 1855 S	140	N/A
780 E 1855 S	106	N/A
800 E 1855 S	131	N/A

EMERSON STREET LANDFILL
EMERSON STREET
(EAST)
PROFILE 5

LOCATION	PARALLEL	PERPENDICULAR	AVERAGE
2820 E 1960 S	26	34	30
2840 E 1960 S			
2860 E 1960 S			
2880 E 1960 S	110	25	67.5
2900 E 1960 S	15	0	7.5
2920 E 1960 S	36	44	40
2940 E 1960 S	51	58	54.5
2960 E 1960 S	52	57	54.5
2980 E 1960 S	54	51	52.5
3000 E 1960 S	44	56	50
3020 E 1960 S	51	60	55.5
3040 E 1960 S	49	53	51
3060 E 1960 S	58	59	58.5
3080 E 1960 S	76	68	72
3100 E 1960 S	35	60	47.5
3120 E 1960 S	54	58	56
3140 E 1960 S	39	43	41
3160 E 1960 S	38	38	38
3180 E 1960 S	43	46	44.5
3200 E 1960 S	56	55	55.5
3220 E 1960 S	30	53	41.5
3240 E 1960 S	58	68	63
3260 E 1960 S	53	54	53.5
5280 E 1960 S	56	49	52.5
3300 E 1960 S	56	58	57
3320 E 1960 S	71	60	65.5
3340 E 1960 S	43	55	49
3360 E 1960 S	59	37	48
3380 E 1960 S	45	32	38.5
3400 E 1960 S	64	30	47
3420 E 1960 S	38	36	37
3440 E 1960 S	77	38	57.5
3460 E 1960 S	78	29	53.5
3480 E 1960 S	69	30	49.5
3500 E 1960 S	83	32	57.5
3520 E 1960 S	82	30	56
3540 E 1960 S	65	30	47.5
3560 E 1960 S	64	34	49
3580 E 1960 S	52	43	47.5
3600 E 1960 S	61	54	57.5
3620 E 1960 S	66	35	50.5
3640 E 1960 S	78	54	66
3660 E 1960 S	55	43	49
3680 E 1960 S	59	50	54.5
3700 E 1960 S	73	57	65
3720 E 1960 S	31	60	45.5
3740 E 1960 S	105	90	97.5
3760 E 1960 S	54	115	84.5
3780 E 1960 S	105	112	108.5

3800	E	1960	S	105	120	112.5
3820	E	1960	S	70	80	75
3840	E	1960	S	62	60	61
3860	E	1960	S	41	52	46.5
3880	E	1960	S	58	55	56.5
3900	E	1960	S	65	58	61.5
3920	E	1960	S	63	57	60
3940	E	1960	S	50	43	46.5
3960	E	1960	S	44	33	38.5
3980	E	1960	S	40	29	34.5
4000	E	1960	S	35	41	38
4020	E	1960	S	43	44	43.5

EMERSON STREET LANDFILL
WEST STREET
PROFILE 6

LOCATION	PARALLEL	PERPENDICULAR	AVERAGE
1855 S 790 E	27	138	82.5
1875 S 790 E			
1895 S 790 E			
1915 S 790 E			
1930 S 790 E	10.5	71	40.8
1950 S 790 E	40.5	38	39
1970 S 790 E	34	31	33
1990 S 790 E	19.5	22	20.8
2010 S 790 E	1	0	1
2030 S 790 E	0	0	0
2050 S 790 E	36	32	34
2070 S 790 E	28.5	26.2	27.35
2090 S 790 E	17.8	19.6	18.7
2110 S 790 E	16.1	17.2	16.7
2130 S 790 E	16.5	16.5	16.5
2150 S 790 E	16.5	15.9	16.2
2170 S 790 E	15.5	16.5	16
2190 S 790 E	13.4	14.9	14.2
2210 S 790 E	12.6	12.6	12.6
2230 S 790 E	11	12.4	11.7
2250 S 790 E	10.5	9.4	10
2270 S 790 E	10.5	9.2	9.9
2290 S 790 E	7.6	7.3	7.5
2310 S 790 E	7	7.5	7.3
2330 S 790 E	8.1	8	8.1
2350 S 790 E	9	5.9	7.5
2370 S 790 E	12.1	4.7	9.9
2390 S 790 E	9.9	4.7	7.3
2410 S 790 E	11	6.1	8.6
2430 S 790 E	12.5	6.9	9.7
2450 S 790 E	11.4	7.9	9.7
2470 S 790 E	11.5	6.6	9.1
2490 S 790 E	14	12	13
2510 S 790 E	14.8	13.5	14.2
2530 S 790 E	9.9	10.8	10.4
2550 S 790 E	14.1	15.8	15
2570 S 790 E	13.5	15.6	14.6

EMERSON STREET LANDFILL
RESOURCE RECOVERY FACILITY (WOODED AREA, EAST)
PROFILE 7

LOCATION	PARALLEL	PERPENDICULAR
310 E 2570 S	0	0
830 E 2570 S	0	21
850 E 2570 S	8.8	4.6
870 E 2570 S	7.5	10.8
890 E 2570 S	2.4	13.8
910 E 2570 S	2.6	18.9
930 E 2570 S	1.1	0.9
950 E 2570 S	0	0
970 E 2570 S	0	0
990 E 2570 S	0	0.8
1010 E 2570 S	0	15.5
1030 E 2570 S	0	18.4
1050 E 2570 S	0	25.8
1070 E 2570 S	0	0
1090 E 2570 S	0	20.2
1110 E 2570 S	2	22
1130 E 2570 S	0	25.9
1150 E 2570 S	0	0
1170 E 2570 S	18.6	27.2
1190 E 2570 S	0.2	11.1
1210 E 2570 S	8.4	14.1
1230 E 2570 S	1.4	9.6
1250 E 2570 S	4.7	11.9
1270 E 2570 S	4.2	12
1290 E 2570 S	8.6	6.7
1310 E 2570 S	8.1	12.2
1330 E 2570 S	5.6	10.4
1350 E 2570 S	7.3	11
1370 E 2570 S	11.5	11.9
1390 E 2570 S	11.2	8.4
1410 E 2570 S	3.1	4.6

EMERSON STREET LANDFILL
RESOURCE AND RECOVERY FACILITY - NORTH PROFILE
PROFILE 8

LOCATION	PARALLEL	PERPENDICULAR
2590 S 1410 E	8.4	0
2610 S 1410 E	0	0
2630 S 1410 E	4.6	2.8
2650 S 1410 E	0	0
2670 S 1410 E	11.4	2.2
2690 S 1410 E	16	14.2
2710 S 1410 E	0	3.8
2730 S 1410 E	8.1	14.2
2750 S 1410 E	7.2	13.2
2770 S 1410 E	16.2	0
2790 S 1410 E	12.1	22
2810 S 1410 E	0	26
2830 S 1410 E	0	0
2850 S 1410 E	0	0
2870 S 1410 E	0	4.2
2890 S 1410 E	0	19.2
2910 S 1410 E	1.6	9.6
2930 S 1410 E	20.5	7.4
2950 S 1410 E	0	0
2970 S 1410 E	0	0
2990 S 1410 E	0	0
3010 S 1410 E	0	0
3030 S 1410 E	0	0
3050 S 1410 E	0	0
3070 S 1410 E	0	0
3090 S 1410 E	0	0
3110 S 1410 E	2.4	0
3130 S 1410 E	0	0
3150 S 1410 E	0	0
3170 S 1410 E	20	15
3200 S 1410 E	49	19

EMERSON STREET LANDFILL
FERRANO STREET PROFILE
PROFILE 9

LOCATION*	PARALLEL	PERPENDICULAR
1410 E 3200 S	49	19
1430 E 3200 S	34	36
1450 E 3200 S	38	27
1470 E 3200 S	44	52
1490 E 3200 S	39.5	54
1510 E 3200 S	38	54
1530 E 3200 S	32.5	44
1550 E 3200 S	26	66
1570 E 3200 S	32	42.5
1590 E 3200 S	36.5	0
1610 E 3200 S	13.9	0
1630 E 3200 S	26	0
1650 E 3200 S	0	0
1670 E 3200 S	10	47
1690 E 3200 S	19	48.5
1710 E 3200 S	17	46
1730 E 3200 S	9.5	44
1750 E 3200 S	6	37
1770 E 3200 S	22	17
1790 E 3200 S	32	24.5
1810 E 3200 S	41.5	13.2
1830 E 3200 S	49.5	19.5
1850 E 3200 S	24.5	50
1870 E 3200 S	46	52
1890 E 3200 S	76	74
1910 E 3200 S	58	181
1930 E 3200 S	53	130
1950 E 3200 S	205	162
1970 E 3200 S	185	280
1990 E 3200 S	190	720
2010 E 3200 S	750	0
2030 E 3200 S	1000	890
2050 E 3200 S	910	780
2070 E 3200 S	890	0
2090 E 3200 S	780	0
2110 E 3200 S	640	0
2130 E 3200 S	505	580
2150 E 3200 S	420	550
2170 E 3200 S	280	600
2190 E 3200 S	340	0
2210 E 3200 S	450	0
2230 E 3200 S	720	0
2250 E 3200 S	370	0
2270 E 3200 S	340	0
2290 E 3200 S	360	0
2310 E 3200 S	340	0
2330 E 3200 S	310	0
2350 E 3200 S	420	0
2370 E 3200 S	290	0
2390 E 3200 S	310	0
2410 E 3200 S	650	0

*SOUTH LOCATION IS NOT CONSTANT ALONG TRAVERSE

2430	E	3200	S	540	0
2450	E	3200	S	490	0
2470	E	3200	S	440	140
2490	E	3200	S	350	220
2510	E	3200	S	390	160
2530	E	3200	S	340	100
2550	E	3200	S	112	168
2570	E	3200	S	52	82
2590	E	3200	S	41	56
2610	E	3200	S	54	0
2630	E	3200	S	61	30
2650	E	3200	S	72	24
2670	E	3200	S	65	20
2690	E	3200	S	44	34
2710	E	3200	S	52	43
2730	E	3200	S	28	48
2750	E	3200	S	61	69
2770	E	3200	S	43	73
2790	E	3200	S	44	65
2810	E	3200	S	38	95
2830	E	3200	S	24	62
2850	E	3200	S	75	62
2870	E	3200	S	52	N/A
2890	E	3200	S	35	58
2910	E	3200	S	42	30.5
2930	E	3200	S	49	33
2950	E	3200	S	44	36
2970	E	3200	S	56	75
2990	E	3200	S	54	61
3010	E	3200	S	56	74
3030	E	3200	S	41	33
3050	E	3200	S	41	41
3070	E	3200	S	74	52
3090	E	3200	S	20	115
3110	E	3200	S	78	0
3130	E	3200	S	44	7
3150	E	3200	S	100	65
3170	E	3200	S	0	120
3190	E	3200	S	94	46
3210	E	3200	S	115	54
3230	E	3200	S	160	82
3250	E	3200	S	130	75
3270	E	3200	S	178	85
3290	E	3200	S	165	90
3310	E	3200	S	135	55
3330	E	3200	S	120	37
3350	E	3200	S	110	31
3370	E	3200	S	110	50
3390	E	3200	S	115	65
3410	E	3200	S	130	30
3430	E	3200	S	115	35
3450	E	3200	S	130	40
3470	E	3200	S	115	35
3490	E	3200	S	100	41
3510	E	3200	S	80	29
3530	E	3200	S	91	34

3550	E	3200	S	94	12
3570	E	3200	S	98	23
3590	E	3200	S	110	50
3610	E	3200	S	120	55
3630	E	3200	S	125	35
3650	E	3200	S	120	48
3670	E	3200	S	95	40
3690	E	3200	S	82	38
3710	E	3200	S	90	37
3730	E	3200	S	110	45
3750	E	3200	S	160	70
3770	E	3200	S	200	140
3790	E	3200	S	135	70
3810	E	3200	S	130	65
3830	E	3200	S	140	70
3850	E	3200	S	145	80
3870	E	3200	S	188	105
3890	E	3200	S	161	110
3910	E	3200	S	160	152
3930	E	3200	S	180	155
3950	E	3200	S	170	130
3970	E	3200	S	132	72
3990	E	3200	S	90	45
4010	E	3200	S	70	26
4030	E	3200	S	115	56

EMERSON STREET LANDFILL
CITY OF ROCHESTER SOLID WASTE FACILITY PROFILE
TRENDING NORTH ACROSS THE FILLED AREA
PROFILE 10

LOCATION	PARALLEL	PERPENDICULAR	AVERAGE
3130 S 4010 E	14.9	16.2	15.55
3110 S 4010 E	18.8	7.8	13.3
3090 S 4010 E	15	9.7	12.35
3070 S 4010 E	10.2	11.2	10.7
3050 S 4010 E	12.4	11.8	12.1
3030 S 4010 E	13.1	16.9	15
3010 S 4010 E	22.9	12.2	17.55
2990 S 4010 E	46	46	46
2970 S 4010 E	9.2	39.5	24.35
2950 S 4010 E	11	10.1	10.55
2930 S 4010 E	23.1	15.8	19.45
2910 S 4010 E	16.9	20.2	18.55
2890 S 4010 E	31	31	31
2870 S 4010 E	41.5	44.5	43
2850 S 4010 E	42	40	41
2830 S 4010 E	42	40.5	41.25
2810 S 4010 E	38	38	38
2790 S 4010 E	36	36	36
2770 S 4010 E	34	34	34
2750 S 4010 E	28	34	31
2730 S 4010 E	31	23	27
2710 S 4010 E	30.5	22	26.25
2690 S 4010 E	17.6	5.8	11.7
2670 S 4010 E	19.8	20.1	19.95
S 4010 E			
S 4010 E			
2620 S 4010 E	16.1	N/A	16.1
2600 S 4010 E	12.4	N/A	12.4
2580 S 4010 E	13.2	15	14.1
2560 S 4010 E	14.5	10.8	12.65
2540 S 4010 E	16	12.1	14.05
2520 S 4010 E	12.4	12.2	12.3
2500 S 4010 E	19.1	17.1	18.1
2480 S 4010 E	26.9	25	25.95
2460 S 4010 E	14	16	15
2440 S 4010 E	42	42.5	42.25
2420 S 4010 E	42.5	59	50.75
2400 S 4010 E	72	68	70
2380 S 4010 E	89	95	92
2360 S 4010 E	122	122	122
2340 S 4010 E	184	188	186
2320 S 4010 E	270	272	271
2300 S 4010 E	300	305	302.5
2280 S 4010 E	284	298	291
2260 S 4010 E	215	220	217.5
2240 S 4010 E	123	126	124.5
2220 S 4010 E	110	115	112.5
2200 S 4010 E	149	138	143.5
2180 S 4010 E	214	205	209.5
2160 S 4010 E	300	240	270
2140 S 4010 E	310	300	305

2120	S	4010	E	230	245	237.5
2100	S	4010	E	320	320	320
2080	S	4010	E	260	215	237.5
2060	S	4010	E	145	115	130
2040	S	4010	E	120	105	112.5
2020	S	4010	E	75	63	69
2000	S	4010	E	4.2	10.8	7.5
1980	S	4010	E	16	0	8
1960	S	4010	E	38	0	19
1940	S	4010	E	22	20	21
1920	S	4010	E	20.5	19.8	20.15
1900	S	4010	E	19.9	19.8	19.85

EMERSON STREET LANDFILL
CITY OF ROCHESTER SOLID WASTE FACILITY
NORTH PROFILE, EAST OF FILLED AREA
PROFILE 11

LOCATION	PARALLEL	PERPENDICULAR	AVERAGE
2420 S 4090 E	23	20	21.5
2400 S 4090 E	22	20	21
2380 S 4090 E	32.5	27	29.75
2360 S 4090 E	62.5	54	58.25
2340 S 4090 E	120	99	109.5
2320 S 4090 E	112	55	83.5
2300 S 4090 E	105	88	96.5
2280 S 4090 E	95	68	81.5
2260 S 4090 E	83	82	82.5
2240 S 4090 E	62	74	68
2220 S 4090 E	56	55.5	55.75
2200 S 4090 E	45	36	40.5
2180 S 4090 E	19.2	13.2	16.2
2160 S 4090 E	9.8	14.2	12
2140 S 4090 E	21	21.5	21.25
2120 S 4090 E	40	32	36
2100 S 4090 E	33	0	16.5
2080 S 4090 E	33.5	36.5	35
2060 S 4090 E	82.5	84	83.25
2040 S 4090 E	67.5	67	67.25
2020 S 4090 E	90	90	90

EMERSON STREET LANDFILL
CITY OF ROCHESTER SOLID WASTE FACILITY
NORTH PROFILE: EMERSON STREET - PARKING LOT
PROFILE 12

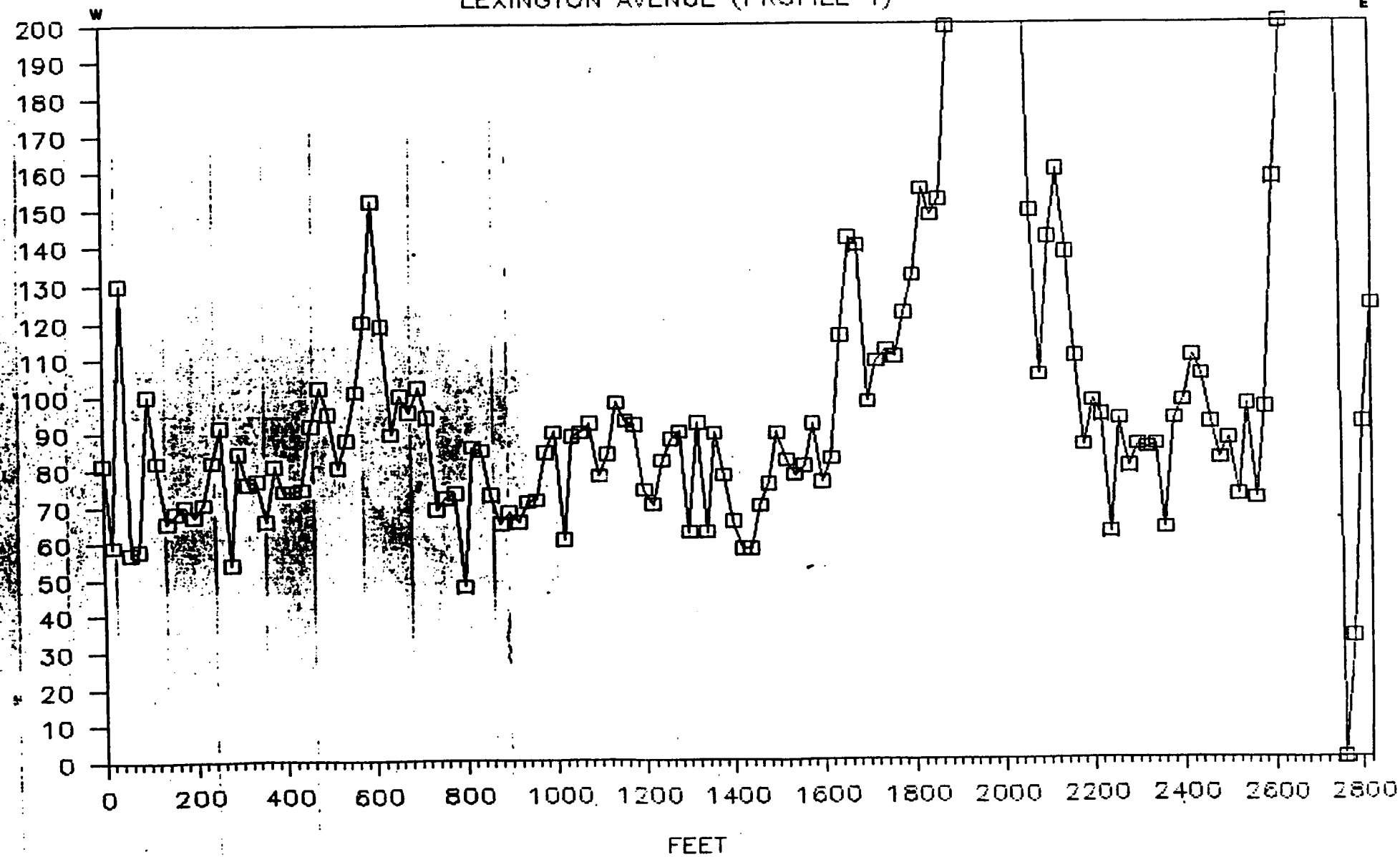
LOCATION	PARALLEL	PERPENDICULAR	AVERAGE
2380 S 4060 E	21.8	19	20.4
2360 S 4060 E	0	47	23.5
2340 S 4060 E	29.1	28.2	28.65
2320 S 4060 E	19.9	20.2	20.05
2300 S 4060 E	19.5	19.2	19.35
2280 S 4060 E	18	18	18
2260 S 4060 E	19.2	18	18.6
2240 S 4060 E	19.9	18.9	19.4
2220 S 4060 E	19.1	19.5	19.3
2200 S 4060 E	19	21	20
2180 S 4060 E	19.8	21.9	20.85
2160 S 4060 E	18.2	18.8	18.5
2140 S 4060 E	16.5	17.8	17.15
2120 S 4060 E	14.8	16	15.4
2100 S 4060 E	13.8	14.8	14.3
2080 S 4060 E	14.4	14	14.2
2060 S 4060 E	15	16.1	15.55
2040 S 4060 E	17.3	20.2	18.75
2020 S 4060 E	18.8	23	20.9
2000 S 4060 E	13.2	17.1	15.15
1980 S 4060 E	14	17.3	15.65

EMERSON STREET LANDFILL
CITY OF ROCHESTER SOLID WASTE FACILITY
EAST PROFILE
PROFILE 13

LOCATION	PARALLEL	PERPENDICULAR	AVERAGE
4010 E 2020 S	82.5	88	85.25
3990 E 2020 S	75	50	62.5
3970 E 2020 S	48	48	48
3950 E 2020 S	98	110	104
3930 E 2020 S	78	87	82.5
3910 E 2020 S	60	72	66
3890 E 2020 S	54	54	54
3870 E 2020 S	28	18.5	23.25
3850 E 2020 S	29	28.5	28.75
3830 E 2020 S	33	36	34.5
2810 E 2020 S	22.6	13.1	17.85
3790 E 2020 S	35	26	30.5
3770 E 2020 S	35	10.5	22.75
3750 E 2020 S	36.5	36	36.25
3730 E 2020 S	40.5	28.5	34.5
3710 E 2020 S	33.5	40	36.75
3690 E 2020 S	37	33	35
3670 E 2020 S	41	38	39.5
3650 E 2020 S	37.5	38	37.75
3630 E 2020 S	40	28	34
3610 E 2020 S	36	54	45
3590 E 2020 S	29.5	72	50.75

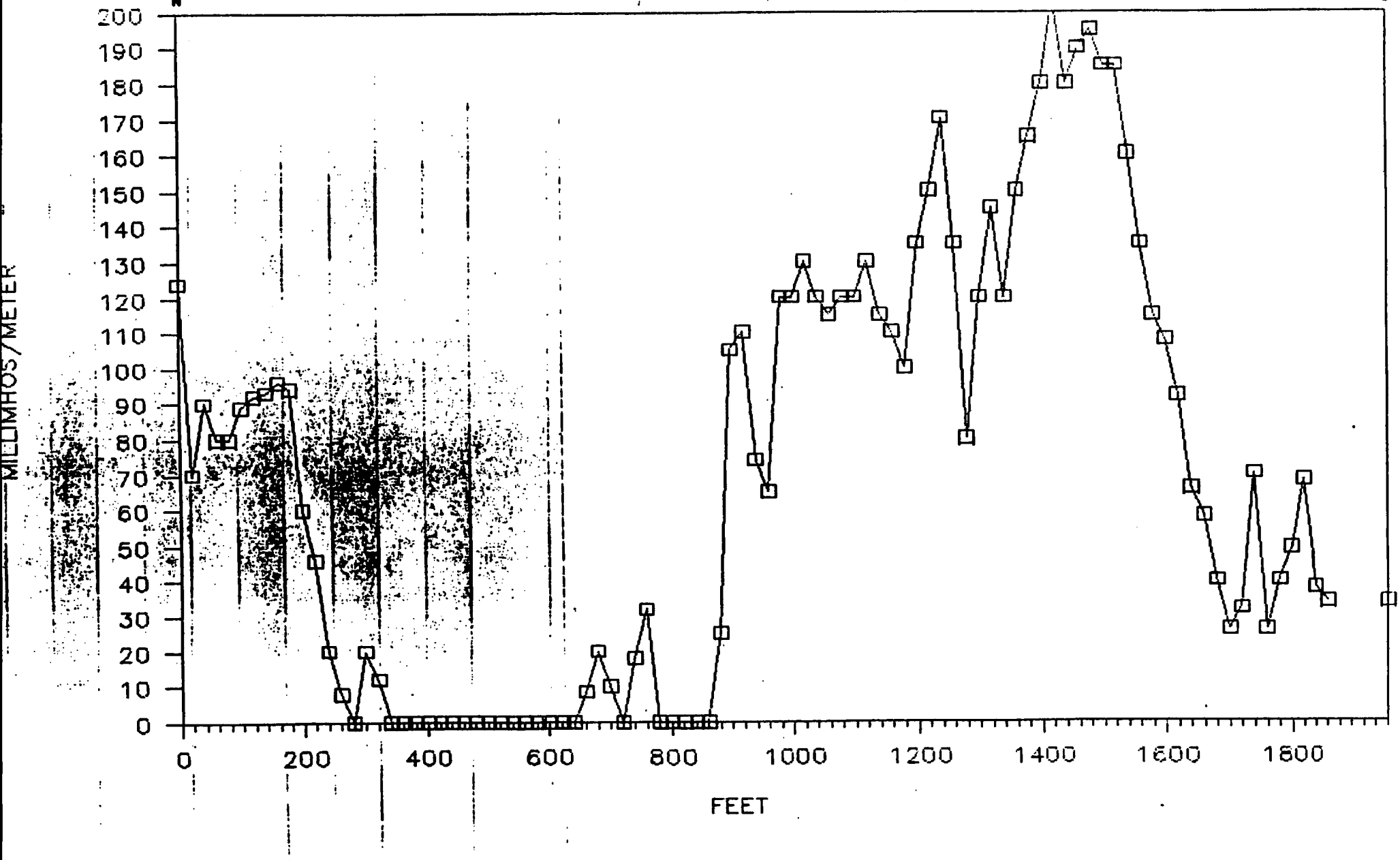
EMERSON STREET LANDFILL

LEXINGTON AVENUE (PROFILE 1)



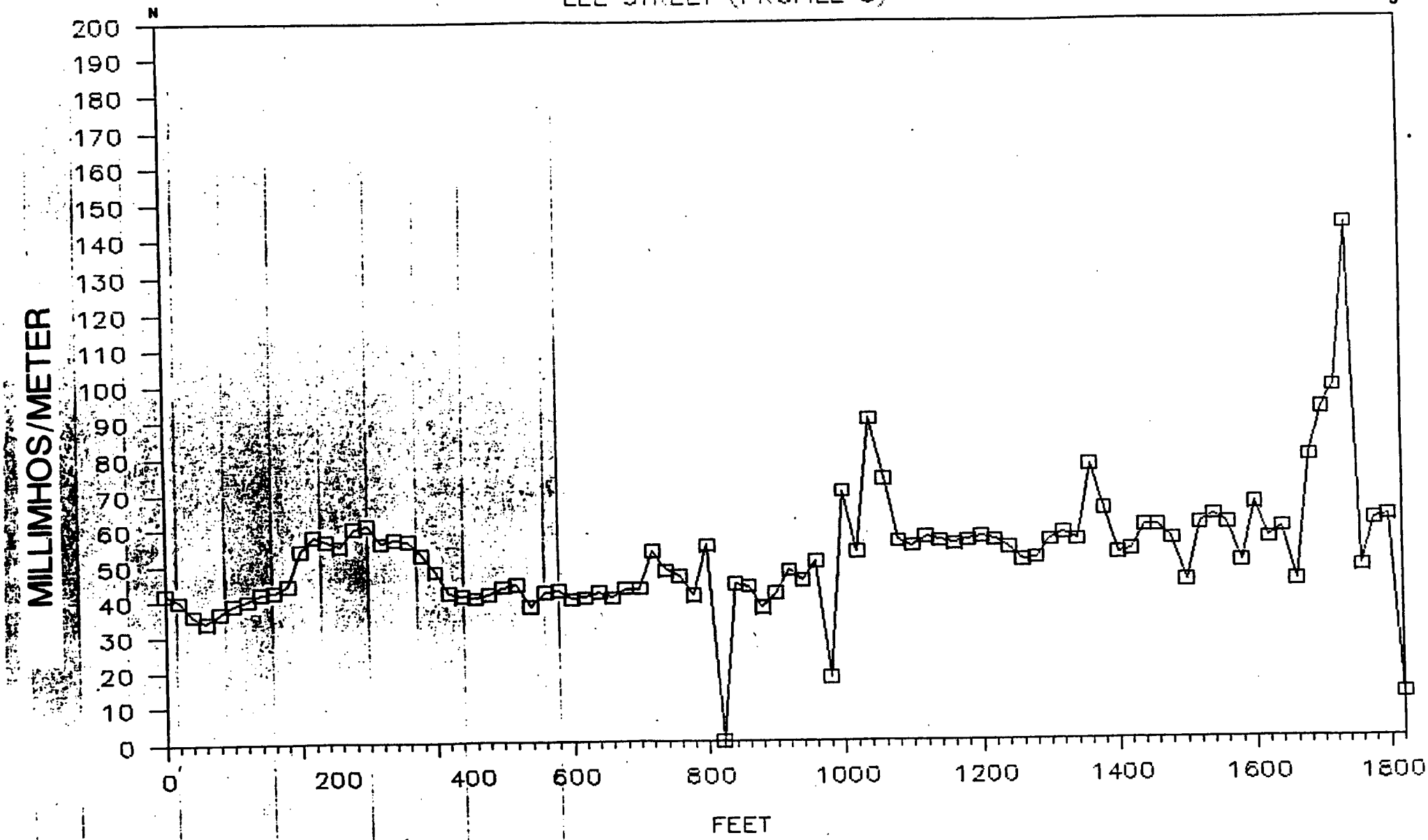
EMERSON STREET LANDFILL

COLFAX STREET (PROFILE 2)



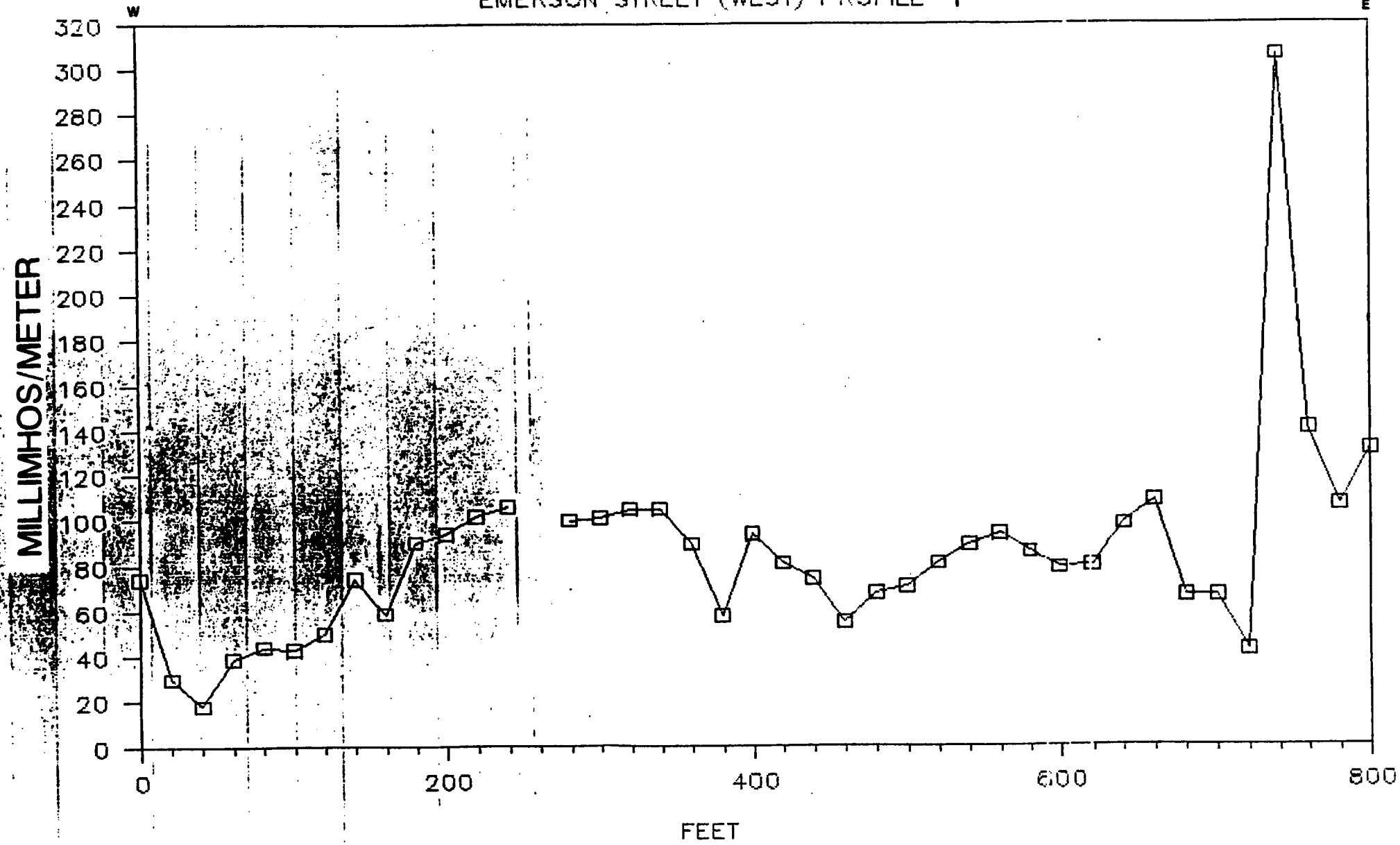
EMERSON STREET LANDFILL

LEE STREET (PROFILE 3)



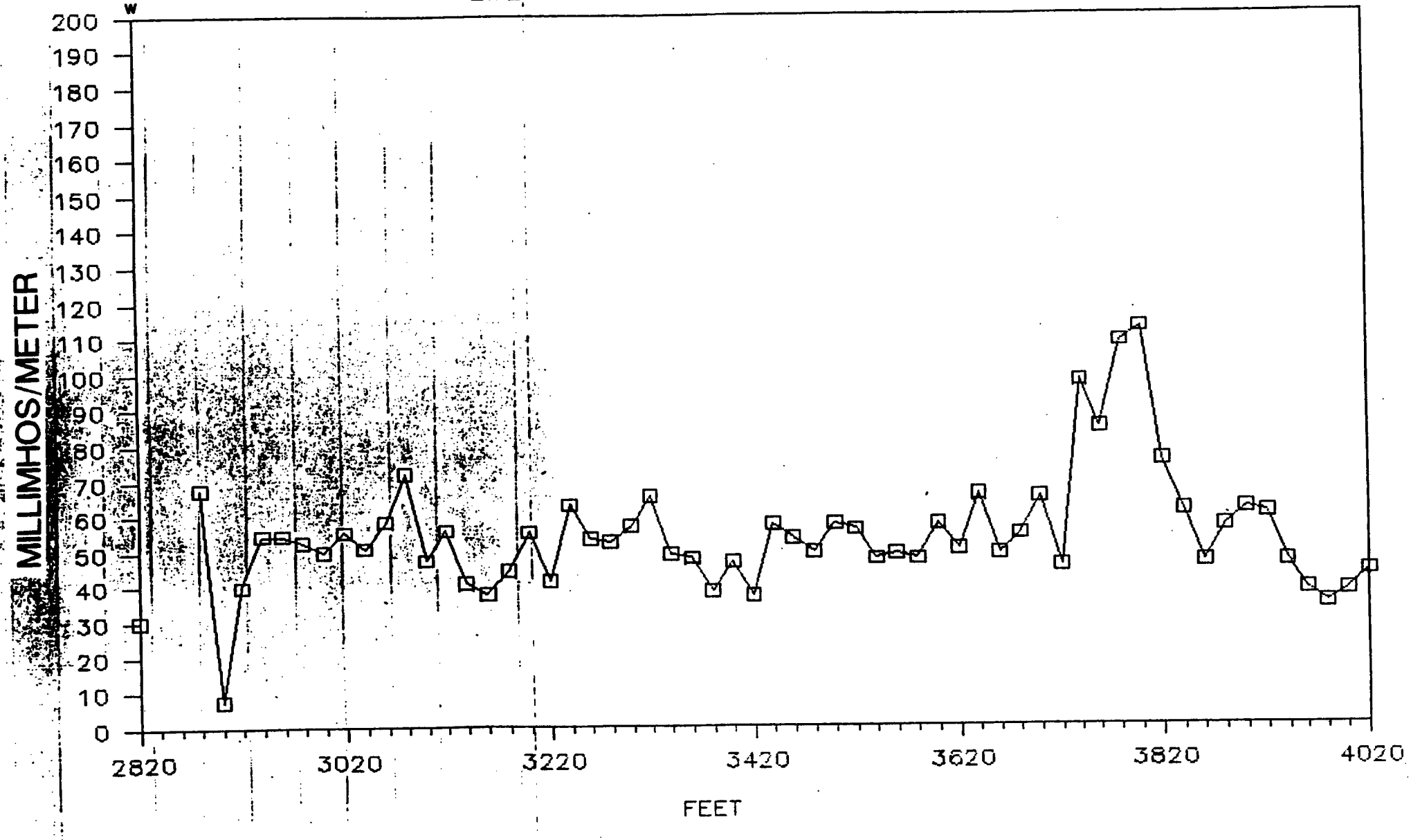
EMERSON STREET LANDFILL

EMERSON STREET (WEST) PROFILE 4



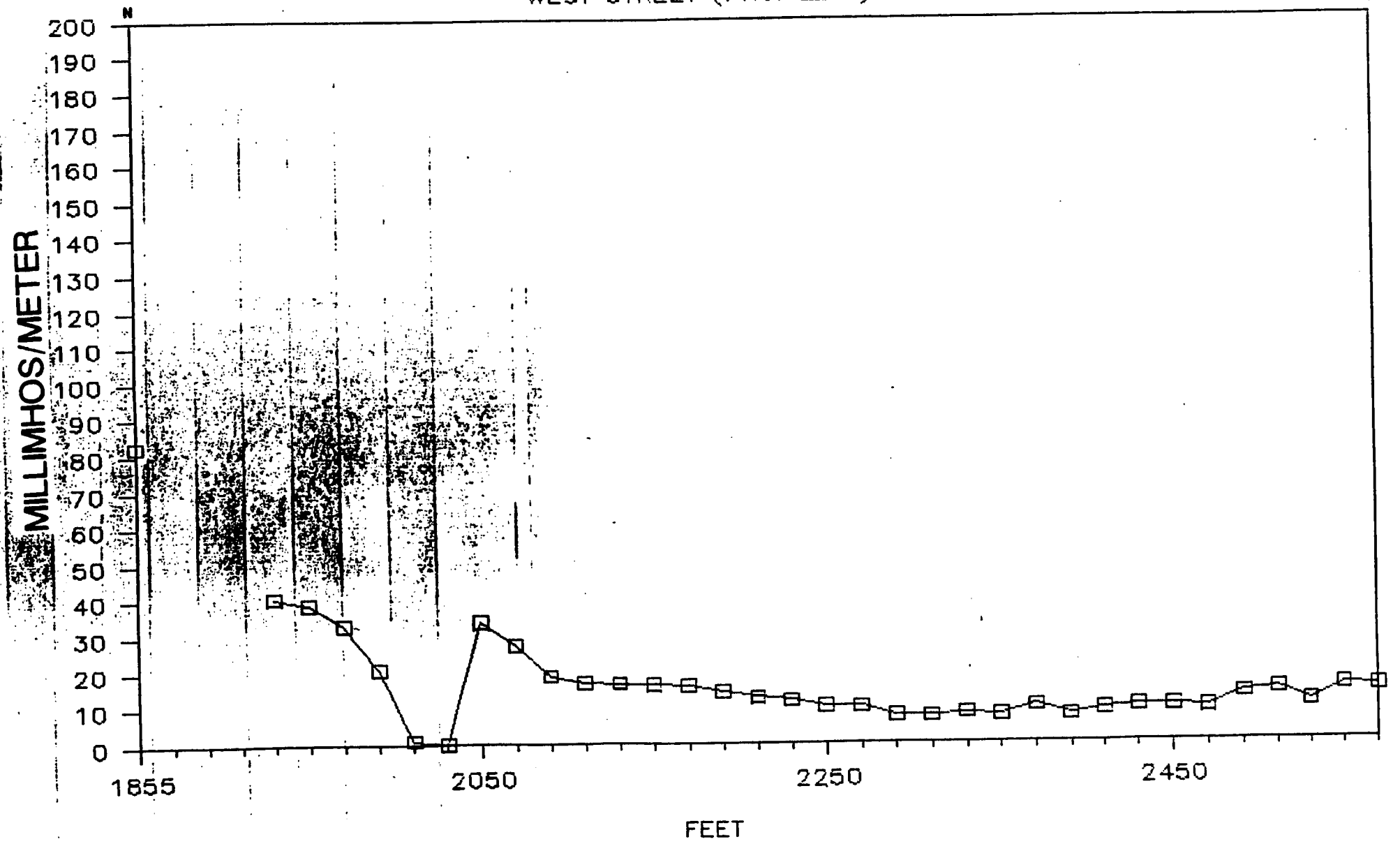
EMERSON STREET LANDFILL

EMERSON STREET—EAST PROFILE 5



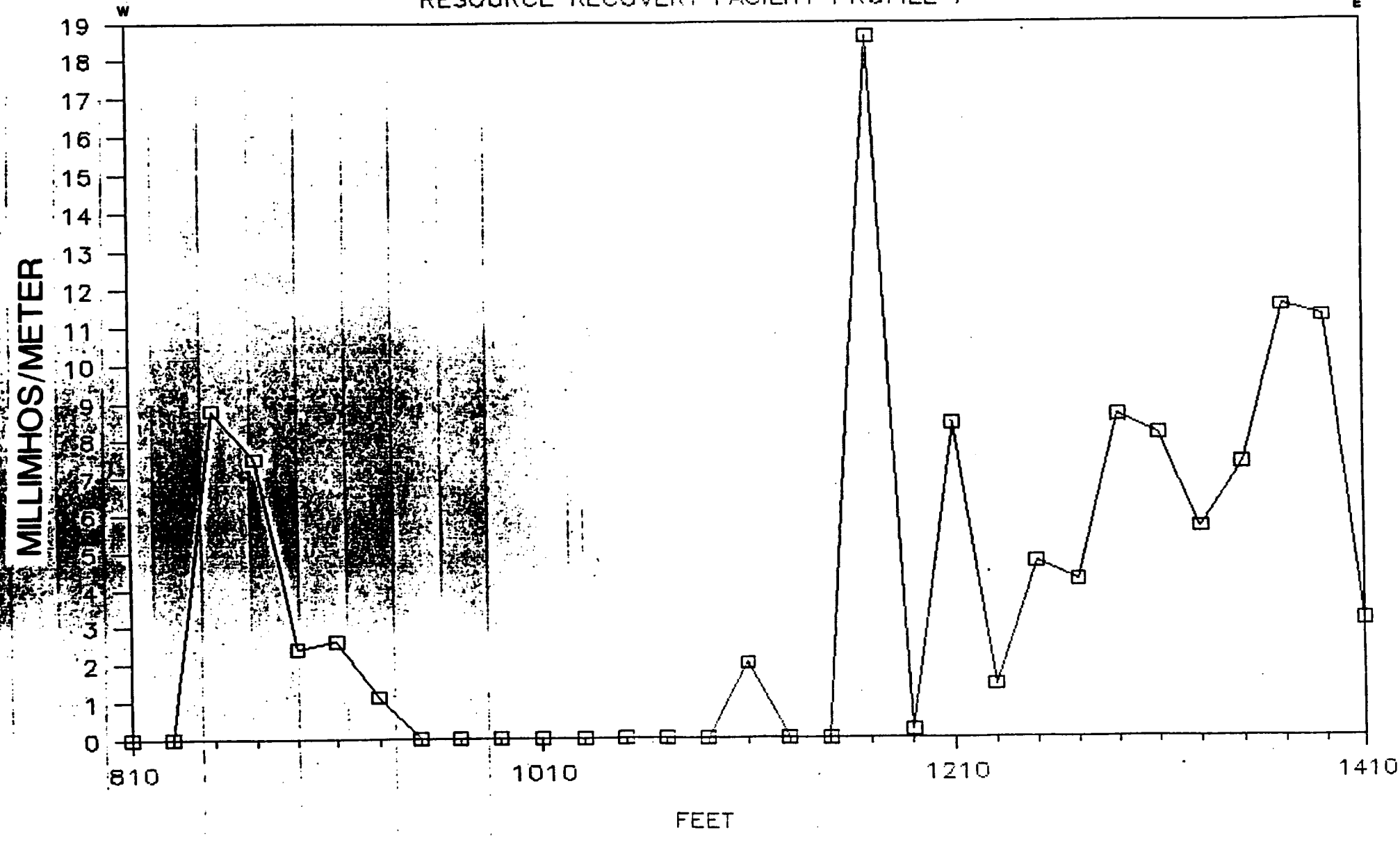
EMERSON STREET LAMDFILL

WEST STREET (PROFILE 6)



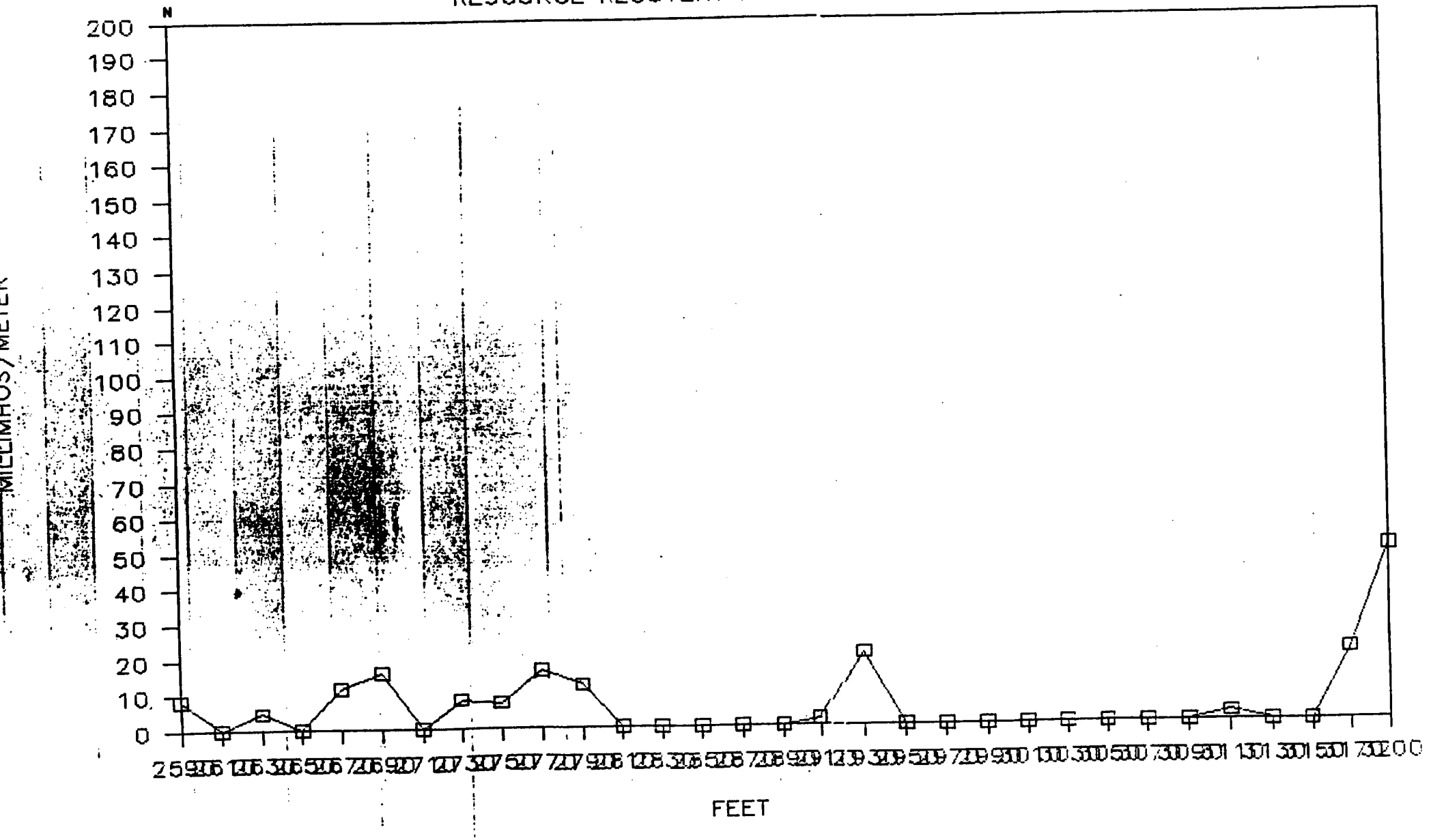
EMERSON STREET PROFILE

RESOURCE RECOVERY FACILITY PROFILE 7



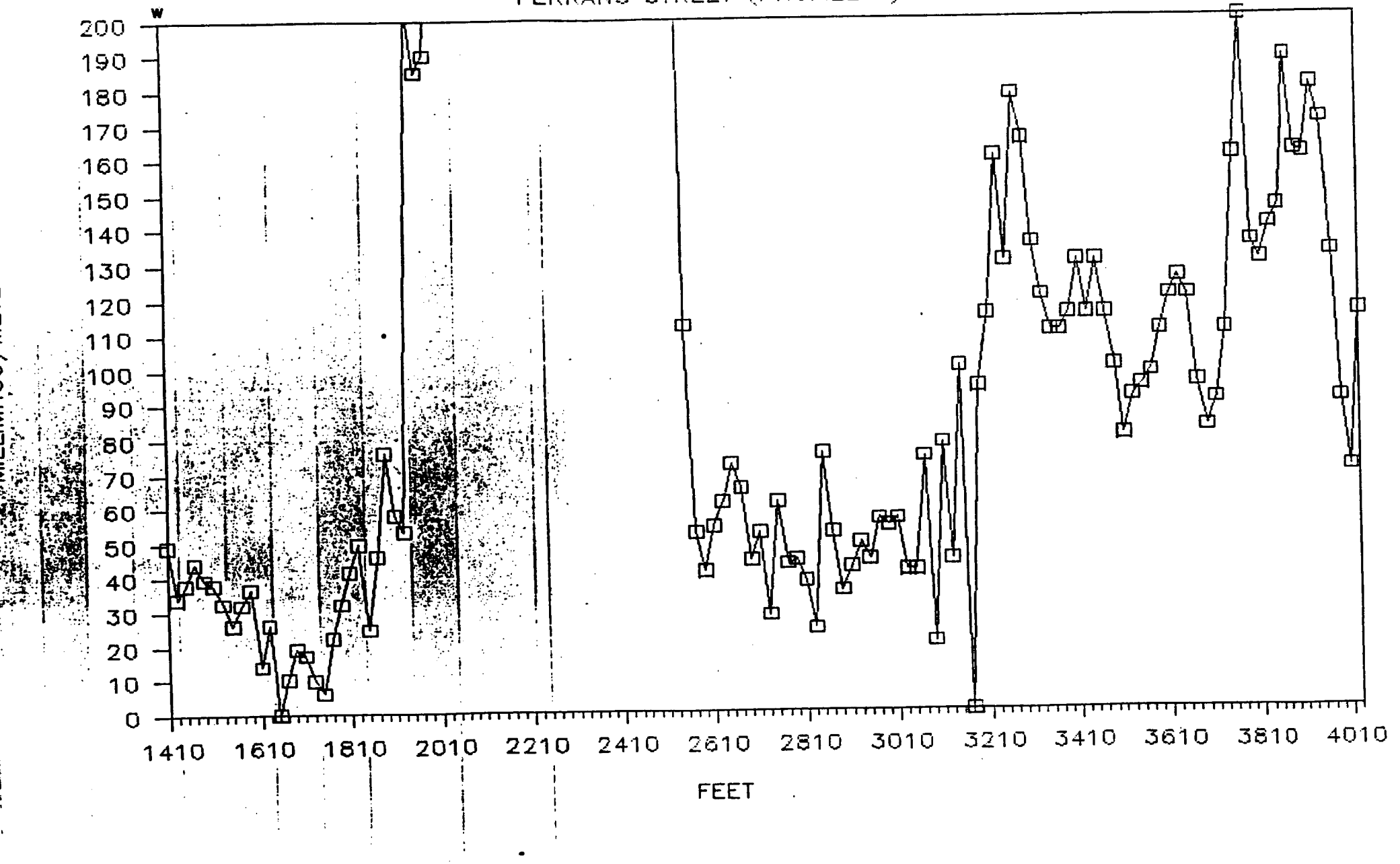
EMERSON STREET LANDFILL

RESOURCE RECOVERY FACILITY—PROFILE 8



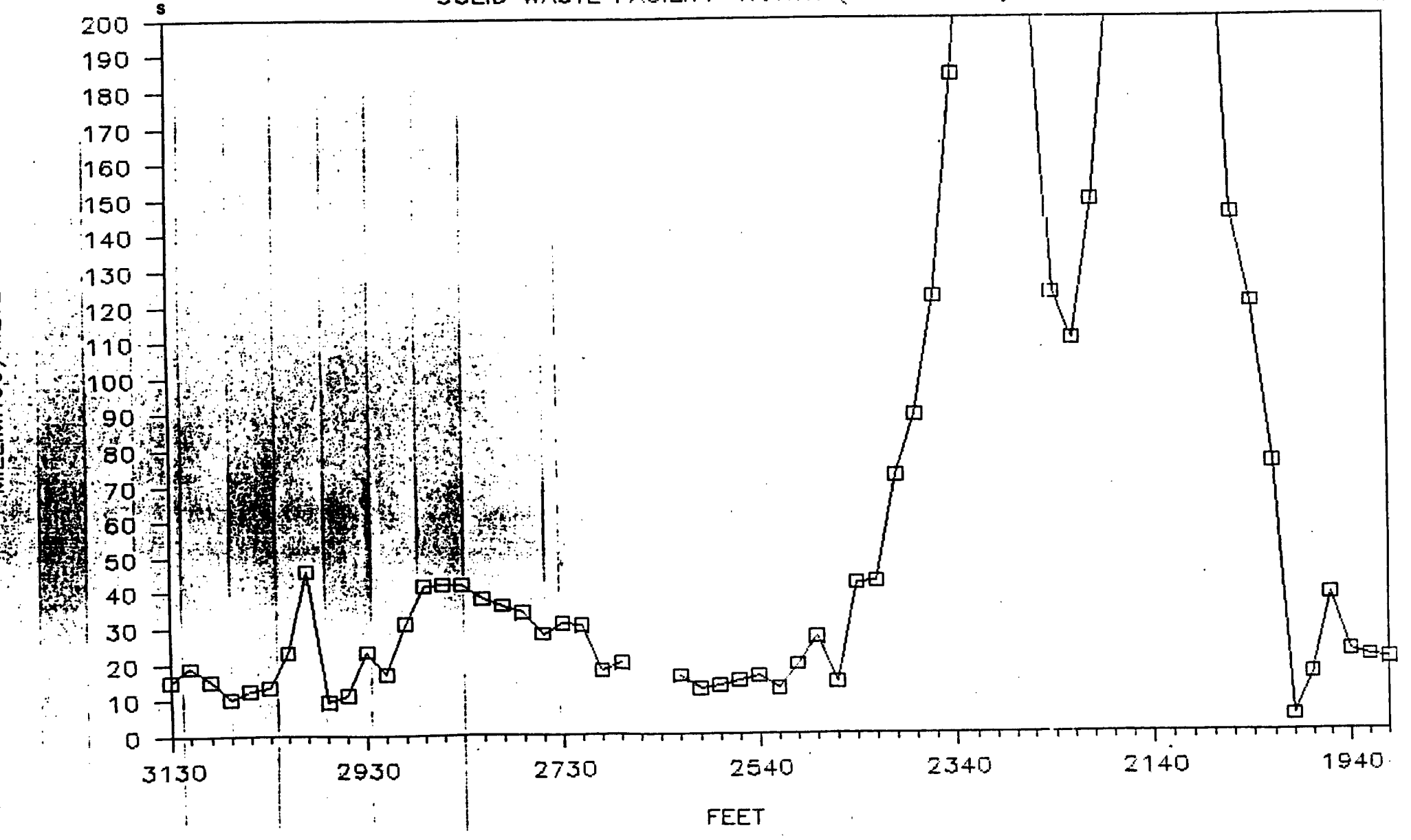
EMERSON STREET LANDFILL

FERRANO STREET (PROFILE 9)



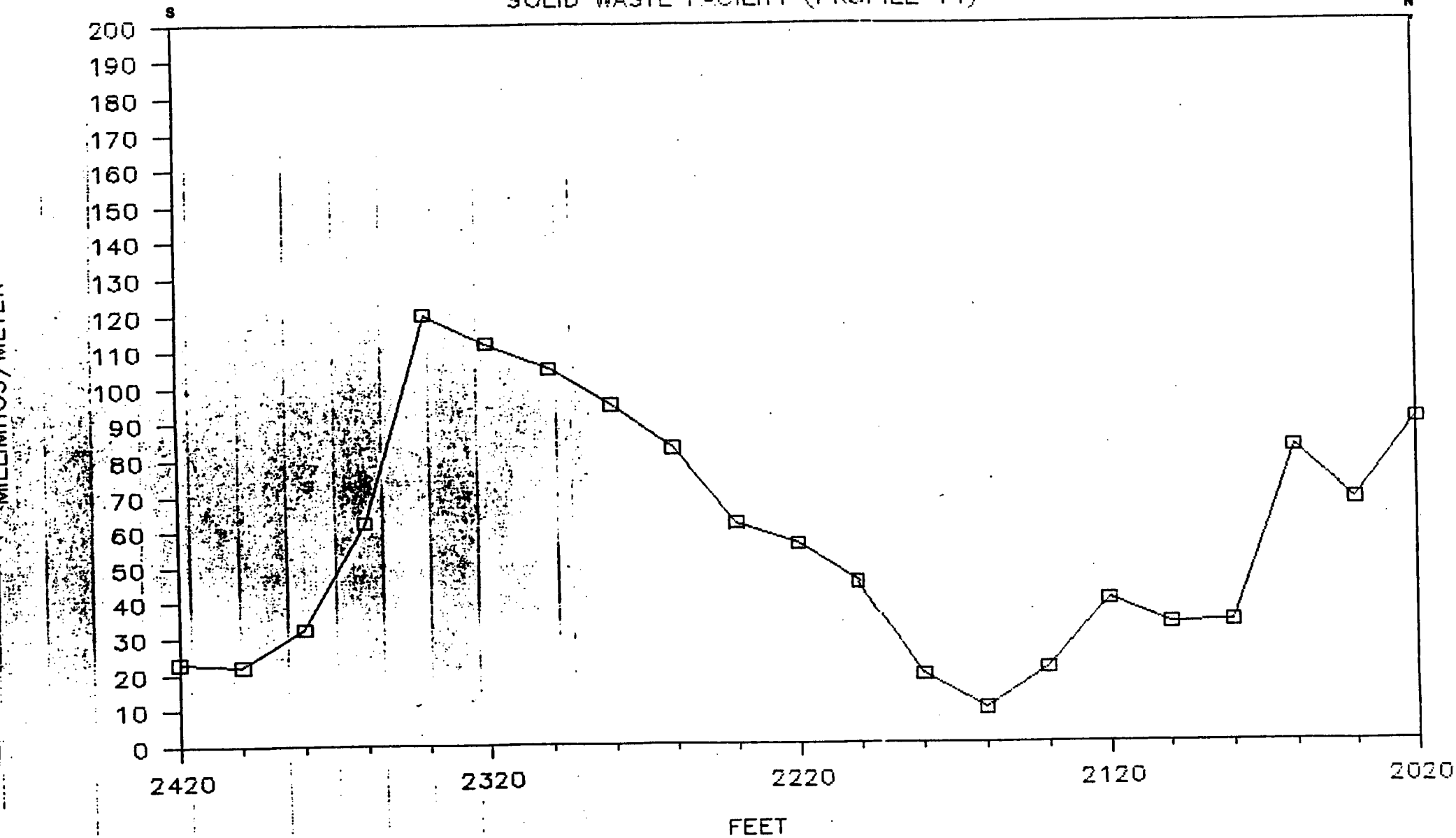
EMERSON STREET LANDFILL

SOLID WASTE FACILITY—NORTH (PROFILE 10)



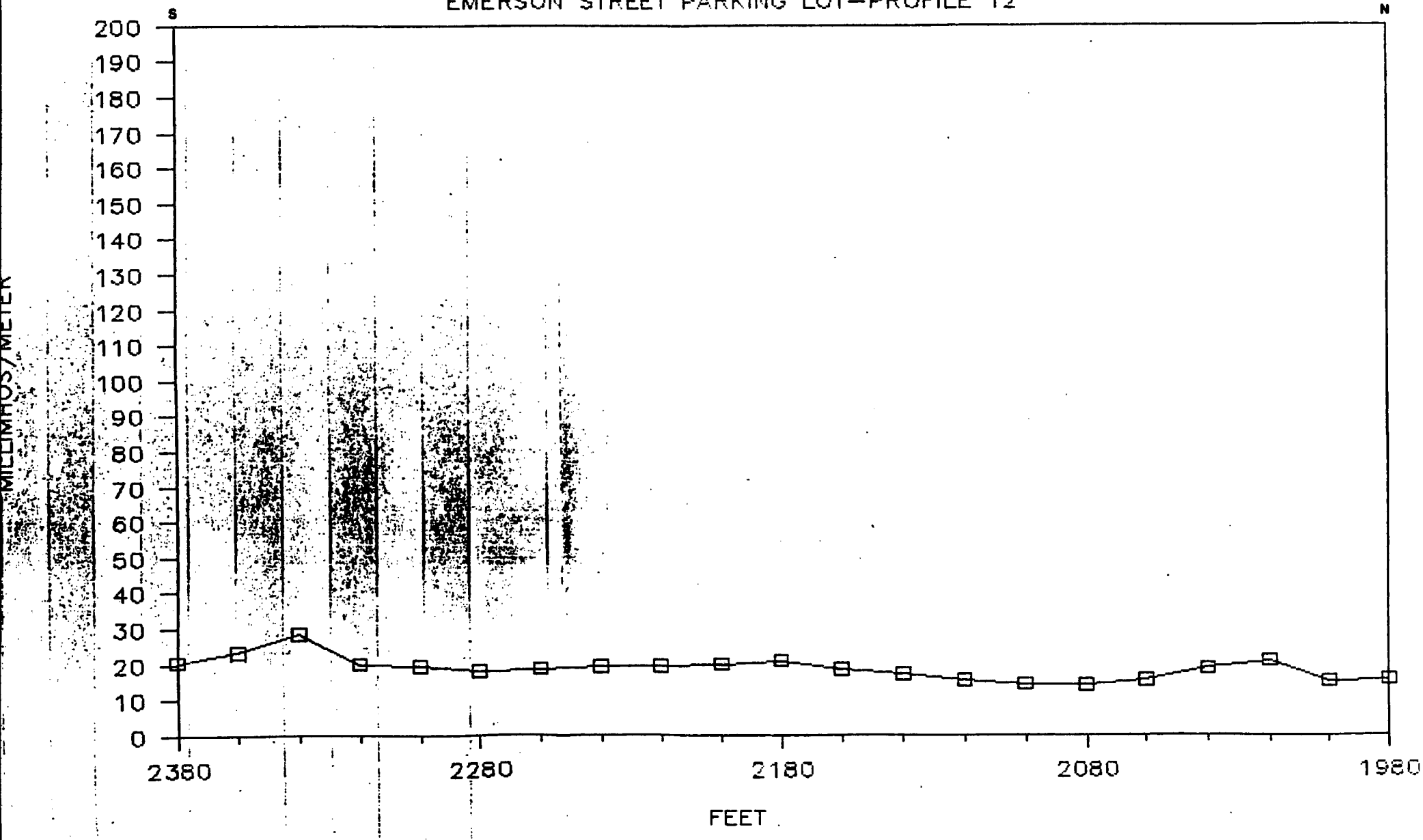
EMERSON STREET LANDFILL

SOLID WASTE FACILITY (PROFILE 11)



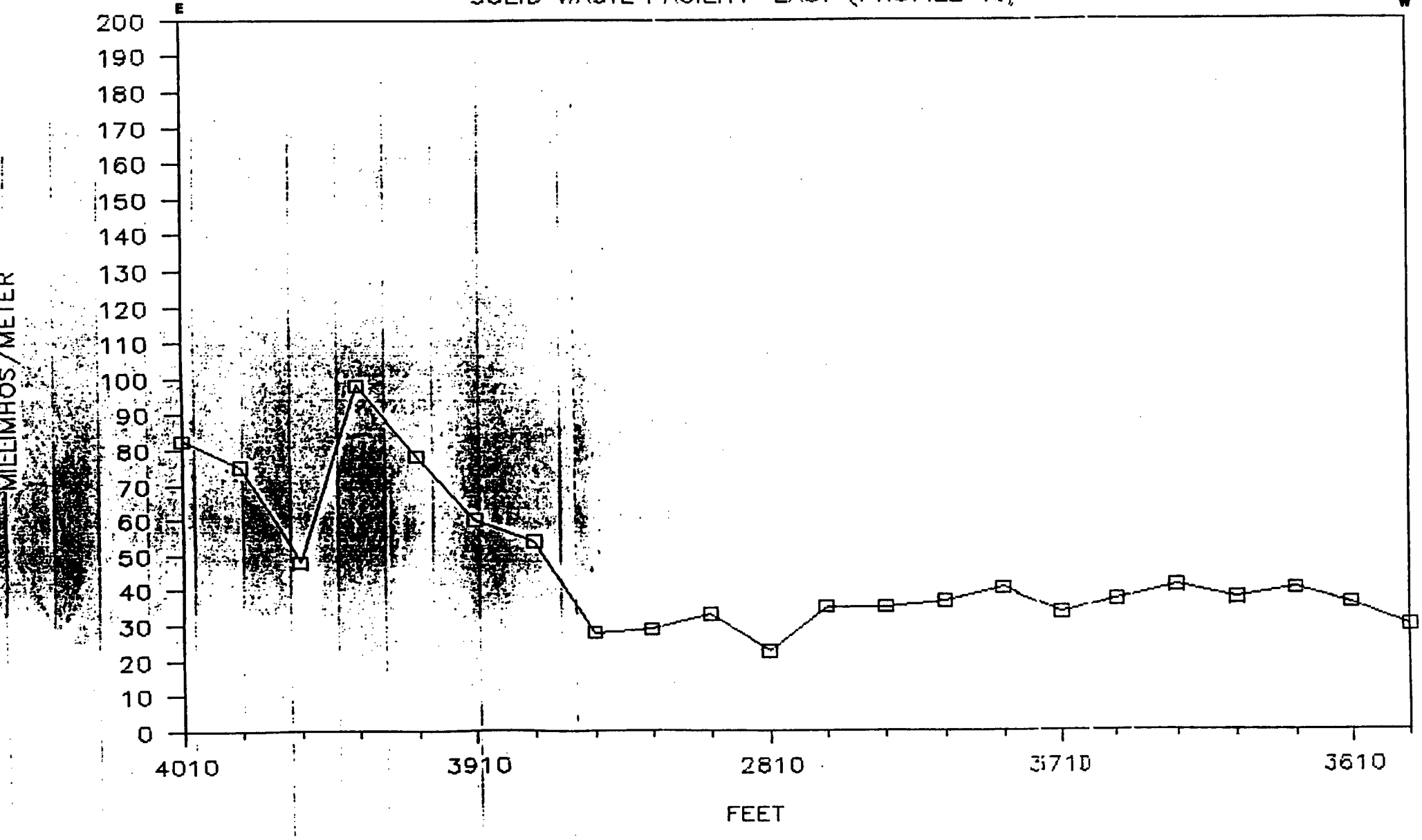
EMERSON STREET LANDFILL

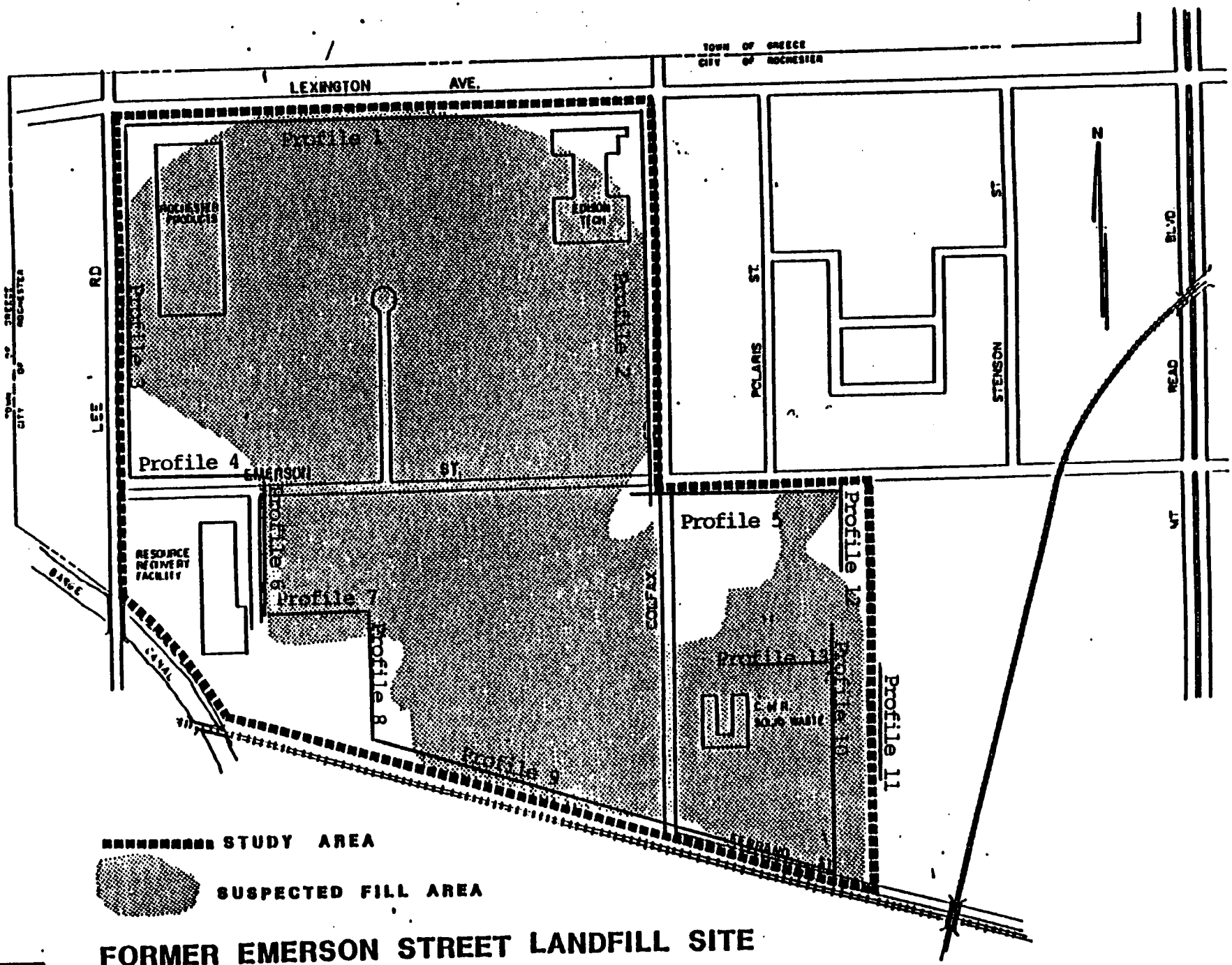
EMERSON STREET PARKING LOT—PROFILE 12



EMERSON STREET LANDFILL

SOLID WASTE FACILITY—EAST (PROFILE 13)





FORMER EMERSON STREET LANDFILL SITE

N.Y.S. REGISTRY # 8-28-023

City of Rochester, New York

Approximate Profile Location

DUNN GEOSCIENCE CORPORATION

8/17/88

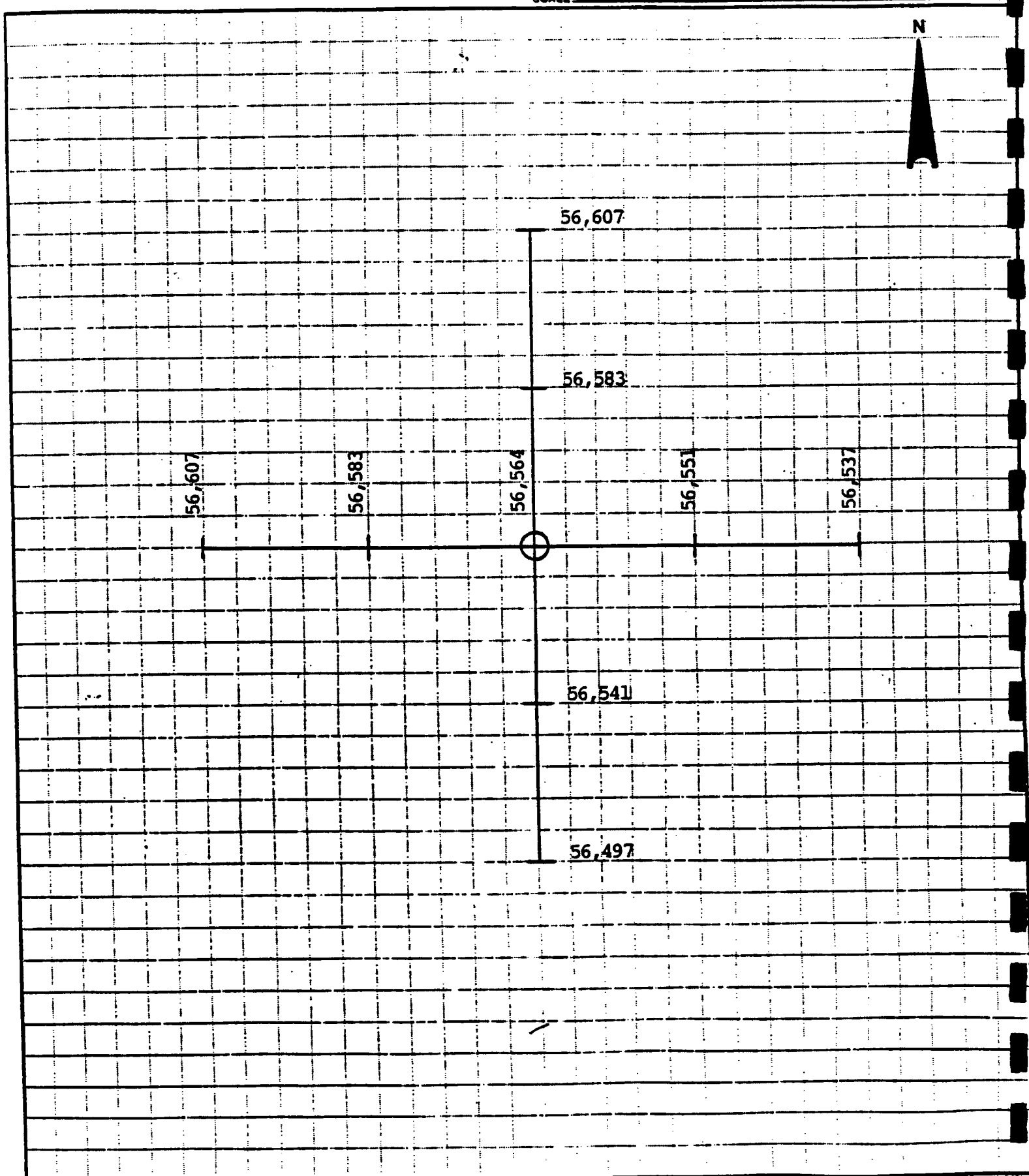
MAGNETOMETER SURVEY

EMERSON STREET

Anticipated background values for the Rochester, New York area are 55,000 - 56,000 gamma's. Proposed drilling locations GW-2,6,7 and 11 were at or slightly above the anticipated background suggesting that small amounts of metal may be present. Proposed well location GW-1,3,4,5,9,10,10a contained at least one value that was moderately to significantly above background. These values probably represent buried metallic debris or the presence of utilities within the vicinity of the survey.

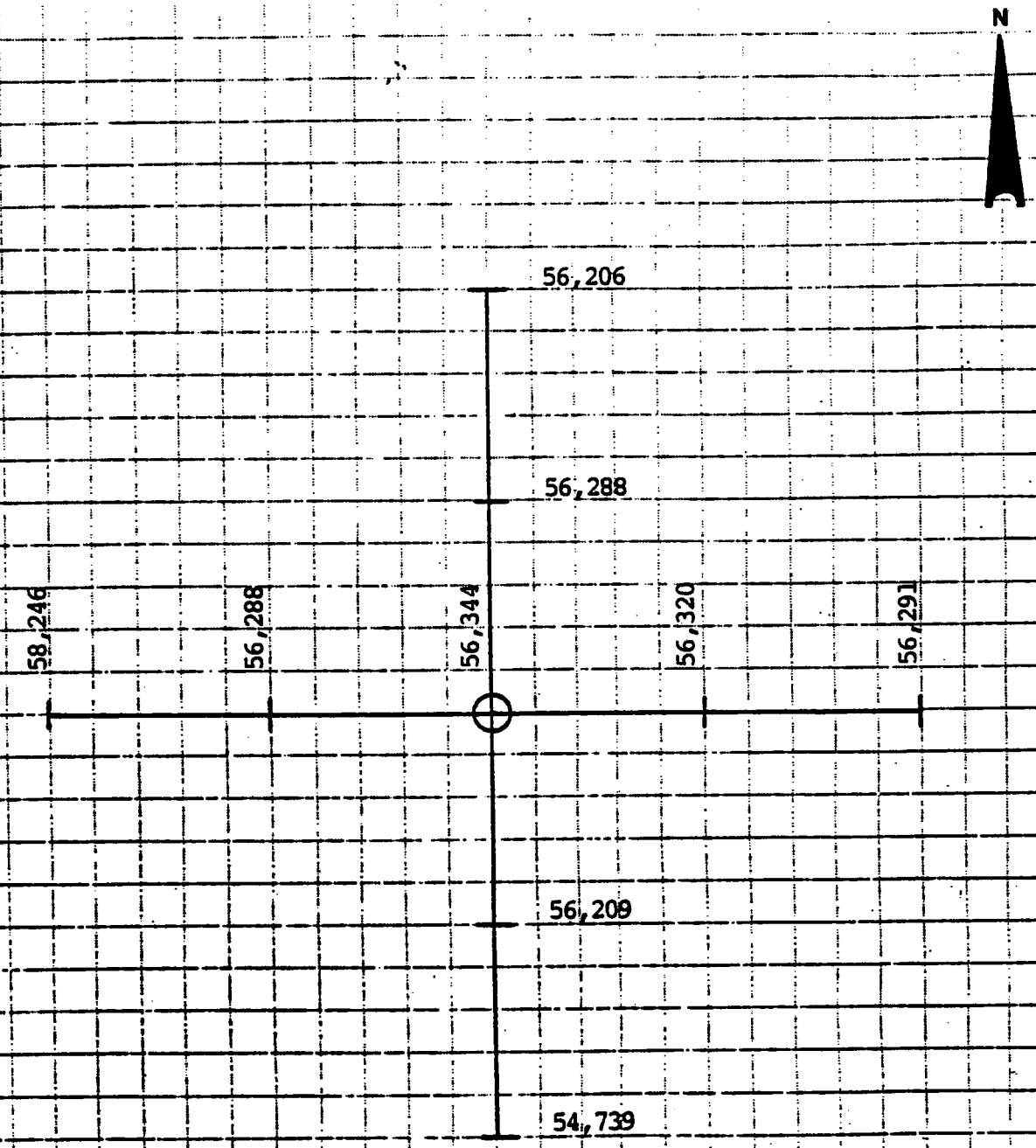
DUNN GEOSCIENCE CORP.
495 Commerce Drive
Amherst, New York 14150
Phone 716/691-3866

JOB: Recra Environmental - Emerson St.
SHEET NO. GW-1 OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE 1" = 8'



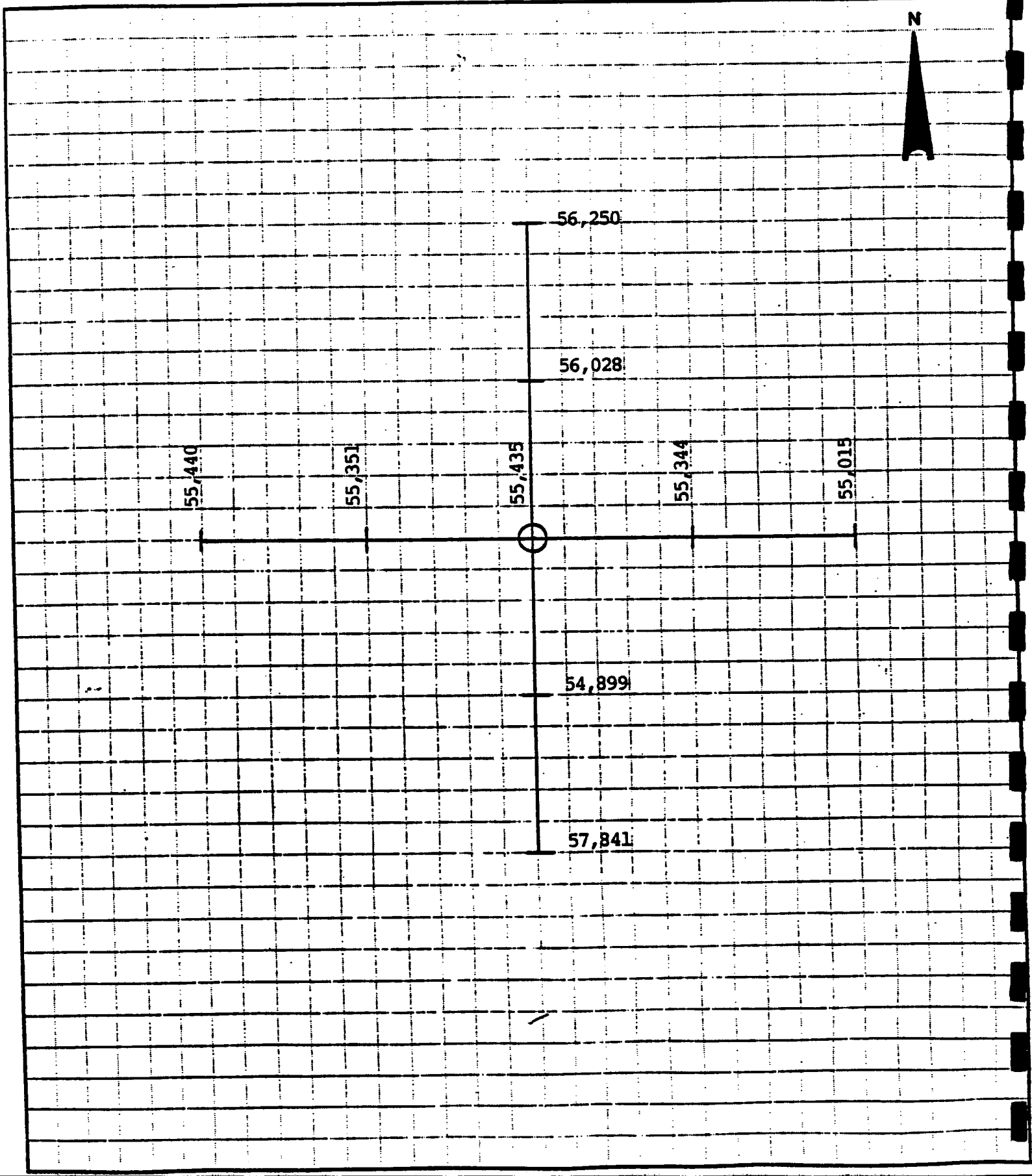
DUNN GEOSCIENCE CORP.
495 Commerce Drive
Amherst, New York 14150
Phone 716/691-3866

JOB: Recra Environmental-Emerson St.
SHEET NO.: GW-2 OF
CALCULATED BY: DATE
CHECKED BY: DATE
SCALE: 1" = 8'



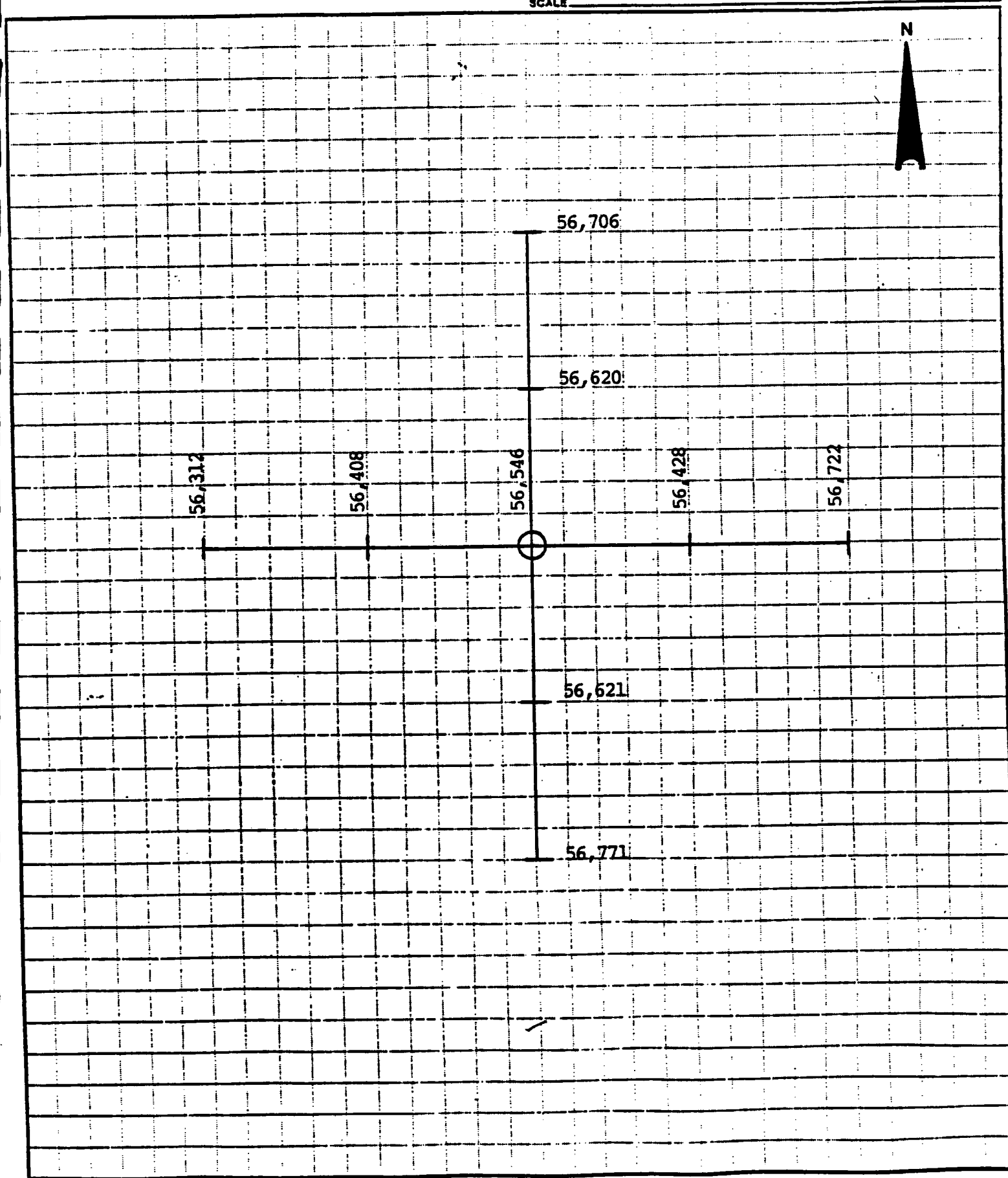
DUNN GEOSCIENCE CORP.
495 Commerce Drive
Amherst, New York 14150
Phone 716/691-3866

JOB: Recra Environmental
SHEET NO. GW-3 OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE 1" = 8'



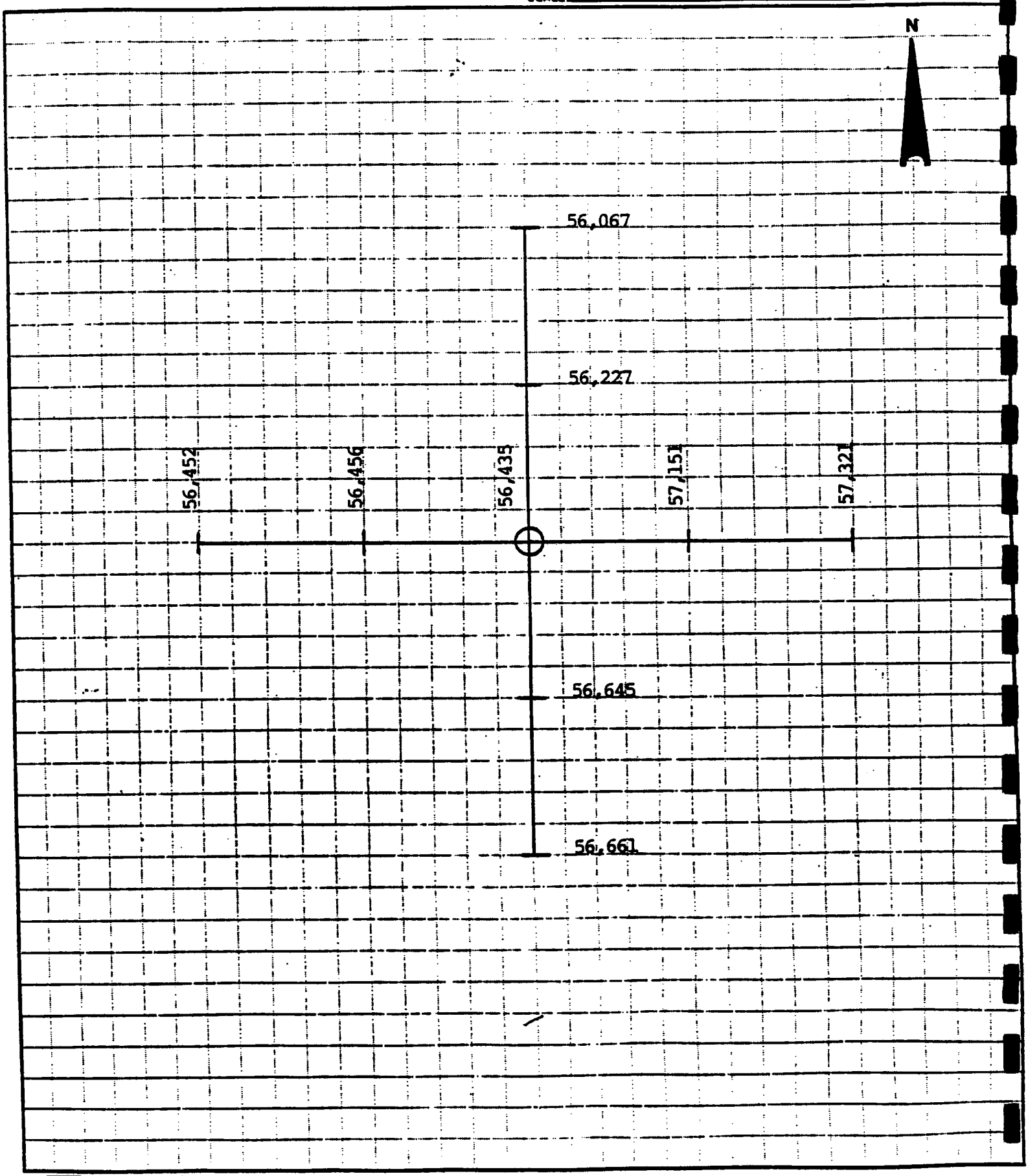
DUNN GEOSCIENCE CORP.
495 Commerce Drive
Amherst, New York 14150
Phone 716/691-3866

JOB: Recra Environmental-Emerson St.
SHEET NO.: GW-4 OF:
CALCULATED BY: DATE:
CHECKED BY: DATE:
SCALE: 1" = 8'



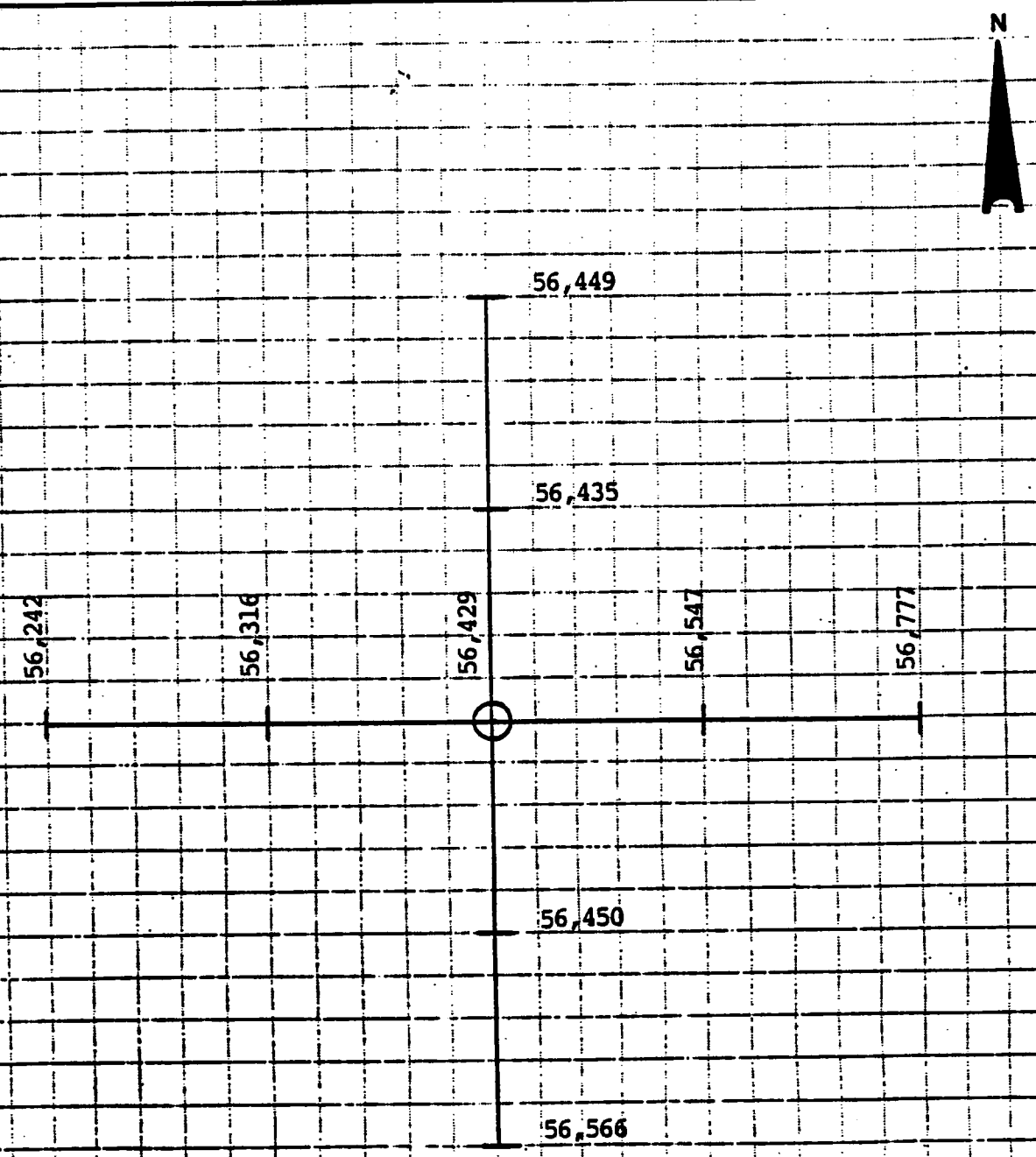
DUNN GEOSCIENCE CORP.
495 Commerce Drive
Amherst, New York 14150
Phone 716/691-3866

JOB Recra Environmental-Emerson St.
SHEET NO. GW-5 OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE 1" = 8'



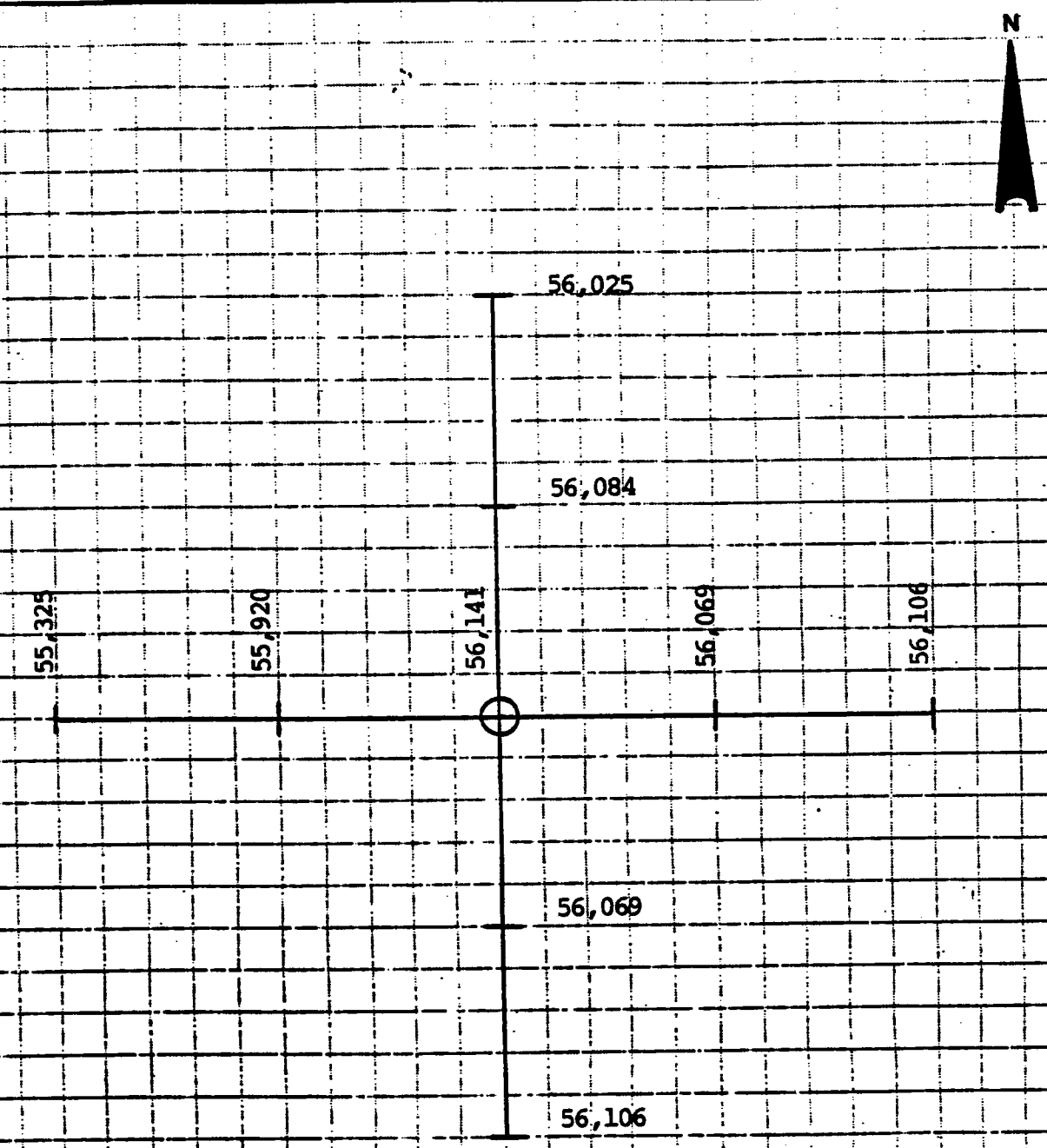
DUNN GEOSCIENCE CORP.
495 Commerce Drive
Amherst, New York 14150
Phone 716/691-3866

JOB: Recra Environmental-Emerson St.
SHEET NO.: GW-6 OF
CALCULATED BY: DATE
CHECKED BY: DATE
SCALE: 1" = 8'



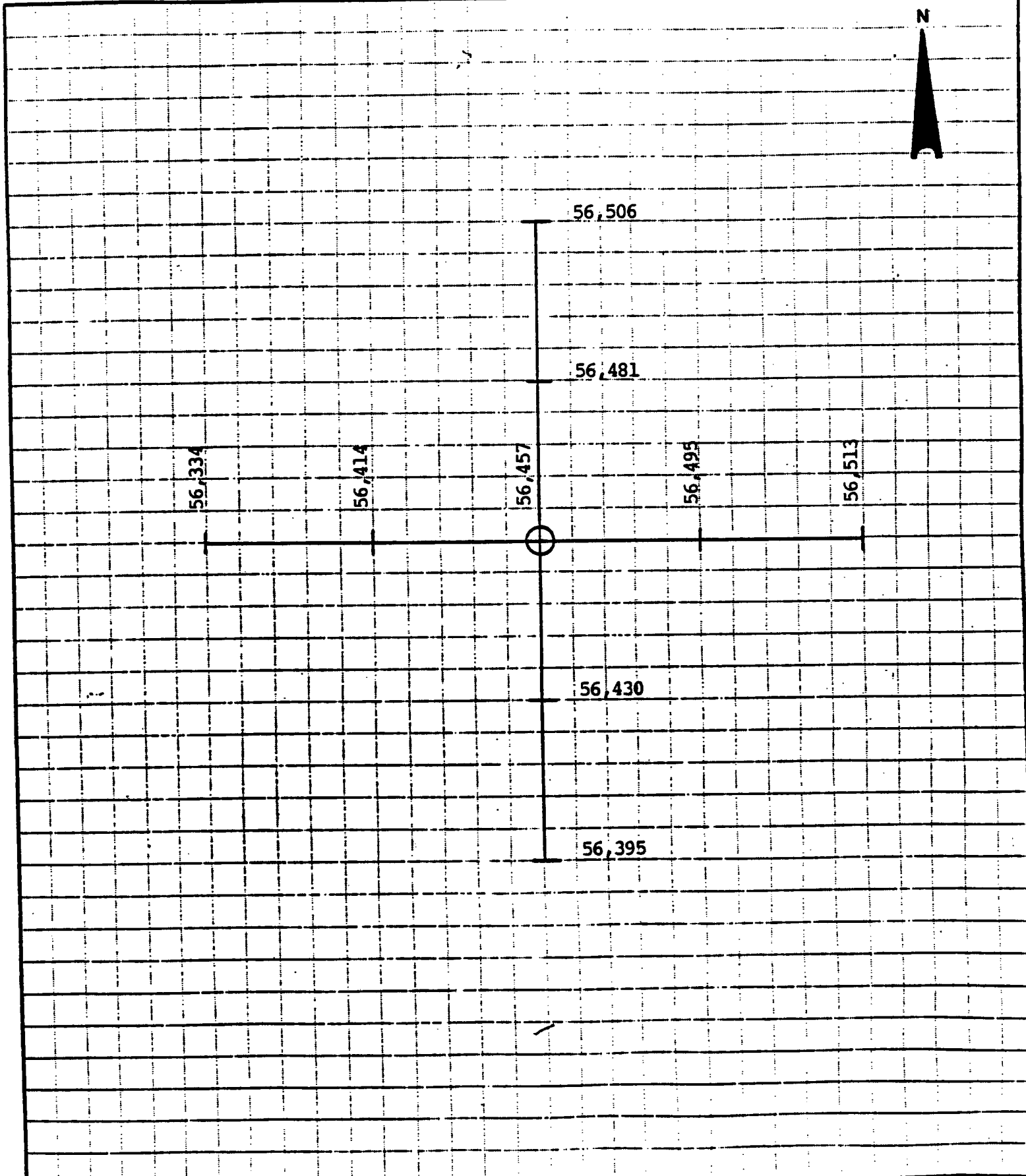
DUNN GEOSCIENCE CORP.
495 Commerce Drive
Amherst, New York 14150
Phone 716/691-3866

JOB: Recra Environmental-Emerson Street
SHEET NO.: GW-7 OF
CALCULATED BY: DATE:
CHECKED BY: DATE:
SCALE: 1" = 8'



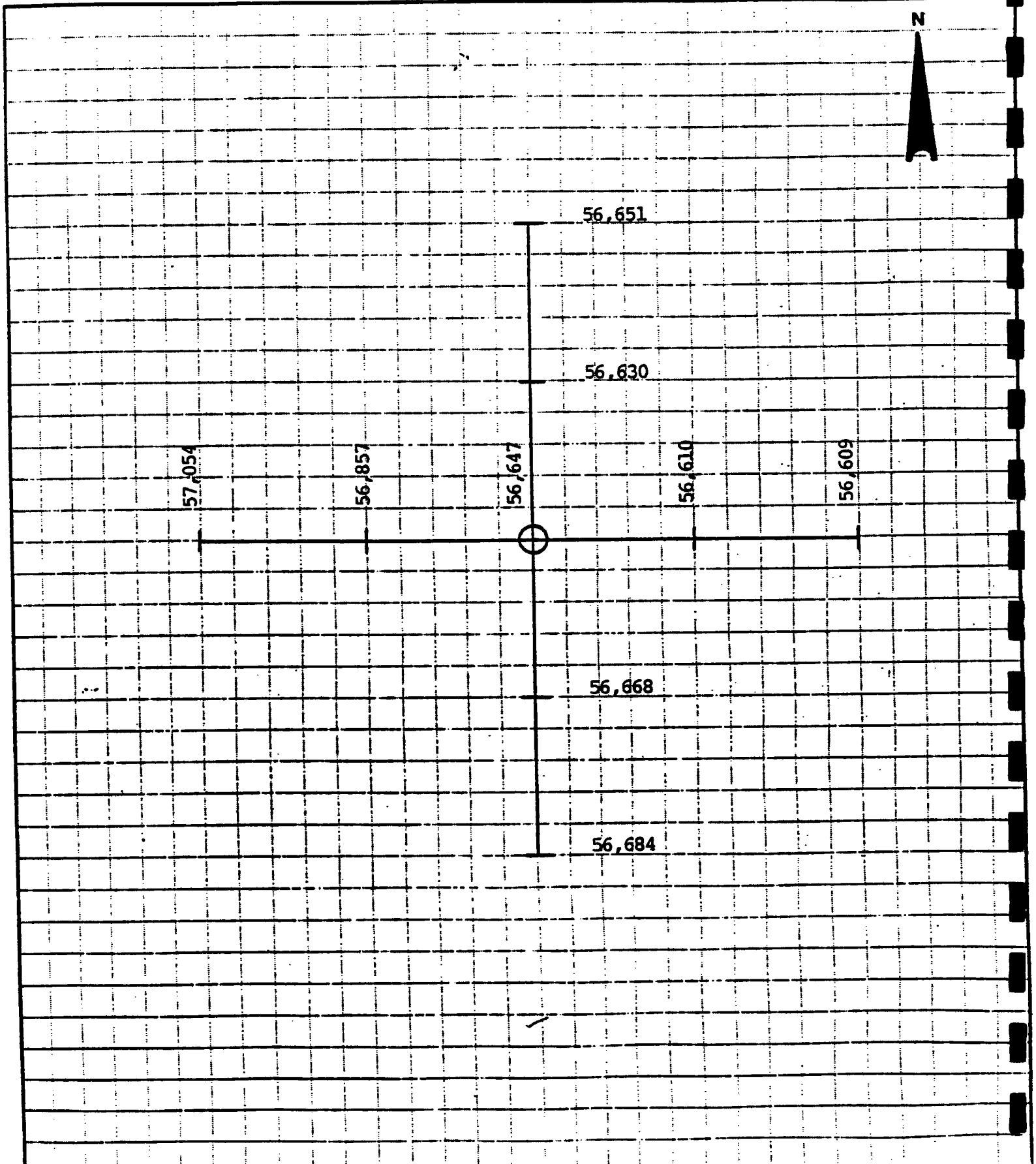
DUNN GEOSCIENCE CORP.
495 Commerce Drive
Amherst, New York 14150
Phone 716/691-3866

JOB: Recra Environmental-Emerson St.
SHEET NO. GW-9 OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE 1" = 8'



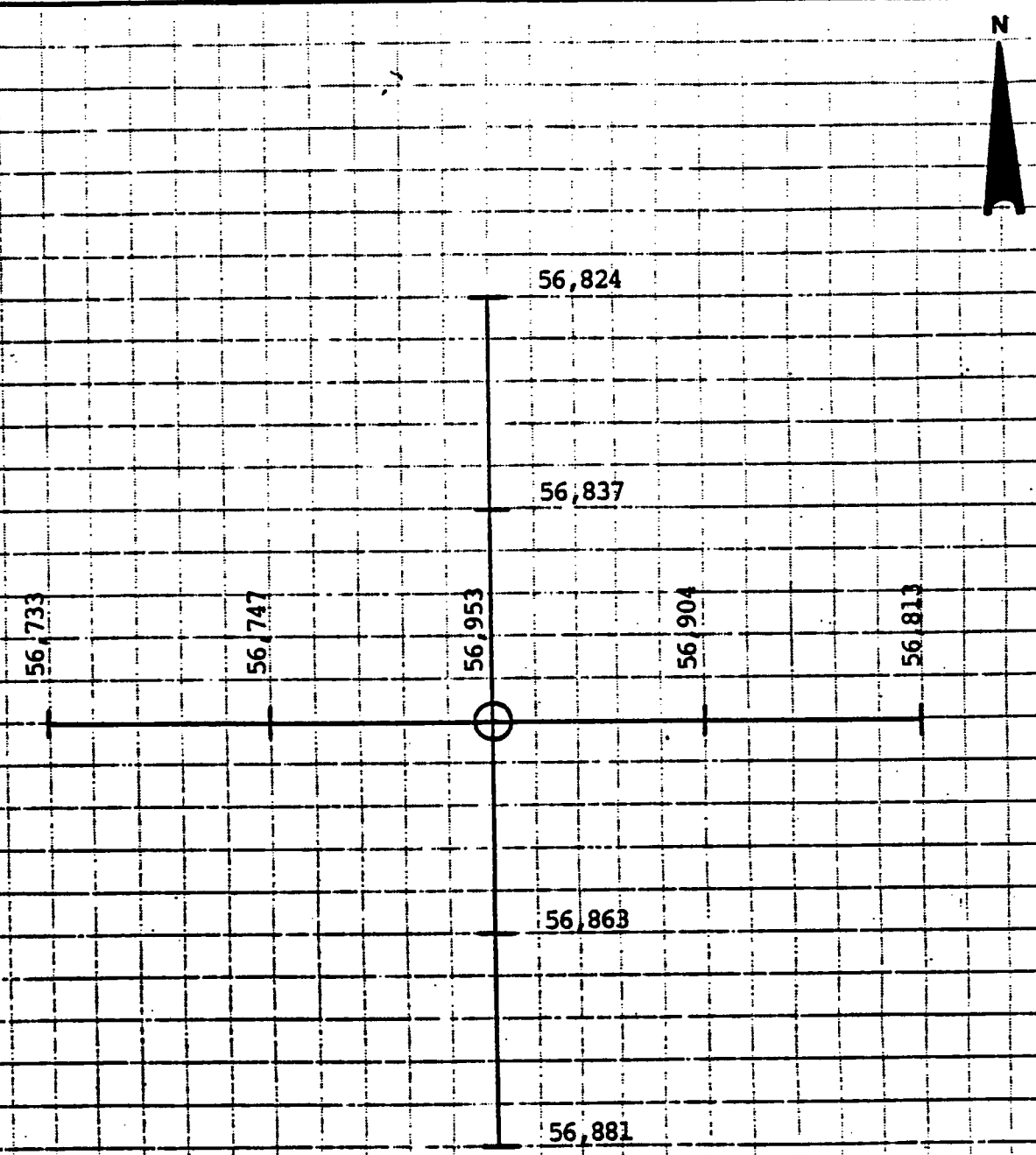
DUNN GEOSCIENCE CORP.
495 Commerce Drive
Amherst, New York 14150
Phone 716/691-3866

JOB: Recra Environmental-Emerson St.
SHEET NO.: GW-10 OF
CALCULATED BY: DATE
CHECKED BY: DATE
SCALE: 1" = 8'



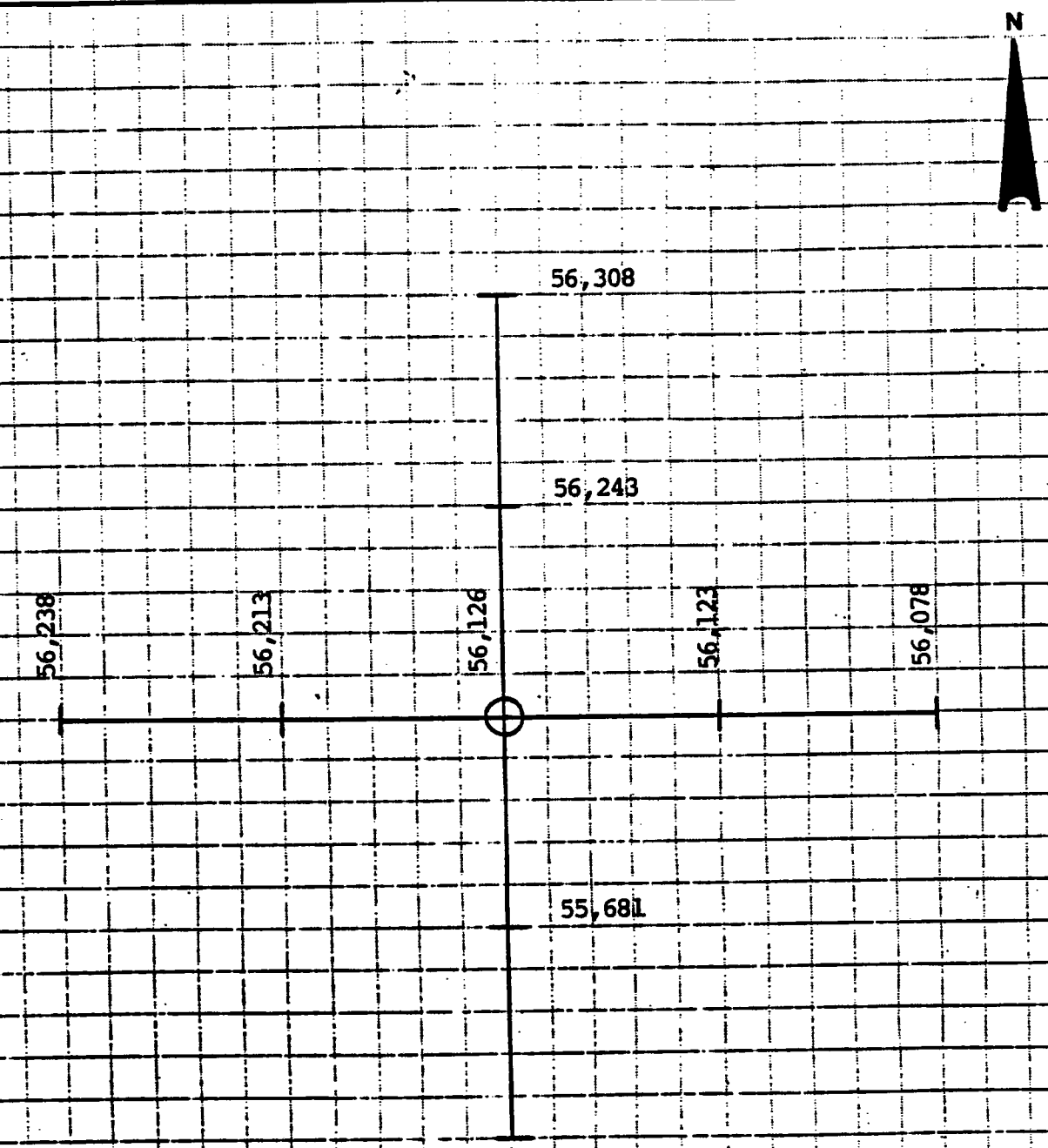
DUNN GEOSCIENCE CORP.
495 Commerce Drive
Amherst, New York 14150
Phone 716/691-3866

JOB Recra Environmental-Emerson St.
SHEET NO. GW-10A OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE 1" = 8'



DUNN GEOSCIENCE CORP.
495 Commerce Drive
Amherst, New York 14150
Phone 716/691-3866

JOB: Recra Environmental-Emerson St.
SHEET NO. GW-11 OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE 1" = 8'



APPENDIX C

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION RADIOLOGICAL SURVEY NOTES

ENSA, INC. RADIOLOGICAL LABORATORY ANALYSIS REPORT ON TEN SOIL SAMPLES

EMERSON STREET LANDFILL #828023

Clear 70° 9/15/88 ①

John Swanson DEC-Avon onsite @ 9:30
Todd Caffoe " "

9:30
Met with Mark Gregor of City of Rochester at west end of DeCardis Truck Rental Lot. Inspected areas to west of this area of fill which elevated levels of radiation was found at ground surface. The areas are approximately 100 yds Southwest of Yellow Freight Lines SW fence corner. Reading ranged from 20 microRems/hr to 170 microRems/hr in three distict areas. Several woodchuck holes were evident which produced ~~the~~ two of the three areas. ~~of~~ The materials obsered to be excavated from the woodchuck holes was burned refuse & glass.

These areas had been discovered by Recra personnel on 9/2/88 during the Phase II radiological survey task. These areas were documented by Robert Steiner of Recra.

(2)

Clear 70° 9/15/88

10:30 Met with Mr. Wernick of Yellow Freight System, Inc. regarding performing the extended radiological survey on this parcel. A conversation evolved concerning the Phase II, and developement of an expansion on the parcel. I described the requirements the City Planning Dept. makes on proposal on or adjacent (within 2000') of waste disposal sites.

11:00 Todd Caffoe & John Swanson ~~per~~ conduct radiological survey of entire at grade area of Yellow Freight Systems parcel. Lines of continuous monitoring with the Ludlum MicroR meter were walked from east to west (and vice versa) at a spacing of 8 to 14' depending on obstructions such as parked trailers and other vehicles. The meter consistently displayed readings ranging from four (4) to eight (8) microRems/hr over the entire site. The survey covered all of the grounds from the south fence line to Emerson St, bounded by the east

(3)

9/15/88 con't

and west fence lines, including those areas of the building at grade level. The only areas of the parcel not survey was the office and warehase space.

12:30 Completed Survey & left Site

John A. Swanson
Assist San. Eng Region 8
Avon

(2)
1/23/89

Sample locations are as follows

Name	Time	R reading	location
RAD-1	11:15	40 [illegible]/hr	Bottom of incinerator stack
RAD-2	11:15	40 [illegible]/hr	Bottom of incinerator stack
RAD-3	11:30	48 [illegible]/hr	West burn pit
RAD 4	11:30	48 [illegible]/hr	East burn pit

12:00 Move to areas marked as "warm" during radiological survey

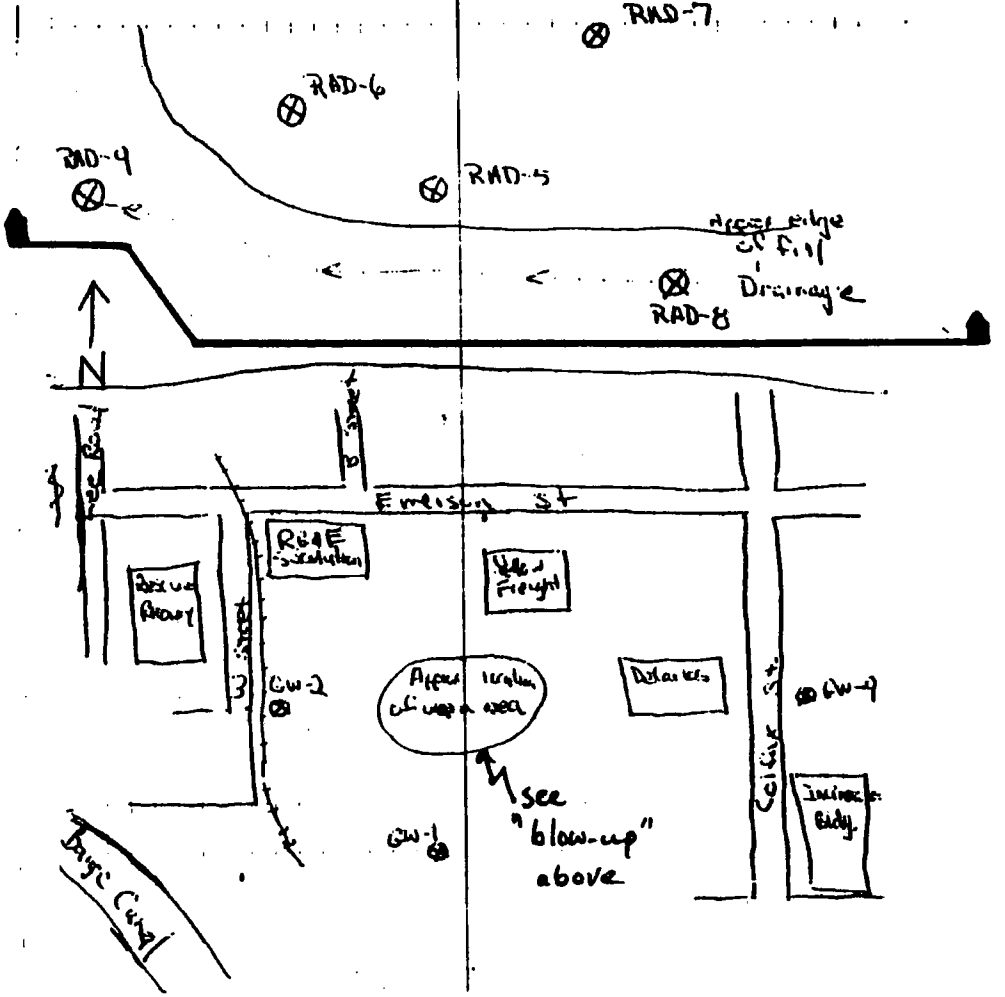
3 sampling areas chosen based upon radiation levels

RAD-5	12:15	140	warm Areas 6-12"
RAD-6	12:30	60	below the surface
RAD-7	12:45	25-30	

Samples obtained using hand auger. 6-12" in depth

Located two addition samples adjacent to warm area. Locations are 'downhill' drainage from warm area. Called RAD-8 + RAD-9

Approx. locations in the warm area



Rad 10 I believe was from drummed auger cuttings. MK.

ENSA, Inc.

• energy science and engineering
• thermal hydraulic analysis
• safety and reliability analysis

4

B-MH-4103
February 13, 1989

Mr. James Stachowski
RECRA Environmental
10 Hazelwood Drive - Suite 106
Amherst, NY 14150

Re: Sample Analysis Results

Ref: SECY-81-576, NRC Policy Issue, dated October 5, 1981

Dear Mr. Stachowski:

The requested analysis was performed on the ten (10) samples as requested in your letter of December 28, 1988. Subsequent to screening studies, only one sample was determined to have significant activity above background. That sample (RAD-5) was then subjected to further detailed analysis as indicated in the attached lab report.

Results of the detailed analysis indicate that sample RAD-5 contains approximately 100 times the normal background levels of thorium-232. This accounts for radioactivity levels in excess of 6 times background. Regarding alpha emissions, the sample contains approximately 100 (pCi/gm).

Comparison of the attached results with the NYS-DEC standards of Part 30 is not possible given that no established criteria are noted for the concentration of radionucleides in soil but only in air and water. Fortunately, however, the U.S. Nuclear Regulatory Commission has adopted a criteria for this type of situation. In Reference 1, which was subsequently

Washington Office: P.O.Box 5537, Rockville, MD 20855 Tele. (301) 330-1800
Buffalo Office: P.O.Box 7, Getzville, NY 14068 Tele. (716) 834-3111
San Jose Office: P.O.Box 20130, San Jose, CA 95160 Tele. (408) 997-1212

adopted as 10CFR-61, three different action levels for thorium in landfills has been defined. These are generally described in the following Table:

Maximum Limits for
Disposal Options (pCi/gm)

Option	Limit
1.(a)	10
2.(b)	50
3. Reserved for Natural Uranium (U^{238} & U^{234}) only	
4.(c)	500

(a) - Based on EPA Cleanup Standards
(b) - Concentrations based on limiting individual doses to 170 mrem/yr
(c) - Concentrations based on limiting individual doses to 500 mrem/yr

Should option 4 requirements be exceeded, ultimate removal to a secure facility may be necessitated. However, based upon my current consulting work on the NYS-DEC Low Level Radioactive Waste Siting criteria, this ultimate option may represent even greater difficulty.

Since sample RAD-5 contains 100(pCi/gm), apparently option 4 applies which includes the following requirements:

> Criteria for disposal under option 4 is predicated upon the assumption that intentional intrusion is less likely to occur if a warning is given in land documents of record not to excavate below burial depths in specified areas of land without clearance by health authorities; not to construct residential or industrial buildings on the site; and not to use specified areas of land for agricultural purposes. In addition recorded title documents would be amended to impose these land use restrictions.

Under this option, burial will be permitted only if it can be demonstrated that the buried materials will be stabilized in place and not be transported away from the site. Acceptability

of the site for disposal will depend on topographical, geological, hydrological and meteorological characteristics of the site. At a minimum, burial depth will be at least four feet below the surface.

My recommendation, based upon the available evidence, is to first conduct additional sampling at the site. This is needed in order to develop a horizontal and vertical profile of conditions at the landfill and to clearly establish the disposal option required. Second, a pathways analysis should be initiated in order to clarify the possible options. This would in turn be based upon the data available at that time.

I hope that this information suffices for the time being. I shall of course be available to discuss these issues further in our Buffalo Office.

Yours very truly,

Martin N. Haas

MNH/acd

enc.

RADIOACTIVITY ASSAY OF TEN LANDFILL SAMPLES 2/5/89

Sample Preparation and Assay

The initial assay of samples were performed by transferring materials directly to tared vials for gamma assay and to 1.25" dia x 1/8" high planchets for alpha and beta assay. The samples contained various amounts of water and were of variable consistency. The alpha and beta assays were performed on infinitely thick samples since the greatest count-rate may be obtained in this way. Unfortunately, precise determination of nuclide concentration is not possible with this technique due to self absorption of the particles emitted by the sample matrix. It does, however, indicate which samples are measurably above background levels and worthy of more elaborate techniques of quantitization. The vials subjected to gamma analysis were by a pulse height analyzer and the spectrum of each was observed covering an energy range of 16-1440 keV. The results of these assays are presented in Table 1.

Results of Screening Assay

Of the ten samples, only sample 5 demonstrated gamma spectral peaks differing from background. Predominant peaks occur at 77 and 249 keV with several other minor peaks at higher energy. Review of tables of gamma energies suggested Thorium-232 and its decay products as being of suitable half-life with energies at these values. A spectrum of a known thorium sample demonstrated an exact agreement of energy and abundance with sample #5. Thorium exhibits alpha, beta and gamma emission in its decay chain, as is observed for sample #5. There is no doubt that this sample contains thorium.

Analysis for Thorium content of sample #5

An aliquot of sample #5 was dried at 125°C for 5 hours, ground to uniform size, and again placed on a tared planchet and vial, and subjected to alpha, beta and gamma assay using the same techniques. Gamma assay involved analysis of the two predominant peaks corrected for system efficiency at those energies and for the rather complex number of gamma rays exhibited by thorium at these two ranges (which are not resolved by the detector due to their closeness together). The decay scheme of thorium (a naturally radioactive element with a specific activity of 0.11 μCi/g) is shown in Table 2. The details of the specific assays are shown in Table 3.

Results of Radioactivity assays

The radioactivity measurement of the thorium decay chain in sample #5 can be assessed by alpha, beta and/or gamma counting of of the samples. The alpha and beta assays have been corrected

for the number of components contributing to activity, since at equilibrium each member of the chain exhibits equal radioactivity. Values reported represent the activity of the parent, Thorium-232 present. The total radioactivity will be approximately 11 times this for the all members. The results based on each of these analyses are as follows:

THORIUM-232 CONTENT OF SAMPLE #5

alpha	100 pCi/g
beta	122 pCi/g
gamma	
77 keV peak	86 pCi/g
248 keV peak	46 pCi/g
Average	88 pCi/g

To compare this level with radioactivity levels typical of background rates in soil, NCRP Report No. 50 (1976) "Environmental Radiation Measurements" lists typical values:

TYPICAL RADIOISOTOPE CONTENT OF SOILS

NUCLIDE	Ci/g	pCi/g
K-40	1.0×10^{-11}	10
Rb-87	3.5×10^{-12}	3.5
Ra-226	8.0×10^{-13}	0.8
Th-232	6.5×10^{-13}	0.7
U-238	6.7×10^{-13}	0.7
TOTAL		15.7

Thus, sample #5 contains about 100-times normal soil thorium content, and about 6-times normal soil total radioactivity.

Alpha decay occurs only for elements of atomic number greater than 82 and is accompanied either gamma or beta emission in addition. Sample #5 is the only one assayed which exhibits such behavior. Levels associated with the other samples are within the range of expected background values. The range of results obtained for sample #5 represent difficulty in precise measurement of alpha and beta emitters at a low concentration in bulk samples, differences of gamma assay at the two energy ranges may either represent some error in the reference literature, or non-equilibrium of the chain of decay products in the sample.

TABLE 1. SCREENING OF SAMPLES FOR ALPHA, BETA AND GAMMA ACTIVITY

SYSTEMS USED:

ALPHA: Zinc Sulfide Detector Efficiency = 11.5%

BETA: GM tube, 1.5 mg/cm² Efficiency = 20.0%

GAMMA: 512 channel PHA, 1.75x2" well
Integral counts 16-1440 keV energy range
Total spectrum observed Efficiency = 75% (80-200 keV)

SAMPLE PREPARATION: Prepared in as-received condition

ALPHA & BETA: As infinitely thick samples on planchets

GAMMA: In polyvials for well crystal

ASSAY DATA

		ALPHA		BETA			GAMMA	
SAMPLE #	WEIGHT,G	C/10M	CPM-BKG	C/10M	CPM-BKG	WEIGHT	C/10M	CPM-BKG
RAD1	0.83	9	0	146	7.9	3.95	4797	25
RAD2	1.35	4	0	134	6.7	4.65	4860	31
RAD3	0.95	15	0.75	156	8.9	4.89	4938	39
RAD4	0.85	8	0.05	146	7.9	3.67	4945	40
RAD5	4.41	34	2.65	531	46.4	13.32	26177	2163
RAD6	1.34	15	0.75	139	7.2	6.94	4829	28
RAD7	1.34	14	0.65	121	5.4	5.73	3751	0
RAD8	2.86	18	1.05	103	3.6	10.29	3484	0
RAD9	2.97	12	0.45	95	2.8	10.34	3493	0
RAD10	2.16	3	0	102	3.5	7.71	3748	0
BKG	0	7.5	-	67	-	0	4547	-
MDA			0.63		1.9			15.6

TABLE 2. COMPONENTS OF THE THORIUM DECAY CHAIN (NCRP REPORT NO. 58)

NUCLIDE	X- AND GAMMA EMISSION AT ≈ 77 KEV (50-100)		AT ≈ 248 (200-290)	
	Energy	%	Energy	%
Th-232	59	0.19		
Ac-228	57.7	0.51	204	0.16
	89.9	2.0	209	3.81
	93.3	3.2	270	3.44
	99.5	1.2	279	0.21
Th-228	84.4	1.17	216	0.27
Ra-224	81	0.13	241	4.05
	83	0.21		
Pb-212	74	10.5	239	43.9
	77	17.7		
	89	7.9		
Bi-212 (36% BRANCHING)			288	0.31
Tl-208	72	2.03	211	0.18
	74	3.42	233	0.31
	85	1.52	252	0.71
			277	6.30
sub total of Bi-212 branch		2.5		2.8
TOTAL GAMMA ABUNDANCES (%/atom)		47.2		58.5

ALPHA EMITTERS IN CHAIN = 5.7

BETA EMITTERS IN CHAIN (> 1 MeV) = 2.5

GAMMA EMITTERS IN CHAIN at 77 keV = 6
at 248 keV = 6

TOTAL MEMBERS OF CHAIN = 11

TABLE 3. ASSAY RESULTS OF DRIED SAMPLE #5

ALPHA ASSAY

Sample Weight = 0.73g = 92 mg/cm²
Sample Counts = 93 c/20m
Background = 13 c/20m
Net sample = 4.0 cpm
Efficiency = 10.9% (Am-241 std)
Sample activity = 36.7 dpm = 16.5 pCi
Ave energy of α = 5.8 MeV (NCRP No 58)
Range in air = 4.6 cm x 1.293 mg/cc = 6.0 mg/cm² (RHHbk)
Detector window and air equivalent = 2.3 mg/cm²
Range in sample of α penetration = 3.7 mg/cm²
Wt of sample of α detection = 3.7 mg/cm² x 7.9 cm² = 29 mg
Activity of sample = 16.5 pCi/0.029 g = 569 pCi/g
Activity of Th-232 = 569/5.7 members = 100 pCi/g

BETA ASSAY

Sample weight = 0.73g = 92 mg/cm²
Sample counts = 1139 c/20m
Background = 75 c/10m
Net sample = 49.5 cpm
Efficiency = 20.0% (Cl-36 std)
Sample activity = 247 dpm = 111 pCi = 153 pCi/g
Self absorption = 50% (CRC Hbk of Radioactive Nuclides, 901)
Sample Activity = 153/.50 = 306 pCi/g
Activity of Th-232 = 306/2.5 = 122 pCi/g

GAMMA ASSAY

Sample weight = 5.48 g

At 77 keV:
Sample counts = 34504/6000 sec = 5.75 cps
Efficiency = 0.70
Gammas/sec = 8.2
Gamma abundance = 0.472
DPS = 17.3
Ci = 4.6×10^{-10}
Ci/g = 8.6×10^{-11}
Specific Act = 86 pCi/g

At 248 keV:
Sample counts = 28595/6000 sec
Efficiency = 0.87
Gammas/sec = 5.48
Gamma abundance = 0.585
DPS = 9.37
Ci = 2.5×10^{-10}
Ci/g = 4.6×10^{-11}
Specific Act = 46 pCi/g

New York State Department of Environmental Conservation

MEMORANDUM

TO: Paul Merges, Director, Bureau of Radiation
FROM: Earl Barcomb, Director, Bureau of Hazardous Site Control
SUBJECT: Emerson Street Phase II Radiation Survey
DATE: NYSDEC Registry ID 828023, T & A Code 1838
February 24, 1989

We have received the draft version of the Phase II report for the referenced project. Included in the report, copied and attached for your review, are the results of the radiological survey and sampling performed as part of the overall investigation. Please review these items and provide comments to be included in our review of the draft Phase II report.

We are working under a deadline for response back to the consultant. Due to this, we need your comments by C.O.B. Friday, March 24, 1989. We would appreciate any effort to assist us in the timely review of this report. I believe Ed Johnson and Steve Zobel of your staff are familiar with this project.

Attachments

bcc: E. Barcomb
M. Komoroske
D. Eaton
File

DE/ch

Mike K
File

15 (12-75)

New York State Department of Environmental Conservation

MEMORANDUM

TO: Earl Barcomb, Director, Bureau of Hazardous Site Control
FROM: Paul S. Merges, Ph.D., Director, Bureau of Radiation PSM
SUBJECT: Emerson Street Phase II Radiation Survey, NYSDEC Registry I.D. 828023, T&A Code 1838
DATE: March 21, 1989

We have reviewed the results of the radiological survey and soil sampling at the Emerson Street Landfill. Based on the information provided, off-site releases of Thorium-232 series radionuclides are unlikely, and any additional sealed sources should have been detected during the traverses of the area.

The Bureau of Radiation has determined that additional soil samples are necessary to confirm the concentration of Th-232 in the soil. The samples should be 500 cc each and must be analyzed via gamma ray spectroscopy utilizing a germanium detector and a multichannel analyzer. Teledyne or Eberline analytical laboratories are recommended to perform the analysis.

MM/jab

cc: Mike Komoroski, BHSC
Ed Johnson
Mike Mason

STATE OF NEW YORK - DEPARTMENT OF HEALTH

INTEROFFICE MEMORANDUM

TO: Dennis Weiss
Bureau of Environmental Exposure Investigation

FROM: William J. Condon, CHP, Chief, Environmental Radiation Section
Bureau of Environmental Radiation Protection

SUBJECT: Emerson Street Landfill Monitoring Results

DATE: May 11, 1989

We reviewed the data attached to your memorandum of April 11, 1989, and concur that additional soil samples are necessary to characterize the Th-232 activity and determine the extent of such activity.

It is also important to note that the samples analyzed were relatively small so that the determination of activity per gram is easily influenced by a small amount of higher activity soil compared to a larger sample where activity 1 gram might be much lower. Gross alpha/beta on soils is not that accurate.

Also, use of a germanium detector is preferred to give better resolution. Analysis should be done for Uranium-238 and Radium-226 as well as Th-232.

Attachment

STATE OF NEW YORK
DEPARTMENT OF HEALTH
Corning Tower The Governor Nelson A. Rockefeller Empire State Plaza Albany, New York 12237

David Axelrod, M.D.
Commissioner

Mr. Barcelo
John S
Mike

RECEIVED
MAY 23 1989
BUREAU OF HAZARDOUS SITE CONTROL
DIVISION OF HAZARDOUS WASTE REMEDIATION

May 12, 1989

Mr. Mike Komoroske
Eastern Investigation Section
Bureau of Hazardous Site Control
NYS Dept. of Environmental Conservation
50 Wolf Road
Albany, New York 12233

RE: Emerson Street Landfill
(C)Rochester, Monroe County
Site ID #828023

Dear Mr. Komoroske:

Attached is a copy of a NYSDOH Bureau of Environmental Radiation Protection Memorandum which discusses the results of the radiological survey and soil sampling conducted by the NYSDEC earlier this year at the Emerson Street landfill. As we discussed in our phone conversation on May 11, 1989, the Health Department is in agreement with the data assessment and recommendations of the DEC Bureau of Radiation as stated in the memorandum from P. Merges, Ph.D. dated March 21, 1989. This memorandum indicates the need for additional soil sampling and analysis to confirm the concentration of Th-232 present in the soils. DOH concurs with the proposed sample size of 500 cc.

Additionally, the DOH believes that the samples should be analyzed for Uranium-238 and Radium-226 in addition to Th-232. These two radionuclides may contribute to the total activity attributed to TH-232, therefore there is a need for specific radioisotope identification. We request that the results of the additional survey and soil sampling be forwarded to our office as they become available.

If you have any questions please call me at 458-6310.

Sincerely,

Dennis R. Weiss

Dennis R. Weiss, P.E.
Sr. Sanitary Engineer
Bureau of Environmental Exposure
Investigation

APPENDIX D

RECRA ENVIRONMENTAL, INC.
SUBSURFACE LOGS
MONITORING WELL CONSTRUCTION DIAGRAMS

BUFFALO DRILLING CO., INC.
LABORATORY GEOTECHNICAL TESTING REPORT

EMERSON STREET LANDFILL #828023

DATE	RECRA ENVIRONMENTAL, INC.	HOLE NO. GW-1
STARTED 8/2/88		SURFACE ELEV. 102.7
FINISHED 8/4/88	SUBSURFACE LOG	G.W. ELEV. 77.85
SHEET 1 OF 1		

PROJECT NYSDEC PHASE II INVESTIGATION SITE #828023

LOCATION EMERSON STREET LANDFILL ROCHESTER, NEW YORK

DEPTH-FT	RECOVERY	SAMPLE TYPE	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	DESCRIPTION	NOTES
	1.0'	SB	1	13	25			Brown SAND and GRAVEL fill, dense, dry occasional cobbles encountered down to bedrock.	Boring advanced with 4-1/4 in. I.D. HSA, truck mounted CME-55 drill rig.
5								Grades to:. . . Very dense.	Auger drilling refused at 6.4 ft. SB-3 from 6.4-6.9 ft. revealed bedrock fragment in sampler. Take 2 ft. core then back into unconsolidated material, resume auger drilling.
	1.8'	SB	2	28	39	26	31		
10	0.5'							[FILL] 10.0'	
	REC 88% RDQ 25%	SB / NX	4 / 2	77				Light to dark gray, fine textured dolomite, numerous horizontal fractures, some show iron staining, intense weathering evident on some fractured surfaces, calcite and gypsum precipitates located on weathered surfaces and vugs.	Auger drilling refusal at 10.0 ft.
15	REC 100% RDQ 44%	NX	3						NX core runs 2-5 drilled on 8/3/88. Rotary drilled with 3-7/8 in. tri-cone bit from 10-28.5 ft. Coring was done with a long ear 5.0 ft. NQ core barrel.
20	REC 98% RDQ 77%	NX	4					At 14.0 ft.: Some drilling fluid return was lost. Water table encountered at approximately 20.5 ft. At 24.0 ft.: Several vertical fractures, possible water producing zone.	Runs 1-3 were drilled using a 58-60 carat drill bit.
25	REC 90% RDQ 68%	NX	5						Runs 4-5 were drilled using a Series 2 drill bit.
								[DOLOMITE BEDROCK] 29.0'	Boring completed at 29.0 ft.
30									Groundwater Elevation taken on 12/16/88.
35									

CLASSIFICATION VISUAL

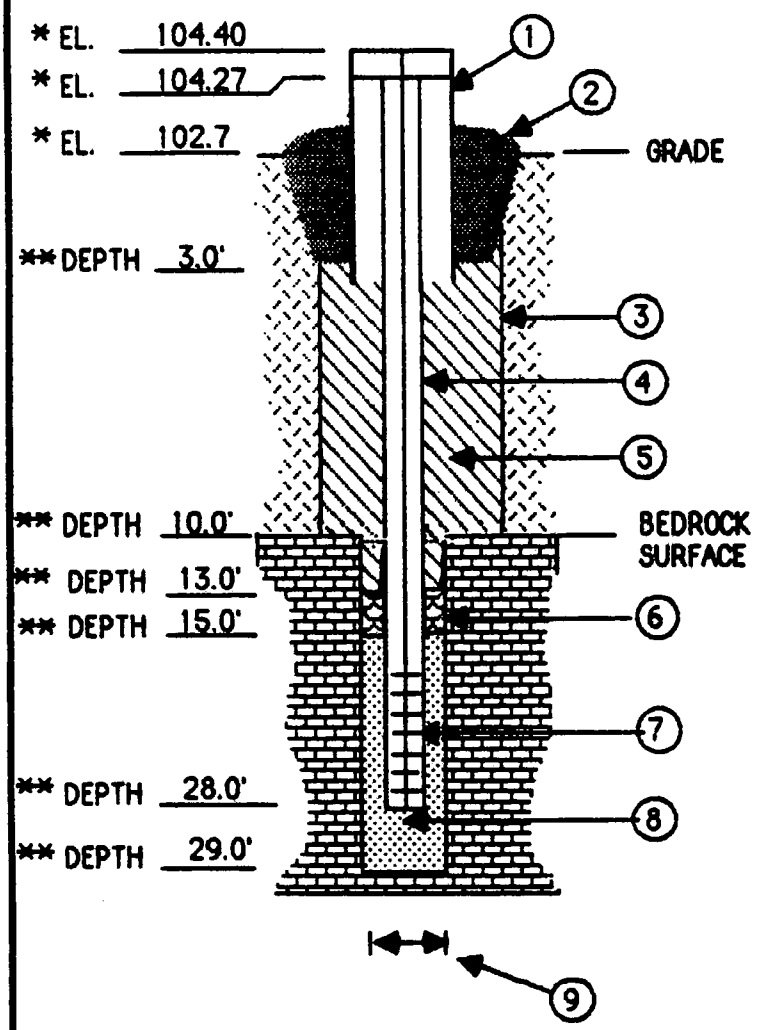
METHOD OF INVESTIGATION ASTM D1586-84, D2113-83

LOG DEVELOPED BY ROBERT STEINER

PB.00214.1

BEDROCK MONITOR WELL CONSTRUCTION DIAGRAM

WELL NO. GW-1
SITE NO. 828023
DATE OF INSTALLATION 8/4/88



1. PROTECTIVE CASING I.D. 4 INCHES
2. SURFACE SEAL TYPE Cement/Sand Mix
3. BOREHOLE DIAMETER 8 INCHES
4. RISER PIPE:
   A. Type Schedule 40 PVC
   B. I.D. 2 INCHES
   C. Length 20 FEET
   D. Joint Type Flush Threaded
5. BACKFILL:
   A. Type Cement/Bentonite Grout
   B. Installation Side discharge tremie
6. TYPE OF SEAL Bentonite Pellets
7. SCREEN
   A. Type Schedule 40 PVC
   B. I.D. 2 INCHES
   C. Slot Size .010 INCHES
   D. Length 10 FEET
8. SCREEN FILTER TYPE No. 3 graded quartzite sand
9. ROCK HOLE DIAMETER 3.9 INCHES

* Ref. Edward O. Watts & Associates, Dwg. No. EJ121188

** Depth in feet below grade.

RECRA ENVIRONMENTAL, INC.	SCALE: NTS	NYSDEC PHASE II INVESTIGATION EMERSON STREET LANDFILL ROCHESTER, NY	BEDROCK MONITOR WELL CONSTRUCTION DIAGRAM	
	BY / DATE			
	DWN. PCB 12/19/88			
	CKD. RES 8/89			
	APPVD.			
	REV.	PROJECT NO. 8C1307A6	A	PB.00213B.1

DATE STARTED 8/18/88 FINISHED 8/19/88 SHEET 1 OF 1	RECRA ENVIRONMENTAL, INC. SUBSURFACE LOG	HOLE NO. GW-2 SURFACE ELEV. 98.2 G.W. ELEV. 74.99

PROJECT NYSDEC PHASE II INVESTIGATION SITE #828023 LOCATION EMERSON STREET LANDFILL ROCHESTER, NEW YORK

DEPTH-FT	RECOVERY	SAMPLE TYPE	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	DESCRIPTION	NOTES
	2.0.'	SB	1	8	16	13	16	Dark brown organic SILT, trace gravel, grading to light brown fine SAND and SILT, dry, medium dense.	Boring advanced with 4 1/4 in. I.D. HSA, truck mounted CME-55 drill rig. Driller - Rocky Baye Assistant - Shawn Penrod
5	2.0'	SB	2	6	10	16	11	At 4.0 ft.: Some gray clay. At 5.0 ft.: Moist.	Augering becomes easier at 2.5 ft.
	1.4'	SB	3	4	8	6	28	[SAND and SILT] 7.5'	HNU = 5-10 ppm on SB-3, possibly due to moisture.
	1.0'	SB	4	50					
10	REC 100% RQD 100%	NX	1					Light gray fine textured dolomite, moderately hard, little weathering, few horizontal fractures, some 4-6" vertical fractures present.	Explosimeter = 0% :LEL ; Geiger Counter = 0 mr/hr. Micro R Meter = 6-8 micro-rem/hr.
15	REC 100% RQD 100%	NX	2					At 12.5 ft.: Few vugs, some light and dark gray mottling. At. 17.5 ft.: Some white precipitate present which is highly reactive to HCl, some yellow precipitate observed which appears to contain sulfur (drilling fluid begins to have a sulfurous odor).	NX core run 1 drilled on 8/18/88. Rotary drilled with 4.5 in. tri-cone bit from 7.5 ft. to 12.5 ft.
20	REC 100% RQD 100%	NX	3					At 19.5 ft.: Encountered water table At 23.0 ft.: Core exhibits increased fracture density and weathering, apparent transmissive zone.	NX core runs 2-4 drilled on 8/19/88. Coring was done using a long ear 5 ft. NQ core barrel. Run 1 was drilled with a 58-60 carat bit.
25	REC 100% RQD 97%	NX	4					[DOLOMITE BEDROCK] 28.0'	Run 2-4 were drilled with a Series 8 bit.
30									Boring completed at 28.0 ft. G.W. elevation taken on 12/16/88.
35									

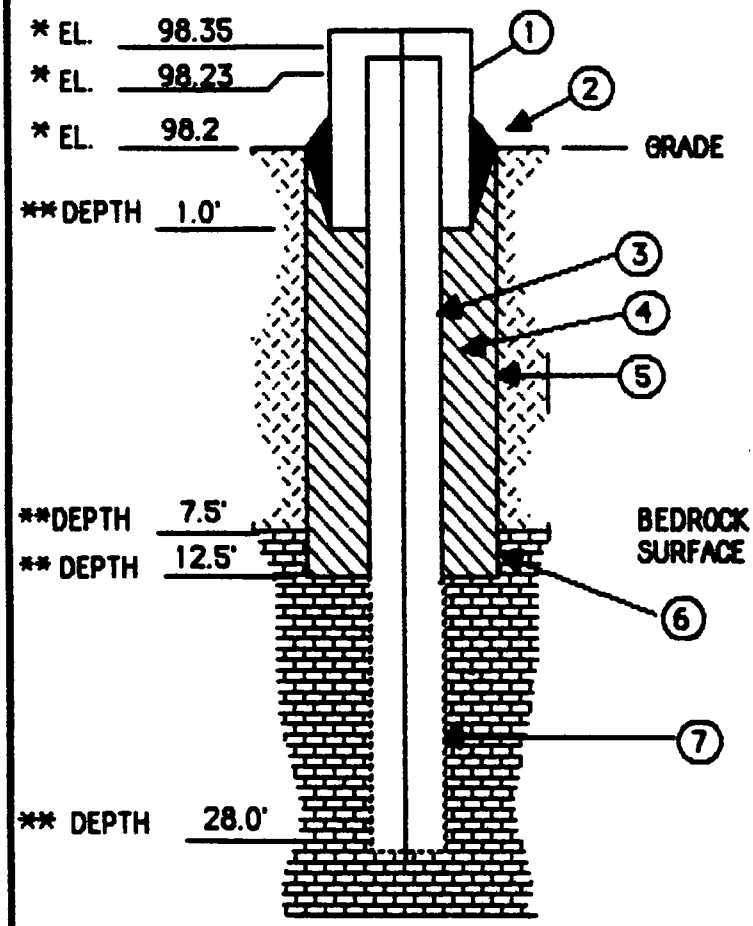
CLASSIFICATION VISUAL METHOD OF INVESTIGATION ASTM D1586-84, D2113-83

LOG DEVELOPED BY ROBERT STEINER

PB.00214.2

BEDROCK MONITOR WELL CONSTRUCTION DIAGRAM

WELL NO. GW-2
SITE NO. 828023
DATE OF INSTALLATION 8/19/88



1. PROTECTIVE CASING I.D. (Curb-box) 6 INCHES
2. SURFACE SEAL TYPE Cement/Sand Mix
3. RISER PIPE:
   A. Type Schedule 40 PVC
   B. I.D. 3 INCHES
   C. Length 13.0 FEET
   D. Joint Type None
4. BACKFILL:
   A. Type Cement/Bentonite Grout
   B. Installation Side discharge tremie
5. BOREHOLE DIAMETER 8 INCHES
6. CASED ROCK HOLE DIAMETER 4.5 INCHES
7. OPEN ROCK HOLE DIAMETER 3 INCHES

* Ref. Edward O. Watts & Associates, Dwg. No. EJ121188

** Depth in feet below grade.

RECRA ENVIRONMENTAL, INC.	SCALE: NTS		NYSDEC PHASE II INVESTIGATION EMERSON STREET LANDFILL ROCHESTER, NY	BEDROCK MONITOR WELL CONSTRUCTION DIAGRAM
		BY / DATE		
	DWN.	PCB 12/19/88		
	CKD.	RSS 8/89		
	APPVD.			
	REV.		PROJECT NO. 8C1307A6	A PB.00213A.1

DATE	RECRA ENVIRONMENTAL, INC.	HOLE NO. GW-3
STARTED 8/5/88	SUBSURFACE LOG	SURFACE ELEV. 109.2
FINISHED 8/8/88		G.W. ELEV. 105.38
SHEET 1 OF 1		

PROJECT NYSDEC PHASE II INVESTIGATION SITE #828023

LOCATION EMERSON STREET LANDFILL ROCHESTER, NEW YORK

DEPTH-FT	RECOVERY	SAMPLE TYPE	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	DESCRIPTION	NOTES
	1.5'	SB	1	2	4	5	7	Brown SILT and SAND, trace clay, little root material, dry, loose.	Boring advanced with 4 1/4 in. I.D. HSA, truck mounted CME-55 drill rig.
5								At 5.3 ft.: Grades to SILT, some sand, trace gravel, moist. At 5.5 ft.: 1-2 in. wet silt layer.	Driller - Rocky Baye Assistant - Shawn Penrod
	1.5'	SB	2	6	11	20	25		
10								At 10.3 ft.: Grades to fine to medium SAND, little clay, trace gravel, moist.	Water level measured at 3.90 ft. on 11/9/88.
	1.4'	SB	3	12	12	44	71		HNU = 0 ppm Explosimeter = 0% LEL Geiger Counter = 0 mr/hr. Micro R meter = 12 micro-rem/hr.
	1.1'	SB	4	13	34	50/.2'		[SILT and SAND] 13.2'	
15	REC 100% RQD 70%	NX	1					Gray, fine textured dolomite, weathered horizontal fractures along bedding surfaces, some mottling, vuggy. White precipitate visible along fractures and in some vugs, slightly to highly reactive to HCl. Hardness ranged from soft to moderately hard depending on the extent of weathering.	Auger drilling refusal at 13.0 ft.
20								[DOLOMITE BEDROCK] 18.5'	NX core run 1 drilled from 13.2 ft. to 18.2 ft. on 8/5/88. Rotary drilled with 3 7/8 in. tri-cone bit from 13.2 ft. to 18.5 ft.
25									Coring was done with a long ear 5 ft. NQ core barrel and a Series 2 bit.
30									Boring Completed at 18.5 ft. G.W. Elevation taken on 12/16/88.
35									

CLASSIFICATION VISUAL

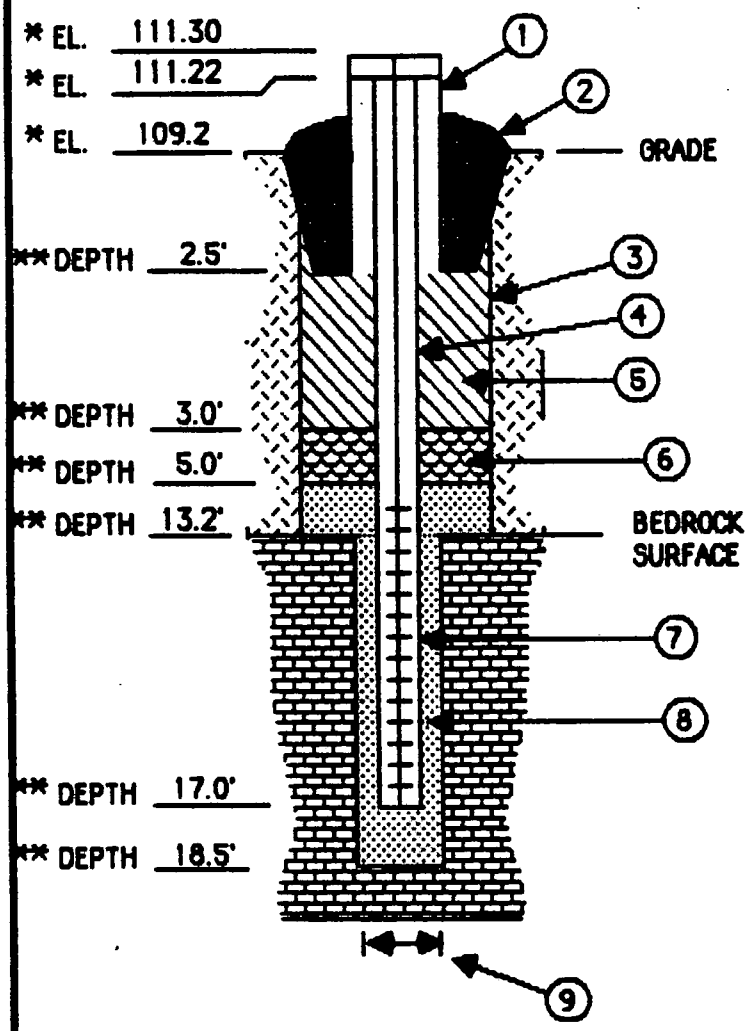
METHOD OF INVESTIGATION ASTM D1586-84, D2113-83

LOG DEVELOPED BY ROBERT STEINER

PB.00214.3

TOP OF ROCK MONITOR WELL CONSTRUCTION DIAGRAM

WELL NO. GW-3
SITE NO. 828023
DATE OF INSTALLATION 8/8/88



* Ref. Edward O. Watts & Associates, Dwg. No. EJ121188

** Depth in feet below grade.

1. PROTECTIVE CASING I.D. 4 INCHES
2. SURFACE SEAL TYPE Cement/Sand Mix
3. BOREHOLE DIAMETER 8 INCHES
4. RISER PIPE:
   - A. Type Schedule 40 PVC
   - B. I.D. 2 INCHES
   - C. Length 9 FEET
   - D. Joint Type Flush Threaded
5. BACKFILL:
   - A. Type Cement/Bentonite Grout
   - B. Installation Side discharge Tremie
6. TYPE OF SEAL Bentonite Pellets
7. SCREEN
   - A. Type Schedule 40 PVC
   - B. I.D. 2 INCHES
   - C. Slot Size .010 INCHES
   - D. Length 10 FEET
8. SCREEN FILTER TYPE No. 3 graded quartzite sand
9. ROCK HOLE DIAMETER 3.9 INCHES

RECRA ENVIRONMENTAL, INC.	SCALE: NTS		NYSDEC PHASE II INVESTIGATION EMERSON STREET LANDFILL ROCHESTER, NY	TOP OF ROCK MONITOR WELL CONSTRUCTION DIAGRAM
		BY / DATE		
	DWN.	PCB 12/19/88		
	CKD.	RES 8/89		
	APPVD.			
	REV.		PROJECT NO. 8C1307A6	A PB.00213.1

DATE STARTED 8/9/88 FINISHED 8/10/88 SHEET 1 OF 1	RECRA ENVIRONMENTAL, INC.	HOLE NO. GW-4 SURFACE ELEV. 107.9 G.W. ELEV. 99.42
	SUBSURFACE LOG	

PROJECT NYSDEC PHASE II INVESTIGATION SITE #828023 LOCATION EMERSON STREET LANDFILL ROCHESTER, NEW YORK

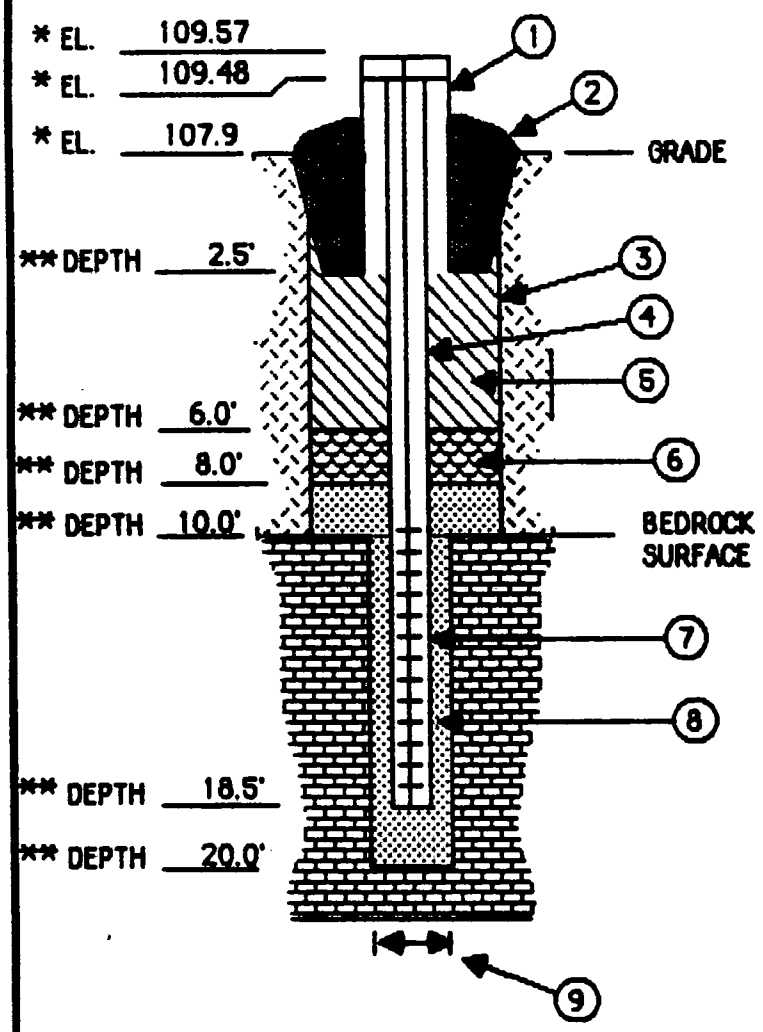
DEPTH-FT	RECOVERY	SAMPLE TYPE	SAMPLE NO	BLOWS ON SAMPLER 0/6 6/12 12/18 18/24		DESCRIPTION	NOTES
	1.5'	SB	1	8 / 16	8 / 12	Light brown SILT and CLAY fill, little to some sand, trace to little gravel, glass, plastic, wood, and paper, dry, loose to medium dense in situ.	Boring advanced with 4 1/4 in. I.D. HSA, truck mounted CME-55 drill rig.
	1.5'	SB	2	6 / 4	5 / 5		Driller - Rocky Baye Assistant - Shawn Penrod
5							
	0.0.'	SB	6	1 / 3	1 / 1	At 8.0 ft.: Wet	HNU = 0 ppm Geiger Counter = 0 mr/hr. Micro R meter = 6-12 micro-rem/hr. Explosimeter = 100% LEL to a depth of about 2.0 ft. Seemed to be gas trapped below plastic liner.
						[FILL] 8.5'	
	1.2'	SB	7	1 / 34	1 / 44	Weathered bedrock zone. 10.0'	
10							
	REC 88% RQD 15%	NX	1			Bedrock: Light gray, fine textured dolomite. Horizontal and vertical fractures, weathering apparent on fractured surfaces, white precipitate visible on fractures and in some vugs, slightly reactive to HCl. Soft to moderately hard depending on extent weathering. Drilling fluid return was lost during entire depth of coring. 20.0'	Auger drilling refusal at 10.0 ft.
15							
	REC 98% RQD 43%	NX	2				NX core run 1 and 2 drilled on 8/9/88. Rotary drilled with 3 7/8 in. tri-cone bit from 10.0 ft. to 20.0 ft. Coring was done with a long ear 5 ft. NQ core barrel and a long ear Series 2 drill bit. Split-barrel samples 3-5 were not included because a new location was needed due to the inability to penetrate the underlying material.
20							
25							
30							Boring Completed at 20.0 ft. G.W. elevation taken on 12/16/88.
35							

CLASSIFICATION VISUAL METHOD OF INVESTIGATION ASTM D1586-84, D2113-83

LOG DEVELOPED BY ROBERT STEINER

TOP OF ROCK MONITOR WELL CONSTRUCTION DIAGRAM

WELL NO. GW-4
SITE NO. 828023
DATE OF INSTALLATION 8/10/88



* Ref. Edward O. Watts & Associates, Dwg. No. EJ121188

** Depth in feet below grade.

1. PROTECTIVE CASING I.D. 4 INCHES
2. SURFACE SEAL TYPE Cement/Sand Mix
3. BOREHOLE DIAMETER 8 INCHES
4. RISER PIPE:
   - A. Type Schedule 40 PVC
   - B. I.D. 2 INCHES
   - C. Length 10 FEET
   - D. Joint Type Flush Threaded
5. BACKFILL:
   - A. Type Cement/Bentonite Grout
   - B. Installation Side discharge Tremie
6. TYPE OF SEAL Bentonite Pellets
7. SCREEN
   - A. Type Schedule 40 PVC
   - B. I.D. 2 INCHES
   - C. Slot Size .010 INCHES
   - D. Length 10 FEET
8. SCREEN FILTER TYPE No. 3 graded quartzite sand
9. ROCK HOLE DIAMETER 3.9 INCHES

RECRA ENVIRONMENTAL, INC.	SCALE: NTS		NYSDEC PHASE II INVESTIGATION EMERSON STREET LANDFILL ROCHESTER, NY	TOP OF ROCK MONITOR WELL CONSTRUCTION DIAGRAM
		BY / DATE		
	DWN.	PCB 12/19/88		
	CKD.	RES 3/89		
	APPVD.			
	REV.		PROJECT NO. 8C1307A6	A PB.00213.2

DATE	RECRA ENVIRONMENTAL, INC.	HOLE NO. GW-5
STARTED 8/11/88		SURFACE ELEV. 96.2
FINISHED 8/12/88	SUBSURFACE LOG	G.W. ELEV. 87.02
SHEET 1 OF 1		

PROJECT NYSDEC PHASE II INVESTIGATION SITE #828023

LOCATION EMERSON STREET LANDFILL ROCHESTER, NEW YORK

DEPTH-FT	RECOVERY	SAMPLE TYPE	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	DESCRIPTION	NOTES
	1.8'	SB	1	6	6	12	18	Light brown SILT, some sand, some gravel, little assorted trash and organic debris, dry, medium dense.	Boring advanced with 4 1/4 in. I.D. HSA, truck mounted CME-55 drill rig. Driller - Rocky Baye Assistant - Shawn Penrod HNU = 1 ppm - SB1-3 Explosimeter = 0% LEL Geiser Counter = 0 mr/hr. Micro R Meter = 6-8 micro-rem/hr. Water level measured at 8.73' on 11/9/88. Auger drilling refusal at 10.0 ft. NX core run 1 drilled from 8.7 ft. - 13.7 ft. on 8/11/88. Rock fragments and cobbles were recovered from 8.7 ft. to 10.0 ft. NX Core run 2 drilled from 13.7 ft. - 18.7 ft. on 8/11/88. Begin to encountter water entering hole at approximately 14.0. Rotary drilled with 3-7/8 in. tri-cone bit from 10.0 ft. to 21.5 ft. Coring was done with a long ear 5 ft. NQ core barrel. Run 1 was drilled with a long ear Series 2 drill bit. Run 2 was drilled with a long ear 58-60 carat drill bit. Boring completed at 21.5 ft. G.W. elevation taken on 12/16/88.
	0.5'	SB	2	7	3	2	2		
5								At 2.0 ft.: Loose in situ.	
	1.5'	SB	3	5	3	4	12	At 6.0 ft.: Little gravel, trash is absent, moist.	
	2.0'	SB	4	10	20	40	21	[FILL] 9.0'	
10								Weathered bedrock zone 10.0'	
	REC 71% RQD 38%	RUN	1					Light gray fine textured dolomite, numerous horizontal fractures, large fracture at 13.2 ft. where drilling fluid was lost. Highly weathered zones from 14.0 ft. to 15.25 ft., slight drilling fluid loss. No precipitate or vugs present. Rock was soft at weathered zones to moderately hard.	
15	REC 100% RQD 64%	RUN	2						
20								[DOLOMITE BEDROCK] 21.5'	
25									
30									
35									

CLASSIFICATION VISUAL

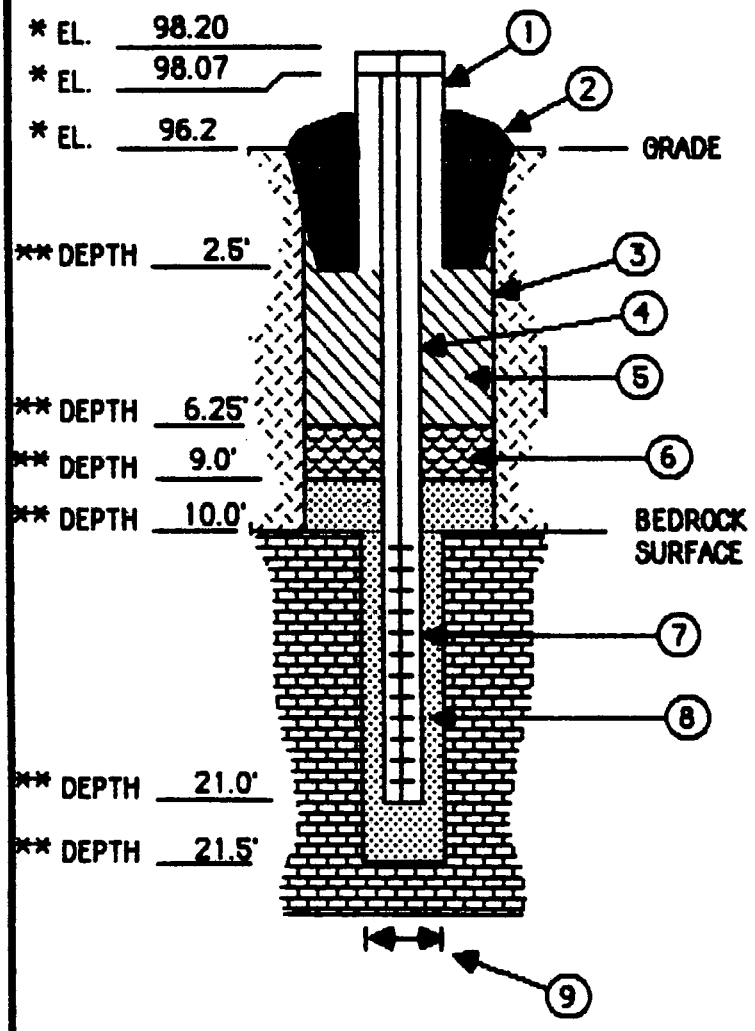
METHOD OF INVESTIGATION ASTM D1586-84, D2113-83

LOG DEVELOPED BY ROBERT STEINER

PB.00214.5

TOP OF ROCK MONITOR WELL CONSTRUCTION DIAGRAM

WELL NO. GW-5
SITE NO. 828023
DATE OF INSTALLATION 8/12/88



1. PROTECTIVE CASING I.D. 4 INCHES
2. SURFACE SEAL TYPE Cement/Sand Mix
3. BOREHOLE DIAMETER 8 INCHES
4. RISER PIPE:
   A. Type Schedule 40 PVC
   B. I.D. 2 INCHES
   C. Length 13 FEET
   D. Joint Type Flush Threaded
5. BACKFILL:
   A. Type Cement/Bentonite Grout
   B. Installation Side discharge Tremie
6. TYPE OF SEAL Bentonite Pellets
7. SCREEN
   A. Type Schedule 40 PVC
   B. I.D. 2 INCHES
   C. Slot Size .010 INCHES
   D. Length 10 FEET
8. SCREEN FILTER TYPE No. 3 graded quartzite sand
9. ROCK HOLE DIAMETER 3.9 INCHES

* Ref. Edward O. Watts & Associates, Dwg. No. EJ121188

** Depth in feet below grade.

RECRA ENVIRONMENTAL, INC.	SCALE: NTS		NYSDEC PHASE II INVESTIGATION EMERSON STREET LANDFILL ROCHESTER, NY	TOP OF ROCK MONITOR WELL CONSTRUCTION DIAGRAM
	BY	DATE		
DWN.	PCB	12/19/88		
CKD.	RSS	8/89		
APPVD.				
REV.			PROJECT NO. 8C1307A6	A PB.00213.3

DATE	RECRA ENVIRONMENTAL, INC.	HOLE NO. GW-6
STARTED 8/16/88		SURFACE ELEV. 99.3
FINISHED 8/17/88	SUBSURFACE LOG	G.W. ELEV. 84.19
SHEET 1 OF 1		

PROJECT NYSDEC PHASE II INVESTIGATION SITE #828023

LOCATION EMERSON STREET LANDFILL ROCHESTER, NEW YORK

DEPTH-FT	RECOVERY	SAMPLE TYPE	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	DESCRIPTION	NOTES
	1.8'	SB	1	5	30	27	27	Light brown fine SAND and SILT, trace gravel, dry, grades to brown-gray and becomes dense at 0.5 ft.	Boring advanced with 4 1/4 in. I.D. HSA, truck mounted CME-55 drill rig. Driller - Rocky Baye Assistant - Shawn Penrod HNU = 0 ppm Explosimeter = 0% LEL Geiger Counter = 0 mr/hr. Micro R Meter = 6-8 micro-rem/hr.
5	1.2'	SB	2	5	2	50/.2		At 5.0 ft.: Gray-black SILT, some clay, grading to brown SILT, some sand, very dense, moist at approximately 5.5 ft. [SILT and SAND] 9.0'	
10	0.4'	SB	3	50				Upper 0.5' highly fractured, penetrated by split barrel sampler. Light gray fine textured dolomite, many horizontal and vertical fractures. Some show intense weathering and rock is quite crumbly. Drilling is much easier than in wells towards the South and West, rock is considerably softer and more weathered. Few vugs are present. Water table located at approximately 14.5'. Drilling fluid return was lost during the entire length of Coring.	Auger drilling refusal at 9.0 ft. NX core run 1 and 2 drilled on 8/16/88 NX core run 3 drilled on 8/17/88 Coring done with a long ear 5.0 ft. NQ core barrel and a 58-60 carat bit. Rotary drilled with a 3-7/8 in. tri-cone bit from 9.0 ft. - 23.7 ft.
	REC 90% RQD 0%	NX	1						
15	REC 96% RQD 8%	NX	2						
20	REC 97% RQD 8%	NX	3					[DOLOMITE BEDROCK] 23.7'	
25									Boring completed at 23.7 ft. G.W. elevation taken on 12/16/88.
30									
35									

CLASSIFICATION VISUAL

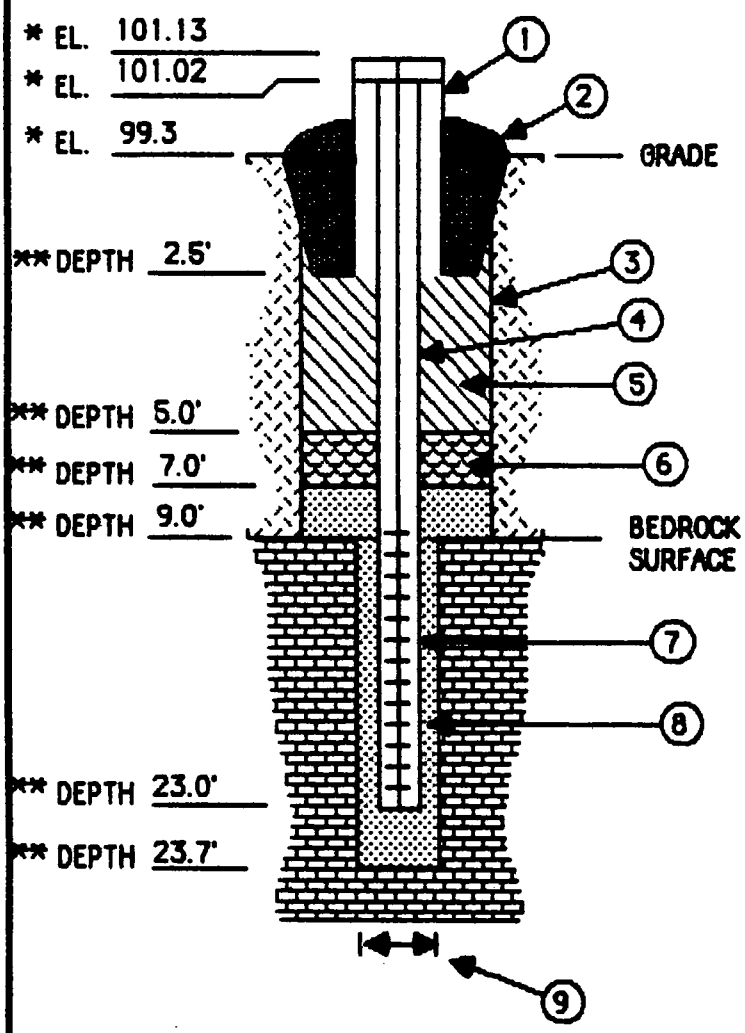
METHOD OF INVESTIGATION ASTM D1586-84, D2113-83

LOG DEVELOPED BY ROBERT STEINER

PB.00214.6

TOP OF ROCK MONITOR WELL CONSTRUCTION DIAGRAM

WELL NO. GW-6
SITE NO. 828023
DATE OF INSTALLATION 8/17/88



1. PROTECTIVE CASING I.D. 4 INCHES
2. SURFACE SEAL TYPE Cement/Sand Mix
3. BOREHOLE DIAMETER 8 INCHES
4. RISER PIPE:
   A. Type Schedule 40 PVC
   B. I.D. 2 INCHES
   C. Length 9.5 FEET
   D. Joint Type Flush Threaded
5. BACKFILL:
   A. Type Cement/Bentonite Grout
   B. Installation Side discharge Tremie
6. TYPE OF SEAL Bentonite Pellets
7. SCREEN
   A. Type Schedule 40 PVC
   B. I.D. 2 INCHES
   C. Slot Size .010 INCHES
   D. Length 15 FEET
8. SCREEN FILTER TYPE No. 3 graded quartzite sand
9. ROCK HOLE DIAMETER 3.9 INCHES

* Ref. Edward O. Watts & Associates, Dwg. No. EJ121188

** Depth in feet below grade.

RECRA ENVIRONMENTAL, INC.	SCALE: NTS		NYSDEC PHASE II INVESTIGATION EMERSON STREET LANDFILL ROCHESTER, NY	TOP OF ROCK MONITOR WELL CONSTRUCTION DIAGRAM
		BY / DATE		
	DWN.	PCB 12/19/88		
	CKD.	R&S 8/89		
	APPVD.			
	REV.		PROJECT NO. 8C1307A6	A / PB.00213.4

DATE	RECRA ENVIRONMENTAL, INC.	HOLE NO. GW-7
STARTED 8/15/88		SURFACE ELEV. 100.6
FINISHED 8/16/88	SUBSURFACE LOG	G.W. ELEV. 88.02
SHEET 1 OF 1		

PROJECT NYSDEC PHASE II INVESTIGATION
SITE #828023

LOCATION EMERSON STREET LANDFILL
ROCHESTER, NEW YORK

DEPTH-FT	RECOVERY	SAMPLE TYPE	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	DESCRIPTION	NOTES
	1.5'	SB	1	6	17	11	4	Light brown SAND and GRAVEL fill, little glass, metal and ash, dry, medium dense. [FILL] 4.0'	Boring advanced with 4 1/4 in. I.D. HSA, truck mounted CME-55 drill rig.
5	2.0'	SB	2	10	14	16	23	Brown SILT, some sand, little red sandstone gravel, dry, medium dense to dense	Driller - Rocky Baye Assistant - Shawn Penrod
	1.7'	SB	3		8	18	50	At 5.5. ft.: Moist [SILT] 9.0'	Transition approximated at 4.0 ft. by auger drilling resistance and inspection of cuttings.
10	0.4'	SB	4	50				Weathered bedrock zone 10.0'	
	REC 93% RQD 15%	NX	1					Gray dolomite, many horizontal fractures, two short vertical fractures perpendicular to bedding surfaces, Rock is soft at weathered surfaces to moderately hard. Numerous vugs, some containing white precipitate highly reactive to HCl. Slight drilling fluid loss during run 2. Water Table encountered at approximately 13.5 ft. [DOLOMITE BEDROCK] 19.5'	HNU = Only reading was 2ppm in Augers at 9.5 ft. Explosimeter = 0% LEL Geiger Counter = 0 mr/hr. Micro R meter = 4-6 micro-rem/hr. Auger drilling refusal at 10.0 ft. after run 1
15	REC 89% RQD 24%	NX	2						NX core run 1 drilled from 9.5 ft. to 14.5 ft. on 8/15/88. NX core run 2 drilled from 14.5 ft. to 17.5 ft. on 8/15/88. Coring was done with a long ear 5 ft. NQ core barrel and a 58-60 caret bit. Rotary drilled with a 3-7/8 in. tri-cone bit from 10.0 ft. to 19.5 ft.
20									
25									
30									Boring completed at 19.5 ft. G.W. elevation taken on 12/16/88.
35									

CLASSIFICATION VISUAL

METHOD OF INVESTIGATION ASTM D1586-84, D2113-83

LOG DEVELOPED BY ROBERT STEINER

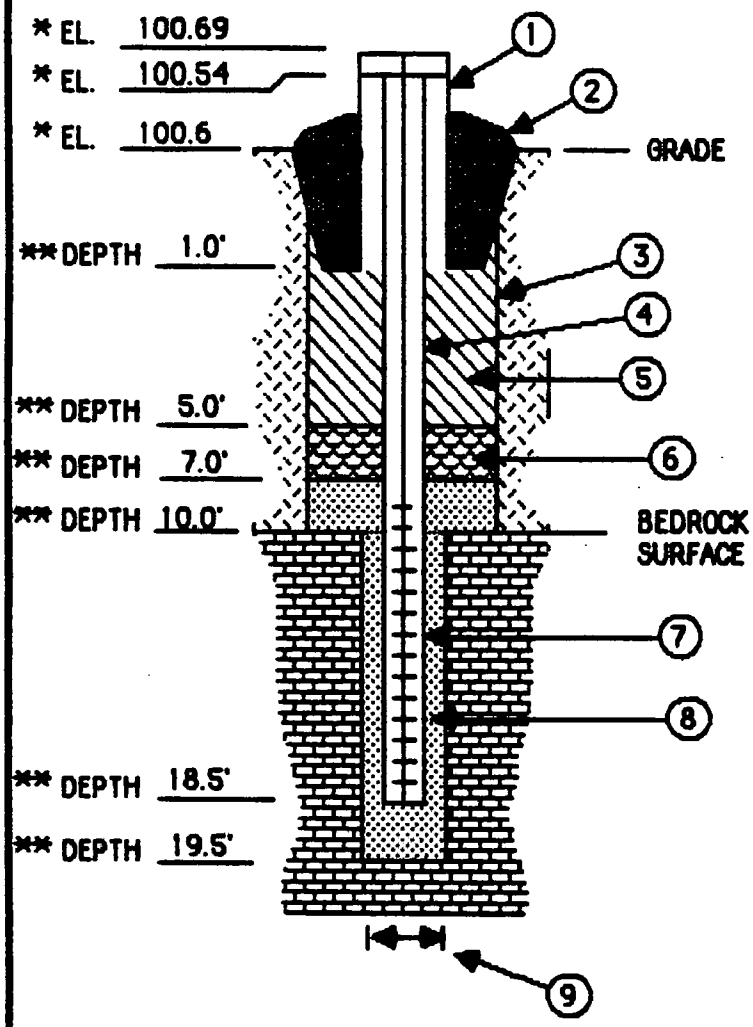
PB.00214.7

TOP OF ROCK MONITOR WELL CONSTRUCTION DIAGRAM

WELL NO. GW-7

SITE NO. 828023

DATE OF INSTALLATION 8/16/88



1. PROTECTIVE CASING I.D. (Curb-box) 6 INCHES
2. SURFACE SEAL TYPE Cement/Sand Mix
3. BOREHOLE DIAMETER 8 INCHES
4. RISER PIPE:
   - A. Type Schedule 40 PVC
   - B. I.D. 2 INCHES
   - C. Length 9 FEET
   - D. Joint Type Flush Threaded
5. BACKFILL:
   - A. Type Cement/Bentonite Grout
   - B. Installation Side discharge Tremie
6. TYPE OF SEAL Bentonite Pellets
7. SCREEN
   - A. Type Schedule 40 PVC
   - B. I.D. 2 INCHES
   - C. Slot Size .010 INCHES
   - D. Length 10 FEET
8. SCREEN FILTER TYPE No. 3 graded quartzite sand
9. ROCK HOLE DIAMETER 3.9 INCHES

* Ref. Edward O. Watts & Associates, Dwg. No. EJ121188

** Depth in feet below grade.

RECRA ENVIRONMENTAL, INC.	SCALE: NTS		NYSDEC PHASE II INVESTIGATION EMERSON STREET LANDFILL ROCHESTER, NY	TOP OF ROCK MONITOR WELL CONSTRUCTION DIAGRAM
		BY / DATE		
	DWN.	PCB 12/19/88		
	CKD.	RES 8/89		
	APPVD.			
	REV.		PROJECT NO. 8C1307A6	A PB.00213.5

DATE	RECRA ENVIRONMENTAL, INC.	HOLE NO. GW-8D
STARTED 8/30/88		SURFACE ELEV. 96.5
FINISHED 9/1/88	SUBSURFACE LOG	G.W. ELEV. 92.25
SHEET 1 OF 1		

PROJECT NYSDEC PHASE II INVESTIGATION SITE #828023 LOCATION EMERSON STREET LANDFILL ROCHESTER, NEW YORK

DEPTH-FT	RECOVERY	SAMPLE TYPE	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	DESCRIPTION	NOTES
	1.7'	SB	1	2	9	28	50/.3'	Brown SAND and SILT, little clay, moist, dense. Grades to brown-gray SAND, trace gravel. At 6 to 6.5 ft. brown, fine SAND, trace red sandstone gravel, saturated. [SAND] 7.0'	Boring advanced with 4-1/4 in. I.D. HSA, truck mounted CME-55 drill rig. Driller - Lee Penrod Assistant - Shawn Penrod HNU = 0 ppm Geiger Counter = 0 mr/hr. Micro R Meter = 6-8 micro-rem/hr. Explosimeter = 0% LEL Auger drilling refusal at 7.0 ft. NX core run 1 and 2 drilled on 8/31/88. NX core run 3 and 4 drilled on 9/1/88. Rotary drilled with 4-1/2 in. tri-cone bit from 7 ft.- 14ft. Coring was done with a long ear 5 ft./NQ core barrel and a Series 8 bit.
5	1.3'	SB	2	18	33	23	22		
10	REC 93% RQD 24%	NX	1					Gray, fine textured dolomite, many horizontal fractures. Rust staining on fractures at 8.5 ft. Some vertical fractures to 14 ft. Few small vugs present. Rock becomes less fractured and moderately hard with depth. Slight drilling fluid loss during Run 3.	
	REC 100% RQD 73%	NX	2						
15	REC 98% RQD 66%	NX	3						
20	REC 99% RQD 85%	NX	4					[DOLOMITE BEDROCK] 24.0'	
25									Boring Completed at 24.0 ft. G.W. elevation taken on 12/16/88.
30									
35									

CLASSIFICATION VISUAL METHOD OF INVESTIGATION ASTM D1586-84, D2113-83

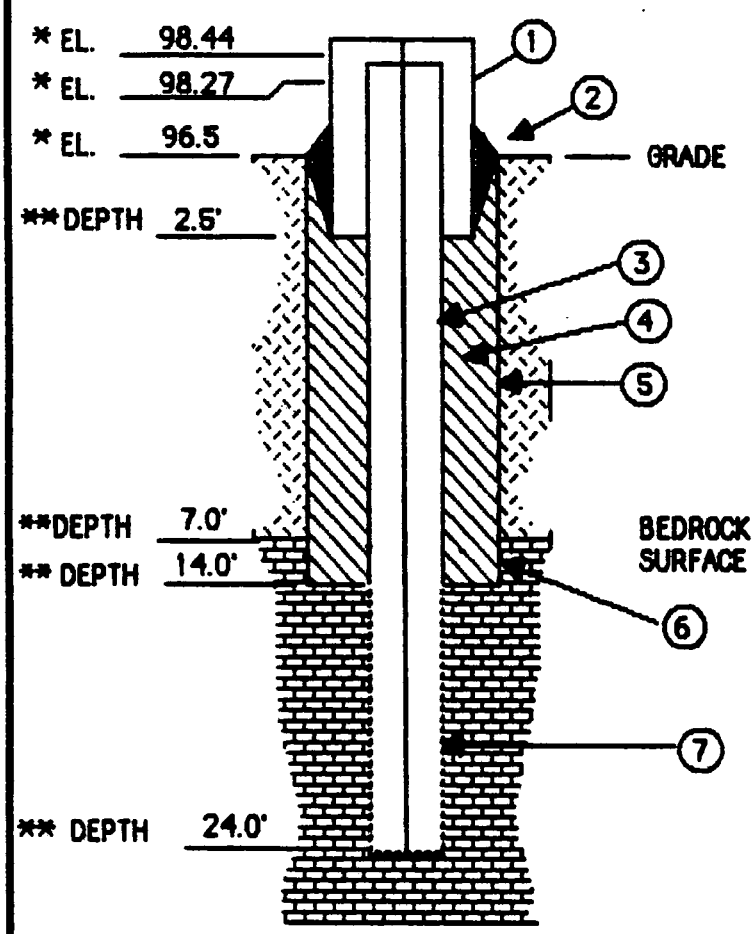
LOG DEVELOPED BY ROBERT STEINER

PB.00214.8D

BEDROCK MONITOR WELL CONSTRUCTION DIAGRAM

WELL NO. GW-8D
SITE NO. 828023
DATE OF INSTALLATION 8/30-9/1/88

1. PROTECTIVE CASING I.D. 4 INCHES
2. SURFACE SEAL TYPE Cement/Sand Mix
3. RISER PIPE:
   A. Type Schedule 40 PVC
   B. I.D. 3 INCHES
   C. Length 16 FEET
   D. Joint Type None
4. BACKFILL:
   A. Type Cement/Bentonite Grout
   B. Installation Side discharge tremie
5. BOREHOLE DIAMETER 8 INCHES
6. CASED ROCK HOLE DIAMETER 4.5 INCHES
7. OPEN ROCK HOLE DIAMETER 3 INCHES



* Ref. Edward O. Watts & Associates, Dwg. No. EJ121188

** Depth in feet below grade.

RECRA ENVIRONMENTAL, INC.	SCALE: NTS		NYSDEC PHASE II INVESTIGATION EMERSON STREET LANDFILL ROCHESTER, NY	BEDROCK MONITOR WELL CONSTRUCTION DIAGRAM
		BY / DATE		
	DWN.	PCB 12/19/88		
	CKD.	RES 5/89		
	APPVD.			
	REV.		PROJECT NO. 8C1307A6	A PB.00213A.2

DATE STARTED 9/1/88 FINISHED 9/2/88 SHEET 1 OF 1	RECRA ENVIRONMENTAL, INC. SUBSURFACE LOG	HOLE NO. GW-8S SURFACE ELEV. 96.0 G.W. ELEV. 92.24

PROJECT NYSDEC PHASE II INVESTIGATION SITE #828023 LOCATION EMERSON STREET LANDFILL ROCHESTER, NEW YORK

DEPTH-FT	RECOVERY	SAMPLE TYPE	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	DESCRIPTION	NOTES
5								Brown SAND and SILT, little clay, moist, dense. Grades to brown-gray SAND, trace gravel. At 6 to 6.5 ft. brown, fine SAND, trace red sandstone gravel, saturated.	Boring advanced with 4-1/4 in. I.D. HSA, truck mounted CME-55 drill rig. Driller - Lee Penrod Assistant - Shawn Penrod HNU = 0 ppm Explosimeter = 0% LEL Geiger Counter = 0 mr/hr. Micro R Meter = 6-8 micro-rem/hr. Auger drilling refusal at 7.0 ft. NX core run 1 drilled on 9/1/88. Coring was done with a long ear 5 ft. NQ core barrel and a Series 8 bit. Rotary drilled with 3-7/8 in. tri-cone bit from 7 ft. to 12.0 ft. Boring Completed at 12.0 ft. G.W. elevation taken on 12/16/88.
	1.8'	SB	1	10	9	10	12	[SAND] 7.0'	
10	REC 95% RQD 40%	NX	1					Light gray fine textured dolomite. Numerous horizontal fractures. Fractures at 7.5 and 8.5 ft. show dark rust staining. Other fractures show weathering and some white precipitate. Rock is soft to moderately hard near end of core.	
15								[DOLOMITE BEDROCK] 12.0'	
20									
25									
30									
35									

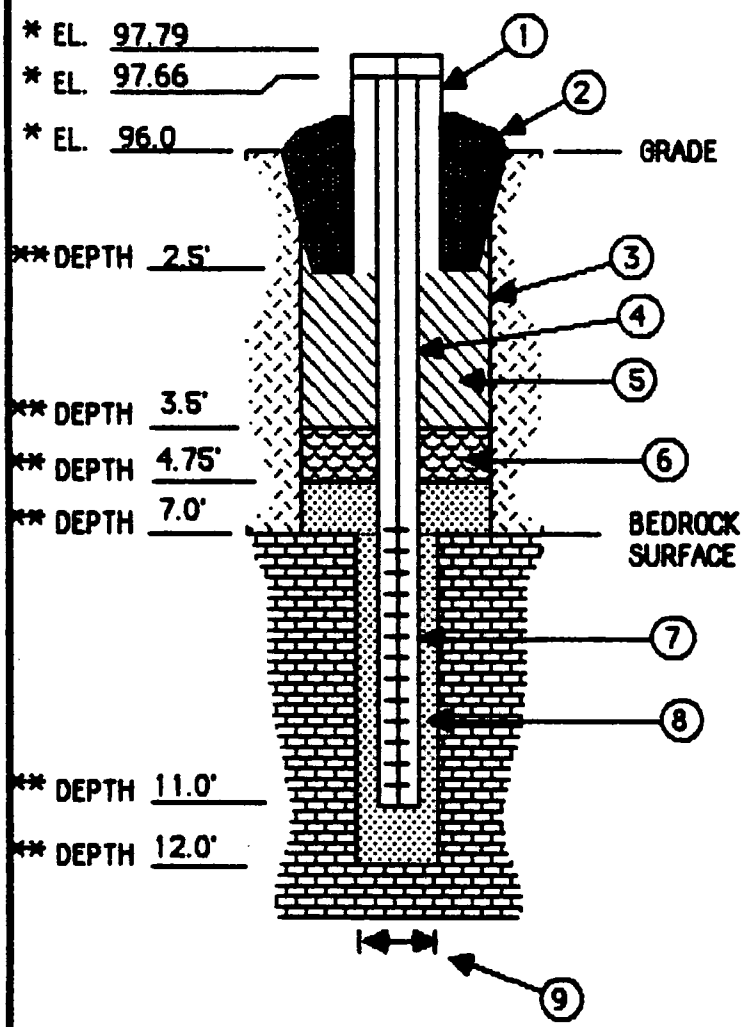
CLASSIFICATION VISUAL METHOD OF INVESTIGATION ASTM D1586-84, D2113-83

LOG DEVELOPED BY ROBERT STEINER

PB.00214.8S

TOP OF ROCK MONITOR WELL CONSTRUCTION DIAGRAM

WELL NO. GW-8S
SITE NO. 828023
DATE OF INSTALLATION 9/2/88



1. PROTECTIVE CASING I.D. 4 INCHES
2. SURFACE SEAL TYPE Cement/Sand Mix
3. BOREHOLE DIAMETER 8 INCHES
4. RISER PIPE:
   A. Type Schedule 40 PVC
   B. I.D. 2 INCHES
   C. Length 8 FEET
   D. Joint Type Flush Threaded
5. BACKFILL:
   A. Type Cement/Bentonite Grout
   B. Installation Side discharge Tremie
6. TYPE OF SEAL Bentonite Pellets
7. SCREEN
   A. Type Schedule 40 PVC
   B. I.D. 2 INCHES
   C. Slot Size .010 INCHES
   D. Length 5 FEET
8. SCREEN FILTER TYPE No. 2 graded quartzite sand
9. ROCK HOLE DIAMETER 3.9 INCHES

* Ref. Edward O. Watts & Associates, Dwg. No. EJ121188

** Depth in feet below grade.

RECRA ENVIRONMENTAL, INC	SCALE: NTS		NYSDEC PHASE II INVESTIGATION EMERSON STREET LANDFILL ROCHESTER, NY	TOP OF ROCK MONITOR WELL CONSTRUCTION DIAGRAM
		BY / DATE		
	DWN.	PCB 12/19/88		
	CKD.	RES 8/89		
	APPVD.			
	REV.		PROJECT NO. 8C1307A6	A PB.00213.6

DATE	RECRA ENVIRONMENTAL, INC.	HOLE NO. GW-9
STARTED 8/22/88		SURFACE ELEV. 100.2
FINISHED 8/24/88	SUBSURFACE LOG	G.W. ELEV. 84.11
SHEET 1 OF 1		

PROJECT NYSDEC PHASE II INVESTIGATION SITE #828023

LOCATION EMERSON STREET LANDFILL ROCHESTER, NEW YORK

DEPTH-FT	RECOVERY	SAMPLE TYPE	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	DESCRIPTION	NOTES
	1.25'	SB	1	7	10	32	50/.1'	Brown SILT, some sand, some gravel, occasional cobble and boulder sized sandstone and dolomite rock fragments, dry, dense	Boring advanced with 4-1/4 in. I.D. HSA, truck mounted CME-55 drill rig.
5	REC 79% RQD 14%	NX	1					[SILT with Rock FRAGMENTS] 5.0'	Driller - Lee Penrod Assistant - Shawn Penrod
10	REC 99% RQD 12%	NX	2					Gray fine textured dolomite, highly fractured, fractures oriented horizontally, vertically and at 45 degrees to coring axis. Rock is soft to moderately hard depending on extent of weathering. Rust staining on fractured surfaces at 8.0 ft. Some mottling beginning at 9.5 ft. At 10.0 ft.: Vuggy with small amount of white precipitate.	HNU = a reading of 2-3 ppm was observed over the drilling fluid during run 3. Explosimeter = 0 % LEL Geiger Counter = 0 mr/hr. Micro R Meter = 5-7 micro-rem/hr. Auger drilling refusal at 5.0 ft.
15	REC 100% RQD 10%	NX	3					Water table encountered at approximately 15.0 ft.	NX core run 1 drilled on 8/22/88. NX core run 2-5 drilled on 8/23/88.
20	REC 93% RQD 52%	NX	4					At 21 ft.: Begin to lose some drilling fluid. From 22 ft. to 27 ft.: Weathering decreases and rock is less fractured.	Coring was done with a long ear 5 ft. NQ core barrel and a Series 8 bit. Rotary drilled with a 3-7/8 in. tri-cone bit from 5.0 to 26.0 ft.
25	REC 99% RQD 58%	NX	5					[DOLOMITE BEDROCK] 27.0'	Boring completed at 27.0 ft.
30									G.W. elevation taken on 12/16/88.
35									

CLASSIFICATION VISUAL

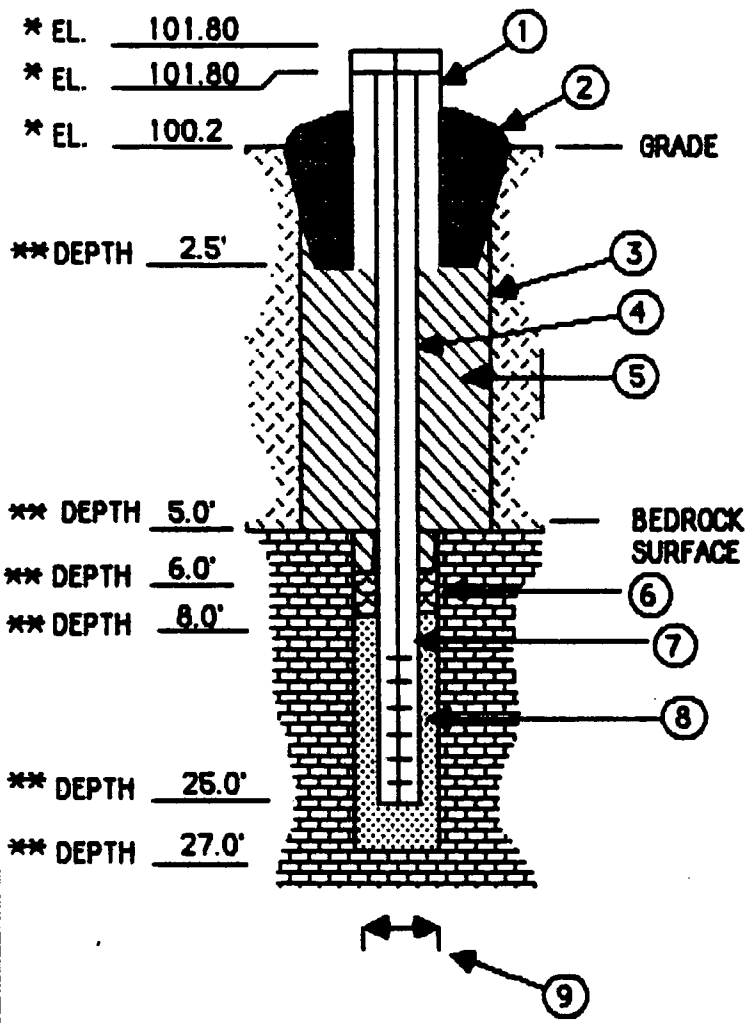
METHOD OF INVESTIGATION ASTM D1586-84, D2113-83

LOG DEVELOPED BY ROBERT STEINER

PB.00214.9

BEDROCK MONITOR WELL CONSTRUCTION DIAGRAM

WELL NO. GW-9
SITE NO. 828023
DATE OF INSTALLATION 8/24/88



1. PROTECTIVE CASING I.D. 4 INCHES
2. SURFACE SEAL TYPE Cement/Sand Mix
3. BOREHOLE DIAMETER 8 INCHES
4. RISER PIPE:
   A. Type Schedule 40 PVC
   B. I.D. 2 INCHES
   C. Length 12 FEET
   D. Joint Type Flush Threaded
5. BACKFILL:
   A. Type Cement/Bentonite Grout
   B. Installation Side discharge tremie
6. TYPE OF SEAL Bentonite Pellets
7. SCREEN
   A. Type Schedule 40 PVC
   B. I.D. 2 INCHES
   C. Slot Size .010 INCHES
   D. Length 15 FEET
8. SCREEN FILTER TYPE No. 2 graded quartzite sand
9. ROCK HOLE DIAMETER 3.9 INCHES

* Ref. Edward O. Watts & Associates, Dwg. No. EJ121188

** Depth in feet below grade.

RECRA ENVIRONMENTAL, INC.	SCALE: NTS		NYSDEC PHASE II INVESTIGATION EMERSON STREET LANDFILL ROCHESTER, NY	BEDROCK MONITOR WELL CONSTRUCTION DIAGRAM
		BY / DATE		
	DWN.	PCB 12/19/88		
	CKD.	DES 8/89		
	APPVD.			
	REV.		PROJECT NO. 8C1307A6	A PB.002138.2

DATE STARTED 8/25/88 FINISHED 8/29/88 SHEET 1 OF 1	RECRA ENVIRONMENTAL, INC. SUBSURFACE LOG	HOLE NO. GW-10D SURFACE ELEV. 99.3 G.W. ELEV. 96.45

PROJECT NYSDEC PHASE II INVESTIGATION SITE #828023 LOCATION EMERSON STREET LANDFILL ROCHESTER, NEW YORK

DEPTH-FT	RECOVERY	SAMPLE TYPE	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	DESCRIPTION	NOTES
								Black organic SILT some brown-gray clay, dry. Grades to brown medium SAND, moist.	Boring advanced with 4 1/4 in. I.D. HSA, truck mounted CME-55 drill rig. Driller - Lee Penrod Assistant - Shawn Penrod
5	1.3'	SB	1	19	21	19	15	At 6.0 ft.: Fine SAND, well graded, saturated. At 7.5 ft.: Some silt, trace gravel.	
	0.8'	SB	2	31	48			[SAND, SILT, and CLAY] 8.0'	HNU = 0 ppm Explosimeter = 0% LEL Geiger Counter = 0 mr/hr. Micro R Meter = 6-7 micro-rem/hr.
	0.6'	SB	3	50/.3'	13	50/.1'			
10	REC 94% RQD 48%	NX	1					Gray fine textured dolomite, numerous horizontal fractures, few vertical fractures to 4 in. Numerous vuggy zones, intense weathering at some fractured areas. White precipitate present in some vugs and on some fractured surfaces. Rock gets harder with depth except for areas of intense weathering.	Auger drilling refusal at 8.0 ft.
15	REC 100% RQD 58%	NX	2					Some drilling fluid loss at 13-14 ft.	Rotary drilled with 4 1/2 in. tri-cone bit from 8 ft. to 10 ft. Then core NX-1 from 10 ft. to 14 ft. and finish rotary drilling to 14 ft. on 8/26/88.
20	REC 98% RQD 79%	NX	3					[DOLOMITE BEDROCK] 13.0'	NX core run 2 &3 drilled on 8/29/88. Coring was done with a long ear 5 ft. NQ core barrel and a Series 8 bit.
25									Boring completed at 24.0 ft.
30									G.W. elevation taken on 12/16/88.
35									

CLASSIFICATION VISUAL METHOD OF INVESTIGATION ASTM D1586-84, D2113-83

LOG DEVELOPED BY ROBERT STEINER

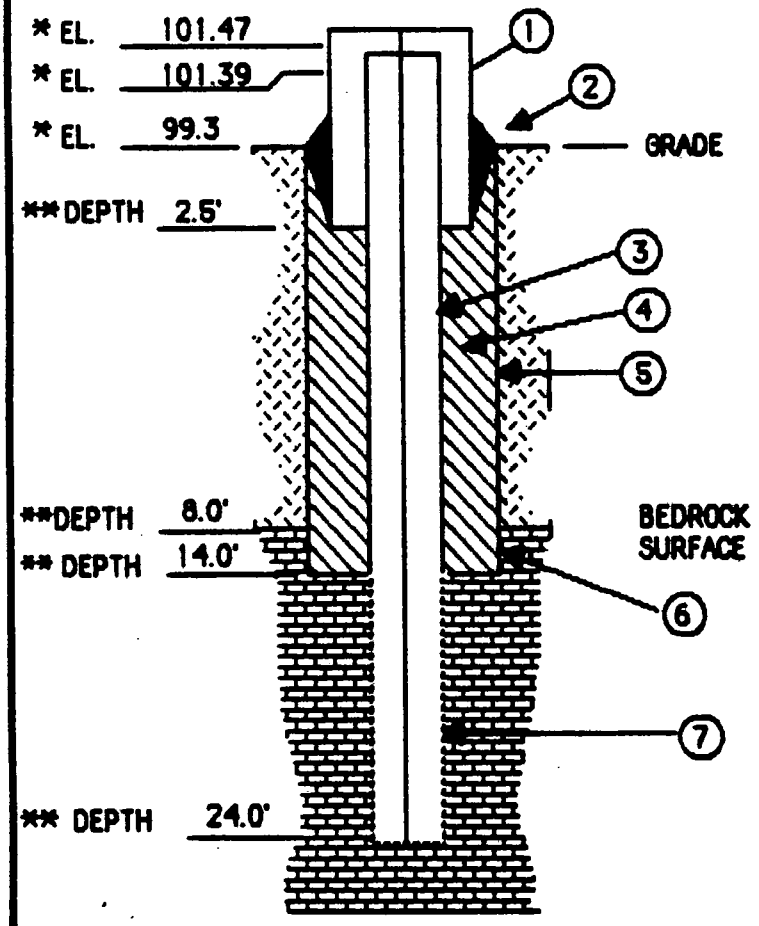
PB.00214.10D

BEDROCK MONITOR WELL CONSTRUCTION DIAGRAM

WELL NO. GW-10D

SITE NO. 828023

DATE OF INSTALLATION 8/26-8/29/88



1. PROTECTIVE CASING I.D. (Curb-box) 4 INCHES
2. SURFACE SEAL TYPE Cement/Sand Mix
3. RISER PIPE:
   A. Type Schedule 40 PVC
   B. I.D. 3 INCHES
   C. Length 15 FEET
   D. Joint Type None
4. BACKFILL:
   A. Type Cement/Bentonite Grout
   B. Installation Side discharge tremie
5. BOREHOLE DIAMETER 8 INCHES
6. CASED ROCK HOLE DIAMETER 4.5 INCHES
7. OPEN ROCK HOLE DIAMETER 3 INCHES

* Ref. Edward O. Watts & Associates, Dwg. No. EJ121188

** Depth in feet below grade.

RECRA ENVIRONMENTAL, INC	SCALE: NTS		NYSDEC PHASE II INVESTIGATION EMERSON STREET LANDFILL ROCHESTER, NY	BEDROCK MONITOR WELL CONSTRUCTION DIAGRAM
		BY / DATE		
	DWN.	PCB 12/19/88		
	CKD.	RES 8/89		
	APPVD.			
	REV.		PROJECT NO. 8C1307A6	A PB.00213A.3

DATE STARTED 8/24/88 FINISHED 8/25/88 SHEET 1 OF 1	RECRA ENVIRONMENTAL, INC. SUBSURFACE LOG	HOLE NO. GW-10S SURFACE ELEV. 99.1 G.W. ELEV. 96.68

PROJECT NYSDEC PHASE II INVESTIGATION SITE #828023 LOCATION EMERSON STREET LANDFILL ROCHESTER, NEW YORK

DEPTH-FT	RECOVERY	SAMPLE TYPE	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	DESCRIPTION	NOTES
	1.0'	SB	1	3	7	7	6	Black organic SILT some brown-gray clay, dry. Grades to brown medium SAND, moist.	Boring advanced with 4 1/4 in. I.D. HSA, truck mounted CME-55 drill rig.
5	1.3'	SB	2	6	9	16	28	At 6.0 ft.: Fine SAND, well graded, saturated. At 7.5 ft.: Some silt, trace gravel. [SAND, SILT and CLAY] 8.0'	Driller - Lee Penrod Assistant - Shawn Penrod
10	REC 100% RQD 63%	NX	1					Gray, fine textured dolomite, soft to moderately hard. Numerous horizontal and vertical fractures. Becomes vuggy at 10.0 ft. Mottling starts at about 11.5 ft. Becomes highly weathered and soft near base. [DOLOMITE BEDROCK] 13.0'	HNU = 0 ppm Explosimeter = 0% LEL Geiger Counter = 0 mr/hr. Micro R Meter = 6-8 micro-rem/hr. Auger drilling refusal at 8.0 ft. NX core run 1 drilled on 8/24/88.
15									Coring was done with a long ear 5 ft. NQ core barrel and a Series 8 bit.
20									Rotary drilled with a 3-7/8 in. tri-cone bit from 8-13 ft.
25									Boring completed at 13.0 ft.
30									G.W. elevation taken on 12/16/88.
35									

CLASSIFICATION VISUAL METHOD OF INVESTIGATION ASTM D1586-84, D2113-83

LOG DEVELOPED BY ROBERT STEINER

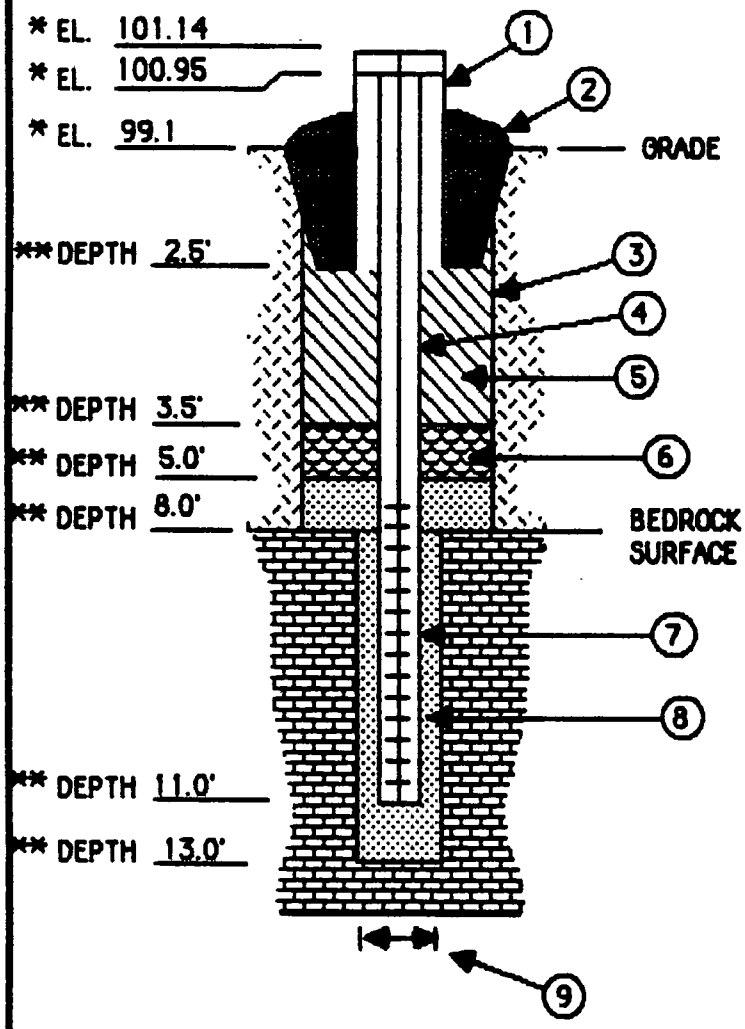
PB.00214.10S

TOP OF ROCK MONITOR WELL CONSTRUCTION DIAGRAM

WELL NO. GW-10S

SITE NO. 828023

DATE OF INSTALLATION 8/25/88



* Ref. Edward O. Watts & Associates, Dwg. No. EJ121188

** Depth in feet below grade.

1. PROTECTIVE CASING I.D. 4 INCHES
2. SURFACE SEAL TYPE Cement/Sand Mix
3. BOREHOLE DIAMETER 8 INCHES
4. RISER PIPE:
   - A. Type Schedule 40 PVC
   - B. I.D. 2 INCHES
   - C. Length 8 FEET
   - D. Joint Type Flush Threaded
5. BACKFILL:
   - A. Type Cement/Bentonite Grout
   - B. Installation Side discharge Tremie
6. TYPE OF SEAL Bentonite Pellets
7. SCREEN
   - A. Type Schedule 40 PVC
   - B. I.D. 2 INCHES
   - C. Slot Size .010 INCHES
   - D. Length 5 FEET
8. SCREEN FILTER TYPE No. 2 graded quartzite sand
9. ROCK HOLE DIAMETER 3.9 INCHES

RECRA ENVIRONMENTAL, INC.	SCALE: NTS		NYSDEC PHASE II INVESTIGATION EMERSON STREET LANDFILL ROCHESTER, NY	TOP OF ROCK MONITOR WELL CONSTRUCTION DIAGRAM
		BY / DATE		
	DWN.	PCB 12/19/88		
	CKD.	RES 8/89		
	APPVD.			
	REV.		PROJECT NO. 8C1307A6	A PB.00213.7

BUFFALO DRILLING COMPANY
INC.

955 NIAGARA STREET
BUFFALO, NEW YORK
14213
(716) 886-0375

December 19, 1988 JOB NO: 88-1244

Recra Environmental, Inc.
Audobon Business Center
10 Hazelwood Drive
Suite 106
Amherst, New York 14150

ATTN: Dr. Roger A. Clark, Ph.D.

RE: Laboratory Soil Analysis Results for
Emerson Street Landfill (#828023),
Recra Environmental Project No. 8C1301A6.

Gentlemen:

Laboratory testing results for fifteen soil samples provided by Recra Environmental, Inc. are presented on the enclosed table and graphs. The samples were tested for particle size (ASTM D422), and moisture content (ASTM D2216). Hydrometer analysis (ASTM D422), was undertaken on twelve samples which were identified to have greater than twenty percent passing the No. 200 sieve.

Thank you for the opportunity to assist on this project. If there are any questions, please call.

Very truly yours,
BUFFALO DRILLING COMPANY, INC.

David M. Frazier
Geologist

DMG:cq

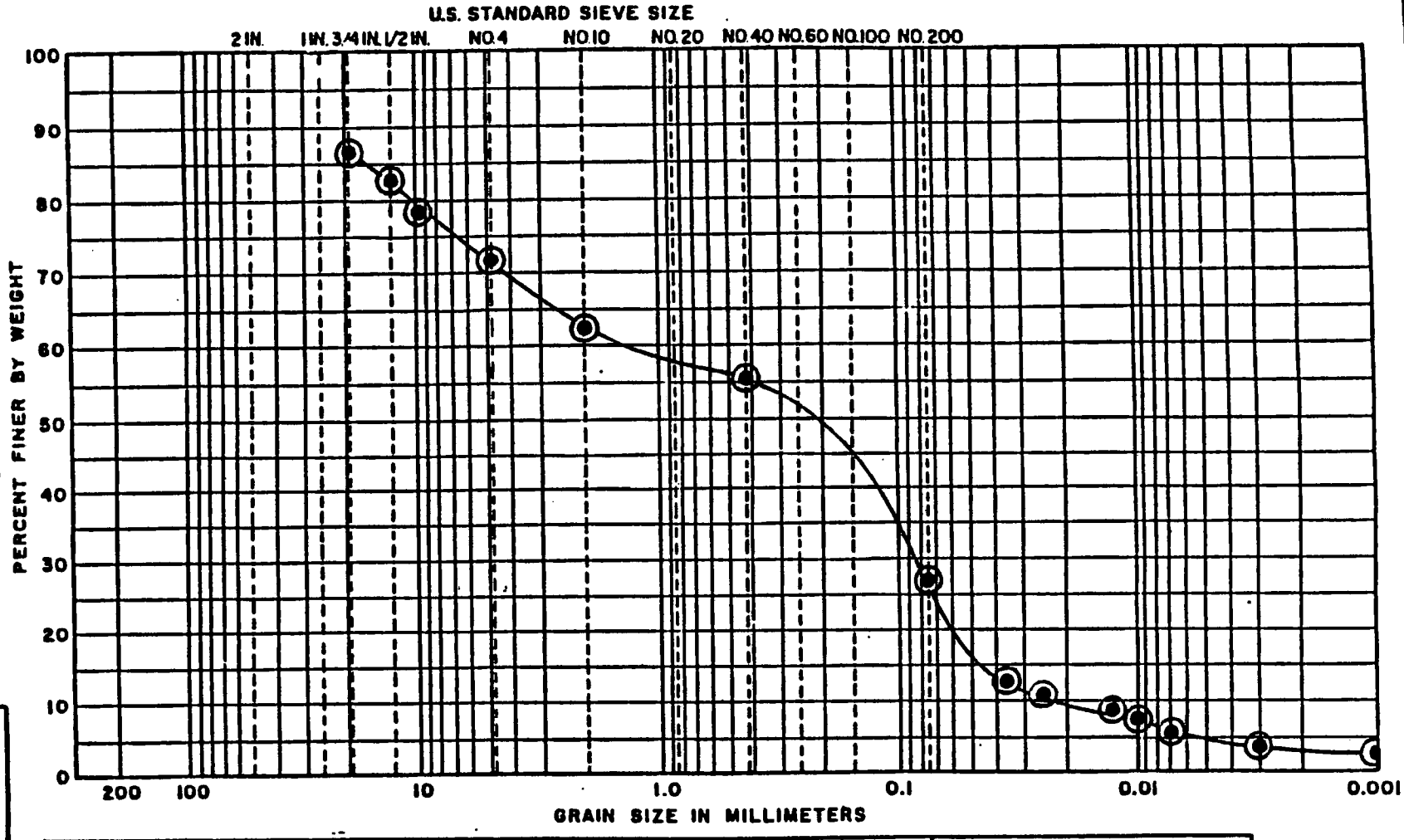
Encl.

CLIENT: Recra Environmental, Inc.
PROJECT: Emerson Street Landfill (#828023)
JOB NO: 88-1244

TABLE 1

BORING NO.	SAMPLE NO.	DEPTH (ft.)	MOISTURE CONTENT (%)	GRADATION ANALYSIS				SAMPLE DESCRIPTION
				GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	
GW-1	SS-2	5-7	3.4	55	36.9	8.1		GRAVEL and f/c Sand, tr Silt
GW-2	SS-2	3-5	11.6	8.8	30.8	40.6	19.8	SILT and f/c Sand, lt. Clay, tr. Gravel
GW-2	SS-3	5-6.5	12.4	6.8	19.8	54.4	19	SILT, lt. f/c Sand, lt. Clay, tr. Gravel
GW-3	SS-2	5-7	13.8	2.6	18.5	52.2	26.7	SILT, some Clay, lt. f/c Sand, tr. Gravel
GW-3	SS-4	12-13.1	8.5	14.4	25.1	35.3	25.2	SILT, some Clay, some f/c Sand, lt. Gravel
GW-4	SS-2	2-4	20.6	4.1	22.5	44.8	28.6	SILT, some Clay, some f/c Sand, tr. Gravel
GW-4	SS-7	7.5-9.5	11.5	58.1	29.1	12.8		GRAVEL, some f/c Sand, lt. Silt
GW-5	SS-3	5-7	34.1	27.9	19.6	41	11.5	SILT, some Gravel, lt. f/c Sand, lt. Clay
GW-6	SS-2	5-6.2	21.0	0	4.7	70.1	25.2	SILT, some Clay, tr. f/m Sand
GW-7	SS-3	7.5-9.0	9.8	11.5	41	35	12.5	f/c SAND and Silt, lt. Clay, lt. Gravel
GW-8D	SS-1	0-2	16.5	8.6	28	40.7	22.7	SILT, some f/c Sand, some Clay, tr. Gravel
GW-8D	SS-2	5-7	14.2	12.8	43.1	37.9	6.2	f/c SAND and Silt, lt. Gravel, tr. Clay
GW-9	SS-1	0-2	37.6	54.5	15	21.1	9.4	GRAVEL, some Silt, lt. f/c Sand, tr. Clay
GW-10D	SS-1	0-2	15.1	44.3	36.4	19.3		GRAVEL and f/c Sand, lt. Silt, tr. Clay
GW-10S	SS-2	5-7	11.7	28.2	44.9	21.7	5.2	f/c SAND, some Gravel, some Silt, tr. Clay

BUFFALO DRILLING COMPANY, INC.
955 NIAGARA STREET
BUFFALO, N.Y. 14213



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

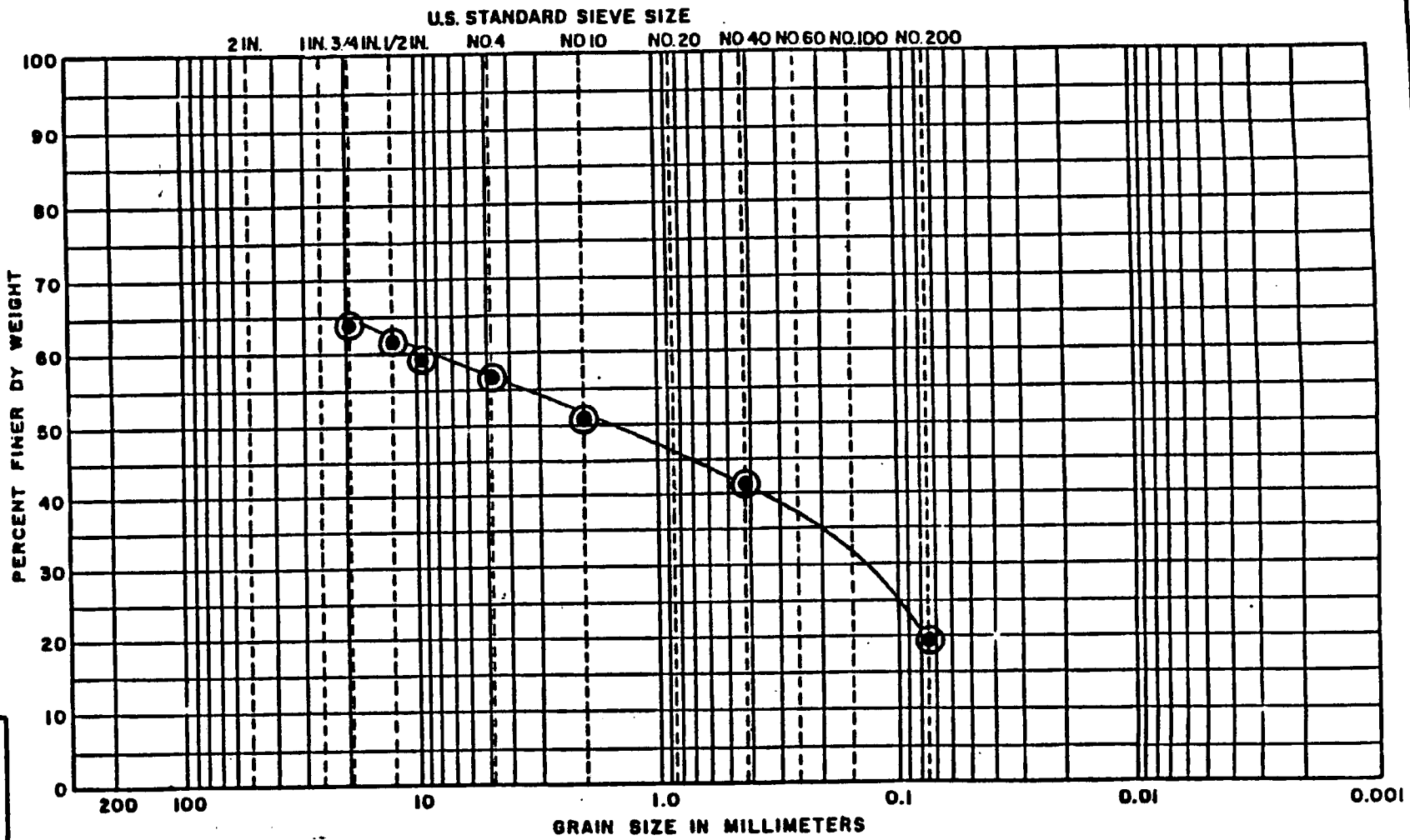
UNIFIED SOIL CLASSIFICATION SYSTEM

BORING NO.	SAMPLE NO.	SYM.	SAMPLE DESCRIPTION
GW-10S	SS-2	◉	f/c SAND, some Gravel, some Silt, tr. Clay
			Emerson Street Landfill #828023

GRADATION TESTS

FILE NO. 88-1244 DATE 12-13-88

BUFFALO DRILLING COMPANY, INC.
955 NIAGARA STREET
BUFFALO, N.Y. 14213



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

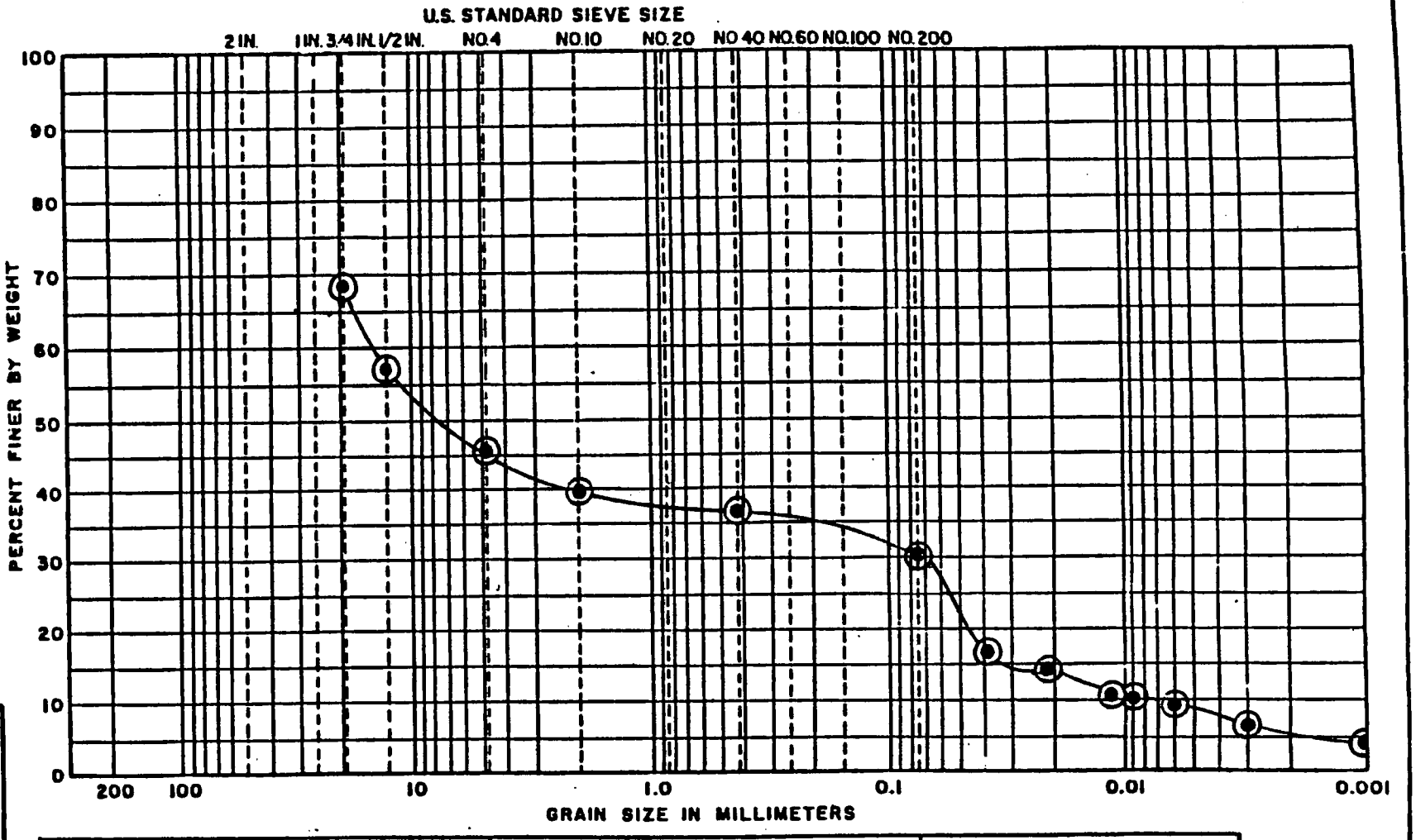
UNIFIED SOIL CLASSIFICATION SYSTEM

BORING NO.	SAMPLE NO.	SYM.	SAMPLE DESCRIPTION
GW-10D	SS-1	◉	GRAVEL and f/c Sand, little Silt, tr. Clay
			Emerson Street Landfill #828023

GRADATION TESTS

FILE NO. 88-1244 DATE 12-13-88

BUFFALO DRILLING COMPANY, INC.
955 NIAGARA STREET
BUFFALO, N.Y. 14213



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

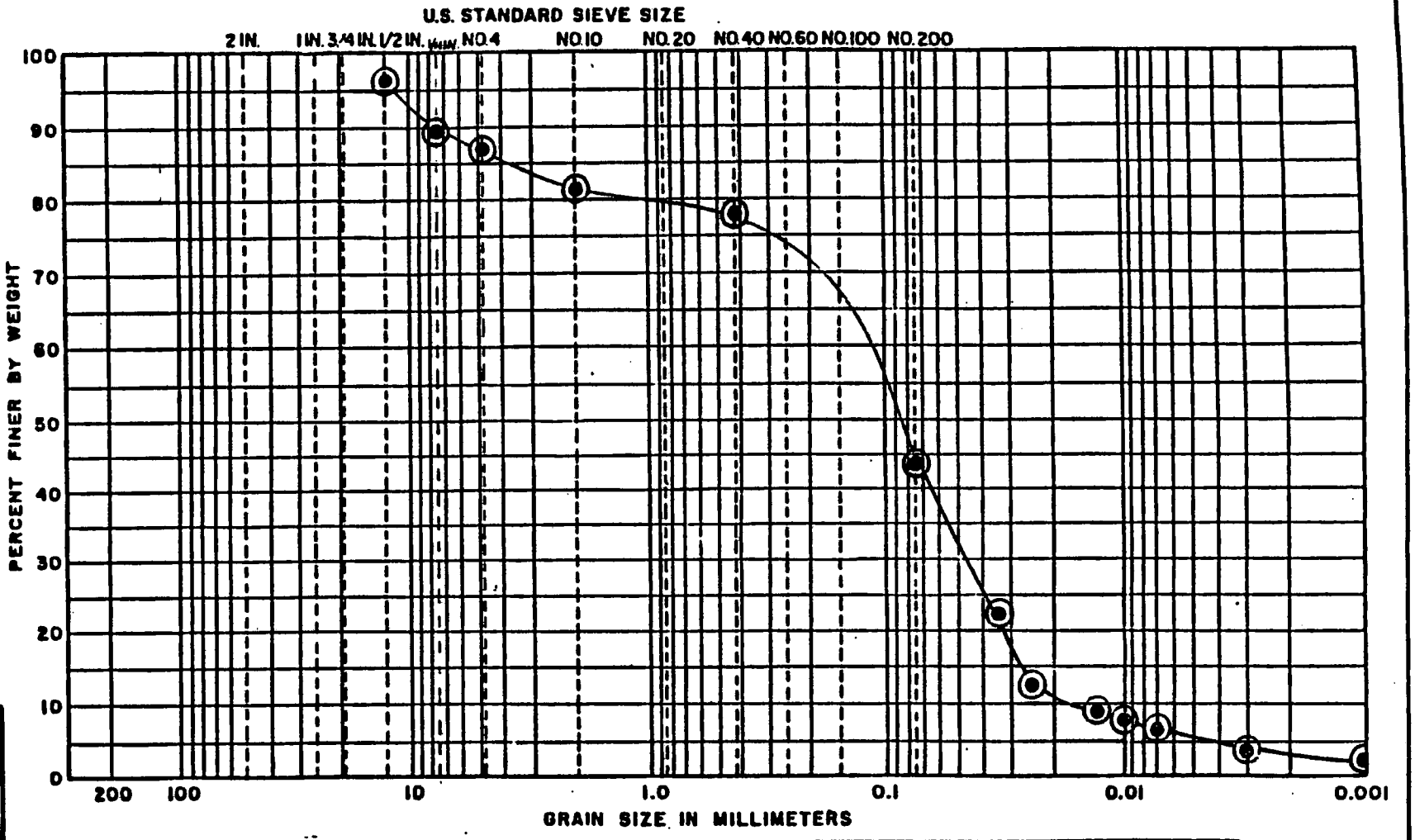
UNIFIED SOIL CLASSIFICATION SYSTEM

BORING NO.	SAMPLE NO.	SYM.	SAMPLE DESCRIPTION
GW-9	SS-1	◉	GRAVEL, some Silt, little f/c Sand, tr. Clay
			Emerson Street Landfill #828023

GRADATION TESTS

FILE NO. 88-1244 DATE 12-13-88

BUFFALO DRILLING COMPANY, INC.
955 NIAGARA STREET
BUFFALO, N.Y. 14213



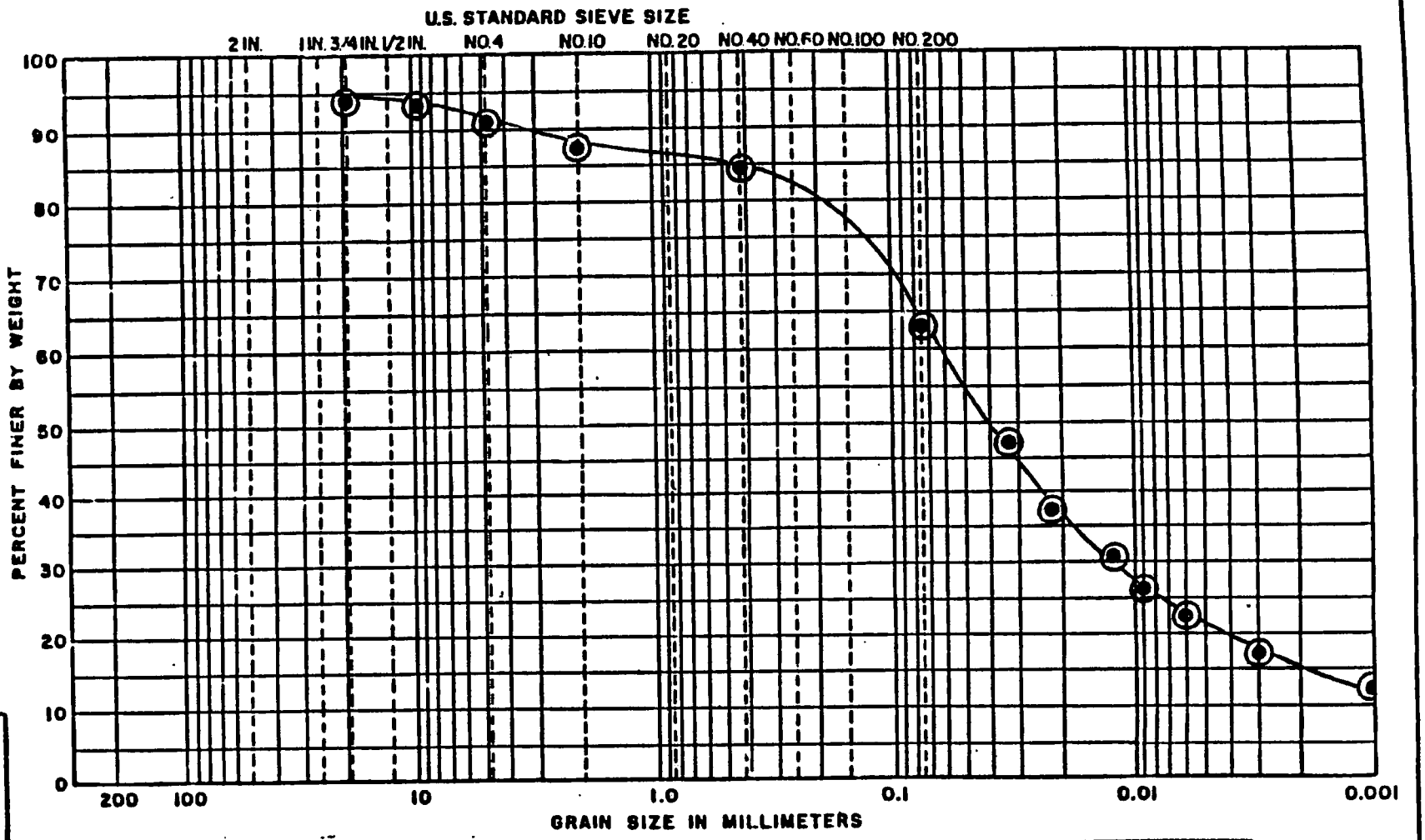
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

UNIFIED SOIL CLASSIFICATION SYSTEM

BORING NO.	SAMPLE NO.	SYM.	SAMPLE DESCRIPTION
GW-8D	SS-2	◉	f/c SAND and Silt, little Gravel, tr. Clay
			Emerson Street Landfill #828023

GRADATION TESTS

FILE NO. 88-1244 DATE 12-12-88



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

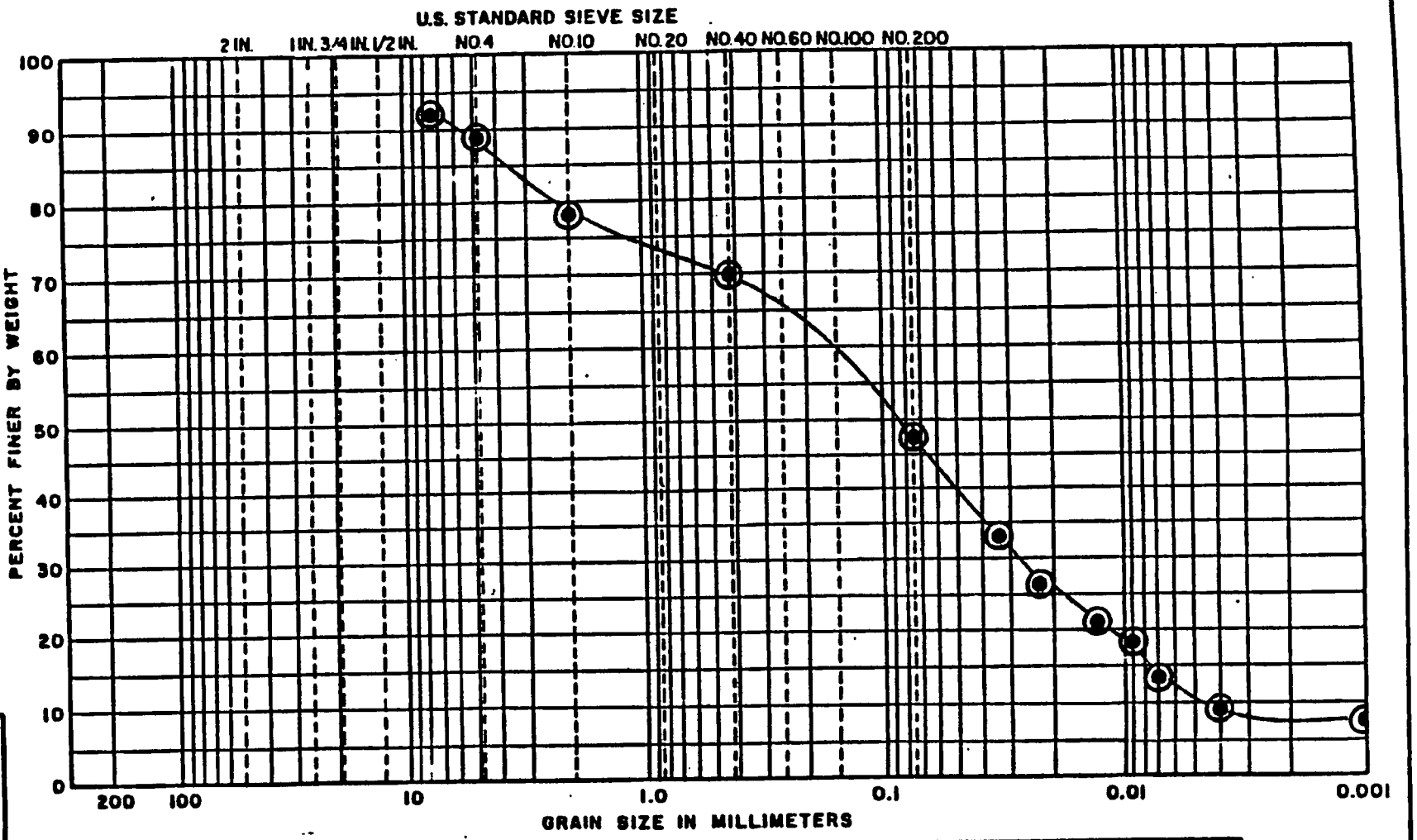
UNIFIED SOIL CLASSIFICATION SYSTEM

BORING NO.	SAMPLE NO.	SYM.	SAMPLE DESCRIPTION
GW-8D	SS-1	◉	SILT, some f/c Sand, some Clay, tr. Gravel
			Emerson Street Landfill #828023

BUFFALO DRILLING COMPANY, INC.
955 NIAGARA STREET
BUFFALO, N.Y. 14213

GRADATION TESTS

FILE NO. 88-1244 DATE 12-12-88



BUFFALO DRILLING COMPANY, INC.
955 NIAGARA STREET
BUFFALO, N.Y. 14213

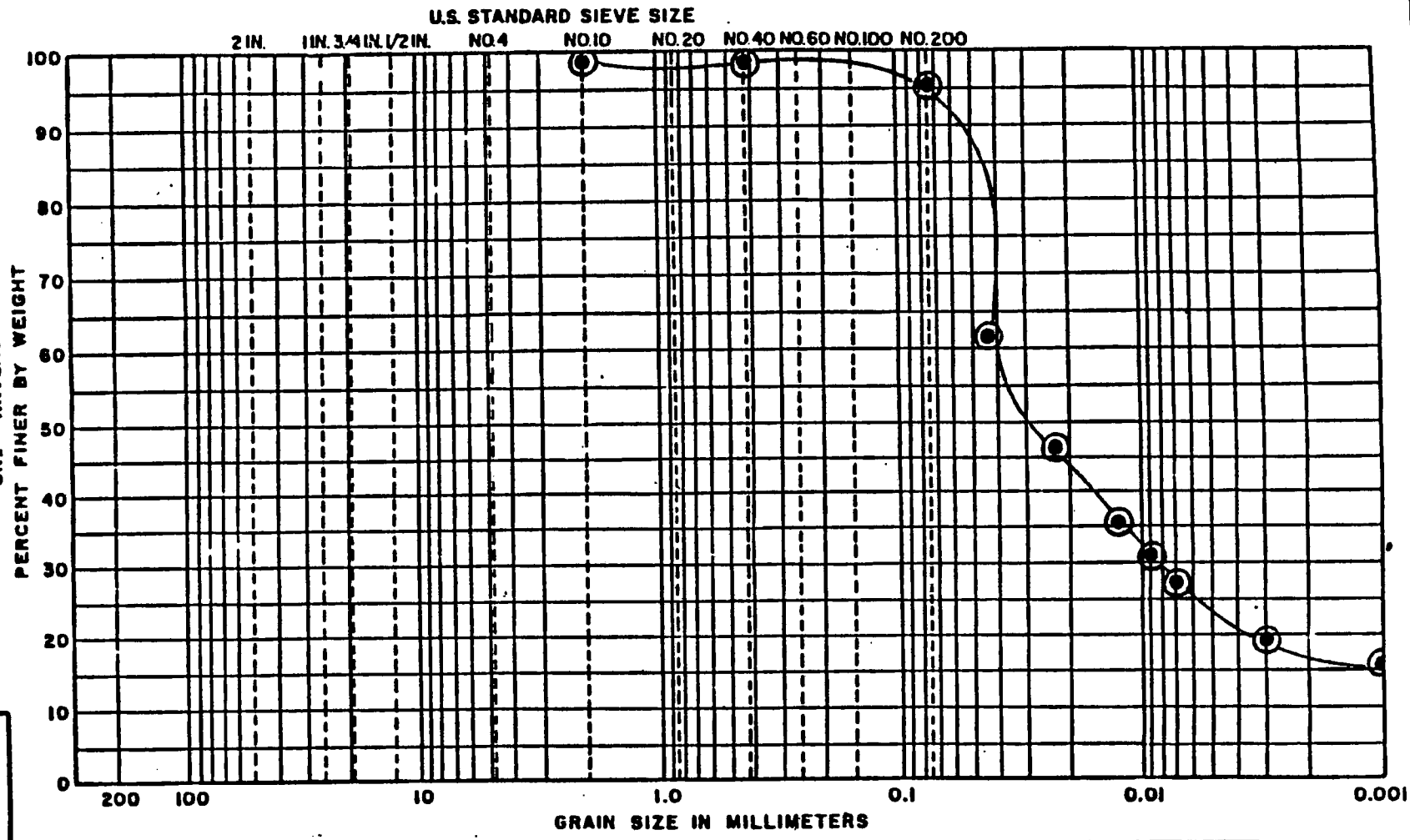
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

UNIFIED SOIL CLASSIFICATION SYSTEM

BORING NO.	SAMPLE NO.	SYM.	SAMPLE DESCRIPTION
GW-7	SS-3	◉	f/c SAND and Silt, little Clay, little Gravel
			Emerson Street Landfill #828023

GRADATION TESTS

FILE NO. 88-1244 DATE 12-12-88



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

UNIFIED SOIL CLASSIFICATION SYSTEM

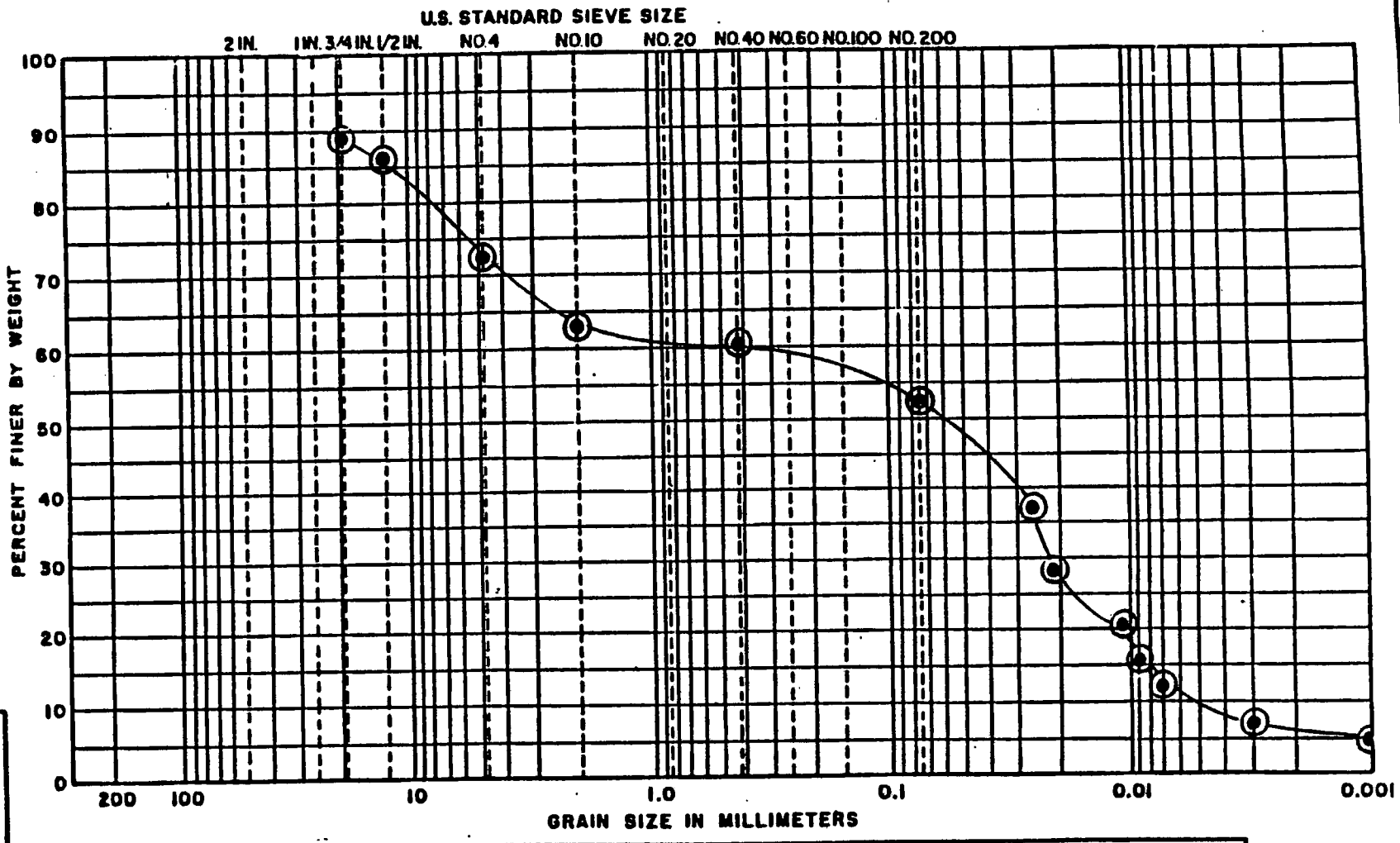
BORING NO	SAMPLE NO.	SYM.	SAMPLE DESCRIPTION
GW-6	SS-2	◉	SILT, some Clay, tr. f/m Sand
			Emerson Street Landfill #828023

BUFFALO DRILLING COMPANY, INC.
955 NIAGARA STREET
BUFFALO, N.Y. 14213

GRADATION TESTS

FILE NO. 88-1244 DATE 12-12-88

BUFFALO DRILLING COMPANY, INC.
955 NIAGARA STREET
BUFFALO, N.Y. 14213



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

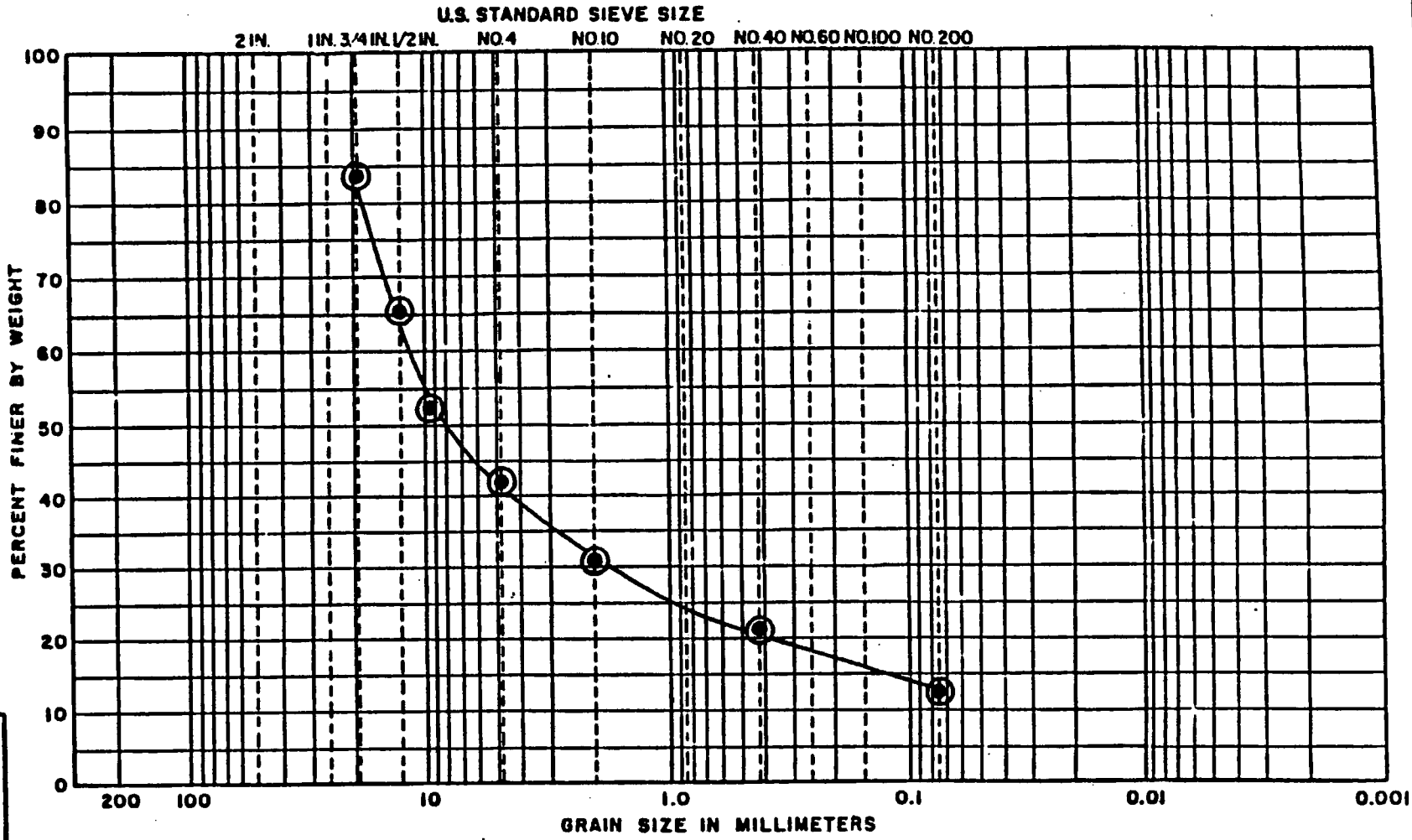
UNIFIED SOIL CLASSIFICATION SYSTEM

BORING NO.	SAMPLE NO.	SYM.	SAMPLE DESCRIPTION
GW-5	SS-3	◉	SILT, some Gravel, little f/c Sand, little Clay
			Emerson Street Landfill #838023

GRADATION TESTS

FILE NO. 88-1244 DATE 12-13-88

BUFFALO DRILLING COMPANY, INC.
955 NIAGARA STREET
BUFFALO, N.Y. 14213



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

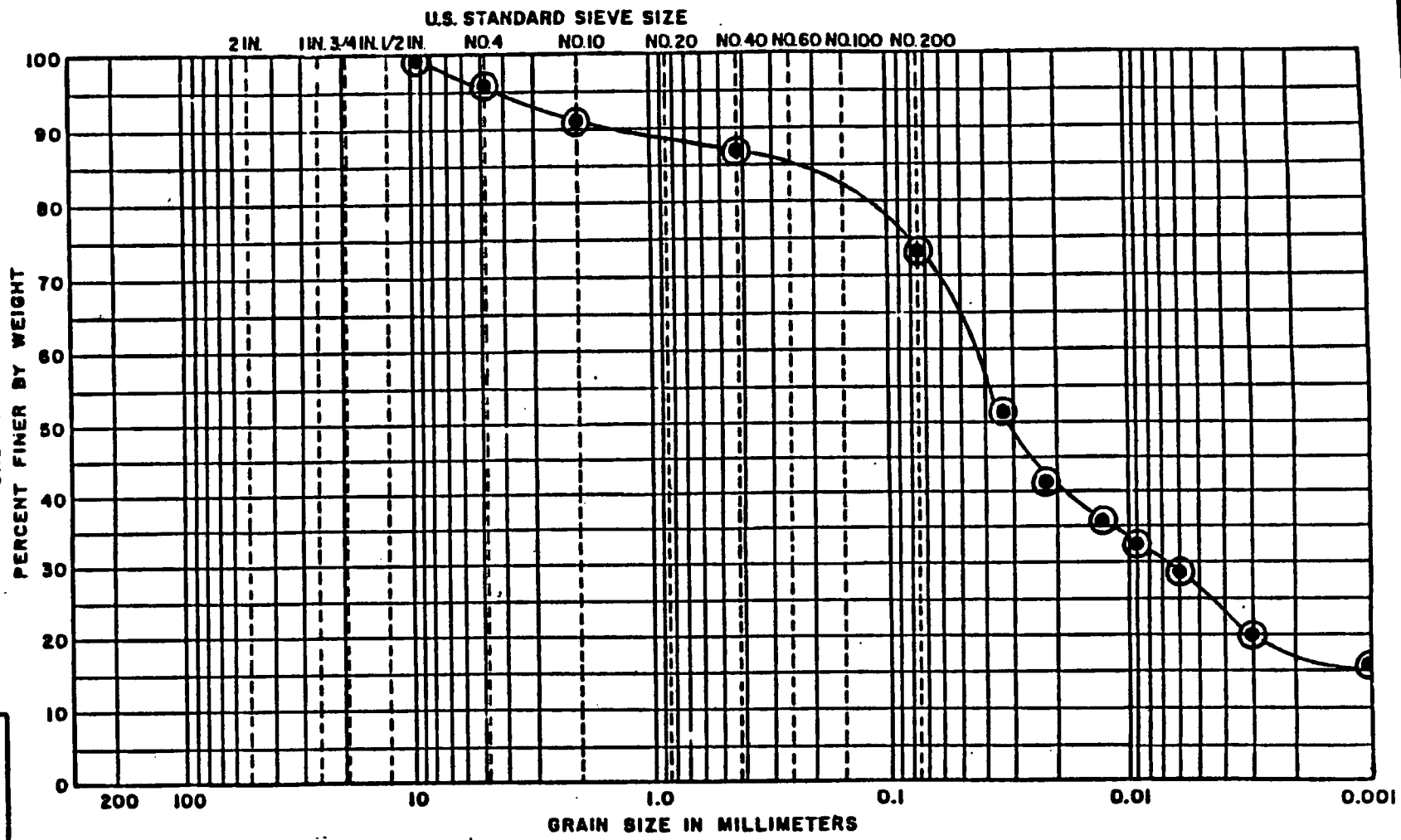
UNIFIED SOIL CLASSIFICATION SYSTEM

BORING NO.	SAMPLE NO.	SYM.	SAMPLE DESCRIPTION
GW-4	SS-7	◉	GRAVEL, some f/c Sand, little Silt
			Emerson Street Landfill #828023

GRADATION TESTS

FILE NO. 88-1244 DATE 12-13-88

BUFFALO DRILLING COMPANY, INC.
955 NIAGARA STREET
BUFFALO, N.Y. 14213



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

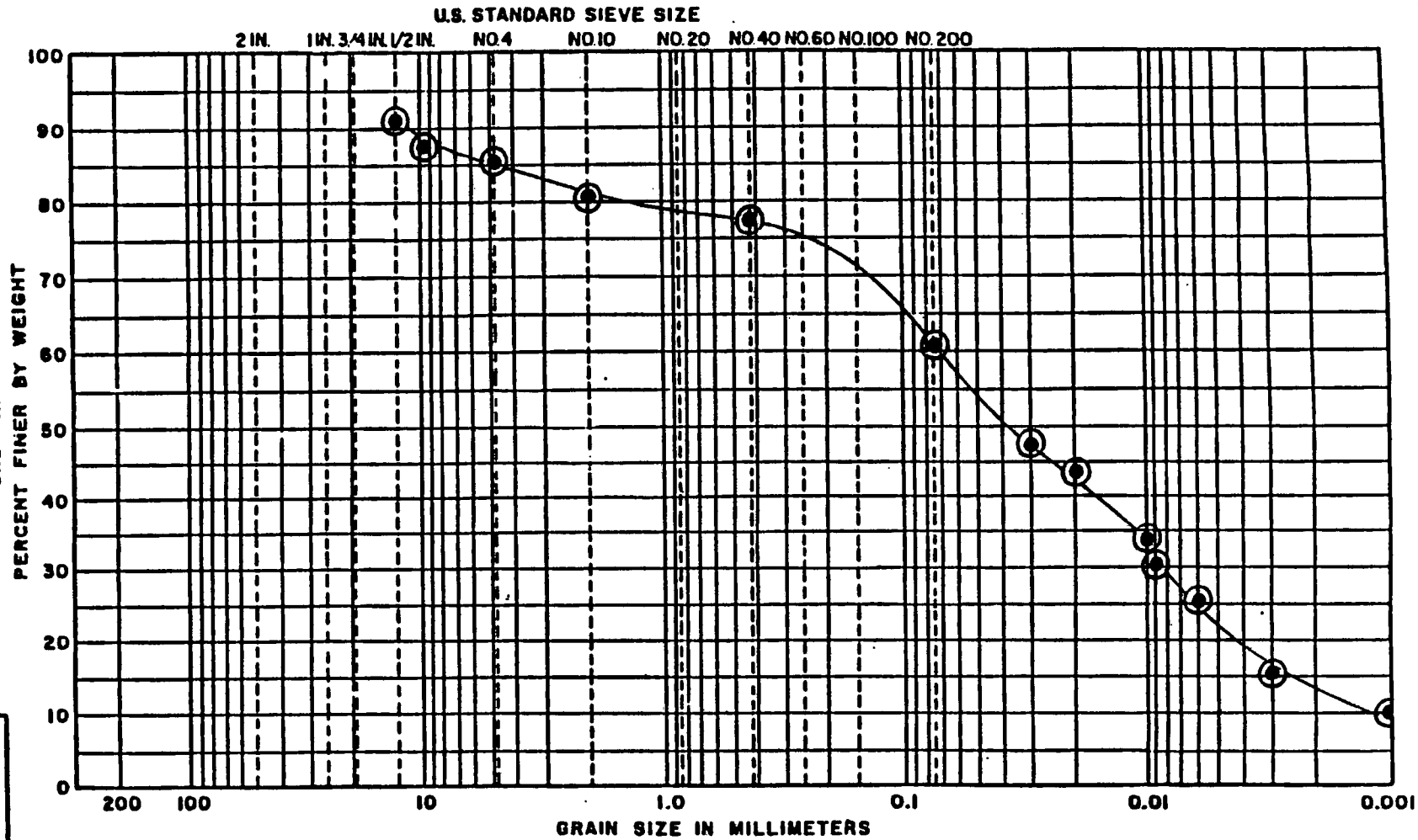
UNIFIED SOIL CLASSIFICATION SYSTEM

BORING NO.	SAMPLE NO.	SYM.	SAMPLE DESCRIPTION
GW-4	SS-2	◉	SILT, some Clay, some f/c Sand, tr. Gravel
			Emerson Street Landfill #838023

GRADATION TESTS

FILE NO. 88-1244 DATE 12-13-88

BUFFALO DRILLING COMPANY, INC.
955 NIAGARA STREET
BUFFALO, N.Y. 14213



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

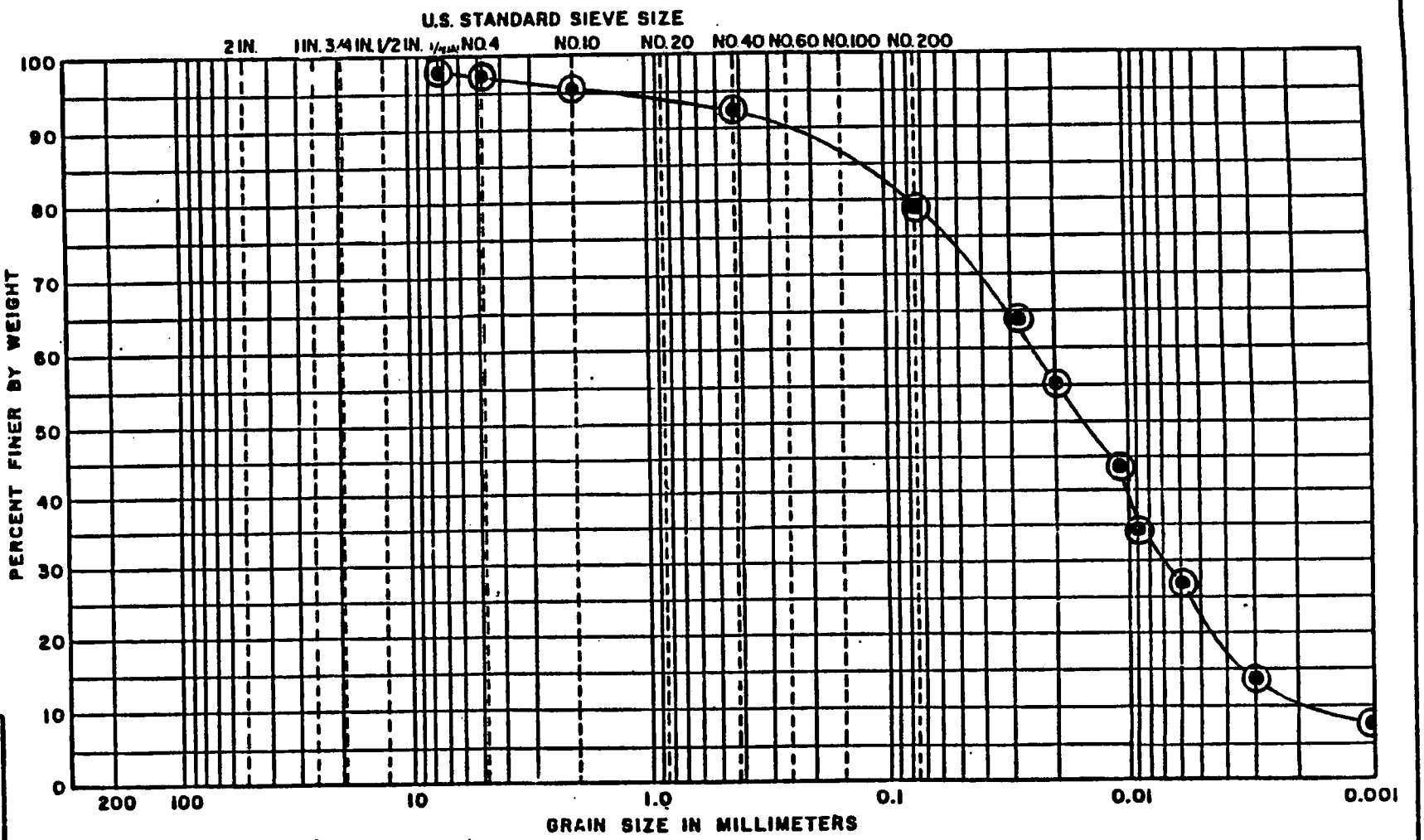
UNIFIED SOIL CLASSIFICATION SYSTEM

BORING NO.	SAMPLE NO.	SYM.	SAMPLE DESCRIPTION
GW-3	SS-4	◉	SILT, some Clay, some f/c Sand, little Gravel
			Emerson Street Landfill #828023

GRADATION TESTS

FILE NO. 88-1244 DATE 12-13-86

BUFFALO DRILLING COMPANY, INC.
955 NIAGARA STREET
BUFFALO, N.Y. 14213



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

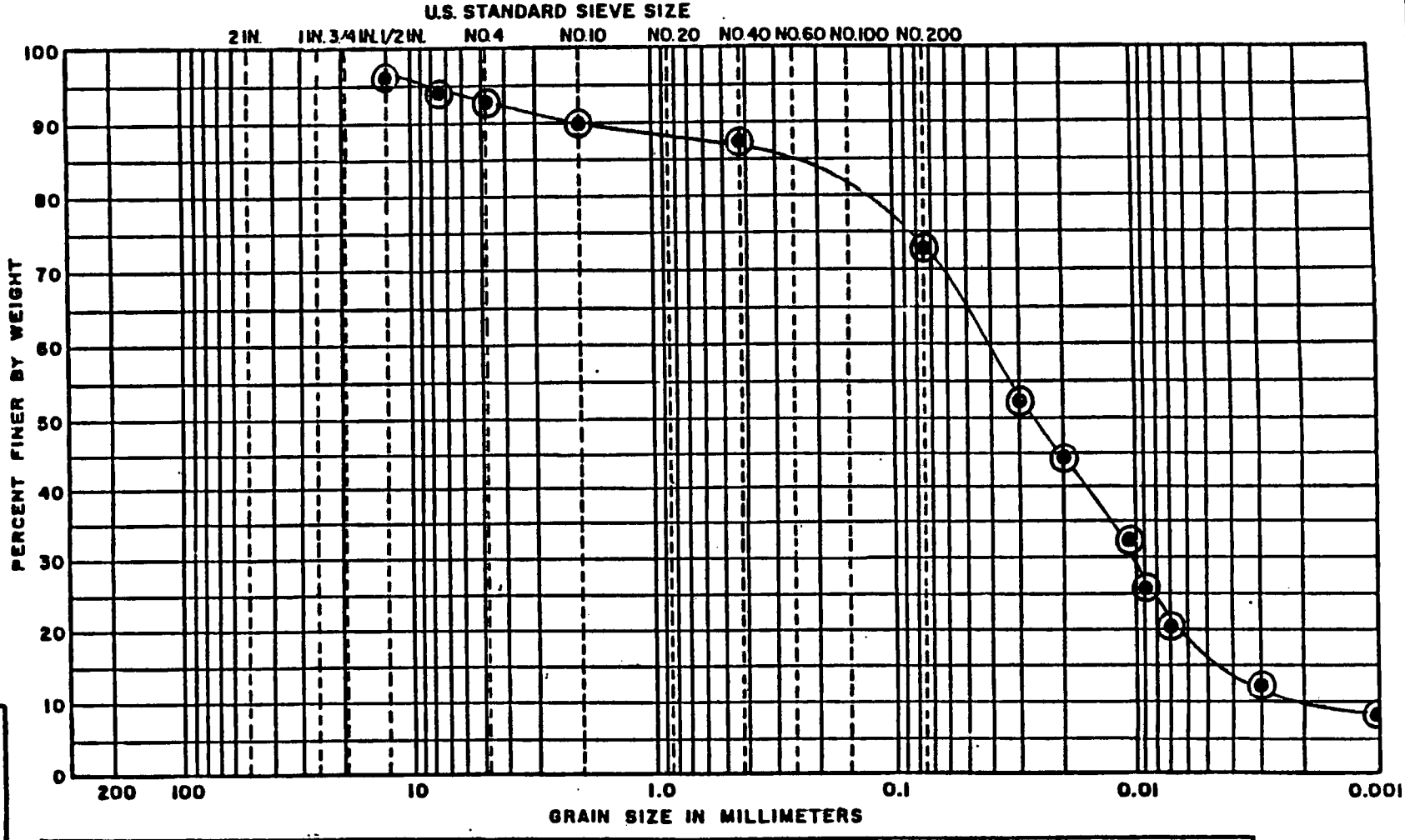
UNIFIED SOIL CLASSIFICATION SYSTEM

BORING NO.	SAMPLE NO.	SYM.	SAMPLE DESCRIPTION
GW-3	SS-2	◉	SILT, some Clay, little f/c Sand, tr. Gravel
			Emerson Street Landfill #828023

GRADATION TESTS

FILE NO. 88-1244 DATE 12-13-88

BUFFALO DRILLING COMPANY, INC.
955 NIAGARA STREET
BUFFALO, N.Y. 14213



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

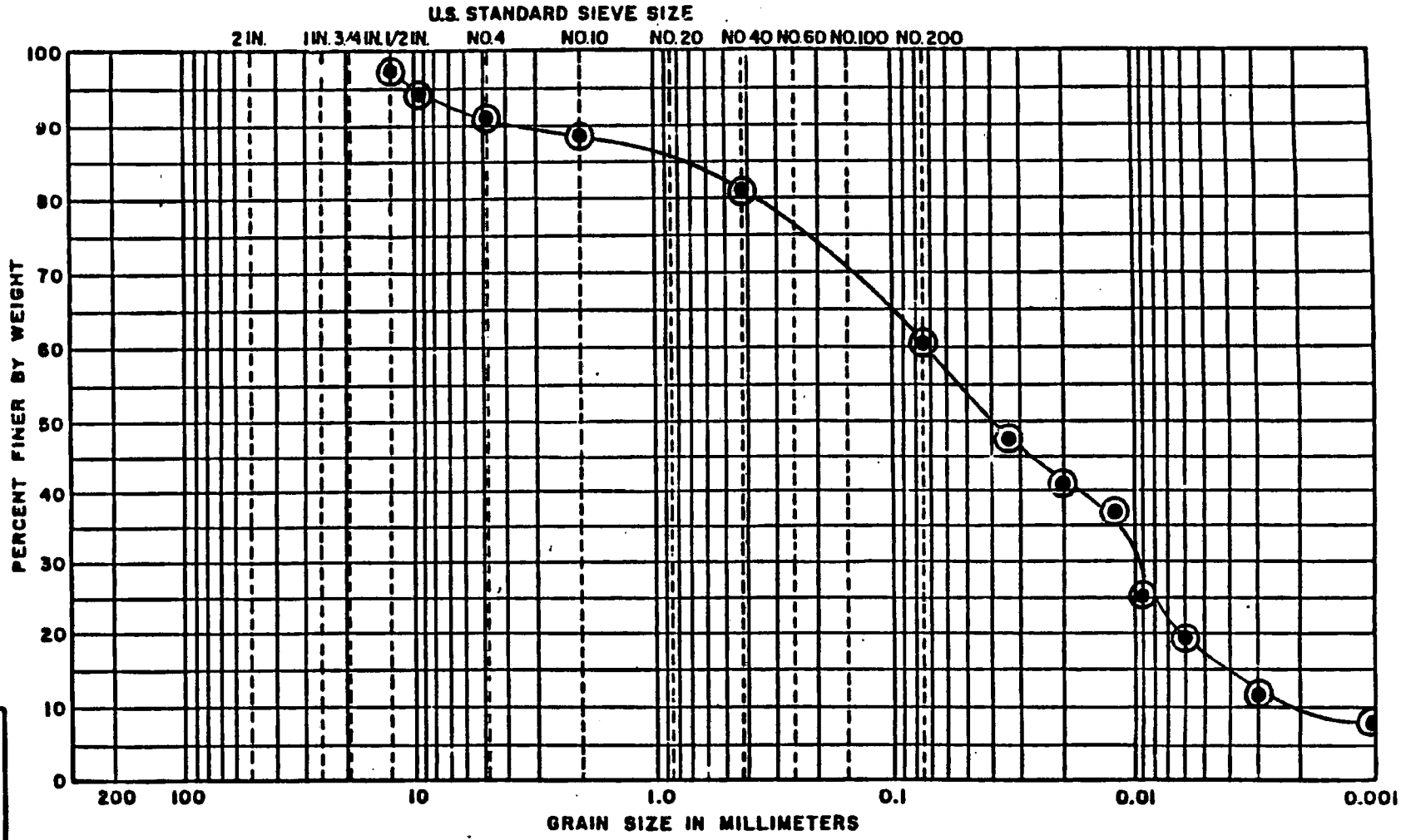
UNIFIED SOIL CLASSIFICATION SYSTEM

BORING NO.	SAMPLE NO.	SYM.	SAMPLE DESCRIPTION
GW-2	SS-3	◉	SILT, little f/c Sand, little Clay, tr. Gravel
			Emerson Street Landfill #828023

GRADATION TESTS

FILE NO. 88-1244 DATE 12-12-88

BUFFALO DRILLING COMPANY, INC.
955 NIAGARA STREET
BUFFALO, N.Y. 14213



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

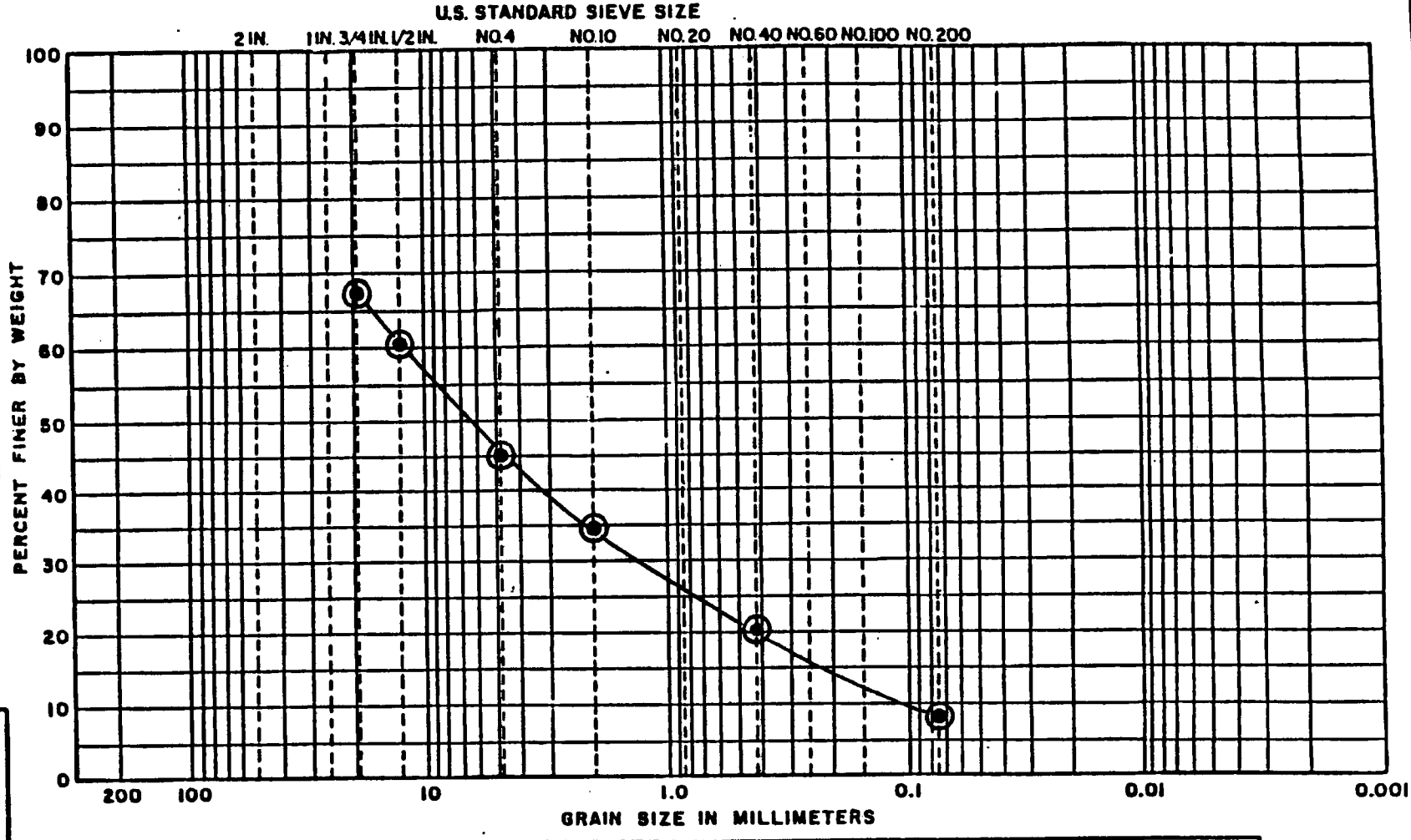
UNIFIED SOIL CLASSIFICATION SYSTEM

BORING NO.	SAMPLE NO.	SYM.	SAMPLE DESCRIPTION
GW-2	SS-2	◉	SILT and f/c Sand, little Clay, tr. Gravel
			Emerson Street Landfill #828023

GRADATION TESTS

FILE NO. 88-1244 DATE 12-13-88

BUFFALO DRILLING COMPANY, INC.
955 NIAGARA STREET
BUFFALO, N.Y. 14213



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

UNIFIED SOIL CLASSIFICATION SYSTEM

BORING NO.	SAMPLE NO.	SYM.	SAMPLE DESCRIPTION
GW-1	SS-2	⊙	GRAVEL and f/c Sand, tr. Silt
			Emerson Street Landfill #828023

GRADATION TESTS

FILE NO. 88-1244 DATE 12-13-88

APPENDIX E

RECRA ENVIRONMENTAL, INC.
WELL DEVELOPMENT DATA

EMERSON STREET LANDFILL
#828023

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION

WELL DEVELOPMENT METHODS

WELL I.D.	PUMPED WITH DRILL RIG	BAILED	ADD AND WITHDRAW POTABLE WATER
GW-1	X	X	
GW-2	X	X	
GW-3	X	X	
GW-4	X	X	
GW-5	X		
GW-6	X		
GW-7	X	X	
GW-8S	X	X	X
GW-8D	X		
GW-9	X		
GW-10S	X	X	X
GW-10D	X		

1/T10390.27

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION

WELL DEVELOPMENT DATA

WELL I.D.	DATE	TIME	pH (STANDARD UNITS)	SPECIFIC CONDUCTANCE (µmhos/cm)	TURBIDITY (NTU)	TEMP (°C)	CUMULATIVE VOLUME EVACUATED IN GALLONS	COMMENTS
GW-1	9/7/88	850	7.24	1,820	>500	17	2	Light gray, few fines settling out.
GW-1	9/7/88	900	7.51	1,740	>500	21	4	Same, slight sulfur odor.
GW-1	9/7/88	915	7.15	2,000	>500	20	7	Same, some small rock fragments.
GW-1	9/7/88	1005	7.40	1,740	15	19	10	Clear
GW-1	9/7/88	1250	7.50	1,720	380	16	12	Light gray, little fine sand.
GW-1	9/8/88	1010	7.16	1,680	90	16	15	Same
GW-1	9/9/88	1215	7.20	1,640	220	18	20	Same, white sand from installation is present.
GW-2	8/19/88	1400	5.70	2,530	65	23	60	Clear
GW-2	8/19/88	1430	6.40	2,230	50	17	110	Clear
GW-2	8/31/88	1550	6.48	4,900	100	17	115	Slightly turbid, gray, few fines.
GW-2	8/31/88	1605	6.58	2,250	75	17	125	Slightly turbid, gray
GW-2	8/31/88	1615	6.72	2,300	60	16	130	Clear

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION

WELL DEVELOPMENT DATA

WELL I.D.	DATE	TIME	pH (STANDARD UNITS)	SPECIFIC CONDUCTANCE (µmhos/cm)	TURBIDITY (NTU)	TEMP (°C)	CUMULATIVE VOLUME EVACUATED IN GALLONS	COMMENTS
GW-2	8/31/88	1630	6.78	2,200	50	16	135	Clear.
GW-3	9/7/88	1320	7.26	3,050	>500	22	6	Light brown, fine sand and silt.
GW-3	9/7/88	1350	7.52	3,850	>500	18	10	Same, some white sand from installation.
GW-3	9/7/88	1420	7.70	2,950	>500	18	14	Same
GW-3	9/8/88	1155	7.20	3,750	>500	21	30	Same
GW-3	9/8/88	1440	7.50	3,670	450	21	33	Less turbid, tan, little silt.
GW-3	9/9/88	1230	7.15	3,500	30	21	43	Clear
GW-4	9/7/88	1615	7.16	3,420	>500	17	5	Gray, little dark fines
GW-4	9/7/88	1630	6.84	3,690	>500	18	12	Same
GW-4	9/8/88	1040	6.80	4,100	100	19	32	Gray, slightly turbid.
GW-4	9/8/88	1055	6.75	3,950	35	18	42	Clear

1/T10390.29

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION

WELL DEVELOPMENT DATA

WELL I.D.	DATE	TIME	pH (STANDARD UNITS)	SPECIFIC CONDUCTANCE (µmhos/cm)	TURBIDITY (NTU)	TEMP (°C)	CUMULATIVE VOLUME EVACUATED IN GALLONS	COMMENTS
GW-5	9/8/88	1110	7.11	2,040	250	19	10	Slightly turbid, gray, few fines.
GW-5	9/8/88	1115	6.98	2,110	90	19	25	Same
GW-5	9/8/88	1125	6.99	2,050	50	17	38	Clear
GW-5	9/8/88	1135	7.00	2,070	44	17	44	Clear
GW-6	9/8/88	1620	7.32	2,600	100	21	20	slightly turbid, gray
GW-6	9/8/88	1625	7.23	2,480	80	19	35	Same
GW-6	9/8/88	1630	7.12	2,510	45	19	40	Clear
GW-6	9/8/88	1635	7.11	2,450	40	18	45	Clear
GW-6	9/8/88	1645	7.12	2,400	40	18	50	Clear
GW-7	9/8/88	1525	7.47	1,200	>500	22	15	Light brown, fine sand and silt.
GW-7	9/8/88	1530	7.35	1,140	300	21	35	Gray, less turbid

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION

WELL DEVELOPMENT DATA

WELL I.D.	DATE	TIME	pH (STANDARD UNITS)	SPECIFIC CONDUCTANCE (µmhos/cm)	TURBIDITY (NTU)	TEMP (°C)	CUMULATIVE VOLUME EVACUATED IN GALLONS	COMMENTS
GW-7	9/8/88	1535	7.33	1,140	135	19	55	Slightly turbid
GW-7	9/8/88	1540	7.37	1,120	60	19	75	Clear
GW-7	9/8/88	1545	7.36	1,130	45	19	85	Clear
GW-8S	9/6/88	1015	7.42	1,630	>500	15	2	Very turbid, brown silt and sand
GW-8S	9/6/88	1020	7.37	2,000	>500	21	4	Same
GW-8S	9/6/88	1025	7.55	1,410	>500	24	7	Turbid, light brown, some fines.
GW-8S	9/6/88	1035	7.23	1,230	>500	18	10	Same, few rock fragments.
GW-8S	9/7/88	1130	7.50	2,200	>500	25	14	Same, slight sulfur odor.
GW-8S	9/8/88	1000	7.02	3,320	140	18	30	Slightly turbid
GW-8S	9/9/88	1150	7.12	2,990	75	21	60	Clear
GW-8D	9/6/88	940	7.47	2,900	150	14	20	Slightly turbid, slight sulfur odor.

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION

WELL DEVELOPMENT DATA

WELL I.D.	DATE	TIME	pH (STANDARD UNITS)	SPECIFIC CONDUCTANCE (µmhos/cm)	TURBIDITY (NTU)	TEMP (°C)	CUMULATIVE VOLUME EVACUATED IN GALLONS	COMMENTS
GW-8D	9/6/88	950	7.00	2,870	60	14	30	Clear
GW-8D	9/6/88	1000	7.12	2,920	18	14	38	Clear
GW-8D	9/6/88	1050	7.24	2,940	40	16	55	Clear
GW-9	9/8/88	1305	7.42	2,480	500	21	5	Light brown, few dark fines.
GW-9	9/8/88	1335	7.54	3,070	210	21	8	Gray, slightly turbid, few fines.
GW-9	9/8/88	1405	7.68	2,960	120	21	10	Same
GW-9	9/8/88	1445	7.24	2,890	45	21	13	Clear
GW-10S	8/29/88	1345	7.75	1,630	>500	16	5	Very turbid, brown, silty.
GW-10S	8/29/88	1350	8.12	2,250	>500	16	7	Same
GW-10S	8/30/88	730	7.34	2,430	>500	14	12	Same
GW-10S	8/30/88	850	7.09	2,710	>500	13	22	Same

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION

WELL DEVELOPMENT DATA

WELL I.D.	DATE	TIME	pH (STANDARD UNITS)	SPECIFIC CONDUCTANCE (µmhos/cm)	TURBIDITY (NTU)	TEMP (°C)	CUMULATIVE VOLUME EVACUATED IN GALLONS	COMMENTS
GW-10S	8/30/88	850	7.26	2,670	300	14	32	Slightly turbid, tan.
GW-10S	8/30/88	915	7.30	2,600	300	16	47	Same
GW-10S	8/30/88	930	7.35	2,710	42	17	52	Clear
GW-10D	8/29/88	1055	6.88	5,390	400	16	20	Turbid, suspended gray fines.
GW-10D	8/29/88	1105	7.05	5,230	140	15	30	Slightly turbid, gray.
GW-10D	8/29/88	1130	6.95	5,140	200	14	50	Same
GW-10D	8/29/88	1310	6.91	5,170	100	14	60	Same
GW-10D	8/29/88	1315	7.02	5,150	70	14	65	Clear
GW-10D	8/29/88	1330	7.20	5,160	>500	15	75	Turbid, gray fines.
GW-10D	8/29/88	1340	7.14	5,010	140	14	80	Slightly turbid, gray.
GW-10D	8/29/88	1420	7.25	4,970	70	14	90	Clear
GW-10D	8/29/88	1435	7.21	4,990	45	14	100	Clear

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APPENDIX F

RECRA ENVIRONMENTAL, INC.
PERMEABILITY TEST CALCULATIONS

EMERSON STREET LANDFILL
#828023

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1031A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 11/10/88

PERFORMED BY: JS/JC/RB TYPE OF TEST: Falling Head

REFERENCE POINT: Top Case HOLE NO.: GW-1

TEST INTERVAL: 62.5 minutes ELEVATION: 104.4 ft.

STATIC GROUNDWATER LEVEL: 21.61 ft. HOLE DEPTH: 30.02 ft. STICK UP: 1.7 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	20.95	0.66	1
2	30	20.97	0.613	0.970
3	90	20.99	0.62	0.940
4	150	21.00	0.61	0.924
5	270	21.02	0.59	0.894
6	390	21.03	0.58	0.879
7	630	21.08	0.53	0.803
8	870	21.10	0.51	0.773
9	1350	21.17	0.44	0.667
10	1830	21.23	0.38	0.576
11	2790	21.34	0.27	0.409
12	3750	21.43	0.18	0.273

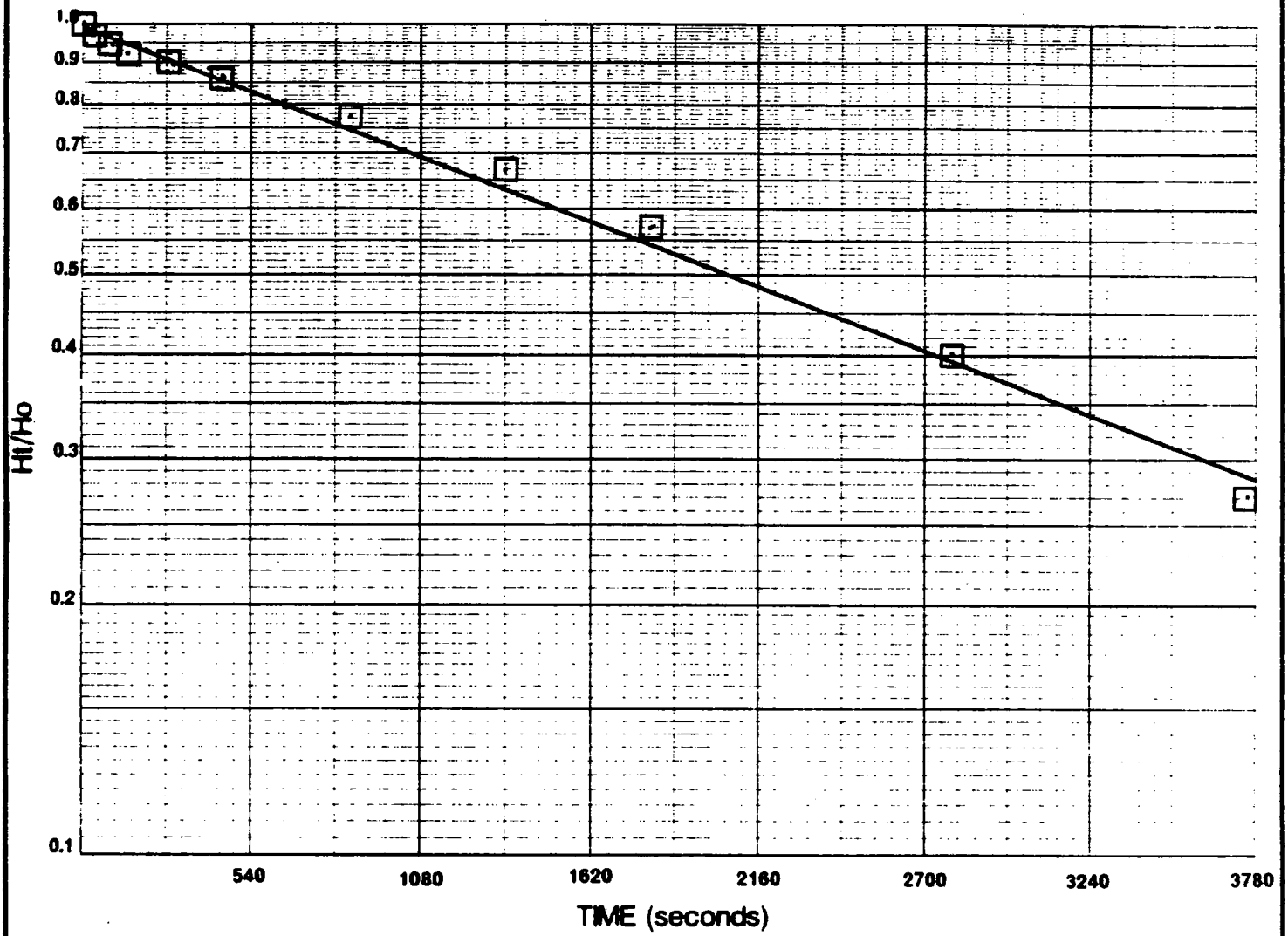
Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 2.54
R: intake point radius (cm) = 4.953
L: length of intake interval (cm) = 246.58
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 200
t2: time (sec) for data point 2 = 3,200
H1: head ratio for data point 1 = 0.932
H2: head ratio for data point 2 = 0.348

Regression Equation: $Log\ (Ht/Ho) = -1.4 \times 10^{-4} t - 0.0019$

Correlation Coefficient: -0.9964

Isotropic Permeability: $K = 1.7 \times 10^{-5}$ cm/sec



RECRA ENVIRONMENTAL INC.

Well I.D.	GW-1
Type of Test	FALLING HEAD
Project Title	EMERSON STREET LANDFILL
Project No.	8C1301A

PERMEABILITY DATA PLOT

1/T10390.38

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1301A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 11/11/88

PERFORMED BY: JS/RB TYPE OF TEST: Rising Head

REFERENCE POINT: Top Case HOLE NO.: GW-1

TEST INTERVAL: 280.5 minutes ELEVATION: 104.40 ft.

STATIC GROUNDWATER LEVEL: 21.61 ft. HOLE DEPTH: 30.02 ft. STICK UP: 1.7 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	23.40	1.79	1
2	30	23.37	1.76	0.983
3	60	23.34	1.73	0.966
4	90	23.32	1.71	0.955
5	120	23.31	1.7	0.950
6	180	23.27	1.66	0.927
7	240	23.24	1.63	0.911
8	300	23.20	1.59	0.888
9	360	23.17	1.56	0.872
10	420	23.13	1.52	0.849
11	540	23.08	1.47	0.821
12	660	23.03	1.42	0.793
13	900	22.95	1.34	0.749
14	1140	22.86	1.25	0.698
15	1380	22.81	1.2	0.670
16	1860	22.69	1.08	0.603
17	2340	22.60	0.99	0.553
18	3300	22.48	0.87	0.486
19	6900	22.41	0.8	0.447
20	10,800	22.36	0.75	0.419
21	16,830	22.34	0.73	0.408

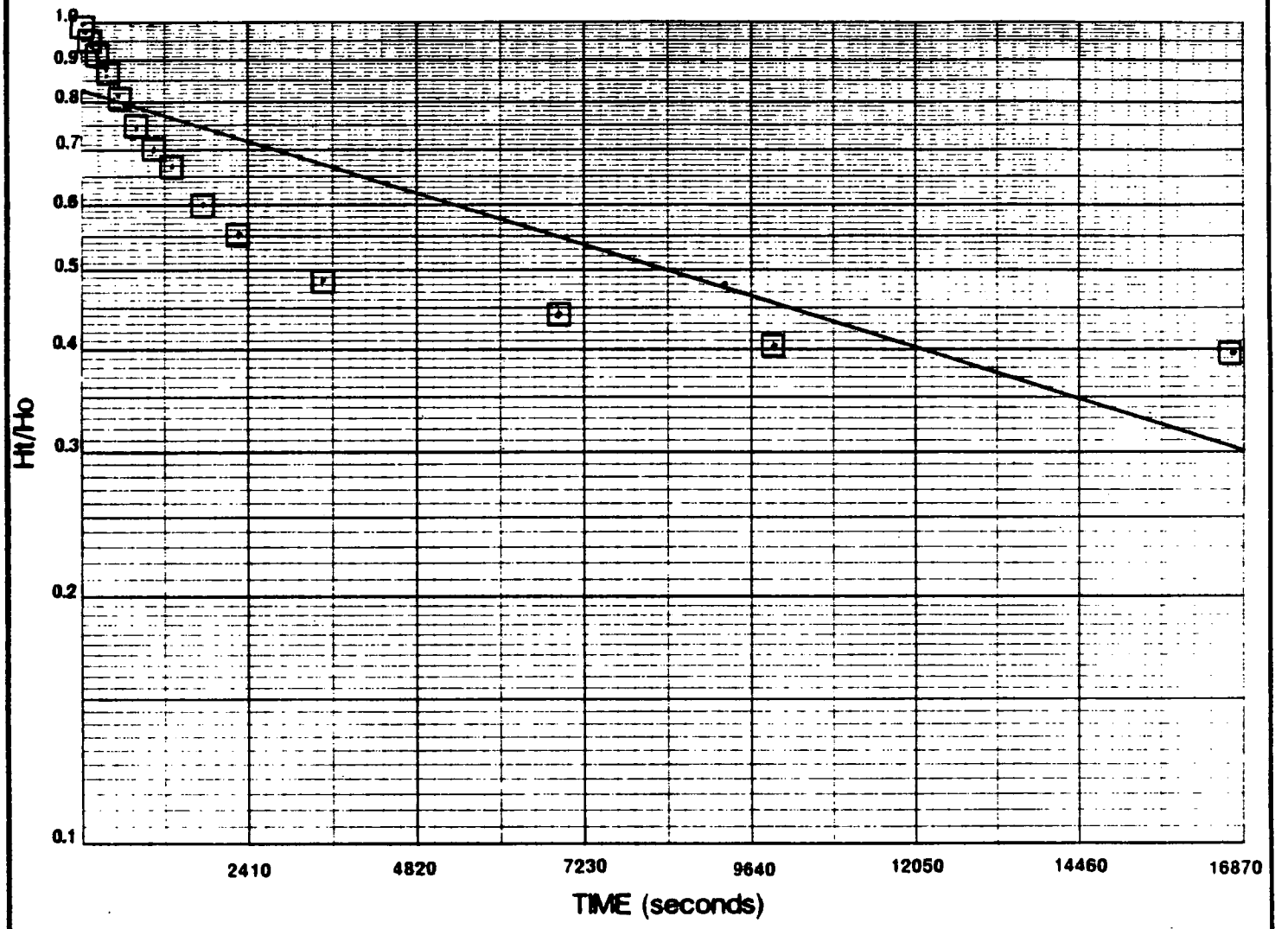
Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 2.54
R: intake point radius (cm) = 4.953
L: length of intake interval (cm) = 246.58
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 200
t2: time (sec) for data point 2 = 9,200
H1: head ratio for data point 1 = 0.8262
H2: head ratio for data point 2 = 0.4870

Regression Equation: $Log (Ht/Ho) = -2.6 \times 10^{-5}t - 0.0778$

Correlation Coefficient: -0.8305

Isotropic Permeability: $K = 3.0 \times 10^{-6}$ cm/sec



RECRA ENVIRONMENTAL INC.

Well I.D. GW-1

Type of Test RISING HEAD

Project Title EMERSON STREET LANDFILL

Project No. 8C1301A

PERMEABILITY DATA PLOT

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1031A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 11/15/88

PERFORMED BY: JS/JB TYPE OF TEST: Falling Head

REFERENCE POINT: Top Case HOLE NO.: GW-2

TEST INTERVAL: 0.5 minutes ELEVATION: 98.35 ft.

STATIC GROUNDWATER LEVEL: 21.11 ft. HOLE DEPTH: 28.35 ft. STICK UP: 0.15 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	18.16	2.95	1
2	30	21.10	0.01	0.003

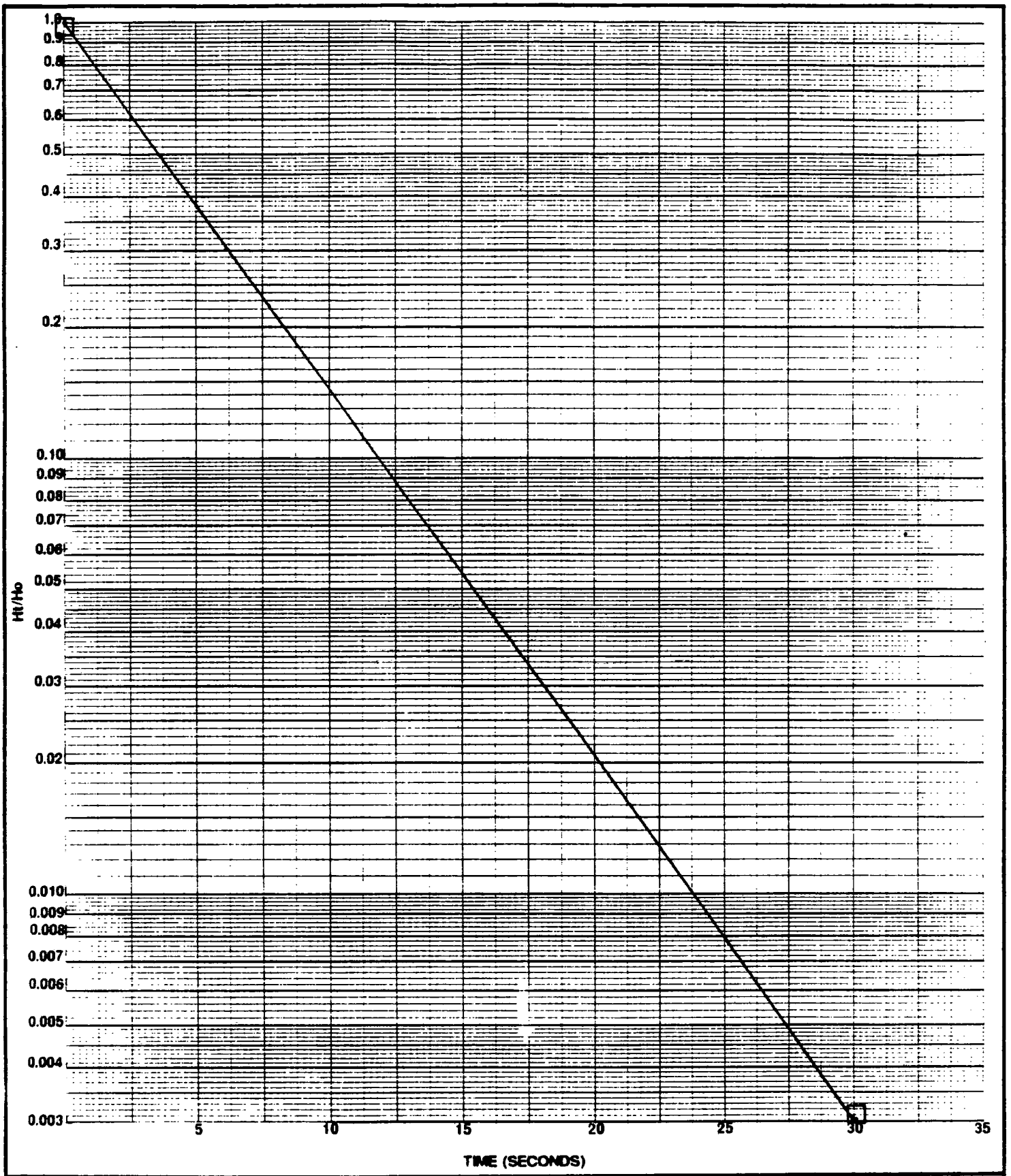
Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 3.81
R: intake point radius (cm) = 3.81
L: length of intake interval (cm) = 214.88
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 5
t2: time (sec) for data point 2 = 25
H1: head ratio for data point 1 = 0.3798
H2: head ratio for data point 2 = 0.0079

Regression Equation: $Log (Ht/Ho) = -8.4 \times 10^{-2} t$

Correlation Coefficient: -1

Isotropic Permeability: $K = 2.6 \times 10^{-2}$ cm/sec



RECRA ENVIRONMENTAL INC.

Well I.D. GW-2

Type of Test FALLING HEAD

Project Title EMERSON STREET LANDFILL

Project No. 8C1301A

PERMEABILITY DATA PLOT

1/T10390.41

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1031A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 11/15/88

PERFORMED BY: JS/JB TYPE OF TEST: Rising Head

REFERENCE POINT: Top Case HOLE NO.: GW-2

TEST INTERVAL: 0.5 minutes ELEVATION: 98.35 ft.

STATIC GROUNDWATER LEVEL: 21.11 ft. HOLE DEPTH: 28.35 ft. STICK UP: 0.15 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	24.06	2.95	1
2	30	21.12	0.01	0.003

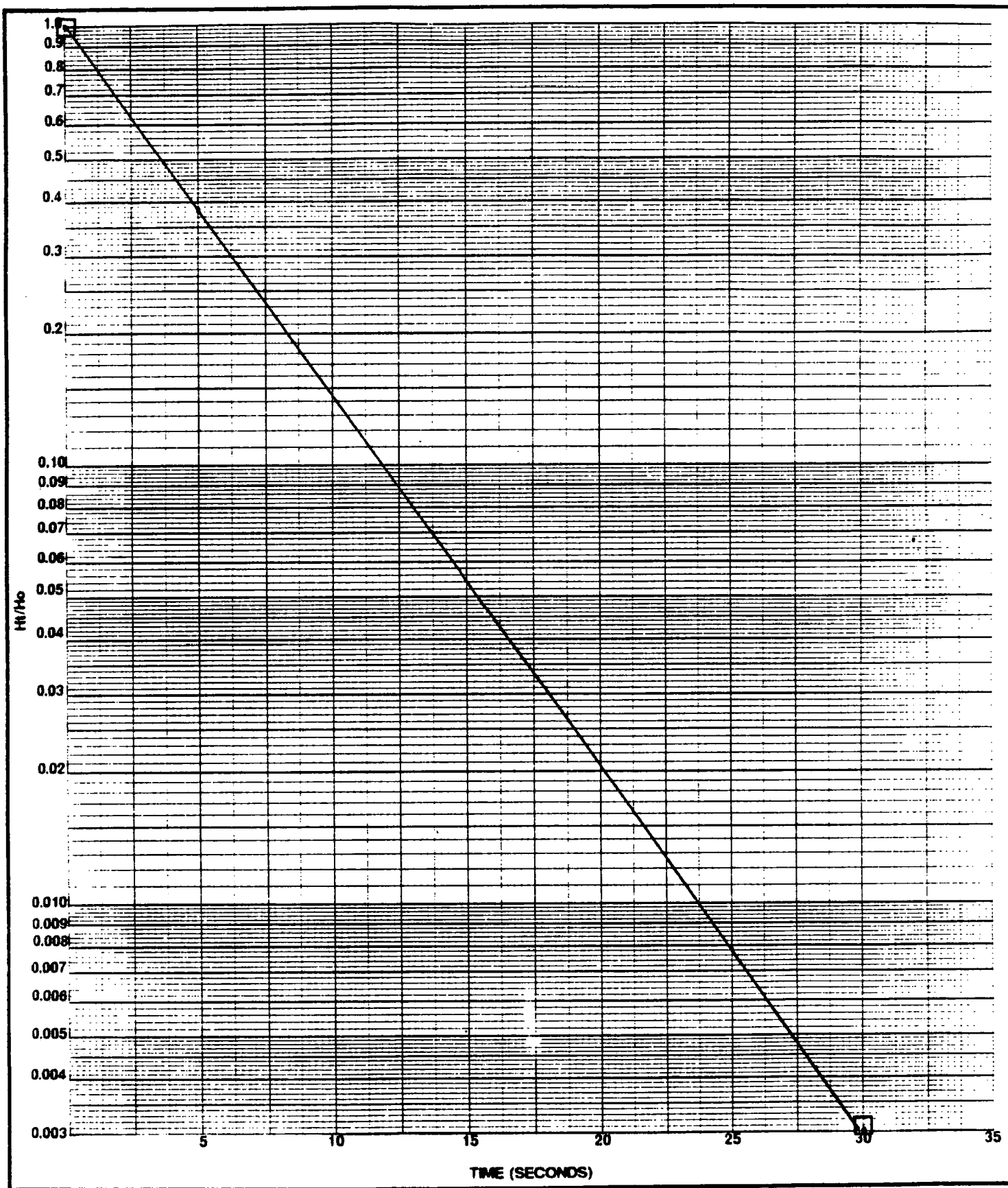
Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 3.81
R: intake point radius (cm) = 3.81
L: length of intake interval (cm) = 214.88
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 5
t2: time (sec) for data point 2 = 25
H1: head ratio for data point 1 = 0.3798
H2: head ratio for data point 2 = 0.0079

Regression Equation: $Log\ (Ht/Ho) = -8.4 \times 10^{-2} t$

Correlation Coefficient: -1

Isotropic Permeability: $K = 2.6 \times 10^{-2}$ cm/sec



RECRA ENVIRONMENTAL INC.

Well I.D. GW-2

Type of Test RISING HEAD

Project Title EMERSON STREET LANDFILL

Project No. 8C1301A

PERMEABILITY DATA PLOT

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1031A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 11/11/88

PERFORMED BY: JC/RB TYPE OF TEST: Falling Head

REFERENCE POINT: Top Case HOLE NO.: GW-3

TEST INTERVAL: 20.5 minutes ELEVATION: 111.30 ft.

STATIC GROUNDWATER LEVEL: 5.96 ft. HOLE DEPTH: 19.22 ft. STICK UP: 2.1 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	4.47	1.49	1
2	30	4.56	1.40	0.940
3	60	4.70	1.26	0.846
4	90	4.77	1.19	0.799
5	120	4.83	1.13	0.758
6	150	4.89	1.07	0.718
7	180	4.95	1.01	0.678
8	210	5.00	0.96	0.644
9	240	5.05	0.91	0.611
10	270	5.10	0.86	0.577
11	330	5.19	0.77	0.517
12	390	5.25	0.71	0.477
13	450	5.31	0.65	0.436
14	510	5.37	0.59	0.396
15	630	5.46	0.50	0.336
16	750	5.54	0.42	0.282
17	990	5.64	0.32	0.215
18	1230	5.70	0.26	0.174

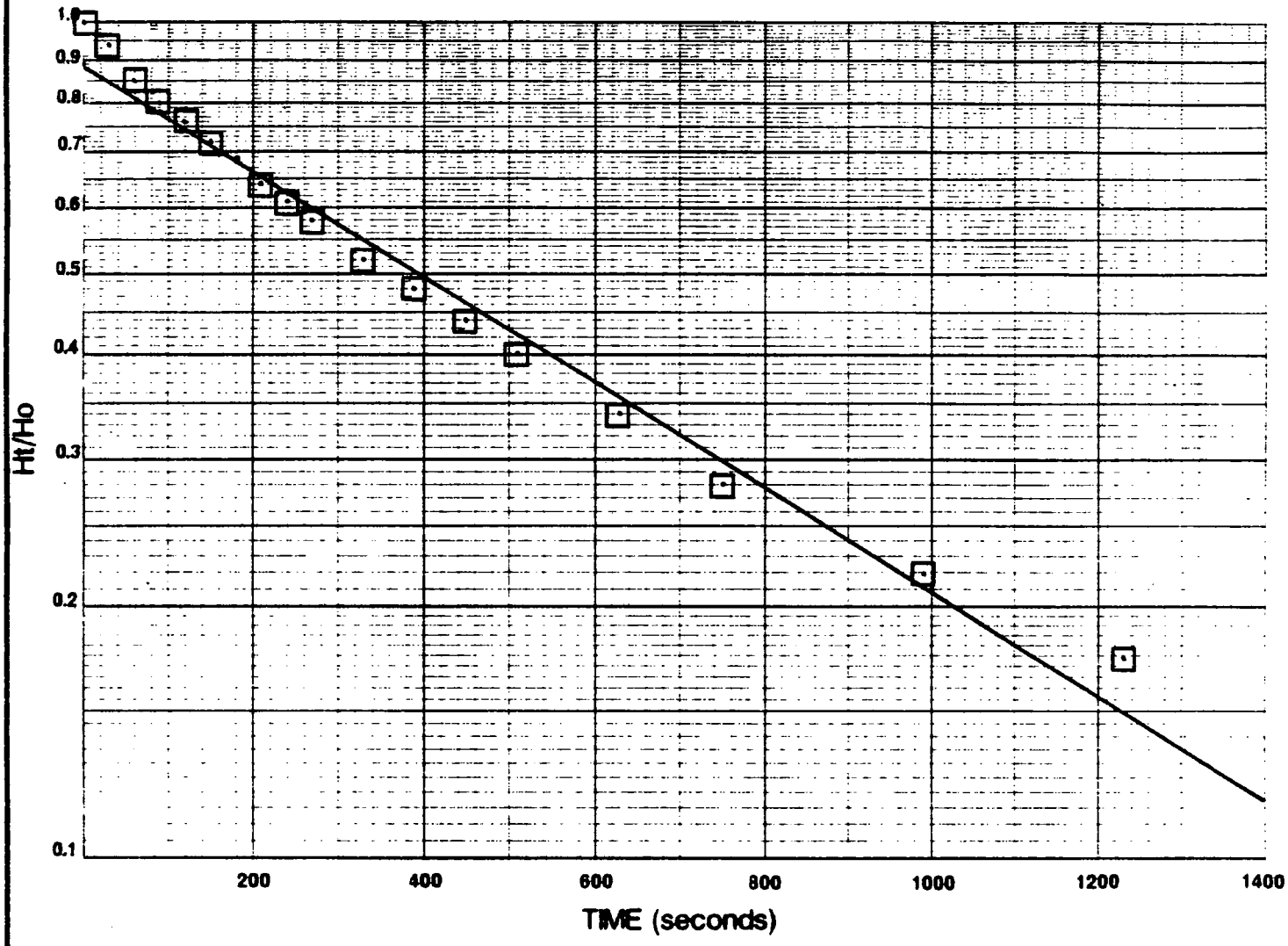
Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 2.54
R: intake point radius (cm) = 8.89
L: length of intake interval (cm) = 365.76
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 90
t2: time (sec) for data point 2 = 990
H1: head ratio for data point 1 = 0.7800
H2: head ratio for data point 2 = 0.2117

Regression Equation: $Log (Ht/Ho) = -6.3 \times 10^{-4} t - 0.0512$

Correlation Coefficient: -0.9911

Isotropic Permeability: $K = 4.8 \times 10^{-5}$ cm/sec



RECRA ENVIRONMENTAL INC.	**Well I.D.** GW-3 **Type of Test** FALLING HEAD **Project Title** EMERSON STREET LANDFILL **Project No.** 8C1301A	PERMEABILITY DATA PLOT

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1031A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 11/11/88

PERFORMED BY: JC/RB TYPE OF TEST: Rising Head

REFERENCE POINT: Top Case HOLE NO.: GW-3

TEST INTERVAL: 36.5 minutes ELEVATION: 111.30 ft.

STATIC GROUNDWATER LEVEL: 5.96 ft. HOLE DEPTH: 19.22 ft. STICK UP: 2.03 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	7.09	1.13	1
2	30	7.07	1.11	0.982
3	60	7.05	1.09	0.965
4	90	7.02	1.06	0.938
5	120	6.99	1.03	0.912
6	150	6.97	1.01	0.894
7	180	6.93	0.97	0.858
8	210	6.91	0.95	0.841
9	270	6.87	0.91	0.805
10	330	6.82	0.86	0.761
11	390	6.78	0.82	0.726
12	510	6.71	0.75	0.664
13	630	6.65	0.69	0.611
14	870	6.54	0.58	0.513
15	1470	6.36	0.40	0.354
16	2070	6.24	0.28	0.248
17	2190	6.23	0.27	0.239

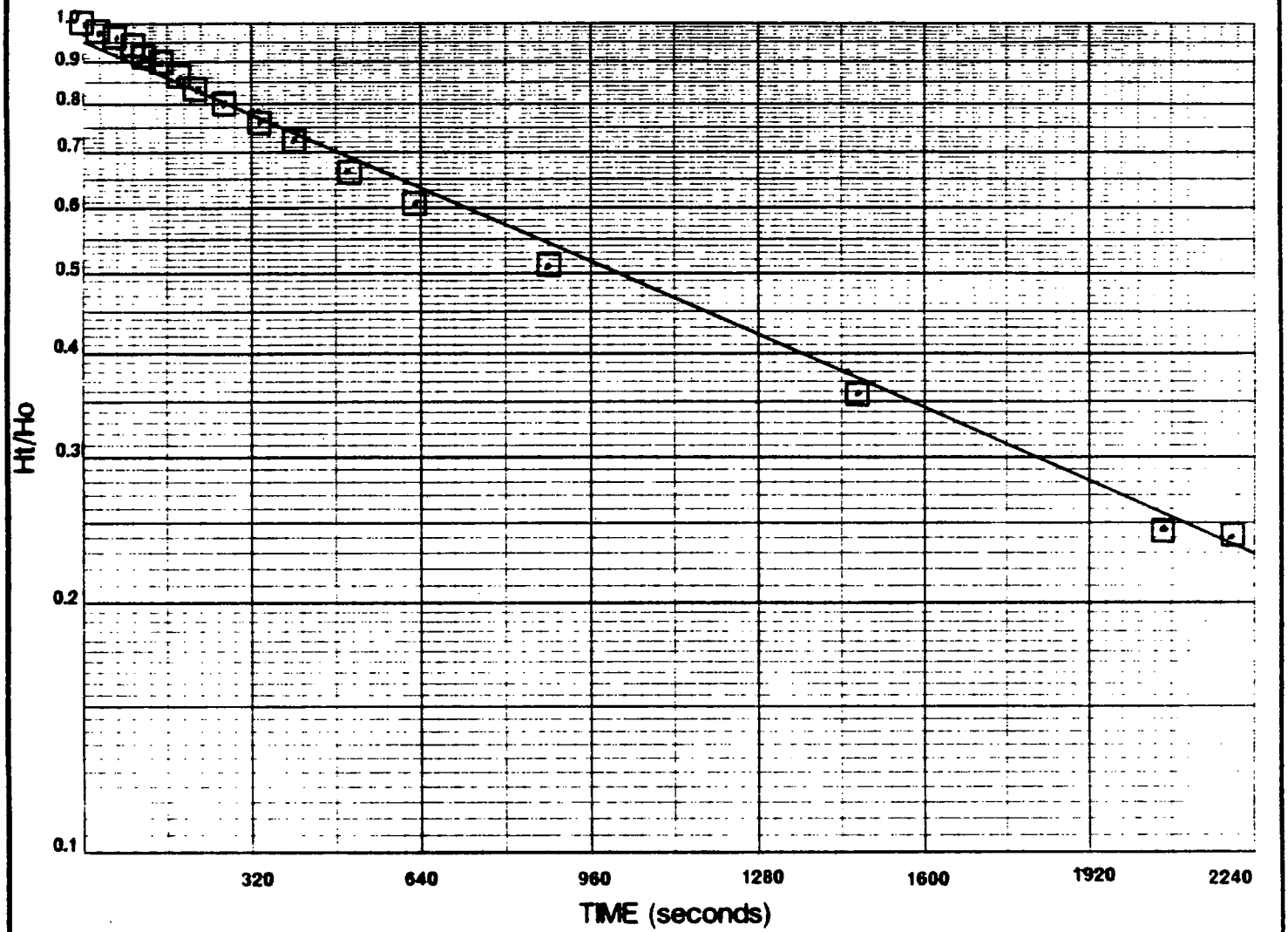
Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 2.54
R: intake point radius (cm) = 8.89
L: length of intake interval (cm) = 365.76
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 100
t2: time (sec) for data point 2 = 1400
H1: head ratio for data point 1 = 0.9071
H2: head ratio for data point 2 = 0.3820

Regression Equation: $Log (Ht/Ho) = -2.9 \times 10^{-4}t - 0.0134$

Correlation Coefficient: -0.9975

Isotropic Permeability: $K = 2.2 \times 10^{-5}$ cm/sec



RECRA ENVIRONMENTAL INC.

Well I.D.	GW-3
Type of Test	RISING HEAD
Project Title	EMERSON STREET LANDFILL
Project No.	8C1301A

PERMEABILITY DATA PLOT

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1031A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 1/14/88

PERFORMED BY: JS/JB TYPE OF TEST: Falling Head

REFERENCE POINT: Top Case HOLE NO.: GW-4

TEST INTERVAL: 1.0 minute ELEVATION: 109.57 ft.

STATIC GROUNDWATER LEVEL: 9.20 ft. HOLE DEPTH: 19.73 ft. STICK UP: 1.67 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	0.84	0.836	1
2	30	9.07	0.13	0.016
3	60	9.16	0.04	0.005

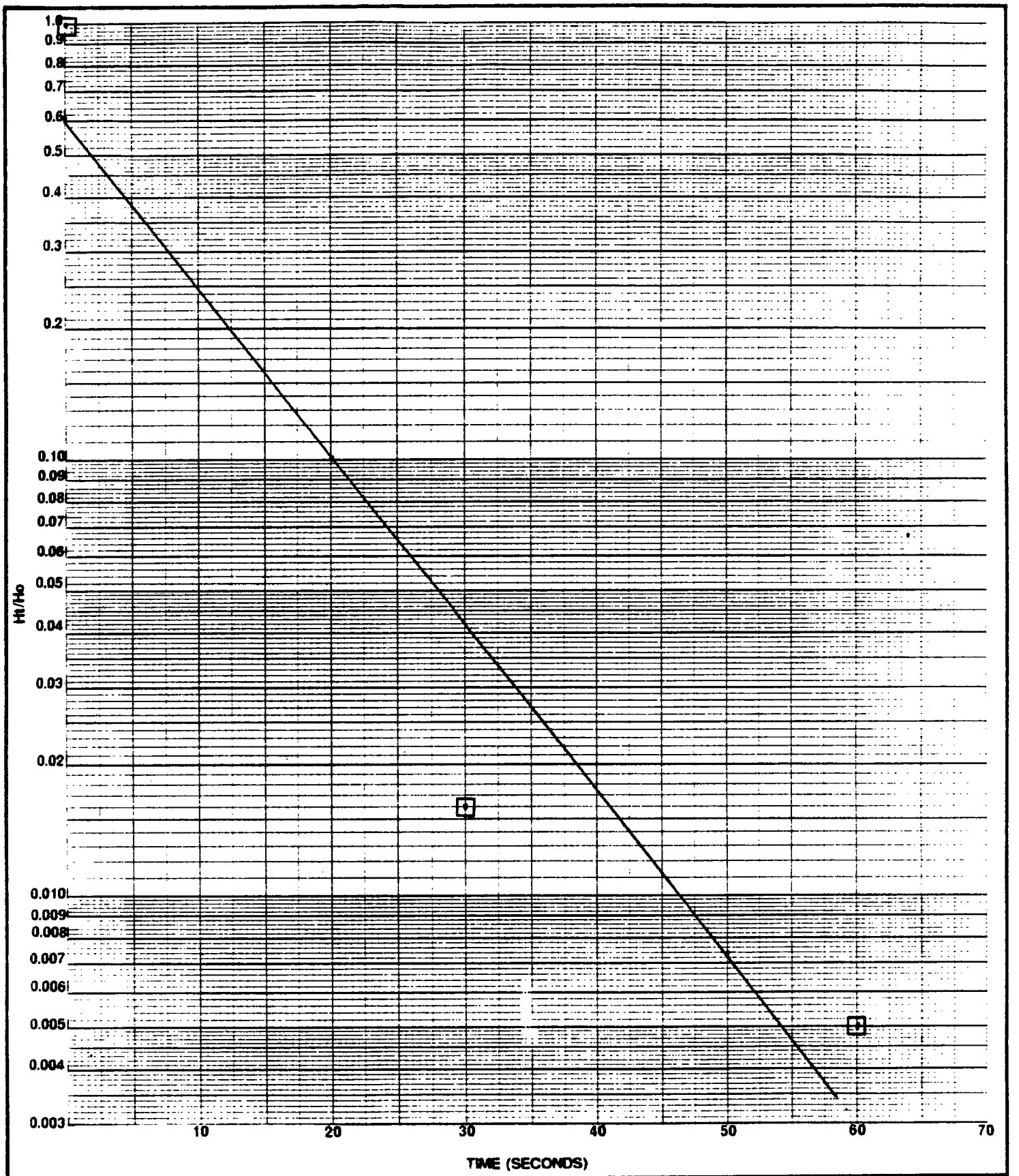
Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 2.54
R: intake point radius (cm) = 4.953
L: length of intake interval (cm) = 350.52
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 20
t2: time (sec) for data point 2 = 50
H1: head ratio for data point 1 = 0.1042
H2: head ratio for data point 2 = 0.0074

Regression Equation: $Log\ (Ht/Ho) = -3.8 \times 10^{-2}t - 0.2151$

Correlation Coefficient: -0.9514

Isotropic Permeability: $K = 3.5 \times 10^{-3}$ cm/sec



RECRA ENVIRONMENTAL INC.

Well I.D. GW-4

Type of Test FALLING HEAD

Project Title EMERSON STREET LANDFILL

Project No. 8C1301A

PERMEABILITY DATA PLOT

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1031A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 11/15/88

PERFORMED BY: JS/JB TYPE OF TEST: Rising Head

REFERENCE POINT: Top Case HOLE NO.: GW-4

TEST INTERVAL: 1.0 minute ELEVATION: 109.57 ft.

STATIC GROUNDWATER LEVEL: 9.25 ft. HOLE DEPTH: 19.73 ft. STICK UP: 1.67 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	17.56	8.31	1
2	30	9.53	0.28	0.034
3	60	9.31	0.06	0.007

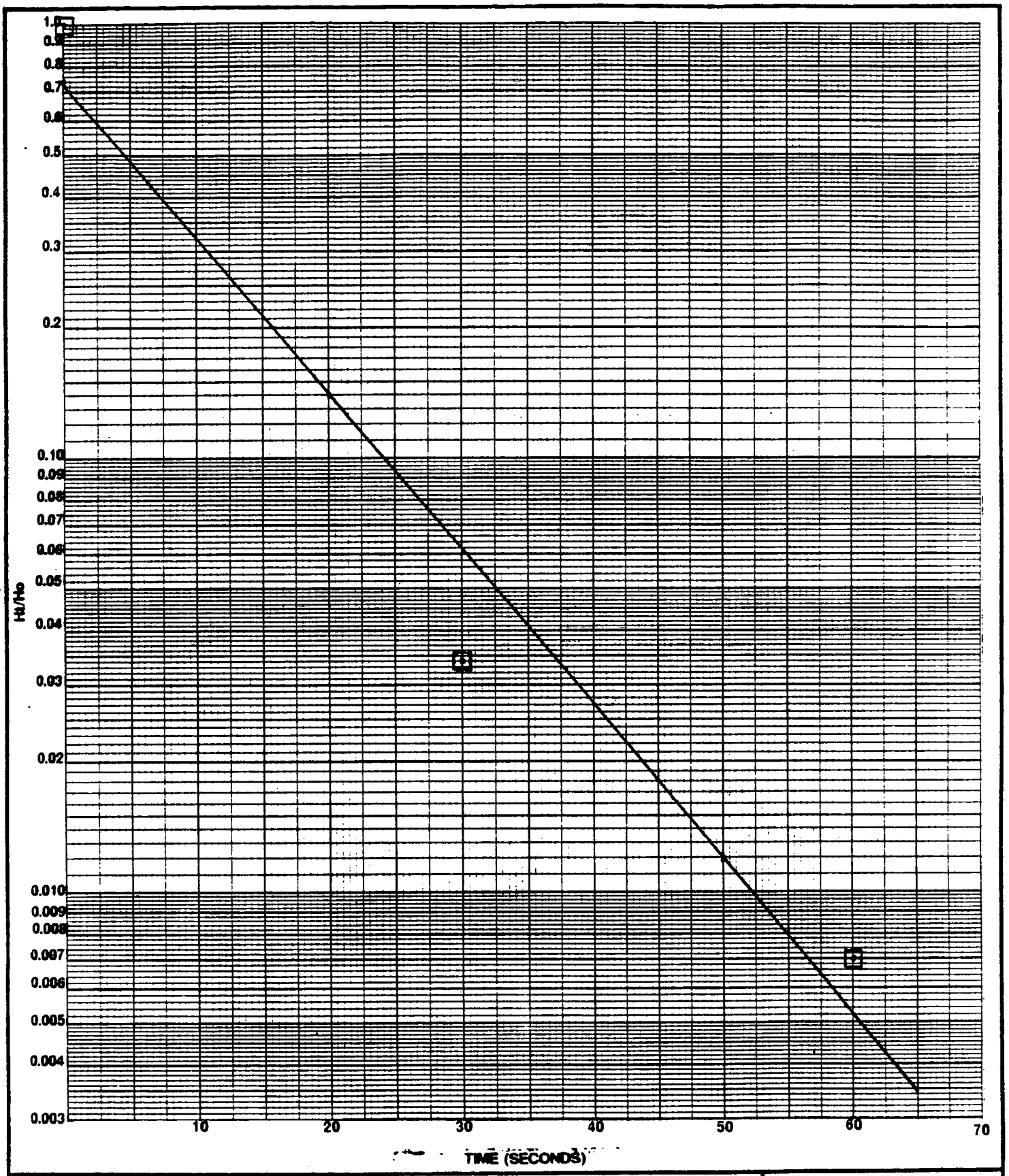
Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 2.54
R: intake point radius (cm) = 4.953
L: length of intake interval (cm) = 350.52
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 20
t2: time (sec) for data point 2 = 50
H1: head ratio for data point 1 = 0.1417
H2: head ratio for data point 2 = 0.0119

Regression Equation: $Log (Ht/Ho) = -3.6 \times 10^{-2} t - 0.1304$

Correlation Coefficient: -0.9787

Isotropic Permeability: $K = 3.2 \times 10^{-3}$ cm/sec



RECRA ENVIRONMENTAL INC.

Well I.D. GW-4

Type of Test RISING HEAD

Project Title EMERSON STREET LANDFILL

Project No. 8C1301A

PERMEABILITY DATA PLOT

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1031A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 11/14-15/88

PERFORMED BY: JB/JS TYPE OF TEST: Falling Head

REFERENCE POINT: Top Case HOLE NO.: GW-5

TEST INTERVAL: 0.5 minute ELEVATION: 98.20 ft.

STATIC GROUNDWATER LEVEL: 10.59 ft. HOLE DEPTH: 23.02 ft. STICK UP: 2 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	2.23	8.36	1
2	30	10.28	0.31	0.037

Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 2.54
R: intake point radius (cm) = 4.953
L: length of intake interval (cm) = 365.76
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 10
t2: time (sec) for data point 2 = 25
H1: head ratio for data point 1 = 0.3332
H2: head ratio for data point 2 = 0.0641

Regression Equation: $Log (Ht/Ho) = -4.8 \times 10^{-2} t$

Correlation Coefficient: -1

Isotropic Permeability: $K = 4.2 \times 10^{-3}$ cm/sec

1/T10390.46

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1031A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 11/14-15/88

PERFORMED BY: JB/JS TYPE OF TEST: Rising Head

REFERENCE POINT: Top Case HOLE NO.: GW-5

TEST INTERVAL: 1.0 minute ELEVATION: 98.20 ft.

STATIC GROUNDWATER LEVEL: 10.72 ft. HOLE DEPTH: 23.02 ft. STICK UP: 2 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	19.08	8.36	1
2	30	12.38	1.66	0.199
3	60	11.11	0.39	0.047

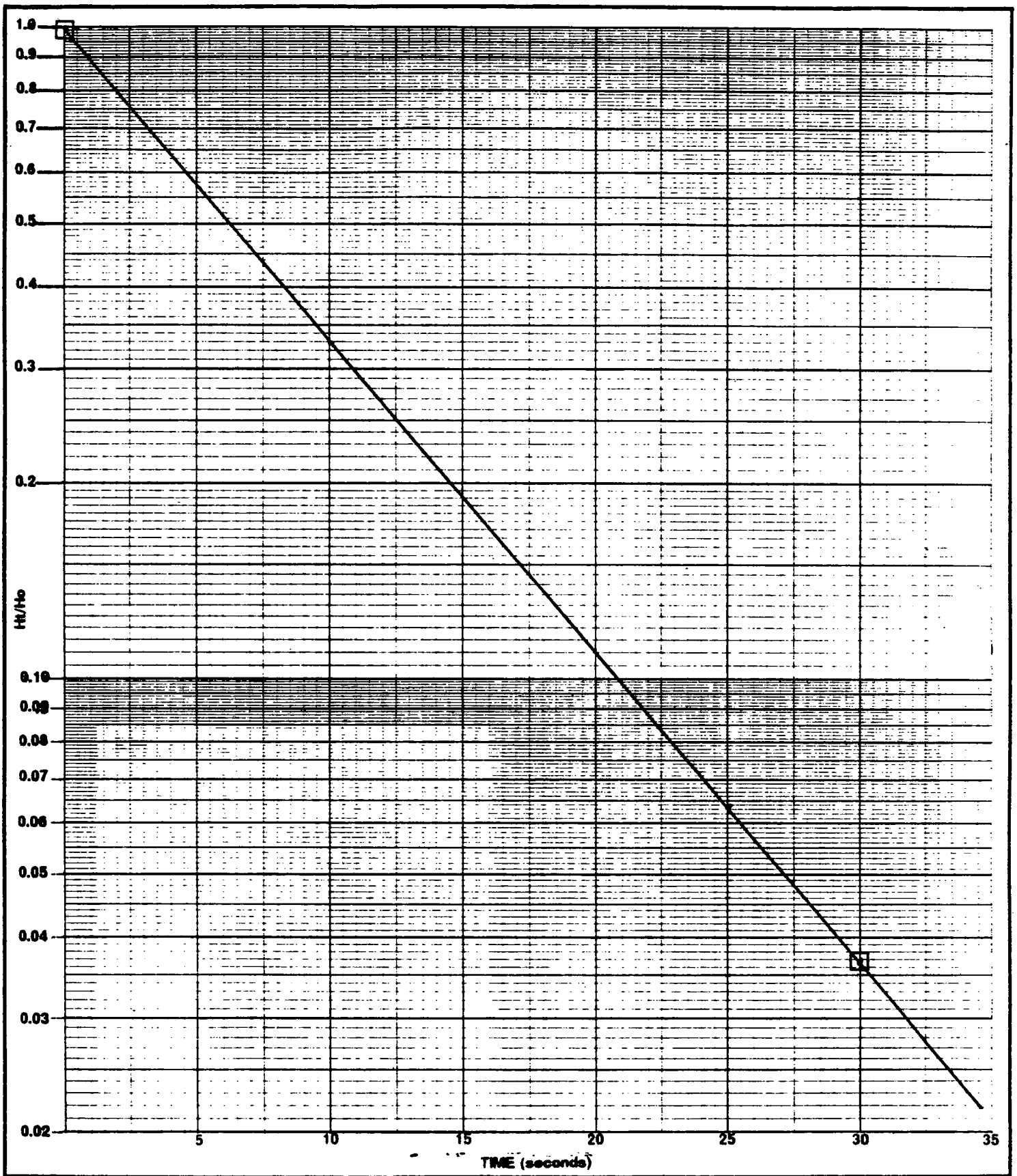
Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 2.54
R: intake point radius (cm) = 4.953
L: length of intake interval (cm) = 365.76
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 10
t2: time (sec) for data point 2 = 50
H1: head ratio for data point 1 = 0.5838
H2: head ratio for data point 2 = 0.0760

Regression Equation: $Log (Ht/Ho) = -2.2 \times 10^{-2} t - 0.0124$

Correlation Coefficient: -0.9995

Isotropic Permeability: $K = 1.9 \times 10^{-3}$ cm/sec



RECRA ENVIRONMENTAL, INC.

Well I.D. GW-5

Type of Test FALLING HEAD

Project Title EMERSON STREET LANDFILL

Project No. 8C1301A

PERMEABILITY DATA PLOT

1/T10390.49

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1031A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 11/14/88

PERFORMED BY: JS/JB TYPE OF TEST: Falling Head

REFERENCE POINT: Top Case HOLE NO.: GW-6

TEST INTERVAL: 0.5 minute ELEVATION: 101.13 ft.

STATIC GROUNDWATER LEVEL: 16.43 ft. HOLE DEPTH: 24.88 ft. STICK UP: 1.83 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	9.75	15.13	1
2	30	16.34	8.54	0.013

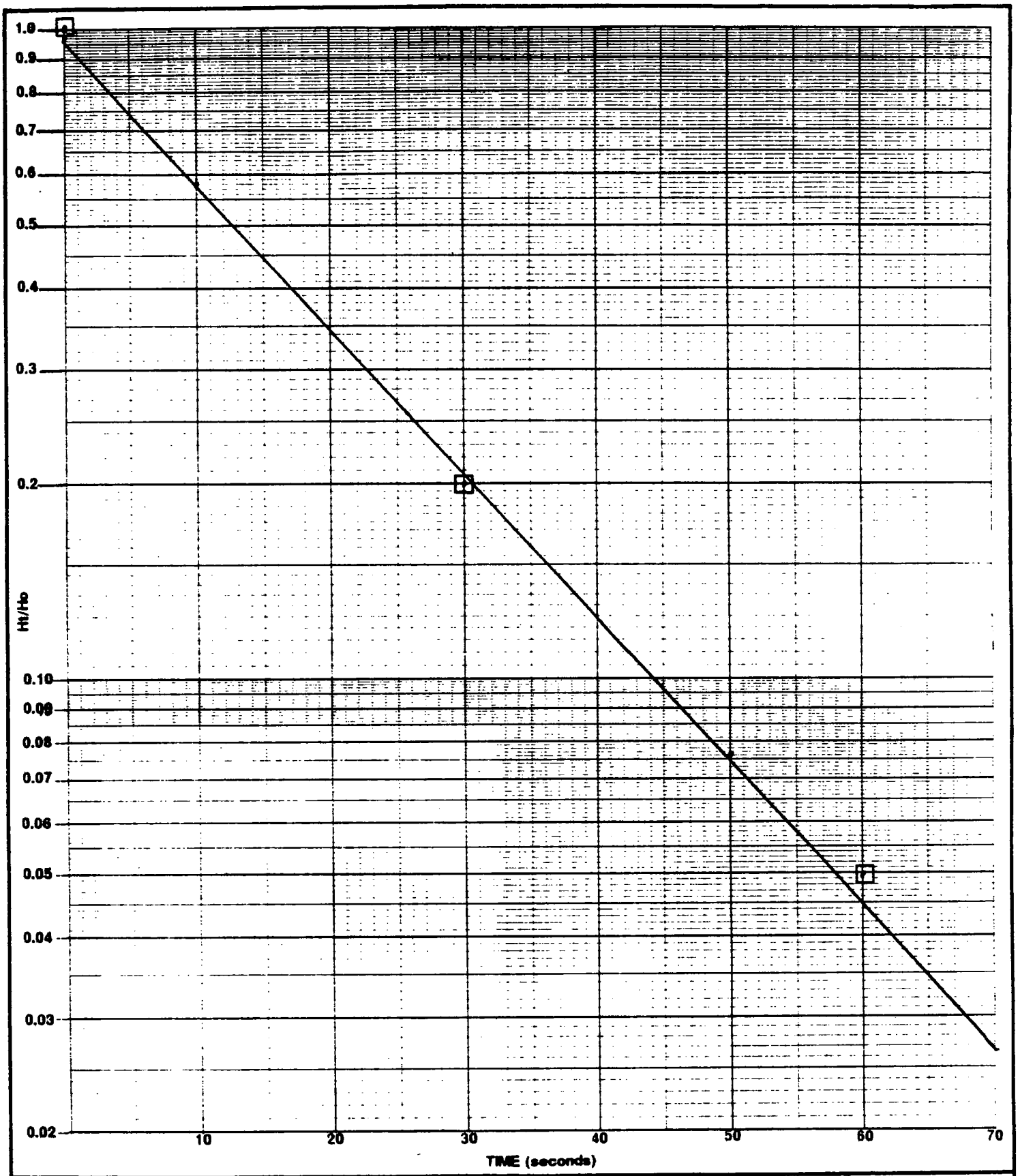
Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 2.54
R: intake point radius (cm) = 4.953
L: length of intake interval (cm) = 256.03
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 10
t2: time (sec) for data point 2 = 20
H1: head ratio for data point 1 = 0.2351
H2: head ratio for data point 2 = 0.0553

Regression Equation: $Log (Ht/Ho) = -6.3 \times 10^{-2} t$

Correlation Coefficient: -1

Isotropic Permeability: $K = 7.3 \times 10^{-3}$ cm/sec



RECRA ENVIRONMENTAL, INC.

Well I.D. GW-5

Type of Test RISING HEAD

Project Title EMERSON STREET LANDFILL

Project No. 8C1301A

PERMEABILITY DATA PLOT

1/T10390.48

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1031A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 11/14/88

PERFORMED BY: JS/JB TYPE OF TEST: Rising Head

REFERENCE POINT: Top Case HOLE NO.: GW-6

TEST INTERVAL: 0.5 minute ELEVATION: 101.13 ft.

STATIC GROUNDWATER LEVEL: 16.43 ft. HOLE DEPTH: 24.88 ft. STICK UP: 1.83 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	23.11	1.77	1
2	30	16.49	8.39	0.009

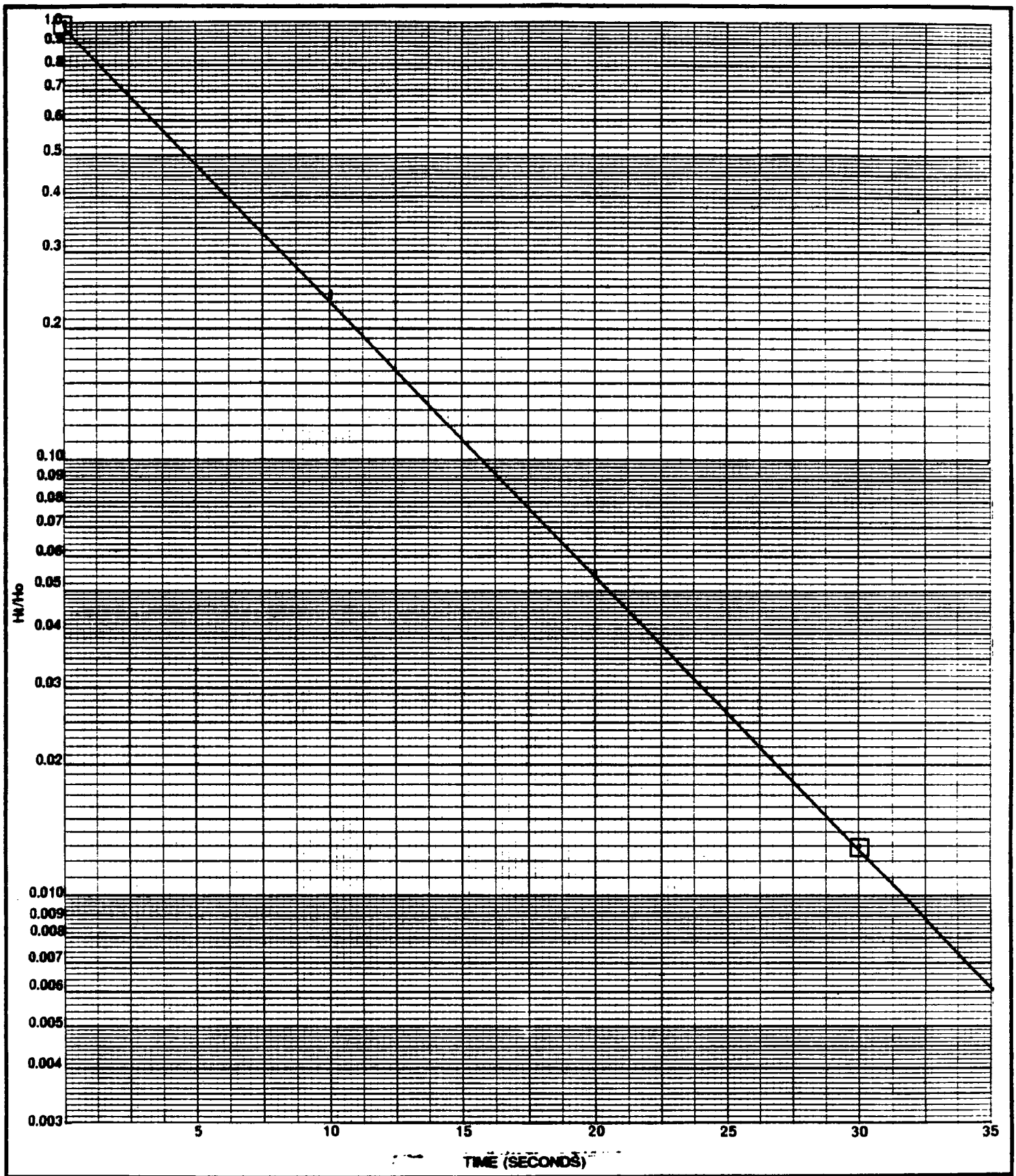
Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 2.54
R: intake point radius (cm) = 4.953
L: length of intake interval (cm) = 256.03
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 10
t2: time (sec) for data point 2 = 20
H1: head ratio for data point 1 = 0.2080
H2: head ratio for data point 2 = 0.0433

Regression Equation: $Log (Ht/Ho) = -6.8 \times 10^{-2} t$

Correlation Coefficient: -1

Isotropic Permeability: $K = 7.9 \times 10^{-3}$ cm/sec



RECRA ENVIRONMENTAL INC.

Well I.D. GW-6

Type of Test FALLING HEAD

Project Title EMERSON STREET LANDFILL

Project No. 8C1301A

PERMEABILITY DATA PLOT

1/T10390.51

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1031A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 11/14/88

PERFORMED BY: JS/JB TYPE OF TEST: Falling Head

REFERENCE POINT: Top Case HOLE NO.: GW-7

TEST INTERVAL: 1.0 minute ELEVATION: 100.69 ft.

STATIC GROUNDWATER LEVEL: 12.55 ft. HOLE DEPTH: 18.39 ft. STICK UP: 0.09 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	7.56	4.99	1
2	30	11.96	0.59	0.118
3	60	12.35	0.2	0.040

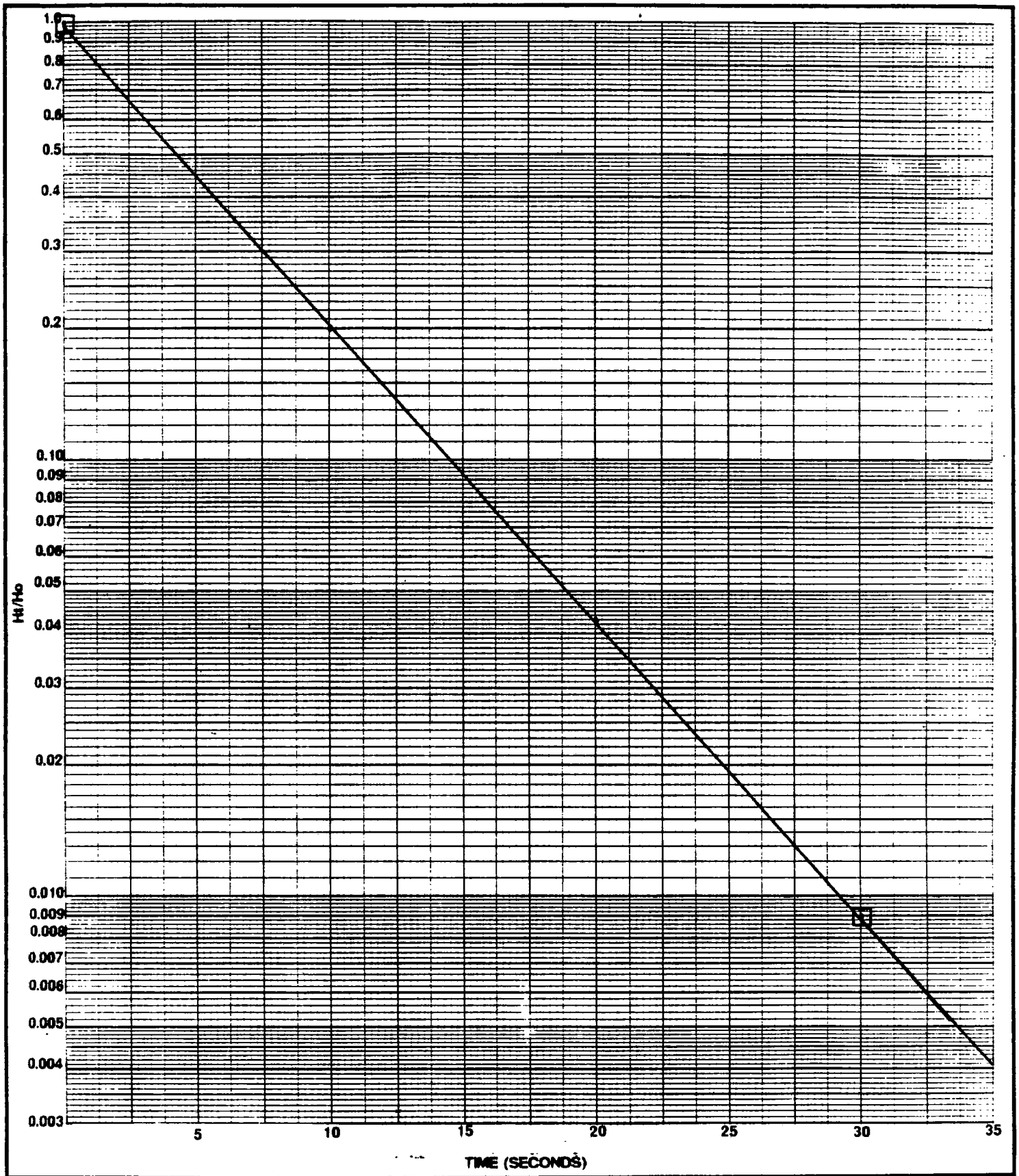
Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 2.54
R: intake point radius (cm) = 4.953
L: length of intake interval (cm) = 185.6
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 10
t2: time (sec) for data point 2 = 50
H1: head ratio for data point 1 = 0.4905
H2: head ratio for data point 2 = 0.0574

Regression Equation: $Log (Ht/Ho) = -2.3 \times 10^{-2}t - 0.0764$

Correlation Coefficient: -0.9826

Isotropic Permeability: $K = 3.4 \times 10^{-3}$ cm/sec



RECRA ENVIRONMENTAL INC.

Well I.D. GW-6

Type of Test RISING HEAD

Project Title EMERSON STREET LANDFILL

Project No. 8C1301A

PERMEABILITY DATA PLOT

1/T10390.50

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1031A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 11/14/88

PERFORMED BY: JS/JB TYPE OF TEST: Rising Head

REFERENCE POINT: Top Case HOLE NO.: GW-7

TEST INTERVAL: 1.0 minute ELEVATION: 100.69 ft.

STATIC GROUNDWATER LEVEL: 12.55 ft. HOLE DEPTH: 18.39 ft. STICK UP: 0.09 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	17.54	4.99	1
2	30	13.34	0.79	0.158
3	60	12.98	0.43	0.086

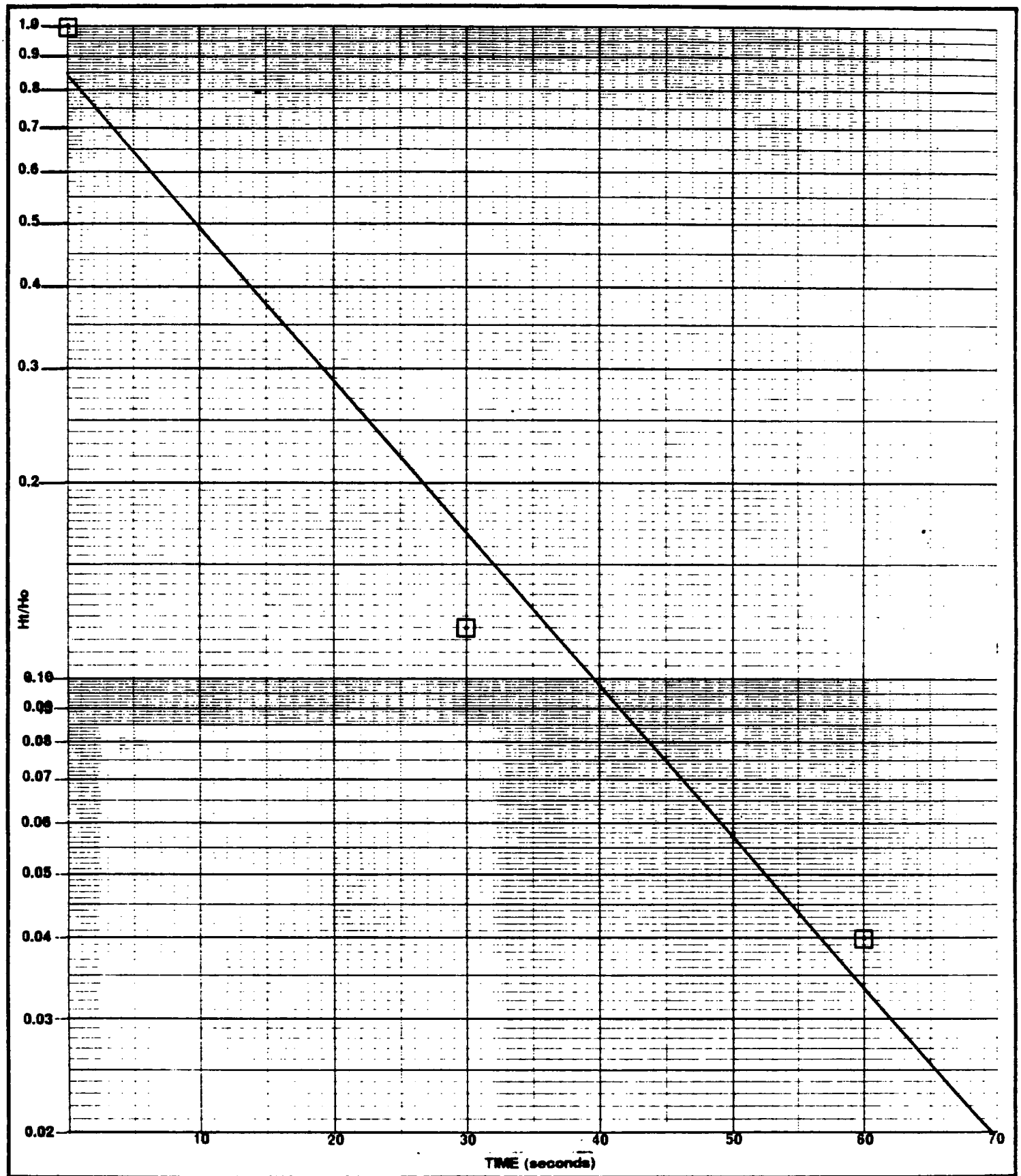
Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 2.54
R: intake point radius (cm) = 4.953
L: length of intake interval (cm) = 185.6
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 10
t2: time (sec) for data point 2 = 50
H1: head ratio for data point 1 = 0.5406
H2: head ratio for data point 2 = 0.1053

Regression Equation: $Log (Ht/Ho) = -1.8 \times 10^{-2} t - 0.0895$

Correlation Coefficient: -0.9602

Isotropic Permeability: $K = 2.6 \times 10^{-3}$ cm/sec



RECRA ENVIRONMENTAL, INC.

Well I.D. GW-7

Type of Test FALLING HEAD

Project Title EMERSON STREET LANDFILL

Project No. 8C1301A

PERMEABILITY DATA PLOT

1/T10390.53

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1031A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 11/10/88

PERFORMED BY: JS/JC/RB TYPE OF TEST: Falling Head

REFERENCE POINT: Top Case HOLE NO.: GW-8D

TEST INTERVAL: 15.5 minutes ELEVATION: 98.44 ft.

STATIC GROUNDWATER LEVEL: 5.77 ft. HOLE DEPTH: 25.92 ft. STICK UP: 1.94 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	5.28	0.49	1
2	30	5.40	0.37	0.755
3	60	5.47	0.30	0.612
4	90	5.52	0.25	0.510
5	150	5.56	0.21	0.423
6	210	5.60	0.17	0.347
7	330	5.61	0.16	0.327
8	450	5.63	0.14	0.286
9	690	5.64	0.13	0.265
10	930	5.66	0.11	0.224

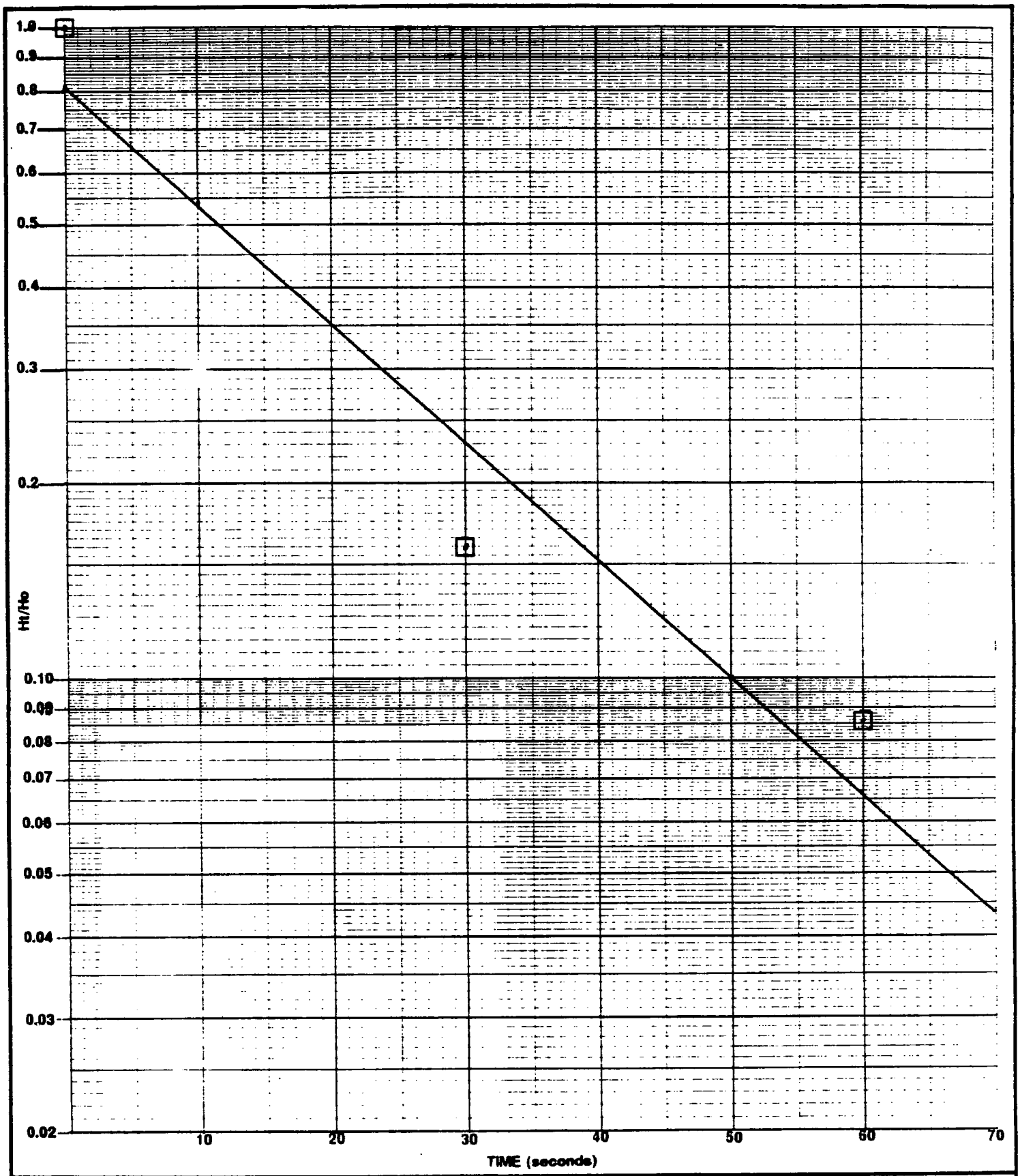
Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 3.81
R: intake point radius (cm) = 3.81
L: length of intake interval (cm) = 304.8
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 50
t2: time (sec) for data point 2 = 850
H1: head ratio for data point 1 = 0.5912
H2: head ratio for data point 2 = 0.2002

Regression Equation: $Log (Ht/Ho) = -5.9 \times 10^{-4}t - 0.1989$

Correlation Coefficient: -0.8639

Isotropic Permeability: $K = 1.4 \times 10^{-4}$ cm/sec



RECRA ENVIRONMENTAL, INC.

Well I.D. GW-7

Type of Test RISING HEAD

Project Title EMERSON STREET LANDFILL

Project No. 8C1301A

PERMEABILITY DATA PLOT

1/T10390.52

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1031A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 11/10/88

PERFORMED BY: JS/JC/RB TYPE OF TEST: Rising Head

REFERENCE POINT: Top Case HOLE NO.: GW-8D

TEST INTERVAL: 5.5 minutes ELEVATION: 98.44 ft.

STATIC GROUNDWATER LEVEL: 5.77 ft. HOLE DEPTH: 25.92 ft. STICK UP: 1.94 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	6.26	0.49	1
2	30	6.08	0.31	0.633
3	60	6.00	0.23	0.469
4	90	5.95	0.18	0.367
5	150	5.90	0.13	0.265
6	210	5.87	0.10	0.204
7	330	5.85	0.08	0.163

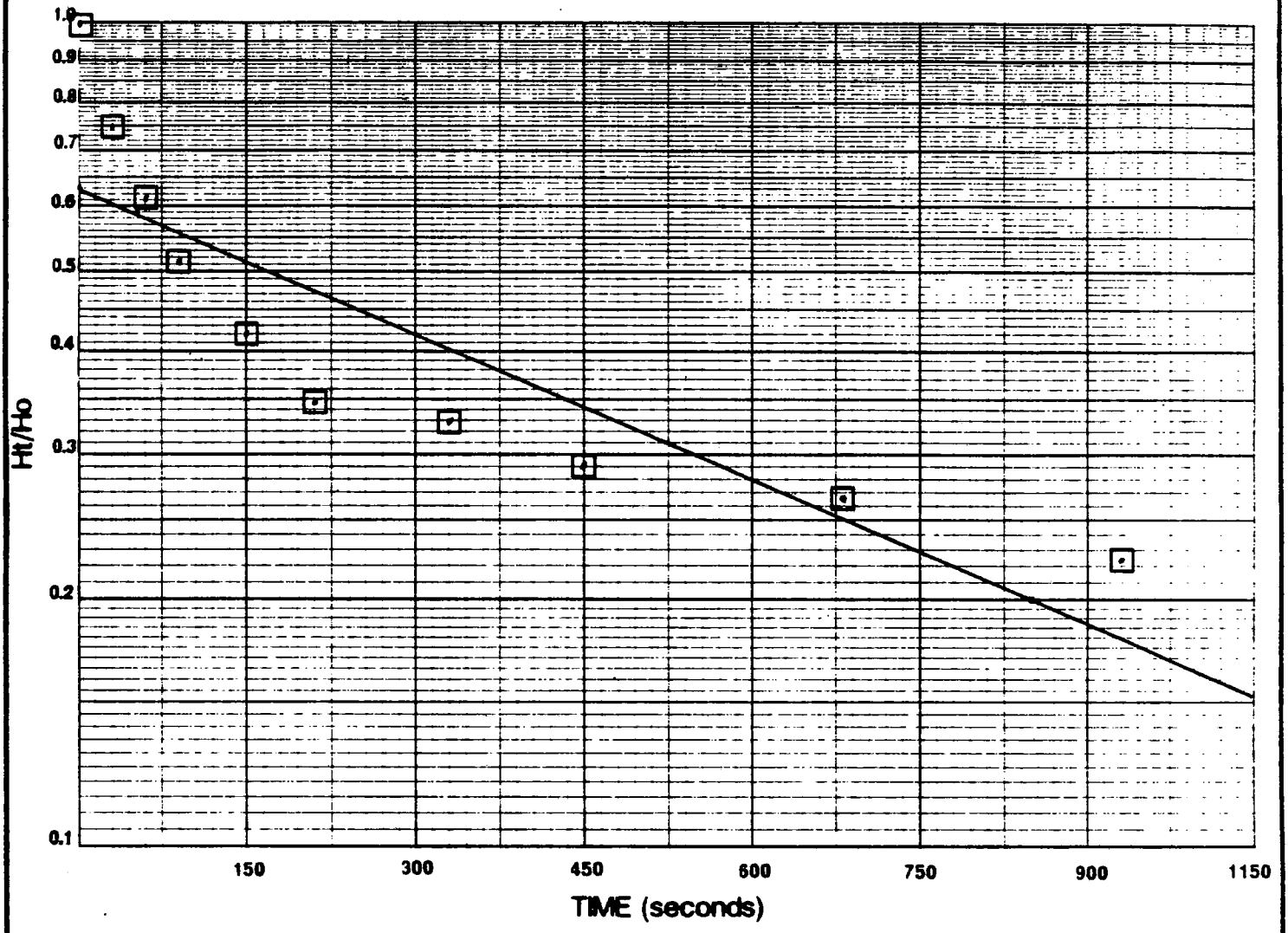
Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 3.81
R: intake point radius (cm) = 3.81
L: length of intake interval (cm) = 304.8
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 40
t2: time (sec) for data point 2 = 180
H1: head ratio for data point 1 = 0.5754
H2: head ratio for data point 2 = 0.2771

Regression Equation: $Log (Ht/Ho) = -2.3 \times 10^{-3} t - 0.1494$

Correlation Coefficient: -0.9390

Isotropic Permeability: $K = 5.4 \times 10^{-4}$ cm/sec



RECRA ENVIRONMENTAL INC.	**Well I.D.** GW-8D **Type of Test** FALLING HEAD **Project Title** EMERSON STREET LANDFILL **Project No.** 8C1301A	PERMEABILITY DATA PLOT

1/T10390.55

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1031A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 11/10/88

PERFORMED BY: JS/JC TYPE OF TEST: Falling Head

REFERENCE POINT: Top Case HOLE NO.: GW-8S

TEST INTERVAL: 6.5 minutes ELEVATION: 97.79 ft.

STATIC GROUNDWATER LEVEL: 5.05 ft. HOLE DEPTH: 12.49 ft. STICK UP: 1.79 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	4.19	0.86	1
2	30	4.28	0.77	0.895
3	60	4.46	0.59	0.686
4	90	4.59	0.46	0.535
5	150	4.67	0.38	0.442
6	270	4.75	0.30	0.349
7	390	4.81	0.24	0.279

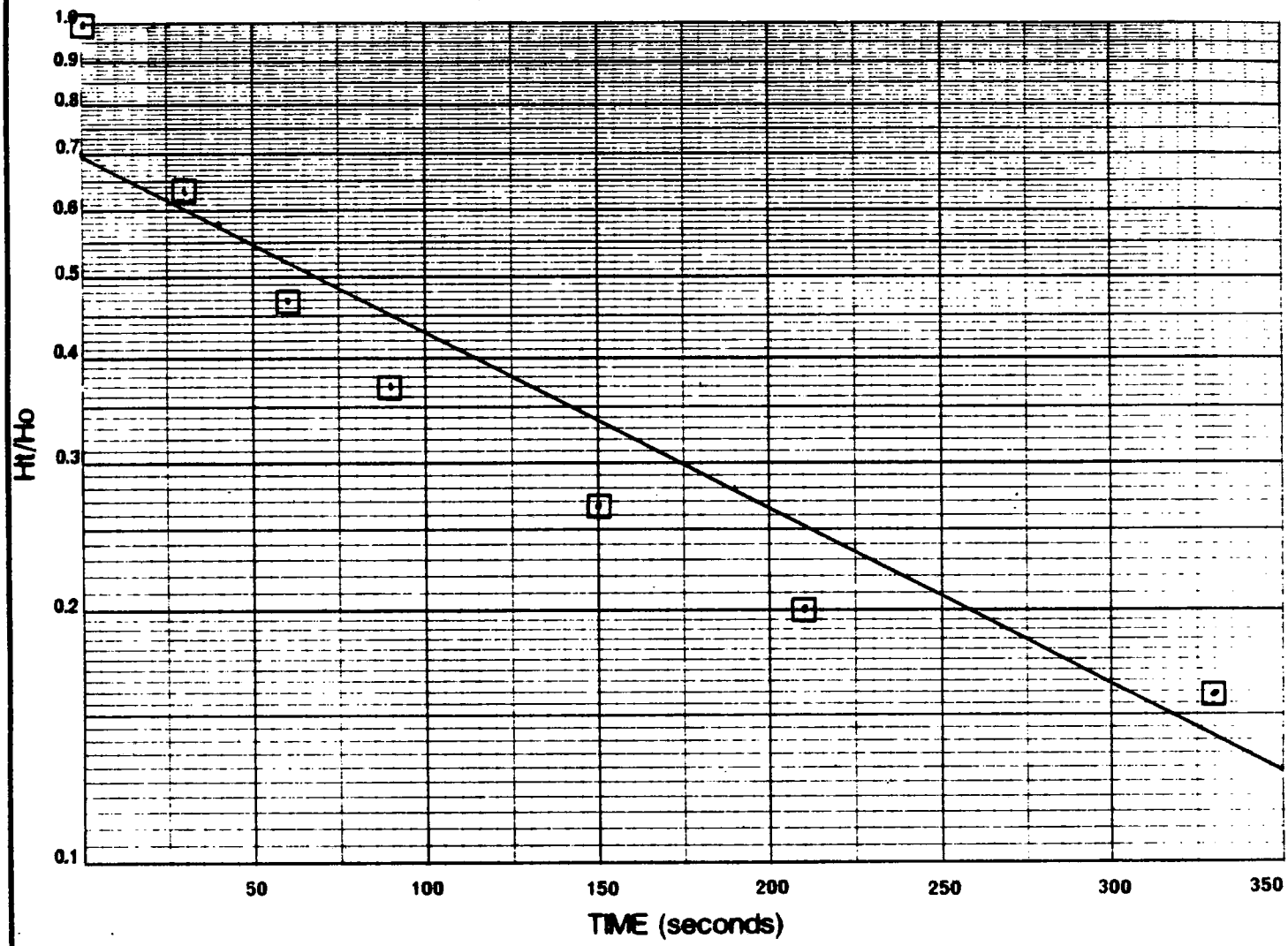
Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 2.54
R: intake point radius (cm) = 7.62
L: length of intake interval (cm) = 190.5
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 60
t2: time (sec) for data point 2 = 360
H1: head ratio for data point 1 = 0.7063
H2: head ratio for data point 2 = 0.2703

Regression Equation: $Log (Ht/Ho) = -1.4 \times 10^{-3}t - 0.0676$

Correlation Coefficient: -0.9518

Isotropic Permeability: K = 1.7 x 10-4 cm/sec



RECRA ENVIRONMENTAL INC.

Well I.D. GW-8D

Type of Test RISING HEAD

Project Title EMERSON STREET LANDFILL

Project No. 8C1301A

PERMEABILITY DATA PLOT

1/T10390.54

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1031A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 11/10/88

PERFORMED BY: JS/JC TYPE OF TEST: Rising Head

REFERENCE POINT: Top Case HOLE NO.: GW-8S

TEST INTERVAL: 5.0 minutes ELEVATION: 97.79 ft.

STATIC GROUNDWATER LEVEL: 5.05 ft. HOLE DEPTH: 12.49 ft. STICK UP: 1.79 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	5.77	0.72	1
2	30	5.61	0.56	0.778
3	60	5.52	0.47	0.653
4	120	5.41	0.36	0.500
5	180	5.34	0.29	0.403
6	300	5.26	0.21	0.292

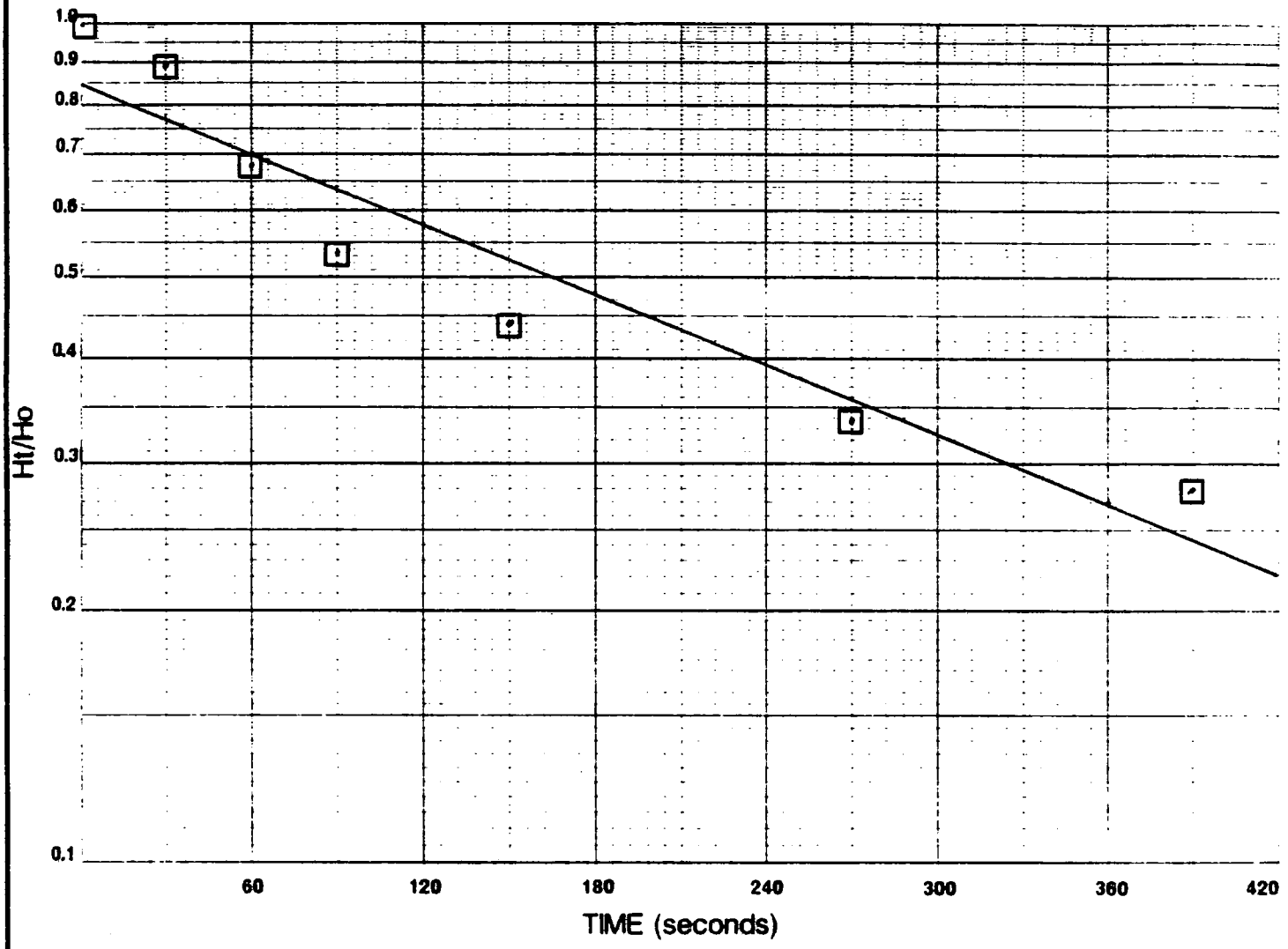
Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 2.54
R: intake point radius (cm) = 7.62
L: length of intake interval (cm) = 190.5
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 20
t2: time (sec) for data point 2 = 220
H1: head ratio for data point 1 = 0.8118
H2: head ratio for data point 2 = 0.3675

Regression Equation: $Log (Ht/Ho) = -1.7 \times 10^{-3} t - 0.0562$

Correlation Coefficient: -0.9801

Isotropic Permeability: $K = 2.2 \times 10^{-4}$ cm/sec



RECRA ENVIRONMENTAL INC.

Well I.D. GW-8s

Type of Test FALLING HEAD

Project Title EMERSON STREET LANDFILL

Project No. 8C1301A

PERMEABILITY DATA PLOT

1/T10390.57

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1031A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 11/15/88

PERFORMED BY: JB/JS TYPE OF TEST: Falling Head

REFERENCE POINT: Top Case HOLE NO.: GW-9

TEST INTERVAL: 65.5 minutes ELEVATION: 101.80 ft.

STATIC GROUNDWATER LEVEL: 17.30 ft. HOLE DEPTH: 26.64 ft. STICK UP: 1.6 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	14.90	2.4	1
2	30	14.94	2.36	0.983
3	60	14.99	2.31	0.963
4	90	15.04	2.26	0.942
5	150	15.13	2.17	0.904
6	210	15.22	2.08	0.867
7	270	15.29	2.01	0.838
8	390	15.44	1.86	0.775
9	510	15.62	1.68	0.700
10	750	15.93	1.37	0.571
11	990	16.04	1.26	0.525
12	1470	16.14	1.16	0.483
13	1950	16.18	1.12	0.467
14	2970	16.21	1.09	0.454
15	3930	16.27	1.08	0.450

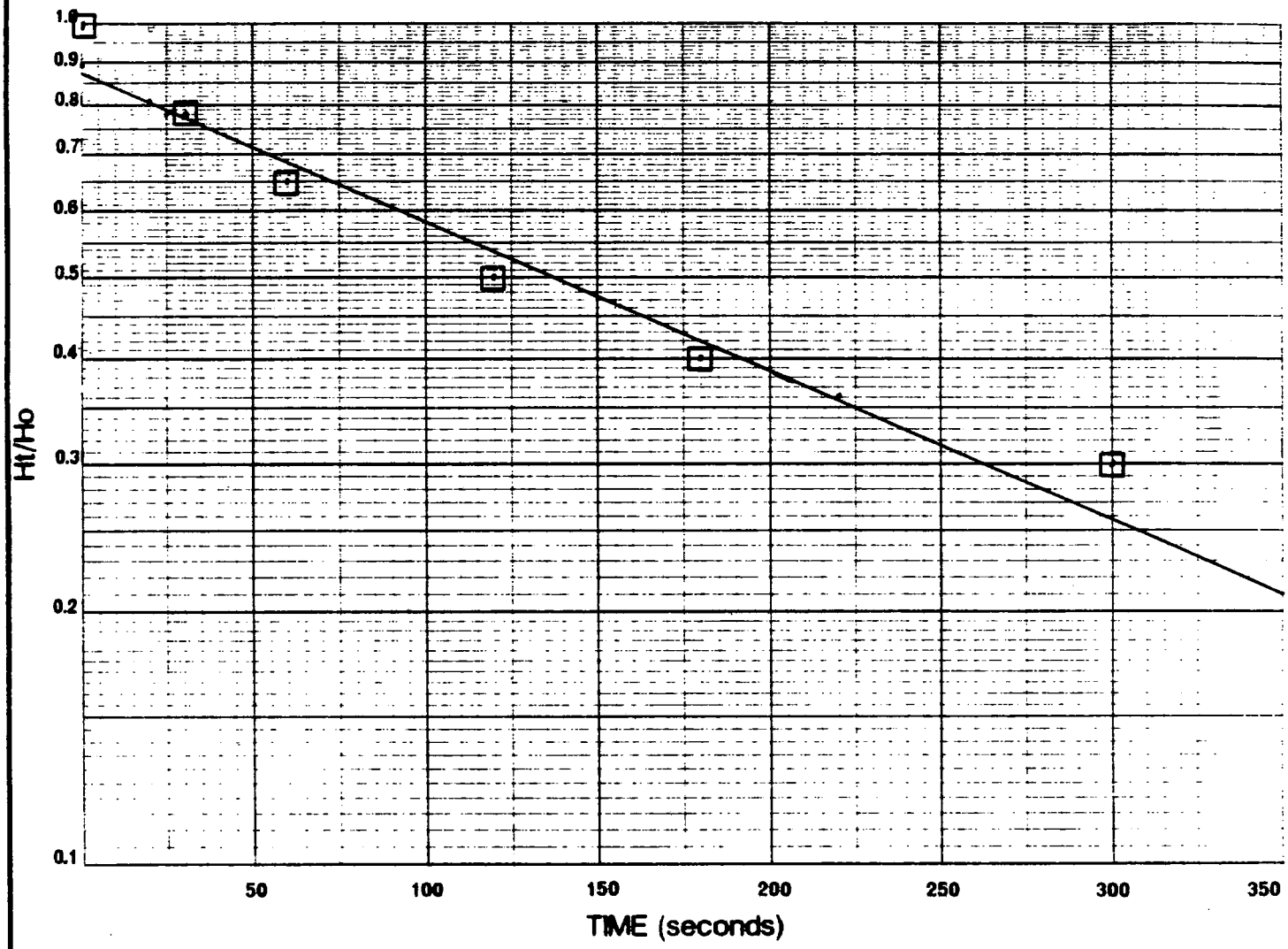
Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 2.54
R: intake point radius (cm) = 4.953
L: length of intake interval (cm) = 283.5
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 100
t2: time (sec) for data point 2 = 1900
H1: head ratio for data point 1 = 0.8393
H2: head ratio for data point 2 = 0.5565

Regression Equation: $Log (Ht/Ho) = -9.9 \times 10^{-5} t - 0.0662$

Correlation Coefficient: -0.8577

Isotropic Permeability: $K = 1.1 \times 10^{-5}$ cm/sec



RECRA ENVIRONMENTAL INC.

Well I.D. GW-8S

Type of Test RISING HEAD

Project Title EMERSON STREET LANDFILL

Project No. 8C1301A

PERMEABILITY DATA PLOT

1/T10390.56

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1031A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 11/15/88

PERFORMED BY: JB/JS TYPE OF TEST: Rising Head

REFERENCE POINT: Top Case HOLE NO.: GW-9

TEST INTERVAL: 23.5 minutes ELEVATION: 101.80 ft.

STATIC GROUNDWATER LEVEL: 17.30 ft. HOLE DEPTH: 26.64 ft. STICK UP: 1.6 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	21.26	3.96	1
2	30	20.39	3.09	0.780
3	60	19.73	2.43	0.614
4	90	19.25	1.95	0.492
5	150	18.83	1.53	0.386
6	210	18.59	1.29	0.326
7	330	18.26	0.96	0.242
8	450	18.07	0.77	0.194
9	690	17.90	0.60	0.152
10	930	17.84	0.54	0.136
11	1410	17.77	0.47	0.119

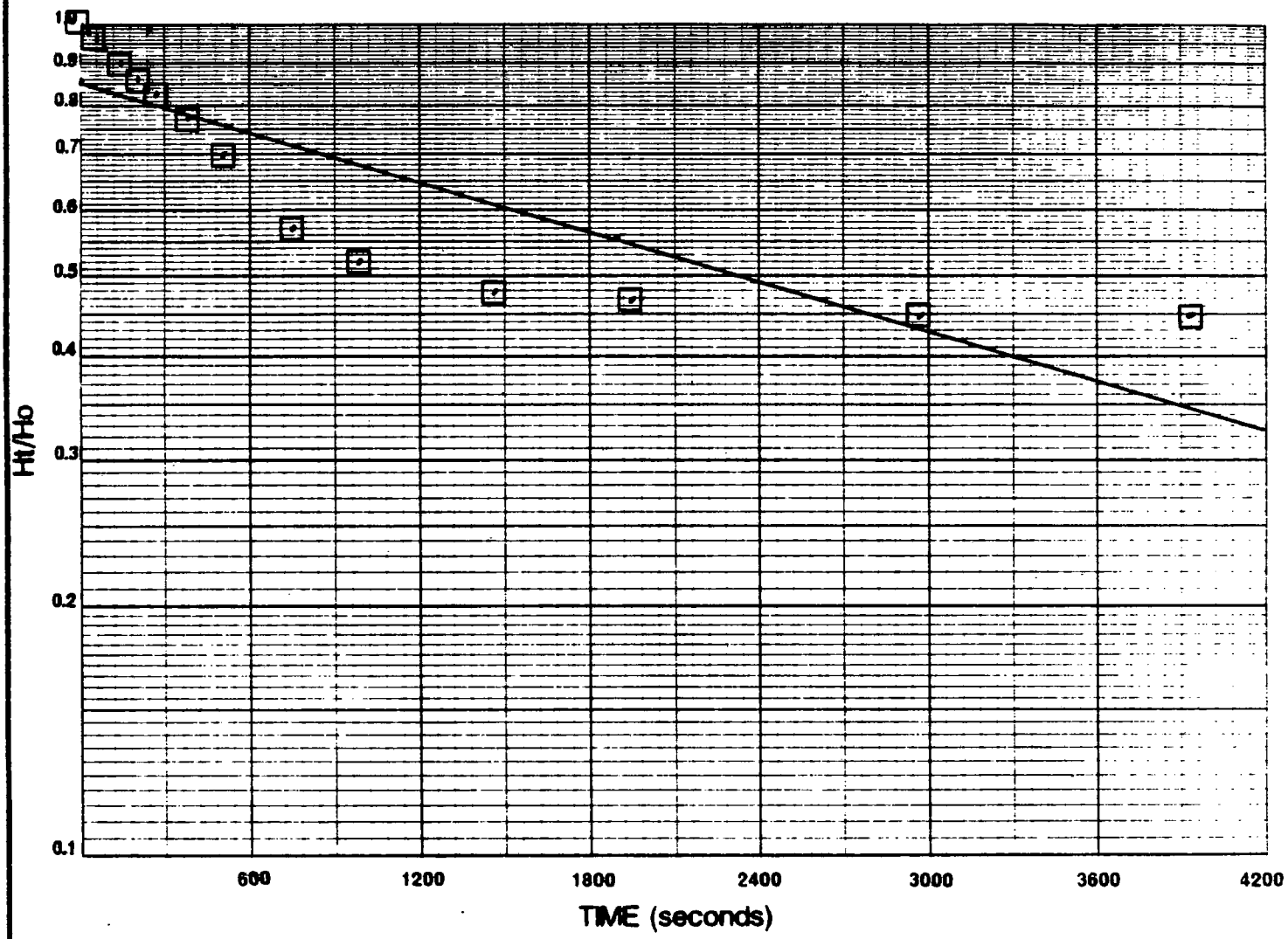
Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 2.54
R: intake point radius (cm) = 4.953
L: length of intake interval (cm) = 283.5
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 100
t2: time (sec) for data point 2 = 700
H1: head ratio for data point 1 = 0.4864
H2: head ratio for data point 2 = 0.2059

Regression Equation: $Log\ (Ht/Ho) = -6.2 \times 10^{-4} t - 0.2508$

Correlation Coefficient: -0.8776

Isotropic Permeability: $K = 6.6 \times 10^{-5}$ cm/sec



RECRA ENVIRONMENTAL INC.

Well I.D. GW-9

Type of Test FALLING HEAD

Project Title EMERSON STREET LANDFILL

Project No. 8C1301A

PERMEABILITY DATA PLOT

1/T10390.59

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1031A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 11/10/88

PERFORMED BY: JS/JC TYPE OF TEST: Falling Head

REFERENCE POINT: Top Case HOLE NO.: GW-10D

TEST INTERVAL: 10.0 minutes ELEVATION: 101.47 ft.

STATIC GROUNDWATER LEVEL: 4.88 ft. HOLE DEPTH: 26.11 ft. STICK UP: 2.17 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	4.11	0.77	1
2	30	4.20	0.68	0.883
3	60	4.33	0.55	0.714
4	120	4.49	0.39	0.506
5	180	4.60	0.28	0.364
6	300	4.70	0.18	0.234
7	420	4.75	0.13	0.169
8	600	4.78	0.10	0.130

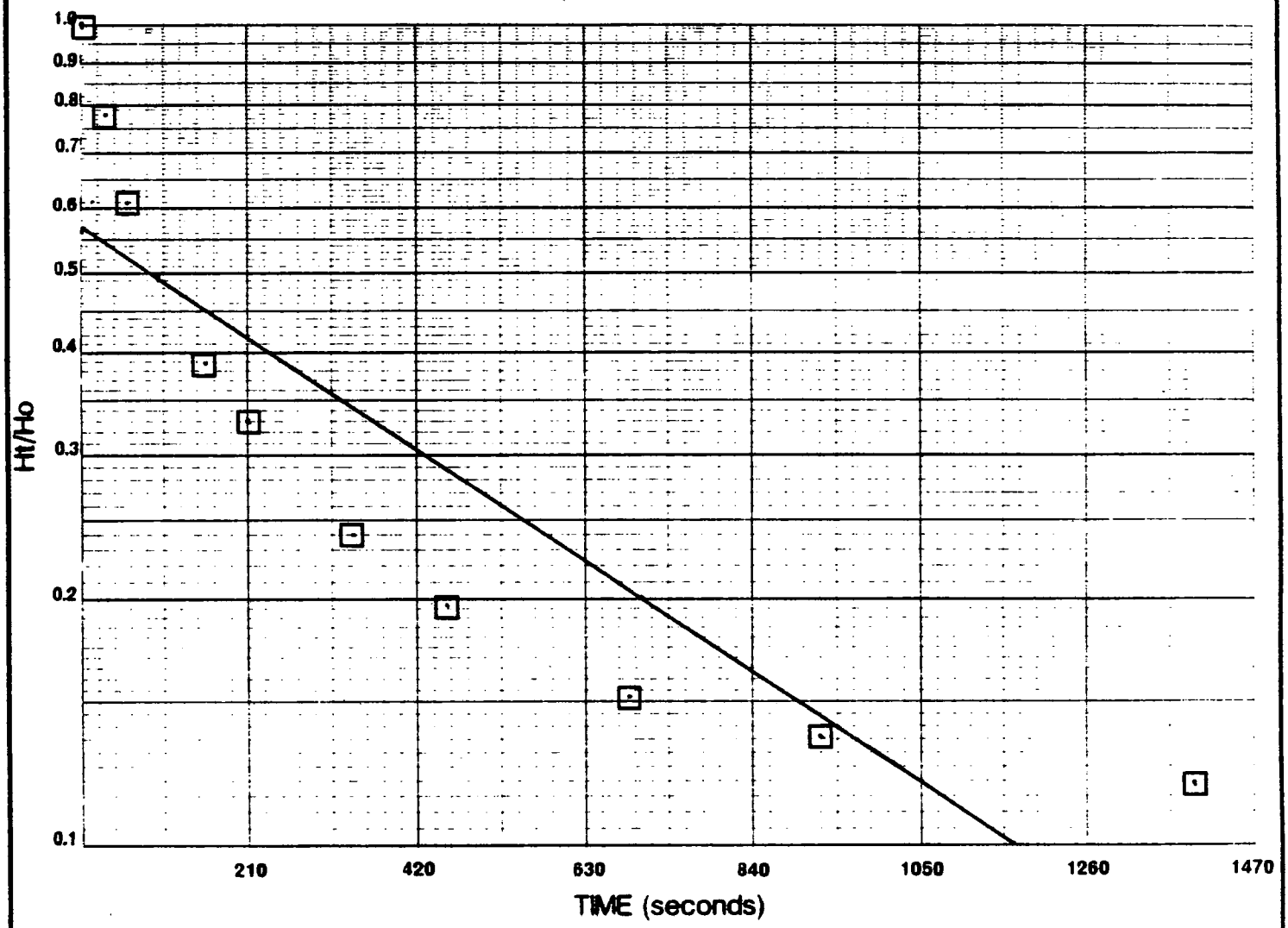
Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 3.81
R: intake point radius (cm) = 3.81
L: length of intake interval (cm) = 304.8
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 50
t2: time (sec) for data point 2 = 450
H1: head ratio for data point 1 = 0.7068
H2: head ratio for data point 2 = 0.1710

Regression Equation: $Log (Ht/Ho) = -1.5 \times 10^{-3} t - 0.0737$

Correlation Coefficient: -0.9719

Isotropic Permeability: $K = 3.7 \times 10^{-4}$ cm/sec



RECRA ENVIRONMENTAL INC.

Well I.D. GW-9

Type of Test RISING HEAD

Project Title EMERSON STREET LANDFILL

Project No. 8C1301A

PERMEABILITY DATA PLOT

1/T10390.58

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1031A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 11/10/88

PERFORMED BY: JS/JC TYPE OF TEST: Rising Head

REFERENCE POINT: Top Case HOLE NO.: GW-10D

TEST INTERVAL: 5.5 minutes ELEVATION: 101.47 ft.

STATIC GROUNDWATER LEVEL: 4.88 ft. HOLE DEPTH: 26.11 ft. STICK UP: 2.17 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	5.53	0.65	1
2	30	5.48	0.60	0.923
3	60	5.37	0.49	0.754
4	90	5.26	0.38	0.585
5	150	5.14	0.26	0.400
6	210	5.05	0.17	0.262
7	330	4.97	0.09	0.138

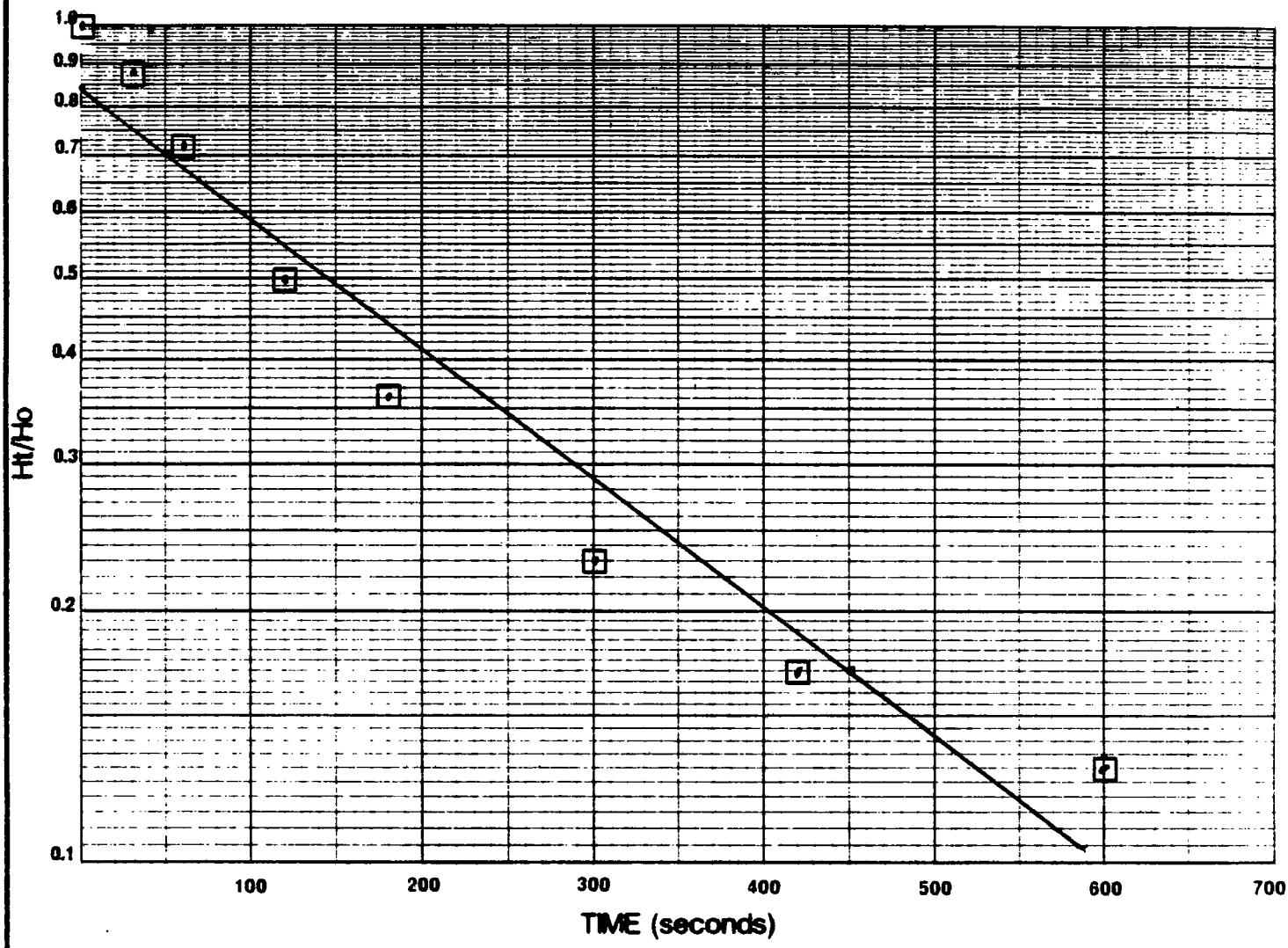
Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 3.81
R: intake point radius (cm) = 3.81
L: length of intake interval (cm) = 304.8
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 50
t2: time (sec) for data point 2 = 250
H1: head ratio for data point 1 = 0.7653
H2: head ratio for data point 2 = 0.2182

Regression Equation: $Log (Ht/Ho) = -2.7 \times 10^{-3}t + 0.0200$

Correlation Coefficient: -0.9975

Isotropic Permeability: $K = 6.5 \times 10^{-4}$ cm/sec



RECRA ENVIRONMENTAL INC.	**Well I.D.** GW-10D **Type of Test** FALLING HEAD **Project Title** EMERSON STREET LANDFILL **Project No.** 8C1301A	PERMEABILITY DATA PLOT

1/T10390.60

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1031A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 11/10/88

PERFORMED BY: JS/JC TYPE OF TEST: Falling Head

REFERENCE POINT: Top Case HOLE NO.: GW-10S

TEST INTERVAL: 7.0 minutes ELEVATION: 101.14 ft.

STATIC GROUNDWATER LEVEL: 4.09 ft. HOLE DEPTH: 13.14 ft. STICK UP: 2.04 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	3.57	0.52	1
2	30	3.77	0.32	0.615
3	60	3.88	0.21	0.404
4	120	3.99	0.1	0.192
5	180	4.02	0.07	0.135
6	300	4.05	0.04	0.077
7	420	4.07	0.02	0.038

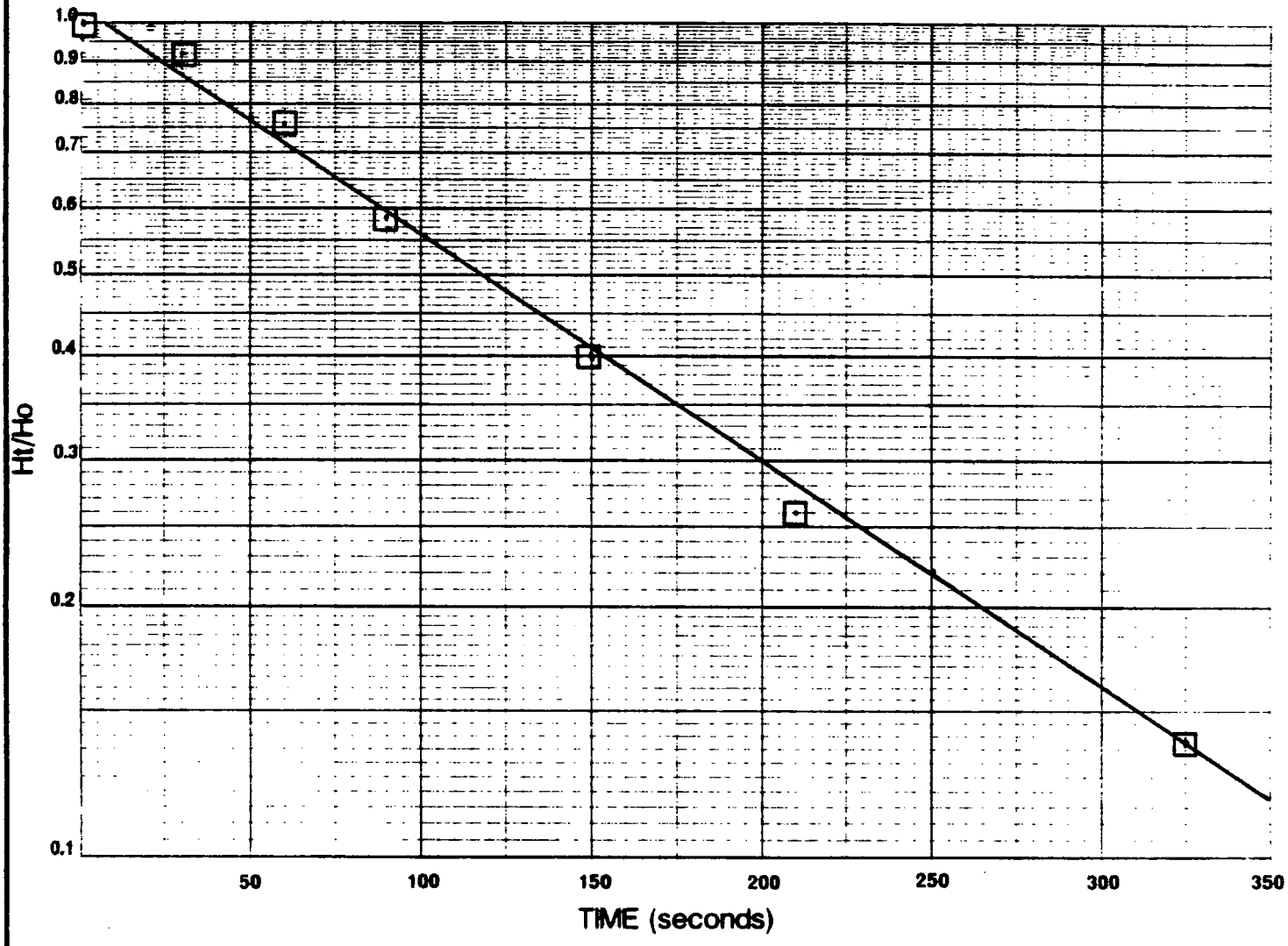
Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 2.54
R: intake point radius (cm) = 7.62
L: length of intake interval (cm) = 182.88
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 20
t2: time (sec) for data point 2 = 320
H1: head ratio for data point 1 = 0.5873
H2: head ratio for data point 2 = 0.0643

Regression Equation: $Log (Ht/Ho) = -3.2 \times 10^{-3}t - 0.1671$

Correlation Coefficient: -0.9724

Isotropic Permeability: $K = 4.1 \times 10^{-4}$ cm/sec



RECRA ENVIRONMENTAL INC.

Well I.D. GW-10D

Type of Test RISING HEAD

Project Title EMERSON STREET LANDFILL

Project No. 8C1301A

PERMEABILITY DATA PLOT

1/T10390.61

PROJECT NAME: NYSDEC Phase II Investigation PROJECT NO.: 8C1031A

LOCATION: Emerson Street Landfill, Rochester, NY DATE: 11/10/88

PERFORMED BY: JS/JC TYPE OF TEST: Rising Head

REFERENCE POINT: Top Case HOLE NO.: GW-10S

TEST INTERVAL: 5.0 minutes ELEVATION: 101.14 ft.

STATIC GROUNDWATER LEVEL: 4.09 ft. HOLE DEPTH: 13.14 ft. STICK UP: 2.04 ft.

N	TIME (seconds)	WATER DEPTH (feet)	HT (feet)	HEAD RATIO (H+/HO)
1	0	5.12	1.03	1
2	30	4.78	0.69	0.670
3	60	4.59	0.5	0.485
4	120	4.33	0.24	0.233
5	180	4.21	0.12	0.117
6	300	4.15	0.06	0.058

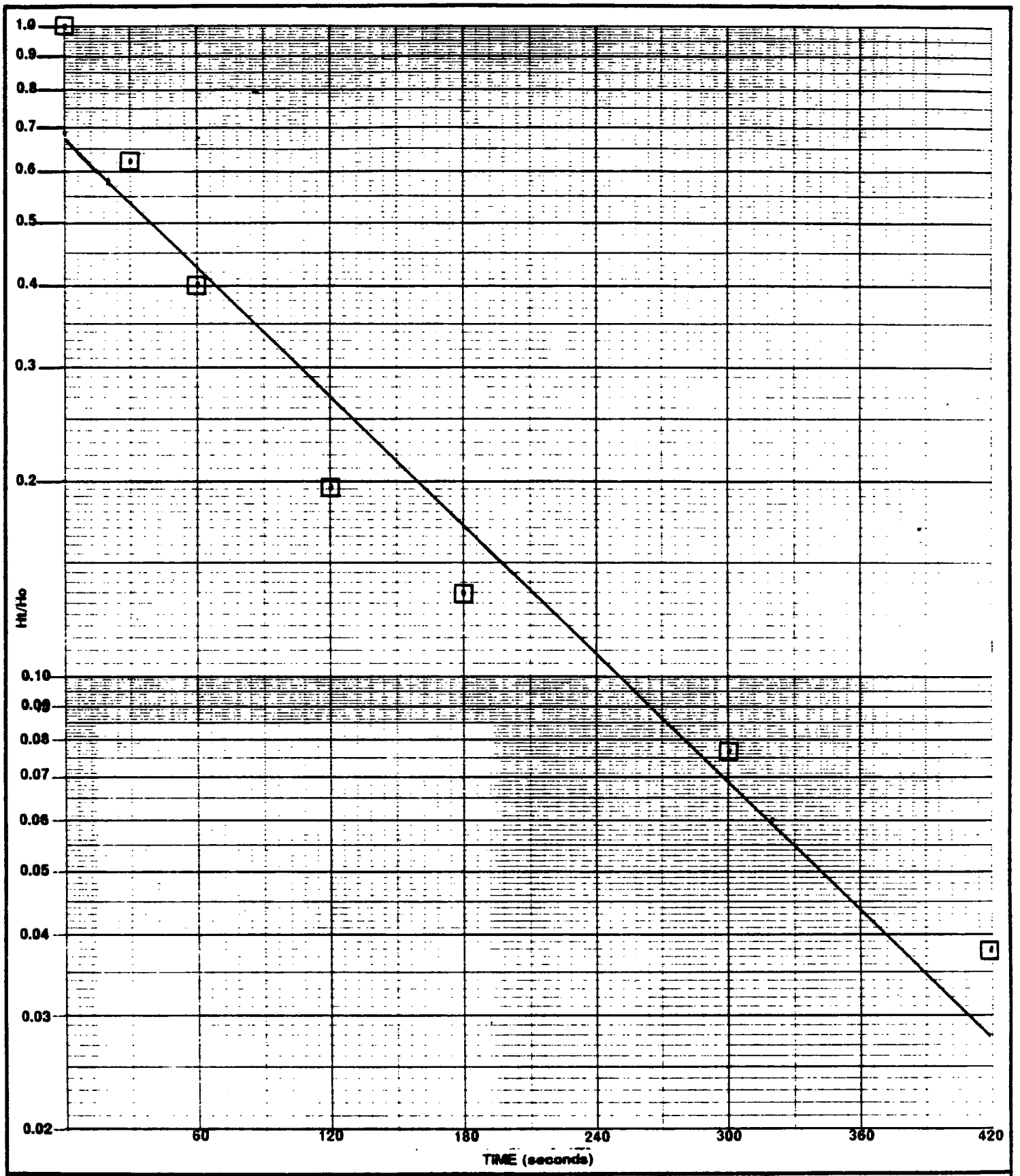
Permeability Equation: $K = r^2/2L \times Ln(mL/R) \times [Ln(H1/H2)/(t2-t1)]$

r: standpipe radius (cm) = 2.54
R: intake point radius (cm) = 7.62
L: length of intake interval (cm) = 182.88
m: square root of (Kh/Kv), ratio of horizontal to vertical permeability, m=1 for isotropy
t1: time (sec) for data point 1 = 20
t2: time (sec) for data point 2 = 240
H1: head ratio for data point 1 = 0.7099
H2: head ratio for data point 2 = 0.0844

Regression Equation: $Log (Ht/Ho) = -4.2 \times 10^{-3}t - 0.0647$

Correlation Coefficient: -0.9872

Isotropic Permeability: $K = 5.4 \times 10^{-4}$ cm/sec



RECRA ENVIRONMENTAL, INC.

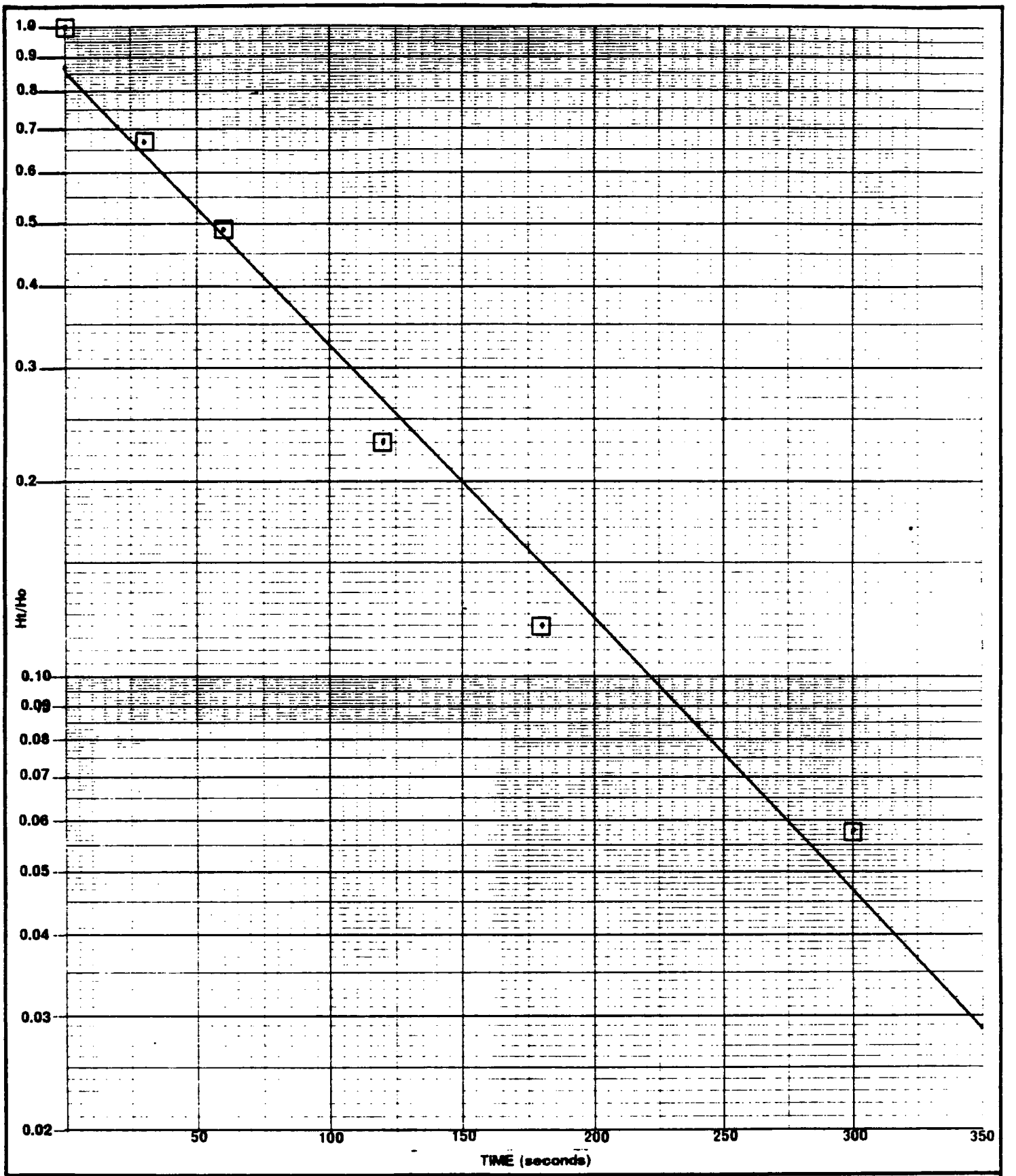
Well I.D. GW-10S

Type of Test FALLING HEAD

Project Title EMERSON STREET LANDFILL

Project No. 8C1301A

PERMEABILITY DATA PLOT



RECRA ENVIRONMENTAL, INC.

Well I.D. GW-10S

Type of Test RISING HEAD

Project Title EMERSON STREET LANDFILL

Project No. 8C1301A

PERMEABILITY DATA PLOT

APPENDIX G

RECRA ENVIRONMENTAL, INC.

FIELD SAMPLING DATA

EMERSON STREET LANDFILL
#828023

1/10390.1

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 WELL # GW-1

TYPE OF SAMPLE Groundwater (X) Grab ( ) Composite ( ) Other

EVACUATION INFORMATION

EVACUATION: Date/Time 9-23-88/8:38 Method of Evac. PVC Bailer

Well Casing Diameter (inches) 2 Total Well Depth (ft) 29.97

Top of Casing to Water Level (ft) 21.45 Standing Water Volume (gal.) 1.39

Total Volume Evac. (Gallons) 4 to dryness

SAMPLING INFORMATION

SAMPLING: Date/Time 9-23-88/13:50-15:30 Method of Sampling PVC Bailer

Top of Casing to Water Level Measurement (ft) 22.70

FIELD MEASUREMENT DATA

pH (Standard Units)	Turbidity (NTU)	Specific Conductance (µmhos/cm)
Date 9-23-88	9-23-88	Date 9-23-88
Time 14:00	14:00	Time 14:00
Taken By R. Bianchi	R. Bianchi	Taken By R. Bianchi
Unit-Brand Beckman	Hach	Unit-Brand Myron-L
Model # PH-11	DR-EL-I	Model # EP-10
Standards Used ( ) 4 (X) 7 (X) 10	Calib. Standard DI water as zero	Calib. Standard 1413
Temp °C 21	Temp °C 21	Temp °C 21
pH 7.18	Turbidity 10	Specific Conductance 1,600

Time	pH (standard units)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Temperature (°C)
14:00	7.18	1,600	10	21

GENERAL INFORMATION

Weather Conditions at Time of Sampling Partly cloudy, 70°F

Sample Characteristics Clear, 3-4 micro-rems/hour

Comments and Observations Evacuated and sampled by Jeff Contino and Rich Bianchi. Standing water volume calculated for well casing & screen.

APPENDIX G

RECRA ENVIRONMENTAL, INC.

FIELD SAMPLING DATA

EMERSON STREET LANDFILL

#828023

1/10390.3

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 WELL # GW-3

TYPE OF SAMPLE Groundwater (X) Grab ( ) Composite ( ) Other

EVACUATION INFORMATION

EVACUATION: Date/Time 9-21-88/8:45 Method of Evac. Peristaltic Pump

Well Casing Diameter (inches) 2 Total Well Depth (ft) 19.24

Top of Casing to Water Level (ft) 6.43 Standing Water Volume (gal.) 2.09

Total Volume Evac. (Gallons) 12 to dryness

SAMPLING INFORMATION

SAMPLING: Date/Time 9-21-88/14:05 Method of Sampling PVC Bailer
Isco Peristaltic Pump

Top of Casing to Water Level Measurement (ft) 7.42

FIELD MEASUREMENT DATA

pH (Standard Units)	Turbidity (NTU)	Specific Conductance (µmhos/cm)
Date 9-21-88	9-21-88	Date 9-21-88
Time 14:22	14:22	Time 14:22
Taken By R. Bianchi	R. Bianchi	Taken By R. Bianchi
Unit-Brand Beckman	Hach	Unit-Brand Myron-L
Model # PH-11	DR-EL-1	Model # EP-10
Standards Used ( ) 4 (x) 7 (x) 10	Calib. Standard DI water as zero	Calib. Standard 1413
Temp °C 18	Temp °C 18	Temp °C 18
pH 7.48	Turbidity 16	Specific Conductance 3,300

Time	pH (standard units)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Temperature (°C)
14:22	7.48	3,300	16	18

GENERAL INFORMATION

Weather Conditions at Time of Sampling Cloudy, windy, 63°F

Sample Characteristics Clear, 3-4 micro-rems/hour

Comments and Observations Evacuated and sampled by Jeff Contino and Rich Bianchi.
Standing water volume calculated for well casing and screen.

1/10390.2

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 WELL # GW-2

TYPE OF SAMPLE Groundwater (X) Grab ( ) Composite ( ) Other

EVACUATION INFORMATION

EVACUATION: Date/Time 9-22-88/11:10 Method of Evac. PVC Bailer

Well Casing Diameter (inches) 3 Total Well Depth (ft) 28.38

Top of Casing to Water Level (ft) 21.00 Standing Water Volume (gal.) 2.71

Total Volume Evac. (Gallons) 9

SAMPLING INFORMATION

SAMPLING: Date/Time 9-22-88/15:14 Method of Sampling PVC Bailer
Isco Pump

Top of Casing to Water Level Measurement (ft) 21.00

FIELD MEASUREMENT DATA

pH (Standard Units)	Turbidity (NTU)	Specific Conductance (µmhos/cm)
Date 9-22-88	9-22-88	Date 9-22-88
Time 16:19	16:19	Time 16:19
Taken By R. Bianchi	R. Bianchi	Taken By R. Bianchi
Unit-Brand Beckman	Hach	Unit-Brand Myron-L
Model # PH-II	DR-EL-1	Model # EP-10
Standards Used ( ) 4 (x) 7 (x) 10	Calib. Standard DI water as zero	Calib. Standard 1413
Temp °C 18	Temp °C 18	Temp °C 18
pH 7.07	Turbidity 40-50	Specific Conductance 2,400

Time	pH (standard units)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Temperature (°C)
16:19	7.07	2,400	40-50	18

GENERAL INFORMATION

Weather Conditions at Time of Sampling Sunny, 72°F

Sample Characteristics Clear, 6-8 micro-rems/hour

Comments and Observations Evacuated and sampled by Jeff Contino and Rich Bianchi.
Standing water volume calculated for well casing and intake.

1/10390.5

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 WELL # GW-5

TYPE OF SAMPLE Groundwater (X) Grab ( ) Composite ( ) Other

EVACUATION INFORMATION

EVACUATION: Date/Time 9-21-88/15:00 Method of Evac. Peristaltic Pump

Well Casing Diameter (inches) 2 Total Well Depth (ft) 23.10

Top of Casing to Water Level (ft) 10.85 Standing Water Volume (gal.) 2.00

Total Volume Evac. (Gallons) 29.5

SAMPLING INFORMATION

SAMPLING: Date/Time 9-21-88/16:30 Method of Sampling PVC Bailer
Isco Peristaltic Pump

Top of Casing to Water Level Measurement (ft) 10.85

FIELD MEASUREMENT DATA

pH (Standard Units)	Turbidity (NTU)	Specific Conductance (µmhos/cm)
Date 9-21-88	9-21-88	Date 9-21-88
Time 16:40	16:40	Time 16:40
Taken By R. Bianchi	R. Bianchi	Taken By R. Bianchi
Unit-Brand Beckman	Hach	Unit-Brand Myron-L
Model # PH-11	DR-EL-1	Model # EP-10
Standards Used ( ) 4 (x) 7 (x) 10	Calib. Standard DI water as zero	Calib. Standard 1413
Temp °C 15	Temp °C 15	Temp °C 15
pH 7.25	Turbidity 30	Specific Conductance 1,800

Time	pH (standard units)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Temperature (°C)
16:40	7.25	1,800	30	15

GENERAL INFORMATION

Weather Conditions at Time of Sampling Cloudy, windy, 65°F

Sample Characteristics Clear, 6-7 micro-rems/hour

Comments and Observations Evacuated and sampled by Rich Bianchi and Jeff Contino.
Standing water volume calculated for well casing and screen.

1/10390.4

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 WELL # GW-4

TYPE OF SAMPLE Groundwater (X) Grab ( ) Composite ( ) Other

EVACUATION INFORMATION

EVACUATION: Date/Time 9-21-88/10:15 Method of Evac. Peristaltic Pump

Well Casing Diameter (inches) 2 Total Well Depth (ft) 19.89

Top of Casing to Water Level (ft) 9.74 Standing Water Volume (gal.) 1.66

Total Volume Evac. (Gallons) 25

SAMPLING INFORMATION

SAMPLING: Date/Time 9-21-88/11:45 Method of Sampling PVC Bailer
Isco Peristaltic Pump

Top of Casing to Water Level Measurement (ft) 9.74

FIELD MEASUREMENT DATA

pH (Standard Units)	Turbidity (NTU)	Specific Conductance (µmhos/cm)
Date 9-21-88	9-21-88	Date 9-21-88
Time 12:06	12:06	Time 12:06
Taken By R. Bianchi	R. Bianchi	Taken By R. Bianchi
Unit-Brand Beckman	Hach	Unit-Brand Myron-L
Model # PH-11	DR-EL-1	Model # EP-10
Standards Used ( ) 4 (x) 7 (x) 10	Calib. Standard DI water as zero	Calib. Standard 1413
Temp °C 17	Temp °C 17	Temp °C 17
pH 6.69	Turbidity 15-50	Specific Conductance 3,600

Time	pH (standard units)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Temperature (°C)
12:06	6.69	3,600	15-50	17

GENERAL INFORMATION

Weather Conditions at Time of Sampling Cloudy, windy, 63°F

Sample Characteristics Clear, 6-7 micro-rems/hour

Comments and Observations Evacuated and sampled by Rich Bianchi and Jeff Contino.
Standing water volume calculated for well casing and screen.

1/10390.7

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 WELL # GW-7

TYPE OF SAMPLE Groundwater (X) Grab ( ) Composite ( ) Other

EVACUATION INFORMATION

EVACUATION: Date/Time 9-20-88/14:35 Method of Evac. PVC Bailer

Well Casing Diameter (inches) 2 Total Well Depth (ft) 18.47

Top of Casing to Water Level (ft) 13.64 Standing Water Volume (gal.) 0.79

Total Volume Evac. (Gallons) 10

SAMPLING INFORMATION

SAMPLING: Date/Time 9-20-88/15:30 Method of Sampling PVC Bailer

Top of Casing to Water Level Measurement (ft) 13.76

FIELD MEASUREMENT DATA

pH (Standard Units)	Turbidity (NTU)	Specific Conductance (µmhos/cm)
Date 9-20-88	9-20-88	Date 9-20-88
Time 15:45	15:45	Time 15:45
Taken By R. Bianchi	R. Bianchi	Taken By R. Bianchi
Unit-Brand Beckman	Hach	Unit-Brand Myron-L
Model # PH-11	DR-EL-1	Model # EP-10
Standards Used ( ) 4 (x) 7 (x) 10	Calib. Standard DI water as zero	Calib. Standard 1413
Temp °C 22	Temp °C 22	Temp °C 22
pH 7.19	Turbidity 22	Specific Conductance 1,000

Time	pH (standard units)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Temperature (°C)
15:45	7.19	1,000	22	22

GENERAL INFORMATION

Weather Conditions at Time of Sampling Cloudy, 70°F, light rain

Sample Characteristics Clear, 8.0 micro-rems/hour

Comments and Observations Evacuated and sampled by Jeff Contino and Rich Bianchi. Standing water volume calculated for well casing and screen.

1/10390.6

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 WELL # GW-6

TYPE OF SAMPLE Groundwater (X) Grab ( ) Composite ( ) Other _____

EVACUATION INFORMATION

EVACUATION: Date/Time 9-23-88/9:31 Method of Evac. Peristaltic Pump

Well Casing Diameter (inches) 2 Total Well Depth (ft) 24.97

Top of Casing to Water Level (ft) 16.05 Standing Water Volume (gal.) 1.46

Total Volume Evac. (Gallons) 18

SAMPLING INFORMATION

SAMPLING: Date/Time 9-23-88/10:20 Method of Sampling PVC Bailer
Isco Peristaltic Pump

Top of Casing to Water Level Measurement (ft) 16.50

FIELD MEASUREMENT DATA

pH (Standard Units)	Turbidity (NTU)	Specific Conductance (µmhos/cm)
Date 9-23-88	9-23-88	Date 9-23-88
Time 10:34	10:34	Time 10:34
Taken By R. Bianchi	R. Bianchi	Taken By R. Bianchi
Unit-Brand Beckman	Hach	Unit-Brand Myron-L
Model # PH-11	DR-EL-1	Model # EP-10
Standards Used ( ) 4 (x) 7 (x) 10	Calib. Standard DI water as zero	Calib. Standard 1413
Temp °C 20	Temp °C 20	Temp °C 20
pH 7.07	Turbidity 10 NTU	Specific Conductance 2500

Time	pH (standard units)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Temperature (°C)
10:34	7.07	2,500	10	20

GENERAL INFORMATION

Weather Conditions at Time of Sampling Partly cloudy, 70°F

Sample Characteristics Clear, 5-6 micro-rems/hour

Comments and Observations Evacuated and sampled by Jeff Contino and Rich Bianchi. Smoke from bonfire at school present near well. Standing water volume calculated for well casing and screen.

1/10390.9

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 WELL # GW-8S

TYPE OF SAMPLE Groundwater (X) Grab ( ) Composite ( ) Other

EVACUATION INFORMATION

EVACUATION: Date/Time 9-22-88/8:56 Method of Evac. Peristaltic Pump

Well Casing Diameter (inches) 2 Total Well Depth (ft) 12.42

Top of Casing to Water Level (ft) 6.08 Standing Water Volume (gal.) 1.03

Total Volume Evac. (Gallons) 17.5

SAMPLING INFORMATION

SAMPLING: Date/Time 9-22-88/13:50 Method of Sampling PVC Bailer
Isco Peristaltic Pump

Top of Casing to Water Level Measurement (ft) 6.35

FIELD MEASUREMENT DATA

pH (Standard Units)	Turbidity (NTU)	Specific Conductance (µmhos/cm)
Date 9-22-88	9-22-88	Date 9-22-88
Time 14:10	14:10	Time 14:10
Taken By R. Bianchi	R. Bianchi	Taken By R. Bianchi
Unit-Brand Beckman	Hach	Unit-Brand Myron-L
Model # PH-11	DR-EL-1	Model # EP-10
Standards Used ( ) 4 (x) 7 (x) 10	Calib. Standard DI water as zero	Calib. Standard 1413
Temp °C 21	Temp °C 21	Temp °C 21
pH 6.89	Turbidity 5-50	Specific Conductance 2,800

Time	pH (standard units)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Temperature (°C)
14:10	6.89	2,800	5-50	21

GENERAL INFORMATION

Weather Conditions at Time of Sampling Sunny, 72°F

Sample Characteristics Clear, 5-7 micro-rems/hour

Comments and Observations Evacuated and sampled by Rich Bianchi and Jeff Contino.
Standing water volume calculated for well casing and screen.

1/10390.8

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 WELL # GW-8D

TYPE OF SAMPLE Groundwater (X) Grab ( ) Composite ( ) Other

EVACUATION INFORMATION

EVACUATION: Date/Time 9-22-88/9:30 Method of Evac. PVC Bailer

Well Casing Diameter (inches) 3 Total Well Depth (ft) 25.49

Top of Casing to Water Level (ft) 6.54 Standing Water Volume (gal.) 6.96

Total Volume Evac. (Gallons) 21

SAMPLING INFORMATION

SAMPLING: Date/Time 9-22-88/14:30 Method of Sampling PVC Bailer
Isco Peristaltic Pump

Top of Casing to Water Level Measurement (ft) 6.95

FIELD MEASUREMENT DATA

pH (Standard Units)	Turbidity (NTU)	Specific Conductance (µmhos/cm)
Date 9-22-88	9-22-88	Date 9-22-88
Time 14:45	14:45	Time 14:45
Taken By R. Bianchi	R. Bianchi	Taken By R. Bianchi
Unit-Brand Beckman	Hach	Unit-Brand Myron-L
Model # PH-11	DR-EL-1	Model # EP-10
Standards Used ( ) 4 (x) 7 (x) 10	Calib. Standard DI water as zero	Calib. Standard 1413
Temp °C 21	Temp °C 21	Temp °C 21
pH 6.91	Turbidity 25-45	Specific Conductance 2,900

Time	pH (standard units)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Temperature (°C)
14:45	6.91	2,900	25-45	21

GENERAL INFORMATION

Weather Conditions at Time of Sampling Sunny, 72°F

Sample Characteristics Clear, 5-6 micro-rems/hour

Comments and Observations Evacuated and sampled by Rich Bianchi and Jeff Contino.
Standing water volume calculated for well casing and intake.

1/10390.11

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 WELL # GW-10D

TYPE OF SAMPLE Groundwater (X) Grab ( ) Composite ( ) Other

EVACUATION INFORMATION

EVACUATION: Date/Time 9-20-88/8:45 Method of Evac. Peristaltic Pump

Well Casing Diameter (inches) 3 Total Well Depth (ft) 25.84

Top of Casing to Water Level (ft) 5.63 Standing Water Volume (gal.) 7.43

Total Volume Evac. (Gallons) 23

SAMPLING INFORMATION

SAMPLING: Date/Time 9-20-88/11:35 Method of Sampling PVC Bailer
Isco Peristaltic Pump

Top of Casing to Water Level Measurement (ft) 5.80

FIELD MEASUREMENT DATA

pH (Standard Units)	Turbidity (NTU)	Specific Conductance (µmhos/cm)
Date 9-20-88	9-20-88	Date 9-20-88
Time 11:30	11:30	Time 11:30
Taken By R. Bianchi	R. Bianchi	Taken By R. Bianchi
Unit-Brand Beckman	Hach	Unit-Brand Myron-L
Model # PH-11	DR-EL-1	Model # EP-10
Standards Used ( ) 4 (x) 7 (x) 10	Calib. Standard DI water as zero	Calib. Standard 1413
Temp °C 20	Temp °C 20	Temp °C 20
pH 6.68	Turbidity 18	Specific Conductance 3,600

Time	pH (standard units)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Temperature (°C)
11:30	6.68	3,600	18	20

GENERAL INFORMATION

Weather Conditions at Time of Sampling Cloudy, 70°F, light rain

Sample Characteristics Clear, 6-8 micro-rems/hour

Comments and Observations Evacuated and sampled by Rich Bianchi and Jeff Contino.
Standing water volume calculated for well casing and intake.

1/10390.10

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 WELL # GW-9

TYPE OF SAMPLE Groundwater (X) Grab ( ) Composite ( ) Other

EVACUATION INFORMATION

EVACUATION: Date/Time 9-20-88/8:00 Method of Evac. PVC Bailer

Well Casing Diameter (inches) 2 Total Well Depth (ft) 26.59

Top of Casing to Water Level (ft) 17.00 Standing Water Volume (gal.) 1.57

Total Volume Evac. (Gallons) 19

SAMPLING INFORMATION

SAMPLING: Date/Time 9-20-88/14:00-17:36 Method of Sampling PVC Bailer
Isco Peristaltic Pump

Top of Casing to Water Level Measurement (ft) 17.05

FIELD MEASUREMENT DATA

pH (Standard Units)	Turbidity (NTU)	Specific Conductance (μmhos/cm)
Date 9-20-88	9-20-88	Date 9-20-88
Time 14:05	14:05	Time 14:05
Taken By R. Bianchi	R. Bianchi	Taken By R. Bianchi
Unit-Brand Beckman	Hach	Unit-Brand Myron-L
Model # PH-11	DR-EL-1	Model # EP-10
Standards Used ( ) 4 (x) 7 (x) 10	Calib. Standard DI water as zero	Calib. Standard 1413
Temp °C 22	Temp °C 22	Temp °C 22
pH 6.99	Turbidity 18-48	Specific Conductance 2,600

Time	pH (standard units)	Specific Conductance (μmhos/cm)	Turbidity (NTU)	Temperature (°C)
14:05	6.99	2,600	18-48	22

GENERAL INFORMATION

Weather Conditions at Time of Sampling Cloudy, 70°F, light rain

Sample Characteristics Clear liquid, 8 micro-rems/hour

Comments and Observations Evacuated and sampled by Rich Bianchi and Jeff Contino.
Standing water volume calculated for well casing and screen.

1/10390.13

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 # SW-1

TYPE OF SAMPLE Surface Water (X) Grab ( ) Composite ( ) Other

SAMPLING INFORMATION

SAMPLING: Date/Time 9-23-88/15:15 Method of Sampling PVC Bailer

FIELD MEASUREMENT DATA

pH (Standard Units)	Turbidity (NTU)	Specific Conductance (µmhos/cm)
Date 9-23-88		Date 9-23-88
Time 15:19		Time 15:19
Taken By R. Bianchi		Taken By R. Bianchi
Unit-Brand Beckman		Unit-Brand Myron-L
Model # PH-11		Model # EP-10
Standards Used ( ) 4 (x) 7 (x) 10	Calib. Standard	Calib. Standard 1413
Temp °C 22	Temp °C	Temp °C 22
pH 7.46	Turbidity	Specific Conductance 360

Time	pH (standard units)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Temperature (°C)
15:19	7.46	360		22

GENERAL INFORMATION

Weather Conditions at Time of Sampling Partly cloudy, 70°F

Sample Characteristics Brown, slightly turbid, 8-10 micro-rems/hour

Comments and Observations Sampled by Rich Bianchi and Jeff Contino from manhole of storm sewer

1/10390.12

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 WELL # GW-10S

TYPE OF SAMPLE Groundwater (X) Grab ( ) Composite ( ) Other

EVACUATION INFORMATION

EVACUATION: Date/Time 9-20-88/8:54 Method of Evac. PVC Bailer

Well Casing Diameter (inches) 2 Total Well Depth (ft) 13.01

Top of Casing to Water Level (ft) 5.50 Standing Water Volume (gal.) 1.23

Total Volume Evac. (Gallons) 25

SAMPLING INFORMATION

SAMPLING: Date/Time 9-20-88/11:10 Method of Sampling PVC Bailer

Top of Casing to Water Level Measurement (ft) 5.75

FIELD MEASUREMENT DATA

pH (Standard Units)	Turbidity (NTU)	Specific Conductance (µmhos/cm)
Date 9-20-88	9-20-88	Date 9-20-88
Time 11:03	11:03	Time 11:03
Taken By R. Bianchi	R. Bianchi	Taken By R. Bianchi
Unit-Brand Beckman	Hach	Unit-Brand Myron-L
Model # PH-11	DR-EL-1	Model # EP-10
Standards Used ( ) 4 (x) 7 (x) 10	Calib. Standard DI water as zero	Calib. Standard 1413
Temp °C 20	Temp °C 20	Temp °C 20
pH 6.99	Turbidity 22	Specific Conductance 2,800

Time	pH (standard units)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Temperature (°C)
11:03	6.99	2,800	22	20

GENERAL INFORMATION

Weather Conditions at Time of Sampling Cloudy, 70°F, light rain

Sample Characteristics Clear, 6-8 micro-rems/hour

Comments and Observations Evacuated and sampled by Rich Bianchi and Jeff Contino. Standing water volume calculated for well casing and screen.

1/10390.16

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 # SW-3

TYPE OF SAMPLE Surface Water (X) Grab ( ) Composite ( ) Other

SAMPLING INFORMATION

SAMPLING: Date/Time 9-26-88/11:00 Method of Sampling PVC Bailer

FIELD MEASUREMENT DATA

pH (Standard Units)	Turbidity (NTU)	Specific Conductance (µmhos/cm)
Date 9-26-88		Date 9-26-88
Time 11:50		Time 11:50
Taken By R. Bianchi		Taken By R. Bianchi
Unit-Brand Beckman		Unit-Brand Myron-L
Model # PH-11		Model # EP-10
Standards Used ( ) 4 (x) 7 (x) 10	Calib. Standard	Calib. Standard 1413
Temp °C 17	Temp °C	Temp °C 17
pH 7.10	Turbidity	Specific Conductance 2,900

Time	pH (standard units)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Temperature (°C)
11:50	7.10	2,900		17

GENERAL INFORMATION

Weather Conditions at Time of Sampling Cloudy, 65°F

Sample Characteristics Brown, turbid 6 micro-rems/hour

Comments and Observations Sampled by Rich Bianchi and Jeff Contino from hole made by hand auger approximately 2 feet deep

1/10390.15

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 # SW-2

TYPE OF SAMPLE Surface Water (X) Grab ( ) Composite ( ) Other

SAMPLING INFORMATION

SAMPLING: Date/Time 9-26-88/10:30 Method of Sampling PVC Bailer

FIELD MEASUREMENT DATA

pH (Standard Units)	Turbidity (NTU)	Specific Conductance (µmhos/cm)
Date 9-26-88		Date 9-26-88
Time 11:56		Time 11:56
Taken By R. Bianchi		Taken By R. Bianchi
Unit-Brand Beckman		Unit-Brand Myron-L
Model # PH-11		Model # EP-10
Standards Used ( ) 4 (x) 7 (x) 10	Calib. Standard	Calib. Standard 1413
Temp °C 17	Temp °C	Temp °C 17
pH 7.34	Turbidity	Specific Conductance 1,800

Time	pH (standard units)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Temperature (°C)
11:56	7.34	1,800		17

GENERAL INFORMATION

Weather Conditions at Time of Sampling Cloudy, 65°F

Sample Characteristics Brown, turbid, 7-9 micro-rems/hour

Comments and Observations Sampled by Jeff Contino and Rich Bianchi
Collected from shallow boreholes made with hand auger.

1/10390.18

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 # SW-5

TYPE OF SAMPLE Basement Sump Water (X) Grab ( ) Composite ( ) Other

SAMPLING INFORMATION

SAMPLING: Date/Time 9-26-88/14:38 Method of Sampling PVC Bailer

FIELD MEASUREMENT DATA

pH (Standard Units)	Turbidity (NTU)	Specific Conductance (µmhos/cm)
Date 9-26-88		Date 9-26-88
Time 15:10		Time 15:10
Taken By R. Bianchi		Taken By R. Bianchi
Unit-Brand Beckman		Unit-Brand Myron-L
Model # PH-11		Model # EP-10
Standards Used ( ) 4 (x) 7 (x) 10	Calib. Standard	Calib. Standard 1413
Temp °C 21	Temp °C	Temp °C 21
pH 8.30	Turbidity	Specific Conductance 1,500

Time	pH (standard units)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Temperature (°C)
15:10	8.30	1,500		21

GENERAL INFORMATION

Weather Conditions at Time of Sampling Cloudy, 70°F

Sample Characteristics Clear with slight orange tint, 7-9 micro-rems/hour

Comments and Observations Sampled by Jeff Contino and Rich Bianchi from sump in basement of CVC Products, Inc., 525 Lee Road

1/10390.17

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 # SW-4

TYPE OF SAMPLE Sump Water (X) Grab ( ) Composite ( ) Other

SAMPLING INFORMATION

SAMPLING: Date/Time 9-26-88/11:40 Method of Sampling PVC Bailer

FIELD MEASUREMENT DATA

pH (Standard Units)	Turbidity (NTU)	Specific Conductance (µmhos/cm)
Date 9-26-88		Date 9-26-88
Time 11:40		Time 11:40
Taken By R. Bianchi		Taken By R. Bianchi
Unit-Brand Beckman		Unit-Brand Myron-L
Model # PH-11		Model # EP-10
Standards Used ( ) 4 (x) 7 (x) 10	Calib. Standard	Calib. Standard 1413
Temp °C 17	Temp °C	Temp °C 17
pH 8.15	Turbidity	Specific Conductance 5,100

Time	pH (standard units)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Temperature (°C)
11:40	8.15	5,100		17

GENERAL INFORMATION

Weather Conditions at Time of Sampling Cloudy, 65°F

Sample Characteristics Clear to light yellow liquid, 6-8 micro-rems/hour

Comments and Observations Sampled by Rich Bianchi and Jeff Contino. Collected from a pit inside Rochester Incinerator building.

1/10390.20

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 # SW-7

TYPE OF SAMPLE Sump Water (X) Grab ( ) Composite ( ) Other

SAMPLING INFORMATION

SAMPLING: Date/Time 9-27-88/8:45 Method of Sampling PVC Bailer

FIELD MEASUREMENT DATA

pH (Standard Units)	Turbidity (NTU)	Specific Conductance (µmhos/cm)
Date 9-27-88		Date 9-27-88
Time 9:00		Time 9:00
Taken By R. Bianchi		Taken By R. Bianchi
Unit-Brand Beckman		Unit-Brand Myron-L
Model # PH-11		Model # EP-10
Standards Used ( ) 4 (x) 7 (x) 10	Calib. Standard	Calib. Standard 1413
Temp °C 18	Temp °C	Temp °C 18
pH 8.64	Turbidity	Specific Conductance 550

Time	pH (standard units)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Temperature (°C)
9:00	8.64	550		18

GENERAL INFORMATION

Weather Conditions at Time of Sampling Sunny, 60°F

Sample Characteristics Brown, turbid, 5-7 micro-rems/hour

Comments and Observations Sampled by Jeff Contino and Rich Bianchi from sump near tennis courts of Edison Tech High School.

1/10390.19

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 # SW-6

TYPE OF SAMPLE Basement Drain Water (X) Grab ( ) Composite ( ) Other

SAMPLING INFORMATION

SAMPLING: Date/Time 9-26-88/15:20 Method of Sampling Mnaual Grab

FIELD MEASUREMENT DATA

pH (Standard Units)	Turbidity (NTU)	Specific Conductance (µmhos/cm)
Date 9-26-88		Date 9-26-88
Time 15:31		Time 15:31
Taken By R. Bianchi		Taken By R. Bianchi
Unit-Brand Beckman		Unit-Brand Myron-L
Model # PH-11		Model # EP-10
Standards Used ( ) 4 (x) 7 (x) 10	Calib. Standard	Calib. Standard 1413
Temp °C 22	Temp °C	Temp °C 22
pH 7.39	Turbidity	Specific Conductance 1,600

Time	pH (standard units)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Temperature (°C)
15:31	7.39	1,600		22

GENERAL INFORMATION

Weather Conditions at Time of Sampling Cloudy, 70°F

Sample Characteristics Clear to dark liquid, little soap suds, 6-8 micro-rems/hour

Comments and Observations Sampled by Jeff Contino and Rich Bianchi from drain in laundry room at Rochester Fitness Club, 687 Lee Road

1/10390.22

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 # SED-1

TYPE OF SAMPLE Sediment (X) Grab ( ) Composite ( ) Other

SAMPLING INFORMATION

SAMPLING: Date/Time 11-28-88/11:40 Method of Sampling Hand Trowel

FIELD MEASUREMENT DATA

Time	pH (standard units)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Temperature (°C)
N/A	N/A	N/A	N/A	N/A

GENERAL INFORMATION

Weather Conditions at Time of Sampling Cloudy, 45°F

Sample Characteristics Dark brown organic sand and silt, moist, 6-8 micro-rems/hour

Comments and Observations Sampled by Jim Bingert and Jeff Contino

1/10390.21

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 # SW-8

TYPE OF SAMPLE Transformer Pit Water (X) Grab ( ) Composite ( ) Other

SAMPLING INFORMATION

SAMPLING: Date/Time 9-27-88/9:35 Method of Sampling PVC Bailer

FIELD MEASUREMENT DATA

pH (Standard Units)	Turbidity (NTU)	Specific Conductance (µmhos/cm)
Date 9-27-88		Date 9-27-88
Time 9:50		Time 9:50
Taken By R. Bianchi		Taken By R. Bianchi
Unit-Brand Beckman		Unit-Brand Myron-L
Model # PH-II		Model # EP-10
Standards Used ( ) 4 (x) 7 (x) 10	Calib. Standard	Calib. Standard 1413
Temp °C 18	Temp °C	Temp °C 18
pH 8.22	Turbidity	Specific Conductance 660

Time	pH (standard units)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Temperature (°C)
9:50	8.22	660		18

GENERAL INFORMATION

Weather Conditions at Time of Sampling Sunny, 60°F

Sample Characteristics Brown, turbid, 6-8 micro-rems/hour

Comments and Observations Sampled by Jeff Contino and Rich Bianchi from transformer pit at Peko Precision Products, 500 Colfax Street

1/10390.24

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 # SED-3

TYPE OF SAMPLE Sediment (X) Grab ( ) Composite ( ) Other

SAMPLING INFORMATION

SAMPLING: Date/Time 11-28-88/13:00 Method of Sampling Hand Auger

FIELD MEASUREMENT DATA

Time	pH (standard units)	Specific Conductance (μmhos/cm)	Turbidity (NTU)	Temperature (°C)
N/A	N/A	N/A	N/A	N/A

GENERAL INFORMATION

Weather Conditions at Time of Sampling Cloudy, 45°F

Sample Characteristics Brown silty soil, wet, 8-9 micro-rems/hour on 9/26/88

Comments and Observations Sampled by Jeff Contino and Jim Bingert

1/10390.23

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 # SED-2

TYPE OF SAMPLE Sediment (X) Grab ( ) Composite ( ) Other

SAMPLING INFORMATION

SAMPLING: Date/Time 11-28-88/12:30 Method of Sampling Hand Trowel

FIELD MEASUREMENT DATA

Time	pH (standard units)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Temperature (°C)
N/A	N/A	N/A	N/A	N/A

GENERAL INFORMATION

Weather Conditions at Time of Sampling Cloudy, 45°F

Sample Characteristics Brown silty soil, moist, 8-9 micro-rems/hour on 9/26/88

Comments and Observations Sampled by Jeff Contino and Jim Bingert

1/10390.26

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 # SED-5

TYPE OF SAMPLE Sediment (X) Grab ( ) Composite ( ) Other

SAMPLING INFORMATION

SAMPLING: Date/Time 11-28-88/12:15 Method of Sampling Hand Trowel

FIELD MEASUREMENT DATA

Time	pH (standard units)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Temperature (°C)
N/A	N/A	N/A	N/A	N/A

GENERAL INFORMATION

Weather Conditions at Time of Sampling Cloudy, 45°F

Sample Characteristics Brown silty soil, 6-8 micro-rems/hour on 9/28/88

Comments and Observations Sampled by Jeff Contino and Jim Bingert

1/10390.25

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 # SED-4

TYPE OF SAMPLE Incinerator Ash (X) Grab ( ) Composite ( ) Other

SAMPLING INFORMATION

SAMPLING: Date/Time 11-28-88/11:56 Method of Sampling Hand Trowel

FIELD MEASUREMENT DATA

Time	pH (standard units)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Temperature (°C)
N/A	N/A	N/A	N/A	N/A

GENERAL INFORMATION

Weather Conditions at Time of Sampling Cloudy, 45°F

Sample Characteristics Gray-black ash, 40-60 micro-rems/hour on 9/26/88

Comments and Observations Sampled by Jeff Contino and Jim Bingert
Collected from bottom of stack in Rochester Incinerator bldg.

1/SD10390.2

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 WELL # GW-4

TYPE OF SAMPLE Groundwater (X) Grab ( ) Composite ( ) Other

EVACUATION INFORMATION

EVACUATION: Date/Time 4-25-89/12:35 Method of Evac. PVC Bailer

Well Casing Diameter (inches) 2 Total Well Depth (ft) 19.74

Top of Casing to Water Level (ft) 7.88 Standing Water Volume (gal.) 12.10

Total Volume Evac. (Gallons) 36

SAMPLING INFORMATION

SAMPLING: Date/Time 4-25-89/14:02 Method of Sampling Peristaltic Pump

Top of Casing to Water Level Measurement (ft) 8.18

FIELD MEASUREMENT DATA

pH (Standard Units)		Turbidity (NTU)		Specific Conductance (¶mhos/cm)	
Date	4-25-89	Date	4-25-89	Date	4-25-89
Time	14:21	Time	14:21	Time	14:21
Taken By	W. Martlock	Taken By	R. Senf	Taken By	W. Martlock
Unit-Brand	HyDac	Unit-Brand	Hach	Unit-Brand	Myron L
Model #	H6973672	Model #	DR-EL-1	Model #	EP-10
Standards Used	(X) 4 (X) 7 ( ) 10	Calib. Standard	DI Water As Zero	Calib. Standard	2767
Temp °C	11.0	Temp °C	11.0	Temp °C	11.0
pH	6.58	Turbidity	45	Specific Conductance	4200

Time	pH (standard units)	Specific Conductance (¶mhos/cm)	Turbidity (NTU)	Temperature (°C)
14:21	6.58	4200	45	11.0

GENERAL INFORMATION

Weather Conditions at Time of Sampling Partly Cloudy, 60°F

Sample Characteristics Clear liquid

Comments and Observations Evacuated & sampled by W. Martlock & R. Senf. Standing water volume calculated for 5" casing & screen

1/SD10390.1

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 WELL # GW-3

TYPE OF SAMPLE Groundwater (X) Grab ( ) Composite ( ) Other

EVACUATION INFORMATION

EVACUATION: Date/Time 4-25-89/11:18 Method of Evac. Peristaltic Pump

Well Casing Diameter (inches) 2 Total Well Depth (ft) 19.23

Top of Casing to Water Level (ft) 4.27 Standing Water Volume (gal.) 15.26

Total Volume Evac. (Gallons) 15 to dry

SAMPLING INFORMATION

SAMPLING: Date/Time 4-25-89/14:51 Method of Sampling Peristaltic Pump

Top of Casing to Water Level Measurement (ft) 5.37

FIELD MEASUREMENT DATA

pH (Standard Units)		Turbidity (NTU)		Specific Conductance (¶mhos/cm)	
Date	4-25-89	Date	4-25-89	Date	4-25-89
Time	15:04	Time	15:04	Time	15:04
Taken By	R.Senf	Taken By	R. Senf	Taken By	R. Senf
Unit-Brand	HyDac	Unit-Brand	Hach	Unit-Brand	Myron L
Model #	H6973672	Model #	DR-EL-1	Model #	EP-10
Standards Used	( ) 4 (X) 7 (X) 10	Calib. Standard	DI Water As Zero	Calib. Standard	2767
Temp °C	11.0	Temp °C	11.0	Temp °C	11.0
pH	7.13	Turbidity	40	Specific Conductance	5000

Time	pH (standard units)	Specific Conductance (¶mhos/cm)	Turbidity (NTU)	Temperature (°C)
15:04	7.13	5000	40	11.0

GENERAL INFORMATION

Weather Conditions at Time of Sampling Sunny, 64°F

Sample Characteristics Clear liquid

Comments and Observations Evacuated & sampled by W. Martlock & R. Senf. Standing water volume calculated for 5" casing & screen

1/SD10390.4

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 WELL # GW-7

TYPE OF SAMPLE Groundwater (X) Grab ( ) Composite ( ) Other

EVACUATION INFORMATION

EVACUATION: Date/Time 4-25-89/17:14 Method of Evac. PVC Bailer

Well Casing Diameter (inches) 2 Total Well Depth (ft) 18.42

Top of Casing to Water Level (ft) 11.36 Standing Water Volume (gal.) 4.61

Total Volume Evac. (Gallons) 14

SAMPLING INFORMATION

SAMPLING: Date/Time 4-25-89/17:24 Method of Sampling Peristaltic Pump

Top of Casing to Water Level Measurement (ft) 13

FIELD MEASUREMENT DATA

pH (Standard Units)		Turbidity (NTU)		Specific Conductance (¶mhos/cm)	
Date	4-25-89	Date	4-25-89	Date	4-25-89
Time	18:16	Time	18:15	Time	18:13
Taken By	R. Senf	Taken By	R. Senf	Taken By	R. Senf
Unit-Brand	HyDac	Unit-Brand	Hach	Unit-Brand	Myron L
Model #	H6973672	Model #	DR-EL-1	Model #	EP-10
Standards Used	(X) 4 (X) 7 ( ) 10	Calib. Standard	DI Water As Zero	Calib. Standard	2767
Temp °C	11.0	Temp °C	11.0	Temp °C	11.0
pH	6.73	Turbidity	100	Specific Conductance	1200

Time	pH (standard units)	Specific Conductance (¶mhos/cm)	Turbidity (NTU)	Temperature (°C)
18:13	6.73	1200	100	11.0

GENERAL INFORMATION

Weather Conditions at Time of Sampling Sunny, 62°F

Sample Characteristics Clear to slightly turbid liquid

Comments and Observations Evacuated & sampled by W. Martlock & R. Senf. Standing water volume calculated for 4" casing & screen

1/SD10390.3

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 WELL # GW-5

TYPE OF SAMPLE Groundwater (X) Grab ( ) Composite ( ) Other

EVACUATION INFORMATION

EVACUATION: Date/Time 4-25-89/15:12 Method of Evac. PVC Bailer

Well Casing Diameter (inches) 2 Total Well Depth (ft) 23.00

Top of Casing to Water Level (ft) 9.92 Standing Water Volume (gal.) 13.34

Total Volume Evac. (Gallons) 40

SAMPLING INFORMATION

SAMPLING: Date/Time 4-25-89/16:10 Method of Sampling Peristaltic Pump

Top of Casing to Water Level Measurement (ft) 9.98

FIELD MEASUREMENT DATA

pH (Standard Units)		Turbidity (NTU)		Specific Conductance (¶mhos/cm)	
Date	4-25-89	Date	4-25-89	Date	4-25-89
Time	16:47	Time	16:47	Time	16:47
Taken By	R. Senf	Taken By	R. Senf	Taken By	R. Senf
Unit-Brand	HyDac	Unit-Brand	Hach	Unit-Brand	Myron L
Model #	H6973672	Model #	DR-EL-1	Model #	EP-10
Standards Used	( ) 4 (X) 7 (X) 10	Calib. Standard	DI Water As Zero	Calib. Standard	2767
Temp °C	11.0	Temp °C	11.0	Temp °C	11.0
pH	7.01	Turbidity	42	Specific Conductance	2500

Time	pH (standard units)	Specific Conductance (¶mhos/cm)	Turbidity (NTU)	Temperature (°C)
16:47	7.01	2500	42	11.0

GENERAL INFORMATION

Weather Conditions at Time of Sampling Sunny, 65°F

Sample Characteristics Clear liquid

Comments and Observations Evacuated & sampled by W. Martlock & R. Senf. Standing water volume calculated for 5" casing & screen

1/SD10390.5

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 WELL # GW-10D

TYPE OF SAMPLE Groundwater (X) Grab ( ) Composite ( ) Other

EVACUATION INFORMATION

EVACUATION: Date/Time 4-25-89/13:10 Method of Evac. Peristaltic Pump

Well Casing Diameter (inches) 4 Total Well Depth (ft) 25.08

Top of Casing to Water Level (ft) 2.95 Standing Water Volume (gal.) 22.57

Total Volume Evac. (Gallons) 67.7

SAMPLING INFORMATION

SAMPLING: Date/Time 4-25-89/15:30 Method of Sampling Peristaltic Pump

Top of Casing to Water Level Measurement (ft) 5.95

FIELD MEASUREMENT DATA

pH (Standard Units)

Date 4-25-89
Time 15:30
Taken By J. Bingert
Unit-Brand Ex-Tech
Model # 1012119158

Standards Used ( ) 4 (X) 7 (X) 10
Temp °C 17
pH 6.80

Turbidity (NTU)

Date 4-25-89
Time 15:30
Taken By J. Bingert
Unit-Brand H.F. Scientific
Model # DRT15C

Calib. Standard 0.1 NTU
Temp °C 17.0
Turbidity .90

Specific Conductance (¶mhos/cm)

Date 4-25-89
Time 15:30
Taken By J. Bingert
Unit-Brand Myron L
Model # EP-10

Calib. Standard 2767
Temp °C 17
Specific Conductance 4600

Time	pH (standard units)	Specific Conductance (¶mhos/cm)	Turbidity (NTU)	Temperature (°C)
15:30	6.80	4600	.90	17

GENERAL INFORMATION

Weather Conditions at Time of Sampling Sunny, 67°F

Sample Characteristics Clear liquid

Comments and Observations Evacuated & sampled by J. Bingert & B. Fisher. Standing volume calculated for 5" casing & screen

1/SD10390.7

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 WELL # GW-9

TYPE OF SAMPLE Groundwater (X) Grab ( ) Composite ( ) Other

EVACUATION INFORMATION

EVACUATION: Date/Time 4-25-89/11:25 Method of Evac. PVC Bailer

Well Casing Diameter (inches) 2 Total Well Depth (ft) 26.43

Top of Casing to Water Level (ft) 17.55 Standing Water Volume (gal.) 9.06

Total Volume Evac. (Gallons) 5 gal. to dryness

SAMPLING INFORMATION

SAMPLING: Date/Time 4-25-89/16:05 Method of Sampling PVC Bailer

Top of Casing to Water Level Measurement (ft) 19.57

FIELD MEASUREMENT DATA

pH (Standard Units)

Date 4-25-89
Time 16:10
Taken By J. Bingert
Unit-Brand Ex-Tech
Model # 1012119158

Standards Used ( ) 4 (X) 7 (X) 10
Temp °C 18
pH 6.98

Turbidity (NTU)

Date 4-25-89
Time 16:10
Taken By J. Bingert
Unit-Brand H.F. Scientific
Model # DRT15C

Calib. Standard 0.1 NTU
Temp °C 18
Turbidity 19.65

Specific Conductance (¶mhos/cm)

Date 4-25-89
Time 16:10
Taken By J. Bingert
Unit-Brand Myron L
Model # EP-10

Calib. Standard 2767
Temp °C 18
Specific Conductance 3200

Time	pH (standard units)	Specific Conductance (¶mhos/cm)	Turbidity (NTU)	Temperature (°C)
16:10	6.98	3200	19.65	18

GENERAL INFORMATION

Weather Conditions at Time of Sampling Sunny, 67°F

Sample Characteristics Clear liquid

Comments and Observations Evacuated & sampled by J. Bingert & B. Fisher. Standing volume calculated for 5" casing & screen

1/SD10390.6

EMERSON STREET LANDFILL (#828023)
PHASE II INVESTIGATION
SAMPLING DATA

SITE Emerson Street Landfill #828023 WELL # GW-10S

TYPE OF SAMPLE Groundwater (X) Grab ( ) Composite ( ) Other

EVACUATION INFORMATION

EVACUATION: Date/Time 4-25-89/13:04 Method of Evac. Peristaltic Pump

Well Casing Diameter (inches) 2 Total Well Depth (ft) 13.17

Top of Casing to Water Level (ft) 2.36 Standing Water Volume (gal.) 11.03

Total Volume Evac. (Gallons) 33

SAMPLING INFORMATION

SAMPLING: Date/Time 4-25-89/13:44 Method of Sampling Peristaltic Pump

Top of Casing to Water Level Measurement (ft) 4.55

FIELD MEASUREMENT DATA

pH (Standard Units)		Turbidity (NTU)		Specific Conductance (¶mhos/cm)	
Date	4-25-89	Date	4-25-89	Date	4-25-89
Time	14:00	Time	14:00	Time	14:00
Taken By	J. Bingert	Taken By	J. Bingert	Taken By	J. Bingert
Unit-Brand	Ex-Tech	Unit-Brand	H.F. Scientific	Unit-Brand	Myron L
Model #	1012119158	Model #	DRT15C	Model #	EP-10
Standards Used	( ) 4 (X) 7 (X) 10	Calib. Standard	0.1 NTU	Calib. Standard	2767
Temp °C	20	Temp °C	20	Temp °C	20
pH	6.99	Turbidity	14.5	Specific Conductance	3300

Time	pH (standard units)	Specific Conductance (¶mhos/cm)	Turbidity (NTU)	Temperature (°C)
14:00	6.99	3300	14.5	20

GENERAL INFORMATION

Weather Conditions at Time of Sampling Sunny, 67°F

Sample Characteristics Clear liquid

Comments and Observations Evacuated & sampled by J. Bingert & B. Fisher. Standing volume calculated for 5" casing & screen

APPENDIX H

REFERENCES

EMERSON STREET LANDFILL

#828023

REFERENCES

1. Richard Guck, University of Rochester, personal interview by Richard Sutherland, Monroe County Health Department, and Ann Nelson, Monroe County Environmental Management Council, April 2, 1981.

2. Robert H. Wilson, University Health Service, letter to John Swanson, Department of Environmental Conservation, December 27, 1985.

3. City of Rochester and Monroe County Environmental Management Council, aerial photographs of the site as follows:

October 5, 1951	ARK-1H-190,191
1955	0719882
July 20, 1958	ARK-2V-58
May, 1961	0719882
September 10, 1964	0719882
November 5, 1965	0719882
October 8, 1969	0719882
April 15, 1970	0719882
August 13, 1970	0719882

4. Rochester Democrat and Chronicle, September 20, 1963, pg. 28.

5. Stan Hanna, formerly of Dugan Brothers Refuse Removal, personal interview by Ann Nelson and louise Hartshorn, Monroe County Environmental Management Council, February 24, 1983.

6. Sherwood Davies, Director of the Bureau of Radiological Health Services (assumed to be for the City of Rochester), letter to Paul Frott, Minnesota Mining and Manufacturing Company, May 7, 1963.

7. EPS Management Consultants, Inc. report, "Feasibility Study for an Industrial Park in Rochester, New York, July 1969," prepared for NYS-ODC, contains 40 page section on "Physical Site Factors."

8. NYS Department of Health, "Comprehensive Solid Wastes Planning Studies," May 1970.

9. Rochester Democrat and Chronicle, March 22, 1970.

10. Dewayne Day, Monroe County Health Department, memorandum to Wendell Ames, August 9, 1971.

11. Rochester Democrat and Chronicle, October 3, 1971.

12. Wetland Boundary Map, July 1985, 3650.021-70000.071.17.D, Department of Environmental Services, Engineering Services, City of Rochester, New York.

13. Weather of U.S. Cities, 2nd Edition, Volume 2, 1985, edited by James A. Ruffner and Frank E. Bair, published by Gale Research Company.

14. Climatic Atlas of the United States, U.S. Department of Commerce, National Climatic Center, Ashville, North Carolina, 1979.

15. Rainfall Frequency Atlas of the United States, Technical Paper No. 40, U.S. Department of Commerce.

16. USGS Topographic Map 7.5 min., Rochester West Quadrangle, New York, 1978.

17. New York State Atlas of Community Water System Services, 1982, New York State Department of Health, Division of Environmental Protection, Bureau of Public Water Supply Protection.

18. Surficial Geologic Map of New York, Finger Lakes sheet, compiled and edited by Ernest H. Muller and Donald H. Caldwell, 1986.

19. Soil Survey, Monroe County, New York, United States Department of Agriculture, Soil Conservation Service, March, 1973.

20. Subsurface Structure and Stratigraphy of Rochester, New York; M.S. thesis by Julie Lynn Scherzer, University of Rochester, 1983.

21. Report on geologic conditions, Combined Sewer Overflow Abatement Program (CSOAP), Phase II, Rochester, New York, by H&A of New York.

22. Geologic Map of New York, Finger Lakes sheet, 1970, by Rickard and Fisher.

23. Site Investigation Report, Outer Loop Industrial Site, Rochester, New York, Empire Soils Investigations, Inc., 1979.

24. Boring Logs, Rochester Drilling Company, from 1980 and 1981.

25. Test Pit Reports, CME Construction Co., Inc., December, 1988.

26. Monroe County Environmental Management Council, Generalized Groundwater Contour Map, 1980.

27. Wayne F. Wegman, Passero, Scardetta Associates, letter to Monroe County Department of Health, April 30, 1981.

28. Richard S. Elliott, Director, Division of Environmental Health, letter to Keith Marshall, Educational Facilities City School District, September 17, 1984.

29. Dennis R. Weiss, Bureau of Environmental Exposure Investigation, letter to Ms. Dorothy R. Pecoraro, Principal, Edison Technical High School, September 3, 1987.

30. Marshall Shannon, General Testing Corporation, letter to Ben Seragusa, Rochester Drilling Company, October 16, 1985.

31. Dennis R. Weiss, Bureau of Environmental Exposure Investigation, letter to Ms. Dorothy R. Pecoraro, Principal, Edison Technical High School, January 4, 1988.

32. NYSDEC, Analytical Results for excavated soils at City of Rochester Forestry Building, March 30, 1989.

33. New York State Department of Environmental Conservation, Division of Water Resources, Groundwater Classifications, Quality Standards and Effluent Standards and/or Limitations, Part 703.

34. NYSDEC, Analytical results for surface water samples from storm sewer outfalls, January 10, 1989.

35. Uncontrolled Hazardous Waste Site Ranking System, A Users Manual, July 16, 1982, Table 2, Permeability of Geologic Materials.

36. H&A of New York, "Report On Drinking Water Well Location Identification Emerson Street Landfill Area Greece and Rochester, New York, May 1989.

37. National Fire Protection Association, National Fire Codes, Volume 13, No. 49, 1976.

38. California Department of Health, Hazardous Waste Management Law, Regulations and Guidelines for Handling Hazardous Wastes.

39. NYSDEC (1985) "Ambient Water Quality Standards", NYCRR PT701.

REF 1

4/81 Interview with Richard Buck, 374 South Road, Scottsville. Conducted by Richard Sutherland and [illegible]

Mr Buck has worked as a maintenance man at the R of R since 1947. He works in the building along Elmwood Avenue where radioactive experiments are conducted.

Between 1947 and 1954 he was instructed to take radioactive animal cages (wooden frames) used for inhalation experiments to the Genesee St dump. Some pigs were also included in the load. Mr Buck and Louis Oakes hauled the cages in a government truck. Apparently an arrangement had been made between the Atomic Energy Commission personnel running the project and the City for the City to accept this waste. Only one haul was made. Mr Buck stated that beryllium was one of the materials.

Since the time the material was dump the R of R has taken over the project

Mrs Buck stated that, as an employee at the hospital, she was instructed to dispose of limited quantities of radioactive material in the sewer

Caledonia Landfill

Excavation for Genesee St dump for Reserve Recovery plant was taken to Caledonia. Hazardous waste from Eilco also went there. Buck's saw barrels with liquid breakages at Caledonia Landfill

Environmental Health & Safety Section
University Health Service
University of Rochester • 300 East River Road • Rochester, New York 14623
UHS
(716) 275-3241

REF 2

December 27, 1985

Mr. John Swanson
NYS Department of Environmental Conservation
Region 8
6274 East Avon-Lima Road
Avon, NY 14414

Dear Mr. Swanson,

During the war and for several years thereafter, the University of Rochester performed a variety of studies on the toxicology of uranium and thorium compounds, in behalf, first, of the U.S. Army Corps of Engineers under the Manhattan Project and later under the Atomic Energy Commission. The interest of these agencies was in the chemical toxicity of the compounds; the radioactivity is so very low for both that its risk was considered a very minor concern. In fact, a five-year inhalation study we performed demonstrated for uranium that radiation injury could not be induced at levels which did not cause chemical effects. Thorium is 1/10 as radioactive, and is even less toxic than uranium.

On completion of the wartime and early post-war studies, the early primitive inhalation equipment was dismantled and discarded, to make way for more-sophisticated designs. I don't recall the exact dates, but those you mentioned would certainly encompass those of removal. I was not involved in the actual discard process, but it is highly probable that the discarded material was taken to Emerson. Because contamination was very slight, and by naturally occurring radioactive materials, the discarded material was treated as routine refuse. The activity probably represented little more than a dozen or two Coleman lantern mantles, which contain thorium. (It should be noted here that even during the war years we did not discard radioactively hazardous materials in any municipal landfills.)

With regard to your contemplated coring at the Emerson site, I can state unequivocally that the radioactive materials discarded by the University pose NO HEALTH HAZARD to the individuals performing the work. Even if the coring penetrated University wastes, it is a virtual certainty that any radioactivity found would be indistinguishable from background. Further, the chemical toxicity is so slight that your crews will have much more to be worried about from other discards (e.g., old lead paint scrapings and peelings).

I hope the foregoing will provide the reassurance your people need for performing this work. I am thoroughly familiar with the fear naive individuals have towards radiation; if you think it would be of any help, I would be happy to discuss it with them in detail.

Very truly yours,

RHWilson

Robert H. Wilson
Environmental Health & Safety

RECEIVED
DEC 31 1985
SOLID WASTE

RHW/bb

SUPPLEMENTARY INFORMATION SOURCES

31. AGENCY FILE INFORMATION

32. PERMITS FOR SITE

33. INTERVIEW INFORMATION

34. CALL-IN INFORMATION

35. FIELD INSPECTION REMARKS

36. ADDITIONAL INFORMATION Other aerial photographs by year:

1930 ... C-2-35, 36

1970 ... 1982-12-522, 523 - ~~major dumping - trucks visible, land mostly~~ vegetated; activity (grading) visible

1975 ... MON 7-024, 025, 026 and MON 7-126, 127, 128

Call from Dick Sutherland - Health Dept in '81 about a proposed subdivision north of Emerson St., east of Polasis St., west of Stenson St., south of Planet St. - asked if dumping occurred in this location - No dumping. Groundwater flows to the NE - 1/22/81 call from HUD (Buffalo) on proposed subdivision - Dick Young gave his comments - met with Charles - HUD 3/23/81 to review Emerson St. maps

FINAL RECOMMENDATIONS

SITE ACTIVITY RECORD

REF 3

1. SITE NAME Emerson Street Dump
2. MUNICIPALITY Rochester
3. ADDRESS
4. GENERAL SITE LOCATION north of Lyell Ave, south of Lexington Ave, east of Lee Rd, west of Mt Read Blvd

SITE NO. 10 QUADRANGLE NO. .08

PLANIMETRIC MAP NO. ____ ORTHOPHOTO NO. 104.51; 104.52; 105.37; 105.45

CLASSIFICATION

D

.01 SITE ACTIVITY .01 GEOLOGY .01 LAND USE

____ WATER WELL CONTAMINATION POTENTIAL

SITE ACTIVITY

5.

PHOTO YEARS	DESCRIPTION OF ACTIVITY OBSERVED ON AERIAL PHOTOGRAPHS	PHOTO NUMBERS
1951	Dumping is occuring north, east, and west of the transfer station. Colfax St has not yet been constructed.	ARK-1H-190,191
1958	Major dumping south of Emerson St and west of Colfax St; dumping south of Lexington Ave in small area; large fill area behind transfer station.	ARK-2V-59,60
1961	Dumping has increased to cover twice the area as in 1958 to date; dumping has extended into wooded areas and wetlands; major activity north of Emerson St	AOB-228,229

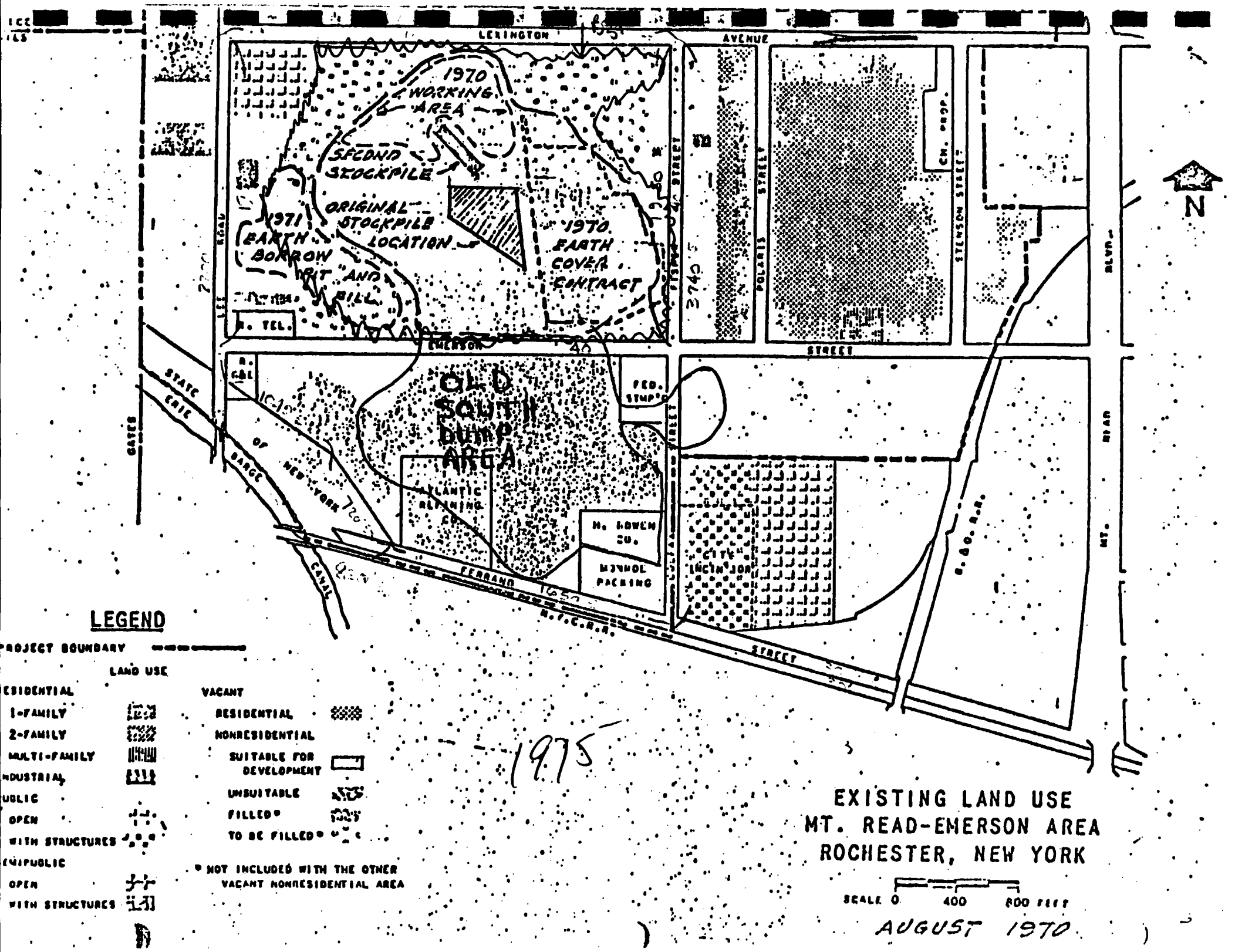
6. ESTIMATED SITE ACREAGE

7. NOTE ON SITE SKETCH MAP OR ORTHOPHOTO MAP RELEVANT ACTIVITIES LISTED BELOW AS WELL AS LAND USE ACTIVITIES ON AND ADJACENT TO THE SITE DURING PERIOD OF OPERATION, INCLUDING INDUSTRIES, COMMERCIAL ESTABLISHMENTS, SAND AND GRAVEL OPERATIONS, ETC.

	SOURCE OF INFORMATION/ DATE		SOURCE OF INFORMATION/ DATE
✓ KNOWN DUMPING	1951-1997: aerial photos	____ DRUM STORAGE	
____ POSSIBLE DUMPING		____ TANK STORAGE	
____ UNSPECIFIED FILLING		____ OIL SPILL	
____ SCATTERED SURFACE DUMPING		____ INJECTION WELL	
____ LAGOON		____ JUNK YARD	
____ CLEAN FILL		____ OTHER	

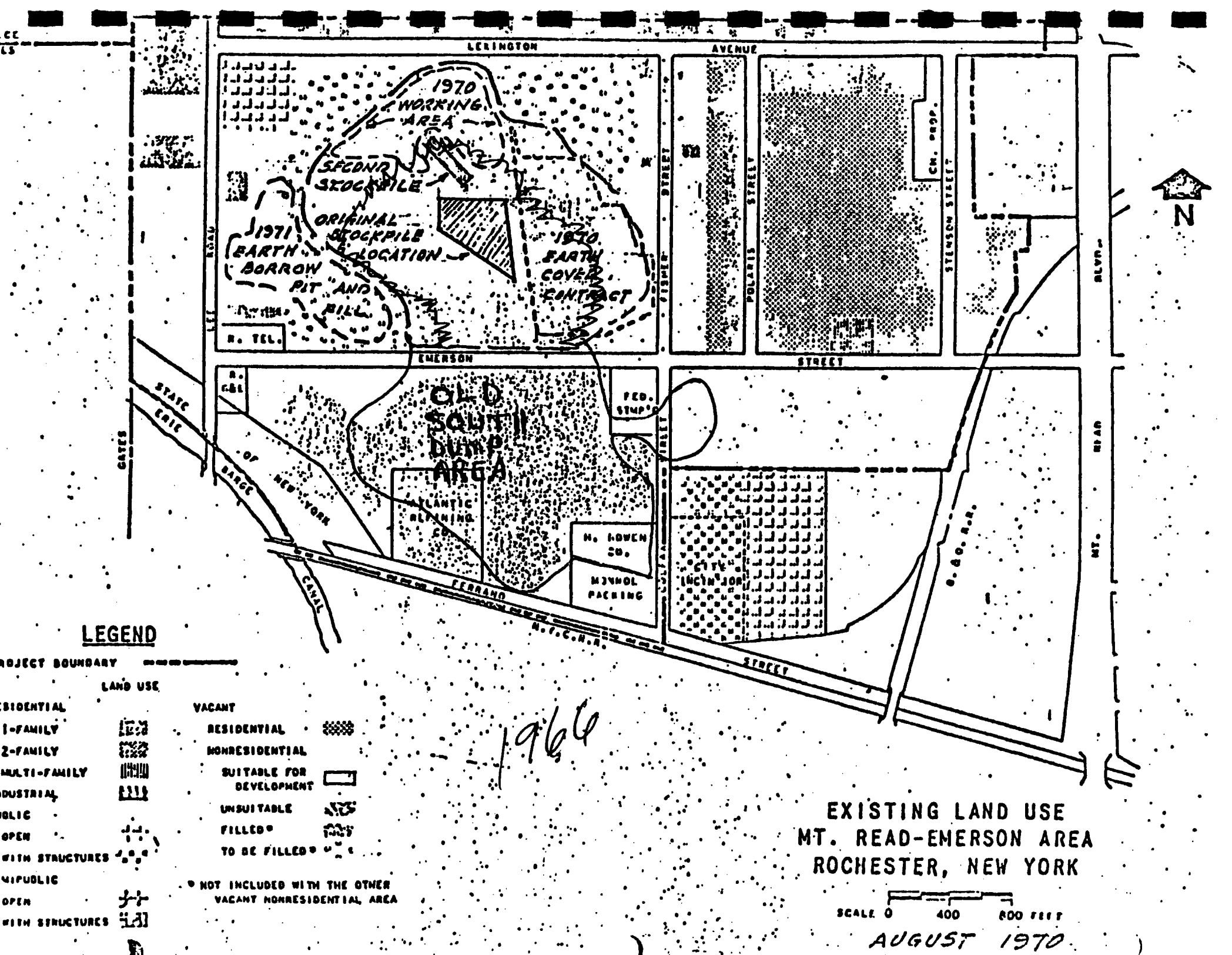
8.

TYPE OF WASTE DISPOSED OF AT SITE	SOURCE OF WASTE	SOURCE OF INFORMATION/ DATE
____ MIXED MUNICIPAL		
____ INDUSTRIAL		
____ CONSTRUCTION/DEMOLITION		
____ TREE/BRUSH		
____ CHEMICAL		
____ FLY ASH FROM POWER GENERATORS		
____ SLUDGE FROM SEWAGE TREATMENT PLANT		
____ AGRICULTURAL/NURSERY DEBRIS		


LEXINGTON AVENUE
1970 WORKING AREA
SECOND STOCKPILE
ORIGINAL STOCKPILE LOCATION
1971 EARTH BORROW PIT AND HILL
1970 EARTH COVER CONTRACT
EMERSON STREET
OLD SOUTH DUMP AREA
ATLANTIC REFINING CO.
H. LOWEN CO.
MANHOL PACKING
CITY INCINERATOR
FEDERAL STUMP
STATE BARGE CANAL
NEW YORK
FERRAND
N.Y.C.R.R.
STREET
STENSON STREET
MT. READ BLVD.
GATES
N
LEGEND
PROJECT BOUNDARY
LAND USE
RESIDENTIAL
1-FAMILY
2-FAMILY
MULTI-FAMILY
INDUSTRIAL
PUBLIC
OPEN
WITH STRUCTURES
SEMI-PUBLIC
OPEN
WITH STRUCTURES
VACANT
RESIDENTIAL
NONRESIDENTIAL
SUITABLE FOR DEVELOPMENT
UNSUITABLE
FILLED*
TO BE FILLED*
* NOT INCLUDED WITH THE OTHER VACANT NONRESIDENTIAL AREA
1975
EXISTING LAND USE
MT. READ-EMERSON AREA
ROCHESTER, NEW YORK
SCALE 0 400 800 FEET
AUGUST 1970

Emison Aerial Photos

9/5/1961	AGB-225	AGB-251
6/3/57	ARK-1H-190	ARK-1H-191
7/20/1955	ARK-2V-59,	ARK-2V-60
7/1/66	ARK-2GG-45	ARK-2GG-46
4/15/70	1982-12-522	1982-12-523
4/23/75	7-024, 7-025, 7-024, 7-126, 7-127, 7-128	



LEGEND

PROJECT BOUNDARY

LAND USE

RESIDENTIAL
- 1-FAMILY
- 2-FAMILY
- MULTI-FAMILY

INDUSTRIAL

PUBLIC
- OPEN
- WITH STRUCTURES

SEMIPUBLIC
- OPEN
- WITH STRUCTURES

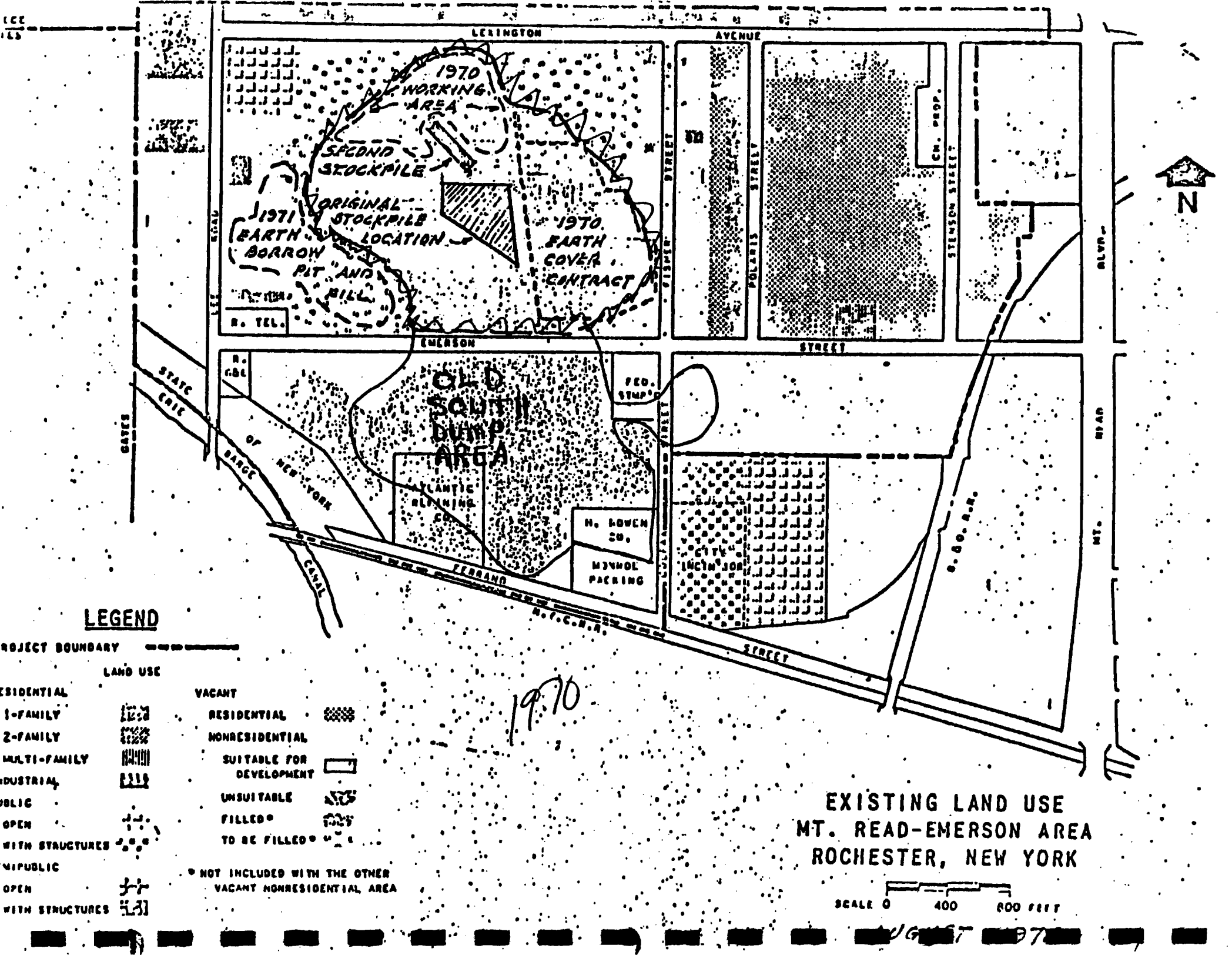
VACANT
- RESIDENTIAL
- NONRESIDENTIAL
  - SUITABLE FOR DEVELOPMENT
  - UNSUITABLE
  - FILLED*
  - TO BE FILLED*

* NOT INCLUDED WITH THE OTHER VACANT NONRESIDENTIAL AREA

EXISTING LAND USE
MT. READ-EMERSON AREA
ROCHESTER, NEW YORK

SCALE 0 400 800 FEET

AUGUST 1970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ORIGINAL STOCKPILE LOCATION
1971 EARTH BORROW PIT AND FILL
1970 EARTH COVER CONTRACT
R. TEL.
EMERSON STREET
OLD SOUTH DUMP AREA
FED. STMP.
STATE BARGE CANAL
ERIE
OF NEW YORK
ATLANTIC REFINING CO.
H. BOWEN CO.
MONROE PACKING
CITY INCINERATOR
FERRAND
N.Y.C.R.R.
STREET
GATES
LEE ROAD
GLENWOOD STREET
POLARIS STREET
STENSON STREET
CH. PROP.
MT. READ BLVD.
N
LEGEND
PROJECT BOUNDARY
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2-FAMILY
MULTI-FAMILY
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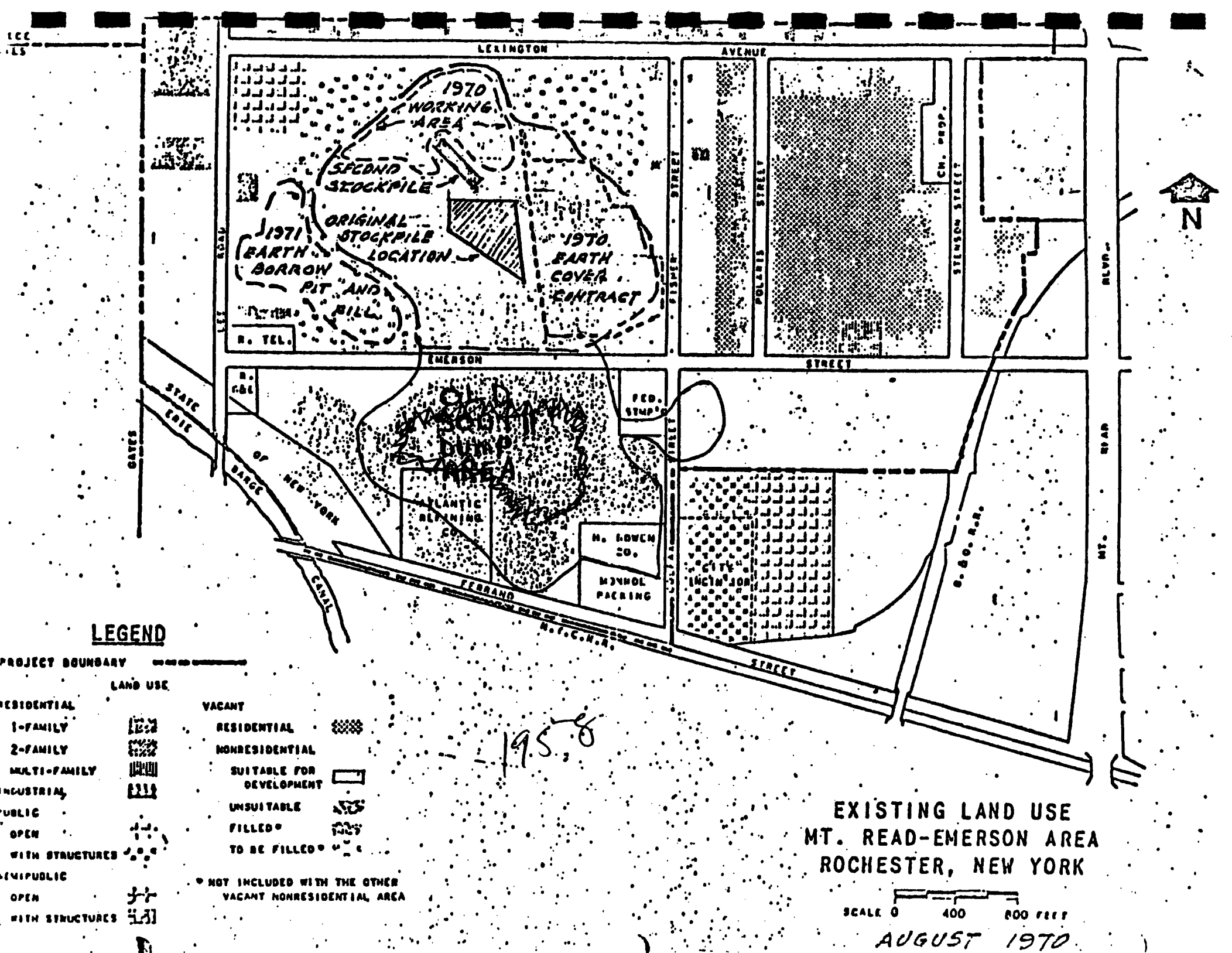
EXISTING LAND USE
MT. READ-EMERSON AREA
ROCHESTER, NEW YORK
SCALE 0 400 800 FEET


LEXINGTON AVENUE
1970 WORKING AREA
SECOND STOCKPILE
ORIGINAL STOCKPILE LOCATION
1971 EARTH BORROW PIT AND HILL
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R. TEL.
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R. G&E
FED. STMP.
OLD DUMP AREA
ATLANTIC REFINING CO.
H. BOWEN CO.
MOHOL PACKING
CITY INCINERATOR
STATE OF NEW YORK BARGE CANAL
FERRAND
N.Y.C.H.R.R.
STREET
GATES
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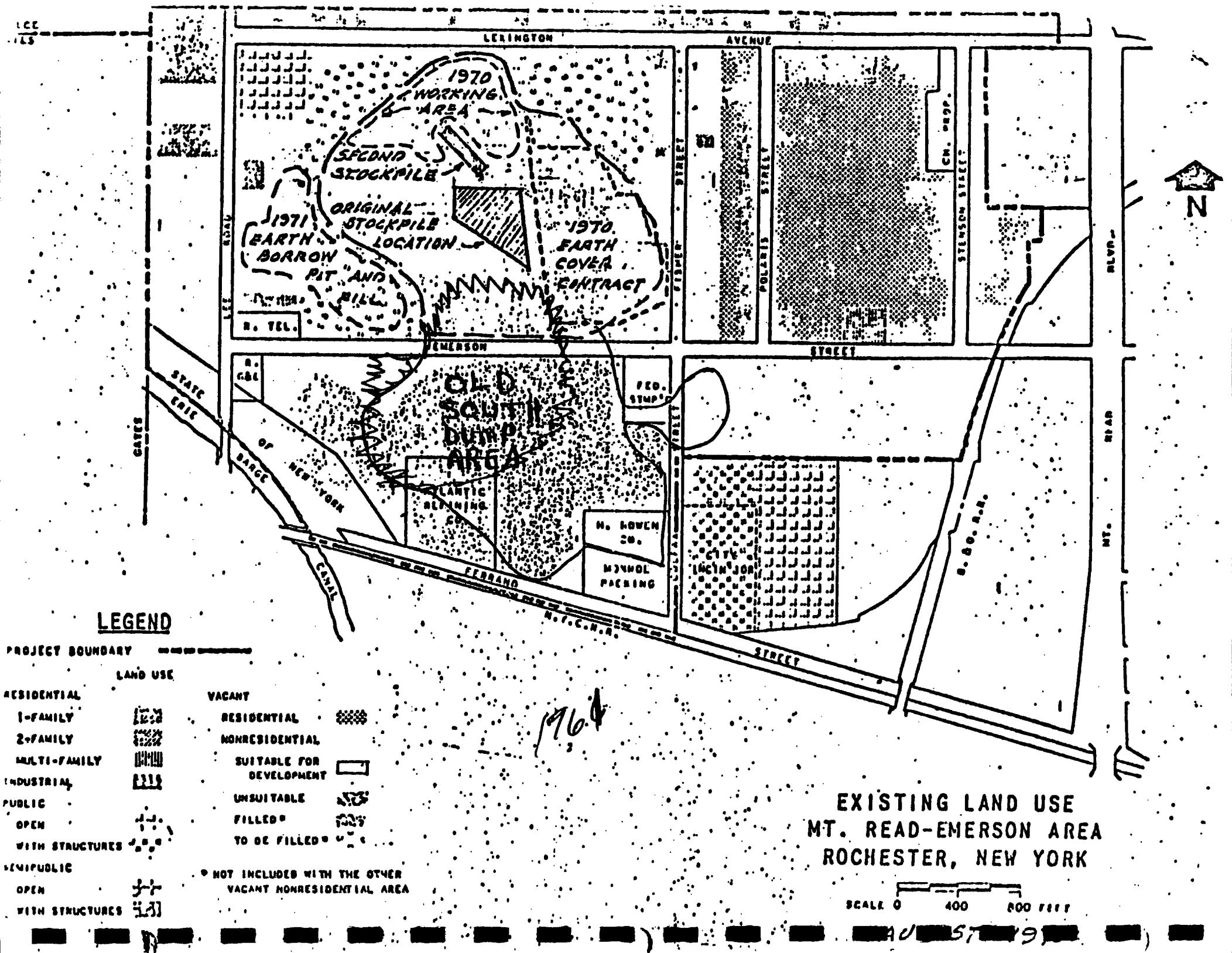
UNSUITABLE
FILLED*
TO BE FILLED*
* NOT INCLUDED WITH THE OTHER VACANT NONRESIDENTIAL AREA
1958
EXISTING LAND USE
MT. READ-EMERSON AREA
ROCHESTER, NEW YORK
SCALE 0 400 800 FEET
AUGUST 1970


LEXINGTON AVENUE
1970 WORKING AREA
SECOND STOCKPILE
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R. TEL.
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STATE BARGE CANAL
ERIE
OF NEW YORK
ATLANTIC BLEACHING CO.
N. BOWEN CO.
MONROE PACKING
CITY INCINERATOR
FERRANO STREET
N.Y.C.R.R.
B.&O.R.R.
GATES
LEE ROAD
FISHER STREET
POTOMAC STREET
STENSON STREET
CH. REP.
MT. READ BLVD.
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PROJECT BOUNDARY
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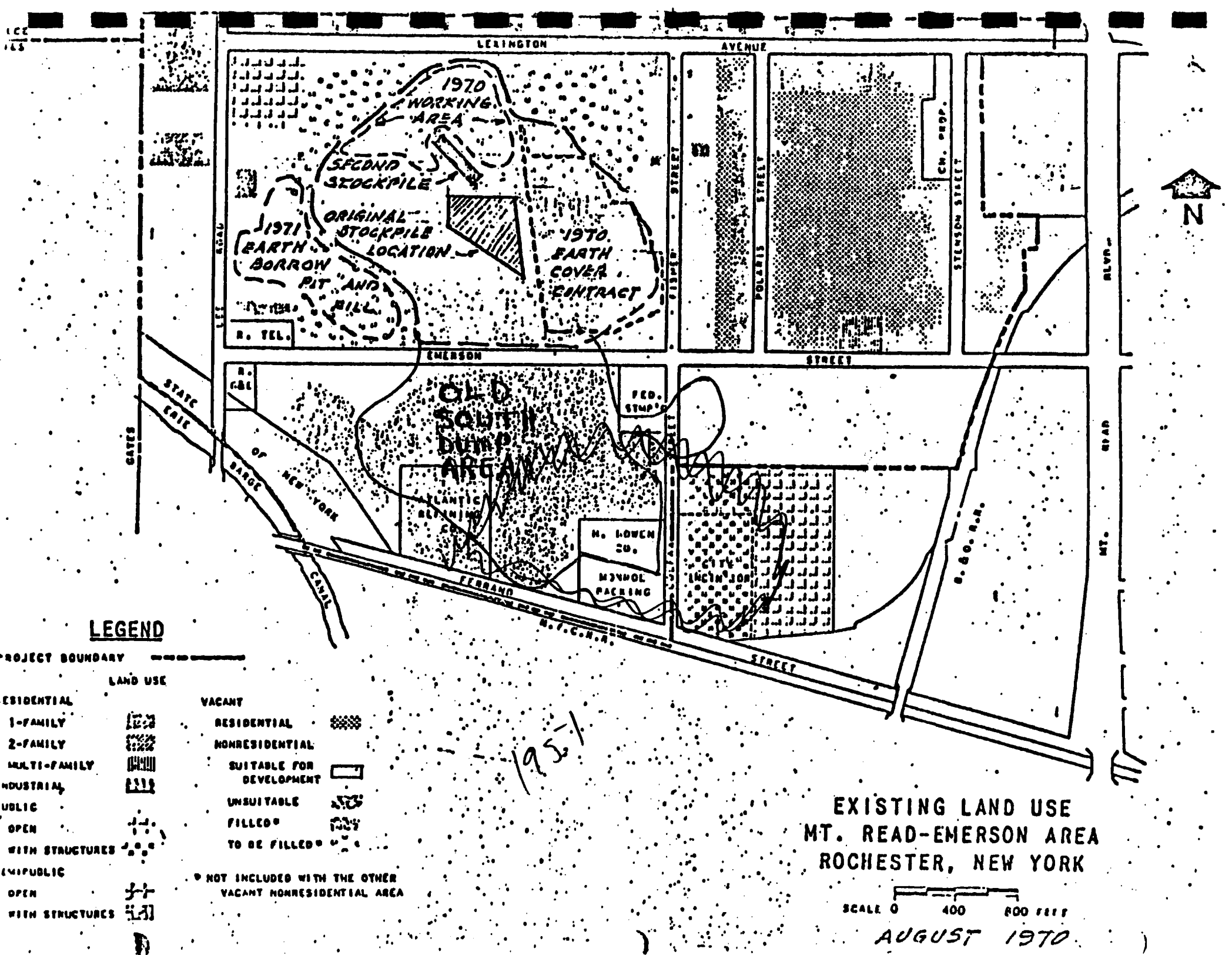
SUITABLE FOR DEVELOPMENT
UNSUITABLE
FILLED*
TO BE FILLED*
* NOT INCLUDED WITH THE OTHER VACANT NONRESIDENTIAL AREA
1964
EXISTING LAND USE
MT. READ-EMERSON AREA
ROCHESTER, NEW YORK
SCALE 0 400 800 FEET



LEGEND

PROJECT BOUNDARY

LAND USE

RESIDENTIAL
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- 2-FAMILY
- MULTI-FAMILY

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PUBLIC
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- WITH STRUCTURES

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VACANT
- RESIDENTIAL
- NONRESIDENTIAL
- SUITABLE FOR DEVELOPMENT
- UNSUITABLE
- FILLED*
- TO BE FILLED*

* NOT INCLUDED WITH THE OTHER VACANT NONRESIDENTIAL AREA

1951

EXISTING LAND USE
MT. READ-EMERSON AREA
ROCHESTER, NEW YORK

SCALE 0 400 800 FEET

AUGUST 1970

REF 4

Refuse Disposal: Candidate' Charge, Official's Response

D. & C. AUG 28 1969

.AS A REPUBLICAN candi-.te for City Council, I am .eply concerned about the ritically serious situation at .e Emerson Street dump.

The millions of tons of .ater pumped into the Emer-.n Street dump to extinguish .res pose a mounting flood .nd health menace to resi-.ents living near streams and .wampy areas in the dump on .merson Street, Lee Road, .exington Avenue and Polaris .reet. Residents in this area .e in imminent danger of .aving this polluted, foul-.melling water shifted onto .eir property. City Hall .ould drain this area imme-.ately and spray the polluted .aters with chemicals.

The Emerson Street dump .as been a festering problem .or years but City Hall has .nerely paid lip service to it. City Hall has even refused to talk to private waste disposal contractors with proposals for more modern systems at less cost to city taxpayers.

Finally, in February 1967, the city appropriated $35,000 to have Greeley & Hansen, consulting engineers, prepare a report on the collection and disposal of solid waste. In April, 1969, another $70,000 was authorized to pay an engineer to design a refuse disposal transfer station.

I inspected a model transfer station last week in Lancaster, Pa., whose plans and specifications could be obtained at little or no cost. Instead of sending one of its own engineers to Lancaster to gather information, as I did, City Hall continues to spend large sums of money on studies and reports.

It takes only two to three months to build a transfer station which cost only $325,000, including the land, in Lancaster. During the past 2½ years the city has already spent over $100,000 for studies and reports on solid-waste disposal, and we still don't have a refuse transfer system. We don't even have a completed study or report from the city's consulting engineers, Greeley & Hansen.

MERWYN M. KROLL, 25 Main St. E.

MERWYN M. KROLL'S letter on the subject of the city's refuse disposal program is based on lack of information and inaccuracy.

The city authorized an appropriation of $35,000 in February 1967 to conduct a study of refuse collection and disposal. At the same time, the state inaugurated a new grant program under which comprehensive waste disposal studies would be underwritten 100 per cent by the state. The city applied for this aid and, after almost a year of negotiation with the county and the State Health Department, received funding for a comprehensive solid-waste study, taking into consideration not only the needs of the city, but also of all the towns and villages in Monroe County.

This comprehensive study was undertaken by the city with Greeley & Hansen Engineers (of Chicago) in January 1968. The preliminary report of that study is completed and is now under review by local

D. & C. AUG 28 1969

.nd state officials. This re-.ort, which will be published soon, is the first comprehen-.ive analysis of refuse dis-.osal problems and needs in Monroe County that has ever been conducted, and it will form the basis for action pro-.grams for the city, the county, the towns and the vil-.lages. The study, I repeat, was paid for entirely by the .tate.

The report of Greeley & Hansen engineers shows conclusively that the most economical and efficient system of refuse disposal for the future will involve sanitary landfills with transfer facilities.

In view of this finding, the city chose not to wait for completion of the published report, but instead authorized the design of a transfer station several months ago. We are, at the same time, preparing specifications to determine the cost of the various alternatives available to the city for sanitary landfills with transfer, including rail haul and other privately contracted operation.

A primary cause of delay in inaugurating a new program has not been the need for transfer facilities but rather the need for new publicly owned landfill sites. According to its original time schedule, the county was to have had refuse disposal districts created and operational this summer. County-owned sanitary landfill sites could provide an ideal solution for the discontinuance of use of the city's current site at Mt. Read - Lexington - Emerson. The county, however, has experienced a nun.ber of delays in inaugurating its program, and the city is looking at other alternatives.

If Mr. Kroll had taken the trouble to check, he would have discovered that city engineers have visited and are familiar with the transfer station in Lancaster, Pa., and a number of other cities. The Lancaster station, although adequate for the job in that locality, would not meet the needs of Rochester.

The station has a limited superstructure, being completely open on one side and, in addition, loading operations are conducted on the outside. Also, the $325,000 cost is for a station considerably smaller than that required to meet our needs.

The city will be building its first transfer station on site of the West Side incin-.tor. The adjacent land, ut-.ing the existing landfill, be developed as an indus-.park. It is important that disposal facilities be att-.tive and free from nuisa-.creating conditions. The .tion under design, there-.will be fully enclosed, with loading operations on the .rior of the structure so a eliminate completely the sibility of nuisance from .or debris. It also will much greater flexibility in kind of equipment that can used than does the Lanc-.station.

ALFRED S. ANGELO
Commissioner, Department of Public Works, City of Rochester

REF 5

CONFERENCE MEMORANDUM
SOLID WASTE UNIT

Date 2-22-83
Time 10:30 am

With Stan Hamma
Title -
Address 1380 E River Road
Brighton, NY
Phone 716-436-7214

RE Emerson Street Dump Waste

Conference by Debbie J.
☒ Telephone ☐ Office

Outline of Discussion:

- He worked for Dugan Brothers - (Ray D) a waste hauler for industrial: Commercial, for 9 months operation between 1962-1965
- He remembers taking low level radiation wastes from Kodak and chemicals from Schlagel.
- He can approximate when this is dumped.

Action to be taken:

meeting 9:30 at MCEMC on Feb 24, 1983

action to be taken:

find out about a person named Tom(?)

to know more about the operations of Dugan Brothers.

- he may be a private hauler now
- worked for Sheriffs depart. in 1970 as patrolman.
- worked for Roadway Trucking
- Belongs to the teamsters
- Ernie Mayer - teamsters president may know Tom (?)

CONFERENCE MEMORANDUM
SOLID WASTE UNIT

Date 2-24-83
Time 1:30

With Stan Hamma
Title —
Address 1380 E River Road
Brighton, NY
Phone 716-436-7214

RE Emerson Street Wastes

Conference by Debbie J.
☐ Telephone ☐ Office ☒ EMC

Outline of Discussion:

Meeting with Ann Nelson, Louise Hartshorn, Stan Hamma

Mr. Hamma hauled wastes from:
* Eastman Kodak - Lincoln Road - radioactive wastes
Bausch & Lomb - St Paul Street - industrial waste
Stromberg Carlson - office waste
Taylor Inst. - office waste
Schagel - 6-55gal drums of chemicals

* Eastman Kodak - hauled 6 times - 35gal drums lined with concrete - low level radiation.

[illegible]:
- Hauled municipal & industrial wastes by day
municipal & drums by night

- He dumped drums of radioactive & chemical wastes in a wet area (South side) near a hedge row of trees.

- Mr. Hamma claims - Gottry Heavy Haulers - hauled everything
999 Beahan Rd 235-7400

REF 6

May 7, 1963

Mr. Paul W. Trott
Radiation Safety Engineer
Minnesota Mining and Manufacturing Company
2501 Hudson Road
St. Paul 19, Minnesota

Dear Mr. Trott:

We are in receipt of your letter dated April 17, 1963 in which you have requested permission to dispose of thoriated glass wastes at the city dump of Rochester.

In the enclosed New York State Sanitary Code under Section 16.8 b, burial is permitted if the total quantity of the radioactive material under consideration does not exceed 1000 times the quantity set forth in Table 4, Appendix 1. In this case natural thorium can be buried up to 50,000 us at any one location and time. If we understand your letter correctly you will nowhere near approach this amount.

This letter may be considered as granting permission for your concern to dispose of the natural thorium wastes described in your letter at the city dump of Rochester providing the above specified code requirements are adhered to.

Very truly yours,

Sherwood Davies, P.E.
Director, Bureau of
Radiological Health Services

VI - PHYSICAL SITE FACTORS

A - DESCRIPTION OF SITE PLAN

1 - Outer Loop Industrial Complex Boundary Description

All that tract or parcel of land situated in the City of Rochester, County of Monroe and State of New York, beginning at a point at the easterly line of Lee Road where the northerly line of property acquired by the State of New York for canal purposes intersects the same, thence westerly along said northerly line extended to the westerly line of Lee Road, thence northwesterly along said northerly line to the City line; thence northerly along the City line to southerly side of Lexington Avenue; thence easterly parallel to Lexington Avenue to the westerly property line of the residential properties on the westerly side of Polaris Street, thence southerly to the intersection of the southerly side of Emerson Street; thence easterly parallel to Emerson Street to the westerly line of the Baltimore and Ohio Railroad lands, thence south westerly along the course of the Baltimore and Ohio Railroad to the southerly line of parcels fronting on the southerly side of Emerson Street, thence westerly along said rear of southerly line to the centerline of Colfax Street, thence southerly along the center line of Colfax Street to the northerly line of Ferrano Street, thence westerly along the northerly line parallel to Ferrano Street to the westerly line of the lands of the Atlantic Refining Company, thence southerly to northerly line of the Penn Central Railroad right of way, thence westerly along the northerly line right of way to the easterly lands acquired by the State of New York for canal purposes; thence northwesterly along said lands of the State of New York to the easterly line of Lee Road and the place of the beginning.

2 - Differences in Boundary from Previous EBSMC Report

The boundary variations between the original Mt. Read-Emerson description dated 1965, and City of Rochester Urban Renewal Plan and the new revised Outer Loop Industrial Complex are the deletion of the entire property area designated for a residential zone, the elimination of the area north of Lexington Avenue between the Outer Loop Expressway and Mt. Read Boulevard, and the addition at the southwest corner of the tract of the New

The ultimate capacities of voltages to be carried along the electrical circuits, as well as other technical details, would be determined by Rochester Gas and Electric Company.

C - ENGINEERING SOILS INVESTIGATION

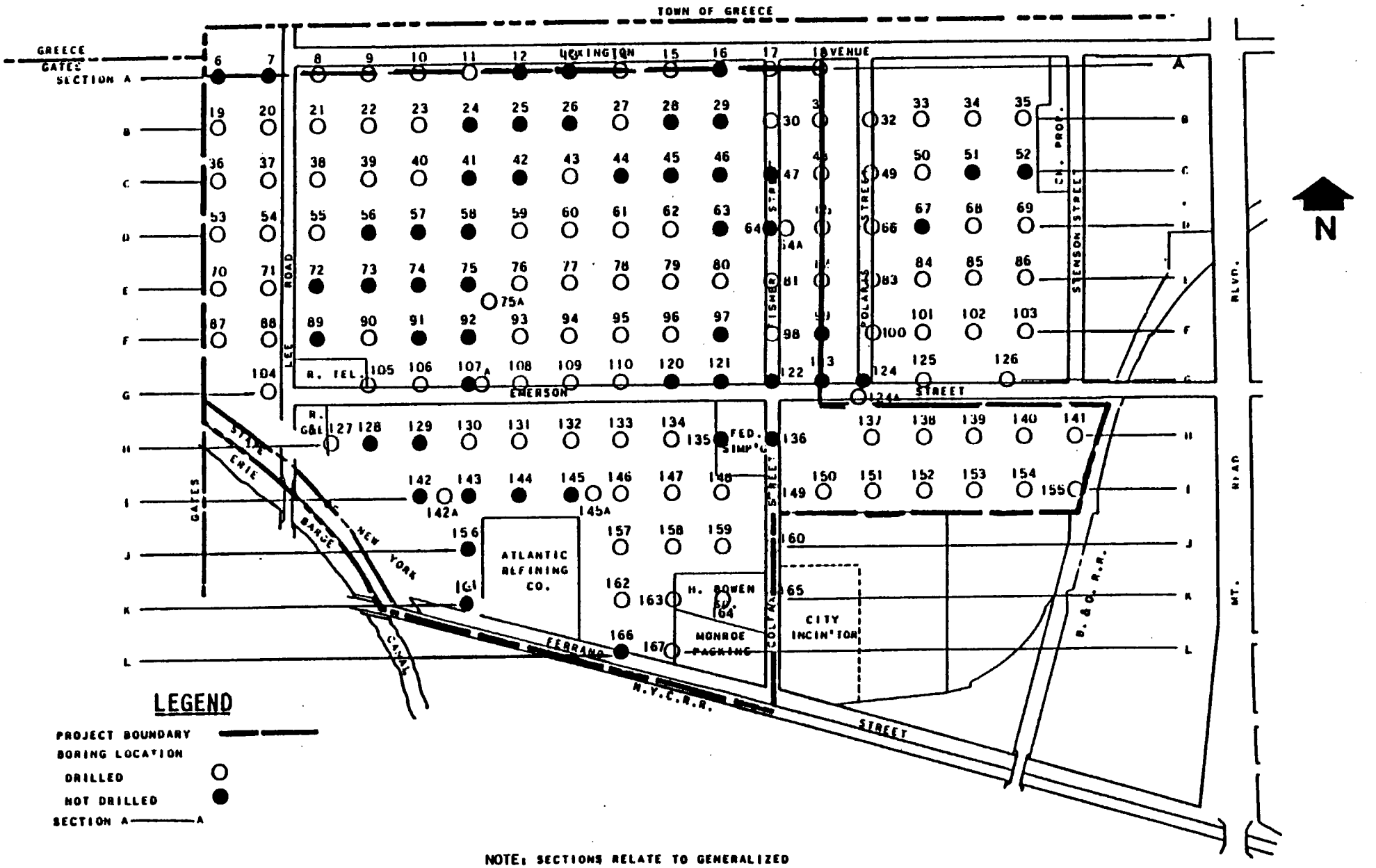
This section involves an investigation of the subsurface conditions existing in the Outer Loop Industrial Complex as they may relate to structural foundation and site-development cost factors. Subsurface conditions become of critical importance in determining the location and extent of the area's load-bearing capacity which, in turn, determines the locations within the site that can be economically developed with regard to utility installation and building construction. Any future development plan, therefore, would be required to conform to the constraints imposed by soil conditions. The findings of this investigation also provide information that will be useful to City departments that may be involved in the development of the area, as well as utility companies and any future developers and constructors.

1 - Subsurface Conditions

Much of the Outer Loop Industrial Complex area has been used for the past 12 years and is currently being used for the disposal of residue from the three city incinerators, including the West Side incinerator which is within the area. Also, bulk refuse which cannot be incinerated or otherwise reduced in volume is being burned in the active portions of the refuse disposal areas of the site. Some of the bulk refuse comes from a few of the adjoining towns as well as the City of Rochester. An examination of the subsurface conditions within the study area was made by Ebasco in 1964. The new borings were taken for this report.

a) Exploration

During September 1964, the entire area which was accessible to a heavy, truck-mounted, auger drill was explored on a 300-foot grid. The borings were 24 inches in diameter and were carried to refusal. Boring locations are shown on drawing number G-180824 in the Appendix and on Map 10. Some of the hole



NOTE: SECTIONS RELATE TO GENERALIZED SUBSURFACE PROFILES REPRESENTED ON DIAGRAM 1.

SOIL BORINGS

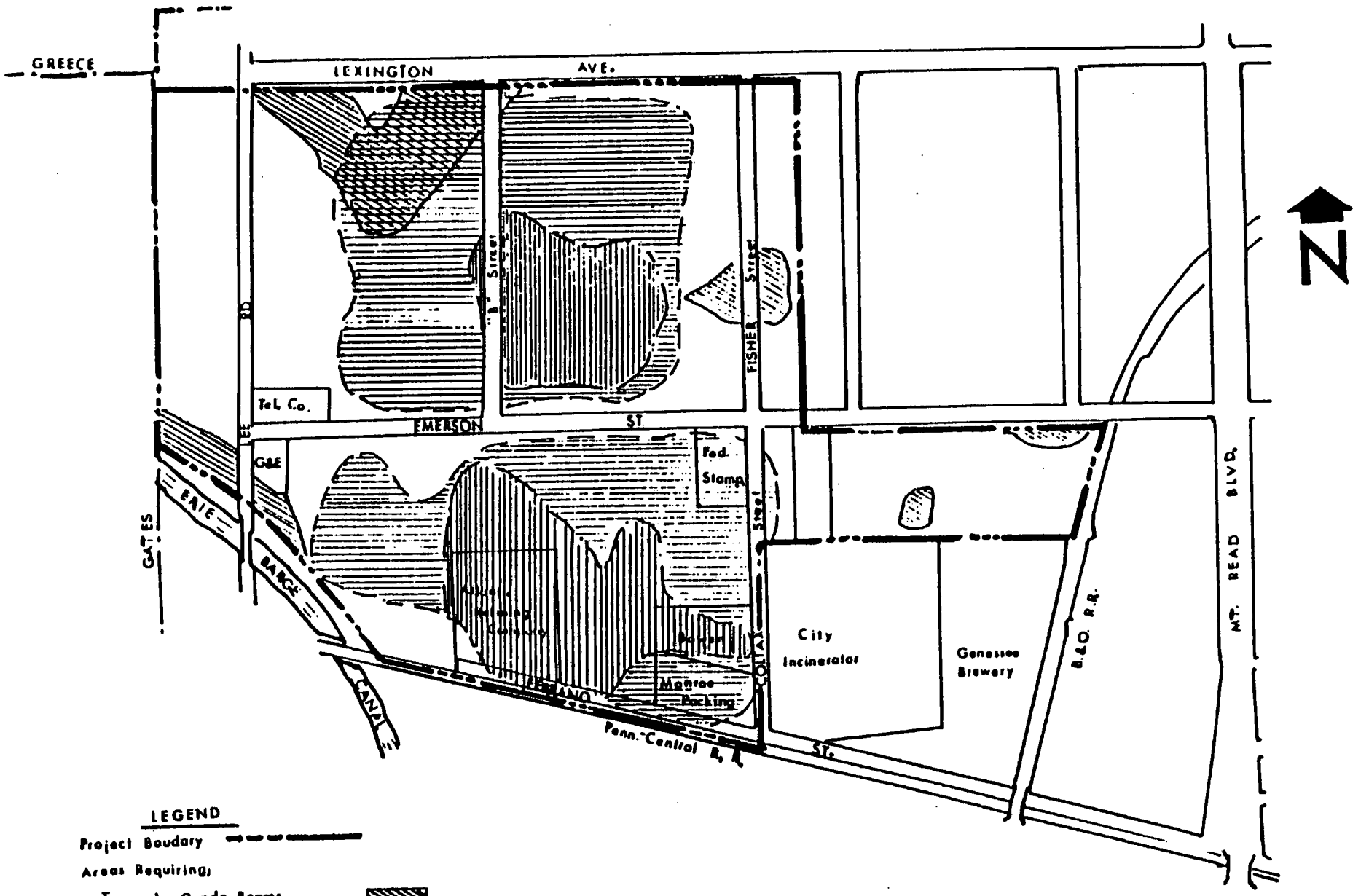
OUTER LOOP INDUSTRIAL COMPLEX — ROCHESTER, N.

EBS MANAGEMENT CONSULTANTS INCORPORATED, N.

Those portions of the area which have been used for refuse disposal were found to contain as much as 20 feet of such refuse for several of the borings. This refuse was found to consist of practically every conceivable form of trash and rubbish including tin cans, bottles, wire, bricks, rubber tires, mattresses, rags, etc. There was no difficulty in penetrating through this fill with the auger except in one case where a large mass of waste electrical conduit was encountered.

In order that the significance of the subsurface findings may be more easily evaluated by those unfamiliar with the graphic representations as shown in the Appendix, a general representation of these findings is graphically shown on Diagram 1, following this page. Essentially, Diagram 1 shows, in isometric form, 12 east-west cross sections through the study area. The base elevation used for all cross sections is 510 feet, and boring hole locations correspond with those on Map 10. If the reader can visualize the subsurface profiles as representing vertical slices through the site, he can more readily grasp the visualization intended. Where data were not available, either because a boring was not made at a particular location, or where the extent of a particular type of surface material was not known, a generalization was made. Of course, only the detailed boring charts in the Appendix can be considered technically correct. However, Diagram 1 is considered to be a fairly accurate representation of existing conditions based on the 1964 borings.

Another feature of Diagram 1 is that it shows the approximate finish grade of the study area when the land fill program would be completed. This finish grade has been approximated from a proposed grading plan as prepared by the City Department of Public Works within the past six years. We agree in the essential details of the proposed grading plan, except that in those areas where a conflict exists with present conditions, because of changes since the grading plan was made, a judgment was made which resulted in the general, future grade lines as represented on Diagram 1. It is estimated that there are approximately 700,000 cubic yards of refuse disposal volume already within the Outer Loop Industrial Complex area bringing the topography of the study area to the proposed finished grade. We have not verified these grades but assume that City of Rochester has followed its plans and which are now complete.



LEGEND

Project Boudary

Areas Requiring:

Type 1— Grade Beams (Rock 0'—4' Below Surface)

Type 2— Footings on Till (Glacial Till more than 4' To Rock)

Type 3— Pile Supported (Rock 4'—10' below fill)

Rock [illegible] more [illegible] fill

FOUNDATION REQUIREMENTS

OUTER LOOP INDUSTRIAL COMPLEX — ROCHESTER, N.Y.

EBS MANAGEMENT CONSULTANTS INCORPORATED, N.Y.

MAP 17

The extent of the area which has been filled with refuse before the site was drilled in September 1964, is shown on drawing number G-180824. The maximum depth of such fill, as mentioned previously, is 20 feet. This depth is encountered in the area north of Emerson Street, in the northwest sector of the study area, which is now the active location for the refuse fill operations. Depth of refuse fill in the older dump area south of Emerson Street is less, averaging about 10 feet. During the course of the refuse fill operation south of Emerson Street, conducted until about 1961, the area southeast of the Colfax-Emerson Street intersection was used primarily for the disposal of hard fill. The area southwest of the Emerson Street-Colfax Street intersection has been used for refuse of the kind found in the northwest sector.

D - SITE DEVELOPMENT FACTORS

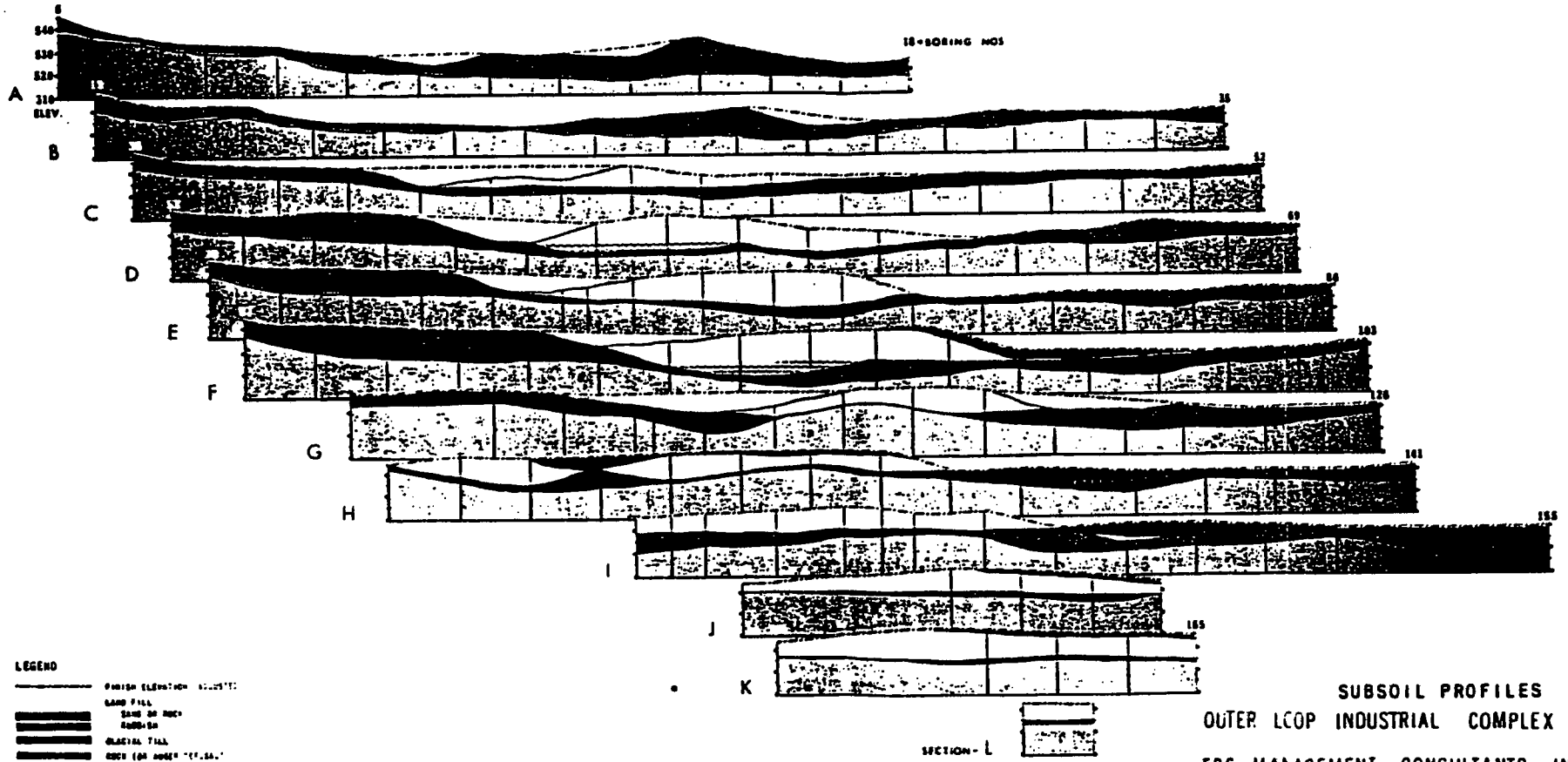
The future development of the Outer Loop Industrial Complex area is related to the City's present refuse disposal area. This area affects the kind of land that could be made available for development within the study area from a foundation viewpoint. It is, therefore, very important that a clear exposition of this relationship be set forth.

1 - Extent of Land Fill Operation

Drawing G-180824, in the Appendix, shows the extent of the area which has been filled with refuse up to the time the site was drilled in September 1964. An additional outline has been added to approximate the total land fill area to 1969. These areas are also shown on Map 10. The maximum depth of fill as mentioned previously, is 20 feet. This depth is found in the active fill portion of the site, north of Emerson Street and west of Fisher Street. The depth of fill in the older dump areas south of Emerson Street averages about 10 feet. The subsurface soil profile sheets (in the Appendix) and Diagram 1 represent the depth of fill in the various areas.

2 - Foundation Requirements

Because of the nature of the refuse fill and its inherent compressibility under load, any future buildings, underground utilities, railroads and streets would be affected. Any development plan must recognize the constraints imposed by the soil subsurface conditions.



LEGEND

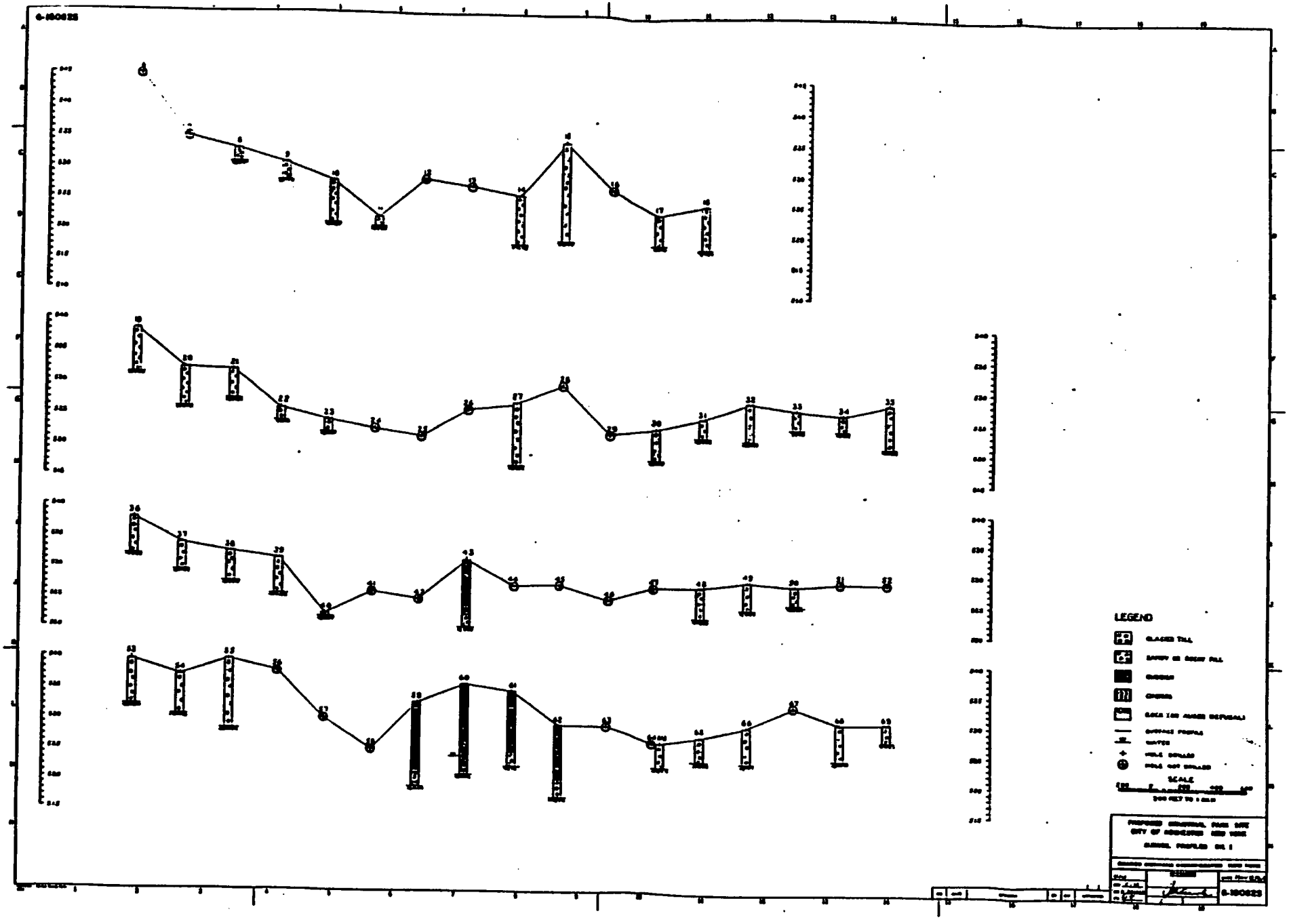
NOTE:
SUBSOIL PROFILE SECTIONS ARE RELATED TO THOSE SHOWN ON MAP 4. BASE ELEVATION IS 510 FEET.

SUBSOIL PROFILES

OUTER LOOP INDUSTRIAL COMPLEX ROCHESTER, N.Y

EBS MANAGEMENT CONSULTANTS INCORPORATED, N.Y

DIAGRAM 1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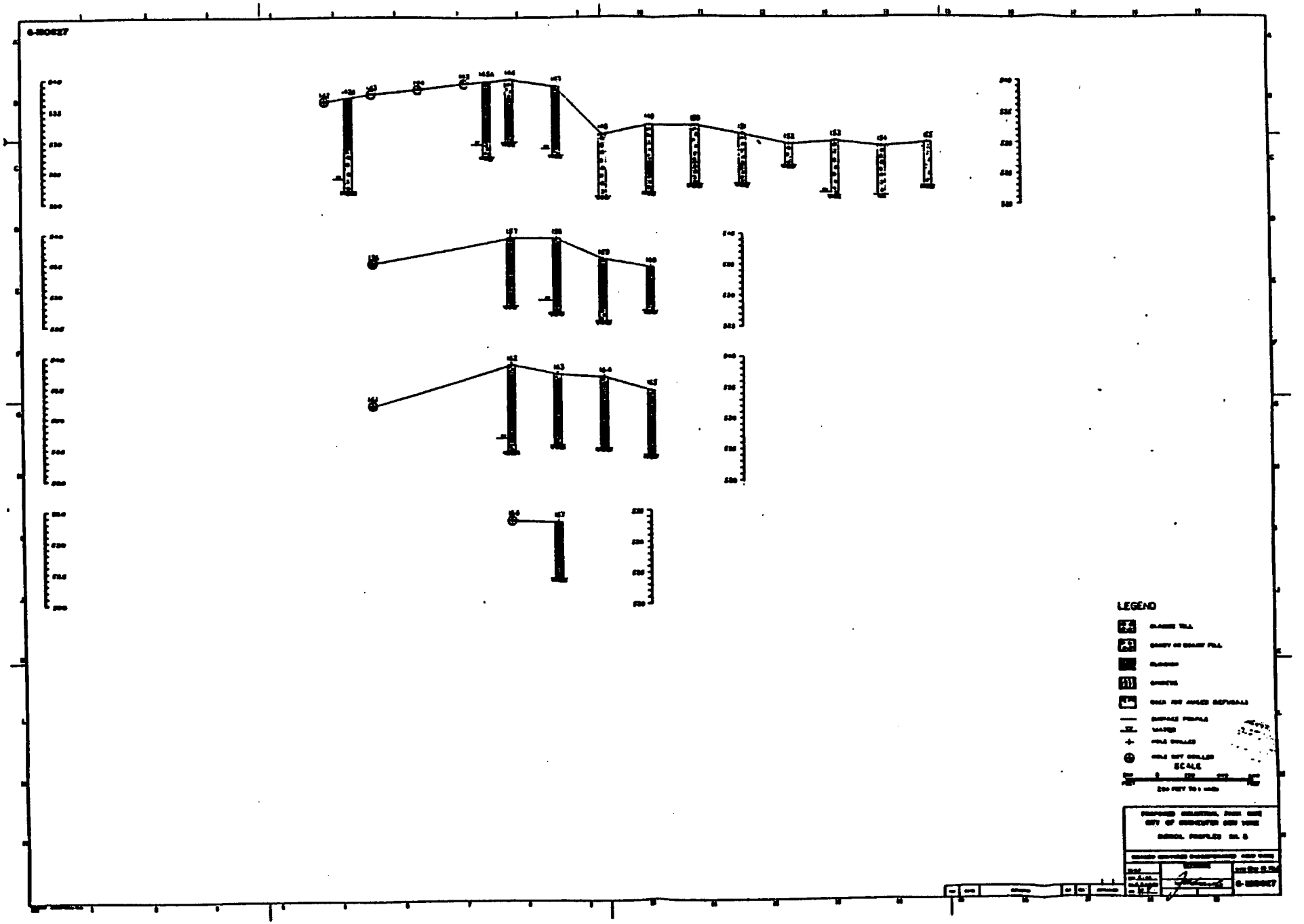
SCALE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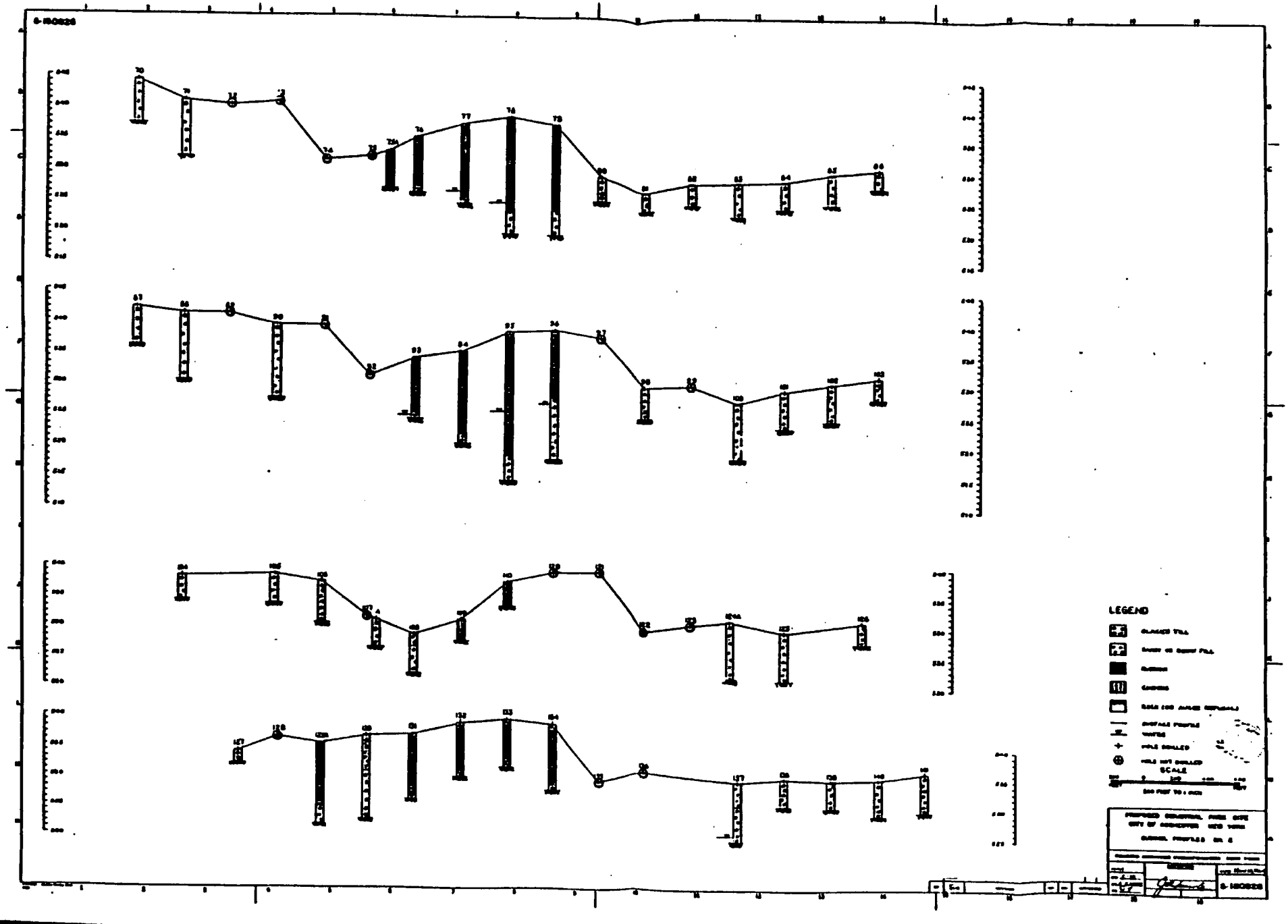

LEGEND
SCALE

REF 8

THE STATE OF NEW YORK
DEPARTMENT OF HEALTH

HOLLIS S. INGRAHAM
Commissioner

COMPREHENSIVE SOLID WASTES PLANNING STUDIES

Project No. CSWP-4, Monroe County

VOLUME I

REPORT

Greeley and Hansen, Engineers
14 East Jackson Boulevard
Chicago, Illinois 60604

May, 1970

MONROE COUNTY, NEW YORK
COMPREHENSIVE SOLID WASTE STUDY

Annual Quantities of Refuse Incinerated by the City of Rochester(1)

Year	Population	Quantities of Refuse		
		Tons	Lbs. per Capita	Cu. Yds. per Capita(4)
1950	332,488(2)	—		
57	322,770	85,525(5)	1060	2.31
58	321,390	170,683	1060	2.31
59	320,000	178,742	1120	2.44
60	318,611(2)	193,191	1210	2.64
61	315,390	208,012	1320	2.88
62	312,180	199,628	1280	2.79
63	308,960	218,808	1420	3.07
64	305,749(2)	230,416	1500	3.26
65	305,680	213,271	1390	3.03
66	305,600	202,984	1330	2.90
67	305,530	206,532	1350	2.94
68	305,450(3)	202,277(5)	1310	2.85
Average	314,100	200,882	1280	2.79

(1) Does not include refuse from Towns.
(2) Census.
(3) Estimate by City.
(4) Based on 460 lbs. per cubic yard.
(5) 6 months only.

REF 9

D.&C. MAR 22 1970

Emerson Landfill On Fire

Rochester firemen spent four hours yesterday combatting the first fire of the year at the Emerson St. landfill.

The 15-acre city dump near Mt. Read Blvd. has been the hotbed of controversy for several years because of the frequent outbreak of smoldering fires there.

In July 1968, a week-long fire during an "atmospheric inversion" resulted in a layer of smoke and fumes lingering over the city. Another fire in August of last year forced cars in the area to drive with headlights on during daylight hours.

The former Democratic administration announced in the fall it hoped to close the landfill by this September.

In January, interim City Manager Edward P. Curtis said he expected a "very specific timetable" for the phasing out of the Emerson Street landfill to be completed soon.

And last night James J. Zieziula of 142 Stenson St. said, "I have no comment at this time."

Ziezula is chairman of the Northwest Neighborhood Association, a group of residents in the area who are trying to get the city to close down the dump and put an end to the recurrent fire hazard.

REF 10

MONROE COUNTY DEPARTMENT OF HEALTH 111 WESTFALL

MEMORANDUM

DATE 8/9/71

TO: Wendell R. Ames, Director-Monroe County Health Department

FROM: Dewayne Day, Principal Public Health Engineer

SUBJECT: Emerson Street Dump

Mr. Kermit E. Hill, City Manager, in a letter to you dated June 7, 1971 requested that the Division of Environmental Sanitation of the Monroe County Health Department make an evaluation of the Emerson Street dump operation. The purpose of the survey was to provide information that would improve the operation, eliminate the neighborhood nuisance and reduce the public health hazards to a minimum during the remaining time the dump will be in operation and the final closing of the site.

The evaluation was to include recommendations for extermination and prevention of rodent immigration, abatement of water pollution and the preparation of the site for change of land use.

Inspections were made by various sections of the Division of Environmental Sanitation and their composite report is attached.

ENVIRONMENTAL EVALUATION OF EMERSON STREET DUMP

COMPOSITE REPORTS FROM VARIOUS SECTIONS OF THE DIVISION OF ENVIRONMENTAL SANITATION, MONROE COUNTY HEALTH DEPARTMENT.

GENERAL CONDITIONS

I. The incinerator residue deposited north by northwest face along Lexington Avenue is compacted but not covered.

II. The area on the northeast section of the site is covered but should be sloped all the way to the road.

III. The area on the southeast corner of the site along Emerson Street is poorly drained with pooling of water. The area should be drained, filled, sloped and covered.

IV. The central area in the south section along Emerson Street has incinerator refuse that is not covered to the west of the central access road. There is ponding of water along the west side of the entrance road parallel to the covered east section of the site. This area should be drained, filled, sloped and covered.

V. Incinerator residue in the north central section of the site is not fully covered.

VI. Refuse is exposed in the central section of the site requireing additional cover.

VII. The southwest section of the site has incinerator residue exposed on the face and top surface. There is ponding of water at the bottom of the face along Emerson Street. This area should be drained, filled, covered and sloped to the street.

VIII. The main entrance to the present disposal area at the far west portion of the site is Hotchkiss Street. A turnaround is 100 yards from Emerson Street. The refuse in this area to the east of the entrance road is not fully covered. Large piles of uncovered refuse are east of the turnaround.

IX. Refuse protrudes on the east side of the road on the west side of the site along Lee Road.

X. More equipment is needed to adequately compact and cover refuse.

XI. More cover material is needed at the site.

RODENT CONTROL

The Rodent Control Section of the Monroe County Health Department, in the spring of 1970 noted extensive rodent activity in the area between Emerson Street and Lexington Avenue and extending from Polaris Street to Lee Road. Rodent infestation was found to be directly west of Polaris Street and around the perimeter of the landfill in the Lee Road area. An intensive baiting plan was implemented in April using Red Squill and Zinc Phosphide baits. Daily baitings and studies were made. Eighteen hundred baits were initially placed. Follow-up baitings averaged twelve hundred bait placements. Bait acceptance was excellent.

Rodent activity in May, 1970 subsided to the point that a control plan involving survey and twelve hundred bait placements periodically every three weeks was set up. This plan extended through the winter and to the present date. Recent survey of the area has been made. Rodent activity is currently at a minimum and a continued plan of baiting every three weeks should suffice.

A letter was sent to Commissioner Keefe on August 10, 1970 by Mr. Salamone stating that the Monroe County Health Department anticipated baiting the area continuously at three week intervals, weather permitting.

The site and fringe areas should be maintained free of tall weeds and all trash should be covered with earth to provide 6 inches of fill over the working face of the area daily and 2 feet for the final surface.

WATER POLLUTION

The top of bedrock in this area is only several feet below the ground surface and drainage is poor and [redacted]

The watercourse that has its origin at the landfill site discharges into a 42" culvert at Polaris Street and eventually to a combined sewer system in Lexington Avenue. The engineering bureau of the City of Rochester has been involved during the past years in a design method to eliminate flooding of the various low-lying areas around the site without success. The Urban Development Corporation has formulated plans for developing this area that includes costly plans for construction of storm and sanitary sewers.

CONFORMITY TO REGULATIONS

The Monroe County Health Department is responsible for the enforcement of Part 19 of [redacted] which deals with the criteria for operation of refuse disposal areas and [redacted] Regulations of the Monroe County Sanitary Code that prohibits open burning of refuse.

Inspections and observations by personnel of the Monroe County Health Department indicate that for the past three years the Emerson Street dump has been in violation of Part 19 of the New York State Sanitary Code. The Monroe County Health Department has recommended to the Environmental Conservation Department of the State of New York that legal action be instigated against the City of Rochester to bring this refuse disposal area into compliance with Part 19.

This action has been requested with full knowledge that compliance to Part 19 is not feasible if the site continues to be operated because of the limited available area, the poor drainage, flooding condition, the limited depth of earth above bedrock and the lack of earth cover needed for a successful operation.

RECOMMENDED PRACTICES

The New York State Department of Environmental Conservation, Bureau of Solid Wastes Engineering in a publication entitled "Sanitary Landfill" makes the following recommendation in closing or converting a dump to a sanitary landfill.

"When a dump is to be closed or converted to a sanitary landfill, a rat poisoning program should be started 4 weeks prior to closing. The site should be blocked off to all traffic, covered with at least 2 feet of compacted earth on top and exposed sides, and posted to prohibit further dumping.

When a landfill is completed, it is necessary to maintain the surface to prevent ponding in low areas caused by differential settlement. Settlement will vary with the nature of the refuse and compaction, ranging up to about 30%, with most of the settlement taking place within the first 2 years. Maintenance is required to prevent cracking of the cover, which could allow gases to escape or allow insects and rodents access to the refuse, as well as allowing surface waters to seep in.

It is also necessary to maintain proper surface water drainage to prevent the seepage of water through the fill either vertically or horizontally. [redacted] The maintenance of access roads is also necessary to prevent potholes. It is good practice to finish off the landfill site with at least 2 feet of earth cover including 6 inches of top soil seeded to grass to prevent wind and water erosion. The carbon dioxide and methane gases that may be generated in a landfill could interfere with vegetation root growth if these gases are not adequately diffused via sand or gravel chimneys or pipe vents. Plants require oxygen penetration to their roots in order to grow. Four feet or more of earth cover may be needed if the area is to be landscaped with trees and shrubs, but the exact amount depends on the plants to be grown."

REF 11

D. & C. OCT 3 1971

Emerson Dump 'Closed Forever'

The Emerson Street landfill was officially closed yesterday noon amid the pomp of speeches and the rumble of freshly-washed garbage trucks.

Five large, yellow garbage trucks led a parade from Jones Park on Lorimer Street to the landfill site.

"Most highly to be commended today are the firemen who spent many days here putting out fires," said Gabriel DeRosa, president of the Northwest Neighborhood Association, which often lobbied against the landfill.

His wife, Rose, added: "I don't care who's in office, but they've done what they said they would."

City officials originally had promised to close the landfill by June 1.

"I'm getting a lot of the credit now and got a lot of the heat before, but it was all a

ers or stood on the compacted dirt near the landfill entrance. One young girl held a sign reading, "Thank You Kermit Hill."

The speakers, including Mayor Stephen May, Councilman John Parrinello and County Legislator Joseph R. Esposito, R-27th, presided over the ceremony from a portable stage flanked by the American flag and a green and white ecological flag.

The landfill received its last load of refuse Friday morning. Two truckloads were actually dumped, however, when the first driver didn't realize he was to wait for photographers to arrive.

The landfill began as the Mt. Read-Emerson Street Industrial Site in 1953. It was later used for dumping ashes from the city's two incinerators.

The city began dumping un-

Two of the city's long, green, enclosed refuse trucks whizzed by the ceremony yesterday enroute to the city's westside transfer station located further down the road. One driver ceremoniously tooted his horn as the rig rumbled past.

"It's all over but the shouting," the city proclaimed in a half page advertisement in yesterday's Democrat and Chronicle. The ad invited residents to the ceremony, saying "It's a great day for the environment."

When the "shouting" finally subsided, workmen tacked two large signs reading "Closed" and "Forever" beside the gate.

REF 12

New York State
Freshwater Wetlands Map

Monroe County

Map 7 of 21

This map was promulgated, pursuant to Article 24 of the Environmental Conservation Law (The Freshwater Wetlands Act) on May 29, 1986 by the Commissioner of New York State Department of Environmental Conservation.

LEGEND:

- Approximate wetland boundary
- U Upland inclusion
- AA-00 Wetland identification code

NOTES:
This map indicates the approximate location of the actual boundaries of wetlands regulated according to the Freshwater Wetlands Act.

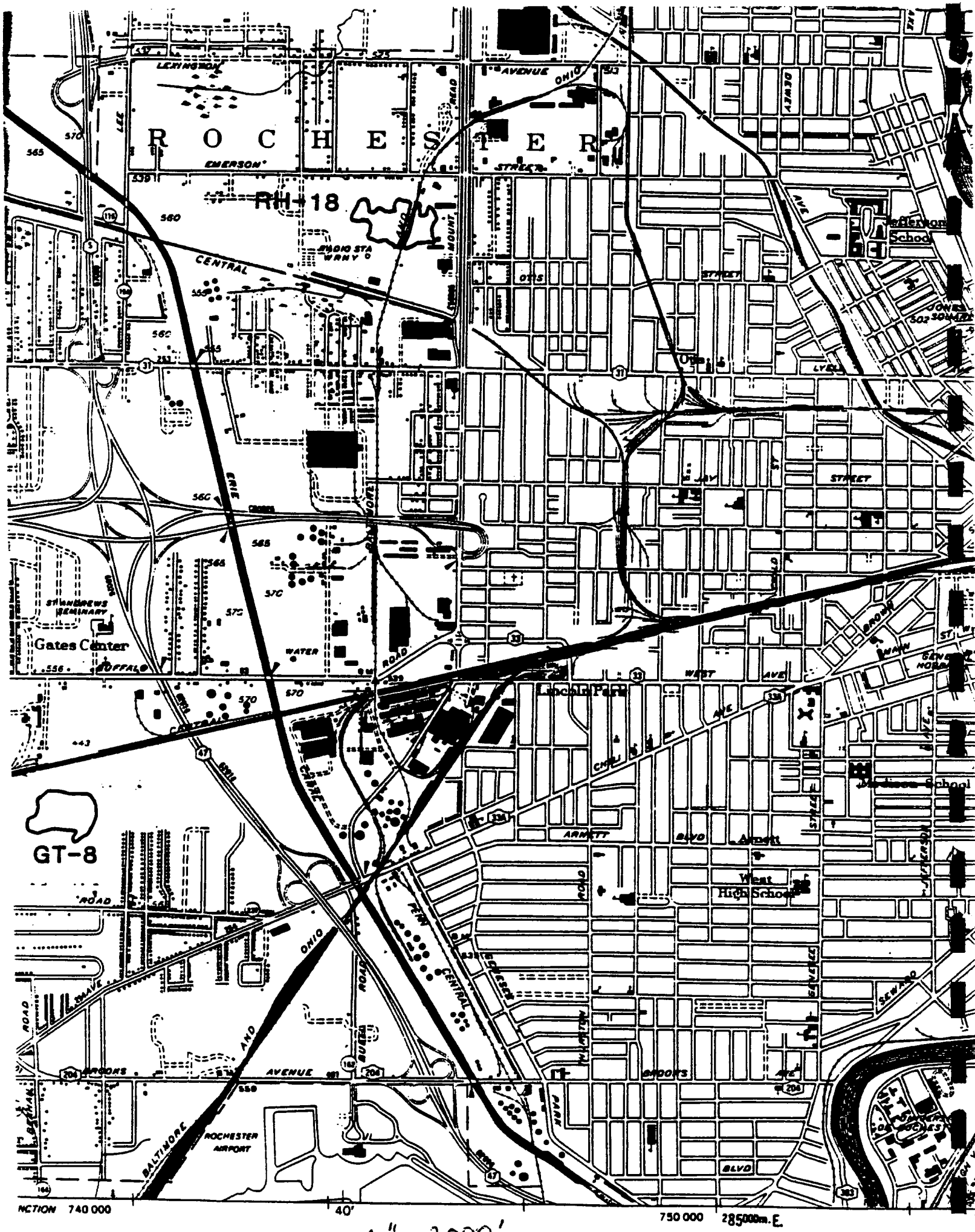
Map information other than the wetland boundaries was prepared by the New York State Department of Transportation and the United States Geological Survey. The locational information provided on the map is for reference only. Marsh symbols do not necessarily indicate the location of a regulated wetland.

Adjacent areas of the regulated wetlands are those areas within 100 feet of the boundary of the wetland. These areas are subject to regulation pursuant to the Freshwater Wetlands Act but are not delineated on this map. An adjacent area may be extended by special order of the Commissioner of the New York State Department of Environmental Conservation or the local regulatory authority.

Copies of Freshwater Wetlands Maps are available from the regional offices of the Department of Environmental Conservation. Maps are available for inspection at these offices and local government clerk's offices.

REVISIONS

Date	Wetland #	Description of change


ROCHESTER
RH-18
GT-8
Gates Center
Lincoln Park
West High School
Madison School
Jefferson School
ROCHESTER AIRPORT
EMERSON STREET
OHIO AVENUE
CENTRAL
ERIE
PENN CENTRAL
BROOKS AVENUE
BALTIMORE AND OHIO
ARNETT BLVD
SEWARD
WEST AVE
MAIN
BUFFALO ROAD
MOUNT READ
LEXINGTON
LEE
OTIS STREET
JAY STREET
ST ANDREWS SEMINARY
WATER
RADIO STA WRNY
740 000
750 000
285000m.E.
40'

1" = 2,000'

REF 13

SEL
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QC
983
W396
1985
v.2

Weather of U.S. Cities

A guide to the weather history of 296 key cities and weather observation stations in the United States and its island territories. Provides narrative summaries and records of weather normals, means, and extremes for each observation point.

SECOND EDITION

Volume 2

City Reports, Montana - Wyoming

James A. Ruffner
and
Frank E. Bair
Editors

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Normals, Means, And Extremes

Month	Heating	Cooling	Mean	Maximum monthly	Year	Minimum monthly	Year	Maximum in 24 hrs.	Year	Maximum monthly	Year	Maximum in 24 hrs.	Year	Relative humidity pct. Hour 01 (Local time)	Hour 07	Hour 13	Hour 19	Mean speed m.p.h.	Prevailing direction	Fastest mile Speed m.p.h.	Direction	Year	Pct. of possible sunshine	Mean sky cover, tenths	Mean number of days Clear	Partly cloudy	Cloudy	Precipitation .01 inch or more	Snow, Ice pellets 1.0 inch or more	Thunderstorms	Heavy fog, visibility ¼ mile or less	Temperature °F Max. 90 and above	Max. 32 and below	Min. 32 and below	Min. 0 and below	Average
				43		43		43		43		43		20	20	20	20	43	23	43	43		43	43	43	43	43	43	43	43	43	20	20	20	20	
JAN	1283	0	2.38	5.29	1990	0.01	1966	1.60	1966	68.0	1970	18.2	1966	77	77	69	79	11.9	WSW	73	W	1968	36	6.2	2	7	22	17	7	0	1	0	17	29	3	[illegible]
FEB	1137	0	2.32	5.07	1958	0.70	1968	2.05	1970	60.0	1958	22.0	1970	77	76	67	73	11.7	WSW	66	W	1968	41	7.0	2	7	19	16	7	0	1	0	15	26	3	997.5
MAR	983	0	2.53	5.42	1962	0.47	1958	2.21	1962	60.3	1959	17.6	1959	76	76	63	69	11.3	WSW	68	W	1968	49	7.0	4	9	18	15	4	1	1	0	4	23	0	[illegible]
APR	570	0	2.64	6.98	1966	1.28	1971	1.99	1963	20.2	1979	6.3	1979	78	77	59	61	10.9	WSW	60	SW	1979	54	6.7	4	8	16	13	1	2	1	0	1	11	0	[illegible]
MAY	274	23	2.58	6.62	1976	0.36	1977	1.69	1976	2.0	1965	2.0	1965	79	77	56	60	9.3	WSW	63	SW	1958	59	6.6	6	10	15	12	0	0	1	0	0	1	0	[illegible]
JUN	61	92	2.78	6.77	1980	0.22	1963	2.06	1958	0.0		0.0		82	83	54	61	8.6	SW	61	SW	1969	66	6.0	7	11	12	10	0	5	1	2	0	0	0	[illegible]
JUL	10	205	2.48	9.78	1967	0.56	1955	2.96	1967	0.0		0.0		82	82	53	59	8.1	SW	56	W	1956	69	5.7	8	13	10	9	0	6	1	5	0	0	0	[illegible]
AUG	23	163	2.28	5.95	1966	0.76	1951	2.39	1966	T	1965	T	1965	86	87	57	67	7.8	SW	59	NE	1955	66	5.9	8	12	11	10	0	6	1	2	0	0	0	997.2
SEP	122	46	2.66	6.10	1977	0.28	1962	3.54	1979	T	1956	T	1956	87	88	61	75	8.2	SW	59	SW	1949	68	6.1	7	11	12	11	0	3	1	1	0	0	0	997.6
OCT	412	0	2.54	7.85	1955	0.23	1963	2.96	1968	1.0	1968	1.0	1968	82	84	61	76	8.9	SW	58	NE	1951	49	6.6	7	8	16	11	0	1	2	0	0	0	0	997.9
NOV	732	0	2.65	9.51	1950	0.44	1976	3.13	1965	17.0	1985	11.2	1963	81	82	69	78	10.3	WSW	59	S	1968	31	6.2	2	6	22	15	2	0	1	0	2	15	0	[illegible]
DEC	1116	0	2.59	5.85	1964	0.62	1950	1.60	1970	46.1	1981	19.1	1978	88	81	76	79	10.9	WSW	56	W	1949	30	6.0	2	5	24	10	6	0	1	0	11	26	1	[illegible]
YEAR	6713	531	31.27	9.78	JUN 1947	0.22	JUN 1963	3.65	MAY 1970	64.0	FEB 1958	22.0	FEB 1978	80	81	62	69	9.6	WSW	73	W	JAN 1968	52	7.0	61	107	197	157	20	29	12	10	52	130	7	[illegible]

FOOTNOTES

Means and extremes above are from existing and comparable exposures. Annual extremes have been exceeded at other sites in the locality as follows: Highest temperature 102 in July 1936; lowest temperature -22 in February 1936; maximum monthly precipitation 0.88 in October 1926; maximum precipitation in 24 hours 4.19 in August 1891; maximum snowfall in 24 hours 29.8 in March 1900.

(a) Length of record, years, through the current year unless otherwise noted, based on January data.
(b) 70° and above at Alaskan stations.
* Less than one half.
T Trace.
BLANK entries denote missing or unreported data.

NORMALS - Based on record for the 1951-1980 period.
MEANS - Length of record in (a) is for complete data years.
EXTREMES- Length of record in (a) may be for other than complete or consecutive data years. Date is the most recent in cases of multiple occurrences.
WIND DIRECTION - Numerals indicate tens of degrees clockwise from true north. 00 indicates calm.
FASTEST MILE WIND - Speed is fastest observed 1-minute value when direction is in tens of degrees.

Snowfall

Season	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Cooling Degree Days

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Precipitation

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

FOOTNOTES

0 indicates a station move or relocation of instruments.

Record snow values above are sums through the current year for the period beginning 1872 for temperature, 1879 for precipitation and 1941 for snowfall. Data are for Kansas City Office Location through September 1948 except through October 1949 for Precipitation and Snowfall.

1965-66	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1966-67	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1967-68	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1968-69	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1969-70	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1970-71	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1971-72	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1972-73	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1973-74	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1974-75	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1975-76	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1976-77	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1977-78	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1978-79	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1979-80	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1980-81	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1981-82	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1982-83	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1983-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Cooling Degree Days

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
1969	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1970	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1971	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1972	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1973	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1974	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1975	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1976	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1977	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1978	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1979	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1980	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1981	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1982	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1983	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Snowfall

Season	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Total
1944-45	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1945-46	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1946-47	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1947-48	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1948-49	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1949-50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1950-51	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1951-52	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1952-53	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1953-54	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1954-55	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1955-56	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1956-57	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1957-58	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1958-59	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1959-60	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1960-61	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1961-62	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1962-63	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1963-64	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1964-65	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1965-66	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1966-67	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1967-68	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1968-69	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1969-70	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1970-71	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1971-72	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1972-73	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1973-74	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1974-75	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1975-76	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1976-77	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1977-78	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1978-79	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1979-80	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1980-81	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9.3	12.0	1.6	0.0	0.0	90.6
1981-82	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	16.0	0.9	12.4	0.0	0.0	128.6
1982-83	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11.6	9.3	12.2	T	0.0	59.9
RECORD MEAN	0.0	T	T	0.1	6.0	19.0	23.0	22.1	14.1	3.6	0.1	0.0	89.6

Precipitation

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1946	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1947	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1948	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1949	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1950	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1951	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1952	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1953	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1954	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1955	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1956	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1957	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1958	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1959	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1960	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1961	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1962	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1963	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1964	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1965	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1966	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1967	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1968	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1969	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1970	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1971	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1972	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1973	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1974	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1975	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1976	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1977	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1978	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1979	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1980	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1981	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1982	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1983	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RECORD MEAN	2.49	2.37	2.62	2.57	2.89	2.99	3.07	2.87	2.74	2.76	2.66	2.60	32.68

FOOTNOTES

Means and extremes above are from existing and comparable exposures. Annual extremes have been exceeded at other sites in the locality as follows: Highest temperature 102 in July 1936; lowest temperature -22 in February 1934; minimum monthly precipitation 0.06 in October 1924; maximum precipitation in 24 hours 4.19 in August 1893; maximum snowfall in 24 hours 29.0 in March 1900.

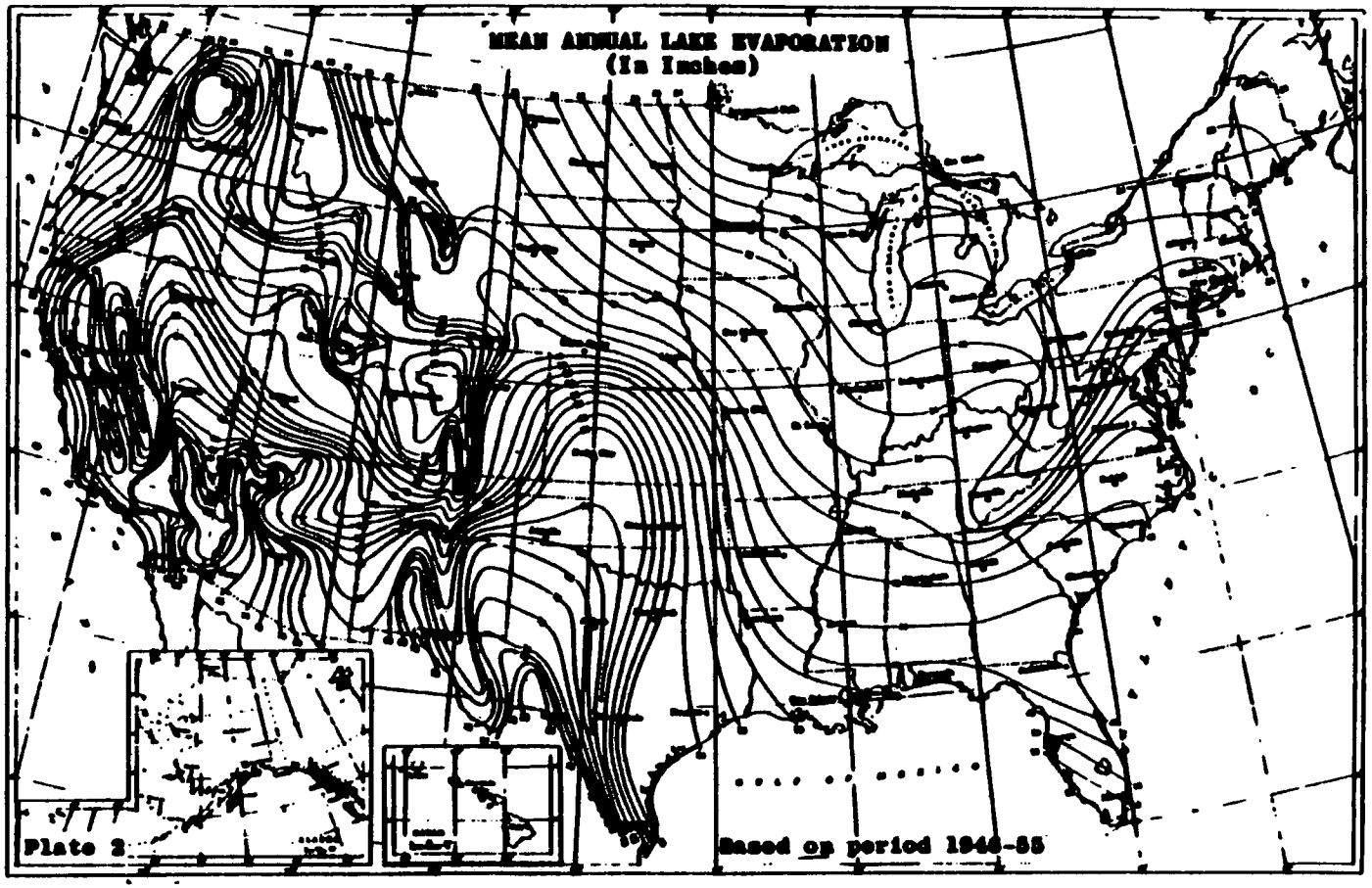
(a) Length of record, years, through the current year unless otherwise noted, based on January data.
(b) 70° and above at Alaskan stations.
* Less than one half.
T Trace.
BLANK entries denote missing or unreported data.

NORMALS - Based on record for the 1951-1980 period.
MEANS - Length of record in (a) is for complete data years.
EXTREMES - Length of record in (a) may be for other than complete or consecutive data years. Date is the most recent in cases of multiple occurrence.
WIND DIRECTION - Numerals indicate tens of degrees clockwise from true north. 00 indicates calm.
FASTEST MILE WIND - Speed is fastest observed 1-minute value when direction is in tens of degrees.

FOOTNOTES

# Indicates a station move or relocation of instruments.

Record mean values above are means through the current year for the period beginning in 1872 for temperature, 1829 for precipitation and 1941 for snowfall. Data are from City Office locations through September 1940 except through October 1940 for Precipitation and Snowfall.



Source: Climatic Atlas of the United States, U.S. Department of Commerce, National Climatic Center, Ashville, N.C., 1979.

FIGURE 4
MEAN ANNUAL LAKE EVAPORATION
(IN INCHES)

REF 14

U.S. DEPARTMENT OF COMMERCE
Lauriston B. Bowles, Secretary

WEATHER BUREAU
F. W. Reichelderfer, Chief

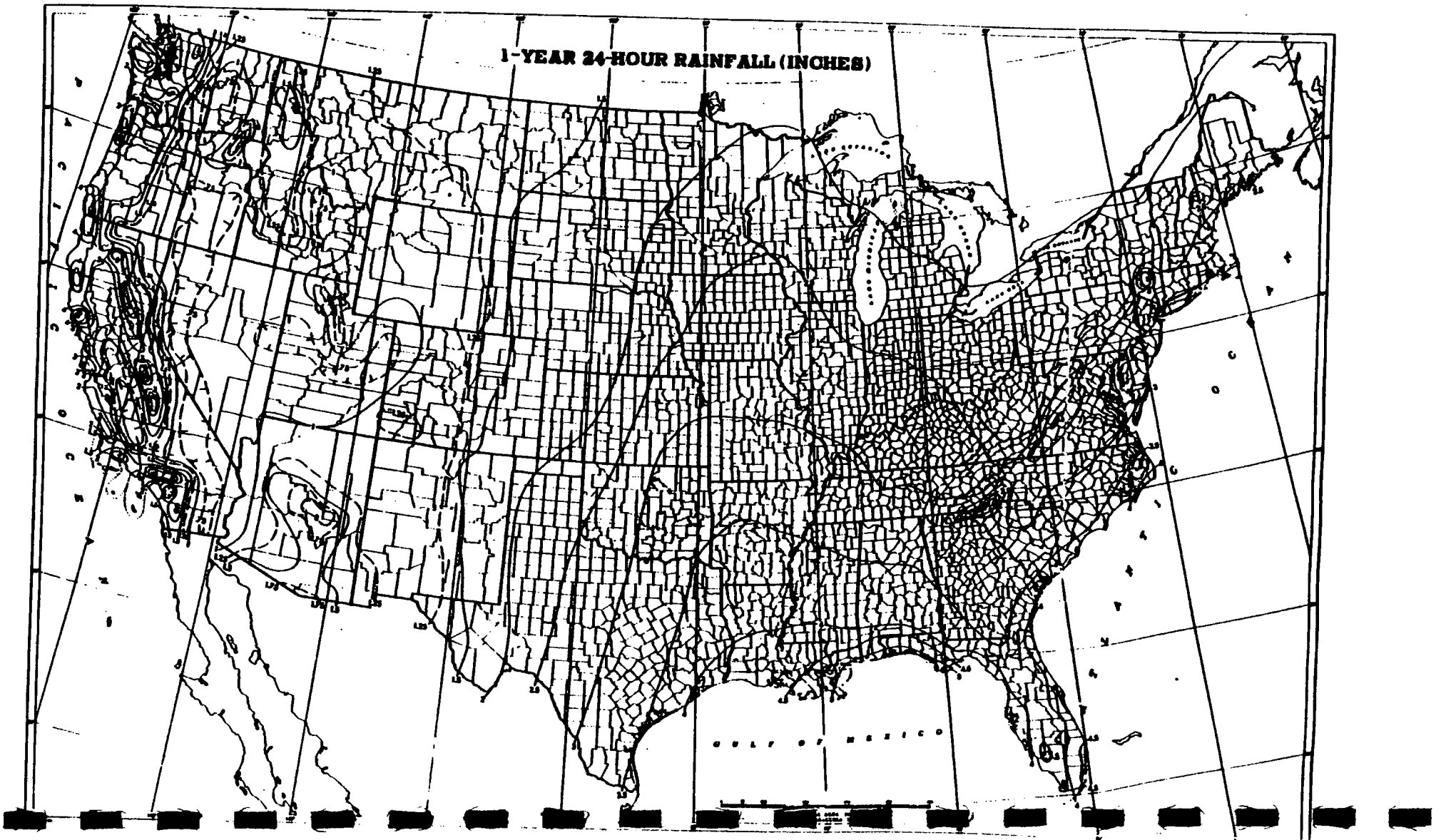
TECHNICAL PAPER NO. 40

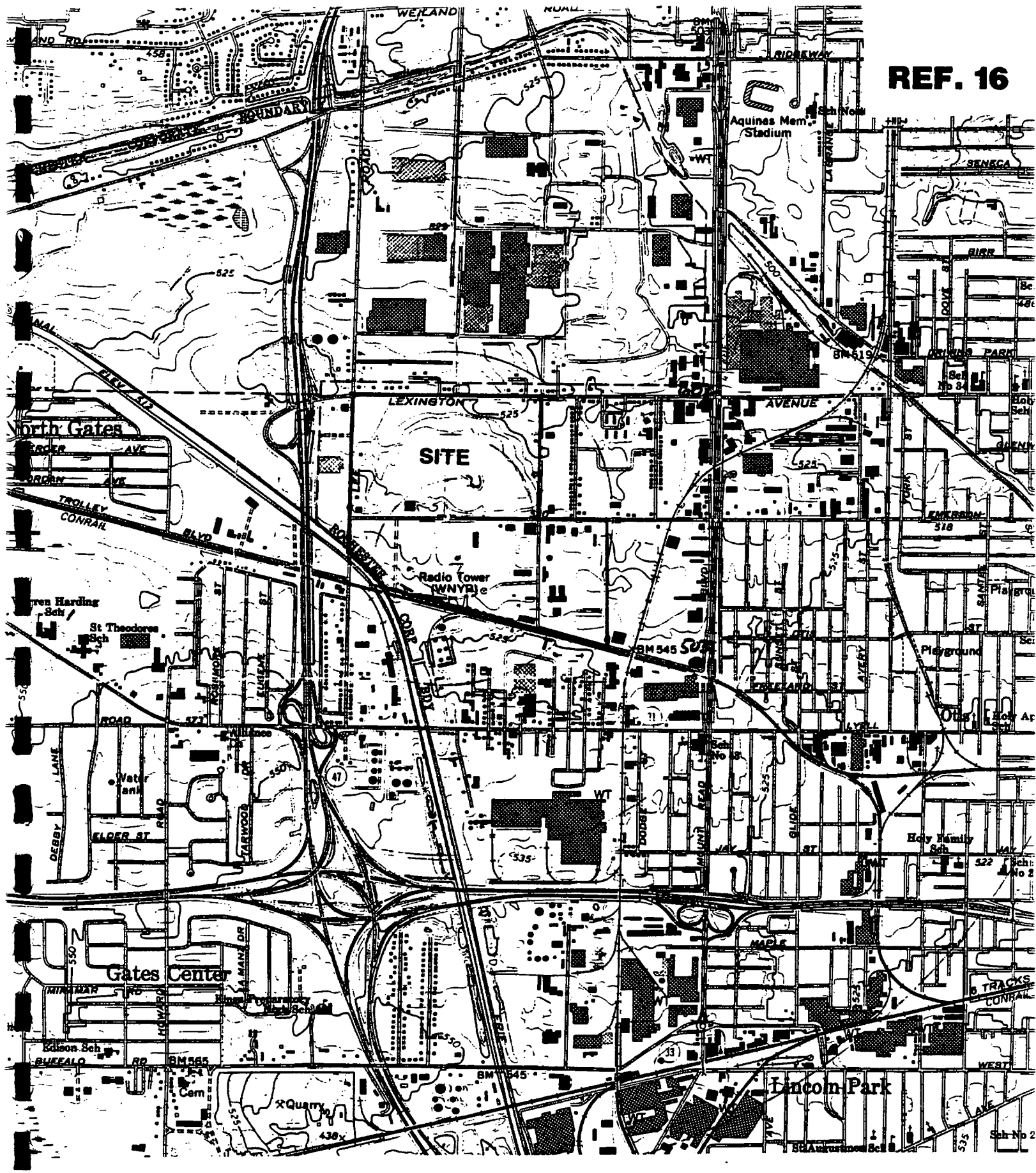
RAINFALL FREQUENCY ATLAS OF THE UNITED STATES

for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years

Prepared by
DAVID M. HERSHFIELD
Cooperative Studies Section, Hydrologic Services Division
for
Engineering Division, Soil Conservation Service
U.S. Department of Agriculture

REF 15


1-YEAR 24-HOUR RAINFALL (INCHES)



SCALE 1:24 000

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

ROCHESTER WEST, N. Y.

N4307.5—W7737.5/7.5

1971

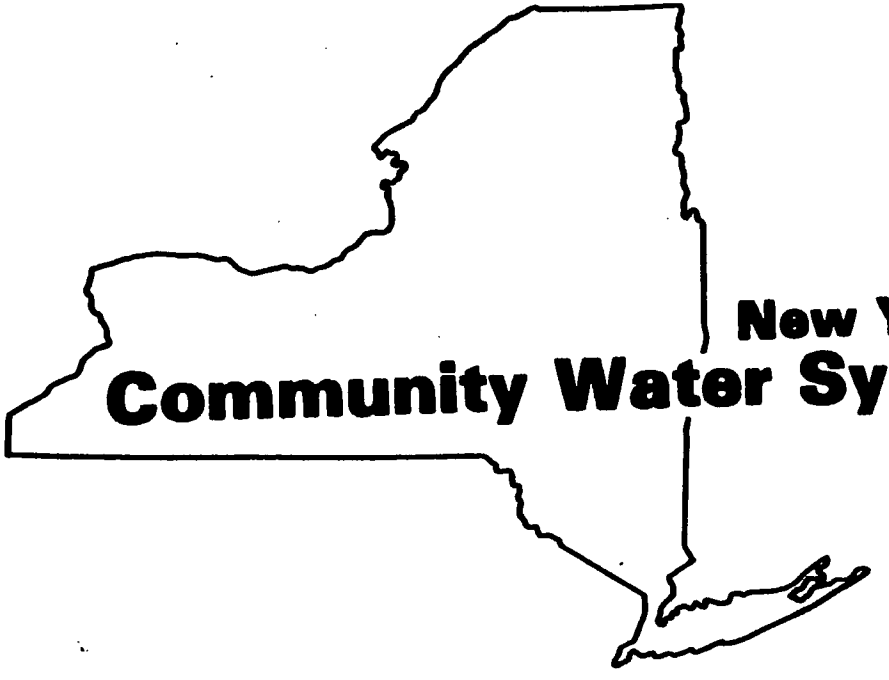
PHOTOREVISED 1978

AMS 5470 II NW—SERIES V821

CONTOUR INTERVAL 5 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS LOW WATER 242.8



New York State Atlas of Community Water System Sources 1982

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

RECEIVED
AUG 3 1 1984
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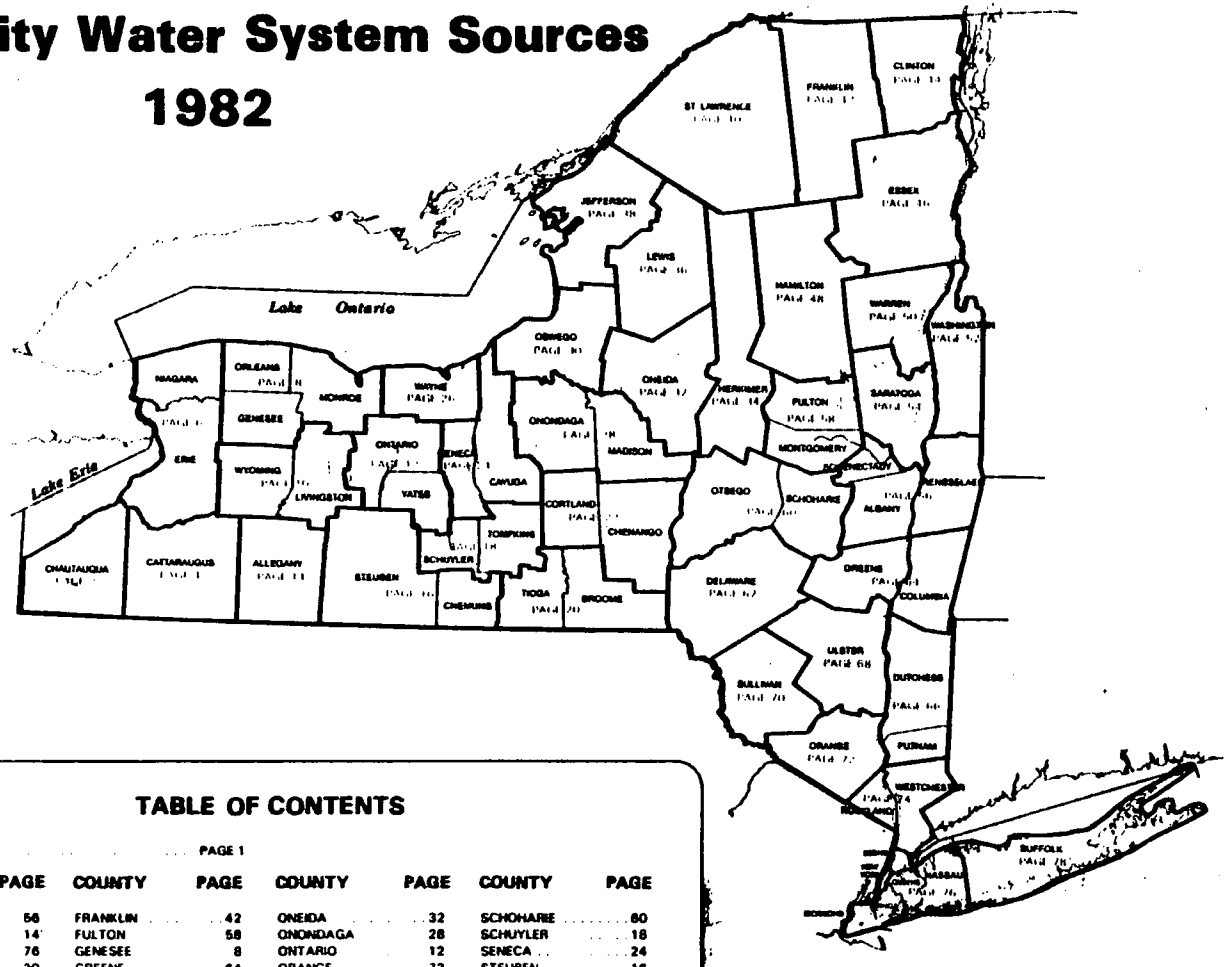
New York State Atlas of Community Water System Sources

1982

NEW YORK STATE DEPARTMENT OF HEALTH



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LEGEND

BOUNDARIES AND PLACES

International
State
County
Town
Indian Reservation
City — Village
Unincorporated Place — Federal Reservation
Built-up Area (Over 25,000 population including any contiguous city or village)

CLASSIFICATION OF POPULATED PLACES

100,000 or more	YONKERS
50,000 to 100,000	Levittown
12,500 to 50,000	Poughkeepsie
2,500 to 12,500	Hampton Bays
250 to 2,500	
250 or less	

TRANSPORTATION

Highways
- Divided Highways
  - Full Control of Access
  - Partial or No Control of Access
- Undivided Highway
- Interchange
- Touring Route (State, U.S., Interstate) or State Parkway
- Touring Route Markers
  - State; U.S.; Interstate

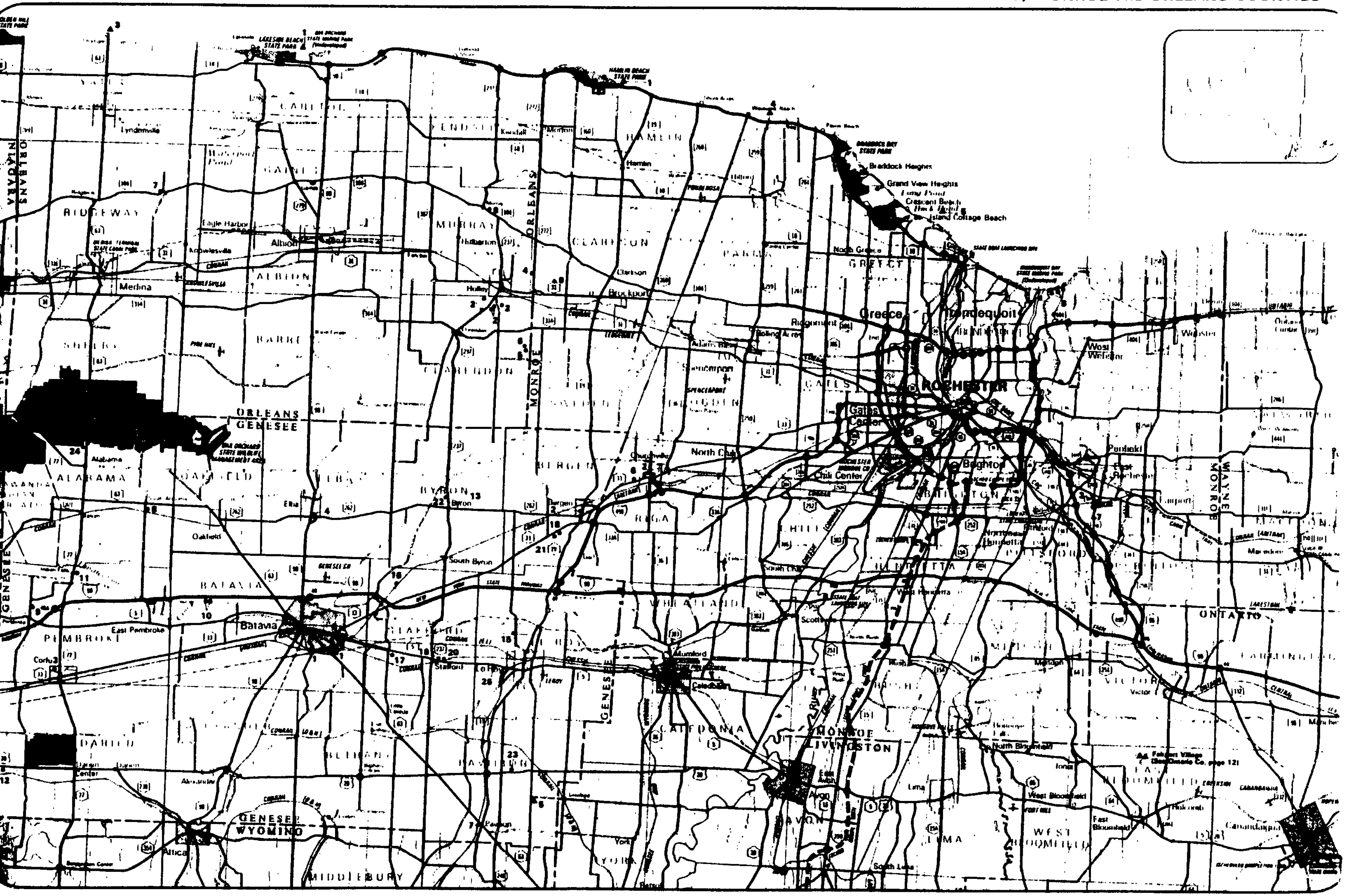
Railroads
- Operating Line — Service Discontinued
- Operator
- Owner (If Other than Operator)
- Company Having Trackage Rights

Airports (Open to the Public, Military)
- Runway under 4000' — Runway over 4000'

Rest Areas
- Food, Gas, Rest Rooms — Rest Rooms
- Gas, Rest Rooms — Parking Only

RECREATION FACILITIES

- State or National Recreation Area
- State Campground
- State Boat Launching Site
- State Canal Park
- State Fish Hatchery
- Other State Recreation Site


NIAGARA
ORLEANS
Lyndonville
RIDGEWAY
Medina
Albion
Knowlesville
Eagle Harbor
ALBION
Holley
Brockport
Clarkson
Hamlin
Kendall
MURRAY
CLARKSON
Braddock Heights
Grand View Heights
Crescent Beach
Island Cottage Beach
Greece
Irondequoit
ROCHESTER
Webster
West Webster
Penfield
East Rochester
Spencerport
Gates Center
North Chili
Chili Center
Churchville
Brighton
Fairport
Pittsford
ORLEANS
GENESEE
Alabama
ALABAMA
Oakfield
Elba
BYRON
Byron
Bergen
RIGA
South Byron
South Chili
BATAVIA
Batavia
East Pembroke
PEMBROKE
Corfu
Stafford
Le Roy
Mumford
Caledonia
CALEDONIA
Scottsville
Rush
WHEATLAND
ONTARIO
Victor
Mendon
DARIEN
Darien Center
Alexander
GENESEE
WYOMING
Attica
MIDDLEBURY
Pavilion
York
MONROE
LIVINGSTON
Avon
AVON
Lima
LIMA
North Bloomfield
West Bloomfield
Honeoye Falls
East Bloomfield
Canandaigua
WAYNE
MONROE

GENESEE COUNTY

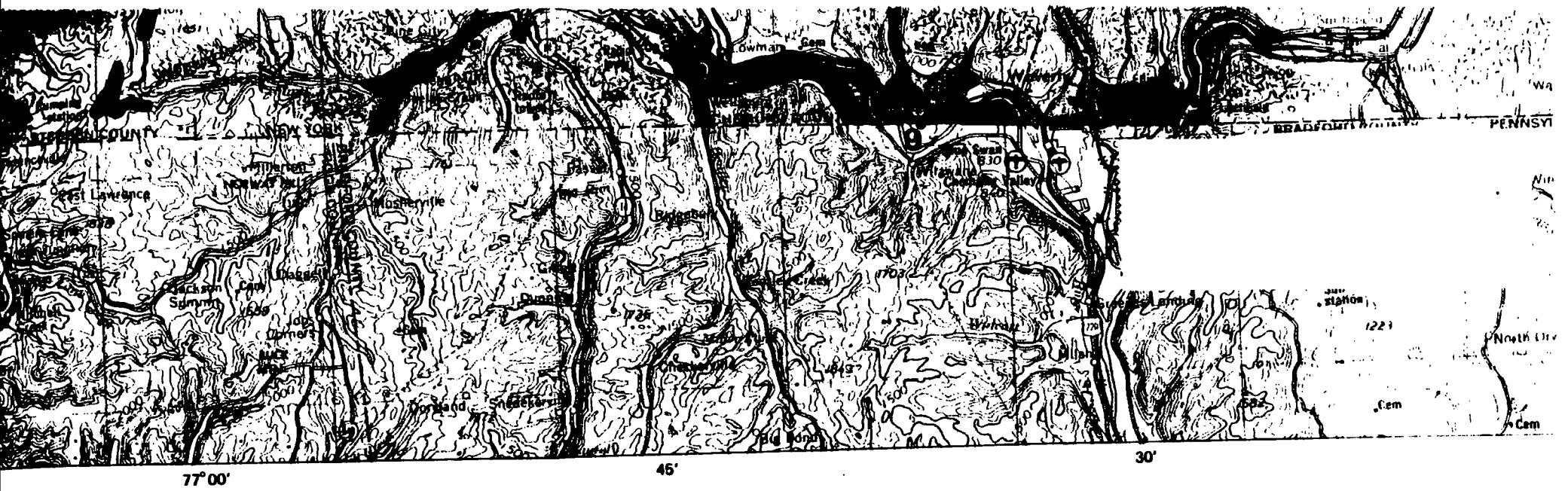
ID NO	COMMUNITY WATER SYSTEM	POPULATION	SOURCE
Municipal Community			
1	Batavia City	16703.	Tonawanda Creek, Wells
2	Bergen Village	1040.	Wells
3	Corfu Village	760.	Wells
4	Elba Village	805.	Wells
5	Leroy Village (See also No 7 Wyoming Co, Page 10)	100.	Lake Leroy
6	Oaks Subdivision	70.	Wells
7	Pavilion Water District #1	560.	Wells
8	South Alabama	50.	Wells
Non Municipal Community			
9	Antonns Trailer Park	56.	Wells
10	Apple Grove Trailer Park	98.	Wells
11	Boulder Trailer Park	24.	Wells
12	Broadway Acres	40.	Wells
13	Chapotts Trailer Park	60.	Wells
14	Del-Mar Trailer Park	NA.	Wells
15	Elmwood Trailer Park	21.	Wells
16	Godfreys Pond	40.	Wells
17	Golden Mobile Home Park	54.	Wells
18	Happy Hollow Trailer Court	15.	Wells
19	Harris Apartments	30.	Wells
20	Hel-ken Apartments	NA.	Wells
21	Huskoy's Trailer Court	20.	Wells
22	Schoolhouse Apartments	18.	Wells
23	Valley View Trailer Park	52.	Wells
24	Weaver Trailer Park	NA.	Wells
25	Willard Apartments	30.	Wells

MONROE COUNTY

ID NO	COMMUNITY WATER SYSTEM	POPULATION	SOURCE
Municipal Community			
1	Brockport Village	10000.	Lake Ontario
2	Churchville Village	1500.	Wells
3	East Rochester Village	8000.	Wells
	Fairport Village (See No 4 Ontario Co, Page 12)	8800	
4	Hilton Village	5000.	Lake Ontario
5	Monroe County Water Authority	150000.	Lake Ontario
6	Park Road Extension	10.	Wells
7	Pittsford Village	3500.	Wells
	Rochester City (See No 11 Livingston Co, Page 10 and No 13 Ontario Co, Page 12)	225000	
8	Webster Village	35000.	Wells
Non Municipal Community			
9	John B. Martin & Sons Trailer Park	250.	Wells

ORLEANS COUNTY

ID NO	COMMUNITY WATER SYSTEM	POPULATION	SOURCE
Municipal Community			
1	Albion Village	5800.	Lake Ontario
2	Holley Village	2100.	Wells
3	Lyndonville Village	1100.	Lake Ontario
Non Municipal Community			
4	County Line Mobile Home Park	NA.	Wells
5	Hovey's Trailer Court	30.	Wells
6	Maples Trailer Park	20.	Wells
7	Oak Orchard Mobile Homes	35.	Wells
8	Ridge Mobile Estates, Inc.	120.	Wells



SURFICIAL GEOLOGIC MAP OF NEW YORK

FINGER LAKES SHEET

Compiled and Edited by: Ernest H. Muller, Donald H. Cadwell

Reconnaissance field review (1985) by: G. Gordon Connally, Richard A. Young

1986

REF 18

Generally well-sorted sand and gravel,
stratified, permeable and well-drained,
deposited at a lake shoreline,
generally non-calcareous,
wave-winnowed lag gravel in isolated drumlin localities,
thickness variable (2-10 meters).

ld - **Lacustrine delta**
Coarse to fine gravel and sand,
stratified, generally well-sorted,
deposited at a lake shoreline,
thickness variable (3-15 meters).

lsc - **Lacustrine silt and clay**
Generally laminated clay and silt
deposited in proglacial lakes,
generally calcareous,
potential land instability,
thickness variable (up to 50 meters).

ls - **Lacustrine sand**
Sand deposits associated with large bodies of water,
generally a near-shore deposit or near a sand source,
well-sorted, stratified,
generally quartz sand,
thickness variable (2-20 meters).

og - **Outwash sand and gravel**
Coarse to fine gravel with sand,
proglacial fluvial deposition,
well-rounded and stratified,
generally finer texture away from ice border,
thickness variable (2-20 meters).

k - **Kame deposits**
Includes kames, eskers, kame terraces, kame deltas,
coarse to fine gravel and/or sand,
deposition adjacent to ice,
lateral variability in sorting, coarseness and thickness,
locally firmly cemented with calcareous cement,
thickness variable (10-30 meters).

km - **Kame moraine**
Variable texture (size and sorting) from boulders to sand,
deposition at an ice margin during deglaciation,
locally cemented with calcareous cement,
thickness variable (10-30 meters).

tm - **Till moraine**
Much like till, but more variable in sorting,
generally more permeable than till,
deposition adjacent to ice,
more variably drained,
may be ablation till,
thickness variable (10-30 meters).

t - **Till**
Variable texture (e.g. clay, silt-clay, boulder clay),
usually poorly sorted diamict,
deposition beneath glacier ice,
generally calcareous in northern part of map,
relatively impermeable (loamy matrix),
variable clast content - ranging from abundant well-rounded diverse lithologies in valley till
angular, more limited lithologies in upland tills,
potential land instability on steep slopes,
thickness variable (1-50 meters).

r - **Bedrock**
Exposed or within 1 meter of surface,
the following types of rock may be exposed:
Paleozoic limestone, sandstone, shale.

Bedrock stipple overprint
bedrock may be within 1-3 meters of surface,
may sporadically crop out,
variable mantle of rock debris and glacial till.

Lake
Smoky Point
Furnaceville
Rigney Bluff
Pittsford
Henrietta
West Henrietta
Macedon Center
Palmyra
Substation
Shortsville
Manchester
Hopewell
Lima
Livonia
Macrowave tower
Radio tower
43°00'
15'

REF 19

SOIL SURVEY

Monroe County New York

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
CORNELL UNIVERSITY AGRICULTURAL EXPERIMENT STATION
Issued March 1973

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, is a general guide to the slope class. Symbols without a slope letter are for those soils or miscellaneous land types where slope is not significant to use and management. A final number, 3, in the symbol shows that the soil is eroded.

SYMBOL	NAME
Al	Alluvial land
AnA	Alton gravelly sandy loam, 0 to 3 percent slopes
AnB	Alton gravelly sandy loam, 3 to 8 percent slopes
AoB	Alton gravelly loam, 3 to 8 percent slopes
AoC	Alton gravelly loam, 8 to 15 percent slopes
ApA	Appleton loam, 0 to 3 percent slopes
ArB	Arkport very fine sandy loam, 0 to 6 percent slopes
ArC	Arkport very fine sandy loam, 6 to 12 percent slopes
ArD	Arkport very fine sandy loam, 12 to 20 percent slopes
AsC	Arkport-Dunkirk very fine sandy loams, 2 to 12 percent slopes
AsD	Arkport-Dunkirk very fine sandy loams, 12 to 25 percent slopes
AtF3	Arkport, Dunkirk and Colonie soils, 20 to 60 percent slopes, eroded
BcB	Benson channery loam, 0 to 8 percent slopes
BrA	Brockport silty clay loam, 0 to 2 percent slopes
Ca	Canandaigua silt loam
CeA	Cayuga silt loam, 0 to 2 percent slopes
CeB	Cayuga silt loam, 2 to 6 percent slopes
CgA	Cazenovia gravelly loam, 0 to 3 percent slopes
CgB	Cazenovia gravelly loam, 3 to 8 percent slopes
ChA	Churchville silt loam, 0 to 2 percent slopes
ChB	Churchville silt loam, 2 to 6 percent slopes
CkA	Cleverock loamy fine sand, 0 to 2 percent slopes
CkB	Cleverock loamy fine sand, 2 to 6 percent slopes
CkC	Cleverock loamy fine sand, 6 to 12 percent slopes
ClA	Collamer silt loam, 0 to 2 percent slopes
ClB	Collamer silt loam, 2 to 6 percent slopes
ClC	Collamer silt loam, 6 to 12 percent slopes
CmA	Collamer silt loam, loamy subsoil variant, 0 to 2 percent slopes
CmB	Collamer silt loam, loamy subsoil variant, 2 to 6 percent slopes
CoB	Colonie loamy fine sand, 0 to 6 percent slopes
CoC	Colonie loamy fine sand, 6 to 12 percent slopes
CoD3	Colonie loamy fine sand, 12 to 20 percent slopes, eroded
Cu	Cosad loamy fine sand
Cw	Cut and fill land
DuB	Dunkirk silt loam, 2 to 6 percent slopes
DuC3	Dunkirk silt loam, 6 to 12 percent slopes, eroded
DuD3	Dunkirk silt loam, 12 to 20 percent slopes, eroded
Ed	Edwards muck
Ee	Eel silt loam
ElA	Elmira loamy fine sand, 0 to 2 percent slopes
ElB	Elmira loamy fine sand, 2 to 6 percent slopes
Fw	Fresh water marsh
GaA	Galen very fine sandy loam, 0 to 2 percent slopes
GaB	Galen very fine sandy loam, 2 to 6 percent slopes
Ge	Genesee silt loam
Hs	Halsey gravelly loam
Hc	Hamlin silt loam
HlA	Hilton fine sandy loam, 0 to 3 percent slopes
HlB	Hilton fine sandy loam, 3 to 8 percent slopes
HtA	Hilton loam, 0 to 3 percent slopes
HtB	Hilton loam, 3 to 8 percent slopes
HmA	Hilton-Cazenovia stony silt loams, 0 to 3 percent slopes
HmB	Hilton-Cazenovia stony silt loams, 3 to 8 percent slopes
HnB	Honeoye silt loam, 3 to 8 percent slopes
HnC	Honeoye silt loam, 8 to 15 percent slopes
HoA	Honeoye silt loam, limestone substratum, 0 to 3 percent slopes
HoB	Honeoye silt loam, limestone substratum, 3 to 8 percent slopes
HuB	Hudson silt loam, 2 to 6 percent slopes
IgB	Ira gravelly fine sandy loam, 0 to 6 percent slopes
LaB	Lansville silt loam, 2 to 6 percent slopes
Lb	Lake beaches
Le	Lakemont silt loam
Lk	Lakemont silt loam, loamy subsoil variant
Ln	Lansean very fine sandy loam
LnA	Lima silt loam, 0 to 3 percent slopes
LnB	Lima silt loam, 3 to 8 percent slopes
LoB	Lima and Cazenovia silt loams, limestone substratum, 0 to 6 percent slopes
Lp	Lockport silty clay loam
Ly	Lyons silt loam
Ma	Madalin silty clay loam
Mb	Made land
MdA	Madrid fine sandy loam, 0 to 3 percent slopes
MdB	Madrid fine sandy loam, 3 to 8 percent slopes
MdC	Madrid fine sandy loam, 8 to 15 percent slopes
MeB	Madrid very stony fine sandy loam, 3 to 8 percent slopes
Mf	Massena fine sandy loam
Mn	Minoa very fine sandy loam
Mr	Muck, deep
Ms	Muck, shallow
Ng	Niagara silt loam
Nr	Niagara silt loam, loamy subsoil variant
OdA	Odessa silt loam, 0 to 2 percent slopes
OdB	Odessa silt loam, 2 to 6 percent slopes
OfB	Ontario fine sandy loam, 3 to 8 percent slopes
OfC	Ontario fine sandy loam, 8 to 15 percent slopes
OnB	Ontario loam, 3 to 8 percent slopes
OnC	Ontario loam, 8 to 15 percent slopes
OnC3	Ontario loam, 8 to 15 percent slopes, eroded
OnD3	Ontario loam, 15 to 25 percent slopes, eroded
OnF	Ontario loam, 25 to 60 percent slopes
OpC	Ontario-Palmyra-Arkport complex, rolling
OpD	Ontario-Palmyra-Arkport complex, hilly
OpF	Ontario-Palmyra-Arkport complex, steep
Ov	Ovid silt loam
Ow	Ovid and Appleton silt loams, limestone substratum
PaA	Palmyra gravelly fine sandy loam, 0 to 3 percent slopes
PaB	Palmyra gravelly fine sandy loam, 3 to 8 percent slopes
PaC	Palmyra gravelly fine sandy loam, 8 to 15 percent slopes
PaD	Palmyra gravelly fine sandy loam, 15 to 25 percent slopes
PaF	Palmyra gravelly fine sandy loam, 25 to 60 percent slopes
PgB	Palmyra gravelly loam, 3 to 8 percent slopes
PhA	Phelps gravelly fine sandy loam, 0 to 3 percent slopes
PhB	Phelps gravelly fine sandy loam, 3 to 8 percent slopes
Pv	Pits and Quarries
Rb	Rhinebeck silt loam
RgB	Rigs silt loam, 2 to 8 percent slopes
Ro	Rock land
SaA	Schoharie silt loam, 0 to 2 percent slopes
SaB	Schoharie silt loam, 2 to 6 percent slopes
ShC3	Schoharie silty clay loam, 6 to 12 percent slopes, eroded
ShD3	Schoharie silty clay loam, 12 to 20 percent slopes, eroded
ShF	Schoharie silty clay loam, 20 to 60 percent slopes
SoB	Sodus gravelly fine sandy loam, 2 to 8 percent slopes
Sn	Sun fine sandy loam
Sr	Sun loam, moderately shallow variant
Ub	Urban land
WaA	Wampsville cobbly loam, 0 to 3 percent slopes
WaB	Wampsville cobbly loam, 3 to 8 percent slopes
WaC	Wampsville cobbly loam, 8 to 15 percent slopes
WlA	Wassaic fine sandy loam, 0 to 4 percent slopes
Wg	Wayland silt loam

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Dual
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Tunnel

Buildings

School

Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport

DRAINAGE

Streams, double line
- Perennial
- Intermittent

Streams, single line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches (CANAL)

Lakes and ponds
- Perennial (SPILLWAY, SP)
- Intermittent (INT)

Spring

Marsh or swamp

Wet spot

Alluvial fan

Drainage end

RELIEF

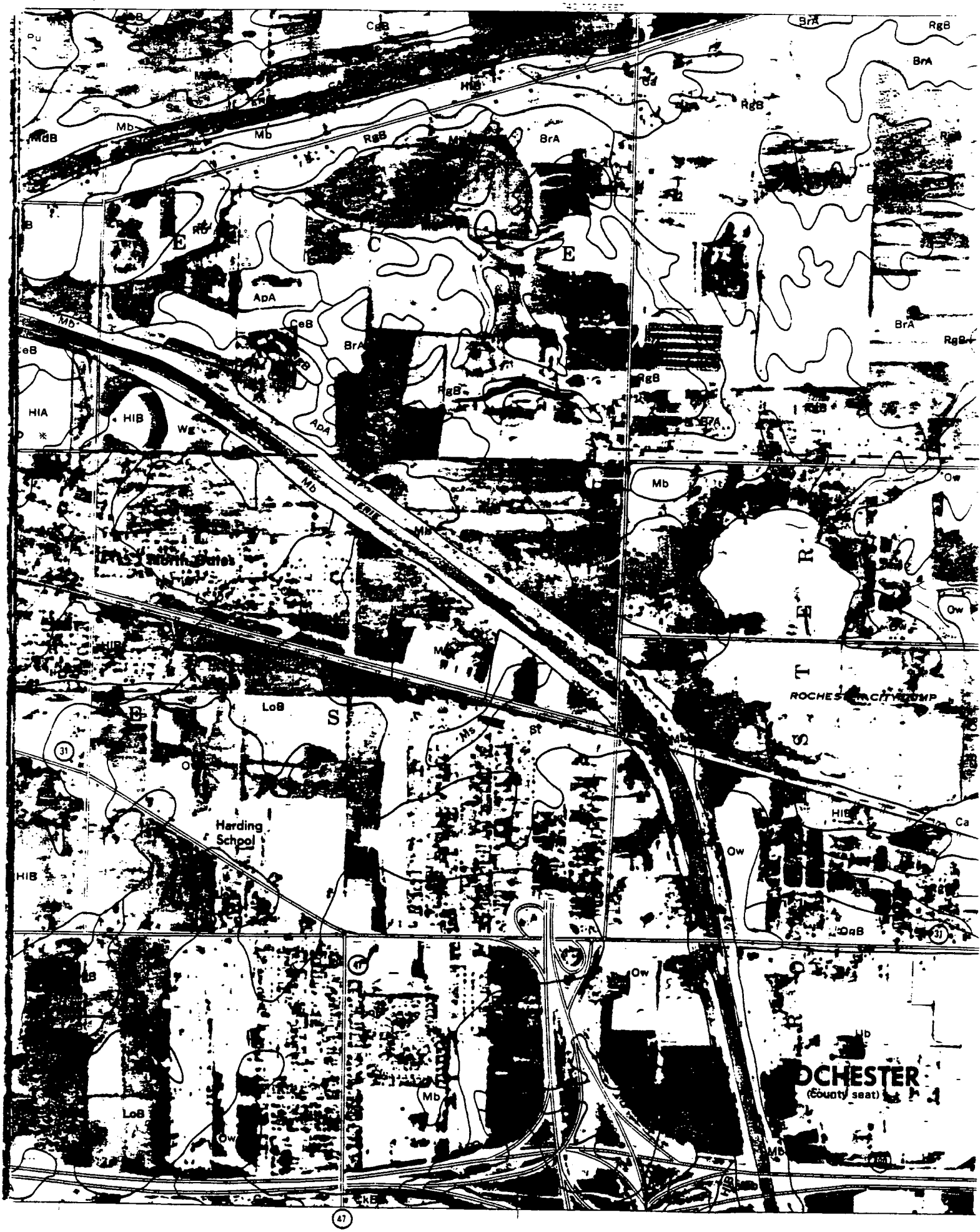
Escarpments
- Bedrock
- Other

Prominent peak

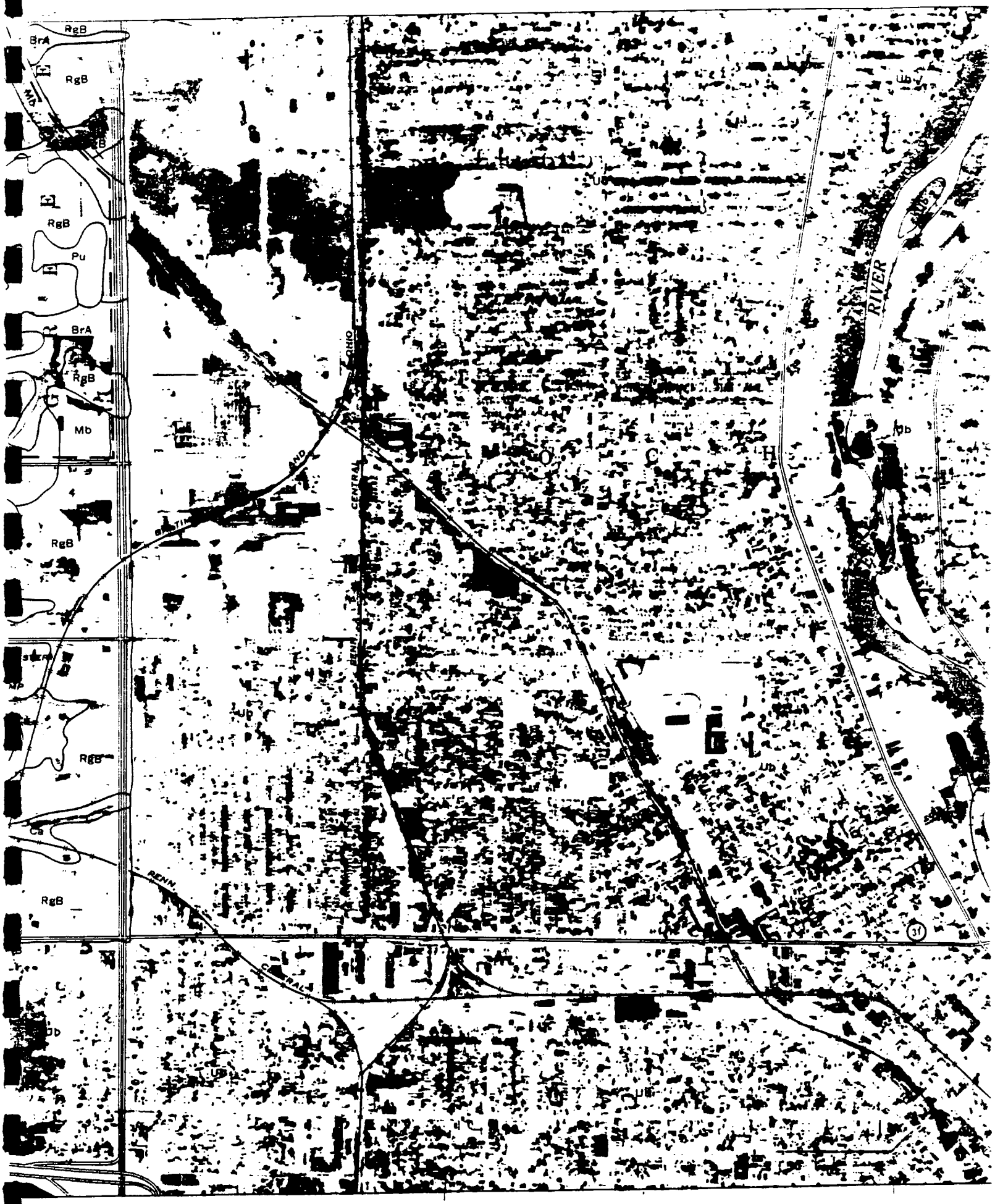
Depressions (Large, Small)
- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

SOIL SURVEY DATA

- Soil boundary and symbol (Da)
- Gravel
- Stoniness: Stony; Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Soil area with clay at 20 to 40 inches
- Soil area with bedrock at 20 to 40 inches


Harding School
ROCHESTER
(County seat)
Mb
Ow
LoB
HIB
HIA
ApA
CeB
BrA
RgB
DaB
Ca
31
47

(Joins sheet 30)
AnB
Ca
Ub
HIB
RIVER
ROCHESTER
(County Seat)
(Joins sheet 40)
(Joins sheet 48)


RgB
BrA
RgB
Mb
RgB
Pu
BrA
RgB
Mb
RgB
RgB
RgB
Ca
RgB
Db
Ub
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Ub
Ub
Ub
Ub
Mb
Mb
RIVER
O
C
H
L
CENTRAL
OHIO
AND
BENN
BENN
CENTRAL
31

REF 20

SUBSURFACE STRUCTURE AND STRATIGRAPHY OF ROCHESTER, NEW YORK

by

Jolie Lynn Scherzer

Submitted in Partial Fulfillment
of the
Requirements for the Degree

MASTER OF SCIENCE

Supervised by
Dr. L. W. Lundgren

Department of Geological Sciences
College of Arts and Sciences

University of Rochester
Rochester, New York

1983

I. INTRODUCTION

1-01. General

Geologic study of the Rochester area began in the early 19th century (Eaton, 1824; Hall, 1840, 1843). These earliest studies were based on information collected largely from bedrock exposures, particularly along the Genesee River Gorge and the old Erie Canal, as well as a few outlying dolomite quarries, streams and railroad cuts. Work centered around naming and describing the rock units and relating them to formations in other parts of New York State. Thus, the geology of Rochester was defined on the basis of surface exposures and extrapolation of information reported about rock units in other regions.

In 1907, C. A. Hartnagel developed the "Geologic Map of Rochester and Ontario Beach Quadrangles." Hartnagel depicted four major formations: the Medina, the Clinton, the Niagara and the Salina along with their constituent units. The surface bedrock units beneath the glacial drift are delineated on Hartnagel's map and each unit is described in the text. Although revisions have been made with respect to the exact boundaries and biostratigraphy of some of the units, general outcrop patterns of the lithologies described by Hartnagel are reasonably accurate.

Continued study during the period following Hartnagel's publication produced revisions and refinements in the detailed stratigraphy and correlations of rocks present in western New York (Clarke and Schuchert, 1900; Sarle, 1901; Grabeau, 1908, 1909; Newland

and Hartnagel, 1908; Chadwick, 1918, 1920 and 1935; Schuchert, 1913; Williams, 1919; Fairchild, 1928; Sanford, 1935a, 1935b; and many others). During this period, additional information became available from test holes drilled for iron-ore recovery (Newland and Hartnagel, 1908), and Chadwick (1918) considered this information sufficient to warrant changes in Hartnagel's 1907 map. In addition, brittle structure in the region was noted early in this century by Chadwick (1920) in his account of a large fault west of Rochester (better known today as the Clarendon-Linden Fault). Moreover, Chadwick reported the existence of small superficial faults between Rochester and Lake Erie, often accompanied by buckling.

Although by the middle of the 20th century the geology of the region was relatively well known (Fairchild, 1928; Sanford, 1935a; Gillette, 1947; and Fisher, 1954, 1959), detailed studies have continued to the present in an attempt to more accurately correlate the Ordovician, Silurian and Devonian rocks in western New York and to more clearly define the environmental conditions under which the strata were deposited (Bolton, 1953, 1964; Zenger, 1962, 1965, 1966; Kilgour, 1963, 1966; Rexroad, 1965; Fisher, 1966; Lumsden and Pelletier, 1969; Martini, 1971; Grasso, 1973; Crowley, 1974; Rickard, 1974, 1975; Brett, 1981; and others). Although there has been an emphasis on sedimentologic and paleontologic studies, brittle structures and other evidence of deformation of bedrock in western New York have been recognized (Parker, 1942; Sutton, 1951; Nickelsen and Hough, 1969; Van Tyne, 1975; and Andrews, 1980). In addition, a relatively large number of recent

studies explore regional rock stress and strain in western New York and southern Canada using various approaches (Rose, 1951; Sbar and Sykes, 1973; Palmer and Lo, 1976; Engelder, 1978; Engelder, T. and Engelder, R., 1977; Goldberg, Zoino, Dunnicliff and Associates, 1978; Lindner and Halpern, 1978; Lo, 1978; Quigley et al., 1978; Kulhawy and O'Rourke, 1981; and others). These studies include observations of deformed fossils, joint system orientations, and rock movements in excavations as well as direct stress and strain measurements using geotechnical instrumentation.

At present, a substantial amount of subsurface information is being generated through geotechnical studies in connection with the design and construction of a large sewer tunnel program (CSOAP, Phase II) within the city of Rochester. Detailed stratigraphic and structural information is available from test borings, surface and subsurface mapping, and in-situ testing. This systematic approach to examining the geology of Rochester adds a relatively large amount of information to the body of material which has been gathered since Hartnagel published his geologic map in 1907. The additional information collected throughout the city by the continuous rock sampling, and with modern engineering and geophysical techniques, permits a significant refinement of what is understood about the subsurface geology of Rochester.

1-02. Purpose and Scope

The purpose of this study is to describe the geologic conditions beneath the city of Rochester in order to provide a framework for interpretation and analysis of geotechnical data by the designers of the various CSOAP tunnel systems. Although geologic structures are relatively minor, it is important to understand the character, extent and development of both the lithologic and structural features in the area in order to design the proposed subsurface structures. Moreover, it is useful to examine whether the geologic structures observed can be related to large-scale regional trends and whether they conform to hypotheses about regional stress systems.

The scope of work included the following:

1. Analysis of rock core recovered from test borings.
2. Geologic reconnaissance and surface mapping of outcrops.
3. Mapping of continuous, exposed sections of rock in both pre-existing and freshly excavated tunnels.
4. A literature search of local and regional geologic references.
5. Preparation of this geologic report summarizing the findings.

1-03. Report Organization

The text of the geologic report is divided into three chapters following the introduction as follows:

Chapter 2: A brief description of the investigative methods and techniques employed during the study.

Chapter 3: A presentation of the geologic conditions in Rochester as disclosed by the recent explorations and literature search.

Chapter 4: A summary of the study and findings.

In addition to a descriptive text, the report contains tables, figures, photographs and maps which serve to outline the important geologic data and illustrate the structural features believed to be present in Rochester. A list of tables and figures is included in the Table of Contents.

1-04. Acknowledgements

This essay represents a slightly modified version of a report written for Monroe County Department of Engineering Sewer Tunnel Projects by H & A of New York, Geotechnical Consultants, while under their employ. In particular, Figures 1-3 and 5-7, and Photographs 1-7 are taken from a report entitled, "Summary of Geologic Conditions Rochester, New York, for Combined Sewer Overflow Abatement Program (CSOAP) Phase II," by H & A of New York Consulting Geotechnical Engineers and Geologists. The report is written as an accompaniment to a series of Geotechnical Data Reports intended for use during design and construction of the proposed sewer tunnels. It is based on available data obtained during ongoing investigations. Further study may yield modification of material as presented within this report.

Successful completion of this study was accomplished through the efforts of several people. Dr. Richard Young was instrumental in determining structural trends from test borings, as well as providing discussions of these trends. Mr. Fred Amos logged rock core and recognized lithologic trends in the bedrock units and Mr. James Ehrets mapped rock exposed both on the surface and in tunnels. Numerous other people who contributed to the success of this study include Messrs. Thomas Grasso, Russell Varnum, Vincent Dick, several faculty members at the University of Rochester, particularly Dr. Carlton Brett, Dr. Robert Sutton and Dr. Lawrence Lundgren, the staff at H & A of New York and especially Dr. Gary Brierley who initiated and supervised the entire effort.

II. INVESTIGATIVE METHODS

2-01. General

Information in this paper was obtained from three general sources: a literature search, subsurface explorations and field mapping. The literature search was initiated in order to gather previously documented information about the geology of the Rochester area. Geologic references, geologic maps and previous engineering reports were consulted. The search reveals that stratigraphic and paleontologic relations are well documented and that studies of geologic structure in the region have followed several approaches as outlined below:

1. Observation of faults, joints, and rock movement in excavations, and relating of their character and orientation to theoretical and laboratory models of stress and strain which cause brittle deformation in rocks (Parker, 1942; Sutton, 1951; Rose, 1951; Nickelsen and Hough, 1967).

2. Study of stress and strain using strain gauges together with X-ray analysis, sonic velocity testing, and observations of mechanical twinning of calcite, solution cleavage, and deformed fossils (Engelder, 1978; Engelder and Engelder, 1977).

3. Analysis of recent movement on faults through "fault-plane solutions" as a method of treating contemporary stress and strain (Sbar and Sykes, 1973).

4. Engineering studies which employ instrumentation to directly measure stress and strain (Goldberg, Zoino, Dunnicliff and Associates, 1976; Lo, 1978) as well as discuss the effects of stress and strain on rock behavior during excavation (Kulhawy and O'Rourke, 1981).

Engineering studies supplied additional information about the top of rock utilizing seismic refraction surveys (Haley & Aldrich, Inc., 1976).

5. Examination of contemporary uplift employing geodetic levelling and remote sensing techniques (Isachsen, 1974, 1975, and 1977; Sutton et al., 1972; Young, 1980).

A list of references outlining additional sources of information is included at the back of this report.

Field investigations which were applied to this report fall into two general categories: subsurface explorations and field mapping, as discussed below.

2-02. Subsurface Investigations

Test borings have been drilled throughout the city for various phases of Rochester Pure Water District's sewer tunnel development program as well as other engineering projects. Test borings used specifically for this report are shown on the Study Area and Boring Location Plan, Figure 1.

Borings drilled for the CSOAP Phase II program represent the majority of the subsurface explorations. In general, approximately 160 borings were drilled along 22 miles of proposed tunnel. These borings were advanced according to accepted practice by truck-mounted rotary drill rigs in 10.0-ft increments using double-tube, M-series, NXW and NQ core barrels which recover rock with a diameter of 2.125 in and 1.813 in, respectively. Water pressure tests for rock permeability and combustible gas measurements were conducted in many of the boreholes for supplemental information.

33 m st[illegible] area - [illegible] summary

Rock core was logged by one individual in order to provide consistency. The rock core was examined closely with respect to the rock's lithology and character. The lithology of each unit was described in detail, noting color, grain size, presence of fossils, rock type, and nature of bedding and contacts with the units above and below. Sedimentologic and structural features such as vugs or cavities, stylolites, mineralization, fractures and shear zones were noted and described. Borings were plotted on a base map and used to outline the stratigraphy of the study area. All elevations contained in this report are referenced to Rochester New City Datum (NCD). To convert NCD to USGS - Mean Sea Level Datum, subtract 1.085 ft.

Test borings drilled for engineering projects other than the CSOAP Phase II program and used for this study were treated in a similar manner. These additional boring logs were taken from several reports and are summarized in a preliminary data packet presented by Haley & Aldrich on 15 January 1981 for the CSOAP tunnelling program.

Base map construction was completed by plotting each boring on a transparent overlay on the Rochester East and Rochester West Topographic Quadrangle Maps. Each boring was labelled with its identification number as well as the elevation of a distinct marker bed used for correlation. Different marker beds were used in different parts of the city as not all beds were penetrated by each boring. Markers used for most correlations include the top of the Furnaceville Hematite Member of the Reynales Limestone, the top of the Irondequoit Limestone and, when necessary, the Rochester Shale (Gates Member)/

Lockport Dolomite (Decew Member) contact (see Figure 2). Where borings did not penetrate the Furnaceville Hematite, but did encounter the Rochester Shale/Irondequoit Limestone contact, an assumed elevation of the Furnaceville Hematite was utilized as a marker assuming a relatively constant rock thickness of 52 ft between the top of the Irondequoit Limestone and the top of the Furnaceville Hematite. It appears that the thickness of units contained within this interval generally does not vary by more than 1 ft within the study area west of the Genesee River.

Once pertinent borings were plotted, correlations were drawn between structural datum planes as they appear in various locations around the city. Strikes and dips of the beds were determined using the standard "three-point" technique. Strike is defined as the compass direction of the straight line which represents the intersection of the dipping beds with a horizontal plane. Dip is the angle down from horizontal of the line perpendicular to the strike which is the steepest gradient of the bedding plane. Strike and dip are simply a means of expressing the orientation of a layer of rock in three-dimensional space. Assuming a strike of N75°E and a relatively constant dip of approximately 0.5° (50 ft/mi) S15°E, any obvious discrepancies between the elevations of a marker bed in two different locations were considered a potential zone of structural deformation. These areas were then examined more closely for evidence of continuous local trends. In addition, systematic changes in the thickness of particular bedrock units were noted and taken into consideration for structural interpretations.

A geologic map outlining the surficial bedrock units in the project area and a structure contour map of the top of the Furnaceville Hematite were prepared and are presented in Figures 3 and 4, respectively. In addition, a general cross section was constructed along a line, A-A', across the city (see Figure 3) by interpolating between borings. Borings used for cross section construction include those which lie directly on line A-A' as well as projections of useful deep borings drilled in the vicinity. Borings were projected to the line of the cross section assuming a N75°E strike and a 50 ft/mi dip S15°E of the bedrock units. The cross section is presented in Figure 5.

2-03. Field Mapping

In general, field mapping was used to supplement lithologic and structural information derived from the test borings. Field mapping consisted of both surficial outcrop mapping and tunnel mapping as described below.

a. Surficial mapping

Measured sections of relatively complete outcrop exposures were completed in certain sections along the Genesee River Gorge and Irondequoit Bay at Glen Edith. In addition, rock exposures along highway cuts, streams and the New York State Barge Canal were examined. Field mapping was conducted in accordance with standard geologic mapping procedures using a Brunton pocket transit, Jacob's staff, hammer and chisel, and 100 ft tape. Lithology and rock

conditions were described, noting essentially the same parameters described during the logging of rock core recovered from test borings. These parameters include rock color, grain size, bedding, lithology, weathering, discontinuities and other pertinent or unusual features.

At smaller outcrops where only one or two rock types are exposed, emphasis was placed on verifying the rock type and measuring joints where possible. Joint measurements consist of joint strike and dip, spacing, planarity (degree of roughness or smoothness of the joint surface), tightness and continuity. It is important to note that joint strike, spacing other than horizontal, and especially fracture continuity are not discernable from test borings alone. A graphic, statistical representation of joint orientations within the study area as measured in the field is presented in Figure 6.

b. Subsurface mapping

Subsurface mapping of tunnels in Rochester was conducted in both in-service sewer tunnels on the west side of the city and in the Culver-Goodman Tunnel which is currently being excavated on the east side of the city starting near Irondequoit Bay. Examining the tunnels afforded an excellent opportunity to observe the character of certain rock units over considerable horizontal distances. Specifically, the older tunnels were inspected for jointing and evidence of shear zones which were anticipated on the basis of offset marker beds noted in test borings drilled in the vicinity of the tunnels. Moreover, the behavior of the rock mass, both during excavation and through time, was observed.

III. GEOLOGIC CONDITIONS

3-01. General

The study area encompasses the entire city of Rochester as well as small areas of its surrounding suburbs. The city is situated in western New York along the southern shore of Lake Ontario between approximately 77°32'30"W and 77°41'00"W longitude, and between 43°07'30"N and 43°15'0"N latitude. The area covers over 60 square miles, and although it incorporates all of Rochester, additional outcrops immediately outside the study area proper were examined for regional control. Considerable attention was given to the west side of the city because a proportionately larger body of information was generated in that region during the most recent phase of the tunnel investigation program.

Rochester lies within the relatively low and flat-lying geographic province known as the Erie-Ontario Lowland which begins at Lake Ontario and extends southward to the Appalachian Plateau. Ground surface elevations rise gently to the south and east throughout the province.

Within the study area, elevations vary from El. 246± ft at Lake Ontario (Mean Water Level) in the north to El. 745± ft atop Pinnacle Hill in the south.

Conspicuous topographic features within the study area include a range of morainal hills near its southern boundary (Pinnacle Hills) and a prominent east-west trending proglacial beach ridge to the north upon which Ridge Road (New York State Route 104) is located. Both features are the result of the most recent glacial events.

The land surface is dissected from south to north by the Genesee River and by numerous small streams. The New York State Barge Canal traverses the city in a general northwest-southeast direction. Aside from Lake Ontario, Irondequoit Bay, near the eastern boundary of the study area, represents the only other surface water body of significance. The bay is separated from Lake Ontario on the north by a barrier bar. Bedrock beneath the bay is relatively deep as a result of deep scouring by glacial action.

The groundwater table generally slopes towards Lake Ontario in the north part of the study area, toward Irondequoit Bay in the east, and toward the Genesee River and the Barge Canal in the west (Young, 1980). The movement of precipitation and runoff into the ground has been influenced by urbanization and storm drainage systems.

The study area is highly urbanized and contains single and multiple family dwellings, small businesses, light and heavy industries, and numerous railroad rights-of-way and highways. The city of Rochester itself has a population of approximately 300,000.

3-02. Historical Background (Geology)

Rock and soil in western New York records four major periods of geologic activity. These periods are represented by marine sedimentation, erosion, glaciation, and post-glacial uplift and erosion. Bedrock in the region includes a thick sequence of sedimentary strata deposited approximately 450 to 350 million years ago during the Upper Ordovician, Silurian and Devonian Periods of the Paleozoic Era (see Table I and Figure 2). During this time, the region was covered almost continuously by large inland seas, bordered by a landmass to the southeast and east. Most of New York, Pennsylvania and southern Ontario were submerged.

The oldest units exposed are the Ordovician Queenston Shale and Lower Silurian Grimsby Sandstone. These units form the surface bedrock units in the northernmost portion of Rochester and represent periods of extensive delta progradation. The overlying Upper Silurian and Devonian beds are primarily shales, siltstones, carbonates and evaporites. These beds are the result of deposition in relatively shallow seas subject to repeated minor fluctuations of the shoreline. Relative fluctuations of the water level had a great influence on the character of sediments deposited. Moreover, there is evidence that suggests parts of western New York were occasionally raised above sea level and exposed to erosion.

By the Early Mississippian Period, land movements associated with the culmination of Appalachian Mountain building to the south and east raised western New York above the inland seas and ended the episode

of marine deposition. Subsequently, the Paleozoic rocks were tilted southward and a southerly drainage system developed along the shallowly dipping beds.

A long period (about 350 million years) of erosion ensued until glaciation occurred during the Pleistocene Epoch. It is estimated that over 2,000 ft of rock was stripped from the region during this time.

During the Tertiary Period, broad regional upwarping may have rejuvenated streams. By this time the southerly-flowing streams had developed an extensive system of east-west tributaries which flowed along outcrops of easily eroded Silurian and Ordovician shales. Consequently, the northernmost east-west tributaries flowing over the shales eroded headward and became dominant east-west trunk streams by capturing adjacent southerly-flowing streams. An ancient Ontarian River, flowing westward through the St. Lawrence Basin, probably was one such trunk stream. The northward sloping bedrock topography of the Rochester area may reflect the glaciated south slope of this broad ancestral Ontarian River Valley.

At a later stage, after early glaciations, the Genesee River developed as a major north-flowing tributary emptying into the glaciated Ontarian Valley, beneath the present Irondequoit Bay. Its tributaries incised east-west strike valleys in the shales south of Rochester. Bedrock elevations show that the buried Genesee River channel and its major tributaries curve westward south of the city proper. The well-developed drainage system formed during Mesozoic and Cenozoic time developed the topographic controls that influenced Pleistocene ice erosion.

Approximately 1.5 to 3.0 million years ago, during the early Pleistocene Epoch when precipitation was greater than today, a large ice cap formed over Quebec. The ice flowed southwestward over New York reaching northern Pennsylvania, northern New Jersey and Long Island during the latest ice advance.

Glacial effects in western New York included ice erosion, subsequent deposition and glacial lake development. During glacial ice advances, the ice was effective in scouring the Tertiary land surface and obliterating or burying much of the pre-existing drainage system. In addition, glacial scouring action deepened the Ontarian and other pre-glacial river valleys such as the Genesee.

Depositional effects of the glacial period are also extensive in western New York. Glacial till was plastered over much of the scoured bedrock while above the till, sand, silt and clay were deposited as outwash or in glacial lakes which occupied the area. Surface topography in the region is a combination of these erosional and depositional processes.

Relatively few changes have occurred in western New York since the disappearance of the glaciers and glacial lakes. Nevertheless, significant effects of post-glacial processes in the Rochester area include Lake Ontario's occupation of the deeply scoured pre-glacial Ontarian River Valley, and establishment of the Genesee River in its present course. In addition, flooding of the Irondequoit Valley (pre-glacial Genesee River Valley) occurred to create the modern Irondequoit Bay by tilting of the bedrock threshold along the St. Lawrence River

during differential post-glacial uplift (Young, 1980). Most recent activity in the Rochester area has been dominated by the gradual rise of Lake Ontario's water level (from about 140 ft below its present elevation) during the waning stages of post-glacial uplift.

3-03. Stratigraphy

Ten geologic rock units are observed within the study area. A brief lithologic description of each unit, in order of occurrence from top to bottom, is presented below. Tables II, III and IV report pertinent borehole data. See Figure 2 for a generalized stratigraphic profile and Appendix A for a detailed description of each unit. Appendix B contains a glossary of some terms used during rock core logging.

LOCKPORT DOLOMITE - Light to medium gray, fine- to medium-grained, thin- to medium-bedded siliceous DOLOMITE with stylolites, argillaceous partings, and trace vugs or cavities often lined by secondary mineralization.

ROCHESTER SHALE - Light to dark gray, fine-grained, fossiliferous dolomitic MUDSTONE with thin interbeds of dolomite and limestone, trace pits and vugs, and secondary gypsum seams and nodules along partings.

IRONDEQUOIT LIMESTONE - Light to medium gray, fine- to medium-grained, thin- to medium-bedded, fossiliferous LIMESTONE with thin interbeds of dark gray, dolomitic shale, trace pits and vugs, gypsum nodules, and secondary gypsum seams in partings.

WILLIAMSON SHALE - Dark greenish gray SHALE with thin limestone beds and trace graptolite fossils.

LOWER SODUS SHALE - Dark greenish gray to grayish brown SHALE with trace fossils and several light gray, thin limestone beds containing abundant brachiopod fossils and locally called the "pearly layers."

REYNALES LIMESTONE	- Light to medium gray, fine- to medium-grained, thin-bedded, fossiliferous, crystalline LIMESTONE with interbeds of dark gray, very thin dolomitic shale, trace stylolites, secondary gypsum seams at partings, and a persistent, red, oolitic, fossiliferous, hematitic limestone bed.
MAPLEWOOD SHALE	- Light greenish gray, argillaceous SHALE.
THOROLD SANDSTONE	- Light gray to greenish gray, fine- to medium-grained SANDSTONE. It is noted that in recent literature, this unit is referred to locally as the Kodak Sandstone.
GRIMSBY SANDSTONE	- Reddish brown, fine- to medium-grained, thin- to thick-bedded SANDSTONE with light gray mottling, thin to widely spaced argillaceous partings, swirly bedding near the top, and cross-bedding in the lowermost section.
QUEENSTON SHALE	- Reddish brown, fine-grained, thin- to thick-bedded SANDSTONE with thin color-banding and light green or gray mottling, and some beds of limestone, siltstone, and shale or mudstone.

Although the dip of the strata may vary within the study area, bedrock generally strikes at N75°E and dips 50 ft/mi S15°E. Further discussion of the structural relationships of bedrock in Rochester is contained in Section 3-04. Refer to Figure 3 for a generalized map outlining the surficial bedrock units in the area and to Figure 5 for a general subsurface cross section through the city.

3-04. Structure

Although it is understood that major geologic structures are absent in the Rochester area (the closest major structure is the Clarendon-Linden Fault near Attica, New York), there is substantial evidence of minor deformation. This deformation has been defined on the basis of correlations between test borings, and is substantiated by

field observations. Both test borings and field evidence suggest that the deformation occurs in several zones (see Figure 4). Deformation within these zones may be a combination of warping, or mild folding, and minor faulting. This is illustrated by exposure in the walls of the New York State Barge Canal (Figure 7). Other exposures in the Genesee River Gorge show similar features (Photographs 1-7).

a. Structural reference surface and correlations

The Furnaceville Hematite Member of the Reynales Limestone was used as the structural reference surface whenever possible in calculating strike and dip and in structure contour mapping. In borings that did not intersect the Furnaceville, the elevation of the hematite member was estimated from the next highest contact penetrated. In most cases the top of the Irondequoit or the Reynales Limestone was used. In other cases, the Lockport/Rochester contact was the only horizon intersected.

The total thickness of the section from the top of the Irondequoit to the top of the Furnaceville Hematite averages between 52 and 53 ft west of the Genesee River, except in the vicinity of Mount Read Boulevard. A thinning of the section to 50 ft occurs along a corridor from Lyell Avenue (B503) north to Driving Park (B603) and extending 1/2 mile east of Mount Read Boulevard. East of the Genesee River, boring B601 contains a thicker (55.6 ft) section for the interval, increasing to about 60.2 ft near the intersection of North Goodman Street and Central Parkway to the north (boring G6).

The uniform thickness of this Irondequoit-Furnaceville interval, in spite of variations within individual units, lends confidence to the structural datum extrapolations. For shallow borings in those areas of varying thickness, a thickness was estimated by extrapolating from thicknesses observed in the nearest deeper holes.

Based on these assumptions, estimated elevations of the Furnaceville Hematite in borings west of the Genesee River are unlikely to be in error by more than 2 ft. Extrapolations from the top of the Reynales (approximately 13 to 17 ft above the Furnaceville Member) are probably accurate to within one foot throughout the area.

The Rochester Shale thicknesses show a slightly more complex pattern of variation. This unit is a maximum of 99 to 100 ft thick in the area between Chili and Lyell Avenues and thins northward to approximately 90 ft near Lexington Avenue. However, there are local exceptions to the pattern that may be, in part, a result of difficulty in consistently recognizing the gradational DeCew-Gates contact. For borings that did not fully penetrate the Rochester Shale, an approximate, extrapolated thickness of the Rochester (about 90 to 100 ft) was used, based on the nearest deeper holes. Although errors of up to 5 ft might occur in some cases, the distribution of deep holes for comparison is reasonably good. The relatively small magnitude and gradual changes in the stratigraphic thicknesses, combined with the closely-spaced borings, allow a reasonably accurate structure contour map (Figure 4) to be compiled. It is noted that the zones of structural deformation, whether potential folds or minor faults, are indicated by relatively abrupt

changes in elevation of units between adjacent pairs of borings with magnitudes in excess of the anticipated stratigraphic variations for equivalent distances.

b. Rock structure

Regional strike and dip of the local rock units is best defined in widely spaced borings away from zones of apparent deformation. The regional dip of the strata is approximated as 50 ft per mile in a SSE direction (S15°E) with a strike of N75°E, based on available boring data and eliminating areas of obvious local anomalies. The structural anomalies that are present do not greatly affect the results of strike and dip calculations when stratigraphic horizons are projected over distances of a mile or more from individual structures.

The greatest structural anomalies are apparent in subsurface profiles constructed in approximately NE-SW directions, whereas the least variation is apparent in borings aligned NW-SE. It is inferred, therefore, that the zones exhibiting anomalous correlations generally strike NW-SE and hence are best observed, or most apparent, when crossed from NE to SW (perpendicularly). Examination proves the structural offsets are not exactly parallel to a predominant NW trending joint set and on the whole do not necessarily follow any major joint trends. Additional evidence for consistent and northwesterly trending structural zones is suggested by localization of several offsets observed in Lake Avenue borings along the west side of the Genesee River. One boring,

LK7, intersected a narrow shear (occurring over less than 1 vertical ft of the boring). Subsequent examination of the west sidewall of the river gorge disclosed a southerly-dipping normal fault trace with about 5 ft of apparent dip-slip displacement (cutting several exposed formations) in the same vicinity. The location of the small fault is consistent with predictions based on the northwesterly trend toward boring LK7 and may suggest a possible continuity of the feature, or at least the zone of deformation which includes it. The southeastward continuation of this feature is parallel to the trend of the gorge itself in this area and was therefore not traceable to the east sidewall. Two other zones of anomalous dips and small faults with similar projected NW trends were located in the Genesee Gorge north of the lower falls (see Figure 4 and Photographs 1, 2 and 3). All the structural zones show a tendency to change rapidly along strike, such that they contrast in appearance on either side of the gorge. Possibly the contrast is due to characteristics imparted by differential stress relief effects resulting from the presence of the deeply cut and eroded river gorge itself.

c. Deformation zones

The best exposure of deformation inferred to characterize the structural zones is visible in the New York State Barge Canal at the western end of the city (zone A in Figure 4). The feature is exposed over an estimated 2,000-ft wide zone of the Gates Dolomite Member of the Rochester Shale and appears to be more continuous and uniform than other

observable structures in the project area. The structure is a faulted, relatively tight, anticlinal fold with a somewhat broader corresponding syncline to the north. Both folds show a concentration of jointing and small faults near their hinge zones. Figure 7 represents a sketch of the exposed structure (also see Photos 4 through 7). The hinge of the anticline trends approximately N70°W, and its northern limb has a relatively steep dip, reverse to the regional trend. In general, dips along the flanks of the exposure are steeper (5°) than the regional dip (0.5°).

The barge canal exposure yields important clues to the nature of deformation existing in the Rochester area and is used here to suggest the character of the structural deformation zones which appear in the region. As has previously been noted, correlations of stratigraphic horizons between borings indicate that in some places offsets of up to 30 ft occur. However, borings alone cannot show the nature of deformation which yields the observed offsets. If a structure such as that observed in the Barge Canal were encountered in borings without surface exposures for comparison, the interpretation of projected faulting or folding would be entirely dependent on the location of adjacent borings. Two borings located on such a structure, while indicating the relative offset, could suggest either normal or reverse faulting. Borings drilled along the southeastward projection of the trend of the canal structure demonstrate this effect (see Figure 4). Nevertheless, it is evident from the borings as well as exposures along the Barge Canal and the Genesee River Gorge that the magnitude of deformation varies along strike of the deformation zones.

Additional surface support for the presence and continuity of the deformation zones occurs north of the canal where an unusual NW trending flexure was also encountered in excavations for the new Resource Recovery Center on Emerson Street. This feature and others have been attributed to surficial thrust deformation of the near-surface bedrock by glacial readvances (Young, personal communication). Although apparently an accurate explanation for a similar feature occurring in Densmore Creek near Irondequoit Bay (Andrews, 1980), the Emerson Street feature may be a continuation of the disturbed zone which includes the barge canal structure (Young, personal communication). Borings east of Mount Read Boulevard along this trend also indicate the structural zone is wider than the section visible at the canal.

In addition, it is interesting, and perhaps not coincidental, that the glaciated escarpment to the north contains two significant erosional reentrants which are aligned with the two most prominent structural trends on the structure contour map. These reentrants appear near the intersection of the Barge Canal with Elmgrove Road and near the intersection of Mount Read Boulevard with Ridgeway Avenue. Differential ice erosion of structurally weakened zones in the escarpment could explain the observed relationships. Another possible explanation is that the reentrants may represent the surface expression of faulted, south-dipping strata. N-S trending normal faults dipping westward, or reverse faults dipping eastward, could produce this effect.

A second major zone of deformation (zone B on Figure 4) appears to trend in a more northerly direction (N50°W) with its southern edge roughly parallel to and south of the western segment of Driving Park Avenue and its northern limit near a parallel line through the lower falls of the Genesee River (a belt approximately 4,000 ft wide). Within this zone there are at least two separate intervals with projected vertical stratigraphic offsets in excess of ≥30 ft over horizontal distances of 2,000 ft. Strata in the center of the zone of deformation (along Lexington Avenue) are structurally 30 ft lower than equivalent rock units to the NE and SW. In boring LX1, the elevation of the Furnaceville Hematite is 360.5 ft whereas the elevation of the same rock unit in boring B602, about 2,200 ft to the SW, is 388.5 ft. LX1 is located updip from B602 (about 15° off strike), yet the reference surface is encountered approximately 28 ft lower in LX1 (see Figure 4). Under normal, undisturbed conditions, one would expect the Furnaceville to be encountered about 5.5 ft higher than at B602, or at El. 394.0 ft in LX1: a discrepancy of 33.5 ft based on the average regional dip. In general, to account for a discrepancy of this magnitude, either a change in dip is required or the presence of a fault, or several faults, with a net vertical component displacement of 33.5 ft. The change in dip would necessarily entail a reversal and an increase from about 0.5°SE to about 2.8°NW: a total change of about 3.3°.

Just to the north of LX1, borings B504 and LN1 lie very nearly along strike. However, the Furnaceville is encountered at about El. 376 ft in B504 and El. 399 ft in LN1: a discrepancy of about 23 ft.

Moreover, there is a fairly good control for estimating the location of the 400-ft contour on the top of the Furnaceville Hematite in this area. From boring LK3 in the northeast, the 400-ft contour undulates only slightly until the rather abrupt discrepancy (suggesting faulting) between borings LN1 and B504, only slightly over 1,000 ft apart (see Figure 4). Borings just north of LN1 indicate there may be a slight increase in dip towards the north.

Approximately 1.5 miles southeast, in the vicinity of LK11, LK16, LK17 and LK21 between Lake Avenue and the Genesee Gorge, another relative dip reversal is observed although discrepancies between borings are not as large as those observed to the northwest. LK16 (343.0 ft Furnaceville elevation), about 950 ft NW of LK17 (349.1 ft Furnaceville elevation), displays a Furnaceville elevation that is lower in the updip boring by 6.1 ft. In addition, the elevation of the Furnaceville is about 343 ft in both borings LK16 and LK21. LK21 is about 1,600 ft SE of LK16. Considering their relative locations, the Furnaceville elevation would be expected to be 8.7 ft lower in LK17 than it is in LK16 and 12.8 ft lower in LK21 than it is in LK16. These represent net discrepancies of 14.8 ft and 12.8 ft, respectively. The magnitude of discrepancies between neighboring borings appears to decrease towards the SE along zone B. Moreover, the discrepancies observed near Lexington Avenue show a complex pattern. As many as three separate changes in dip (across discrete flexures and/or minor faults) are required to explain the anomalous stratigraphic displacements between adjacent borings, particularly borings B602, LX1, LN5, B504, LN1, LN4, B603 and LN3 (see Figure 4).

The trend of this zone of deformation is inferred to be oriented in a more northerly direction than the zone intersecting the Barge Canal (refer to Figure 4) because of its possible relation to the Rochester Shale reentrant to the NW and the absence of compatible structures of equivalent magnitude in the Genesee River Gorge north of the Middle Falls. As presently delineated, both the areas just south and east of Holleder Stadium (borings LX1, B603, LN1, LN4, etc.) and the area east of Edgerton Park (borings LK11, LK16, LK17, LK21, etc.), where anomalous stratigraphic behavior is observed, are included. The lack of adequate rock exposures and the parallel trend of the Genesee River south of the Upper Falls preclude observations in the area where the structure might cross the river along its southeastern end. However, the southern edge of the zone near the river corresponds with a series of three former waterfalls near Broad Street that were blasted away in the early 1820's during canal construction. Possibly the falls were the result of outcropping of offset or folded beds subject to weathering processes which differentially affected the softer units. Nevertheless, the southeastward projection of this second zone of structural deformation intersects the Barge Canal structural trend (zone A on Figure 4) in an area where the regional dip appears anomalously flat in three widely-spaced borings (MR1, MR3, and MR4). Structures present in this zone may have a cross section similar to that seen in the Barge Canal north of Lyell Avenue (minor faults and open folds), but it appears they would involve a greater downwarping of the central portion of the zone, and a greater number of dip changes are inferred from the numerous borings

along the west edge of the Genesee River Gorge. The lack of borings east of the river between East Avenue and Interstate Route 490 East prevents definition of any structure where the two trends appear to intersect.

A third corridor of structural deformation with an assumed NW trend, possibly parallel to the Driving Park structure zone, crosses Norton Street on the east side of the river between the gorge and Carter Street (zone C on Figure 4). There are only five widely-spaced borings which define this zone, but anomalous offsets of 5 ft to 15 ft are apparent between each set of adjacent holes. Supporting evidence of this structural zone appears in the Genesee River Gorge about 700 ft north of the Veterans Memorial Bridge where an anomalous dip of the strata was noted. In addition, some small offsets may be present along the NW projection of this trend in the vicinity of Eastman Avenue (see Figures 1 and 4). This structural trend, however, seems to diminish to the southeast. South of Norton Street, when projecting the Furnaceville datum across the study area to borings drilled for the Culver-Goodman Tunnel (see Figure 1), little deformation is obvious. This lends further support to the interpretation that the broad deformational zones consist of a series of flexures or small en echelon faults whose compensating offsets do not necessarily greatly disturb the regional dip of the strata along the strike of the structural zone itself. Only profiles which cross the features show anomalous stratigraphic discontinuities or dip reversals, and these occur only over relatively short distances.

It is notable that a small fault exposed in the Culver-Goodman Tunnel south of Norton Street near Densmore Creek has a trend of approximately N55°W. This trend is roughly parallel to the presumed trend of all the structures except the one intersecting the Barge Canal. One additional potential zone of deformation appears in the extreme SW corner of the project area (zone D on Figure 4). Between Buffalo Road and Chili Avenue, a series of small offsets appear likely, but their trend can only be presumed parallel to those farther north. The existence of this additional deformation as well as the fault exposed in the Culver-Goodman Tunnel suggests that other deformational zones may be present in other parts of the city.

Additional support for a fault or fold zone explanation for the observed stratigraphic offsets was obtained from a survey of older sewer tunnels on the west side of the river, particularly in the vicinity of Lexington Avenue. Sets of joints in the existing Lexington Avenue sewer tunnel trending N80°W, N60°W, and N10°E were observed near lined sections west of Dewey Avenue. Three sections of this tunnel were lined in areas compatible with the projected intersections of significant stratigraphic offset zones. These are between Dewey Avenue and Maryland Street, from Lake Avenue to Tacoma Street, and west of Starling Street (see Figures 1 and 4). Very small faults were also observed near the west end of the Lexington Avenue sewer tunnel in a smaller branch line coming from Malvern Avenue. The lined portion of this same branch sewer is also in line with the projected zone of deformation that crosses Lexington Avenue near Tacoma Street (see Figure 4).

In summary, the best composite view of the apparent structural style of the "zones" of deformation appears to be the 2,000-ft section in the Barge Canal north of Lyell Avenue (see Figures 4 and 7, and Photographs 4 through 7). This structure is visible only when the canal is drained to a low water level during the winter months. The apparent undulation of the Furnaceville datum across all the zones of deformation implies that structures are more deep seated than, and unrelated to, simple shallow glacial deformation. The structures do not greatly influence the regional dip or strike of the rocks and are therefore probably not the boundaries of large-scale tilted fault blocks, but merely narrow wrinkle-like folds or minor en echelon faults superimposed on the regional dip of the rocks. Some of the structures may be subparallel to one of the minor northwesterly joint sets and involve 2,000- to 4,000-ft wide zones of deformation that may include open folds, small faults, and increased joint frequency.

The structural offsets observed in the boring data are apparently preglacial, as the rock surface has been glacially scoured so as to remove the structural relief observable within the limits of the present data. Many of the zones of apparent structural offset cannot be located more closely than within 200 to 1,000 ft (the distance between borings). Thus it is presently impossible to determine what percentage of the deformation is faulting and what is due to gentle warping. If the structures are basically compressional with superimposed tensional

features (of younger age), it is likely that both gentle folding and associated minor faulting are involved within the major zones of deformation.

d. Nature of individual faults

During the later part of the investigation, a conspicuous fault was intersected in boring LN5, located between LaGrange and Newbury Streets, north of Driving Park Avenue. This boring is located in the region close to Driving Park Avenue where large offsets were inferred. Comparison of this boring with the Furnaceville datum approximately 800 ft north in boring LN1 indicates an apparent offset of about 17 or 18 ft, based on the average regional dip.

In boring LN5, the shear zone appears as a narrow (approximately 2 in) zone where the base of the Maplewood Shale is in contact with a thin gray shaly bed in the middle of the Grimsby Sandstone. By comparison with adjacent borings it has been determined that approximately 19 ft of rock is missing between the shear surfaces, including 2 ft of Maplewood, all the Thorold, and about 12 to 14 ft of upper Grimsby. The lower surface of the shear zone is distinctly slickensided and is a sharp contact. The upper surface in the Maplewood is slightly more disturbed, but the narrow interval shows relatively little significant deterioration of the rock on either side. The slickensided lower surface has a dip of approximately 50 to 55°.

Thus, in the case of this single fault, the stratigraphic anomaly between LN5 and LN1 can be explained as a narrow, discrete fault, dipping moderately steeply (possibly about 50° to 55°) and yielding 19± ft of missing section, suggesting a vertical component displacement of up to 19± ft. The amount of dip-slip displacement is expected to be greater than the 19 ft, depending on dip angle of the fault. Moreover, the fact that strata are missing suggests the fault is a normal fault, and because the missing strata lie below the Furnaceville Hematite, it is inferred that at the location of LN5, the Furnaceville Hematite is encountered on the downthrown side of the fault. Just to the north, the 23-ft discrepancy previously noted in the elevation of the Furnaceville between borings B504 and LN1 also indicates that B504 would be located on the downthrown side of a fault located between them. If the fault encountered in LN5 were to continue northwestward, it is suggested that its surface expression would lie just east of LN5 with a strike of between N55°W to N25°W or at least varying within an arc of 30 to 50°, depending on its actual location relative to LN5.

In summary, the faults observed in the Barge Canal, the Culver-Goodman Tunnel, the Genesee River Gorge, and in test borings LN5 and LK7 are NW-trending normal faults with dips greater than 50°. The thickness of individual shear zones along the faults varies from about an inch to a foot in width. The wider zones of disturbance are seen in the shales, especially in the Genesee Gorge. For more information about

the location and nature of other zones of low quality bedrock, the reader is referred to the Geotechnical Data Reports by H & A of New York, specifically the test boring logs.

e. Jointing

In general, jointing within the study area occurs in virtually all units, both in borings and in outcrop where it may be more pronounced due to the influence of weathering processes. Joint orientation, spacing and frequency appear to be consistent within a particular lithologic unit but not necessarily between them.

Generally, joints in the area are both continuous and discontinuous. Continuous joints extend from 3.0 ft to more than 40.0 ft along their strike, whereas discontinuous joints are relatively short (less than 3.0 ft) and are generally confined to one lithologic unit. Discontinuous joints in the area are characteristically tight (or slightly open where weathered), curved fractures which often terminate in bedding planes. They are responsible for the blocky appearance often displayed in the sandstones and limestones. Although numerous in most lithologic units, the highest number of discontinuous joints occurs in the shales.

Continuous joints in the area are essentially vertical, but dips of up to 80° are noted. These joints are commonly present in the most competent rock units and they may cross lithologic boundaries. It is noted that their character may change when they cross into units with very different properties. Generally, continuous joints range from

slightly continuous (3.0 to 10.0 ft long) to highly continuous (greater than 40.0 ft in extent). The surfaces of these joints vary from rough to smooth, depending upon lithology. These joints are usually open, except where locally filled by secondary gypsum and calcite. Spacing between the joints occurring in outcrop is normally on the order of 10 to 20 ft. Occasionally, several very closely-spaced joints were noted to occur over a span of 1 to 2 ft. Photographs 8, 9 and 10 illustrate continuous joints observed.

Joint trends were determined for the continuous joints by recording the total number of joints falling into each 20° range of azimuth (from N0°E). The results for three sections of Rochester and for all joints measured are shown on Figure 6. Each shaded sector on the diagrams indicates the strike of the joint set and the sector's length is proportional to the number of joints in that set.

As shown on Figure 6, continuous joints in the area fall into several sectors. On the basis of their orientation and occurrence, two dominant and several subordinate joint sets can be defined. The most dominant sets trend N71°E and N16°W. Two additional sets occur trending about N45°E and N45°W. The prominence of these third and fourth sets varies slightly from outcrop to outcrop, but they are always less conspicuous than the sets striking N71°E and N16°W. These orientations appear consistent throughout the area and generally agree with orientations reported by others (Goldberg, Zoino, Dunnicliff and Associates, 1976; Haley & Aldrich, 1976, 1978; Kulhawy and O'Rourke, 1981; and others).

In addition, a possible fifth joint set striking approximately N80°W (with an occasional joint oriented 90° to it) occurs in areas of structural deformation previously discussed. This set rarely appears in outcrops. Considering its association with local structural discontinuities, this joint set may possibly represent localized variation in the orientation of the set striking N71°E. It has been noted by others that regional joint systems may be modified by local compressional structural elements (Nickelsen and Hough, 1967).

In general, jointing in the area is consistent with regional trends defined for western New York (Parker, 1942; Sutton, 1951; Nickelsen and Hough, 1967). Parker describes the dominant joint set in the northwestern part of Appalachian Plateau as striking about N70°E. This set appears as far south as Pennsylvania. Two additional sets are reported by Parker striking N59°E and N20°E to N24°W. The latter set shows a general swing from N24°W in western New York to N20°E in central New York while the other sets maintain a relatively consistent orientation throughout. Sutton describes predominant joint sets striking N45°W and N75°E in the Batavia Quadrangle. Nonetheless, the major joint systems in the region appear consistent over relatively small areas. Localized dominant trends are present and overlap dominant trends in adjacent areas (Nickelsen and Hough, 1967).

The origin of joints in the region is discussed extensively in the literature. It is generally believed that both relict principal tectonic stresses and variable principal stresses due to topography,

unloading and present tectonic conditions combine to influence joint development. Joint orientation was probably determined by release of stress as the rocks are brought near the surface by uplift and erosion.

3-05. Stress

The state of stress which exists in a rock mass is important for both structural interpretation and engineering design. Because stress relief associated with excavation can yield significant rock deformations, an awareness of the presence, orientation and magnitude of principal, horizontal rock stresses is essential for the proper design of structures which involve bedrock excavation.

It is known that high horizontal compressive stresses exist at shallow depths throughout western New York. High compressive stress is usually understood to mean stresses which exceed those expected from the effects of lithostatic loading alone (greater than about one third of the vertical load; Sbar and Sykes, 1973). Most evidence of this contemporary stress comes from engineering observations of rock squeeze, in-situ stress measurements, and seismic activity. Rock squeeze features are described for many localities in western New York and Ontario, Canada. They most commonly appear as:

1. Natural "pop-ups" of rock outcrops at a distance from and unassociated with excavation, faulting, and post-glacial folding (Lo, 1978; Sbar and Sykes, 1973).

2. Direct, inward, lateral movements of open trench excavations and unsupported tunnel walls, as well as bridge foundations and abutments (Rose, 1951; Hogg, 1959; Sbar and Sykes, 1973; Lo, 1978; Quigley et al., 1978; Kulhawy and O'Rourke, 1981).

3. Cracking, buckling or heaving of quarry or tunnel floors and cracking or movement at the springline of tunnel linings (Lo, 1978; Bowen et al., 1976; Kulhawy and O'Rourke, 1981).

In-situ stress measurements in the region are another indicator of stress conditions. Measurements are most frequently recorded using overcoring, undercoring and hydrofracture techniques. Although the values obtained for the orientation and magnitude of principal stress components may vary, generally good agreement between these methods is reported. A brief description of these measurement techniques as well as a compilation of many stress measurements for North America is contained in Lindner and Halpern (1978). Some stress measurements for this region are presented here in Table V. In general, in-situ stress measurements indicate an E to NE maximum compression which may reach up to 2,100 psi (Palmer and Lo, 1976). This is not inconsistent with the sense of rock squeeze movements reported to occur between Rochester and Niagara Falls (Rose, 1951).

Current seismic activity is another stress indicator. Stress conditions can be assessed by applying the "fault plane solution" technique on recently recorded earthquakes. This method uses the motion of P-waves to determine the trend of principal stress axes. Using this technique, maximum principal stress is also reported to be nearly horizontal and trending E to NE in western New York (Sbar and Sykes, 1973).

Despite the consistency of values reported for the contemporary stress regime, there is substantial evidence that the orientation of principal stresses has changed through time. It is important to note that the current stress system may be defined by present tectonic stress as well as remnant stresses of older systems. While the orientation of current stress is defined by fault plane solutions and in-situ stress measurements, the presence, orientation and magnitude of the past stress regimes are inferred from studies of jointing, faulting and folding as well as solution cleavage and deformed fossils. It is also noted that some authors believe that present day horizontal stresses may merely be the relative effect of uplift and overburden removal since the last ice age. Others believe that they may be in part the influence of contemporary doming in the Adirondack region (Isachsen, 1975).

Although it is very difficult to assess the relative contribution of each possible influence on the present stress regime, Sbar and Sykes (1975) note a consistency in orientation of current stress measurements throughout North America. They conclude that this broad regional pattern is indicative of tectonic stress. Nevertheless, it has been noted that many deformational features (such as jointing, faulting and deformed fossils) in western New York appear to bear no relationship to the E to NE trend of contemporary stress (Engelder, in press). Other features, however, such as rock squeeze phenomena and earthquakes, clearly show the direct effects of this contemporary stress system. It appears that a single model relating rock behavior to stress distribution is not yet available.

IV. SUMMARY

A substantial amount of stratigraphic and structural information has been obtained through subsurface explorations and a general geologic survey initiated for a recent tunnelling program in Rochester, New York. Information gathered through a literature survey, test borings, surface and subsurface mapping and engineering instrumentation was used to describe the general geologic conditions beneath the city. Geologic conditions are described in text supplemented by tables, figures, maps and photographs which illustrate the findings.

Ten sedimentary rock formations of Ordovician and Silurian age are present in the Rochester area. In order of occurrence from top to bottom, they are:

Lockport Dolomite

Rochester Shale

Irondequoit Limestone

Williamson Shale

Lower Sodus Shale

Reynales Limestone

Maplewood Shale

Thorold (Kodak) Sandstone

Grimsby Sandstone

Queenston Shale

Lithologic descriptions for each unit as revealed by test borings are contained in Section 3-03 and in Appendix A. A general stratigraphic profile is presented in Figure 2.

Minor geologic structure in Rochester is revealed by test borings and substantiated by surface and subsurface mapping. In general, it appears that structural deformations occur in at least three zones trending N70°W and N50°W (see Figure 4). The zones may be 2,000 to 4,000 ft wide, up to 4 miles long, and display individual offsets of up to 30 ft.

Structural deformation appears to be expressed by a combination of minor faulting, gentle warping and increased joint frequency (see Figure 7 and Photographs 1 through 7). The observed faults are characteristically steeply dipping (greater than 50°), normal faults of small displacement and are most often tight or well-healed in both tunnel exposures and borings. Observed shear zones associated with the faults are usually narrow (about 1 in to 1 ft wide) and may have slickensided surfaces. Relatively little significant deterioration of the rock has been noted on either side of the shear zones. The shale units may show slightly greater disturbance. Although a definitive statement about the age of most recent activity cannot be made, historic seismic activity in the region implies that these structures are neither currently active nor related to the Clarendon-Linden Fault trend near Attica.

It appears that a major portion of stratigraphic offset in some areas may be a result of the strata warping rather than faulting. Only a small increase in dip is necessary to explain an apparent 30-ft offset associated with a fault exhibiting only 5 ft of displacement. The flexures generally show increases in dip up to approximately 5°, the steeper part usually occurring to the north where a reverse dip relationship is displayed. The warping appears to terminate gradually, but over a relatively short distance, as the beds resume their normal dip at the boundaries of the structural corridors. It is noted that several discrete changes in dip may be present within one zone of deformation suggesting more than one flexure or offset may be present in the zone.

Increased joint frequency is also associated with the structural zones. Joints in these areas are continuous and usually strike approximately N80°W. Four additional sets of continuous joints are apparent in Rochester. These sets usually appear as two approximately orthogonal groups striking about N71°E/N16°W and N45°E/N45°W, the former being the most dominant. These joints occur in virtually all lithologic units and are characterized by smooth to rough, nearly vertical, open surfaces, occasionally calcite or gypsum filled, and a spacing of 10 to 20 ft. The orientation and character of joint sets in the Rochester area appears consistent with regional joint sets described in the literature for the Appalachian Plateau province in western New York.

Joint patterns and structural deformation zones generally result from stress imposed on bedrock units. There is evidence, however, suggesting that the stress system present in western New York has changed through time. Although measurements of contemporary horizontal stresses reveal an E to NE maximum principal compressive stress operating at present, the system of jointing, and possibly faulting and warping, may reflect the influence of an ancient stress regime. Nevertheless, it is noted that the present stress regime is considered responsible for many rock squeeze features observed in the Rochester area.

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A. GEOLOGIC REFERENCES

B. MAPS

C. ENGINEERING REPORTS

A. GEOLOGIC REFERENCES

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TABLE I

Geological Time Scale

Era	Period	Epoch	TIME IN MILLIONS OF YEARS Beginning	Duration
CENOZOIC	Quaternary	Holocene (recent)	0.01	
		Pleistocene	3±	2.99
	Tertiary	Pliocene	5	2±
		Miocene	25	20
		Oligocene	34	9
		Eocene	49	15
		Paleocene	64	15
MESOZOIC	Cretaceous		130	66
	Jurassic		180	50
	Triassic		220	40
PALEOZOIC	Permian		270	50
	Pennsylvanian		325	55
	Mississippian		355	30
	Devonian		410	55
	Silurian		430	20
	Ordovician		500	70
	Cambrian		600	100
PRECAMBRIAN				
FORMATION OF THE EARTH			4,600	

NOTE: Table derived from various geologic sources.

TABLE II

Summary of Selected Borehole Data

Boring Number	Ground Surface Elevation	Depth to Lockport	Depth to Rochester	Depth to Irondequoit	Depth to Williamson	Depth to Lower Sodus	Depth to Reynales	Depth to Furnaceville	Depth to Maplewood	Depth to Thorold	Depth to Grimsby	Depth to Queenston
AL 1	520.4	10.0	46.2	145.9	---	---	---	198.9*	---	---	---	--
2	518.8	14.5	38.8	134.8	152.2	157.3	170.7	187.8*	---	---	---	--
3	524.2	14.0	74.6	---	---	---	---	226.1*	---	---	---	--
4	517.9	19.0	48.7	145.9	---	---	---	198.9*	---	---	---	--
5	521.5	17.0	59.3	---	---	---	---	210.3*	---	---	---	--
6	519.4	15.9	68.7	---	---	---	---	220.2*	---	---	---	--
7	532.5	10.5	95.0	---	---	---	---	246.0*	---	---	---	--
8	517.4	17.5	42.8	139.1	156.2	---	---	192.1*	---	---	---	--
9	541.2	11.5	123.7	223.9	240.9	---	---	275.9*	---	---	---	--
10	539.9	8.5	116.0	---	---	---	---	268.0*	---	---	---	--
11	540.6	17.0	109.0	---	---	---	---	262.0*	---	---	---	--
12	526.7	12.5	50.0	152.0	169.5	---	---	205.0*	---	---	---	--
13	520.0	16.0	64.6	163.3	---	---	---	215.8*	---	---	---	--
14	531.5	20.0	86.3	---	---	---	---	237.3*	---	---	---	--
B 501	546.6	10.5	125.5	---	---	---	---	278.5*	---	---	---	--
502	504.8	11.2	29.8	128.9	146.5	154.4	---	181.9*	---	---	---	--
503	528.5	7.0	36.0	134.5	151.2	156.7	170.0	187.5*	---	---	---	--
504	495.1	--	10.0	68.5	85.0	91.4	104.5	119.2	122.8	139.2	142.0	--
505	455.3	--	---	---	---	---	---	---	25.0	29.0	29.8	79.5
506	410.4	--	---	---	---	---	---	---	---	---	26.0	34.2
507	530.2	10.0	---	---	---	---	---	---	---	---	---	--
508	530.5	7.3	---	---	---	---	---	---	---	---	---	--
509	518.1	16.0	---	---	---	---	---	---	---	---	---	--
510	519.9	11.0	36.0	---	---	---	---	185.0*	---	---	---	--
511	496.5	11.0	53.2	---	---	---	---	201.9*	---	---	---	--
512	468.3	--	16.6	---	---	---	---	---	---	---	---	--
513	510.1	10.1	18.5	106.2	---	---	---	158.2*	---	---	---	--
514	452.7	--	---	11.5	16.2	24.2	36.5	52.5	55.9	---	---	--
515	483.1	--	34.4	---	---	---	---	---	---	---	---	--
516	423.0	--	---	---	---	---	---	---	---	---	21.0	46.2
B 601	517.5	15.5	140.2	236.6	255.1	259.4	275.9	292.2	295.1	---	---	--
602	528.3	--	7.5	89.5	107.6	112.0	124.5	139.8	143.7	161.0	164.8	--
603	496.3	--	16.5	21.5	39.8	44.7	56.4	72.0	75.8	93.9	96.1	--

TABLE II (cont.)

Boring Number	Ground Surface Elevation	Depth to Lockport	Depth to Rochester	Depth to Irondequoit	Depth to Williamson	Depth to Lower Sodus	Depth to Reynales	Depth to Furnaceville	Depth to Maplewood	Depth to Thorold	Depth to Grimsby	Depth to Queenston
C 1	490.2	7.0	128.0	212.5	---	---	---	271.5*	---	---	---	--
3	463.8	4.5	25.0	109.0	128.0	135.0	153.0	168.8	171.0	188.0	194.0	--
4	469.3	8.0	35.0	124.0	141.0	150.0	167.0	184.0	187.0	---	---	--
6	469.0	9.5	46.5	131.0	148.5	156.5	173.5	190.5	193.0	---	---	--
8	485.9	6.5	110.0	201.0	---	---	---	260.0*	---	---	---	--
9	486.8	31.5	90.0	183.0	201.0	208.0	---	242.0*	---	---	---	--
15	470.7	5.5	45.0	143.0	159.0	166.5	184.0	201.0*	---	---	---	--
16	467.4	12.5	76.0	156.0	175.5	182.5	---	215.0*	---	---	---	--
17	487.9	8.5	122.0	205.0	---	---	---	264.0*	---	---	---	--
20	455.6	--	17.6	87.0	105.0	112.0	129.3	145.3*	148.6	165.0	173.8	--
D 1	444.5	--	6.5	56.0	74.0	81.0	99.0	114.1	117.5	132.5	141.0	--
3	452.0	--	10.8	69.5	90.0	96.5	114.0	129.9	133.0	150.0	157.5	--
4	431.4	--	10.0	29.0	46.5	55.0	72.0	87.7	91.0	106.5	116.5	--
7	402.3	--	---	---	---	---	36.0	46.8	50.0	64.5	69.5	--
8	397.2	--	---	---	---	---	---	---	---	62.0	64.5	117.5
13	380.4	--	---	---	---	---	---	---	---	---	62.0	93.0
19	424.5	--	---	13.0	30.5	39.0	57.0	70.2*	73.5	89.5	99.8	--
DE 1	445.1	--	---	---	---	---	19.5	31.3	33.1	54.5	56.1	--
2	447.9	--	---	---	---	---	---	---	30.3	41.7	43.5	91.4
3	415.8	--	---	---	---	---	---	---	---	---	23.5	34.2
4	452.7	--	---	10.0	18.6	23.1	36.2	52.1	55.8	74.6	77.0	--
5	445.9	--	---	---	---	---	21.5	23.2	26.6	45.3	47.7	96.4
6	412.5	--	---	---	---	---	---	---	---	---	14.6	26.6
7	411.1	--	---	---	---	---	---	---	---	---	24.5	31.3
8	428.7	--	---	---	---	---	---	---	---	13.5	14.4	--
9	431.1	--	---	---	---	---	---	---	---	12.6	14.0	--
10	435.0	--	---	---	---	---	---	---	---	---	25.0	--
11	431.0	--	---	---	---	---	---	---	---	17.0	19.0	66.4
12	430.4	--	---	---	---	---	---	---	---	17.0	19.9	66.2
13	425.6	--	---	---	---	---	---	---	---	15.0	17.0	--
G 2	465.5	7.0	22.0	108.0	126.0	133.5	149.5	165.5	169.0	185.0	192.5	--
3	467.7	14.6	23.0	103.5	123.0	129.5	146.0	159.8	165.5	182.0	190.0	--
4	494.7	15.0	90.0	173.0	192.0	198.5	216.5	232.0*	---	---	---	--
5	490.6	14.0	80.0	163.5	181.0	190.0	205.0	222.5*	---	---	---	--
6	480.2	4.5	50.0	136.5	156.5	164.5	180.0	196.7	199.5	---	---	--

TABLE II (cont.)

Boring Number		Ground Surface Elevation	Depth to Lockport	Depth to Rochester	Depth to Irondequoit	Depth to Williamson	Depth to Lower Sodus	Depth to Reynales	Depth to Furnaceville	Depth to Maplewood	Depth to Thorold	Depth to Grimsby	Depth to Queenston
G	7	459.4	--	10.3	82.5	101.5	107.5	125.0	141.3	144.5	160.7	168.0	--
	8	477.6	8.0	39.0	128.0	148.0	154.0	170.5	187.5	190.5	206.0	---	--
	9	504.0	22.0	84.0	170.5	188.5	196.5	214.5	229.5*	---	---	---	--
	16	492.6	15.5	86.0	165.0	183.0	190.3	207.5	224.0*	---	---	---	--
LK	1	461.1	--	13.5	36.0	54.4	60.6	74.7	88.9	92.0	109.8	113.8	--
	2	482.9	--	24.0	42.4	61.1	67.1	78.9	94.5	98.2	116.9	119.2	--
	3	458.7	--	---	---	---	33.0	45.9	61.4	64.8	84.2	86.5	--
	4	445.3	--	---	---	---	---	28.9	41.2	45.0	63.6	66.3	112.0
	5	491.7	--	31.0	63.3	80.8	86.1	99.5	115.3	119.3	137.3	140.6	--
	6	415.7	--	---	---	---	---	---	---	---	---	20.0	63.5
	7	485.0	--	20.0	83.7	101.0	107.0	120.3	134.9	138.1	---	---	--
	8	424.9	--	---	---	---	---	---	---	---	30.2	32.3	80.6
	9	423.1	--	---	---	---	---	15.5	---	16.3	35.0	37.2	85.6
	10	506.0	--	50.9	70.6	88.8	94.2	107.2	122.4	126.3	144.3	147.8	--
	11	489.2	--	17.5	93.3	111.3	117.6	129.3	145.1	148.3	166.6	171.4	--
	12	411.6	--	---	---	---	---	---	---	---	---	10.8	45.9
	13	414.9	--	---	---	---	---	---	---	15.5	29.1	32.7	78.9
	14	468.5	--	---	53.1	66.3	72.3	86.0	101.1	104.3	122.3	126.7	--
	15	468.8	--	---	50.7	---	---	---	---	---	---	---	--
	16	487.5	--	15.6	92.3	110.0	116.1	128.9	144.5	148.0	165.4	169.2	--
	17	490.0	--	20.5	89.3	106.4	112.4	125.4	140.9	144.3	162.2	166.4	--
	18	504.7	--	43.0	72.5	90.7	96.5	109.3	124.7	128.4	146.4	149.8	--
	19	399.7	--	---	---	---	---	---	---	---	---	11.5	48.8
	20	476.1	--	12.9	66.7	84.3	90.2	103.0	119.2	122.0	140.6	145.4	--
	21	480.6	--	37.5	85.0	103.0	108.8	121.9	137.5	140.7	158.6	163.5	--
LN	1	490.7	--	11.7	41.4	59.4	65.5	77.9	92.0	96.0	114.3	116.9	--
	2	461.0	--	---	---	---	---	8.6	19.0	23.6	41.9	43.9	96.0
	3	491.5	--	---	15.7	28.2	32.4	44.8	60.0	63.8	82.3	83.9	133.0
	4	493.1	--	11.0	30.8	48.6	53.8	66.7	82.0	85.4	103.6	105.0	153.4
	5	493.5	--	7.1	66.1	83.7	89.0	101.3	117.5	121.1	---	136.6	--
	6	492.8	--	14.0	22.0	39.8	45.4	57.2	74.0	76.8	94.7	97.1	142.9
	7	495.6	--	9.2	72.8	90.7	96.2	108.0	123.0	126.9	145.1	147.8	--
LX	1	500.7	--	10.5	88.1	107.0	111.7	124.5	140.2	143.5	---	---	--
	2	502.4	5.5	10.4	104.2	121.9	128.8	140.0	156.2*	---	---	---	--
	3	497.0	5.5	10.0	102.5	121.1	127.1	139.3	154.5*	---	---	---	--
	4	473.2	--	15.5	50.3	67.8	74.0	87.0	102.3	105.8	---	---	--

TABLE II (cont.)

Boring Number	Ground Surface Elevation	Depth to Lockport	Depth to Rochester	Depth to Irondequoit	Depth to Williamson	Depth to Lower Sodus	Depth to Reynales	Depth to Furnaceville	Depth to Maplewood	Depth to Thorold	Depth to Grimsby	Depth to Queenston
LY 1	521.1	7.0	30.7	127.8	148.0	153.3	165.5	180.8	---	---	---	--
2	523.1	6.5	40.1	137.1	154.3	160.0	173.0	190.1*	---	---	---	--
3	517.3	16.8	36.0	133.8	151.5	157.0	169.8	186.8*	---	---	---	--
4	523.5	9.0	37.2	135.3	153.2	158.1	171.3	188.3*	---	---	---	--
5	500.7	13.3	21.8	123.3	140.6	145.4	159.6	176.3*	---	---	---	--
6	508.1	11.0	32.8	131.2	149.4	155.5	---	184.2*	---	---	---	--
7	530.6	5.0	32.3	129.4	146.6	151.4	164.6	182.4*	---	---	---	--
8	529.2	5.0	32.7	128.3	148.4	152.9	165.8	181.3*	---	---	---	--
9	524.4	12.0	35.4	131.1	149.2	153.8	---	184.1*	---	---	---	--
MR 1	503.8	18.0	149.3	---	---	---	---	299.3*	---	---	---	--
2	517.7	11.0	140.7	---	---	---	---	291.7*	---	---	---	--
3	506.1	25.5	152.4	246.2	---	---	---	303.2*	---	---	---	--
4	512.9	21.0	153.3	252.2	---	---	---	308.2*	---	---	---	--
P 101	425.2	--	---	---	---	---	---	---	---	29.0	31.0	--
103	498.0	--	14.0	111.7	129.5	136.8	152.0	164.1	167.7	---	---	--
104	477.5	18.0	102.0	184.5	199.0	209.0	227.3	242.3	245.0	---	---	--
110	390.3	--	---	---	---	20.0	21.5	37.3*	---	---	---	--
SM 1	486.4	1.5	32.0	135.3	---	---	---	188.3*	---	---	---	--
2	483.1	--	18.3	99.9	117.5	123.8	136.2	151.4	155.0	---	---	--
3	498.5	8.0	29.1	125.6	---	---	---	178.1*	---	---	---	--
4	496.7	6.0	37.3	135.6	---	---	---	188.6*	---	---	---	--
5	502.6	15.0	42.0	139.5	---	---	---	192.5*	---	---	---	--
6	492.7	14.0	50.2	---	---	---	---	199.2*	---	---	---	--
7	515.4	9.0	93.2	---	---	---	---	242.2*	---	---	---	--
8	526.1	26.2	119.6	---	---	---	---	269.1*	---	---	---	--
9	524.6	31.0	89.5	---	---	---	---	238.5*	---	---	---	--
10	492.0	7.4	---	---	---	---	---	---	---	---	---	--
11	491.2	15.0	---	---	---	---	---	---	---	---	---	--
12	488.4	4.5	37.1	133.7	---	---	---	186.7*	---	---	---	--
13	492.8	7.6	---	---	---	---	---	---	---	---	---	--
14	499.7	15.0	---	---	---	---	---	---	---	---	---	--
15	497.5	11.5	55.3	150.1	---	---	---	204.1*	---	---	---	--
16	497.0	12.5	---	---	---	---	---	---	---	---	---	--
17	493.8	6.0	---	---	---	---	---	---	---	---	---	--
18	494.6	11.9	---	---	---	---	---	---	---	---	---	--

TABLE II (cont.)

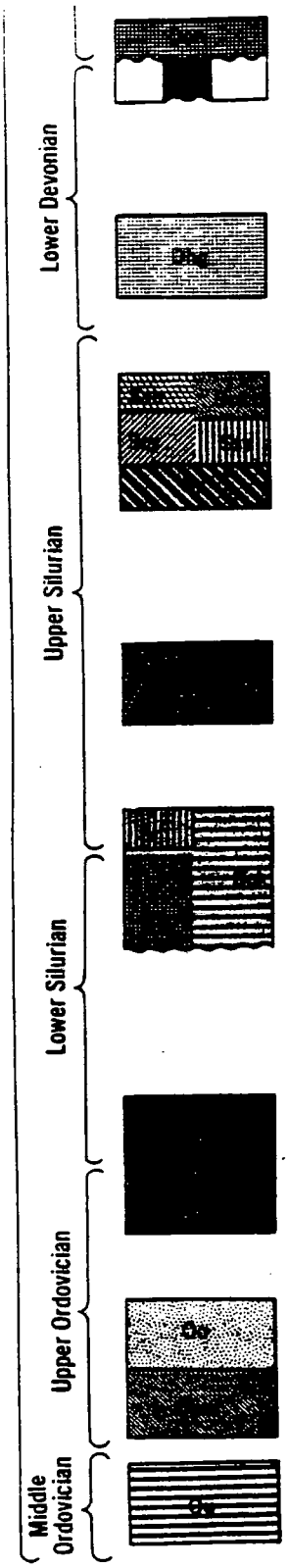
Boring Number	Ground Surface Elevation	Depth to Lockport	Depth to Rochester	Depth to Irondequoit	Depth to Williamson	Depth to Lower Sodus	Depth to Reynales	Depth to Furnaceville	Depth to Maplewood	Depth to Thorold	Depth to Grimsby	Depth to Queenston
SM 19	521.2	24.2	123.9	---	---	---	---	274.9*	---	---	---	--
20	495.0	12.3	53.1	147.7	---	---	---	201.7*	---	---	---	--
21	495.0	5.0	96.5	---	---	---	---	247.5*	---	---	---	--
SN 1	420.1	--	---	---	---	---	23.5	34.6	38.2	56.1	60.2	107.5
2	449.6	--	10.0	25.7	44.2	50.7	64.0	79.5	82.6	101.2	105.6	--
3	467.4	--	10.0	64.8	83.7	91.1	104.2	120.0	123.4	139.5	146.0	--
SP 1	405.1	--	---	---	---	---	---	---	---	---	---	29.0
2	410.7	--	---	---	---	---	---	---	---	---	---	26.0
3	411.2	--	---	---	---	---	---	---	---	---	---	25.3
4	410.4	--	---	---	---	---	---	---	---	---	---	35.0
5	408.7	--	---	---	---	---	---	---	---	---	---	34.5
6	407.0	--	---	---	---	---	---	---	---	---	---	46.5
7	405.3	--	---	---	---	---	---	---	---	---	---	52.0
8	403.6	--	---	---	---	---	---	---	---	---	---	60.0
9	402.1	--	---	---	---	---	---	---	---	---	---	65.5
10	397.2	--	---	---	---	---	---	---	---	---	---	68.0
11	398.6	--	---	---	---	---	---	---	---	---	---	83.5
12	395.5	--	---	---	---	---	---	---	---	---	---	86.0
13	392.5	--	---	---	---	---	---	---	---	---	---	96.5
14	384.1	--	---	---	---	---	---	---	---	---	---	88.3
15	374.6	--	---	---	---	---	---	---	---	---	---	82.7
16	377.4	--	---	---	---	---	---	---	---	---	---	77.7
17	370.9	--	---	---	---	---	---	---	---	---	---	93.0
18	368.1	--	---	---	---	---	---	---	---	---	---	92.5
19	366.0	--	---	---	---	---	---	---	---	---	---	101.4
20	358.6	--	---	---	---	---	---	---	---	---	---	100.8
21	355.0	--	---	---	---	---	---	---	---	---	---	100.0
22	335.9	--	---	---	---	---	---	---	---	---	---	85.4
23	329.8	--	---	---	---	---	---	---	---	---	---	84.4
24	271.5	--	---	---	---	---	---	---	---	---	---	28.5
25	422.9	--	---	---	---	---	---	13.0	15.8	36.0	39.0	84.9
26	416.2	--	---	---	---	---	---	---	---	---	20.5	64.9
27	413.6	--	---	---	---	---	---	---	---	---	10.0	56.6
28	409.3	--	---	---	---	---	---	---	---	---	8.0	41.0
29	406.4	--	---	---	---	---	---	---	---	---	19.5	58.5
30	402.7	--	---	---	---	---	---	---	---	---	---	24.3
32	411.3	--	---	---	---	---	---	---	---	---	10.3	44.3

TABLE II (cont.)

Boring Number		Ground Surface Elevation	Depth to Lockport	Depth to Rochester	Depth to Irondequoit	Depth to Williamson	Depth to Lower Sodus	Depth to Reynales	Depth to Furnaceville	Depth to Maplewood	Depth to Thorold	Depth to Grimsby	Depth to Queenston
SS	1	508.9	8.5	62.7	160.2	---	---	---	212.7*	---	---	---	--
	2	505.7	7.0	30.8	137.5	---	---	---	190.0*	---	---	---	--
	3	507.8	10.2	55.5	151.9	---	---	---	204.4*	---	---	---	--
	4	500.8	10.7	27.7	125.7	---	---	---	178.2*	---	---	---	--
	5	531.3	9.0	101.8	201.4	219.8	224.6	238.5	253.7	256.9	274.8	279.7	--
	6	525.2	12.5	86.6	---	---	---	---	236.1*	---	---	---	--
	7	528.5	11.5	97.8	---	---	---	---	247.3*	---	---	---	--
	8	518.8	14.0	76.3	---	---	---	---	225.8*	---	---	---	--
	9	530.9	10.0	104.3	199.9	217.6	223.7	237.2	252.5	255.8	---	---	--
	10	530.3	7.5	99.0	200.3	217.8	---	---	252.8*	---	---	---	--
	11	532.5	9.5	104.8	198.1	---	---	---	250.6*	---	---	---	--
TC	1	427.8	--	---	---	---	---	---	---	---	---	15.0	50.5
	2	433.3	--	---	---	---	---	---	---	---	---	16.8	54.4
	3	441.6	--	---	---	---	---	---	---	---	---	11.1	61.5
	4	439.1	--	---	---	---	---	---	---	---	---	16.1	57.1
	5	430.9	--	---	---	---	---	---	---	---	---	8.5	46.9
	6	454.4	--	---	---	---	---	---	---	---	26.2	27.5	77.5
	7	435.7	--	---	---	---	---	---	---	---	---	12.0	51.6

NOTES:

1. Depths are in feet from the ground surface. Elevations are referenced to Rochester New City Datum (NCD).
2. N.A. indicates data not available.
3. Depths denoted by an asterisk are estimated depths of the Furnaceville Hematite based on depths to shallower units encountered in the borehole.
4. See Figure 1 for locations of test borings.
5. Test boring data obtained from Monroe County Department of Engineering Sewer Tunnel projects.
6. Refer to accompanying report for additional information.



Don Onondaga Limestone—Seneca, Morehouse (cherty) and Nedrow Limestone Members, Edgecliff cherty Limestone Member, local bioherms.

Do Oriskany Sandstone.

HELDERBERG GROUP
0-200 ft. (0-60 m.)

Dhg Coeymans and Manlius Limestones; Rondout Dolostone.

AKRON DOLOSTONE, COBLESKILL LIMESTONE, AND SALINA GROUP
700-1000 ft. (210-300 m.)

Sab Akron Dolostone; Bertie Formation—dolostone, shale.

Scy Camillus and Syracuse Formations—shale, dolostone, gypsum, salt.

Scc Cobleskill Limestone; Bertie and Camillus Formations—dolostone, shale.

Ssy Syracuse Formation—dolostone, shale, gypsum, salt.

Sv Vernon Formation—shale, dolostone.

LOCKPORT GROUP
80-175 ft. (25-55 m.)

Sl Oak Orchard and Penfield Dolostones, both replaced eastwardly by Sconondoa Formation—limestone, dolostone.

CLINTON GROUP
150-325 ft. (40-100 m.)

Sr Decew Dolostone; Rochester Shale.

Sik Irondequoit Limestone; Williamson Shale; Wolcott Furnace Hematite; Wolcott Limestone; Sodus Shale; Bear Creek Shale; Wallington Limestone; Furnaceville Hematite; Maplewood Shale; Kodak Sandstone.

Scl Herkimer Sandstone; Kirkland Hematite; Willowvale Shale; Westmoreland Hematite; Sauquoit Formation—sandstone, shale; Oneida Conglomerate.

MEDINA GROUP AND QUEENSTON FORMATION
0-900 ft. (0-270 m.)

Sm Medina Group: Grimbsy Formation—sandstone, shale.

Oq Queenston Formation—shale, siltstone.

SmOq Undifferentiated Medina Group and Queenston Formation.

LORRAINE GROUP
700-900 ft. (210-270 m.)

Oo Oswego Sandstone.

Opw Pulaski and Whetstone Gulf Formations—siltstone, shale.

TRENTON GROUP
100-300 ft. (30-90 m.)

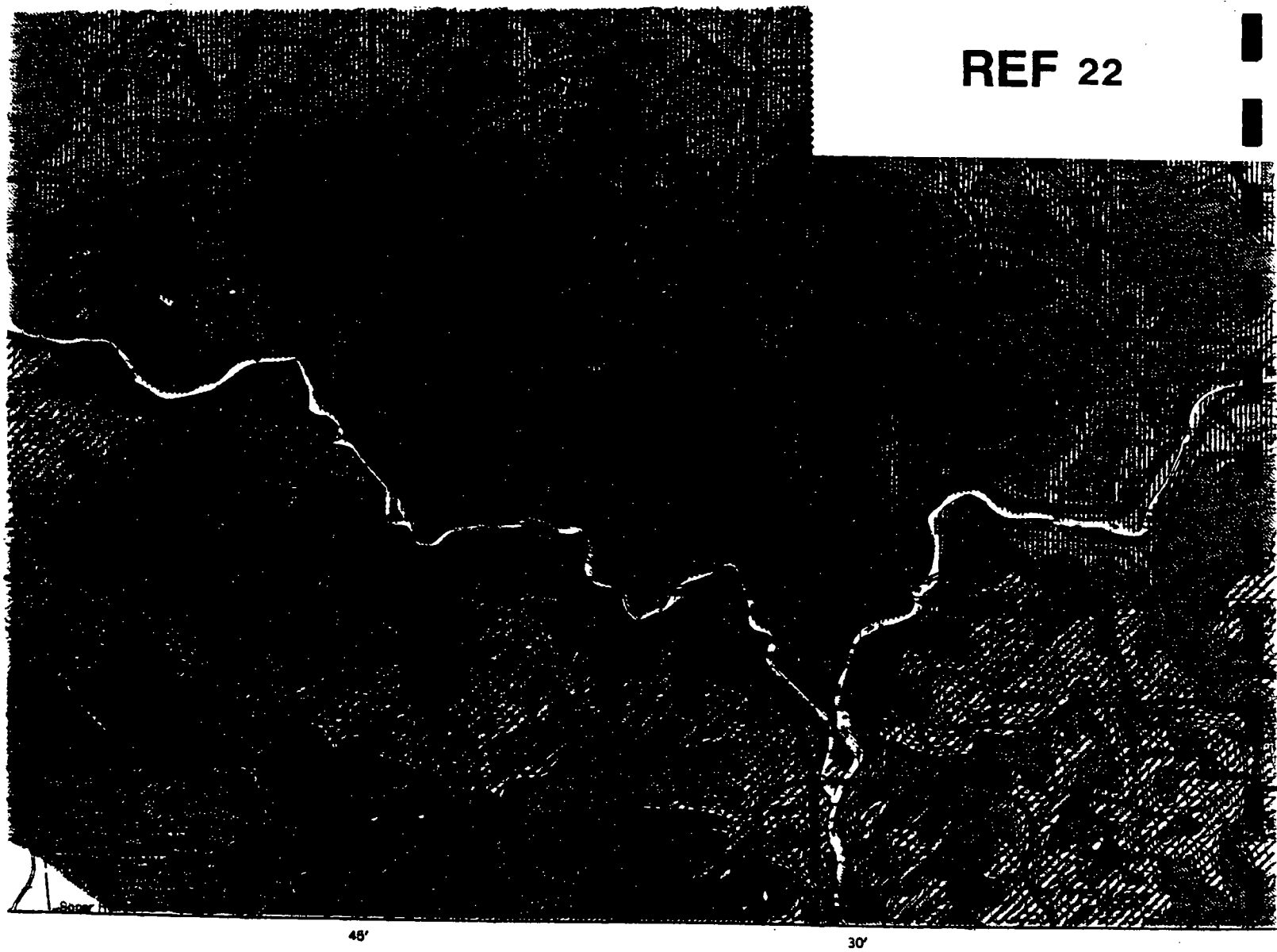
Ou Utica Shale.

MAP SYMBOLS

Observed or approximately located contact.

Conjectural contact; includes projections beneath extensive Quaternary cover and many contacts based on reconnaissance mapping.

REF 22



GEOLOGIC MAP OF NEW YORK

1970

Finger Lakes Sheet

Scale 1:250,000

5 0 5 10 15 Statute Miles 20

5 0 5 10 15 20 25 Kilometers 30

CONTOUR INTERVAL 100 FEET

REYNALES LIMESTONE

Light to medium gray, fine to medium-grained, crystalline, thin-bedded, fossiliferous LIMESTONE, with trace stylolites, and interbeds of dark gray, very thin dolomitic shale. Average thickness of the Reynales Formation in boreholes is 19 ft.

Generally, the Reynales is the most geologically complex formation in the project area. Many of the limestone beds in the Reynales are fossiliferous (most notable are the large, thick shells of the brachiopod Pentamerus) and a few are dolomitic. Some of the thinner beds contain very thin zones of fine-grained quartz silt which are observed to occur anywhere within the formation and usually in minor amounts. In addition, thin siliceous zones and lenses (such as chalcedony or chert) sometimes occur in limestone beds throughout the Reynales. The Reynales also contains a very persistent bed of red, medium-grained, oolitic, fossiliferous, hematitic limestone called the Furnaceville Hematite Member (about 2 to 4 ft. above the base of the Reynales). The Furnaceville serves as a distinctive "marker bed" for structural interpretation.

Very close to moderately close partings occur between beds of differing lithologies or as stylolitic seams in the limestone beds. Frequently, secondary gypsum seams occur along these partings. The shale beds of the formation are often jointed and occasionally sheared. In one borehole, a limestone bed is cut by a high angle, brecciated fault which is well sealed by a secondary deposit of gypsum. In addition, several shale beds are severely altered to clay, particularly below the Furnaceville Member within the bottom two to four feet of the formation.

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LOWER SODUS SHALE

Dark greenish gray to grayish brown SHALE with a few fossils. Average thickness of the Lower Sodus Shale in the boreholes is 13 to 14 ft.

The upper quarter of the formation is dark greenish gray. Immediately below this zone is a zone of varying brownish gray colors with a more prominent brownish zone occurring persistently in the lower half of the formation. The lowermost few feet of the Lower Sodus is invariably dark greenish gray.

Several light gray, thin to very thin, closely to moderately closely spaced shell limestone beds occur in the upper part of the formation. These beds are composed almost exclusively of the brachiopod Coelospira hemispherica. None of these beds were noted near the base of the formation.

Low angle joints occur frequently, but high angle joints also occur. The upper boundary of the Lower Sodus Shale is sometimes marked by a thin to very thin, severely weathered zone immediately below the overlying Williamson Shale. It is noted that the Upper Sodus Shale is not generally recognized in the Rochester area.

374813
MEMO
N & A OF NEW YORK

WILLIAMSON SHALE

Dark greenish gray SHALE with a few fossils, averaging 5 to 6 ft. thick in boreholes.

Several light gray, very thin limestone beds occur in the upper one-third and lower few inches of the formation. In addition, one to several black or dark gray, very thin shale zones containing the distinctive fossil graptolite, Monograptus clintonensis, are present in the lower few inches of the formation. The bottommost limestone bed occurring below the lowest graptolite bed in the formation is considered the contact between the Williamson Shale and the underlying Lower Sodus Shale.

Low angle joints are frequent in the Williamson Shale and high angle joints were also noted.

IRONDEQUOIT LIMESTONE

Light to medium gray, fine to medium-grained, thin to medium-bedded, fossiliferous LIMESTONE interbedded with dark gray, thin to very thin, dolomitic SHALE. Average thickness of the Irondequoit Limestone in boreholes is 18 ft.

The limestone bedding is wavy (individual beds thicken and thin markedly) and the shale beds are thickest in the lower quarter of the formation. Occasionally, trace pits, vugs, and gypsum nodules are present in the Irondequoit, and often secondary gypsum seams occur in closely to moderately closely spaced partings or between shale and limestone beds. The shale beds are frequently jointed and occasionally contain shears. In some areas the shales are severely weathered to clay.

The upper contact of the Irondequoit Limestone with the overlying Rochester Shale is relatively sharp. The contact is placed at the top of the uppermost relatively thick limestone bed underlying the lowermost highly fossiliferous bed which is contained within the Rochester Shale.

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ROCHESTER SHALE

Light to dark gray, fine-grained, fossiliferous, dolomitic MUDSTONE with interbeds of limestone and dolomite. The Rochester Formation is about 95 to 100 ft. thick.

The Rochester is traditionally called a shale, but it is not fissile and is harder and thicker-bedded than a shale. The upper 8 to 12 ft. of the formation consists of thin to very thin, closely to moderately closely spaced dolomite beds and is called the Gates Dolomite Member. From approximately 15 to 25 ft. below the top of the Rochester to the base of the formation, light gray, very thin, moderately closely spaced limestone beds are present. These beds increase in thickness and frequency with depth. The basal few feet of the Rochester are usually darker gray and highly fossiliferous. Some of the very thin limestone beds contain fine quartz silt and are quite dense. These beds usually grade into the overlying and underlying mudstone without any evidence of partings at the boundaries.

Pits, small vugs, gypsum nodules, and calcitic fossils are present in the formation. Pits and vugs occur in trace amounts in the upper Rochester and their frequency decreases downwards. No particular zones of these features are discernable in the cores and they do not always occur at partings. Gypsum nodules vary in size, reaching 0.2 ft. wide in the cores, and occur in trace amounts throughout the formation, very often at partings. Secondary gypsum seams are also present in closely to very closely spaced partings throughout the formation except near the top of rock where the seams may be severely weathered.

Joints are not frequent, but may occur at all angles. They are usually smooth, contain a trace to no gypsum, or may be healed by secondary gypsum seams. Partings occur, usually parallel to the bedding but occasionally dipping at low angles, and almost invariably contain gypsum seams. Although infrequent, partings throughout the Rochester have been noted weathering to clay. In addition, clay beds of up to 0.2 ft. in thickness have been observed. Vertical cracks are frequent in the thin limestone beds.

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LOCKPORT FORMATION

Light to medium gray, fine to medium-grained, thin to medium-bedded, siliceous DOLOMITE. Thickness of the Lockport Dolomite is about 200 ft.

The Lockport Formation includes three members. The uppermost member is called the Oak Orchard Dolomite, and it is known to be over 100 ft. thick in western New York. Underlying the Oak Orchard are the Penfield Dolomite, which is about 75 ft. thick, and the basal Decew Dolomite, which is about 22 ft. thick. The Decew Dolomite exhibits very thin color-banding and mottling in various shades of gray and it is finer-grained than either the Oak Orchard or the Penfield.

Very closely to moderately closely spaced argillaceous partings and stylolites are present throughout the Lockport. The middle 20 ft. of the Penfield Member contains numerous, discontinuous, wavy, argillaceous streaks which roughly parallel the bedding; some are stylolitic. The argillaceous partings in this section of rock are generally parallel to the bedding, except toward the base of the Penfield where a 20 ft. section of dolomite contains wavy and uneven partings which may slope at high angles, may appear as silty bands 1/8 to 1/4 in. thick, and are frequently slickensided, striated shears of small displacement. In the Decew Member, secondary gypsum seams appear in closely to moderately closely spaced partings, and very thin clay partings occur in the basal few feet. Some cross-bedding was observed in the lower 35 ft. of the Penfield Member.

Pits and vugs occur throughout the Lockport; particularly in the Oak Orchard Member. The pits and vugs in the Oak Orchard usually contain crystal linings of dolomite, calcite and quartz over very thin crusts of aragonite. Trace amounts of fluorite, sphalerite, selenite, galena and sulfur also occur in the Oak Orchard. Trace amounts of gypsum nodules were encountered in the upper 20 ft. of the Penfield Member and in the Decew Member.

In boreholes, joints are encountered infrequently within the Lockport Formation, except at shallow depths. The contact between the Lockport (Decew Member) and the Rochester (Gates Member) is gradational. Occasionally, there is a very thin, severely weathered clay parting, but usually the boundary is marked only by an increasing amount of dark dolomitic mudstone between increasingly thinner dolomite beds, in the base of the Decew Member.

LITHOLOGIC DESCRIPTIONS

Lithologic descriptions are general and based on observations of rock core recovered from test borings. They are in general agreement with outcrop exposures. Actual rock conditions may vary over distance and with exposure to weathering.

FILE NO 374813

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A P P E N D I X A

LITHOLOGIC DESCRIPTION SHEETS
from
Observations of Rock Core

by

H & A of New York

June 1981

FILE NO 374813

TABLE III (cont.)

NOTES:

1. Table taken from Lindner, E.N. and Halpern, J.A. (1978) "In-Situ Stress in North America: A Compilation," Int. Jour. Rock Mech. and Mining Sci., v.15:183-203. A brief description of stress measurement techniques is contained therein.

2. Refer to accompanying report for additional information.

TABLE III (cont.)

LOCATION	LATITUDE/ LONGITUDE	STRESS ORIENTATION	LITHOLOGIC UNIT	TECHNIQUE AND COMMENTS
Rochester, NY (cont.)		N32°W		
		N38°W		
		N22°W		
Scarborough, Canada	43°00' 79°16'	N90°E	Shale	Undercoring; tunnel; average of 10 tests
Somerset, NY	43°20' 78°34'	N15°W	Sandstone	Overcoring; outcrop
		N45°W		
		N60°W		
		N15°W		
		N15°W		
		N10°W		
		N15°E		
Sterling, NY	43°17' 76°37'	N22°W	Sandstone	Overcoring; outcrop
		N53°W		
		N72°W		
		N46°W		
Thorold, Canada	43°06' 79°16'	N27°W	Dolomite, dolomitic Limestone, shaly Limestone, Limestone	Overcoring; outcrop; used smaller diamond core barrel than standard
		N88°W		
		N62°E		
		N76°E		
		N60°E		
		N58°E		
		N56°E		
		N60°E		

BIBLIOGRAPHY

For referencing convenience, the bibliography is divided into three sections as follows:

A. GEOLOGIC REFERENCES

B. MAPS

C. ENGINEERING REPORTS

with the faults are usually narrow (about 1 in. to 1 ft. wide) and may have slickensided surfaces. Relatively little significant deterioration of the rock has been noted on either side of the shear zones. The shale units may show slightly greater disturbance. Although a definitive statement about the age of most recent activity cannot be made, historic seismic activity in the region implies that these structures are neither currently active nor related to the Clarendon-Linden Fault trend near Attica.

It appears that a major portion of stratigraphic offset in some areas may be a result of the strata warping rather than faulting. Only a small increase in dip is necessary to explain an apparent 30-foot offset associated with a fault exhibiting only 5 ft. of displacment. The flexures generally show increases in dip up to approximately 5°, the steeper part usually occurring to the north where a reverse dip relationship is displayed. The warping appears to terminate gradually, but over a relatively short distance, as the beds resume their normal dip at the boundaries of the structural corridors. It is noted that several discrete changes in dip may be present within one zone of deformation suggesting more than one flexure or offset may be present in the zone.

Increased joint frequency is also associated with the structural zones. Joints in these areas are continuous and usually strike approximately N80°W. Four additional sets of continuous joints are apparent in Rochester. These sets usually appear as two approximately orthogonal groups striking about N71°E/N16°W and N45°E/N45°W, the former being the most dominant. These joints occur in virtually all lithologic units and are characterized by smooth to rough, nearly vertical, open surfaces, occasionally calcite or gypsum filled, and a spacing of 10 to 20 ft. The orientation and character of joint sets in the Rochester area appears consistent with regional joint sets described in the literature for the Appalachian Plateau province in western New York.

Joint patterns and structural deformation zones generally result from stress imposed on bedrock units. There is evidence, however, suggesting that the stress system present in western New York has changed through time. Although measurements of contemporary horizontal stresses reveal an E to NE maximum principal compressive stress operating at present, the system of jointing, and possibly faulting and warping, may reflect the influence of an ancient stress regime. Nevertheless, it is noted that the present stress regime is considered responsible for many rock squeeze features observed in the Rochester area.

IV. SUMMARY

A substantial amount of stratigraphic and structural information has been obtained through subsurface explorations and a general geologic survey initiated for a recent tunnelling program in Rochester, New York. Information gathered through a literature survey, test borings, surface and subsurface mapping and engineering instrumentation was used to describe the general geologic conditions beneath the city. Geologic conditions are described in text supplement by tables, figures, maps and photographs which illustrate the findings.

Ten sedimentary rock formations of Ordovician and Silurian age are present in the Rochester area. In order of occurrence from top to bottom, they are:

Lockport Dolomite
Rochester Shale
Irondequoit Limestone
Williamson Shale
Lower Sodus Shale
Reynales Limestone
Maplewood Shale
Thorold (Kodak) Sandstone
Grimsby Sandstone
Queenston Shale

Lithologic descriptions for each unit as revealed by test borings are contained in Section 3-03 and in Appendix A. A general stratigraphic profile is presented in Figure 2.

Minor geologic structure in Rochester is revealed by test borings and substantiated by surface and subsurface mapping. In general, it appears that structural deformations occur in at least three discrete zones trending N70°W and N50°W (see Figure 4). The zones may be 2000 to 4000 ft. wide, up to 4 miles long, and display individual offsets of up to 30 ft.

Structural deformation appears to be expressed by a combination of minor faulting, gentle warping and increased joint frequency (see Figure 7 and Photographs 1 through 7). The observed faults are characteristically steeply dipping (greater than 50°), normal faults of small displacement and are most often tight or well-healed in both tunnel exposures and borings. Observed shear zones associated

It is also noted that some authors believe that present day horizontal stresses may merely be the relative effect of uplift and overburden removal since the last ice age. Others believe that they may be in part the influence of contemporary doming in the Adirondack region (Isachsen, 1975).

Although it is very difficult to assess the relative contribution of each possible influence on the present stress regime, Sbar and Sykes (1973) note a consistency in orientation of current stress measurements throughout North America. They conclude that this broad regional pattern is indicative of tectonic stress. Nevertheless, it has been noted that many deformational features (such as jointing, faulting and deformed fossils) in western New York appear to bear no relationship to the E to NE trend of contemporary stress (Engelder, in press). Other features, however, such as rock squeeze phenomena and earthquakes, clearly show the direct effects of this contemporary stress system. It appears that a single model relating rock behavior to stress distribution is not yet available.

1. Natural "pop-ups" of rock outcrops at a distance from and unassociated with excavation, faulting, and postglacial folding (Lo, 1978; Sbar and Sykes, 1973).

2. Direct, inward, lateral movements of open trench excavation and unsupported tunnel walls, as well as bridge foundations and abutments (Rose, 1951; Hogg, 1959; Sbar and Sykes, 1973; Lo, 1978; Quigley et al., 1978; Kulhawy and O'Rourke, 1981).

3. Cracking, buckling or heaving of quarry or tunnel floors and cracking or movement at the springline of tunnel linings (Lo, 1978; Bowen et al., 1976; Kulhawy and O'Rourke, 1981).

In-situ stress measurements in the region are another indicator of stress conditions. Measurements are most frequently recorded using overcoring, undercoring and hydrofracture techniques. Although the values obtained for the orientation and magnitude of principal stress components may vary, generally good agreement between these methods is reported. A brief description of these measurement techniques as well as a compilation of many stress measurements for North America is contained in Lindner and Halpern (1978). Some stress measurements for this region are presented here in Table III. In general, in-situ stress measurements indicate an E to NE maximum compression which may reach up to 2100 psi (Palmer and Lo, 1976). This is not inconsistent with the sense of rock squeeze movements reported to occur between Rochester and Niagara Falls (Rose, 1951).

Current seismic activity is another stress indicator. Stress conditions can be assessed applying the "fault plane solution" technique on recently recorded earthquakes. This method uses the motion of P-waves to determine the trend of principal stress axes. Using this technique, maximum principal stress is also reported to be nearly horizontal and trending E to NE in western New York (Sbar and Sykes, 1973).

Despite the consistency of values reported for the contemporary stress regime, there is substantial evidence that the orientation of principal stresses has changed through time. It is important to note that the current stress system may be defined by present tectonic stress as well as remnant stresses of older systems. While the orientation of current stress is defined by fault plane solutions and in-situ stress measurements, the presence, orientation and magnitude of the past stress regimes is inferred from studies of jointing, faulting and folding as well as solution cleavage and deformed fossils.

In general, jointing in the area is consistent with regional trends defined for western New York (Parker, 1942; Nickelsen and Hough, 1967). Parker describes the dominant joint set in the northwestern part of Appalachian Plateau as striking about N70°E. This set appears as far south as Pennsylvania. Two additional sets are reported by Parker striking N59°E and N20°E to N24°W. The latter set shows a general swing from N24°W in western New York to N20°E in central New York while the other sets maintain a relatively consistent orientation throughout. Nonetheless, the major joint systems in the region appear consistent over relatively small areas. Localized dominant trends are present and overlap dominant trends in adjacent areas (Nickelsen and Hough, 1967).

The origin of joints in the region is discussed extensively in the literature. It is generally believed that both relict principal tectonic stresses and variable principal stresses due to topography, unloading and present tectonic conditions combine to influence joint development. Joint orientation was probably determined by release of stress as the rocks are brought near the surface by uplift and erosion.

3-05. STRESS

The state of stress which exists in a rock mass is important for both structural interpretation and engineering design. Because stress relief associated with excavation can yield significant rock deformations, an awareness of the presence, orientation and magnitude of principal, horizontal rock stresses is essential for the proper design of structures which involve bedrock excavation.

It is known that high horizontal compressive stresses exist at shallow depths throughout western New York. High compressive stress is usually understood to mean stresses which exceed those expected from the effects of lithostatic loading alone (greater than about one-third of the vertical load; Sbar and Sykes, 1973). Most evidence of this contemporary stress comes from engineering observations of rock squeeze, in-situ stress measurements, and seismic activity.

Rock squeeze features are described for many localities in western New York and Ontario, Canada. They most commonly appear as:

Continuous joints in the area are essentially vertical, but dips of up to 80° are noted. These joints are commonly present in the most competent rock units and they may cross lithologic boundaries. It is noted that their character may change when they cross into units with very different properties. Generally, continuous joints range from slightly continuous (3.0 to 10.0 ft. long) to highly continuous (greater than 40.0 ft. in extent). The surfaces of these joints vary from rough to smooth, depending upon lithology. These joints are usually open, except where locally filled by secondary gypsum and calcite. Spacing between the joints occurring in outcrop is normally on the order of 10 to 20 ft. Occasionally, several very closely spaced joints were noted to occur over a span of 1 to 2 ft. Photographs 8, 9 and 10 illustrate highly continuous joints observed.

Joint trends were determined for the continuous joints by recording the total number of joints falling into each 20° range of azimuth (from N0°E). The results for three sections of Rochester and for and for all joints measured are shown on Figure 6. Each shaded sector on the diagrams indicates the strike of the joint set and the sector's length is proportional to the number of joints in that set.

As shown on Figure 6, continuous joints in the area fall into several sectors. On the basis of their orientation and occurrence, two dominant and several subordinate joint sets can be defined. The most dominant sets trend N71°E and N16°W. Two additional sets occur trending about N45°E and N45°W. The prominence of these third and fourth sets varies slightly from outcrop to outcrop, but they are always less conspicuous than the sets striking N71°E and N16°W. These orientations appear consistent throughout the area and generally agree with orientations reported by others (Goldberg, Zoino, Dunnicliff and Associates, 1976; Haley & Aldrich, Inc., 1976, 1978; Kulhawy and O'Rourke, 1981; and others).

In addition, a possible fifth joint set striking approximately N80°W (with an occasional joint oriented 90° to it), occurs in areas of structural deformation previously discussed. This set rarely appears in outcrops. Considering its association with local structural discontinuities, this joint set may possibly represent localized variation in the orientation of the set striking N70°E. It has been noted by others that regional joint systems may be modified by local compressional structural elements (Nickelsen and Hough, 1967).

TABLE III

SUMMARY OF REGIONAL STRESS MEASUREMENTS

LOCATION	LATITUDE/ LONGITUDE	STRESS ORIENTATION	LITHOLOGIC UNIT	TECHNIQUE AND COMMENTS
Alma Township, NY	42°01' 78°04'	N77°E	Sandstone	Hydrofracture; deep borings; average of 3 oil wells
Bradford, PA	41°58' 78°39'	N70°E	Sandstone	Hydrofracture; oil field; sandstone is between layers of shale
Clarendon, NY	43°19' 78°06'	N64°E	Sandstone/ Limestone	Hydrofracture; deep boring
Dale, NY	42°48' 78°10'	E-W?	Sandstone	Hydrofracture; deep boring; orientation questionable
Niagara Falls, NY	43°04' 79°05'	N55°E N34°E	Dolomite	Overcoring; outcrop; conditions probably due to proximity of Niagara Gorge
Port Hope, Canada	43°54' 78°30'	N15°W	Limestone	Overcoring; outcrop
Rochester, NY	43°10' 77°37'	N76°E N80°W N80°W N82°W N86°E N10°E N62°E N18°E N39°E N11°E N76°E	Dolomite	Overcoring; some measurements made near vertical fractures and may not be representative of natural stresses

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TABLE II (cont.)

NOTES:

1. Depths are in feet from the ground surface. Elevations are referenced to Rochester New City Datum (NCD).
2. N.A. indicates data not available.
3. See Figure 1 for locations of test borings.
4. Test boring data obtained from Monroe County Department of Engineering Sewer Tunnel projects.
5. Refer to accompanying report for additional information.

TABLE II (cont.)

BORING NUMBER	GROUND SURFACE ELEVATION	DEPTH TO LOCKPORT	DEPTH TO ROCHESTER	DEPTH TO IRONDEQUOIT	DEPTH TO WILLIAMSON	DEPTH TO LOWER SODUS	DEPTH TO REYNALES	DEPTH TO FURNACEVILLE	DEPTH TO MAPLEWOOD	DEPTH TO THOROLD	DEPTH TO GRIMSBY	DEPTH TO QUEENSTON
SP 26	416.2	--	---	---	---	---	---	---	---	---	20.5	64.9
27	413.6	--	---	---	---	---	---	---	---	---	10.0	56.6
28	409.3	--	---	---	---	---	---	---	---	---	8.0	41.0
29	406.4	--	---	---	---	---	---	---	---	---	19.5	58.5
30	402.7	--	---	---	---	---	---	---	---	---	---	24.3
32	411.3	--	---	---	---	---	---	---	---	---	10.3	44.3
SS 1	508.9	8.5	62.7	160.2	---	---	---	---	---	---	---	--
2	505.7	7.0	30.8	137.5	---	---	---	---	---	---	---	--
3	507.8	10.2	55.5	151.9	---	---	---	---	---	---	---	--
4	500.8	10.7	27.7	125.7	---	---	---	---	---	---	---	--
5	531.3	9.0	101.8	201.4	219.8	224.6	238.5	253.7	256.9	274.8	279.7	--
6	525.2	12.5	86.6	---	---	---	---	---	---	---	---	--
7	528.5	11.5	97.8	---	---	---	---	---	---	---	---	--
8	518.8	14.0	76.3	---	---	---	---	---	---	---	---	--
9	530.9	10.0	104.3	199.9	217.6	223.7	237.2	252.5	255.8	---	---	--
10	530.3	7.5	99.0	200.3	217.8	---	---	---	---	---	---	--
11	532.5	9.5	104.8	198.1	---	---	---	---	---	---	---	--
TC 1	427.8	--	---	---	---	---	---	---	---	---	15.0	50.5
2	433.3	--	---	---	---	---	---	---	---	---	16.8	54.4
3	441.6	--	---	---	---	---	---	---	---	---	11.1	61.5
4	439.1	--	---	---	---	---	---	---	---	---	16.1	57.1
5	430.9	--	---	---	---	---	---	---	---	---	8.5	46.9
6	454.4	--	---	---	---	---	---	---	---	26.2	27.5	77.5
7	435.7	--	---	---	---	---	---	---	---	---	12.0	51.6

TABLE II (cont.)

BORING NUMBER	GROUND SURFACE ELEVATION	DEPTH TO LOCKPORT	DEPTH TO ROCHESTER	DEPTH TO IRONDEQUOIT	DEPTH TO WILLIAMSON	DEPTH TO LOWER SODUS	DEPTH TO REYNALES	DEPTH TO FURNACEVILLE	DEPTH TO MAPLEWOOD	DEPTH TO THOROLD	DEPTH TO GRIMSBY	DEPTH TO QUEENSTON
SN 1	420.1	--	---	---	---	---	23.5	34.6	38.2	56.1	60.2	107.5
2	449.6	--	10.0	25.7	44.2	50.7	64.0	79.5	82.6	101.2	105.6	---
3	467.4	--	10.0	64.8	83.7	91.1	104.2	120.0	123.4	139.5	146.0	---
SP 1	405.1	--	---	---	---	---	---	---	---	---	---	29.0
2	410.7	--	---	---	---	---	---	---	---	---	---	26.0
3	411.2	--	---	---	---	---	---	---	---	---	---	25.3
4	410.4	--	---	---	---	---	---	---	---	---	---	35.0
5	408.7	--	---	---	---	---	---	---	---	---	---	34.5
6	407.0	--	---	---	---	---	---	---	---	---	---	46.5
7	405.3	--	---	---	---	---	---	---	---	---	---	52.0
8	403.6	--	---	---	---	---	---	---	---	---	---	60.0
9	402.1	--	---	---	---	---	---	---	---	---	---	65.5
10	397.2	--	---	---	---	---	---	---	---	---	---	68.0
11	398.6	--	---	---	---	---	---	---	---	---	---	83.5
12	395.5	--	---	---	---	---	---	---	---	---	---	86.0
13	392.5	--	---	---	---	---	---	---	---	---	---	96.5
14	384.1	--	---	---	---	---	---	---	---	---	---	88.3
15	374.6	--	---	---	---	---	---	---	---	---	---	82.7
16	377.4	--	---	---	---	---	---	---	---	---	---	77.7
17	370.9	--	---	---	---	---	---	---	---	---	---	93.0
18	368.1	--	---	---	---	---	---	---	---	---	---	92.5
19	366.0	--	---	---	---	---	---	---	---	---	---	101.4
20	358.6	--	---	---	---	---	---	---	---	---	---	100.8
21	355.0	--	---	---	---	---	---	---	---	---	---	100.0
22	335.9	--	---	---	---	---	---	---	---	---	---	85.4
23	329.8	--	---	---	---	---	---	---	---	---	---	84.4
24	271.5	--	---	---	---	---	---	---	---	---	---	28.5
25	422.9	--	---	---	---	---	---	13.0	15.8	36.0	39.0	84.9

TABLE II (cont.)

BORING NUMBER	GROUND SURFACE ELEVATION	DEPTH TO LOCKPORT	DEPTH TO ROCHESTER	DEPTH TO IRONDEQUOIT	DEPTH TO WILLIAMSON	DEPTH TO LOWER SODUS	DEPTH TO REYNALES	DEPTH TO FURNACEVILLE	DEPTH TO MAPLEWOOD	DEPTH TO THOROLD	DEPTH TO GRIMSBY	DEPTH TO QUEENSTON
MR 1	503.8	18.0	149.3	---	---	---	---	---	---	---	---	--
2	517.7	11.0	140.7	---	---	---	---	---	---	---	---	--
3	506.1	25.5	152.4	246.2	---	---	---	---	---	---	---	--
4	512.9	21.0	153.3	252.2	---	---	---	---	---	---	---	--
P 101	425.2	--	---	---	---	---	---	---	---	29.0	31.0	--
103	498.0	--	14.0	111.7	129.5	136.8	152.0	164.1	167.7	---	---	--
104	477.5	18.0	102.0	184.5	199.0	209.0	227.3	242.3	245.0	---	---	--
110	390.3	--	---	---	---	20.0	21.5	---	---	---	---	--
SM 1	486.4	1.5	32.0	135.3	---	---	---	---	---	---	---	--
2	483.1	--	18.3	99.9	117.5	123.8	136.2	151.4	155.0	---	---	--
3	498.5	8.0	29.1	125.6	---	---	---	---	---	---	---	--
4	496.7	6.0	37.3	135.6	---	---	---	---	---	---	---	--
5	502.6	15.0	42.0	139.5	---	---	---	---	---	---	---	--
6	492.7	14.0	50.2	---	---	---	---	---	---	---	---	--
7	515.4	9.0	93.2	---	---	---	---	---	---	---	---	--
8	526.1	26.2	119.6	---	---	---	---	---	---	---	---	--
9	524.6	31.0	89.5	---	---	---	---	---	---	---	---	--
10	492.0	7.4	---	---	---	---	---	---	---	---	---	--
11	491.2	15.0	---	---	---	---	---	---	---	---	---	--
12	488.4	4.5	37.1	133.7	---	---	---	---	---	---	---	--
13	492.8	7.6	---	---	---	---	---	---	---	---	---	--
14	499.7	15.0	---	---	---	---	---	---	---	---	---	--
15	497.5	11.5	55.3	150.1	---	---	---	---	---	---	---	--
16	497.0	12.5	---	---	---	---	---	---	---	---	---	--
17	493.8	6.0	---	---	---	---	---	---	---	---	---	--
18	494.6	11.9	---	---	---	---	---	---	---	---	---	--
19	521.2	24.2	123.9	---	---	---	---	---	---	---	---	--
20	495.0	12.3	53.1	147.7	---	---	---	---	---	---	---	--
21	495.0	5.0	96.5	---	---	---	---	---	---	---	---	--

TABLE II (cont.)

BORING NUMBER	GROUND SURFACE ELEVATION	DEPTH TO LOCKPORT	DEPTH TO ROCHESTER	DEPTH TO IRONDEQUOIT	DEPTH TO WILLIAMSON	DEPTH TO LOWER SODUS	DEPTH TO REYNALES	DEPTH TO FURNACEVILLE	DEPTH TO MAPLEWOOD	DEPTH TO THOROLD	DEPTH TO GRIMSBY	DEPTH TO QUEENSTON
LY 7	530.6	5.0	32.3	129.4	146.6	151.4	164.6	---	---	---	---	---
8	529.2	5.0	32.7	128.3	148.4	152.9	165.8	---	---	---	---	---
9	524.4	12.0	35.4	131.1	149.2	153.8	---	---	---	---	---	---
LK 1	461.1	--	13.5	36.0	54.4	60.6	74.7	88.9	92.0	109.8	113.8	---
2	482.9	--	24.0	42.4	61.1	67.1	78.9	94.5	98.2	116.9	119.2	---
3	458.7	--	---	---	---	33.0	45.9	61.4	64.8	84.2	86.5	---
4	445.3	--	---	---	---	---	28.9	41.2	45.0	63.6	66.3	112.0
5	491.7	--	31.0	63.3	80.8	86.1	99.5	115.3	119.3	137.3	140.6	---
6	415.7	--	---	---	---	---	---	---	---	---	20.0	63.5
7	485.0	--	20.0	83.7	101.0	107.0	120.3	134.9	138.1	---	---	---
8	424.9	--	---	---	---	---	---	---	---	30.2	32.3	80.6
9	423.1	--	---	---	---	---	15.5	---	16.3	35.0	37.2	85.6
10	506.0	--	50.9	70.6	88.8	94.2	107.2	122.4	126.3	144.3	147.8	---
11	489.2	--	17.5	93.3	111.3	117.6	129.3	145.1	148.3	166.6	171.4	---
12	411.6	--	---	---	---	---	---	---	---	---	10.8	45.9
13	414.9	--	---	---	---	---	---	---	15.5	29.1	32.7	78.9
14	468.5	--	---	53.1	66.3	72.3	86.0	101.1	104.3	122.3	126.7	---
15	468.8	--	---	50.7	---	---	---	---	---	---	---	---
16	487.5	--	15.6	92.3	110.0	116.1	128.9	144.5	148.0	165.4	169.2	---
17	490.0	--	20.5	89.3	106.4	112.4	125.4	140.9	144.3	162.2	166.4	---
18	504.7	--	43.0	72.5	90.7	96.5	109.3	124.7	128.4	146.4	149.8	---
19	399.7	--	---	---	---	---	---	---	---	---	11.5	48.8
20	476.1	--	12.9	66.7	84.3	90.2	103.0	119.2	122.0	140.6	145.4	---
21	480.6	--	37.5	85.0	103.0	108.8	121.9	137.5	140.7	158.6	163.5	---
LX 1	500.7	--	10.5	88.1	107.0	111.7	124.5	140.2	143.5	---	---	---
2	502.4	5.5	10.4	104.2	121.9	128.8	140.0	---	---	---	---	---
3	497.0	5.5	10.0	102.5	121.1	127.1	139.3	---	---	---	---	---
4	473.2	--	15.5	50.3	67.8	74.0	87.0	102.3	105.8	---	---	---

TABLE II (cont.)

BORING NUMBER	GROUND SURFACE ELEVATION	DEPTH TO LOCKPORT	DEPTH TO ROCHESTER	DEPTH TO IRONDEQUOIT	DEPTH TO WILLIAMSON	DEPTH TO LOWER SODUS	DEPTH TO REYNALES	DEPTH TO FURNACEVILLE	DEPTH TO MAPLEWOOD	DEPTH TO THOROLD	DEPTH TO GRIMSBY	DEPTH TO QUEENSTON
DE 1	445.1	--	---	---	---	---	19.5	31.3	33.1	54.5	56.1	--
2	447.9	--	---	---	---	---	---	---	30.3	41.7	43.5	91.4
3	415.8	--	---	---	---	---	---	---	---	---	23.5	34.2
4	452.7	--	---	10.0	18.6	23.1	36.2	52.1	55.8	74.6	77.0	--
5	445.9	--	---	---	---	---	21.5	23.2	26.6	45.3	47.7	96.4
6	412.5	--	---	---	---	---	---	---	---	---	14.6	26.6
7	411.1	--	---	---	---	---	---	---	---	---	24.5	31.3
8	428.7	--	---	---	---	---	---	---	---	13.5	14.4	--
9	431.1	--	---	---	---	---	---	---	---	12.6	14.0	--
10		--	---	---	---	---	---	---	---	---	25.0	--
11	431.0	--	---	---	---	---	---	---	---	17.0	19.0	66.4
12	430.4	--	---	---	---	---	---	---	---	17.0	19.9	66.2
13	425.6	--	---	---	---	---	---	---	---	15.0	17.0	--
G 2	465.5	7.0	22.0	108.0	126.0	133.5	149.5	165.5	169.0	185.0	192.5	--
3	467.7	14.6	23.0	103.5	123.0	129.5	146.0	159.8	165.5	182.0	190.0	--
4	494.7	15.0	90.0	173.0	192.0	198.5	216.5	---	---	---	---	--
5	490.6	14.0	80.0	163.5	181.0	190.0	205.0	---	---	---	---	--
6	480.2	4.5	50.0	136.5	156.5	164.5	180.0	196.7	199.5	---	---	--
7	459.4	--	10.3	82.5	101.5	107.5	125.0	141.3	144.5	160.7	168.0	--
8	477.6	8.0	39.0	128.0	148.0	154.0	170.5	187.5	190.5	206.0	---	--
9	504.0	22.0	84.0	170.5	188.5	196.5	214.5	---	---	---	---	--
16	492.6	15.5	86.0	165.0	183.0	190.3	207.5	---	---	---	---	--
LY 1	521.1	7.0	30.7	127.8	148.0	153.3	165.5	180.8	---	---	---	--
2	523.1	6.5	40.1	137.1	154.3	160.0	173.0	---	---	---	---	--
3	517.3	16.8	36.0	133.8	151.5	157.0	169.8	---	---	---	---	--
4	523.5	9.0	37.2	135.3	153.2	158.1	171.3	---	---	---	---	--
5	500.7	13.3	21.8	123.3	140.6	145.4	159.6	---	---	---	---	--
6	508.1	11.0	32.8	131.2	149.4	155.5	---	---	---	---	---	--

TABLE II (cont.)

BORING NUMBER	GROUND SURFACE ELEVATION	DEPTH TO LOCKPORT	DEPTH TO ROCHESTER	DEPTH TO IRONDEQUOIT	DEPTH TO WILLIAMSON	DEPTH TO LOWER SODUS	DEPTH TO REYNALES	DEPTH TO FURNACEVILLE	DEPTH TO MAPLEWOOD	DEPTH TO THOROLD	DEPTH TO GRIMSBY	DEPTH TO QUEENSTON
B 514	452.7	--	---	11.5	16.2	24.2	36.5	52.5	55.9	---	---	--
515	483.1	--	34.4	---	---	---	---	---	---	---	---	--
516	423.0	--	---	---	---	---	---	---	---	---	21.0	46.2
B 601	517.5	15.5	140.2	236.6	255.1	259.4	275.9	292.2	295.1	---	---	--
602	528.3	--	7.5	89.5	107.6	112.0	124.5	139.8	143.7	161.0	164.8	--
603	496.3	--	16.5	21.5	39.8	44.7	56.4	72.0	75.8	93.9	96.1	--
C 1	490.2	7.0	128.0	212.5	---	---	---	---	---	---	---	--
3	463.8	4.5	25.0	109.0	128.0	135.0	153.0	168.8	171.0	188.0	194.0	--
4	469.3	8.0	35.0	124.0	141.0	150.0	167.0	184.0	187.0	---	---	--
6	469.0	9.5	46.5	131.0	148.5	156.5	173.5	190.5	193.0	---	---	--
8	485.9	6.5	110.0	201.0	---	---	---	---	---	---	---	--
9	486.8	31.5	90.0	183.0	201.0	208.0	---	---	---	---	---	--
15	470.7	5.5	45.0	143.0	159.0	166.5	184.0	---	---	---	---	--
16	467.4	12.5	76.0	156.0	175.5	182.5	---	---	---	---	---	--
17	487.9	8.5	122.0	205.0	---	---	---	---	---	---	---	--
20	455.6	--	17.6	87.0	105.0	112.0	129.3	N.A.	148.6	165.0	173.8	--
D 1	444.5	--	6.5	56.0	74.0	81.0	99.0	114.1	117.5	132.5	141.0	--
3	452.0	--	10.8	69.5	90.0	96.5	114.0	129.9	133.0	150.0	157.5	--
4	431.4	--	10.0	29.0	46.5	55.0	72.0	87.7	91.0	106.5	116.5	--
7	402.3	--	---	---	---	---	36.0	46.8	50.0	64.5	69.5	--
8	397.2	--	---	---	---	---	---	---	---	62.0	64.5	117.5
13	380.4	--	---	---	---	---	---	---	---	---	62.0	93.0
19	424.5	--	---	13.0	30.5	39.0	57.0	N.A.	73.5	89.5	99.8	--

TABLE II

SUMMARY OF SELECTED BOREHOLE DATA

BORING NUMBER	GROUND SURFACE ELEVATION	DEPTH TO LOCKPORT	DEPTH TO ROCHESTER	DEPTH TO IRONDEQUOIT	DEPTH TO WILLIAMSON	DEPTH TO LOWER SODUS	DEPTH TO REYNALES	DEPTH TO FURNACEVILLE	DEPTH TO MAPLEWOOD	DEPTH TO THOROLD	DEPTH TO GRIMSBY	DEPTH TO QUEENSTON
AL 1	520.4	10.0	46.2	145.9	---	---	---	---	---	---	---	--
2	518.8	14.5	38.8	134.8	152.2	157.3	170.7	---	---	---	---	--
3	524.2	14.0	74.6	---	---	---	---	---	---	---	---	--
4	517.9	19.0	48.7	145.9	---	---	---	---	---	---	---	--
5	521.5	17.0	59.3	---	---	---	---	---	---	---	---	--
6	519.4	15.9	68.7	---	---	---	---	---	---	---	---	--
7	532.5	10.5	95.0	---	---	---	---	---	---	---	---	--
8	517.4	17.5	42.8	139.1	156.2	---	---	---	---	---	---	--
9	541.2	11.5	123.7	223.9	240.9	---	---	---	---	---	---	--
10	539.9	8.5	116.0	---	---	---	---	---	---	---	---	--
11	540.6	17.0	109.0	---	---	---	---	---	---	---	---	--
12	526.7	12.5	50.0	152.0	169.5	---	---	---	---	---	---	--
13	520.0	16.0	64.6	163.3	---	---	---	---	---	---	---	--
14	531.5	20.0	86.3	---	---	---	---	---	---	---	---	--
B 501	546.6	10.5	125.5	---	---	---	---	---	---	---	---	--
502	504.8	11.2	29.8	128.9	146.5	154.4	---	---	---	---	---	--
503	528.5	7.0	36.0	134.5	151.2	156.7	170.0	---	---	---	---	--
504	495.1	--	10.0	68.5	85.0	91.4	104.5	119.2	122.8	139.2	142.0	--
505	455.3	--	---	---	---	---	---	---	25.0	29.0	29.8	79.5
506	410.4	--	---	---	---	---	---	---	---	---	26.0	34.2
507	530.2	10.0	---	---	---	---	---	---	---	---	---	--
508	530.5	7.3	---	---	---	---	---	---	---	---	---	--
509	518.1	16.0	---	---	---	---	---	---	---	---	---	--
510	519.9	11.0	36.0	---	---	---	---	---	---	---	---	--
511	496.5	11.0	53.2	---	---	---	---	---	---	---	---	--
512	468.3	--	16.6	---	---	---	---	---	---	---	---	--
513	510.1	10.1	18.5	106.2	---	---	---	---	---	---	---	--

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with a thin gray shaly bed in the middle of the Grimsby Sandstone. By comparison with the adjacent borings it has been determined that approximately 19 feet of rock are missing between the shear surfaces including two feet of Maplewood, all the Thorold, and about 12 to 14 feet of upper Grimsby. The lower surface of the shear zone is distinctly slickensided and is a sharp contact. The upper surface in the Maplewood is slightly more disturbed, but the narrow interval shows relatively little significant deterioration of the rock on either side. The slickensided lower surface has a dip of approximately 50 to 55 degrees.

Thus, in the case of this single fault, the stratigraphic anomaly between LN-5 and LN-1 can be explained as a narrow, discrete fault with 19± feet of displacement. The fault dips moderately steeply and is assumed to be a normal fault dipping to the southwest.

In summary, the general nature of faults that have been observed in the Barge Canal, the Culver-Goodman Tunnel, the Genesee River gorge, and in test borings LN-5 and LK-7 consists of NW-trending normal faults with dips greater than 50 degrees. The thickness of individual shear zones along the faults varies from about an inch to a foot in width. The greater widths of disturbance are associated with the shale lithologies, especially as seen in the Genesee gorge. For more information about the location and nature of other zones of low quality bedrock, the reader is referred to the Geotechnical Data Reports, specifically the test boring logs.

e. JOINTING

In general, jointing within the study area occurs in virtually all units, both in borings and in outcrop where they may be more pronounced due to the influence of weathering processes. Joint orientation, spacing and frequency appear to be consistent within a particular lithologic unit but not necessarily between them.

In general, joints in the area are both continuous and discontinuous. Continuous joints extend from 3.0 ft. to more than 40.0 ft. along their strike whereas discontinuous joints are relatively short (less than 3.0 ft.) and are generally confined to one lithologic unit. Discontinuous joints in the area are characteristically tight (or slightly open where weathered), curved fractures which often terminate in bedding planes. They are responsible for the blocky appearance often displayed in the sandstones and limestones. Although numerous in most lithologic units, the highest number of discontinuous joints occurs in the shales.

In summary, the best composite view of the apparent structural style of the "zones" of deformation appears to be the 2000-foot section in the Barge Canal north of Lyell Avenue (see Figures 4 and 7, and Photographs 4 through 7). This structure is visible only when the canal is drained to a low water level during the winter months. The apparent undulation of the Furnaceville datum across all the zones of deformation implies that structures are more deep-seated than and unrelated to simple shallow glacial deformation. The structures do not greatly influence the regional dip or strike of the rocks and are therefore probably not the boundaries of large-scale tilted fault blocks, but merely narrow wrinkle-like compressional features superimposed on the regional dip of the rocks.

Some of the structures may be sub-parallel to one of the minor northwesterly joint sets and involve 2000 to 4000-foot wide zones ~~of deformation that include open folds, small faults, and increased joint frequency.~~

The structural offsets observed in the boring data are apparently preglacial, as the rock surface has been glacially scoured so as to remove the structural relief observable within the limits of the present data.

~~Many of the zones of apparent structural offset cannot be~~ located more ~~closely than~~ within 200 ~~to 1000~~ ft. (the distance ~~between borings). Thus it is presently impossible to determine what percentage of the deformation is faulting and what is due to gentle warping.~~ If the structures are basically compressional with superimposed tensional features (of younger age), it is likely that both gentle folding and associated minor faulting are involved within the major zones of deformation.

d. NATURE OF INDIVIDUAL FAULT ZONES

During the later part of the investigation, a conspicuous fault was intersected in boring LN-5, located between LaGrange and Newbury Streets, north of Driving Park Avenue. ~~This boring is located just north of the large offset inferred to be located close to Driving Park Avenue.~~ Comparison of this boring with the Furnaceville datum approximately 800 ft. north in boring LN-1 indicates an apparent offset of about 17 or 18 ft., based on the average regional dip.

The shear zone in boring LN-5 is a narrow (approximately 2 in.) zone where the base of the Maplewood Shale is in contact

this structural zone appears in the Genesee River gorge about 700 ft. north of the Veterans Memorial Bridge where an anomalous dip of the strata was noted. In addition, some small offsets may be present along the NW projection of this trend in the vicinity of Eastman Avenue (see Figures 1 and 4). This structural trend, however, seems to die out to the southeast. When projecting the Furnaceville datum from Norton St. southeastward to borings drilled for the Culver-Goodman Tunnel (see Figure 1), little deformation is obvious. This lends further support to the interpretation that the broad deformational zones consist of a series of flexures or small en echelon faults whose compensating offsets do not necessarily greatly disturb the regional dip of the strata along the strike of the structural zone itself. Only profiles which cross the features show anomalous stratigraphic discontinities or dip reversals, and these occur only over relatively short distances.

It is notable that a small fault exposed in the Culver-Goodman Tunnel south of Norton Street near Densmore Creek has a trend of approximately N55°W. This trend is roughly parallel to the presumed trend of all the structures except the one intersecting the Barge Canal. One additional potential zone of deformation appears in the extreme SW corner of the project area (zone D on Figure 4). Between Buffalo Road and Chili Avenue, a series of small offsets appear likely, but their trend can only be presumed parallel to those farther north. The existence of this additional deformation as well as the fault exposed in the Culver-Goodman Tunnel, suggest that other deformational zones may be present in other parts of the city.

Additional support for a fault or fold zone explanation for the observed stratigraphic offsets was sought from a survey of older sewer tunnels on the west side of the river. Partial support for the existence and trend of the features in the vicinity of Lexington Avenue was obtained. Sets of joints in the existing Lexington Ave. sewer tunnel trending N80°W, N60°W, and N10°E were observed near lined sections west of Dewey Ave. Three sections of this tunnel were lined in areas compatible with the projected intersections of significant stratigraphic offset zones. These are between Dewey Ave. and Maryland St., from Lake Ave. to Tacoma St., and west of Starling St. (see Figures 1 and 4). Very small faults were also observed near the west end of the Lexington Avenue sewer tunnel in a smaller branch line coming from Malvern Ave. The lined portion of this same branch sewer is also in line with the projected zone of deformation that crosses Lexington Ave. east of Tacoma St. (see Figure 4).

The second major zone of deformation (zone B on Figure 4) appears to trend in a more northerly direction (N50°W) with its southern edge roughly parallel to and south of Driving Park Avenue and its northern limit near a parallel line through the lower falls of the Genesee River (a belt approximately 4000 ft. wide). Within this zone there are at least two separate intervals with projected vertical stratigraphic offsets in excess of 30 ft. over horizontal distances of 2000 ft. Strata in the center of the zone of deformation (along Lexington Ave.) are structurally 30 ft. lower than equivalent rock units to the NE or SW. However, the amount of displacement seems to decrease along the structure toward the NW and the SE. As many as 5 separate changes in dip (across discrete flexures and/or minor faults) are required to explain the anomalous offsets of strata in adjacent borings. The trend of this zone of deformation is inferred to be oriented in a more northerly direction than the zone intersecting the Barge Canal (refer to Figure 4) because of its possible relation to the termination of the Irondequoit Limestone scarp to the NW and the absence of compatible structures of equivalent magnitude in the Genesee River gorge north of the Middle Falls. The lack of adequate rock exposures and the parallel trend of the Genesee River south of the Upper Falls preclude observations in the area where the structure might cross the river along its southeastern end. However, the southern edge of the zone near the river corresponds with a series of 3 former water falls near Broad Street that were blasted away in the early 1820's during canal construction. Nevertheless, the southeastward projection of this second zone of structural deformation intersects the Barge Canal structural trend (zone A on Figure 4) in an area where the regional dip appears anomalously flat in three widely-spaced borings (MR1, MR3, and MR4). The structure may have a cross-section similar to that seen in the Barge Canal north of Lyell Avenue (minor faults and open folds), but it appears to involve a greater downwarping of the central portion of the zone, and a greater number of dip changes are inferred from the numerous borings along the west edge of the Genesee River gorge. The lack of borings east of the river between East Avenue and Interstate Route 490 East prevents definition of the structure where the two trends appear to intersect.

A third corridor of structural deformation with an assumed NW trend, possibly parallel to the Driving Park structure zone, crosses Norton Street on the east side of the river between the gorge and Carter Street (zone C on Figure 4). There are only 5 widely spaced borings which define this zone, but anomalous offsets of 5 ft. to 15 ft. are apparent between each set of adjacent holes. Supporting evidence of

c. STRUCTURAL ZONES

The best exposed structural zone (zone A in Figure 4) is visible in the New York State Barge Canal (see Figure 7 and Photographs 4 through 7). This structure trends approximately N70°W and appears to be the most continuous and uniform structure in the project area. It appears to be a faulted anticlinal flexure with a somewhat broader synclinal warp to the north. The north side of the small anticline has a steeper dip, reverse to the regional trend, and both folds show a concentration of jointing and small faults near the center of the flexures. In general, dips are steeper (5°) than the regional trend (0.5°) on the flanks of the 2000-foot wide exposed zone.

It is noted that if such a structure were encountered in borings without any surface exposures for comparison, the interpreted sense of any projected faulting or warping would be entirely dependent on the location of adjacent borings. Two borings randomly located on such a structure could suggest either normal or reverse faulting. Borings drilled along the southeastward projection of the trend of the canal structure demonstrate this effect (see Figure 4). The magnitudes of the individual flexures and small faults undoubtedly increase or decrease, or die out, along the strike as interpreted from the borings and as observed at the canal and in the gorge.

North of the canal, an unusual NW trending flexure was also encountered in the excavations for the new Resource Recovery Center on Emerson Street. This feature and others have been attributed to surficial thrust deformation of the near-surface bedrock by glacial readvances. Although apparently an accurate explanation for a similar feature occurring in Densmore Creek near Irondequoit Bay (Andrews, 1980), the Emerson Street feature may be part of the adjacent barge canal structure. Borings east of Mt. Read Blvd. along this trend also indicate the structural zone is wider than the section visible at the canal.

It is interesting, and perhaps not coincidental, that the glaciated escarpment to the north, capped by the Irondequoit Limestone, contains two significant erosional reentrants which are aligned with the two most prominent structural trends on the structure contour map. These reentrants appear near the intersection of the Barge Canal with Elmgrove Road and near the intersection of Mt. Read Blvd. with Ridgeway Avenue. Differential ice erosion of structurally weakened zones in the escarpment could explain the observed relationships.

allow a reasonably accurate structure contour map (Figure 4) to be compiled. It should be noted that the zones of structural deformation, whether potential folds or minor faults, are indicated by relatively abrupt changes between adjacent pairs of borings with magnitudes in excess of the anticipated stratigraphic variations for equivalent distances.

b. ROCK STRUCTURE

The regional strike and dip of the local rock units is best defined by widely spaced borings located away from zones of apparent anomalous deformation. The structural anomalies that are present do not greatly affect the results of strike and dip calculations when stratigraphic horizons are projected over distances of a mile or more from individual structures.

The greatest stratigraphic anomalies are apparent in subsurface profiles constructed in approximately NE-SW directions, whereas the least variation is apparent in borings aligned in NW-SE directions.

After reviewing available boring data and eliminating the areas of obvious local anomalies, the regional dip of the strata is best approximated as 50 feet per mile in a SSE direction (S15^{o}E) with a strike of N75^{o}E.

It was initially assumed that the structural offsets were parallel to one of the NW trending joint sets because of the pattern of stratigraphic displacements in the initial borings. However, upon further examination, it was determined that the zones of structural deformation do not necessarily follow major joint trends. Apparent localization of several offsets in the Lake Avenue borings along the west side of the Genesee River resulted in a search to locate visible structures in the gorge. One boring, LK-7, intersected a narrow shear (less than one ft.). Subsequently, a southerly dipping normal fault trace with about 5 ft. of displacement was discovered in the same vicinity on the west side of the gorge. Its location is consistent with a northwest trend toward boring LK-7. The SE continuation of this feature is parallel to the trend of the gorge itself and was not traceable to the east side. Two other zones of anomalous dips and small faults with similar projected NW trends were located north of the lower falls (see Figure 4 and Photographs 1, 2 and 3). All the structures show a tendency to change rapidly along strike, such that they contrast in appearance on either side of the gorge.

a. STRATIGRAPHIC CORRELATIONS

The Furnaceville Hematite Member of the Reynales Limestone was used as the datum whenever possible for strike and dip calculations and structure contour mapping. For those borings that did not intersect the Furnaceville the next highest contact penetrated was used to extrapolate the elevation of the hematite. In most cases the top of the Irondequoit or the Reynales Limestone was used. In other cases the Lockport/Rochester contact was the only horizon available for structural analysis.

The total thickness of the section from the top of the Irondequoit to the top of the Furnaceville Hematite averages between 52 and 53 ft. west of the Genesee River, except in the vicinity of Mt. Read Blvd. A thinning of the section to 50 ft. occurs along a corridor from Lyell Ave. (B503) north to Driving Park (B603) and extending 1/2 mile east of Mt. Read Blvd. East of the Genesee River, boring B601 contains a thicker (55.6 ft.) section for the interval, increasing to about 60.2 ft. near the intersection of N. Goodman Street and Central Parkway to the north (boring G6). The uniform thickness of this Irondequoit-Furnaceville interval, in spite of variations within individual units, lends confidence to the structural datum extrapolations. For shallow borings in areas of changing thicknesses, a gradual change in the direction of the nearest deeper hole was assumed.

Based on these assumptions, data for the borings west of the Genesee River are unlikely to be in error by more than 2 ft. where the Irondequoit Limestone or the Furnaceville were used. Extrapolations from the top of the Reynales (approximately 13 to 17 ft. above the Furnaceville Member) are probably accurate to within one foot throughout the area.

The Rochester Shale thicknesses show a slightly more complex pattern of variation. It is a maximum of 99 to 100 feet thick in the area between Chili and Lyell Avenues. It thins northward to approximately 90 ft. near Lexington Avenue. However, there are local exceptions to the pattern that may be, in part, a result of the difficulty in consistently picking the gradational Decew-Gates contact. For borings that did not fully penetrate the Rochester Shale, the approximate extrapolated thickness of the Rochester (90 to 100 ft.) was used, based on the nearest deeper holes. Although errors of up to 5 ft. might occur in some cases, the distribution of deep holes for comparison is reasonably good. The relatively small magnitude and gradual changes in the stratigraphic thicknesses, combined with the closely-spaced borings,

GRIMSBY SANDSTONE	-	Reddish brown, fine to medium-grained, thin to thick-bedded SANDSTONE with light gray mottling, thin to widely spaced argillaceous partings, swirly bedding near the top, and cross-bedding in the lowermost section.
QUEENSTON SHALE	-	Reddish brown, fine-grained, thin to thick-bedded SANDSTONE with thin color-banding and light green or gray mottling, and some beds of limestone, siltstone, and shale or mud-stone.

Although the dip of the strata may vary within the study area, bedrock generally strikes at N75°E and dips 50 ft./mi. S15°E. Further discussion of the structural relationships of bedrock in Rochester is contained in Section 3-04. Refer to Figure 3 for a generalized map outlining the surficial bedrock units in the area and to Figure 5 for a general subsurface cross-section through the city.

3-04. STRUCTURE

Although it has been assumed that major geologic structures are absent in the Rochester area (the closest major structure is the Clarendon-Linden Fault near Attica, New York), there is substantial evidence of minor structural deformation. These deformations have been defined on the basis of correlations between test borings, and are substantiated by field observations. Field evidence suggests that the deformation occurs in several discrete zones (see Figure 4). Within these zones deformation probably occurs as a combination of warping and minor faulting of the strata. Figure 7 is a sketch of the deformation as observed in the walls of the New York State Barge Canal. It serves to illustrate the nature of structural deformation inferred to exist in one or more zones in the city. Photographs 1 through 7 illustrate the type of deformation as it appears in the Genesee River gorge and in the Barge Canal.

IRONDEQUOIT LIMESTONE	-	Light to medium gray, fine to medium-grained, thin to medium-bedded, fossiliferous LIMESTONE with thin interbeds of dark gray, dolomitic shale, trace pits and vugs, gypsum nodules, and secondary gypsum seams in partings.
WILLIAMSON SHALE	-	Dark greenish gray SHALE with thin limestone beds and trace graptolite fossils.
LOWER SODUS SHALE	-	Dark greenish gray to grayish brown SHALE with trace fossils and several light gray, thin limestone beds containing abundant brachiopod fossils and locally called the "pearly layers."
REYNALES LIMESTONE	-	Light to medium gray, fine to medium-grained, thin-bedded, fossiliferous, crystalline LIMESTONE with interbeds of dark gray, very thin dolomitic shale, trace stylolites, secondary gypsum seams at partings, and a persistent, red, oolitic, fossiliferous, hematitic limestone bed.
MAPLEWOOD SHALE	-	Light greenish gray, argillaceous SHALE.
THOROLD SANDSTONE	-	Light gray to greenish gray, fine to medium-grained SANDSTONE. It is noted that in recent literature, this unit is referred to locally as the Kodak Sandstone.

Relatively few changes have occurred in western New York since the disappearance of the glaciers and glacial lakes. Nevertheless, significant effects of post-glacial processes in the Rochester area include Lake Ontario's occupation of the deeply scoured pre-glacial Ontarian River Valley, and establishment of the Genesee River in its present course. In addition, flooding of the Irondequoit Valley (pre-glacial Genesee River Valley) occurred to create the modern Irondequoit Bay by tilting of the bedrock threshold along the St. Lawrence River during differential post-glacial uplift (Young, 1980a). Most recent activity in the Rochester area has been dominated by the gradual rise of Lake Ontario's water level (from about 140 ft. below its present elevation) during the waning stages of post-glacial uplift.

3-03. STRATIGRAPHY

Ten geologic rock units are observed within the study area. A brief lithologic description of each unit, in order of occurrence from top to bottom, is presented below. See Figure 2 for a generalized stratigraphic profile and Appendix A for a detailed description of each unit. Appendix B contains a glossary of some terms used during rock core logging.

LOCKPORT DOLOMITE	-	Light to medium gray, fine to medium-grained, thin to medium-bedded siliceous DOLOMITE with stylolites, argillaceous partings, and trace vugs or cavities often lined by secondary mineralization.
ROCHESTER SHALE	-	Light to dark gray, fine-grained, fossiliferous dolomitic MUDSTONE with thin interbeds of dolomite and limestone, trace pits and vugs, and secondary gypsum seams and nodules along partings.

A long period (about 350 million years) of erosion ensued until glaciation occurred during the Pleistocene Epoch. It is estimated that over 2000 ft. of rock was stripped from the region during this time.

During the Tertiary Period, broad regional upwarping may have rejuvenated streams. By this time the southerly flowing streams had developed an extensive system of east-west tributaries which flowed along outcrops of easily eroded Silurian and Ordovician Shales. Consequently, the northernmost east-west tributaries flowing over the shales eroded headward and became dominant east-west trunk streams by capturing adjacent southerly flowing streams. An ancient Ontarian River, flowing westward through the St. Lawrence Basin, probably was one such trunk stream.

The northward sloping bedrock topography of the Rochester area may reflect the glaciated south slope of this broad ancestral Ontarian River Valley. At a later stage, after early glaciations, the Genesee River developed as a major north-flowing tributary emptying into the glaciated Ontarian Valley, beneath the present Irondequoit Bay. Its tributaries incised east-west strike valleys in the shales south of Rochester. Bedrock elevations show that the buried Genesee River channel and its major tributaries curve westward south of the city proper. The well-developed drainage system formed during Mesozoic and Cenozoic time developed the topographic controls that influenced Pleistocene ice erosion.

Approximately 1.5 to 3.0 million years ago, during the early Pleistocene Epoch when precipitation was greater than today, a large ice cap formed over Quebec. The ice flowed southwestward over New York reaching northern Pennsylvania, northern New Jersey and Long Island during the latest ice advance.

Glacial effects in western New York included ice erosion, subsequent deposition and glacial lake development. During glacial ice advances, the ice was effective in scouring the Tertiary land surface and obliterating or burying much of the pre-existing drainage system. In addition, glacial scouring action deepened the Ontarian and other pre-glacial river valleys such as the Genesee.

Depositional effects of the glacial period are also extensive in western New York. Glacial till was plastered over much of the scoured bedrock while above the till, sand, silt and clay were deposited as outwash or in glacial lakes which occupied the area. Surface topography in the region is a combination of these erosional and depositional processes.

The groundwater table generally slopes towards Lake Ontario in the north part of the study area, toward the bay in the east, and toward the Genesee River and the Barge Canal in the west (Young, 1980b). The movement of precipitation and runoff into the ground has been influenced by urbanization and storm drainage systems.

The study area is highly urbanized and contains single and multiple family dwellings, small businesses, light and heavy industries, and numerous railroad rights-of-way and highways. The City of Rochester itself has a population of approximately 300,000.

3-02. HISTORICAL BACKGROUND (GEOLOGY)

Rock and soil in western New York records four major periods of geologic activity. These periods are represented by marine sedimentation, erosion, glaciation, and post-glacial uplift and erosion.

Bedrock in the region includes a thick sequence of sedimentary strata deposited approximately 450 to 350 million years ago during the Upper Ordovician, Silurian and Devonian Periods of the Paleozoic Era (see Table I and Figure 2). During this time, the region was covered almost continuously by large inland seas, bordered by a landmass to the southeast and east. Most of New York, Pennsylvania and southern Ontario were submerged.

The oldest units exposed are the Ordovician Queenston Shale and Lower Silurian Grimsby Sandstone. These units form the surface bedrock units in the northernmost portion of Rochester and represent periods of extensive delta progradation. The overlying Upper Silurian and Devonian beds are primarily shales, siltstones, carbonates and evaporites. These beds were the result of deposition in relatively shallow seas subject to repeated minor fluctuations of the shoreline. Relative fluctuations of the water level had a great influence on the character of sediments deposited. Moreover, there is evidence that suggests parts of western New York were occasionally raised above sea level and exposed to erosion.

By the Early Mississippian Period, land movements associated with the culmination of Appalachian Mountain building to the south and east raised western New York above the inland seas and ended the episode of marine deposition. Subsequently, the Paleozoic rocks were tilted southward and a southerly drainage system developed along the shallow dipping beds.

III. GEOLOGIC CONDTIONS

3-01. GENERAL

The study area encompasses the entire City of Rochester as well as small areas of its surrounding suburbs. The city is situated in western New York along the southern shore of Lake Ontario between approximately 77°32'30"W and 77°41'00"W longitude, and between 43°07'30"N and 43°15'0"N latitude. The area covers approximately 60 square miles, and although it incorporates all of Rochester, additional outcrops immediately outside the study area proper were examined for regional control. Considerable attention was given to the west side of the city because a proportionately larger body of information was generated in that region during the most recent phase of the tunnel investigation program.

Rochester lies within the relatively low and flat-lying geographic province known as the Erie-Ontario Lowland which begins at Lake Ontario and extends southward to the Appalachian Plateau. Ground surface elevations rise gently to the south and east throughout the province.

Within the study area, elevations vary from El. 246± ft. at Lake Ontario (Mean Water Level) in the north to El. 745± ft. atop Pinnacle Hill in the south.

Conspicuous topographic features within the study area include a range of morainal hills at its southern boundary (Pinnacle Hills) and a prominent east-west trending proglacial beach ridge to the north upon which Ridge Road (New York State Route 104) is located. Both features are the result of the most recent glacial events.

The land surface is dissected from north to south by the Genesee River and by numerous small streams. The New York State Barge Canal traverses the city in a general northwest-southeast direction. Aside from Lake Ontario, the other surface water body of significance is Irondequoit Bay, near the eastern boundary of the study area. The bay is separated from Lake Ontario on the north by a barrier bar. Bedrock beneath the bay is relatively deep as a result of deep scouring by glacial action.

transit, Jacob's staff, hammer and chisel, and 100 ft. tape. Lithology and rock conditions were described noting essentially the same parameters described during the logging of rock core recovered from test borings. These parameters include rock color, grain size, bedding, lithology, weathering, discontinuities and other pertinent or unusual features.

At smaller outcrops where only one or two rock types are exposed, emphasis was placed on verifying the rock type and measuring joints where possible. Joint measurements consist of joint strike and dip, spacing, planarity (degree of roughness or smoothness of the joint surface), tightness and continuity. It is important to note that joint strike, spacing other than horizontal, and especially fracture continuity are not discernable from test borings alone. A graphic, statistical representation of joint orientations within the study area as measured in the field is presented in Figure 6.

b. SUBSURFACE MAPPING

Subsurface mapping of tunnels in Rochester was conducted in both in-service sewer tunnels on the west side of the city and in the Culver-Goodman Tunnel which is currently being excavated on the east side of the city starting near Irondequoit Bay. Examining the tunnels afforded an excellent opportunity to observe the character of certain rock units over considerable horizontal distances. Specifically, the older tunnels were inspected for joints and evidence of shear zones which were anticipated on the basis of offset marker beds noted in test borings drilled in the vicinity of the tunnels. Moreover, the behavior of the rock mass, both during excavation and through time, was observed.

within this interval generally does not vary by more than 1 ft. within the study area west of the Genesee River.

Once pertinent borings were plotted, correlations were drawn between structural datum planes as they appear in various locations around the city. Strikes and dips of the beds were determined using the standard "three-point" technique. Strike is defined as the compass direction of the straight line which represents the intersection of the dipping beds with a horizontal plane. Dip is the angle down from horizontal of the line perpendicular to the strike which is the steepest gradient of the bedding plane. Strike and dip are simply a means of expressing the orientation of a layer of rock in three-dimensional space. Assuming a strike of N75°E and a relatively constant dip of approximately 0.5° (50 ft./mi.) S15°E, any obvious discrepancies between the elevations of a marker bed in two different locations were considered a potential zone of structural deformation. These areas were then examined more closely for evidence of continuous local trends. In addition, systematic changes in the thickness of particular bedrock units were noted and taken into consideration for structural interpretations.

A geologic map outlining the surficial bedrock units in the project area and a structure contour map of the top of the Furnaceville Hematite were prepared and are presented in Figures 3 and 4, respectively. In addition, a general cross-section was constructed along a line, A-A', across the city (see Figure 3) by interpolating between borings. Borings used for cross-section construction include those which lie directly on line A-A' as well as projections of useful deep borings drilled in the vicinity. Borings were projected to the line of the cross-section assuming a N75°E strike and a 50 ft./mi. dip S15°E of the bedrock units. The cross-section is presented in Figure 5.

2-03. FIELD MAPPING

In general, field mapping was used to supplement lithologic and structural information derived from the test borings. Field mapping consisted of both surficial outcrop mapping and tunnel mapping as described below.

a. SURFICIAL MAPPING

Measured sections of relatively complete outcrop exposures were completed in certain sections along the Genesee River gorge and Irondequoit Bay at Glen Edith. In addition, rock exposures along highway cuts, streams and the New York State Barge Canal were examined. Field mapping was conducted in accordance with standard geologic mapping procedures using a Brunton pocket

program as well as other engineering projects. Test borings used specifically for this report are shown on the Study Area and Boring Location Plan, Figure 1.

Borings drilled for the CSOAP Phase II program represent the majority of the subsurface explorations. In general, approximately 160 borings were drilled along 22 miles of tunnel. These borings were advanced according to accepted practice by truck-mounted rotary drill rigs in 10.0-ft. increments using double-tube, M-series, NXW and NQ core barrels which recover rock with a diameter of 2.125 in. and 1.813 in., respectively. Water pressure tests for rock permeability and combustible gas measurements were conducted in many of the boreholes for supplemental information.

Rock core was logged by one individual in order to provide consistency. The rock core was examined closely with respect to the rock's lithology and character. The lithology of each unit was described in detail, noting color, grain size, presence of fossils, rock type, and nature of bedding and contacts with the units above and below. Sedimentalogic or structural features such as vugs or cavities, stylolites, mineralization, fractures and shear zones were noted and described. Borings were plotted on a base map and used to outline the stratigraphy of the study area. All elevations contained in this report are referenced to Rochester New City Datum. To convert NCD to USGS - Mean Sea Level Datum, subtract 1.085 ft.

Test borings drilled for engineering projects other than the CSOAP Phase II program and used for this study were treated in a similar manner. These additional boring logs were taken from several reports and are summarized in a preliminary data packet presented by Haley & Aldrich on 15 January 1981 for the CSOAP tunnelling program.

Base map construction was completed by plotting each boring on a transparent overlay on the Rochester East and Rochester West Topographic Quadrangle Maps. Each boring was labelled with its identification number as well as the elevation of a distinct marker bed used for correlation. Different marker beds were used in different parts of the city as not all beds were penetrated by each boring. Markers used for most structural correlations include the top of the Furnaceville Hematite Member of the Reynales Limestone, the top of the Irondequoit Limestone and, when necessary, the Rochester Shale (Gates Member)/Lockport Dolomite (Decew Member) contact (see Figure 2). Where borings did not penetrate the Furnaceville Hematite, but did encounter the Rochester Shale/Irondequoit Limestone contact, an assumed elevation of the Furnaceville Hematite was utilized as a marker assuming a relatively constant rock thickness of 52 ft. between the top of the Irondequoit Limestone and the top of the Furnaceville Hematite. It appears that the thickness of units contained

II. INVESTIGATIVE METHODS

2-01. GENERAL

Information in this paper was obtained from three general sources: a literature search, subsurface explorations and field mapping. The literature search was initiated in order to gather previously documented information about the geology of the Rochester area. Geologic references, geologic maps and previous engineering reports were consulted. The search reveals that stratigraphic and paleontologic relations are well documented and that studies of geologic structure in the region have followed several approaches as outlined below:

1. Observation of faults, joints, and rock movement in excavations, and relating of their character and orientation to theoretical and laboratory models of stress and strain which cause brittle deformation in rocks (Parker, 1942; Rose, 1951; Nickelsen and Hough, 1967).
2. Study of stress and strain using strain gauges together with X-ray analysis, sonic velocity testing, and observations of mechanical twinning of calcite, solution cleavage, and deformed fossils (Engelder, 1978; Engelder and Engelder, 1977).
3. Analysis of recent movement on faults through "fault-plane solutions" as a method of treating contemporary stress and strain (Sbar and Sykes, 1973).
4. Engineering studies which employ instrumentation to directly measure stress and strain (Goldberg, Zoino, Dunnicliff and Associates, 1976; Lo, 1978) as well as discuss the effects of stress and strain on rock behavior during excavation (Kulhawy and O'Rourke, 1981). Engineering studies supplied additional information about the top of rock utilizing seismic refraction surveys (Haley & Aldrich, Inc., 1976).
5. Examination of contemporary uplift employing geodetic levelling and remote sensing techniques (Isachsen, 1974, 1975, and 1977; Sutton et al., 1972; Young, 1980a).

A list of references outlining additional sources of information is included at the back of this report.

Field investigations which were applied to this report fall into two general categories: subsurface explorations and field mapping, as discussed below.

2-02. SUBSURFACE INVESTIGATIONS

Test borings have been drilled throughout the city for various phases of Rochester Pure Water District's sewer tunnel development

4. A literature search of local and regional geologic references.
5. Preparation of this geologic report summarizing the findings.

1-03. REPORT ORGANIZATION

The text of the geologic report is divided into three chapters following the introduction as follows:

Chapter 2: A brief description of the investigative methods and techniques employed during the study.

Chapter 3: A presentation of the geologic conditions in Rochester as disclosed by the recent explorations and literature search.

Chapter 4: A summary of the study and findings.

In addition to a descriptive text, the report contains tables, figures, photographs and maps which serve to outline the important geologic data and illustrate the structural features believed to be present in Rochester. A list of tables and figures is included in the Table of Contents.

1-04. LIMITATIONS

The descriptions of geologic conditions contained in this report are intended for use in combination with Geotechnical Data Reports for proposed Tunnel Systems, which are to be issued separately. The significance of geologic conditions relative to design and construction of proposed subsurface structures must be evaluated by each Tunnel Designer or Contractor based on their own knowledge and experience in the Rochester area, and in other localities having similar subsurface conditions, taking into account the details of their own proposed design and construction techniques.

1-05. ACKNOWLEDGEMENTS

Successful completion of this study was accomplished through the efforts of several people. Dr. Richard Young was instrumental in determining structural trends from test borings. Mr. Fred Amos logged rock core and recognized lithologic trends in the bedrock units and Mr. James Ehrets mapped rock exposed both on the surface and in tunnels. Numerous other people who contributed to the success of this study include Messrs. Thomas Grasso, Russell Varnum, Vincent Dick, several faculty members at the University of Rochester, particularly Dr. Carlton Brett, Dr. Robert Sutton and Dr. Lawrence Lundgren, the staff at H & A of New York and especially Dr. Gary Brierley who supervised the entire effort.

Fisher, 1966; Lumsden and Pelletier, 1969; Martini, 1971; Grasso, 1973; Crowley, 1974; Rickard, 1974, 1975; Brett, 1981; and others). Although there has been an emphasis on sedimentologic and paleontologic studies, brittle structures and other evidence of deformation of bedrock in western New York have been recognized (Parker, 1942; Nickelsen and Hough, 1969; Van Tyne, 1975; and Andrews, 1980). In addition, a relatively large number of recent studies explore regional rock stress and strain in western New York and southern Canada using various approaches (Rose, 1951; Sbar and Sykes, 1973; Palmer and Lo, 1976; Engelder, undated, 1978; Goldberg, Zoino, Dunnicliff and Associates, 1978; Lindner and Halpern, 1978; Lo, 1978; Quigley et al., 1978; Kulhawy and O'Rourke, 1981; and others). These studies include observations of deformed fossils, joint system orientations, and rock movements in excavations as well as direct stress and strain measurements using geotechnical instrumentation.

At present, a substantial amount of subsurface information is being generated through geotechnical studies in connection with the design and construction of a large sewer tunnel program (CSOAP, Phase II) within the City of Rochester. Detailed stratigraphic and structural information is available from test borings, surface and subsurface mapping, and in-situ testing. This systematic approach to examining the geology of Rochester adds a relatively large amount of information to the body of material which has been gathered since Hartnagel published his geologic map in 1907. The additional information collected throughout the city by the continuous rock sampling, and with modern engineering and geophysical techniques, permits a significant refinement of what is understood about the subsurface geology of Rochester.

1-02. PURPOSE AND SCOPE

The purpose of this study is to describe the geologic conditions beneath the City of Rochester in order to provide a framework for interpretation and analysis of geotechnical data by the designers of the various CSOAP tunnel systems. Although geologic structures are relatively minor, it is important to understand the character, extent and development of both the lithologic and structural features in the area in order to design the proposed subsurface structures. Moreover, it is useful to examine whether the geologic structures observed can be related to large-scale regional trends and whether they conform to hypotheses about regional stress systems.

The scope of work included the following:

1. Analysis of rock core recovered from test borings.
2. Geologic reconnaissance and surface mapping of outcrops.
3. Mapping of continuous, exposed sections of rock in both pre-existing and freshly excavated tunnels.

I. INTRODUCTION

1-01. GENERAL

Geologic study of the Rochester area began in the early nineteenth century (Eaton, 1824; Hall, 1840, 1843). These earliest studies were based on information collected largely from bedrock exposures, particularly along the Genesee River gorge and the old Erie Canal, as well as a few outlying dolomite quarries, streams and railroad cuts. Work centered around naming and describing the rock units and relating them to formations in other parts of New York State. Thus, the geology of Rochester was defined on the basis of surface exposures and extrapolation of information reported about rock units in other regions.

In 1907, C.A. Hartnagel developed the "Geologic Map of Rochester and Ontario Beach Quadrangles." Hartnagel depicted four major formations: the Medina, the Clinton, the Niagara and the Salina along with their constituent units. The surface bedrock units beneath the glacial drift are delineated on Hartnagel's map and each unit is described in the text. Although revisions have been made with respect to the exact boundaries and biostratigraphy of some of the units, general outcrop patterns of the lithologies described by Hartnagel are reasonably accurate.

Continued study during the period following Hartnagel's publication produced revisions and refinements in the detailed stratigraphy and correlations of rocks present in western New York (Clarke and Schuchert, 1900; Sarle, 1901; Grabeau, 1908, 1909; Newland and Hartnagel, 1908; Chadwick, 1918, 1920 and 1935; Schuchert, 1913; Williams, 1919; Fairchild, 1928; Sanford, 1935a, 1935b; and many others). During this period, additional information became available from test holes drilled for iron-ore recovery (Newland and Hartnagel, 1908) and Chadwick (1918) considered this information sufficient to warrant changes in Hartnagel's 1907 map. In addition, brittle structure in the region was noted early in the twentieth century by Chadwick (1920) in his account of a large fault west of Rochester (better known today as the Clarendon-Linden Fault). Moreover, Chadwick reported the existence of small superficial faults between Rochester and Lake Erie, often accompanied by buckling.

Although by the middle of the twentieth century the geology of the region was relatively well known (Fairchild, 1928; Sanford, 1935a; Gillette, 1947; and Fisher, 1954, 1959), detailed studies have continued to the present in an attempt to more accurately correlate the Ordovician, Silurian and Devonian rocks in western New York and to more clearly define the environmental conditions under which the strata were deposited (Bolton, 1953, 1964; Zenger, 1962, 1965, 1966; Kilgour, 1963, 1966; Rexroad, 1965;

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It has been a pleasure assisting you on this project and we look forward to continued involvement. If you have any questions about the report, please contact us.

Sincerely yours,
H & A OF NEW YORK

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30 June 1981
File No. 374813

Lozier-Seelye-Tonias
Joint Venture
Terminal Building
65 Broad Street
Rochester, New York 14614

Attn: Mr. Elias Tonias

Subject: Summary of Geologic Conditions
CSOAP, Phase II
Rochester, New York

Gentlemen:

We are pleased to submit 25 copies of a report entitled "Summary of Geologic Conditions, Rochester, New York", prepared in accordance with our contract with L-S-T dated 26 February 1981.

The report contains a discussion of geologic conditions in Rochester, with emphasis on the CSOAP Project Area. The geological information presented is intended to provide a framework for interpretation of geotechnical data by the CSOAP Tunnel Designers. Geotechnical Data Reports are to be issued separately for each tunnel system.

Lithologic descriptions are provided for the ten rock formations present within the project area. The stratigraphy of the units and data relative to structural deformation and jointing patterns are outlined. Figure 2 is a General Stratigraphic Column and Figure 3 is a Geologic Map of the area. A Generalized Cross-Section is shown on Figure 5.

REF 21

REPORT ON GEOLOGIC CONDITIONS COMBINED SEWER OVERFLOW ABATEMENT PROGRAM (CSOAP) PHASE II ROCHESTER, NEW YORK

FOR
LOZIER-SEELYE-TONIAS
JOINT VENTURE
65 BROAD STREET
ROCHESTER, NEW YORK

BY
H & A OF NEW YORK
CONSULTING GEOTECHNICAL ENGINEERS
AND GEOLOGISTS

File No. 374813

June 1981

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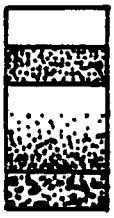
VISUAL GLOSSARY
OF TERMS USED IN CORE BORING REPORT

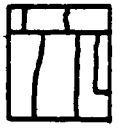
Bedding:
swirly

Banding:
Very thin color
thin color

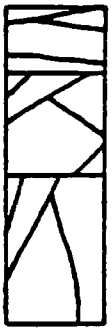
Grain size:
fine
medium
fine to medium
coarse



Joints:
vertical



low angle
moderately dipping
high angle

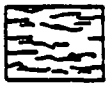


Mottling:

Partings:

Pits:

Streaks:
discontinuous argillaceous



Slickensides:

trace slickensides

Wavy argillaceous bands

Stylolites

Vugs

Weathering:
slight (SL)
moderate (MOD)
severe (SEV)

NOTE: See verbal descriptions and text for additional information.

Parting: Natural break in the rock caused by change in lithology or grain size, parallel to the bedding. Unlike joints, which can be limited in extent or trend by the thickness of the formation, partings are usually persistent in every direction parallel to the bedding. Often marked by a very thin bed or seam of soft rock or mineral. Stylolitic partings are rough, irregular, and faced with argillaceous material.

Pit: Cavity up to 1/4 in size.

Shear: A localized expression of strain resulting from stresses which cause or tend to cause slippage along a plane at the contact of two contiguous parts of a body.

Short: Less than 1 in.

Slickensides: Smooth, highly polished argillaceous facing on a shear. Trace slickensides is not highly polished, but marked by some sign of small movement, such as very small polished areas and/or parallel grooves and striations on a joint face.

Small: Less than 1 in.

Spacing:

Very closely spaced:	Less than 2 in apart.
Closely spaced:	From 2 to 12 in apart.
Moderately closely spaced:	12 to 36 in apart.
Widely spaced:	36 to 120 in apart.

Trace: Amount less than 10%; not common.

Vug: Cavity larger than a pit; from 1/4 to 2 in in size.

Wavy: Curved; smoothly uneven.

Weathering:

Slightly weathered (SL):	Not stained, discolored or noticeably degraded, but presumably altered somewhat from condition of original lithification.
Moderately weathered (MOD):	Stained, discolored, pitted, or bounded by eroded partings.
Severely weathered (SEV):	Disintegrated.

GLOSSARY OF TERMS USED IN CORE BORING REPORTS

Bedding:

Very thin-bedded:	Bed less than 2 in thick.
Thin-bedded:	Bed 2 to 12 in thick.
Medium-bedded:	Bed 12 to 36 in thick.
Thick-bedded:	Bed 36 to 120 in thick.
Swirly bedding:	Tightly curved, wavy pattern throughout texture of rock.

Color-banding: Shades of alternating color in very thin bands parallel to the bedding. Differing lithology or grain size in the various bands is possible.

Druse, drusy: Coating or very thin layer of very small crystals massed together.

Fissile: Exhibiting the property of easily splitting into very thin layers parallel to the bedding.

Friable: Easily crumbled, as would be the case with rock that is poorly cemented.

Grain size:

Fine-grained (rock):	Grain size not visible to just barely visible with the naked eye.
Medium-grained (rock):	Grain size barely to easily visible with the naked eye; up to 1/8 in.
Coarse-grained (rock):	Grain size from 1/8 in to 1/4 in.

Joints:

Low angle:	Natural breaks inclined to the bedding plane from 5° to 35°.
Moderately dipping:	Natural breaks inclined to the bedding plane from 35° to 55°.
High angle:	Natural breaks inclined to the bedding plane from 55° to 85°.
Vertical:	Natural breaks inclined to the bedding plane from 85° to 90°.

Mottling: Irregular color patches of limited extent.

Oolitic: Composed of smooth, rounded granules.

A P P E N D I X B

GLOSSARY OF TERMS USED IN CORE BORING REPORTS

by

H & A of New York

June 1981

QUEENSTON SHALE

Reddish brown, fine-grained, thin- to thick-bedded, nonfossiliferous SANDSTONE. The thickness of this unit is known to be about 1,000 ft.

Greenish grey to light grey mottling and thin to very thin color-banding are observed. Some such color bands are limestone beds. The lithology of this unit varies considerably. Grain size varies from fine-grained sand to silt and clay-sized particles. The relatively coarser-grained sandstone beds may reach 2 to 3 ft in thickness and occur throughout the formation.

Closely to very closely spaced, nonparallel, low angle joints with weakly striated surfaces (referred to as trace slickensides in core boring reports) occur in the beds of finest grain size. In addition, low angle joints (and occasional shears) occur at partings. Partings are not prominent but where present they are reddish brown, argillaceous, and closely to widely spaced. Gypsum seams parallel to the bedding are sometimes observed in the more coarsely-grained sandstone beds.

GRIMSBY SANDSTONE

Reddish brown, fine- to medium-grained, thin- to medium- or thick-bedded SANDSTONE. Average thickness of the Grimsby Sandstone in core borings is 48 ft.

The Grimsby Sandstone exhibits considerable color variation and light grey mottling. In addition, the lower third of the formation is markedly coarser grained and generally friable.

Swirly bedding is observed, especially in the upper third of the formation, and is probably due to the activities of marine worms which disturbed the original bedding leaving the rock with a unique texture. Cross-bedding occurs in the thick bottom bed of the formation and serves to weaken the rock slightly. The cross-bedding dips slightly, and joints or partings are found parallel to it.

Joints of varying angles are also found at partings and are reddish brown, argillaceous, and closely to widely spaced. Joints exhibiting varying degrees of weathering are also observed within the sandier beds. Occasionally, secondary gypsum seams are seen in partings parallel to bedding.

THOROLD SANDSTONE*

Light grey to greenish grey, fine- to medium-grained, nonfossiliferous SANDSTONE, averaging 3.5 ft thick in boreholes.

Rarely, there is a thin to very thin zone of mottled, reddish brown coloration in the lower third of the unit. Grain size appears nearly constant throughout and the grains are well cemented.

The Thorold appears as a single bed and no partings are evident. Joints are uncommon and the rock is usually only slightly weathered. The lower boundary of the Thorold is somewhat transitional; only color serves to distinguish it from the underlying Grimsby Sandstone and usually no parting is observed at the contact.

*Referred to locally as the Kodak Sandstone in recent references.

MAPLEWOOD SHALE

Light greenish grey, argillaceous, nonfossiliferous SHALE. Average thickness of the Maplewood in boreholes is 18 to 19 ft.

Virtually no variation in lithology is noticeable, except at the base of the unit where there are a few inches of darker grey, harder shale.

Joints are abundant and occasional shears have been noted.

REYNALES LIMESTONE

Light to medium grey, fine- to medium-grained, crystalline, thin-bedded, fossiliferous LIMESTONE, with trace stylolites, and interbeds of dark grey, very thin dolomitic shale. Average thickness of the Reynales Formation in boreholes is 19 ft.

Generally, the Reynales is the most geologically complex formation in the project area. Many of the limestone beds in the Reynales are fossiliferous (most notable are the large, thick shells of the brachiopod Pentamerus) and a few are dolomitic. Some of the thinner beds contain very thin zones of fine-grained quartz silt which are observed to occur anywhere within the formation and usually in minor amounts. In addition, thin siliceous zones and lenses (such as chalcedony or chert) sometimes occur in limestone beds throughout the Reynales. The Reynales also contains a very persistent bed of red, medium-grained, oolitic, fossiliferous, hematitic limestone called the Furnaceville Hematite Member (about 2 to 4 ft above the base of the Reynales). The Furnaceville serves as a distinctive "marker bed" for structural interpretation.

Very close to moderately close partings occur between beds of differing lithologies or as stylolitic seams in the limestone beds. Frequently, secondary gypsum seams occur along these partings. The shale beds of the formation are often jointed and occasionally sheared. In one borehole, a limestone bed is cut by a high angle, brecciated fault which is well sealed by a secondary deposit of gypsum. In addition, several shale beds are severely altered to clay, particularly below the Furnaceville Member within the bottom two to four feet of the formation.

LOWER SODUS SHALE

Dark greenish grey to greyish brown SHALE with a few fossils. Average thickness of the Lower Sodus Shale in the boreholes is 13 to 14 ft.

The upper quarter of the formation is dark greenish grey. Immediately below this zone is a zone of varying brownish grey colors with a more prominent brownish zone occurring persistently in the lower half of the formation. The lowermost few feet of the Lower Sodus is invariably dark greenish grey.

Several light grey, thin to very thin, closely to moderately closely spaced shell limestone beds occur in the upper part of the formation. These beds are composed almost exclusively of the brachiopod Coelospira hemispherica. None of these beds were noted near the base of the formation.

Low angle joints occur frequently, but high angle joints also occur. The upper boundary of the Lower Sodus Shale is sometimes marked by a thin to very thin, severely weathered zone immediately below the overlying Williamson Shale. It is noted that the Upper Sodus Shale is not generally recognized in the Rochester area.

WILLIAMSON SHALE

Dark greenish grey SHALE with a few fossils, averaging 5 to 6 ft thick in boreholes.

Several light grey, very thin limestone beds occur in the upper one-third and lower few inches of the formation. In addition, one to several black or dark grey, very thin shale zones containing the distinctive fossil graptolite, Monograptus clintonensis, are present in the lower few inches of the formation. The bottommost limestone bed occurring below the lowest graptolite bed in the formation is considered the contact between the Williamson Shale and the underlying Lower Sodus Shale.

Low angle joints are frequent in the Williamson Shale and high angle joints were also noted.

IRONDEQUOIT LIMESTONE

Light to medium grey, fine- to medium-grained, thin- to medium-bedded, fossiliferous LIMESTONE interbedded with dark grey, thin to very thin, dolomitic SHALE. Average thickness of the Irondequoit Limestone in boreholes is 18 ft.

The limestone bedding is wavy (individual beds thicken and thin markedly) and the shale beds are thickest in the lower quarter of the formation. Occasionally, trace pits, vugs, and gypsum nodules are present in the Irondequoit, and often secondary gypsum seams occur in closely to moderately closely spaced partings or between shale and limestone beds. The shale beds are frequently jointed and occasionally contain shears. In some areas the shales are severely weathered to clay.

The upper contact of the Irondequoit Limestone with the overlying Rochester Shale is relatively sharp. The contact is placed at the top of the uppermost relatively thick limestone bed underlying the lowermost highly fossiliferous bed which is contained within the Rochester Shale.

ROCHESTER SHALE

Light to dark grey, fine-grained, fossiliferous, dolomitic MUDSTONE with interbeds of limestone and dolomite. The Rochester Formation is about 95 to 100 ft thick.

The Rochester is traditionally called a shale, but it is not fissile and is harder and thicker bedded than a shale. The upper 8 to 12 ft of the formation consists of thin to very thin, closely to moderately closely spaced dolomite beds and is called the Gates Dolomite Member. From approximately 15 to 25 ft below the top of the Rochester to the base of the formation, light grey, very thin, moderately closely spaced limestone beds are present. These beds increase in thickness and frequency with depth. The basal few feet of the Rochester are usually darker grey and highly fossiliferous. Some of the very thin limestone beds contain fine quartz silt and are quite dense. These beds usually grade into the overlying and underlying mudstone without any evidence of partings at the boundaries.

Pits, small vugs, gypsum nodules, and calcitic fossils are present in the formation. Pits and vugs occur in trace amounts in the upper Rochester and their frequency decreases downwards. No particular zones of these features are discernable in the cores and they do not always occur at partings. Gypsum nodules vary in size, reaching 0.2 ft wide in the cores, and occur in trace amounts throughout the formation, very often at partings. Secondary gypsum seams are also present in closely to very closely spaced partings throughout the formation except near the top of rock where the seams may be severely weathered.

Joints are not frequent, but may occur at all angles. They are usually smooth, contain a trace to no gypsum, or may be healed by secondary gypsum seams. Partings occur, usually parallel to the bedding but occasionally dipping at low angles, and almost invariably contain gypsum seams. Although infrequent, partings throughout the Rochester have been noted weathering to clay. In addition, clay beds of up to 0.2 ft in thickness have been observed. Vertical cracks are frequent in the thin limestone beds.

LOCKPORT FORMATION

Light to medium grey, fine- to medium-grained, thin- to medium-bedded, siliceous DOLOMITE. Thickness of the Lockport Dolomite is about 200 ft.

The Lockport Formation includes three members. The uppermost member is called the Oak Orchard Dolomite, and it is known to be over 100 ft thick in western New York. Underlying the Oak Orchard are the Penfield Dolomite, which is about 75 ft thick, and the basal Decew Dolomite, which is about 22 ft thick. The Decew Dolomite exhibits very thin color-banding and mottling in various shades of grey and it is finer grained than either the Oak Orchard or the Penfield.

Very closely to moderately closely spaced argillaceous partings and stylolites are present throughout the Lockport. The middle 20 ft of the Penfield Member contains numerous, discontinuous, wavy argillaceous streaks which roughly parallel the bedding; some are stylolitic. The argillaceous partings in this section of rock are generally parallel to the bedding, except toward the base of the Penfield where a 20 ft section of dolomite contains wavy and uneven partings which may slope at high angles, may appear as silty bands 1/8 to 1/4 in thick, and are frequently slickensided, striated shears of small displacement. In the Decew Member, secondary gypsum seams appear in closely to moderately closely spaced partings, and very thin clay partings occur in the basal few feet. Some cross-bedding was observed in the lower 35 ft of the Penfield Member.

Pits and vugs occur throughout the Lockport; particularly in the Oak Orchard Member. The pits and vugs in the Oak Orchard usually contain crystal linings of dolomite, calcite and quartz over very thin crusts of aragonite. Trace amounts of fluorite, sphalerite, selenite, galena and sulfur also occur in the Oak Orchard. Trace amounts of gypsum nodules were encountered in the upper 20 ft of the Penfield Member and in the Decew Member.

In boreholes, joints are encountered infrequently within the Lockport Formation, except at shallow depths. The contact between the Lockport (Decew Member) and the Rochester (Gates Member) is gradational. Occasionally, there is a very thin, severely weathered clay parting, but usually the boundary is marked only by an increasing amount of dark dolomitic mudstone between increasingly thinner dolomite beds, in the base of the Decew Member.

LITHOLOGIC DESCRIPTIONS

Lithologic descriptions are general and based on observations of rock core recovered from test borings. They are in general agreement with outcrop exposures. Actual rock conditions may vary over distance and with exposure to weathering.

A P P E N D I X A

LITHOLOGIC DESCRIPTION SHEETS

from

Observations of Rock Core

by

H & A of New York

June 1981

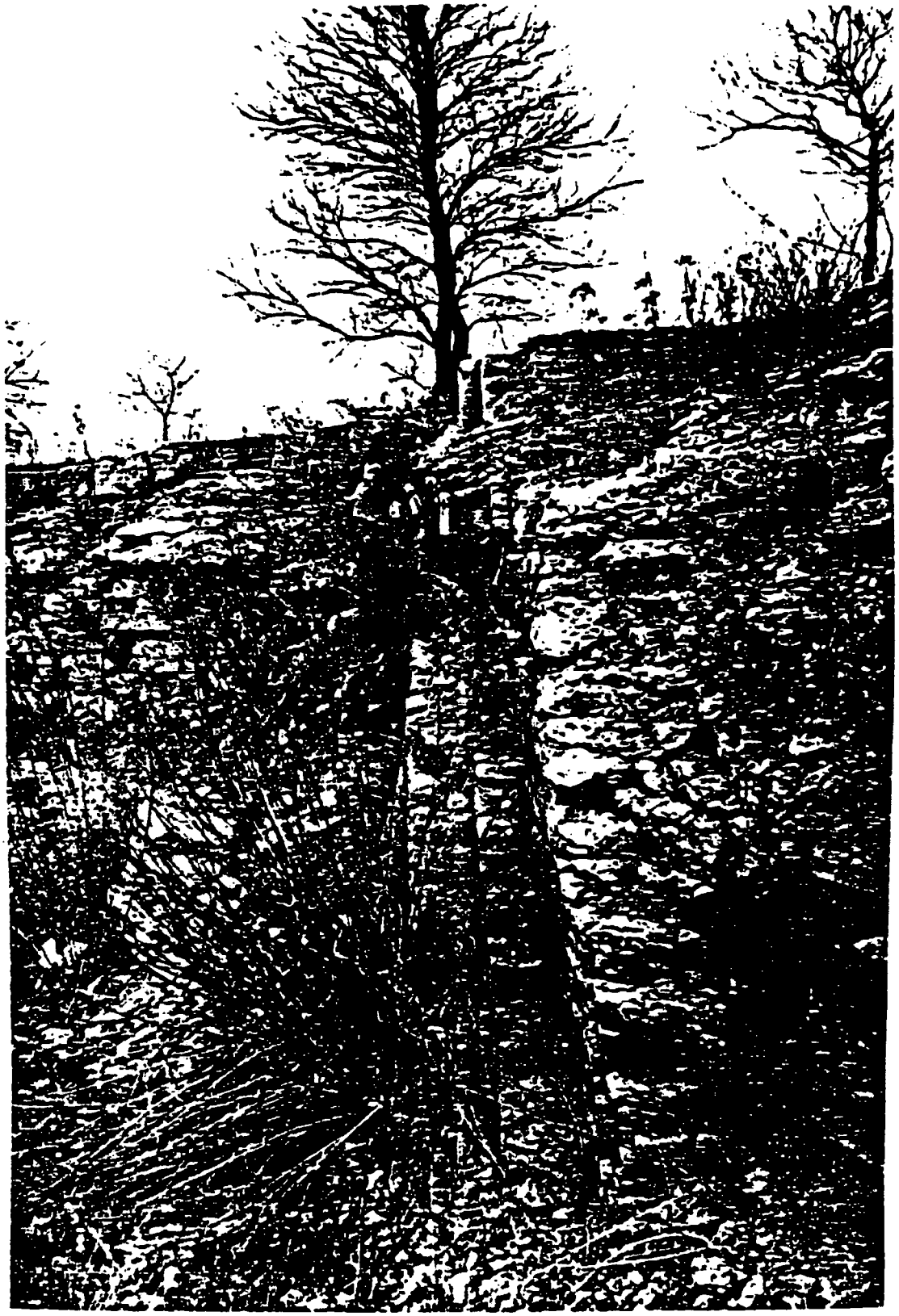


Photo No. 10. Closely spaced joints in Route 490 road cut, Town of Gates. Rock unit is the Penfield Member of the Lockport Dolomite.

Photo No. 9. Trace of continuous joint across median of Route 490. Joint is visible in road cut across the highway.

Photo No. 8. Trace of continuous joint across Route 490 road cuts, Town of Gates.

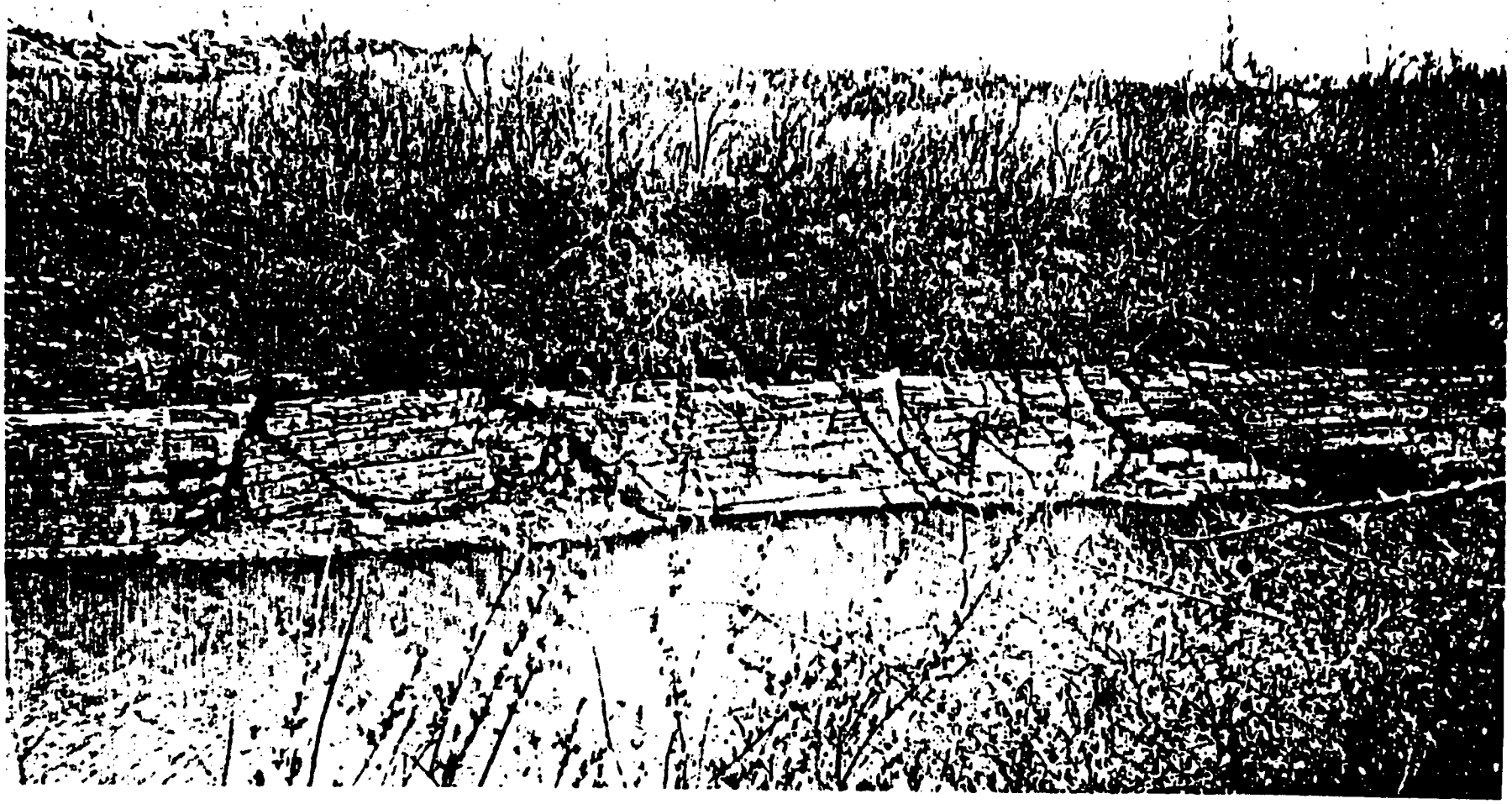


Photo No. 7. Joints and small shears in east wall of canal approximately 500 feet north of structure zone shown in Photos 4-6.

Photo No. 6. Close-up of fold zone shown in Photo No. 5. Rock unit is the Gates Member of the Rochester Shale formation.

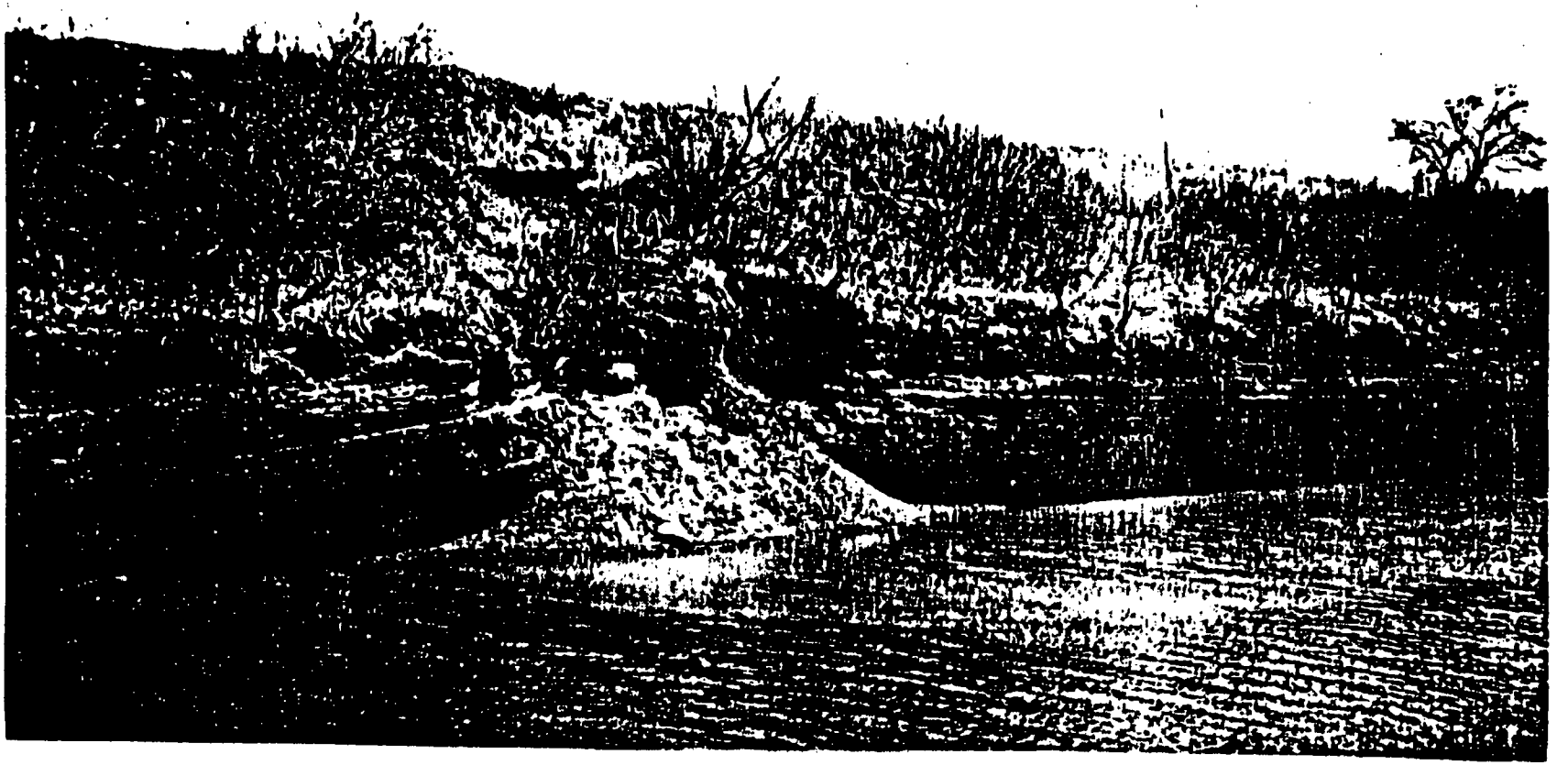


Photo No. 5. Folded and sheared zone in canal. View is towards the southeast.

Photo No. 4. Structure in Barge Canal just north of Lyell Avenue. View is towards the southeast at east wall of canal. Photo taken during winter at low-water level.

Photo No. 3. Close-up of shear along right (south) side of structure in Photo No. I. Arrows indicate relative displacement along shear zone (dashed). Solid line traces a thin limestone bed (note drag fold) in the Lower Sodus Shale.

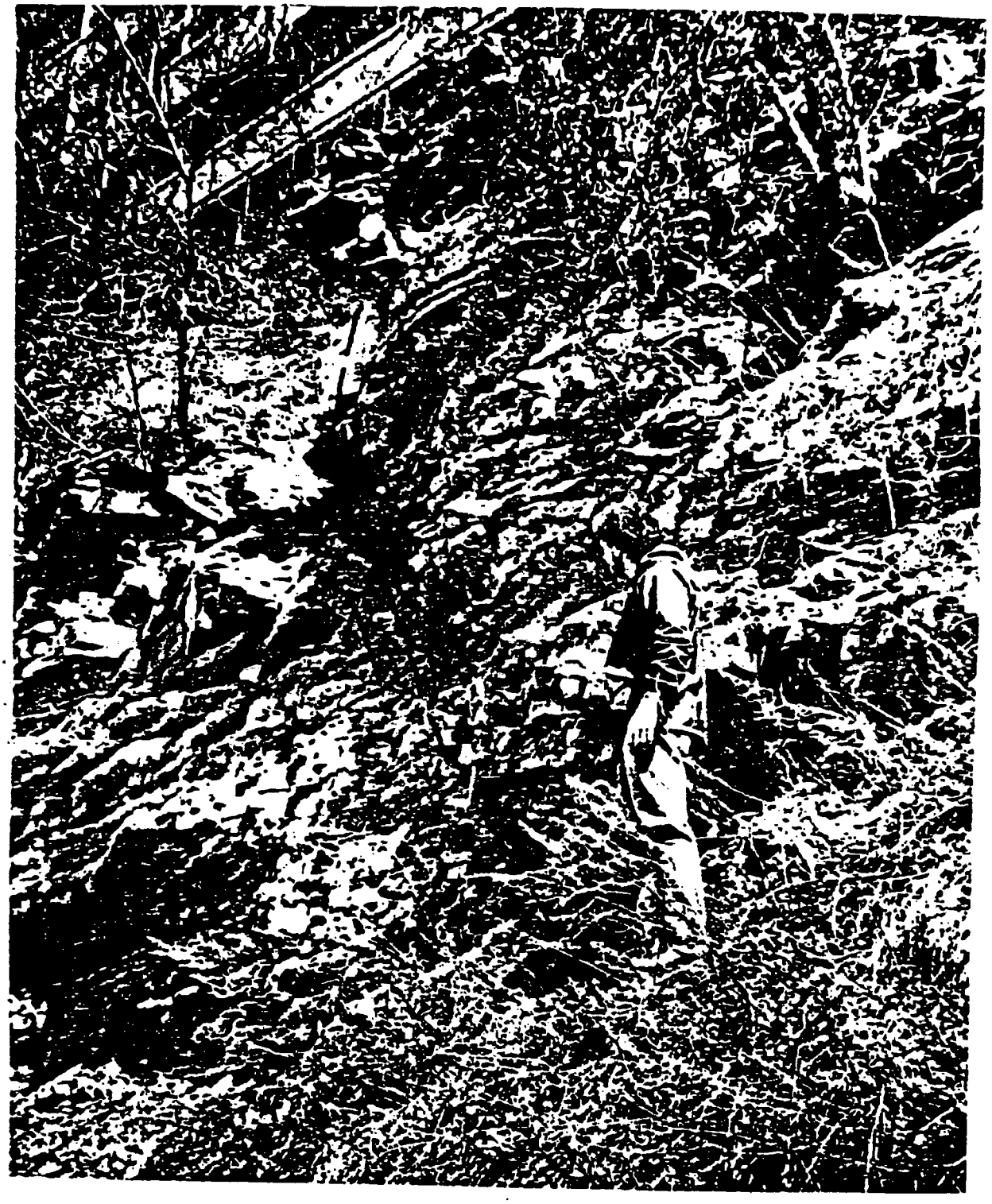


Photo No. 2. View of shear along left (north) side of structure shown in Photo No. 1. Arrows indicate relative displacement along shear zone (dashed). Rock formation is the Irondequoit Limestone.

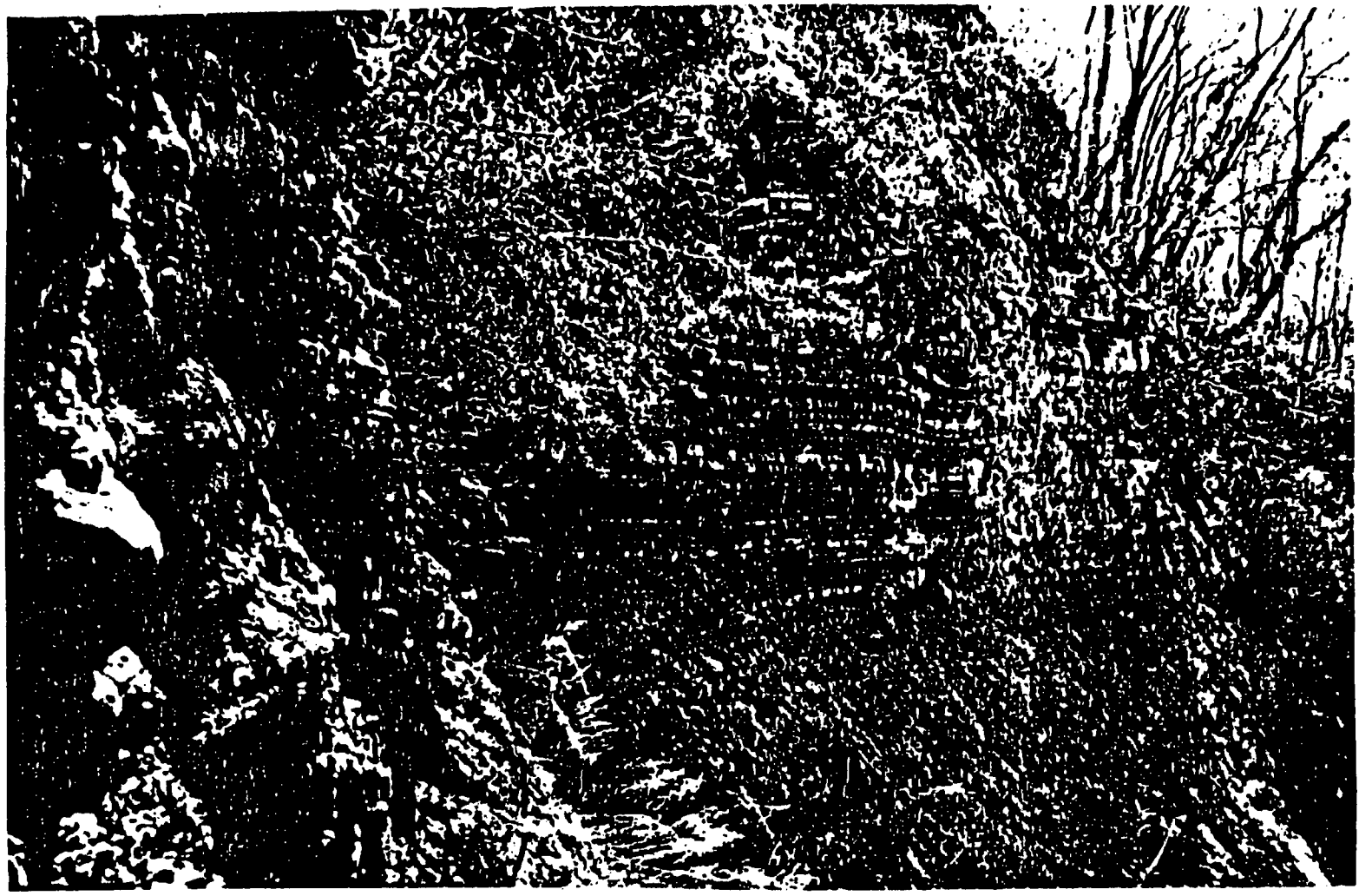


Photo No. 1. Oblique view of structure near the Lower Falls in Genesee Gorge. Arrows indicate graben-type displacement along two shear zones. Rock formations in view include the Lower Sodus Shale, the Williamson Shale and the Irondequoit Limestone.

TABLE V (cont.)

Location	Latitude/ Longitude	Stress Orientation	Lithologic Unit	Technique and Comments
Somerset, NY	43°20' 78°34'	N15°W N45°W N60°W N15°W N15°W N10°W N15°E	Sandstone	Overcoring; outcrop
Sterling, NY	43°17' 76°37'	N22°W N53°W N72°W N46°W	Sandstone	Overcoring; outcrop
Thorold, Canada	43°06' 79°16'	N27°W N88°W N62°E N76°E N60°E N58°E N56°E N60°E	Dolomite, dolomitic Limestone, shaly Limestone, Limestone	Overcoring; outcrop; used smaller diamond core barrel than standard

NUTES:

1. Table taken from Lindner, E. N. and Halpern, J. A. (1978) "In-Situ Stress in North America: A Compilation," Int. Jour. Rock. Mech. and Mining Sci., v.15:183-203. A brief description of stress measurement techniques is contained therein.

2. Refer to accompanying report for additional information.

TABLE V

Summary of Regional Stress Measurements

Location	Latitude/ Longitude	Stress Orientation	Lithologic Unit	Technique and Comments
Alma Township, NY	42°01' 78°04'	N77°E	Sandstone	Hydrofracture; deep borings; average of 3 oil wells
Bradford, PA	41°58' 78°39'	N70°E	Sandstone	Hydrofracture; oil field; sandstone is between layers of shale
Clarendon, NY	43°19' 78°06'	N64°E	Sandstone/ Limestone	Hydrofracture; deep boring
Dale, NY	42°48' 78°10'	E-W?	Sandstone	Hydrofracture; deep boring; orientation questionable
Niagara Falls, NY	43°04' 79°05'	N55°E N34°E	Dolomite	Overcoring; outcrop; conditions probably due to proximity of Niagara Gorge
Port Hope, Canada	43°54' 78°30'	N15°W	Limestone	Overcoring; outcrop
Rochester, NY	43°10' 77°37'	N76°E N80°W N80°W N82°W N86°E N10°E N62°E N18°E N39°E N11°E N76°E N32°W N38°W N22°W	Dolomite	Overcoring; some measurements made near vertical fractures and may not be representative of natural stresses
Scarborough, Canada	43°00' 79°16'	N90°E	Shale	Undercoring; tunnel; average of 10 tests

TABLE IV (cont.)

Boring Number	Overburden Thickness	Lockport Thickness	Rochester Thickness	Irondequoit Thickness	Williamson Thickness	Lower Sodus Thickness	Reynales Thickness	Furnaceville Thickness	Maplewood Thickness	Thorold Thickness	Grimsby Thickness	Queenston Thickness
SS 1	8.5	(54.2)	97.5	--	--	--	--	--	--	--	--	---
2	7.0	(23.8)	106.7	--	--	--	--	--	--	--	--	---
3	10.2	(45.3)	96.4	--	--	--	--	--	--	--	--	---
4	10.7	(17.0)	98.0	--	--	--	--	--	--	--	--	---
5	9.0	(92.8)	99.6	18.4	4.8	13.9	15.2	3.2	17.9	4.9	--	---
6	12.5	(74.1)	---	--	--	--	--	--	--	--	--	---
7	11.5	(86.3)	---	--	--	--	--	--	--	--	--	---
8	14.0	(62.3)	---	--	--	--	--	--	--	--	--	---
9	10.0	(94.3)	95.6	17.7	6.1	13.5	15.3	3.3	--	--	--	---
10	7.5	(91.5)	101.3	17.5	--	--	--	--	--	--	--	---
11	9.5	(95.3)	93.3	--	--	--	--	--	--	--	--	---
TC 1	15.0	---	---	--	--	--	--	--	--	--	(35.5)	---
2	16.8	---	---	--	--	--	--	--	--	--	(37.6)	---
3	11.1	---	---	--	--	--	--	--	--	--	(50.4)	---
4	16.1	---	---	--	--	--	--	--	--	--	(41.0)	---
5	8.5	---	---	--	--	--	--	--	--	--	(38.4)	---
6	26.2	---	---	--	--	--	--	--	--	(1.3)	50.0	---
7	12.0	---	---	--	--	--	--	--	--	--	(39.6)	---

NOTES:

1. Thicknesses represent entire unit, except where denoted by parentheses. All thicknesses are expressed in feet.
2. Thickness of Reynales Limestone includes the interval from the top of the Reynales to the top of the Furnaceville Hematite. Thickness of the Furnaceville Hematite represents the interval from the top of the Furnaceville to the top of the Maplewood Shale.
3. N.A. indicates data not available.
4. See Figure 1 for locations of test borings.
5. Test boring data obtained from Monroe County Department of Engineering Sewer Tunnel projects.
6. Refer to accompanying report for additional information.

TABLE IV (cont.)

Boring Number	Overburden Thickness	Lockport Thickness	Rochester Thickness	Irondequoit Thickness	Williamson Thickness	Lower Sodus Thickness	Reynales Thickness	Furnaceville Thickness	Maplewood Thickness	Thorold Thickness	Grimsby Thickness	Queenston Thickness
SM 19	24.2	(99.7)	---	--	--	--	--	--	--	--	--	---
20	12.3	(40.8)	94.6	--	--	--	--	--	--	--	--	---
21	5.0	(91.5)	---	--	--	--	--	--	--	--	--	---
SN 1	23.5	---	---	--	--	--	(11.1)	3.6	17.9	4.1	47.3	---
2	10.0	---	(15.7)	18.5	6.5	13.3	15.5	3.1	18.6	4.4	--	---
3	10.0	---	(54.8)	18.9	7.4	13.1	15.8	3.4	16.1	6.5	--	---
SP 1	29.0	---	---	--	--	--	--	--	--	--	--	---
2	26.0	---	---	--	--	--	--	--	--	--	--	---
3	25.3	---	---	--	--	--	--	--	--	--	--	---
4	35.0	---	---	--	--	--	--	--	--	--	--	---
5	34.5	---	---	--	--	--	--	--	--	--	--	---
6	46.5	---	---	--	--	--	--	--	--	--	--	---
7	52.0	---	---	--	--	--	--	--	--	--	--	---
8	60.0	---	---	--	--	--	--	--	--	--	--	---
9	65.5	---	---	--	--	--	--	--	--	--	--	---
10	68.0	---	---	--	--	--	--	--	--	--	--	---
11	83.5	---	---	--	--	--	--	--	--	--	--	---
12	86.0	---	---	--	--	--	--	--	--	--	--	---
13	96.5	---	---	--	--	--	--	--	--	--	--	---
14	88.3	---	---	--	--	--	--	--	--	--	--	---
15	82.7	---	---	--	--	--	--	--	--	--	--	---
16	77.7	---	---	--	--	--	--	--	--	--	--	---
17	93.0	---	---	--	--	--	--	--	--	--	--	---
18	92.5	---	---	--	--	--	--	--	--	--	--	---
19	101.4	---	---	--	--	--	--	--	--	--	--	---
20	100.8	---	---	--	--	--	--	--	--	--	--	---
21	100.0	---	---	--	--	--	--	--	--	--	--	---
22	85.4	---	---	--	--	--	--	--	--	--	--	---
23	84.4	---	---	--	--	--	--	--	--	--	--	---
24	28.5	---	---	--	--	--	--	--	--	--	--	---
25	13.0	---	---	--	--	--	--	(2.8)	20.2	3.0	45.9	---
26	20.5	---	---	--	--	--	--	--	--	--	(44.4)	---
27	10.0	---	---	--	--	--	--	--	--	--	(46.6)	---
28	8.0	---	---	--	--	--	--	--	--	--	(33.0)	---
29	19.5	---	---	--	--	--	--	--	--	--	(39.0)	---
30	24.3	---	---	--	--	--	--	--	--	--	--	---
32	10.3	---	---	--	--	--	--	--	--	--	(34.0)	---

TABLE IV (cont.)

Boring Number	Overburden Thickness	Lockport Thickness	Rochester Thickness	Irondequoit Thickness	Williamson Thickness	Lower Sodus Thickness	Reynales Thickness	Furnaceville Thickness	Maplewood Thickness	Thorold Thickness	Grimsby Thickness	Queenston Thickness
LY 1	7.0	(23.7)	97.1	20.2	5.3	12.2	15.3	--	--	--	--	---
2	6.5	(33.6)	97.0	17.2	5.7	13.0	--	--	--	--	--	---
3	16.8	(19.2)	97.8	17.7	5.5	12.8	--	--	--	--	--	---
4	9.0	(28.2)	98.1	17.9	4.9	13.2	--	--	--	--	--	---
5	13.3	(8.5)	101.5	17.3	4.8	14.2	--	--	--	--	--	---
6	11.0	(21.8)	98.4	18.2	6.1	--	--	--	--	--	--	---
7	5.0	(27.3)	97.1	17.2	4.8	13.2	--	--	--	--	--	---
8	5.0	(27.7)	95.6	20.1	4.5	12.9	--	--	--	--	--	---
9	12.0	(23.4)	95.7	18.1	4.6	--	--	--	--	--	--	---
MR 1	18.0	(131.3)	---	--	--	--	--	--	--	--	--	---
2	11.0	(129.7)	---	--	--	--	--	--	--	--	--	---
3	25.5	(126.9)	93.8	--	--	--	--	--	--	--	--	---
4	21.0	(132.3)	98.9	--	--	--	--	--	--	--	--	---
P 101	29.0	---	---	--	--	--	--	--	--	(2.0)	--	---
103	14.0	---	(97.7)	17.8	7.3	15.2	12.1	3.6	--	--	--	---
104	18.0	(84.0)	82.5	14.5	10.0	18.3	15.0	2.7	--	--	--	---
110	20.0	---	---	--	--	(1.5)	--	--	--	--	--	---
SM 1	1.5	(30.5)	103.3	--	--	--	--	--	--	--	--	---
2	18.3	---	(81.6)	17.6	6.3	12.4	15.2	3.6	--	--	--	---
3	8.0	(21.1)	96.5	--	--	--	--	--	--	--	--	---
4	6.0	(31.3)	98.3	--	--	--	--	--	--	--	--	---
5	15.0	(27.0)	97.5	--	--	--	--	--	--	--	--	---
6	14.0	(36.2)	---	--	--	--	--	--	--	--	--	---
7	9.0	(84.2)	---	--	--	--	--	--	--	--	--	---
8	26.2	(93.4)	---	--	--	--	--	--	--	--	--	---
9	31.0	(58.5)	---	--	--	--	--	--	--	--	--	---
10	7.4	---	---	--	--	--	--	--	--	--	--	---
11	15.0	---	---	--	--	--	--	--	--	--	--	---
12	4.5	(32.6)	96.6	--	--	--	--	--	--	--	--	---
13	7.6	---	---	--	--	--	--	--	--	--	--	---
14	15.0	---	---	--	--	--	--	--	--	--	--	---
15	11.5	(43.8)	94.8	--	--	--	--	--	--	--	--	---
16	12.5	---	---	--	--	--	--	--	--	--	--	---
17	6.0	---	---	--	--	--	--	--	--	--	--	---
18	11.9	---	---	--	--	--	--	--	--	--	--	---

TABLE IV (cont.)

Boring Number		Overburden Thickness	Lockport Thickness	Rochester Thickness	Irondequoit Thickness	Williamson Thickness	Lower Sodus Thickness	Reynales Thickness	Furnaceville Thickness	Maplewood Thickness	Thorold Thickness	Grimsby Thickness	Queenston Thickness
G	7	10.3	---	(72.2)	19.0	6.0	17.5	16.3	3.2	16.2	7.3	--	---
	8	8.0	(31.0)	89.0	20.0	6.0	16.5	17.0	3.0	15.5	--	--	---
	9	22.0	(62.0)	86.5	18.0	8.0	18.0	--	--	--	--	--	---
	16	15.5	(70.5)	79.0	18.0	7.3	17.2	--	--	--	--	--	---
LK	1	13.5	---	(22.5)	18.4	6.2	14.1	14.2	3.1	17.8	4.0	--	---
	2	24.0	---	(18.4)	18.7	6.0	11.8	15.6	3.7	18.7	2.3	--	---
	3	33.0	---	---	--	--	(12.9)	15.5	3.4	19.4	2.3	--	---
	4	28.9	---	---	--	--	--	(12.3)	3.8	18.6	2.7	45.7	---
	5	31.0	---	(32.3)	17.5	5.3	13.4	15.8	4.0	18.0	3.3	--	---
	6	20.0	---	---	--	--	--	--	--	--	--	(43.5)	---
	7	20.0	---	(63.7)	17.3	6.0	13.3	14.6	3.2	--	--	--	---
	8	30.2	---	---	--	--	--	--	--	--	(2.1)	48.3	---
	9	15.5	---	---	--	--	--	(0.8)	--	18.7	2.2	48.4	---
	10	50.9	---	(19.7)	18.2	5.4	13.0	15.2	3.9	18.0	3.5	--	---
	11	17.5	---	(75.8)	18.0	6.3	11.7	15.8	3.2	18.3	4.8	--	---
	12	10.8	---	---	--	--	--	--	--	--	--	(35.1)	---
	13	15.5	---	---	--	--	--	--	--	(13.6)	3.6	46.2	---
	14	53.1	---	---	(13.2)	6.0	13.7	15.1	3.2	18.0	4.4	--	---
	15	50.7	---	---	--	--	--	--	--	--	--	--	---
	16	15.6	---	(76.7)	17.7	6.1	12.8	15.6	3.5	17.4	3.8	--	---
	17	20.5	---	(68.8)	17.1	6.0	13.0	15.5	3.4	17.9	4.2	--	---
	18	43.0	---	(29.5)	18.2	5.8	12.8	15.4	3.7	18.0	3.4	--	---
	19	11.5	---	---	--	--	--	--	--	--	--	(37.3)	---
	20	12.9	---	(53.8)	17.6	5.9	12.8	16.2	2.8	18.6	4.8	--	---
	21	37.5	---	(47.5)	18.0	5.8	13.1	15.6	3.2	17.9	4.9	--	---
LN	1	11.7	---	(29.7)	18.0	6.1	12.4	14.1	4.0	18.3	2.6	--	---
	2	8.6	---	---	--	--	--	(10.4)	4.6	18.3	2.0	52.1	---
	3	15.7	---	---	(12.5)	4.2	12.4	15.2	3.8	18.5	1.6	49.1	---
	4	11.0	---	(19.8)	17.8	5.2	12.9	15.3	3.4	18.2	1.4	48.4	---
	5	7.1	---	(59.0)	17.6	5.3	12.3	16.2	3.6	--	15.5	--	---
	6	14.0	---	(8.0)	17.8	5.6	11.8	16.8	2.8	17.9	2.4	45.8	---
	7	9.2	---	(63.6)	17.9	5.5	11.8	15.0	3.9	18.2	2.7	--	---
LX	1	10.5	---	(77.6)	18.9	4.7	12.8	15.7	3.3	--	--	--	---
	2	5.5	(4.9)	93.8	17.7	6.9	11.2	--	--	--	--	--	---
	3	5.5	(4.5)	92.5	18.6	6.0	12.2	--	--	--	--	--	---
	4	15.5	---	(34.8)	17.5	6.2	13.0	15.3	3.5	--	--	--	---

TABLE IV (cont.)

Boring Number		Overburden Thickness	Lockport Thickness	Rochester Thickness	Irondequoit Thickness	Williamson Thickness	Lower Sodus Thickness	Reynales Thickness	Furnaceville Thickness	Maplewood Thickness	Thorold Thickness	Grimsby Thickness	Queenston Thickness
C	1	7.0	(121.0)	84.5	--	--	--	--	--	--	--	--	---
	3	4.5	(20.5)	84.0	19.0	7.0	18.0	15.8	2.2	17.0	6.0	--	---
	4	8.0	(27.0)	89.0	17.0	9.0	17.0	17.0	3.0	--	--	--	---
	6	9.5	(37.0)	84.5	17.5	8.0	17.0	17.0	2.5	--	--	--	---
	8	6.5	(103.5)	91.0	--	--	--	--	--	--	--	--	---
	9	31.5	(58.5)	93.0	18.0	7.0	--	--	--	--	--	--	---
	15	5.5	(39.5)	98.0	16.0	7.5	17.5	--	--	--	--	--	---
	16	12.5	(63.5)	80.0	19.5	7.0	--	--	--	--	--	--	---
	17	8.5	(113.5)	83.0	--	--	--	--	--	--	--	--	---
	20	17.6	---	(69.4)	18.0	7.0	17.3	N.A.	N.A.	16.4	8.8	--	---
D	1	6.5	---	(49.5)	18.0	7.0	18.0	15.1	3.4	15.0	8.5	--	---
	3	10.8	---	(58.7)	20.5	6.5	17.5	15.9	3.1	17.0	7.5	--	---
	4	10.0	---	(19.0)	17.5	8.5	17.0	15.7	3.3	15.5	10.0	--	---
	7	36.0	---	---	--	--	--	(10.8)	3.2	14.5	5.0	--	---
	8	62.0	---	---	--	--	--	--	--	--	(2.5)	53.0	---
	13	62.0	---	---	--	--	--	--	--	--	--	(31.0)	---
	19	13.0	---	---	(17.5)	8.5	18.0	N.A.	N.A.	16.0	10.3	--	---
DE	1	19.5	---	---	--	--	--	(11.8)	1.8	21.4	1.6	--	---
	2	30.3	---	---	--	--	--	--	--	(11.4)	1.8	47.9	---
	3	23.5	---	---	--	--	--	--	--	--	--	(10.7)	---
	4	10.0	---	---	(8.6)	4.5	13.1	15.9	3.7	18.8	2.4	--	---
	5	21.5	---	---	--	--	--	(1.7)	3.4	18.7	2.4	48.7	---
	6	14.6	---	---	--	--	--	--	--	--	--	(12.0)	---
	7	24.5	---	---	--	--	--	--	--	--	--	(6.8)	---
	8	13.5	---	---	--	--	--	--	--	--	(0.9)	--	---
	9	12.6	---	---	--	--	--	--	--	--	(1.4)	--	---
	10	25.0	---	---	--	--	--	--	--	--	--	--	---
	11	17.0	---	---	--	--	--	--	--	--	(2.0)	47.4	---
	12	17.0	---	---	--	--	--	--	--	--	(2.9)	46.3	---
	13	15.0	---	---	--	--	--	--	--	--	(2.0)	--	---
G	2	7.0	(15.0)	86.0	18.0	7.5	16.0	16.0	3.5	16.0	7.5	--	---
	3	14.6	(8.4)	80.5	19.5	6.5	16.5	13.8	5.7	16.5	8.0	--	---
	4	15.0	(75.0)	83.0	19.0	6.5	18.0	--	--	--	--	--	---
	5	14.0	(66.0)	83.5	17.5	9.0	15.0	--	--	--	--	--	---
	6	4.5	(45.5)	86.5	20.0	8.0	15.5	16.7	2.8	--	--	--	---

TABLE IV

Summary of Rock Unit Thicknesses in Selected Boreholes

Boring Number	Overburden Thickness	Lockport Thickness	Rochester Thickness	Irondequoit Thickness	Williamson Thickness	Lower Sodus Thickness	Reynales Thickness	Furnaceville Thickness	Maplewood Thickness	Thorold Thickness	Grimsby Thickness	Queenston Thickness
AL 1	10.0	(36.2)	99.7	--	--	--	--	--	--	--	--	---
2	14.5	(24.3)	96.0	17.4	5.1	13.4	--	--	--	--	--	---
3	14.0	(60.6)	---	--	--	--	--	--	--	--	--	---
4	19.0	(29.7)	97.2	--	--	--	--	--	--	--	--	---
5	17.0	(42.3)	---	--	--	--	--	--	--	--	--	---
6	15.9	(52.8)	---	--	--	--	--	--	--	--	--	---
7	10.5	(84.5)	---	--	--	--	--	--	--	--	--	---
8	17.5	(25.3)	96.3	17.1	--	--	--	--	--	--	--	---
9	11.5	(112.2)	100.2	17.0	--	--	--	--	--	--	--	---
10	8.5	(107.5)	---	--	--	--	--	--	--	--	--	---
11	17.0	(92.0)	---	--	--	--	--	--	--	--	--	---
12	12.5	(37.5)	102.0	17.5	--	--	--	--	--	--	--	---
13	16.0	(48.6)	98.7	--	--	--	--	--	--	--	--	---
14	20.0	(66.3)	---	--	--	--	--	--	--	--	--	---
B 501	10.5	(115.0)	---	--	--	--	--	--	--	--	--	---
502	11.2	(18.6)	99.1	17.6	7.9	--	--	--	--	--	--	---
503	7.0	(29.0)	98.5	16.7	5.5	13.3	--	--	--	--	--	---
504	10.0	---	(58.5)	16.5	6.4	13.1	14.7	3.6	16.4	2.8	--	---
505	25.0	---	---	--	--	--	--	--	(4.0)	0.8	49.7	---
506	26.0	---	---	--	--	--	--	--	--	--	(8.2)	---
507	10.0	---	---	--	--	--	--	--	--	--	--	---
508	7.3	---	---	--	--	--	--	--	--	--	--	---
509	16.0	---	---	--	--	--	--	--	--	--	--	---
510	11.0	(25.0)	---	--	--	--	--	--	--	--	--	---
511	11.0	(42.2)	---	--	--	--	--	--	--	--	--	---
512	16.6	---	---	--	--	--	--	--	--	--	--	---
513	10.1	(8.4)	87.7	--	--	--	--	--	--	--	--	---
514	11.5	---	---	(4.7)	8.0	12.3	16.0	3.4	--	--	--	---
515	34.4	---	---	--	--	--	--	--	--	--	--	---
516	21.0	---	---	--	--	--	--	--	--	--	(25.2)	---
B 601	15.5	(124.7)	96.4	18.5	4.3	16.5	16.3	2.9	--	--	--	---
602	7.5	---	(82.0)	18.1	4.4	12.5	15.3	3.9	17.3	3.8	--	---
603	16.5	---	(5.0)	18.3	4.9	11.7	15.6	3.8	18.1	2.2	--	---

TABLE III (cont.)

Boring Number	Ground Surface Elevation	Lockport Elevation	Rochester Elevation	Irondequoit Elevation	Williamson Elevation	Lower Sodus Elevation	Reynales Elevation	Furnaceville Elevation	Maplewood Elevation	Thorold Elevation	Grimsby Elevation	Queenston Elevation
SS 1	508.9	(500.4)	446.2	348.7	---	---	---	296.2*	---	---	---	---
2	505.7	(498.7)	474.9	368.2	---	---	---	315.7*	---	---	---	---
3	507.8	(497.6)	452.3	355.9	---	---	---	303.7*	---	---	---	---
4	500.8	(490.1)	473.1	375.1	---	---	---	322.6*	---	---	---	---
5	531.3	(522.3)	429.5	329.9	311.5	306.7	292.8	277.6	274.4	256.5	251.6	---
6	525.2	(512.7)	438.6	---	---	---	---	289.1*	---	---	---	---
7	528.5	(517.0)	430.7	---	---	---	---	281.2*	---	---	---	---
8	518.8	(504.8)	442.5	---	---	---	---	293.0*	---	---	---	---
9	530.9	(520.9)	426.6	331.0	313.3	307.2	293.7	278.4	275.1	---	---	---
10	530.3	(522.8)	431.3	330.0	312.5	---	---	277.5*	---	---	---	---
11	532.5	(523.0)	427.7	334.4	---	---	---	281.9*	---	---	---	---
TC 1	427.8	---	---	---	---	---	---	---	---	---	(412.8)	377.3
2	433.3	---	---	---	---	---	---	---	---	---	(416.5)	378.9
3	441.6	---	---	---	---	---	---	---	---	---	(430.5)	380.1
4	439.1	---	---	---	---	---	---	---	---	---	(423.0)	382.0
5	430.9	---	---	---	---	---	---	---	---	---	(422.4)	384.0
6	454.4	---	---	---	---	---	---	---	---	(428.2)	426.9	376.9
7	435.7	---	---	---	---	---	---	---	---	---	(423.7)	384.1

NOTES:

1. Elevations are referenced to Rochester New City Datum (NCD) and are expressed in feet.
2. All elevations refer to unit tops except where denoted by parentheses.
3. Elevations of the Furnaceville Hematite denoted by an asterisk are estimations based on the elevations of shallower units encountered in the boring.
4. See Figure 1 for locations of test borings.
5. Test boring data obtained from Monroe County Department of Engineering Sewer Tunnel projects.
6. Refer to accompanying report for additional information.

TABLE III (cont.)

Boring Number	Ground Surface Elevation	Lockport Elevation	Rochester Elevation	Irondequoit Elevation	Williamson Elevation	Lower Sodus Elevation	Reynales Elevation	Furnaceville Elevation	Maplewood Elevation	Thorold Elevation	Grimsby Elevation	Queenston Elevation
SM 19	521.2	(497.0)	397.3	---	---	---	---	246.3*	---	---	---	---
20	495.0	(482.7)	441.9	347.3	---	---	---	293.3*	---	---	---	---
21	495.0	(490.0)	398.5	---	---	---	---	247.5*	---	---	---	---
SN 1	420.1	---	---	---	---	---	(396.6)	385.5	381.9	364.0	359.9	312.6
2	449.6	---	(439.6)	423.9	405.4	398.9	385.6	370.1	367.0	348.4	344.0	---
3	467.4	---	(457.4)	402.6	383.7	376.3	363.2	347.4	344.0	327.9	321.4	---
SP 1	405.1	---	---	---	---	---	---	---	---	---	---	(376.1)
2	410.7	---	---	---	---	---	---	---	---	---	---	(384.7)
3	411.2	---	---	---	---	---	---	---	---	---	---	(385.9)
4	410.4	---	---	---	---	---	---	---	---	---	---	(375.4)
5	408.7	---	---	---	---	---	---	---	---	---	---	(374.2)
6	407.0	---	---	---	---	---	---	---	---	---	---	(360.5)
7	405.3	---	---	---	---	---	---	---	---	---	---	(353.3)
8	403.6	---	---	---	---	---	---	---	---	---	---	(343.6)
9	402.1	---	---	---	---	---	---	---	---	---	---	(336.6)
10	397.2	---	---	---	---	---	---	---	---	---	---	(329.2)
11	398.6	---	---	---	---	---	---	---	---	---	---	(315.1)
12	395.5	---	---	---	---	---	---	---	---	---	---	(309.5)
13	392.5	---	---	---	---	---	---	---	---	---	---	(296.0)
14	384.1	---	---	---	---	---	---	---	---	---	---	(295.8)
15	374.6	---	---	---	---	---	---	---	---	---	---	(291.9)
16	377.4	---	---	---	---	---	---	---	---	---	---	(299.7)
17	370.9	---	---	---	---	---	---	---	---	---	---	(277.9)
18	368.1	---	---	---	---	---	---	---	---	---	---	(275.6)
19	366.0	---	---	---	---	---	---	---	---	---	---	(264.6)
20	358.6	---	---	---	---	---	---	---	---	---	---	(257.8)
21	355.0	---	---	---	---	---	---	---	---	---	---	(255.0)
22	335.9	---	---	---	---	---	---	---	---	---	---	(250.5)
23	329.8	---	---	---	---	---	---	---	---	---	---	(245.4)
24	271.5	---	---	---	---	---	---	---	---	---	---	(243.0)
25	422.9	---	---	---	---	---	---	(409.9)	407.1	386.9	383.9	338.0
26	416.2	---	---	---	---	---	---	---	---	---	(395.7)	351.3
27	413.6	---	---	---	---	---	---	---	---	---	(403.6)	357.0
28	409.3	---	---	---	---	---	---	---	---	---	(401.3)	368.3
29	406.4	---	---	---	---	---	---	---	---	---	(386.9)	347.9
30	402.7	---	---	---	---	---	---	---	---	---	---	(378.4)
32	411.3	---	---	---	---	---	---	---	---	---	(401.0)	367.0

TABLE III (cont.)

Boring Number	Ground Surface Elevation	Lockport Elevation	Rochester Elevation	Irondequoit Elevation	Williamson Elevation	Lower Sodus Elevation	Reynales Elevation	Furnaceville Elevation	Maplewood Elevation	Thorold Elevation	Grimsby Elevation	Queenston Elevation
LY 1	521.1	(514.1)	490.4	393.3	373.1	367.8	355.6	340.3	---	---	---	---
2	523.1	(516.6)	483.0	386.0	368.8	363.1	350.1	333.0*	---	---	---	---
3	517.3	(500.5)	481.3	383.5	365.8	360.3	347.5	330.5*	---	---	---	---
4	523.5	(514.5)	486.3	388.2	370.3	365.4	352.2	335.2*	---	---	---	---
5	500.7	(487.4)	478.9	377.4	360.1	355.3	341.1	324.4*	---	---	---	---
6	508.1	(497.1)	475.3	376.9	358.7	352.6	---	323.9*	---	---	---	---
7	530.6	(525.6)	498.3	401.2	384.0	379.2	366.0	348.2*	---	---	---	---
8	529.2	(524.2)	496.5	400.9	380.8	376.3	363.4	347.9*	---	---	---	---
9	524.4	(512.4)	489.0	393.3	375.2	370.6	---	340.3*	---	---	---	---
MR 1	503.8	(485.8)	354.5	---	---	---	---	204.5*	---	---	---	---
2	517.7	(506.7)	377.0	---	---	---	---	226.0*	---	---	---	---
3	506.1	(480.6)	353.7	259.9	---	---	---	202.9*	---	---	---	---
4	512.9	(491.9)	359.6	260.7	---	---	---	204.7*	---	---	---	---
P 101	425.2	---	---	---	---	---	---	---	---	(396.2)	394.2	---
103	498.0	---	(484.0)	386.3	368.5	361.2	346.0	333.9	330.3	---	---	---
104	477.5	(459.5)	375.5	293.0	278.5	268.5	250.2	235.2	232.5	---	---	---
110	390.3	----	---	---	---	(370.3)	368.8	353.0*	---	---	---	---
SM 1	486.4	(484.9)	454.4	351.1	---	---	---	298.1*	---	---	---	---
2	483.1	---	(464.8)	383.2	365.6	359.3	346.9	331.7	328.1	---	---	---
3	498.5	(490.5)	469.4	372.9	---	---	---	320.4*	---	---	---	---
4	496.7	(490.7)	459.4	361.1	---	---	---	308.1*	---	---	---	---
5	502.6	(487.6)	460.6	363.1	---	---	---	310.1*	---	---	---	---
6	492.7	(478.7)	442.5	---	---	---	---	293.5*	---	---	---	---
7	515.4	(506.4)	422.2	---	---	---	---	273.2*	---	---	---	---
8	526.1	(499.9)	406.5	---	---	---	---	257.0*	---	---	---	---
9	524.6	(493.6)	435.1	---	---	---	---	286.1*	---	---	---	---
10	492.0	(484.6)	---	---	---	---	---	---	---	---	---	---
11	491.2	(476.2)	---	---	---	---	---	---	---	---	---	---
12	488.4	(483.9)	451.3	354.7	---	---	---	301.7*	---	---	---	---
13	492.8	(485.2)	---	---	---	---	---	---	---	---	---	---
14	499.7	(484.7)	---	---	---	---	---	---	---	---	---	---
15	497.5	(486.0)	442.2	347.4	---	---	---	293.4*	---	---	---	---
16	497.0	(484.5)	---	---	---	---	---	---	---	---	---	---
17	493.8	(487.8)	---	---	---	---	---	---	---	---	---	---
18	494.6	(482.7)	---	---	---	---	---	---	---	---	---	---

TABLE III (cont.)

Boring Number		Ground Surface Elevation	Lockport Elevation	Rochester Elevation	Irondequoit Elevation	Williamson Elevation	Lower Sodus Elevation	Reynales Elevation	Furnaceville Elevation	Maplewood Elevation	Thorold Elevation	Grimsby Elevation	Queenston Elevation
G	7	459.4	---	(449.1)	376.9	357.9	351.9	334.4	318.1	314.9	298.7	291.4	---
	8	477.6	(469.6)	438.6	349.6	329.6	323.6	307.1	290.1	287.1	271.6	---	---
	9	504.0	(482.0)	420.0	333.5	315.5	307.5	289.5	274.5*	---	---	---	---
	16	492.6	(477.1)	406.6	327.6	309.6	302.3	285.1	268.6*	---	---	---	---
LK	1	461.1	---	(447.6)	425.1	406.7	400.5	386.4	372.2	369.1	351.3	347.3	---
	2	482.9	---	(458.9)	440.5	421.8	415.8	404.0	388.4	384.7	366.0	363.7	---
	3	458.7	---	---	---	---	(425.7)	412.8	397.3	393.9	374.5	372.2	---
	4	445.3	---	---	---	---	---	(416.4)	404.1	400.3	381.7	379.0	333.3
	5	491.7	---	(460.7)	428.4	410.9	405.6	392.2	376.4	372.4	354.4	351.1	---
	6	415.7	---	---	---	---	---	---	---	---	---	(395.7)	352.2
	7	485.0	---	(465.0)	401.3	384.0	378.0	364.7	350.1	346.9	---	---	---
	8	424.9	---	---	---	---	---	---	---	---	(394.7)	392.6	344.3
	9	423.1	---	---	---	---	---	(407.6)	---	406.8	388.1	385.9	337.5
	10	506.0	---	(455.1)	435.4	417.2	411.8	398.8	383.6	379.7	361.7	358.2	---
	11	489.2	---	(471.7)	395.9	377.9	371.6	359.9	344.1	340.9	322.6	317.8	---
	12	411.6	---	---	---	---	---	---	---	---	---	(400.8)	365.7
	13	414.9	---	---	---	---	---	---	---	(399.4)	385.8	382.2	336.0
	14	468.5	---	---	(415.4)	402.2	396.2	382.5	367.4	364.2	346.2	341.8	---
	15	468.8	---	---	(418.1)	---	---	---	---	---	---	---	---
	16	487.5	---	(471.9)	395.2	377.5	371.4	358.6	343.0	339.5	322.1	318.3	---
	17	490.0	---	(469.5)	400.7	383.6	377.6	364.6	349.1	345.7	327.8	323.6	---
	18	504.7	---	(461.7)	432.2	414.0	408.2	395.4	380.0	376.3	358.3	354.9	---
	19	399.7	---	---	---	---	---	---	---	---	---	(388.2)	350.9
	20	476.1	---	(463.2)	409.4	391.8	385.9	373.1	356.9	354.1	335.5	330.7	---
	21	480.6	---	(443.1)	395.6	377.6	371.8	358.7	343.1	339.9	322.0	317.1	---
LN	1	490.7	---	(479.0)	449.3	431.3	425.2	412.8	398.7	394.7	376.4	116.9	---
	2	461.0	---	---	---	---	---	(454.7)	442.0	437.4	419.1	417.1	365.0
	3	491.5	---	---	(475.8)	463.3	459.1	446.7	431.5	427.7	409.2	407.6	358.5
	4	493.1	---	(482.1)	462.3	444.5	439.3	426.4	411.1	407.7	389.5	388.1	339.7
	5	493.5	---	(486.4)	427.4	409.8	404.5	392.2	376.0	372.4	---	356.9	---
	6	492.8	---	(478.8)	470.8	453.0	447.4	435.6	418.8	416.0	398.1	395.7	349.9
	7	495.6	---	(486.4)	422.8	404.9	399.4	387.6	372.6	368.7	350.5	347.8	---
LX	1	500.7	---	(490.2)	412.6	393.7	389.0	376.2	360.5	357.2	---	---	---
	2	502.4	(496.9)	492.0	398.2	380.5	373.6	362.4	346.2*	---	---	---	---
	3	497.0	(491.5)	487.0	394.5	375.9	369.9	357.7	342.5*	---	---	---	---
	4	473.2	---	(457.7)	422.9	405.4	399.2	386.2	370.9	367.4	---	---	---

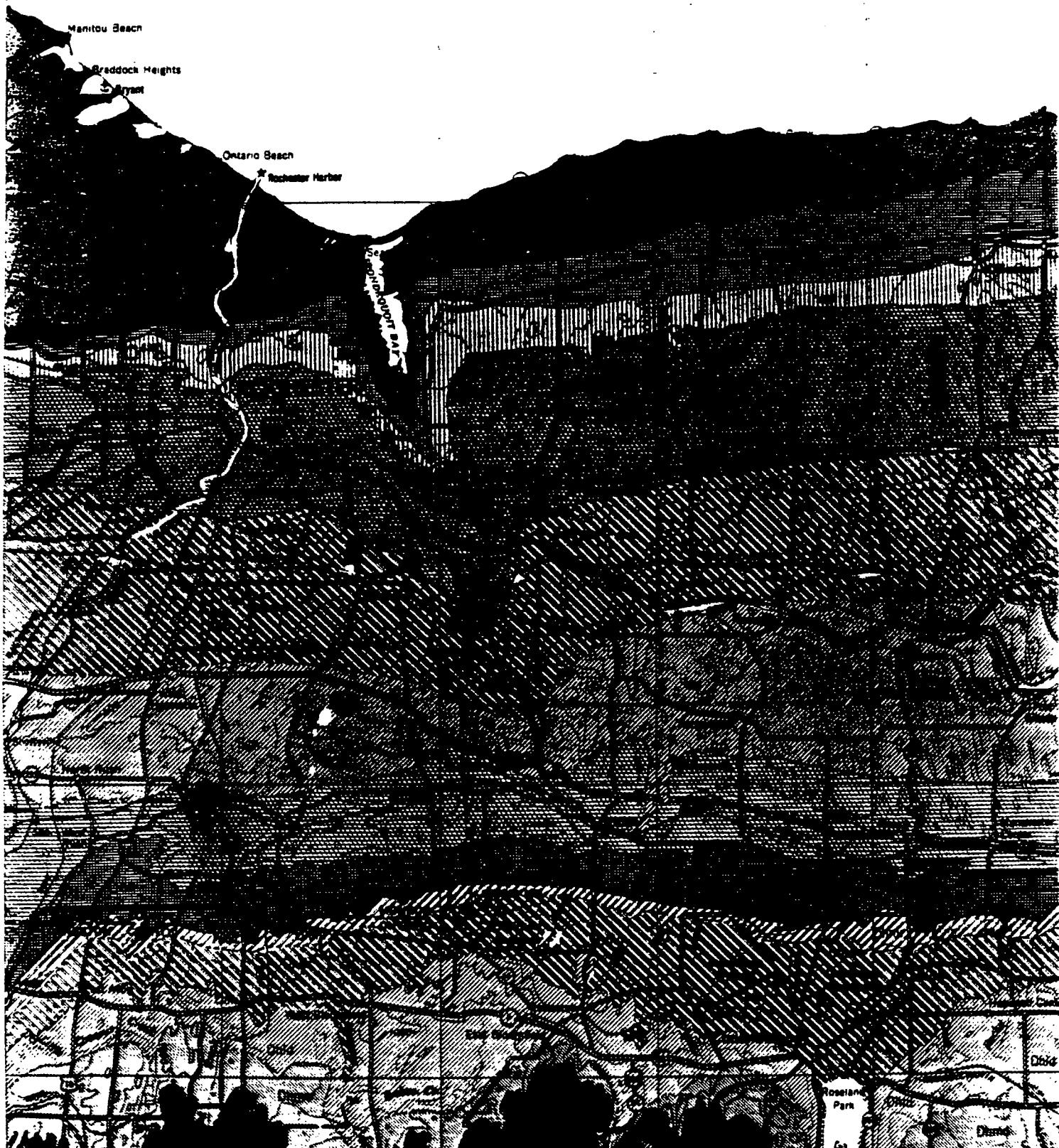
TABLE III (cont.)

Boring Number	Ground Surface Elevation	Lockport Elevation	Rochester Elevation	Irondequoit Elevation	Williamson Elevation	Lower Sodus Elevation	Reynales Elevation	Furnaceville Elevation	Maplewood Elevation	Thorold Elevation	Grimsby Elevation	Queenston Elevation
C 1	490.2	(483.2)	362.2	277.7	---	---	---	218.7*	---	---	---	---
3	463.8	(459.3)	438.8	354.8	335.8	328.8	310.8	295.0	292.8	275.8	269.8	---
4	469.3	(461.3)	434.3	345.3	328.3	319.3	302.3	285.3	282.3	---	---	---
6	469.0	(459.5)	422.5	338.0	320.5	312.5	295.5	278.5	276.0	---	---	---
8	485.9	(479.4)	375.9	284.9	---	---	---	225.9*	---	---	---	---
9	486.8	(455.3)	396.8	303.8	285.8	278.8	---	244.8*	---	---	---	---
15	470.7	(465.2)	425.7	327.7	311.7	304.2	286.7	269.7*	---	---	---	---
16	467.4	(454.9)	391.4	311.4	291.9	284.9	---	252.4*	---	---	---	---
17	487.9	(479.4)	365.9	282.9	---	---	---	223.9*	---	---	---	---
20	455.6	---	(438.0)	368.6	350.6	343.6	326.3	310.3*	307.0	290.6	281.8	---
D 1	444.5	---	(438.0)	388.5	370.5	363.5	345.5	330.4	327.0	312.0	303.5	---
3	452.0	---	(441.2)	382.5	362.0	355.5	338.0	322.1	319.0	302.0	294.5	---
4	431.4	---	(421.4)	402.4	384.9	376.4	359.4	343.7	340.4	324.9	314.9	---
7	402.3	---	---	---	---	---	(366.3)	355.5	352.3	337.8	332.8	---
8	397.2	---	---	---	---	---	---	---	---	(335.2)	332.7	279.7
13	380.4	---	---	---	---	---	---	---	---	---	(318.4)	287.4
19	424.5	---	---	(411.5)	394.0	385.5	367.5	354.3*	351.0	335.0	324.7	---
DE 1	445.1	---	---	---	---	---	(425.6)	413.8	412.0	390.6	389.0	---
2	447.9	---	---	---	---	---	---	--	(417.6)	406.2	404.4	356.5
3	415.8	---	---	---	---	---	---	---	---	---	(392.3)	381.6
4	452.7	---	---	(442.7)	434.1	429.6	416.5	400.6	396.9	378.1	375.7	---
5	445.9	---	---	---	---	---	(424.4)	422.7	419.3	400.6	398.2	349.5
6	412.5	---	---	---	---	---	---	---	---	---	397.9	385.9
7	411.1	---	---	---	---	---	---	---	---	---	(386.6)	379.8
8	428.7	---	---	---	---	---	---	---	---	(415.2)	414.3	---
9	431.1	---	---	---	---	---	---	---	---	(418.5)	417.1	---
10	435.0	---	---	---	---	---	---	---	---	---	(410.0)	---
11	431.0	---	---	---	---	---	---	---	---	(414.0)	412.0	364.6
12	430.4	---	---	---	---	---	---	---	---	(413.4)	410.5	364.2
13	425.6	---	---	---	---	---	---	---	---	(410.6)	408.6	---
G 2	465.5	(458.5)	443.5	357.5	339.5	332.0	316.0	300.0	296.5	280.5	273.0	---
3	467.7	(453.1)	444.7	364.2	344.7	338.2	321.7	307.9	302.2	285.7	277.7	---
4	494.7	(479.7)	404.7	321.7	302.7	296.2	278.2	262.7*	---	---	---	---
5	490.6	(476.6)	410.6	327.1	309.6	300.6	285.6	268.1*	---	---	---	---
6	480.2	(475.7)	430.2	343.7	323.7	315.7	300.2	283.5	280.7	---	---	---

TABLE III

Summary of Rock Unit Elevations in Selected Boreholes

Boring Number	Ground Surface Elevation	Lockport Elevation	Rochester Elevation	Irondequoit Elevation	Williamson Elevation	Lower Sodus Elevation	Reynales Elevation	Furnaceville Elevation	Maplewood Elevation	Thorold Elevation	Grimsby Elevation	Queenston Elevation
AL 1	520.4	(510.4)	474.2	374.5	---	---	---	321.5*	---	---	---	---
2	518.8	(504.3)	480.0	384.0	366.6	361.5	348.1	331.0*	---	---	---	---
3	524.2	(510.2)	449.6	---	---	---	---	298.1*	---	---	---	---
4	517.9	(498.9)	469.2	372.0	---	---	---	319.0*	---	---	---	---
5	521.5	(504.5)	462.2	---	---	---	---	311.2*	---	---	---	---
6	519.4	(503.5)	450.7	---	---	---	---	299.2*	---	---	---	---
7	532.5	(522.0)	437.5	---	---	---	---	286.5*	---	---	---	---
8	517.4	(499.9)	474.6	378.3	361.2	---	---	325.3*	---	---	---	---
9	541.2	(529.7)	417.5	317.3	300.3	---	---	265.3*	---	---	---	---
10	539.9	(531.4)	423.9	---	---	---	---	271.9*	---	---	---	---
11	540.6	(523.6)	431.6	---	---	---	---	278.6*	---	---	---	---
12	526.7	(514.2)	476.7	374.7	357.2	---	---	321.7*	---	---	---	---
13	520.0	(504.0)	455.4	356.7	---	---	---	304.2*	---	---	---	---
14	531.5	(511.5)	445.2	---	---	---	---	294.2*	---	---	---	---
B 501	546.6	(536.1)	421.1	---	---	---	---	268.1*	---	---	---	---
502	504.8	(493.6)	475.0	375.9	358.3	350.4	---	322.9*	---	---	---	---
503	528.5	(521.5)	492.5	394.0	377.3	371.8	358.5	341.0*	---	---	---	---
504	495.1	---	(485.1)	426.6	410.1	403.7	390.6	375.9	372.3	355.9	353.1	---
505	455.3	---	---	---	---	---	---	---	(430.3)	426.3	425.5	375.8
506	410.4	---	---	---	---	---	---	---	---	---	(384.4)	376.2
507	530.2	(520.2)	---	---	---	---	---	---	---	---	---	---
508	530.5	(523.2)	---	---	---	---	---	---	---	---	---	---
509	518.1	(502.1)	---	---	---	---	---	---	---	---	---	---
510	519.9	(508.9)	483.9	---	---	---	---	334.9*	---	---	---	---
511	496.5	(485.5)	443.3	---	---	---	---	294.6*	---	---	---	---
512	468.3	---	(451.7)	---	---	---	---	---	---	---	---	---
513	510.1	(500.0)	491.6	403.9	---	---	---	351.9*	---	---	---	---
514	452.7	---	---	(441.2)	436.5	428.5	416.2	400.2	396.8	---	---	---
515	483.1	---	(448.7)	---	---	---	---	---	---	---	---	---
516	423.0	---	---	---	---	---	---	---	---	---	(402.0)	376.8
B 601	517.5	(502.0)	377.3	280.9	262.4	258.1	241.6	225.3	222.4	---	---	---
602	528.3	---	(520.8)	438.8	420.7	416.3	403.8	388.5	384.6	367.3	363.5	---
603	496.3	---	(479.8)	474.8	456.5	451.6	439.9	424.3	420.5	402.4	400.2	---


Manitou Beach
Braddock Heights
Bryant
Ontario Beach
Rochester Harbor
Roseland Park