Van De Mark Chemical Co., Inc.

FORMER LANDFILL INVESTIGATION & CLOSURE PLAN

April, 1984
Ref. No. 1277

Advanced Environmental Systems Inc.
Conestoga Rovers & Associates Limited

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1.0 INTRODUCTION

In the fall of 1983, Van De Mark Chemical Company, Inc. (VDM) authorized Advanced Environmental Systems, Inc. and Conestoga-Rovers & Associates Limited to complete a closure investigation of a former landfill site located on VDM property. The former landfill operated under Permit 2111 which was issued February 9, 1979 by the New York State Department of Environmental Conservation and which expired in February 1982. (A copy of the permit application is enclosed in Appendix A). The area had been used by VDM as a disposal area since approximately 1957.

The following report presents details on the regional and local geology including soil conditions, groundwater conditions, local topography, surface drainage and local groundwater quality. This report also addresses environmental concerns and recommends a closure plan.

Background information was provided by historic studies of the area undertaken by Woodward-Clyde Consultants and Bechtel Associates Professional Corporation for adjacent construction operations and from investigations previously undertaken by VDM.

2.0 EXISTING CONDITIONS

2.1 SITE LOCATION

The former Van De Mark Landfill is located within the Northwestern limits of the City of Lockport, New York. A site location plan is presented in Figure 1. The former landfill is located approximately 275 yards west of the Van De Mark Chemical Plant on a plateau bordered to the west and south by an embankment sloping down to Eighteen Mile Creek. The Somerset Railroad passes close by to the East. Mill Street, to the North, allows access to the 2.1 acre site.

2.2 SITE TOPOGRAPHY

The plateau upon which the former landfill site is situated, is relatively flat having an approximate elevation of 444.0 A.M.S.L. The landfill is bordered on the west and south by a steep vertical descent on the order of 85 feet; and is bordered to the north-east by a steep embankment being on the order of 24 feet high. A general site plan indicating surface contours is shown in Figure 2.

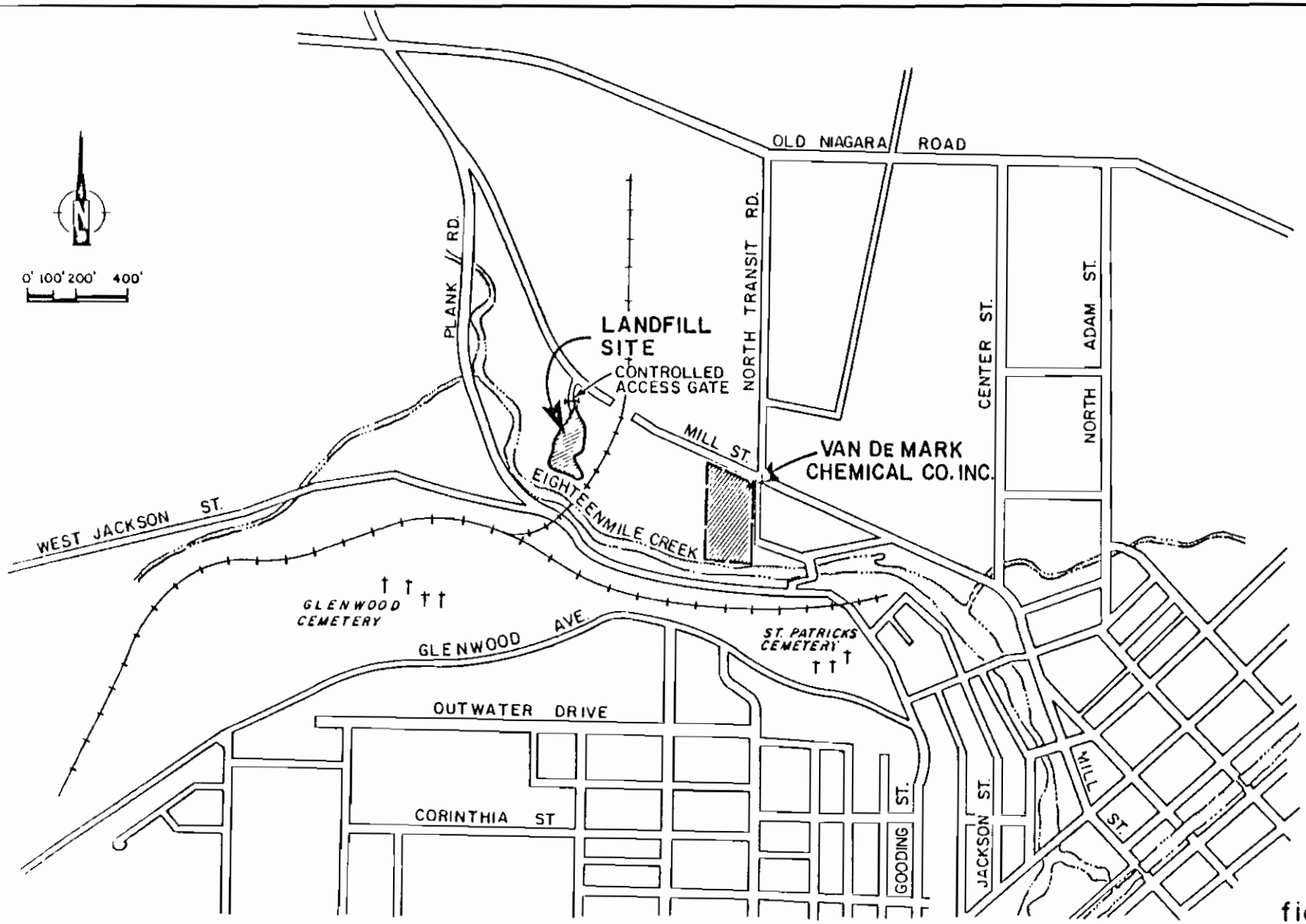

figure 1

SITE LOCATION PLAN
VAN De MARK LANDFILL
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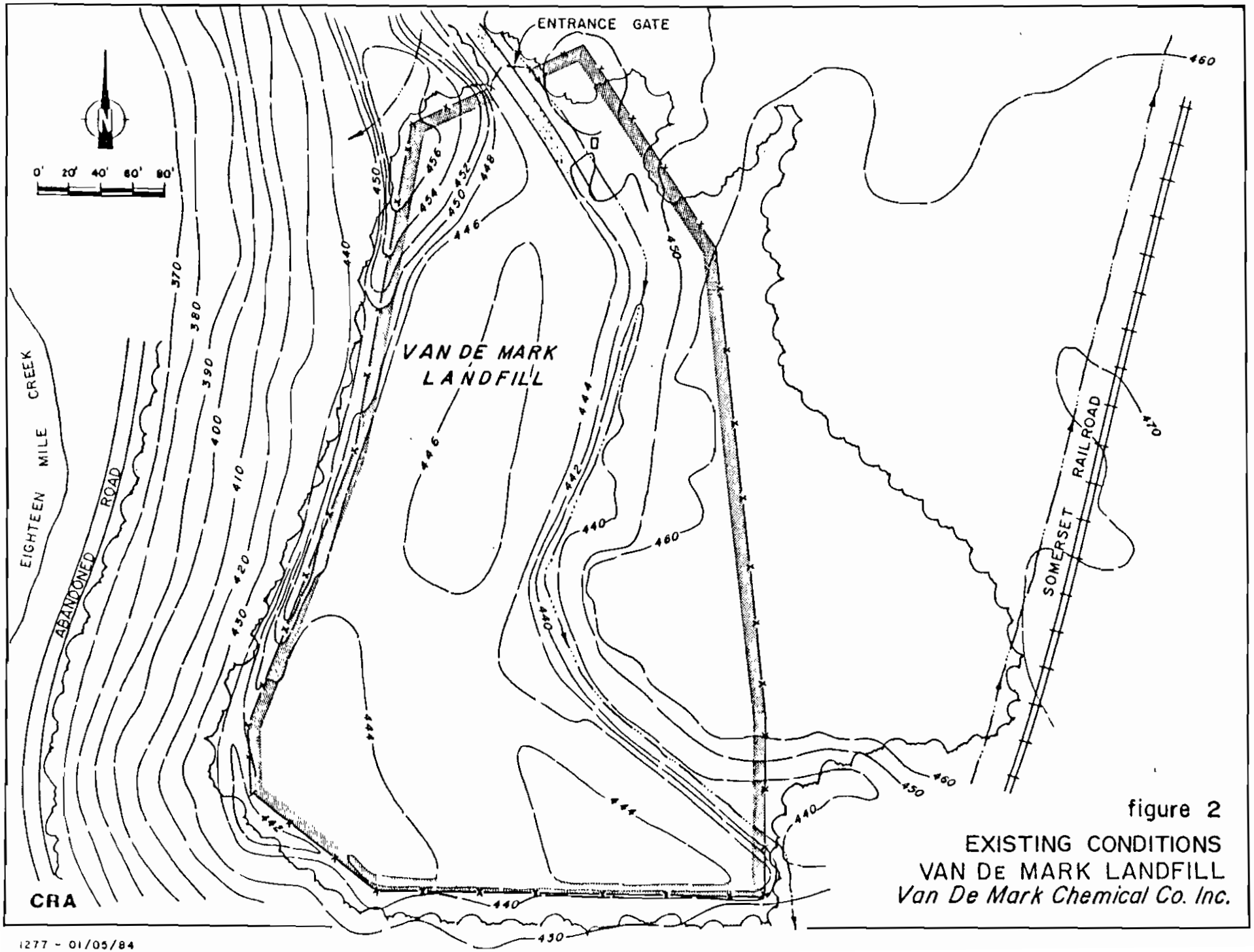

figure 2
EXISTING CONDITIONS
VAN DE MARK LANDFILL
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A small berm, one to two feet in height, extends along the edge of the western and southern disposal limits to prevent on-site surface water discharge to Eighteen Mile Creek which runs along the base of the steep slope. A drainage ditch along the base of the incline located east and northeast of the landfilled area provides the site with a surface drainage outlet.

3.0 LANDFILL PRACTICES

The Van De Mark Landfill can be subdivided into two major disposal areas as shown by Figure 3. The Western region consists of an area which was used for waste disposal between 1957 and 1979 by VDM. In this area, landfilling methods were generally random, consisting of excavation, disposal and covering. The waste consisted mainly of drums of silicon tetrachloride ($SiCl_4$) and chlorodisiloxane formed as by-products during the commercial production of phosgene.

The Eastern region of the landfill was used for the disposal of similar by-products as well as carbon and silicon carbide. Such waste was disposed of according to Permit 2111, issued February 9, 1979 and which expired in February 1982. The drummed waste was deposited in pits on a base of crushed limestone and backfilled with crushed limestone. The drums were then perforated to enhance the neutralizing of the waste. The cover consisted of bags of finish lime and agricultural lime beneath an earthen cap of red silty clayey soils. Upon expiry of Permit 2111 VDM began disposal of pretreated wastes to the Lockport Wastewater Treatment Plant.

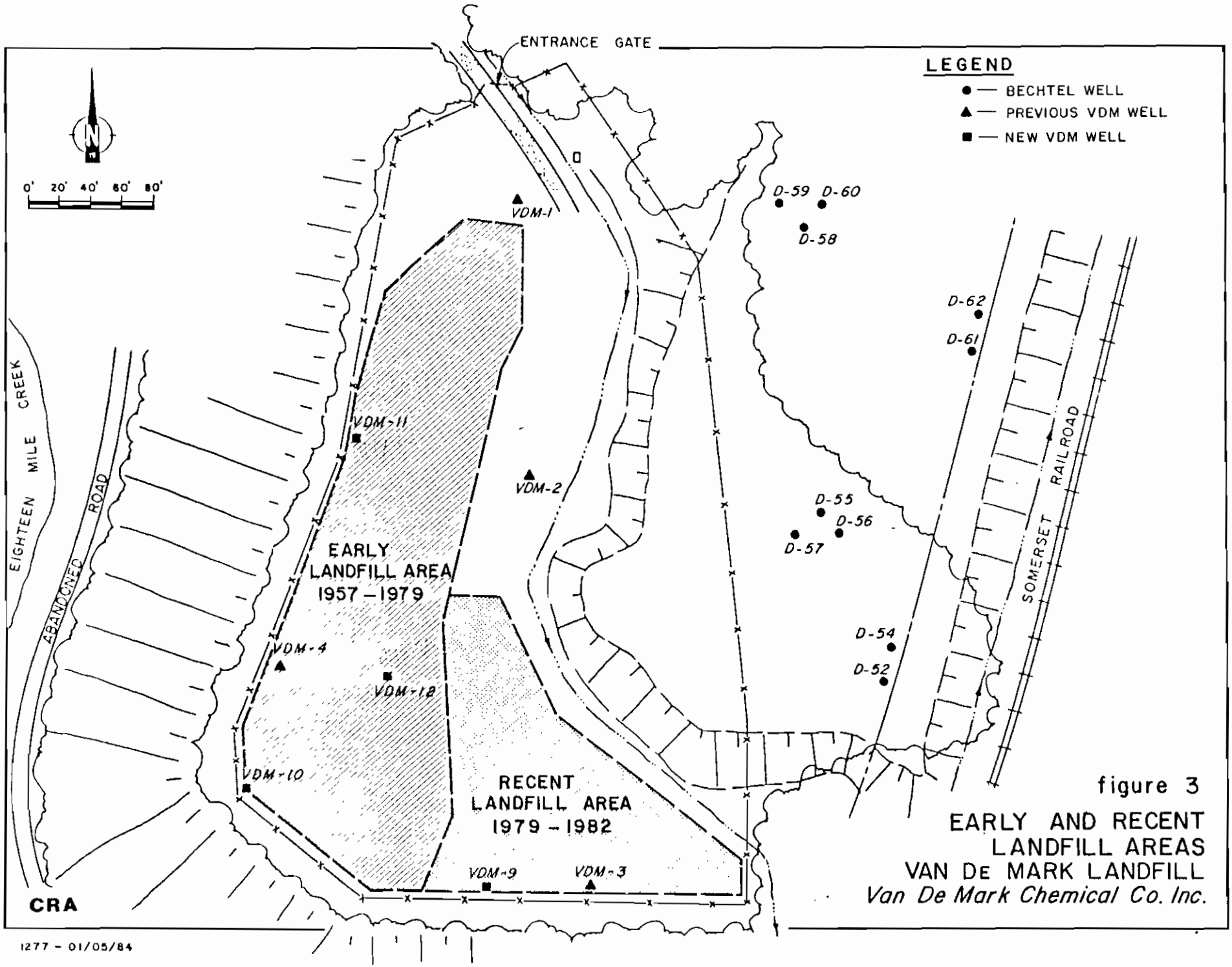

figure 3

EARLY AND RECENT LANDFILL AREAS
VAN DE MARK LANDFILL
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4.0 OBSERVATION WELL INSTALLATION

From December 1 to 9, 1983, Earth Dimensions, Inc. installed four (4) groundwater monitoring wells; three (3) monitoring wells (VDM-9, VDM-10, VDM-11) were located downgradient of the landfilled area and one (VDM-12) was installed in the central portion of the earlier landfilled area. The locations of these wells are presented in Figure 4. The direction of groundwater flow was interpreted from previous reports by Whitmore and by Bechtel. Previous wells installed by Bechtel and Whitmore as discussed in Section 4.3, are also included on Figure 4.

4.1 DOWNGRADIENT WELLS

The 1983 groundwater monitoring wells installed by CRA were placed between the landfill and top of bank as follows:

i) midway along the southern limit (VDM-9)
ii) at the southwest corner (VDM-10)
iii) midway along the west limit of the landfill (VDM-11)

The purpose of these wells was to intercept the groundwater flowing beneath the landfill and

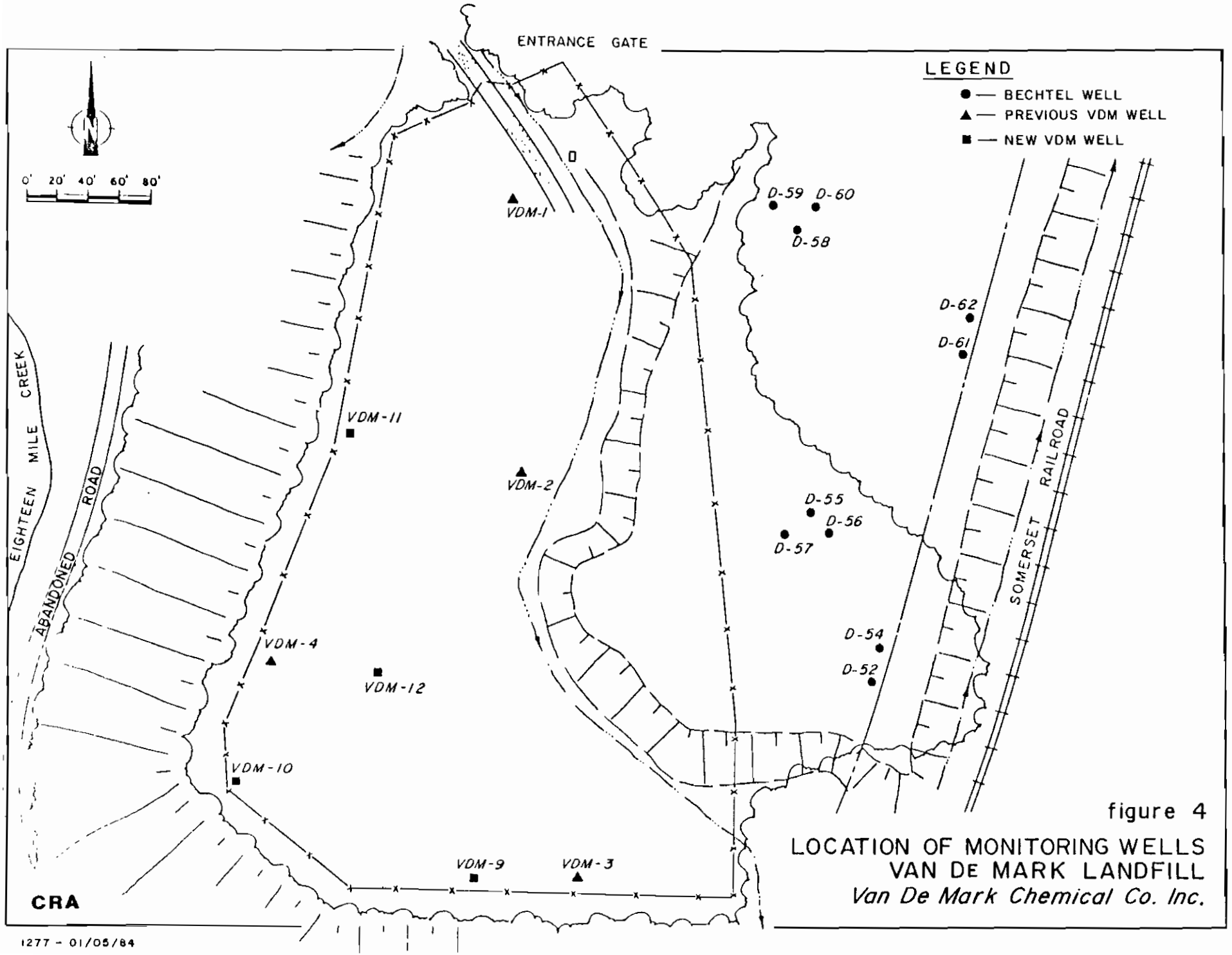

figure 4

LOCATION OF MONITORING WELLS
VAN DE MARK LANDFILL
Van De Mark Chemical Co. Inc.

discharging to the embankment along Eighteen Mile Creek.

Prior to installation it was proposed that the three downgradient monitoring wells would be installed so as to monitor a 10-foot interval of bedrock which straddled the Grimsby-Power Glen Contact. This was assumed to be the first significant water bearing interval to be encountered. Upon drilling it was found that the Grimsby Formation was not present in the area of the landfill due to former limestone-sandstone open pit quarry operations. Therefore the installations were modified such that VDM-9 and VDM-11 both monitor an interval which straddles the bedrock-overburden interface. The bedrock-overburden interface was observed to be the first encountered water bearing interval and closely approximates the expected top of the Power Glen Formation at VDM-11 and the Power Glen-Whirlpool Contact at VDM-9. Due to the weathered nature of the rock samples, the Power Glen-Whirlpool Contact at VDM-9 was not positively identified. VDM-10 monitors an interval which includes the Power Glen-Whirlpool Contact and the Whirlpool-Queenston Contact. VDM-10 was drilled down to intercept the Queenston Formation so as to provide geologic stratigraphy of the south-west area of the landfill. The monitoring

interval of VDM-10 was chosen to investigate any downward migration of contaminants.

Initially the monitoring well installations in the bedrock were not to include a screen, however, partial monitoring within the overburden required the use of a screen and sand pack. All three (3) wells were constructed of 2-inch PVC riser pipe and a 5 foot PVC well screen. The wells were installed through the augers which were progressively removed in conjunction with the backfilling operation. The annular space between the borehole wall and the well was backfilled with the following material:

1. a measured quartzite sandpack
2. a measured granular bentonite seal above the sandpack
3. a cement-bentonite grout to the surface (3% bentonite was added to prevent grout shrinkage).

Each of the three downgradient monitoring wells is protected by a 4-inch diameter steel casing with lockable cap. A typical monitoring well installation is detailed in Figure 5. Complete well logs are enclosed in Appendix 'B'.

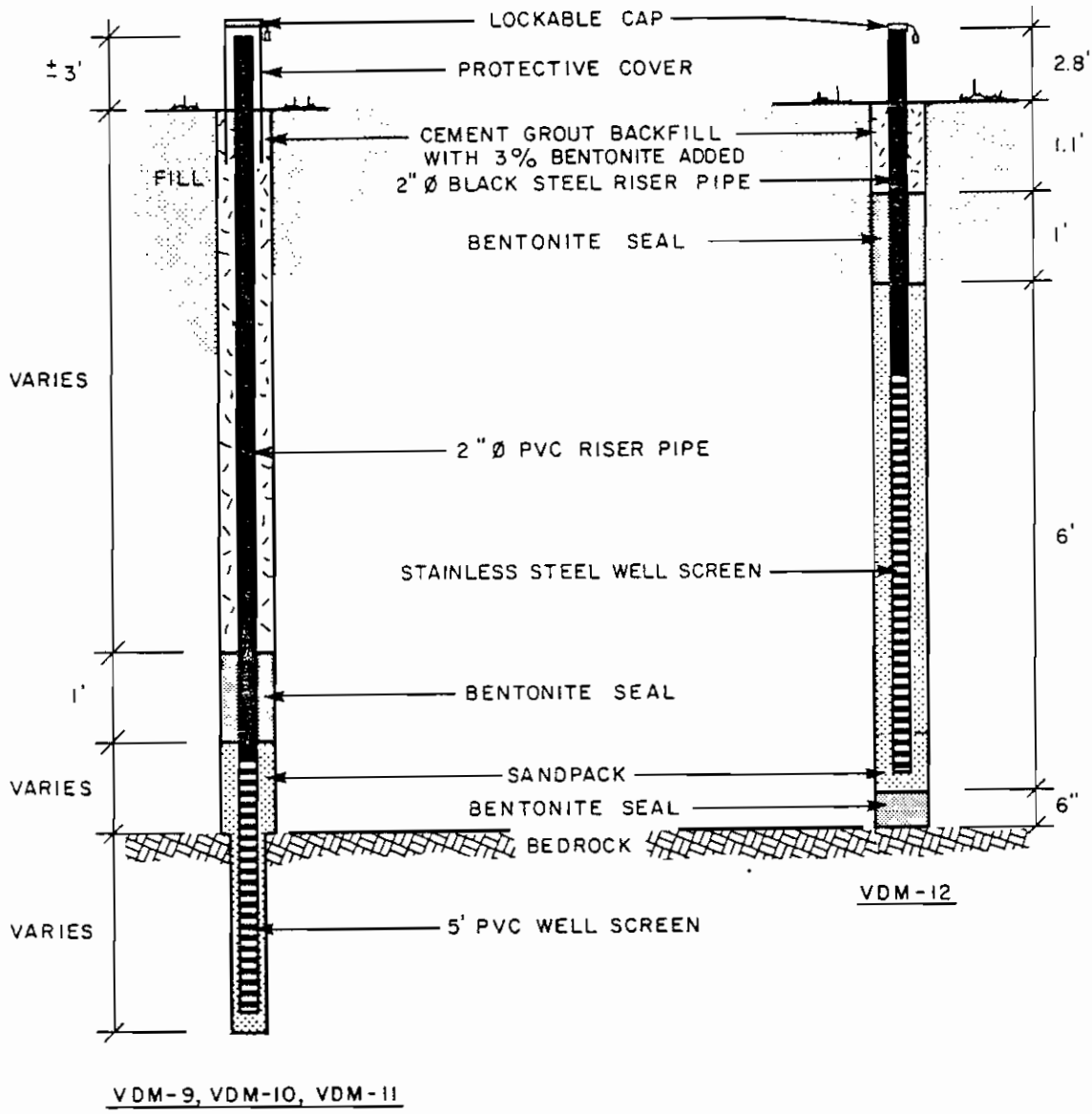

figure 5

MONITORING WELL INSTALLATION

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4.2 LANDFILL OBSERVATION WELL

Groundwater monitoring well VDM-12 is located approximately in the middle of the area landfilled between 1957 and 1979. Due to the random landfilling techniques used to dispose of waste in the early landfill area, leachate generation in this portion of the landfill was deemed to be a worst case condition.

VDM-12 was constructed of 2-inch diameter black steel pipe attached to a 2-inch diameter stainless steel well screen. VDM-12 was installed and backfilled (with a measured quartsite sandpack, measured bentonite plug and cement grout) and is protected by a 4-inch diameter steel casing with locking cap. VDM-12 is screened from 6 inches above bedrock to approximately 2-feet below grade.

Proper safety precautions were taken during all drilling and well installation activities. Respirators and quantities of lime to buffer any acid releases were kept close at hand. All drilling cuttings were temporarily placed in a 55-gallon drum and then disposed of in a pit on the landfill site and covered with a layer of lime and a layer of soil.

4.3 PREVIOUSLY INSTALLED WELLS

Wells previously installed include those constructed by Bechtel and by Whitmore. The Bechtel wells were completed in September and October of 1981 as part of a hydrogeologic investigation performed for the Somerset Railroad Corporation. Sample boring log and groundwater observation well report included in Appendix C pertain to Well D-55 used to gather background or upgradient data for this closure study.

Wells VDM-1 through VDM-4 were installed by Whitmore in relation to previous landfill studies. Associated well logs are also included in Appendix A.

5.0 HYDROGEOLOGIC INVESTIGATION

5.1 ON-SITE STRATIGRAPHY

The geologic stratigraphy of the landfill area was logged during the monitoring well installation program through split spoon sampling of the soil materials and NX coring of the bedrock. Complete well installation and stratigraphic logs are presented in Appendix 'B'.

The principle overburden material consisted of a matrix of red colored rock fragments and red brown clayey silt fill. This fill layer ranged in depth from 5 to 15 feet. Only trace amounts of waste materials were found at VDM-12 and the downgradient wells.

The bedrock in the area of the Van De Mark Landfill has been reported to include the lower 3 formations of the Nedina group; the Grimsby, Power Glen and Whirlpool in descending order. Below them is found the Queenston Formation (Bechtel, 1982). A general cross-section of the area is described on Table 1.

TABLE 1

GENERAL STRATIGRAPHIC COLUMN - VDM LANDFILL

System	Series	Group	Formation	Member	Thickness	Description
Silurian	Niagaran	Medina	Grimsby	Zone A	+60'	Sandstone, Siltstone with interbedded Shale: Dark red brown to light green to white sandstone and siltstone with red and green shale interbeds. Sandstone/Siltstone: Thin to medium-bedded, very fine to medium grained, medium hard to very hard, fresh, occasional green mottling, fossiliferous. Shale: Thin bedded to fissile, medium soft, moderately to severaly weathered.
			Power Glen		27.0'	Shale: With interbedded Dolomite and calcareous Sandstone: 60% shale, 40% dolomite and sandstone. Shale: dark gray to green, thin-bedded to fissile, medium soft to soft, microcrystalline, severely weathered. Dolomite and Sandstone: dark gray to green thin-bedded, medium hard, fine-grained, fresh to moderately weathered. Sandstone is cross-bedded.
			Whirlpool		12.0'	Sandstone: White with black speckling (quartz and unknown black mineral), thin-bedded in upper 2', medium-bedded to massive in remainder, fine-grained, hard to very hard, fresh. Cross-bedded, ripple marks.
Ordovician	Cincinnatian	Richmond	Queenston		1200'+	Claystone: Dark reddish-brown with pale green mottling and occasional thin pale green claystone interbeds, medium soft to very soft, clacareous, fresh to completely weathered.

Source: "Closure Plan for Solid Waste Management Facility VAN DE MARK Chemical Company Inc., Lockport, N.Y.", July 1 1982 by William W. Whitmore, Consulting Engineers.

The overlying bedrock encountered during the installation of well VDM-10 was of the Power Glen Formation. As indicated by borehole logs of VDM-1, VDM-2, VDM-3, VDM-4 and VDM-10 and supported by the Bechtel report, the Grimsby Formation has been removed in the landfill area by previous quarry operations and has been replaced with a layer of fill.

The overlying bedrock encountered during installation of wells VDM-9 and VDM-11 was soft, very weathered shale which could be augered. Due to the weathered nature of the rock a positive identification of the formation was not made. However, the top of rock at VDM-10, VDM-11 and VDM-12 was in close proximity to the Grimsby-Power Glen contact while at VDM-9, the top of rock was very close to the Power Glen-Whirlpool contact as interpolated from the Whitmore Report. Beneath the weathered rock, the Power Glen Formation was encountered at VDM-10 and VDM-11. The Power Glen Formation consists of grey shale interbedded with dolomite and sandstone and is approximately 12 feet thick in this area as indicated by local borings although the general geologic section refers to a regional average thickness of 27 feet. Top of Rock and top of Power Glen Formation contours are presented on Figures 6 and 7.

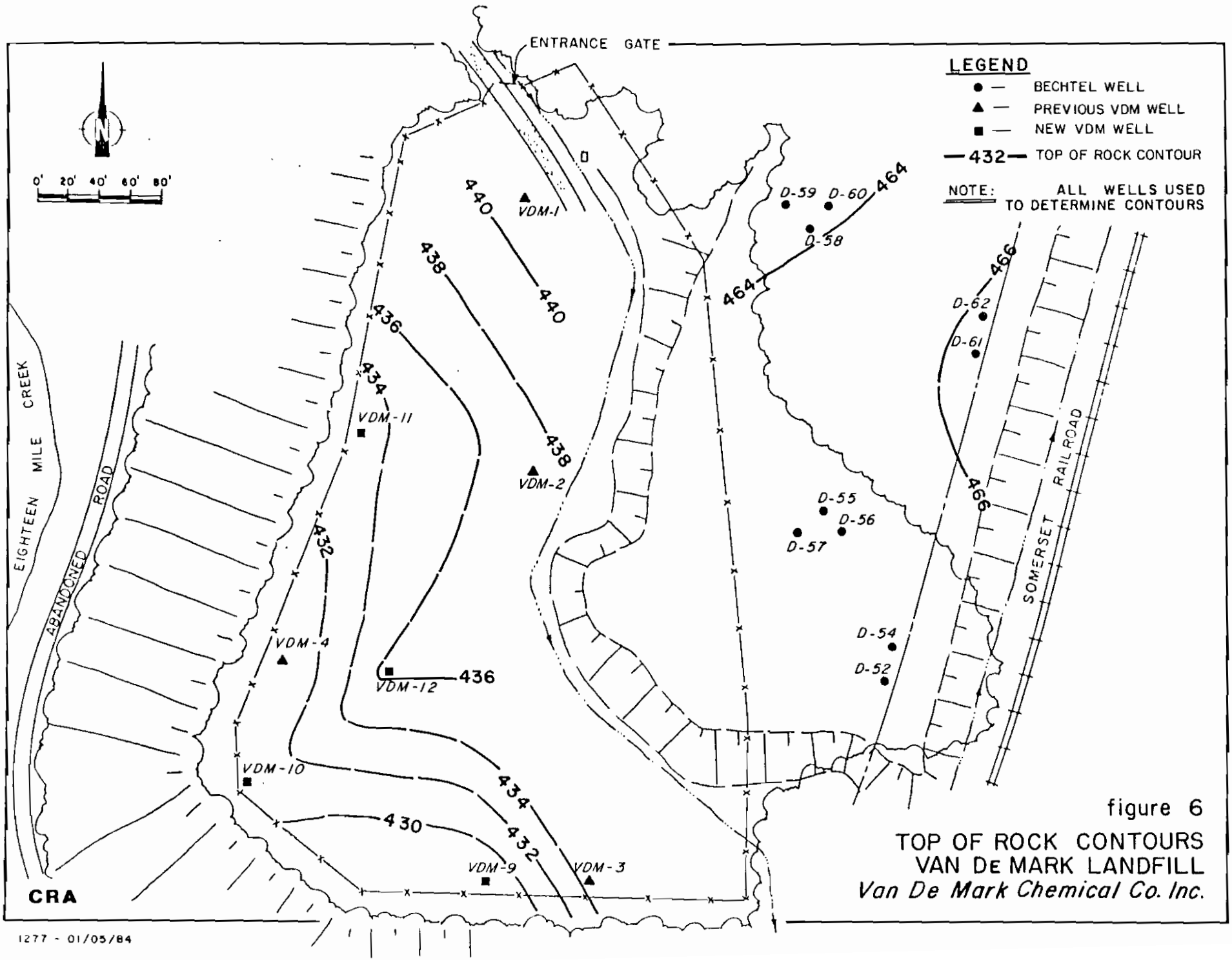

figure 6

TOP OF ROCK CONTOURS
VAN DE MARK LANDFILL
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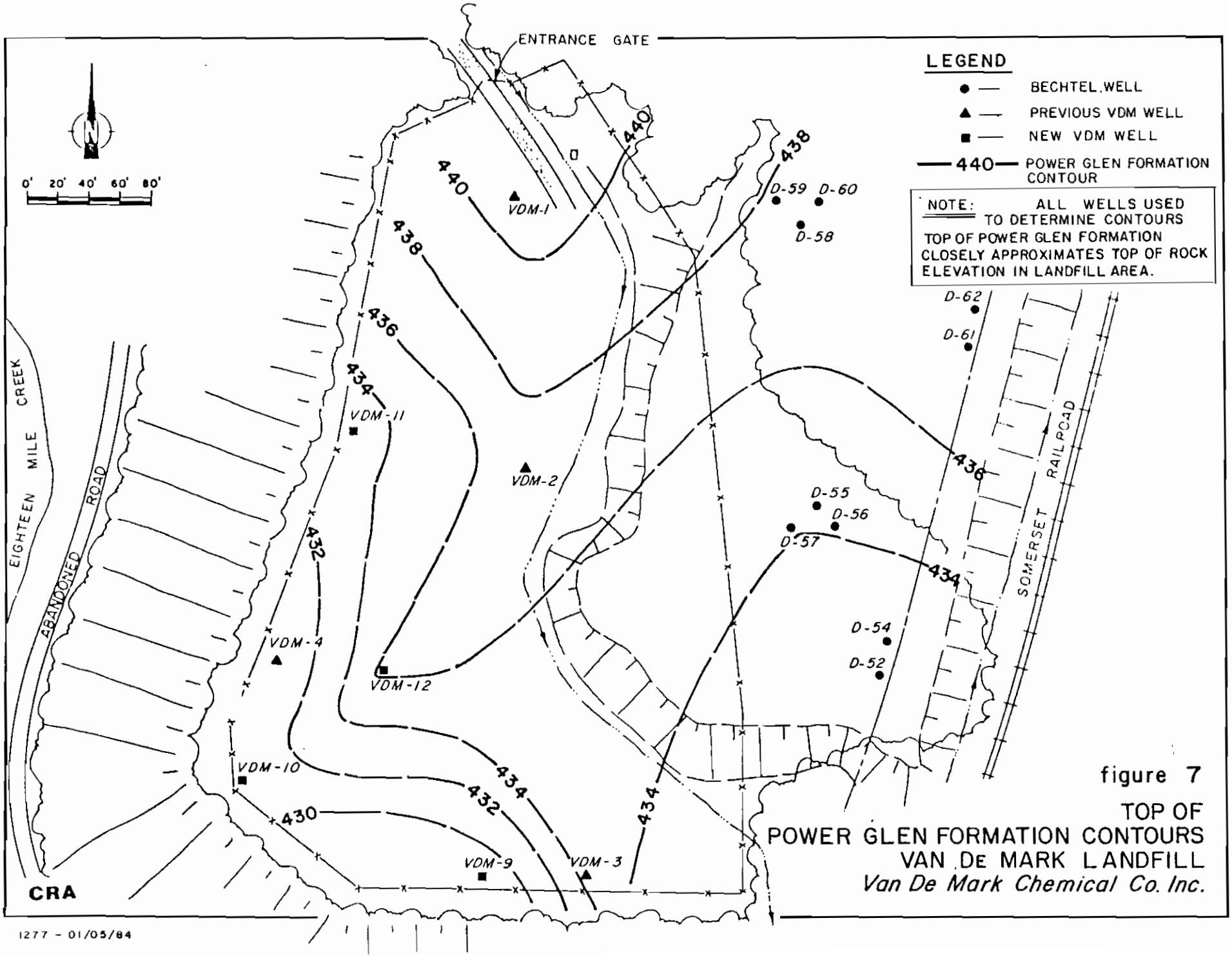

figure 7

TOP OF
POWER GLEN FORMATION CONTOURS
VAN DE MARK LANDFILL
Van De Mark Chemical Co. Inc.

At VDM-10, NX coring extended below the Power Glen Formation, through the Whirlpool Formation to intercept the Queenston Formation. In the area of the VDM Landfill, the Whirlpool Formation is approximately 15 ft. thick consisting of buff colored sandstone. The Queenston Formation is made up of dark red-brown shale (claystone) with interbedded green shale. The top of the Queenston Formation Contours are presented on Figure 8.

Two geologic cross-sections through the landfill area have been prepared. A plan view locating the cross-sections is presented in Figure 9. Figures 10 and 11 present the cross-sectional views.

5.2 GROUNDWATER

Groundwater elevations measured in the overburden/bedrock interface monitoring wells within the VDM Landfill area (VDM-1, VDM-2, VDM-9, VDM-11, and D-55 and D-61) indicate that the general groundwater flow is in a southerly direction towards the embankment leading to Eighteen Mile Creek. Due to the removal of the Grimsby Formation in the area of the landfill the overburden/bedrock interface aquifer is

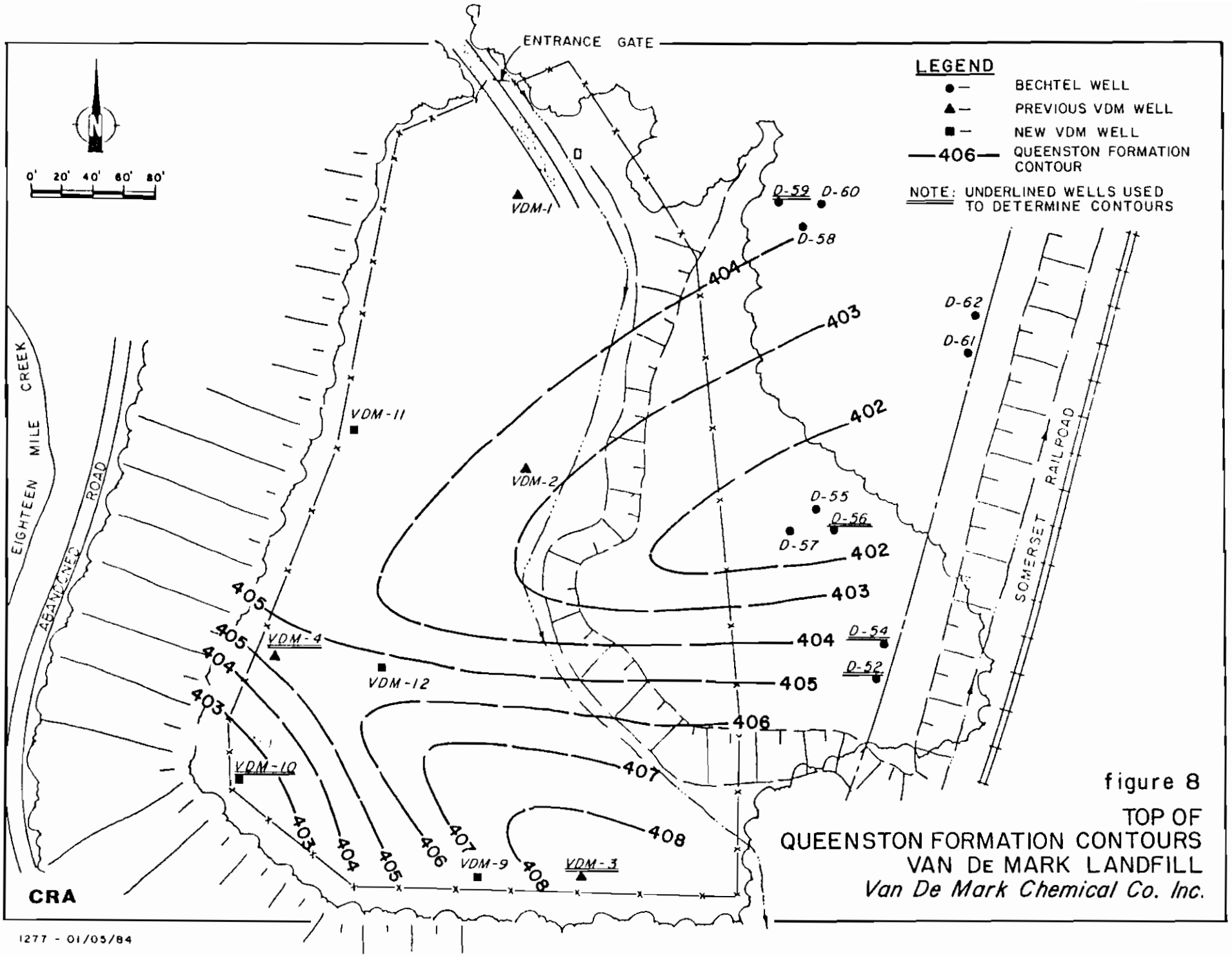

figure 8

TOP OF QUEENSTON FORMATION CONTOURS
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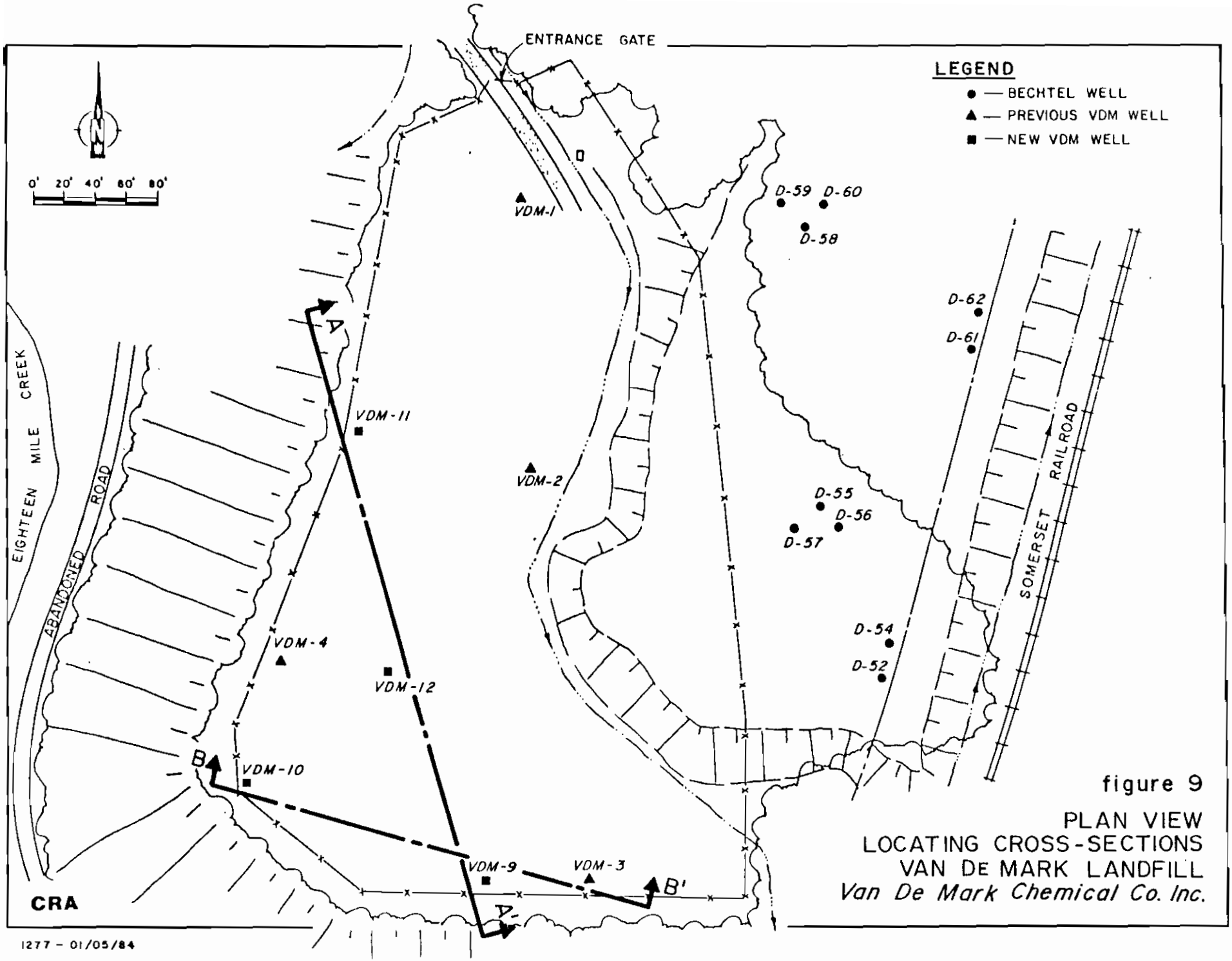

figure 9

PLAN VIEW
LOCATING CROSS-SECTIONS
VAN DE MARK LANDFILL
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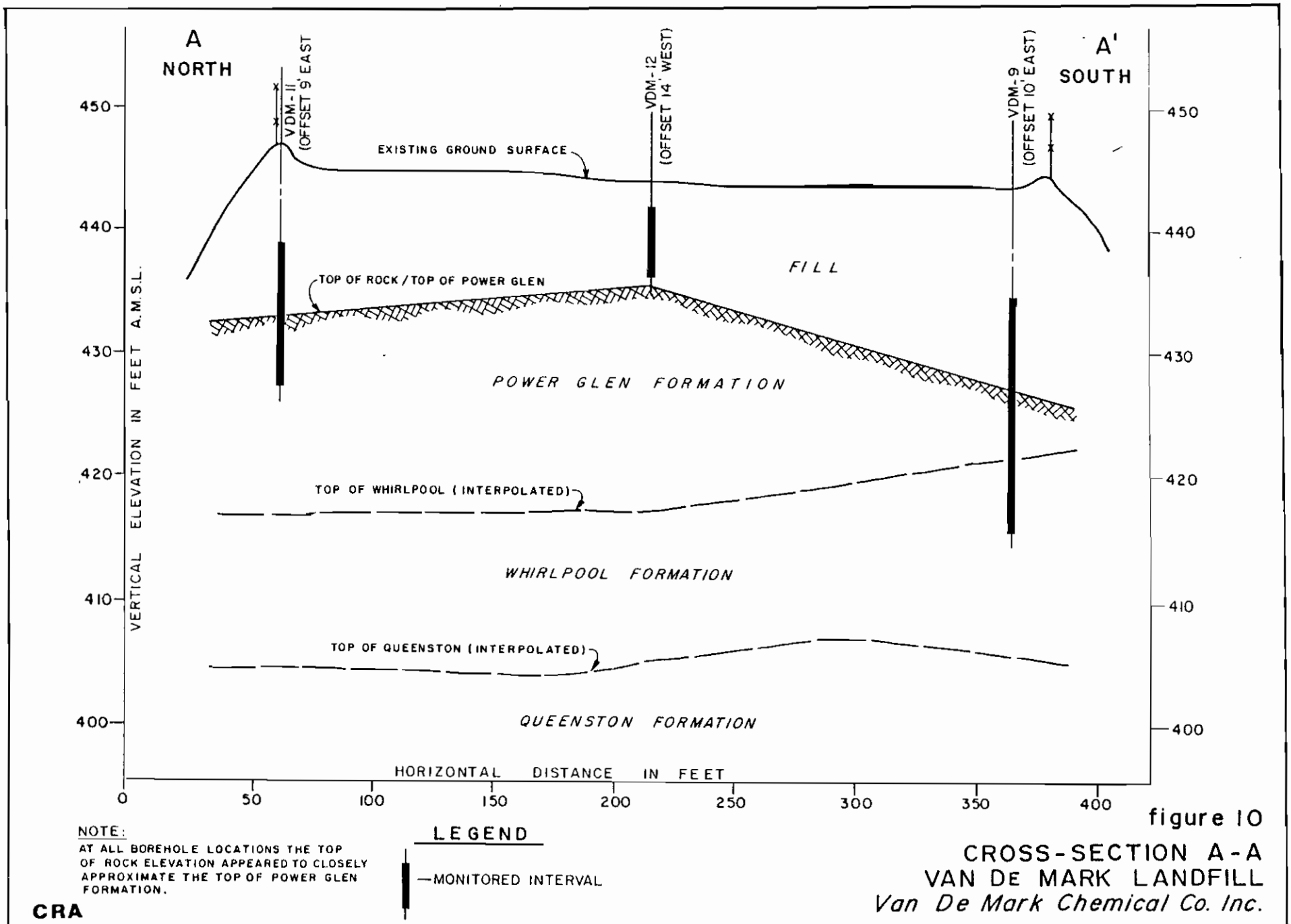

NOTE:
AT ALL BOREHOLE LOCATIONS THE TOP OF ROCK ELEVATION APPEARED TO CLOSELY APPROXIMATE THE TOP OF POWER GLEN FORMATION.

LEGEND

—MONITORED INTERVAL

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figure 10

CROSS-SECTION A-A
VAN DE MARK LANDFILL
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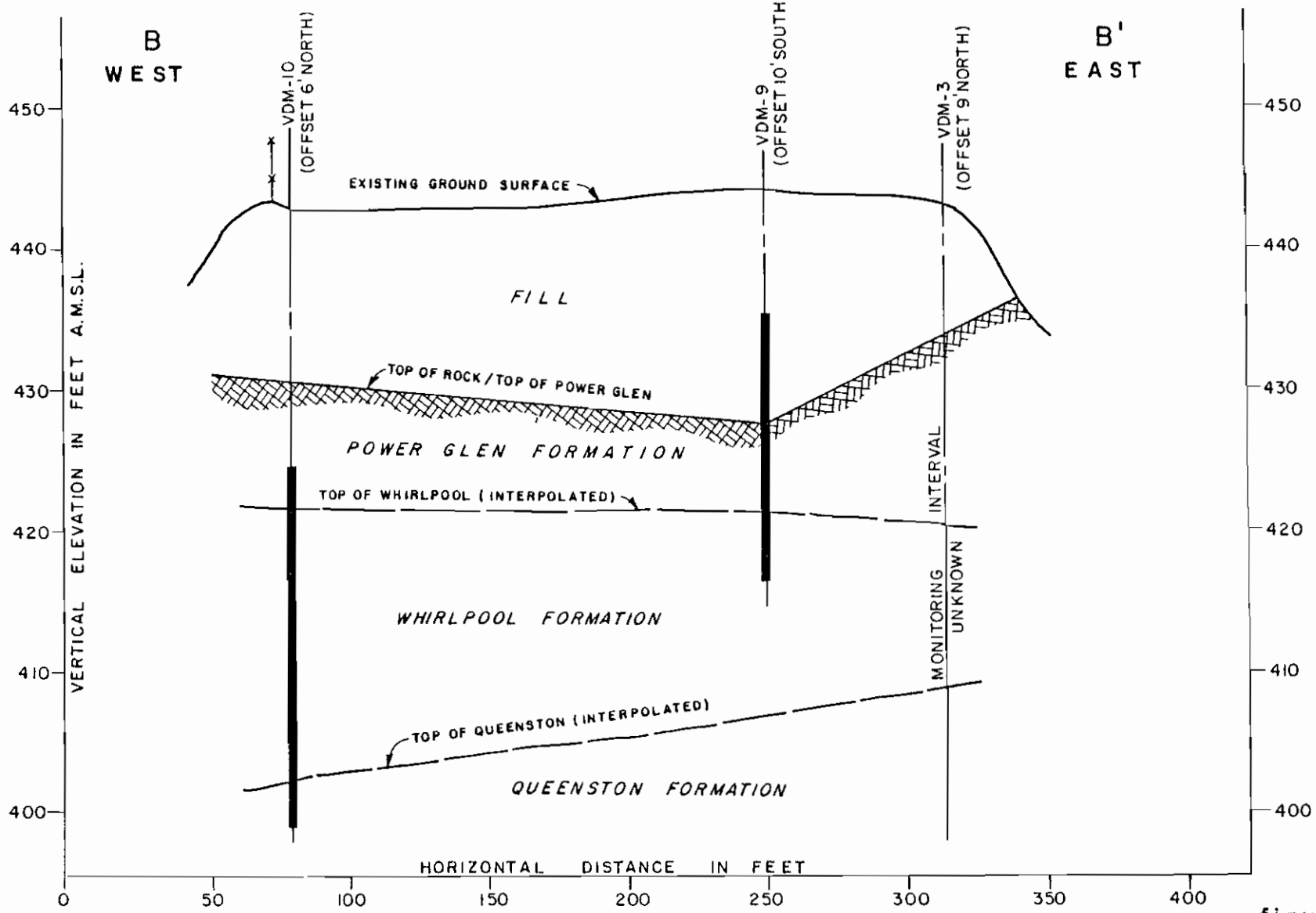

NOTE:
AT ALL BOREHOLE LOCATIONS THE TOP OF ROCK ELEVATION APPEARED TO CLOSELY APPROXIMATE THE TOP OF POWER GLEN FORMATION.

LEGEND

—MONITORED INTERVAL

figure II

CROSS-SECTION B-B
VAN DE MARK LANDFILL
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believed to be connected with the Grimsby/Power Glen contact groundwater in the area east of the landfill to the railroad cut and are therefore considered to be the same aquifer. Grimsby/Power Glen Aquifer water surface contours are presented by Figure 12.

A completed list of groundwater elevations measured during the investigation are presented in Table 2.

An inspection of the embankment leading down to Eighteen Mile Creek was undertaken during the spring of 1984 to identify possible seepage areas. Only one such seep was identified. It was located west of VDM-10 and was estimated to have a flow rate of less than 0.5 GPM. The seep was located at an elevation similar to the Whirlpool Formation.

Based on the facts that, i) the major water bearing intervals are postulated to be the bedding planes in the bedrock formation, ii) the major flow direction is southerly towards the embankment and iii) only one seepage point was observed along the embankment, it is assumed that the discharge of groundwater to the embankment and thus to Eighteen Mile Creek from the site is minimal. The major flowpaths through the bedrock are expected to be lateral rather

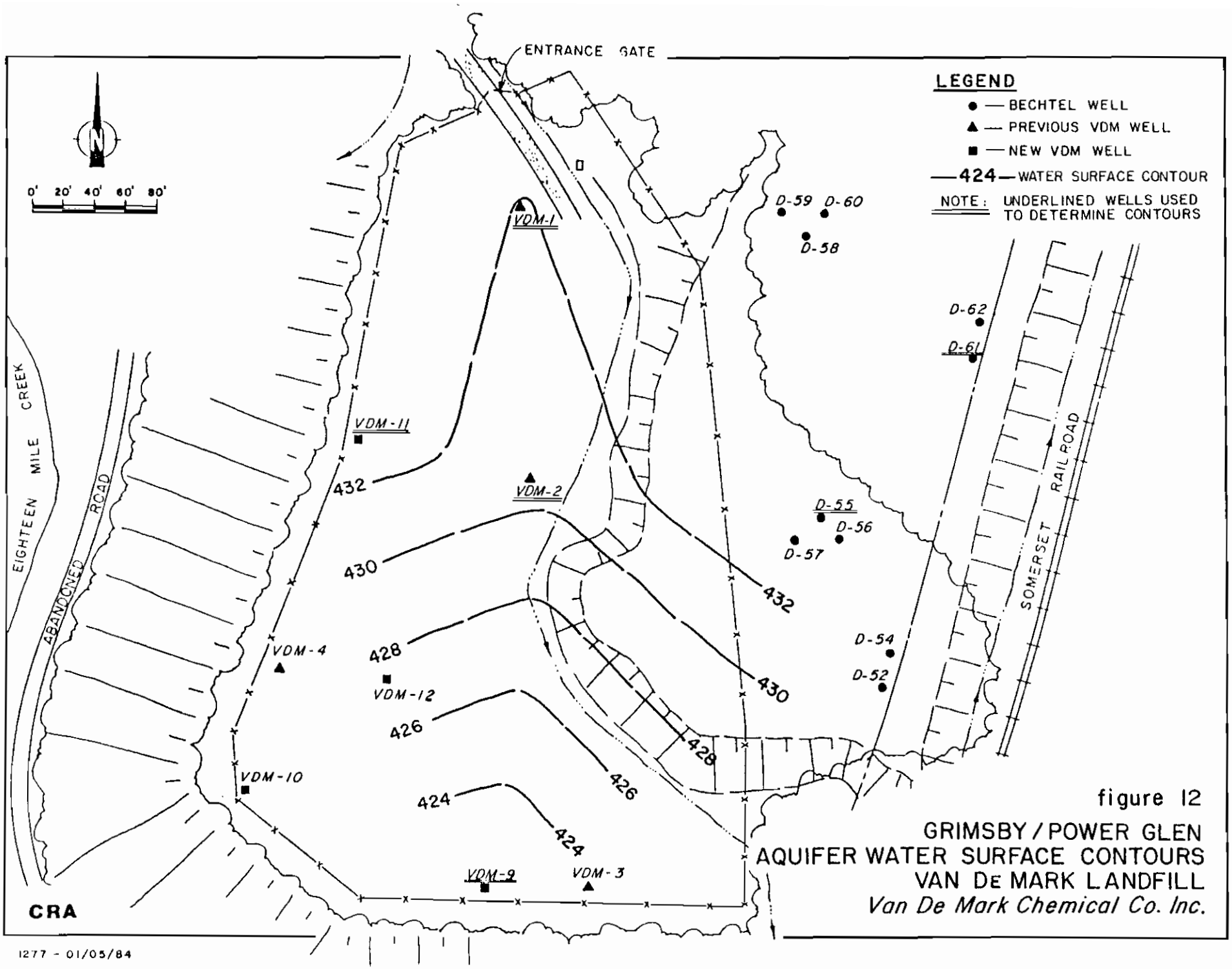

figure 12

GRIMSBY / POWER GLEN
AQUIFER WATER SURFACE CONTOURS
VAN DE MARK LANDFILL
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TABLE 2

WATER LEVEL ELEVATIONS

	INTERVAL	12/14/83	12/16/83	01/05/84	01/24/84	01/30/84	03/15/84
VDM-1	GRIMSBY - POWER GLEN	432.16	431.96	-	-	-	-
VDM-2	GRIMSBY - POWER GLEN	430.71	430.73	-	-	-	-
VDM-3	-	414.24	414.12	-	-	-	-
VDM-4	-	395.51	396.18	-	-	-	-
VDM-9	OVERBURDEN - BEDBROCK	421.95	421.64	421.62	421.43	421.54	421.86
VDM-10	WHIRLPOOL - QUEENSTON	427.58	414.41	413.42	412.82	413.37	413.07
VDM-11	OVERBURDEN - BEDROCK	433.14	433.14	431.45	431.25	431.22	431.42
VDM-12	PERCHED	437.91	437.36	-	-	-	-
D-55	GRIMSBY - POWER GLEN	434.23	433.82	433.70	432.71	433.56	433.51
D-61	GRIMSBY - POWER GLEN	432.79	432.73	433.06	432.51	432.61	-

NOTES - GRIMSBY - POWER GLEN CONTACT AQUIFER WHICH INCLUDES THE OVERBURDEN-BEDROCK INTERFACE IN THE AREA OF THE LANDFILL

than vertical. The vertical migration of groundwater beneath the site is further restricted by the presence of the Queenston Shale which is typically considered to be an aquitard.

6.0 GROUNDWATER QUALITY MONITORING

6.1 WELL DEVELOPMENT

The sampling program was preceded by a well development program for the newly installed wells. Well development took place during December 14 to 16, 1983 and was based on the requirement that 3 well volumes be extracted per day for 3 days. Well VDM-10 provided good recovery, wells VDM-9 and VDM-11 required 2 bailings in one day to extract the necessary groundwater volume and VDM-12 had to be bailed intermittantly throughout the program as recovery was slow.

6.2 ANALYTICAL PARAMETERS

Based on the waste materials deposited in the landfill (including drummed silicon tetrachloride and chlorodisiloxane), the anticipated leachate produced would be typically acidic and high in chlorides. This would result in iron leaching both from the geologic environment and metal containers. As a result, groundwater samples were analyzed for the following parameters: chlorides, pH, iron.

To investigate if the above parameters are representative of site conditions a water sample from VDM-12 was also analyzed for the Priority Pollutants.

The protocols for analyses were as follows:

1) Chloride - Method 325.3 Titrametric - Mercuric Nitrate

2) Iron - Method 236.1 Atomic Absorption - Flame Technique

3) pH - Standard Methods, 15th Edition, Method 423

4) Priority Pollutants - U.S. EPA 600/4-79-020, March 1979.

These analytical protocols are as specified in the approved "Revised Monitoring Program Van De Mark Landfill Site", October 15, 1983 with the exception that the approved Iron Analysis method was to be by atomic absorption method 236.2, furnace technique.

6.3 INITIAL SAMPLING

The initial round of groundwater samples were collected on January 6, 1984. Each of the sampling wells had been purged on January 5, 1984 and allowed to recover. The recovery of the wells was slow, especially VDM-12, which required repeated sampling over 19 days to obtain sufficient volume of groundwater to allow for laboratory testing. Groundwater samples were obtained by bailing with a stainless steel bailer. The bailer was subject to a water wash and acetone-hexane-acetone-distilled water rinses between each sampling.

The wells sampled were VDM-9, VDM-10, VDM-11, VDM-12 and D-55. Well D-55, which provided background information is located to the east of the landfill and was installed by Bechtel. The monitoring interval of well D-55 coincides with the Grimsby-Power Glen contact.

The results of chemical analyses of the samples collected during the first round are presented in Tables 3 and 4.

First round analytical results revealed lower pH values of the downgradient and

TABLE 3

INITIAL ROUND SAMPLING RESULTS

Well No.	pH (Std. Units)	Chlorides (mg/L or ppm)	Iron (mg/L or ppm)
VDM-9	5.660	9,197	81.0
VDM-10	5.321	7,730	27.5
VDM-11	3.628	1,859	45.3
VDM-12	4.275	50,682 (51,660)[1]	9,800.0
D-55	7.545	49	<0.2

[1] - Duplicate sample

Notes:

1) Samples collected January 6, 1984
2) Analysis performed by Advanced Environmental Systems, Inc.

TABLE 4

PRIORITY POLLUTANT SURVEY - WELL VDM-12

SUMMARY[1]

(Expressed as micrograms per liter or ppb)

Parameter	Original Sample	Duplicate Sample
Volatiles (31)[2]		
Chloromethane	550	.390
Methylene Chloride[3]	.330	.290
Chloroform	.500	.500
Carbon Tetrachloride	BDL[4]	28
Tetrachloroethylene	110	120
Base/Neutral Extractables (46)		
Octylphthalate	100	NR[5]
Pesticides/PCB's (25)	BDL	NR
Acid Extractables (11)	BDL	NR
Total Recoverable Phenols (mg/L or ppm)	0.08	NR
Total Cyanide	BDL	NR
Cadmium	.294	
Chromium	4250	
Copper	31.000	
Lead	.485	
Nickel	22.900	
Silver	870	
Thallium	1120	
Zinc	497.000	
Beryllium	186	

1 - This table lists only those parameters identified from the total of 128; all others are below detection limits. The complete analytical report is provided in Appendix A.
2 - Number of Compounds
3 - The field blank contained 11 ug/L methylene chloride
4 - BDL - Below Detection Limits
5 - Duplicate analysis not requested

- Samples collected January 24, 1984
- Analyses performed by Advanced Environmental Systems Inc.
- Further metals analyses forthcoming

landfill wells, (especially VDM-11), than the neutral pH value of the upgradient well D-55. High chloride and iron concentrations were indicated by the landfill monitoring wells relative to the background well. As previously mentioned, low pH and elevated chlorides and soluble iron concentrations were expected based on the type of waste materials deposited in the landfill.

The priority pollutant survey completed on samples collected from VDM-12 revealed the following parameters as being above the detection limits:

1) Volatiles; Chloromethane, Methylene Chloride, Chloroform, Carbon Tetrachloride, and Tetrachloroethylene,

2) Base/Neutral extractables; Octylphthalate,

3) Total Recoverable Phenols, and

4) Metals; Cadmium, Chromium, Copper, Lead, Nickel Silver, Thallium, Zinc, Beryllium. Further metals analyses are forthcoming.

6.4 SECOND SAMPLING SURVEY

Based on the information gained through the analysis of the initial round of water samples, a set of parameters were chosen for groundwater quality confirmation. These parameters were:

1) Volatiles - Chloromethane, Methylene Chloride, Chloroform, Carbon Tetrachloride, and Tetrachloroethylene;

2) Total Recoverable Phenols;

3) Metals - Cadmium, Chromium, Copper, Lead, Nickel, Silver, Thallium, Zinc and Beryllium, and others yet to be determined.

Low levels of Octylphthalate (100 ppb) were found in the VDM-12 sample. Low level presence of octylphthalate is not considered to be of significant environmental importance and therefore was not included for in the second sampling survey.

The second round sampling survey was carried out on March 21, 1984. Sampling results are presented in Appendix D.

Second round sample analyses for pH, chlorides and iron revealed similar analytical results to the first round with the exception of the soluble iron concentrations which were typically higher for the second set of samples (See Table 5, Appendix D).

Analyses of samples from the downgradient wells indicate reduced concentrations of methylene chloride and chloroform, compared to those observed in the landfill well (VDM-12) with VDM-11 having the highest downgradient concentrations. The presence of carbon tetrachloride and tetrachloroethylene was only observed in VDM-11 and VDM-12. It is to be noted that VDM-11 is located in the older landfill area where disposal methods were not regulated. All observed volatile concentrations were less than 1 ppm in the landfill well and less than 0.35 ppm in the downgradient wells. Upgradient well (D-55) does not contain any of the parameters included in the sampling program.

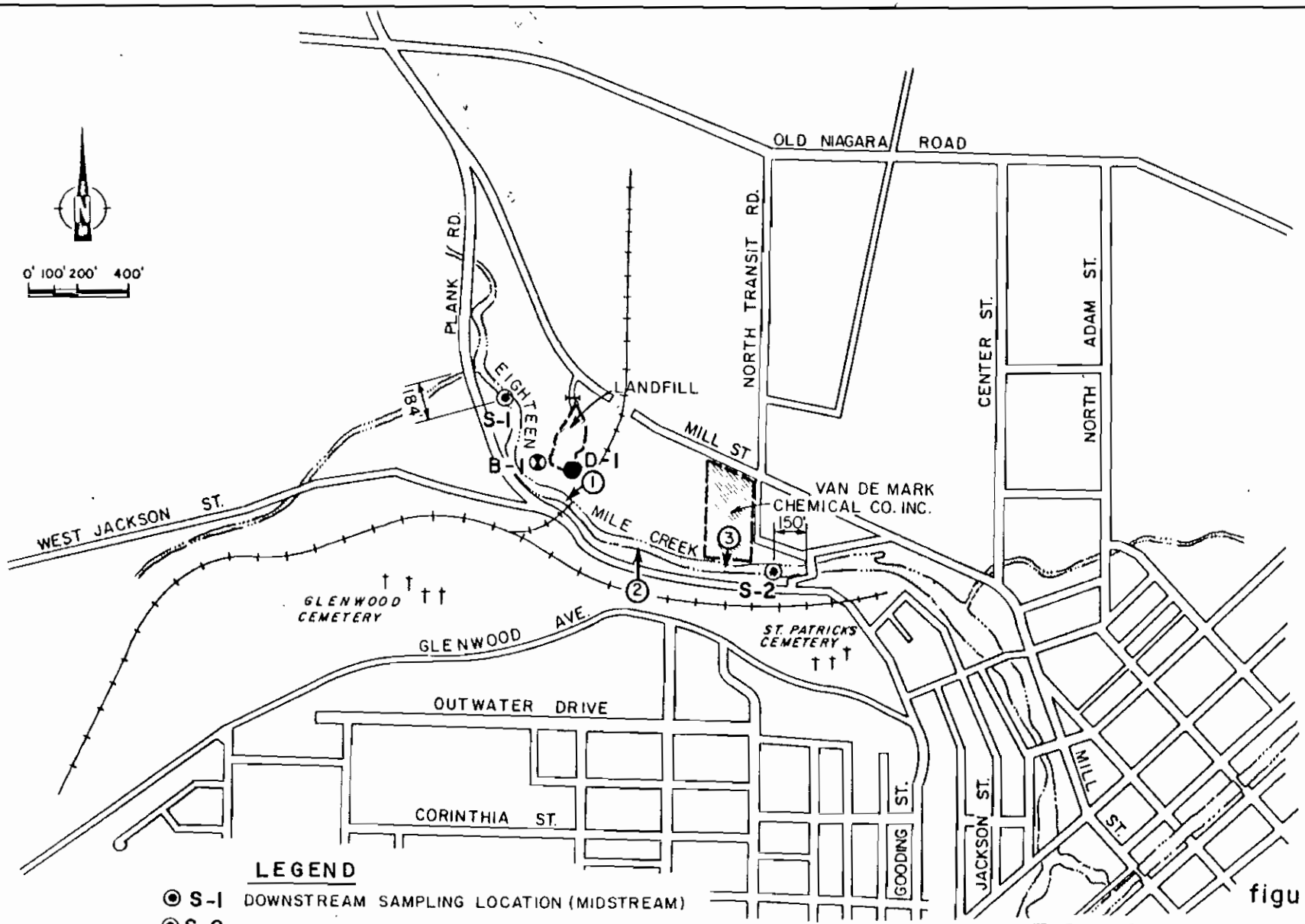
6.5 EIGHTEEN MILE CREEK SAMPLING

Since on-site monitoring indicated low level water quality impacts due to the landfill, it was deemed appropriate to undertake off-site monitoring to measure off-site impact.

On April 17, 1984, water samples were taken from Eighteen Mile Creek at locations upstream and downstream of that portion of the creek which could be impacted by runoff from beneath the Van De Mark Landfill. As shown on Figure 13, samples were taken at locations situated immediately upstream of the Waste Water Treatment Plant and downstream of the twin culverts at North Transit Road in the vicinity of the Van De Mark Plant. A sample was also taken from the seep on the embankment below the landfill in the area of VDM-10.

At each creek sampling location 3-VOA and 2-metals samples were collected. The samples were taken from approximately mid-stream at a depth of 3 to 6 inches below the surface. The samples were kept cool and transfered to the AES laboratory the same day.

In addition, samples were collected for pH determination at several locations along Eighteen Mile Creek and in the area of the landfill on April 26, 1984 and again on May 2, 1984 as shown on Figure 14. The results indicate that the pH maintains a level of between 6.2 and 8.7 along that portion of the creek in the vicinity of the landfill. (pH sample results are presented in Table 5).



CRA

figure 13

EIGHTEEN MILE CREEK
SAMPLING LOCATIONS
VAN DE MARK LANDFILL
Van De Mark Chemical Co. Inc.

1277 - 01/05/84

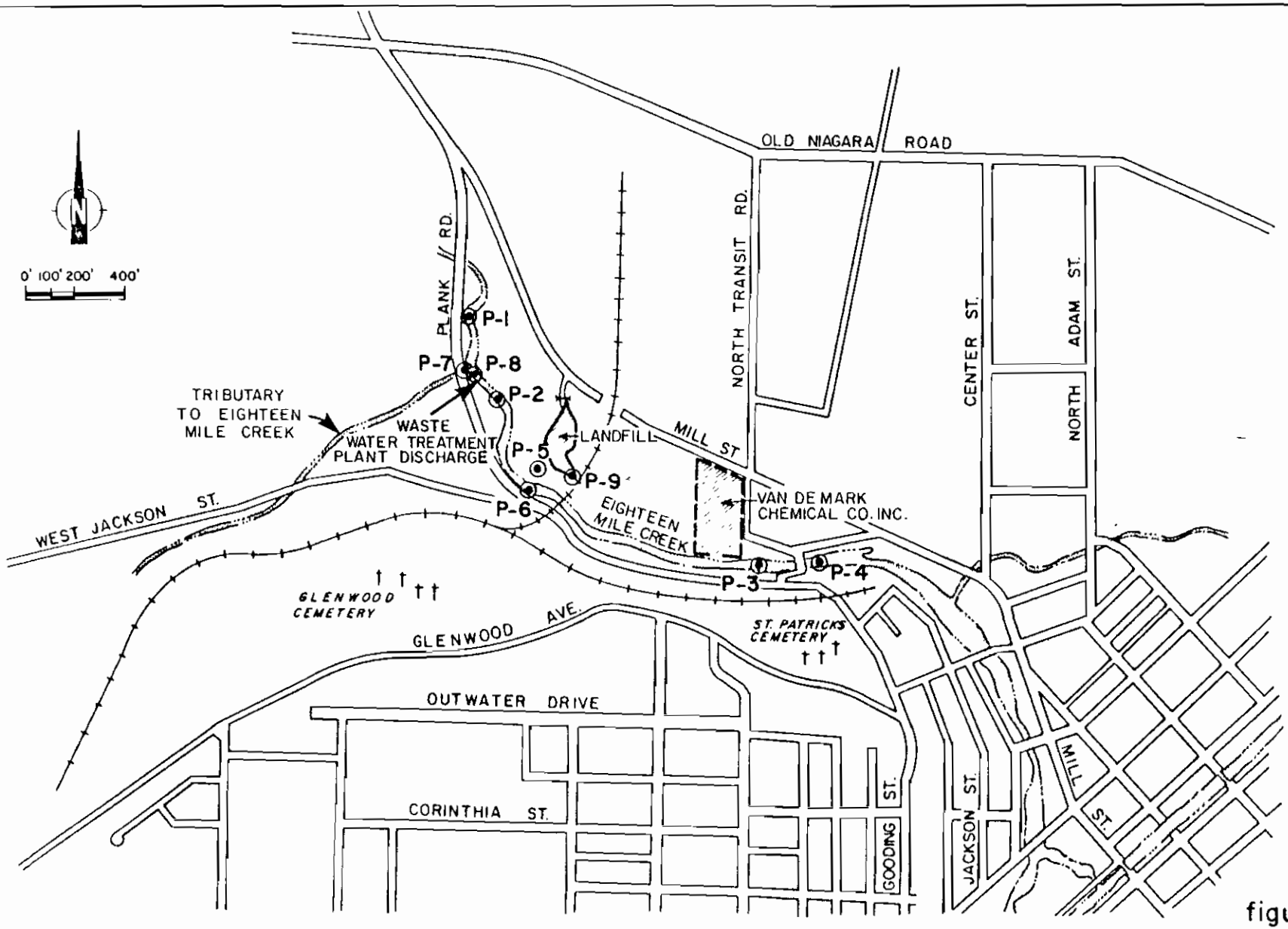


figure 14

PH SAMPLE LOCATIONS
VAN DE MARK LANDFILL
Van De Mark Chemical Co. Inc.

LEGEND

◉ P-1 APPROXIMATE PH SAMPLE LOCATION
(SAMPLES TAKEN AT MIDSTREAM WHERE APPROPRIATE)

CRA

1277-01/05/84

TABLE 5

CREEK pH LEVELS

Sample No.	Location	Sampled April 26 1984	Sampled May 2 1984	Sampled May 3 1984
1	Midstream-Eighteen Mile Creek - 70 yds downstream of closest small bridge north of West Jackson Street	6.8	6.2	7.5
2	Midstream - Eighteen Mile Creek - 115 ft. upstream of most southerly Wastewater Treatment Plant discharge	7.5	--	8.4
3	Midstream - Eighteen Mile Creek - 75 ft. east of abandoned railway bridge at North Transit Road	8.0	8.4	8.5
4	Midstream - Eighteen Mile Creek - 35 ft. east of twin culverts at North Transit Road	7.8	8.4	8.5
5	Seep on embankment face in area of VDM-10 at approximate elevation of Whirlpool Formation	5.3	5.3	--
6	Midstream - Eighteen Mile Creek - opposite embankment seep area in vicinity of VDM-10	8.6	8.7	8.7
7	Midstream - tributary to Eighteen Mile Creek at entrance to Eighteen Mile Creek	--	7.1	7.6
8	Immediate vicinity of downstream discharge to Eighteen Mile Creek from Waste Water Treatment Plant	--	6.9	7.6
9	Midstream - drainage ditch to east of landfill site	--	5.3	4.8

Eighteen Mile Creek is considered to be a Class D stream. Information supplied by VDM suggests that the low flows do not fall below an average minimum of approximately 75 cfs.

Discharges to the stream between the sampling locations include the following:

1) Stormwater drainage system discharge from the Somerset Railroad cut North of Eighteen Mile Creek.

2) Stormwater drainage system discharge from West Jackson Street and from upper mountain area; Glenwood Avenue.

3) Drainage from VDM Pumping Lift Station.

4) Surface drainage from VDM Landfill Site.

The City of Lockport Wastewater Treatment Plant discharges to Eighteen Mile Creek immediately downstream of the VDM property.

Analyses of samples from Eighteen Mile Creek indicated that only tetrachloroethylene was detected in the creek and only at a concentration equal to upstream quality (1 ppb). The analyses completed to date are presented in Tables 6 and 7. The results of the metal analysis of the stream samples indicate no change in stream water quality along the site.

Analyses of the groundwater seep sample revealed the presence of chloroform at an approximate concentration of 0.2 ppm. The completed analytical results are presented in Table 6.

6.6 DRAINAGE DITCH SAMPLING

Samples of the existing surface drainage ditch have been collected and are shown on Tables 5 and 6. The results show very low concentrations of the volatile organics (Maximum 25 ppb chloroform) and an elevated chloride concentration of 3624 ppm. The analyses for iron are not yet completed. The ditch flow has a slightly reduced pH.

TABLE 6

ANALYTICAL RESULTS FROM THE EMBANKMENT SEEP, THE LANDFILLED DRAINAGE DITCH AND EIGHTEEN MILE CREEK

Sample Number Sample Source Sampling Date	F-1 Field Blank 04/17/84	S-1 Downstream 04/17/84	S-2 Upstream 04/17/84	B-1 Bedrock Seep 04/17/84	F-2 Field Blank 05/03/84	D-1 Ditch 05/03/84
Chloromethane (ppb)	<0.37	<0.37	<0.37	<0.37	<0.28	<0.28
Methylene Chloride (ppb)	5.81	1.52	<0.04	1.88	3.61	2.26
Chloroform (ppb)	<0.20	<0.20	<0.20	185.58	<0.08	24.88
Carbon Tetrachloride (ppb)	<0.21	<0.21	<0.21	<0.21	<0.17	4.98
Tetrachloroethylene (ppb)	0.71	1.09	1.08	1.18	1.47	11.81
Chlorides (ppm)	I	I	I	I	--	3624
Total Iron	I	I	I	I	--	I

I - incomplete, to be submitted upon completion.

TABLE 7

METALS ANALYSES -EIGHTEEN MILE CREEK SAMPLES

SAMPLE NUMBER SAMPLE SOURCE SAMPLING DATE	S-1 DOWNSTREAM 4/17/84	DUPLICATE DOWNSTREAM 4/17/84	S-2 UPSTREAM 4/17/84	DUPLICATE UPSTREAM 4/17/84
Atimony (ppb)	3.7	5.0	4.4	4.7
Arsenic (ppb)	I	I	I	I
Berylium (ppb)	<0.5	<0.5	<0.5	<0.5
Cadmium (ppb)	<1.0	1.2	<1.0	<1.0
Chromium (ppb)	<10.0	<10.0	<10.00	<10.0
Copper (ppb)	15.7	12.4	11.3	11.7
Lead (ppb)	<5.0	<5.0	<5.0	<5.0
Mercury (ppb)	I	I	I	I
Nickel (ppb)	<50.0	<50.0	<50.0	<50.0
Selenium (ppb)	I	I	I	I
Silver (ppb)	<1.0	1.8	1.7	1.6
Thallium (ppb)	<1.0	<1.0	<1.0	<1.0
Zinc (ppb)	34	30	34	34
Iron (ppb)	17000	17000	19000	19000

I - Incomplete, to be submitted upon completion.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 ENVIRONMENTAL IMPACT

As indicated by the results of the sample analyses, the groundwater leaching through the VDM Landfill to Eighteen Mile Creek below has no significant detrimental impact to the off-site environment. The reasons for this are:

1) On-site water quality impact is restricted to a low pH and low concentrations of volatile organics.

2) Groundwater flowing toward and discharging as seepage from the embankment, is expected to be treated by air stripping and buffering.

3) Eighteen Mile Creek intercepts any runoff from the site. The assimilative capacity of the Creek for the low discharge from the site is measured to be adequate. (see Section 6.5).

7.2 CLOSURE PLAN RECOMMENDATIONS

The recommended closure activities include site grading, injection of lime, conditioning of surface soils and seeding of the landfill area. The site grading and cleanup will be such that infiltration will be better distributed and will enhance the treatment of the low pH problem. Buffering of low pH levels in the groundwater through the addition of lime will be reduce the observed heavy metals concentration in the groundwater.

The proposed closure plan will consist of the following:

a) Backfill all minor depressions of the landfill surface with lime.

b) Add some lime to the base of the pit located at the northern limits of the recently landfilled area.

c) Since the water is reactive, it is recommended that the final grading plan minimize the area of existing cover soil disturbance. The proposed final grading plan is presented in Figure 15.

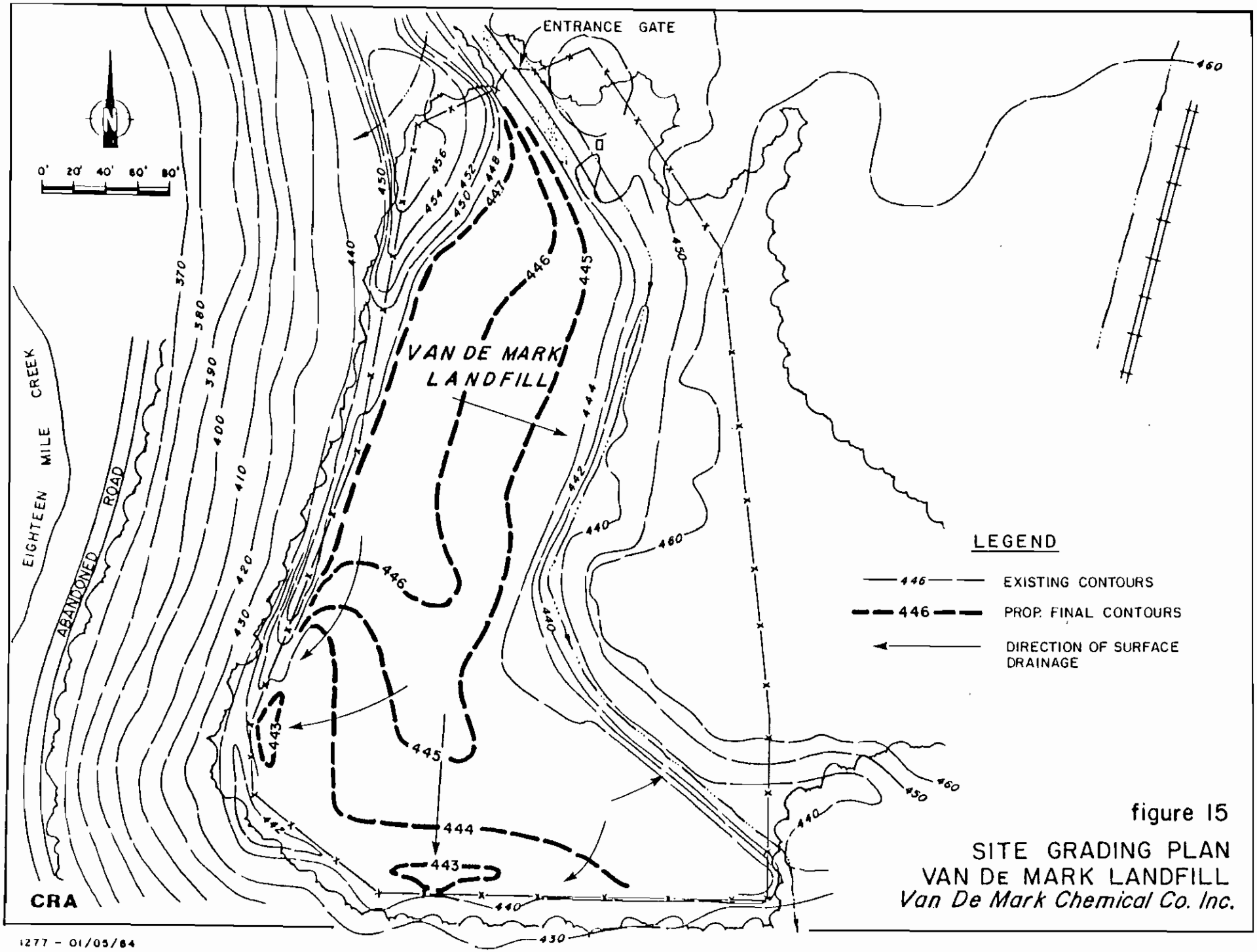


figure 15

SITE GRADING PLAN
VAN DE MARK LANDFILL
Van De Mark Chemical Co. Inc.

1277 - 01/05/84

d) Condition, fertilize and seed the site as recommended by Randall's floristic survey which forms a part of the Whitmore report. Randall suggests

i) to disk or harrow the site to assist seed germination,

ii) apply 500 lb/acre of 15-15-15 (N,P,K) fertilizer,

iii) single application of:

- Crownvetch - var. 'Penngift' - 10 lb/acre;
- Birdsfoot trefoil - var. 'Empire' - 6 lbs/acre (preferred) or var. 'Viking' - 6 lbs/acre; and
- Perennial rye grass - 10 lbs/acre (preferred) or Reed canary grass - 10 lbs/acre (post-seeding conditioning by raking, rolling or meekering is recommended)

e) Implement maintenance program.

f) Implement groundwater monitoring program.

g) The ditch is presently performing as designed. The pH is being buffered, iron is precipitated and volatiles are being air stripped from the groundwater. To

ensure that the above continues the following work is proposed:

(i) review of monitoring data with each analysis.
(ii) add lime as required
(iii) periodically remove iron staining to improve aesthetics (dispose on site under cap).

h) To enhance the buffering capacity of the groundwater, the following work will be attempted: (It is recognized that this effort may be of limited success.)

- add lime solution to upgradient wells VDM-1 and VDM-2. The amount and scheduling of injection of pH adjusting solution will be dependent upon the resultant groundwater quality observed at downgradient wells during the ongoing monitoring programs.

7.3 MAINTENANCE PLAN

The proposed maintenance plan will consist of semi-annual inspections of the site. During each inspection, the cover will be inspected for isolated depressions. Any such area will be filled with lime, recovered and reseeded.

7.4 GROUNDWATER MONITORING PLAN

The groundwater monitoring plan will consist of the collection of groundwater samples for analysis of the following identified parameters:

pH - VDM-9, VDM-10, VDM-11, VDM-12, and East Ditch

Chlorides - VDM-9, VDM-10, VDM-11, VDM-12, and East Ditch

Iron - VDM-9, VDM-10, VDM-11, VDM-12, and East Ditch

Methylene Chloride - VDM-9, VDM-10, VDM-11, VDM-12, and East Ditch

Chloroform - VDM-9, VDM-10, VDM-11, VDM-12, and East Ditch

Chloromethane - VDM-12

Carbon Tetrachloride - VDM-11 and VDM-12

Tetrachloroethylene - VDM-11, VDM-12

The sampling frequency will be as follows:

Year 1 - quarterly

Year 2 and 3 - semi-annually

Thereafter - annually

After each sampling and analysis, the data will be reviewed and submitted to the NYSDEC. The evaluation will include recommendations for site work as deemed appropriate.

All of Which is Respectfully Submitted,

CONESTOGA-ROVERS & ASSOCIATES LIMITED

Frank A. Rovers, P. Eng.

David E. Black, B.A.Sc.

REFERENCES

Advanced Environmental Systems Inc., and Conestoga-Rovers & Associates Limited, "Revised Monitoring Program, Van De Mark Landfill Site", October 15, 1983.

Bechtel Associates Professional Corporation, "Somerset Railroad Project, Hydrogeologic Study, Danielewicz Route, Station 51+810 to 52+330", February, 1982.

William W. Whitmore, Consulting Engineers, "Application for Approval to Construct a Solid Waste Management Facility", June 29, 1977.

William W. Whitmore, Consulting Engineers, "Closure Plan for Solid Waste Management Facility Van De Mark Chemical Co. Inc., Lockport, N.Y.", July 1, 1982.

APPENDIX A

APPLICATION FOR APPROVAL TO CONSTRUCT A SOLID WASTE MANAGEMENT FACILITY

(1973) NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

APPLICATION FOR APPROVAL TO CONSTRUCT A SOLID WASTE MANAGEMENT FACILITY

APPLICATION INSTRUCTIONS ON REVERSE SIDE

FOR STATE USE ONLY

PROJECT NO.	DATE RECEI
DEPARTMENT ACTION ☐ Approved ☐ Disapproved	DATE

1. OWNER'S NAME	2. ADDRESS (Street, City, State, Zip Code)	3. Telephone No.
Van De Mark Chemical Co., Inc.	1 N. Transit Rd., Lockport, N. Y. 14094	716-433-6764
4. OPERATOR'S NAME	5. ADDRESS (Street, City, State, Zip Code)	6. Telephone No.
SAME	SAME	SAME
7. ENGINEER'S NAME	8. ADDRESS (Street, City, State, Zip Code)	9. Telephone No.
William W. Whitmore III, P.E.P.C.	50 W. Genesee St., Lockport, New York 14094	716-434-0242

ENGINEER'S N.Y.S. LICENSE NO.: 24360 PE

10. TYPE OF PROJECT FACILITIES:
☐ Composting ☐ Transfer ☐ Shredding ☐ Baling ☐ Sanitary Landfill ☐ Incineration
☐ Pyrolysis ☐ Resource Recovery-Energy ☐ Resource Recovery-Materials ☒ Other Chemical Waste Lan

Briefly describe the project including the basic process and major components:

After preparing existing site per approved plan, transport metal drums of chemical waste from pla: to site, excavate trenches, place drums in trench, cover, regrade & replant surface. Monitoring reports monthly

Describe location of facility. (Attach a USGS Topographic Map showing the exact location of the facility)

See attached DWG. VDM-1965 Aerial Photograph and USGS Location Map

13. County in which facility is located:	14. Environmental Conservation Region in which facility is located:
Niagara	Region 9

Municipalities Served by Facility		County	No. of Municipa
None	N/A	N/a	N/A

Describe briefly how the proposed facility relates to the Comprehensive Solid Waste Management Plan for the Municipality. Explain any deviation from that Pla:

Not Municipal Disposal Plan
To serve Van De Mark Chemical Co., Inc. only. No other conveniently available site approved for this waste.

If the facility is other than a sanitary landfill, describe the residues in terms of quantities and types. Also indicate the methods and locations of residue disp or, if recyclable, indicate markets:

Ref to Engineering Report attached and Topographic site location and site development drawing VDM-1966, Sections and Details VDM-1967. Waste is dry mix containing 30-70 % Hexachlorodisiloxane 30-50 % Silicon Tetrachloride, and 5-30 % Carbon and Silicon Carbide package in sealed steel drums for safe handling.

If the facility is a sanitary landfill, provide the following information:

a. Total useable area – 2.1 + Acres
b. Distance to nearest surface water – 200± Feet
c. Depth to nearest ground water – 20'-24'± Feet
d. Depth to nearest rock – 5-11'± Feet
e. Distance to nearest airport – 6± miles
f. Expected life of site – 30 -40 years
g. Is site on a flood plain? ☐ Yes ____ Year Flood ☒ No
h. Predominant type of soil on site: Red/Br. silt sand, gravel w (Use Unified Soil Classification System) R/G. sandstone shale-so

19. Anticipated construction starting and completion dates From	To	20. Estimated Population Served Current	Design
July, 1977	October, 1977	N/A	N/A

21. Estimated Cost Initial	Annual	22. Estimated Daily Tonnages of Solid Waste Current	Design
$10,000-$20,000	$5000	0.625 Tons/Day	300 Tons/Year

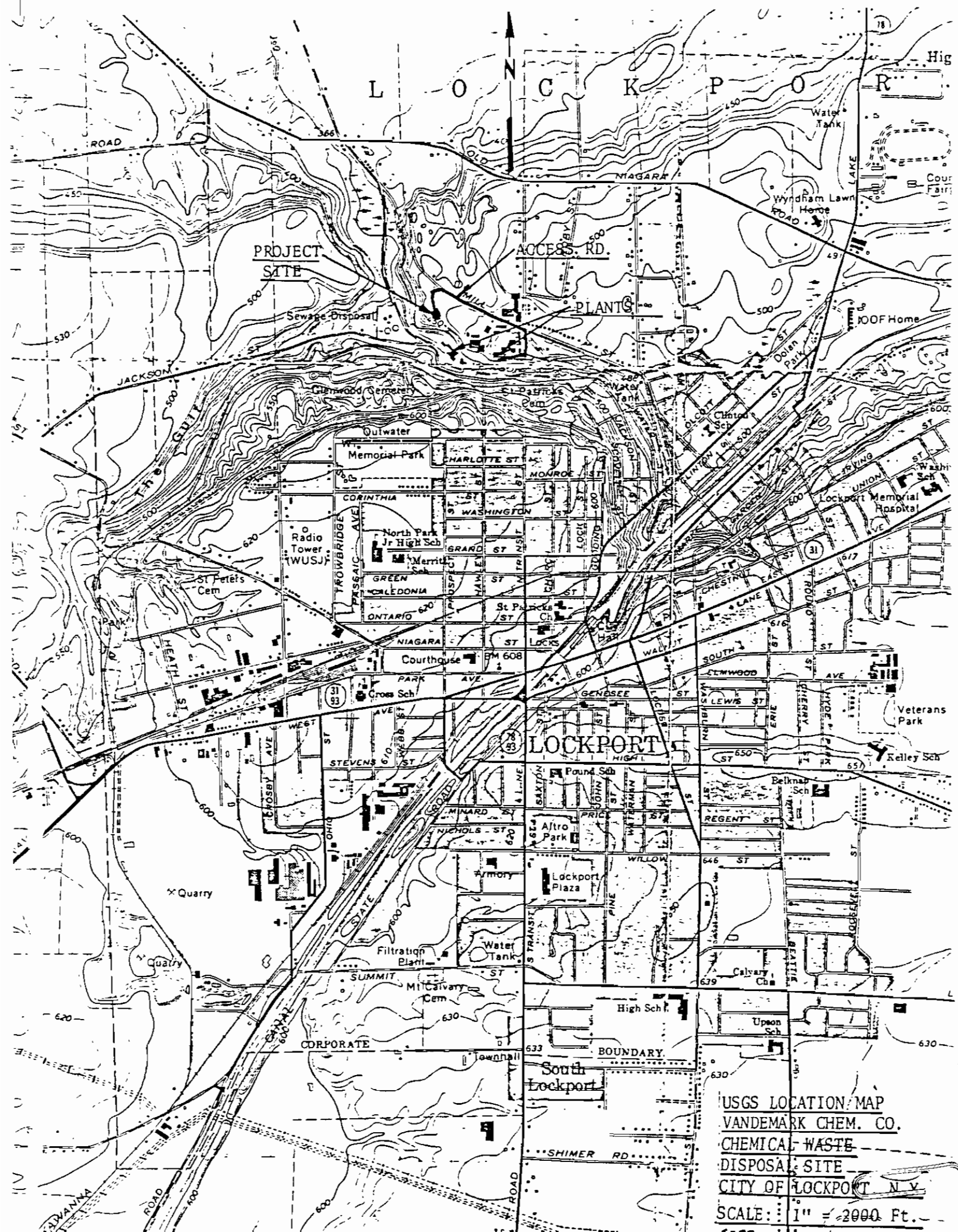
Operating Hours per Day	24. Are attached plans and specifications in substantial conformance with "Content Guidelines for Plans and Specifications"? ☒ Yes ☐ No
Waste Deliveries on Weekly Basis	

CERTIFICATION:

The undersigned does hereby certify that the information in this application and in other attached statements and exhibits is true, correct and complete to the best of his knowledge and belief.

June 29, 1977
Date

VAN DE MARK CHEMICAL CO., INC.
Allan B. Van De Mark — Signature and Title — Secretary



USGS LOCATION MAP
VANDEMARK CHEM. CO.
CHEMICAL WASTE
DISPOSAL SITE
CITY OF LOCKPORT N.Y.
SCALE: 1" = 2000 Ft.

WILLIAM W. WHITMORE III, P.E. P.C.
WILLIAM W. WHITMORE III, P.E.
HAL G. ROGERS, P. E.

CONSULTING ENGINEERS

MEMBER

CIVIL
STRUCTURAL
MECHANICAL
ELECTRICAL

INDUSTRIAL . COMMERCIAL . MUNICIPAL . INSTITUTIONAL 50 WEST GENESEE STREET P.O. DRAWER J, . LOCKPORT, N. Y. 14094 . 716 . 434-0242

June 29, 1977

New York State Department of Environmental Conservation
Region 9 Environmental Quality Office
584 Delaware Avenue
Buffalo, New York 14202

ATTENTION: Mr. John McMahan P.E.
Mr. Paul Foersch P.E.

RE: Van De Mark Chemical Company, Inc., File No. 76-37

SUBJECT: Transmittal of Engineering Report for Solid Waste Disposal Site

Gentlemen:

At the request of Van De Mark Chemical Company, Inc., we have prepared the following Engineering report for application and approval for the use of an existing site on their property in Lockport for the disposal of chemical waste from the plant. This application is made on the basis of the requirements of NYCRR Part 360 of Title 6 of Official Compilation of Codes, Rules and Regula- of the State of New York, Environmental Conservation Laws Section 27-0501.

The following information is submitted on the basis of the Tentative Check List for Sanitary Landfill Design Submissions, New York State Department Environmental Conservation, Division of Solid Waste Management, dated 1973 as a guide. This report consists of the following items;

Item 1 - General description of the site and surrounding area, identification of the waste, method of handling to the site, expected life to the site, operating period, record of dumping, site access and final site use.
Item 2 - Transmittal of scale aerial photograph, VDM-1965, showing location of the site in the City of Lockport and relative to adjacent developed properties and the chemical plant.
Item 3 - Transmittal of the topographic maps of the disposal area and surrounding land areas with location of soil borings, existing elevations and proposed elevations, outline of site and surface drainage.
Item 4 - Transmittal VDM-1967, disposal site cross section showing existing ground elevations and proposed changes, details of method of filling proposed.
Item 5 - Transmittal of Empire Soils Investigations, Inc. Site Investigation report No. 77-BD-21 dated June, 1977 with subsurface logs, soils analysis-chemical tests.
Item 6 - Transmittal of reports from the consulting biologist, Dr. Robert Sweeney, Director, Great Lakes Laboratory, Buffalo, New York, as follows:

a. Chemical report describing water quality of the stream and ground water during the several test periods of the investigation.
b. Vegetative-landscaping report of the site with recommendations for site management.
c. Discussion of the adaptability of this site for the proposed solid waste disposal of the chemical waste without major impact on the aquatic or terrestrial environment of the area and/or ground water. This includes a detailed proposal for design of the disposal area, operational program and site for optimum use of the site while maintaining protection to the environment.

Based on the conclusion of the soil, chemical, biological and environmental investigations, we feel that the site is suitable for its intended use and therefore request immediate approval of application and proposed operation/management plan as presented.

Should additional investigations or data be required, including changes in the method of operation, or details of site preparation be required for final approval, we will prepare them immediately and submit for further discussion and approval. Please advise if you will require further conference on this matter.

Respectfully submitted,

William W. Whitmore III, P.E.P.C.
Consulting Engineers, for
Van De Mark Chemical Company, Inc.

Enclosures: Descriptions, reports, photographs, applications, Application Form SW-7
cc: Van De Mark Chemical Company, Inc.
Mr. Ernest Gedeon, Niagara County Health Department

June 29, 1977
PROJECT: Solid Waste Disposal Site
OWNER: Van De Mark Chemical Company, Inc.
1 North Transit Road, Lockport, New York 14094
SUBJECT: General Information and Site Details

A. GENERAL

1. Location: The existing solid waste disposal site which will be reused for this project, is west of the existing Van De Mark Chemical Company, Inc. Plant in an unpopulated area, partially wooded and formerly the sandstone, limestone open pit quarry of approximately 2.10 plus or minus acres. The site is in the northwest section of the City of Lockport in an industrial zoned area in the City Limits. Access is gained from a controlled section of Mill Street and private road to the site. The portion of Mill Street to be used for access is closed to the general public by a locked gate approximately one thousand feet west of the intersection of Mill and North Transit Road. It is located on an escarpment area bounded on the south and west sides by Eighteen Mile Creek. Elevation of the Creek of 359 is considerably lower than the bottom elevation of the proposed dump site of approximately 438 plus or minus USGS. There are no residential dwellings within approximately fifteen hundred feet of this site. The City of Lockport Waste Treatment Plant is approximately five hundred feet west of the site at elevation 362 plus or minus USGS. McGonigle & Hilger Roofing, Inc. warehouse and office east of the site at elevation 474 plus or minus. & Norton Laboratories Manufacturing Plant is approximately thirteen hundred feet due east of the disposal site at elevation 475 plus or minus. Van De Mark Chemical Corporation Plant on Eighteen Mile Creek is approximately five hundred feet southeast of the site and the chlorine plant is approximately fifteen hundred feet east of the site. New York State Electric and Gas Corporation Sub-station is four hundred feet north of the plant and the remaining property between Mill Street and Old Niagara Road is vacant wooded property owned by C.B. Whitmore Company, Inc. There are no water, sanitary or power facilities immediately available to the disposal site.

2. Waste materials for disposal: Van De Mark Chemical Company intends to dispose of approximately fifty to sixty steel drums of waste (375 cu.ft) plus or minus per month. The material consists of thirty to seventy per cent Hexachlorodisiloxane, ten to fifty per cent Silicon Tetrachloride, and five to thirty per cent Carbon and Silicon Carbide. The Hexachlorodisiloxane and Silicon Tetrachloride decompose into sand (Silicon Dioxide) and Hydrochloric Acid. Carbon and Silicon Carbide remain unchanged. With Limestone soil the resultant product from the interaction of the above chemicals decomposition is instant with water. If residue is buried in drums the owner reports that in four to eight months, the only visible remains are part of the drums rings used to seal the open head drum tops. Their experience indicates that eventually the entire mass will become a sand pile with some salt content. The material is to be hauled in the steel drums from the plant in the bucket of a rubber tired highlift to minimize possibility of accidental dropping of the drums or opening during handling. This method has proven to be the best and safest of several methods previously tried by the owner. No treatment before packaging in the steel drums with sealed tops is contemplated prior to burial.

3. The Plant Superintendant delegates the use of the waste disposal site, the handling of the material and delivery to the site, and the onsite excavation, burial and covering to a plant foreman who will carry out the management and submit the necessary monitoring report.

4. Expected Life of the Site: The expected volume per year of waste to be disposed of is between one hundred sixty-seven and two hundred cubic yards in volume based on a three foot depth of burial over eighty per cent of the land area of the site; it is expected that the capacity is sufficient for between thirty and forty years of burial at the average rate. This is deemed sufficient for present requirements.

5. Lands and Rights-of-way: The Van De Mark Chemical Company owns in excess of fifty acres on this site which is presently unsuitable for development due to the ground conditions of rock, the lack of public utilities and the general topography of the site. The land area adjacent to Mill Street access (the City street right-of-way) is presently unsuitable for residential development and might, in the foreseeable future, be adaptable to use for light industrial development on this fifty-eight plus or minus acres. By mutual consent of the land owners abutting Mill Street in this area, a control gate has been placed at each end of Mill Street and is controlled by those property owners to prevent access by the general public. This is monitored by Van De Mark Chemical on a regular basis.

6. Final Site Use: From the Environmental and Soils Reports, Chemical Analysis of the waste and rate of decomposition to a sandy consistency and mixed with rock cover, it can be assumed that at some future date the site could generally be used for industrial development. Since the area involved is approximately five per cent of the entire land owned by the Chemical Company, it would not create a difficult situation for further industiral development. There appears to be no reason to expect a major environmental problem from the site use in the future.

B. SITE DESCRIPTION

1. Location, size and topography is covered in the general description.

2. Topography varies from a relatively low slope of approximately .25 % to a steep slope along the south and west escarpment of 50% plus or minus slopes. Drainage generally follows existing swales and ditches running from Mill Street south and westerly to the edge of the escarpment and then into Eighteen Mile Creek in irregular pattern.

3. Cover Vegetation: The general area surrounding the site has been recently levelled by bulldozing rock and clay with removal of all vegetation, trees and shrubs. The bank of the escarpment immediately opposite the site is barren of trees but is covered with hardy shrubs and other vegetation with rock outcroppings. The area west and south and northwest of the disposal site is partially wooded area with undergrowth and vegetation, rock outcroppings.

4. Soil Profiles: Reference is made to the attached Empire Soils Investi-

tion Incorporated Site Investigation Report dated June, 1977, describing the soils profile based on four borings from cased monitoring wells and two additional borings to confirm depth to rock and overlying soil consistencies. In general, red-brown silt sand, gravel, rock fragments some vegetation and organic roots, traces of gray clay and sand make up the overburden of the rock cover varying from approximately five to seven feet in the areas not previously used for burial. Depth to ground water at time of drilling varied from five to ninety feet and has been observed to rise in the shaft to approximately the twenty-four foot level.

5. Bedrock type and depth: The top of gray sandstone and/or shale from surface varies from five to thirteen feet plus or minus and continues to the bottom of the ninety foot drill holes with five to ten per cent seams based on recoveries. Chemical tests were made as presented in the soils analysis of the Empire Soils Report for pH, nitrogen-nitrates, phosphorus, chlorides, and phenols. The pH range of 7.85 to 8.45 would indicate a generally neutral soil and rock characteristic.

6. Surface Waters: Surface water running across the easterly and northerly portions of the site from under Mill Street are spring fed and are channelled under the access road through culverts to open ditches for final disposal over the escarpment to Eighteen Mile Creek. There is an existing clay and rock lined drainage ditch around the east and north perimeter of the disposal site carrying surface water from the higher elevations east of the site to a discharge point on the escarpment to Eighteen Mile Creek. Generally the runoff and drainage conditions are excellent for surface water. Eighteen Mile Creek, at an elevation of approximately sixty to eighty feet below the top of the escarpment and site area provide the major drainage outlet for the area.

7. Availability of Cover Material: Based on the proposed trenching method of disposal in the site, there is sufficient material available for covering the waste with the excess material to be discarded in adjacent land areas for grading purposes.

8. Quality of the surface and ground water has been established in the biological chemical testing report attached to this report and is being monitored to assess any effects from surface drainage through the waste material to the ground water below the disposal area.

C. DESIGN SPECIFICATIONS

1. Site Preparation: The existing site will be graded to the contours shown in the cross section using existing , preparing the surrounding three sides of the site with the same clay material to contain surface water with general grading to allow drainage to the center of the waste site. The existing drainage ditches on the north and east side of the site will be approved adjacent to the dikes to assure that all surface water will be carried around the site and discharged to the Creek without contamination from the surface waste on the site.

2. Equipment: The owner has contracted for the use of bulldozer equipment, trench excavating equipment and transportation equipment to maintain the site in proper physical condition and to deliver, bury

and cover the waste as proposed in the Operation/Management Plan attached.

3. Landscaping: The report on vegetation- landscaping attached, describes in detail the type of vegetation and planting required to maintain the site in proper conditions and to add to the transpiration of surface water accumulating in the waste area. In addition, the root system will be developed which will be reduce erosion and which can allow for temporary removal of the hardy planning during trenching and burial operations and replanting over the backfilled areas to maintain continuous cover.

4. Roads and Fencing: The security of the site is generally assured by the control gate on Mill Street and access by responsible persons under direction of the property owner. Should a fence be required, a chain link fence with barbed wire and padlock gates would be installed on the high escarpment areas surrounding the northwest, north and east sides of the site to over the edge of the embankment. The fence on the embankment is not deemed necessary because of the excessive slope.

D. OPERATING PROCEDURES

1. The recommendations of the biologist and the consultant for vegetation-landscaping contained in the attached report will be augmented by the owner in the operation of the waste site. Areas previously used for dumping in which complete disintegration of the chemical waste has occurred will be regraded to the inside of the site to allow maximum possible area for future use. Top elevation will be approximately equal to the top of the dike elevation. The new bottom level of the remaining portions of the waste site will be regraded to allow drainage generally toward the center of the site using existing overburden materials. It would be expected that the filling would be started in the south and southeast sections of the dike area trenching in a generally east-west direction, covering and grading approximately equal to the top of the dike, sloped toward the center of the site. Side embankments would be held to a compacted one on one excess cover material would be removed from the site. Access road would then be continuous from Mill Street into the entrance of the prepared area to the south end of the area proceeding northerly as it is filled.

2. Road Maintenance and Placement of Wastes: The roadway, presently existing on solid clay-rock formations is graded with pressed stone, crowned for drainage to the sides and is easily maintained in wet weather. Little difficulty will be experienced in maintaining machines and truck access to the site on the existing road.

3. Compaction and Cover Material Management: Compaction of the backfill will be accomplished with the backhoe-bulldozer grading equipment sufficient to allow moisture runoff as planned. The specified vegetation and planting will be placed on the entire site and dike areas immediately following completion of the grading and prior to use for burying the waste. As waste is buried this cover material will be

temporarily removed, the material placed in trenches, compacted and graded and the vegetation replanted over the newly disturbed areas.

4. Leachate Control and Rodent Control: Monitoring wells surrounding the site are properly protected and will be periodically observed, test samples taken and necessary chemical tests made and reported in accordance with the proposed Management Plan. There is no danger of infestations of rodents due to the nature of the waste and lack of organic materials.

5. Winter Operations: Winter Operations will be carried on at a normal rate during periods of access to the site with snowplowing. However, temporary storage of the waste material in drums can be accomplished at the chemical plant without hazard until access to the site is assured and ground conditions are satisfactory for excavation and backfilling.

6. Fire and Dust Control: Fire control is not a needed item on the site due to lack of burnable materials placed in the waste disposal site. Dust control is not considered to be an item after the proper establishment of the plantings and ground cover. Road dust on access roads is not to be considered a disturbing influence on the adjacent uninhabited property.

7. Monitoring Program: A monitoring program will be established in accordance with the recommendations of the biologists as contained in the attached report with necessary chemical testing being accomplished by the Van De Mark Chemical Chemist.. Outside chemical tests to verify results will be made as requested.
8. Sign requirements: Required danger, warning and no admittance signs will be placed at the control gates and at the access to the site on all sides in accordance with the State requirements.

9. Emergency and Safety Equipment: Machine operators and disposal site supervisory personnel will be equiped with safety helmets, eye and nose protection and safety breathing apparatus in the event of release of toxic acid fumes during burial operations. Normal care in handling and burial of the waste in the past was found to minimize any hazard from this source.

E. CONCLUSIONS:

Based on the results of soil and subsurface investigations, chemical testing of surface, subsurface and ground water, biological and environmental analysis of the effects of the waste disposal on the surrounding area, it is felt that the proposed method of disposal will result in a safe and a sanitary and acceptable program. Monitoring wells with the required reporting and investigation will assure continuous control of unstable factors and allow for corrective measures to be taken immediately. Cooperation of the owner and his determination to follow the guidelines, modified from time to time as necessary to maintain the proposed condition, should assure a proper acceptable management program. Any change in the characteristics, volume or method of handling would obviously require rein-

vestigations and analysis to assure continual conformance to the approved method.

LIST OF ATTACHMENTS

1. Empire Soils Investigations, Inc.
   Soils Analysis and Report No. 77-BD-21 Pages 1-3
   June 1977

   Soils Analysis
   Boring Logs B-1 - B-6

2. Site Photographs, April 1977 1-15

3. Water Quality Investigations of the Proposed Van De Mark Chemical Company Landfill Site, Lockport, New York June, 1977 - Great Lakes Laboratory, Doctor Robert Sweeney

4. Preliminary Floristic Survey of Lockport Stone Quarry - Van De Mark Chemical Company, Inc. Waste Disposal Site, Lockport, New York, and Recommendations concerning Landscaping, Reseeding and Maintenance - Great Lakes Laboratory, Doctor Eric Randall

5. Comments Regarding the Design and Management of the Proposed Van De Mark Chemical Company, Inc. Industrial Solid Waste Landfill Site, Lockport, New York, June, 1977 - Doctor Robert B. Sweeney, Director, Great Lakes Laboratory.

6. List of Drawings:
   USGS Location Map - Scale 1" = 2000 Ft., Lockport, N. Y.
   VDM-1965 Aerial Location Map - Aerial Photograph: Scale 1" = 200 Ft.
   VDM-1966 Site Location Map and Disposal Site Layout: Topograph Map Scale 1" = 50 Ft., 2 Ft. contours
   VDM-1967 Disposal Site Cross Sections and Details, Construction Notes.

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SITE INVESTIGATION REPORT
LOCKPORT STONE QUARRY
LOCKPORT, NEW YORK

FOR
W. W. WHITMORE III
LOCKPORT, NEW YORK

JOB NO.: 77-BD-21
JUNE 1977

SITE INVESTIGATION REPORT
LOCKPORT STONE QUARRY
LOCKPORT, NEW YORK

I. INTRODUCTION

This report presents the results of a subsurface investigation performed at the Van DeMark Chemical Co., Inc. Disposal Site at the Lockport Stone Quarry, authorized by Mr. William Whitmore III, who is representing Van DeMark.

The field work was performed between April 27 and May 10, 1977. A total of six (6) test borings were advanced at locations designated by Mr. Whitmore at the site.

All borings were advanced by employing two and one-half inch (2½") diameter hollow stem auger flight casing. Representative samples of the overburden were obtained by driving a two inch (2") O. D. split spoon sampler into the undisturbed soil beneath the casing with a one-hundred forty (140) pound slide weight free falling thirty inches (30") per blow.* Standard sampling techniques were employed obtaining samples at five foot intervals with random extra samples being obtained wherever necessary.

Rock was investigated at four of the six boring locations by means of a "B" size diamond bit rotary drill.

The test borings varied in depth from 6.7 feet at boring 6 to 90 feet at borings 3 and 4.

*This operation is the Standard Penetration Test and is described in greater detail in ASTM D-1586 "Standard Method for Penetration Test and Split Barrel Sampling of Soils". The sampling spoon used permitted a 24 inch long sampling run. Where 24 inch sampling run was used, the Standard Penetration Number (SPN), as defined in the Standard, was obtained by combining the blow counts for the second and third 6 inch increment of each sample run. The values are shown as the "N" value on the attached logs.

I. INTRODUCTION - Continued

The soil and rock samples retrieved were carefully transported to our laboratory where they were visually classified by an engineering geologist. Attached to this report are the subsurface logs which were prepared for each boring completed during the investigation, with reference to the drillers' logs. These logs comprise the basic records of the work performed, as well as the materials encountered.

At the request of Mr. Whitmore, soil samples retrieved from borings 5 and 6 were subjected to various chemical tests, the results of which are appended to this report.

We have also included our "GENERAL INFORMATION AND KEY TO SUBSURFACE LOGS" as a supplement to this report for an explanation of the terms, symbols and definitions which we utilized in our visual clasisfications.

II. SUBSURFACE CONDITIONS

In general, the site is an abandoned stone quarry which is presently being used as a chemical waste disposal by Van DeMark Chemical Co., Inc.

The site is covered with a thin layer or crust of overburden soil consisting of reddish-brown silts and sand, with varying amounts of gravel, rock fragments and organic inclusions located within the actual detailed soil matrix. The soil existed in a dry to moist-firm to very compact condition. The depth of the overburden soils ranged from 5.0 feet at boring B-1 to 13.0 feet at boring B-3. The permeability of these materials is rather low due to the extreme compactness of the soil. In order to determine an accurate groundwater elevation on the site, close monitoring of the well-points should be performed. During drilling operations, freewater was encountered at only two of the borings, which does not indicate enough in-

II. SUBSURFACE CONDITIONS - Continued

formation to estimate groundwater.

Bedrock was investigated at the locations of B-1 and B-2 to a depth 23.0 feet and at B-3 and B-4 to a depth 90.0 feet. The rock retrieved varied distinctly at various depths within each boring. Weathering and seams were prominent in all of the borings, the seams occurring at greater depths at deep core locations. Based on the quality of the rock, primarily considering the extent of the seams and the amount of water loss during drilling, the rock formation could act as an aquifer for groundwater.

A very detailed description of soil and rock conditions is provided on the attached subsurface logs for your review.

If you have any further questions on subsoil conditions, or if we can help you in any way, please feel free to contact our office.

Respectfully submitted,

EMPIRE SOILS INVESTIGATIONS, INC.

Stanley J. Blas Jr.

Stanley J. Blas, Jr.
Resident Engineer

SJB/ja

Enclosure

SOILS ANALYSIS

CHEMICAL TESTS

	B-5	B-6
pH	8.45	7.85
Nitrogen - Nitrate	.4 Mil./Liter	.27 Mil./Liter
Phosphorous	.1 Mil./Liter	.08 Mil./Liter
Chloride	2.8 Mil./Liter	3.4 Mil./Liter
Phenols	1 part/Billion (Micro/Liter)	1 Part/Billion (Micro/Liter)

DATE
STARTED 5/2/77
FINISHED 5/2/77
SHEET 1 OF 1

EMPIRE SOILS INVESTIGATIONS, INC.

SUBSURFACE LOG

HOLE NO B-1
SURF. ELEV 437.7±
G. W. DEPTH See Note

PROJECT Lockport Stone Quarry
LOCATION Lockport, New York

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18-	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0									
		1	17	29	35	64		Red-brown SILT, SAND, GRAVEL, with ROCK fragments, trace embedded roots (Moist - Very Compact)	NOTE #1: No freewater at completion
		2	100/.2						Top of Rock @ 5.0'
5								Grey SANDSTONE, hard, sound	"B" size core Run #1, 5'-7' 60% Recovery
								Green massive SHALE, soft, weathered with very weathered seams at 9.7', — 13.0'-13.5'	Run #2, 7'-12' 90% Recovery
10									Run #3, 12'-17' 90% Recovery
15									Run #4, 17'-22' 90% Recovery
20									
								Bottom of Hole @ 22.0'	NOTE #2: Observation well installed to 22.0' @ this location
25									
30									
35									
40									

N = No. blows to drive 2 "spoon 12 "with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive "casing "with lb. weight falling "per blow.

CLASSIFICATION Visual By Soils Engineer

DATE
STARTED 5/4/77
FINISHED 5/4/77
SHEET 1 OF 1

EMPIRE SOILS INVESTIGATIONS, INC.

SUBSURFACE LOG

HOLE NO B-2
SURF. ELEV 441.7±
G. W. DEPTH See Note

PROJECT Lockport Stone Quarry
LOCATION Lockport, New York

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0									
		1	17	25	30	55		Reddish-brown SILT, little sand and gravel (Dry - Very Compact)	NOTE #1: On completion free-water @ 2.0'
5		2	17	35	48	83		-grades SILT and SAND, some embedded Gravel, with embedded grey Rock fragments (Moist - Very Compact)	Top of Rock @ 8.0'
10								Green massive SHALE, soft, slightly weathered and slightly fractured	"B" size core Run #1, 8'-13' 94% Recovery
15									Run #2, 13'-18' 96% Recovery
20									Run #3, 18'-23' 84% Recovery
25								Bottom of Hole @ 23.0'	NOTE #2: Wellpoint installed at this location to depth of 23.0'
30									
35									
40									

N = No. blows to drive 2 "spoon 12 "with 140 lb. pin wt. falling 30 "per blow. CLASSIFICATION Visual By

DATE
STARTED
FINISHED
SHEET 1 OF 3

EMPIRE SOILS INVESTIGATIONS, INC.

SUBSURFACE LOG

HOLE NO. B-3
SURF. ELEV. 442.2±
G. W DEPTH See Note

PROJECT Lockport Stone Quarry
LOCATION Lockport, New York

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18-	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	7	8	9	17		Reddish-grey SILT and weathered ROCK (Dry - Firm)	NOTE: Groundwater observation well installed to bottom of hole at this location
5		2	100/.4					Reddish-brown FILL, SAND, SILT, GRAVEL, with trace gypsum, with trace cemented condition (Moist - Very Compact)	
10		3	100/.2						
		4	100/.2						Top of Rock @ 13.0'
								Grey SANDSTONE, hard, sound	"B" size core Run #1, 13'-18' 90% Recovery Seam 16.4'-16.8'
15								Green massive SHALE, soft, weathered with some fractures	
									Run #2, 18'-23' 86% Recovery Seams 18.8'-19.1' 21.0'-21.4'
20									
									Run #3, 23'-28' 92% Recovery Seams 24.2'-24.4' 27.2'-27.3'
25								Extremely fractured and weathered seam 24.2'-24.7'	
								Grey SANDSTONE, hard, sound, slightly fractured	Run #4, 28'-33' 92% Recovery Seam 28.2'-28.4'
30									
									Run #5, 33'-38' 100% Recovery
35									
									Run #6, 38'-43'
40									

N = No. blows to drive 2 "spoon 12 "with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive ____ "casing ____ "with ____ lb. weight falling ____ "per blow.

CLASSIFICATION Visual By
Soils Engineer

DATE
STARTED
FINISHED
SHEET 2 OF 3

EMPIRE SOILS INVESTIGATIONS, INC.

SUBSURFACE LOG

HOLE NO. B-3
SURF. ELEV.
G. W. DEPTH See Note

PROJECT Lockport Stone Quarry
LOCATION Lockport, New York

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
40								Red SHALE, soft, weathered with extremely weathered seams at 41.1', 42.2', 43.6'-47', 53', 59.6'-60.4', 65.5'-66.5', 68.7', 72.7'	96% Recovery Seam 42.0'-42.2'
									Run #7, 43'-48' 76% Recovery
45									
									Run #8, 48'-53' 92% Recovery Seam 52.4'-52.7'
50									
									Run #9, 53'-58' 90% Recovery Seam 55.8'-56.1'
55									
									Run #10, 58'-63' 94% Recovery
60									
									Run #11, 63'-68' 94% Recovery
65									
									Run #12, 68'-73' 94% Recovery
70								-becomes slightly weathered @ 72.3'	
									Run #13, 73'-78' 100% Recovery
75									
									Run #14, 78'-83'
80									

N = No. blows to drive 2 "spoon 12 "with 140 lb. pin wt. falling 30 "per blow.

CLASSIFICATION Visual By
Soils Engineer

DATE
STARTED
FINISHED
SHEET 3 OF 3

EMPIRE SOILS INVESTIGATIONS, INC.

SUBSURFACE LOG

HOLE NO B-3
SURF. ELEV
G. W. DEPTH See Note

PROJECT Lockport Stone Quarry
LOCATION Lockport, New York

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18-	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
80									90% Recovery
85									Run #15, 83'-88' 96% Recovery
90									Run #16, 88'-90' 95% Recovery
								Bottom of Hole @ 90.0'	
95									
100									
105									
110									
115									
120									

N = No. blows to drive 2 "spoon 12 "with 140 lb. pin wt. falling 30 "per blow.
C = No. blo[illegible] "[illegible]" with [illegible] lb. weight falling [illegible] "per blow.

CLASSIFICATION Visual By
Soils Engineer

DATE
STARTED 4/27/77
FINISHED 4/27/77
SHEET 1 OF 3

EMPIRE SOILS INVESTIGATIONS, INC.

SUBSURFACE LOG

HOLE NO B-4
SURF ELEV 442.20
G. W DEPTH See Note

PROJECT Lockport Stone Quarry
LOCATION Lockport, New York

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18-	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0									NOTE: Casing @ 9', no free-water Boring completed, freewater @ 25' Water observation well installed to 90'
		1	17	18	19	37		Reddish-brown organic SILT, trace sand and embedded gravel, with embedded roots and organic material (Damp - Compact)	
5		2	21	44	60	104		-grades reddish-brown SILT, little sand, trace fragments, with partings of grey sand (Dry - Very Compact)	
		3	100/0					Grey SANDSTONE, hard, sound	"B" size core Run #1, 9'-14' 66% Recovery
10								Green massive SHALE, soft, fractured and weathered	
15									Run #2, 14'-19' 88% Recovery
20								SANDSTONE seam at 20.8'-21.1'	Run #3, 19'-24' 98% Recovery
								Grey SANDSTONE, hard, sound, slightly fractured	
25								Green SHALE seam 24.7'-25.4'	Run #4, 24'-29' 100% Recovery
30								Weathered seam 29.8'-30.3'	Run #5, 29'-34' 92% Recovery
35								Green SHALE, massive, soft, weathered Becomes red and very weathered at 35.3'	Run #6, 34'-39' 50% Recovery Lost all drill water
40									

N = No. blows to drive 2 "spoon 12 "with 140 lb. pin wt. falling 30 "per blow.

CLASSIFICATION Visual By Soils Engineer

DATE
STARTED 4/27/77
FINISHED 4/27/77
SHEET 2 OF 3

EMPIRE SOILS INVESTIGATIONS, INC.

SUBSURFACE LOG

HOLE NO B-4
SURF ELEV
G. W. DEPTH

PROJECT Lockport Stone Quarry
LOCATION Lockport, New York

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18-	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
40									Run #7, 39'-44' 68% Recovery
45								Green seam 46'-46.2'	Run #8, 44'-49' 78% Recovery
50								Green seams 51'-51.4', 52.5'-52.7', 53.1'-53.8', 60.5'-60.7', 75.1'-75.3'	Run #9, 49'-54' 100% Recovery
55									Run #10, 54'-59' 96% Recovery
60								-becomes slightly weathered @ 62' with weathered and fractured seams @ 71', 74.7', 77.7', 79', 79.5', 82', 86.6'	Run #11, 59'-64' 94% Recovery
65									Run #12, 64'-69' 100% Recovery
70									Run #13, 69'-74' 100% Recovery
75									Run #14, 74'-79' 100% Recovery
80									Run #15, 79'-84' 100% Recovery

N = No. blows to drive 2 "spoon 12 "with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive "casing "with lb. weight falling "per blow.

CLASSIFICATION Visual By Soils Engineer

DATE
STARTED 4/27/77
FINISHED 4/27/77
SHEET 3 OF 3

EMPIRE SOILS INVESTIGATIONS, INC.

SUBSURFACE LOG

HOLE NO B-4
SURF. ELEV
G. W. DEPTH

PROJECT Lockport Stone Quarry
LOCATION Lockport, New York

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18-	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
80									Run #16, 84'-89' 100% Recovery
85									Run #17, 89'-90' 100% Recovery
90								Bottom of Hole @ 90.0'	
95									
100									
105									
110									
115									
120									

N = No. blows to drive 2 "spoon 12 "with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive ____ "casing ____ "with ____ lb. weight falling ____ "per blow.

CLASSIFICATION Visual By
Soils Engineer

DATE
STARTED 5/4/77
FINISHED 5/4/77
SHEET 1 OF 1

EMPIRE SOILS INVESTIGATIONS, INC.

SUBSURFACE LOG

HOLE NO B-5
SURF. ELEV 443.0±
G. W. DEPTH See Note

PROJECT Lockport Stone Quarry
LOCATION Lockport, New York

DEPTH-FT.	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	17	19		54		Reddish-brown FILL, SAND, SILT, GRAVEL - large fragments blocking spoon sampler	NOTE: No freewater encountered
			35	44				(Dry to Moist - Firm to Compact)	
		2	27	100/.4					
5		3	12	17		36			
			19	24					
		4	12	19		48		-grades with weathered ROCK	
			29	40					
		5	39	20					
10			100/.3					Bottom of Hole @ 9.3'	
15									
20									
25									
30									
35									
40									

N = No blows to drive 2 "spoon 12 "with 140 lb. pin wt. falling 30 "per blow.

CLASSIFICATION Visual By

DATE
STARTED 5/4/77
FINISHED 5/4/77
SHEET 1 OF 1

EMPIRE SOILS INVESTIGATIONS, INC.

SUBSURFACE LOG

HOLE NO B-6
SURF. ELEV 412.0±
G. W. DEPTH See Notes

PROJECT Lockport Stone Quarry
LOCATION Lockport, New York

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18-	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	15	22		57		Reddish-brown FILL, SAND, SILT, GRAVEL, with FRAGMENTS (Moist - Firm to Very Compact)	Upon completion, freewater @ 5.2'
			35	39					
		2	10	12		29			
			17	21					
5		3	12	18		39		-grades with some weathered ROCK	
			21	32					
		4	59	100/.4				Bottom of Hole @ 6.7'	
10									
15									
20									
25									
30									
35									
40									

N = No. blows to drive 2 "spoon 12 "with 140 lb. pin wt. falling 30 "per blow.
C = No. blows to drive ____ "casing ____ "with ____ lb. weight falling ____ "per blow.

CLASSIFICATION Visual By
Soils Enginee

GENERAL INFORMATION & KEY TO SUBSURFACE LOGS

The Subsurface Logs attached to this report present the observations and mechanical data collected by the driller while at the site, supplemented by classification of the materials removed from the borings as determined through visual identification by technicians in the laboratory. It is cautioned that the materials removed from the borings represent only a fraction of the total volume of the deposits at the site and may not necessarily be representative of the subsurface conditions between adjacent borings or between the sampled intervals. The data presented on the Subsurface Logs together with the recovered samples will provide a basis for evaluating the character of the subsurface conditions relative to the proposed construction. The evaluation must consider all the recorded details and their significance relative to each other. Often analyses of standard boring data indicate the need for additional testing and sampling procedures to more accurately evaluate the subsurface conditions. Any evaluations of the contents of this report and the recovered samples must be performed by Professionals having experience in Soil Mechanics and Foundation Engineering. The information presented in the following defines some of the procedures and terms used on the Subsurface Logs to describe the conditions encountered.

① The figures in the Depth column defines the scale of the Subsurface Log.

② The Sample column shows, graphically, the exact depth range from which a sample was recovered. See Table I for a description of the symbols used to signify the various types of samples.

③ The Sample No is used for identification on sample containers and/or Laboratory Test Reports.

④ Blows on Sampler – shows the results of the "Penetration Test", recording the number of blows required to drive a split spoon sampler into the soil beneath the casing. The number of blows required for each six inches penetration is recorded. The total number of blows required for the last 12 inches of penetration are summarized in the "N" column. The outside diameter of the sampler, the hammer weight and the length of drop are noted at the bottom of the Subsurface Log.

⑤ Blows on Casing – shows the number of blows required to advance the casing a distance of 12 inches. The casing size, the hammer weight and the length of drop are noted at the bottom of the Subsurface Log. If the casing is advanced by means other than driving, the method of advancement will be indicated in the Notes column or under Method of Investigation at the bottom of the Subsurface Log.

⑥ All recovered soil samples are reviewed in the laboratory by technicians. The visual descriptions are made on basis of the sample as recovered and in accordance with the Unified Classification System. Guide Lines for the terms used in descriptions are presented in Tables II and III. The description of the relative soil compactness or consistency is based upon the penetration records as defined in Table IV. The description of the soil moisture is based upon the condition of the sample as recovered. The moisture condition is described as dry, damp, moist or wet. Water used to advance the boring may have affected the in-situ moisture content of the sample. Special terms are used as required to describe materials in greater detail; several such terms are listed in Table V. When sampling gravelly soils with a standard two-inch diameter split spoon, the true percentage of gravel is often not recovered due to the relatively small sampler diameter. The presence of boulders and large gravel is sometimes, but not necessarily, detected by an evaluation of the casing and sampler blows or through the "action" of the drill rig as reported by the driller.

⑦ The description of rock shown is based upon the recovered rock core. Terms frequently used in the description are included in Table VI.

⑧ Miscellaneous observation and procedures noted by the driller are shown in this column, including water level observations. It is important to realize that the reliability of the water level observations depend upon the soil type (water does not readily stabilize in a hole through fine grained soils), and that drill water used to advance the borings may have influenced the observations. The ground water level typically will fluctuate seasonally. One or more perched or trapped water levels may exist in the ground seasonally. All the available readings should be evaluated. If definite conclusions cannot be made, it is often prudent to examine the conditions more thoroughly through test pit excavations or water observation installations.

⑨ The length of core run is defined as length of penetration between retrievals of the core barrel from the bore hole, expressed in feet and tenths of feet. The core recovery expresses the length of core recovered from the core barrel per core run, in percent. The size core barrel used is also noted. The more commonly used sizes of core barrels are denoted "AX" and "NX". The "NX" core, being larger in diameter than "AX" core, often produces better recovery, and is frequently utilized where accurate information regarding the geologic conditions and engineering properties is needed. The "NX" core barrel requires the use of four inch diameter casing.

DATE
STARTED 5-1-70
FINISHED 5-1-70
SHEET 1 OF 1

EMPIRE SOILS INVESTIGATIONS, INC.

SUBSURFACE LOG

BORE NO. B-175
SURF. ELEV. 325.6
G.W. DEPTH See Note #1

PROJECT XXX
LOCATION YYY

DEPTH	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER (0"–6" / 6"–12" / 12"–18" / N)	BLOWS ON CASING	CROSS SECTION	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	2 / 2 / 3 / 5	10		TOPSOIL 3"	Note #1
				15		Brown SILT, some Sand, trace clay (Moist - Loose)	GW at 2.0' completion GW at 2.2' 24 hrs after completion
				50/5'		Gray SHALE, medium hard weathered, thin bedded some fractures	Cored 2.5' - 5.0', Run #1 95% Recovery AX Core
5							

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

TABLE I

- Split Spoon Sample
- Shelby Tube Sample
- Auger or Pit Sample
- Rock Core

TABLE II

Identification of soil type is made on basis of an estimate of particle sizes, and in the case of fine grained soils also on basis of plasticity.

Soil Type	Soil Particle Size	
Boulder	> 12"	
Cobble	3" – 12"	
Gravel - Coarse	3" – 3/4"	Coarse Grained (Granular)
Gravel - Fine	3/4" – #4	
Sand - Coarse	#4 – #10	
Sand - Medium	#10 – #40	
Sand - Fine	#40 – #200	
Silt - Non Plastic (Granular)	< #200	Fine Grained
Clay - Plastic (Cohesive)		

TABLE III

The following terms are used in classifying soils consisting of mixtures of two or more soil types. The estimate is based on weight of total sample.

Term	Percent of Total Sample
"and"	35 – 50
"some"	20 – 35
"little"	10 – 20
"trace"	less than 10

(When sampling gravelly soils with a standard split spoon, the true percentage of gravel is often not recovered due to the relatively small sampler diameter.)

TABLE IV

The relative compactness or consistency is described in accord with the following terms:

Granular Soils		Cohesive Soils	
Term	Blows per Foot, N	Term	Blows per Foot, N
Loose	< 10	Very Soft	< 2
Firm	11 – 30	Soft	3 – 5
Compact	31 – 50	Medium	6 – 15
Very Compact	> 51	Stiff	16 – 25
		Hard	> 26

(Large particles in the soils will often significantly influence the blows per foot recorded during the Penetration Test.)

TABLE V

Varved –	Alternating layers, seams, and partings of soils.
Layer –	Soil deposit more than 6" thick.
Seam –	Soil deposit less than 6" thick.
Parting –	Soil deposit less than 1/8" thick.
Uniform –	All grains are of about the same diameter.

TABLE VI

Rock Classification Terms		Meaning	
Hardness	Soft	Scratched by fingernail	
	Medium Hard	Scratched easily by penknife	
	Hard	Scratched with difficulty by penknife	
	Very Hard	Cannot be scratched by penknife	
Weathering	Very Weathered	Judged from the relative amounts of disintegrating iron staining, core recovery, clay seams, etc.	
	Weathered		
	Sound		
Bedding	Laminated	Natural breaks in Rock Layers	< 1"
	Thin bedded		1" – 4"
	Bedded		4" – 12"
	Thick bedded		12" – 36"
	Massive		> 36"

(Fracturing refers to natural breaks in the rock oriented at some angle to the rock layers.)

APPENDIX B

BOREHOLE/WELL INSTALLATION LOGS

VDM 9, VDM 10, VDM 11, VDM 12

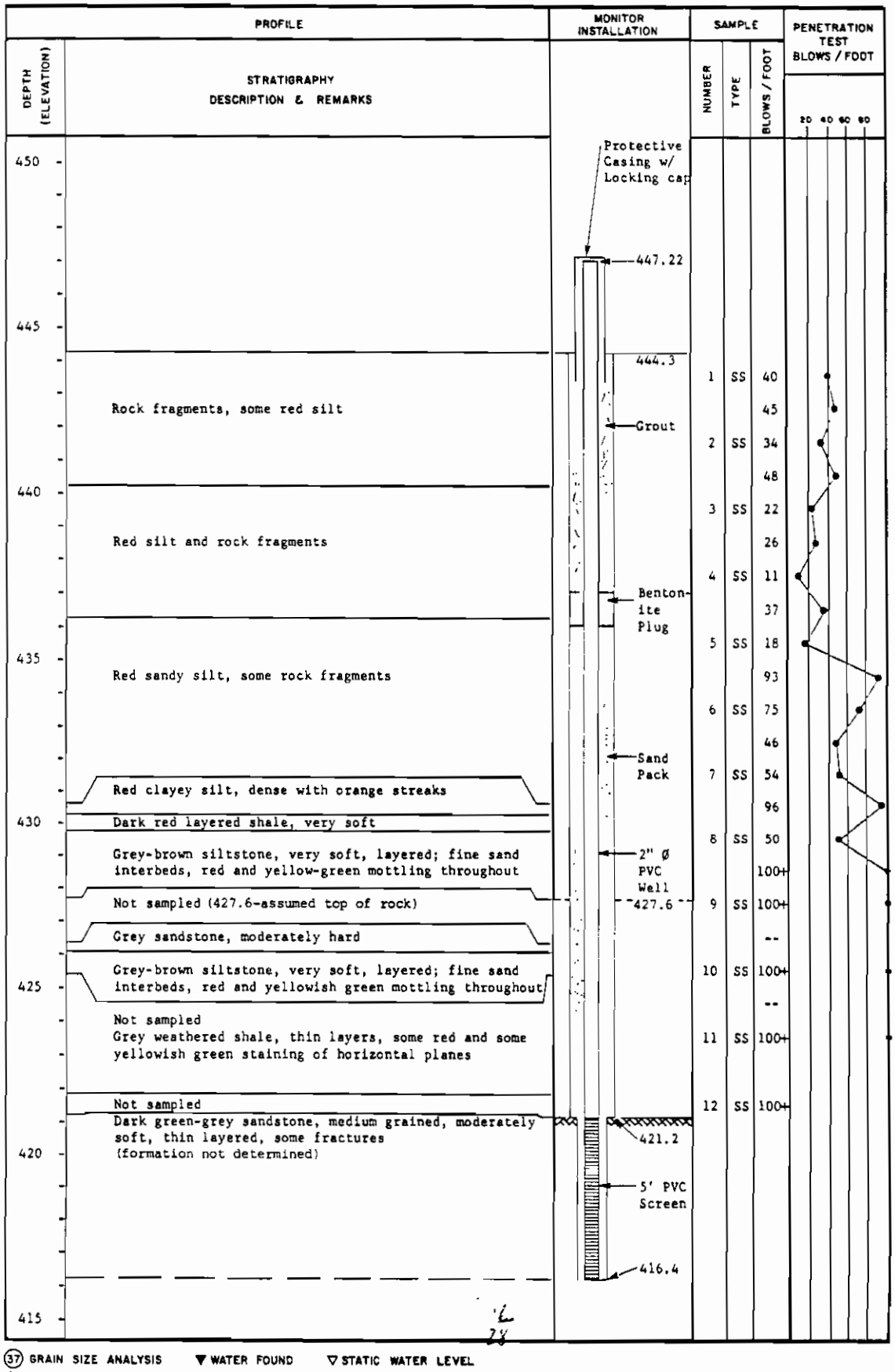
STRATIGRAPHIC AND INSTRUMENTATION LOG

PROJECT NAME: VAN DE MARK LANDFILL SITE JOB NO.: 1277 HOLE NO.: VDM-9

CLIENT: VAN DE MARK CHEMICAL COMPANY DATE COMPLETED: DECEMBER 9, 1983

HOLE TYPE 8" Ø HOLLOW STEM AUGER LOCATION: MID-SOUTHERN LIMIT OF LANDFILL

GEOLOGIST / ENGINEER: DAVE BLACK GROUND ELEVATION: 444.3 TOP OF PIPE ELEVATION: 447.22



(37) GRAIN SIZE ANALYSIS ▼ WATER FOUND ▽ STATIC WATER LEVEL

STRATIGRAPHIC AND INSTRUMENTATION LOG

PROJECT NAME VAN DE MARK LANDFILL SITE JOB NO.: 1277 HOLE NO VDM-10 Pg 1 of 2

CLIENT: VAN DE MARK CHEMICAL COMPANY DATE COMPLETED: DECEMBER 7, 1983

HOLE TYPE 8" Ø HOLLOW STEM AUGER LOCATION: SOUTHWEST CORNER LANDFILL

GEOLOGIST / ENGINEER: DAVE BLACK GROUND ELEVATION: 442.6 TOP OF PIPE ELEVATION: 444.67

DEPTH (ELEVATION)	STRATIGRAPHY DESCRIPTION & REMARKS	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE TYPE	BLOWS / FOOT	PENETRATION TEST BLOWS / FOOT (20 40 60 80)
445		Protective Casing w/ Locking cap; 444.67				
	Red clayey silt, some rock fragments, fine gravel, and root fibers	442.6	1	SS	25	
	Rock fragments				91	
440	Soft rock fragments, some red clayey silt, pebbles, trace root fibers		2	SS	100+	
					77	
			3	SS	28	
					28	
	No recovery	Grout	4	SS	36	
435					38	
	Rock fragments, some red clayey silty sand		5	SS	44	
					97	
	Dense grey siltstone, layered, greenish		6	SS	28	
	Auger refusal				100+	
	Light grey sandstone, medium grained	430.6				
430	Grey interbedded shale and dolomite/limestone - fissile to thin bedded - highly fractured (vertical and horizontal) - hematitic staining on fractured faces					
	Increasing dolomite beds	Bentonite Plug				
425						
	Grey dolomite/limestone, aphanitic - thin bedded, highly fractured - hematitic and MnO staining on fractures	Sand Pack				
420	Greenish grey to buff interbedded siltstone and sandstone, aphanitic to fine grained - thin to medium beds - frequent fractures along horizontal parting planes and some vertical fractures - some MnO staining - allochthonous sandstone fragments					
415	Grey shale, moderately soft interbedded with moderately hard buff sandstone	2" PVC				
	Buff sandstone moderately hard interbedded with grey moderately soft shale (thin beds)					

(37) GRAIN SIZE ANALYSIS ▼ WATER FOUND ▽ STATIC WATER LEVEL

STRATIGRAPHIC AND INSTRUMENTATION LOG

PROJECT NAME: VAN DE MARK LANDFILL SITE JOB NO.: 1277 HOLE NO.: VDM-10 Pg 2 of 2

CLIENT VAN DE MARK CHEMICAL COMPANY DATE COMPLETED: DECEMBER 7, 1983

HOLE TYPE 8" Ø HOLLOW STEM AUGER LOCATION: SOUTHWEST CORNER OF LANDFILL

GEOLOGIST / ENGINEER: DAVE BLACK GROUND ELEVATION: 442.6 TOP OF PIPE ELEVATION: 444.67

PROFILE		MONITOR INSTALLATION	SAMPLE			PENETRATION TEST BLOWS / FOOT
DEPTH (ELEVATION)	STRATIGRAPHY DESCRIPTION & REMARKS		NUMBER	TYPE	BLOWS / FOOT	20 40 60 80
410	Buff sandstone moderately hard interbedded with grey moderately soft shale (thin beds)	2" PVC; Sand Pack				
405		5' PVC Screen				
	Buff sandstone moderately hard, massive					
	WHIRLPOOL-QUEENSTON interface (olive green) Red shale moderately soft - thin bedded - green shale interbed					
400		398.7				
		397.2				
395		444.6 397.2 47.4 444.6 398.7 45.9				

(37) GRAIN SIZE ANALYSIS ▼ WATER FOUND ▽ STATIC WATER LEVEL

STRATIGRAPHIC AND INSTRUMENTATION LOG

PROJECT NAME: VAN DE MARK LANDFILL SITE JOB NO. 1277 HOLE NO. VDM-11

CLIENT: VAN DE MARK CHEMICAL COMPANY DATE COMPLETED: DECEMBER 9, 1983

HOLE TYPE: 8" Ø HOLLOW STEM AUGER LOCATION: MID-WESTERN LIMIT OF LANDFILL

GEOLOGIST / ENGINEER: DAVE BLACK GROUND ELEVATION: 447.4 TOP OF PIPE ELEVATION: 450.42

DEPTH (ELEVATION)	STRATIGRAPHY DESCRIPTION & REMARKS	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE TYPE	BLOWS / FOOT	PENETRATION TEST BLOWS / FOOT (20 40 60 80)
455		Protective Steel Casing w/ Locking Cap				
450		450.42				
		447.4				
	Red silt, rock fragments Trace unknown green material		1	SS	44	
					33	
445	Red silt, rock fragments, dark oily appearance to soils, some fine sand and cinders throughout		2	SS	17	
		Grout			49	
			3	SS	12	
					30	
			4	SS	16	
440		Bentonite Plug			53	
	Greenish rock fragments (sandstone)		5	SS	69	
	Red silt and greenish sandstone fragments having some red staining	2" Ø PVC			35	
	Same - less sandstone fragments		6	SS	74	
		Sand Pack			100+	
435	Red-brown clayey silt with grey and yellow-green mottling, some rock fragments		7	SS	48	
		433.4			100+	
	Auger refusal Dark red-brown sandstone, fine grained, well cemented, highly fractured					
	Green-grey shale, fine grained - sandstone interbeds - many horizontal fractures - some vertical fractures	5' PVC Screen				
430		427.7 427.5				
425						

447
427
20

(37) GRAIN SIZE ANALYSIS ▼ WATER FOUND ▽ STATIC WATER LEVEL

STRATIGRAPHIC AND INSTRUMENTATION LOG

PROJECT NAME: VAN DE MARK LANDFILL SITE JOB Nº: 1277 HOLE Nº: VDM-12

CLIENT VAN DE MARK CHEMICAL COMPANY DATE COMPLETED: DECEMBER 2, 1983

HOLE TYPE: 8" Ø HOLLOW STEM AUGER LOCATION: CENTER OF EARLY LANDFILL AREA

GEOLOGIST / ENGINEER: DAVE BLACK GROUND ELEVATION: 444.7 TOP OF PIPE ELEVATION: 447.52

DEPTH (ELEVATION)	STRATIGRAPHY DESCRIPTION & REMARKS	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE BLOWS / FOOT	PENETRATION TEST BLOWS / FOOT
450		447.52 2" Ø Black Steel Pipe				
445	Red silty clayey sand, medium grained, some angular rock fragments, some green slag, trace black deposits	444.7 Grout	1	SS	100+	
	Red sandy silt, some angular rock fragments, lime green slag at 4.0 feet	Bentonite Plug	2	SS	55	
	Brown sandy silt, trace of angular rock fragments and green slag	5' SS Screen	3	SS	75	
440	Red sandy silt, some angular rock fragments, dark oily deposits and trace of wood fragments	Sand Pack	4	SS	24	
	Rock fragments	Bentonite	5	SS	100+	
435		436.1				

(37) GRAIN SIZE ANALYSIS ▼ WATER FOUND ▽ STATIC WATER LEVEL

APPENDIX C

HISTORICAL BORELOGS

Source: 'Somerset Railroad Project - Hydrogeologic Study Danielewicz Route Station 51 + 810 to 52 + 330',

February 1982, by

Bechtel Associates Professional Corporation

GROUND WATER OBSERVATION WELL REPORT

PROJECT Somerset Railroad - Van De Mark

LOCATION N1,160,756 E468,241

Date Completed 10/19/81 Original Depth 46.7 (cored)

Inspected By J. C. Isham Date 10/19/81

Checked By _____ Date _____

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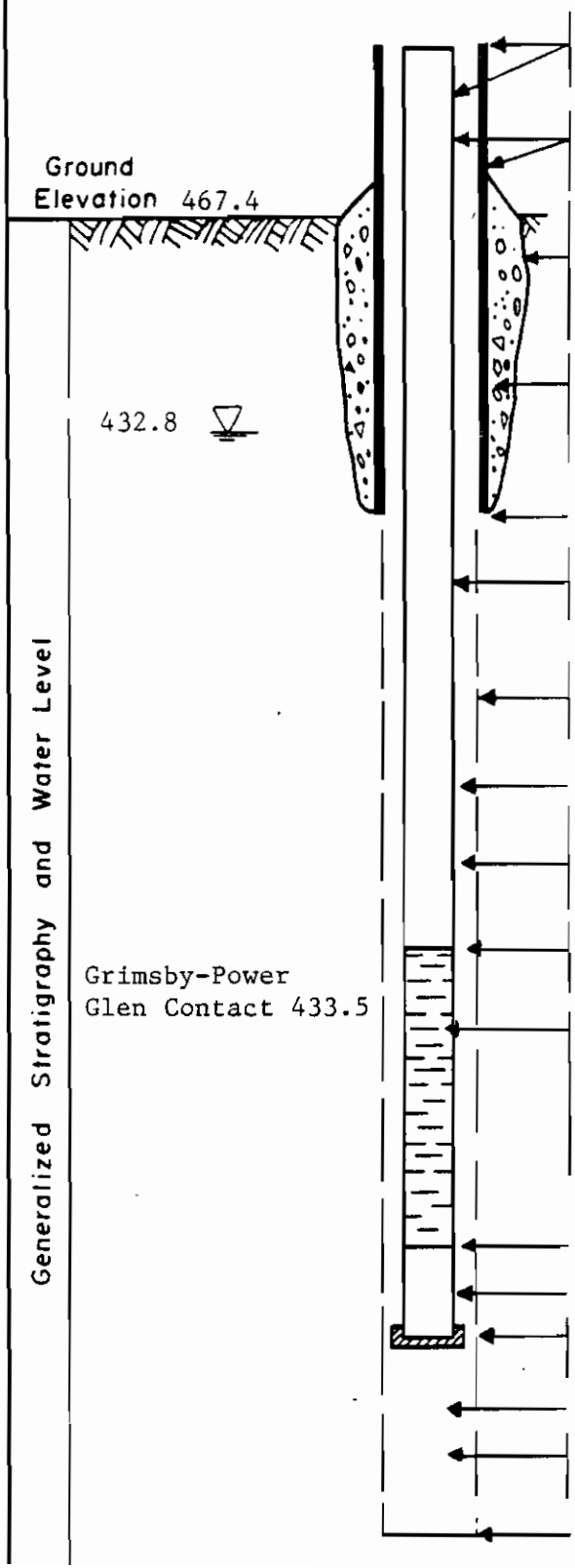
Well No. D-55

Aquifer Grimsby-Power Glen Contact

Elev. Interval 420.7-439.4'



Elevation of top of surface casing / riser pipe.	469.36/469.36'
Heigth of top of surface casing / riser pipe above ground surface.	2.0/2.0'
Depth of surface seal below ground surface	3.0'
Type of surface seal: Cement	
I.D of surface casing.	4"
Type of surface casing: Cast iron with lock cap	
Depth of surface casing below ground	3.0'
I.D. of riser pipe.	2"
Type of riser pipe: Sch 80 PVC	
Diameter of borehole	0.5'
Depth of borehole (reamed)	45.0'
Type of backfill: Cement	
Elev./depth top of seal.	442.3/25.1'
Type of seal: Bentonite	
Elev./depth bottom of seal.	439.4/28.0'
Type of sand pack. 0-02 (fine to med. sand)	
Depth of top of sand pack.	439.4/28.0'
Elev./depth top of screened section.	432.9/34.5'
Type of screened section: Sch 80 PVC	
Describe openings 0.010" machine slot - horizontal slot	
I.D. of screened section.	2.0"
Elev./depth bottom of screened section.	423.3/44.1'
Length of blank section.	0.9'
Elev./depth bottom of plugged blank section.	422.4/45.0'
Elev./depth bottom of sand column.	422.4/45.0'
Type of backfill below observation pipe. Cuttings	
Elev./depth of hole..	420.7/46.7'

BORING LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
Somerset Railroad	14818	1 OF 2	D-55

SITE	COORDINATES	ANGLE FROM HORIZ.	BEARING
Van De Mark	N 1,160,756 E 468,241	90°	—

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE (INCHES)	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH (FT.)
10/14/81	10/16/81	J. Jensen/Empire	CME 55	NX	2.7	44	46.7

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP OF CASING (FT.)	GROUND EL. (FT.)	DEPTH/EL. GROUND WATER (FT.)	DEPTH/EL. TOP OF ROCK (FT.)
42.4/96.4	3	2	469.36	467.4	34.6/432.8	2.7/464.7

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
140#/30"	—	D. L. Middleton

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	PENETRATION BLOWS 1ST 6"	2ND 6"	3RD 6"	ELEVATION (FT.)	DEPTH-FT	UNIFIED SOIL CLASSIFICATION	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							467.4					
SS	2	0.7	17	5	7	10				1	0'-2.7' Red-brown, fine to coarse, m. dense SAND, moist, trace organics. some fine gravel, some angular cobbles.	8" PVC surface casing cemented to a depth of 3 ft.
SS	0.7	0.1		100/2	—	—	464.7			2	Red-brown to white, loose, moist, fine SAND, two angular cobbles.	
				RQD %						RUN 1	2.7'-31.9' GRIMSBY FM. Dk. red brown to pale green, med. hard to v. soft, fresh to highly weathered, fine grained to microcrystalline inter-bedded SANDSTONE, SILTSTONE & SHALE, shale weathered to clay, bedding thin & horizontal with few bedding plane separations. Highly jointed, horizontal to 30° in SS iron oxide stains present in some joints.	Water used as drilling fluid.
NX	5.0	5.0	100	19				5				Lost 50% of water at 11.2.
NX	2.0	2.0	100	32						2		Lost all water at 28.2. Lost water in highly fractured vuggy zone.
NX	2.0	1.6	80	0				10		RUN 3	Yellow-brown stains in horizontal joints at 13.1, 18.2, 23.1, 23.3, 25.0.	Changed core bits at end of Run 4. Metal from auger tooth at bottom hole. Lost diamond core bit at end of run 4, used old bit to TD. Fished out plenty metal shavings.
NX	5.0	4.7	94	16				15		RUN 4		
END BOX 1										RUN 5		
NX	5.0	4.4	88	57			447.1	20			20.3'-31.9' Basal GRIMSBY FM.: Mottled pale green to white, red-brown, v. hard, fresh to slightly weathered, fine grained SANDSTONE, horizontal bedding, some beds angle at 30°, horizontal & vertical joints. Horizontal joint spacing .2'-.9' yellow-brown staining on joints 27.8 vertical fracture to 28.0 yellow-brown stains.	
NX	5.0	4.9	98	88				25		RUN 6		
NX	5.0	4.9	98	46	Packer Test #2 2.1 x 10^{-3} cm/sec			30		RUN 7	28.15-29.0 vertical joint extends from horizontal joint at 28.15, at 29.0 vertical joint fades out. Dk. red brown to black stains present. 29.65-30.3 See page 2 for tabulation of joints.	
END BOX 2							435.5					
NX	5.0	5	100	18						RUN 8	31.9'-46.7' POWER GLEN FM.: Dk. reddish brown to pale green to green to white, v. soft to v. hard, slight to severely weathered, v. fine grained to micro-crystalline, SHALE calcareous	
							432.4					

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: Van De Mark

HOLE NO.: D-55

BECHTEL

BORING LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
Somerset Railroad	14818	2 of 2	D-55

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	PENETRATION BLOWS 1ST 6"	2ND 6"	3RD 6"	ELEVATION (FT.)	DEPTH-FT	UNIFIED SOIL CLASSIFICATION	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
				RQD %			432.4			8	31.9'-46.7' POWER GLEN FM. (cont.): SANDSTONE, LIMESTONE, DOLOMITE, SILTSTONE, occasional slump features. Bedding is thin & horizontal. Occasional bedding joints. 31.7-31.9 vertical joints. 31.9-32.1 severely weathered zone, weathered to clay, rock fragments present.	
NX	5.0	4.9	98	78	Packer Test #1 1.7×10^{-4} cm/sec			40		RUN 9		
NX	5.0	5	100	16				45		RUN 10		
							420.7					
END BOX 3								50			Boring completed at 46.7 ft. Boring completed as observation well. See observation well completion report for construction details. Horizontal bedding joints exist throughout the rock. Vertical joints 27.8-28.0 coating 28.15-30.3 coating 38.9-39.0 coating 39.1-39.2 coating 46.7-47.2 no coating 29.65-30.3 severely weathered zone, v. vuggy, looks eaten away, no visible coatings in vugs. joint spacing 2 cm, 28.1-30.3 connected by vertical joint.	Boring reamed to 6" nom. diam. Reamed to 45'.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: Van De Mark

HOLE NO.: D-55

APPENDIX D

ANALYTICAL RESULTS

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

RESULTS OF ANALYSIS

TABLE NO. 1

TYPE OF ANALYSIS: First Round of Sampling for Three Parameters - Samples Collected January 6, 1984

UNIT OF MEASURE: See below

CLIENT: Van deMark Chemical

Analysis	Unit of Measure	SAMPLE IDENTIFICATION					
		VDM-9	VDM-10	VDM-11	VDM-12	D-55	
pH	Std.	5.660	5.321	3.628	4.275	7.545	
Chlorides	mg/l	9,197	7,730	1,859	50,682 (51,660)[1]	49	
Soluble Iron	mg/l	81.0	27.5	45.3	9,800.0	<0.2	

COMMENTS: [1]Duplicate Analysis

Table 2. Priority Pollutant Survey
Well VDM-12, Samples Collected
January 24, 1984 *

Summary[1]

(Expressed as micrograms per liter or ppb)

Parameter	Original Sample	Duplicate Sample
Volatiles (31)[2]		
Chloromethane	550	390
Methylene Chloride[3]	330	290
Chloroform	500	500
Carbon Tetrachloride	BDL[4]	28
Tetrachloroethylene	110	120
Base/Neutral Extractables(46)		
Octylphthalate	100	NR[5]
Pesticides/PCB's (25)	BDL	NR
Acid Extractables (11)	BDL	NR
Total Recoverable Phenols (mg/l or ppm)	0.08	NR
Total Cyanide	BDL	NR

[1] This table lists only those parameters identified from the total of 128; all others are below detection limits. The complete analytical report is provided in Appendix A.
[2] Number of Compounds
[3] The field blank contained 11 ug/l methylene chloride
[4] BDL - Below Detection Limits
[5] Duplicate analysis not requested.

*Well VDM-12 was purged on January 5, 1984. It took 19 days for this purged well to recharge to a sufficient volume for sampling.

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

RESULTS OF ANALYSIS

TABLE NO. 2 Cont'd

TYPE OF ANALYSIS: Priority Pollutant Metals Concentrations

in VDM-12, Collected January 6, 1984

UNIT OF MEASURE: micrograms/liter, or ppb

CLIENT: Van deMark Chemical

ANALYSIS	SAMPLE IDENTIFICATION					
	VDM-12					
Cadmium	294					
Chromium	4,250					
Copper	31,000					
Lead	4,850					
Nickel	22,900					
Silver	870					
Thallium	1,120					
Zinc	497,000					
Beryllium	186					

COMMENTS: Due to the sample matrix interferences in the sample, the analyses of 13 Priority Pollutant metals has been difficult. Alternate methods are being implemented and results will be provided upon completion.

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

RESULTS OF ANALYSIS

TABLE NO. 3

PAGE 4 OF 16

Second Round of Sampling of Selected Volatile Organics Compounds found in VDM-12 Priority Pollutant Survey *

UNIT OF MEASURE: micrograms/liter, or ppb

CLIENT: Van DeMark Chemical (AHC)

ANALYSIS	SAMPLE IDENTIFICATION					
	(VDM-9) 3/21/84 Bld.Field Dup.	3/21/84 VDM-9	3/21/84 VDM-10	3/21/84 VDM-11	3/21/84 VDM-12	3/21/84 D-55
Chloromethane	<0.26	<1.31	<0.26	<0.26	858.21	<0.26
Methylene Chloride	350.07	263.13	41.70	231.76	897.64	3.76
Chloroform	134.59	169.21	97.60	196.36	615.83	<0.13
Carbon Tetrachloride	<0.22	<1.11	<0.22	71.57	<5.56	<0.22
Tetrachloroethylene	<0.14	<0.68	<0.14	230.43	33.59	<0.14
Phenols (mg/1)	.020	.010	.200	.013	.043	.005

ANALYSIS	3/21/84 Field Blank
Chloromethane	<0.26
Methylene Chloride	10.20
Chloroform	<0.13
Carbon Tetrachloride	<0.22
Tetrachloroethylene	<0.14

COMMENTS: *All the compounds found in the January 24, 1984 Priority Pollutant Survey were selected except for octyl phthalate.

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

RESULTS OF ANALYSIS

TABLE NO. 4

Second Round of Sampling of Selected Metal Compounds Found in First Round of Sampling. Samples Collected 3/21/84.

UNIT OF MEASURE: micrograms/liter, or ppb

CLIENT: Van deMark Chemical

ANALYSIS		SAMPLE IDENTIFICATION					
		(VDM-9) Fld.Dup. 3/21/84	VDM-9 3/21/84	VDM-10 3/21/84	VDM-11 3/21/84	VDM-12 3/21/84	D-55 3/21/84
Cadmium		91	96	40	17	204	9
Chromium		190	190	160	190	5260	<160
Copper		7700	7800	290	510	57000	80
Lead		900	750	70	100	22200	30
Nickel		1700	1730	310	600	26600	<100
Silver		220	210	60	60	210	50
Thallium		790	850	300	200	1230	<200
Zinc		3150	3050	1140	2920	226000	0.25
Beryllium		28	28	<10	16	182	<10

COMMENTS: Due to the sample matrix interferences in the sample, the analyses of 13 Priority Pollutant metals has been difficult. Alternate methods are being

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

RESULTS OF ANALYSIS

TABLE NO. 5

Second Round of Sampling for Three Parameters

PAGE 6 OF 16

as used in the First Round of Sampling

Samples Collected March 21, 1984

UNIT OF MEASURE: milligrams/liter, or ppm

CLIENT: Van DeMark Chemical (AHG)

ANALYSIS	SAMPLE IDENTIFICATION					
	(VDM-9) Blind Fld.Dup.	VDM-9	VDM-10	VDM-11	VDM-12	D-55
pH	4.904	4.793	6.358	2.365	4.014	6.671
Chlorides	15,968	15,068	5,039	1,859	53,593	636
Soluble Iron	870	880	<.1	228	17,500	<.1

COMMENTS:

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

QUALITY ASSURANCE - Accuracy

TABLE NO. 6

TYPE OF ANALYSIS: Spiked Sample Analysis for Volatile Organics VDM-10

UNITS OF MEASURE: micrograms/liter, or ppb.

CLIENT: Van DeMark Chemical (AHC)

ANALYSIS	TYPE	ORIGINAL CONCEN.	ADDED CONCEN.	EXPECTED CONCEN.	REPORTED CONCEN.	PERCENT RECOVERY	95% CONFID. INTERVAL
Chloromethane	Spike	<0.26	20.0	20.0	22.76	113.8	NA*
Chloroform	Spike	9.76	7.64	17.40	19.94	114.6	"
Carbon Tetrachloride	Spike	<0.22	7.27	7.28	8.10	111.3	"
Tetrachloroethylene	Spike	<0.14	8.36	8.36	9.36	112.0	"

Comments: *NA - not applicable

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

QUALITY ASSURANCE - Precision

TABLE NO. 7

TYPE OF ANALYSIS: Duplicate Analysis

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for Volatile Organics Sample VDM-10

UNITS OF MEASURE: micrograms per liter, or ppb

CLIENT: Van deMark Chemical (AHG)

ANALYSIS	SAMPLE	ORIGINAL CONCEN.	DUPLICATE CONCEN.	AVERAGE CONCEN.	RANGE	REL. % DIFFER.
Chloromethane	VDM-10	<0.26	<0.26	NA	NA	NA
Methylene Chloride	VDM-10	41.37	42.03	41.70	0.66	1.6
Chloroform	VDM-10	98.73	96.46	97.60	2.27	2.3
Carbon Tetrachloride	VDM-10	<0.22	<0.22	NA	NA	NA
Tetrachloroethylene	VDM-10	<0.14	<0.14	NA	NA	NA

COMMENTS:

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

QUALITY ASSURANCE - Accuracy

TABLE NO. 8

TYPE OF ANALYSIS: EPA and Spiked Sample

Test Control

Samples Collected 3/21/84

UNITS OF MEASURE: milligrams/liter, or ppm

CLIENT: Van deMark Chemical

ANALYSIS	TYPE	ORIGINAL CONCEN.	ADDED CONCEN.	EXPECTED CONCEN.	REPORTED CONCEN.	PERCENT RECOVERY	95% CONFID. INTERVAL
Soluble Iron	EPA	.80	---	.80	.79	98.8	.70---.88
Soluble Iron (Field Dup.)*	Spike	.44	1.0	1.44	1.50	104.2	---
Soluble Iron (VDM-9)	Spike	.44	1.0	1.44	1.50	104.2	---
Soluble Iron (VDM-10)	Spike	.05	0.5	.55	.56	101.8	---
Soluble Iron (VDM-11)	Spike	1.14	1.0	2.14	2.22	103.7	---
Soluble Iron (VDM-12)	Spike	0.88	1.0	1.88	1.95	103.7	---
Soluble Iron (D-55)	Spike	.03	0.5	.53	.57	107.5	---

Comments: *Field Duplicate - VDM-9

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

QUALITY ASSURANCE - Accuracy

TABLE NO. 9

TYPE OF ANALYSIS: EPA & Spiked Sample

Test Control

PAGE 10 OF 16

UNITS OF MEASURE: Micrograms/liter, or ppb

CLIENT: Van deMark Chemical

ANALYSIS	TYPE	ORIGINAL CONCEN.	ADDED CONCEN.	EXPECTED CONCEN.	REPORTED CONCEN.	PERCENT RECOVERY	95% CONFID. INTERVAL
Copper	EPA	339	---	339	330	97.3	302---368
Copper (VDM-12, 1/6/84)	Spike	160	500	660	670	101.5	---
Copper (Fld.Dup., 3/21/84)*	Spike	390	500	890	890	100.0	---
Copper (VDM-9, 3/21/84)	Spike	390	500	890	890	100.0	---
Copper (VDM-10, 3/21/84)	Spike	150	500	650	650	100.0	---
Copper (VDM-11, 3/21/84)	Spike	260	500	760	750	98.7	---
Copper (VDM-12, 3/21/84)	Spike	290	500	790	790	100.0	---
Copper (D-55, 3/21/84)	Spike	40	500	540	570	105.6	---
Lead	EPA	43	---	43	43	100.0	3.4---5.4
Lead (VDM-12, 1/6/84)	Spike	24	25	49	48	98.0	---
Lead (Fld.Dup., 3/21/84)	Spike	45	25	70	71	101.4	---
Lead (VDM-9, 3/21/84)	Spike	4	25	29	34	117.2	---
Lead (VDM-10, 3/21/84)	Spike	33	25	58	56	96.6	---
Lead (VDM-11, 3/21/84)	Spike	50	25	75	79	105.3	---
Lead (VDM-12, 3/21/84)	Spike	11	25	36	35	97.2	---

Comments: *Field Duplicate - VDM-9

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

QUALITY ASSURANCE - Accuracy

TABLE NO. 9 Cont'd

TYPE OF ANALYSIS: EPA & Spiked Sample

PAGE 11 OF 16

Test Control

UNITS OF MEASURE: micrograms/liter, or ppb

CLIENT: Van deMark Chemical

ANALYSIS	TYPE	ORIGINAL CONCEN.	ADDED CONCEN.	EXPECTED CONCEN.	REPORTED CONCEN.	PERCENT RECOVERY	95% CONFID. INTERVAL
Lead (D-55, 3/21/84)	Spike	12	25	37	37	100.0	---
Cadmium	EPA	39	---	39	37	94.9	31---42.8
Cadmium (VDM-12, 1/6/84)	Spike	147	50	197	217	110.2	---
Cadmium (Fld.Dup. 3/21/84) *	Spike	46	50	96	102	106.3	---
Cadmium (VDM-9, 3/21/84)	Spike	48	50	98	107	109.2	---
Cadmium (VDM-10, 3/21/84)	Spike	20	50	70	73	104.3	---
Cadmium (VDM-10, 3/21/84)	Spike	9	50	59	63	106.8	---
Cadmium (VDM-11, 3/21/84)	Spike	102	50	152	161	105.9	---
Cadmium (VDM-12, 3/21/84)	Spike	5	50	55	58	105.5	---
Chromium	EPA	261	---	261	258	98.9	210---306
Chromium (VDM-12, 1/6/84)	Spike	2130	1000	3130	3100	99.0	---
Chromium (Fld.Dup. 3/21/84)	Spike	100	1000	1100	1160	105.5	---
Chromium (VDM-9, 3/21/84)	Spike	100	100	1100	1160	105.5	---
Chromium (VDM-10, 3/21/84)	Spike	80	1000	1080	1130	104.6	---
Chromium (VDM-11, 3/21/84)	Spike	100	1000	1100	1160	105.5	---

Comments: *Field Duplicate - VDM-9

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

QUALITY ASSURANCE - Accuracy

TABLE NO. 9 Cont'd

TYPE OF ANALYSIS: EPA & Spiked Sample

Test Controls

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UNITS OF MEASURE: micrograms/liter, or ppb

CLIENT: Van deMark Chemical

ANALYSIS	TYPE	ORIGINAL CONCEN.	ADDED CONCEN.	EXPECTED CONCEN.	REPORTED CONCEN.	PERCENT RECOVERY	95% CONFID. INTERVAL
Chromium (VDM-12, 3/21/84)	Spike	2630	1000	3630	3600	99.2	---
Chromium (D-55, 3/21/84	Spike	<100	1000	1000	990	99.0	---
Nickel	EPA	210	---	210	200	95.2	180--- 240
Nickel (VDM-12, 1/6/84)	Spike	1150	1000	2150	2200	102.3	---
Nickel (Fld.Dup. 3/21/84)*	Spike	850	1000	1850	1940	104.9	---
Nickel (VDM-9, 3/21/84)	Spike	850	1000	1850	1960	105.9	---
Nickel (VDM-10, 3/21/84)	Spike	150	1000	1150	1200	104.3	---
Nickel (VDM-11, 3/21/84)	Spike	300	1000	1300	1310	100.8	---
Nickel (VDM-12, 3/21/84)	Spike	1330	1000	2330	2370	101.7	---
Nickel (D-55, 3/21/84)	Spike	<100	1000	1000	1050	105.0	---
Silver	EPA	1000	---	1000	1000	100.0	---
Silver (VDM-12, 1/6/84)	Spike	440	500	940	930	98.9	---
Silver (Fld.Dup. 3/21/84)	Spike	110	500	610	630	103.3	---
Silver (VDM-9, 3/21/84)	Spike	110	500	610	620	101.6	---
Silver (VDM-10, 3/21/84)	Spike	30	500	530	480	90.6	---

Comments: *Field Duplicate - VDM-9

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

QUALITY ASSURANCE - Accuracy

TABLE NO. 9 Cont'd

TYPE OF ANALYSIS: EPA & Spiked Sample

PAGE 13 OF 16

Test Controls

UNITS OF MEASURE: micrograms/liter, or ppb

CLIENT: Van deMark Chemical

ANALYSIS	TYPE	ORIGINAL CONCEN.	ADDED CONCEN.	EXPECTED CONCEN.	REPORTED CONCEN.	PERCENT RECOVERY	95% CONFID. INTERVAL
Silver (VDM-11, 3/21/84)	Spike	30	500	530	500	94.3	---
Silver (VDM-12, 3/21/84)	Spike	110	500	610	610	100.0	---
Silver (D-55, 3/21/84)	Spike	<50	500	500	440	88.0	---
Thallium	EPA	2520	---	2520	2530	100.4	1440---3680
Thallium (VDM-12, 1/6/84)	Spike	560	2000	2560	2980	116.4	---
Thallium (Fld.Dup. 3/21/84)*	Spike	400	2000	2400	2330	97.1	---
Thallium (VDM-9, 3/21/84)	Spike	420	2000	2420	2380	98.3	---
Thallium (VDM-10, 3/21/84)	Spike	150	2000	2150	2160	100.5	---
Thallium (VDM-10, 3/21/84)	Spike	620	2000	2620	2650	101.1	---
Zinc	EPA	420	---	420	420	100.0	380---450
Zinc (VDM-12, 1/6/84)	Spike	250	500	750	750	100.0	---
Zinc (Fld.Dup., 3/21/84)	Spike	160	500	660	660	100.0	---
Zinc (VDM-9 3/21/84)	Spike	150	500	650	650	100.0	---
Zinc (VDM-10, 3/21/84)	Spike	60	500	560	560	100.0	---
Zinc (VDM-11, 3/21/84	Spike	150	500	650	640	98.5	---

Comments: *Field Duplicate - VDM-9

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

QUALITY ASSURANCE - Accuracy

TABLE NO. 9 Cont'd

TYPE OF ANALYSIS: EPA & Spiked Sample

Test Control

PAGE 14 OF 16

UNITS OF MEASURE: micrograms/liter, or ppb

CLIENT: Van deMark Chemical

ANALYSIS	TYPE	ORIGINAL CONCEN.	ADDED CONCEN.	EXPECTED CONCEN.	REPORTED CONCEN.	PERCENT RECOVERY	95% CONFID. INTERVAL
Zinc (VDM-12, 3/21/84)	Spike	110	500	610	610	100.0	---
Zinc (D-55, 3/21/84)	Spike	120	500	620	630	101.6	---
Beryllium	EPA	235	---	235	234	99.6	207---257
Beryllium (VDM-12, 1/6/84)	Spike	93	100	193	182	94.3	---
Beryllium (Fld.Dup., 3/21/84)*	Spike	14	100	114	117	102.6	---
Beryllium (VDM-9, 3/21/84)	Spike	14	100	114	109	95.6	---
Beryllium (VDM-10, 3/21/84)	Spike	<5	100	100	101	101.0	---
Beryllium (VDM-11, 3/21/84)	Spike	8	100	108	97	89.8	---
Beryllium (VDM-11, 3/21/84)	Spike	91	100	191	182	95.3	---
Beryllium (VDM-12, 3/21/84)	Spike	<5	100	100	97	97.0	---

Comments: *Field Duplicate - VDM-9

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

QUALITY ASSURANCE - Accuracy

TABLE NO. 10

TYPE OF ANALYSIS: Spiked Sample, EPA and Standard Test Control Analysis

UNITS OF MEASURE: milligrams/liter, or ppm

CLIENT: Van DeMark Chemical (AHG)

ANALYSIS	TYPE	ORIGINAL CONCEN.	ADDED CONCEN.	EXPECTED CONCEN.	REPORTED CONCEN.	PERCENT RECOVERY	95% CONFID. INTERVAL
pH	Std.	7.0	--	7.0	6.978	99.7	NA
Chloride	EPA	17.8	--	17.8	16.6	93.4	NA
Phenol	EPA	.040	--	.040	.045	112.5	NA
Phenol (VDM-9) (Field Dup.)	Spike	.020	.400	.420	.375	89.3	NA
Phenol (VDM-10)	Spike	.200	.400	.600	.567	94.5	NA

Comments:

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

QUALITY ASSURANCE - Precision

TABLE NO. 11

TYPE OF ANALYSIS: Duplicate Analysis for Chlorides & Phenols

UNITS OF MEASURE: milligrams/liter, or ppm

CLIENT: Van DeMark Chemical (AHG)

ANALYSIS	SAMPLE	ORIGINAL CONCEN.	DUPLICATE CONCEN.	AVERAGE CONCEN.	RANGE	REL. % DIFFER.
Chloride	VDM-11	1,859	1,859	1,859	0	0
Chloride	VDM-12	53,471	53,715	53,593	122	.23
Phenol	VDM-11	.010	.016	.013	.003	23.1

COMMENTS: