ERM-Northeast

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FINAL REMEDIAL INVESTIGATION
VAN DER HORST CORPORATION SITE
PLANT NO. 2
SITE NO. 9-05-22
OLEAN, CATTARAUGUS COUNTY

TEXT
VOLUME I OF II

JULY 1992

SUBMITTED TO:

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF HAZARDOUS WASTE REMEDIATION
ALBANY, NEW YORK 12233

SUBMITTED BY:

ERM-NORTHEAST, INC.
5500 MAIN STREET
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ERM-Northeast

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Note: Phase II Field Data was previously submitted as a separate volume in February, 1992

EXECUTIVE SUMMARY

This report summarizes the findings and conclusions of the Phase I and II Remedial Investigations (RI) conducted by ERM-Northeast (ERM) at the Van Der Horst Plant No. 2 facility between August 1989 and November 1991. Originally, a third phase (Phase III) of the RI was to be undertaken after completion of the Phase II RI. Since Phase II and Phase III of the RI were performed simultaneously and incorporated into the Phase II RI, both will hereafter be referred to as the Phase II RI. Work done by ERM to develop the Phase II RI report included a field exploration program and a reduction and analysis of the field data.

Field work completed during both phases of the RI included installation of 38 test borings, 30 monitoring wells, a surface geophysical survey, water level monitoring, in situ hydraulic testing of monitoring wells, and sampling and testing from various media including 270 surface and subsurface soil samples, 1 catch basin sediment sample, 9 surface water/sediment samples, 67 plant building surface samples, and 45 ground water samples. Laboratory testing of those samples was performed by a NYSDEC approved laboratory. The major findings of the RI Phases I and II are summarized below.

Environmental Conditions

The Van Der Horst Corporation of America Plant No. 2 is a former iron plating facility in the City of Olean, Cattaraugus County, New York. Plant No. 2 was in operation from 1951 until 1987. The site has an areal extent of approximately 17.5 acres. Several environmental problems were identified at the site prior to ERM's RI/FS study, including:

- The disposal and burial of unknown drummed materials on-site. At least one partially-filled drum and some drum debris is still present in a former disposal area. The former disposal areas have been found to contain higher than background levels of chromium, lead and barium.
- The abandonment of numerous unsecured containers and vats of chemicals. These were left inside the plant building after the former owner, R. G. Scott Corporation, filed for bankruptcy in 1989.

Geologic Conditions

The Plant No. 2 site is overlain by a silt to silty-sand material that has an average thickness of 10 feet. Beneath this silty layer lies a sand and gravel deposit which is highly variable in composition. Below the sand and gravel, and approximately 80 feet below ground level, lies the top surface of a shale bedrock.

A large clay lens occurs within the sand and gravel deposit at the northeastern end of the site. The thickness of the lens varies from 9 to 25 feet. The top surface of the clay lens ranges in depth from 25 to 35 feet.

Much of the site is covered with fill material which mainly consists of cinders and broken concrete debris. This fill was found to have a thickness of less than 2 feet outside of the former drum disposal area.

Ground Water Flow

Ground water flow in the shallow monitoring wells is primarily towards the west with an average lateral gradient of 0.0035. Ground water in the deep monitoring wells generally flows toward the southwest at an average lateral gradient of 0.0013.

Average downward vertical gradient at monitoring well pairs, range from 0.002 to -0.191. These values are related to the head difference between shallow and deep wells. Negative vertical gradients indicate that there is a downward vertical component to ground water flow.

The aquifer at Plant No. 2 appears to occur in two different hydraulic settings. Throughout most of the site, the aquifer is divided into a shallow and deep aquifers which are separated by a low permeability clay or silty sand. However, west of the Plant No. 2 building the aquifer occurs as a single unconfined unit.

The following average aquifer characteristics have been calculated or estimated from on-site slug test and aquifer test data:

Parameter	Method	Value
Hydraulic Cond.	Shallow Well Slug Test	0.045 ft/min
Hydraulic Cond.	Deep Well Slug Test	0.122 ft/min
Storativity	Regional Pumping Tests	0.015
Specific Yield	Estimated Range	0.15 - 0.25

Public Health Risk Assessment

The public health risk assessment concluded that under current conditions there are carcinogenic effects from chromium in fugitive dust emissions from soil (incidental ingestion by children). Under future conditions, if no remedial action is taken, the carcinogenic effects include arsenic, benzene, and beryllium, in drinking water, and chromium in fugitive dust emissions in soil. Additionally, the risk assessment concluded that noncarcinogenic effects under future conditions include chromium and lead in groundwater.

Based on the environmental risk assessment, no adverse effects to sensitive environmental resources are expected to occur as a result of the site contaminants. However, several of the contaminants found in sediment and surface water samples collected from Two Mile Creek are above SCGs and may be impacting benthic and aquatic life in this creek.

The following chromium cleanup levels were recommended in the final risk assessment: surface and subsurface soil (50 mg/Kg); ground water (50 ug/L); and creek sediment (26 mg/kg). Surface and subsurface soil cleanup levels were determined from calculations of exposure to fugitive dust emissions. The ground water cleanup criterion was based on NYSDEC ground water standards. The sediment cleanup level is 26 mg/kg, as per NYSDEC sediment criteria for chromium.

Delineation of Contamination

Soil

Three historical source areas (Areas 1, 2 and 4) of soil contamination were identified during the review of data from the Phase I and II RI. These source areas were locales where specific plant activities and disposal practices have been identified as contributing to surface and subsurface soil contamination. Both areas contain at least one subsurface soil sample which had a chromium concentration exceeding 1000 mg/Kg.

Historical Source Area 1 is located inside the fenced-in former drum disposal area and extends east, past the plant building, and south from the Two Mile Creek flood control berm to the main plant building south wall. This area encompasses approximately 5 acres. One subsurface soil sample in this area had a chromium concentration of 13,100 ppm, or about 1.3 percent.

Historical Source Area 2 is located adjacent and underneath a production vat that was formerly used in a plating process in the plant. Based on the analysis of subsurface soil samples it is believed that the vat leaked during plant operations. One saturated subsurface soil sample from this area had a chromium concentration of 1420 mg/Kg. Area 2 is believed to be the primary source of ground water contamination at the site. Ground water from Area 2 monitoring well MW-20 had a chromium concentration of 1680 ug/L.

Historical Source Area 4 is believed to be located in the subsurface soil beneath or upgradient of monitoring well MW-9. Chromium concentrations in the ground water obtained from this well exceeded 10,000 ppb. Therefore, it is suspected that subsurface soil in the vicinity of this well is contributing to the elevated contamination levels in the ground water. No subsurface soils were analyzed from this location, however, a sediment sample collected from a nearby catch basin exhibited a chromium concentration of

43,000 ppm. The location of the catch basin is upgradient of MW-9 and the elevated chromium levels may be contributing to the concentrations found in the well water. Further investigation is recommended to delineate this potential source area.

One Potential Source Area (Area 3) was identified during the both phases of the RI. This area was identified primarily from the analytical results of ground water samples and is located where limited soil samples were collected.

Potential Source Area 3 is believed to be located in the subsurface soil beneath or upgradient of monitoring well MW-10. Chromium concentrations in the ground water obtained from MW-10S during the Phase II RI exceeded 800 ppb. The elevated levels of chromium in the ground water appear to indicate that the subsurface soil in the vicinity of this well is contributing to the elevated contamination levels in the water. Analytical results from two subsurface soil samples collected from this location during the Phase I RI did not indicate elevated levels of contaminants. Therefore, further investigation also is recommended to delineate this potential source area.

Ground Water

Chromium, manganese, lead, arsenic, beryllium, and benzene have been determined to be the principle ground water contaminants.

Analytical data from Phase I and II ground water samples indicate that the majority of volatile organic contamination appears to occur from an off-site source. Concentrations of chromium contamination below 100 ppb detected in the on-site monitoring wells may also have originated from an off-site source. However, chromium contamination exceeding 100 ppb in the shallow monitoring well samples appears to to be due to potential source areas in the subsurface soil near MW-10, MW-9 and inside the plant building beneath the former EMD process vat. Ground water migration of the shallow aquifer has been mapped to flow toward the west. The extent of the shallow chromium plume has not been fully delineated; shallow down gradient perimeter wells exhibit chromium levels higher than 50 ppb.

Furthermore, the extent of the chromium contamination in the deep monitoring wells also appears to be undefined. Three of the twelve deep monitoring wells exhibited chromium contamination levels over 50 ppb. Two of the wells, MW-10D and MW-5D are located on-site and one, MW-8D, is located off-site and downgradient.

Catch Basin

A sediment sample was collected from a catch basin that intercepts a drain running from a former wax dipping vat inside the plant to Two Mile Creek. The analysis of this sample indicates that the drain sediment contains elevated levels of chromium, mercury, arsenic, barium and lead. The extent of contamination and the direction of migration from the vat, drain, or alleged creek outfall have not been determined.

Two Mile Creek

Creek sediment and surface water samples were collected at locales adjacent to the plant property and at off-site locations. Chromium concentrations exceeding 26 ppm were measured in all of the sediment samples collected from Two Mile Creek. This analytical data appears to indicate that chromium contamination in stream sediment is attributable to former Plant 2 operations.

Cadmium was detected in one creek sediment sample at a concentration above 3 ppm during the Phase I RI. Further sediment sampling and analysis during the Phase II RI indicated that five (5) additional sediment samples exhibited cadmium levels exceeding 3 ppm. Since this stream is located adjacent to a major state highway and receives runoff from its surface, it is difficult to determine where the source of cadmium contamination is located based on the samples collected. Further upstream sediment sampling may be warranted to determine background levels of cadmium.

Building Interior Surfaces

Chromium, lead and arsenic were detected in the wipe and dust samples collected inside the plant building and are considered the primary interior contaminants. Elevated levels of these contaminants were found near process vats and ventilation ducts, however, a number of samples obtained from the building walls also exhibited high concentrations of inorganics.

Fifteen samples of various materials, including pipe insulation elbows and floor tiles, were obtained from numerous locations inside the facility and analyzed for asbestos content. Asbestos containing fibers were detected in all but two of the samples collected. In most samples the asbestos content consisted of approximately 40% chrysotile and amosite based on the the total sample volume.

Based upon the overall results from the Phase II building interior samples and the previously collected EPA building samples (submitted to NYSDEC April 3, 1991), most of the floors, walls and equipment inside Plant 2 are contaminated with chromium, lead and in some areas, arsenic. Additionally, many of the pipe joints and elbows are covered with asbestos containing materials.

Remedial Action Objectives

The remedial action objectives are contingent upon the current and future use of ground water by local residents and the potential for contaminant migration to public supply wells. The public water supply information has, in part, been collected by the NYSDEC during a residential well survey. The results, with USGS records, indicate that the withdrawal of ground water is presently not taking place. However, assuming that there is some future exposure path for the contaminated ground water, the following remedial action objectives have been developed:

- Remediate identified areas of contaminated surface and subsurface soil to limit future migration of chromium, lead, arsenic and volatile organics;
- Remediate identified areas of contaminated stream sediment to limit future migration of chromium and contamination of surface water;
- Remediate ground water to acceptable risk levels for chromium, lead and volatile organics;
- Remediate the building drain system of residual contamination between the site and Two Mile Creek; and,
- Remediate or demolish the on-site building structures.

<u>Recommendations for the Remedial Action Program</u>

The Phase I and II RIs have provided an extensive amount of information regarding the physical characteristics of the study area and the contaminants of interest. However, some additional study will be required for the remedial design programs. Some recommended studies for the initial phase of the remedial action program are summarized below:

1) The horizontal extent of total chromium ground water contamination needs to be further delineated with additional shallow monitoring wells northwest of the site. Ground water modeling data should be generated from an on-site aquifer pumping test, performed after the limits of total chromium contamination in the shallow aquifer have been defined. Ground water flow simulations should be undertaken and used to optimize the recovery of contaminated ground water from the entire plume. The following factors will be evaluated during modeling:

   - Numbers of recovery wells;
   - Recovery well locations; and
   - Recovery well pumping rates.

2) The area of subsurface soil contamination (Figures 6-10, 6-11) should be further defined vertically and horizontally to determine remedial action methodologies and cleanup costs. Due to the limited number of samples obtained for laboratory analysis the extent of contamination cannot be accurately estimated in the unsaturated soil. Furthermore, no vertical limits have been determined for the extent of chromium contamination in the saturated soil.

3) Based on the soil classification descriptions and slug test data it is believed that the aquifer characteristics at Plant 2 are significantly different from those encountered at Plant

1. Therefore, the data generated during the pump test at Plant 1 cannot be used accurately to represent the Plant 2 aquifer conditions and properties. An aquifer pumping test is recommended and should be performed in order to obtain data concerning aquifer permeability, transmissivity and the impact of the underlying, spatially discontinuous clay lens. These data will help determine the direction and rate of contamination transport in the aquifer. This, in turn, will assist in determining the potential measures required to remediate the ground water contamination.

4) Treatability studies will be required to determine the methods applicable for the remediation of the contaminated soil.

5) The delineation of the suspected subsurface source areas near MW-10 and MW-9 is required to determine the origin and extent of contamination contributing to the elevated levels of inorganics in these wells. This delineation is also required to determine remedial action methodologies and cleanup costs.

1.0 INTRODUCTION

This report summarizes the results, findings and conclusions of ERM-Northeast, Inc.'s (ERM) Remedial Investigation (RI) conducted for the New York State Department of Environmental Conservation (NYSDEC). The investigation was conducted at the Van Der Horst Plant No. 2 iron-plating facility in Olean, New York during two separate phases. The Phase I information will only be summarized in this report, since this data was previously included in reports submitted to the NYSDEC in October 1990. The Phase II data will be presented and discussed in detail and the conclusions presented in this report will be based on information obtained from both phases. Referenced documentation for the RI is contained in associated appendices.

1.1 Purpose of RI Study

The purpose of the RI study was to assess the nature, extent and potential source(s) of contamination at the site. This process was conducted in two phases, beginning in November 1989 and ending in November 1991. Ultimately, it was the intent of the RI, through two separate phases, to compile sufficient data so that cost-effective and environmentally sound long-term remedial actions would be developed during the Feasibility Study (FS).

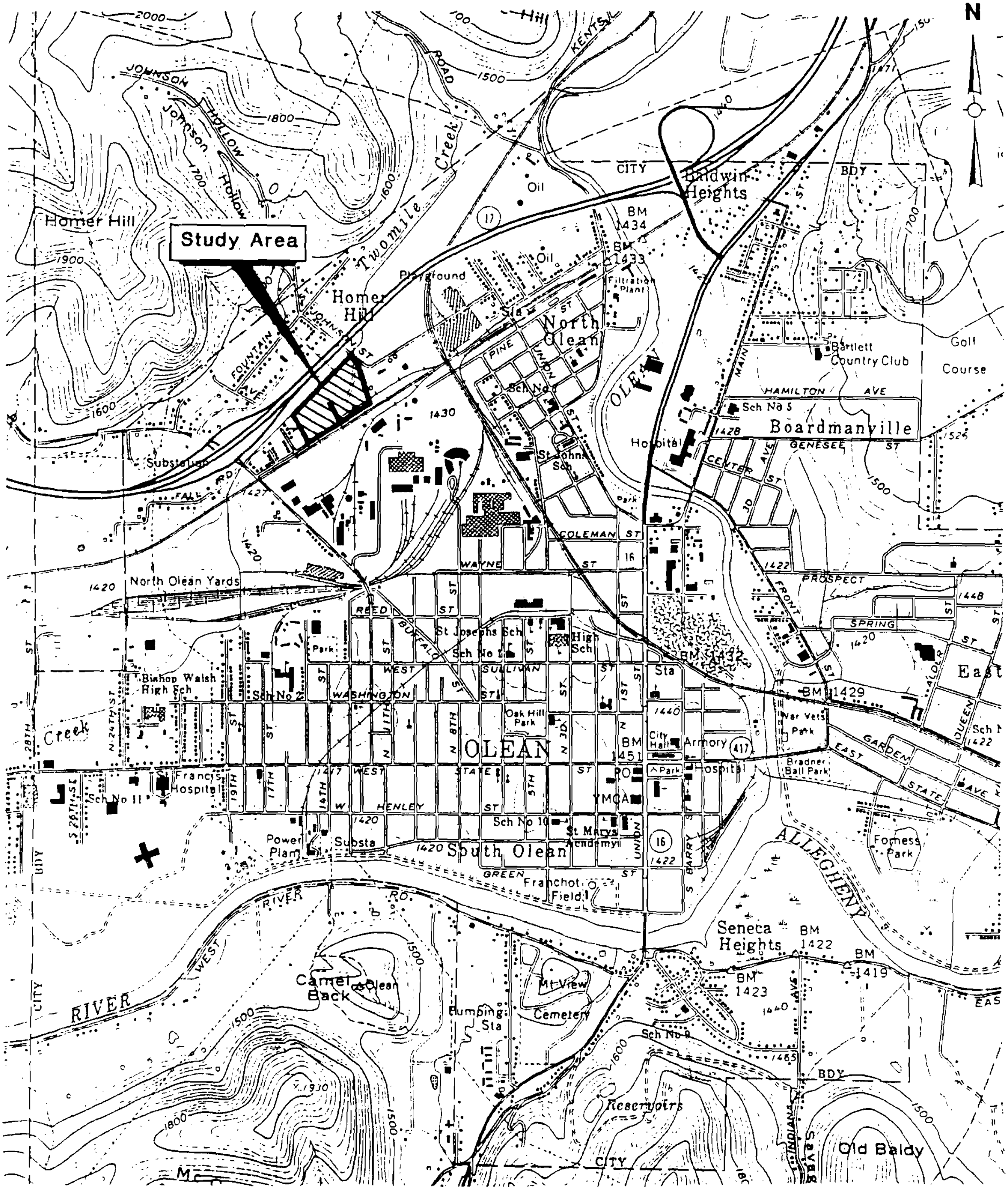
1.2 Background

1.2.1 Site Description

The former Van Der Horst Corporation of America Plant No. 2 iron plating facility is located in a mixed residential/industrial area between Connell and Franklin Streets in the northern section of the City of Olean, Cattaraugus County, New York (Figure 1-1). The site is defined, for the purpose of this study, as the Van Der Horst property between Connell Street and Johnson Street (Figure 1-2). It is approximately 17.5 acres in area and is situated in the valley of the Allegheny River Basin. Bordering the site to the north is Two Mile Creek, which has been modified by the Army Corps of Engineers for flood control in 1952, and New York Route 17; to the east are Johnson Street and several industrial properties; to the south is a Conrail right-of-way, and to the west are several residential properties located along Avenue A.

Several other industrial facilities are located near the Plant No. 2, shown on Figure 1-1. The larger facilities include an Agway fertilizer plant, CONAP, two Dresser-Rand plants, Dexter Corp. plastics manufacturing facility and a several acre tract of land owned by Felmont Oil Company which was formerly used for above-ground storage of their locally produced Pennsylvania Grade crude oil. The building structures on this latter property have been

FIGURE 1-1
Site Location Map - Van Der Horst Company
RI/FS Plant No. 2



Source: USGS Quadrangle Map, Olean, N.Y.

Scale: 1"-2000'

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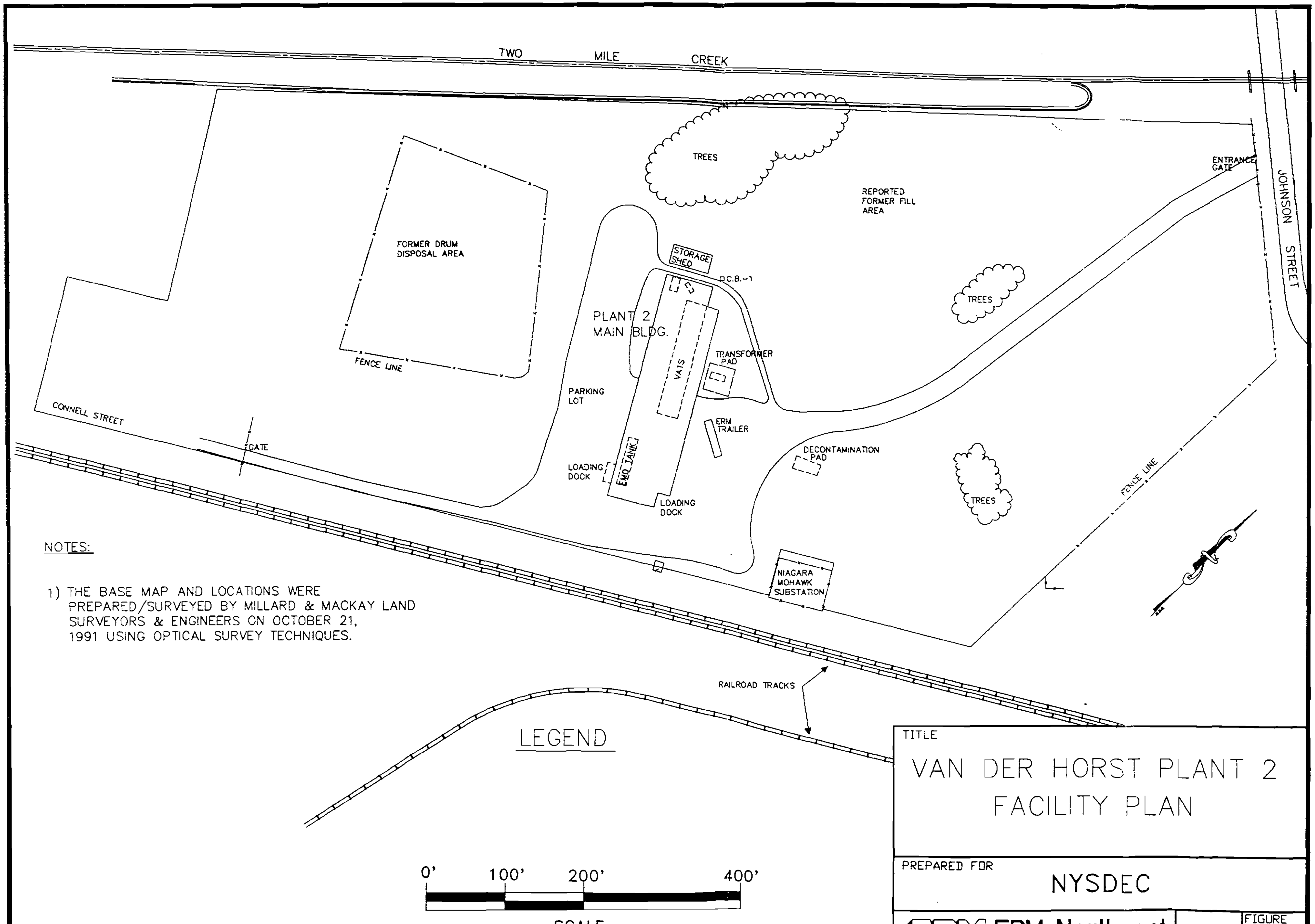


NOTES:

1) THE BASE MAP AND LOCATIONS WERE PREPARED/SURVEYED BY MILLARD & MACKAY LAND SURVEYORS & ENGINEERS ON OCTOBER 21, 1991 USING OPTICAL SURVEY TECHNIQUES.

TITLE

VAN DER HORST PLANT 2
FACILITY PLAN

PREPARED FOR
NYSDEC

ERM-Northeast
Environmental Resources Management

DATE

FIGURE
1-2

razed and the entire tract is presently a vacant field. This property was the site of one of the country's first oil refineries, the Socony-Vacuum Oil Company, prior to ownership by Felmont Oil. The refinery operated from 1861 to 1954, and had a processing capacity of 7,000 barrels/day, primarily of lubricating oils and greases.

1.2.2 Site History

Dr. Hendrik Van Der Horst founded the Van Der Horst corporation in 1940 with the intention of servicing the local oil field industry and railroad companies. His first manufacturing operations were located in Olean at Plant No.1, and consisted of the electrolytic deposition of hard-chrome plating on various types of customized metal parts.

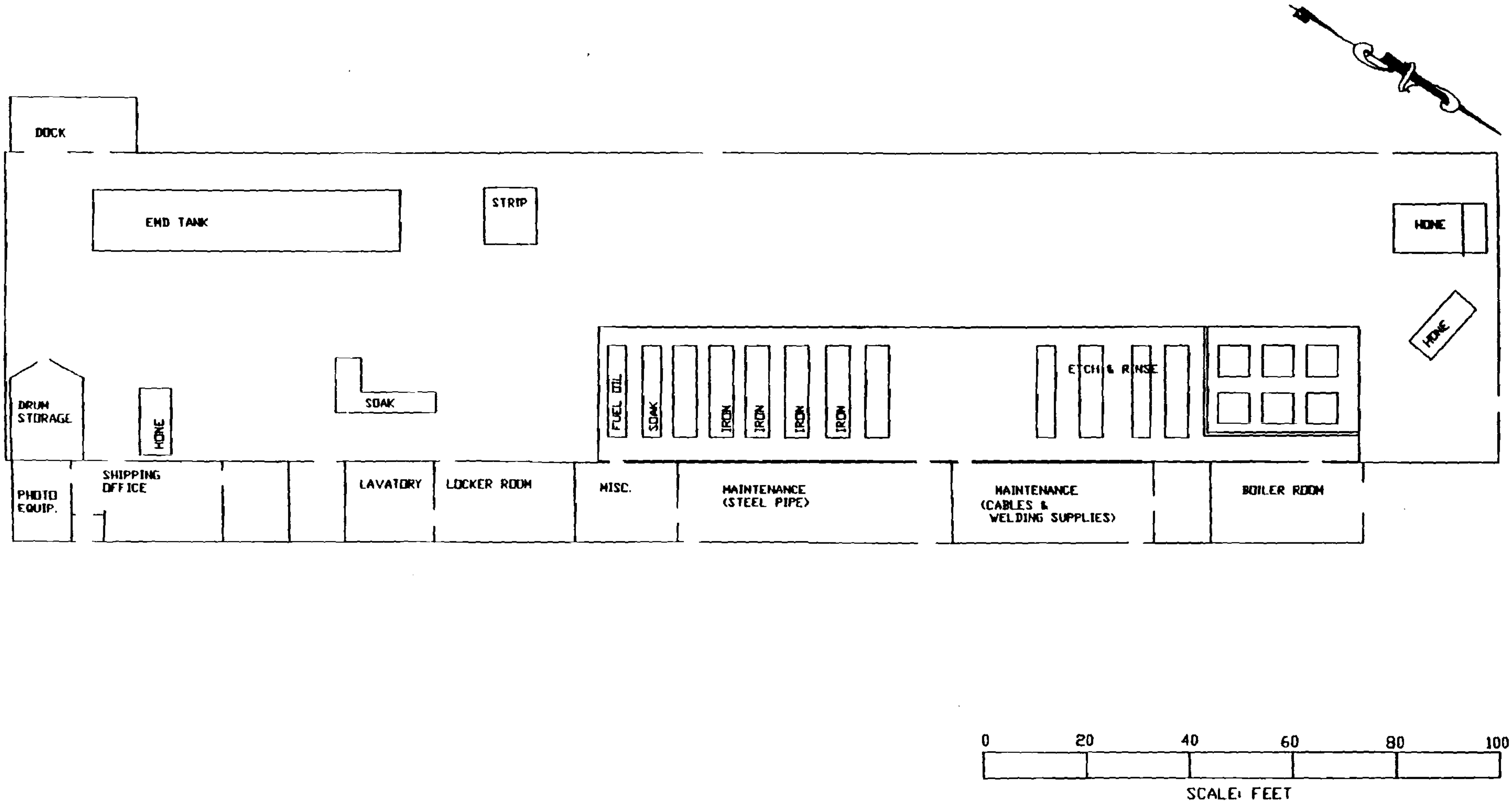
The Van Der Horst Corporation opened a second plant, Plant No. 2, in 1951 on Connell Street in Olean. This plant was constructed to perform a new iron plating process called Vanderloy M™ that was designed and patented by the corporation. The iron-plating process was used to repair and restore the worn surfaces of machinery components, including cylinders and crankshafts, for a cost that was less than that of purchasing new components. The plant was in operation from the early 1950's, during which time the primary activities were iron plating and subsequent machining.

In May, 1968, Van Der Horst Corporation of America was acquired by Unochrome to become a subsidiary of the largest chrome-plating company in the world. However, the operations at Plant Nos. 1 and 2 remained essentially unchanged. Five years later the Van Der Horst subsidiary was acquired by the R. G. Scott Corporation, headquartered in Mesquite, Texas.

In June, 1987, Van Der Horst ceased all operations at their Olean facilities after the employee's independent union rejected a contract proposal calling for benefit cuts and a 30% reduction in wages for all employees. The contract dispute was not settled and by October, 1987 the plant property was reportedly for sale. In May, 1989 the corporation filed for bankruptcy.

The plant's plating processes utilized many large open holding vessels containing a variety of hazardous substances (see Figure 1-3). Several are located below grade to the approximate depth of 20 feet, which also corresponds to the approximate top of the ground water table at the site. The tanks, containing acids, caustics, oils, sludges, and spent plating solutions were emptied by the USEPA in early 1991.

Some areas located on the Van Der Horst property contain stressed vegetation and disposed fill material (Figure 1-2). A few of these areas also contain rusted metal drums, partially filled with white and yellow crystalline powder. Several of the drums



NOTES

1) THE FIGURE WAS ADAPTED FROM A BUILDING PLAN PROVIDED BY THE USEPA AND FROM 'VAN DER HORST PLANT NO. 2 SAMPLE LOCATION PLAN' PREPARED BY MILLARD & MAC KAY ON OCTOBER 24, 1991.

2) SAMPLING LOCATIONS WERE MEASURED FROM FIXED LANDMARKS BY ERM AND PLOTTED ON THE BASE MAP BY SCALING THE DISTANCES. THESE LOCATIONS SHOULD BE CONSIDERED ACCURATE TO THE DEGREE IMPLIED BY THE METHOD USED.

TITLE
VAN DER HORST PLANT #2
ROOM & VAT
IDENTIFICATION

PREPARED FOR
NYSDEC

ERM-Northeast
Environmental Resources Management

DATE

FIGURE
1-3

were removed by the USEPA in the Spring of 1989, but at least one drum and some drum debris remains on-site. The on-site disposal of wastes reportedly occurred throughout the plant's active period, which ceased in the Summer of 1987.

Public concern has been expressed over the potential threat to ground water quality. Approximately 13,500 people live in the City of Olean and are dependant upon the local water sources in the Allegheny River Basin. These sources include private wells, municipal wells, and the Allegheny River. The confluence of Two Mile Creek with the Allegheny River is approximately two miles southwest of Plant No. 2.

During the fall of 1988 the NYSDEC initiated a program to conduct an RI/FS at the Van Der Horst Corporation Plant 1., which is one-half mile southeast of Plant No. 2. At that time City of Olean officials informed the NYSDEC of the presence of potentially hazardous wastes and materials inside both plants. During a preliminary investigation conducted in September 1988, NYSDEC collected several soil samples at Plant No. 2. The analytical results from soil sampling revealed the presence of chromium and barium on the site. Shortly thereafter, the NYSDEC requested that the USEPA perform an emergency response to properly containerize and dispose of the abandoned process materials and wastes at both plants. At Plant No. 2, the EPA erected a fence around a former drum disposal area to restrict access and prevent contact with the potentially contaminated soil. A small scale removal action was also undertaken by the EPA to remove contaminated surface materials. It was at this point that the NYSDEC decided to concurrently conduct a full scale RI/FS at Plant 2.

Field activities for the Phase I RI were undertaken in November 1989 and completed in August 1990. The report for the Phase I Investigation and the Phase I and II Feasibility Study was submitted to the NYSDEC in October 1990. Based on the investigation results and ERM recommendations, the NYSDEC decided to conduct a Phase II and III RI and Final FS to further delineate the amount and extent of contamination found on-site. Consequently, the Phase II and III RIs were combined, with field work commencing in September 1991 and completed in November 1991.

1.2.3 Current Situation

Presently, the plant is not operating and most production equipment has been removed from the interior of the building. The property is not entirely fenced and is therefore accessible to the public. The flood control berm bordering Two Mile Creek is used by local residents as a thoroughfare to proceed between Johnson Street and Avenue A. The entrance gates at Connell Street and Johnson Street restrict access to vehicular traffic and have been chained and locked. The gate leading to the fenced-in former drum disposal area is also secured.

The USEPA remediation of the plant interior, with respect to the removal of unsecured chemicals and process soultions, has been completed.

A Phase II Work Plan was submitted to the NYSDEC in April 1991 for the purpose of further deliniating on and off-site contamination. A Phase III Work Plan was also submitted to the NYSDEC in April 1991, to investigate the subsurface conditions beneath and inside the building structure. Operations for both phases were combined into a single phase, Phase II, and field work began in September 1991. By November 1991 the field tasks of the RI were completed.

1.3 Report Organization

This RI report presents the findings of the Phase II RI study and incorporates information generated during the Phase I RI. Work was conducted in general accordance with the NYSDEC and USEPA requirements and protocols, and the report format is also in general accordance with by "USEPA Guidance for Conducting RI/FS Under CERCLA". (Table 3-3 EPA/540/G-89/004, October, 1988). The organization of this report is as follows:

FIELD DATA (seperate volume)

2.0 REMEDIAL INVESTIGATION PROGRAM

2.1 Project Overview

The objective of ERM's RI program was to delineate the extent of soil, creek and ground water contamination on Van Der Horst Corporation's Plant No. 2 and adjacent properties. Emphasis was placed on delineating three potential environmental problems: 1) the magnitude and extent of soil contamination on the plant grounds and residential properties immediately adjacent to the site; 2) contamination present in Two Mile Creek; and 3) the lateral and vertical extent of ground water contamination.

The initial project task (Task 1) of the Phase I RI involved the preparation and submittal of a Work Plan, which included a QA/QC Plan and a Health and Safety Plan. The Work Plan for characterizing the site was an expansion of ERM's original RI/FS proposal. The QA/QC Plan contained the methodologies and protocols that were to be used when conducting the RI study while the Health-and-Safety Plan outlined the procedures for protection of on-site field personnel, as well as the surrounding community. All three plans were submitted for review to the Division of Hazardous Waste Remediation, NYSDEC Central Office in September, 1989; and were reviewed by the NYSDEC Central Office, Region 9 Office, and Olean sub-office, the NYSDOH, and the CCDOH. A final Work Plan was submitted by ERM and approved by the NYSDEC in October of 1989. The Phase I RI included the following tasks:

- A Literature Review of the Plant History
- Geophysical Study
- Monitoring Well/Test Boring Installation
- On-Site Soil Investigation
- Monitoring Well Development
- Preparation of a Base/Topographic Site Map
- Ground Water Sampling
- Aquifer Hydraulic Property Evaluation
- Off-Site Soil Evaluation
- Two Mile Creek Sampling

Field investigation work commenced in November, 1989 and continued until August 1990. The report for the Phase I investigation and the Phase I and II Feasibility Study was submitted to the NYSDEC in October 1990. The report identified the general response actions, evaluated the remedial technologies and formulated the remedial action alternatives based on data generated during the Phase I RI. A detailed evaluation and design of the alternatives will be presented in the Phase III Feasibility Study.

The combined Phase II and III RI was conducted at the Van Der Horst Plant No. 2 between August 1991 and November 1991. This phase of the investigation was undertaken to further deliniate the extent of contamination detected in the surface and subsurface soil; stream sediment; and, ground water during the Phase I RI. The investigation was also conducted to investigate the conditions inside and beneath the building structure; to provide a better understanding of the aquifer properties; and to attempt to determine the source(s) of ground water contamination. The Phase II RI included the following tasks:

- Review of EPA and Existing Facility Data
- Sampling of Asbestos Containing Materials
- Sampling of Building Interior Surfaces
- On-Site Soil Sampling
- Additional Two Mile Creek Sampling
- Catch Basin Sampling
- Off-Site Soil Sampling
- Installation of Monitoring Wells and Test Borings
- Additional Ground Water Sampling
- Surveying of Sample Locations
- Assessment of Ground Water Characteristics
- Final Risk Assessment

Field samples collected during the Phase II RI were analyzed for chemical parameters that reflected the facility's manufacturing and waste handling history, and the results of previous sampling by the CCDOH, NYSDEC and ERM's Phase I RI. Analytical parameters for each matrix are summarized on Table 4-1.

2.2 Review of EPA and Existing Facility Data

Concurrent with field studies, a record search of the Van Der Horst facility was conducted at the relevant federal, state and municipal offices. A list of the sources contacted for literature review is presented on Table 2-1 of the Phase I RI Report. During the course of the field studies, several persons familiar with problems at Plant No. 2 were visited and interviewed. The individuals interviewed included: Mr.Gibbons, Olean Fire Chief; Mr. Helgas, CCDOH; Mr. Marcus, Olean DPW; Mr. Concannon, NYSDEC and

Gino Lorenzino, a former Van Der Horst employee. Site specific, local and regional background information collected under this task is presented in Appendix A and summarized in Section 1.0 of the Phase I RI Report.

During the Phase II RI, Mr. Jack Harmon of the USEPA was contacted early in 1991 in regard to additional Plant 2 analytical data. This information was generated from samples obtained by a USEPA subcontractor at the Plant 2 facility during activities that took place in 1990. The information obtained from the EPA was then used to determine the location of many of the interior wipe and scrape samples that were collected during the Phase II RI. Furthermore, a file search was conducted at the plant facility to obtain information about underground storage tanks, air emission permits, and discharge points. The information gained during the file search was used to locate several Phase II borings, monitoring wells and building samples. These locations included:

- B-35 and B-36, located adjacent to an underground storage tank;
- Monitoring wells MW-19 and MW-20, located adjacent to former processing tanks and hones;
- Catch Basin sample CB-1, taken from inside a drain catch basin; and,
- Wipe samples taken from several exhaust systems and process vat hoods.

2.3 Sampling of Asbestos Containing Materials

During the Phase II RI, 14 grab samples were taken of pipe and elbow insulation, and flooring materials suspected of containing asbestos. The samples provided an initial screening for asbestos containing materials inside the building; necessary in the event that the building is demolished. The samples were analyzed using polarized-light microscopy for identification of the asbestos fibers. Asbestos containing material was identified in 13 of the 15 samples analyzed. The results of the analysis are presented on Table 4-9 and discussed in Section 4.6.3 of this report. The locations of the asbestos samples are shown on Figure 2-1

2.4 Sampling of Building Interior Surfaces

Wipe and dust samples were also collected during the Phase II RI and analyzed to assess the extent of chemical contamination inside the plant building (see Figure 2-2). Thirty-eight (38) wipe samples were collected from various areas including: 1) inside the process tank exhaust ductwork; 2) at twenty-five foot intervals along the entire interior wall; and 3) in several anterooms adjacent to the main facility floor. Fifteen (15) dust samples were collected from various areas on the main work area floor. All of the (38) wipe and (15) dust samples were analyzed for total concentration of chromium, arsenic, lead, barium and manganese.

LEGEND

AS-2-1 ● ASBESTOS SAMPLE LOCATION

NOTES

1) THE FIGURE WAS ADAPTED FROM A BUILDING PLAN PROVIDED BY THE USEPA AND FROM 'VAN DER HORST PLANT NO. 2 SAMPLE LOCATION PLAN' PREPARED BY MILLARD & MAC KAY ON OCTOBER 24, 1991.

2) SAMPLING LOCATIONS WERE MEASURED FROM FIXED LANDMARKS BY ERM AND PLOTTED ON THE BASE MAP BY SCALING THE DISTANCES. THESE LOCATIONS SHOULD BE CONSIDERED ACCURATE TO THE DEGREE IMPLIED BY THE METHOD USED.

3) THE CONCENTRATION DATA SHOWN WERE PROVIDED BY CHOPRA-LEE, INC.

4) ND= NOT DETECTED

TITLE
VAN DER HORST PLANT #2
BUILDING ASBESTOS
SAMPLE LOCATIONS

PREPARED FOR
NYSDEC

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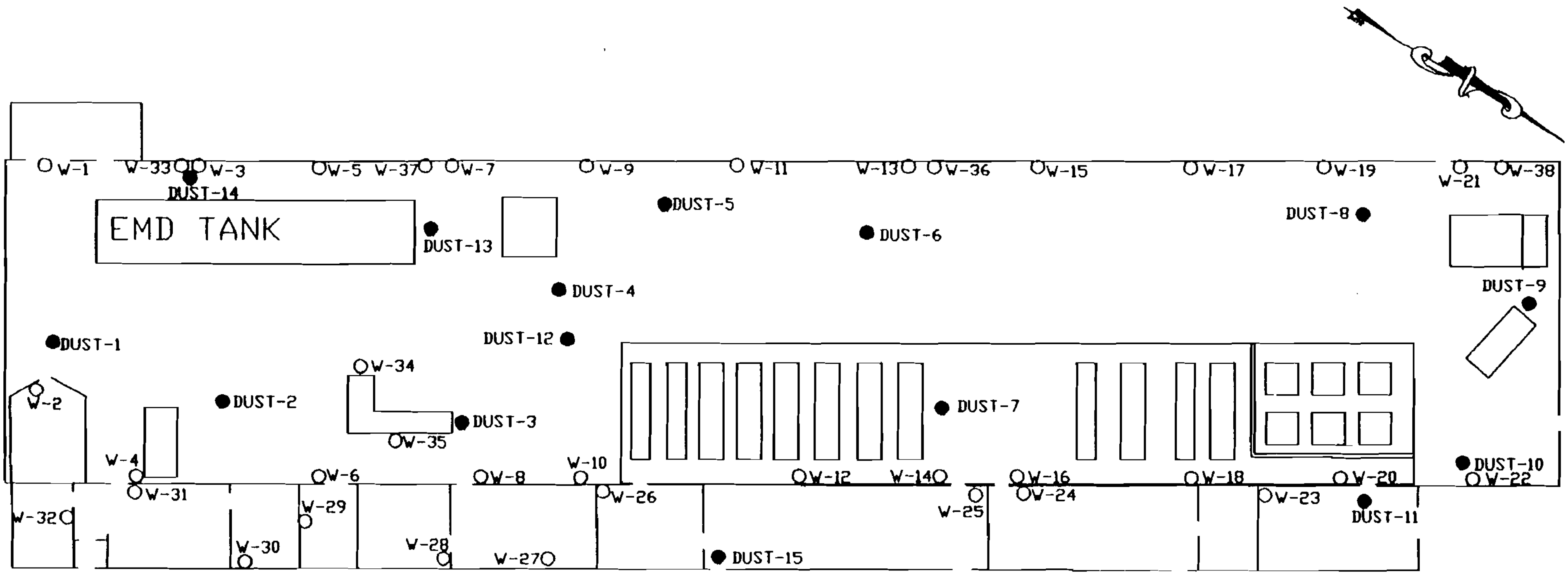
Environmental Resources Management

DATE

FIGURE
2-1



0 20 40 60 80 100

SCALE: FEET

LEGEND

DUST-12	●	DUST SAMPLE LOCATION
W-2	○	WIPE SAMPLE LOCATION

NOTES

1) THE FIGURE WAS ADAPTED FROM A BUILDING PLAN PROVIDED BY THE USEPA AND FROM 'VAN DER HORST PLANT NO. 2 SAMPLE LOCATION PLAN' PREPARED BY MILLARD & MAC KAY ON OCTOBER 24, 1991.

2) SAMPLING LOCATIONS WERE MEASURED FROM FIXED LANDMARKS BY ERM AND PLOTTED ON THE BASE MAP BY SCALING THE DISTANCES. THESE LOCATIONS SHOULD BE CONSIDERED ACCURATE TO THE DEGREE IMPLIED BY THE METHOD USED.

TITLE

VAN DER HORST PLANT #2
DUST & WIPE
SAMPLE LOCATIONS

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Environmental Resources Management

DATE

FIGURE
2-2

The wipe sample locations are listed on Table 2-1. The results of the wipe and dust samples are presented in Tables 4-7 and 4-8 and are discussed in Section 4.6.1 and 4.6.2 of this report.

2.5 On-Site Soil Evaluation

Two hundred forty (240) on-site soil samples were collected during the two phases of the RI. The sample locations are shown on Figures 2-3 and 2-4. The analytical results of the Phase II samples are presented on Tables 4-2, 4-3 and 4-4 and discused in sections 4.2 and 4.3 of this report. The Phase II samples were collected from the surface as well as from various depths in order to assess the lateral and vertical extent of previously detected contamination and to assess potential source areas.

2.5.1 On-Site Subsurface Soil

During the Phase I RI a total of fifty-three (53) on-site subsurface soil samples were collected and analyzed for chemical parameters to tenatively identify potential on-site source areas. The soil sampling locations are indicated on Figure 2-2 of the Phase I RI Report. The analysis results are presented in Section 4.0 of the Phase I RI Report.

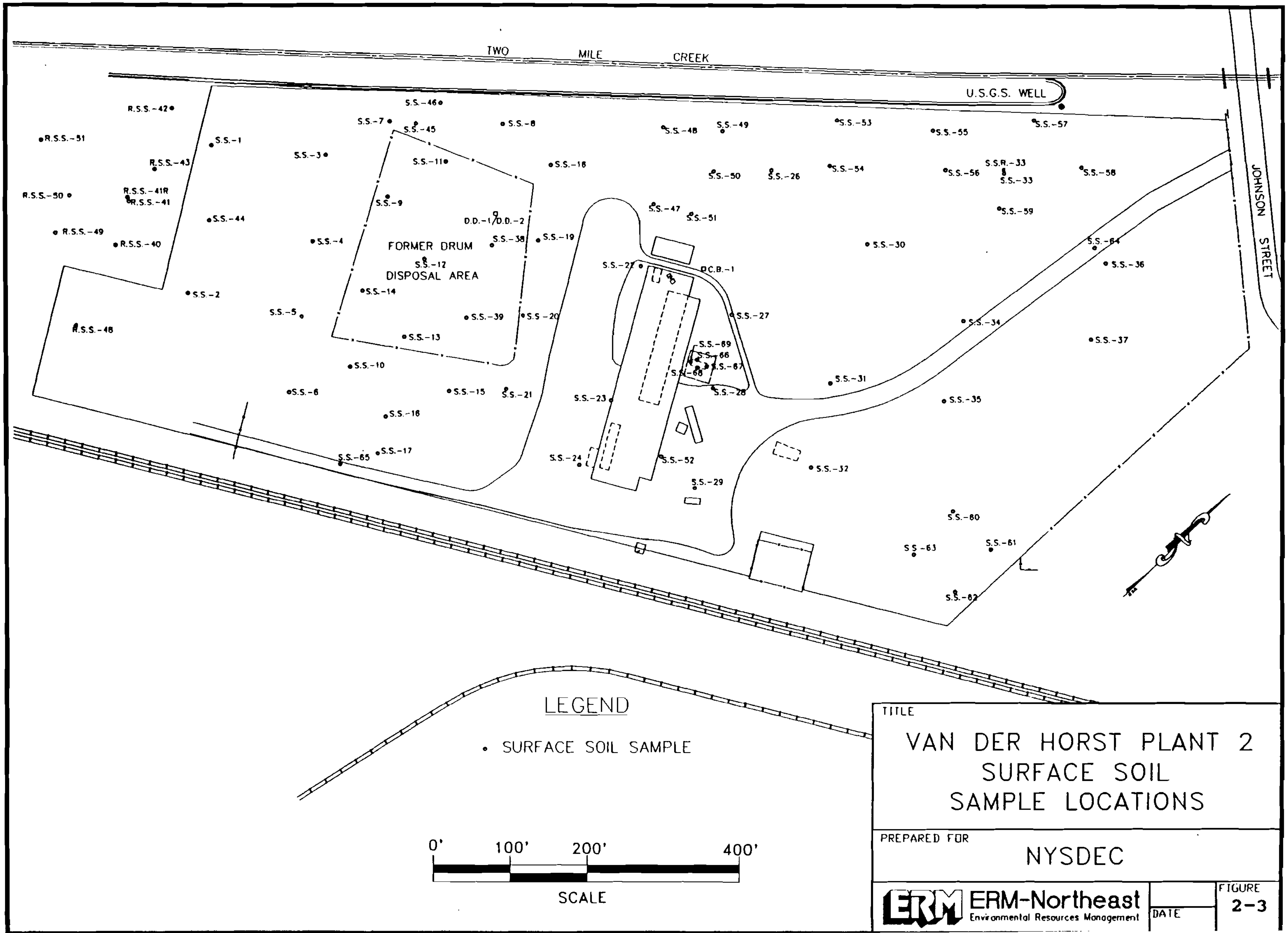
The Phase II subsurface soil sampling program served to

TABLE 2-1

VAN DER HORST PLANT 2, PHASE II
WIPE SAMPLE LOCATIONS

SAMPLE NUMBER	SAMPLE LOCATION *
W-1	loading dock door
W-2	interior window
W-3	metal control box
W-4	vertical beam
W-5	metal control panel
W-6	wall
W-7	wall
W-8	wall
W-9	wall
W-10	exterior of small acid tank
W-11	side door
W-12	control box #16
W-13	wall
W-14	metal control box
W-15	base of crane
W-16	wall
W-17	vertical beam
W-18	wall
W-19	wall
W-20	wall
W-21	exterior of exhaust hood
W-22	wall
W-23	exterior of cylindrical exhaust duct
W-24	wall
W-25	side of metal control panel
W-26	exterior of small tank
W-27	exterior of radiator
W-28	wall
W-29	wall
W-30	window
W-31	wall
W-32	door of photographic machine
W-33	exhaust fan apparatus
W-34	inside tank exhaust hood
W-35	inside vat exhaust duct
W-36	inside exhaust fan duct
W-37	inside vat exhaust duct
W-38	inside exhaust hood

* See Figure 2-3 for map location of samples



TITLE

VAN DER HORST PLANT 2
SURFACE SOIL
SAMPLE LOCATIONS

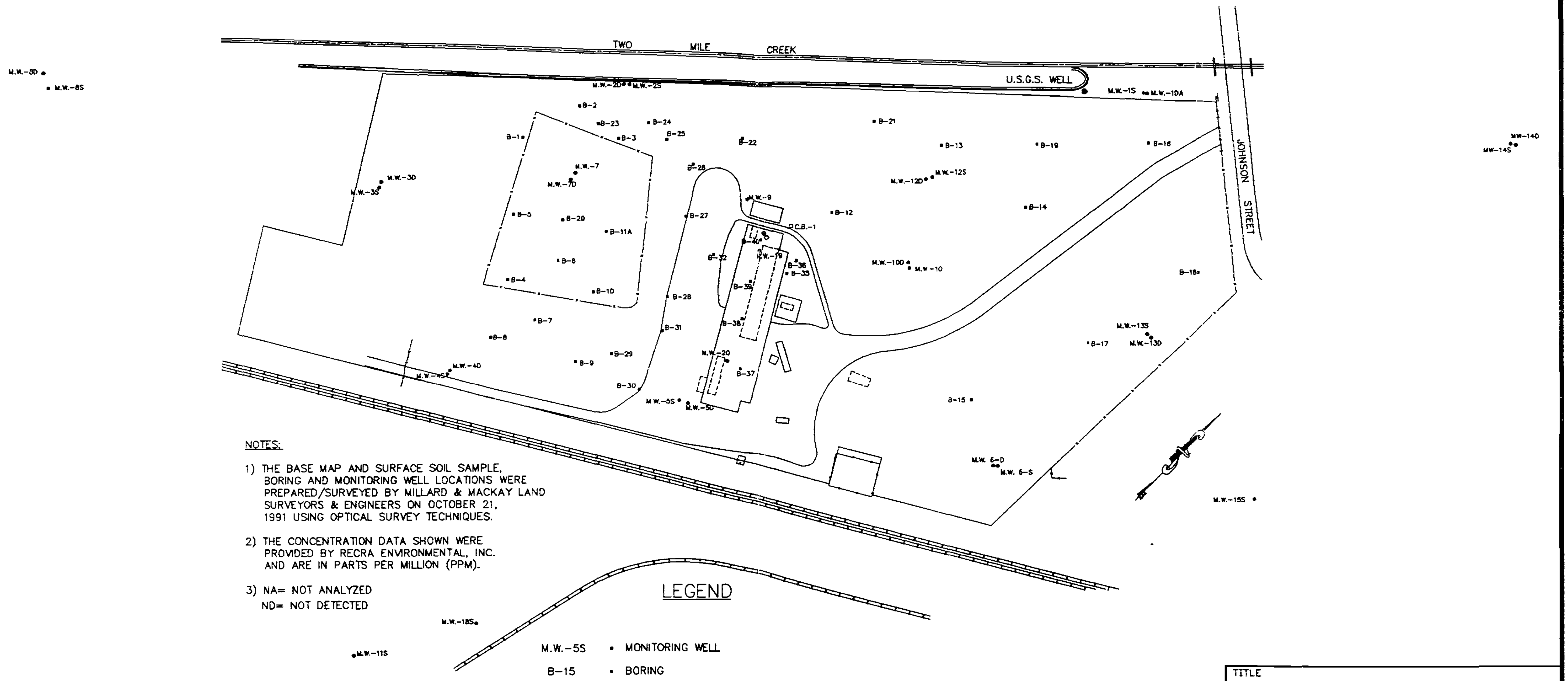
PREPARED FOR

NYSDEC

ERM-Northeast
Environmental Resources Management

DATE

FIGURE
2-3



NOTES:

1) THE BASE MAP AND SURFACE SOIL SAMPLE, BORING AND MONITORING WELL LOCATIONS WERE PREPARED/SURVEYED BY MILLARD & MACKAY LAND SURVEYORS & ENGINEERS ON OCTOBER 21, 1991 USING OPTICAL SURVEY TECHNIQUES.

2) THE CONCENTRATION DATA SHOWN WERE PROVIDED BY RECRA ENVIRONMENTAL, INC. AND ARE IN PARTS PER MILLION (PPM).

3) NA= NOT ANALYZED
ND= NOT DETECTED

LEGEND

M.W.-5S • MONITORING WELL
B-15 • BORING

0' 100' 200' 400'
SCALE

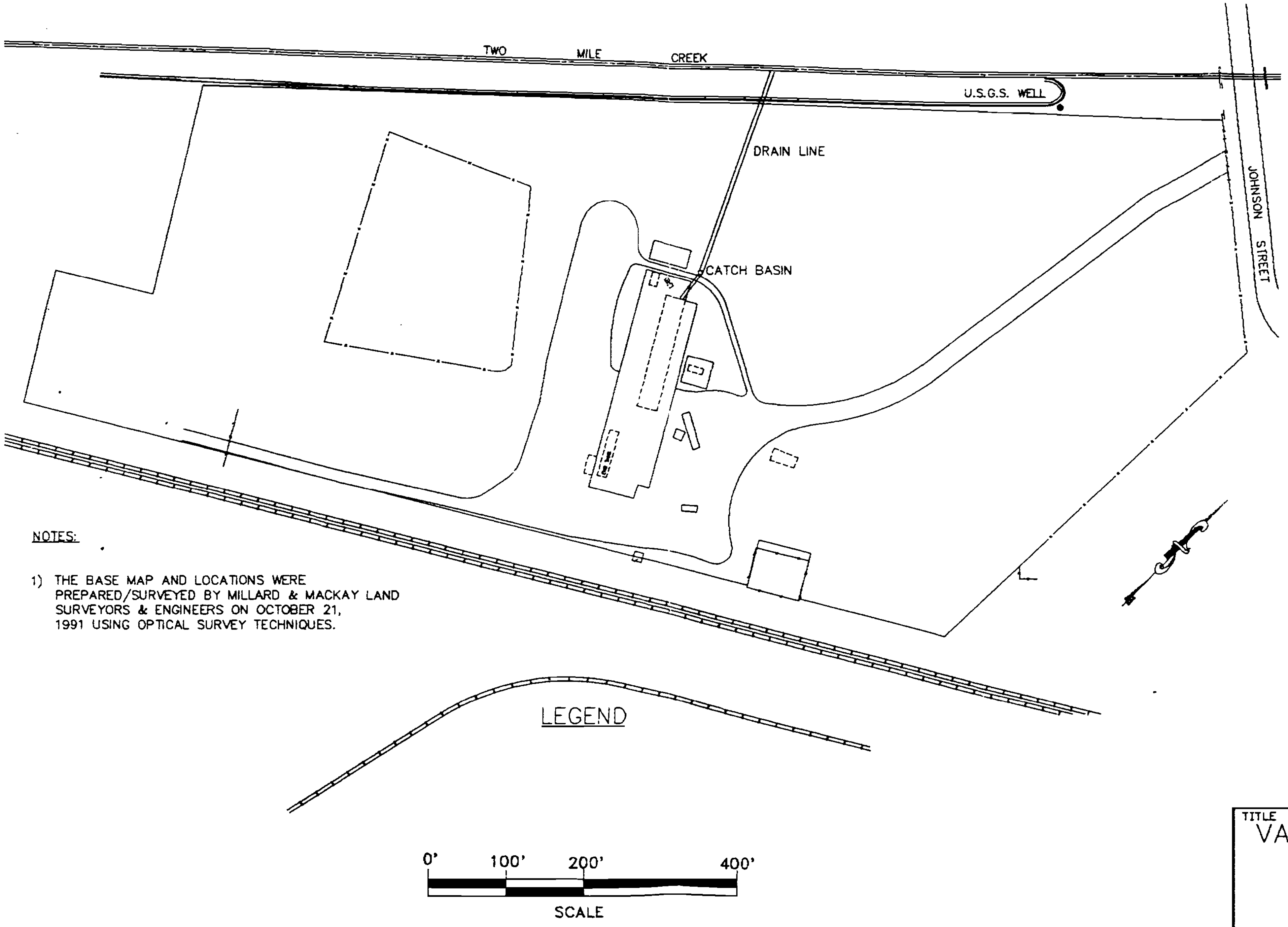
TITLE
VAN DER HORST PLANT 2
MONITORING WELL AND
SOIL BORING LOCATIONS

PREPARED FOR
NYSDEC

ERM-Northeast
Environmental Resources Management

DATE

FIGURE
2-4



NOTES:

1) THE BASE MAP AND LOCATIONS WERE PREPARED/SURVEYED BY MILLARD & MACKAY LAND SURVEYORS & ENGINEERS ON OCTOBER 21, 1991 USING OPTICAL SURVEY TECHNIQUES.

TITLE
VAN DER HORST PLANT 2
CATCH BASIN AND
DRAIN LINE
LOCATION MAP

PREPARED FOR
NYSDEC

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Environmental Resources Management

DATE

FIGURE
2-7

further delineate the extent of on and off-site contamination identified during the Phase I RI. Samples were also collected to assess the lateral and vertical extent of soil contamination beneath the plant building. One hundred seventeen (117) subsurface soil samples were collected from 30 on-site soil borings during the Phase II and sent for chemical analysis. The samples were collected from borings drilled by hollow stem auger to a depths varying from 6 inches to 32 feet below grade. Split spoon samples were continuously collected during drilling and all borings not converted to wells were backfilled with tremied grout upon completion. Site selection criteria for the soil borings are as follows:

1) B-23 through B-32 - to assess the horizontal and vertical extent of the contamination detected in the former drum disposal area. Twenty samples were collected from these locations, two from each boring, and all were analyzed for total chromium, arsenic, cadmium and lead.

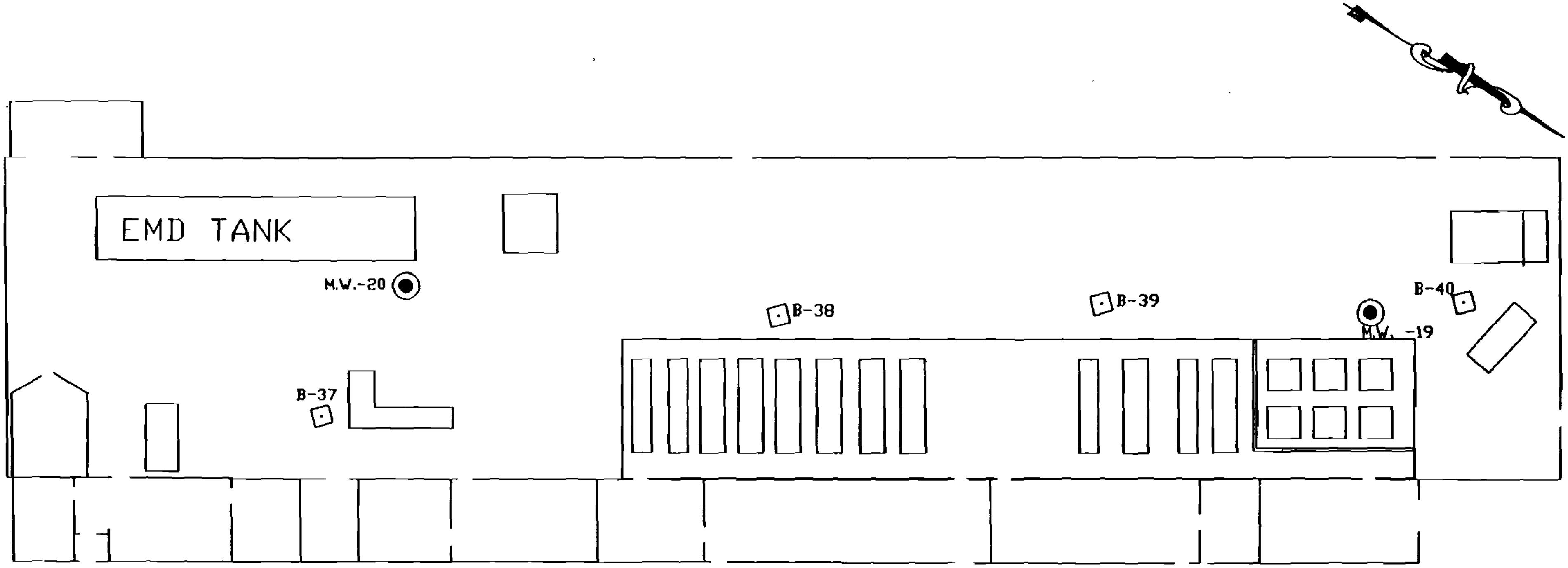
2) B-21 and B-22 - to further delineate areas where minimal subsurface information was obtained during the Phase I RI. Four samples were collected from these locations, two from each boring, and all were analyzed for total chromium, arsenic, barium, cadmium,manganese, zinc and

lead. One sample from each boring was also analyzed for TCL VOA.

3) B-19 - to assess the vertical extent of contamination detected in the surface soil during the Phase I RI. Seven samples were collected from this location and analyzed for total chromium, arsenic and lead. One sample was also analyzed for TCL VOA.

4) B-35 and B-36 - to assess whether a 6000 gallon underground fuel oil tank is contributing to volatile orgainc contamination detected in the ground water during the Phase I RI. Twenty samples were obtained from these locations, ten from each boring, and analyzed for chromium, arsenic, lead, barium, and manganese. Two samples from each boring were also analyzed for TCL+20 Semivolatile organics and TCL+10 Volatile organics.

5) B-37 through B-40, MW-19 and MW-20 - to assess whether there is soil contamination adjacent to the numerous vats, vaults, hones, and tanks inside the plant building and to determine if soil contamination has migrated into the ground water (see Figure 2-5). Sixty samples were collected from these locations, ten from each boring, and analyzed for total chromium, arsenic, lead, barium, and



LEGEND

M.W.-20 ● MONITORING WELL LOCATION

B-37 ⊡ BORING LOCATION

0 20 40 60 80 100

SCALE: FEET

NOTES

1) THE FIGURE WAS ADAPTED FROM A BUILDING PLAN PROVIDED BY THE USEPA AND FROM 'VAN DER HORST PLANT NO. 2 SAMPLE LOCATION PLAN' PREPARED BY MILLARD & MAC KAY ON OCTOBER 24, 1991.

2) SAMPLING LOCATIONS WERE MEASURED FROM FIXED LANDMARKS BY ERM AND PLOTTED ON THE BASE MAP BY SCALING THE DISTANCES. THESE LOCATIONS SHOULD BE CONSIDERED ACCURATE TO THE DEGREE IMPLIED BY THE METHOD USED.

TITLE

VAN DER HORST PLANT #2
WELL & BORING
LOCATIONS

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DATE

FIGURE 2-5

manganese. Two samples from each boring were analyzed for TCLP metals and one sample from each boring was analyzed for volatile organic compounds.

6) MW-12D - to assess the vertical extent of contamination detected in a suspected ground water source area. Two samples were obtained from this location and analyzed for total chromium, arsenic, lead, barium, cadmium, manganese and TCL VOA.

7) MW-13 - to assess the vertical and horizontal extent of on-site ground water contamination detected during the Phase I RI. Three samples were collected at this location and analyzed for total chromium, arsenic, lead, cadmium, barium, manganese and TCL VOA.

2.5.2 On-Site Surface Soil

During the Phase I RI forty-one (41) on-site surface soil sample were collected and analyzed for site specific parameters. These samples were collected to identfy and delineate potential areas of surface soil contamination. The analytical results of these samples are presented and discussed in the Plant 2 Phase I RI Report.

During the Phase II RI surface soil samples were collected at 29 locations (SS-45 through SS-69) from a depth of 1" to 3" below grade. Four samples (SS-33R, DD-2, SS-64, SS-65) were also analyzed for grain size analysis to assist in determining potential fugitive dust generation. Four samples (SS-66 through SS-69) were collected adjacent to the on-site transformers and analyzed for total chromium, arsenic, lead, barium, manganese and PCBs. Twelve samples (SS-52 through SS-63) were analyzed for total chromium, arsenic and lead. Seven samples (SS-45 through SS-51) were analyzed for total chromium, arsenic, lead, manganese and TCL VOA. Two samples (SS-33R, DD-2) were analyzed for TCLP metals for comparison with landfill acceptance criteria.

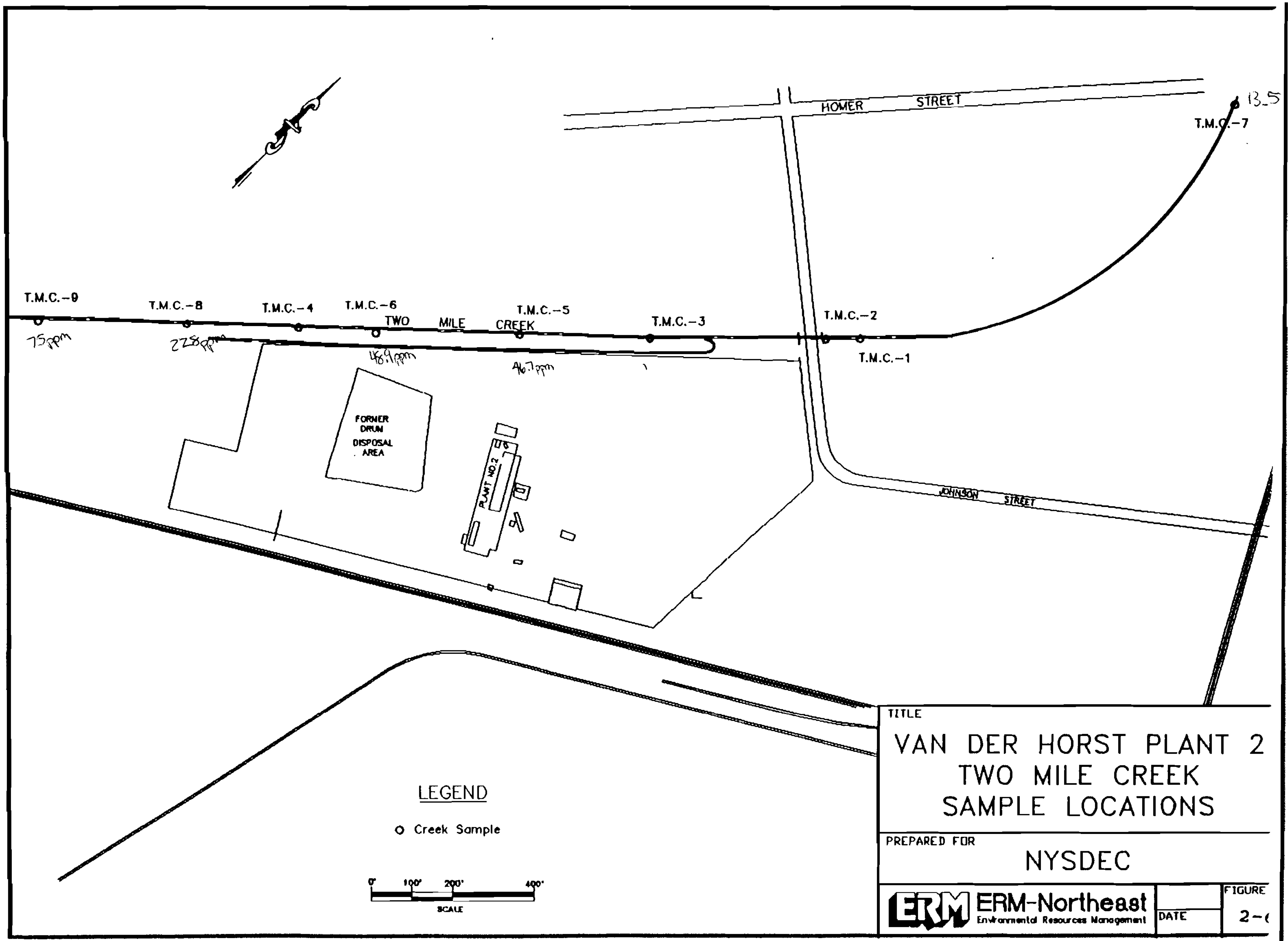
2.6 Two Mile Creek Sampling

Four samples of surface water and four samples of stream sediment were collected from Two Mile Creek during the Phase I RI. This sampling was conducted to evaluate whether iron, chromium and hexavalent chromium, which were formerly regulated under the site's surface water discharge permit, are migrating off-site via the creek. This sampling was also conducted to evaluate whether the chromium and barium present in the on-site surface soil were deposited in the stream sediment or are being transported off site. The Phase I study concluded that chromium and cadmium detected in the stream sediment and water may be impacting benthic and aquitic life in the creek.

During the Phase II RI five additional samples of stream sediment and surface water were collected from Two Mile Creek to further delineate contamination detected during the Phase I RI. Two samples were collected from on-site locations and three from off-site (see Figure 2-6). The sediment samples (TMC-5 through TMC-10) were collected from the grassy banks of the creek with a dedicated pre-cleaned stainless steel trowel. These samples were analyzed for total chromium, arsenic, cadmium, lead, manganese, beryllium, and TCL VOA. The surface water samples (TMC-5W through TMC-10W) were collected by submerging the sample bottles below the water surface. These samples were analyzed for hexavalent chromium, total chromium, arsenic, lead, cadmium, manganese, beryllium and pH. The results of the analysis are presented on Tables 4-11 and 4-12 and discussed in detail in Section 4.8 of this report.

2.7 Catch Basin Sampling

An on-site catch basin was sampled during the Phase II RI to determine the potential impact that discharge from an interior drain may have had on Two Mile Creek. The drain is located in a below grade-level vault that formerly contained several wax dipping



TITLE

VAN DER HORST PLANT 2
TWO MILE CREEK
SAMPLE LOCATIONS

PREPARED FOR

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DATE

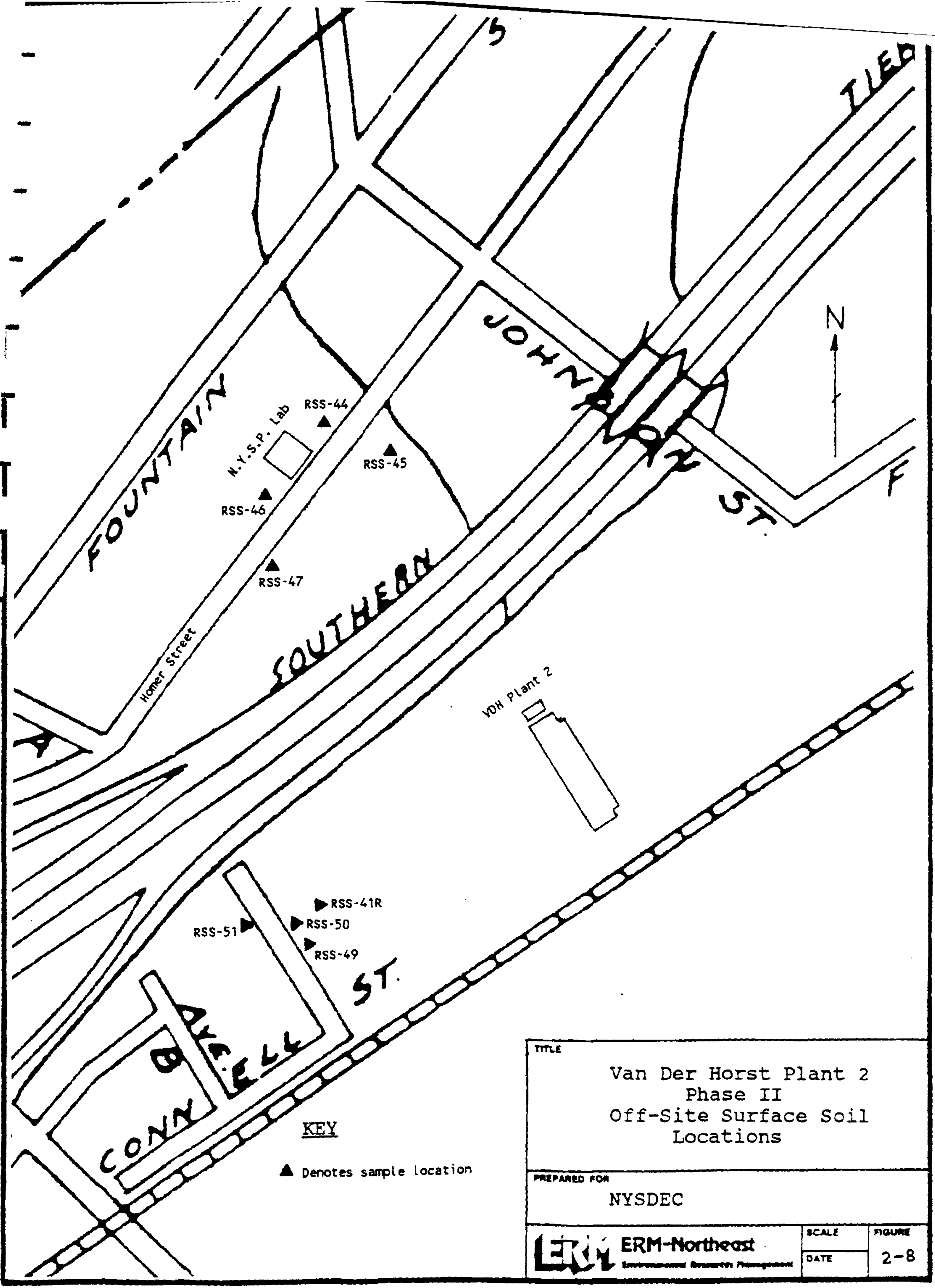
FIGURE
2-

vats (see Figure 2-7). According to the former plant maintenance personnel the drain lead from the vault through the catch basin and on to Two Mile Creek. The discharge point at the creek was not located by ERM staff but the catch basin sediment was sampled and analyzed for TCL VOA, TAL metals, semi-volatile compounds and pesticides/PCBs. The results of the catch basin sample analysis are presented on Table 4-10 and discussed in Section 4.7 of this report.

2.8 Off-Site Soil Evaluation

A total of thirty (30) off-site soil samples were collected for chemical analysis during the two phases of the RI program. For the purposes of this report, off-site is defined as those samples collected outside the boundaries of the 17.5 acre plant property. The sample locations are shown on Figures 2-3, 2-4, 2-8 and 2-9. The analytical results for the Phase II samples are presented in Tables 4-5 and 4-6 and discussed in sections 4.4 and 4.5 of this report.

During the Phase I RI, samples were collected to address issues raised by the local residents that hazardous materials from the Van Der Horst facilities were allegedly being disposed of on the Plant 2 property. The people were concerned that the disposed waste could potentially impact the surrounding neighborhood and



TITLE

Van Der Horst Plant 2
Phase II
Off-Site Surface Soil
Locations

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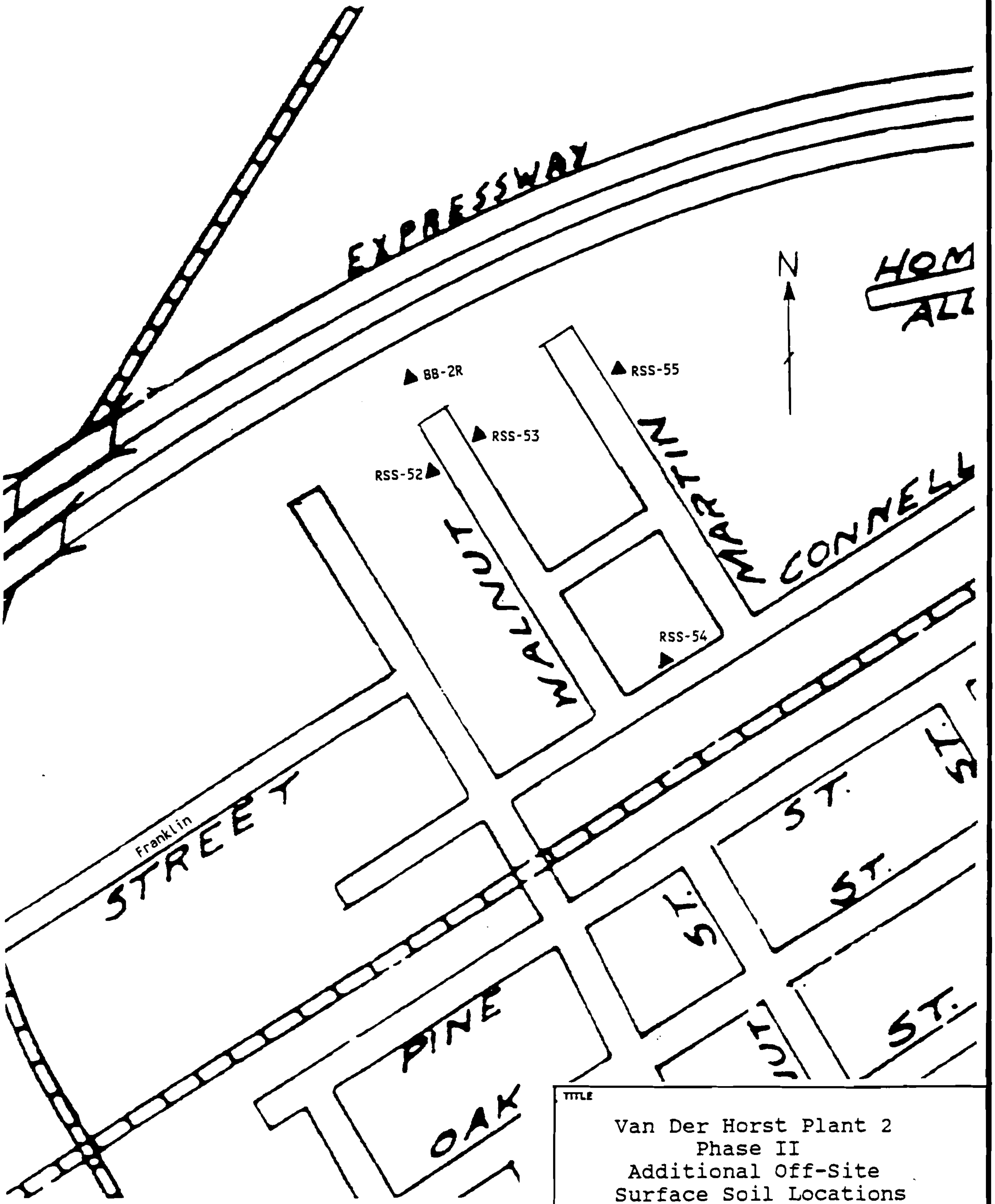
SCALE	FIGURE
DATE	2-8



TITLE

Van Der Horst Plant 2
Phase II
Additional Off-Site
Surface Soil Locations

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Environmental Resources Management

SCALE	FIGURE
DATE	2-9

KEY

▲ Denotes sample location

underlying ground water table. The information obtained during the Phase I RI was used to determine if plant activities were responsible for depositing contaminants in the residential soil. These analytical data were also used to evaluate the short and long-term health risks associated with the soil.

The Phase II soil samples served to delineate areas where minimal information was obtained during the Phase I RI. The Phase II soil samples also provided further data for the evaluation of the health risks associated with the soil and served to further delineate the vertical and horizontal extent of soil contamination detected during the Phase I RI.

2.8.1 Off-Site Surface Soil

During the Phase I RI six (6) samples of surface soil were collected from locations adjacent to the southwestern perimeter of the Van Der Horst property and from the public right-of-ways adjacent to Fall Road and Walnut Street. The off-site soil samples were obtained from 1 to 3 inches below grade. The locations of these samples are shown on Figure 2-3 of the Phase I RI Report. The analytical results are also discussed in detail in the Phase I RI Report.

During the Phase II RI fourteen (14) surface soil samples were collected to evaluate background concentrations and assess the extent of off-site contamination migration. Four samples were collected from each of three residential areas to the southwest, northwest and northeast of the plant property. Two other samples (BB-2R, RSS-41R) were collected to confirm levels of contamination detected at the Phase I locations (BB-2, RSS-41). All Phase II off-site surface soil samples were analyzed for total chromium, arsenic, lead and manganese. BB-2R was also analyzed for TCL volatiles and RSS-41R was also analyzed for total barium and zinc.

2.8.2 Off-Site Subsurface Soil

No off-site subsurface soil samples were collected during the Phase I RI. During the Phase II RI, ten (10) off-site subsurface soil samples were collected for chemical analysis. The samples were obtained to assess the vertical and horizontal extent of off-site contamination identified in the Phase I surface soil samples. Other samples were collected to identify background levels chemicals in the subsurface soil. These subsurface samples were collected with a split-spoon sampler during the installation of five off-site ground water monitoring wells (MW-8, MW-11, MW-14, MW-15, and MW-16). Two samples were obtained from each boring and analyzed for total chromium, arsenic, lead, manganese and TCL volatiles.

2.9 Geophysical Study

A geophysical study was conducted at Van Der Horst Plant No. 2 by ERM to identify on-site anomalies. The survey was carried out on the plant grounds using linear transects spaced at uniform distances of 150 ft. by 100 ft. Instruments used included a DM-22 magnetometer and a single-frequency electromagnetic instrument (EM-38). These less sensitive methods were chosen due to the presence of excessive background interference, caused mainly by metallic building components and stock-piles of scrap metal. This survey indicated at least one suspected drum burial area inside the fenced-in former disposal area. The results of the geophysical survey are discussed in Section 3.3 of the Phase I RI Report.

2.10 Monitoring Well Installation

Thirty (30) monitoring wells were drilled and sampled during the two phases of the RI. Fifteen wells were installed during the Phase I RI and fifteen were installed during the Phase II RI. The 30 wells were installed to evaluate subsurface conditions, the local direction of ground water flow, and the overall ground water quality in the vicinity of and beneath the site and plant building.

Figure 2-4 presents the locations of all monitoring wells drilled and Table 2-2 summarizes the Phase 2 monitoring well construction data. The sample analysis results for the 15 wells sampled during the Phase I RI are presented in the Phase I RI Report. All monitoring wells were sampled during the Phase II RI. The analysis results of the Phase II sampling event are discussed in detail in Section 4.9 of this report.

2.10.1 Monitoring Well Locations

Well locations for both phases of the RI were selected based on: 1) a site reconnaissance with NYSDEC field personnel, based on visual evidence of surface disposal (stained soil, etc.).; 2) anticipated directions of ground water flow; 3) preliminary results of the geophysical and soil boring surveys; and, 4) drilling rig location accessibility. The Phase II RI wells were also located based on analytical results of the Phase I wells and preliminary ground water flow studies.

The local direction of ground water flow was not certain at the start of the Phase I drilling program since the existing regional ground water contour maps (USGS, 1985) were developed when the nearby Felmont industrial wells were in operation. Thus, the direction of ground water flow was

TABLE 2-2

SUMMARY OF MONITORING WELL DATA

Boring Number	Date Completed	Ground Surface Elevation (ft)	Monitoring Point (I.C.) Elevation (ft)	Depth of Boring (ft)	Bottom of Boring Elevation (ft)	Screened Interval Depth (ft)	Screened Interval Elevation (ft)	Sand Pack Depth (ft)	Sand Pack Elevation (ft)
MW-1S	2-1-90	1422.26	1425.51	25.0	1397.26	8.0-23.0	1414.26-1399.26	6.0-25.0	1416.26-1397.26
MW-1D	2-15-90	1422.25	1425.01	60.0	1362.25	53.0-58.0	1369.25-1364.25	49.5-59.5	1372.75-1362.75
MW-2S	2-6-90	1419.06	1421.52	24.6	1394.46	8.0-23.0	1411.06-1396.06	6.0-24.6	1413.06-1394.46
MW-2D	2-8-90	1419.02	1421.58	58.8	1360.22	52.0-57.0	1367.02-1362.02	49.0-58.8	1370.02-1360.22
MW-3S	2-23-90	1419.69	1422.13	25.0	1394.69	9.0-24.0	1410.69-1395.69	6.0-25.0	1413.69-1394.69
MW-3D	3-5-90	1419.47	1422.22	59.5	1359.97	52.5-57.5	1366.97-1361.97	46.5-59.5	1372.97-1359.97
MW-4S	1-6-90	1419.74	1422.70	25.0	1394.74	9.0-24.0	1410.74-1395.74	6.0-25.0	1413.74-1394.74
MW-4D	1-31-90	1419.75	1422.98	55.0	1364.75	47.0-52.0	1372.75-1367.75	45.0-53.0	1374.75-1366.75
MW-5S	2-28-90	1420.65	1423.14	30.0	1390.65	7.0-22.0	1413.65-1398.65	4.4-30.0	1416.25-1390.63
MW-5D	1-30-90	1420.90	1424.50	57.5	1363.40	49.7-54.7	1371.20-1366.20	46.8-57.5	1374.10-1363.40
MW-6S	2-5-90	1427.27	1430.25	32.2	1395.07	16.0-31.0	1411.27-1396.27	14.0-34.2	1413.27-1393.07
MW-6D	2-21-90	1427.50	1430.04	58.4	1369.10	51.0-56.0	1376.50-1371.50	47.5-58.4	1380.00-1369.10
MW-7	3-8-90	1419.84	1422.84	27.5	1392.34	10.0-25.0	1409.84-1394.84	6.5-27.5	1413.34-1392.34
MW-7D	10-3-91	1420.15	1423.05	58.5	1361.65	53.0-58.0	1367.15-1362.15	50.0-58.5	1370.15-1361.65
MW-8S	10-15-91	1416.12	1415.71	23.5	1392.62	7.0-22.0	1409.12-1394.12	5.0-23.5	1411.12-1392.62
MW-8D	10-15-91	1416.00	1416.16	59.7	1356.30	54.5-59.5	1361.50-1356.50	51.6-59.7	1364.40-1356.30
MW-9	1-30-90	1421.20	1424.12	22.0	1399.20	4.0-19.0	1417.20-1402.20	3.0-22.0	1418.20-1399.20

TABLE 2-2 Cont.

SUMMARY OF MONITORING WELL DATA

Boring Number	Date Completed	Ground Surface Elevation (ft)	Monitoring Point (I.C.) Elevation (ft)	Depth of Boring (ft)	Bottom of Boring Elevation (ft)	Screened Interval Depth (ft)	Screened Interval Elevation (ft)	Sand Pack Depth (ft)	Sand Pack Elevation (ft)
MW-10	2-21-90	1420.55	1422.85	30.0	1390.55	8.0-23.0	1412.55-1397.55	7.5-30.0	1413.05-1390.55
MW-10D	9-25-91	1421.20	1424.27	60.0	1361.20	55.0-60.0	1366.20-1361.20	51.8-60.0	1369.40-1361.20
MW-11	11-17-91	1427.23	1430.60	37.0	1390.23	18.0-33.0	1409.23-1394.23	13.5-37.0	1413.73-1390.23
MW-12S	9-18-91	1420.00	1423.25	28.0	1392.00	13.0-28.0	1407.00-1392.00	10.0-28.0	1410.00-1392.00
MW-12D	9-23-91	1419.85	1422.53	59.0	1360.85	53.8-58.8	1366.05-1361.05	50.3-58.8	1369.55-1360.85
MW-13S	10-1-91	1426.00	1429.37	27.4	1398.60	12.4-27.4	1413.60-1398.60	9.0-27.4	1417.00-1398.60
MW-13D	9-30-91	1426.20	1429.57	60.7	1365.50	55.0-60.0	1371.20-1366.20	51.0-60.7	1375.20-1365.50
MW-14S	10-4-91	1425.76	1428.43	33.4	1392.36	16.6-31.6	1409.16-1394.16	14.0-33.4	1411.76-1392.36
MW-14D	10-9-91	1425.46	1428.22	63.0	1362.46	57.3-63.2	1368.16-1362.26	55.0-62.3	1370.46-1362.26
MW-15	10-11-91	1427.86	1427.89	34.0	1393.86	17.0-32.0	1410.86-1395.86	16.7-34.0	1411.16-1395.86
MW-16	10-23-91	1429.35	1432.63	37.0	1392.35	21.5-36.5	1407.85-1392.85	18.5-37.0	1410.85-1392.85
MW-19	9-11-91	1422.94	1422.56	33.0	1389.94	14.0-29.0	1408.94-1493.94	13.5-33.0	1409.44-1389.94
MW-20	9-11-91	1423.27	1423.06	33.0	1390.27	12.0-27.0	1411.27-1396.27	10.5-33.0	1412.77-1390.27

inferred to be from northeast to southwest, based on local surface water conditions. After conducting the Phase I RI it was found that the inferred NE to SW direction of ground water flow was correct and the Phase II wells were located to fill the Phase I data gaps.

The Phase II RI monitoring well locations were chosen to assess the ground water conditions off-site, inside the plant building, and in suspected contaminated areas. Five of the wells (MW-14S, 14D, 15S, 13S and 13D) were installed at upgradient positions. MW-20S and 19S were installed inside the plant building and MW-12S, 12D, 10D, and 7D were installed at other various locations on-site to assess suspected contamination source areas. MW-8S, 8D, 16S, and 11S were installed at downgradient locations to assess the possible migration of contamination off-site.

2.10.2 Test Boring Methodologies

All borings and wells were drilled using a truck mounted drilling rig outfitted with either 6 or 4.5 inch inside diameter (I.D.) hollow-stem augers. Drilling operations were monitored by an ERM geologist. While installing the wells and borings, soil samples were collected and used to describe and characterize the subsurface materials. These samples were collected using either a 2 or 3 inch I.D. split spoon sampler that was driven 2 feet beyond the augers by a 140 pound hammer free falling 30 inches. At clustered wells, soil samples were collected only during the drilling of the deep well, since the shallow well was located a few feet away. Descriptions of the soil samples collected during the Phase II RI were recorded on boring logs, which are included in the Phase II Field Data. This information was submitted to the NYSDEC in February 1992 as a seperate volume of this report.

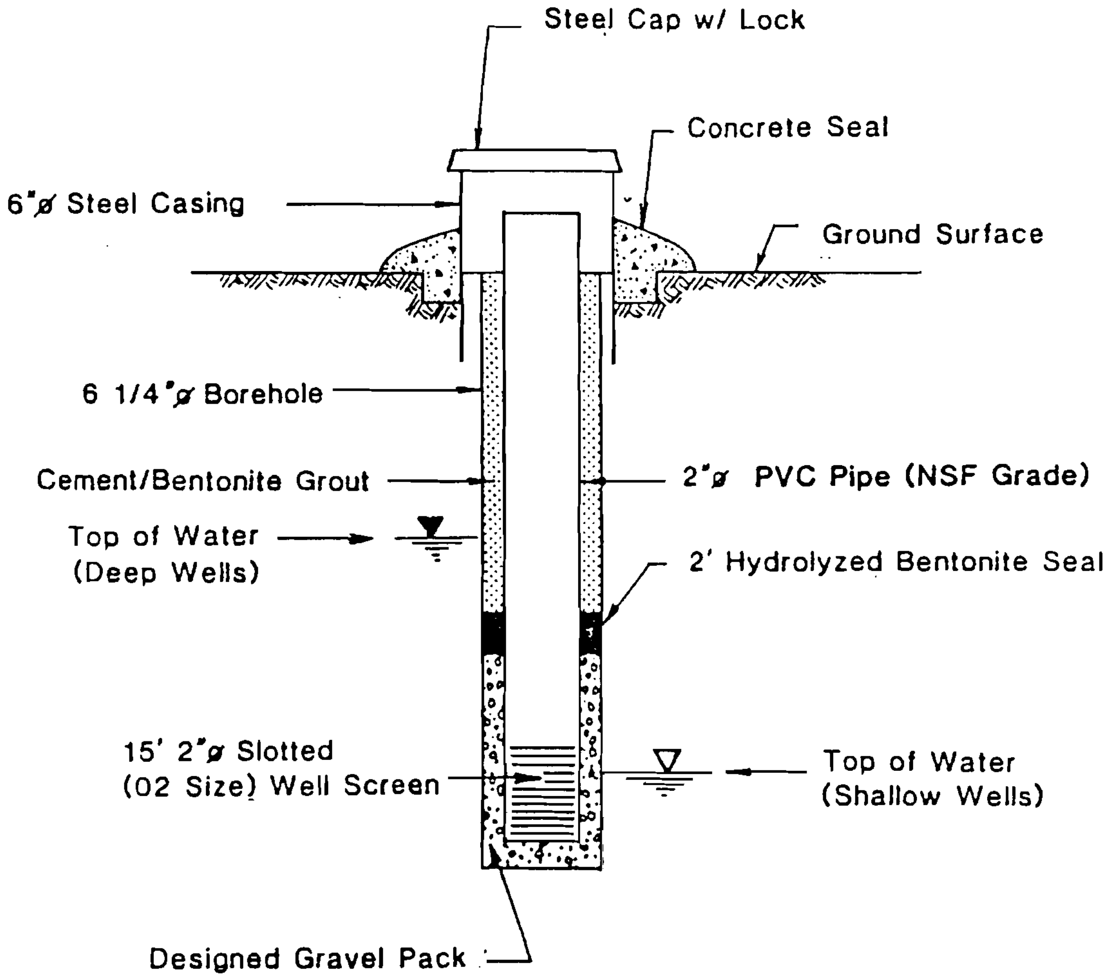
2.10.3 Shallow Monitoring Wells

In each Phase II shallow well, a 15-foot section of slotted 2-inch I.D. NSF-approved Schedule 40 PVC well screen was installed. The top of the well screen was positioned between one to three feet above the top of the water table. A flush jointed, threaded, 2-inch I.D. Schedule 40 PVC, NFS approved riser pipe was then extended from the screen to 2.5 feet above ground surface. A sand pack was placed around the well screen and extended to approximately two feet above it. The sand pack was overlain by two feet of hydrolyzed bentonite pellets or tremied bentonite grout. The remainder of the annular space was filled with a cement/bentonite grout of the following ratio: 12 lbs. of cement, 1 lb. of bentonite, and 1 gallon of potable water. Locking, protective outer casings were cemented in place to secure the riser pipes and protect the wells. The concrete was sloped at the base of the protective casing to promote drainage away from the wells (see Figure 2-10).

2.10.4 Deep Monitoring Wells

The deep monitoring wells were installed in the lower portion of the aquifer and constructed using a five foot length of screen. The well screens of the deep wells were located below the depth that a clay lens was expected to be encountered. A sand pack was placed around the screen and riser pipe was extended from the screen to 2.5 feet above land surface. A thick bentonite slurry was then tremied immediately above the sand pack. Finally, the wells were grouted and covered by a protective casing in much the same manner as the shallow wells.

During the drilling of two deep wells, MW-13D and MW-14D, a clay lens was encountered. These wells were therefore constructed using 10" steel casing to seal off the upper aquifer zone. The casing was installed by first overdrilling the borehole annulus with 8 1/4" I.D. augers to a depth where the clay was encountered. After overdrilling, the casing was placed in the boring and cemented in place by filling the



TITLE

VAN DER HORST RI/FS
PLANT NO. 2
GROUND WATER
MONITORING WELL

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Environmental Resources Management

SCALE	FIGURE
DATE	2-10

borehole with a cement/bentonite slurry to approximately 8 feet below grade. Once the grout mixture had set the boring was redrilled with 4 1/4" augers to its total depth. The screen, sand pack, and riser pipe were then installed in much the same manner as the other deep wells. Monitoring well installation reports for each of the wells are included in the Field Data volume of this report.

2.10.5 Monitoring Well Development

The wells were undisturbed for a period of time after construction to allow the materials to stabilize. To insure an effective hydraulic connection between the monitoring well and the aquifer, the wells were then developed by surging with a bailer and limited pumping. A number of wells were initially bailed several times to remove silt that clogged the well screen and surrounding filter pack. Afterwards, the wells were sufficiently cleared to allow sustained withdrawal with the use of a centrifugal pump.

Samples of the discharged ground water were routinely collected and analyzed with a turbidity meter during well development. All of the monitoring wells initially produced turbid water. For the majority of the wells, development continued until the turbidity of the discharged water was visually sediment free and numerically less than 50 National Turbidity Units (NTU). A number of wells could not be developed to the 50 NTU level even after extensive pumping. None the less, these wells were still considered sufficiently developed enough to sample. The turbidity readings obtained at the different stages of well development are shown in Table 2-3.

The ground water removed from the monitoring wells during development and pre-sample purging was containerized in 55 gallon drums and then transferred into several on-site holding tanks. The holding tanks were then emptied, after municipal approval, into Olean's sanitary sewer system. Development equipment (bailers, rope, hosing) was dedicated to each well and all spent disposable equipment was containerized on-site in 55-gallon drums, now stored inside the plant building.

2.10.6 Drilling Related Activities

Drilling equipment and material used to install the wells was cleaned with a steam cleaner prior to use in the boring. Soil generated during the drilling of the wells and test borings was stored on-site and will be disposed of in accordance with applicable NYSDEC regulations and TCLP analytical results.

TABLE 2-3

VAN DER HORST PLANT 2, PHASE II

MONITORING WELL DEVELOPMENT INFORMATION

WELL NUMBER	TOTAL WATER PURGED (gal)	FINAL NTU	pH	CONDUCTIVITY (μmhos)	TEMPERATURE (C)
MW-7D	170	50	7.7	520	9.8
MW-8S	300	N/A	7.7	500	10
MW-8D	222	50	7.5	550	9
MW-10D	200	40	7.2	800	7.5
MW-11S	150	N/A	7.6	610	9.5
MW-12S	306	275*	7.5	760	9.2
MW-12D	170	45	7.6	500	9.8
MW-13S	83	24	7.7	990	9.8
MW-13D	138	25	7.6	450	9
MW-14S	141	40	7.6	1300	7.5
MW-14D	220	45	7.7	560	7
MW-15S	144	N/A	7.8	650	9
MW-16S	210	N/A	7.6	720	9
MW-19	155	20	8.5	720	8.5
MW-20	315	90*	7	1200	9

* Turbidity of well water could not be lowered to 50 NTU

N/A NTU reading unavailable

Potential personal and community health and safety concerns played an integral part in the well installation program. Level D protective clothing was worn by all on-site personnel, and a field trailer with a telephone was maintained on-site. The downwind and work area air quality was continuously monitored during all drilling operations, and all exhumed soil and well water were immediately containerized and brought on-site to a secured storage area.

2.11 Ground Water Sampling

Following well development, unfiltered ground water samples were collected from all Phase I and Phase II monitoring wells using dedicated bottom-loading PVC bailers with a polypropylene rope. Prior to well sampling, a minimum of three volumes of well water was bailed from each monitoring well. Sampling and purging equipment was thoroughly cleaned prior to use, in accordance with the procedures outlined in the site-specific QA/QC Plan (September, 1989). The samples were collected and immediately packed on ice in insulated coolers. Within twelve hours of collection the samples were delivered to the analytical laboratory.

During the Phase I RI, samples from the fifteen wells were analyzed for TCL+30 parameters, hexavalent chromium, cyanide and pH. Sampling results are discussed in Section 4.0. of the Phase I RI Report.

During the Phase II RI, samples from the Phase I wells and all but two of the recently installed Phase II wells were sampled and analyzed for hexavalent chromium, total chromium, arsenic, lead, barium, manganese and TCL VOA. Samples from the remaining two wells, MW-19 and MW-20, were analyzed for hexavalent chromium, TCL VOA, TAL metals, pesticides/PCBs, and semi-volatile organics. The results of the Phase II ground water sample analysis is presented on Table 4-13 and discussed in Section 4.9 of this report.

2.12 Additional Surveying of Sample Locations

During the Phase I RI a licenced land surveyor prepared a base map of the study area. This map included the location and elevation of all on-site monitoring wells and samples obtained during the Phase I RI. Important on-site features such as buildings, fence lines and roads were also included on the map.

During the Phase II RI the additional sample and monitoring well locations were added to the previously generated base map. Site boundaries were more accurately delineated and the interior plant building, with its numerous production vats, was precisely mapped.

A second map was produced to include the study areas for both Van Der Horst facilities. This map included all off-site well and sample locations for both phases of the Plant No. 2 RI, and cultural features such as city streets, houses, and railroad tracks. Monitoring well locations for Plant No. 1 are also included on the second map to more accurately map the regional ground water level surface. A computer file of the base map, compatable with Autocadd Version 10, was enhanced with the revisions to facilitate subsequent figure generation.

2.13 Aquifer Characteristics and Hydraulic Testing

Static ground water levels were measured twenty-one times at monitoring wells during the period of March 1990 through January 1992. Water levels from these wells and other nearby wells were used to create ground water contour maps (see Appendix A). Water level data were also evaluated to determine ground water flow direction, horizontal and vertical hydraulic gradients, water level fluctuation, and ground water depth at the Plant No. 2 site. These data are discussed in Section 3.3.2 of this report.

Slug tests were conducted during the Phase I and II RI to estimate the hydraulic conductivity of the aquifer surrounding the deep and shallow monitoring wells. Both falling head and constant head slug tests were run in each monitoring well. Slug test data were analyzed with the AQTESOLV™ computer program. A summary of hydraulic conductivities is presented in Section 3.4 and slug test plots and raw data can be found in the Field Data, submitted as a seperate volume of this report.

A ground water recovery simulation was performed for Plant No. 2 to estimate the location and the number and discharge volume of recovery wells required to capture the ground water plume of chromium contamination. The USGS ground water flow model MODFLOW and the Walton pumping test model were used to simulate and evaluate the recovery well system. Aquifer parameters used in the model were obtained from on-site slug test data, on-site lithologic logs, and regional hydraulic testing results. Modeling assumptions, procedures, results, limitations and conclusions are presented in Section 3.5 of this report.

2.14 Final Risk Assessment

The risk assessment completed for the Phase I RI has been revised based on the findings of the Phase II RI. The purpose of the final baseline risk assessment is to evaluate risks to human health and the environment under existing conditions. It is an evaluation of the no action alternative as required in the U.S. EPA guidance documents. The baseline risk assessment is used as a benchmark against which the remedial alternatives are evaluated.

In this way, risks associated with the remedial alternatives can be quantitatively compared to each other and to current conditions in order to best select an appropriate remedial action.

3.0 AQUIFER CHARACTERISTICS AND HYDRAULIC TESTING

3.1 Geology

3.1.1 Regional Geology

The City of Olean is located within the Allegheny River Basin of the Appalachian Plateau Physiographic Province. The glaciated Allegheny River valley trends east to west and has been eroded several hundred feet into bedrock. Bedrock outcrops can be seen on the steep hills forming the north and south sides of the valley, while bedrock on the valley floor is covered by up to three hundred feet of sediment, consisting mainly of glaciofluvial outwash. These surficial glacial deposits are present at the Van Der Horst Plant No. 2 site and overlie the Upper Devonian shale and siltstone bedrock.

Previous geological studies (USGS, 1987b; USGS, 1988) have concluded that the overlying surficial material locally consists of unconsolidated glacial and fluvial deposits, ranging from 150 to 300 feet in thickness. Theses deposits primarily consist of unconsolidated sediments, which have tentatively been identified as lacustrine clays and silts. Such sediments were deposited in glacial lakes and locally can range up to 150 feet in thickness (USGS, 1988). Shallower sediments consist of till and stratified drift which were deposited by a former glacial ice tongue that had extended down Olean Creek. The post-glacial deposits generally consist of well sorted sand-and-gravel alluvium overlain by silt, and range from 10 to 30 feet in thickness.

The surficial soils in the valleys are classified as Recent alluvium and exhibit a wide range of sediment grain size. These deposits are made up of gravelly silt loams which may range in thickness from 10 to 30 feet in some areas of the valleys.

A valley fill deposit of fluvial sands and gravels generally occurs beneath the Recent alluvium. The fluvial deposits are typically 40 to 60 feet thick and extend to an average depth of 80 feet below land surface. This deposit of fluvial sands and gravels constitutes the major aquifer in the Olean area and is saturated at depths of 15 - 20 feet below grade. Clay lenses have been documented to occur within the valley fill deposit.

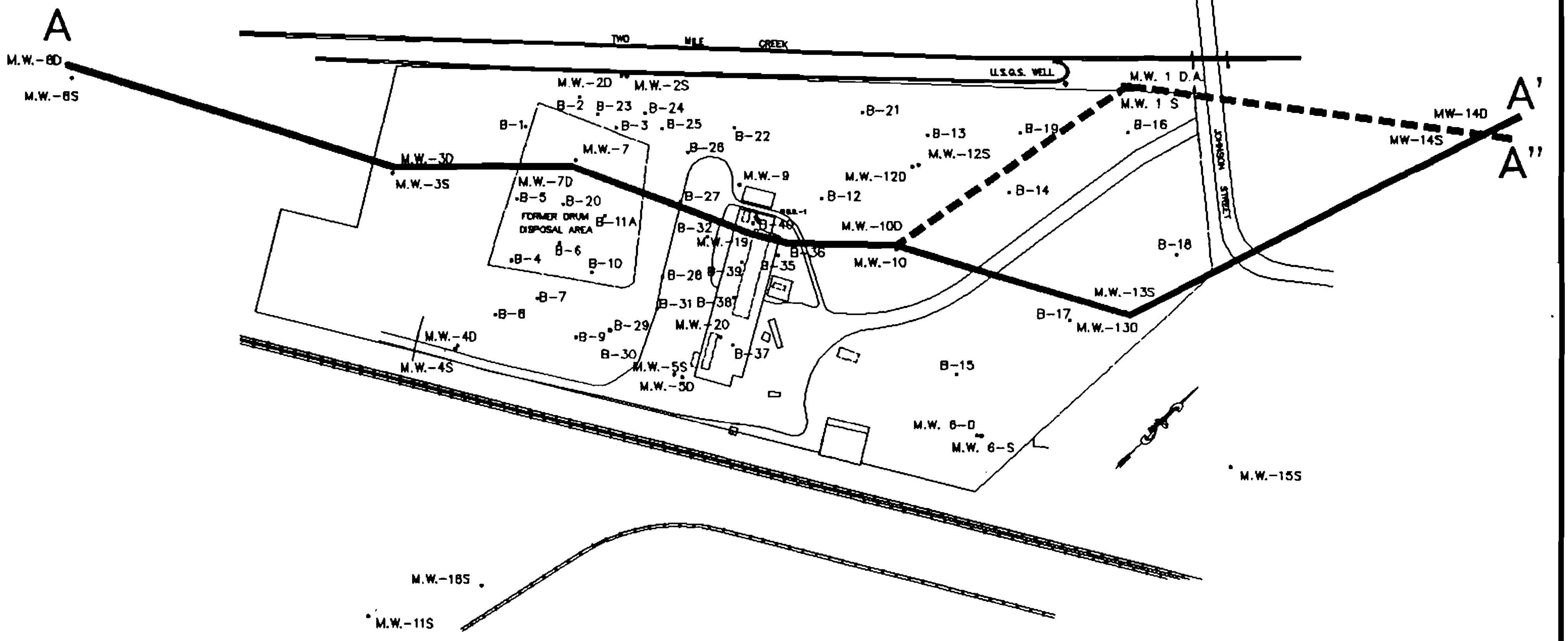
3.1.2 Site Geology

Geologic information at Van Der Horst Plant No. 2 was primarily obtained from soil samples collected during the drilling of test borings and monitoring wells. Deep monitoring wells were drilled and sampled to an approximate depth of 60 feet. These wells provided the deepest geological information at the site. Detailed drilling log descriptions are presented in Section B of a separate volume, entitled "Field Data." The details of each individual well construction are presented in Section C of the Field Data volume.

Figure 3-1 shows the locations of 2 cross sections (A - A' and A - A'') at the Plant No. 2 site. These cross sections are respectively presented in Figures 3-2 and 3-3.

The site is overlain by silt to silty sand material that ranges in thickness between 4 and 29 feet. This layer has an average thickness of approximately 10 feet.

Beneath this silty layer lies a sand and gravel deposit with occasional cobbles. This layer is highly variable in composition, however, there appears to be a general tendency beneath most of the site for the gravel deposit to be less silty with depth. The sand and gravel deposit is the primary water bearing zone beneath the site. Most of the well screens for the shallow and deep monitoring wells were set within this interval.



LEGEND

M.W.-5D • – MONITORING WELL

B-30 • – SOIL BORING

▬ – CROSS SECTION LINE A'

▬ ▬ – CROSS SECTION LINE A''

0' 100' 200' 400'
SCALE

TITLE
VAN DER HORST PLANT 2
GEOLOGIC CROSS SECTION
LOCATION MAP

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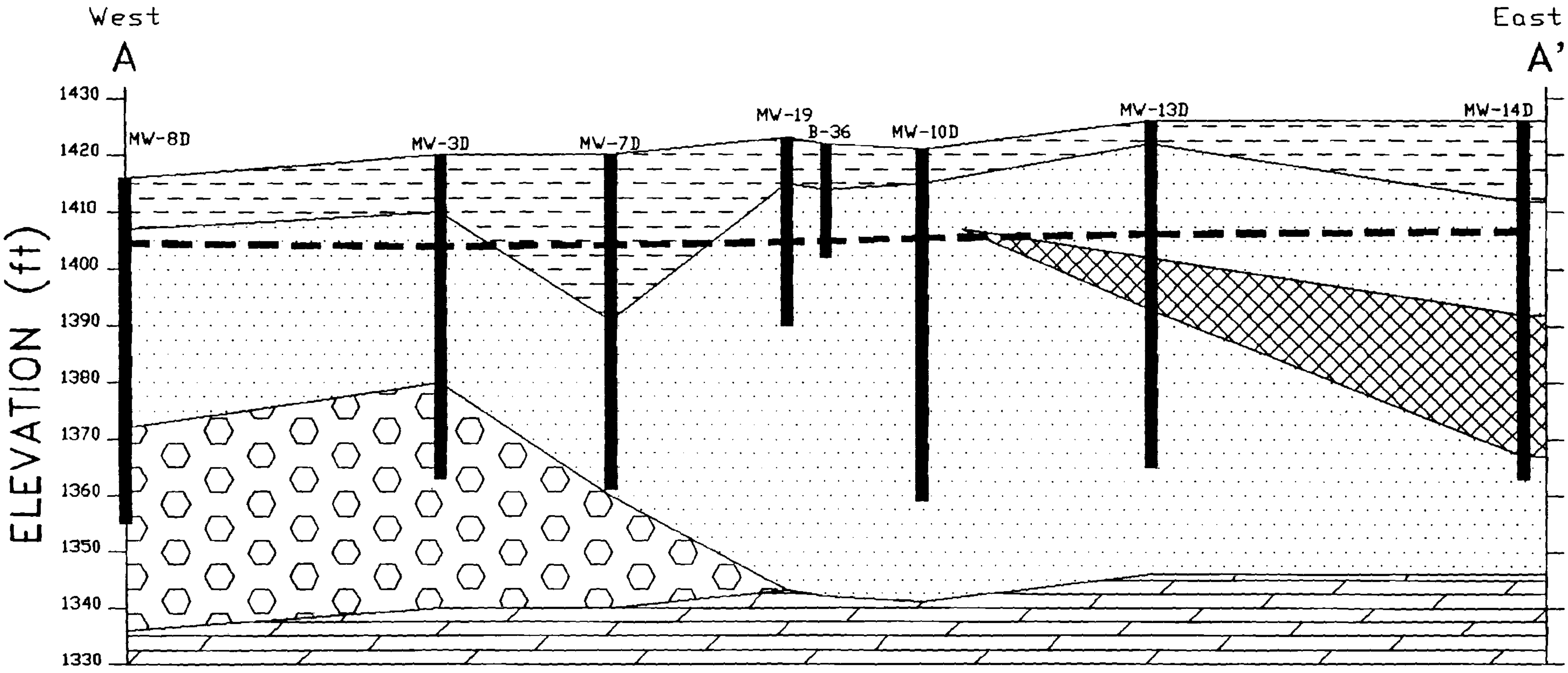
DATE

FIGURE
3-1



LEGEND

- ▩ Clay
- ☰ Silt and Silty-Sand
- ⬚ Sand and Gravel
- ⬡ Gravel and Sand
- ▤ Shale Bedrock
- ▬ ▬ Water Table on 10-29-91

TITLE

VAN DER HORST PLANT
GEOLOGIC CROSS SECTIO
A – A'

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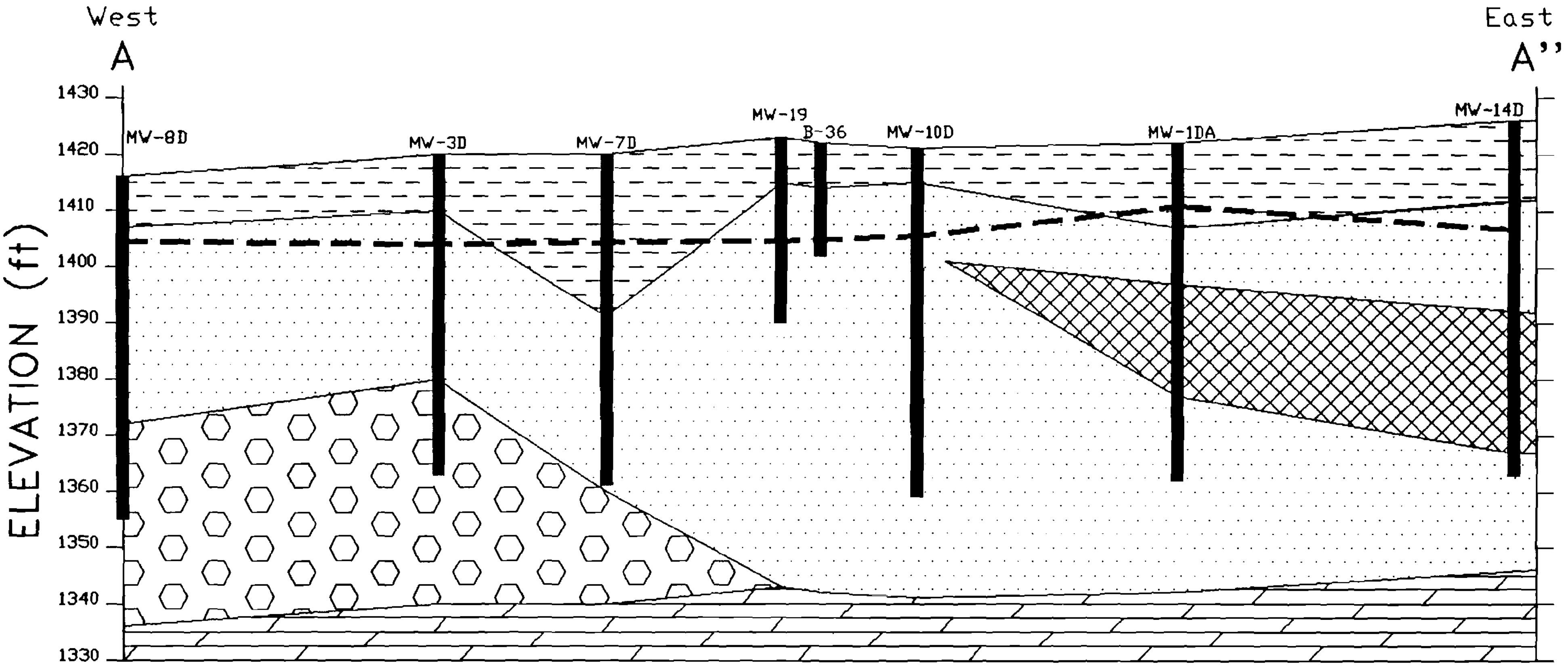
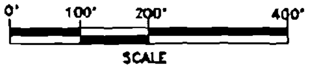
DATE

FIGUR
3-



LEGEND

▩ Clay
▤ Silt and Silty-Sand
░ Sand and Gravel
⬡ Gravel and Sand
☰ Shale Bedrock
- - - Water Table on 10-29-91



TITLE
VAN DER HORST PLANT 2
GEOLOGIC CROSS SECTION
A – A''

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Environmental Resources Management

DATE

FIGURE
3-3

A large clay lens was found within the sand and gravel deposit at the northeastern end of the site. The lens thickness varies from 25 feet in MW-14D to 9 feet in MW-13D. Laboratory permeability testing was performed during the Phase I RI on this clay with a Shelby tube soil sample collected from MW-1DA. This sample was sent to a subcontracted geotechnical laboratory where permeability testing, using a flexible walled permeameter, was completed. A permeability of 2.1×10^{-7} cm/sec (4.1×10^{-7} ft/min) was measured in the sample.

A zone of gravel and sand (i.e., more gravel than sand) occurs in the lower portion of the unconsolidated deposits at the southwestern end of the site. This zone is predominated by gravel sized material.

The shale bedrock beneath the site is believed to occur at an approximate depth of 80 feet. No on-site wells were drilled into the shale. The estimate for bedrock depth is based on USGS geologic cross sections which were located near the Plant No. 2 site (USGS, 1987b).

Much of Van Der Horst Plant No. 2 site is overlain by fill materials. During the drilling program, ERM personnel found the fill material to consist mainly of cinders and broken concrete debris. The distribution and thickness of the fill was found to vary; however, only in the former drum disposal area was fill found to be greater than two feet thick.

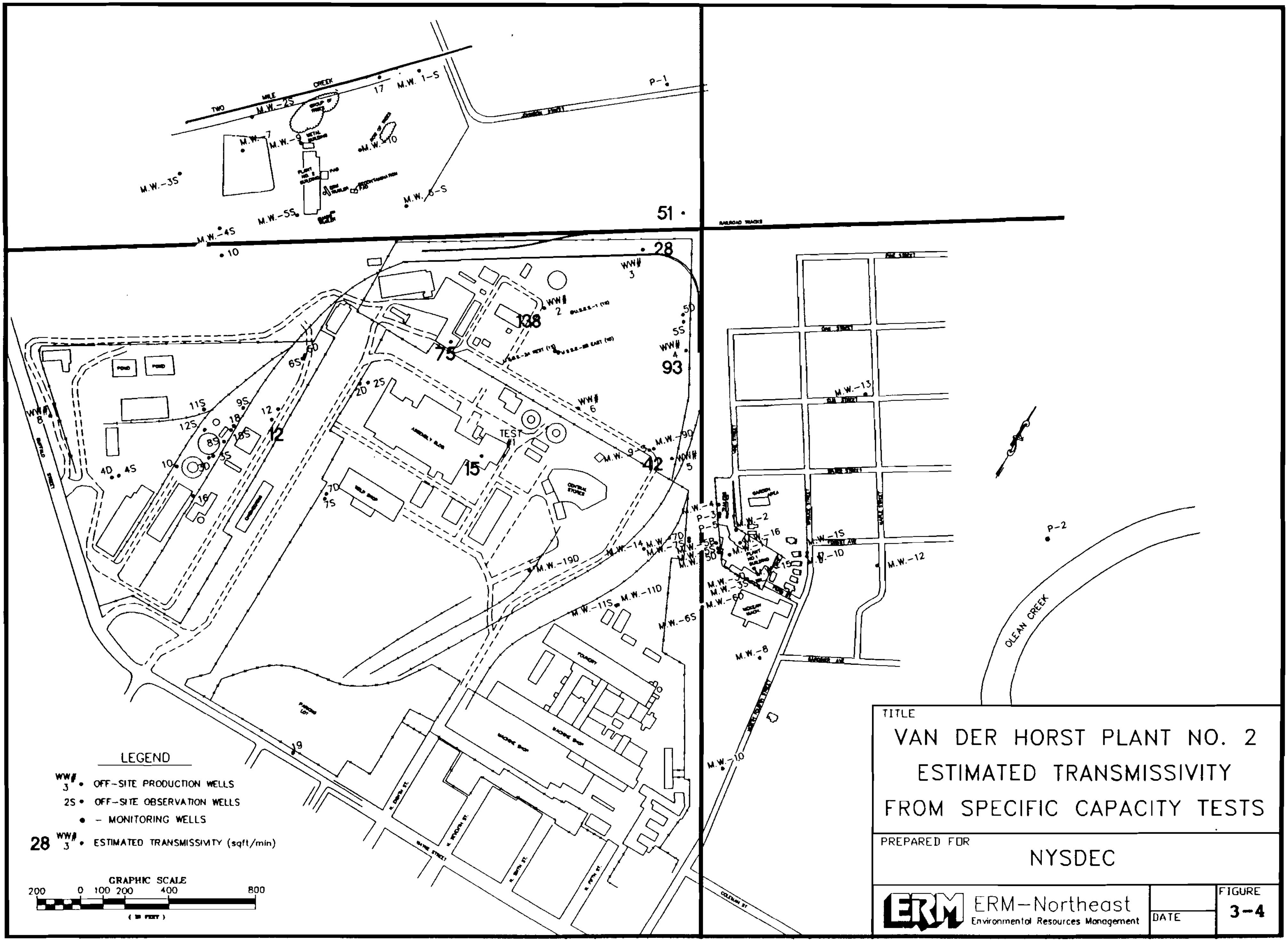
3.2 Regional Hydrogeology

Previous studies have indicated that the aquifer beneath the site regionally consists of 20 to 100 feet of coarse sand and gravel outwash that underlies the valleys of the Allegheny River and its tributaries. These deposits form an extensive and high yielding aquifer that has provided millions of gallons a day to industrial and municipal wells. At some locales, relatively thin lenses of silt and clay occur between depths of 30 to 50 feet. These fine grained materials act as a localized semi-confining bed that separates the aquifer into an upper and lower layer. One such lens was found immediately south of the site on a portion of the Felmont Oil Company property and on the Agway property. A similar clay lens was found at the northeast end of the Plant No. 2 site.

The USGS has monitored the water levels of 50 to 95 wells in the Olean area since the early 1970s. According to one study (Water Resources Investigation Report 87-4043, 1988), the lower 30 feet of the aquifer, at some locales, is more permeable than the upper 50 feet, and has yielded up to 500-1000 gal/min. The ground water from this aquifer has been used for a municipal drinking source and industrial/institutional purposes. The USGS recorded transmissivity values between 1,700 and 200,000 ft^2/day, and the hydraulic conductivity is between reportedly 300 and 1,500 feet/day for the uppermost aquifer material. The coefficient of storage value was reported to be 0.015.

The USGS also ran specific capacity tests in several of the production wells near Plant No. 2. The estimated transmissivities from these tests ranged from 12 to 138 ft^2/min and are shown in Figure 3-4.

In 1984, the ground water flow was to the south and southwest -- toward the Allegheny River, and radially toward cones of depression created by localized industrial pumping (USGS, 1985). At that time, the localized pumping included production wells at the Felmont-Oil well field, which have since been shut down, and a purge well at the Agway property. The pumping of these wells had created a cone of depression of up to 30 feet vertically and extending laterally as far away as Olean Creek to the east (approximately 4,000 feet). Hydraulic conductivity values were calculated by the USGS from pumping tests at the Felmont production wells and were found to range from 300 to 1,500 ft/day (USGS, 1985).



TITLE

VAN DER HORST PLANT NO. 2
ESTIMATED TRANSMISSIVITY
FROM SPECIFIC CAPACITY TESTS

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FIGURE
3-4

The following average aquifer characteristics have been calculated or estimated during RI Phases I and II from slug test and aquifer test data at Plant No. 1:

Parameter	Method	Value
Transmissivity	P-5 Pumping Test	193 ft^2/min
Hydraulic Cond.	P-5 Pumping Test	2.8 ft/min
Hydraulic Cond.	Shallow Well Slug Tests	0.2 ft/min
Hydraulic Cond.	Deep Well Slug Tests	0.10 ft/min
Storativity	Pumping Test	0.017
Specific Yield	Estimated Range	0.15 - 0.25

Calculated and estimated aquifer characteristics at Plant No. 2 are presented in the slug testing results (Section 3.4) and in the modeling assumptions (Section 3.5.3).

Ground water is recharged by infiltration of precipitation and underflow from the Olean Creek and Allegheny River valleys. Recharge to the aquifers is estimated to be 19 inches per year (USGS, 1988) and is probably greater through infiltration in areas near surface-water bodies (e.g., Two Mile Creek).

3.3 Ground Water Flow

3.3.1 Regional Ground Water Flow

Static ground water levels were measured twenty-one times at monitoring wells during the period of March 1990 through January 1992. Water levels were measured to the nearest 0.01 feet with an electronic water level indicator. These tabulated data are presented in Table 3-1.

Figure 3-5 presents the October 29, 1991 regional ground water flow in shallow wells throughout the area surrounding Plants No. 1 and No. 2. Ground water flow pattern on this date is believed to be representative of typical regional flow conditions. Additional regional ground water contour maps are presented in Appendix A. The direction of flow downgradient of Plant No. 2 was towards the west. The hydraulic gradient in Figure 3-5 ranged from 0.00025 west of Plant No. 1 to 0.0035 at Plant No. 2.

In general, the ground water flow direction in the shallow wells located along the railroad tracks between Plants No. 1 and No. 2, is to the southeast. This southeastern component of ground water flow is believed to result from the much lower hydraulic conductivity of the shallow sediments

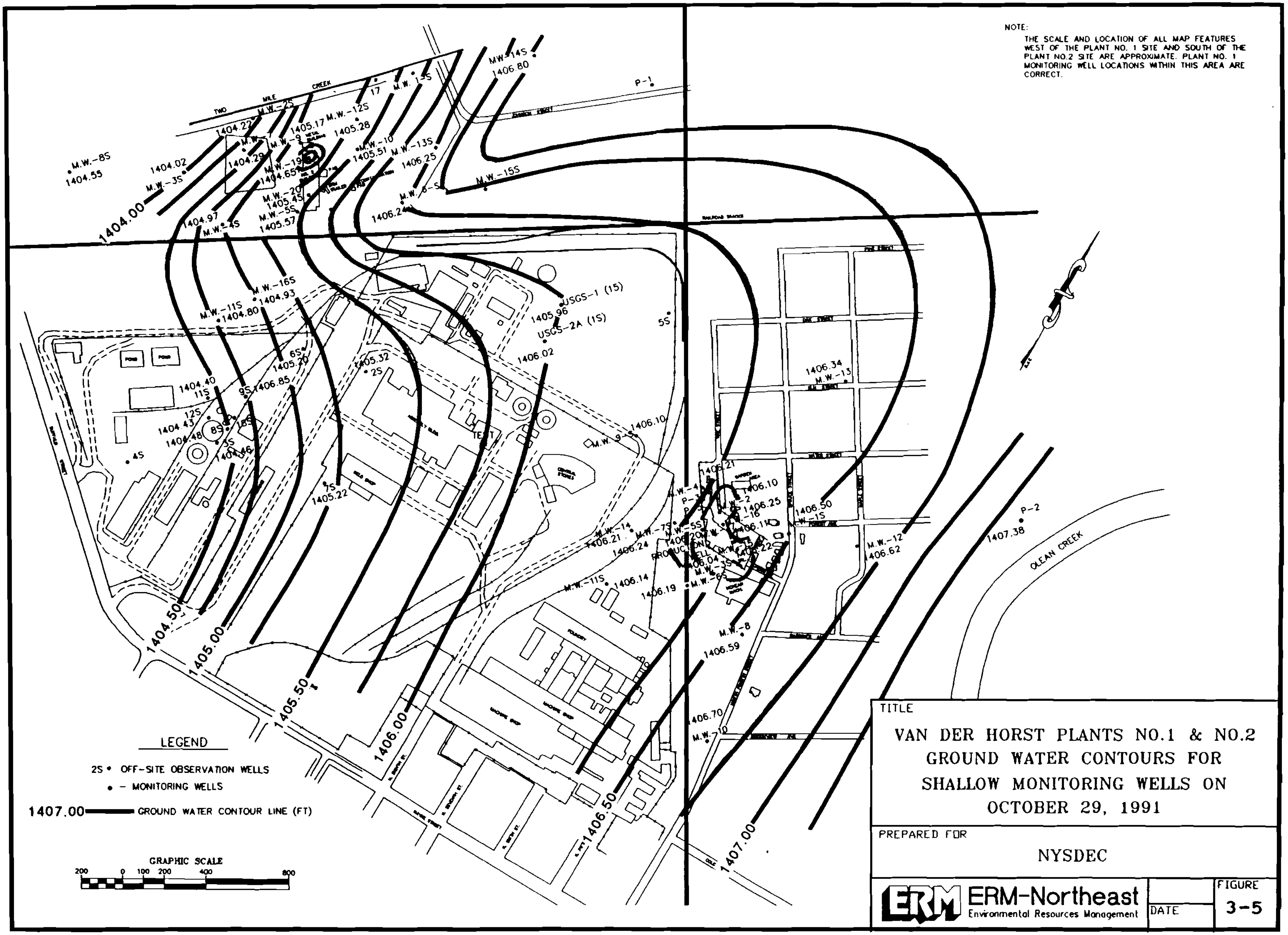
TABLE 3-1

WATER LEVEL DATA FOR VDH PLANT 2

LOCATION	MONITORING POINT ELEVATION (FEET)	PARAMETER	27-Mar-90	2-Apr-90	19-Apr-90	24-Apr-90	25-Apr-90	10-May-90	18-May-90	25-May-90	20-Jun-90	17-Jul-90	21-Sep-90	2-Oct-90	1-Nov-90	13-Dec-90	4-Jan-91	7-Feb-91	1-Mar-91	3-Apr-91	18-Jul-91	29-Oct-91	30-Jan-92
MW-1S	1425.51	Depth to Water (FT.)	11.00	11.24	10.96	10.92		10.95	10.27	10.62	11.41	11.35	11.38	11.34	10.84	11.04	10.43	10.76	11.15	11.46	13.41	14.67	11.86
		Static Water Level (FT)	1414.51	1414.27	1414.55	1414.59		1414.56	1415.24	1414.89	1414.10	1414.16	1414.13	1414.17	1414.67	1414.47	1415.08	1414.75	1414.36	1414.05	1412.10	1410.84	1413.65
MW-1DA	1425.02	Depth to Water (FT.)	14.50	14.18	13.92	13.89		14.28	13.38	13.00	14.73	15.78	15.72	15.47	13.00	13.93	11.97	13.82	13.82	13.98	17.78	19.58	16.78
		Static Water Level (FT)	1410.52	1410.84	1411.10	1411.13		1410.74	1411.64	1412.02	1410.29	1409.24	1409.30	1409.55	1412.02	1411.09	1413.05	1411.20	1411.20	1411.04	1407.24	1405.44	1408.24
MW-2S	1421.52	Depth to Water (FT.)	12.10	12.25	11.87	11.90	11.92	12.41	11.90	11.03	12.87	13.80	13.69	13.51	11.11	12.08	9.91	11.98	11.90	12.10	15.75	17.30	14.60
		Static Water Level (FT)	1409.42	1409.27	1409.65	1409.62	1409.60	1409.11	1409.62	1410.49	1408.65	1407.72	1407.83	1408.01	1410.41	1409.44	1411.61	1409.54	1409.62	1409.42	1405.77	1404.22	1406.92
MW-2D	1421.58	Depth to Water (FT.)	12.10	12.26	11.89	11.92	11.93	12.38	11.92	11.06	12.85	13.78	13.66	13.47	11.12	12.09	9.93	12.01	11.92	12.09	15.72	17.26	14.58
		Static Water Level (FT)	1409.48	1409.32	1409.69	1409.66	1409.65	1409.20	1409.66	1410.52	1408.73	1407.80	1407.92	1408.11	1410.46	1409.49	1411.65	1409.57	1409.66	1409.49	1405.86	1404.32	1407.00
MW-3S	1422.13	Depth to Water (FT.)	12.55	13.12	12.74	12.78	12.78	13.28	12.72	11.93	13.75	14.65	14.53	14.34	12.03	12.99	10.79	12.89	12.81	12.98	16.64	18.11	15.42
		Static Water Level (FT)	1409.58	1409.01	1409.39	1409.35	1409.35	1408.85	1409.41	1410.20	1408.38	1407.48	1407.60	1407.79	1410.10	1409.14	1411.34	1409.24	1409.32	1409.15	1405.49	1404.02	1406.71
MW-3D	1422.22	Depth to Water (FT.)	13.15	13.27	12.89	12.94	12.94	13.45	12.92	12.08	13.91	14.81	14.68	14.49	12.18	13.15	10.95	13.06	12.96	13.13	16.80	18.22	15.56
		Static Water Level (FT)	1409.07	1408.95	1409.33	1409.28	1409.28	1408.77	1409.30	1410.14	1408.31	1407.41	1407.54	1407.73	1410.04	1409.07	1411.27	1409.16	1409.26	1409.09	1405.42	1404.00	1406.66
MW-4S	1422.70	Depth to Water (FT.)	11.75	11.90	11.67	11.73	11.72	12.02	10.36	10.45	12.30	13.33	13.56	13.32	10.83	11.67	9.67	11.48	11.61	11.96	15.74	17.73	14.94
		Static Water Level (FT)	1410.95	1410.80	1411.03	1410.97	1410.98	1410.68	1412.34	1412.25	1410.40	1409.37	1409.14	1409.38	1411.87	1411.03	1413.03	1411.22	1411.09	1410.74	1406.96	1404.97	1407.76
MW-4D	1422.98	Depth to Water (FT.)	13.67	11.84	13.46	13.51	13.44	14.00	13.53	12.67	14.44	15.34	15.21	15.02	12.73	13.69	11.53	13.61	13.52	13.67	17.29	18.73	16.10
		Static Water Level (FT)	1409.31	1411.14	1409.52	1409.47	1409.54	1408.98	1409.45	1410.31	1408.54	1407.64	1407.77	1407.96	1410.25	1409.29	1411.45	1409.37	1409.46	1409.31	1405.69	1404.25	1406.88
MW-5S	1423.14	Depth to Water (FT.)	11.75	11.90	11.74	11.74	11.74	12.03	11.38	10.61	12.27	13.50	13.92	13.41	10.76	11.57	9.69	11.52	11.62	11.93	15.35	17.57	15.56
		Static Water Level (FT)	1411.39	1411.24	1411.40	1411.40	1411.40	1411.11	1411.76	1412.53	1410.87	1409.64	1409.22	1409.73	1412.38	1411.57	1413.45	1411.62	1411.52	1411.21	1407.79	1405.57	1407.58
MW-5D	1424.50	Depth to Water (FT.)	14.80	14.98	14.63	14.66	14.62	15.15	14.72	13.81	15.53	16.46	16.31	16.12	13.82	14.79	12.67	14.76	14.65	14.78	18.39	19.91	17.28
		Static Water Level (FT)	1409.70	1409.52	1409.87	1409.84	1409.88	1409.35	1409.78	1410.69	1408.97	1408.04	1408.19	1408.38	1410.68	1409.71	1411.83	1409.74	1409.85	1409.72	1406.11	1404.59	1407.22
MW-6S	1430.25	Depth to Water (FT.)	17.65	17.77	17.55	17.61		18.02	17.07	16.53	18.16	19.37	19.70	19.41	16.83	17.51	15.84	17.43	17.43	17.48	21.63	24.01	21.50
		Static Water Level (FT)	1412.60	1412.48	1412.70	1412.64		1412.23	1413.18	1413.72	1412.09	1410.88	1410.55	1410.84	1413.42	1412.74	1414.41	1412.82	1412.82	1412.77	1408.62	1406.24	1408.75
MW-6D	1430.04	Depth to Water (FT.)	20.70	20.18	19.87	19.88		20.37	19.98	19.05	20.71	21.65	21.51	21.31	19.01	19.98	17.91	19.96	19.87	19.97	23.51	25.09	22.52
		Static Water Level (FT)	1409.34	1409.86	1410.17	1410.16		1409.67	1410.06	1410.99	1409.33	1408.39	1408.53	1408.73	1411.03	1410.06	1412.13	1410.08	1410.17	1410.07	1406.53	1404.95	1407.52
MW-7	1422.84	Depth to Water (FT.)	13.30	13.38	12.88	12.93	12.90	13.25	12.85	12.09	13.80	14.82	14.82	14.64	12.29	13.19	11.08	13.05	12.99	13.21	17.04	18.55	15.88
		Static Water Level (FT)	1409.54	1409.46	1409.96	1409.91	1409.94	1409.59	1409.99	1410.75	1409.04	1408.02	1408.02	1408.20	1410.55	1409.65	1411.76	1409.79	1409.85	1409.63	1405.80	1404.29	1406.96
MW-7D	1423.05	Depth to Water (FT.)																				18.74	16.08
		Static Water Level (FT)																				1404.31	1406.97

TABLE 3-1, CONTD.
WATER LEVEL DATA FOR VDH PLANT 2

LOCATION	MONITORING POINT ELEVATION (FEET)	PARAMETER	27-Mar-90	2-Apr-90	19-Apr-90	24-Apr-90	25-Apr-90	10-May-90	18-May-90	25-May-90	20-Jun-90	17-Jul-90	21-Sep-90	2-Oct-90	1-Nov-90	13-Dec-90	4-Jan-91	7-Feb-91	1-Mar-91	3-Apr-91	18-Jul-91	29-Oct-91	30-Jan-92
MW-8S	1415.71	Depth to Water (FT.)																				11.16	7.38
		Static Water Level (FT)																				1404.55	1408.33
MW-8D	1416.16	Depth to Water (FT.)																				12.27	9.62
		Static Water Level (FT)																				1403.89	1406.54
MW-9	1424.12	Depth to Water (FT.)	13.42	13.47	12.88	12.88		13.17	11.23	11.88	13.50	14.09	14.28	8.87	12.10	12.95	11.00	12.83	12.82	12.93	17.00	18.95	14.50
		Static Water Level (FT)	1410.70	1410.65	1411.24	1411.24		1410.95	1412.89	1412.24	1410.62	1410.03	1409.84	1415.25	1412.02	1411.17	1413.12	1411.29	1411.30	1411.19	1407.12	1405.17	1409.62
MW-10	1422.85	Depth to Water (FT.)	11.35	11.52	11.33	11.33	11.31	11.70	10.89	10.23	12.00	13.27	13.45	13.04	10.35	11.23	9.30	11.10	11.19	11.29	15.42	17.34	14.80
		Static Water Level (FT)	1411.50	1411.33	1411.52	1411.52	1411.54	1411.15	1411.96	1412.62	1410.85	1409.58	1409.40	1409.81	1412.50	1411.62	1413.55	1411.75	1411.66	1411.56	1407.43	1405.51	1408.05
MW-10D	1424.27	Depth to Water (FT.)																				19.41	16.76
		Static Water Level (FT)																				1404.86	1407.51
MW-11S	1430.60	Depth to Water (FT.)																				25.80	23.28
		Static Water Level (FT)																				1404.80	1407.32
MW-12S	1423.25	Depth to Water (FT.)																				17.97	15.20
		Static Water Level (FT)																				1405.28	1408.05
MW-12D	1422.53	Depth to Water (FT.)																				17.72	15.02
		Static Water Level (FT)																				1404.81	1407.51
MW-13S	1429.37	Depth to Water (FT.)																				23.12	20.44
		Static Water Level (FT)																				1406.25	1408.93
MW-13D	1429.57	Depth to Water (FT.)																				24.55	22.00
		Static Water Level (FT)																				1405.02	1407.57
MW-14S	1428.43	Depth to Water (FT.)																				21.63	19.00
		Static Water Level (FT)																				1406.80	1409.43
MW-14D	1428.22	Depth to Water (FT.)																				22.38	19.62
		Static Water Level (FT)																				1405.84	1408.60
MW-15S	1427.89	Depth to Water (FT.)																				25.22	22.66
		Static Water Level (FT)																				1402.67	1405.23
MW-16S	1432.63	Depth to Water (FT.)																				27.70	25.09
		Static Water Level (FT)																				1404.93	1407.54
MW-19	1422.56	Depth to Water (FT.)																				17.91	15.20
		Static Water Level (FT)																				1404.65	1407.36
MW-20	1423.06	Depth to Water (FT.)																				17.61	15.32
		Static Water Level (FT)																				1405.45	1407.74
USGS	1423.75	Depth to Water (FT.)																					15.46
		Static Water Level (FT)																					1408.29



NOTE:
THE SCALE AND LOCATION OF ALL MAP FEATURES WEST OF THE PLANT NO. 1 SITE AND SOUTH OF THE PLANT NO.2 SITE ARE APPROXIMATE. PLANT NO. 1 MONITORING WELL LOCATIONS WITHIN THIS AREA ARE CORRECT.

LEGEND

2S • OFF-SITE OBSERVATION WELLS
• – MONITORING WELLS
1407.00 ▬ GROUND WATER CONTOUR LINE (FT)

GRAPHIC SCALE
200 0 100 200 400 800

TITLE

VAN DER HORST PLANTS NO.1 & NO.2
GROUND WATER CONTOURS FOR
SHALLOW MONITORING WELLS ON
OCTOBER 29, 1991

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FIGURE
3-5

northwest of Johnson Street. The gradient in the shallow wells of this area is not believed to be representative of the overall regional flow direction of the aquifer.

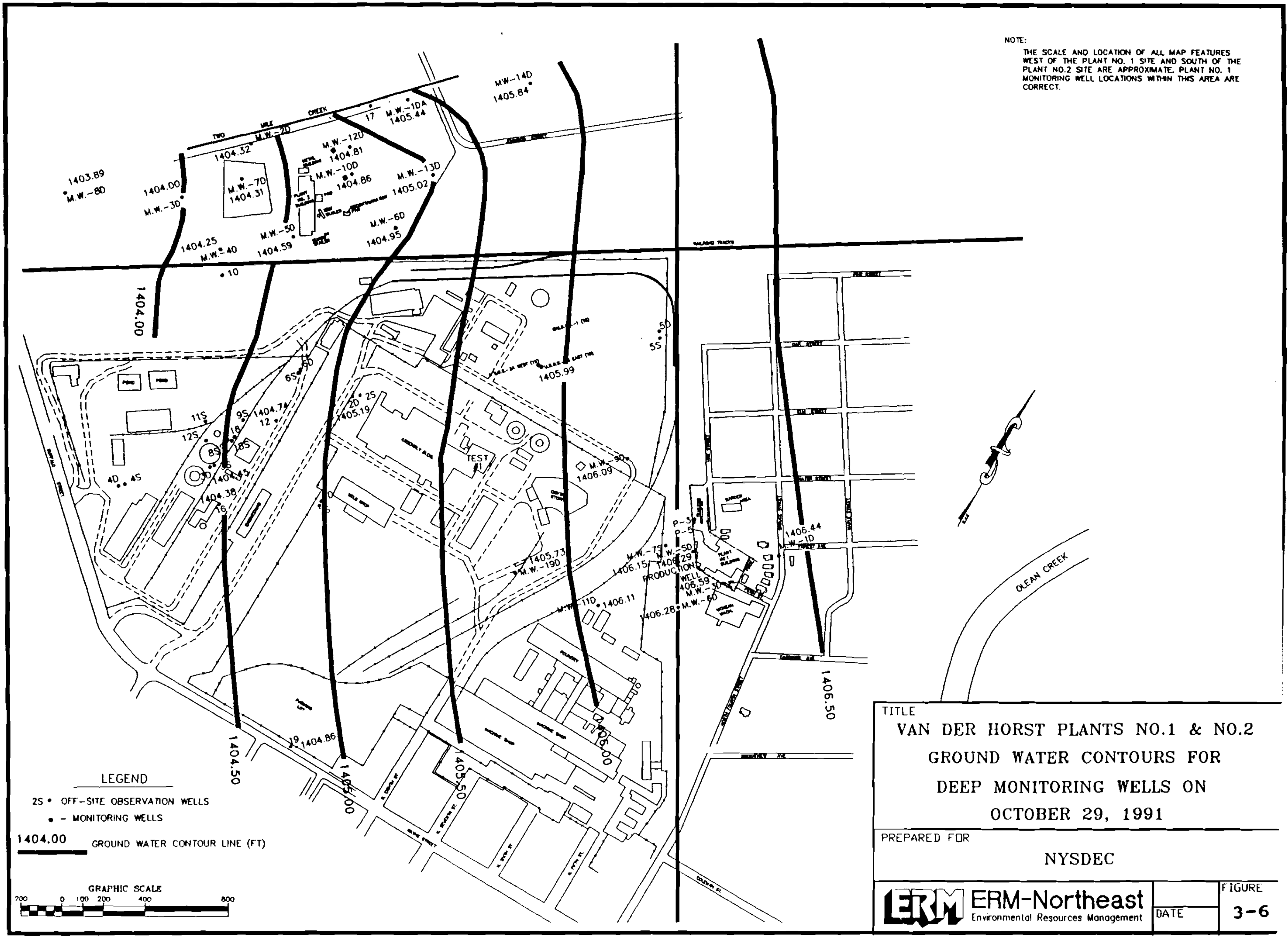
Figure 3-6 presents the regional ground water flow in the deep wells. The flow direction in the deep wells throughout the most of the region surrounding Plants No. 1 and No. 2 is to the southwest. The ground water flow direction in the northeast corner of Plant No. 2 is to the southwest. The hydraulic gradient ranges from 0.0004 at Plant No. 1 to 0.0017 in the southeast corner of Plant No. 2. The direction and magnitude of the hydraulic gradient in the deep monitoring wells is believed to be representative of the predominant flow characteristics of that portion of the aquifer.

3.3.2 Ground Water Flow at Plant 2

Shallow Wells

Water level data were also plotted on the Plant No. 2 base map and used to generate local ground water contour maps. Ground water contours for shallow and deep monitoring wells, generated from water level data obtained on October 29, 1991 are illustrated in Figures 3-7 and 3-8. The contours in these figures are representative of the general pattern of ground

NOTE:
THE SCALE AND LOCATION OF ALL MAP FEATURES WEST OF THE PLANT NO. 1 SITE AND SOUTH OF THE PLANT NO.2 SITE ARE APPROXIMATE. PLANT NO. 1 MONITORING WELL LOCATIONS WITHIN THIS AREA ARE CORRECT.



TITLE
VAN DER HORST PLANTS NO.1 & NO.2
GROUND WATER CONTOURS FOR
DEEP MONITORING WELLS ON
OCTOBER 29, 1991

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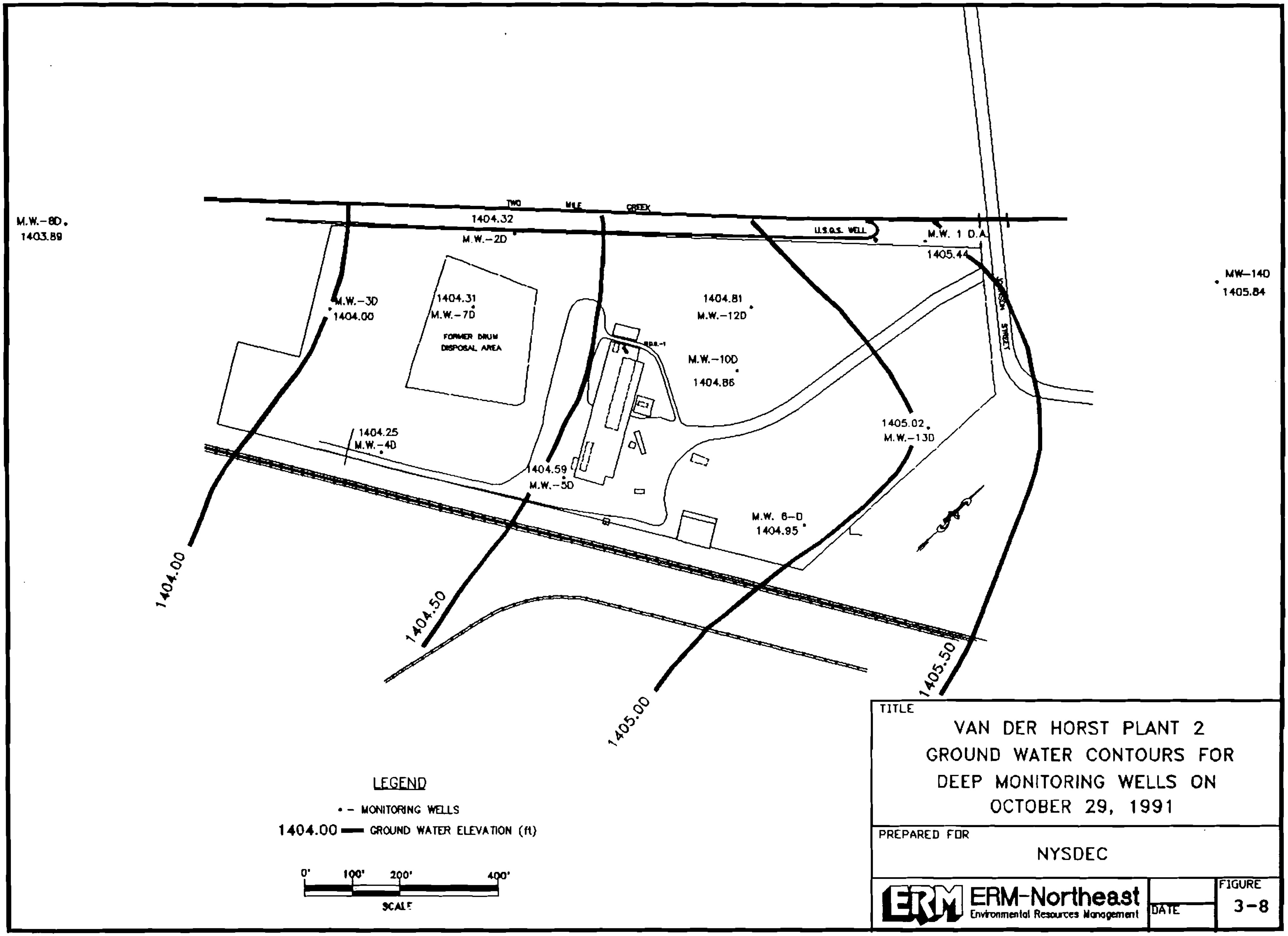
FIGURE 3-6



TITLE

VAN DER HORST PLANT 2
GROUND WATER CONTOURS FOR
DEEP MONITORING WELLS ON
OCTOBER 29, 1991

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FIGURE
3-8

water flow beneath the site. Other ground water contour maps generated for Plant No. 2 are presented in Appendix A.

The general direction of ground water flow in the shallow wells of the upper aquifer is consistently to the west. The average horizontal hydraulic gradient in the shallow wells was 0.0035 and, to date, has ranged from 0.0015 to 0.01.

A depression in the potentiometric surface beneath the Plant No. 2 building at MW-19 appears to occur only in the October 29, 1991 water data. The depression was not observed in the January 30, 1992 data. Further water level readings would be required to substantiate and delineate this feature.

Water level data from shallow monitoring wells MW-1S, MW-8S and MW-15S were not used for the interpretation of ground water flow in the shallow aquifer. MW-1S appeared to be locally confined and not in good hydraulic connection with the remaining wells in the shallow aquifer. Water level fluctuation data indicated that levels in MW-1S did not parallel the other Phase I monitoring wells (see the **Water Level Fluctuation** subsection). Also, a comparison of water level data and the geologic log indicated that the potentiometric surface at MW-1S was above the water-bearing silty-sand. This silty-sand aquifer appeared to be confined by a silty-clay layer, thus, when punctured, the water level within the well rose above the confining unit.

Monitoring well MW-15S water level data were found to be approximately four feet lower than estimated by regional ground water contours. This difference could have resulted from survey error; however, the depth to water in MW-15S is considerably greater than in other shallow wells. A low water level could be produced by an active production well, but no wells were known to be pumping during water level measurements. The actual cause of this deviation is presently unknown.

Water levels from MW-8S do not fit the pattern of ground water observed in the rest of the wells at Plant No. 2. The installation of additional downgradient wells and subsequent ground water level measurements would allow a more accurate use of MW-8S data in the ground water flow interpretation.

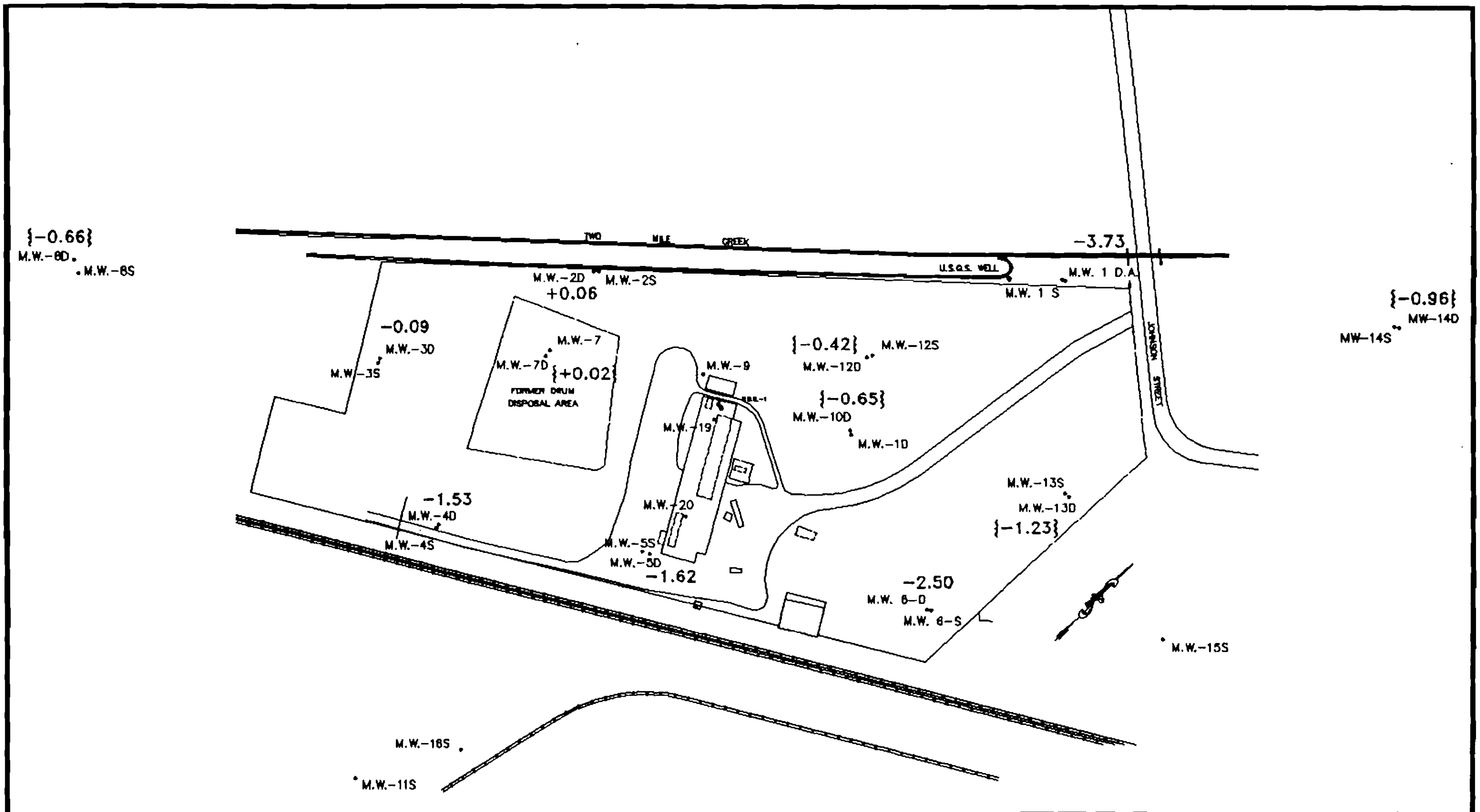
Deep Wells

The typical deep well ground water flow direction was towards the southwest. However, the range of flow directions in the deep wells was from south to west. The average horizontal hydraulic gradient at Plant No. 2 was 0.0013 and fluctuated between 0.0007 and 0.001.

Vertical Gradient

Ground water within the aquifer was also found to have a vertical flow component. The average vertical hydraulic gradient within the aquifer was calculated at each of the shallow and deep well pairs. This calculation was performed by dividing the average water level difference between the well pair by the vertical distance between the bottom of the shallow well sand pack and the top of the deep well sand pack. Average head differences and vertical gradients are shown in Figures 3-9 and 3-10, respectively. Negative values on these figures indicate that the water elevation in the shallow well was higher than the water level in the deep well, hence a downward vertical gradient.

A negative vertical gradient indicates that the ground water has a downward flow component. In other words, as ground water migrates in an aquifer with a negative vertical gradient, the water moves in both a horizontal and a downward direction. The converse is true in an aquifer with an upward vertical gradient.



LEGEND

• - MONITORING WELLS
-0.72 - AVERAGE HEAD DIFFERENCE (ft)
{+0.02} - HEAD DIFFERENCE FOR PHASE II WELLS ON OCTOBER 29, 1991

0' 100' 200' 400'
SCALE

Note: A negative value of head difference indicates that the water elevation in the shallow well was higher than the water elevation in the deep well.

TITLE
VAN DER HORST PLANT 2
AVERAGE HEAD DIFFERENCE
BETWEEN SHALLOW AND
DEEP MONITORING WELLS

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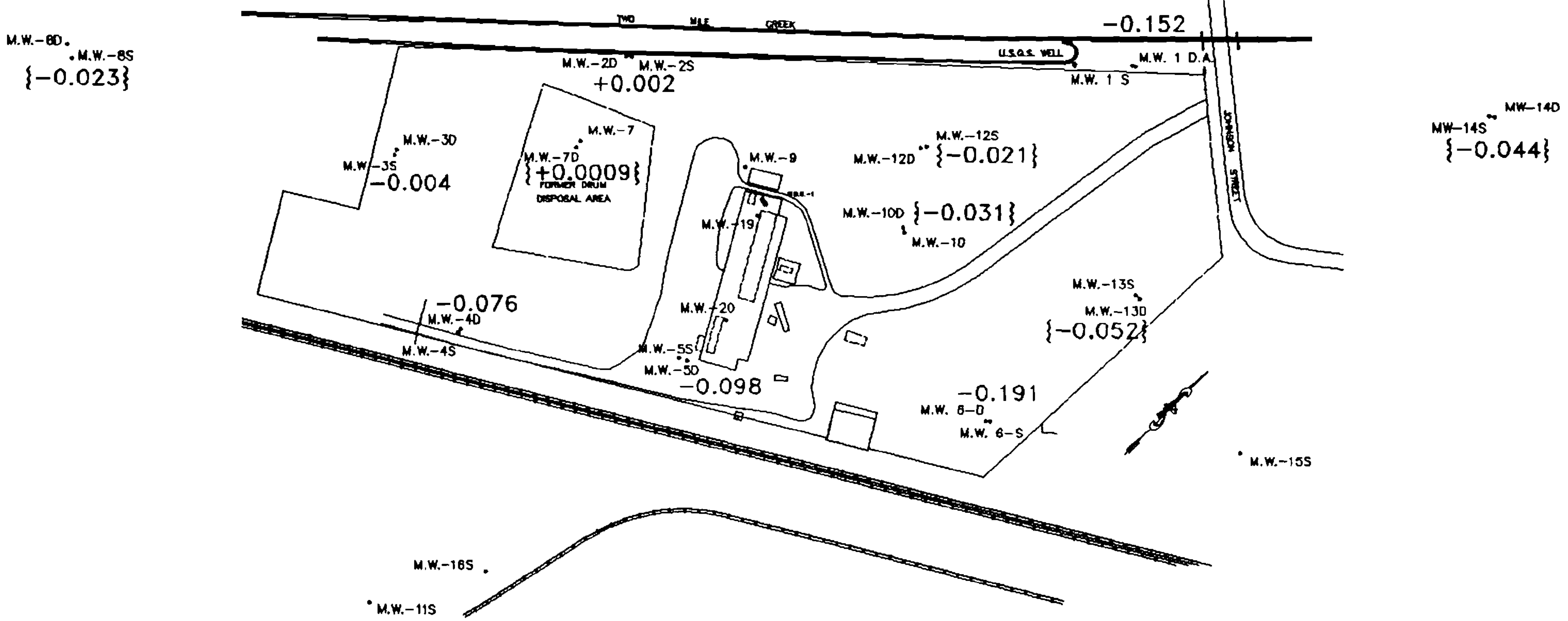
FIGURE
3-9



LEGEND

• - MONITORING WELLS

-0.152 - AVERAGE VERTICAL GRADIENT (ft/ft)

{-0.023} - VERTICAL GRADIENT FOR PHASE II WELLS ON OCTOBER 29, 1991

Note: A negative vertical gradient indicates that the water elevation in the shallow well was higher than the water elevation in the deep well.

0' 100' 200' 400'

SCALE

TITLE

VAN DER HORST PLANT 2 AVERAGE VERTICAL GRADIENT BETWEEN SHALLOW AND DEEP MONITORING WELLS

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FIGURE
3-10

The vertical gradient generally increased towards the east, except at monitoring well MW-1S. The magnitude of the vertical gradient over most of the site indicated that there was hydraulic separation between the shallow and deep aquifers.

A relatively small vertical gradient was observed at monitoring well pairs MW-2S and MW-2D; MW-3S and MW-3D; and MW-7 and MW-7D. This low vertical gradient implied that there was good hydraulic connection between the deep and shallow monitoring wells at these locations. The aquifer in this region was believed to act as a single, unconfined unit. The silty-sand layers detected in MW-2D and MW-3D did not appear to function as confining layers for the deep aquifer. The vertical component of ground water flow within this unconfined portion of the aquifer appeared to be negligible.

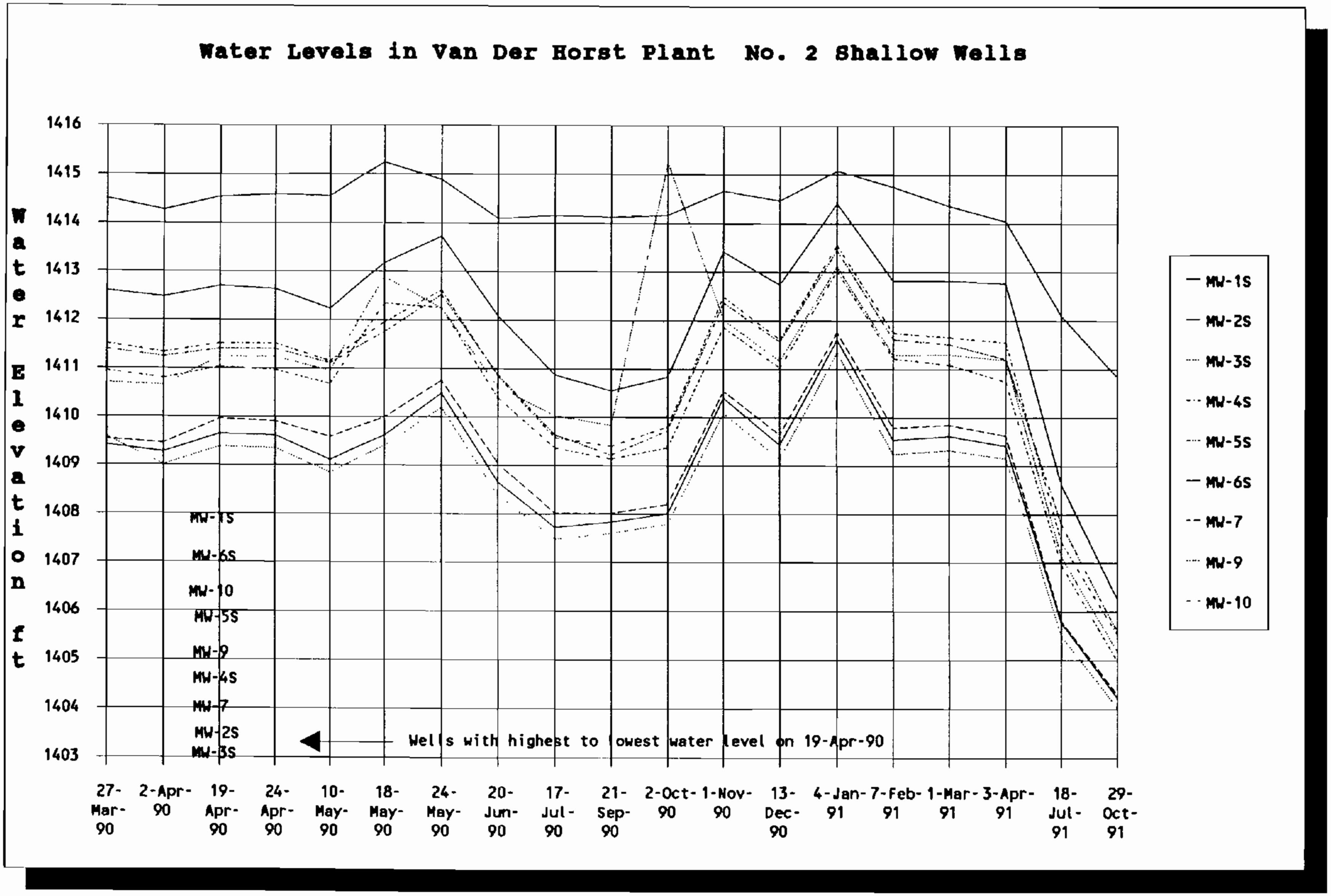
Water Level Fluctuation

During the course of the RI, there were significant fluctuations in the water levels observed in the monitoring wells. These fluctuations are believed to be seasonal rising and falling trends of the aquifer, which are in response to variations in precipitation and above freezing temperatures in the winter. The highest ground water levels measured during the study occurred in January 1991. Accumulated snow melted during this month due to above freezing temperatures. Relatively low water levels have been recorded during winter months when the temperature has been below freezing. The lowest water levels were measured in October 1991, which was a month of little precipitation. The average water level difference between these two dates (excluding MW-1S) was approximately 7.61 feet.

The depth of ground water below ground level, in Phase I wells, has been measured as shallow as 7.18 feet in MW-1S and as deep as 22.55 feet in MW-4. The deepest water level observed in Phase II monitoring wells was 25.19 in MW-15S during the October 1991 round of measurement. Some of this variation in depth to water is a function of the east (MW-1S) to west (MW-4S) direction of flow in the aquifer.

Water level measurements in monitoring well MW-1S indicate that the shallow aquifer in this area is not under the same hydraulic conditions found at other areas on, or surrounding the Plant No. 2 site. Figure 3-11 illustrates that MW-1S water level fluctuations do not directly parallel levels recorded in other shallow wells. The difference between the highest and lowest levels in MW-1S is 4.24 ft, compared to an average difference of 7.61 ft in the other

Figure 3-11


Water Levels in Van Der Horst Plant No. 2 Shallow Wells
Water Elevation ft
1416
1415
1414
1413
1412
1411
1410
1409
1408
1407
1406
1405
1404
1403
27-Mar-90
2-Apr-90
19-Apr-90
24-Apr-90
10-May-90
18-May-90
24-May-90
20-Jun-90
17-Jul-90
21-Sep-90
2-Oct-90
1-Nov-90
13-Dec-90
4-Jan-91
7-Feb-91
1-Mar-91
3-Apr-91
18-Jul-91
29-Oct-91
MW-1S
MW-2S
MW-3S
MW-4S
MW-5S
MW-6S
MW-7
MW-9
MW-10
MW-1S
MW-6S
MW-10
MW-5S
MW-9
MW-4S
MW-7
MW-2S
MW-3S
Wells with highest to lowest water level on 19-Apr-90

Phase I wells. The smaller difference in the highest and lowest levels in MW-1S may result from the locally confining conditions present in the shallow aquifer at this well.

Monitoring wells MW-9 and MW-4S were also found to occasionally deviate from the trend of the other shallow wells. However, during most measurement rounds the water levels in MW-9 and MW-4S parallelled the other shallow wells. Presently there is no explanation of the occasional water level deviation in MW-9 and MW-4S.

Water level measurements in deep monitoring wells are presented in Figure 3-12. All Phase I deep wells parallel each other, except for the April 2, 1990 measurement in MW-4D.

Figure 3-13 presents a combined view of water levels for shallow and deep monitoring wells. This figure shows the nearly identical water level patterns in both shallow and deep monitoring wells.

3.4 Phase I and II Slug Testing at Plant No. 2

Slug tests were performed in all Phase I and II monitoring wells to estimate the hydraulic conductivity of the aquifer material surrounding the well screen. Water level fluctuations

Figure 3-12

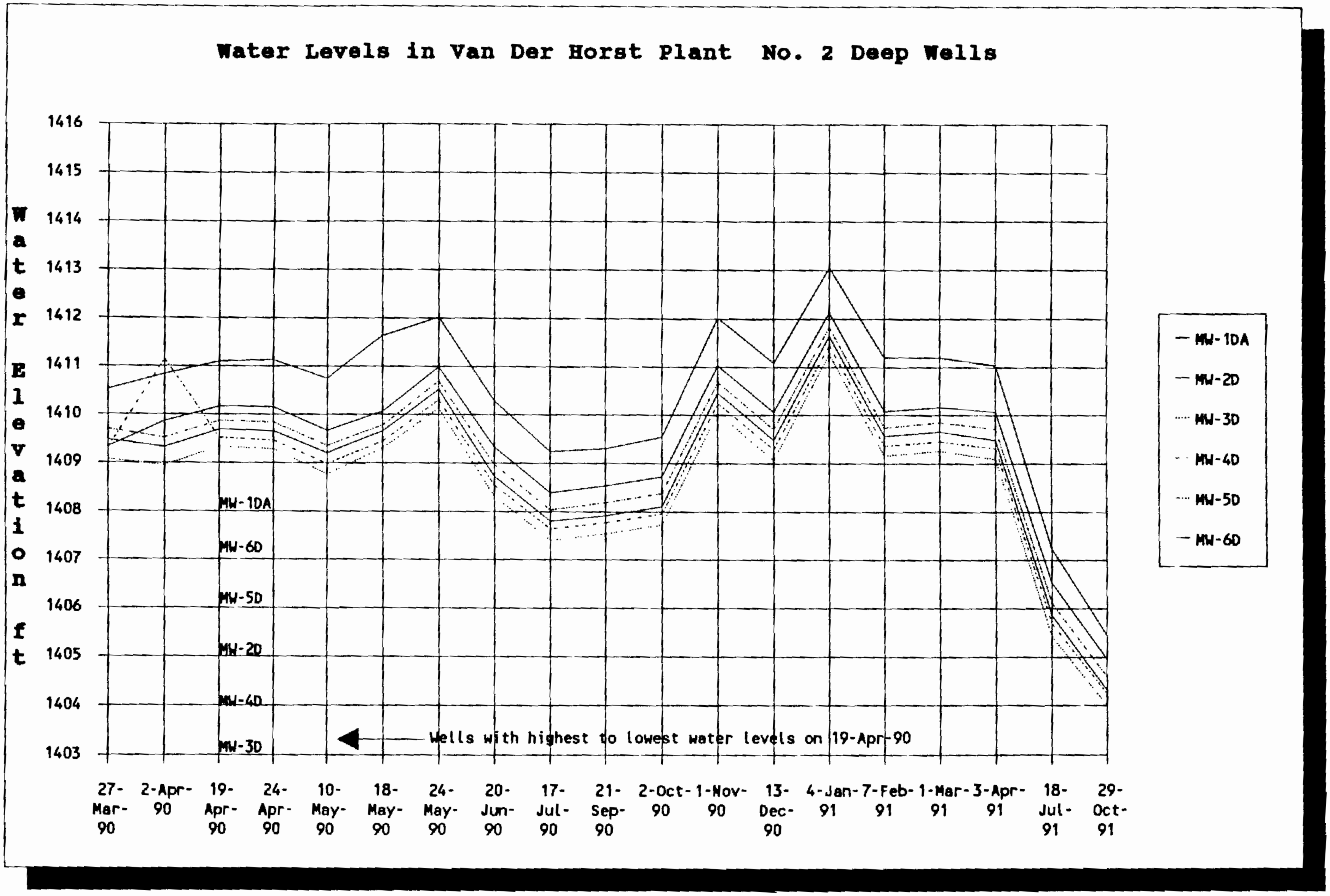
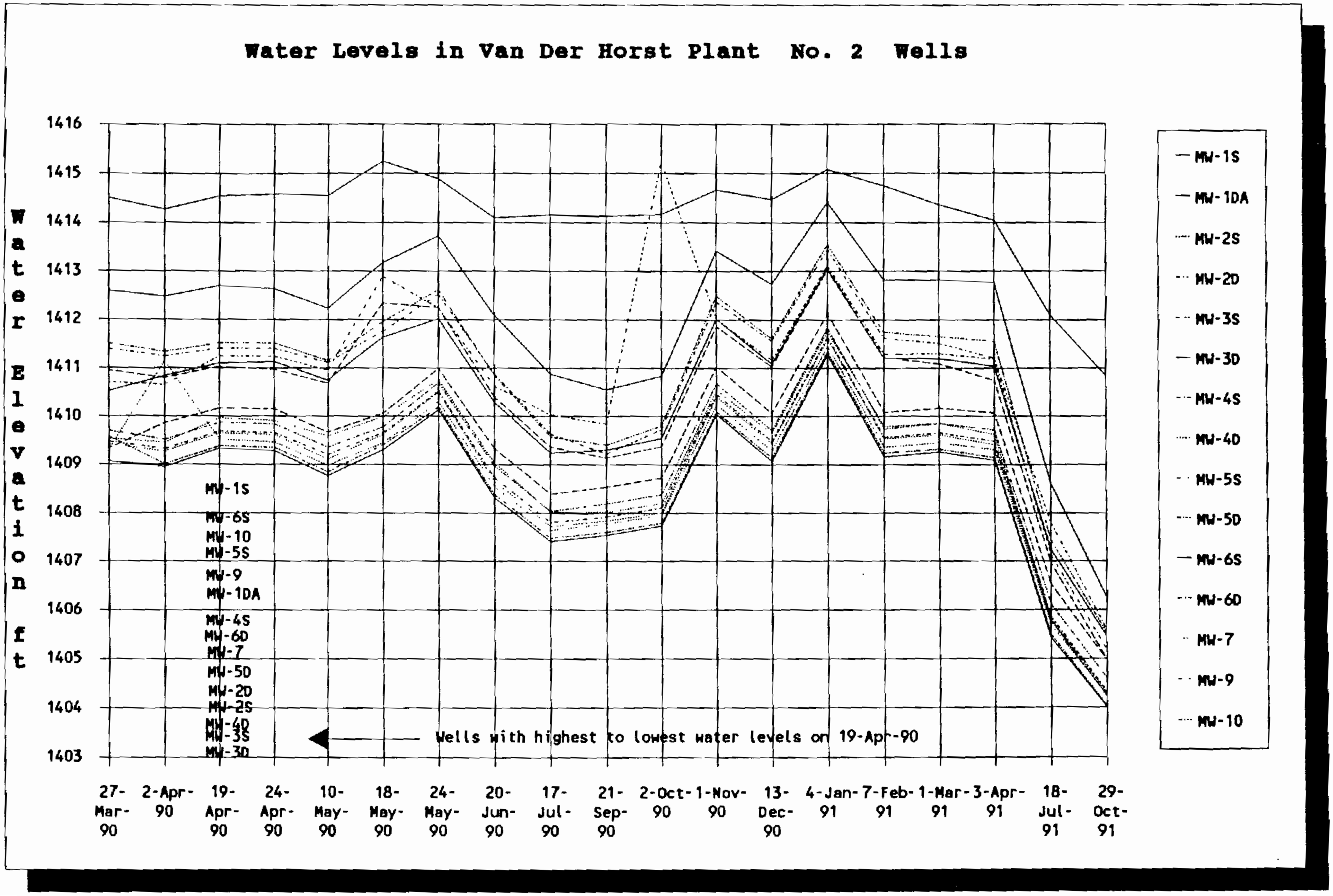

Water Levels in Van Der Horst Plant No. 2 Deep Wells
Water Elevation ft
1416
1415
1414
1413
1412
1411
1410
1409
1408
1407
1406
1405
1404
1403
27-Mar-90
2-Apr-90
19-Apr-90
24-Apr-90
10-May-90
18-May-90
24-May-90
20-Jun-90
17-Jul-90
21-Sep-90
2-Oct-90
1-Nov-90
13-Dec-90
4-Jan-91
7-Feb-91
1-Mar-91
3-Apr-91
18-Jul-91
29-Oct-91
MW-1DA
MW-6D
MW-5D
MW-2D
MW-4D
MW-3D
Wells with highest to lowest water levels on 19-Apr-90
MW-1DA
MW-2D
MW-3D
MW-4D
MW-5D
MW-6D

Figure 3-13


Water Levels in Van Der Horst Plant No. 2 Wells

within the well were initiated by rapidly introducing a solid PVC slug into the water column and measuring the rate that the displaced well water fell and returned to equilibrium (falling head). The second step of the test was to remove the PVC slug and measure the rate at which the water level rose and returned to equilibrium (rising head). The induced water level changes were recorded with an In-Situ Data Logger, Model SE-1000B in combination with a 15-psi pressure transducer. A summary of the slug test results is presented in Table 3-2.

Phase I and II slug test data were analyzed and plotted using the AQTESOLV™ program. The Bouwer and Rice slug test evaluation method (1976) was used in AQTESOLV™ since all of the monitoring wells partially penetrate the aquifer. Phase II slug test data, computer plots and AQTESOLV™ data analysis equations are included in Section D of the Field Data volume. Phase I slug test data can be found in Appendix E of the of the Van Der Horst Plant No. 2 Phase I RI/FS.

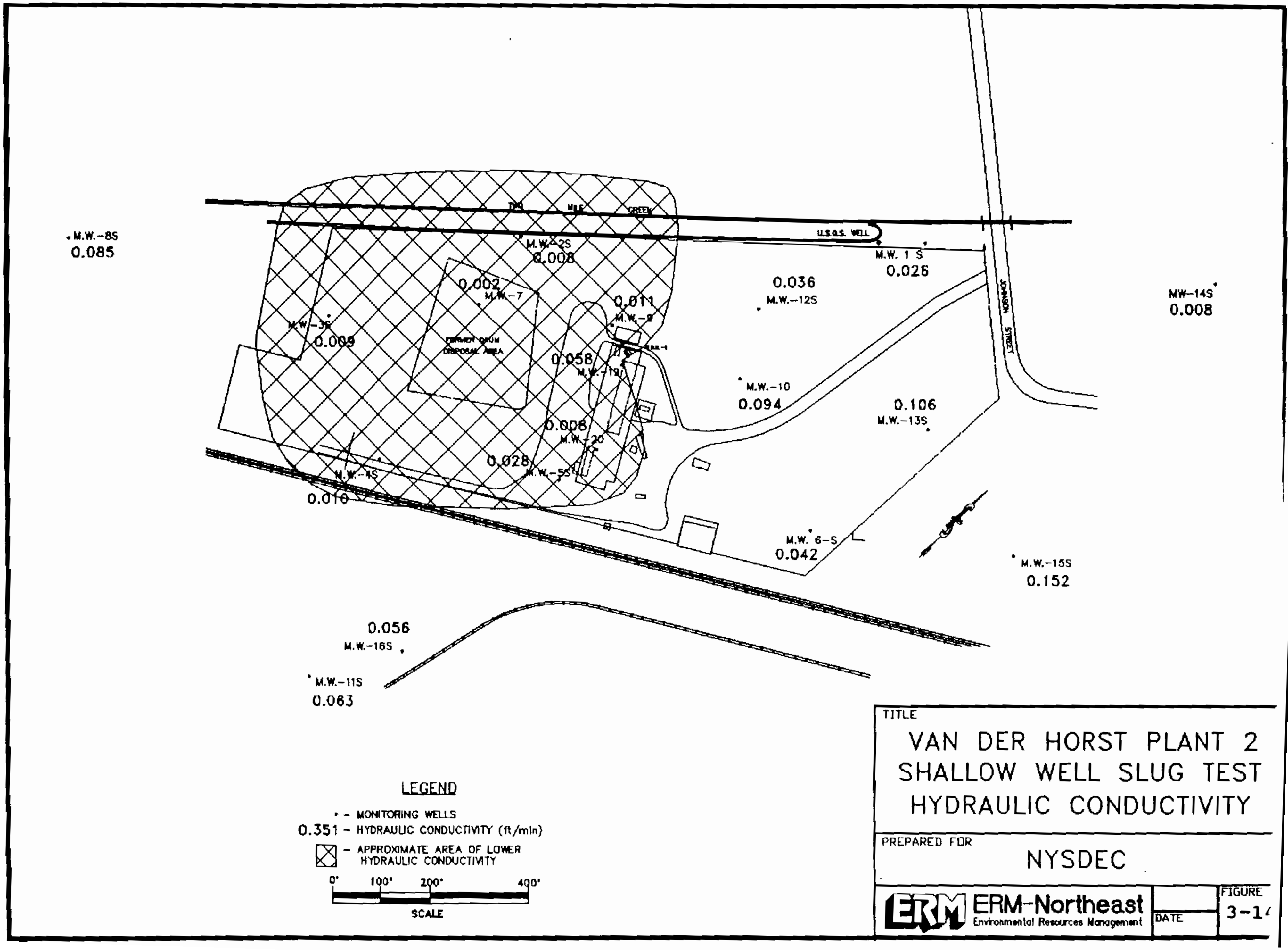
A map of the average hydraulic conductivities from slug test analysis is illustrated for the shallow and deep wells in Figures 3-14 and 3-15. The hydraulic conductivity of the shallow aquifer beneath and west of the Plant No. 2 building is approximately 10 times less than beneath the rest of the site. Hydraulic

Table 3-2

Slug Test Hydraulic Conductivity for Plant No. 2 Wells

Monitoring Well	Falling Head Hydraulic Conductivity (ft/min)	Rising Head Hydraulic Conductivity (ft/min)	Average Hydraulic Conductivity (ft/min)
MW-1S	0.017	0.035	0.026
MW-1DA	0.028	0.024	0.026
MW-2S	0.006	0.009	0.008
MW-2D	0.027	0.027	0.027
MW-3S	0.007	0.012	0.009
MW-3D	0.043	0.304	0.173
MW-4S	0.008	0.013	0.01
MW-4D	0.012	0.015	0.013
MW-5S	0.037	0.018	0.028
MW-5D	0.555	0.147	0.351
MW-6S	0.064	0.02	0.042
MW-6D	0.088	0.18	0.134
MW-7S	0.002	0.002	0.002
MW-7D	0.023	0.022	0.022
MW-8S	0.088	0.083	0.085
MW-8D	0.099	0.144	0.122
MW-9S	0.01	0.012	0.011
MW-10S	0.088	0.099	0.094
MW-10D	0.124	0.107	0.115
MW-11S	0.054	0.072	0.063
MW-12S	0.033	0.04	0.036
MW-12D	0.208	0.075	0.142
MW-13S	0.091	0.121	0.106
MW-13D	0.11	0.255	0.183
MW-14S	0.008	0.008	0.008
MW-14D	0.153	0.159	0.156
MW-15S	0.126	0.179	0.152
MW-16S	0.036	0.076	0.056
MW-19	0.075	0.04	0.058
MW-20	0.006	0.01	0.008

	(ft/min)
Average Shallow Well Hydraulic Conductivity =	0.045
Average Deep Well Hydraulic Conductivity =	0.122



LEGEND

• - MONITORING WELLS
0.351 - HYDRAULIC CONDUCTIVITY (ft/min)
☒ - APPROXIMATE AREA OF LOWER HYDRAULIC CONDUCTIVITY

TITLE
VAN DER HORST PLANT 2
SHALLOW WELL SLUG TEST
HYDRAULIC CONDUCTIVITY

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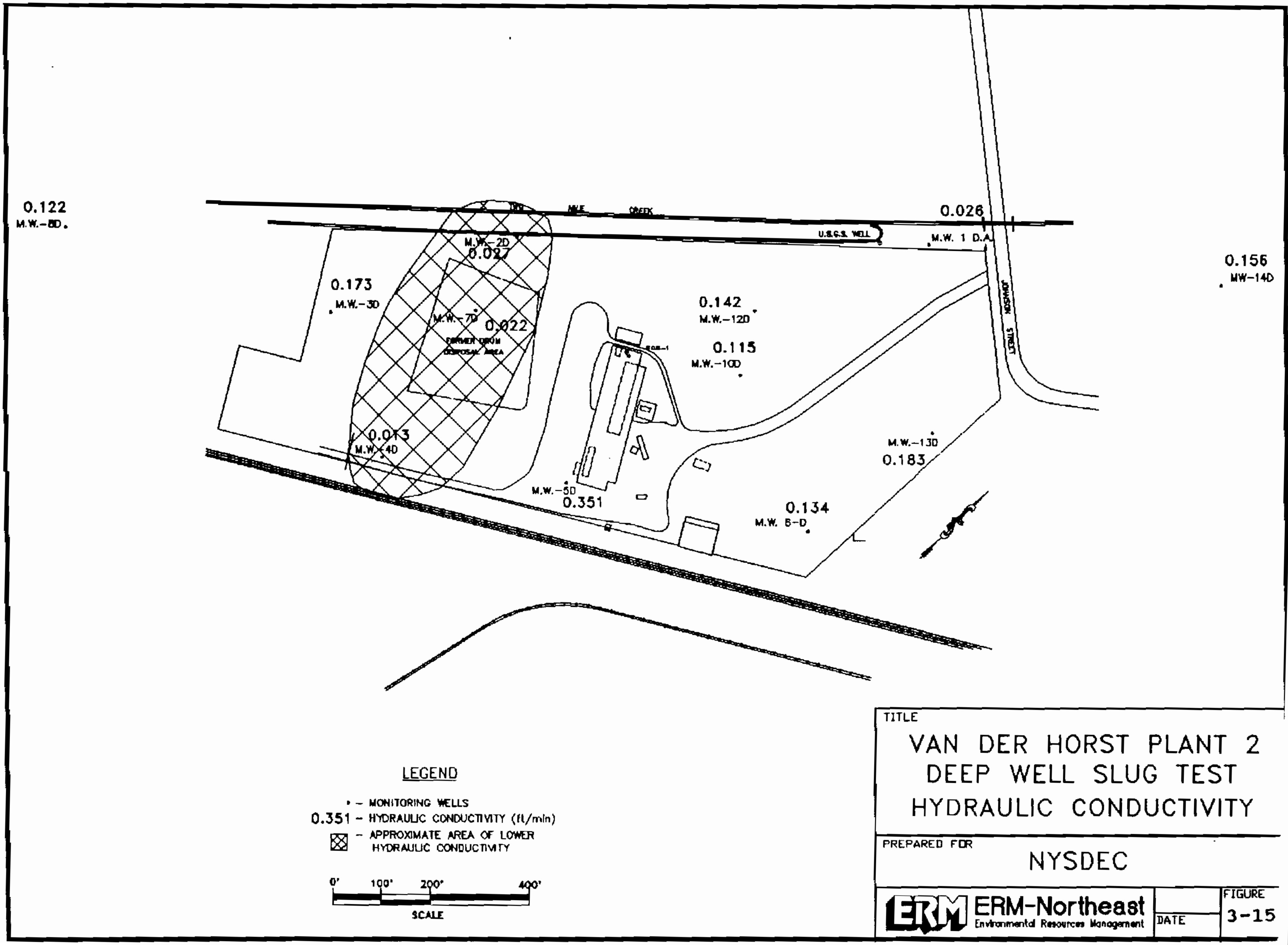
FIGURE
3-1



TITLE

VAN DER HORST PLANT 2
DEEP WELL SLUG TEST
HYDRAULIC CONDUCTIVITY

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FIGURE
3-15

conductivity also tends to increase towards the southwest. Monitoring wells MW-19 and MW-1S are exceptions to these trends. The range of shallow aquifer hydraulic conductivity is 0.0002 to 0.152 ft/min and the average is 0.045 ft/min.

In the deep aquifer there is an area west of the Plant No. 2 building which had a hydraulic conductivity approximately 5 to 10 times less than the rest of the aquifer beneath the site. The hydraulic conductivity range in the deep aquifer was 0.013 to 0.351 ft/min and the average was 0.122.

3.5 Ground Water Recovery Well Simulation

3.5.1 Purpose and Goals

The purpose of recovery well simulation was to provide a rough estimate of the well system necessary to capture contaminated ground water beneath and downgradient of the Plant No. 2 site. These data provided approximate information for the following components of the recovery well system:

- Number of pumping wells
- Pumping rate for each well
- Well locations
- Recovery well system ground water capture area

3.5.2 Procedure

Prior to recovery well simulation, a review of slug test, ground water elevation, and geologic cross-section data was conducted for Plant No. 2. Information from previous hydrogeologic studies was also examined, when appropriate. These data were evaluated to develop a conceptual hydrogeologic model of the site. Assumptions of the conceptual model and deviations from actual aquifer conditions are presented in Section 3.5.3.

Following development of the conceptual model, single well pumping test simulations were run using the Walton analytical model PT1 (ref). Each simulation was run for a duration of 1 year, and incorporated the parameters from the conceptual model.

The Walton analytical model results were used to estimate well discharges and locations for the recovery well system. These data also enabled an appropriate grid size and model area to be selected for the numerical ground water flow modeling.

After completion of the Walton model runs, conceptual model data were input into the numerical flow model MODFLOW.

MODFLOW was utilized to simulate the drawdown from multiple recovery wells. The modelled area consisted of a 2500 ft square grid surrounded by constant head boundaries. Each grid node was 50 ft by 50 ft. Recovery wells were assigned to the nearest appropriate grid location in the model.

No model calibration was performed, since the purpose of modeling was to only determine the general drawdown pattern of multiple recovery wells. A single recovery well simulation was conducted in order to compare MODFLOW drawdown data with the Walton model results. Consequently, it is recommended (see Section 7.2.2) that a detailed pumping test be performed at Plant No. 2 prior to performing any remedial designs of the waste-water treatment system.

The MODFLOW drawdown data were used to estimate the recovery well capture area for Plant No. 2. Drawdown data were first contoured with the Golden Graphics TOPO™ program. Next, the drawdown contours were overlain on shallow aquifer ground water contours from October 29, 1991 water level data. The recovery well drawdown data were subtracted from the ground water elevation data at points where the two sets of contour lines intersected. Finally, the resultant elevation data (ground water elevation minus drawdown) were contoured to obtain the estimated ground water elevations during recovery well pumping. The area of ground water capture was based on the resultant ground water elevation contour data.

3.5.3 Assumptions

The following assumptions were made about the shallow aquifer parameters at Van Der Horst Plant No. 2 for the Walton and MODFLOW models:

Parameter	Value/Type
Aquifer Type	Unconfined
Aquifer Material	Homogeneous
Aquifer Base	Impermeable
Aquifer Thickness	60 ft
Aquifer Recharge	0 (No Recharge)
Hydraulic Gradient	0 (Flat)
Hydraulic Conductivity	0.01 ft/min
Storativity	0.015
Specific Yield	0.20

These aquifer parameter values were based on best available data or modeling constraint requirements. The remainder of this section will discuss the known and potential deviations between the actual shallow aquifer conditions and parameters assumed in the models. Potential drawdown differences resulting from these deviations will also be addressed.

Aquifer Base

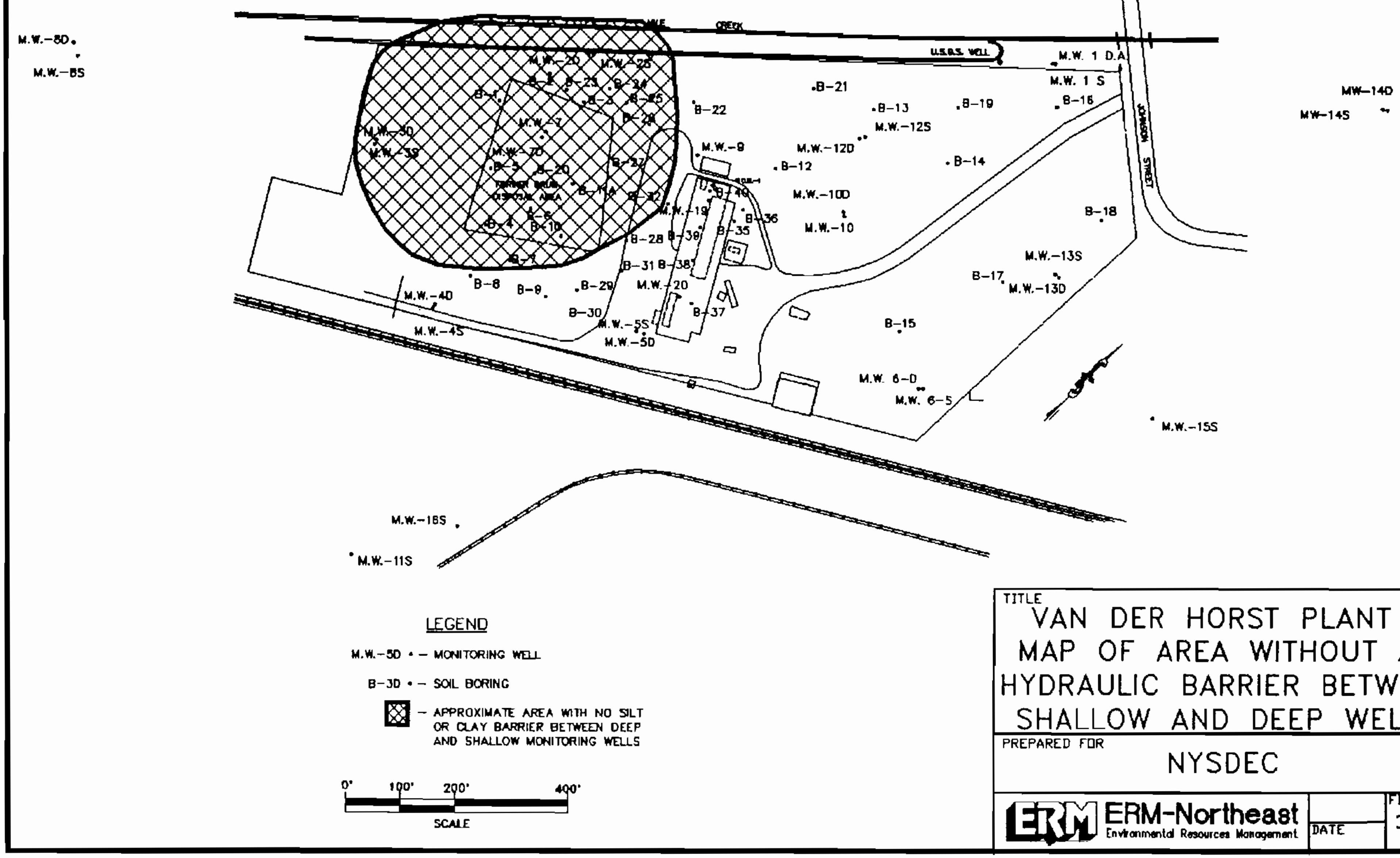
Two hydraulic settings appear to be present in the aquifer at Plant No. 2. Beneath most of the Plant No. 2 site the shallow aquifer is hydraulically separated from the deep aquifer by a silty or clayey unit of lower hydraulic conductivity than the two aquifers. This unit forms the base of the shallow aquifer.

West of the Plant No. 2 building there is no hydraulic barrier between the deep and shallow monitoring wells (see Figure 3-16). In this area ground water occurs as one unconfined aquifer.

Most of the chromium contamination in ground water at Plant No. 2 has migrated within the portion of the aquifer with no hydraulic separation between the shallow and deep wells (see Figure 3-17). For this reason, the Walton and MODFLOW models assume that the aquifer is unconfined and that the aquifer base is the Devonian shale and siltstone.

Aquifer Thickness

The saturated thickness of the aquifer at Plant No. 2 was assumed to be approximately 60 ft for ground water modeling



TITLE

VAN DER HORST PLANT 2 MAP OF AREA WITHOUT AN HYDRAULIC BARRIER BETWEEN SHALLOW AND DEEP WELLS

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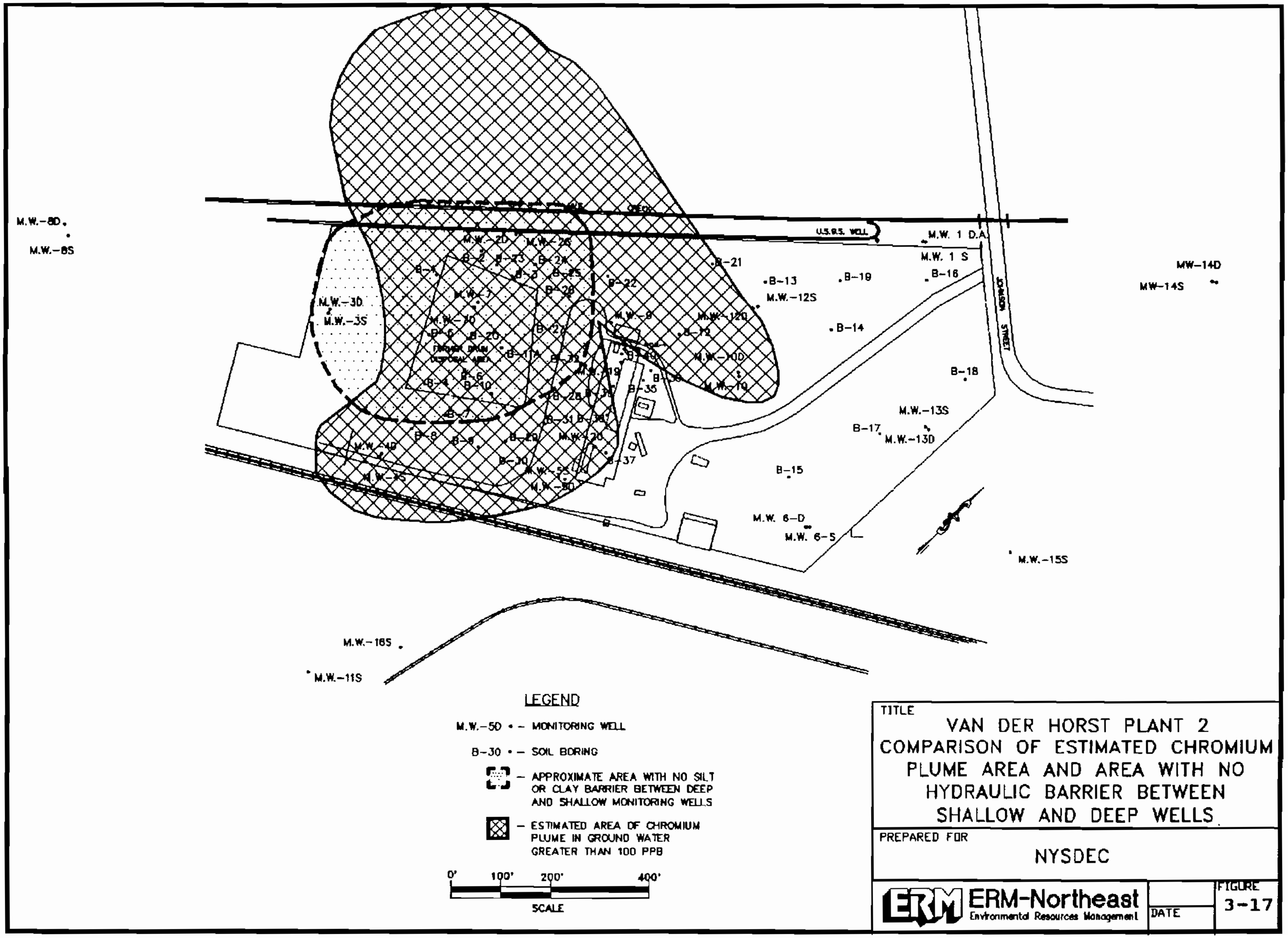
FIGURE
3-16



TITLE

VAN DER HORST PLANT 2
COMPARISON OF ESTIMATED CHROMIUM
PLUME AREA AND AREA WITH NO
HYDRAULIC BARRIER BETWEEN
SHALLOW AND DEEP WELLS

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FIGURE 3-17

purposes. This estimate is based on the assumption that the shale and siltstone aquifer base lies at a depth of 80 ft. No on-site wells have been drilled to this depth, however USGS data have been used to make this estimate. If the actual saturated thickness is greater than 60 ft the capture area will decrease, if less than 60 ft the capture area will increase. The shallow aquifer thickness ranges from 14 to 25 ft in regions where the hydraulic barrier is present.

Aquifer Recharge

Aquifer recharge from surface infiltration is believed to occur throughout the entire site. The primary sources of recharge are considered to be rainwater, snowmelt and Two Mile Creek. No recharge was incorporated into the MODFLOW model because the model was not calibrated. Aquifer recharge would decrease the capture area of the recovery wells. Thus, it is recommended that a post ROD and pre-remedial design pumping test and calibrated modeling effort be performed.

Hydraulic Gradient

A flat water table with no hydraulic gradient was assumed for the Walton and MODFLOW model simulations. This condition was used for MODFLOW for two reasons. First, the model was not calibrated to non-pumping flow conditions. Secondly, the model was only used to provide an estimate of recovery well drawdown. All water level changes in the model resulted from recovery well pumping, rather than from ground water flow during non-pumping conditions. A sloping water table would reduce the downgradient capture area and increase the upgradient capture area.

Hydraulic Conductivity

Slug test results may not have yielded a representative value of average hydraulic conductivity for the shallow aquifer at Plant No. 2. Slug test data are generally less representative of highly conductive aquifers than of moderately conductive aquifers. For example, the average hydraulic conductivity calculated from slug test data at Plant No. 1 was 0.2 ft/min, whereas the average hydraulic conductivity from the pumping test was 2.8 ft/min.

The slug test procedure does not always provide sufficient stress on highly conductive aquifers to yield representative results. Pumping tests are a better method to estimate the hydraulic conductivity in a highly conductive aquifer. If the aquifer surrounding the shallow monitoring wells has a higher hydraulic conductivity than the assumed value of 0.01 ft/min, the ground water capture area would be smaller.

Aquifer Heterogeneity

Aquifer heterogeneity may also effect the size of the estimated recovery well capture area. Deeper portions of the aquifer are more hydraulically conductive than the aquifer surrounding the shallow monitoring wells. Since ground water contamination was primarily found in the shallow monitoring wells, the recovery wells would be screened within the same interval as the shallow wells. During pumping, ground water from the deeper portions of the aquifer would move upward to replenish some of the water from the shallow aquifer. This process would decrease the size of the capture area.

3.5.4 Results

Single Pumping Well Simulations

The Walton model was used to simulate drawdown for single wells, pumping for 1 year, at discharges of 5, 10, 15, 20 and 25 gpm. The optimum discharge for recovery well purposes appeared to be 25 gpm, based on previously defined aquifer parameters.

A simulation of a single well, 1-year pumping test, at 25 gpm was also run with the MODFLOW model. A drawdown comparison for the two simulations is presented in Figure 3-18. The two models yielded fairly similar results, Although the Walton model predicted greater drawdown. Most of the differences in drawdown can be attributed to MODFLOW numerical modeling parameters (ie. size of grid nodes and constant head grid boundaries). MODFLOW and Walton model output data are presented in Appendix B.

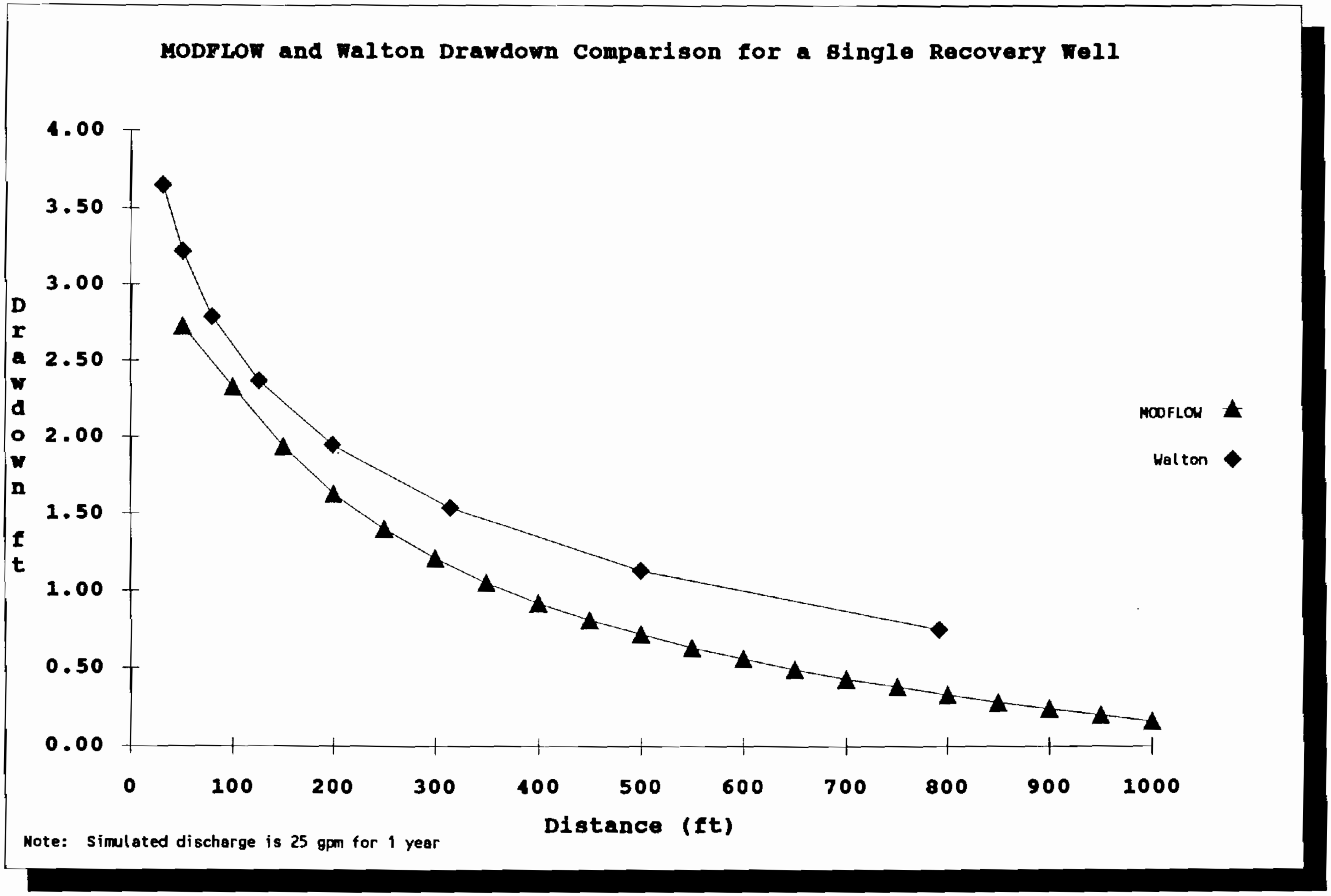
Three Recovery Well Simulation

Following the single pumping well simulations, MODFLOW was used to model a three-well recovery system. Each of the three wells was pumping at a rate of 25 gpm for a period of one year. Model output data are also located in Appendix B.

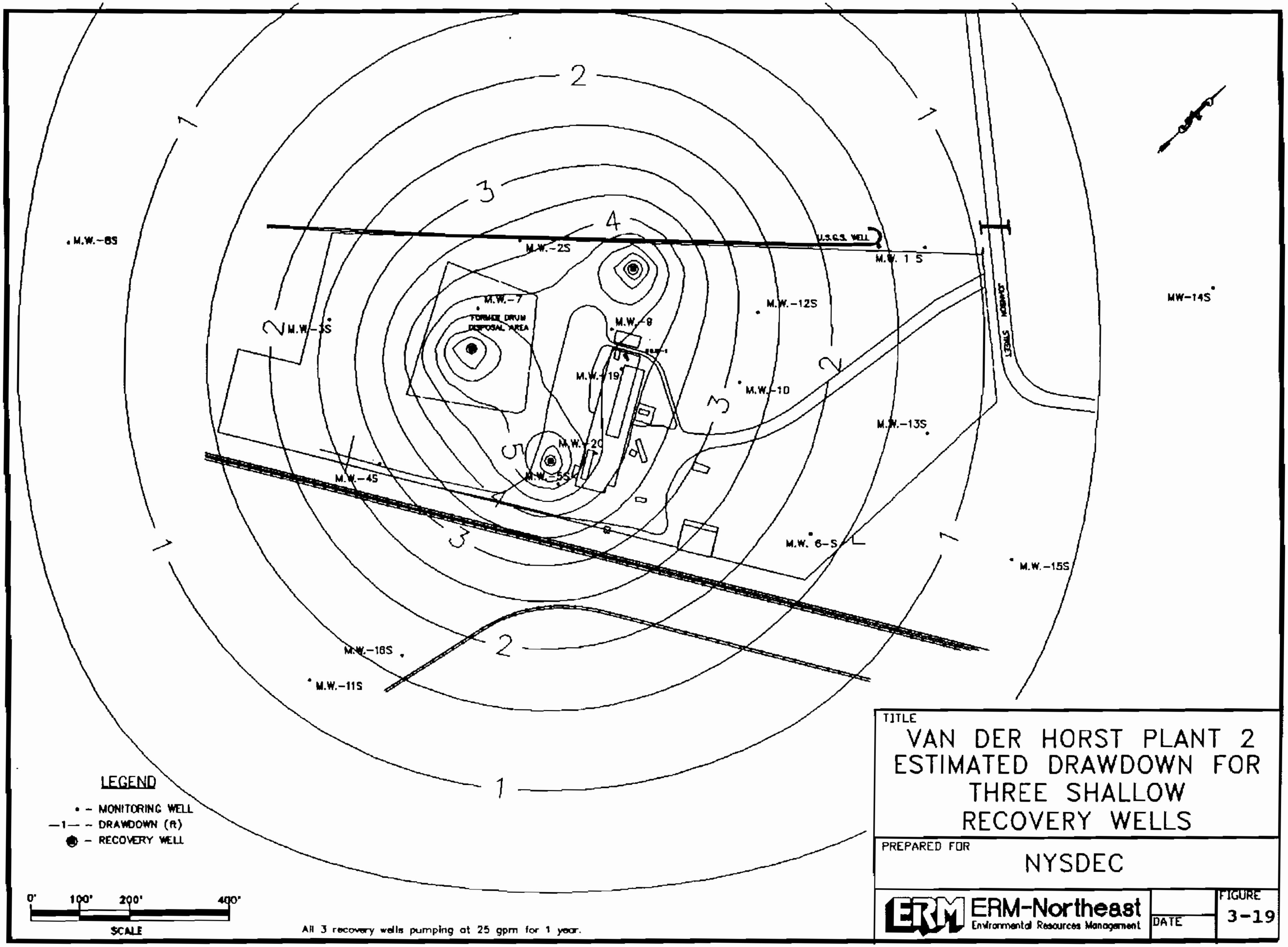
Figure 3-19 illustrates the three recovery well locations and predicted drawdown for one year of pumping. The 0.5-foot drawdown contour encircles the site at approximately 1100 ft from the geometric center of the three recovery wells.

The predicted ground water capture area of the three-well recovery system and the non-pumping, shallow aquifer, ground water contours on October 29, 1991 are shown in Figure 3-20.

Figure 3-18


MODFLOW and Walton Drawdown Comparison for a Single Recovery Well

Note: Simulated discharge is 25 gpm for 1 year



All 3 recovery wells pumping at 25 gpm for 1 year.

TITLE
VAN DER HORST PLANT 2
ESTIMATED DRAWDOWN FOR
THREE SHALLOW
RECOVERY WELLS

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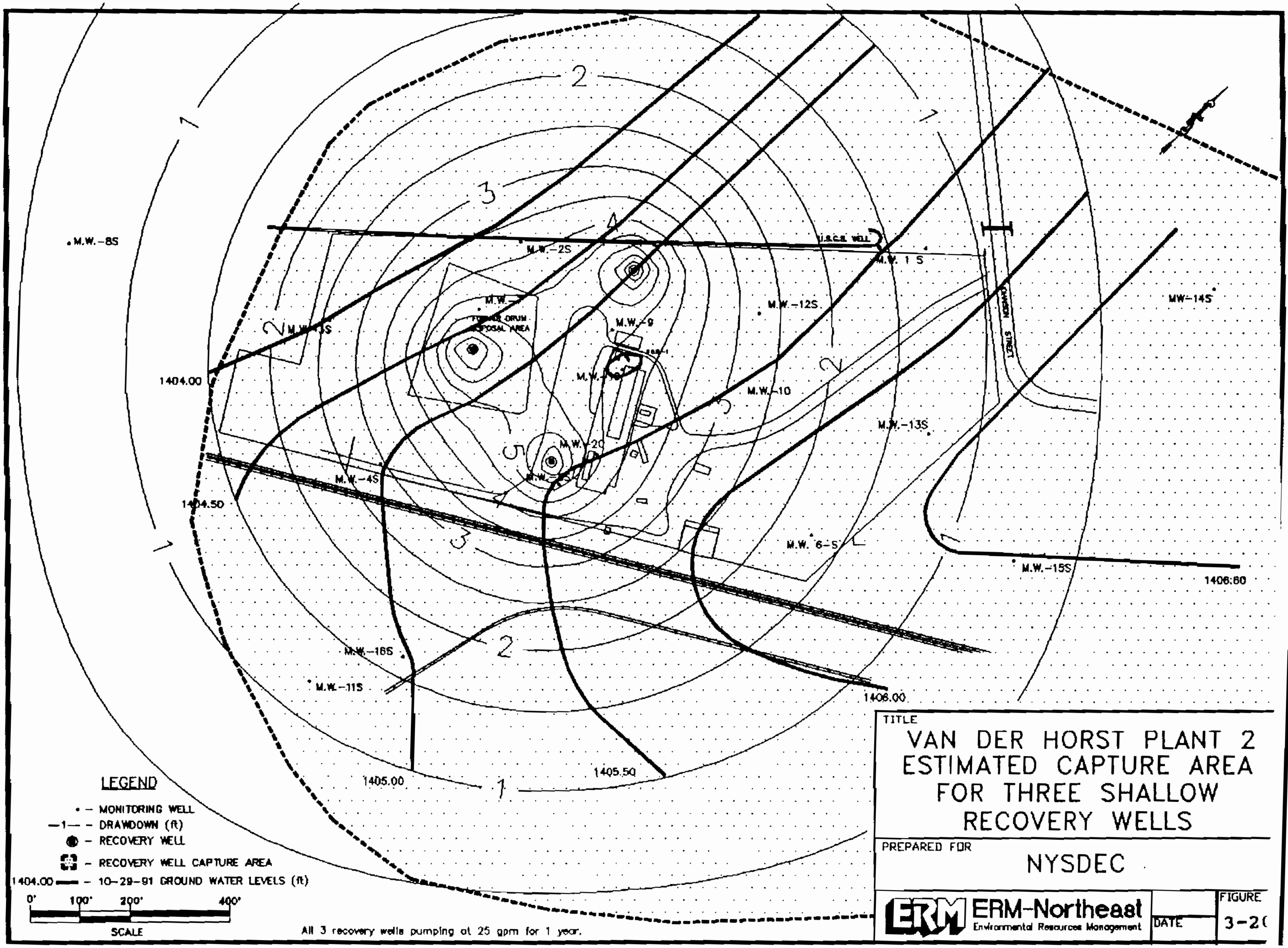
FIGURE
3-19



All 3 recovery wells pumping at 25 gpm for 1 year.

TITLE
VAN DER HORST PLANT 2
ESTIMATED CAPTURE AREA
FOR THREE SHALLOW
RECOVERY WELLS

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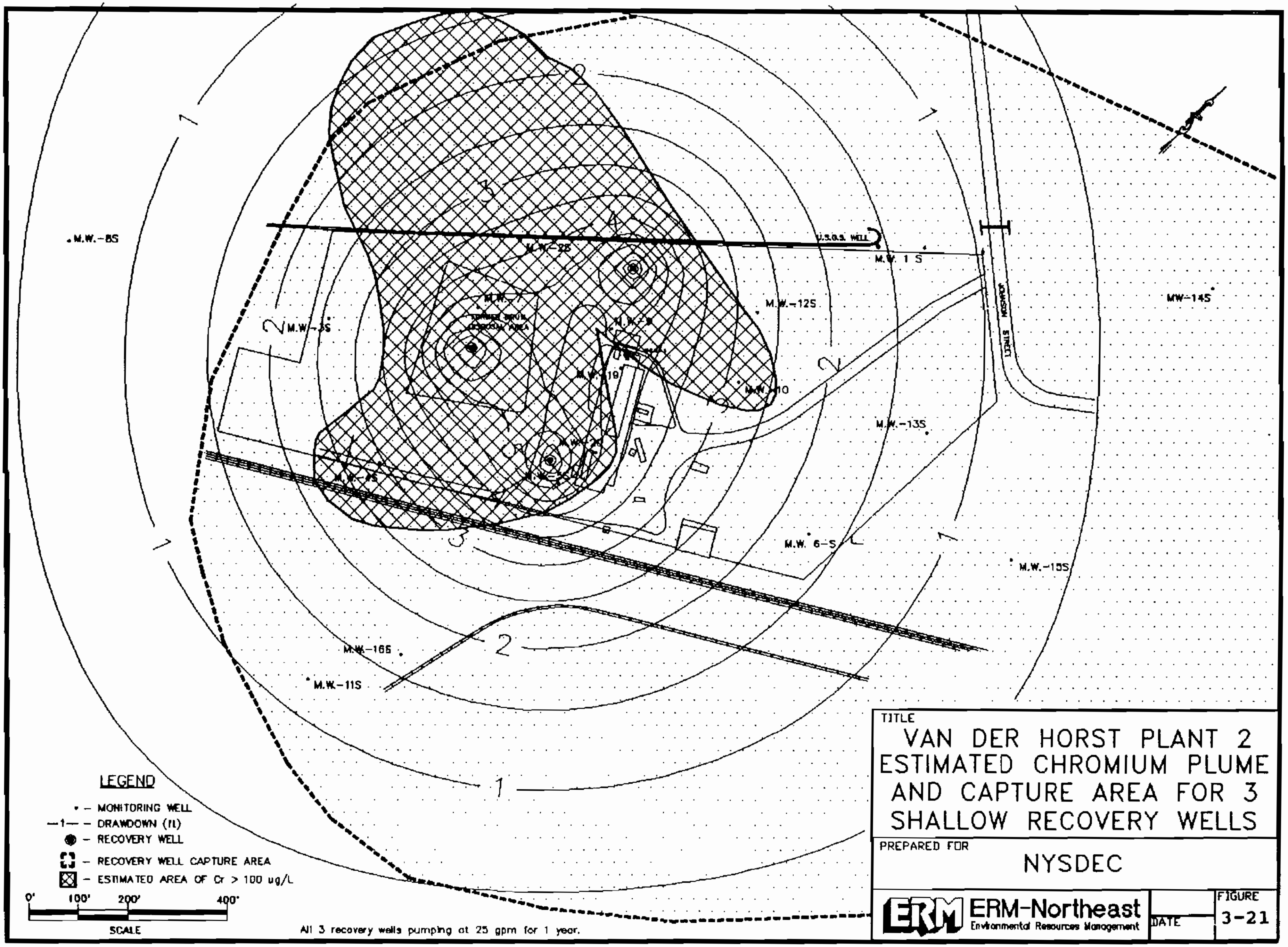
FIGURE
3-2

The predicted capture area covers the entire site and extends approximately 400 ft beyond the site boundary, west of the main building.

Figure 3-21 depicts the relationship between the predicted recovery well capture area and the estimated extent of the chromium plume in ground water. The predicted well capture area appears to encompass most of the estimated chromium plume. A small area at the western end of the estimated plume may extend beyond the capture area. This area may not be significant, since the actual limits of the chromium plume have not yet been determined, and the modeling effort described herein was not calibrated.

3.5.5 Data Limitations

The primary concern about the recovery well simulation was the uncertainty of the drawdown predicted by the MODFLOW model. Drawdown uncertainty resulted from the known and potential deviations between the hydraulic parameters used in the model and actual conditions in the aquifer. Parameter deviations in the aquifer base, aquifer recharge, hydraulic gradient, hydraulic conductivity and aquifer heterogeneity could significantly alter the drawdown and capture area from the model-predicted results.



All 3 recovery wells pumping at 25 gpm for 1 year.

TITLE

VAN DER HORST PLANT 2
ESTIMATED CHROMIUM PLUME
AND CAPTURE AREA FOR 3
SHALLOW RECOVERY WELLS

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FIGURE
3-21

The MODFLOW model grid boundaries may have also impacted the predicted capture area for the recovery wells. All four model boundaries were assigned a constant head. Drawdown within the model may somewhat reduced by the influence of these constant head boundaries. The reduction in drawdown would be greatest near the edge of the model. A drawdown reduction would decrease the size of the predicted recovery well capture area.

Another element of data uncertainty was the extent and concentration of ground water contamination in the shallow aquifer. Phase II shallow monitoring wells did not delineate the downgradient plume boundary. Metal contamination (primarily chromium and lead) has migrated west of monitoring well network along the northwest site boundary. Based on Phase I and II ground water sampling results, the extent of the plume in the shallow aquifer could only be estimated. The number of recovery wells, and well locations selected for the model were based on the estimated limits of shallow aquifer contamination.

3.5.6 Conclusions

The estimated drawdown for the three-well recovery system evaluated in this study appears to capture most of the estimated extent of chromium contamination in the aquifer. However, the recovery well estimate probably represents at best, an idealized maximum capture area. The actual ground water capture area would be expected to be less for several reasons:

- Since the aquifer beneath the pumped interval has a higher hydraulic conductivity than the pumped interval;
- Since the model assumed that there was no aquifer recharge;
- Downgradient of the recovery wells, since the hydraulic gradient is not flat; and
- If the hydraulic conductivity of the pumped interval is greater than value estimated from slug test data.
- If the aquifer has a saturated thickness greater than 60 ft.

The influence of the constant head boundaries on predicted drawdown would have the opposite effect on the size of the predicted capture. Constant head boundaries in the model decreased the predicted size of the capture area. However, model boundary affects are believed to be small compared to the influence of the other hydraulic parameters which were previously discussed.

4.0 OVERVIEW OF PHASE II CHEMICAL ANALYSIS

4.1 General

The following media were sampled and tested during the two phases of the RI study:

- On-site and off-site surface and subsurface soil;
- Dust and surface material obtained from the walls and floors of the building interior;
- Material suspected of containing asbestos, obtained from pipe insulation and floor tile inside the plant facility;
- Sediment, collected from an on-site drain catch basin;
- Surface water and sediment from Two Mile Creek; and,
- Ground water from on-site and off-site monitoring wells;

Analytical results of the samples collected during the Phase II RI will be presented as summary tables in the associated subsection of Section 4.0. Analytical data summary tables for the Phase I RI samples have been included in the Phase I report and will not be presented here. A summary of the Phase II samples collected and the associated analyses is shown on Table 4-1. Sampling locations are shown on Figures 2-1 through 2-8. The data was reviewed and modified by an ERM QA/QC specialist and a copy of the QA/QC data review is provided in Appendix C.

TABLE 4-1
SUMMARY OF PHASE II SAMPLING PROGRAM

SAMPLING LOCATION	ANALYSES
On-Site Soils	
SS-45 through SS-51	Total chromium, lead, arsenic, manganese and TCL VOA
SS-52 through SS-63	Total chromium, lead and arsenic
SS-33R, DD-2, and B-28 (0-2')	TCLP parameter analysis
SS-64, SS-65, DD-2, and SS-33R	Grain Size Analysis
SS-66 through SS-69	PCBs, total chromium, arsenic, lead, barium and manganese
B-19 (9 samples)	Total chromium, lead, arsenic and TCL VOA
B-21 and B-22 (4 samples)	Total chromium, lead, arsenic, manganese, barium, cadmium, zinc and TCL VOA
B-23 through B-32 (20 samples)	Total chromium, lead, arsenic, and cadmium
B-35 through B-40 (57 samples)	Total chromium, lead, arsenic, manganese, barium,
(4 samples)	TCL+20,
(8 samples)	TCLP Metals,
(4 samples)	TCL VOAs
(5 samples)	TCL+10
MW-12, MW-13 (4 samples)	Total chromium, cadmium, arsenic, lead, beryllium, manganese, TCL VOA
MW-19, MW-20 (20 samples)	Total chromium, arsenic, lead, barium, manganese, TCLP Metals and VOAs
Off-Site Soils	
BB-2R (1 sample)	Total chromium, lead, arsenic, manganese and TCL VOA
RSS-41R (1 sample)	Total chromium, lead, arsenic, manganese, barium and zinc
MW-8S, MW-11S, MW-14S through MW-16S (10 samples)	Total chromium, lead, arsenic, manganese and TCL VOA
12 residential soil samples (RSS-44 through RSS-55)	Total chromium, lead, arsenic and manganese
Ground Water	
28 Phase I and II on and off-site wells	Total chromium, lead, arsenic, manganese, beryllium, hexavalent chromium, pH and TCL VOA
2 Phase II interior Wells (MW-19 and MW-20)	TCL+30, hexavalent chromium and pH
Two Mile Creek	
5 sediment samples (TMC-5 through TMC-9)	Total chromium, lead, arsenic, cadmium, manganese, beryllium and TCL VOA
5 surface water samples (TMC-5W through TMC-9W)	Total chromium, lead, arsenic, cadmium, manganese, beryllium, pH and hexavalent chromium
Catch Basin	
1 sediment sample (CB-1)	TCL+30, pH and hexavalent chromium

TABLE 4-1 (Con't)
SUMMARY OF PHASE II SAMPLING PROGRAM

SAMPLING LOCATION	ANALYSES
Building Interior Samples	
38 Wipe Samples (W-1 through W-38)	Total chromium, arsenic, lead, barium and manganese
15 Dust Samples (D-1 through D-15)	Total chromium, arsenic, lead, barium and manganese
14 pipe insulation samples (AS-2-1 through AS-2-14)	Asbestos content

Note:

1) Analysis was conducted at the lowest practical detection limit
2) TCL VOA (Target Compound List) includes: 38 volatile organic compounds
3) TCL+30 includes: TCL metals, semivolatiles + 20, volatile organics + 10, and pesticides/PCBs
4) Table does not include the Phase II QA/QC or waste stream samples that were collected and analyzed

Presented below is a summary and overview of the Phase II analytical sampling results. This is followed by a baseline risk assessment (Section 5.0) which used data from both phases of the RI to evaluate risks to human health and the environment. Section 6.0 discusses the potential sources and extent of contamination, and graphically shows the distribution of contaminants relative to Plant No. 2.

4.2 On-Site Surface Soil

Table 4-2 presents the analytical results for the twenty-nine (29) surface soil samples collected from on-site locations during the Phase II RI. These samples, SS-33R, SS-45 through SS-69 and DD-2, were collected to delineate the extent of contaminated areas identified during the Phase I RI, and to collect information in areas not previously sampled. Four samples, SS-64, SS-65, DD-2, and SS-33R, were analyzed for grain size analysis to assess the potential of fugitive dust migration from on-site materials. All other samples were analyzed for total chromium, arsenic and lead parameters. Several of these samples were also analyzed for other parameters, including: PCBs, TCL+10 volatile organics, barium, manganese and TCL volatile organics (see Figure 2-4).

TABLE 4-2

VAN DER HORST PLANT 2, PHASE II
ON-SITE SURFACE SOIL SAMPLES
TCL VOLATILE ORGANIC COMPOUNDS

SAMPLE NUMBER	SS-45		DUP-10		SS-46		SS-47	
MATRIX	Soil		Soil		Soil		Soil	
DATE SAMPLED	19-Sep-91		19-Sep-91		19-Sep-91		18-Sep-91	
UNITS	µg/Kg		µg/Kg		µg/Kg		µg/Kg	
COMPOUND								
chloromethane	U	J	U	J	U		U	J
bromomethane	U	J	U	J	U		U	J
vinyl chloride	U	J	U	J	U		U	J
chloroethane	U	J	U	J	U		U	J
methylene chloride	U	J	U	J	U		U	J
acetone	U	J	U	J	U		U	J
carbon disulfide	U	J	U	J	U		U	J
1,1-Dichloroethene	U	J	U	J	U		U	J
1,1-Dichloroethane	U	J	U	J	U		U	J
1,2-Dichloroethene(total)	U	J	U	J	U		U	J
chloroform	U	J	U	J	U		U	J
1,2-Dichloroethane	U	J	U	J	U		U	J
2-Butanone	U	J	U	J	U		U	J
1,1,1-trichloroethane	U	J	U	J	U		U	J
carbon tetrachloride	U	J	U	J	U		U	J
vinyl acetate	U	J	U	J	U		U	J
bromodichloromethane	U	J	U	J	U		U	J
1,2-dichloropropane	U	J	U	J	U		U	J
cis-1,3-Dichloropropene	U	J	U	J	U		U	J
trichloroethene	U	J	U	J	U		U	J
dibromochloromethane	U	J	U	J	U		U	J
1,1,2-Trichloroethane	U	J	U	J	U		U	J
benzene	U	J	U	J	U		U	J
trans-1,3-Dichloropropene	U	J	U	J	U		U	J
bromoform	U	J	U	J	U		U	J
4-Methyl-2-Pentanone	U	J	U	J	U		U	J
2-Hexanone	U	J	U	J	U		U	J
tetrachloroethene	U	J	U	J	U		U	J
1,1,2,2-Tetrachloroethane	U	J	U	J	U		U	J
toluene	U	J	U	J	U		U	J
chlorobenzene	U	J	U	J	U		U	J
ethylbenzene	U	J	U	J	U		U	J
styrene	U	J	U	J	U		U	J
total xylenes	U	J	U	J	U		U	J

Qualifier Codes:

B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.

J: This result should be considered a quantitative estimate.

U: This compound was not detected.

NA: This analyte was not analyzed.

TABLE 4-2, Contd.

VAN DER HORST PLANT 2, PHASE II
ON-SITE SURFACE SOIL SAMPLES
TCL VOLATILE ORGANIC COMPOUNDS

SAMPLE NUMBER	SS-48	SS-49 (RE)	SS-50	SS-51
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	19-Sep-91	19-Sep-91	19-Sep-91	18-Sep-91
UNITS	µg/Kg	µg/Kg	µg/Kg	µg/Kg
COMPOUND				
chloromethane	U	U J	U J	U
bromomethane	U	U J	U J	U
vinyl chloride	U	U J	U J	U
chloroethane	U	U J	U J	U
methylene chloride	U	U J	U J	U
acetone	U	U J	U J	U
carbon disulfide	U	U J	U J	U
1,1-Dichloroethene	U	U J	U J	U
1,1-Dichloroethane	U	U J	U J	U
1,2-Dichloroethene(total)	U	U J	U J	U
chloroform	U	U J	U J	U
1,2-Dichloroethane	U	U J	U J	U
2-Butanone	U	U J	U J	U
1,1,1-trichloroethane	U	U J	U J	U
carbon tetrachloride	U	U J	U J	U
vinyl acetate	U	U J	U J	U
bromodichloromethane	U	U J	U J	U
1,2-dichloropropane	U	U J	U J	U
cis-1,3-Dichloropropene	U	U J	U J	U
trichloroethene	U	U J	U J	U
dibromochloromethane	U	U J	U J	U
1,1,2-Trichloroethane	U	U J	U J	U
benzene	U	U J	U J	U
trans-1,3-Dichloropropene	U	U J	U J	U
bromoform	U	U J	U J	U
4-Methyl-2-Pentanone	U	U J	U J	U
2-Hexanone	U	U J	U J	U
tetrachloroethene	U	U J	U J	U
1,1,2,2-Tetrachloroethane	U	U J	U J	U
toluene	U	U J	U J	U
chlorobenzene	U	U J	U J	U
ethylbenzene	U	U J	U J	U
styrene	U	U J	U J	U
total xylenes	U	U J	U J	U

Qualifier Codes:

B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.

J: This result should be considered a quantitative estimate.

U: This compound was not detected.

NA: This analyte was not analyzed.

TABLE 4-2, Contd.

VAN DER HORST PLANT 2, PHASE II
ON-SITE SURFACE SOIL SAMPLES
PCBs

SAMPLE NUMBER	SS-66	SS-67
MATRIX	Soil	Soil
DATE SAMPLED	16-Sep-91	16-Sep-91
UNITS	µg/Kg	µg/Kg
ANALYTE		
Aroclor 1016	U	U
Aroclor 1221	U	U
Aroclor 1232	U	U
Aroclor 1242	U	U
Aroclor 1248	U	U
Aroclor 1254	U	U
Aroclor 1260	U	U

SAMPLE NUMBER	SS-68	SS-69	DUP-7
MATRIX	Soil	Soil	Soil
DATE SAMPLED	17-Sep-91	17-Sep-91	17-Sep-91
UNITS	µg/Kg	µg/Kg	µg/Kg
ANALYTE			
Aroclor 1016	U	U	U
Aroclor 1221	U	U	U
Aroclor 1232	U	U	U
Aroclor 1242	U	U	U
Aroclor 1248	U	U	U
Aroclor 1254	U	U	U
Aroclor 1260	U	U	U

QUALIFIER CODES

B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.
J: This result should be considered a quantitative estimate.
NA: This parameter not analyzed for this sample.
U: This parameter was not detected.

TABLE 4-2, Contd.

VAN DER HORST PLANT 2, PHASE II
ON-SITE SURFACE SOIL
TOTAL METALS

SAMPLE NUMBER	SS-45	DUP-10	SS-46	SS-47
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	19-Sep-91	19-Sep-91	19-Sep-91	18-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	20 J	22.3 J	29.4 J	19.1 J
Chromium	115 J	105 J	17.6 J	1480 J
Lead	49.1	72	45.2 J	366
Manganese	186 J	164 J	910 J	571 J

SAMPLE NUMBER	SS-48	SS-49	SS-50	SS-51
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	19-Sep-91	19-Sep-91	19-Sep-91	18-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	32.7 J	39 J	14.9 J	22.2 J
Chromium	21 J	21 J	76.3 J	371 J
Lead	84.4 J	154	262	137
Manganese	799 J	536 J	1070 J	709 J

SAMPLE NUMBER	SS-52	SS-53	SS-54
MATRIX	Soil	Soil	Soil
DATE SAMPLED	18-Sep-91	19-Sep-91	19-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg
ANALYTE			
Arsenic	24.1 J	13.1 J	12.7 J
Chromium	131 J	17.5 J	18.6 J
Lead	142 J	72.2 J	90.3 J

SAMPLE NUMBER	SS-55	DUP-9	SS-56	SS-57
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	19-Sep-91	19-Sep-91	19-Sep-91	19-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	12 J	12.3 J	37 J	24 J
Chromium	14.9 J	16.7 J	15.9 J	17.3 J
Lead	86.9 J	85.3 J	147 J	79.3 J

J: This result should be considered a quantitative estimate.

TABLE 4-2,

VAN DER HORST PLANT 2, PHASE II
ON-SITE SURFACE SOIL
TOTAL METALS

SAMPLE NUMBER	SS-58	SS-59	SS-60	SS-61
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	19-Sep-91	19-Sep-91	18-Sep-91	18-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	45.3 J	28.4 J	16.6 J	47.8 J
Chromium	18 J	38.1 J	13.1 J	23 J
Lead	124 J	144 J	126 J	208 J

SAMPLE NUMBER	SS-62	SS-63	SS-66
MATRIX	Soil	Soil	Soil
DATE SAMPLED	18-Sep-91	18-Sep-91	16-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg
ANALYTE			
Arsenic	47.9 J	105 J	33.4 J
Barium	NA	NA	116 BJ
Chromium	17.7 J	16.4 J	37.2 J
Lead	134 J	137 J	79.6 J
Manganese	NA	NA	515 J

SAMPLE NUMBER	SS-67	DUP-6	SS-68	SS-69
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	16-Sep-91	16-Sep-91	17-Sep-91	17-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	21.6 J	21.8 J	24.5 J	20.1 J
Barium	119 J	137 J	99.7 J	344 J
Chromium	27.7 J	38.8 J	39.8 J	48 J
Lead	73.5 J	80.1 J	286 J	126 J
Manganese	637 J	587 J	806 J	431 J

Qualifier Codes:
B: Indicates a value greater than or equal to the instrument detection limit but less than the CRDL.
J: This result should be considered a quantitative estimate.
U: This analyte was not detected.
NA: The sample was not analyzed for this analyte.

TABLE 4-2, Contd.

VAN DER HORST PLANT 2, PHASE II
ON-SITE SURFACE SOIL SAMPLES
TCLP METALS

SAMPLE NUMBER		DD-2	SS-33R	B-28 (0"-3")
MATRIX		"Soil"	Soil	Soil
DATE SAMPLED		23-Sep-91	17-Sep-91	17-Sep-91
UNITS		µg/L	µg/L	µg/L
ANALYTE	**EPA LIMITS FOR TCLP ANALYSIS (µg/L)**			
Arsenic	5000	18 J	9 B	U
Barium	100000	U	227	2650
Cadmium	1000	U	U	12.6
Chromium	5000	88	28	120
Lead	5000	U	U	U
Mercury	200	U J	U	0.85
Selenium	1000	U J	U	U
Silver	5000	58 J	U	U

Qualifier Codes:

B: Indicates a value greater than or equal to the instrument detection limit but less than the CRDL.

J: This result should be considered a quantitative estimate.

U: This analyte was not detected.

▨: This concentration exceeds EPA TCLP limits.

4.2.1 Organics and PCBs

No volatile organics, tentatively identified compounds (TICs), or PCBs were detected in the on-site surface soil samples during the Phase II RI.

4.2.2 Inorganics

The presence of inorganics was detected in all of the on-site surface soil samples. The majority of the samples were analyzed for total arsenic, chromium, lead and manganese. The levels detected for arsenic in these samples ranged from 12 ppm in SS-55 to 105 ppm in SS-63. Chromium concentrations ranged from 13.1 ppm in SS-60 to 1480 ppm in SS-47. On-site surface soil samples contained lead concentrations ranging from 49.1 ppm in SS-45 to 366 ppm in SS-47. The levels detected for manganese ranged from 186 ppm in SS-45 to 1070 ppm in SS-50. Other on-site surface soil samples (SS-66 through SS-69) were analyzed for the presence of barium. Detected barium levels in these samples ranged from 99.7 ppm in SS-68 to 344 ppm in SS-69. Three of the on-site surface soil samples were also analyzed for TCLP Metals. None of the detected parameters exceeded the USEPA limits for TCLP analysis.

4.2.3 Grain Size Analysis

Four surface soil samples, SS-33R, DD-2, SS-64, and SS-65, were collected during the Phase II RI and subjected to grain size analysis to determine the potential for fugitive dust. The samples were obtained from two areas where elevated levels of chromium were detected during the Phase I RI and from two locations on the plant access road. Tests were conducted using the ASTM D1140 method to determine the amount of material in soils finer than a No. 200 sieve and ASTM D422 method of determining particle size analysis of soils. The major constituents of samples SS-33R and DD-2 are described as silt and clay, while the remaining two samples, SS-64 and SS-65, are described as sand. The grain size curves are presented on figures 4-1 through 4-4 and the sample descriptions are presented on Table 4-3.

4.3 On-Site Subsurface Soil

A total of 117 on-site subsurface soil samples were collected from numerous borings during the Phase II RI (see Figure 2-3). These samples were collected to assess the vertical extent of contamination in the suspected source areas and to further characterize areas where little subsurface information was obtained during the Phase I RI. The majority of these samples were

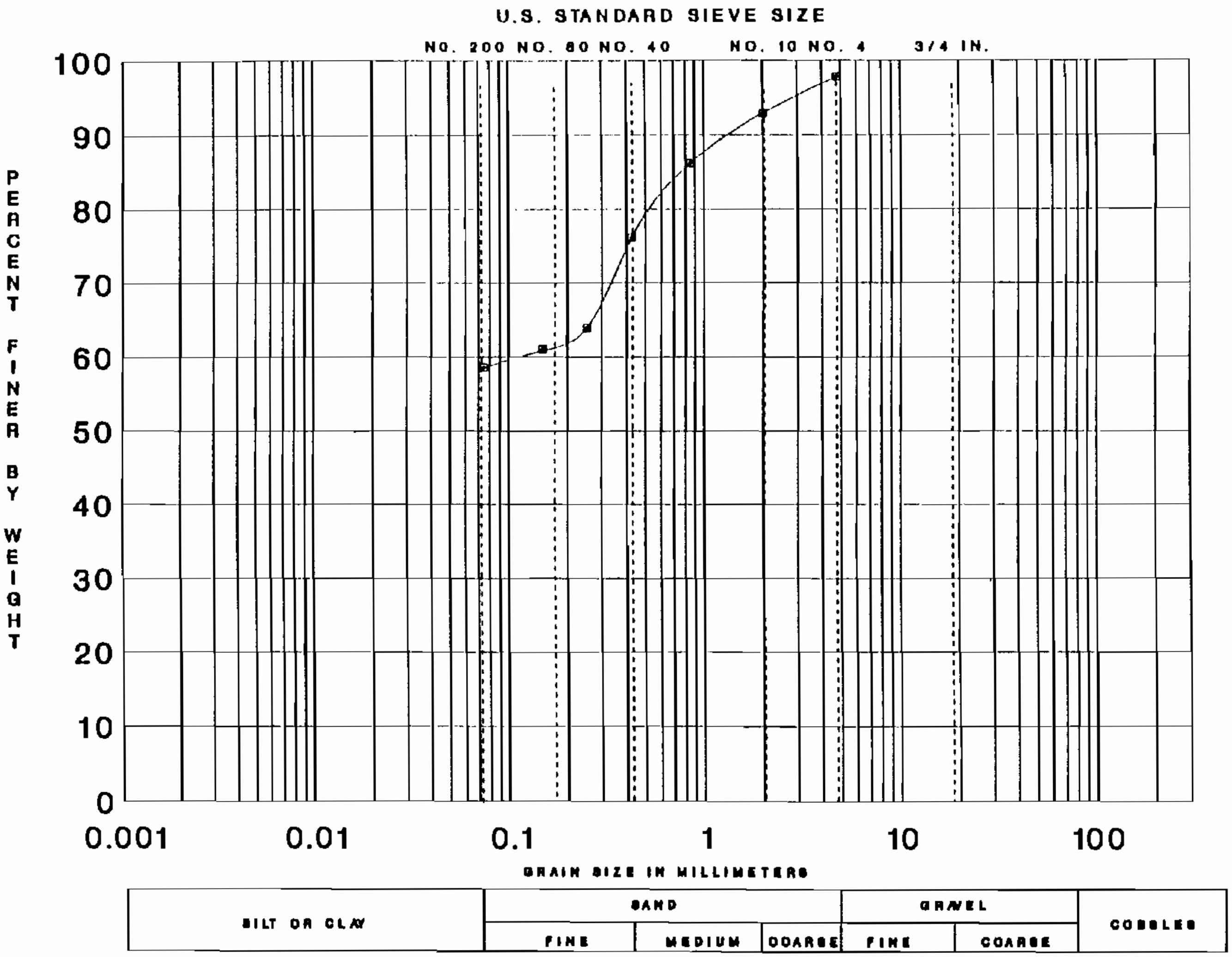
TABLE 4-3

VAN DER HORST PLANT 2, PHASE II
SURFACE SOIL SAMPLES
SUMMARY OF GRAIN SIZE ANALYSIS RESULTS

SAMPLE NUMBER	*GRADATION ANALYSIS (%)*			SAMPLE DESCRIPTION
	GRAVEL	SAND	SILT & CLAY	
SS-33R	2.3	39.2	58.5	SILT & CLAY and f/c sand, trace gravel
DD-2	6	30.5	63.5	SILT & CLAY, some f/c sand, trace gravel
SS-64	29.6	41.6	28.8	f/c SAND, some gravel, some silt & clay
SS-65	21.7	54.2	24.1	f/c SAND, some silt & clay, some gravel

GRAIN SIZE ANALYSIS

Van Der Horst, Plant #2 SS-33R
November 13, 1991



Graph is based on results generated by Buffalo Drilling grain size analyses.

TITLE

VAN DER HORST PLANT 2, PHASE II

SS-33R GRAIN SIZE ANALYSIS

PREPARED FOR

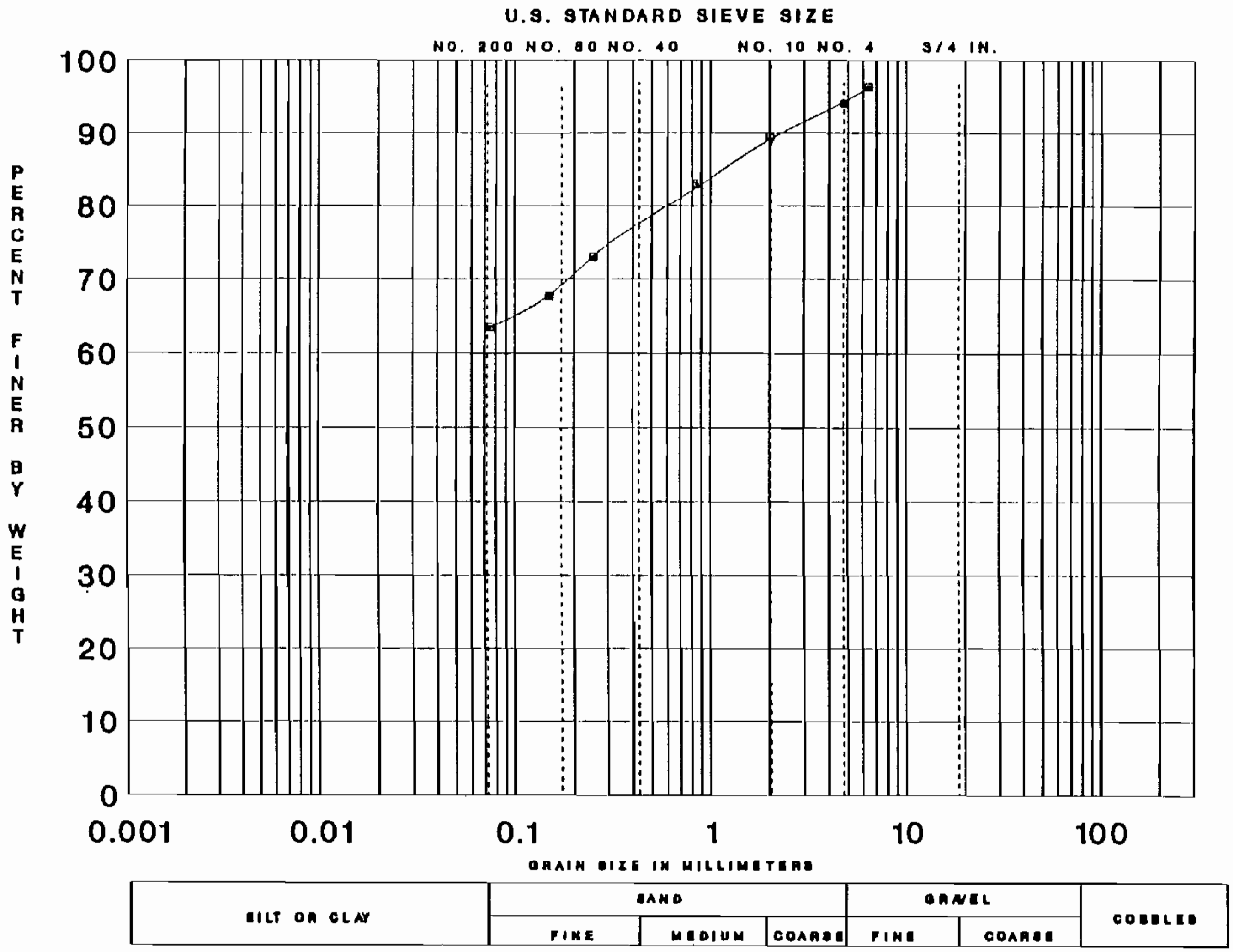
NYSDEC

ERM-Northeast
Environmental Resources Management

SCALE	FIGURE
DATE	4-1

GRAIN SIZE ANALYSIS

Van Der Horst, Plant #2 DD-2
November 13, 1991



Graph is based on results generated by
Buffalo Drilling grain size analyses.

TITLE

VAN DER HORST PLANT 2, PHASE II
DD-2 GRAIN SIZE ANALYSIS

PREPARED FOR

NYSDEC

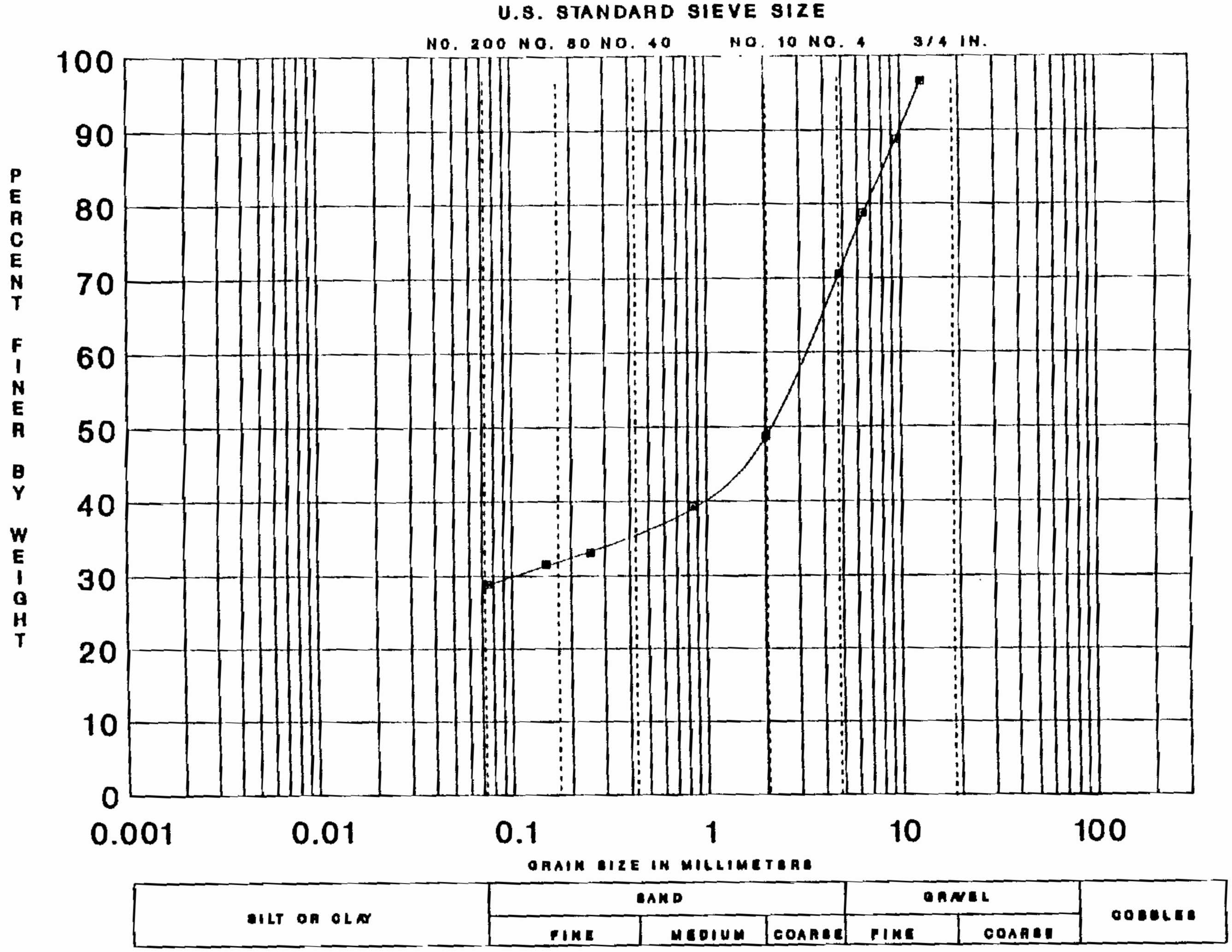
ERM-Northeast
Environmental Resources Management

SCALE

DATE

FIGURE
4-2

GRAIN SIZE ANALYSIS



Graph is based on results generated by
Buffalo Drilling grain size analyses.

TITLE

VAN DER HORST PLANT 2, PHASE II

SS-64 GRAIN SIZE ANALYSIS

PREPARED FOR

NYSDEC

ERM-Northeast
Environmental Resources Management

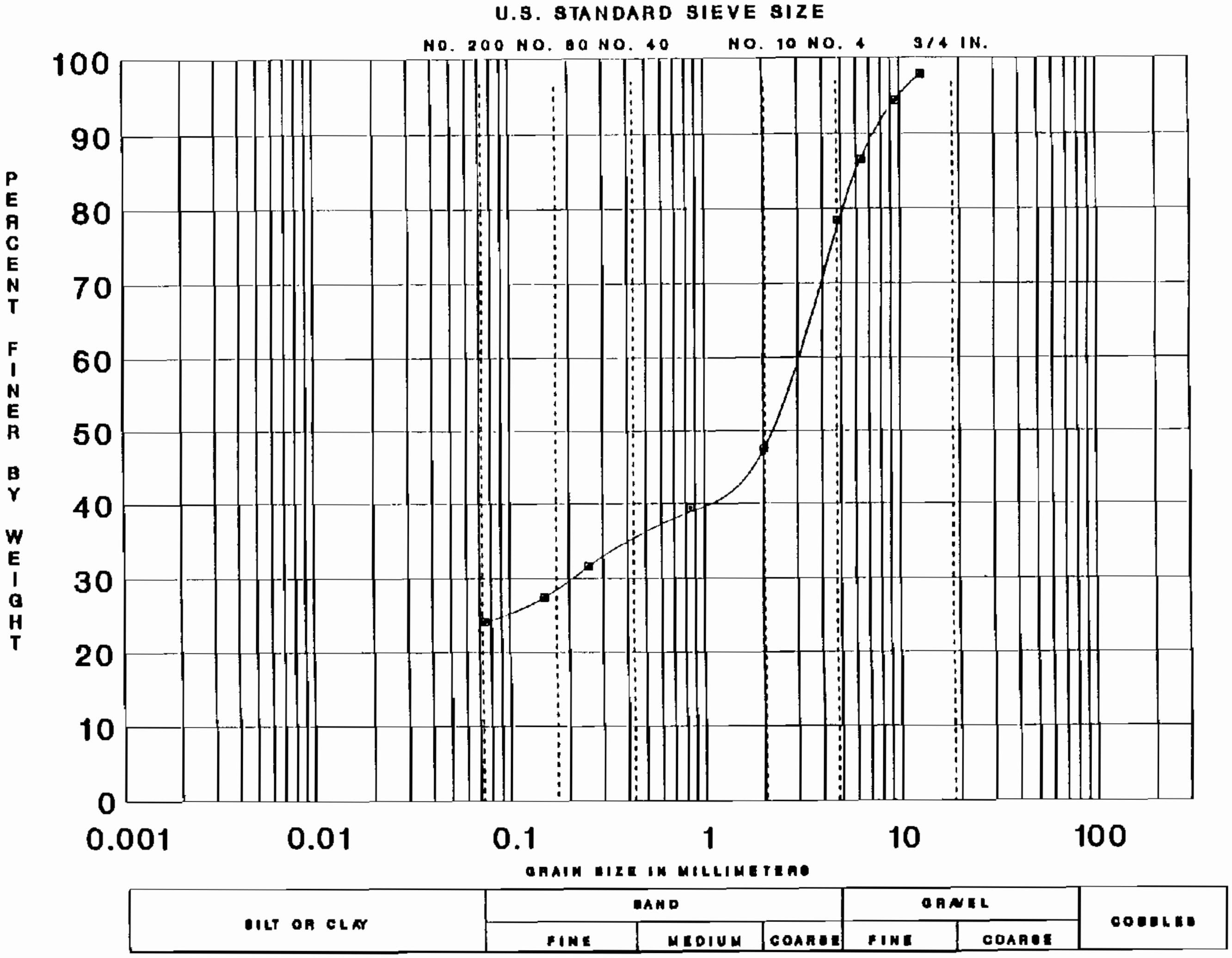
SCALE

DATE

FIGURE
4-3

GRAIN SIZE ANALYSIS

Van Der Horst, Plant #2 SS-65
November 13, 1991



Graph is based on results generated by Buffalo Drilling grain size analyses.

TITLE

VAN DER HORST PLANT 2, PHASE II

SS-65 GRAIN SIZE ANALYSIS

PREPARED FOR

NYSDEC

ERM-Northeast
Environmental Resources Management

SCALE	FIGURE 4-4
DATE	

analyzed for total chromium, arsenic, lead, barium and manganese. A limited number were also analyzed for TCLP metals and TCL volatile organic parameters. The results of these analyses are presented on Table 4-4.

4.3.1 Inorganics

The presence of inorganics was detected in all of the on-site subsurface soil samples. All of the samples were analyzed for total arsenic, chromium, and lead. Specific samples were also analyzed for other metals, which included: barium, beryllium, cadmium, manganese and zinc. The levels detected for arsenic in these samples ranged from 4.4 ppm in B-36 (16'-18') to 67.4 ppm in MW-13D (0'-2'). Chromium concentrations ranged from 3.6 ppm in MW-13D (14'-16') to 13,100 ppm in B-28 (2'-4'). Detected on-site surface soil sample lead concentrations ranged from 8.9 ppm in MW-12D (9'-11') to 982 ppm in B-22 (0'-2'). Concentrations detected for manganese ranged from 193 ppm in B-36 (4'-6') to 2850 ppm in B-37 (10'-12'). For those samples analyzed for cadmium, concentrations ranged from 1.1 ppm in B-31 (0-2') to 6.8 ppm in B-21 (0-2'). Detected barium levels in selected samples ranged from 20.3 ppm in MW-13D (14'-16') to 204 ppm in B-22 (2'-4'). Zinc concentrations in selected samples ranged from 44.5 ppm in B-22 (14'-16') to 161 ppm in B-22 (2'-4').

TABLE 4-4

VAN DER HORST PLANT 2, PHASE II
ON-SITE SUBSURFACE SOIL SAMPLES
TOTAL METALS

SAMPLE NUMBER	B-19 (2'-4')		B-19 (4'-6')		B-19 (6'-8')		B-19 (8-10')	
MATRIX	Soil		Soil		Soil		Soil	
DATE SAMPLED	17-Sep-91		17-Sep-91		17-Sep-91		17-Sep-91	
UNITS	mg/Kg		mg/Kg		mg/Kg		mg/Kg	
ANALYTE								
Arsenic	10.9	J	8.9	J	6.3	J	6.3	J
Chromium	14.5	J	12.8	J	8.4	J	11.1	J
Lead	27.1	J	19.6	J	20.9	J	20.4	J

SAMPLE NUMBER	B-19 (10-12')		B-19 (12-14')		B-19 (14-16')	
MATRIX	Soil		Soil		Soil	
DATE SAMPLED	17-Sep-91		17-Sep-91		17-Sep-91	
UNITS	mg/Kg		mg/Kg		mg/Kg	
ANALYTE						
Arsenic	21.8	J	12.8	J	7.1	J
Chromium	12.7	J	9.2	J	6.8	J
Lead	40.3	J	20.6	J	24.8	J

SAMPLE NUMBER	B-21 (0'-2')		B-21 (2'-4')		DUP-11	
MATRIX	Soil		Soil		Soil	
DATE SAMPLED	24-Sep-91		24-Sep-91		24-Sep-91	
UNITS	mg/Kg		mg/Kg		mg/Kg	
ANALYTE						
Arsenic	16.2	J	7.6	J	6.7	J
Barium	173	J	122	J	143	J
Cadmium	6.8	J	5.8	J	7.4	J
Chromium	17.5	J	12.4	J	12.4	J
Lead	58.9		22.5	J	17.2	J
Manganese	942	J	295	J	633	J
Zinc	114	J	48.8	J	51.4	J

SAMPLE NUMBER	B-22 (0'-2')		B-22 (2'-4')		B-22 (14-16')	
MATRIX	Soil		Soil		Soil	
DATE SAMPLED	17-Sep-91		17-Sep-91		17-Sep-91	
UNITS	mg/Kg		mg/Kg		mg/Kg	
ANALYTE						
Arsenic	21.1	J	21.9	J	10.8	J
Barium	154	J	204	J	63.4	J
Cadmium	3.2	J	U	J	U	J
Chromium	759	J	104	J	11.1	J
Lead	982	J	124	J	16.6	J
Manganese	570	J	952	J	729	J
Zinc	131	J	161	J	44.5	J

Qualifier Codes:
B: Indicates a value greater than or equal to the instrument detection limit but less than the CRDL.
J: This result should be considered a quantitative estimate.
U: This analyte was not detected.
NA: The sample was not analyzed for this analyte.

TABLE 4-4, Contd.

VAN DER HORST PLANT 2, PHASE II
ON-SITE SUBSURFACE SOIL SAMPLES
TOTAL METALS

SAMPLE NUMBER	B-23 (0'-2')	B-23 (2'-4')	B-24 (0'-2')	B-24 (2'-4')
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	17-Sep-91	17-Sep-91	17-Sep-91	17-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	17.4 J	8.5 J	23 J	34.1 J
Cadmium	1.6 J	U	1.8 J	U
Chromium	1340	109	958	478
Lead	341 J	62.6 J	747 J	615 J

SAMPLE NUMBER	B-25 (0'-2')	B-25 (2'-4')	B-26 (0'-2')	B-26 (2'-4')
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	17-Sep-91	17-Sep-91	17-Sep-91	17-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	25.5 J	20.5 J	22 J	22 J
Cadmium	1.5 J	U	1.6 J	1.2 J
Chromium	1490	721	42	46.4
Lead	129 J	35.6 J	135 J	150 J

SAMPLE NUMBER	B-27 (0'-2')	B-27 (2'-4')	B-28 (0'-2')	B-28 (2'-4')
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	17-Sep-91	17-Sep-91	17-Sep-91	17-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	12.9 J	8.5 J	5.8 J	20.2 J
Cadmium	U	U	2.4 J	U
Chromium	230	229	1600	13100
Lead	33.6 J	57.1 J	287 J	141 J

SAMPLE NUMBER	B-29 (0'-2')	B-29 (2'-4')	B-30 (0'-2')	B-30 (2'-4')
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	17-Sep-91	17-Sep-91	17-Sep-91	17-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	16 J	18.2 J	8.5 J	9.6 J
Cadmium	1.3 J	U	U	U
Chromium	158	132	35.1	11
Lead	118 J	80.4 J	33.2 J	17.6 J

Qualifier Codes:
B: Indicates a value greater than or equal to the instrument detection limit but less than the CRDL.
J: This result should be considered a quantitative estimate.
U: This analyte was not detected.
NA: The sample was not analyzed for this analyte.

TABLE 4-4, Contd.

VAN DER HORST PLANT 2, PHASE II
ON-SITE SUBSURFACE SOIL SAMPLES
TOTAL METALS

SAMPLE NUMBER	B-31 (0'-2')	DUP-8	B-32 (0'-2')	B-32 (2'-4')
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	17-Sep-91	17-Sep-91	17-Sep-91	17-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	15.2 J	18.3 J	12.3 J	32.6 J
Cadmium	1.1 J	U	1.6 J	U
Chromium	659	194	451	37.3
Lead	172 J	99 J	187 J	44.3 J

SAMPLE NUMBER	B-35 (0'-2')	B-35 (2'-4')	B-35 (4'-6')	DUP-3
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	16-Sep-91	16-Sep-91	16-Sep-91	16-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	11.7	14.3	17.9	11.1
Barium	66.6 J	73.2 J	96.8 J	105 J
Chromium	23.4 J	52.3 J	26.1 J	19 J
Lead	34.8 J	40.1 J	40.2 J	39.4 J
Manganese	260 J	430 J	686 J	692 J

SAMPLE NUMBER	B-35 (6'-8')	B-35 (8-10')	B-35 (12-14')	B-35 (16-18')
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	16-Sep-91	16-Sep-91	16-Sep-91	16-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	11.9	10.4	5.2	6.8
Barium	103 J	43.9 J	29.2 BJ	46.7 J
Chromium	23.5 J	15 J	8.9 J	5.7 J
Lead	26.5 J	32.6 J	12.1 J	10.4 J
Manganese	790 J	607 J	397 J	696 J

SAMPLE NUMBER	B-35 (18-20')	B-36 (0'-2')	B-36 (2'-4')	B-36 (4'-6')
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	16-Sep-91	16-Sep-91	16-Sep-91	16-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	9.8	15 J	12.5 J	7.6
Barium	85.9 J	61.6 J	100 J	27.5 BJ
Chromium	11.1 J	21.1 J	17.6 J	17.5 J
Lead	51.4 J	40.3 J	40.7 J	33.7 J
Manganese	593 J	382 J	296 J	193 J

Qualifier Codes:
B: Indicates a value greater than or equal to the instrument detection limit but less than the CRDL
J: This result should be considered a quantitative estimate.
U: This analyte was not detected.
NA: The sample was not analyzed for this analyte.

TABLE 4-4, Contd.

VAN DER HORST PLANT 2, PHASE II
ON-SITE SUBSURFACE SOIL SAMPLES
TOTAL METALS

SAMPLE NUMBER	B-36 (6'-8')		B-36 (8-10')		B-36 (10-12')		B-36 (14-16')	
MATRIX	Soil		Soil		Soil		Soil	
DATE SAMPLED	16-Sep-91		16-Sep-91		16-Sep-91		16-Sep-91	
UNITS	mg/Kg		mg/Kg		mg/Kg		mg/Kg	
ANALYTE								
Arsenic	11.8		17.8		6.6		4.8	
Barium	43.9	BJ	63.2	J	81.6	J	37.9	BJ
Chromium	23.8	J	9.4	J	11.3	J	8.9	J
Lead	22.7	J	20.3	J	9	J	9.6	J
Manganese	255	J	315	J	1010	J	1020	J

SAMPLE NUMBER	B-36 (16-18')		B-36 (18-20')		B-37 (4"-2')		B-37 (2'-4')	
MATRIX	Soil		Soil		Soil		Soil	
DATE SAMPLED	16-Sep-91		16-Sep-91		13-Sep-91		13-Sep-91	
UNITS	mg/Kg		mg/Kg		mg/Kg		mg/Kg	
ANALYTE								
Arsenic	4.4		7	J	17	J	12.5	J
Barium	44.6	J	45.8	J	105	J	62.9	J
Chromium	6.3	J	10.4	J	14.5	J	55.6	J
Lead	10.1	J	13.9	J	57.5	J	51.7	J
Manganese	463	J	576	J	509		685	

SAMPLE NUMBER	B-37 (4'-6')		B-37 (6'-8')		B-37 (8'-10')		B-37 (10-12')	
MATRIX	Soil		Soil		Soil		Soil	
DATE SAMPLED	13-Sep-91		13-Sep-91		13-Sep-91		13-Sep-91	
UNITS	mg/Kg		mg/Kg		mg/Kg		mg/Kg	
ANALYTE								
Arsenic	U	J	U	J	5.8	J	6.8	J
Barium	56.4	J	53.9	J	62.1	J	45.8	J
Chromium	12.9	J	6.7	J	9.2	J	8.8	J
Lead	24.6	J	22.6	J	24.1	J	22.2	J
Manganese	1240		405		217		2850	J

SAMPLE NUMBER	B-37 (12-14')		B-37 (14-16')		B-37 (16-18')		B-37 (18-20')	
MATRIX	Soil		Soil		Soil		Soil	
DATE SAMPLED	13-Sep-91		13-Sep-91		13-Sep-91		13-Sep-91	
UNITS	mg/Kg		mg/Kg		mg/Kg		mg/Kg	
ANALYTE								
Arsenic	5	J	5	J	4.9	J	4.5	J
Barium	23.5	BJ	30.9	J	36.9	BJ	31.4	BJ
Chromium	4.7	J	6	J	8.5	J	7.2	J
Lead	21.4	J	19.3	J	19.3	J	20	J
Manganese	415		509		575		1540	

Qualifier Codes:
B: Indicates a value greater than or equal to the instrument detection limit but less than the CRDL.
J: This result should be considered a quantitative estimate.
U: This analyte was not detected.
NA: The sample was not analyzed for this analyte.

TABLE 4-4, Contd.

VAN DER HORST PLANT 2, PHASE II
ON-SITE SUBSURFACE SOIL SAMPLES
TOTAL METALS

SAMPLE NUMBER	B-38 (8"-2')		B-38 (2'-4')		B-38 (4'-6')		DUP-2	
MATRIX	Soil (Water)		Soil (Water)		Soil (Water)		Soil (Water)	
DATE SAMPLED	12-Sep-91		12-Sep-91		12-Sep-91		12-Sep-91	
UNITS	mg/Kg		mg/Kg		mg/Kg		mg/Kg	
ANALYTE								
Arsenic	U	J	12	J	U	J	10.9	J
Barium	70	J	144	J	86.6	J	111	J
Chromium	16.9	J	10.5	J	17.3	J	19.2	J
Lead	27.7	J	88.9		41.8		38.6	J
Manganese	236		424		257		697	

SAMPLE NUMBER	B-38 (6'-8')		B-38 (8'-10')		B-38 (10-12')		B-38 (12-14')	
MATRIX	Soil		Soil		Soil		Soil	
DATE SAMPLED	12-Sep-91		12-Sep-91		12-Sep-91		12-Sep-91	
UNITS	mg/Kg		mg/Kg		mg/Kg		mg/Kg	
ANALYTE								
Arsenic	7.9	J	U	J	7	J	6.9	J
Barium	53.9	J	65.7	J	69.5	J	75.1	J
Chromium	11	J	8.5	J	9.4	J	10.4	J
Lead	22.7	J	21	J	13.7	J	18.9	J
Manganese	395		252		549		586	J

SAMPLE NUMBER	B-38 (14-16')		B-38 (16-18')		B-38 (18-20')	
MATRIX	Soil		Soil		Soil	
DATE SAMPLED	12-Sep-91		12-Sep-91		12-Sep-91	
UNITS	mg/Kg		mg/Kg		mg/Kg	
ANALYTE						
Arsenic	5.3	J	9.5	J	13.1	J
Barium	45	J	52.9	J	88	J
Chromium	6	J	180	J	11.4	J
Lead	13	J	10.8	J	27.9	J
Manganese	920		963		814	

SAMPLE NUMBER	B-39 (5"-2')		B-39 (2'-4')		B-39 (4'-6')		B-39 (6'-8')	
MATRIX	Soil		Soil		Soil		Soil	
DATE SAMPLED	13-Sep-91		13-Sep-91		13-Sep-91		13-Sep-91	
UNITS	mg/Kg		mg/Kg		mg/Kg		mg/Kg	
ANALYTE								
Arsenic	12.8	J	11.2	J	21.3	J	13.7	J
Barium	64.8	J	101	J	54.6	J	62.8	J
Chromium	10.5	J	11.3	J	14.2	J	16.1	J
Lead	24.6	J	10.9	J	14.8	J	25.2	J
Manganese	2130		713		280		389	

Qualifier Codes:
B: Indicates a value greater than or equal to the instrument detection limit but less than the CRDL.
J: This result should be considered a quantitative estimate.
U: This analyte was not detected.
NA: The sample was not analyzed for this analyte.

TABLE 4-4, Contd.

VAN DER HORST PLANT 2, PHASE II
ON-SITE SUBSURFACE SOIL SAMPLES
TOTAL METALS

SAMPLE NUMBER	B-39 (8'-10')	B-39 (10-12')	B-39 (12-14')	B-39 (14-16')
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	13-Sep-91	13-Sep-91	13-Sep-91	13-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	6.2 J	8.6 J	8.3 J	8 J
Barium	52.7 J	77.9 J	41.2 BJ	45.1 J
Chromium	7.8 J	8.6 J	6.8 J	7.7 J
Lead	12.1 J	19.4 J	11.9 J	16.3 J
Manganese	216	349	1340	2550

SAMPLE NUMBER	B-39 (16-18')	B-39 (18-20')	B-40 (5"-2')	B-40 (2'-4')
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	13-Sep-91	13-Sep-91	12-Sep-91	12-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	10.6 J	9 J	10.4 J	20.5 J
Barium	32 BJ	86.5 J	78.8 J	68.6 J
Chromium	50.9 J	8.6 J	13.1 J	13.1 J
Lead	22.7 J	19.7 J	25.6 J	28.8 J
Manganese	794 J	1070	821	575

SAMPLE NUMBER	B-40 (4'-6')	B-40 (6'-8')	B-40 (8'-10')	B-40 (10-12')
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	12-Sep-91	12-Sep-91	12-Sep-91	12-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	8.9 J	9.2	6.5 J	39 J
Barium	32.8 BJ	44.6 BJ	56.8 J	62 J
Chromium	14.1 J	14.5 J	10.1 J	9.4 J
Lead	20.4 J	22.1 J	12.1 J	48.2 J
Manganese	240	223 J	206	779

SAMPLE NUMBER	B-40 (12-14'	B-40 (14-16')	B-40 (16-18')	B-40 (18-20')
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	12-Sep-91	12-Sep-91	12-Sep-91	12-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	11.3 J	5.4 J	6.2 J	11.4
Barium	62.8 J	62 J	39.9 BJ	118 J
Chromium	7.1 J	8.9 J	9 J	8.8 J
Lead	15 J	13.8 J	10.6 J	27 J
Manganese	1040	2130	1020 J	2150 J

Qualifier Codes:
B: Indicates a value greater than or equal to the instrument detection limit but less than the CRDL.
J: This result should be considered a quantitative estimate.
U: This analyte was not detected.
NA: The sample was not analyzed for this analyte.

TABLE 4-4, Contd.

VAN DER HORST PLANT 2, PHASE II
ON-SITE SUBSURFACE SOIL SAMPLES
TOTAL METALS

SAMPLE NUMBER	MW-12D (4-6')	MW-12D (9-11')	MW-13D (0-2')	MW-13D (14-16')	DUP-12
MATRIX	Soil	Soil	Soil	Soil	Soil
DATE SAMPLED	19-Sep-91	19-Sep-91	26-Sep-91	26-Sep-91	26-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE					
Arsenic	7.6 J	12.6 J	67.4 J	7.2 J	5.4 J
Barium	NA	NA	197 J	20.3 BJ	26.1 BJ
Beryllium	U	U	U J	U J	U J
Cadmium	U	U	6.3 J	3.2 J	3.5 J
Chromium	12.6 J	8.8 J	11.1 J	3.6 J	6.6 J
Lead	41.6 J	8.9 J	88.5	13.3 J	10 J
Manganese	485 J	610 J	254 J	807 J	407 J
Zinc	NA	NA	104 J	NA	NA

SAMPLE NUMBER	MW-19 (6"-2')	MW-19 (2'-4')	MW-19 (4'-6')	MW-19 (6'-8')
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	10-Sep-91	10-Sep-91	10-Sep-91	10-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	12.9 J	13 J	11.5 J	10.7 J
Barium	79.5 J	69.2 J	35.2 BJ	34 BJ
Chromium	83.7 J	19.8 J	20 J	13.7 J
Lead	26.9 J	26.3 J	17.2 J	21.8 J
Manganese	657 J	525 J	325 J	229 J

SAMPLE NUMBER	MW-19 (8-10')	MW-19 (10-12')	MW-19 (12-14')	MW-19 (14-16')
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	10-Sep-91	10-Sep-91	10-Sep-91	10-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	18.4 J	6.9 J	7.6 J	4.8 J
Barium	74.4 J	66.9 J	73.1 J	31 BJ
Chromium	11.5 J	25.1 J	18.9 J	7.9 J
Lead	22.5 J	20.2 J	21.6 J	15.6 J
Manganese	304 J	734 J	855 J	1050 J

Qualifier Codes:
B: Indicates a value greater than or equal to the instrument detection limit but less than the CRDL.
J: This result should be considered a quantitative estimate.
U: This analyte was not detected.
NA: The sample was not analyzed for this analyte.

TABLE 4-4, Contd.

VAN DER HORST PLANT 2, PHASE II
ON-SITE SUBSURFACE SOIL SAMPLES
TOTAL METALS

SAMPLE NUMBER	MW-19 (16-18')		MW-19 (18-20')		MW-20 (6"-2')		MW-20 (4-6')	
MATRIX	Soil		Soil		Soil		Soil	
DATE SAMPLED	10-Sep-91		10-Sep-91		11-Sep-91		11-Sep-91	
UNITS	mg/Kg		mg/Kg		mg/Kg		mg/Kg	
ANALYTE								
Arsenic	9.4	J	15.6	J	8.8	J	13.5	J
Barium	77.6	J	53.8	J	86.9	J	88.7	J
Chromium	23.7	J	11.6	J	16.9	J	13.6	J
Lead	12.3	J	18.3	J	22	J	26.3	J
Manganese	2230	J	725	J	776	J	854	J

SAMPLE NUMBER	MW-20 (6'-8')		MW-20 (8-10')		DUP-1	
MATRIX	Soil		Soil		Soil	
DATE SAMPLED	11-Sep-91		11-Sep-91		11-Sep-91	
UNITS	mg/Kg		mg/Kg		mg/Kg	
ANALYTE						
Arsenic	8	J	9	J	7.7	J
Barium	46.3	J	56.2	J	47.9	J
Chromium	10.9	J	12	J	11.6	J
Lead	25.7	J	17.6	J	20.1	J
Manganese	997		876	J	715	J

SAMPLE NUMBER	MW-20 (12-14')		MW-20 (14-16')		MW-20 (16-18')	
MATRIX	Soil		Soil		Soil	
DATE SAMPLED	11-Sep-91		11-Sep-91		11-Sep-91	
UNITS	mg/Kg		mg/Kg		mg/Kg	
ANALYTE						
Arsenic	4.7	J	5.4	J	6.1	J
Barium	41.5	BJ	44.7	J	26.1	BJ
Chromium	9.5	J	180	J	893	J
Lead	16.1	J	17.1	J	17.2	J
Manganese	482	J	793	J	374	

SAMPLE NUMBER	MW-20 (18-20')		MW-20 (25-27')		MW-20 (30-32')	
MATRIX	Soil		Soil		Soil	
DATE SAMPLED	11-Sep-91		11-Sep-91		11-Sep-91	
UNITS	mg/Kg		mg/Kg		mg/Kg	
ANALYTE						
Arsenic	10.3	J	8.5	J	13	J
Barium	45.8	J	55.6	J	65.1	J
Chromium	1420	J	727	J	686	J
Lead	22.7	J	24.9	J	24.7	J
Manganese	364		558		295	

Qualifier Codes:
B: Indicates a value greater than or equal to the instrument detection limit but less than the CRDL.
J: This result should be considered a quantitative estimate.
U: This analyte was not detected.
NA: The sample was not analyzed for this analyte.

TABLE 4-4, Contd.

VAN DER HORST PLANT 2, PHASE II
ON-SITE SUBSURFACE SOIL SAMPLES
TCLP METALS

SAMPLE NUMBER		B-37 (8-10')	B-37 (16-18')	B-38 (6'-8')	B-38 (18-20')
MATRIX		Soil (Water)	Soil (Water)	Soil (Water)	Soil (Water)
DATE SAMPLED		13-Sep-91	13-Sep-91	12-Sep-91	12-Sep-91
UNITS		µg/L	µg/L	µg/L	µg/L
ANALYTE	**EPA LIMITS FOR TCLP ANALYSIS (µg/L)**				
Aresenic	5000	18 J	U J	12 J	U
Barium	100000	723	621	497	1220
Cadmium	1000	8	6	U	6
Chromium	5000	U	U	U	U
Lead	5000	51.4	U	U	U
Mercury	200	U	U	U	U
Selenium	1000	U	U	U	U
Silver	5000	U	14	U	16

SAMPLE NUMBER		B-39 (8'-10')	B-40 (4'-6')	B-40 (14-16')
MATRIX		Soil (Water)	Soil (Water)	Soil (Water)
DATE SAMPLED		13-Sep-91	12-Sep-91	12-Sep-91
UNITS		µg/L	µg/L	µg/L
ANALYTE	**EPA LIMITS FOR TCLP ANALYSIS (µg/L)**			
Aresenic	5000	12 J	7 B	U
Barium	100000	454	328	895
Cadmium	1000	U	8	U
Chromium	5000	U	U	U
Lead	5000	U	U	U
Mercury	200	U	U	U
Selenium	1000	U	U	U
Silver	5000	U	U	14

SAMPLE NUMBER		MW-19 (4-6')	MW-20 (16-18')
MATRIX		Soil (Water)	Soil (Water)
DATE SAMPLED		10-Sep-91	11-Sep-91
UNITS		µg/L	µg/L
ANALYTE	**EPA LIMITS FOR TCLP ANALYSIS (µg/L)**		
Aresenic	5000	U	U J
Barium	100000	500	489
Cadmium	1000	U	6
Chromium	5000	U	U
Lead	5000	U	U
Mercury	200	U	U
Selenium	1000	U	U
Silver	5000	17	12

Qualifier Codes:
B: Indicates a value greater than or equal to the instrument detection limit but less than the CRDL.
J: This result should be considered a quantitative estimate.
U: This analyte was not detected.
░: This concentration exceeds EPA TCLP limits.

TABLE 4-4, Contd.

VAN DER HORST PLANT 2, PHASE II
ON-SITE SUBSURFACE SOIL SAMPLES
TCL VOLATILE ORGANIC COMPOUNDS

SAMPLE NUMBER	B-19 (8-10')	B-21 (2'-4')	B-22 (2'-4')	B-35 (10-12')	B-35 (14-16')
MATRIX	Soil	Soil	Soil	Soil	Soil
DATE SAMPLED	17-Sep-91	24-Sep-91	17-Sep-91	17-Sep-91	17-Sep-91
UNITS	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
COMPOUND					
chloromethane	U	U	U	U	U
bromomethane	U	U	U	U	U
vinyl chloride	U	U	U	U	U
chloroethane	U	U	U	U	U
methylene chloride	U	U	U	U	U
acetone	U	U	U	U	U
carbon disulfide	U	U	U	U	U
1,1-Dichloroethene	U	U	U	U	U
1,1-Dichloroethane	U	U	U	U	U
1,2-Dichloroethene(total)	U	U	U	U	U
chloroform	U	U	U	U	U
1,2-Dichloroethane	U	U	U	U	U
2-Butanone	U	U	U	U	U
1,1,1-trichloroethane	U	U	2 J	U	U
carbon tetrachloride	U	U	U	U	U
vinyl acetate	U	U	U	U	U
bromodichloromethane	U	U	U	U	U
1,2-dichloropropane	U	U	U	U	U
cis-1,3-Dichloropropene	U	U	U	U	U
trichloroethene	U	2 J	2 J	U	U
dibromochloromethane	U	U	U	U	U
1,1,2-Trichloroethane	U	U	U	U	U
benzene	U	U	U	U	U
trans-1,3-Dichloropropene	U	U	U	U	U
bromoform	U	U	U	U	U
4-Methyl-2-Pentanone	U	U	U	U	U
2-Hexanone	U	U	U	U	U
tetrachloroethene	U	2 J	49	U	U
1,1,2,2-Tetrachloroethane	U	U	U	U	U
toluene	U	U	0.3 J	U	U
chlorobenzene	U	U	U	U	U
ethylbenzene	U	U	U	U	U
styrene	690 J	U	U	U	U
total xylenes	1200	U	U	U	U

TENTATIVELY IDENTIFIED COMPOUNDS:

Total alkyl cyclohexane	25000 J	U	U	7100 J	8800 J
Alkyl saturated hydrocarbon	6000 J	U	U	U	U
Total unknown	34500 J	114 J	U	33900 J	19800 J

Qualifier Codes:

B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.

J: This result should be considered a quantitative estimate.

U: This compound was not detected.

NA: This analyte was not analyzed.

TABLE 4-4, Contd.

VAN DER HORST PLANT 2, PHASE II
ON-SITE SUBSURFACE SOIL SAMPLES
TCL VOLATILE ORGANIC COMPOUNDS

SAMPLE NUMBER	B-36 (2'-4')	B-36 (12-14')	DUP-5	B-36 (18-20')
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	16-Sep-91	16-Sep-91	16-Sep-91	16-Sep-91
UNITS	µg/Kg	µg/Kg	µg/Kg	µg/Kg
COMPOUND				
chloromethane	U	U	U	U
bromomethane	U	U	U	U
vinyl chloride	U	U	U	U
chloroethane	U	U	U	U
methylene chloride	U	U	U	U
acetone	U	U	U	U
carbon disulfide	U	U	U	U
1,1-Dichloroethene	U	U	U	U
1,1-Dichloroethane	U	U	U	U
1,2-Dichloroethene(total)	U	U	U	U
chloroform	U	U	U	U
1,2-Dichloroethane	U	U	U	U
2-Butanone	U	U	U	U
1,1,1-trichloroethane	U	U	U	U
carbon tetrachloride	U	U	U	U
vinyl acetate	U	U	U	U
bromodichloromethane	U	U	U	U
1,2-dichloropropane	U	U	U	U
cis-1,3-Dichloropropene	U	U	U	U
trichloroethene	U	U	U	U
dibromochloromethane	U	U	U	U
1,1,2-Trichloroethane	U	U	U	U
benzene	12 J	U	U	U
trans-1,3-Dichloropropene	U	U	U	U
bromoform	U	U	U	U
4-Methyl-2-Pentanone	U	U	U	U
2-Hexanone	U	U	U	U
tetrachloroethene	U	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U	U
toluene	U	U	U	U
chlorobenzene	U	U	U	U
ethylbenzene	130 J	U	U	U
styrene	U	U	U	U
total xylenes	470 J	U	U	220 J

TENTATIVELY IDENTIFIED COMPOUNDS:

Total alkyl cyclohexane	U	U	U	10600 J
Alkyl saturated hydrocarbon	U	1000 J	1700 J	2600 J
Total unknown	17800 J	17560 J	16600 J	18400 J

Qualifier Codes:

B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.

J: This result should be considered a quantitative estimate.

U: This compound was not detected.

NA: This analyte was not analyzed.

TABLE 4-4, Contd.

VAN DER HORST PLANT 2, PHASE II
ON-SITE SUBSURFACE SOIL SAMPLES
TCL VOLATILE ORGANIC COMPOUNDS

SAMPLE NUMBER	B-37 (10-12')		B-38 (12-14')		B-39 (16-18')		B-40 (16-18')	
MATRIX	Soil		Soil		Soil		Soil	
DATE SAMPLED	13-Sep-91		12-Sep-91		13-Sep-91		12-Sep-91	
UNITS	µg/Kg		µg/Kg		µg/Kg		µg/Kg	
COMPOUND								
chloromethane	U		U		U		U	
bromomethane	U		U		U		U	
vinyl chloride	U		U		U		U	
chloroethane	U		U		U		U	
methylene chloride	U		U.		U		U	
acetone	U		U		U		U	
carbon disulfide	U		U		U		U	
1,1-Dichloroethene	U		U		U		U	
1,1-Dichloroethane	U		U		U		U	
1,2-Dichloroethene(total)	U		U		U		U	
chloroform	U		U		U		U	
1,2-Dichloroethane	U		U		U		U	
2-Butanone	U		U		U		U	
1,1,1-trichloroethane	490	J	280	J	U		U	
carbon tetrachloride	U		U		U		U	
vinyl acetate	U		U		U		U	
bromodichloromethane	U		U		U		U	
1,2-dichloropropane	U		U		U		U	
cis-1,3-Dichloropropene	U		U		U		U	
trichloroethene	1200		670	J	350	J	290	J
dibromochloromethane	U		U		U		U	
1,1,2-Trichloroethane	U		U		U		U	
benzene	U		U		U		U	
trans-1,3-Dichloropropene	U		U		U		U	
bromoform	U		U		U		U	
4-Methyl-2-Pentanone	U		U		U		U	
2-Hexanone	U		U		U		U	
tetrachloroethene	U		U		U		U	
1,1,2,2-Tetrachloroethane	U		U		U		U	
toluene	U		U		U		U	
chlorobenzene	U		U		U		U	
ethylbenzene	U		U		U		U	
styrene	U		U		U		U	
total xylenes	U		U		U		U	

TENTATIVELY IDENTIFIED COMPOUNDS:

Alkyl substituted alkane	U		U		3100	J	U	
Alkyl substituted alkene	11000	J	23000	J	U		U	
Alkyl cyclohexane	U		U		5900	J	U	
Cyclohexane derivative	U		11000	J	U		U	
Alkyl cyclohexane derivative	3800	J	U		1700	J	U	
Dimethyl cyclohexane isomer	6900	J	U		8400	J	U	
Trimethyl cyclohexane isomer	9000	J	20000	J	U		U	
Unknown cyclo alkane	U		18000	J	U		U	
Alkyl hydrocarbon	U		U		2400	J	U	
Total unknown hydrocarbon	6100	J	U		U		U	
Total unknown	30400	J	128000	J	21600	J	49500	J

Qualifier Codes:
B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.
J: This result should be considered a quantitative estimate.
U: This compound was not detected.
NA: This analyte was not analyzed.

TABLE 4-4, Contd.

VAN DER HORST PLANT 2, PHASE II
ON-SITE SUBSURFACE SOIL SAMPLES
TCL VOLATILE ORGANIC COMPOUNDS

SAMPLE NUMBER	MW-12D (4'-6')	MW-12D (9-11')	MW-13D (0'-2')	MW-13D (9-11')
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	19-Sep-91	19-Sep-91	26-Sep-91	26-Sep-91
UNITS	µg/Kg	µg/Kg	µg/Kg	µg/Kg
COMPOUND				
chloromethane	U	U	U	U
bromomethane	U	U	U	U
vinyl chloride	U	U	U	U
chloroethane	U	U	U	U
methylene chloride	U	U	U	U
acetone	U	U	75	U
carbon disulfide	U	U	U	U
1,1-Dichloroethene	U	U	U	U
1,1-Dichloroethane	U	U	U	U
1,2-Dichloroethene(total)	U	U	U	U
chloroform	U	U	U	U
1,2-Dichloroethane	U	U	U	U
2-Butanone	U	U	U	U
1,1,1-trichloroethane	U	U	U	U
carbon tetrachloride	U	U	U	U
vinyl acetate	U	U	U	U
bromodichloromethane	U	U	U	U
1,2-dichloropropane	U	U	U	U
cis-1,3-Dichloropropene	U	U	U	U
trichloroethene	U	U	4 J	U
dibromochloromethane	U	U	U	U
1,1,2-Trichloroethane	U	U	U	U
benzene	U	U	U	U
trans-1,3-Dichloropropene	U	U	U	U
bromoform	U	U	U	U
4-Methyl-2-Pentanone	U	U	U	U
2-Hexanone	U	U	U	U
tetrachloroethene	U	U	2 J	U
1,1,2,2-Tetrachloroethane	U	U	U	U
toluene	U	U	U	U
chlorobenzene	U	U	U	U
ethylbenzene	U	U	U	U
styrene	U	U	U	U
total xylenes	U	U	13	U

TENTATIVELY IDENTIFIED COMPOUNDS:

Hexane	U	U	29 JN	U
Naphthalene derivative	U	U	U	900 J
Alkyl cycloalkane	U	U	U	5600 J
Alkyl cyclohexane	U	U	U	16000 J
Methyl cyclohexane	U	U	20 JN	U
Alkyl saturated hydrocarbon	U	U	9 J	U
Alkyl substituted hydrocarbon	U	U	19 J	U
Unsaturated hydrocarbon	U	U	18 J	U
Total unknown	U	U	60 J	3370 J

Qualifier Codes:

B:	This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.
J:	This result should be considered a quantitative estimate.
U:	This compound was not detected.
NA:	This analyte was not analyzed.
N:	Soil matrix spike recovery was outside the NYSDEC CLP QC limits.

TABLE 4-4, Contd.

VAN DER HORST PLANT 2, PHASE II
ON-SITE SUBSURFACE SOIL SAMPLES
TCL VOLATILE ORGANIC COMPOUNDS

SAMPLE NUMBER	MW-19 (16-18')	MW-20 (14-16')
MATRIX	Soil	Soil
DATE SAMPLED	10-Sep-91	11-Sep-91
UNITS	µg/Kg	µg/Kg
COMPOUND		
chloromethane	U	U
bromomethane	U	U
vinyl chloride	U	U
chloroethane	U	U
methylene chloride	U	U
acetone	U	U
carbon disulfide	U	U
1,1-Dichloroethene	U	U
1,1-Dichloroethane	U	U
1,2-Dichloroethene(total)	U	U
chloroform	U	U
1,2-Dichloroethane	U	U
2-Butanone	U	U
1,1,1-trichloroethane	U	U
carbon tetrachloride	U	U
vinyl acetate	U	U
bromodichloromethane	U	U
1,2-dichloropropane	U	U
cis-1,3-Dichloropropene	U	U
trichloroethene	U	U
dibromochloromethane	U	U
1,1,2-Trichloroethane	U	U
benzene	U	U
trans-1,3-Dichloropropene	U	U
bromoform	U	U
4-Methyl-2-Pentanone	U	U
2-Hexanone	U	U
tetrachloroethene	U	U
1,1,2,2-Tetrachloroethane	U	U
toluene	U	U
chlorobenzene	U	U
ethylbenzene	U	U
styrene	U	U
total xylenes	U	U

TENTATIVELY IDENTIFIED COMPOUNDS:

	MW-19 (16-18')		MW-20 (14-16')	
Alkyl substituted alkane	U		1800	J
Alkyl substituted alkene	U		6200	J
Alkyl cyclohexane derivative	U		3500	J
Cyclohexane derivative	1200	J	U	
Dimethyl cyclohexane isomer	2500	J	U	
Trimethyl cyclohexane isomer	2300	J	6900	J
Unsaturated hydrocarbon	U		1900	J
Total unknown hydrocarbon	11340	J	19600	J
Total unknown	4300	J	12900	J

Qualifier Codes:

B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.

J: This result should be considered a quantitative estimate.

U: This compound was not detected.

NA: This analyte was not analyzed.

TABLE 4-4, Contd.

VAN DER HORST PLANT 2, PHASE II
ON-SITE SUBSURFACE SOIL SAMPLES
TCL SEMIVOLATILE ORGANIC COMPOUNDS

SAMPLE NUMBER	B-35 (10-12')	DUP-4	B-35 (14-16')	B-36 (2'-4')	B-36 (12-14')
MATRIX	Soil	Soil	Soil	Soil	Soil
DATE ANALYZED	16-Sep-91	16-Sep-91	16-Sep-91	16-Sep-91	16-Sep-91
% MOISTURE	12%	8%	6%	21%	8%
UNITS	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
COMPOUND					
Phenol	U	U	U	U	U
bis(2-Chloroethyl)Ether	U	U	U	U	U
2-Chlorophenol	U	U	U	U	U
1,3-Dichlorobenzene	U	U	U	U	U
1,4-Dichlorobenzene	U	U	U	U	U
benzyl alcohol	U	U	U	U	U
1,2-Dichlolobenzene	U	U	U	U	U
2-Methylphenol	U	U	U	U	U
bis(2-Chloroisopropyl)Ether	U	U	U	U	U
4-Methylphenol	U	U	U	U	U
N-Nitroso-Di-n-Propylamine	U	U	U	U	U
hexachloroethane	U	U	U	U	U
nitrobenzene	U	U	U	U	U
isophorone	U	U	U	U	U
2-Nitrophenol	U	U	U	U	U
2,4-Dimethylphenol	U	U	U	U	U
benzoic acid	U	U	U	U	U
bis(2-Chloroethoxy)Methane	U	U	U	U	U
2,4-Dichlorophenol	U	U	U	U	U
1,2,4-Trichlorobenzene	U	U	U	U	U
Naphthalene	U	U	U	U	U
4-Chloroaniline	U	U	U	U	U
hexachlorobutadiene	U	U	U	U	U
4-Chloro-3-Methylphenol	U	U	U	U	U
2-Methylnaphthalene	U	U	U	2500	U
hexachlorocyclopentadiene	U	U	U	U	U
2,4,6-Trichlorophenol	U	U	U	U	U
2,4,5-Trichlorophenol	U	U	U	U	U
2-Chloronaphthalene	U	U	U	U	U
2-Nitroaniline	U	U	U	U	U
Dimethyl phthalate	U	U	U	U	U
acenaphthylene	U	U	U	U	U
2,6-Dinitrotoluene	U	U	U	U	U

Qualifier Codes:
B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.
J: This result should be considered a quantitative estimate.
U: This compound was not detected.

TABLE 4-4, Contd.

VAN DER HORST PLANT 2, PHASE II
ON-SITE SUBSURFACE SOIL SAMPLES
TCL SEMIVOLATILE ORGANIC COMPOUNDS

SAMPLE NUMBER	B-35 (10-12')	DUP-4	B-35 (14-16')	B-36 (2'-4')	B-36 (12-14')
MATRIX	Soil	Soil	Soil	Soil	Soil
DATE ANALYZED	16-Sep-91	16-Sep-91	16-Sep-91	16-Sep-91	16-Sep-91
% MOISTURE	12%	8%	6%	21%	8%
UNITS	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
COMPOUND					
3-Nitroaniline	U	U	U	U	U
acenaphthene	U	U	U	U	U
2,4-Dinitrophenol	U	U	U	U	U
4-Nitrophenol	U	U	U	U	U
Dibenzofuran	U	U	U	U	U
2,4-Dinitrotoluene	U	U	U	U	U
Diethylphthalate	U	U	U	U	U
4-Chlorophenyl-phenylether	U	U	U	U	U
fluorene	U	U	220 J	390 J	56 J
4-Nitroaniline	U	U	U	U	U
4,6-Dinitro-2-Methylphenol	U	U	U	U	U
N-Nitrosodiphenylamine (1)	U	U	U	360 J	U
4-Bromophenyl-phenylether	U	U	U	U	U
hexachlorobenzene	U	U	U	U	U
pentachlorophenol	U	U	U	U	U
phenanthrene	61 J	U	570 J	1100	240 J
anthracene	U	U	U	U	U
Di-n-Butylphthalate	U	U	U	U	U
fluoranthene	U	U	U	160 J	U
pyrene	U	U	260 J	180 J	110 J
butylbenzylphthalate	U	U	U	U	U
3,3'-Dichlorobenzidine	U	U	U	U	U
benzo (a) Anthracene	U	U	U	75 J	U
chrysene	U	U	U	99 J	U
bis(2-Ethylhexyl)Phthalate	120 J	360 J	260 J	440 J	U
Di-n-Octyl Phthalate	U	U	U	U	U
benzo (b) Fluoranthene	66 J	U	U	95 J	U
benzo (k) Fluoranthene	U	U	U	34 J	U
benzo (a) Pyrene	U	U	U	56 J	U
indeno (1,2,3-cd) Pyrene	U	U	U	U	U
Dibenz (a,h) Anthracene	U	U	U	U	U
Benzo (g,h,i) Perylene	U	U	U		U

TENTATIVELY IDENTIFIED COMPOUNDS:

Total alkyl cyclohexane	1800 J	3600 J	6400 J	U	2100 J
Total alkyl cycloalkane	U	U	10700 J	10500 J	1100 J
Cyclohexane derivative	1400 J	U	3500 J	U	2600 J
Pentanone derivative	U	24000 J	U	U	U
Dimethyl naphthalene isomer	U	U	U	13100 J	1300 J
Trimethyl naphthalene isomer	U	U	U	5300 J	U
Total alkyl saturated hydrocarbon	15390 J	17400 J	36600 J	73100 J	8300 J
Total alkyl substituted hydrocarbon	3390 J	3390 J	U	U	U
Total unknown hydrocarbon	5500 J	1500 J	2300 J	5800 J	12200 J
Total unknown	3260 J	6540 J	22900 J	17500 J	10900 J

Qualifier Codes:
B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.
J: This result should be considered a quantitative estimate.
U: This compound was not detected.

Beryllium was not detected in any of the on-site subsurface soil samples analyzed. Ten of the on-site subsurface soil samples were also analyzed for TCLP Metals. None of the detected parameters exceeded the USEPA limits for TCLP analysis.

4.3.2 Organics

A number of volatile organics were detected in the on-site subsurface soil samples. These included: benzene, detected in B-36 (2'-4') at 12 ppb; ethylbenzene, detected in B-36 (2'-4') at 130 ppb; tetrachloroethene, detected in B-21 (2'-4'), B-22 (2'-4') and MW-13D (0-2') at 2 ppb, 49 ppb, and 2 ppb, respectively; trichloroethene, detected in B-21 (2'-4'), B-22 (2'-4'), B-37 (10'-12'), B-38 (12'-14'), B-39 (16'-18'), B-40 (16'-18'), and MW-13D (0-2') at 2 ppb, 2 ppb, 1200 ppb, 670 ppb, 350 ppb, 290 ppb and 4 ppb, respectively; 1,1,1-trichloroethane, detected in B-22 (2'-4'), B-37 (10'-12') and B-38 (12'-14') at 490 ppb and 280 ppb, respectively; total xylenes, detected in B-19 (8'-10') at 1200 ppb, B-36 (2'-4'), at 470 ppb, B-36 (18'-20'), at 220 ppb and MW-13 (0-2') at 13 ppb; styrene, detected in B-19 (8'-10') at 690 ppb; toluene, detected in B-22 (2'-4') at 0.3 ppb and, acetone, detected in MW-13D (0'-2') at 75 ppb. Semivolatile organics detected included: phenanthrene and 2-Methylnaphthalene, detected in B-

36 (2'-4') at 1100 ppb and 2500 ppb, respectively. Numerous other semivolatile and tentatively identified compounds (TICs) were also detected and quantitatively estimated in many of the on-site subsurface soil samples.

4.4 Off-Site Surface Soil

Table 4-5 presents the analytical test results for the 14 surface soil samples (RSS-44 through RSS-55, BB-2R, RSS-41R) collected off-site. All of the above samples were analyzed for total chromium, arsenic, lead, and manganese to assess whether contaminated fugitive dust had migrated off-site. BB-2R was additionally analyzed for TCL volatile organics to verify the presence of methylene chloride detected near this location during the Phase I RI.

4.4.1 Inorganics

Inorganics were detected in all off-site surface soil samples. Arsenic was detected in all samples and concentrations ranged from 5.9 ppm in BB-2R to 26 ppm in RSS-53. Chromium concentrations ranged from 12.3 ppm (BB-2R) to 19.6 ppm (RSS-50) and lead levels were detected at 21.9 ppm for (RSS-44) to 398 ppm (RSS-41R). Manganese was also detected in all off-site surface soil samples. Levels ranged

TABLE 4-5

VAN DER HORST PLANT 2, PHASE II
OFF-SITE SURFACE SOIL SAMPLES

TOTAL METALS:

SAMPLE NUMBER	BB-2R		RSS-41R		RSS-44		RSS-45	
MATRIX	Soil		Soil		Soil		Soil	
DATE SAMPLED	21-Oct-91		21-Oct-91		21-Oct-91		21-Oct-91	
UNITS	mg/Kg		mg/Kg		mg/Kg		mg/Kg	
ANALYTE								
Arsenic	5.9	J	22.4	J	12.7	J	12.2	J
Barium	NA		250	J	NA		NA	
Chromium	12.3	J	17.4	J	13.6	J	14.3	J
Lead	156	J	398	J	21.9	J	29.3	J
Manganese	702	J	632	J	560	J	702	J
Zinc	NA		273	J	NA		NA	

SAMPLE NUMBER	RSS-46		RRS-47		RSS-48		DUP-16A	
MATRIX	Soil		Soil		Soil		Soil	
DATE SAMPLED	21-Oct-91		21-Oct-91		21-Oct-91		21-Oct-91	
UNITS	mg/Kg		mg/Kg		mg/Kg		mg/Kg	
ANALYTE								
Arsenic	14.8	J	11	J	16.4	J	21.8	J
Chromium	15.6	J	14.1	J	15.1	J	15.1	J
Lead	72.6	J	28.1	J	60.2	J	60.9	J
Manganese	635	J	677	J	1070	J	U	J

SAMPLE NUMBER	RSS-49		RSS-50		RSS-51		RSS-52	
MATRIX	Soil		Soil		Soil		Soil	
DATE SAMPLED	21-Oct-91		21-Oct-91		21-Oct-91		21-Oct-91	
UNITS	mg/Kg		mg/Kg		mg/Kg		mg/Kg	
ANALYTE								
Arsenic	17.4	J	20.6	J	14.3	J	23.7	J
Chromium	16.6	J	19.6	J	19.4	J	15.2	J
Lead	140	J	130	J	51.3	J	84.3	J
Manganese	578	J	624	J	604	J	1080	J

SAMPLE NUMBER	RSS-53		RSS-54		RSS-55	
MATRIX	Soil		Soil		Soil	
DATE SAMPLED	21-Oct-91		21-Oct-91		21-Oct-91	
UNITS	mg/Kg		mg/Kg		mg/Kg	
ANALYTE						
Arsenic	26	J	16.3	J	11.8	J
Chromium	16.1	J	19	J	16.6	J
Lead	95.5	J	110	J	149	J
Manganese	766	J	790	J	647	J

TCL VOLATILE ORGANICS:

SAMPLE NUMBER	BB-2R (RE)	
MATRIX	Soil	
DATE SAMPLED	21-Oct-91	
UNITS	µg/Kg	
COMPOUND		
chloromethane	U	
bromomethane	U	
vinyl chloride	U	
chloroethane	U	
methylene chloride	U	
acetone	U	
carbon disulfide	U	
1,1-Dichloroethene	U	
1,1-Dichloroethane	U	
1,2-Dichloroethene(total)	U	
chloroform	U	
1,2-Dichloroethene	U	
2-Butanone	U	
1,1,1-trichloroethane	U	
carbon tetrachloride	U	
vinyl acetate	U	
bromodichloromethane	U	
1,2-dichloropropane	U	
cis-1,3-Dichloropropene	U	
trichloroethene	U	
dibromochloromethane	U	
1,1,2-Trichloroethane	U	
benzene	7	J
trans-1,3-Dichloropropene	U	
bromoform	U	
4-Methyl-2-Pentanone	U	J
2-Hexanone	U	J
tetrachloroethene	U	J
1,1,2,2-Tetrachloroethane	U	J
toluene	U	J
chlorobenzene	U	J
ethylbenzene	U	J
styrene	U	J
total xylenes	U	J

Qualifier Codes:

U: This compound was not detected.

NA: This analyte was not analyzed.

J: This result should be considered a quantitative estimate.

from 560 ppm (RSS-44) to 1080 ppm (RSS-52).

4.4.2 Organics

BB-2R was the only off-site surface soil sample analyzed for volatile organics. Only benzene was detected in this sample, at a concentration of 7 ppb.

4.5 Off-Site Subsurface Soils

Ten off-site subsurface samples, obtained from five locations, were collected during the Phase II RI and analyzed for total chromium, arsenic, lead, manganese, and TCL volatile organics. The samples were collected from the unsaturated zone to vertically assess the potential presence of contamination at these off-site locations. The results of these analyses are presented on Table 4-6 and discussed below.

4.5.1 Organics

A number of volatile and semivolatile organics were detected in the off-site subsurface soil samples. These included: acetone, detected in MW-16S (19'-21') at 3,400 ppb; total xylenes, detected in two subsurface samples at concentrations of 2600 ppb in MW-14S (9'-11') to 19,000 ppb in

TABLE 4-6

VAN DER HORST PLANT 2, PHASE II
OFF-SITE SUBSURFACE SOIL SAMPLES
TCL VOLATILE ORGANIC COMPOUNDS

SAMPLE NUMBER	MW-8D (0'-2')	MW-8D (9'-11')	MW-11S (0'-2')	MW-11S (19-21')
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	14-Oct-91	14-Oct-91	16-Oct-91	16-Oct-91
UNITS	µg/Kg	µg/Kg	µg/Kg	µg/Kg
COMPOUND				
chloromethane	U	U	U	U
bromomethane	U	U	U	U
vinyl chloride	U	U	U	U
chloroethane	U	U	U	U
methylene chloride	U	U	U	U
acetone	8 J	U	U	U
carbon disulfide	U	U	U	U
1,1-Dichloroethene	U	U	U	U
1,1-Dichloroethane	U	U	U	U
1,2-Dichloroethene(total)	U	U	U	U
chloroform	U	U	U	U
1,2-Dichloroethane	U	U	U	U
2-Butanone	U	U	U	U
1,1,1-trichloroethane	U	U	U	U
carbon tetrachloride	U	U	U	U
vinyl acetate	U	U	U	U
bromodichloromethane	U	U	U	U
1,2-dichloropropane	U	U	U	U
cis-1,3-Dichloropropene	U	U	U	U
trichloroethene	U	U	U	U
dibromochloromethane	U	U	U	U
1,1,2-Trichloroethane	U	U	U	U
benzene	U	2 J	U	U
trans-1,3-Dichloropropene	U	U	U	U
bromoform	U	U	U	U
4-Methyl-2-Pentanone	U	U	U	U
2-Hexanone	U	U	U	U
tetrachloroethene	U	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U	U
toluene	U	U	U	U
chlorobenzene	U	U	U	U
ethylbenzene	U	U	U	U
styrene	U	U	U	U
total xylenes	U	U	U	U

TENTATIVELY IDENTIFIED COMPOUNDS:

Total methyl cyclohexane	U	U	U	16000 JN
Total dimethyl cyclohexane	U	U	U	195000 J
Total trimethyl cyclohexane	U	U	U	220000 J
Alkyl saturated hydrocarbon	U	U	U	110000 J
Total unknown	20 J	U	U	566000 J

Qualifier Codes:

B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.

J: This result should be considered a quantitative estimate.

U: This compound was not detected.

NA: This analyte was not analyzed.

N: Soil matrix spike recovery was outside the NYSDEC CLP QC limits.

TABLE 4-6, Contd.

VAN DER HORST PLANT 2, PHASE II
OFF-SITE SUBSURFACE SOIL SAMPLES
TCL VOLATILE ORGANIC COMPOUNDS

SAMPLE NUMBER	MW-14S (9-11')	MW-14S (14-16')	MW-15S (4-6')	MW-15S (14-16')
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	3-Oct-91	3-Oct-91	10-Oct-91	10-Oct-91
UNITS	µg/Kg	µg/Kg	µg/Kg	µg/Kg
COMPOUND				
chloromethane	U	U	U	U
bromomethane	U	U	U	U
vinyl chloride	U	U	U	U
chloroethane	U	U	U	U
methylene chloride	U	U	0.4 J	U
acetone	U	U	U	U
carbon disulfide	U	U	U	U
1,1-Dichloroethene	U	U	U	U
1,1-Dichloroethane	U	U	U	U
1,2-Dichloroethene(total)	U	U	U	U
chloroform	U	U	U	U
1,2-Dichloroethane	U	U	U	U
2-Butanone	U	U	U	U
1,1,1-trichloroethane	U	U	U	U
carbon tetrachloride	U	U	U	U
vinyl acetate	U	U	U	U
bromodichloromethane	U	U	U	U
1,2-dichloropropane	U	U	U	U
cis-1,3-Dichloropropene	U	U	U	U
trichloroethene	U	U	U	U
dibromochloromethane	U	U	U	U
1,1,2-Trichloroethane	U	U	U	U
benzene	U	U	U	U
trans-1,3-Dichloropropene	U	U	U	U
bromoform	U	U	U	U
4-Methyl-2-Pentanone	U	U	U	U
2-Hexanone	U	U	U	U
tetrachloroethene	U	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U	U
toluene	U	U	U	1 J
chlorobenzene	U	U	U	U
ethylbenzene	950	8200	U	U
styrene	U	U	U	U
total xylenes	2600	19000	U	U

TENTATIVELY IDENTIFIED COMPOUNDS:

Alkyl substituted hydrocarbon	9500 J	41800 J	U	U
Methyl cyclohexane	U	55000 JN	U	U
Unsaturated hydrocarbon	U	U	U	55 J
Total unknown	29200 J	46300 J	U	87 J

Qualifier Codes:
B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.
J: This result should be considered a quantitative estimate.
U: This compound was not detected.
NA: This analyte was not analyzed.
N: Soil matrix spike recovery was outside the NYSDEC CLP QC limits.

TABLE 4-6, Contd.

VAN DER HORST PLANT 2, PHASE II
OFF-SITE SUBSURFACE SOIL SAMPLES
TCL VOLATILE ORGANIC COMPOUNDS

SAMPLE NUMBER	MW-16S (0'-2')		MW-16S (19-21')	
MATRIX	Soil		Soil	
DATE SAMPLED	18-Oct-91		18-Oct-91	
UNITS	µg/Kg		µg/Kg	
COMPOUND				
chloromethane	U		U	J
bromomethane	U		U	J
vinyl chloride	U		U	J
chloroethane	U		U	J
methylene chloride	U		U	J
acetone	U		3400	J
carbon disulfide	U		U	J
1,1-Dichloroethene	U		U	J
1,1-Dichloroethane	U		U	J
1,2-Dichloroethene(total)	U		U	J
chloroform	U		U	J
1,2-Dichloroethane	U		U	J
2-Butanone	U		U	J
1,1,1-trichloroethane	U		U	J
carbon tetrachloride	U		U	J
vinyl acetate	U		U	J
bromodichloromethane	U		U	J
1,2-dichloropropane	U		U	J
cis-1,3-Dichloropropene	U		U	J
trichloroethene	U		U	J
dibromochloromethane	U		U	J
1,1,2-Trichloroethane	U		U	J
benzene	U		U	J
trans-1,3-Dichloropropene	U		U	J
bromoform	U		U	J
4-Methyl-2-Pentanone	U		U	J
2-Hexanone	U		U	J
tetrachloroethene	U		U	J
1,1,2,2-Tetrachloroethane	U		U	J
toluene	0.4	J	U	J
chlorobenzene	U		U	J
ethylbenzene	U		U	J
styrene	U		U	J
total xylenes	U		120	J

TENTATIVELY IDENTIFIED COMPOUNDS:

Alkyl cyclo alkane	U	5400	J
Cyclohexane derivative	U	6700	J
Trimethyl cyclohexane isomer	U	5000	J
Ethylmethyl cyclohexane isomer	U	4000	J
Oxygenated compound	U	4200	J
Alkyl saturated hydrocarbon	U	7200	J
Alkyl substituted hydrocarbon	U	13000	J
Total unknown	U	9700	J

Qualifier Codes:

B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.

J: This result should be considered a quantitative estimate.

U: This compound was not detected.

NA: This analyte was not analyzed.

TABLE 4-6, Contd.

VAN DER HORST PLANT 2, PHASE II
OFF-SITE SUBSURFACE SOIL SAMPLES
TOTAL METALS

SAMPLE NUMBER	MW-8D (0-2')		MW-8D (9-11')		MW-11S (0-2')	
MATRIX	Soil		Soil		Soil	
DATE SAMPLED	14-Oct-91		14-Oct-91		16-Oct-91	
UNITS	mg/Kg		mg/Kg		mg/Kg	
ANALYTE						
Arsenic	10.7	J	33.9	J	8.8	J
Chromium	28.4	J	21.4	J	21.8	J
Lead	51.3	J	21.7	J	27.2	J
Manganese	794		1320		209	

SAMPLE NUMBER	MW-11S (19-21')		MW-14S (9-11')		MW-14S (14-16')	
MATRIX	Soil		Soil		Soil	
DATE SAMPLED	16-Oct-91		3-Oct-91		3-Oct-91	
UNITS	mg/Kg		mg/Kg		mg/Kg	
ANALYTE						
Arsenic	13.7	J	11.7	J	7.6	J
Chromium	22.9	J	13	J	9.8	J
Lead	24.5	J	25.5	J	23.9	J
Manganese	1140		577	J	717	J

SAMPLE NUMBER	MW-15S (4-6')		MW-15S (14-16')		MW-16S (0-2')		MW-16S (19-21')	
MATRIX	Soil		Soil		Soil		Soil	
DATE SAMPLED	10-Oct-91		10-Oct-91		18-Oct-91		18-Oct-91	
UNITS	mg/Kg		mg/Kg		mg/Kg		mg/Kg	
ANALYTE								
Arsenic	11.5	J	10	J	35.6	J	8.6	J
Chromium	16.1	J	18	J	11	J	12.5	J
Lead	26.2	J	12.5	J	48.2	J	18.9	J
Manganese	1020		443		1280		566	

Qualifier Codes:
U: This analyte was not detected.
NA: The sample was not analyzed for this analyte.
J: This result should be considered a quantitative estimate.

MW-14S (4'-6'); and, ethylbenzene, detected in two subsurface samples, MW-14S (9'-11') and MW-14S (14'-16'), at concentrations of 950 ppb and 8200 ppb respectively. Numerous other tentatively identified compounds (TICs) were detected and quantitatively estimated a number of the on-site subsurface soil samples.

4.5.2 Inorganics

Concentrations of the specified inorganic compounds were detected in all of the off-site subsurface soils collected. Detected arsenic levels ranged from 7.6 ppm in MW-14S (14'-16') to 35.6 ppm in MW-16S (0-2'). Chromium ranged in concentration from 9.8 ppm in MW-14S (14'-16') to 28.4 ppm in MW-8D (0-2'). Analysis for lead indicated a range of concentration from 12.5 ppm for MW-15S (14'-16') to 51.3 ppm in MW-8D (0-2'). Finally, manganese was detected at concentrations ranging from 209 ppm in MW-11S (0-2') to 1,320 ppm in MW-8D (9'-11').

4.6 Building Interior Samples

A total of sixty-seven (67) wipe, dust and asbestos samples were collected from the interior of the plant building (see Figures 2-1 and 2-2). The samples were obtained and analyzed to assess the extent of contamination inside the facility and to assist in determining possible remedial measures, if necessary.

4.6.1 Wipe Samples

A summary of the analytical results for the thirty-eight (38) wipe samples, W-1 through W-38, is presented on Table 4-7. These samples were collected from the walls of the plant interior, various exhaust ducts and machine surfaces to assess the extent of contamination inside the building and on the production equipment. The samples were analyzed for total chromium, arsenic, lead, barium and manganese. Arsenic was detected in twenty-eight (28) of the samples with concentrations ranging from 5 ppb/wipe in W-29 to 160 ppb/wipe in W-26. Barium was detected in thirty-five (35) out of thirty-eight samples. Concentrations ranged from 100 ppb/wipe in W-2 to 11,300 ppb/wipe in W-26. Chromium was detected in all wipe samples. Levels ranged from 167 ppb/wipe in W-32 to 20,900 ppb/wipe in W-7. The levels of lead contamination ranged from 58 ppb/wipe in W-32 to 11,600 ppb/wipe in W-16. Lead was detected in all thirty-eight wipe samples. Finally, manganese contamination was detected in all wipe samples and ranged from 39 ppb/wipe in W-27 to 2800 ppb/wipe in W-26.

TABLE 4-7

VAN DER HORST PLANT 2, PHASE II
WIPE SAMPLES
TOTAL METALS

SAMPLE NUMBER	W-1		W-2		W-3		W-4	
MATRIX	Wipe		Wipe		Wipe		Wipe	
DATE SAMPLED	4-Oct-91		4-Oct-91		4-Oct-91		4-Oct-91	
UNITS	µg/L/Wipe		µg/L/Wipe		µg/L/Wipe		µg/L/Wipe	
ANALYTE								
Arsenic	12	J	11	J	U	J	16	J
Barium	130	BJ	100	BJ	180	BJ	440	J
Chromium	514	J	194	J	4770	J	7680	J
Lead	350	J	260	J	230	J	1950	J
Manganese	92	J	98	J	59	J	440	J

SAMPLE NUMBER	W-5		W-6		W-7		W-8	
MATRIX	Wipe		Wipe		Wipe		Wipe	
DATE SAMPLED	4-Oct-91		4-Oct-91		4-Oct-91		4-Oct-91	
UNITS	µg/L/Wipe		µg/L/Wipe		µg/L/Wipe		µg/L/Wipe	
ANALYTE								
Arsenic	6	BJ	14	J	28	J	13	J
Barium	250	J	280	J	935	J	185	BJ
Chromium	12800	J	2480	J	20900	J	1400	J
Lead	265	J	620	J	5140	J	1260	J
Manganese	162	J	254	J	464	J	153	J

SAMPLE NUMBER	W-9		W-10		W-11		W-12	
MATRIX	Wipe		Wipe		Wipe		Wipe	
DATE SAMPLED	4-Oct-91		4-Oct-91		4-Oct-91		4-Oct-91	
UNITS	µg/L/Wipe		µg/L/Wipe		µg/L/Wipe		µg/L/Wipe	
ANALYTE								
Arsenic	68.1	J	U	J	U	J	7	BJ
Barium	365	J	U	J	110	BJ	235	J
Chromium	2030	J	193	J	214	J	791	J
Lead	1820	J	124	J	180	J	640	J
Manganese	368	J	52	J	56	J	432	J

Qualifier Codes:

B: Indicates a value greater than or equal to the instrument detection limit but less than the CRDL

J: This result should be considered a quantitative estimate.

U: This analyte was not detected.

NA: The sample was not analyzed for this analyte.

TABLE 4-7, Contd.

VAN DER HORST PLANT 2, PHASE II
WIPE SAMPLES
TOTAL METALS

SAMPLE NUMBER	W-13		W-14		W-15		W-16	
MATRIX	Wipe		Wipe		Wipe		Wipe	
DATE SAMPLED	4-Oct-91		4-Oct-91		4-Oct-91		4-Oct-91	
UNITS	µg/L/Wipe		µg/L/Wipe		µg/L/Wipe		µg/L/Wipe	
ANALYTE								
Arsenic	18	J	57.4	J	U	J	18	J
Barium	160	BJ	510	J	275	J	2730	J
Chromium	582	J	486	J	630	J	312	J
Lead	1190	J	500	J	320	J	11600	J
Manganese	259	J	224	J	748	J	1040	J

SAMPLE NUMBER	W-17		W-18		W-19		W-20	
MATRIX	Wipe		Wipe		Wipe		Wipe	
DATE SAMPLED	4-Oct-91		4-Oct-91		4-Oct-91		4-Oct-91	
UNITS	µg/L/Wipe		µg/L/Wipe		µg/L/Wipe		µg/L/Wipe	
ANALYTE								
Arsenic	73	J	10	J	6	BJ	26	J
Barium	1620	J	410	J	1160	J	485	J
Chromium	4900	J	720	J	98	J	286	J
Lead	2050	J	1040	J	4870	J	2250	J
Manganese	2780	J	356	J	125	J	224	J

SAMPLE NUMBER	W-21		W-22		DUP-14		W-23	
MATRIX	Wipe		Wipe		Wipe		Wipe	
DATE SAMPLED	26-Sep-91		26-Sep-91		26-Sep-91		15-Oct-91	
UNITS	µg/L/Wipe		µg/L/Wipe		µg/L/Wipe		µg/L/Wipe	
ANALYTE								
Arsenic	8	BJ	13	J	10	J	13	J
Barium	170	BJ	230	J	225	J	768	J
Chromium	268	J	326	J	358	J	842	J
Lead	520	J	600	J	500	J	3190	J
Manganese	122	J	106	J	180	J	316	J

Qualifier Codes:
B: Indicates a value greater than or equal to the instrument detection limit but less than the CRDL
J: This result should be considered a quantitative estimate.
U: This analyte was not detected.
NA: The sample was not analyzed for this analyte.

TABLE 4-7, Contd.

VAN DER HORST PLANT 2, PHASE II
WIPE SAMPLES
TOTAL METALS

SAMPLE NUMBER	W-24		W-25		W-26		W-27	
MATRIX	Wipe		Wipe		Wipe		Wipe	
DATE SAMPLED	15-Oct-91		15-Oct-91		15-Oct-91		15-Oct-91	
UNITS	µg/L/Wipe		µg/L/Wipe		µg/L/Wipe		µg/L/Wipe	
ANALYTE								
Arsenic	U	J	9	BJ	160	J	U	J
Barium	112	BJ	175	BJ	11300	J	117	BJ
Chromium	245	J	262	J	172	J	177	J
Lead	335	J	84.8	J	365	J	90	J
Manganese	1560	J	1610	J	2800	J	39	J

SAMPLE NUMBER	W-28		W-29		W-30		DUP-15A	
MATRIX	Wipe		Wipe		Wipe		Wipe	
DATE SAMPLED	15-Oct-91		15-Oct-91		15-Oct-91		15-Oct-91	
UNITS	µg/L/Wipe		µg/L/Wipe		µg/L/Wipe		µg/L/Wipe	
ANALYTE								
Arsenic	U	J	5	BJ	U	J	U	J
Barium	140	BJ	187	BJ	162	BJ	92.9	BJ
Chromium	216	J	224	J	261	J	198	J
Lead	63	J	460	J	180	J	220	J
Manganese	58.6	J	83	J	84.8	J	54.3	J

SAMPLE NUMBER	W-31		W-32		W-33		W-34	
MATRIX	Wipe		Wipe		Wipe		Wipe	
DATE SAMPLED	15-Oct-91		15-Oct-91		24-Oct-91		24-Oct-91	
UNITS	µg/L/Wipe		µg/L/Wipe		µg/L/Wipe		µg/L/Wipe	
ANALYTE								
Arsenic	U	J	U	J	51.5	J	17	J
Barium	114	BJ	316	J	240	J	290	J
Chromium	302	J	167	J	3390	J	1900	J
Lead	2520	J	58	J	950	J	800	J
Manganese	115	J	113	J	133	J	698	J

SAMPLE NUMBER	W-35		W-36		W-37		W-38		DUP-17	
MATRIX	Wipe		Wipe		Wipe		Wipe		Wipe	
DATE SAMPLED	24-Oct-91		24-Oct-91		24-Oct-91		24-Oct-91		24-Oct-91	
UNITS	µg/L/Wipe		µg/L/Wipe		µg/L/Wipe		µg/L/Wipe		µg/L/Wipe	
ANALYTE										
Arsenic	25.1	J	8	BJ	29	J	8	BJ	6	BJ
Barium	260	J	U	J	U	J	420	J	310	J
Chromium	3580	J	230	J	1630	J	856	J	581	J
Lead	1740	J	105	J	700	J	140	J	140	J
Manganese	689	J	387	J	1360	J	329	J	271	J

Qualifier Codes:
B: Indicates a value greater than or equal to the instrument detection limit but less than the CRDL.
J: This result should be considered a quantitative estimate.
U: This analyte was not detected.
NA: The sample was not analyzed for this analyte.

4.6.2 Dust Samples

Fifteen (15) dust samples, designated DUST-1 through DUST-15, were collected from various locations on the facility floor. These samples were collected to assess the extent of contamination on the facility floor and to obtain an initial screening of where further sampling may be required during the design phase of the feasibility study. All dust samples were analyzed for total chromium, arsenic, lead, barium and manganese. The sample analysis results are presented on Table 4-8. Chromium was detected in all dust samples at values ranging from 280 ppm in DUST-11 to 46,900 ppm in DUST-13. Arsenic was detected in all dust samples at values ranging from 9.4 ppm in DUST-10 to 250 ppm in DUST-7. All samples contained detectable levels of lead. Concentrations ranged from 298 ppm in DUST-10 to 6400 ppm in DUST-7. Barium was detected in all wipe samples. Levels of contamination ranged from 63.9 ppm in DUST-10 to 2440 ppm in DUST-13.

4.6.3 Asbestos Samples

Fourteen (14) samples (AS-2-1 through AS-2-14) of material suspected of containing asbestos were collected during the Phase II RI. These samples were obtained to determine if asbestos was present and, if so, to assess the type and percentage of asbestos present. The samples consisted of pipe and elbow insulation and floor tiles collected from various areas throughout the facility. Polarized Light Microscopy results are presented on Table 4-9.

Thirteen of the fifteen samples analyzed indicated the presence of one or more forms of asbestos. Values ranged from 5% to 75% total content for chrysotile and 10% to 20% total content for amosite.

4.7 Catch Basin Sample

One sediment sample (CB-1) was collected from an exterior on-site catch basin. This exterior catch basin is part of an underground piping system that connected an internal building drain to an alleged Two Mile Creek outfall. The drain is located in a below-grade vault that contains vats formerly used in a wax dipping process. The drain is suspected of discharging to Two Mile Creek but its outfall has been covered and was not located by ERM personnel. This sample was analyzed for TCL volatile and semi-volatile organics, TAL metals, hexavalent chromium and pesticides/PCBs. The catch basin location is shown on Figure 2-6 and the analytical results are presented on Table 4-10.

TABLE 4-8

VAN DER HORST PLANT 2, PHASE II
DUST SAMPLES
TOTAL METALS

SAMPLE NUMBER	DUST-1	DUP-13	DUST-2	DUST-3
MATRIX	"Dust"	"Dust"	"Dust"	"Dust"
DATE SAMPLED	26-Sep-91	26-Sep-91	26-Sep-91	26-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	12.1 J	19.1 J	21.4 J	24.6 J
Barium	654 J	714 J	788 J	836 J
Chromium	3140	3090 J	3050	3760
Lead	1110	921	2540	2140
Manganese	1190	1110 J	1270	1050

SAMPLE NUMBER	DUST-4	DUST-5	DUST-6	DUST-7
MATRIX	"Dust"	"Dust"	"Dust"	"Dust"
DATE SAMPLED	26-Sep-91	26-Sep-91	26-Sep-91	26-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	21.4 J	41.4 J	48 J	250 J
Barium	430 J	400 J	112 J	353 J
Chromium	5700	3020	1710	22800
Lead	3390	2910	360	6400
Manganese	956	1740	2840	1780

SAMPLE NUMBER	DUST-8	DUST-9	DUST-10	DUST-11
MATRIX	"Dust"	"Dust"	"Dust"	"Dust"
DATE SAMPLED	26-Sep-91	26-Sep-91	26-Sep-91	26-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	22.6 J	9.6 J	9.4 J	11 J
Barium	159 J	150 J	63.9 J	211 J
Chromium	1320	764	791	280
Lead	404	325	298	412
Manganese	715	942	703	692

SAMPLE NUMBER	DUST-12	DUST-13	DUST-14	DUST-15
MATRIX	"Dust"	"Dust"	"Dust"	"Dust"
DATE SAMPLED	26-Sep-91	26-Sep-91	26-Sep-91	26-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	21.9 J	19.7 J	21 J	28.9 J
Barium	335 J	2440 J	1470 J	297 J
Chromium	3290	46900	46500	1040
Lead	752	5150	3840	964
Manganese	729	1200	1460	1320

J: This result should be considered a quantitative estimate.

TABLE 4-9

VAN DER HORST PLANT 2, PHASE II
BUILDING INTERIOR
ASBESTOS SAMPLES

SAMPLE NUMBER	AS-2-1	AS-2-2	AS-2-3	AS-2-4	AS-2-5
DATE SAMPLED	8-Nov-91	8-Nov-91	8-Nov-91	8-Nov-91	8-Nov-91
UNITS	% OF TOTAL	% OF TOTAL	% OF TOTAL	% OF TOTAL	% OF TOTAL
ASBESTOS:					
CHRYSOTILE	40	38	—	75	18
AMOSITE	—	—	—	—	20
NONASBESTOS:					
CELLULOSE	3	5	55	<1	<1
MINERAL WOOL	—	—	—	—	—
FIBROUS GLASS	—	—	—	—	—
NONFIBROUS MATERIAL	57	57	45	24	61

SAMPLE NUMBER	AS-2-6	AS-2-7	AS-2-8	AS-2-9	AS-2-10
DATE SAMPLED	8-Nov-91	8-Nov-91	8-Nov-91	8-Nov-91	8-Nov-91
UNITS	% OF TOTAL	% OF TOTAL	% OF TOTAL	% OF TOTAL	% OF TOTAL
ASBESTOS:					
CHRYSOTILE	23	20	20	30	40
AMOSITE	18	10	15	20	—
NONASBESTOS:					
CELLULOSE	<1	<1	<1	<1	10
MINERAL WOOL	25	25	25	—	15
FIBROUS GLASS	30	40	—	—	30
NONFIBROUS MATERIAL	3	4	39	49	5

SAMPLE NUMBER	AS-2-11	AS-2-12(A)	AS-2-12(B)	AS-2-13	AS-2-14
DATE SAMPLED	8-Nov-91	8-Nov-91	8-Nov-91	8-Nov-91	8-Nov-91
UNITS	% OF TOTAL	% OF TOTAL	% OF TOTAL	% OF TOTAL	% OF TOTAL
ASBESTOS:					
CHRYSOTILE	18	5	—	20	20
AMOSITE	20	—	—	15	15
NONASBESTOS:					
CELLULOSE	<1	<1	<1	<1	<1
MINERAL WOOL	25	—	—	25	25
FIBROUS GLASS	33	—	—	30	35
NONFIBROUS MATERIAL	3	94	99	9	4

TABLE 4-10

VAN DER HORST PLANT 2, PHASE II
CATCH BASIN SEDIMENT SAMPLES
TCL VOLATILE ORGANICS

SAMPLE NUMBER	CB-1 (RE)	
MATRIX	Soil	
DATE SAMPLED	27-Sep-91	
UNITS	µg/Kg	
COMPOUND		
chloromethane	U	J
bromomethane	U	J
vinyl chloride	U	J
chloroethane	U	J
methylene chloride	U	J
acetone	140	J
carbon disulfide	19	J
1,1-Dichloroethene	U	J
1,1-Dichloroethane	U	J
1,2-Dichloroethene(total)	16	J
chloroform	0.8	J
1,2-Dichloroethane	U	J
2-Butanone	U	J
1,1,1-trichloroethane	U	J
carbon tetrachloride	U	J
vinyl acetate	U	J
bromodichloromethane	U	J
1,2-dichloropropane	U	J
cis-1,3-Dichloropropene	U	J
trichloroethene	18	J
dibromochloromethane	U	J
1,1,2-Trichloroethane	U	J
benzene	7	BJ
trans-1,3-Dichloropropene	U	J
bromoform	U	J
4-Methyl-2-Pentanone	U	J
2-Hexanone	U	J
tetrachloroethene	22	J
1,1,2,2-Tetrachloroethane	U	J
toluene	18	BJ
chlorobenzene	13	BJ
ethylbenzene	1	J
styrene	U	J
total xylenes	U	

TENTATIVELY IDENTIFIED COMPOUNDS:

Alkyl cyclohexane	180	J
Unsaturated hydrocarbon	70	J
Total unknown	1055	J

Qualifier Codes:

B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.

J: This result should be considered a quantitative estimate.

U: This compound was not detected.

NA: This analyte was not analyzed.

TABLE 4-10, Contd.

VAN DER HORST PLANT 2, PHASE II
CATCH BASIN SEDIMENT SAMPLES
TCL SEMIVOLATILE ORGANICS

SAMPLE NUMBER	CB-1 (RE)	
MATRIX	Soil	
DATE ANALYZED	27-Sep-91	
% MOISTURE	52%	
UNITS	µg/Kg	
COMPOUND		
Phenol		
bis(2-Chloroethyl)Ether	760	J
2-Chlorophenol	U	
1,3-Dichlorobenzene	U	
1,4-Dichlorobenzene	1800	
benzyl alcohol	U	
1,2-Dichlolobenzene	U	
2-Methylphenol	U	
bis(2-Chloroisopropyl)Ether	U	
4-Methylphenol	2400	
N-Nitroso-Di-n-Propylamine	U	
hexachloroethane	U	
nitrobenzene	U	
isophorone	U	
2-Nitrophenol	U	
2,4-Dimethylphenol	U	
benzoic acid	U	
bis(2-Chloroethoxy)Methane	U	
2,4-Dichlorophenol	U	
1,2,4-Trichlorobenzene	U	
Naphthalene	670	J
4-Chloroaniline	U	
hexachlorobutadiene	U	
4-Chloro-3-Methylphenol	U	
2-Methylnaphthalene	770	J
hexachlorocyclopentadiene	U	
2,4,6-Trichlorophenol	U	
2,4,5-Trichlorophenol	U	
2-Chloronaphthalene	U	
2-Nitroaniline	U	
Dimethyl phthalate	U	
acenaphthylene	U	
2,6-Dinitrotoluene	U	

SAMPLE NUMBER	CB-1 (RE)	
MATRIX	Soil	
DATE ANALYZED	27-Sep-91	
% MOISTURE	52%	
UNITS	µg/Kg	
COMPOUND		
3-Nitroaniline	U	
acenaphthene	U	
2,4-Dinitrophenol	U	
4-Nitrophenol	U	
Dibenzofuran	U	
2,4-Dinitrotoluene	U	
Diethylphthalate	U	
4-Chlorophenyl-phenylether	U	
fluorene	U	
4-Nitroaniline	U	
4,6-Dinitro-2-Methylphenol	U	
N-Nitrosodiphenylamine (1)	U	
4-Bromophenyl-phenylether	U	
hexachlorobenzene	U	
pentachlorophenol	U	
phenanthrene	U	
anthracene	U	
Di-n-Butylphthalate	U	
fluoranthene	U	
pyrene	2400	
butylbenzylphthalate	U	
3,3'-Dichlorobenzidine	U	
benzo (a) Anthracene	980	J
chrysene	750	J
bis(2-Ethylhexyl)Phthalate	64000	E
Di-n-Octyl Phthalate	U	
benzo (b) Fluoranthene	860	J
benzo (k) Fluoranthene	U	
benzo (a) Pyrene	240	J
indeno (1,2,3-cd) Pyrene	U	
Dibenz (a,h) Anthracene	U	
Benzo (g,h,i) Perylene	U	

TENTATIVELY IDENTIFIED COMPOUNDS:

Alkyl saturated hydrocarbon	32900	J
Long chain hydrocarbon	5100	J
Total unknown hydrocarbon	45800	J
Unknown acid	3900	J
Unknown ester	15300	J
Total unknown	29900	J

Qualifier Codes:

B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.

J: This result should be considered a quantitative estimate.

U: This compound was not detected.

NA: This analyte was not analyzed.

E: This value is estimated due to the presence of interference.

TABLE 4-10, Contd.

VAN DER HORST PLANT 2, PHASE II
CATCH BASIN SEDIMENT SAMPLES

TAL METALS & HEX. CHROMIUM:

SAMPLE NUMBER	CB-1	
MATRIX	Soil	
DATE ANALYZED	27-Sep-91	
UNITS	mg/Kg	
ANALYTE		
Aluminum	4830	J
Antimony	425	BJ
Arsenic	147	J
Barium	935	J
Beryllium	U	J
Cadmium	38.9	J
Calcium	28300	J
Chromium	43000	J
Cobalt	30.7	J
Copper	3370	J
Iron	250000	J
Lead	3720	J
Magnesium	4840	J
Manganese	1340	J
Mercury	4.1	J
Nickel	759	J
Potassium	586	BJ
Selenium	U	J
Silver	16.1	J
Sodium	3160	J
Thallium	U	J
Vanadium	47.2	J
Zinc	1560	J

Hexavalent Chromium	39.2	J

PESTICIDES/PCBs:

SAMPLE NUMBER	CB-1	
MATRIX	Soil	
DATE ANALYZED	27-Sep-91	
UNITS	µg/Kg	
COMPOUND		
alpha-BHC	U	
beta-BHC	U	
delta-BHC	U	
gamma-BHC(Lindane)	29	J
Heptachlor	120	
Aldrin	76	
Heptachlor epoxide	43	
Endosulfan I	U	
Dieldrin	U	
4,4'-DDE	U	
Endrin	U	
Endosulfan II	U	
4,4'-DDD	4.8	J
Endosulfan sulfate	970	
4,4'-DDT	U	
Methoxychlor	U	
Endrin ketone	U	
alpha-chlordane	U	
gamma-chlordane	28	J
Toxaphene	U	
Aroclor-1016	U	
Aroclor-1221	U	
Aroclor-1232	U	
Aroclor-1242	U	
Aroclor-1248	U	
Aroclor-1254	U	
Aroclor-1260	U	

Qualifier Codes:

B : This result is qualitatively invalid because the analyte was also detected in a blank at a similar concentration.
J : This result should be considered a quantitative estimate.
U : This analyte was not detected.
NA : This analyte was not analyzed.

4.7.1 Organics

Several volatile organics were detected in the catch basin sample. These included: acetone, at 140 ppb; carbon disulfide, at 19 ppb; 1,2-Dichloroethene (total), at 16 ppb; chloroform, at 0.8 ppb; trichloroethene, at 18 ppb; benzene, at 7 ppb; tetrachloroethene, at 22 ppb; toluene, at 18 ppb; chlorobenzene, at 13 ppb and ethylbenzene, at 1 ppb.

Several semi-volatile organics were also detected in CB-1. These included: bis(2-Chloroethyl)Ether, at 760 ppb; 1,4 Dichlorobenzene, at 1800 ppb; 4-Methylphenol, at 2400 ppb; Napthalene, at 670 ppb; 2-Methylnapthalene at 770 ppb; pyrene, at 2400 ppb, benzo (a) Anthracene, at 980 ppb; chrysene, at 750 ppb; bis(2-Ethylhexyl)Phthalate, at 64000 ppb; benzo (b) Floranthene, at 860 ppb; and, benzo (a) Pyrene, at 240 ppb.

4.7.2 Inorganics

Twenty (20) inorganic compounds were detected upon analysis of CB-1. Of concern are: barium, at 935 ppm; cadmium, at 38.9 ppm; chromium, at 43,000 ppm; mercury at 4.1 ppm; lead, at 3720 ppm; zinc, at 1560 ppm; and, hexavalent chromium, at 39.2 ppm.

4.7.3 Pesticides/PCBs

Four pesticide organic compounds were detected in CB-1 upon analysis. The detected compounds included: Heptaclor, at 120 ppb; Aldrin, at 76 ppb; Endosulfan sulfate, at 970 ppb; and, Heptaclor epoxide, at 43 ppb.

4.8 Two Mile Creek Samples

Tables 4-11 and 4-12 include a summary of the analytical results for the Two Mile Creek surface water and sediment samples collected during the Phase II RI. Five (5) samples of each media were sampled and designated TMC-5 through TMC-9 for the sediment and TMC-5W through TMC-9W for the surface water (see Figure 2-5). The sediment samples were analyzed for TCL volatile organics, total chromium, arsenic, lead, cadmium, beryllium and manganese. The surface water samples were also analyzed for the above metals plus hexavalent chromium.

4.8.1 Inorganics

The inorganic analysis of surface water samples TMC-5W through TMC-9W found no detectable levels of arsenic in those samples. Barium was detected in all samples at levels ranging from 47.9 ppb in TMC-5W to 144 ppb in TMC-8W. Cadmium was

TABLE 4-11

VAN DER HORST PLANT 2, PH. 2 & 3
TWO MILE CREEK SURFACE WATER SAMPLES
TOTAL METALS

SAMPLE NUMBER	TMC-5W	TMC-6W	TMC-7W	DUP-16
MATRIX	Water	Water	Water	Water
DATE SAMPLED	27-Sep-91	27-Sep-91	27-Sep-91	27-Sep-91
UNITS	µg/L	µg/L	µg/L	µg/L
ANALYTE				
Arsenic	U	U	U	U
Barium	47.9 B	64 B	67 B	64.5 B
Beryllium	U	U	U	U
Cadmium	U	U	U	U
Chromium	U	U	U	U
Lead	3 J	5 J	6	4
Manganese	78.9 J	210 J	45.7 J	47.1 J
Zinc	NA	NA	66.1	NA

Hexavalent Chromium	18	18	21	20

SAMPLE NUMBER	TMC-8W	TMC-9W
MATRIX	Water	Water
DATE SAMPLED	27-Sep-91	27-Sep-91
UNITS	µg/L	mg/Kg
ANALYTE		
Arsenic	5 B	U
Barium	144 B	75.9 B
Beryllium	U	U
Cadmium	5.9	U
Chromium	15.8	16.3
Lead	25	12
Manganese	1060 J	282 J
Zinc	105	59.4

Hexavalent Chromium	16	22

Qualifier Codes:
B: Indicates a value greater than or equal to the instrument detection limit but less than the CRDL.
J: This result should be considered a quantitative estimate.
U: This analyte was not detected.
NA: The sample was not analyzed for this analyte.

TABLE 4-12

VAN DER HORST PLANT 2, PHASE II
TWO MILE CREEK SEDIMENT SAMPLES
TOTAL METALS

SAMPLE NUMBER	TMC-5	TMC-6	TMC-7	DUP-15
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	27-Sep-91	27-Sep-91	27-Sep-91	27-Sep-91
UNITS	mg/Kg	mg/Kg	mg/Kg	mg/Kg
ANALYTE				
Arsenic	13.1 J	16.2 J	8.5 J	6 J
Barium	132 J	171 J	119 J	76.7 J
Beryllium	U J	U J	U J	U J
Cadmium	7.8 J	11.5 J	7.5 J	4.7 J
Chromium	46.7 J	48.9 J	13.5 J	10.6 J
Lead	70.8 J	68.1 J	31.3 J	22.1 J
Manganese	414 J	1050 J	517 J	327 J

SAMPLE NUMBER	TMC-8	TMC-9
MATRIX	Soil	Soil
DATE SAMPLED	27-Sep-91	27-Sep-91
UNITS	mg/Kg	mg/Kg
ANALYTE		
Arsenic	12.4 J	12.1 J
Barium	160 J	180 J
Beryllium	U J	U J
Cadmium	9.4 J	11.3 J
Chromium	228 J	75.8 J
Lead	69.9 J	74.8 J
Manganese	632 J	934 J

Qualifier Codes:

B: Indicates a value greater than or equal to the instrument detection limit but less than the CRDL.

J: This result should be considered a quantitative estimate.

U: This analyte was not detected.

NA: The sample was not analyzed for this analyte.

TABLE 4-12, Contd.

VAN DER HORST PLANT 2, PHASE II
TWO MILE CREEK SEDIMENT SAMPLES
TCL VOLATILES

SAMPLE NUMBER	TMC-5	TMC-6	TMC-7	DUP-15
MATRIX	Soil	Soil	Soil	Soil
DATE SAMPLED	27-Sep-91	27-Sep-91	27-Sep-91	27-Sep-91
UNITS	µg/Kg	µg/Kg	µg/Kg	µg/Kg
COMPOUND				
chloromethane	U	U	U	U
bromomethane	U	U	U	U
vinyl chloride	U	U	U	U
chloroethane	U	U	U	U
methylene chloride	U	U	U	U
acetone	U	U	74	U
carbon disulfide	U	U	U	U
1,1-Dichloroethene	U	U	U	U
1,1-Dichloroethane	U	U	U	U
1,2-Dichloroethene(total)	U	U	U	U
chloroform	U	U	U	U
1,2-Dichloroethane	U	U	U	U
2-Butanone	U	U	U	U
1,1,1-trichloroethane	U	U	U	U
carbon tetrachloride	U	U	U	U
vinyl acetate	U	U	U	U
bromodichloromethane	U	U	U	U
1,2-dichloropropane	U	U	U	U
cis-1,3-Dichloropropene	U	U	U	U
trichloroethene	U	4 J	U	U
dibromochloromethane	U	U	U	U
1,1,2-Trichloroethane	U	U	U	U
benzene	U	U	U	U
trans-1,3-Dichloropropene	U	U	U	U
bromoform	U	U	U	U
4-Methyl-2-Pentanone	U	U	U	U
2-Hexanone	U	U	U	U
tetrachloroethene	U	0.5 J	U	U
1,1,2,2-Tetrachloroethane	U	U	U	U
toluene	U	U	U	U
chlorobenzene	U	U	U	U
ethylbenzene	U	U	U	U
styrene	U	0.5 J	U	U
total xylenes	U	U	U	U

TENTATIVELY IDENTIFIED COMPOUNDS:

Alkyl substituted compound	U	20 J	U	28 J
Unknown hydrocarbon	63 J	U	U	U
Total unknown	U	U	22 J	12 J

Qualifier Codes:

B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.

J: This result should be considered a quantitative estimate.

U: This compound was not detected.

NA: This analyte was not analyzed.

VAN DER HORST PLANT 2, PHASE II
TWO MILE CREEK SEDIMENT SAMPLES
TCL VOLATILES

SAMPLE NUMBER	TMC-8	TMC-9
MATRIX	Soil	Soil
DATE SAMPLED	27-Sep-91	27-Sep-91
UNITS	µg/Kg	µg/Kg
COMPOUND		
chloromethane	U	U
bromomethane	U	U
vinyl chloride	U	U
chloroethane	U	U
methylene chloride	U	U
acetone	U	U
carbon disulfide	U	U
1,1-Dichloroethene	U	U
1,1-Dichloroethane	U	U
1,2-Dichloroethene(total)	U	U
chloroform	U	U
1,2-Dichloroethane	U	U
2-Butanone	U	U
1,1,1-trichloroethane	U	U
carbon tetrachloride	U	U
vinyl acetate	U	U
bromodichloromethane	U	U
1,2-dichloropropane	U	U
cis-1,3-Dichloropropene	U	U
trichloroethene	U	U
dibromochloromethane	U	U
1,1,2-Trichloroethane	U	U
benzene	U	U
trans-1,3-Dichloropropene	U	U
bromoform	U	U
4-Methyl-2-Pentanone	U	U
2-Hexanone	U	U
tetrachloroethene	U	U
1,1,2,2-Tetrachloroethane	U	U
toluene	U	U
chlorobenzene	U	U
ethylbenzene	U	U
styrene	U	U
total xylenes	U	U

TENT. IDENT. COMPOUNDS:

Total unknown	105	J	30	J

Qualifier Codes:

B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.

J: This result should be considered a quantitative estimate.

U: This compound was not detected.

NA: This analyte was not analyzed.

detected in one surface water sample, TMC-4W, at a level of 5.9 ppb. Levels of chromium contamination were detected in two of the surface water samples, ranging from 15.8 ppm for TMC-8W to 16.3 ppb in TMC-9W. Lead concentrations were detected in all samples and ranged from 3 ppb in TMC-5W to 31.3 ppb in TMC-7W. Concentrations of manganese were detected in all surface water samples and ranged from 45.7 ppb in TMC-7W to 1060 ppb in TMC-8W. Beryllium was undetected in the surface water samples collected during the phase II RI. Hexavalent chromium was detected in all surface water samples and ranged in concentration from 16 ppb in TMC-8W to 22 ppb in TMC-9W.

Inorganics analysis of the stream sediment samples detected the following elements in all samples analyzed: 1) Arsenic, in levels that ranged from 8.5 ppm in TMC-7 to 16.2 ppm in TMC-6; 2) barium, in concentrations that ranged from 119 ppm in TMC-7 to 180 ppm in TMC-9; 3) chromium, detected in levels that ranged from 13.5 ppm in TMC-7 to 228 ppm in TMC-8; 4) cadmium, in concentrations that ranged from 7.5 ppm in TMC-7 to 11.5 ppm in TMC-6; 5) lead, in levels that ranged from 31.3 ppm in TMC-7 to 74.8 ppm in TMC-9; and 6) manganese, detected in levels that ranged from 414 ppm in TMC-5 to 1050 ppm in TMC-6.

4.8.2 Organics

The analysis of Two Mile Creek sediment samples, TMC-5 through TMC-9, for the presence of volatile organics detected acetone in TMC-7 at a concentration of 74 ppb.

4.9 Ground Water Samples

Table 4-13 presents the analytical results for ground water samples collected during the Phase II RI. During the Phase II RI, samples from the Phase I and II ground water monitoring wells (30 in total) were tested for TCL volatile organics, hexavalent chromium, pH and total chromium, arsenic, lead, beryllium and manganese.

4.9.1 Organics and Pesticides/PCBs

TCL volatile organics detected in the ground water samples include: total xylenes, carbon disulfide, tricloroethene, benzene, toluene, 1,2-Dichloroethene (total), vinyl chloride and ethylbenzene. Total xylenes were detected in eighteen (18) of the thirty wells sampled. Concentrations of this compound ranged from 5 ppb in MW-20 to a level that exceeded the calibration range of the GS/MS instrument in MW-14S. Carbon disulfide was detected in samples from two wells,

TABLE 4-13

VAN DER HORST PLANT 2, PHASE II
GROUND WATER SAMPLES
TCL VOLATILE ORGANICS

SAMPLE NUMBER	MW-1S-W		MW-1D-W		MW-2S-W		MW-2D-W	
MATRIX	Water		Water		Water		Water	
DATE SAMPLED	5-Nov-91		5-Nov-91		6-Nov-91		6-Nov-91	
UNITS	µg/L		µg/L				µg/L	
COMPOUND								
chloromethane	U		U	J	U		U	
bromomethane	U		U	J	U		U	
vinyl chloride	U		U	J	U		U	
chloroethane	U		U	J	U		U	
methylene chloride	U		U	J	U		U	
acetone	U		U	J	U		U	
carbon disulfide	U		U	J	U		U	
1,1-Dichloroethene	U		U	J	U		U	
1,1-Dichloroethane	U		U	J	U		U	
1,2-Dichloroethene(total)	U		U	J	U		U	
chloroform	U		U	J	U		U	
1,2-Dichloroethane	U		U	J	U		U	
2-Butanone	U		U	J	U		U	
1,1,1-trichloroethane	U		U	J	U		U	
carbon tetrachloride	U		U	J	U		U	
vinyl acetate	U		U	J	U		U	
bromodichloromethane	U		U	J	U		U	
1,2-dichloropropane	U		U	J	U		U	
cis-1,3-Dichloropropene	U		U	J	U		U	
trichloroethene	U		U	J	U		U	
dibromochloromethane	U		U	J	U		U	
1,1,2-Trichloroethane	U		U	J	U		U	
benzene	U		U	J	64		31	
trans-1,3-Dichloropropene	U		U	J	U		U	
bromoform	U		U	J	U		U	
4-Methyl-2-Pentanone	U		U	J	U		U	
2-Hexanone	U		U	J	U		U	
tetrachloroethene	U		U	J	U		U	
1,1,2,2-Tetrachloroethane	0.6	J	U	J	U		U	
toluene	U		U	J	0.8	J	22	
chlorobenzene	U		U	J	U		U	
ethylbenzene	U		U	J	0.2	J	3	J
styrene	U		U	J	U		U	
total xylenes	U		U	J	0.7	J	73	

TENTATIVELY IDENTIFIED COMPOUNDS:

Methyl cyclopentene	U		U		U		180	J
Methyl cyclopentene isomer	U		U		26	J		
Ethyl methyl benzene isomer	9	J	U		U		U	
Trimethyl benzene isomer	U		47	J	U		U	
Alkyl cycloalkane	U		U		8	J	170	J
Alkyl substituted hydrocarbon	U		U		U		130	J
Unsaturated hydrocarbon	U		U		81	J	402	J
Total unknown	7	J	12	J	35	J	750	J

Qualifier Codes:

B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.

J: This result should be considered a quantitative estimate.

U: This compound was not detected.

NA: This analyte was not analyzed.

TABLE 4-13, Contd.

VAN DER HORST PLANT 2, PHASE II
GROUND WATER SAMPLES
TCL VOLATILE ORGANICS

SAMPLE NUMBER	MW-3S-W		MW-3D-W		MW-4S-W (RE)		MW-4D-W	
MATRIX	Water		Water		Water		Water	
DATE SAMPLED	5-Nov-91		5-Nov-91		5-Nov-91		5-Nov-91	
UNITS	µg/L		µg/L		µg/L		µg/L	
COMPOUND								
chloromethane	U		U	J	U	J	U	J
bromomethane	U		U	J	U	J	U	J
vinyl chloride	U		U	J	U	J	U	J
chloroethane	U		U	J	U	J	U	J
methylene chloride	U		U	J	U	J	U	J
acetone	U		U	J	U	J	U	J
carbon disulfide	U		U	J	U	J	U	J
1,1-Dichloroethene	U		U	J	U	J	U	J
1,1-Dichloroethane	U		U	J	U	J	U	J
1,2-Dichloroethene(total)	U		U	J	U	J	U	J
chloroform	U		U	J	U	J	U	J
1,2-Dichloroethane	U		U	J	U	J	U	J
2-Butanone	U		U	J	U	J	U	J
1,1,1-trichloroethane	U		U	J	U	J	U	J
carbon tetrachloride	U		U	J	U	J	U	J
vinyl acetate	U		U	J	U	J	U	J
bromodichloromethane	U		U	J	U	J	U	J
1,2-dichloropropane	U		U	J	U	J	U	J
cis-1,3-Dichloropropene	U		U	J	U	J	U	J
trichloroethene	U		U	J	U	J	U	J
dibromochloromethane	U		U	J	U	J	U	J
1,1,2-Trichloroethane	U		U	J	U	J	U	J
benzene	9		18	J	U	J	26	J
trans-1,3-Dichloropropene	U		U	J	U	J	U	J
bromoform	U		U	J	U	J	U	J
4-Methyl-2-Pentanone	U		U	J	U	J	U	J
2-Hexanone	U		U	J	U	J	U	J
tetrachloroethene	U		U	J	U	J	U	J
1,1,2,2-Tetrachloroethane	U		U	J	U	J	U	J
toluene	4	J	18	J	U	J	14	J
chlorobenzene	U		U	J	U	J	U	J
ethylbenzene	0.9	J	0.9	J	U	J	U	J
styrene	U		U	J	U	J	U	J
total xylenes	7		31	J	U	J	6	J

TENTATIVELY IDENTIFIED COMPOUNDS:

Alkyl cycloalkane	6	J	150	J	U		U	
Cyclohexane derivative	10	J	U		U		U	
Ethylmethyl benzene isomer	U		U		19	J	U	
Hexene isomer	34	J	200	J	U		140	J
Methyl cyclohexene isomer	56	J	U		U		U	
Methyl cyclopentene	U		150	J	U		U	
Methyl cyclopentene isomer	15	J	U		U		96	J
Saturated hydrocarbon	U		150	J	U		U	
Unsaturated hydrocarbon	46	J	201	J	U		190	J
Alkyl unsaturated hydrocarbon	U		317	J	8	J	U	
Unknown hydrocarbon	U		U		U		51	J
Total unknown	48	J	333	J	U		219	J

Qualifier Codes:

B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.

J: This result should be considered a quantitative estimate.

U: This compound was not detected.

NA: This analyte was not analyzed.

TABLE 4-13, Contd.

VAN DER HORST PLANT 2, PHASE II
GROUND WATER SAMPLES
TCL VOLATILE ORGANICS

SAMPLE NUMBER	MW-5S-W	DUP-18	MW-5D-W
MATRIX	Water	Water	Water
DATE SAMPLED	7-Nov-91	7-Nov-91	7-Nov-91
UNITS	µg/L	µg/L	µg/L
COMPOUND			
chloromethane	U	U	U
bromomethane	U	U	U
vinyl chloride	U	U	U
chloroethane	U	U	U
methylene chloride	U	U	U
acetone	U	U	U
carbon disulfide	21	7	U
1,1-Dichloroethene	U	U	U
1,1-Dichloroethane	U	U	U
1,2-Dichloroethene(total)	U	U	U
chloroform	U	U	U
1,2-Dichloroethane	U	U	U
2-Butanone	U	U	U
1,1,1-trichloroethane	U	U	U
carbon tetrachloride	U	U	U
vinyl acetate	U	U	U
bromodichloromethane	U	U	U
1,2-dichloropropane	U	U	U
cis-1,3-Dichloropropene	U	U	U
trichloroethene	U	U	U
dibromochloromethane	U	U	U
1,1,2-Trichloroethane	U	U	U
benzene	34	24	U
trans-1,3-Dichloropropene	U	U	U
bromoform	U	U	U
4-Methyl-2-Pentanone	U	U	U
2-Hexanone	U	U	U
tetrachloroethene	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U
toluene	21	18	U
chlorobenzene	U	U	U
ethylbenzene	0.3 J	0.3 J	U
styrene	U	U	U
total xylenes	17	15	U

TENTATIVELY IDENTIFIED COMPOUNDS:

Alkyl substituted hydrocarbon	147 J	135 J	U
Alkyl cycloalkane	80 J	72 J	U
Methyl cyclopentene isomer	130 J	130 J	U
Unsaturated hydrocarbon	140 J	U	
Unknown hydrocarbon	68 J	U	
Total unknown	340 J	546 J	U

Qualifier Codes:

B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.

J: This result should be considered a quantitative estimate.

U: This compound was not detected.

NA: This analyte was not analyzed.

TABLE 4-13, Contd.

VAN DER HORST PLANT 2, PHASE II
GROUND WATER SAMPLES
TCL VOLATILE ORGANICS

SAMPLE NUMBER	MW-6S-W	MW-6D-W	MW-7S-W	MW-7D-W
MATRIX	Water	Water	Water	Water
DATE SAMPLED	5-Nov-91	5-Nov-91	6-Nov-91	6-Nov-91
UNITS	µg/L	µg/L	µg/L	µg/L
COMPOUND				
chloromethane	U	U	U	U
bromomethane	U	U	U	U
vinyl chloride	U	U	U	U
chloroethane	U	U	U	U
methylene chloride	U	U	U	U
acetone	U	U	U	U
carbon disulfide	U	U	U	U
1,1-Dichloroethene	U	U	U	U
1,1-Dichloroethane	U	U	U	U
1,2-Dichloroethene(total)	U	U	U	U
chloroform	U	U	U	U
1,2-Dichloroethane	U	U	U	U
2-Butanone	U	U	U	U
1,1,1-trichloroethane	U	U	U	U
carbon tetrachloride	U	U	U	U
vinyl acetate	U	U	U	U
bromodichloromethane	U	U	U	U
1,2-dichloropropane	U	U	U	U
cis-1,3-Dichloropropene	U	U	U	U
trichloroethene	U	U	U	U
dibromochloromethane	U	U	U	U
1,1,2-Trichloroethane	U	U	U	U
benzene	U	24	170	14
trans-1,3-Dichloropropene	U	U	U	U
bromoform	U	U	U	U
4-Methyl-2-Pentanone	U	U	U	U
2-Hexanone	U	U	U	U
tetrachloroethene	U	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U	U
toluene	U	19	33	12
chlorobenzene	U	U	U	U
ethylbenzene	U	5	86	0.8 J
styrene	U	U	U	U
total xylenes	U	22	140	26

TENTATIVELY IDENTIFIED COMPOUNDS:

	MW-6S-W	MW-6D-W	MW-7S-W	MW-7D-W
Aromatic derivative	U	U	U	39 J
Alkyl cycloalkene	U	U	84 J	170 J
Methyl cyclohexane isomer	U	U	73 J	U
Methyl cyclohexene isomer	U	90 J	U	U
Methyl cyclopentene isomer	U	160 J	110 J	170 J
Ethylmethyl benzene isomer	U	U	U	21 J
Saturated hydrocarbon	U	100 J	U	U
Alkyl unsaturated hydrocarbon	U	U	25 J	U
Unsaturated hydrocarbon	U	128 J	247 J	370 J
Unknown hydrocarbon	U	U	59 J	160 J
Total unknown	14 J	561 J	178 J	354 J

Qualifier Codes:
B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.
J: This result should be considered a quantitative estimate.
U: This compound was not detected.
NA: This analyte was not analyzed.

TABLE 4-13, Contd.

VAN DER HORST PLANT 2, PHASE II
GROUND WATER SAMPLES
TCL VOLATILE ORGANICS

SAMPLE NUMBER	MW-8S-W		MW-8D-W		MW-9-W	
MATRIX	Water		Water		Water	
DATE SAMPLED	5-Nov-91		5-Nov-91		6-Nov-91	
UNITS	µg/L		µg/L		µg/L	
COMPOUND						
chloromethane	U	J	U	J	U	
bromomethane	U	J	U	J	U	
vinyl chloride	U	J	U	J	U	
chloroethane	U	J	U	J	U	
methylene chloride	U	J	U	J	U	
acetone	U	J	U	J	U	
carbon disulfide	U	J	U	J	U	
1,1-Dichloroethene	U	J	U	J	U	
1,1-Dichloroethane	U	J	U	J	U	
1,2-Dichloroethene(total)	U	J	U	J	18	
chloroform	U	J	U	J	U	
1,2-Dichloroethane	U	J	U	J	U	
2-Butanone	U	J	U	J	U	
1,1,1-trichloroethane	U	J	U	J	U	
carbon tetrachloride	U	J	U	J	U	
vinyl acetate	U	J	U	J	U	
bromodichloromethane	U	J	U	J	U	
1,2-dichloropropane	U	J	U	J	U	
cis-1,3-Dichloropropene	U	J	U	J	U	
trichloroethene	U	J	U	J	3	J
dibromochloromethane	U	J	U	J	U	
1,1,2-Trichloroethane	U	J	U	J	U	
benzene	U	J	50	J	U	
trans-1,3-Dichloropropene	U	J	U	J	U	
bromoform	U	J	U	J	U	
4-Methyl-2-Pentanone	U	J	U	J	U	
2-Hexanone	U	J	U	J	U	
tetrachloroethene	U	J	U	J	2	J
1,1,2,2-Tetrachloroethane	U	J	U	J	U	
toluene	U	J	32	J	U	
chlorobenzene	U	J	U	J	U	
ethylbenzene	U	J	2	J	U	
styrene	U	J	U	J	U	
total xylenes	U	J	31	J	U	

TENTATIVELY IDENTIFIED COMPOUNDS:

Hexene isomer	U		160	J	U	
Cyclohexane derivative	U		U		6	J
Methyl cyclopentane	U		83	JN	U	
Unsaturated hydrocarbon	U		671	J	U	
Total unknown	U		267	J	U	

Qualifier Codes:

B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.

J: This result should be considered a quantitative estimate.

U: This compound was not detected.

NA: This analyte was not analyzed.

N: Soil matrix spike recovery was outside the NYSDEC CLP QC limits.

TABLE 4-13, Contd.

VAN DER HORST PLANT 2, PHASE II
GROUND WATER SAMPLES
TCL VOLATILE ORGANICS

SAMPLE NUMBER	MW-10S-W	MW-10D-W	DUP-19
MATRIX	Water	Water	Water
DATE SAMPLED	7-Nov-91	7-Nov-91	7-Nov-91
UNITS	µg/L	µg/L	µg/L
COMPOUND			
chloromethane	U	U	U
bromomethane	U	U	U
vinyl chloride	U	U	U
chloroethane	U	U	U
methylene chloride	U	U	U
acetone	U	U	U
carbon disulfide	U	9	10
1,1-Dichloroethene	U	U	U
1,1-Dichloroethane	U	U	U
1,2-Dichloroethene(total)	U	U	U
chloroform	U	U	U
1,2-Dichloroethane	U	U	U
2-Butanone	U	U	U
1,1,1-trichloroethane	U	U	U
carbon tetrachloride	U	U	U
vinyl acetate	U	U	U
bromodichloromethane	U	U	U
1,2-dichloropropane	U	U	U
cis-1,3-Dichloropropene	U	U	U
trichloroethene	U	U	U
dibromochloromethane	U	U	U
1,1,2-Trichloroethane	U	U	U
benzene	17	55	57
trans-1,3-Dichloropropene	U	U	U
bromoform	U	U	U
4-Methyl-2-Pentanone	U	U	U
2-Hexanone	U	U	U
tetrachloroethene	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U
toluene	24	52	54
chlorobenzene	U	U	U
ethylbenzene	150	46	46
styrene	U	U	U
total xylenes	140	91	93

TENTETIVELY IDENTIFIED COMPOUNDS:

	MW-10S-W		MW-10D-W		DUP-19	
Aromatic derivative	100	J	U		U	
Cyclohexane	270	JN	U		210	JN
Methyl cyclohexene isomer	U		190	J	U	
Alkyl cycloalkane	200	J	U		U	
Alkyl cyclopentene	U		U		300	J
Methyl cyclopentene isomer	250	J	270	J	U	
Dimethyl cyclopentene isomer	U		62	J	U	
Alkyl substituted hydrocarbon	470	J	270	J	201	J
Unsaturated hydrocarbon	440	J	120	J	470	J
Unknown hydrocarbon	U		140	J	U	
Total unknown	490	J	634	J	580	J

Qualifier Codes:

B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.

J: This result should be considered a quantitative estimate.

U: This compound was not detected.

NA: This analyte was not analyzed.

N: Soil matrix spike recovery was outside the NYSDEC CLP QC limits.

TABLE 4-13, Contd.

VAN DER HORST PLANT 2, PHASE II
GROUND WATER SAMPLES
TCL VOLATILE ORGANICS

SAMPLE NUMBER	MW-11S-W		MW-12S-W		MW-12D-W	
MATRIX	Water		Water		Water	
DATE SAMPLED	4-Nov-91		6-Nov-91		6-Nov-91	
UNITS	µg/L		µg/L		µg/L	
COMPOUND						
chloromethane	U		U		U	
bromomethane	U		U		U	
vinyl chloride	U		U		U	
chloroethane	U		U		U	
methylene chloride	U		U		U	
acetone	U		U		U	
carbon disulfide	U		U		3	J
1,1-Dichloroethene	U		U		U	
1,1-Dichloroethane	U		U		U	
1,2-Dichloroethene(total)	U		U		U	
chloroform	U		U		U	
1,2-Dichloroethane	U		U		U	
2-Butanone	U		U		U	
1,1,1-trichloroethane	U		U		U	
carbon tetrachloride	U		U		U	
vinyl acetate	U		U		U	
bromodichloromethane	U		U		U	
1,2-dichloropropane	U		U		U	
cis-1,3-Dichloropropene	U		U		U	
trichloroethene	U		U		U	
dibromochloromethane	U		U		U	
1,1,2-Trichloroethane	U		U		U	
benzene	U		16		15	
trans-1,3-Dichloropropene	U		U		U	
bromoform	U		U		U	
4-Methyl-2-Pentanone	U		U		U	
2-Hexanone	U		U		U	
tetrachloroethene	U		U		U	
1,1,2,2-Tetrachloroethane	U		U		U	
toluene	U		14		6	
chlorobenzene	U		U		U	
ethylbenzene	U		2	J	0.9	J
styrene	U		U		U	
total xylenes	4	J	92		7	

TENTATIVELY IDENTIFIED COMPOUNDS:

Cyclohexane	250	JN	U		U	
Methyl cyclohexane	600	JN	U		U	
Methyl cyclopentane	140	JN	U		U	
Methyl cyclopentene isomer	U		110	J	U	
Trimethyl benzene isomer	U		34	J	67	J
Alkyl cyclohexane	120	J	U		U	
Alkyl cycloalkane	66	J	90	J	48	J
Alkyl substituted hydrocarbon	U		46	J	U	
Unsaturated hydrocarbon	U		161	J	169	J
Unknown hydrocarbon	U		70	J	U	
Total unknown	392	J	270	J	319	J

Qualifier Codes:

B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.
J: This result should be considered a quantitative estimate.
U: This compound was not detected.
NA: This analyte was not analyzed.
N: Soil matrix spike recovery was outside the NYSDEC CLP QC limits.

TABLE 4-13, Contd.

VAN DER HORST PLANT 2, PHASE II
GROUND WATER SAMPLES
TCL VOLATILE ORGANICS

SAMPLE NUMBER	MW-13S-W		MW-13D-W		MW-14S-W		MW-14D-W	
MATRIX	Water		Water		Water		Water	
DATE SAMPLED	5-Nov-91		5-Nov-91		5-Nov-91		4-Nov-91	
UNITS	µg/L		µg/L				µg/L	
COMPOUND								
chloromethane	U	J	U		U		U	
bromomethane	U	J	U		U		U	
vinyl chloride	U	J	U		U		U	
chloroethane	U	J	U		U		U	
methylene chloride	U	J	U		U		U	
acetone	U	J	U		U		U	
carbon disulfide	U	J	U		U		U	
1,1-Dichloroethene	U	J	U		U		U	
1,1-Dichloroethane	U	J	U		U		U	
1,2-Dichloroethene(total)	U	J	U		U		U	
chloroform	U	J	U		U		U	
1,2-Dichloroethane	U	J	U		U		U	
2-Butanone	U	J	U		U		U	
1,1,1-trichloroethane	U	J	U		U		U	
carbon tetrachloride	U	J	U		U		U	
vinyl acetate	U	J	U		U		U	
bromodichloromethane	U	J	U		U		U	
1,2-dichloropropane	U	J	U		U		U	
cis-1,3-Dichloropropene	U	J	U		U		U	
trichloroethene	U	J	U		U		U	
dibromochloromethane	U	J	U		U		U	
1,1,2-Trichloroethane	U	J	U		U		U	
benzene	72	J	12		81		U	
trans-1,3-Dichloropropene	U	J	U		U		U	
bromoform	U	J	U		U		U	
4-Methyl-2-Pentanone	U	J	U		U		U	
2-Hexanone	U	J	U		U		U	
tetrachloroethene	U	J	U		U		U	
1,1,2,2-Tetrachloroethane	U	J	U		U		U	
toluene	34	J	10		70		U	
chlorobenzene	U	J	U		U		U	
ethylbenzene	20	J	3	J	230	E	U	
styrene	U	J	U		U		U	
total xylenes	39	J	14		300	E	U	

TENTATIVELY IDENTIFIED COMPOUNDS:

Alkyl saturated hydrocarbon	U		U		U		21	J
Alkyl substituted hydrocarbon	89	J	U		U		U	
Alkyl cycloalkane	U		U		390	J	29	J
Alkyl cyclohexane derivative	66	J	U		U		U	
Hexene isomer	U		96	J	U		U	
Methyl cyclohexane	U		U		U		38	JN
Methyl cyclohexene isomer	U		41	J	U		U	
Methyl cyclopentane	93	JN	U		U		U	
Methyl cyclopentene	120	J	U		U		U	
Methyl cyclopentene isomer	U		85	J	200	J	U	
Saturated hydrocarbon	U		76	J	U		U	
Unsaturated hydrocarbon	533	J	68	J	250	J	U	
Total unknown	497	J	191	J	606	J	96	J

Qualifier Codes:

E: Concentration exceeded the calibration range of the GC/MS instrument.

B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.

J: This result should be considered a quantitative estimate.

U: This compound was not detected.

NA: This analyte was not analyzed.

N: Soil matrix spike recovery was outside the NYSDEC CLP QC limits.

TABLE 4-13, Contd.

VAN DER HORST PLANT 2, PHASE II
GROUND WATER SAMPLES
TCL VOLATILE ORGANICS

SAMPLE NUMBER	MW-15S-W		MW-16S-W		MW-19-W		DUP-20		MW-20-W	
MATRIX	Water		Water		Water		Water		Water	
DATE SAMPLED	4-Nov-91		4-Nov-91		7-Nov-91		7-Nov-91		7-Nov-91	
UNITS	µg/L		µg/L		µg/L		µg/L		µg/L	
COMPOUND										
chloromethane	U		U		U		U		U	
bromomethane	U		U		U		U		U	
vinyl chloride	U		U		0.8	J	0.8	J	43	
chloroethane	U		U		U		U		U	
methylene chloride	U		U		U		U		U	
acetone	U		U		U		U		U	
carbon disulfide	U		10		U		U		3	J
1,1-Dichloroethene	U		U		U		U		2	J
1,1-Dichloroethane	U		U		U		U		U	
1,2-Dichloroethene(total)	U		U		2	J	2	J	110	
chloroform	U		U		U		U		U	
1,2-Dichloroethane	U		U		U		U		U	
2-Butanone	U		U		U		U		U	
1,1,1-trichloroethane	U		U		U		U		U	
carbon tetrachloride	U		U		U		U		U	
vinyl acetate	U		U		U		U		U	
bromodichloromethane	U		U		U		U		U	
1,2-dichloropropane	U		U		U		U		U	
cis-1,3-Dichloropropene	U		U		U		U		U	
trichloroethene	U		U		U		U		33	
dibromochloromethane	U		U		U		U		U	
1,1,2-Trichloroethane	U		U		U		U		U	
benzene	81		0.8	J	37		35		3	J
trans-1,3-Dichloropropene	U		U		U		U		U	
bromoform	U		U		U		U		U	
4-Methyl-2-Pentanone	U		U		U		U		U	
2-Hexanone	U		U		U		U		U	
tetrachloroethene	U		U		U		U		U	
1,1,2,2-Tetrachloroethane	U		U		U		U		U	
toluene	9		0.6	J	5		4	J	1	J
chlorobenzene	U		U		U		U		U	
ethylbenzene	0.8	J	U		3	J	2	J	0.4	J
styrene	U		U		U		U		U	
total xylenes	15		2	J	8		U		5	

TENTATIVELY IDENTIFIED COMPOUNDS:

Cyclohexane	U		12	JN	U		U		43	JN
Cyclohexane derivative	U		U		12	J	U		U	
Alkyl cyclohexane	68	J	14	J	U		U		U	
Methyl cyclohexane	540	JN	78	JN	U		U		U	
Methyl cyclohexene isomer	U		6	J	U		U		U	
Dimethyl cyclohexane isomer	U		U		U		U		20	J
Methyl cyclopentane	160	JN	14	JN	U		U		U	
Methyl cyclopentene isomer	U		U		U		35	J	U	
Trimethyl benzene isomer	U		U		58	J	64	J	54	J
Alkyl substituted hydrocarbon	U		U		40	J	20	J	U	
Unsaturated hydrocarbon	U		U		135	J	80	J	30	J
Total unknown	813	J	56	J	142	J	181	J	173	J

Qualifier Codes:
B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.
J: This result should be considered a quantitative estimate.
U: This compound was not detected.
NA: This analyte was not analyzed.
N: Soil matrix spike recovery was outside the NYSDEC CLP QC limits.

TABLE 4-13, Contd.

VAN DER HORST PLANT 2, PHASE II
GROUND WATER SAMPLES
TCL SEMIVOLATILE ORGANIC COMPOUNDS

SAMPLE NUMBER	MW-19-W	DUP-20	MW-20-W
MATRIX	Water	Water	Water
DATE ANALYZED	7-Nov-91	7-Nov-91	7-Nov-91
UNITS	µg/L	µg/L	µg/L
COMPOUND			
Phenol	U	U	U
bis(2-Chloroethyl)Ether	U	U	U
2-Chlorophenol	U	U	U
1,3-Dichlorobenzene	U	U	U
1,4-Dichlorobenzene	U	U	U
benzyl alcohol	U	U	U
1,2-Dichlolobenzene	U	U	U
2-Methylphenol	U	U	U
bis(2-Chloroisopropyl)Ether	U	U	U
4-Methylphenol	U	U	U
N-Nitroso-Di-n-Propylamine	U	U	U
hexachloroethane	U	U	U
nitrobenzene	U	U	U
isophorone	U	U	U
2-Nitrophenol	U	U	U
2,4-Dimethylphenol	U	U	U
benzoic acid	U	U	U
bis(2-Chloroethoxy)Methane	U	U	U
2,4-Dichlorophenol	U	U	U
1,2,4-Trichlorobenzene	U	U	U
Naphthalene	U	U	U
4-Chloroaniline	U	U	U
hexachlorobutadiene	U	U	U
4-Chloro-3-Methylphenol	U	U	U
2-Methylnaphthalene	U	7 J	U
hexachlorocyclopentadiene	U	U	U
2,4,6-Trichlorophenol	U	U	U
2,4,5-Trichlorophenol	U	U	U
2-Chloronaphthalene	U	U	U
2-Nitroaniline	U	U	U
Dimethyl phthalate	U	U	U
acenaphthylene	U	U	U
2,6-Dinitrotoluene	U	U	U

Qualifier Codes:

B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.

J: This result should be considered a quantitative estimate.

U: This compound was not detected.

TABLE 4-13, Contd.

VAN DER HORST PLANT 2, PHASE II
GROUND WATER SAMPLES
TCL SEMIVOLATILE ORGANIC COMPOUNDS

SAMPLE NUMBER	MW-19-W		DUP-20		MW-20-W	
MATRIX	Water		Water		Water	
DATE ANALYZED	7-Nov-91		7-Nov-91		7-Nov-91	
UNITS	µg/L		µg/L		µg/L	
COMPOUND						
3-Nitroaniline	U		U		U	
acenaphthene	U		U		U	
2,4-Dinitrophenol	U	J	U	J	U	J
4-Nitrophenol	U		U		U	
Dibenzofuran	U		U		U	
2,4-Dinitrotoluene	U		U		U	
Diethylphthalate	U		U		U	
4-Chlorophenyl-phenylether	U		U		U	
fluorene	5	J	6	J	U	
4-Nitroaniline	U		U		U	
4,6-Dinitro-2-Methylphenol	U		U		U	
N-Nitrosodiphenylamine (1)	U		11	J	41	
4-Bromophenyl-phenylether	U		U		U	
hexachlorobenzene	U		U		U	
pentachlorophenol	U		U		U	
phenanthrene	3	J	4	J	U	
anthracene	U		U		U	
Di-n-Butylphthalate	U		U		U	
fluoranthene	U		U		U	
pyrene	U		U		U	
butylbenzylphthalate	U		U		U	
3,3'-Dichlorobenzidine	U		U		U	
benzo (a) Anthracene	U		U		U	
chrysene	3	J	U		U	
bis(2-Ethylhexyl)Phthalate	U		4	J	U	
Di-n-Octyl Phthalate	U		U		U	
benzo (b) Fluoranthene	U		U		U	
benzo (k) Fluoranthene	U		U		U	
benzo (a) Pyrene	U		U		U	
indeno (1,2,3-cd) Pyrene	U		U		U	
Dibenz (a,h) Anthracene	U		U		U	
Benzo (g,h,i) Perylene	U		U		U	

TENTATIVELY IDENTIFIED COMPOUNDS:

Trimethyl naphthalene isome	U		50	J	U	
Tetramethyl benzene isomer	U		U		18	J
Cyclohexyl derivative	42	J	U		U	
Alkyl cyclohexane derivative	U		U		36	J
Alkyl cycloalkane	U		36	J	U	
Alkyl saturated hydrocarbon	716	J	975	J	190	J
Total unknown	690	J	461	J	68	J

Qualifier Codes:

B: This result is qualitatively invalid because the compound was also detected in a blank at a similar concentration.

J: This result should be considered a quantitative estimate.

U: This compound was not detected.

TABLE 4-13, Contd.

VAN DER HORST PLANT 2, PHASE II
GROUND WATER SAMPLES
PESTICIDES/PCBs

SAMPLE NUMBER	MW-19-W	DUP-20	MW-20-W
MATRIX	Water	Water	Water
DATE ANALYZED	7-Nov-91	7-Nov-91	7-Nov-91
UNITS	µg/L	µg/L	µg/L
COMPOUND			
alpha-BHC	U	U	U
beta-BHC	U	U	U
delta-BHC	U	U	U
gamma-BHC(Lindane)	U	U	U
Heptachlor	U	U	U
Aldrin	U	U	U
Heptachlor epoxide	U	U	U
Endosulfan I	U	U	U
Dieldrin	U	U	U
4,4'-DDE	U	U	U
Endrin	U	U	U
Endosulfan II	U	U	U
4,4'-DDD	U	U	U
Endosulfan sulfate	U	U	U
4,4'-DDT	U	U	U
Methoxychlor	U	U	U
Endrin ketone	U	U	U
alpha-chlordane	U	U	U
gamma-chlordane	U	U	U
Toxaphene	U	U	U
Aroclor-1016	U	U	U
Aroclor-1221	U	U	U
Aroclor-1232	U	U	U
Aroclor-1242	U	U	U
Aroclor-1248	U	U	U
Aroclor-1254	U	U	U
Aroclor-1260	U	U	U

Qualifier Codes:

B: This result is qualitatively invalid because the compound was also dete
in a blank at a similar concentration.

J: This result should be considered a quantitative estimate.

U: This compound was not detected.

TABLE 4-13, Contd.

VAN DER HORST PLANT 2, PHASE II
GROUND WATER SAMPLES
TOTAL METALS & HEX CHROME

SAMPLE NUMBER	MW-1S-W		MW-1D-W		MW-2S-W		MW-2D-W	
MATRIX	Water		Water		Water		Water	
DATE SAMPLED	5-Nov-91		5-Nov-91		6-Nov-91		6-Nov-91	
UNITS	µg/L		µg/L		µg/L		µg/L	
ANALYTE								
Arsenic	43		11	J	46.4	J	20	J
Beryllium	U	J	U	J	U		U	
Chromium	68	J	22	J	393	J	38	J
Lead	102	J	19	J	200	J	63	J
Manganese	4350	J	1200	J	6770	J	2510	J
Hexavalent Chromium	58	J	56	J	U		20	

SAMPLE NUMBER	MW-3S-W		MW-3D-W		MW-4S-W		MW-4D-W	
MATRIX	Water		Water		Water		Water	
DATE SAMPLED	5-Nov-91		5-Nov-91		5-Nov-91		5-Nov-91	
UNITS	µg/L		µg/L		µg/L		µg/L	
ANALYTE								
Arsenic	41		20.7		26		35	
Beryllium	U	J	U	J	6.4	J	U	J
Chromium	62	J	U	J	187	J	22	J
Lead	155	J	8	J	293	J	18	J
Manganese	12200	J	1330	J	13100	J	1780	J
Hexavalent Chromium	55	J	30	J	68	J	52	J

SAMPLE NUMBER	MW-5S-W		MW-5D-W		DUP-18	
MATRIX	Water		Water		Water	
DATE SAMPLED	7-Nov-91		7-Nov-91		7-Nov-91	
UNITS	µg/L		µg/L		µg/L	
ANALYTE						
Arsenic	31	J	8	BJ	27	J
Beryllium	U		U		U	
Chromium	U	J	362	J	23.8	J
Lead	37	J	55	J	30	J
Manganese	1800	J	2240	J	1860	J
Hexavalent Chromium	U		U		U	

SAMPLE NUMBER	MW-6S-W		MW-6D-W		MW-7S-W		MW-7D-W	
MATRIX	Water		Water		Water		Water	
DATE SAMPLED	5-Nov-91		5-Nov-91		6-Nov-91		6-Nov-91	
UNITS	µg/L		µg/L		µg/L		µg/L	
ANALYTE								
Arsenic	90		34		55	J	26	J
Beryllium	U	J	U	J	11		U	
Chromium	66	J	20	J	539	J	28.8	J
Lead	153	J	72.8	J	600	J	55	J
Manganese	3880	J	1800	J	11500	J	2380	J
Hexavalent Chromium	88	J	58	J	17		16	

Qualifier Codes:

B: Indicates a value greater than or equal to the instrument detection limit but less than the CRDL.

J: This result should be considered a quantitative estimate.

U: This analyte was not detected.

NA: The sample was not analyzed for this analyte.

TABLE 4-13, Contd.

VAN DER HORST PLANT 2, PHASE II
GROUND WATER SAMPLES
TOTAL METALS & HEX CHROME

SAMPLE NUMBER	MW-8S-W		MW-8D-W		MW-9-W	
MATRIX	Water		Water		Water	
DATE SAMPLED	5-Nov-91		5-Nov-91		6-Nov-91	
UNITS	µg/L		µg/L		µg/L	
ANALYTE						
Arsenic	29		7	B	50	J
Beryllium	U	J	U	J	16.7	
Chromium	64	J	74	J	10100	J
Lead	100	J	76.1	J	6380	J
Manganese	4550	J	2420	J	26500	J
Hexavalent Chromium	62	J	63	J	15	

SAMPLE NUMBER	MW-10S-W		MW-10D-W		DUP-19		MW-11S-W		MW-12S-W		MW-12D-W	
MATRIX	Water		Water		Water		Water		Water		Water	
DATE SAMPLED	7-Nov-91		7-Nov-91		7-Nov-91		4-Nov-91		6-Nov-91		6-Nov-91	
UNITS	µg/L		µg/L		µg/L		µg/L		µg/L		µg/L	
ANALYTE												
Arsenic	179	J	93	J	78.1	J	44		97.2	J	20	J
Beryllium	15		U		U		U	J	U		U	
Chromium	827	J	58	J	54.4	J	114	J	87	J	U	J
Lead	1670	J	156	J	170	J	518	J	309	J	34	J
Manganese	84500	J	4550	J	4530	J	6080	J	6760	J	1050	J
Hexavalent Chromium	U		U		U		37	J	19		23	

SAMPLE NUMBER	MW-13S-W		MW-13D-W		MW-14S-W		MW-14D-W	
MATRIX	Water		Water		Water		Water	
DATE SAMPLED	5-Nov-91		5-Nov-91		4-Nov-91		4-Nov-91	
UNITS	µg/L		µg/L		µg/L		µg/L	
ANALYTE								
Arsenic	67		27		60		19	
Beryllium	U	J	U	J	6.4	J	U	J
Chromium	58	J	33	J	197	J	13	J
Lead	189	J	70.5	J	467	J	38.8	J
Manganese	4470	J	2640	J	19100	J	556	J
Hexavalent Chromium	36	J	40	J	46	J	U	J

SAMPLE NUMBER	MW-15S-W		MW-16S-W	
MATRIX	Water		Water	
DATE SAMPLED	4-Nov-91		4-Nov-91	
UNITS	µg/L		µg/L	
ANALYTE				
Arsenic	45	B	78	
Beryllium	5.8	J	U	J
Chromium	208	J	40	J
Lead	555	J	88.1	J
Manganese	9070	J	1790	J
Hexavalent Chromium	73	J	44	J

Qualifier Codes:
B: Indicates a value greater than or equal to the instrument detection limit but less than the CRDL.
J: This result should be considered a quantitative estimate.
U: This analyte was not detected.
NA: The sample was not analyzed for this analyte.

TABLE 4-13, Contd.

VAN DER HORST PLANT 2, PHASE II
GROUND WATER SAMPLES
TAL METALS/HEX CHROME

SAMPLE NUMBER		MW-19-W		DUP-20		MW-20-W	
MATRIX		Water		Water		Water	
DATE ANALYZED		7-Nov-91		7-Nov-91		7-Nov-91	
UNITS		µg/L		µg/L		µg/L	
ANALYTE	**NYS CLASS GA WATER QUALITY STANDARDS µg/L**						
Aluminum	100	37300	J	18900	J	6300	J
Antimony	3	U		U		U	
Arsenic	25	58.9	J	24	J	8	BJ
Barium	1000	884		715		309	
Beryllium	3	U		U		U	
Cadmium	10	U	J	U	J	U	J
Calcium	———	204000	BJ	239000	BJ	466000	BJ
Chromium	50	56.2	J	29.5	J	1680	J
Cobalt	5	28	B	U		U	
Copper	200	110		98		35	
Iron	300	85300	J	42300	J	15100	J
Lead	25	170	J	89	J	41	J
Magnesium	35000	36600		28900		22200	
Manganese	300	5920	J	4030	J	2030	J
Mercury	2	U		U		U	
Nickel	———	157	J	98	J	43	J
Potassium	———	8980		6900		5900	
Selenium	10	U	R	U	R	U	R
Silver	50	U	J	U	J	U	J
Sodium	20000	49300		50800		49100	
Thallium	8	U		U		U	
Vanadium	14	40	B	U		U	
Zinc	300	266		158		64	
Hexavalent Chromium		U		U		U	

Qualifier Codes:

B: This result is qualitatively invalid because the analyte was also detected in a blank at a similar concentration.

J: This result should be considered a quantitative estimate.

U: This analyte was not detected.

▨: This result exceeds NYS Class GA water quality standards.

R: Analytical result was rejected.

MW-10D and MW-16S, at concentrations of 9 ppb and 10 ppb, respectively. Trichloroethene was detected in the sample obtained from MW-20 at a concentration of 33 ppb. Benzene was detected in nineteen (19) of the thirty wells. Concentrations of benzene ranged from 9 ug/L in MW-3S to 170 ug/L in MW-7S. Toluene was detected in sixteen (16) of the thirty wells. Concentrations of toluene ranged from 5 ppb in MW-19 to 70 ppb in MW-14S. 1,2-Dichloroethene (total) was detected in one ground water sample, MW-20, at a concentration of 110 ppb. Vinyl chloride was also detected in MW-20, at a concentration of 43 ppb. Ethylbenzene was detected in samples from six (6) wells and ranged in concentration from 5 ppb in MW-6D to a level that exceeded the calibration range of the GS/MS instrument in MW-14S. Other tentatively identified VOCs and unknowns were also detected in the ground water samples.

Two ground water samples, MW-19 and MW-20, were analyzed for semi-volatile compounds during the Phase II sampling. One semi-volatile organic compound, N-Nitrosodiphenylamine, was detected in MW-20 at a concentration of 41 ppb. Several other tentatively identified semi-VOCs and unknowns were also detected during analysis. No TCL Pesticides or PCB compounds were detected during analysis of the groundwater samples.

4.9.2 Inorganics

Inorganics were detected in all ground water samples tested. Arsenic was detected in all wells and ranged in concentration from 7 ppb in MW-8D to 179 ppb in MW-10S. Twenty-two (22) wells exceeded the NYSDEC Class GA drinking water standard, 25 ppb, for total arsenic. Chromium was detected in twenty-seven (27) wells and ranged in concentration from 13 ppb in MW-14D to 10,100 ppb in MW-9. Twenty (20) wells exceeded the NYSDEC Class GA drinking water standard, 50 ppb, for total chromium. Manganese was detected in all wells at concentrations ranging from 556 ppb in MW-14D to 84,500 ppb in MW-10S. All of the wells exceeded the NYSDEC Class GA drinking water standard, 300 ppb, for total manganese. Lead was detected in all wells and ranged in concentration from 8 ppb in MW-3D to 6380 ppb in MW-9. Twenty-seven (27) wells exceeded the NYSDEC Class GA drinking water standard, 25 ppb, for total lead. Beryllium was detected in six of the wells and ranged in concentration from 5.8 ppb for MW-15S to 16.7 ppb for MW-9. All six of these wells exceeded the NYSDEC Class GA drinking water standard, 3 ppb, for total beryllium. Hexavalent chromium was detected in Twenty-two (22) wells and ranged in concentration from 14 ppb in MW-14D to 88 ppb in MW-6S. Ten of these wells exceeded the NYSDEC Class GA drinking water standard, 50 ppb, for hexavalent chromium.

5.0 PUBLIC HEALTH AND ENVIRONMENTAL RISK ASSESSMENT

A full baseline public health and environmental risk assessment was conducted as part of the Phase I investigation (ERM, 1991). In this report, analytical data from the Phase II investigation are reviewed to determine if any changes or additions to the baseline risk assessment are necessary (Section 5.1). Based on the results of the baseline risk assessment and the evaluation of the Phase II data, a final risk assessment for the site was prepared. Section 5.2 summarizes the final risk assessment. Using the results of this risk assessment, cleanup levels are derived (Section 5.3) for those chemicals and media at the site for which remediation may be necessary based on unacceptable risks to human health and the environment or exceedence of standards or guidelines.

5.1 Evaluation of Phase II Data

The purpose of the Phase II investigation was to collect additional field data required to complete the delineation of contamination at the site and to provide information necessary for the feasibility study. As described in the preceding sections, the Phase II investigation involved additional sampling of soils, ground water, and Two Mile Creek surface water and sediments. In this section, the additional data is reviewed in terms of the previously conducted risk assessment to determine if any of the conclusions reached in the earlier study are no longer valid or require further evaluation. A summary of the conclusions of the Phase I risk assessment is provided in Table 5-1.

This evaluation is divided into four sections:

- review of new soil data (Section 5.1.1);
- review of new ground water data (Section 5.1.2);
- review of new Two Mile Creek data with respect to impacts to human health (Section 5.1.3); and
- review of new Two Mile Creek data with respect to impacts to aquatic life (Section 5.1.4).

5.1.1 Review of Phase II Soil Data

5.1.1.1 Phase II On-Site Soil Data

A total of 135 additional on-site soil samples were collected in the Phase II investigation. These samples were analyzed for a limited number of inorganics, volatile organics, semi-volatile organics, and PCBs. (No PCBs were detected). Potential exposures involving chemicals in soil identified and evaluated in the Phase I risk assessment include: 1) inhalation of fugitive dust emissions by nearby

TABLE 5-1

SUMMARY OF CHEMICALS FOR WHICH PROJECTED INTAKES EXCEED ACCEPTABLE INTAKES - PHASE I

	Noncarcinogenic Effects	Carcinogenic Effects
Current Conditions	o No adverse effects	o Chromium in fugitive dust emissions
Future Conditions	o Lead and manganese in ground water	o Chromium in fugitive dust emissions o Arsenic, benzene, beryllium, bis(2-chloroethyl)ether, and tetrachloroethene in ground water

residents under current conditions and by construction workers or landscapers under hypothetical future conditions; 2) inhalation of volatilized organics from site soil by nearby residents and future construction workers; and 3) direct contact with site soil by nearby residents (trespassers) and future construction workers. Each of these exposure routes was reevaluated based on the new data.

5.1.1.1.1 Fugitive Dust Emissions

In the previous study, fugitive dust emissions from site soil were quantitatively evaluated for each of the identified chemicals of concern under current and future conditions. As indicated in Table 5-1, the presence of chromium in site soil was found to present unacceptable risks to nearby residents and future construction workers. Therefore, no further evaluation of chromium based on Phase II data was required. Analysis of the Phase II results for the remaining chemicals of concern under current and future conditions is provided below.

Fugitive Dust - Current Conditions

In the Phase I investigation, fugitive dust emissions arising from traffic in the unpaved driveways and parking areas of the site due to contamination in surface soil were quantitatively evaluated. The population of concern was residents in the site vicinity. Since none of the surface samples collected in the Phase II investigation are from unpaved or unvegetated areas of the site where vehicular traffic is likely to occur, no further evaluation of this exposure route is required.

Fugitive Dust - Future Conditions

In the Phase I investigation, fugitive dust emissions resulting from construction activities at the site under hypothetical future conditions were quantitatively evaluated. Because significant earth-moving activities could occur, it was conservatively assumed that all soil at the site, regardless of depth, could contribute to fugitive dust emissions.

Of the previously identified chemicals of concern in fugitive dust emissions, seven chemicals (in addition to chromium) were analyzed for in one or more samples in the Phase II investigation. These chemicals are arsenic, barium, benzo(a)pyrene, beryllium, cadmium, lead, and manganese. The average concentrations of these seven chemicals in Phase II samples were calculated and compared to the average concentrations reported in the Phase I study to see if there were any significant differences. The average concentrations of the seven chemicals in Phase II samples were, in all cases, less than the average concentrations used to evaluate risk in Phase I.

5.1.1.1.2 Volatilization of Organics from Site Soil

In the Phase I investigation, volatilization of organics from site soil was quantitatively evaluated for methylene chloride, the only volatile organic of concern in site soil. No unacceptable risks to nearby residents (current conditions) or hypothetical site construction workers (future conditions) were found to result from the presence of methylene chloride.

In the Phase II investigation, 26 on-site soil samples were analyzed for volatile organics. Methylene chloride was not detected in any samples. The Phase II data were reviewed to determine if any new chemicals should be added to the list of potential chemicals of concern due to volatilization. One chemical, trichloroethene, was detected in 8 of 26 samples at a maximum concentration of 1.2 mg/kg. This chemical was not detected in the Phase I sampling. However, if it were ranked with the other chemicals detected in soil as was done in the Phase I report to identify chemicals of concern (see Table 5-3 of ERM, 1991), it would score higher than methylene chloride. Therefore, potential impacts associated with inhalation of trichloroethene were quantitatively evaluated, as described below.

The concentration of trichloroethene in air resulting from volatilization from site soils was calculated based on the Phase II soil data using the same methodology used in the previous report. An area of approximately 240,000 ft^2 was identified as the area of source emissions based on the sampling data. This area has an average trichloroethene concentration of 149 ug/kg. It was conservatively assumed that only 1 cm of clean soil occurs over the trichloroethene contaminated soil.

The estimated ambient concentration of trichloroethene due to volatilization from site soils based on the Phase II data is 1.96×10^{-4} mg/m^3. This concentration is below the NYSDEC Ambient Guideline Concentration (AGC) for trichloroethene of 4.5×10^{-4} mg/m^3. Using the same assumptions as in the Phase I report, this concentration would result in an average daily intake of 2.29×10^{-5} mg/kg/day. The potency factor for trichloroethene is 1.7×10^{-2} $(mg/kg/day)^{-1}$ which results in a carcinogenic risk level of 3.9×10^{-7}. This level is below the de minimis risk level of 1×10^{-6}. Therefore, no significant risks to nearby residents or hypothetical future site construction workers are expected to result from volatilization of contaminants from site soil based on Phase I and Phase II data.

5.1.1.1.3 Direct Contact with Site Soil

In the Phase I study, direct contact with on-site soils by trespassers from nearby residences (current conditions) and hypothetical short-term construction workers (future conditions) was quantitatively evaluated as a potential route of concern. No significant adverse health effects were found to result from direct contact with site soils based on these data. Using the results of the Phase II data, each of these exposure routes is evaluated in the following sections.

Direct Contact with Site Soil - Current Conditions

Under current conditions, trespassers could potentially be exposed to contaminants in site surface soils. In the Phase II investigation, surface soil samples were analyzed for volatile organics, PCBs, and inorganics. No PCBs were detected. Volatile organics were only detected in surface soils in the catch basin sample, and the concentrations detected there are not expected to result in significant adverse health effects. Therefore, the only contaminants to be evaluated are inorganics.

A total of 23 surface soil samples were analyzed for the following inorganics in the Phase II investigation: arsenic, barium, chromium, lead, and manganese. The average concentrations of these inorganics in Phase II surface soil samples were calculated and compared to the average concentrations used in the Phase I study to see if there were any significant differences. The average concentrations of barium, chromium, lead and manganese in Phase II samples are less than in Phase I samples. Therefore, based on the results of the previous investigation, the presence of these inorganics in surface soil is not expected to pose an unacceptable risk to human health via direct contact.

The average concentration of arsenic in Phase II samples (30 mg/kg) is somewhat higher than in Phase I samples (22 mg/kg). In the Phase I study, although calculations for arsenic showed a carcinogenic risk marginally in excess of the de minimis risk for this exposure route, arsenic was eliminated as a chemical of concern because of the conservative assumptions incorporated into the risk calculation. First, the carcinogenic potency of arsenic is currently under review. The oral potency factor originally cited by the U.S. EPA was later reduced by an order to magnitude (indicating that arsenic is a less potent carcinogen than previously believed) and recent U.S. EPA guidance states that the currently recommended potency factor may overestimate the true risk (U.S. EPA, 1989d). Second, out of a total of 94 Phase I samples, arsenic was detected in excess of regional background concentrations in only two samples. Similarly, only one of the 23 Phase II samples exceeded regional background concentrations (see Table 5-2, page 5-6 of the Phase I Report for background soil concentrations). However, due to the apparent elevated (i.e., above background) on-site arsenic concentrations in some soil samples and uncertainties regarding the future use of the site, arsenic was included as a chemical of concern and was reevaluated based on the Phase II data.

Direct Contact with Site Soil - Future Conditions

Under future conditions, hypothetical short-term site construction workers could be exposed to contaminants in soil through direct contact. As described in the Phase I investigation, the average site-wide concentrations of the chemicals of concern in soil were used to evaluate direct contact by construction workers since significant earth-moving activities could take place. Therefore, the average site-wide concentrations of the chemicals of concern in Phase II soil samples were calculated and compared to the average concentrations reported in the Phase I study to see if there were any significant differences. The average concentrations of the chemicals of concern were, in all cases, lower in the Phase II samples than in the Phase I samples. Therefore, since no significant risks to human health were identified based on the Phase I data, direct contact with site soil is not expected to result in significant adverse impacts to construction workers.

5.1.1.2 Phase II Off-Site Soil Data - Residential Areas

A total of 14 off-site residential surface soil samples were collected during the Phase II investigation. All of the samples were analyzed for a limited number of inorganics (arsenic, barium, chromium, lead, manganese, and zinc) and one sample was analyzed for TCL volatile organics. No significant concentrations of volatile organics were detected. The Phase II residential off-site concentrations of inorganics were evaluated in the same manner as the Phase I data by comparing the ranges of concentrations detected to regional and site-specific background levels (see Table 5-2 of the Phase I report). The only chemical detected in concentrations outside of the range of regional background concentrations in Phase II samples is lead. The average concentration of lead in Phase II samples is less than the average in Phase I samples. Since the Phase I investigation did not identify any significant risks to human health based on the higher lead concentrations, direct contact with residential soils potentially impacted by previous site emissions are not expected to result in significant health impacts.

5.1.2 Review of Phase II Ground Water Data

The Phase II ground water data were initially reviewed to determine if any additions to the list of chemicals of concern were required. A total of 30 wells were sampled in the Phase II investigation. These wells include all of the wells sampled in the Phase I investigation as well as the additional wells installed in the Phase II investigation. Based on a comparison of the Phase I and Phase II data, with particular emphasis on on-site wells, no new chemicals of concern were identified in the Phase II study.

Table 5-2 presents the average concentrations of each of the chemicals of concern in on-site wells in the Phase I and Phase II investigations. This table also presents the applicable federal and New York State standards and guidelines.

TABLE 5-2
COMPARISON OF AVERAGE ON-SITE CONCENTRATIONS OF THE CHEMICALS OF CONCERN IN GROUND WATER WITH RELEVANT STANDARDS AND GUIDANCE VALUES

CHEMICAL	PHASE I - AVERAGE ON-SITE CONCENTRATION (MG/L)	PHASE II - AVERAGE ON-SITE CONCENTRATION (MG/L)	SDWA MCL(1) (MG/L)	SDWA MCLG(1) (MG/L)	NYS DOH MCL(2) (MG/L)	NYS GWQS (3) (MG/L)
Antimony	0.010	ND	0.005(4)	0.003(4)		0.003(5)
Arsenic	0.021	0.046	0.05		0.05	0.025
Barium	0.481	0.555	2	2	1	1
Benzene	0.011	0.027	0.005	Zero	0.005	0.0007
Beryllium	0.003	0.002	0.001(4)	Zero(4)		0.003(5)
Bis(2-Chloroethyl)ether	0.008	NA(6)			0.05	0.001
Chromium - Total	0.166	0.639	0.1	0.1	0.05	0.05
Chromium - Hexavalent	0.009	0.028				0.05
Lead	0.063	0.470	0.015(7)	Zero	0.05	0.025
Manganese	4.767	8.88				0.300
Tetrachloroethene	0.004	<0.001	0.005	Zero	0.005	

(1) Source: U.S. EPA, 1991a.

(2) Source: Chapter I, State Sanitary Code, Subpart 5-1, Public Water Supplies. July 3, 1991.

(3) New York State Ground Water Quality Standards for the protection of human health for Class GA waters (NYSDEC, 1991). All values listed are standards except as noted.

(4) Proposed MCL or MCLG.

(5) New York State Ambient Water Quality Guidance Value (NYSDEC, 1990).

(6) Not analyzed in any on-site samples.

(7) Treatment technique is triggered by exceedences of the lead action level of 0.015 mg/l. Standard applies at the tap.

As indicated in Table 5-1, concentrations of arsenic, benzene, beryllium, bis(2-chloroethyl)ether, lead, manganese and tetrachloroethene in Phase I samples resulted in unacceptable risks to human health. The average concentrations of arsenic, benzene beryllium, lead and manganese in the Phase II study are essentially the same as or higher than in the Phase I study. Bis(2-chloroethyl)ether was not detected in Phase II samples. However, only two on-site wells were sampled for semi-volatile organics. Therefore, no further evaluation of these six chemicals is required, and they remain as chemicals of concern to be evaluated for remediation based on future use of site ground water for water supply.

Based on the results of Phase I and Phase II sampling, antimony and tetrachloroethene are not expected to result in unacceptable risks to human health. Antimony did not pose a risk based on Phase I data and was not detected in Phase II. Although tetrachloroethene posed a risk to human health based on Phase I samples, it was only detected in one sample at a maximum concentration of 0.002 mg/l in the Phase II investigation. Since the average concentration detected in Phase I is less than the federal and state drinking water standards, and because of its even lower frequency of detection in Phase II, tetrachloroethene is eliminated as a contaminant of concern in ground water.

The remaining chemicals (barium and chromium) were not identified as posing a risk to human health in the Phase I investigation. However, the average concentrations detected in Phase II are higher than in Phase I. Therefore, the more recent higher values were quantitatively evaluated to determine if they present a risk to human health.

The average daily intakes of barium and chromium resulting from ingestion of ground water in the site vicinity were calculated using the Phase II sampling results and the same methodology (for evaluation of adults) used in the previous report. As described in that report, there are currently no potable wells reported in the immediate site vicinity. However, in order to evaluate on-site ground water quality, it was conservatively assumed that a well was constructed in the site vicinity in the future.

Table 5-3 compares the results of the analyses based on Phase I and Phase II data. As indicated in this table, the hazard quotients for these chemicals are less than 1.0. As an additional evaluation, the risk levels associated with ingestion of barium and chromium in ground water (based on the higher Phase II data as presented in Table 5-3) were also calculated using exposure assumptions appropriate for children ages 6-18 (exposure duration 12 years, body weight of 44 Kg, averaging time of 12 years).

TABLE 5-3
EVALUATION OF RISK ASSOCIATED WITH INGESTION OF BARIUM AND CHROMIUM IN GROUND WATER BASED ON PHASE I AND PHASE II RESULTS

	PHASE I				PHASE II			
CHEMICAL	AVERAGE CONCENTRATION IN ON-SITE GROUND WATER (MG/L)	PROJECTED AVERAGE DAILY INTAKE (MG/KG/DAY)	ACCEPTABLE DAILY INTAKE (RFD) (MG/KG/DAY)	HAZARD QUOTIENT	AVERAGE CONCENTRATION IN ON-SITE GROUND WATER (MG/L)	PROJECTED AVERAGE DAILY INTAKE (MG/KG/DAY)	ACCEPTABLE DAILY INTAKE (RFD) (MG/KG/DAY)	HAZARD QUOTIENT
Barium	0.481	1.37 x 10-2	5.00 x 10-2	0.027	0.555	1.59 x 10-2	5.00 x 10-2	0.32
Chromium-Total	0.166	4.74 x 10-3	1.00 x 10+0	0.0047	0.639	1.83 x 10-2	1.00 x 10+0	0.018
Chromium-Hexavalent	0.009	2.57 x 10-4	5.00 x 10-3	0.052	0.028	8.00 x 10-4	5.00 x 10-3	0.16

Neither barium nor chromium is carcinogenic via ingestion (HEAST, 1992); therefore, nocarcinogenic risk calculation was required. The results are summarized below.

Chemical	Projected Average Daily Intake (mg/Kg/day)	Acceptable Daily Intake (mg/Kg/day)	Hazard Quotient
Barium	2.52×10^{-2}	7.00×10^{-2}	0.36
Chromium (Total)	2.90×10^{-2}	1.00×10	0.029
Chromium (Hexavalent)	1.27×10^{-3}	5.00×10^{-3}	0.25

Therefore, based on the results of the Phase I and Phase II investigations, neither barium nor chromium in site ground water pose a significant risk to human health (adults or children).

5.1.3 Review of Phase II Two Mile Creek Data with Respect to Impacts to Human Health

The only potentially significant human exposure route for contamination in Two Mile Creek, as described in the Phase I investigation, is dermal absorption resulting from contact with surface water. A total of 5 new samples were collected in the Phase II investigation to evaluate Two Mile Creek surface water (TMC-5W - TMC-9W). Samples were analyzed for metals. Chemicals detected in significantly higher concentrations in one or more downstream samples than in upstream samples (collected in Phase I) include barium, chromium, lead, manganese and zinc. Elevated concentrations were detected primarily at TMC-8W.

Results of the Phase I investigation showed that none of the chemicals present in Two Mile Creek surface waters resulted in unacceptable risks to human health. Because the concentrations of the inorganics listed above are greater in Phase II than in Phase I, exposure to nearby residents via dermal contact with Two Mile Creek waters was quantitatively evaluated for these chemicals, as described below.

Exposures to barium, chromium, lead, manganese, and zinc in Two Mile Creek by nearby residents were calculated using the same methodology used to evaluate these impacts in the Phase I report. The population of concern, as described in that report, is teenagers (ages 12-18) from nearby residential areas wading through the creek, resulting in exposure to the lower portions of their legs and feet. The resulting average daily intakes are presented in Table 5-4. As indicated in this table, the hazard quotients are at least four orders of magnitude below 1.0. The risk levels associated with direct contact with Two Mile Creek waters was also calculated using exposure assumptions appropriate for children ages 6-18 (skin surface of 2200 cm^2, exposure duration of 12 years, body weight of 44 Kg, averaging time of 12 years). The results are summarized below.

TABLE 5-4

EVALUATION OF DIRECT CONTACT WITH TWO MILE CREEK WATERS

CHEMICAL	AVERAGE CONCENTRATION IN PHASE II SAMPLES (UG/L)	AVERAGE DAILY INTAKE (MG/KG/DAY)	SUBCHRONIC RFD(1) (MG/KG/DAY)	HAZARD QUOTIENT
Barium	79.5	1.98 x 10-7	0.05	4.0 x 10-6
Chromium-Total	9.42	2.35 x 10-8	10	2.3 x 10-9
Chromium-Hexavalent	19	4.74 x 10-8	0.02	2.4 x 10-6
Lead	10	2.49 x 10-8	0.0014(2)	1.8 x 10-5
Manganese	278	6.93 x 10-7	0.1	6.9 x 10-6
Zinc	77	1.92 x 10-7	0.2	9.6 x 10-7
			Pathway Hazard Index	3.2 x 10-5

(1) Source: U.S. EPA, 1991b, except as noted.

(2) No subchronic RfD available. Chronic RfD is from U.S. EPA, 1986.

Chemical	Average Daily Intake (mg/Kg/day)	Subchronic RfD (mg/Kg/day)	Hazard Quotient
Barium	2.09×10^{-7}	0.05	4.2×10^{-6}
Chromium (Total)	2.48×10^{-8}	10	2.5×10^{-9}
Chromium (Hexavalent)	5.00×10^{-8}	0.02	2.5×10^{-6}
Lead	2.63×10^{-8}	0.0014	1.9×10^{-5}
Manganese	8.81×10^{-7}	0.1	8.8×10^{-6}
Zinc	2.02×10^{-7}	0.2	1.0×10^{-6}

Therefore, based on the results of both the Phase I and Phase II data, direct contact with Two Mile Creek waters does not pose a significant risk to human health.

Table 5-5 presents a summary of the conclusions of the Phase I and Phase II investigations with respect to impacts to human health. Comparing this table to Table 5-1, the only difference from the Phase I conclusions is that tetrachloroethane is eliminated as a chemical of concern for remediation in ground water.

TABLE 5-5

SUMMARY OF CHEMICALS FOR WHICH PROJECTED INTAKES EXCEED ACCEPTABLE INTAKES - PHASE I AND PHASE II

	Noncarcinogenic Effects	Carcinogenic Effects
Current Conditions	o No adverse effects	o Chromium in fugitive dust emissions
Future Conditions	o Lead and manganese in ground water	o Chromium in fugitive dust emissions o Arsenic, benzene, beryllium, and bis(2-chloroethyl)ether in ground water

5.1.4 Review of Phase II Two Mile Creek Data with Respect to Impacts to Aquatic Life

5.1.4.1 Surface Water

As described in Section 5.3, five inorganics (barium, chromium, lead, manganese, and zinc) were detected in higher concentrations in Phase II surface water samples than the upstream samples in the Phase I investigation. Table 5-6 compares the range of concentrations and the average concentration of each of the chemicals of concern detected in Phase II to relevant standards for the protection of aquatic life. As indicated in this table, the average concentrations of hexavalent chromium and lead exceed both the NYSDEC and the U.S. EPA standards or guidelines. The average concentration of zinc exceeds the NYSDEC standard but is less than the U.S. EPA Ambient Water Quality Criterion (AWQC). The relevant standards and guidelines for barium, total chromium, and

TABLE 5-6
COMPARISON OF PHASE II RESULTS OF TWO MILE CREEK SURFACE WATER SAMPLES TO RELEVANT STANDARDS AND GUIDELINES

Chemical	Range of Detected Concentrations (ug/l)	Average Concentration (ug/l)	NYS SWQS(1) (ug/l)	U.S. EPA AWQC(2) (ug/l)
Barium	47.9-144	79.5	NA	50,000(3)
Chromium-Total	ND-16.3	9.42	163(4)	163(4)
Chromium-Hexavalent	16-22	19	11	11
Lead	3-25	10	2.2(4)	2.2(4)
Manganese	45.7-1,060	335	NA	1,500->1,000,000(5)
Zinc	59.4 - 105	77	30	83 (4)

NOTE: NA = none available
ND = not detected

(1) New York State Surface Water Quality Standards for the protection of aquatic life for Class A, A-S, AA, AA-S, B, C waters. Source: 6 NYCRR 700-705 effective September 1, 1991.

(2) Ambient Water Quality Criteria for the protection of aquatic life (chronic exposure), except as noted.

(3) No AWQC established; however, in the AWQC document EPA notes that soluble barium concentrations in fresh water would generally have to exceed 50 mg/l before toxicity to aquatic life would be expected.

(4) Standard is hardness dependent. The average hardness of 75 mg/l based on Phase I samples was used to calculate the standard. The standard applies to the acid-soluble form of the chemical.

(5) No AWQC established; however, in the AWQC document EPA lists this range as a tolerance value and concludes that manganese is not considered a problem in fresh waters.

manganese were not exceeded. In the Phase I investigation, cadmium was detected in one sample (9 ug/l), which exceeded the NYSDEC standard of 0.91 ug/l. In the Phase II investigation, cadmium was again detected in only one sample, at a concentration of 5.9 ug/l.

5.1.4.2 Sediments

A total of 5 new sediment samples from Two Mile Creek were collected in the Phase II investigation (TMC-5 - TMC-9) The samples were analyzed for metals and volatile organics. The only chemicals detected in significantly higher concentrations in downstream sediment samples than in upstream samples (TMC-1 and TMC-2 from the Phase I investigation) are acetone, barium, cadmium, chromium, and manganese. The results of the Phase I investigation indicated that the presence of chromium in sediments may pose a threat to aquatic life. The results of the Phase II study are consistent with this conclusion. Table 5-7 compares the results of the Phase II samples to upstream samples collected during Phase I and to applicable sediment guidelines as presented in the Phase I report. As indicated in this table, the average concentration of chromium in Phase II samples exceeds both the NYSDEC background levels and the NYSDEC proposed sediment criterion (see table 5-36, page 5-103 in the Phase I Report for sediment

TABLE 5-7

COMPARISON OF TWO MILE CREEK SEDIMENT CONCENTRATIONS WITH RELEVANT GUIDELINES (MG/KG)

CHEMICAL	UPSTREAM CONCENTRATIONS(1)	AVERAGE CONCENTRATION IN PHASE II SAMPLES (TMC-5-TMC-9)	GUIDELINES			
			NYSDEC BACKGROUND(2)	NYSDEC PROPOSED CRITERION(2)	NYSDEC LIMIT OF TOLERANCE(2)	OTHER CRITERIA AND GUIDELINES
Volatile Organics						
Acetone	<0.021, <0.020	0.0148	--	--	--	18(3)
Inorganics						
Barium	144, 154	148	--	--	--	20(5), 500(6)
Cadmium	1.4, 1.8	9.2	2.5	0.8	10	31(4)
Chromium	61.6J, 63.1J	82.3	75	26	111	--
Manganese	337J, 317J	690	1200	428	1100	--

NOTE: -- = none available
J = estimated value

(1) Analytical results for TMC-1S and TMC-2S from the Phase I Investigation.
(2) Source: NYSDEC, 1989b.
(3) Calculated using the equilibrium partitioning approach. See ERM, 1991.
(4) U.S. EPA threshold concentrations for sediment (U.S. EPA, 1987).
(5) Source: U.S. EPA Region V Guideline for the classification of Great Lakes Harbor Sediments as "Non-Polluted" (U.S. EPA, 1977).
(6) Source: Wisconsin Department of Natural Resources (WDNR) Interim Criteria for In-Water Disposal of Dredged Sediment (Sullivan, et al., 1985).

background values). The average concentration of cadmium (9.2 mg/kg) exceeds the NYSDEC proposed criterion (0.8 mg/kg) but is within the NYSDEC limit of tolerance (10 mg/kg) and the U.S. EPA threshold concentration for sediment (31 mg/kg). The average concentration of manganese (690 mg/kg) exceeds the NYSDEC proposed criterion (428 mg/kg) but is within the NYSDEC background level and limit of tolerance. The average concentrations of the remaining chemicals (acetone and barium) are within the listed guidelines.

5.2 Final Risk Assessment

As described in Section 5.1, a full baseline public health and environmental risk assessment was conducted as part of the Phase I investigation. A second round of sampling (Phase II) was later performed. The data from this latter round were reviewed to determine if any changes or additions to the baseline risk assessment were necessary. In this section, the final risk assessment for the site is presented. The final risk assessment incorporates data from both phases of the remedial investigation.

The purpose of the risk assessment is to establish the degree of hazard posed by existing conditions. The risk assessment is then used to develop and evaluate remedial alternatives in the feasibility study. The risk assessment was performed in accordance with relevant U.S. EPA and NYSDEC guidance documents, including Risk Assessment Guidance for Superfund - Volume I (Human Health Evaluation Manual) and Volume II (Environmental Evaluation Manual) (U.S. EPA, 1989a; 1989b), and NYSDEC Habitat Based Assessment (NYSDEC, 1989a). The methodology and results for the public health and environmental risk assessment are summarized in the following sections.

5.2.1 Public Health Risk Assessment

The public health risk assessment was divided into five steps. These steps are: 1) selection of indicator chemicals or chemicals of concern, 2) identification of exposure routes, 3) quantification of potential exposures, 4) toxicity assessment and 5) risk characterization. Each of these steps is described below.

At sites where a number of chemicals have been detected, U.S. EPA guidance suggests reducing the number of chemicals that warrant a complete and thorough evaluation through the selection of indicator chemicals or chemicals of concern. The criteria used in the selection of indicator chemicals include chemical toxicity information, site concentration data, and environmental mobility. The indicator chemicals thus selected are expected to include those chemicals which present the greatest risk to public health. Media sampled in the remedial investigation to which significant human exposure could occur include soil, ground water, and surface water (Two Mile Creek). The indicator chemicals selected for each of these media are presented in Table 5-8.

In the second step of the risk assessment, pathways by which human exposure to contaminants in soil, ground water, and surface water were identified. Figure 5-1 presents a diagram outlining the major potential routes of contaminant exposure. Exposure routes under both existing conditions and projected future conditions were identified. Currently, the site is inactive. Because the site is industrially zoned and because it is bordered by a large area of industrial properties to the south and east, it was assumed that the most likely future use of the site is for industrial purposes. Residential areas are located to the southwest of the site. Potential exposures which were quantitatively evaluated include:

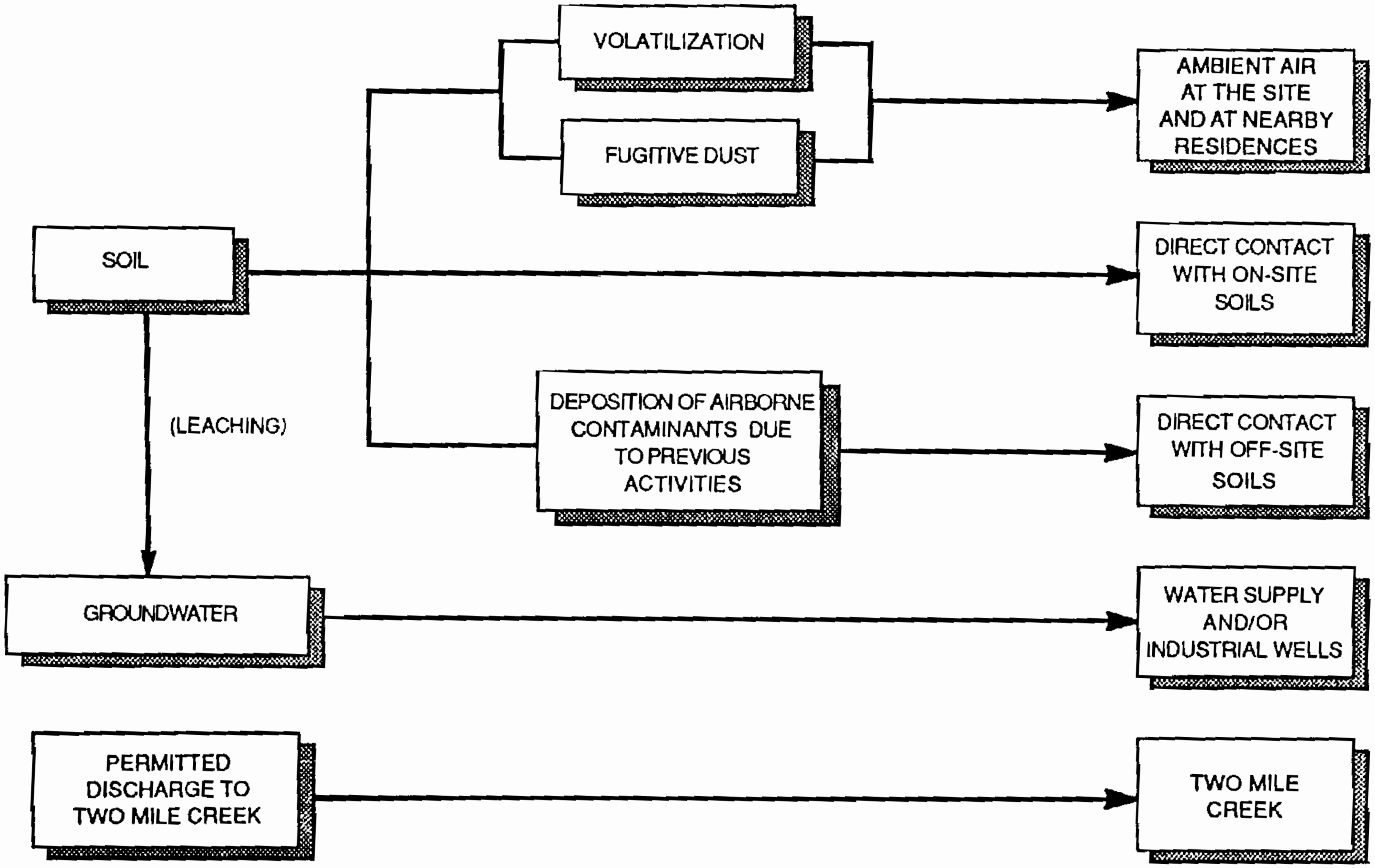
1. Inhalation of fugitive dust emissions from on-site soils by nearby residents and by hypothetical future construction workers or landscapers.

TABLE 5-8

INDICATOR CHEMICALS EVALUATED IN THE RISK ASSESSMENT

SOIL	GROUND WATER	SURFACE WATER
Arsenic	Antimony	Barium
Barium	Arsenic	Cadmium
Benzo(a)pyrene	Barium	Chromium
Beryllium	Benzene	Lead
Cadmium	Beryllium	Manganese
Chromium	Bis(2-chloroethyl)ether	Zinc
Copper	Chromium	
Lead	Lead	
Manganese	Manganese	
Methylene Chloride	Tetrachloroethene	
Nickel		
Trichloroethene		

FIGURE 5-1
POTENTIAL EXPOSURE PATHWAYS



ERM-Northeast
Environmental Resources Management

2. Inhalation of volatilized organics from site soils by nearby residents and by future construction workers.

3. Direct contact with on-site soils by nearby residents (trespassers) and by future construction workers.

4. Direct contact with off-site soils by residents in the site vicinity. (These soils may have been impacted by previous emissions from the site).

5. Ingestion of water from a future hypothetical domestic well situated in the vicinity of the site. (Based on available data, there are no active public or domestic water wells within approximately 1 mile of the site. However, because the aquifer underlying the site is hydrogeologically suitable for water supply, it was conservatively assumed that such a well is installed in the future).

6. Direct contact with Two Mile Creek waters by nearby residents.

In the third step, potential exposures for each of the pathways identified above were quantitatively evaluated. For each potential exposure route, exposure point concentrations of each of the indicator chemicals were compiled from monitoring data or calculated using environmental fate models. The exposure point concentrations were then compared to New York State Standards, Criteria, & Guidance Values (SCGs), where available, or other criteria. Table 5-9 summarizes the standards and criteria used in the risk assessment.

Chromium was the only chemical for which projected concentrations in ambient air exceeded corresponding guideline concentrations. Concentrations of lead exceeded the U.S. EPA interim guidance cleanup level for soil (U.S. EPA, 1989c) in several on-site locations. The average concentrations of antimony, arsenic, benzene, beryllium, bis(2-chloroethyl) ether, chromium, lead, and manganese in on-site ground water exceeded one or more corresponding SCGs. Because SCGs do not exist for all chemicals in all media, average daily intakes are calculated for each exposure route based on the exposure point concentrations in accordance with U.S. EPA guidance. These average daily intakes were then compared to acceptable daily intakes and resulting risks were calculated.

The fourth step consisted of a toxicity assessment of the indicator chemicals. In this step, health-based acceptable daily intakes (for noncarcinogens) and potency factors (for carcinogens) were compiled and derived in order to evaluate

TABLE 5-9

NEW YORK STATE STANDARDS, CRITERIA AND GUIDELINES (SCGs) APPLICABLE TO THE VAN DER HORST SITE[1]

NYSDOH

- Part 5 of the State Sanitary Code, Drinking Water Supplies

NYSDEC Division of Water

- 6 NYCRR Part 703 - Ground Water Quality Regulations
- Ambient Water Quality Standards and Guidance Values (Technical and Operations Guidance Series (TOGs) 1.1.1.)

NYSDEC Division of Air

- Air Guide 1 - Guidelines for the Control of Toxic Ambient Air Contaminants

NYSDEC Division of Fish and Wildlife

- 6 NYCRR Part 608 - Use and Protection of Waters
- ECL Article 24 and Article 71, Title 23 - Freshwater Wetlands Act (and implementing regulations)
- 6 NYCRR Part 182 - Endangered and Threatened Species of Fish and Wildlife

Other Standards and Guidelines

- National Ambient Air Quality Standards (NAAQS)
- NYSDEC Proposed Sediment Criteria
- OSHA Permissible Exposure Limits
- U.S. EPA Interim Guidance Cleanup Level for Lead in Soil
- U.S. EPA Maximum Contaminant Levels (MCLs)

(1) Source: New York State Standards, Criteria, and Guidelines (equivalent to ARARs). Revised 8/90.

the average daily intakes projected in Step 3. In addition, detailed toxicological profiles of each of the indicator chemicals were prepared.

The fifth step, risk characterization, used projected average daily intakes and health-based acceptable daily intakes and potency factors to quantitatively evaluate and characterize the risk to human health associated with the site. The methods used to evaluate noncarcinogenic and carcinogenic risks for each exposure pathway are summarized below.

Noncarcinogenic risks were evaluated by comparing the total average daily intake (chronic daily intake) with acceptable chronic intakes for that exposure route. A Hazard Quotient was then calculated for each chemical. A Hazard Quotient value greater than 1.0 (unity) indicates the possibility of a health hazard to the exposed population.

For potential carcinogens, risks are estimated as probabilities. The excess cancer risk due to exposure to each chemical via ingestion or inhalation was estimated as follows:

$$\begin{array}{l} \text{Added Lifetime} \\ \text{Cancer Risk} \end{array} = \begin{array}{c} \text{PF} \\ (\text{mg/kg/day})^{-1} \end{array} \times \begin{array}{l} \text{Estimated Lifetime} \\ \text{Average Daily} \\ \text{Intake (mg/kg/day)} \end{array}$$

The PF (EPA's carcinogen potency factor) is an upper 95% confidence limit on the probability of response per unit intake of a chemical over a lifetime. EPA's target risk range, as established in the National Contingency Plan (NCP), is 10^{-4} to 10^{-6}. A risk of one in a million (1×10^{-6}) is considered to be an acceptable or de minimis risk.

Based on the results of the risk assessment, Table 5-10 presents a list of those chemicals and exposure routes for which remediation may be necessary due to unacceptable risks or exceedance of SCGs. The chemicals to be evaluated for remediation in soil in the feasibility study are chromium, arsenic and lead. Under current and future conditions, the risk associated with chromium in site soils due to inhalation of fugitive dust emissions exceeds the acceptable or de minimis risk. It should be noted that this calculation assumes that all chromium present at the site occurs as hexavalent chromium. Under ambient conditions, hexavalent chromium is reduced to trivalent chromium in soils; therefore, it is unlikely that all chromium is present as hexavalent chromium. Current laboratory techniques are not adequate to distinguish between hexavalent and the less toxic and noncarcinogenic trivalent chromium in soils. Although concentrations lead in site soil did not result in

TABLE 5-10

SUMMARY OF CHEMICALS TO BE EVALUATED FOR REMEDIATION IN THE FEASIBILITY STUDY - FINAL RISK ASSESSMENT

	Noncarcinogenic Effects	Carcinogenic Effects	Impacts to Aquatic Life
Current Conditions	• Lead in soil	• Chromium in fugitive dust emissions • Arsenic in soil	• Chromium in sediment
Future Conditions	• Chromium and lead in ground water	• Chromium in fugitive dust emissions • Arsenic in soil • Arsenic, benzene, and beryllium in ground water	• Chromium in sediment

Note: Arsenic is included on this table because it exceeds the NYDEC site-specific SCG for arsenic in soil of 35 ppm.

unacceptable risks, the EPA proposed cleanup level (a potentially applicable SCG) isexceeded in a number of samples. Therefore, lead is included as a chemical of concern in soil to be evaluated in the feasibility study and the NYSDEC has selected a soil remediation cleanup level of 500 ppm for lead.

The presence of arsenic in on-site surface soils presents a risk which marginally exceeds the de minimis risk due to: 1) current incidental ingestion of soil by nearby residents and; 2) future inhalation of fugitive dust by construction workers. The carcinogenic risk associated with inhalation and ingestion of arsenic in soil were recalculated using the average arsenic concentration from both phases. These recalulations are shown below:

Exposure Route	Carcinogenic Risk
Incidental Soil Ingestion by Nearby Residents (Current Conditions)	$2 X 10^{-6}$
Incidental Soil Ingestion by Construction Workers (Future Conditions)	$2 X 10^{-7}$
Inhalation of Fugitive Dusts by Nearby Residents (Current Conditions)	$6 X 10^{-8}$
Inhalation of Fugitive Dusts by Construction Workers (Future Conditions)	$2 X 10^{-6}$

The risk calculation used for arsenic was conservative for the following reasons. First, the potency factor for arsenic is currently under review, and there are some indications that this number may be too high (too conservative). Second, out of a total of 117 samples, arsenic was detected in excess of regional background concentrations in three samples (see Table 5-2, page 5-6 of the Phase I Report for soil background values). Although the calculated risk is within the target risk range cited by U.S. EPA (10^{-4} to 10^{-6}), the NYSDEC has selected a site-specific soil remediation cleanup level of 35 ppm for arsenic due to the unknown future use of the site and the exceedence of background arsenic levels in some on-site samples.

Chemicals in ground water for which remediation may be necessary based on the results of the risk assessment include arsenic, benzene, beryllium, chromium, and lead. This conclusion is based on the assumption that ground water in the immediate site vicinity is used as a source of domestic water supply. This list includes all of the chemicals for which calculated intakes exceeded acceptable intakes (See Table 5-5) except manganese and bis(2-chloroethyl)ether. The reasons for eliminating manganese and bis(2-chloroethyl)ether as chemicals to be remediated in groundwater are provided below. Although concentrations of chromium in site ground water did not result in unacceptable health risks, the average concentration of this chemical exceeds applicable SCGs and it was therefore included as a chemical to be evaluated for remediation in the feasibility study.

The average concentration of manganese in ground water in Phase I samples resulted in a noncarcinogenic hazard quotient of 1.4, which marginally exceeds the acceptable hazard quotient of 1.0. There are no federal or state primary drinking water standards (MCLs) for manganese. The NYSDEC ground water quality standard is 0.300 mg/l. A review of both Phase I and Phase II data shows that, with the exception of MW-1S and MW-1D in Phase I samples, the ground water quality standard is exceeded in all wells sampled in this investigation, including upgradient wells MW-14S, MW-14D, and MW-15D. Therefore, since the average site-wide concentration of manganese resulted in only a marginal exceedence of the hazard quotient, and since it appears that regional concentrations of manganese in ground water exceed the NYSDEC ground water quality standard, remediation for this chemical at the site is not considered necessary or feasible.

Bis(2-chloroethyl)ether was not detected in any shallow monitoring wells at the site nor was it detected in any soil samples at the site. Therefore, it is not clear that the site is the source of this contamination. Bis(2-chloroethyl) ether was detected in five deep wells, at concentrations ranging from 2 ug/l to 21 ug/l. The maximum detected concentration is below the NYSDOH MCL for this chemical (50 ug/l). Furthermore, the average concentration of bis(2-chloroethyl)ether in Phase I and Phase II samples is well below the minimum detection limit for the chemical in this investigation (12 ug/l). Finally, the calculated carcinogenic risk associated with ingestion of bis(2-chloroethyl) ether (1 x 10^{-4}) is within U.S. EPA's target risk range (10^{-6} to 10^{-4}) for cleanup of Superfund sites. Therefore, bis(2-chloroethyl)ether was eliminated as a chemical to be remediated in site ground water.

5.2.2 Environmental Risk Assessment

The purpose of the environmental assessment was to determine if contaminants present at the site pose a current or potential future threat to ecological resources. The assessment was performed in accordance with NYSDEC draft guidance on Habitat Based Assessment (HBA) (NYSDEC, 1989a) and the U.S. EPA guidance manual on environmental risk assessment entitled "Risk Assessment Guidance for Superfund - Environmental Evaluation Manual (U.S. EPA, 1989b). The environmental assessment consists of four steps: 1) site description; 2) resource characterization; 3) hazard threshold identification; and 4) risk characterization. A summary of the findings is provided below.

No adverse impacts to sensitive environmental resources are expected to occur as a result of site contamination based on a review of fish and wildlife-related SCGs (freshwater wetlands, regulated streams, navigable waterbodies, and significant habitats/endangered and threatened species).

A review of the surface water data from Two Mile Creek suggests that adverse impacts to aquatic life due to the presence of cadmium, hexavalent chromium, and lead may be occurring. Hexavalent chromium and lead were present in all Phase II samples in excess of the relevant standards. Cadmium was only detected in one sample in each round of sampling, but those concentrations exceeded the relevant SCG.

Comparison of Two Mile Creek sediment concentrations to proposed NYSDEC and U.S. EPA criteria indicates that adverse effects to benthic life may result from the presence of chromium. The NYSDEC limit of tolerance for chromium is exceeded in three of seven downstream samples. In determining the need for remediation of metals-contaminated sediments, the NYSDEC guidance document on Habitat Based Assessment recommends that if NYSDEC-established limits of tolerance are exceeded in significant portions of the ecosystem of concern, it is highly likely that biota are impaired and remediation should be considered necessary. However, it may be noted that Two Mile Creek is an intermittent stream which is unlikely to support significant permanent populations of benthic organisms.

Based on the results of the environmental risk assessment, remediation of Two Mile Creek sediments for chromium is considered necessary and will be evaluated in the feasibility study. Remediation of Two Mile Creek sediments is expected to remove or significantly reduce the source of surface water contamination for hexavalent chromium, and to a lesser extent, for cadmium and lead. Therefore, remediation for chemicals in surface water independent of sediment remediation is not considered necessary.

5.3 Development of Site Remediation Goals

Based on the results of the final assessment, remediation is considered necessary for three chemicals in soil: chromium, arsenic and lead. For ground water, chemicals for which remediation may be necessary based on unacceptable risks or exceedence of SCGs include arsenic, benzene, beryllium, chromium, and lead. Due to potential impacts to aquatic life, remediation of Two Mile Creek sediment for chromium will be addressed. Site remediation goals for these chemicals in soil, ground water, and sediment are developed in Sections 5.3.1, 5.3.2, and 5.3.3, respectively.

5.3.1 Development of Soil Remediation Goals

5.3.1.1 Lead

In general, remediation goals or cleanup levels are based on New York State Standards, Criteria, and Guidance Values (SCGs), wherever possible. Although no SCG has been developed for lead in soil, the U.S. EPA has established an interim guidance cleanup level for lead at Superfund sites. This level, 500 to 1,000 ppm, in considered to be protective of human health for direct contact in residential settings (U.S. EPA, 1989c). As discussed in Section 5.2.1, based on zoning patterns, future use of the site is expected to be industrial rather than residential. Exposure to contaminants in soil at industrial facilities is expected to be lower than at residential properties. However, the lower end of the range cited by U.S. EPA for residential properties (500 ppm) has been adopted as the site cleanup level for lead in soil by the NYSDEC.

5.3.1.2 Chromium

No SCGS for chromium in soil have been established by NYSDEC. Therefore, the site cleanup level for chromium was developed using risk assessment methodology. The cleanup level derived in this manner represents a level determined to be fully protective of human health and the environment based on current and expected future uses of the site. The cleanup goal was derived in accordance with guidance provided in the U.S. EPA Human Health Evaluation Manual (Part A) (U.S. EPA, 1989a).

As described in Section 5.2, the final risk assessment found that chromium in soil poses a potentially unacceptable risk to human health as a result of exposures via inhalation of fugitive dust emissions. In addition, the average concentration of chromium in ground water exceeds applicable SCGs. Chromium in soil is expected to be a source of chromium contamination in ground water. Therefore, two route-specific cleanup goals were developed for chromium in soils: (1) a risk-based cleanup goal based on inhalation of fugitive dust emissions; and (2) a risk-based cleanup goal based on leaching of chromium in soil in ground water. The lower of the two cleanup goals was then adopted as the site cleanup level.

5.3.1.2.1 Fugitive Dust Emissions

A health-based soil cleanup goal for chromium based on fugitive dust emissions is determined by "back-calculating" from an established acceptable daily intake or acceptable ambient concentration. This process is essentially the same process as was used in the baseline risk assessment, but the calculations are performed in reverse order. In the baseline risk assessment, risks associated with inhalation of chromium in fugitive dusts were evaluated for nearby residents and for future hypothetical site construction workers. Since the risk to construction workers was greater than that to nearby residents (due to greater intakes), the cleanup level was based on exposures to construction workers.

The NYSDEC has established Short-term Guideline Concentrations (SGCs) for chemicals in air under Air Guide 1 (NYSDEC, 1991b). The SGCs are designed to preclude any significant health or environmental effects which might be associated with short-term exposures to air contaminants. Since the construction workers of concern at this site are expected to be at the site for a total of 6 months, the SGC for chromium were used to develop the health-based cleanup level. The SGC is used as the starting point and an acceptable concentration in soil is "back-calculated" from the acceptable ambient concentration using the same methodology used in the baseline risk assessment.

The ambient concentration of the chemicals of concern in air due to fugitive dust emissions during construction activities (C_{air} in mg/m^3) was calculated in the baseline risk assessment using the following equation:

$$C_{air} = D \times C_{dust} \times kg/10^6 \text{ mg}$$

where D equals the average dust level at the site (mg/m^3) and C_{dust} equals the concentration of the chemical of concern in dust (mg/kg). It was assumed that the concentration of each chemical in dust (C_{dust}) is the same as in soils (U.S. EPA, 1988). Therefore, the soil cleanup level can be calculated by rearranging this equation and replacing the calculated concentration in air with the SGC, as shown below:

$$\text{Soil Cleanup Level (mg/kg)} = C_{air} \times 10^6/D$$

The maximum allowable dust level for respirable particulates under OSHA is 5 mg/m^3 (OSHA, 1989). This maximum level is not expected to occur throughout the site during the entire workday for the entire 6-month construction period. Therefore, it was conservatively assumed that the average dust level (D) during construction activities is 3 mg/m^3. The SGCs for hexavalent chromium and trivalent chromium are 1.0×10^{-4} mg/m^3 and 1.2×10^{-1} mg/m^3, respectively (NYSDEC, 1991b). As discussed in Section 5.2.1, current laboratory techniques are not adequate to distinguish between hexavalent and the less toxic and noncarcinogenic trivalent chromium in soils. However, under ambient conditions, hexavalent chromium is reduced to trivalent chromium in soils. Thus, in most soils, chromium will be present predominantly in the trivalent state (ATSDR, 1991). Therefore, it was assumed that the ratio of trivalent to hexavalent chromium in onsite soil is 1:1 (half trivalent chromium, half hexavalent chromium). In a study of 38 chromium-contaminated sites in Hudson County, New Jersey, which received chromate slag from local chromate-producing industries as fill and diking materials, the ratio of trivalent to hexavalent chromium in soil (based on a previously used analytical method) ranged from 5:1 to over 500:1 (ESE, 1988). Therefore, an assumed ratio of 1:1 is very conservative.

The resulting soil cleanup level for hexavalent chromium is given by:

$$(1.0 \times 10^{-4}\ mg/m^3) \times (10^6\ mg/kg)/(3\ mg/m^3) =$$

33 mg/kg or approximately 30 mg/kg.

Conservatively assuming a ratio of trivalent to hexavalent chromium of 1:1, the soil cleanup level for total chromium based on inhalation of fugitive dust is 60 mg/kg. Due to the numerous conservative assumptions incorporated into this calculation, a chromium cleanup level of 60 mg/kg is expected to be fully protective of human health for inhalation exposures.

5.3.1.2.2 Leaching of Chromium in Soil to Ground Water

In developing a soil cleanup level for chromium based on leaching, it was conservatively assumed that ground water in the site vicinity could be used for domestic water in the future. Therefore, it was concluded that soils should be cleaned up to a level such that leaching from any residual contamination would not result in the applicable SCG being exceeded in ground water. The NYSDOH MCL and the NYSDEC ground water quality standard is 0.05 mg/l. Although the federal MCL is 0.1 mg/l and the NYSDOH MCL is scheduled to be changed to 0.1 mg/l later this year, the lower (more conservative) ground water quality standard (0.05 mg/l) was used to derive the soil cleanup level.

The soil cleanup level for chromium based on leaching was "back-calculated" from the NYSDEC ground water quality standard using the soil/water partition coefficient. In using this model, it is assumed that residual contamination in soil in the unsaturated zone leaches out in percolating rainfall to the maximum extent predicted by the soil/water partition coefficient. The contaminated rainfall then discharges to ground water. Based on the low organic content of the soil and the low gradient of the water table at this site, it was conservatively assumed that chromium leaches downward without any retardation and without any significant dilution at the water table.

The equation used to calculate the soil cleanup level for chromium using the soil/water partition coefficient is given by:

$$Cs = Kd \times Cw$$

where:

Cs = Allowable concentration of chromium in soil (mg/kg)
Kd = Soil/water partition coefficient (ml/g)
Cw = NYSDEC ground water quality standard (mg/l)

This equation is the same equation recommended by the NYSDEC for development of cleanup levels for petroleum-contaminated soil (NYSDEC, 1990b). (The soil/water partition coefficient (Kd) is equal to the product of fraction of total organic carbon (f) and the organic carbon partition coefficient (Koc), as cited in that guidance document).

The mean soil/water partition coefficients for a variety of soils for trivalent and hexavalent chromium are 2200 ml/g and 37 ml/g, respectively (Baes and Sharp, 1983). Assuming that half of the chromium present in soil at the site is present as hexavalent chromium, an average soil/water partition coefficient of (2200 + 27) / 2 or 1119 ml/g was calculated for use in this equation. The resulting allowable concentration in soil is given by 1119 ml/g x 0.05 mg/l = 56 mg/kg or approximately 50 mg/kg.

5.3.1.2.3 Selection of Site Soil Cleanup Level for Chromium

The soil cleanup level for chromium based on exposures to fugitive dust emissions is 60 mg/kg. The soil cleanup level based on exposures to ground water receiving contaminated leachate from overlying soils is 50 mg/kg. Therefore, the lowest cleanup level, 50 mg/kg, is selected as the site cleanup level. Because of the numerous conservative assumptions used in these calculations, cleanup of soils to 50 mg/kg is expected to be fully protective of human health and the environment via all potential exposure pathways (fugitive dust, direct contact, and leaching of contamination to ground water).

5.3.1.3 Arsenic

As previously mentioned, the carcinogenic risk levels associated with arsenic in soil were within the U.S. EPA target risk range. The carcinogenic risks for arsenic associated with incidental soil ingestion under current conditions and inhalation of fugitive dust by construction workers were only marginally over the de minimis risk of 10^{-6}. However, based on the exceedence of arsenic background levels in some of the on-site soil samples and uncertainties regarding the future use of the site, NYSDEC has set a site-specific cleanup level for arsenic of 35 ppm.

5.3.2 Selection of Ground Water Cleanup Levels

As described above, the contaminants for which remediation may be necessary based on exceedance of SCGs or unacceptable risks to human health and the environment include arsenic, benzene, beryllium, chromium and lead. New York State Standards, Criteria, and Guidance Values (SCGs) have been established for all of these chemicals; therefore, risk-based cleanup levels were not developed. Applicable SCGs include the NYSDOH and federal drinking water standards and the NYSDEC ground water quality standards. The lowest of

TABLE 5-11

GROUND WATER CLEANUP LEVELS

Chemical	SDWA MCL(1) (ug/l)	NYSDOH MCL(2) (ug/l)	NYSDEC Ground Water Quality Standard(3) (ug/l)	Site Cleanup Level (ug/l)
Arsenic	50	50	25	25
Benzene	5	5	0.7	0.7
Beryllium	--(4)	--	3(5)	3
Chromium	100	50	50	50
Lead	TT(6)	50	25	25

(1) Safe Drinking Water Act Maximum Contaminant Level.

(2) NYSDOH Maximum Contaminant Level (State Sanitary Code Part 5 - Drinking Water Supplies).

(3) NYSDEC, 1991a.

(4) No MCL has been adopted. Proposed MCL is 1 ug/l.

(5) New York State Ambient Water Quality Guidance Value for Class GA Ground Water.

(6) MCL is a treatment technique (TT) which is triggered by exceedances of the lead action level of 15 ug/l. Standard applies at the tap.

these standards was selected as the site cleanup level for each chemical. Table 5-11 presents the resulting cleanup levels for the chemicals potentially requiring remediation in ground water at the site.

5.3.3 Selection of Two Mile Creek Cleanup Levels (Aquatic Impacts)

As discussed in Section 5.2, remediation of Two Mile Creek sediments for chromium is considered necessary based on potential adverse impacts to aquatic life. The NYSDEC has established a proposed criterion for chromium in sediment of 26 mg/kg (NYSDEC, 1989b). Therefore, this level was selected as the cleanup level for Two Mile Creek sediment.

5.3.4 Summary of Site Remediation Goals

Table 5-12 summarizes the soil, ground water, and Two Mile Creek sediment cleanup levels for all chemicals for which remediation may be necessary at the site. Remediation for these chemicals will be addressed in the feasibility study.

TABLE 5-12

SUMMARY OF SITE CLEANUP LEVELS

Soil

Chemical	Cleanup Level
Chromium	50 mg/kg
Lead	500 mg/kg
Arsenic	35 mg/kg

Ground Water

Chemical	Cleanup Level
Arsenic	25 ug/l
Benzene	0.7 ug/l
Beryllium	3 ug/l
Chromium	50 ug/l
Lead	25 ug/l

Sediment

Chemical	Cleanup Level
Chromium	26 mg/kg

6.0 DELINEATION OF CONTAMINATION

6.1 Introduction

This section identifies the source areas at the site and summarizes the extent and magnitude of contamination. Although this section focuses on the recently obtained Phase II RI data, the analytical results from both phases of investigation have been used to delineate the extent of contamination in the soil, sediment, building interior, surface water and ground water.

The Phase I Risk Assessment identified fifteen (15) separate indicator chemicals found in either the soil, sediment, ground water and/or surface water during the Phase I RI. These indicator chemicals were selected based on their toxicity, concentrations, mobility and frequency of occurrence in the study area. Zinc and tetrachloroethene were detected during the Phase II RI, bringing the number of chemicals of concern to 17.

Based on the past activities at Van Der Horst Plant No. 2 and the sampling data, it appears that the chromium and lead measured in the study area are: 1) the result of past disposal/discharge activities at the site; and 2) the inorganic indicator elements detected most frequently above background concentrations. Bis(2-chloroethyl)ether is the organic indicator chemical that appears to be the result of past site activities and was measured most frequently above background concentrations. The petroleum hydrocarbons and various other VOC and semi-VOC indicator chemicals encountered are not associated with past operations at the Van Der Horst Plant. Additionally, arsenic, although identified in the Phase I RI as an indicator chemical of concern, was detected only infrequently above background concentrations. Therefore, this section addresses the identification of potential sources at Plant No. 2 and the extent of contamination, based on the chromium, lead and arsenic concentrations measured in the soil, sediment, surface water, building interior and ground water.

6.2 Extent of Contamination

This section summarizes the extent of the contamination detected during both phases of the RI in the soil, creek sediment and water, building interior and groundwater.

The RI data indicates the existence of a ground water plume with concentrations that generally diminish away from the site. The plume properties and contamination concentrations are discussed in more detail in Sections 3.0 and 4.0 of this report. However, ground water samples collected from the perimeter wells along the northwestern side of the study area contained some contaminants above drinking water standards, so that the northwestern extent of ground water contamination off-site remains unknown. Off-site, upgradient wells also exhibited levels of chromium contamination above drinking water standards. Additional study is necessary to delineate the extent of ground water contamination and to assess the extent off-site contamination is migrating on-site. However, for the purpose of this discussion ERM has attempted to approximate the area associated with the primary contaminants of concern.

A soil clean-up level of 50 mg/Kg was used at the nearby Plant No. 1 site to delineate the extent of chromium contamination. This cleanup level was calculated based on the exposure to fugitive dust emissions and will also be used for the purpose of this report. A stream sediment clean-up level of 26 mg/Kg, dry weight, for total chromium has been selected to delineate the extent of the Two Mile Creek sediment contamination. Additionally, a ground water clean-up level of 50 ug/L for hexavalent and total chromium has been selected to delineate the extent of ground water contamination, based on New York State Ground Water Quality standards.

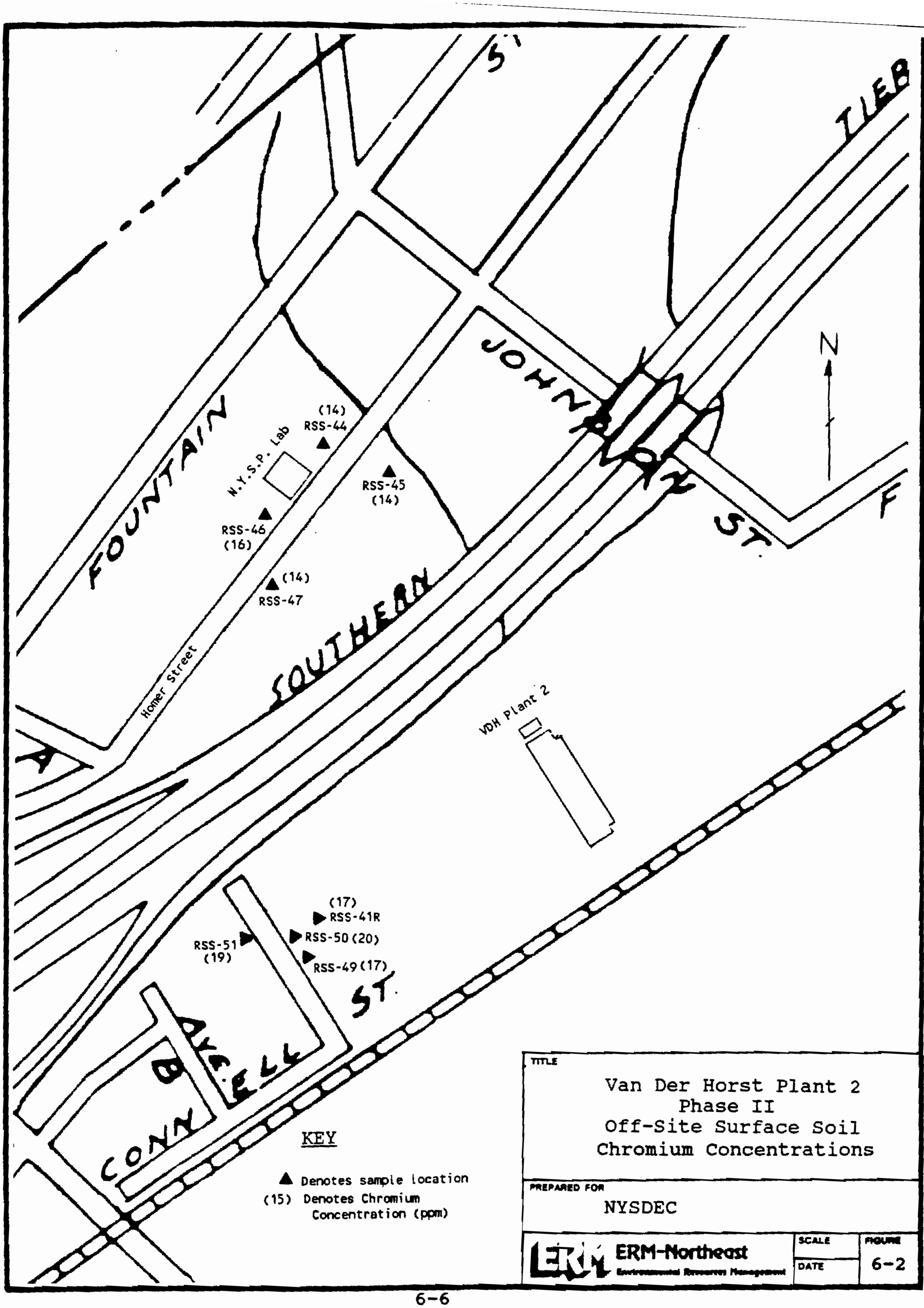
6.2.1 Surface Soil

6.2.1.1 Inorganics

The objective of the Phase II RI surface soil sampling program was to more precisely delineate the extent of surficial chromium, lead and arsenic concentrations in the study area. The parameters selected for analysis and the surface soil sampling locations were chosen based on data needs identified by the Phase I RI report.

Figures 6-1 through 6-3 present the total chromium concentrations measured in the surface soil samples collected during the entire RI. Based on these figures, it appears that the area of surface soil chromium contamination includes: The majority of the surface soil encompassing the eastern half of the fenced in former drum disposal area to approximately 100 feet east of the plant building; and, from the Two Mile Creek flood control berm to the southern edge of the plant building.

Lead concentrations measured in the on-site surface soil samples were, in a number of cases, higher than the concentrations measured in the background samples (see Figures 6-4 through 6-6). Elevated lead concentrations detected in Phase I and II surface soil samples generally appear to correspond with the occurrence of the elevated surface soilchromium concentrations. A portion of the adjacent residential area also exhibited slightly higher than background values for lead concentrations. However, the elevated concentrations detected at these locations appear to



TITLE

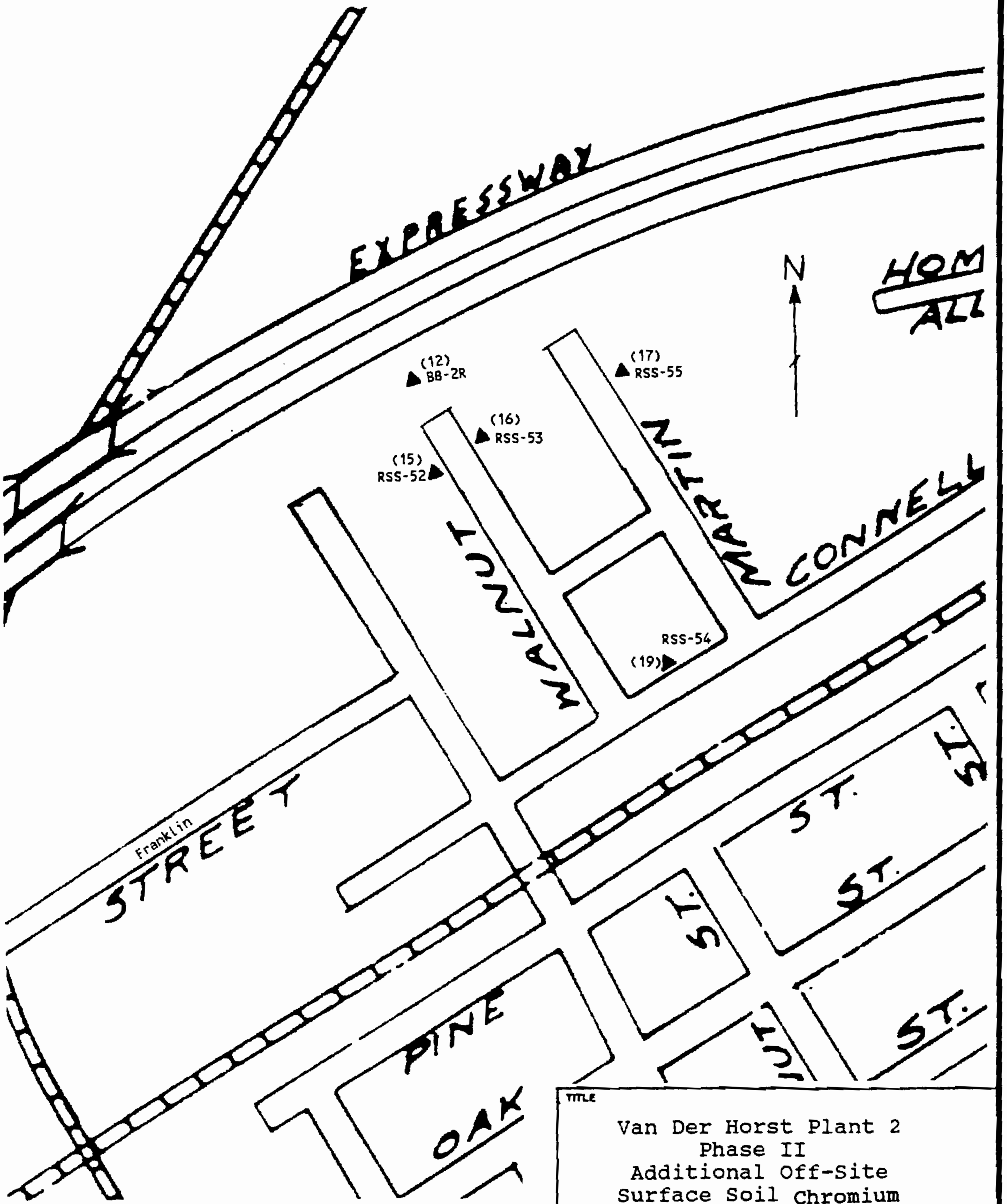
Van Der Horst Plant 2
Phase II
Off-Site Surface Soil
Chromium Concentrations

PREPARED FOR

NYSDEC

ERM-Northeast
Environmental Resources Management

SCALE	FIGURE
DATE	6-2



KEY

▲ Denotes sample location

(15) Denotes Chromium Concentration (ppm)

TITLE

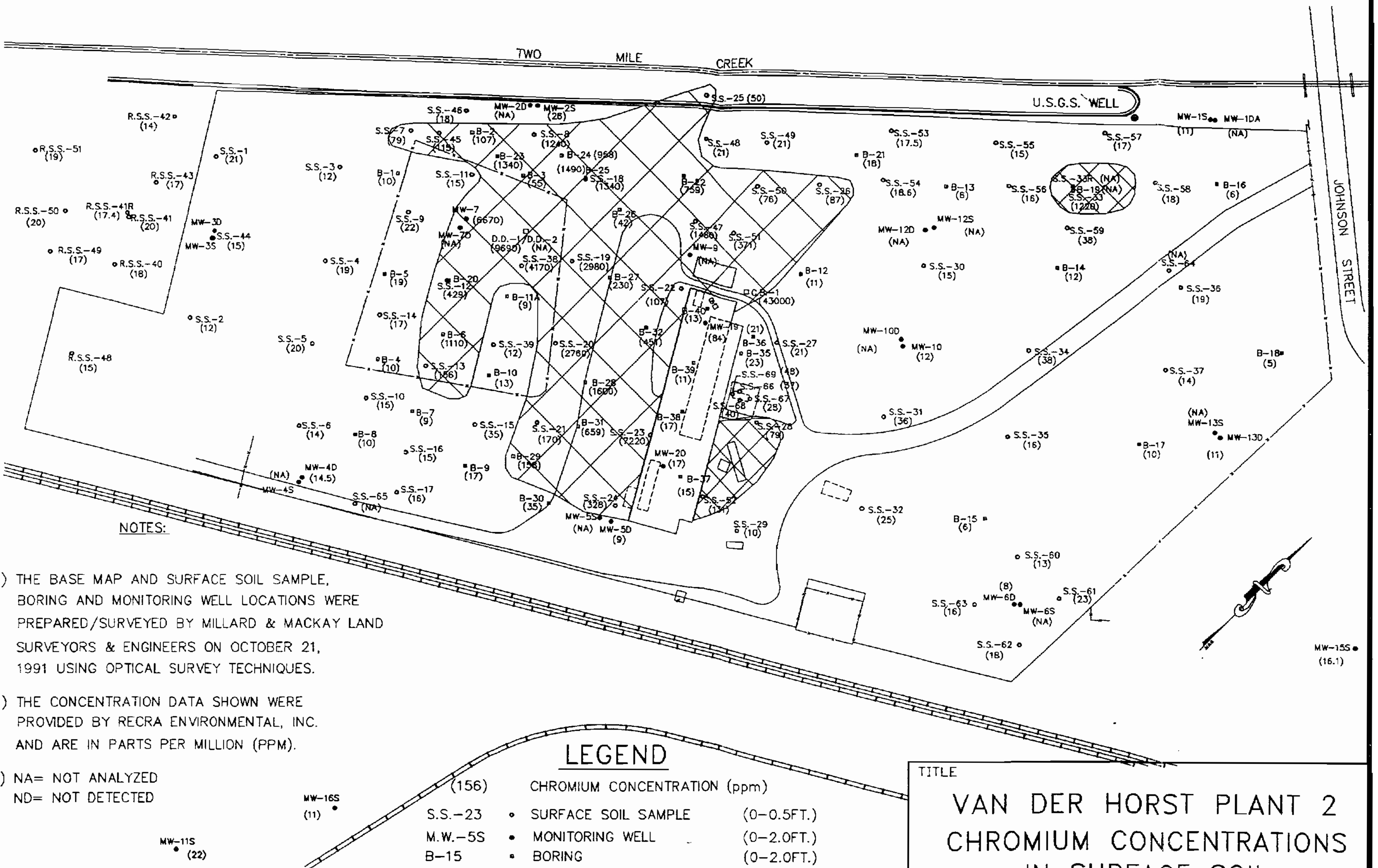
Van Der Horst Plant 2
Phase II
Additional Off-Site
Surface Soil Chromium
Concentrations

PREPARED FOR

NYSDEC

ERM-Northeast
Environmental Resources Management

SCALE	FIGURE
DATE	6-3



NOTES:

1) THE BASE MAP AND SURFACE SOIL SAMPLE, BORING AND MONITORING WELL LOCATIONS WERE PREPARED/SURVEYED BY MILLARD & MACKAY LAND SURVEYORS & ENGINEERS ON OCTOBER 21, 1991 USING OPTICAL SURVEY TECHNIQUES.

2) THE CONCENTRATION DATA SHOWN WERE PROVIDED BY RECRA ENVIRONMENTAL, INC. AND ARE IN PARTS PER MILLION (PPM).

3) NA= NOT ANALYZED
ND= NOT DETECTED

4) THE BOUNDARY OF THE SHADED AREA ON THIS FIGURE WAS BASED ON INTERPOLATION OF WIDELY SPACED DATA POINTS. THE AREA ENCOMPASSED BY THE SHADING IS AN APPROXIMATION OF THE EXTENT OF CHROMIUM CONTAMINATION ABOVE 50 PPM.

LEGEND

(156)		CHROMIUM CONCENTRATION (ppm)	
S.S.-23	○	SURFACE SOIL SAMPLE	(0-0.5FT.)
M.W.-5S	●	MONITORING WELL	(0-2.0FT.)
B-15	■	BORING	(0-2.0FT.)
▨		APPROXIMATE AREA OF SURFACE SOIL CONTAINING CHROMIUM CONCENTRATIONS ABOVE 50 PPM	

0' 100' 200' 400'

SCALE

TITLE

VAN DER HORST PLANT 2
CHROMIUM CONCENTRATIONS IN SURFACE SOIL

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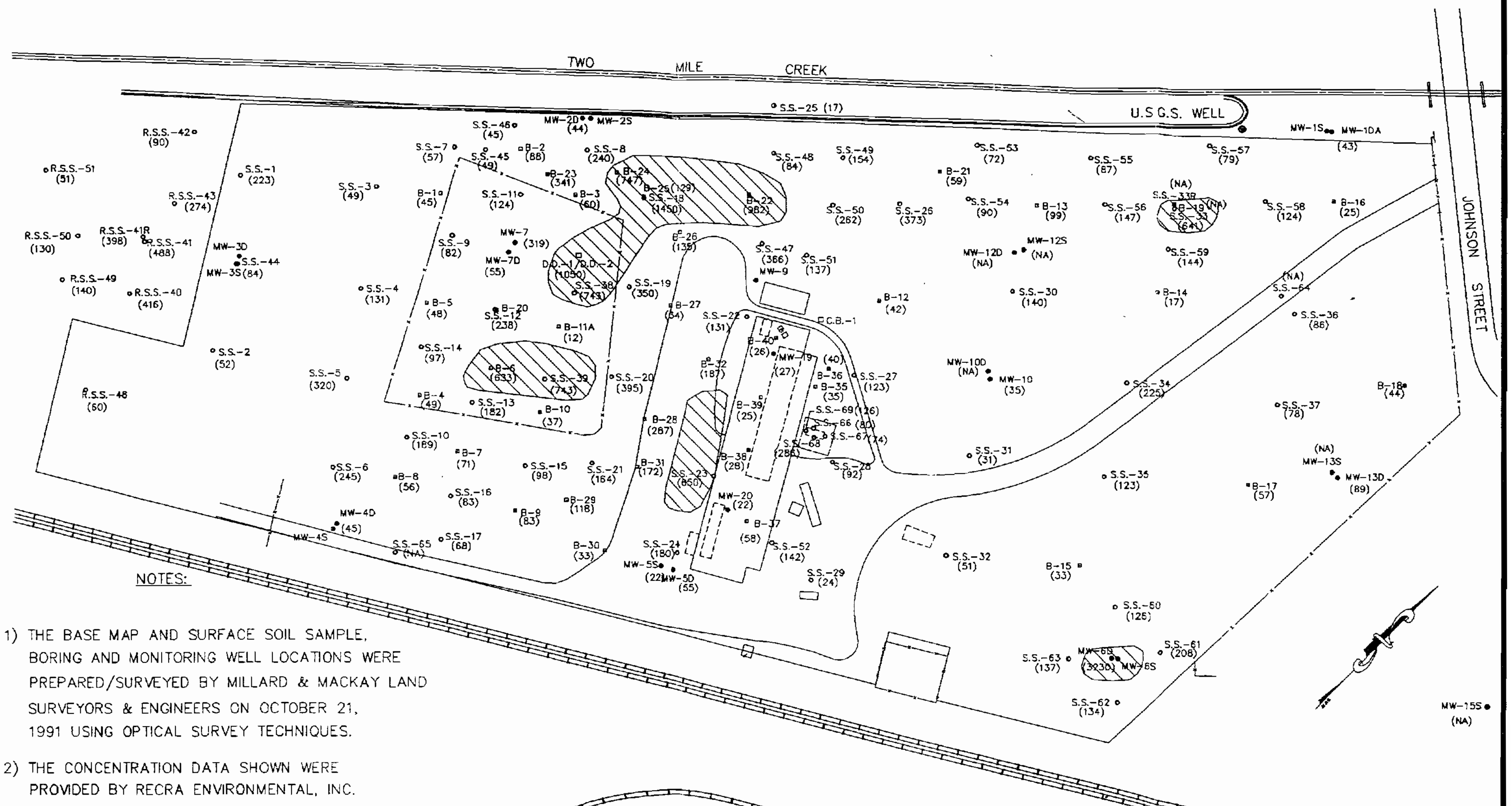
ERM-Northeast
Environmental Resources Management

DATE

FIGURE
6-1



NOTES:

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2) THE CONCENTRATION DATA SHOWN WERE PROVIDED BY RECRA ENVIRONMENTAL, INC. AND ARE IN PARTS PER MILLION (PPM).

3) NA= NOT ANALYZED
ND= NOT DETECTED

4) THE BOUNDARY OF THE SHADED AREA ON THIS FIGURE WAS BASED ON INTERPOLATION OF WIDELY SPACED DATA POINTS. THE AREA ENCOMPASSED BY THE SHADING IS AN APPROXIMATION OF THE EXTENT OF LEAD CONTAMINATION ABOVE 500 PPM.

LEGEND

(156)		LEAD CONCENTRATION (PPM)	
S.S.-23	○	SURFACE SOIL SAMPLE	(0-0.5FT.)
M.W.-5S	●	MONITORING WELL	(0-2.0FT.)
B-15	▪	BORING	(0-2.0FT.)
▨		APPROXIMATE AREA OF SURFACE SOIL CONTAINING LEAD CONCENTRATIONS ABOVE 500 PPM	

0' 100' 200' 400'

SCALE

TITLE

VAN DER HORST PLANT 2
LEAD CONCENTRATIONS
IN SURFACE SOIL

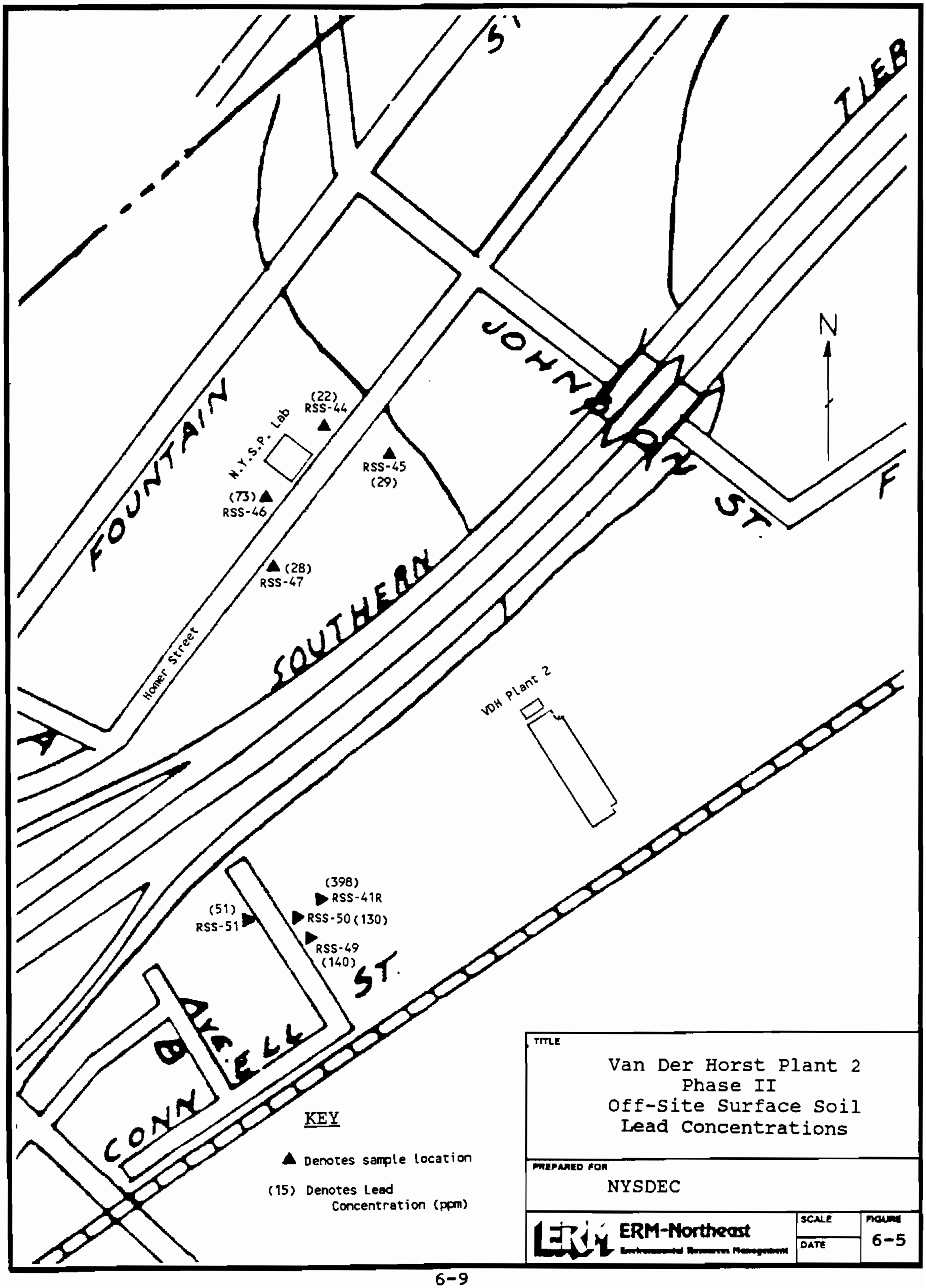
PREPARED FOR

NYSDEC

ERM-Northeast
Environmental Resources Management

DATE

FIGURE
6-4



KEY

▲ Denotes sample location

(15) Denotes Lead Concentration (ppm)

TITLE

Van Der Horst Plant 2
Phase II
Off-Site Surface Soil
Lead Concentrations

PREPARED FOR

NYSDEC

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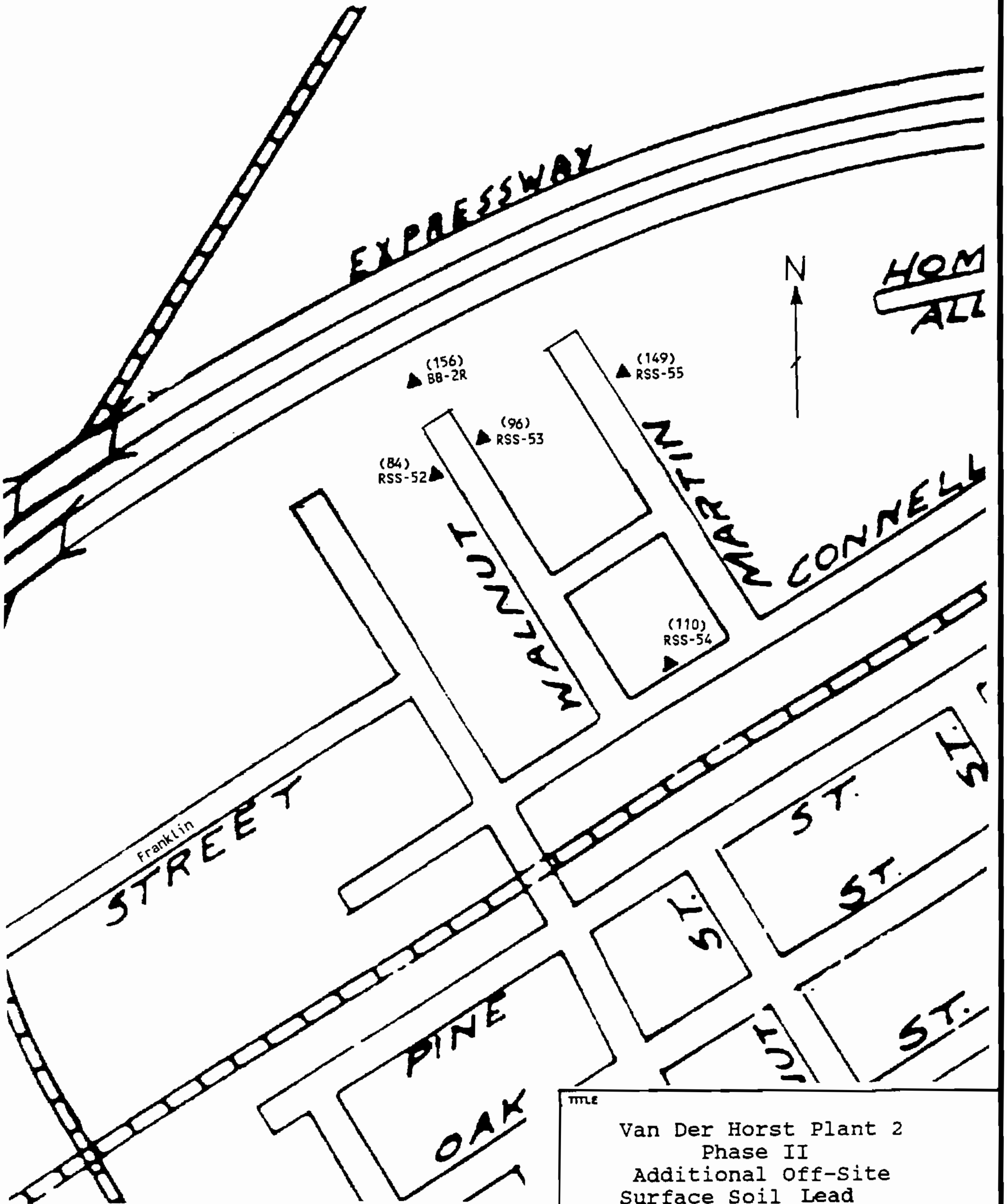
Environmental Resources Management

SCALE	FIGURE
DATE	6-5



KEY

▲ Denotes sample location

(15) Denotes Lead Concentration (ppm)

TITLE

Van Der Horst Plant 2
Phase II
Additional Off-Site
Surface Soil Lead
Concentrations

PREPARED FOR

NYSDEC

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Environmental Resources Management

SCALE	FIGURE
	6-6
DATE	

be from off-site sources and not as a result of Plant No. 2 operations. On-site elevated lead Figure 6-6 concentrations appear to be a result of the former on-site activities, although only five locations exhibited levels above the NYSDEC Standard of 500 ppm.

Arsenic concentrations measured in 13 of the Phase I and Phase II surface soil samples were above the limit of 35 ppm. These samples are located in 7 different on-site areas and one area located south of the site (see Figure 6-33, page 54). Sample SS-12 had the highest value, 390 ppm, detected for arsenic in a surface soil sample. It is not clear whether or not these areas of elevated arsenic concentrations constitute an on-site source area. Many of the high arsenic areas are widely separated and may not have a similar source.

A limited number of surface soil samples were analyzed for TCLP inorganic parameters (see Table 4-2). These samples were collected from locations indicating high levels of chromium or lead detected during the Phase I RI. Of the three samples collected none was classified as hazardous. However, detectable quantities of arsenic, chromium, silver, barium, cadmium and mercury were present in the extract of one or more of these samples. These compounds ranged upwards to 18 ppb for arsenic; 2650 ppb for barium; 12.6 ppb for cadmium; 120

ppb for chromium; 0.85 ppb for mercury; and, 58 ppb for silver.

6.2.1.2 Organics

Figure 6-7 presents the concentration levels of volatile and semi-volatile compounds detected in surface soil during both phases of the RI. As indicated on the figure, the surface contaminants consist primarily of methylene chloride, acetone, toluene and polyaromatic hydrocarbons (PAHs).

6.2.2 Subsurface Soil

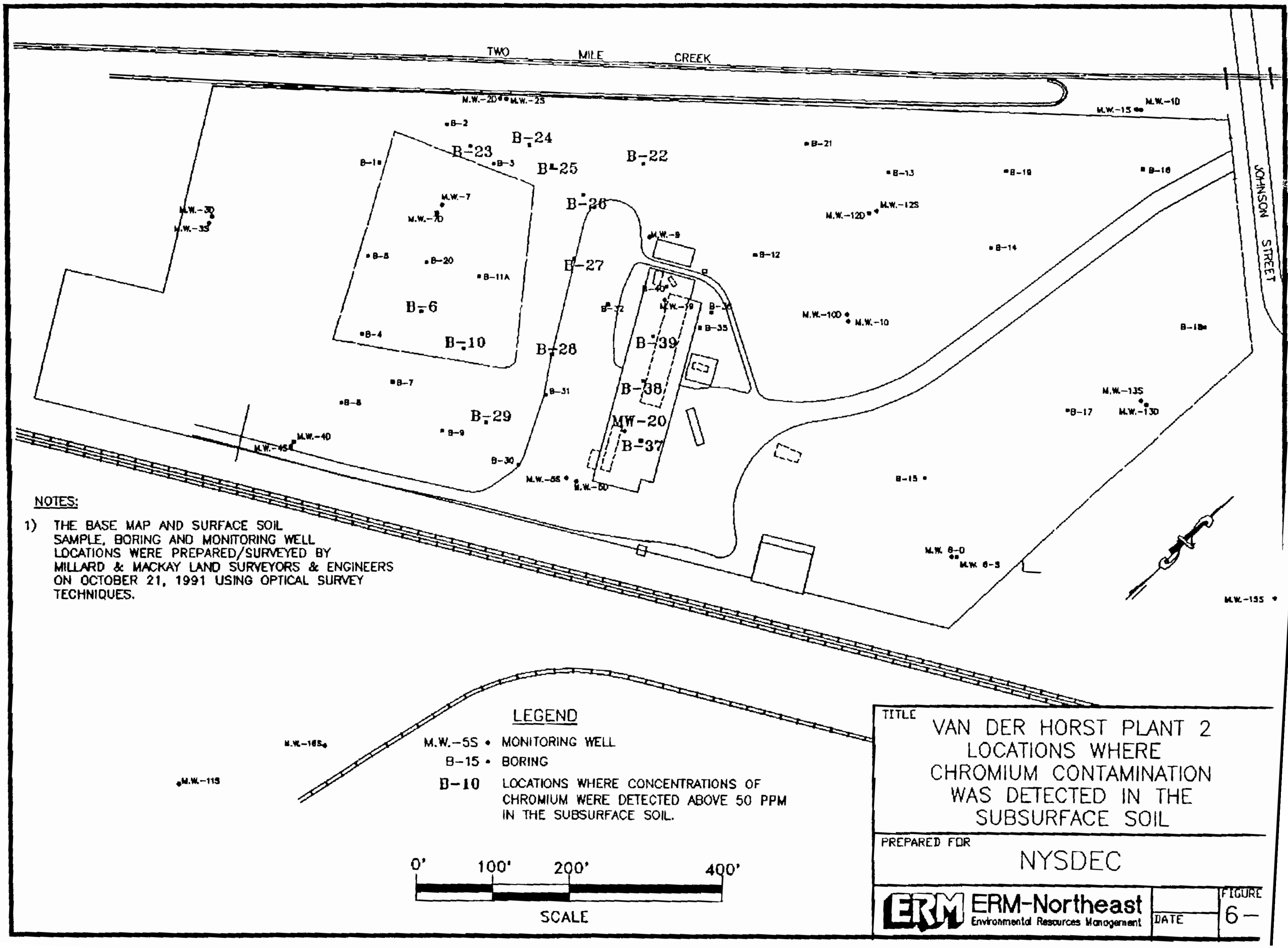
6.2.2.1 Inorganics

Subsurface soil samples were collected at soil borings and monitoring wells adjacent to and inside the Plant No. 2 building and off-site to evaluate chromium, lead and arsenic levels. The subsurface contamination information is limited, since not all borings were continuously sampled and not all samples from the borings were submitted for laboratory analysis. Generally, chromium concentrations were found to be the highest of these three metals. Areas with high lead levels generally also had high chromium concentrations.

Chromium contamination was also found in many soil samples with low concentrations of lead.

Figure 2-3 indicates the subsurface soil sample locations, while Figure 6-8 indicates the subsurface sampling locations where elevated chromium concentrations, over 50 ppm, were detected. Included are a small area near the southeast corner of the former drum disposal area and an area encompassing the plant building, extending west toward the former drum disposal area and northwest toward the Two Mile Creek flood control berm. However, these areas may not represent the total extent of subsurface contamination, since not all borings were continuously sampled and not all samples collected were analyzed. Therefore, the extent of the subsurface soil contamination has not been fully delineated.

The vertical distribution of chromium contamination in unsaturated soil obtained from two borings in this area of the building follows a pattern of: 1) Low levels from surface to approximately 16 feet below grade; 2) Increased concentrations between 16 and 18 feet below grade; and, 3) Decreased concentrations from 18 to 20 feet below grade. Additionally, chromium concentrations detected in monitoring well MW-20 follow a similar pattern, with the exception that elevated



NOTES:

1) THE BASE MAP AND SURFACE SOIL SAMPLE, BORING AND MONITORING WELL LOCATIONS WERE PREPARED/SURVEYED BY MILLARD & MACKAY LAND SURVEYORS & ENGINEERS ON OCTOBER 21, 1991 USING OPTICAL SURVEY TECHNIQUES.

TITLE

VAN DER HORST PLANT 2
LOCATIONS WHERE
CHROMIUM CONTAMINATION
WAS DETECTED IN THE
SUBSURFACE SOIL

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NYSDEC

ERM-Northeast
Environmental Resources Management

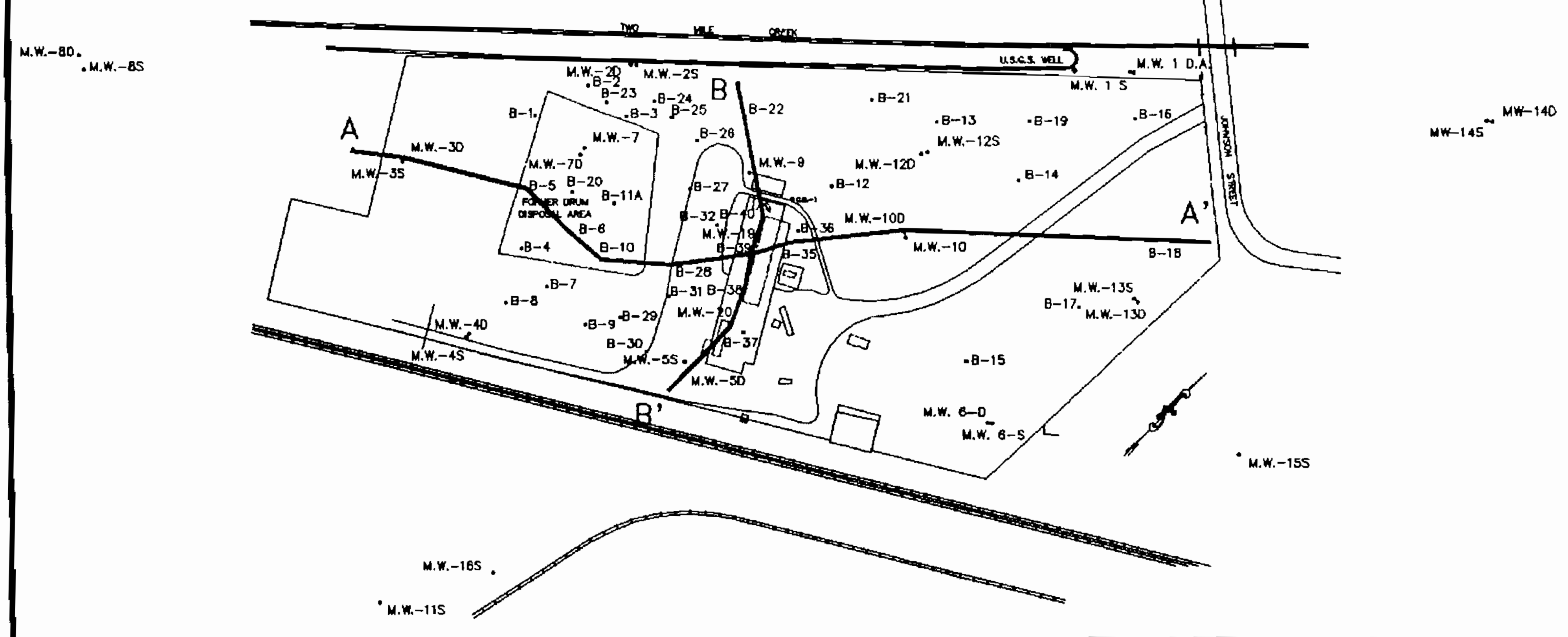
DATE

FIGURE
6-

levels are detected at 14 to 16 feet below grade and remain elevated to a least 32 feet, and more than likely deeper.

The soil profile of MW-20 indicates that chromium contamination greater than 50 mg/Kg extends beneath the water table, approximately 18 feet below grade. At this location, chromium levels in the soil beneath the water table were greater than those in the soil above the water table. This was most evident in the sample obtained from a depth of 18'-20'. This sample was below the water table and had a chromium concentration of 1420 mg/Kg. The soil profile map is presented on Figure 6-9 and the soil profiles are presented in Figures 6-10 and 6-11.

The high concentration of chromium in the 18'- 20' soil sample from MW-20 may have been caused by plating solutions leaking from the EMD plating tank (Figure 2-2). This monitoring well was drilled as close to the plating tank as access would allow. This vat is approximately 60 feet long and below grade to a depth of two feet. It is presently believed that chromic acid, leaking from the tank, has resulted in the high levels of chromium in the soil beneath the water table. It is also believed that the soil, contaminated by the leaking tank, acts as a source area for ground water contamination. This would explain why saturated



TITLE

VAN DER HORST PLANT 2
SOIL PROFILE LOCATION MAP

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NYSDEC

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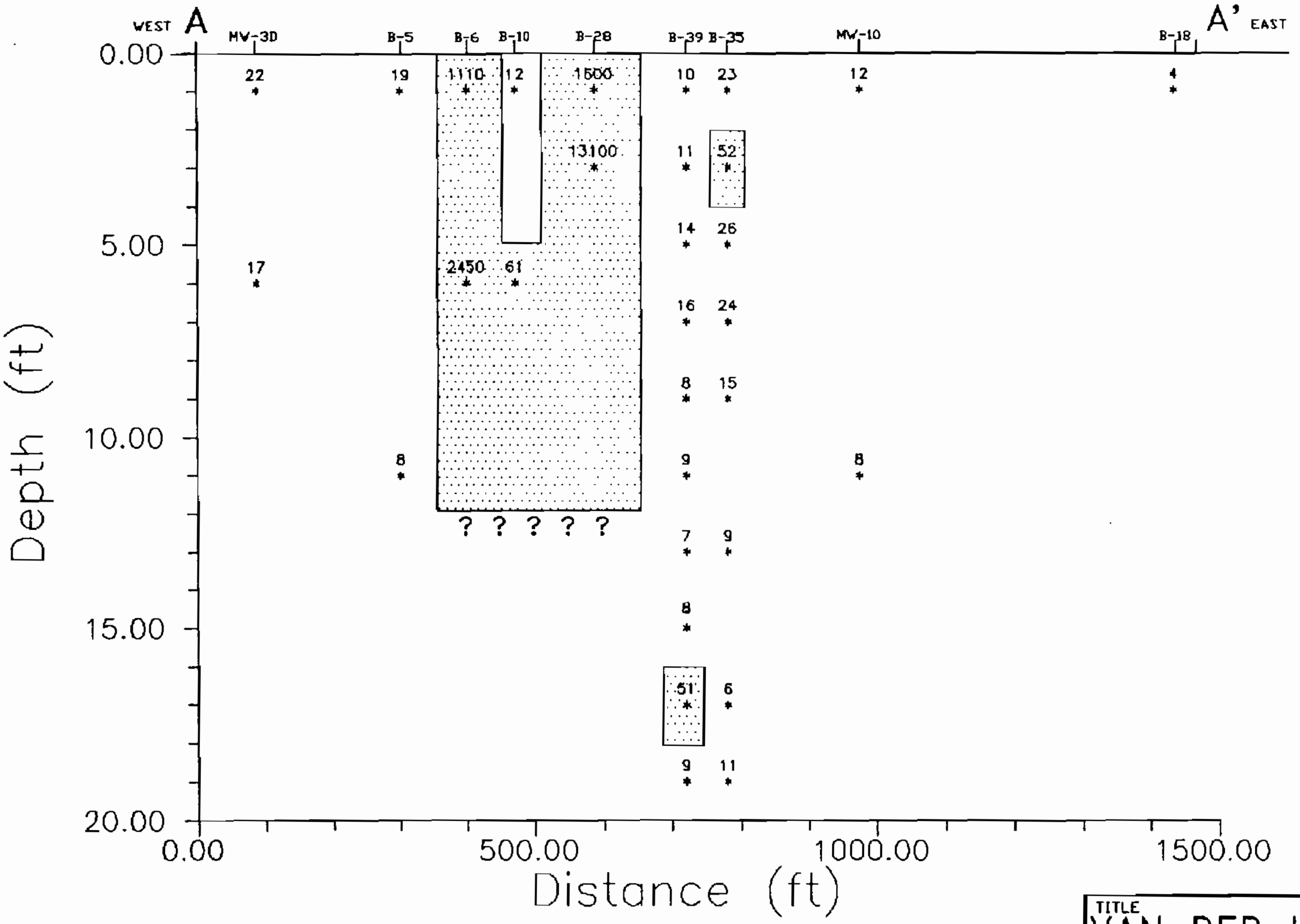
Environmental Resources Management

DATE

FIGURE
6-9



LEGEND

17 * Chromium Concentration (mg/Kg)

▨ Estimated Area of Chromium Concentrations > 50 mg/Kg

? ? Unknown Depth of Chromium Concentrations > 50 mg/Kg

TITLE
VAN DER HORST PLANT 2
SUBSURFACE SOIL
CHROMIUM LEVELS ALONG
PROFILE A – A'

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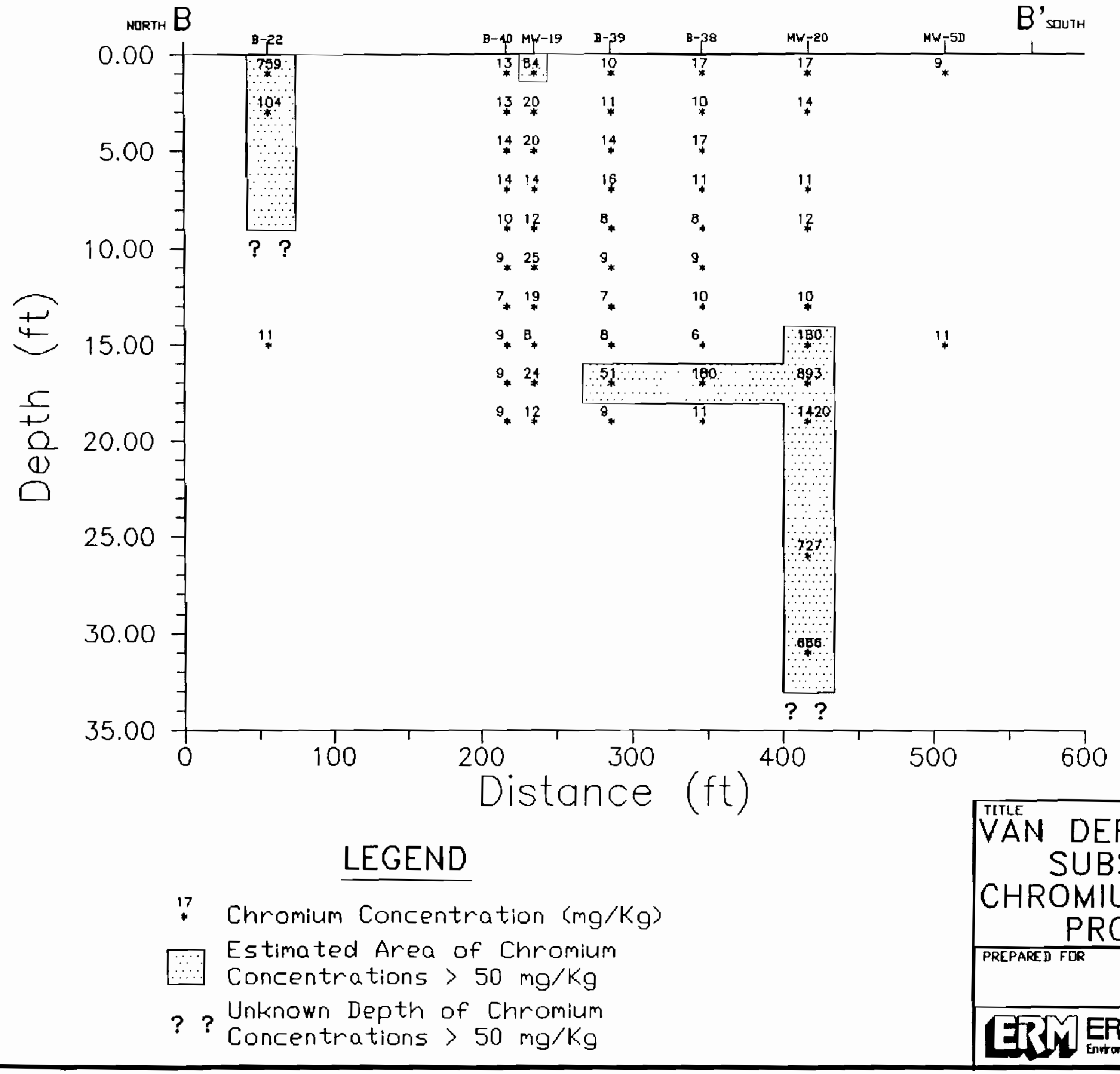
Environmental Resources Management

DATE

FIGURE
6-10



TITLE

VAN DER HORST PLANT 2
SUBSURFACE SOIL
CHROMIUM LEVELS ALONG
PROFILE B – B'

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Environmental Resources Management

DATE

FIGURE
6-11

soil concentrations are higher than the local ground water concentrations.

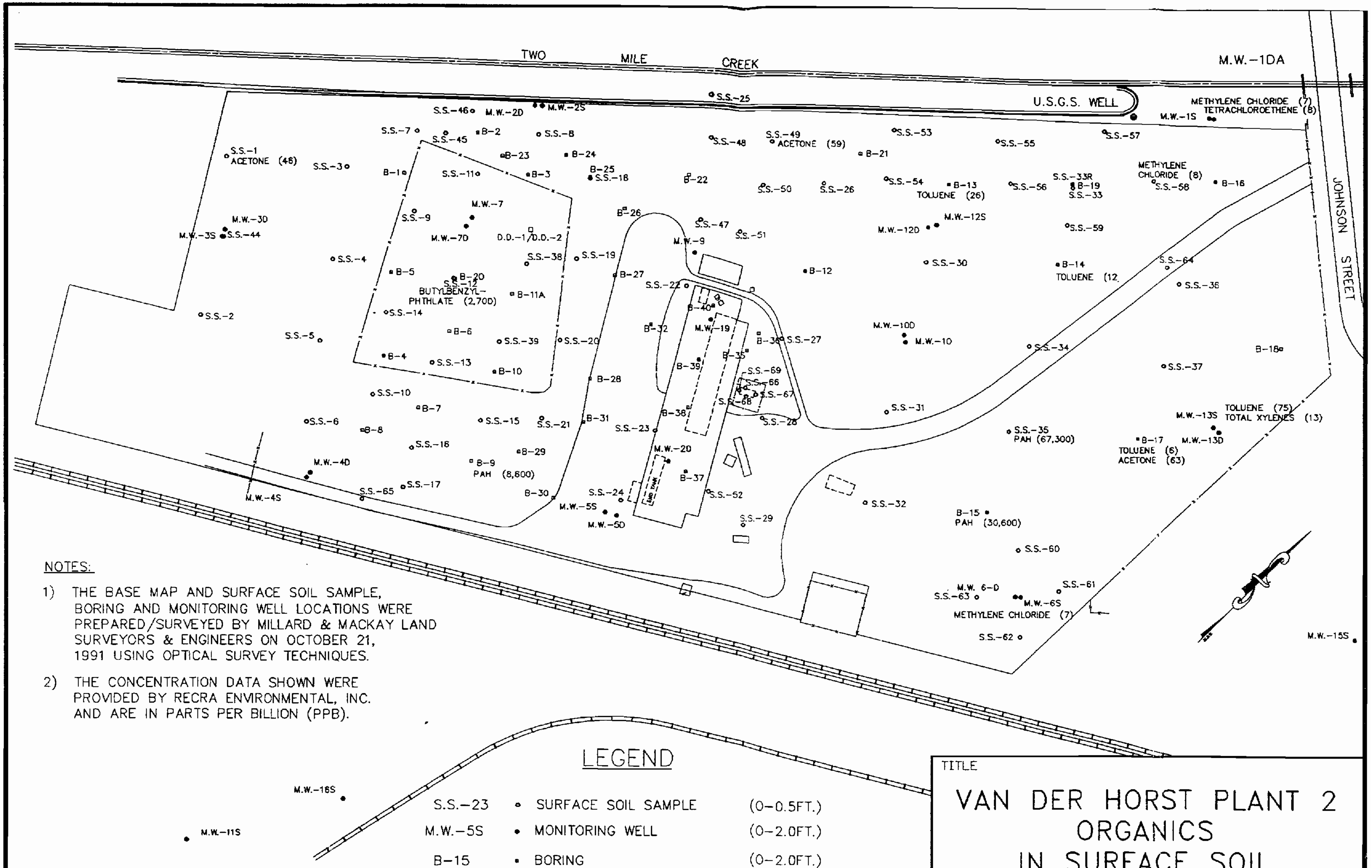
Total chromium was detected at a concentration of 1680 ug/L (or 1.68 mg/L) in ground water from MW-20. This is the second highest level of chromium found in ground water at the site, however the soil sample from 25' - 27' has a higher concentration than the ground water, 727 mg/Kg. Saturated soil with chromium concentrations of this magnitude would release high levels of chromium to ground water. The saturated soil around MW-20 is believed to be a source of ground water chromium contamination at Plant No. 2, due to the continuous release of chromium to ground water.

High levels of chromium in the saturated soil may not be effectively remediated by pump and treat methods. Chromium may continue to leach from the aquifer material until equilibrium is reached between the soil and the ground water. Years of pumping may be necessary before equilibrium conditions could be reached and a level of 50 ppb for chromium contamination could be stabilized in the ground water.

A limited number of subsurface soil samples were analyzed for TCLP inorganic parameters (see Table 4-4). These samples were collected from locations indicating high levels of chromium or lead detected during the Phase I RI and from the subsurface of the Plant 1 building. Of the nine samples collected none was classified as hazardous. However, detectable quantities of arsenic, silver, barium, lead, and cadmium were present in the extract of one or more of these samples. These compounds ranged upwards to 18 ppb for arsenic; 1220 ppb for barium; 8.0 ppb for cadmium; 51.4 ppb for lead; and, 17 ppb for silver.

6.2.2.2 Organics

Figure 6-12 presents the sample locations and concentration levels of volatile and semi-volatile compounds detected in subsurface soil during both phases of the RI. As indicated on the figure, the subsurface contaminants consist primarily of methylene chloride, acetone, toluene, total xylenes and polyaromatic hydrocarbons (PAHs). There were three separate locations where tetrachloroethene and trichloroethene were detected in the subsurface soil. These samples, MW-1, B-37 and B-22, were widely separated and collected at different depths. However, other areas where organics were detected are located in or adjacent to former disposal areas or the plant building. This appears to indicate that some subsurface contamination is a result of the Plant 2 operations.



NOTES:

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2) THE CONCENTRATION DATA SHOWN WERE PROVIDED BY RECRA ENVIRONMENTAL, INC. AND ARE IN PARTS PER BILLION (PPB).

LEGEND

S.S.-23	○	SURFACE SOIL SAMPLE	(0-0.5FT.)
M.W.-5S	●	MONITORING WELL	(0-2.0FT.)
B-15	▪	BORING	(0-2.0FT.)
(12)		CONCENTRATION OF ORGANIC COMPOUND (PPB)	

0' 100' 200' 400'

SCALE

TITLE

VAN DER HORST PLANT 2
ORGANICS
IN SURFACE SOIL

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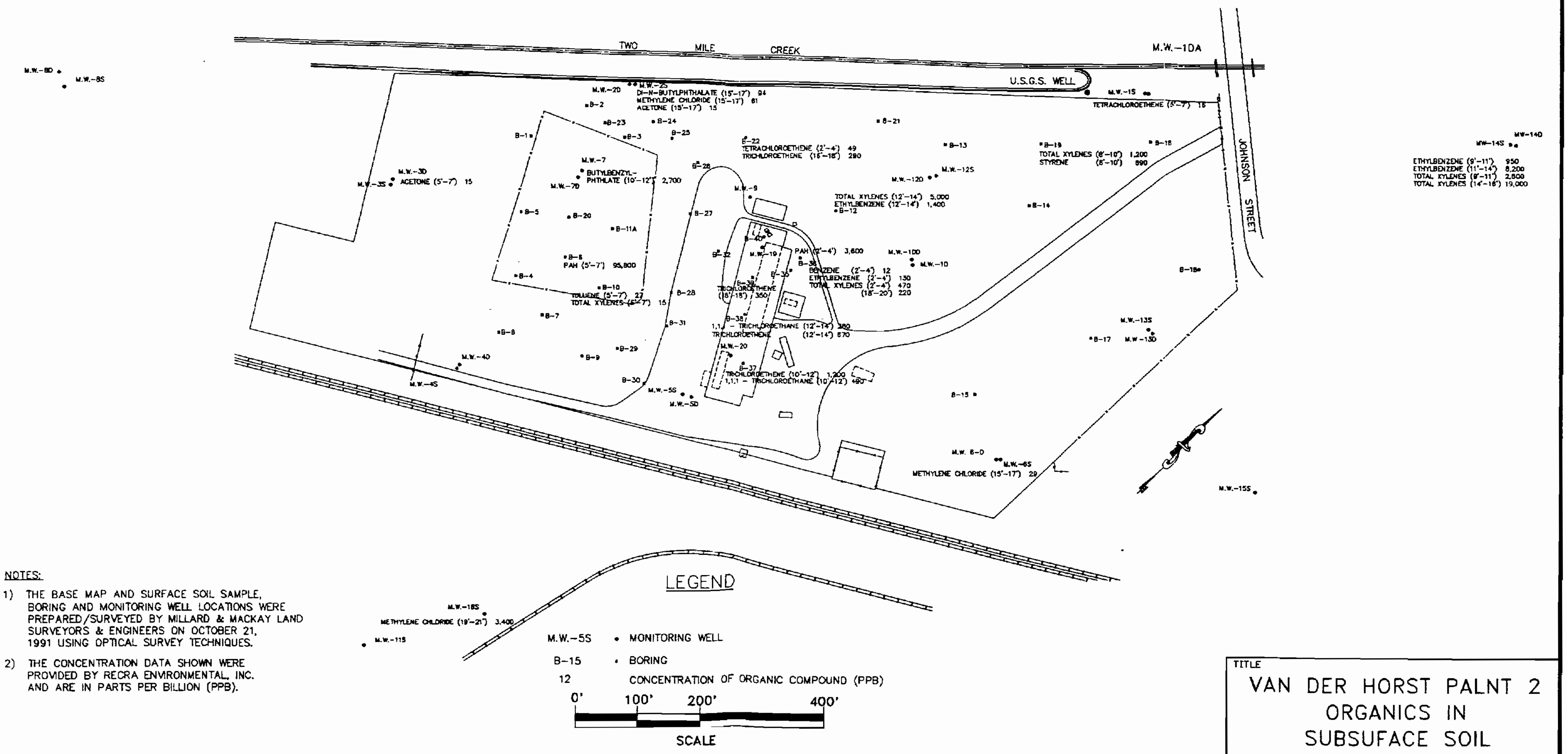
NYSDEC

ERM-Northeast
Environmental Resources Management

DATE

FIGURE
6-7



NOTES:

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2) THE CONCENTRATION DATA SHOWN WERE PROVIDED BY RECRA ENVIRONMENTAL, INC. AND ARE IN PARTS PER BILLION (PPB).

LEGEND

M.W.-5S ● MONITORING WELL

B-15 • BORING

12 CONCENTRATION OF ORGANIC COMPOUND (PPB)

0' 100' 200' 400'

SCALE

TITLE

VAN DER HORST PALNT 2
ORGANICS IN
SUBSUFACE SOIL

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Environmental Resources Management

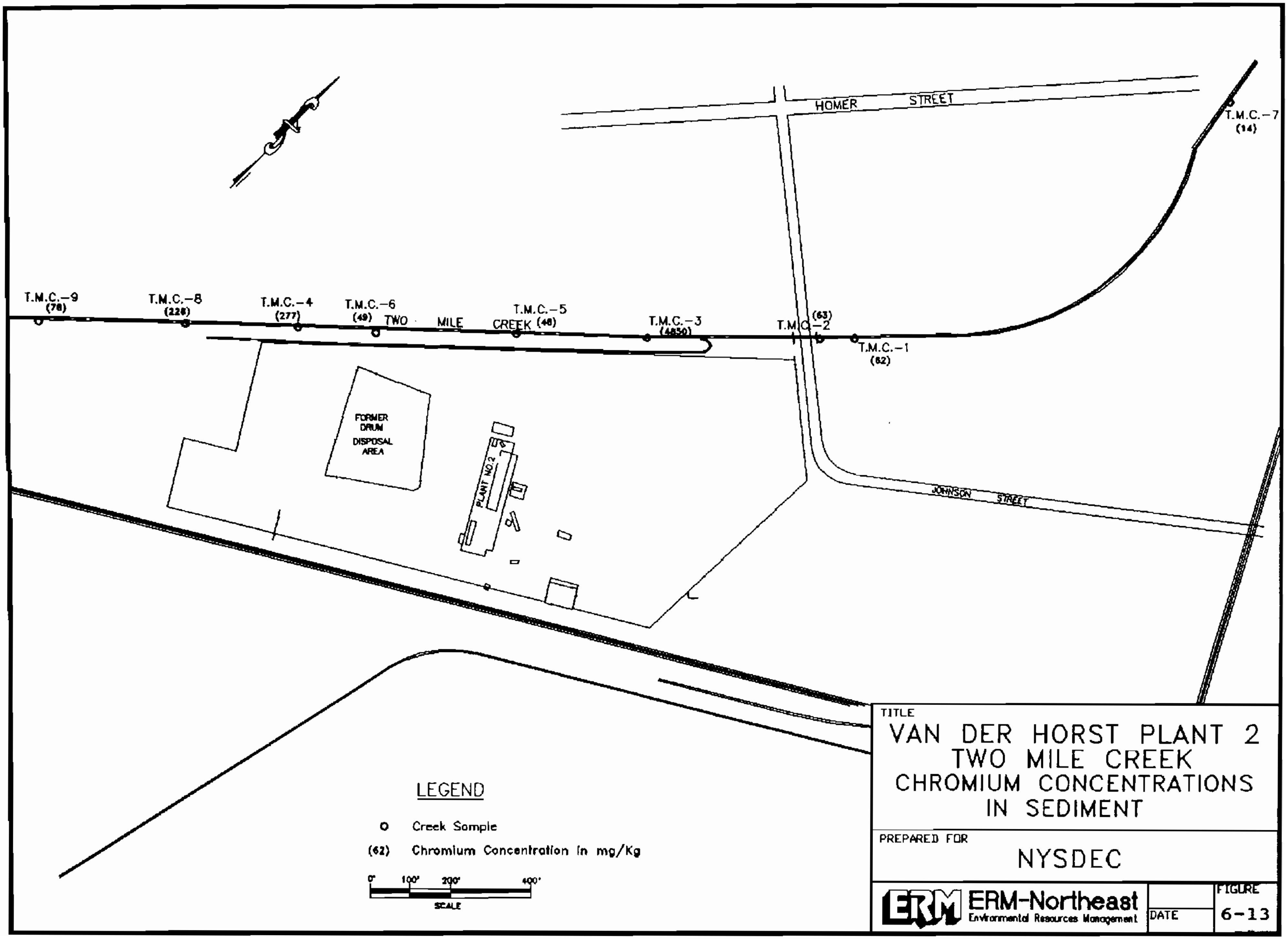
DATE

FIGURE
6-12

6.2.3 Two Mile Creek Sediment

The lateral extent of elevated chromium concentrations in Two Mile Creek sediment appears to extend past the downstream site boundary (see Figure 6-13). The upstream concentrations of total chromium in the stream sediments exhibited a chromium concentration of 14 ppm in sample TMC-7. The sediment samples collected downstream of the plant property exhibited elevated levels of chromium at 228 ppm for TMC-8 and 76 ppm for TMC-9. A sample, TMC-3, collected adjacent to the Plant 2 property exhibited a chromium level of 4850 ppm. This appears to indicate that the former practices and operations at Plant are a potential source of the stream sediment contamination.

Cadmium was identified as being a contaminant of concern in the Two Mile Creek sediments. Six of the nine sediment samples collected during both phases of the RI exhibited concentrations above 3 ppm (see Figure 6-14). The downstream sediment sample, TMC-9, exhibited one of the highest detected concentrations, 11.3 ppm. However, the upstream sediment sample also exhibited a comparatively high concentration of 7.5 ppm for cadmium. Based on the analysis for cadmium, it appears as if the source of this contamination has not been delineated. Further sampling is recommended to establish the natural background levels of cadmium in the stream sediment.



TITLE

VAN DER HORST PLANT 2
TWO MILE CREEK
CHROMIUM CONCENTRATIONS IN SEDIMENT

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NYSDEC

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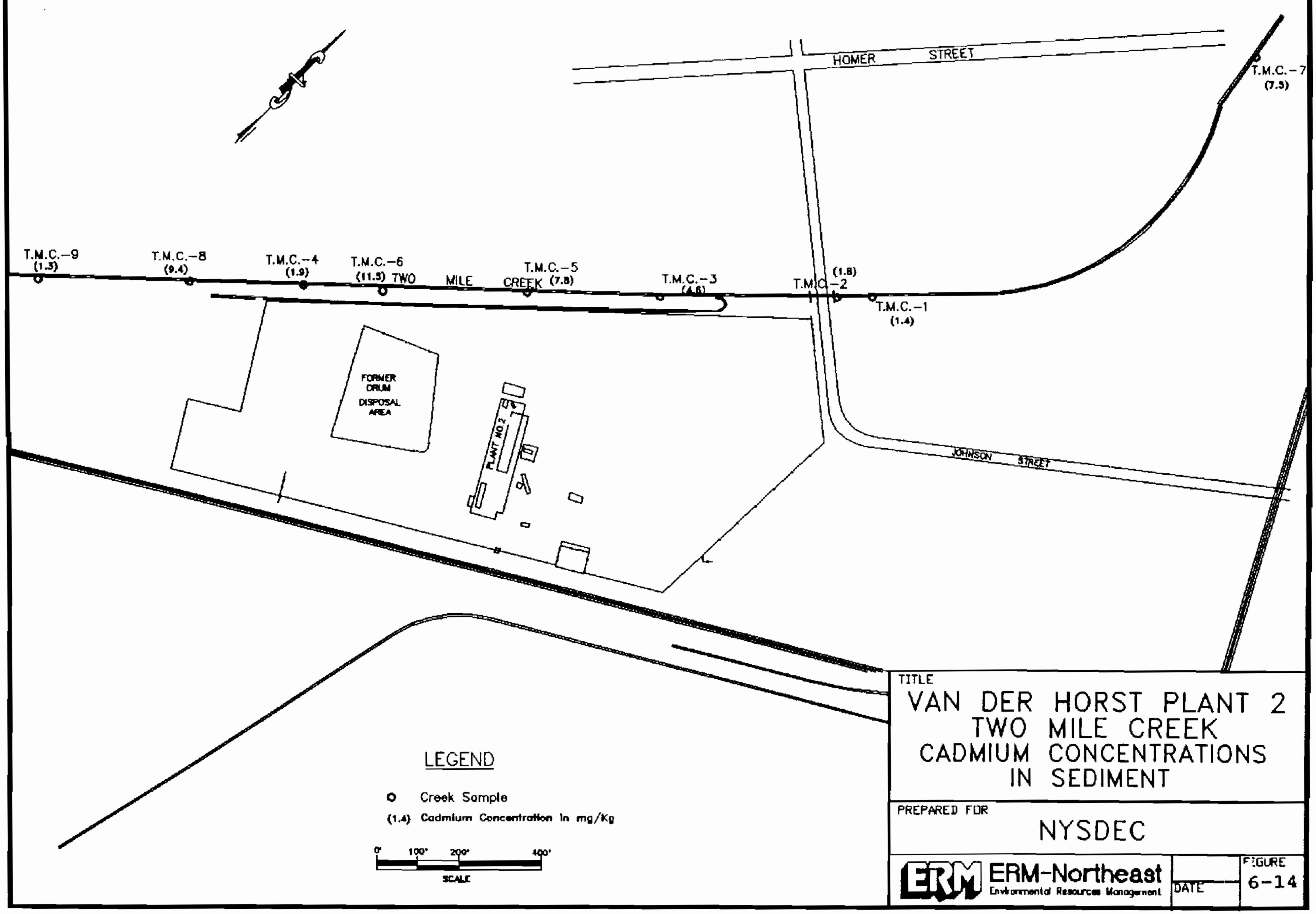
Environmental Resources Management

DATE

FIGURE 6-13



TITLE

VAN DER HORST PLANT 2
TWO MILE CREEK
CADMIUM CONCENTRATIONS
IN SEDIMENT

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ERM-Northeast
Environmental Resources Management

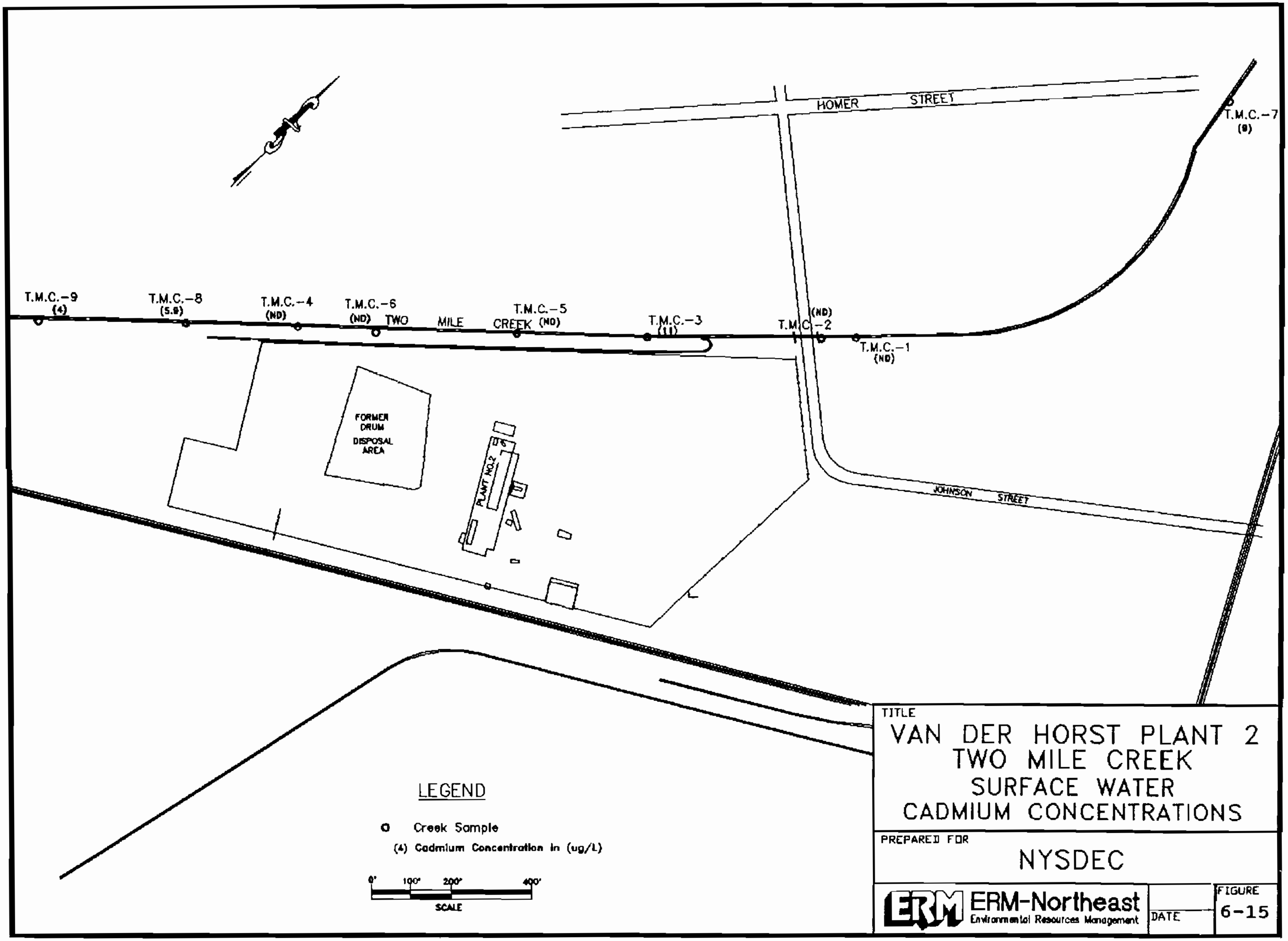
DATE

FIGURE
6-14

The background levels could then be compared to those detected near the plant boundary in order to determine if the contamination is the result of practices at the Plant 2 facility.

6.2.4 Surface Water in Two Mile Creek

Cadmium was the only potential chemical of concern identified in surface water samples collected from Two Mile Creek during the Phase I RI. This element was detected at a concentration of 11 ppb in sample TMC-3. Additional sampling and analysis of stream surface water during the Phase II RI indicated two other samples with detectable levels of cadmium. These included TMC-7, an upstream sample and TMC-8, a downstream sample (see Figure 6-15). The levels detected were 9 ppb and 6 ppb, respectively. Therefore it appears as if the surface water may have been impacted by the plant operations, but a potential point source for the cadmium contamination has not been delineated.



TITLE

VAN DER HORST PLANT 2
TWO MILE CREEK
SURFACE WATER
CADMIUM CONCENTRATIONS

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Environmental Resources Management

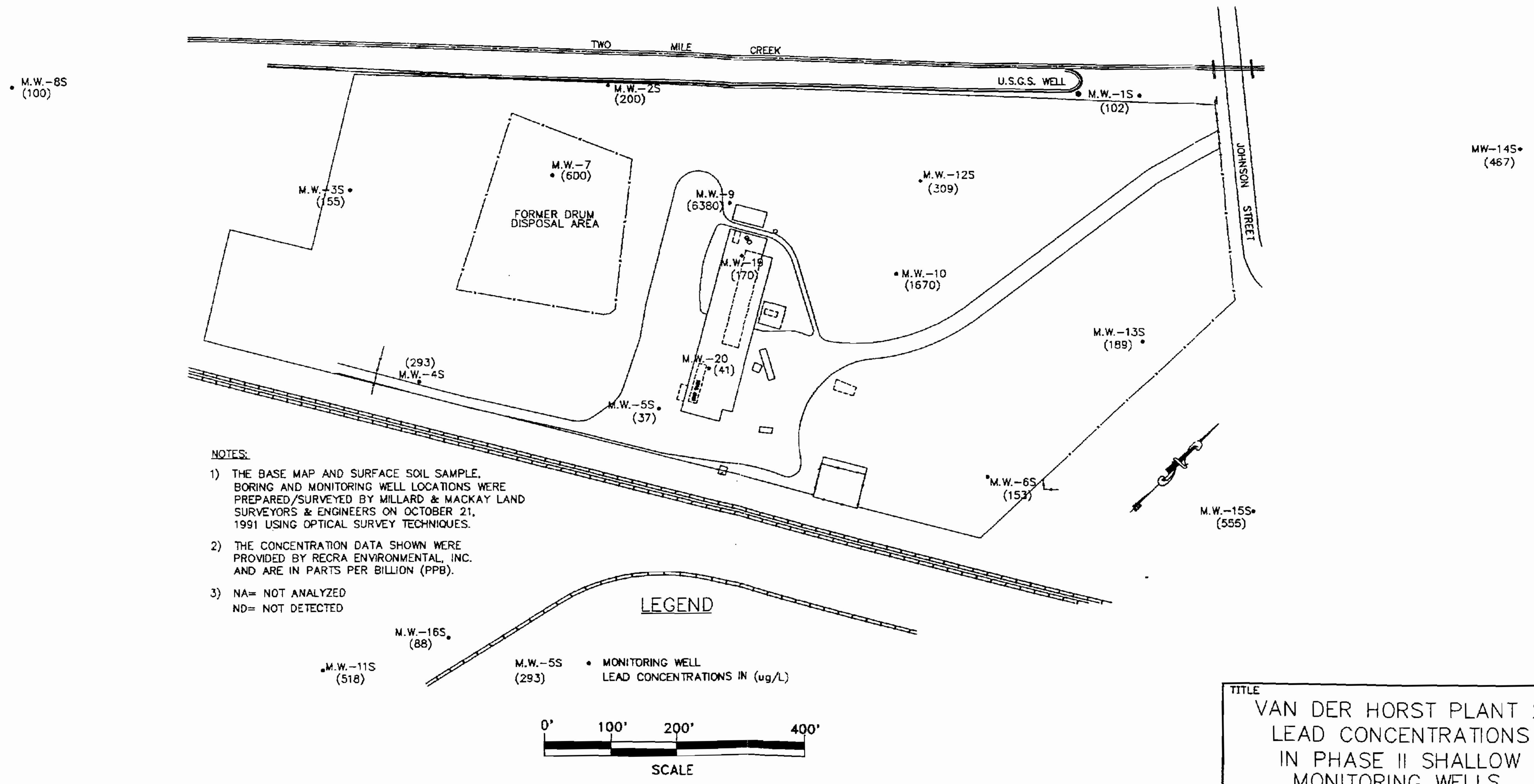
DATE

FIGURE
6-15

6.2.5 Ground Water

6.2.5.1 Organics

During the Phase I RI, benzene, toluene, ethylbenzene and total xylenes were detected, separately and in combination, in six of the fifteen wells sampled. Trichloroethene and tetrachloroethene were also detected in two other wells. During the Phase II RI, benzene, toluene, ethylbenzene and total xylenes were detected in twenty of the thirty wells sampled. This included two off-site upgradient wells and one downgradient off-site well. Figure 6-16 presents a volatile organic concentration map for the volatile organic compounds measured in the ground water samples collected during the Phase II RI. Based on this map, it appears that an off-site source is contributing to the majority of the volatile organic compound levels detected in the groundwater samples; namely: benzene, toluene, ethylbenzene and total xylenes. Since much of this site and the surrounding adjacent area was once used by a former petroleum refinery, it is possible that the compounds mentioned above are the result of the refinery activities and not that of Plant 2.



NOTES:

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2) THE CONCENTRATION DATA SHOWN WERE PROVIDED BY RECRA ENVIRONMENTAL, INC. AND ARE IN PARTS PER BILLION (PPB).

3) NA= NOT ANALYZED
ND= NOT DETECTED

LEGEND

M.W.-5S (293) • MONITORING WELL LEAD CONCENTRATIONS IN (ug/L)

TITLE
VAN DER HORST PLANT 2
LEAD CONCENTRATIONS
IN PHASE II SHALLOW
MONITORING WELLS

PREPARED FOR
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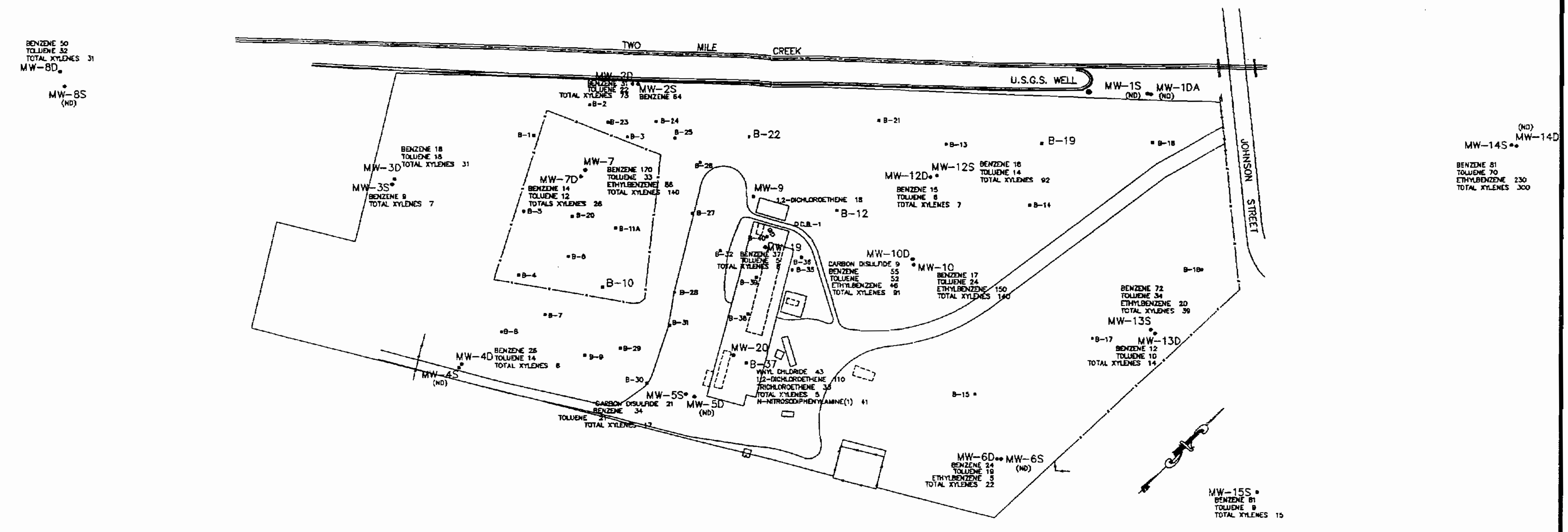
DATE

FIGURE
6-19



NOTES:

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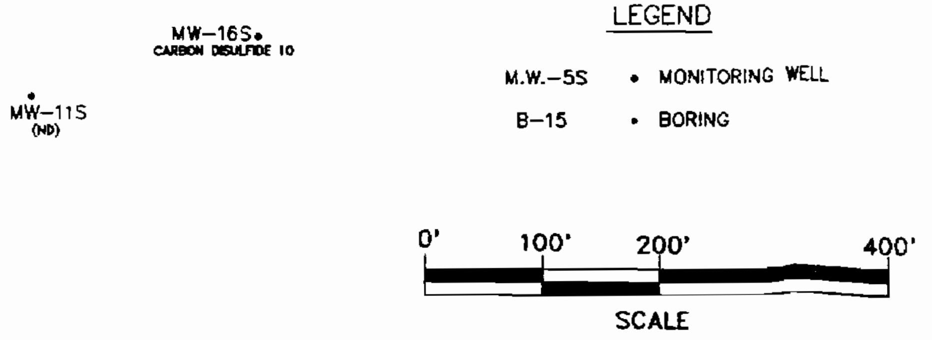
2) THE CONCENTRATION DATA SHOWN WERE PROVIDED BY RECRA ENVIRONMENTAL, INC. AND ARE IN PARTS PER BILLION (PPB).

3) ND= NOT DETECTED



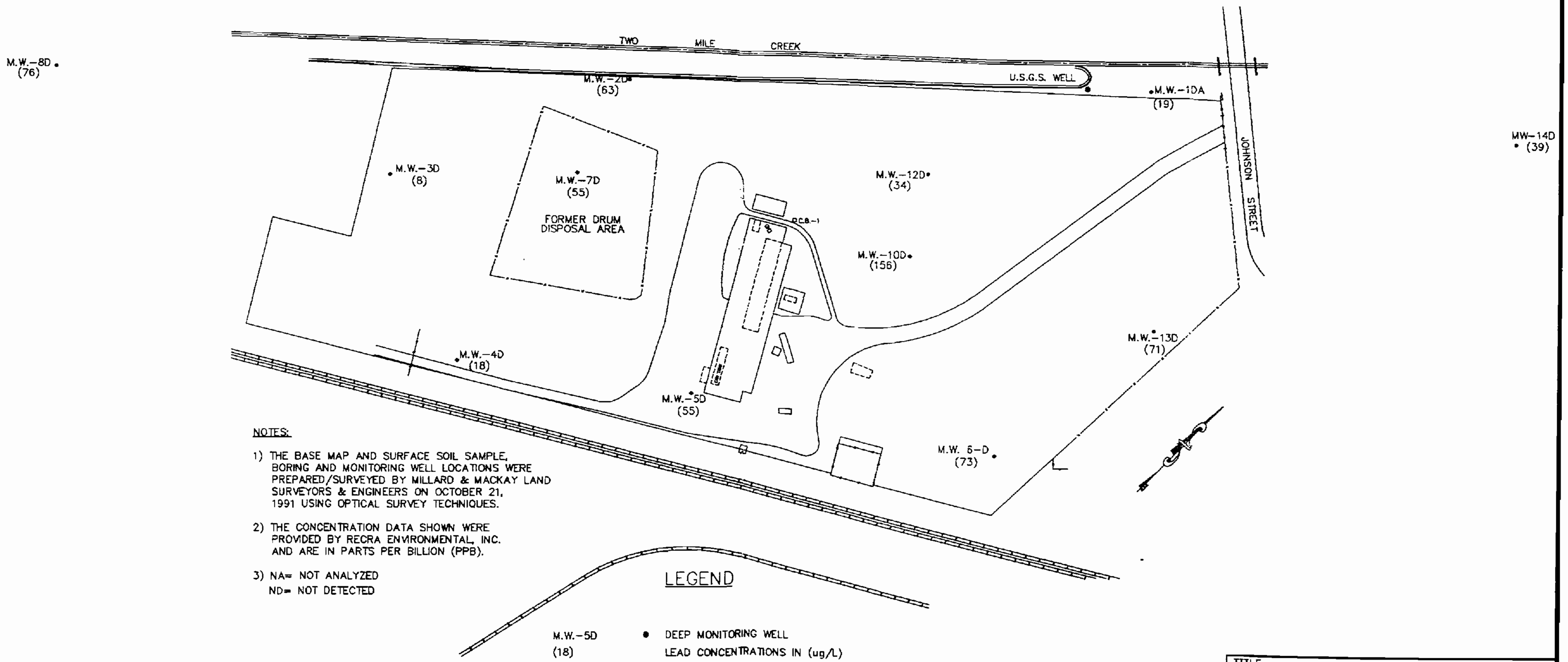
TITLE
VAN DER HORST PLANT 2
ORGANICS IN
GROUND WATER

PREPARED FOR
NYSDEC

ERM-Northeast
Environmental Resources Management

DATE

FIGURE
6-16



NOTES:

1) THE BASE MAP AND SURFACE SOIL SAMPLE, BORING AND MONITORING WELL LOCATIONS WERE PREPARED/SURVEYED BY MILLARD & MACKAY LAND SURVEYORS & ENGINEERS ON OCTOBER 21, 1991 USING OPTICAL SURVEY TECHNIQUES.

2) THE CONCENTRATION DATA SHOWN WERE PROVIDED BY RECRA ENVIRONMENTAL, INC. AND ARE IN PARTS PER BILLION (PPB).

3) NA= NOT ANALYZED
ND= NOT DETECTED

LEGEND

M.W.-5D (18) ● DEEP MONITORING WELL
LEAD CONCENTRATIONS IN (ug/L)

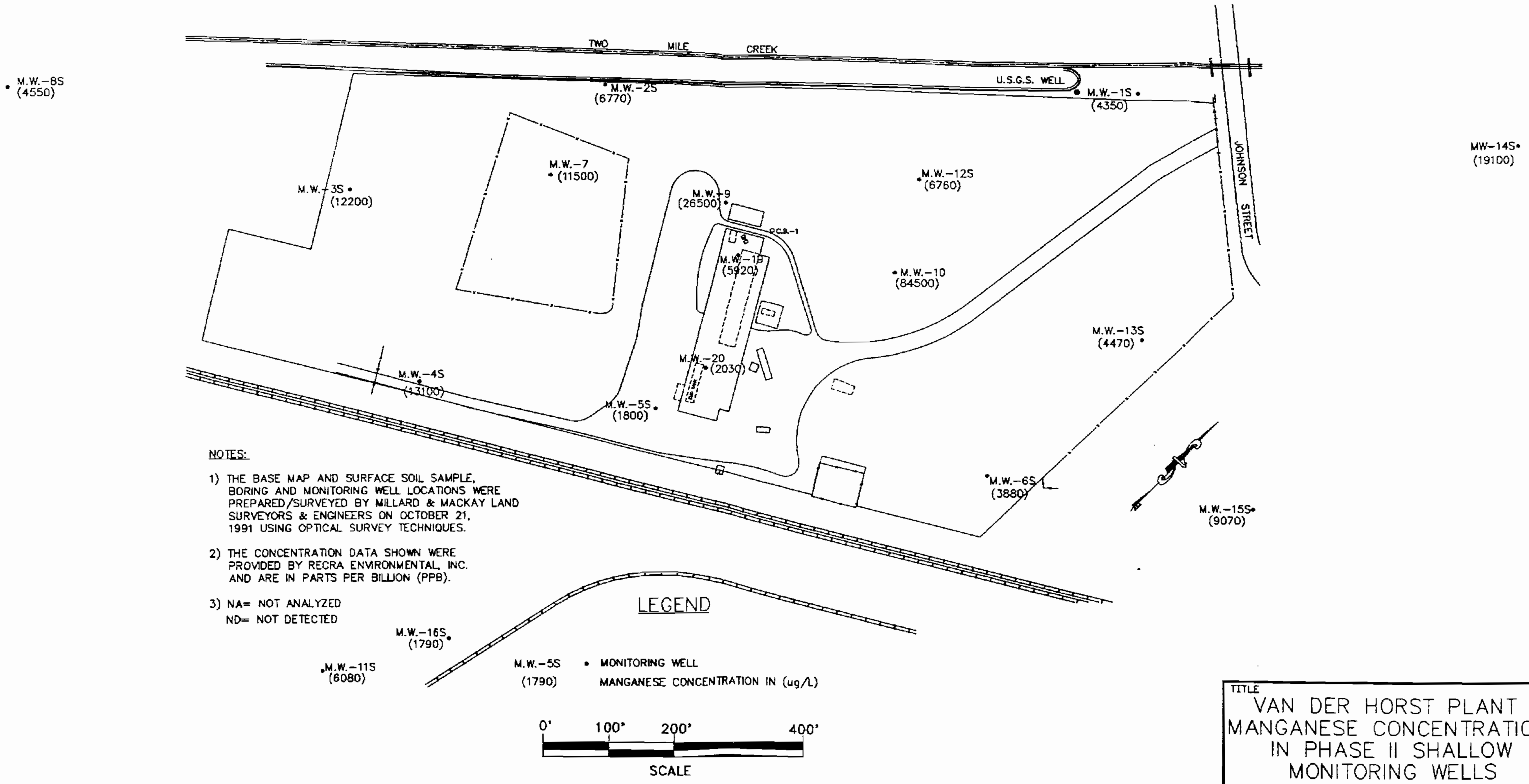
TITLE
VAN DER HORST PLANT 2
LEAD CONCENTRATIONS
IN PHASE II DEEP
MONITORING WELLS

PREPARED FOR
NYSDEC

ERM-Northeast
Environmental Resources Management

DATE

FIGURE
6-20



NOTES:

1) THE BASE MAP AND SURFACE SOIL SAMPLE, BORING AND MONITORING WELL LOCATIONS WERE PREPARED/SURVEYED BY MILLARD & MACKAY LAND SURVEYORS & ENGINEERS ON OCTOBER 21, 1991 USING OPTICAL SURVEY TECHNIQUES.

2) THE CONCENTRATION DATA SHOWN WERE PROVIDED BY RECRA ENVIRONMENTAL, INC. AND ARE IN PARTS PER BILLION (PPB).

3) NA= NOT ANALYZED
ND= NOT DETECTED

LEGEND

M.W.-5S	● MONITORING WELL
(1790)	MANGANESE CONCENTRATION IN (ug/L)

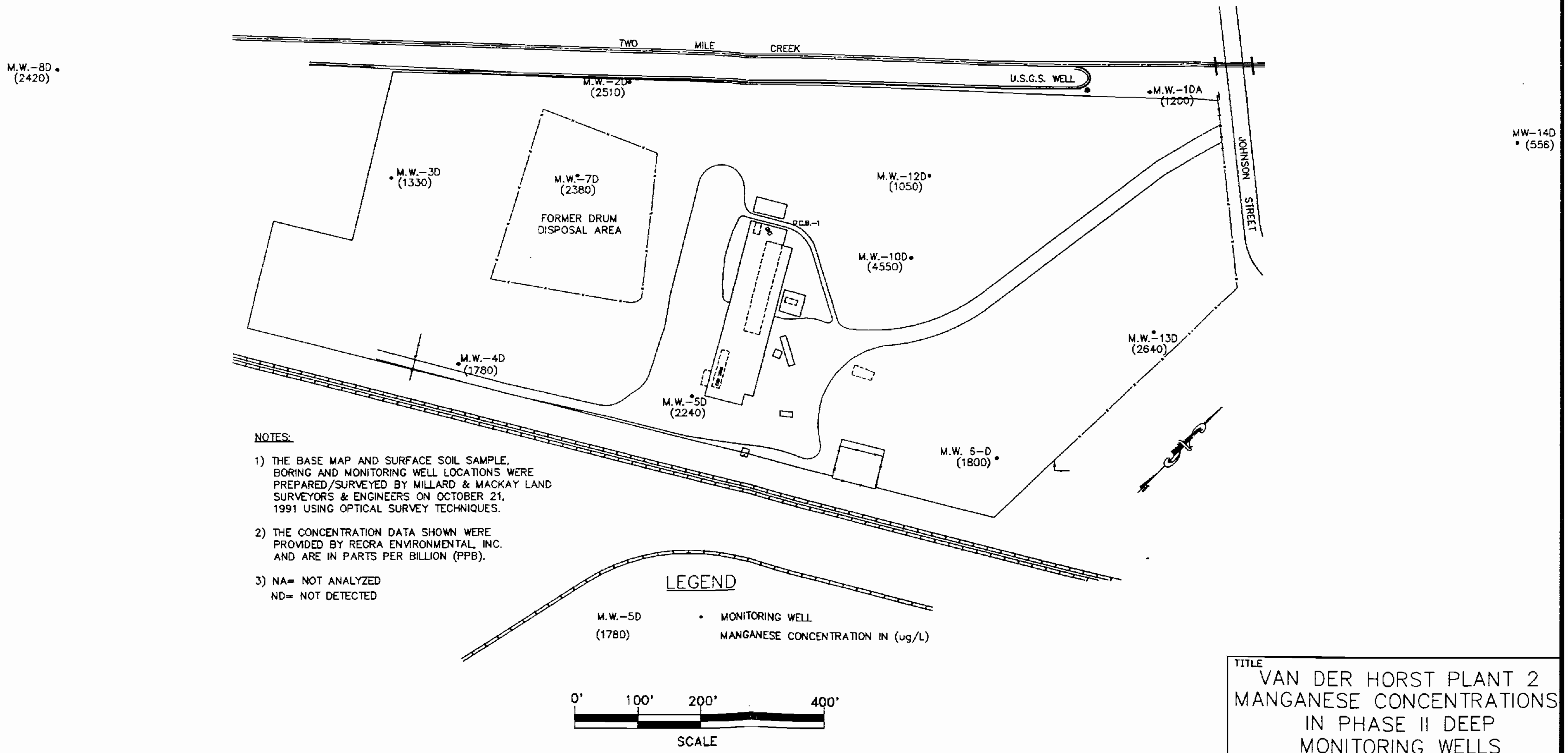
TITLE
VAN DER HORST PLANT 2
MANGANESE CONCENTRATIONS
IN PHASE II SHALLOW
MONITORING WELLS

PREPARED FOR
NYSDEC

ERM-Northeast
Environmental Resources Management

DATE

FIGURE
6-21



NOTES:

1) THE BASE MAP AND SURFACE SOIL SAMPLE, BORING AND MONITORING WELL LOCATIONS WERE PREPARED/SURVEYED BY MILLARD & MACKAY LAND SURVEYORS & ENGINEERS ON OCTOBER 21, 1991 USING OPTICAL SURVEY TECHNIQUES.

2) THE CONCENTRATION DATA SHOWN WERE PROVIDED BY RECRA ENVIRONMENTAL, INC. AND ARE IN PARTS PER BILLION (PPB).

3) NA= NOT ANALYZED
ND= NOT DETECTED

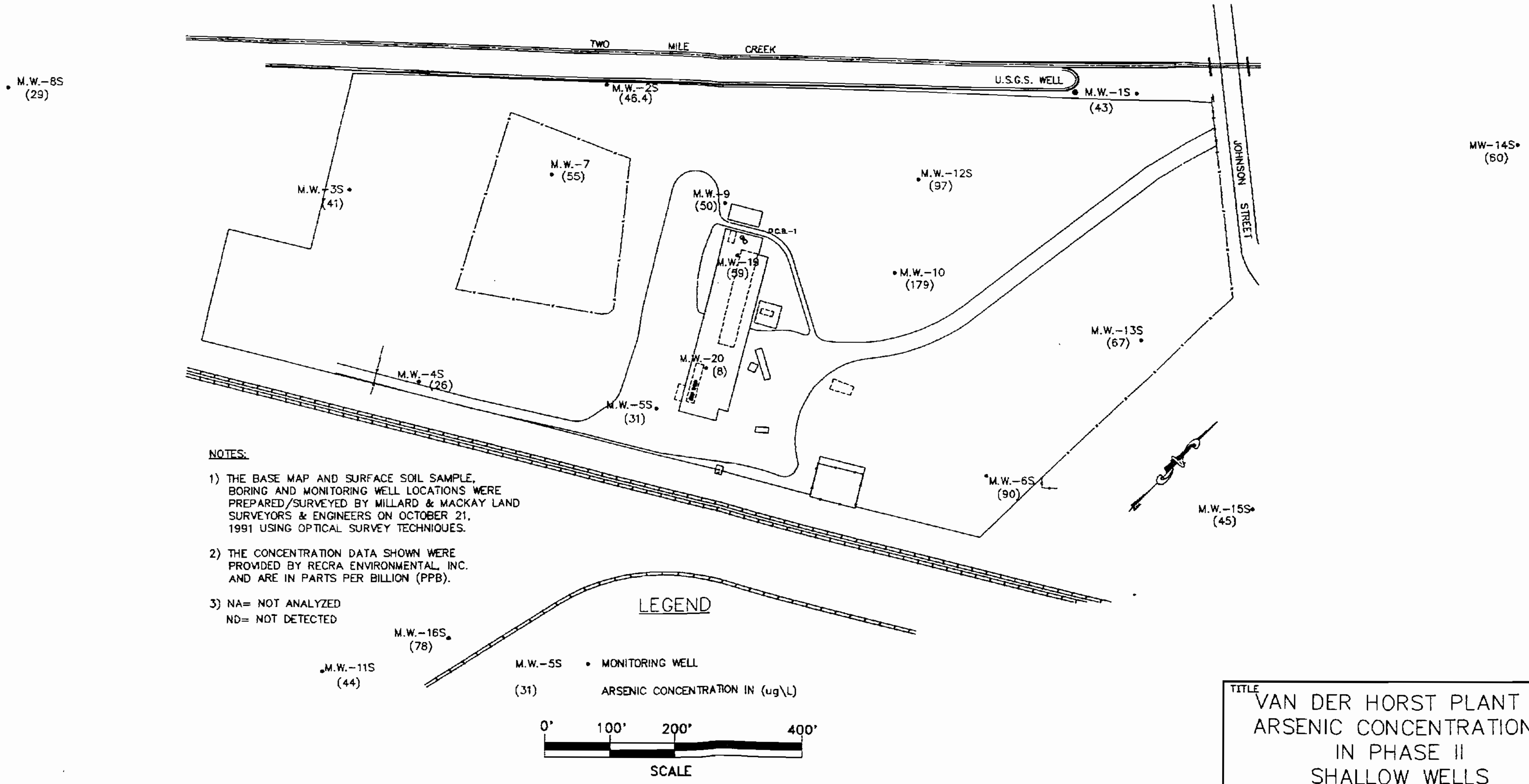
TITLE
VAN DER HORST PLANT 2
MANGANESE CONCENTRATIONS
IN PHASE II DEEP
MONITORING WELLS

PREPARED FOR
NYSDEC

ERM-Northeast
Environmental Resources Management

DATE

FIGURE
6-22



NOTES:

1) THE BASE MAP AND SURFACE SOIL SAMPLE, BORING AND MONITORING WELL LOCATIONS WERE PREPARED/SURVEYED BY MILLARD & MACKAY LAND SURVEYORS & ENGINEERS ON OCTOBER 21, 1991 USING OPTICAL SURVEY TECHNIQUES.

2) THE CONCENTRATION DATA SHOWN WERE PROVIDED BY RECRA ENVIRONMENTAL, INC. AND ARE IN PARTS PER BILLION (PPB).

3) NA= NOT ANALYZED
ND= NOT DETECTED

LEGEND

M.W.-5S • MONITORING WELL

(31) ARSENIC CONCENTRATION IN (ug\L)

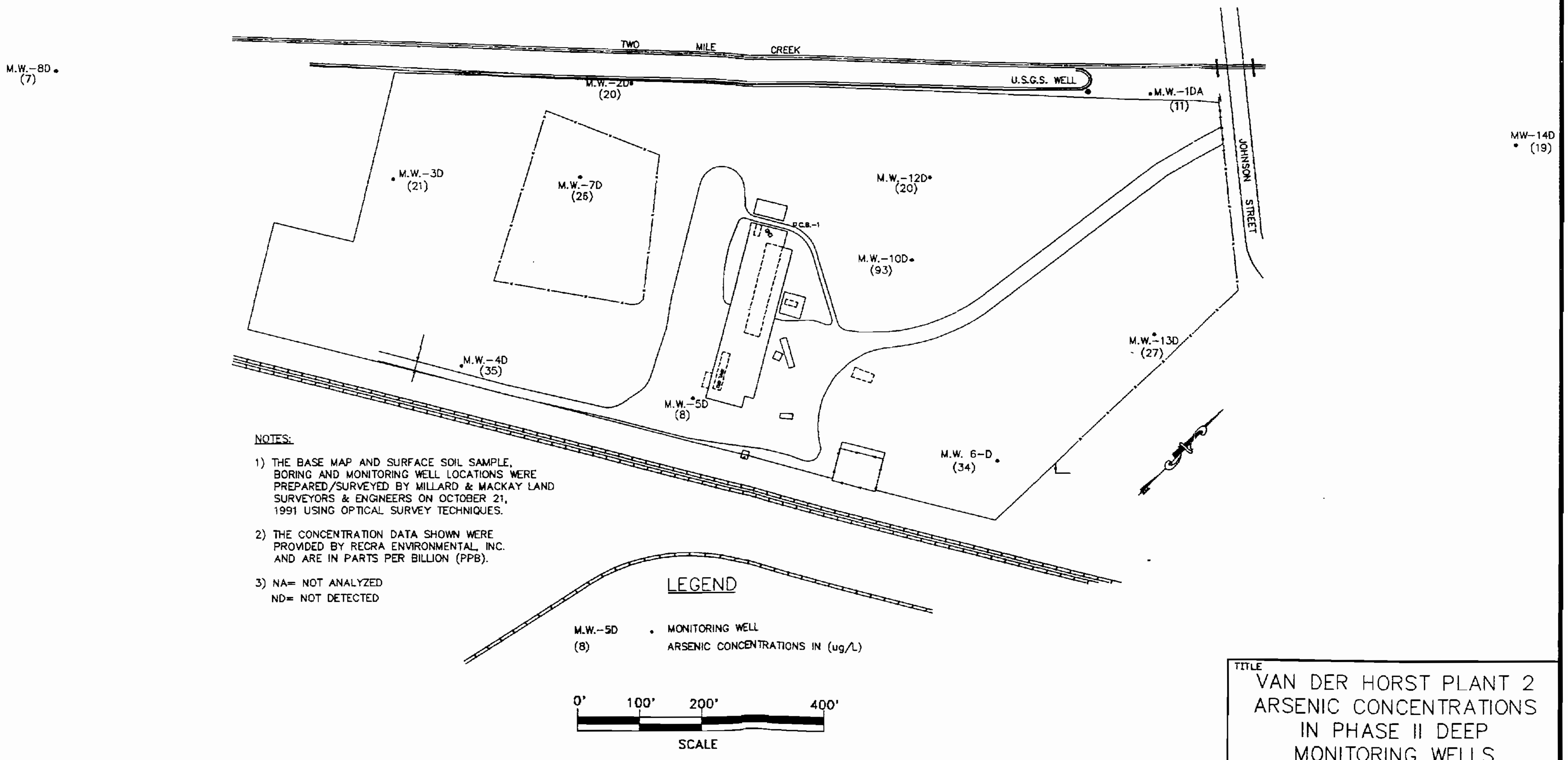
TITLE
VAN DER HORST PLANT 2
ARSENIC CONCENTRATIONS
IN PHASE II
SHALLOW WELLS

PREPARED FOR
NYSDEC

ERM-Northeast
Environmental Resources Management

DATE

FIGURE
6-23



NOTES:

1) THE BASE MAP AND SURFACE SOIL SAMPLE, BORING AND MONITORING WELL LOCATIONS WERE PREPARED/SURVEYED BY MILLARD & MACKAY LAND SURVEYORS & ENGINEERS ON OCTOBER 21, 1991 USING OPTICAL SURVEY TECHNIQUES.

2) THE CONCENTRATION DATA SHOWN WERE PROVIDED BY RECRA ENVIRONMENTAL, INC. AND ARE IN PARTS PER BILLION (PPB).

3) NA= NOT ANALYZED
ND= NOT DETECTED

LEGEND

M.W.-5D	•	MONITORING WELL
(8)		ARSENIC CONCENTRATIONS IN (ug/L)

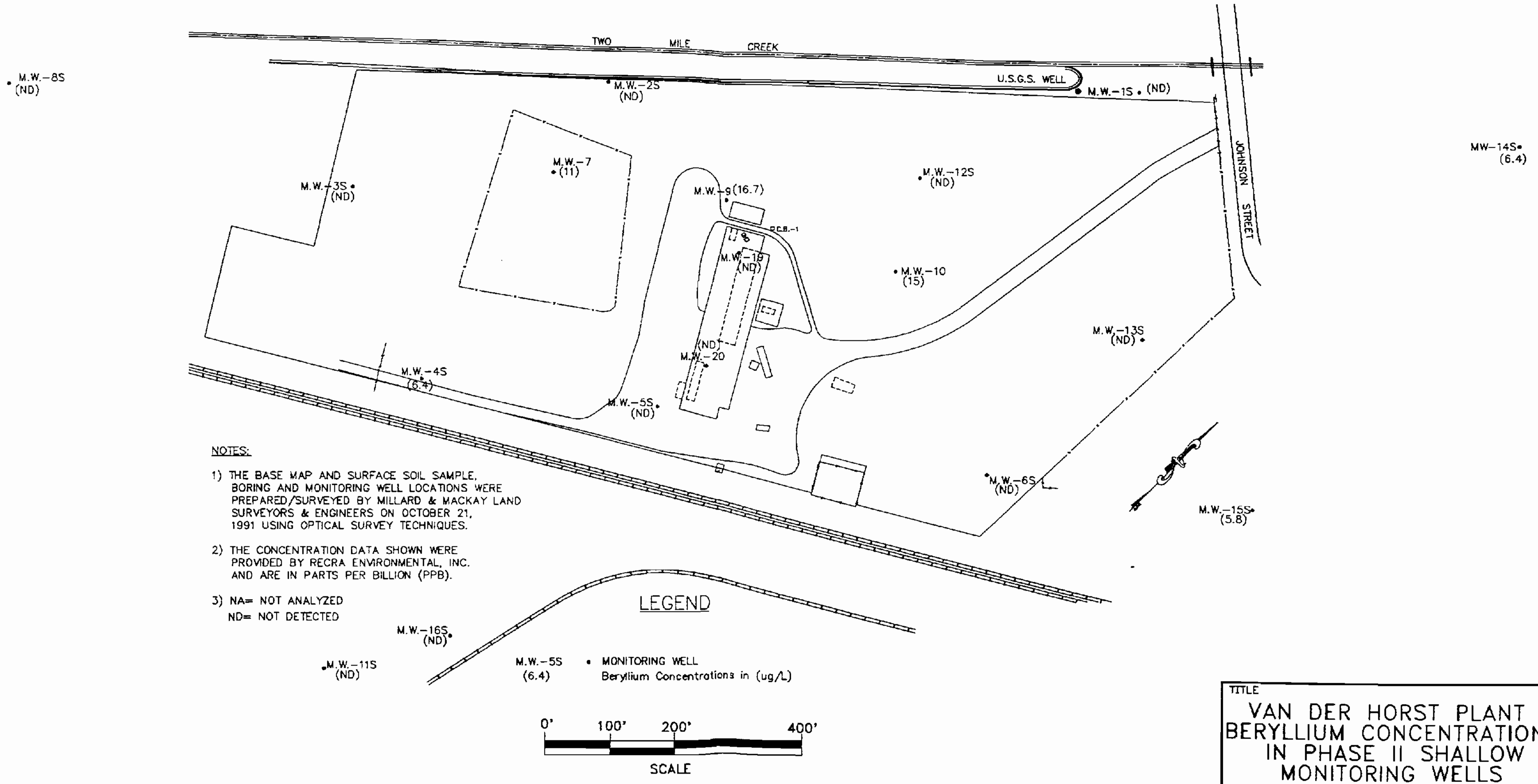
TITLE
VAN DER HORST PLANT 2
ARSENIC CONCENTRATIONS
IN PHASE II DEEP
MONITORING WELLS

PREPARED FOR
NYSDEC

ERM-Northeast
Environmental Resources Management

DATE

FIGURE
6-24



NOTES:

1) THE BASE MAP AND SURFACE SOIL SAMPLE, BORING AND MONITORING WELL LOCATIONS WERE PREPARED/SURVEYED BY MILLARD & MACKAY LAND SURVEYORS & ENGINEERS ON OCTOBER 21, 1991 USING OPTICAL SURVEY TECHNIQUES.

2) THE CONCENTRATION DATA SHOWN WERE PROVIDED BY RECRA ENVIRONMENTAL, INC. AND ARE IN PARTS PER BILLION (PPB).

3) NA= NOT ANALYZED
ND= NOT DETECTED

LEGEND

M.W.-5S (6.4) • MONITORING WELL
Beryllium Concentrations in (ug/L)

TITLE
VAN DER HORST PLANT 2
BERYLLIUM CONCENTRATIONS
IN PHASE II SHALLOW
MONITORING WELLS

PREPARED FOR
NYSDEC

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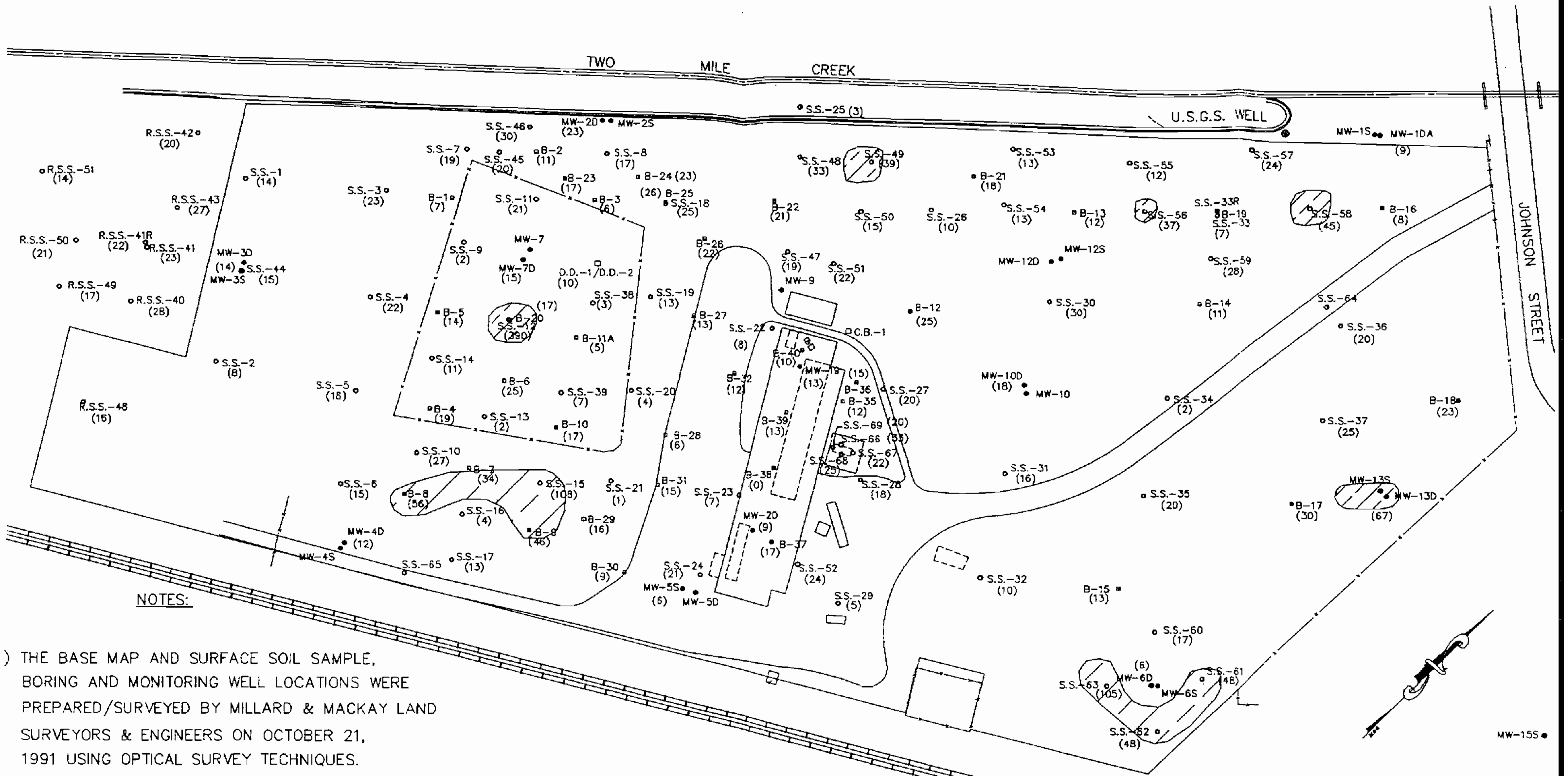
Environmental Resources Management

DATE

FIGURE
6-25



NOTES:

1) THE BASE MAP AND SURFACE SOIL SAMPLE, BORING AND MONITORING WELL LOCATIONS WERE PREPARED/SURVEYED BY MILLARD & MACKAY LAND SURVEYORS & ENGINEERS ON OCTOBER 21, 1991 USING OPTICAL SURVEY TECHNIQUES.

2) THE CONCENTRATION DATA SHOWN WERE PROVIDED BY RECRA ENVIRONMENTAL, INC. AND ARE IN PARTS PER MILLION (PPM).

3) THE BOUNDARY OF THE SHADED AREA ON THIS FIGURE WAS BASED ON INTERPOLATION OF WIDELY SPACED DATA POINTS. THE AREA ENCOMPASSED BY THE SHADING IS AN APPROXIMATION OF THE EXTENT OF ARSENIC CONTAMINATION ABOVE 35 PPM.

LEGEND

(156)		ARSENIC CONCENTRATION (ppm)	
S.S.-23	○	SURFACE SOIL SAMPLE	(0-0.5FT.)
M.W.-5S	●	MONITORING WELL	(0-2.0FT.)
B-15	▪	BORING	(0-2.0FT.)
	▨	APPROXIMATE AREA OF SURFACE SOIL CONTAINING ARSENIC CONCENTRATIONS ABOVE 35 PPM	

0' 100' 200' 400'

SCALE

TITLE

VAN DER HORST PLANT 2 ARSENIC CONCENTRATIONS IN SURFACE SOIL

PREPARED FOR

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Environmental Resources Management

DATE

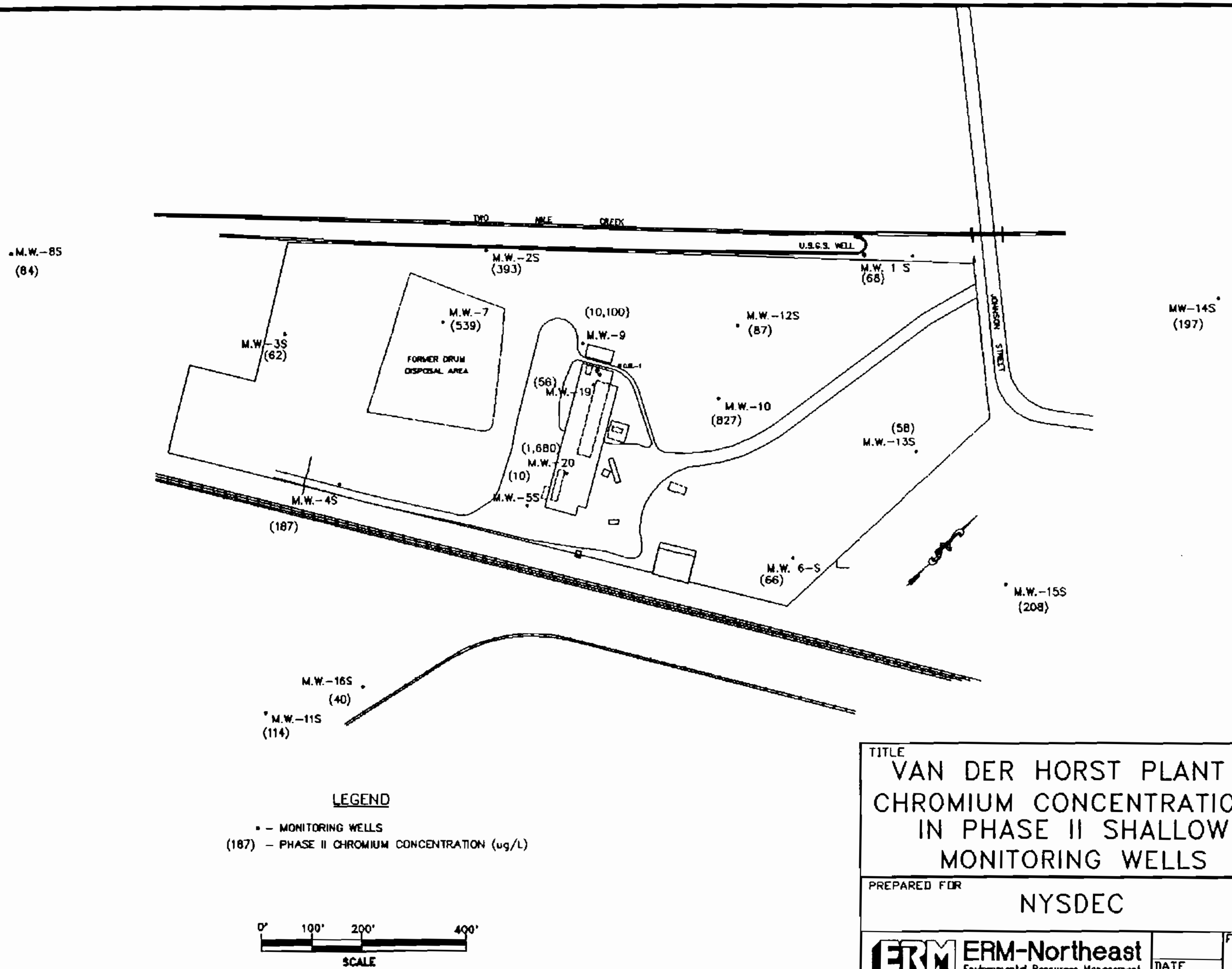
FIGURE
6-34

Other compounds were detected during the Phase II RI which were not detected during the Phase I; however, the distribution of these volatile compounds is far less extensive. These include: Carbon disulfide, detected in two on-site wells and one off-site well; 1,2-Dichloroethene (total), detected in two on-site wells; vinyl chloride, detected in one on-site well; N-Nitrosodiphenylamine (1), detected in one on-site well; and trichloroethene, detected in one on-site well (but) other than those where it was detected during the Phase I RI. The potential sources for the 1,2-Dichloroethene, carbon disulfide, vinyl chloride and N-Nitrosodiphenylamine appear to be from on-site. These compounds are found in wells that are inside or in very close proximity to the plant building. Trichloroethene has been detected in three different wells over the course of the investigation, MW-9, MW-2S and MW-20. This compound is used as a degreasing agent and could be attributed to Plant 2 practices. The lateral distribution of the organic compounds within the water bearing zone appears to be evenly distributed. During the Phase II RI, six out of eighteen of the shallow wells and three out of the twelve deep wells had no detectable levels of organic compounds.

6.2.5.2 Inorganics

Figure 6-17 presents a concentration map for the total chromium measured in the shallow ground water samples collected during the Phase II RI. Concentrations of total chromium equal to or greater than 50 ppb were measured in all shallow monitoring wells with the exception of MW-5S, and MW-16S (40 ppb). The concentrations of total chromium detected in the deep wells exceeded 50 ppb in three of the wells sampled, MW-10D, MW-5D and MW-8D (see Figure 6-18). Based on comparison of the relative concentrations measured in the Phase I and Phase II samples, the contamination appears to be from three sources: 1) the southwest corner inside the plant building, which corresponds to the location of the former EMD vat; 2) an undelineated source, on-site and beneath or upgradient of monitoring well MW-10; and, 3) an on-site undelineated source, beneath or upgradient of monitoring well MW-9.

During Phase II lead concentrations exceeding 25 ppb were detected in samples taken from all shallow wells. Based on comparison of the relative concentrations measured in the Phase I and Phase II samples, the contamination appears to be from five sources: 1) the



TITLE

VAN DER HORST PLANT 2
CHROMIUM CONCENTRATIONS
IN PHASE II SHALLOW
MONITORING WELLS

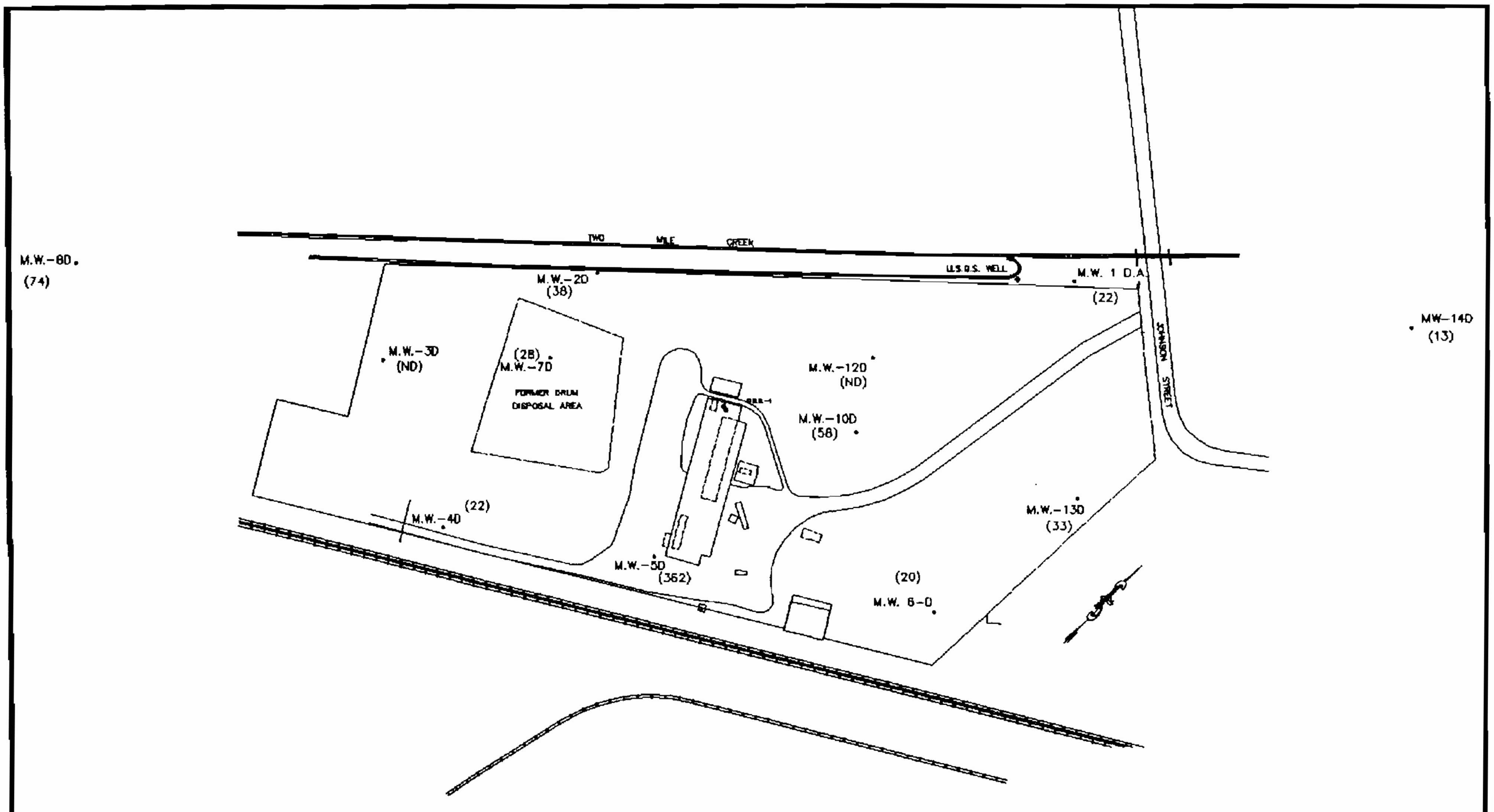
PREPARED FOR

NYSDEC

ERM-Northeast
Environmental Resources Management

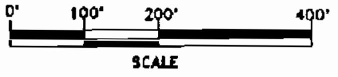
DATE

FIGURE
6-17



LEGEND

• – MONITORING WELLS
(187) – PHASE II CHROMIUM CONCENTRATION (ug/L)



TITLE
VAN DER HORST PLANT 2
CHROMIUM CONCENTRATIONS
IN PHASE II DEEP
MONITORING WELLS

PREPARED FOR
NYSDEC

ERM-Northeast
Environmental Resources Management

DATE

FIGURE
6-18

fenced-in former drum disposal area; 2) the reported former fill area near MW-10; 3) an undefined source area adjacent to or upgradient of MW-9; 4) an off-site source upgradient of MW-13S and MW-6S; and, 5) an off-site source upgradient of MW-4S. Figures 6-19 and 6-20 present total lead concentration maps for samples collected from the shallow and deep wells during the Phase II RI.

Concentrations of manganese exceeding 300 ppb were detected in all the shallow wells during the Phase II RI. Based on comparison of the relative concentrations measured in the Phase I and Phase II samples, there appears to be three sources of manganese contamination: 1) the reported former fill area near MW-10; 2) an area at or upgradient of MW-4S; and, 3) an off-site source near the east property line. Figure 6-21 presents a total manganese concentration map for samples collected from the shallow wells during the Phase II RI. Figure 6-22 presents a total manganese concentration map for samples collected from the deep wells during the Phase II RI.

Another possible explanation for the elevated manganese levels detected in the shallow ground water samples may, in part, be due to the natural background levels found in the aquifer. Levels above the 300 ppb standard were also detected in upgradient wells at the Plant No. 1 site.

During the Phase II RI arsenic was detected in all of the shallow wells at concentrations above 25 ppb, except MW-20 (see Figure 6-23). The highest level of arsenic found in the shallow wells was detected in MW-10S at 179 ppb. Five of the twelve deep wells also exhibited levels of arsenic above 25 ppb (see Figure 6-24). The highest level of arsenic found in the deep wells was detected in MW-10D at 93 ppb. These data also indicate two potential source areas: 1) the subsurface soil adjacent to or upgradient of MW-10S and MW-10D; and, 2) the subsurface soil in upgradient areas to the east and northeast of the site.

Beryllium was detected in six (6) shallow wells during the Phase II RI (see Figure 6-25). All six of these wells exceeded the NYSDEC Drinking Water Standard of 3 ppb for this element. The highest levels of beryllium were found in MW-10S and MW-9 at 15 ppb and 16.7 ppb, respectively. The source area for the beryllium contamination has not been adequately delineated; off-site and on-site wells both exhibit elevated levels of this element. However, concentrations detected in wells MW-10S and MW-9 appear to indicate that potential source areas may be located in the subsurface beneath or upgradient of these wells. No detectable concentrations of beryllium were found in the ground water samples taken from the deep monitoring wells during the Phase II RI.

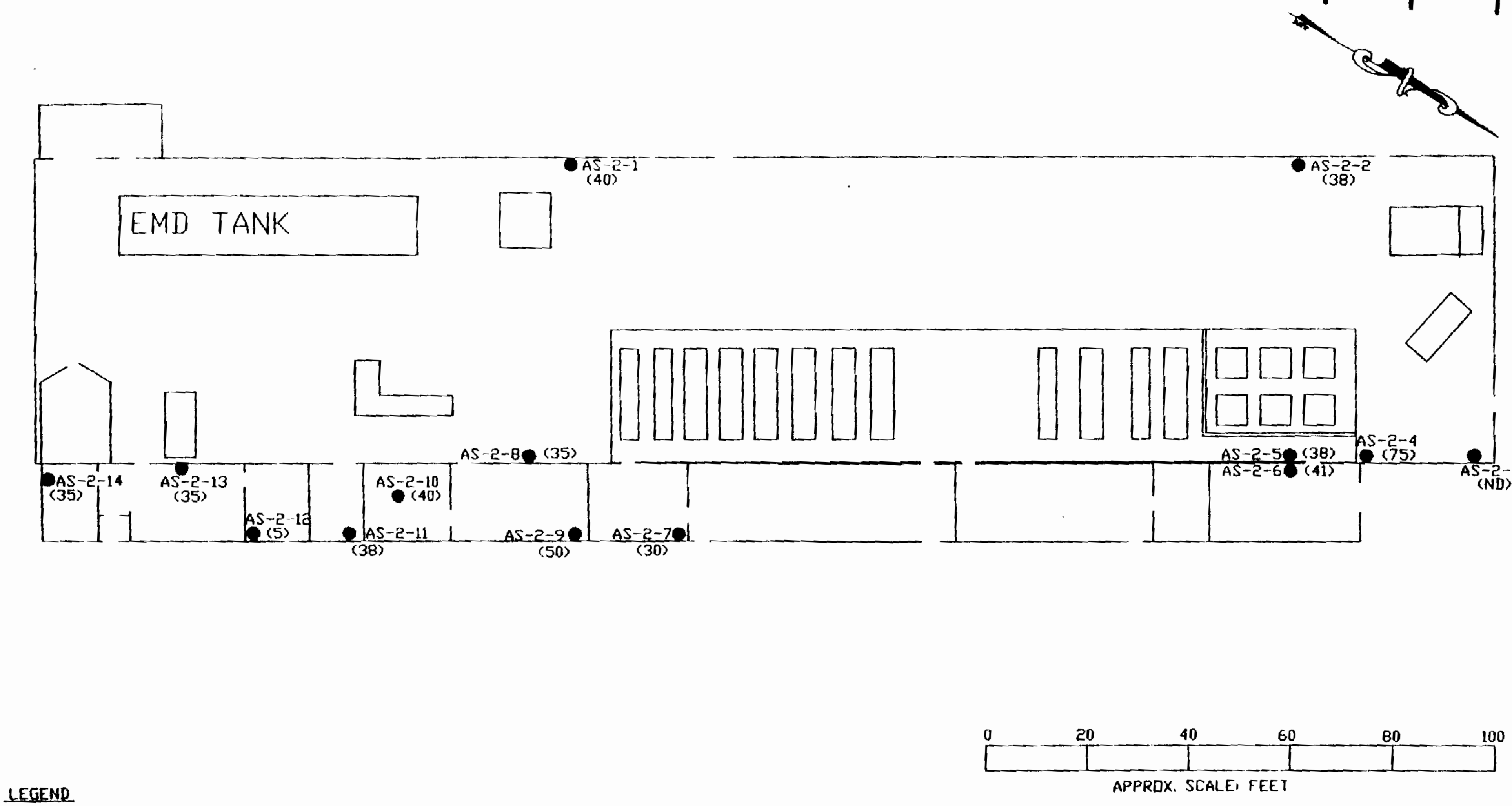
Overall, the lateral extent of the inorganic contamination appears to be greater in the shallow overburden aquifer than the lower overburden aquifer. The extent of the inorganic contamination in the shallow aquifer has not been fully delineated. All but two of the shallow wells, one on-site (MW-5S) and one off-site (MW-16S), exceeded a total chromium level of 50 ppb. Additionally, all shallow wells also indicated elevated levels for lead and manganese. The vertical extent of the chromium contamination appears better defined. Only two on-site deep wells exceeded 50 ppb for total chromium. However, the total chromium concentration in the off-site downgradient deep well, MW-8D, also exceeded 50 ppb, and the chromium level of the nearest upgradient deep well. Manganese and lead were also detected in MW-8D at levels higher than those in the nearest upgradient well, MW-3D. Therefore, it appears as if an off-site source is contributing to the contamination detected in MW-8D.

The upgradient areas to the east and northeast of the site appear to be potential source areas contributing to the slightly elevated chromium, lead, and arsenic levels in the shallow aquifer. These areas may also be a source of the manganese contamination. However, some of the concentrations may result from the chemical composition of the aquifer material.

6.2.6 Asbestos, Wipe and Dust Building Samples

Fifteen samples of various materials, including pipe insulation elbows and floor tiles, were collected from numerous locations and analyzed for asbestos content. Asbestos containing fibers were detected in all but two of the samples collected. For the majority of the samples where asbestos was detected, the asbestos content was approximately 40% of the total sample volume (see Figure 6-26).

Chromium and lead were the primary contaminants detected in most of the samples collected from the building structures. Chromium concentrations at all building sample locations are



LEGEND

AS-2-1	●	ASBESTOS SAMPLE LOCATION
(40)		ASBESTOS CONCENTRATION IN (% TOTAL VOLUME)

NOTES

1) THE FIGURE WAS ADAPTED FROM A BUILDING PLAN PROVIDED BY THE USEPA AND FROM 'VAN DER HORST PLANT NO. 2 SAMPLE LOCATION PLAN' PREPARED BY MILLARD & MAC KAY ON OCTOBER 24, 1991.

2) SAMPLING LOCATIONS WERE MEASURED FROM FIXED LANDMARKS BY ERM AND PLOTTED ON THE BASE MAP BY SCALING THE DISTANCES. THESE LOCATIONS SHOULD BE CONSIDERED ACCURATE TO THE DEGREE IMPLIED BY THE METHOD USED.

3) THE CONCENTRATION DATA SHOWN WERE PROVIDED BY CHOPRA-LEE, INC.

4) ND= NOT DETECTED

TITLE
VAN DER HORST PLANT #2
BUILDING ASBESTOS
SAMPLE CONCENTRATIONS

PREPARED FOR
NYSDEC

ERM-Northeast
Environmental Resources Management

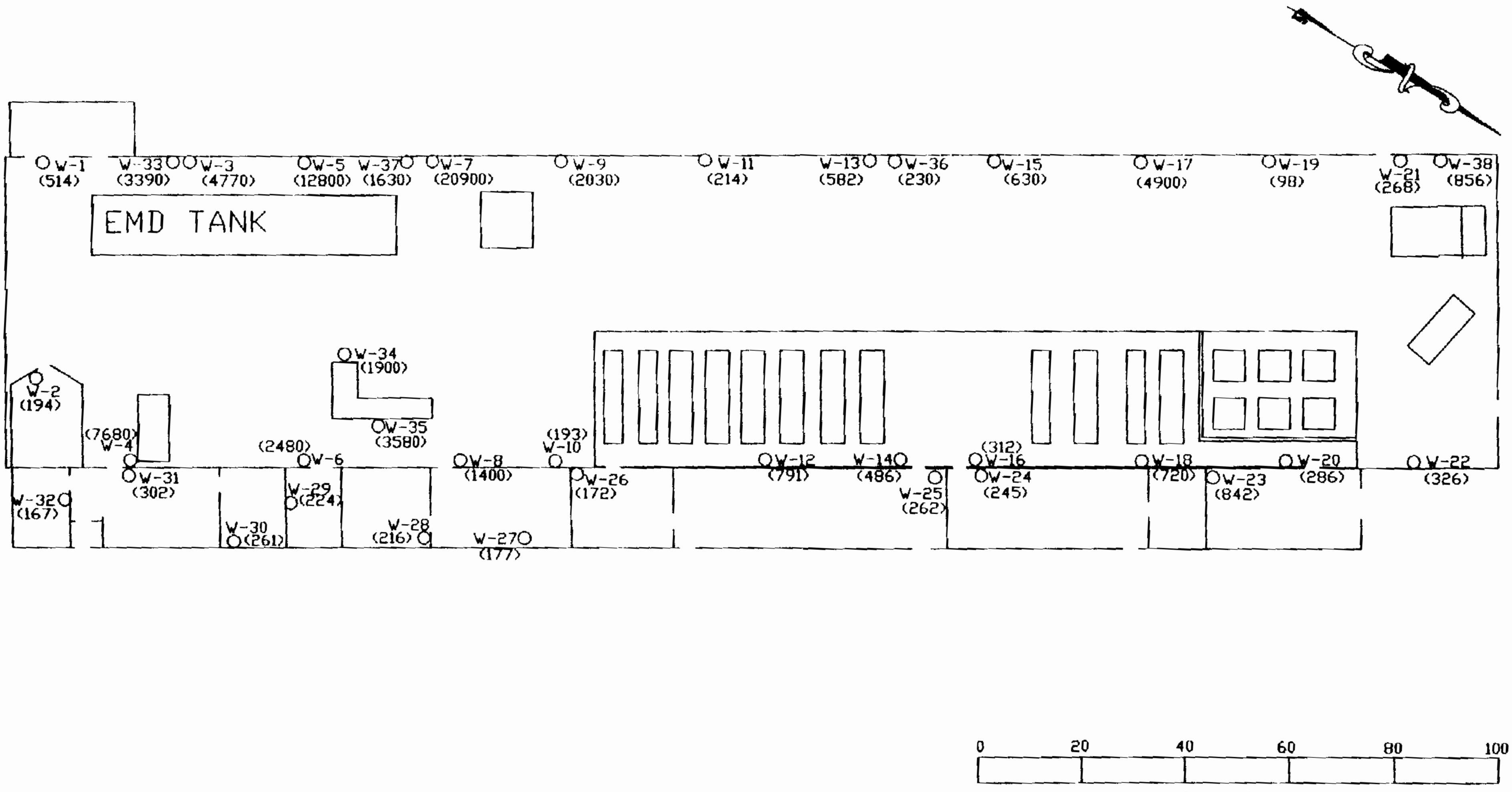
DATE

FIGURE
6-2

shown in Figures 6-27 and 6-28. Lead concentrations are shown on Figure 6-29 and 6-30.

The highest chromium concentrations (ranging from 1900 to 20,900 ug/L/wipe) were detected in wipe samples collected from the area immediately adjacent to the former EMD plating tank (W-3, W-5, W-7, W-9, and W-33), from process tank exhaust hoods (W-34 and W-35) and on two vertical structure beams (W-4 and W-17). Elevated levels of chromium were also detected in all dust samples collected from the plant floor. The highest concentrations of chromium were detected in DUST-14 at 46,500 mg/Kg and DUST-13 at 46,900 mg/Kg, samples collected on the factory floor near the former EMD tank. Sample DUST-13 also had the highest level of barium detected, 2440 mg/Kg.

Lead was another major contaminant in many of the building interior samples. Samples W-7 and W-19 had the highest lead levels of the wipe samples (5140 and 4870 ug/L/wipe, respectively). Both samples were collected from areas on the facility walls. Approximately half of the dust samples also exhibited lead concentrations greater than 1000 mg/Kg. The highest level of lead contamination, 6400 mg/Kg/, was detected in sample DUST-7, collected adjacent to the processing vats on the former production floor. Two other samples, DUST-14 and DUST-13, also contained relatively high



LEGEND

W-2 ○ WIPE SAMPLE LOCATION
(514) CHROMIUM CONCENTRATION (ug/L/WIPE)

NOTES

1) THE FIGURE WAS ADAPTED FROM A BUILDING PLAN PROVIDED BY THE USEPA AND FROM 'VAN DER HORST PLANT NO. 2 SAMPLE LOCATION PLAN' PREPARED BY MILLARD & MAC KAY ON OCTOBER 24, 1991.

2) SAMPLING LOCATIONS WERE MEASURED FROM FIXED LANDMARKS BY ERM AND PLOTTED ON THE BASE MAP BY SCALING THE DISTANCES. THESE LOCATIONS SHOULD BE CONSIDERED ACCURATE TO THE DEGREE IMPLIED BY THE METHOD USED.

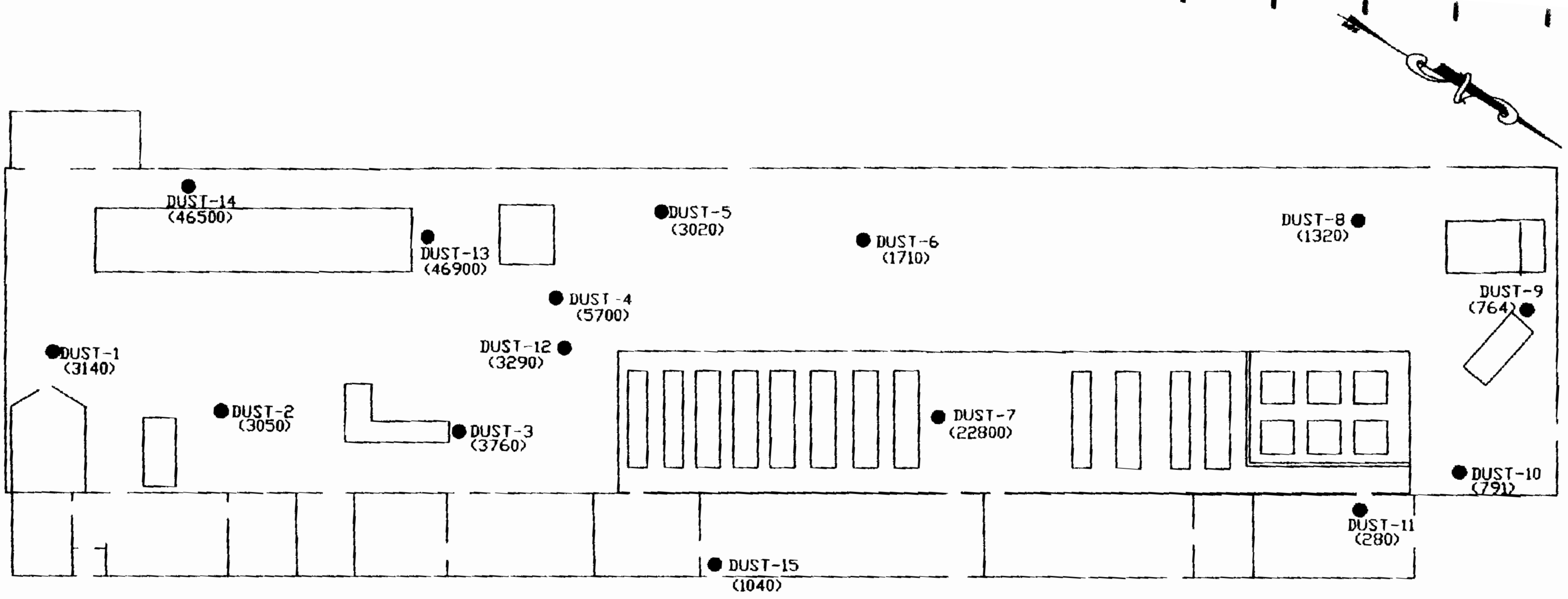
TITLE
VAN DER HORST PLANT #2
CHROMIUM CONCENTRATIONS
IN WIPE SAMPLES

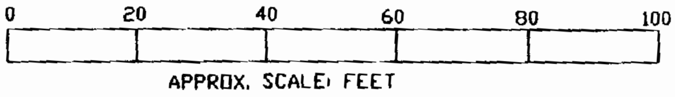
PREPARED FOR
NYSDEC

ERM-Northeast
Environmental Resources Management

DATE

FIGURE
6-27





LEGEND

DUST-12 ● DUST SAMPLING LOCATION
(3140) CHROMIUM CONCENTRATION (mg/kg)

NOTES

1) THE FIGURE WAS ADAPTED FROM A BUILDING PLAN PROVIDED BY THE USEPA AND FROM 'VAN DER HORST PLANT NO. 2 SAMPLE LOCATION PLAN' PREPARED BY MILLARD & MAC KAY ON OCTOBER 24, 1991.

2) SAMPLING LOCATIONS WERE MEASURED FROM FIXED LANDMARKS BY ERM AND PLOTTED ON THE BASE MAP BY SCALING THE DISTANCES. THESE LOCATIONS SHOULD BE CONSIDERED ACCURATE TO THE DEGREE IMPLIED BY THE METHOD USED.

TITLE
VAN DER HORST PLANT #2
CHROMIUM CONCENTRATIONS
IN DUST SAMPLES

PREPARED FOR
NYSDEC

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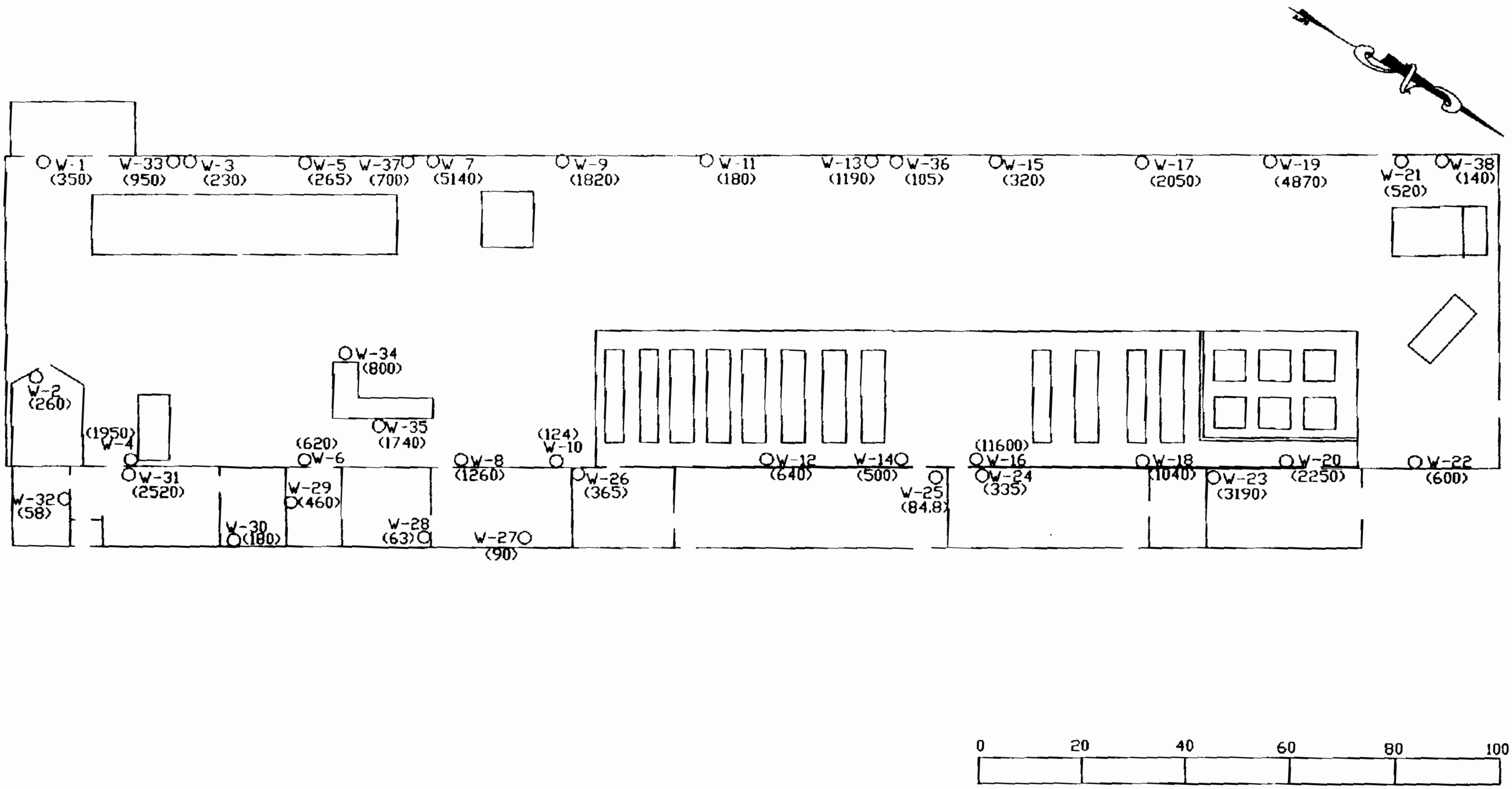
Environmental Resources Management

DATE

FIGU
6-



LEGEND

W-2 ○ WIPE SAMPLE LOCATION
(350) LEAD CONCENTRATION (ug/L/WIPE)

NOTES

1) THE FIGURE WAS ADAPTED FROM A BUILDING PLAN PROVIDED BY THE USEPA AND FROM 'VAN DER HORST PLANT NO. 2 SAMPLE LOCATION PLAN' PREPARED BY MILLARD & MAC KAY ON OCTOBER 24, 1991.

2) SAMPLING LOCATIONS WERE MEASURED FROM FIXED LANDMARKS BY ERM AND PLOTTED ON THE BASE MAP BY SCALING THE DISTANCES. THESE LOCATIONS SHOULD BE CONSIDERED ACCURATE TO THE DEGREE IMPLIED BY THE METHOD USED.

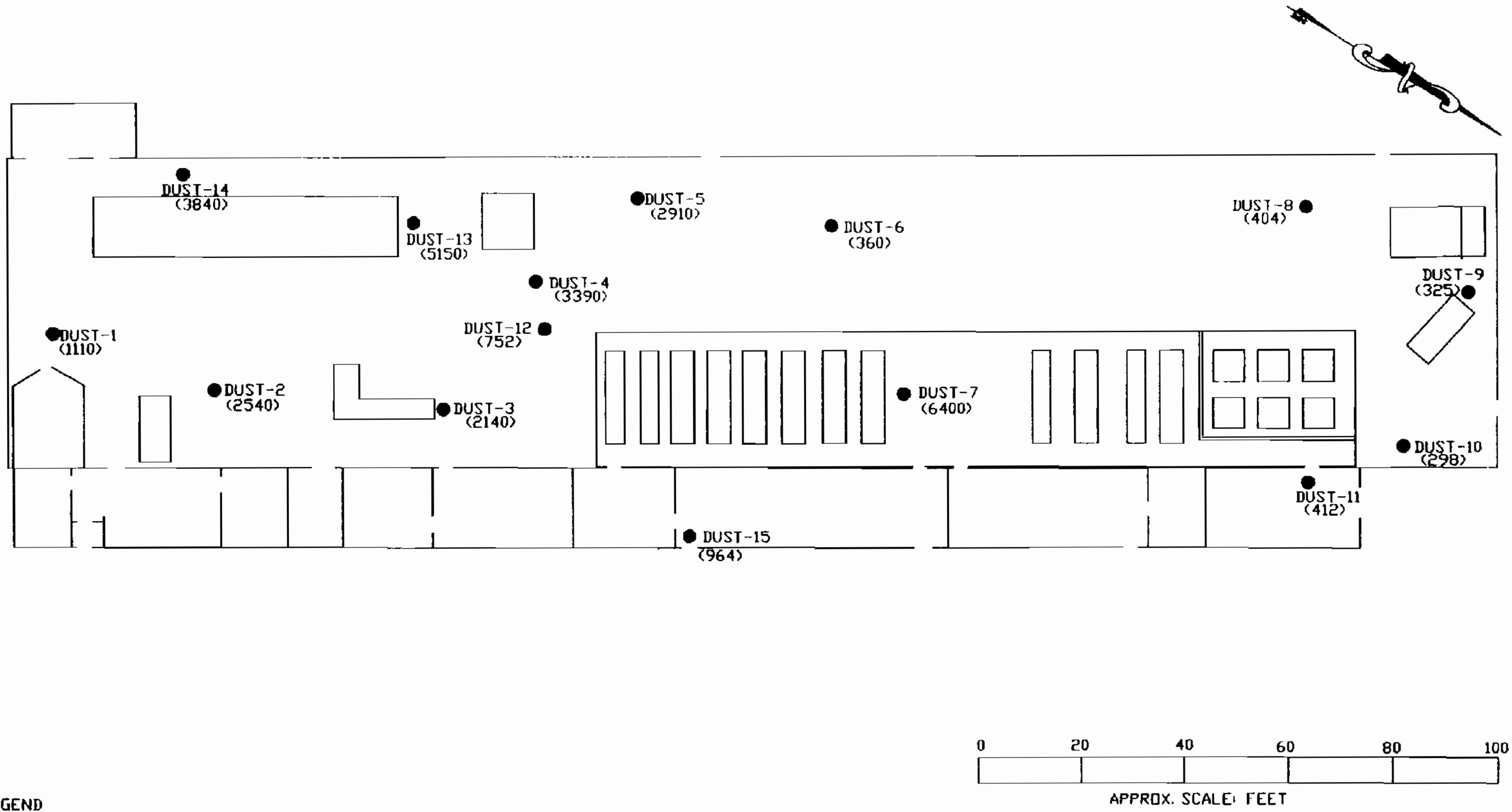
TITLE
VAN DER HORST PLANT #2
LEAD CONCENTRATIONS
WIPE SAMPLES

PREPARED FOR
NYSDEC

ERM-Northeast
Environmental Resources Management

DATE

FIGURE
6-29



LEGEND

DUST-12 ● DUST SAMPLING LOCATION
(1110) LEAD CONCENTRATION (mg/kg)

NOTES

1) THE FIGURE WAS ADAPTED FROM A BUILDING PLAN PROVIDED BY THE USEPA AND FROM 'VAN DER HORST PLANT NO. 2 SAMPLE LOCATION PLAN' PREPARED BY MILLARD & MAC KAY ON OCTOBER 24, 1991.

2) SAMPLING LOCATIONS WERE MEASURED FROM FIXED LANDMARKS BY ERM AND PLOTTED ON THE BASE MAP BY SCALING THE DISTANCES. THESE LOCATIONS SHOULD BE CONSIDERED ACCURATE TO THE DEGREE IMPLIED BY THE METHOD USED.

TITLE
VAN DER HORST PLANT #2
LEAD CONCENTRATIONS
IN DUST SAMPLES

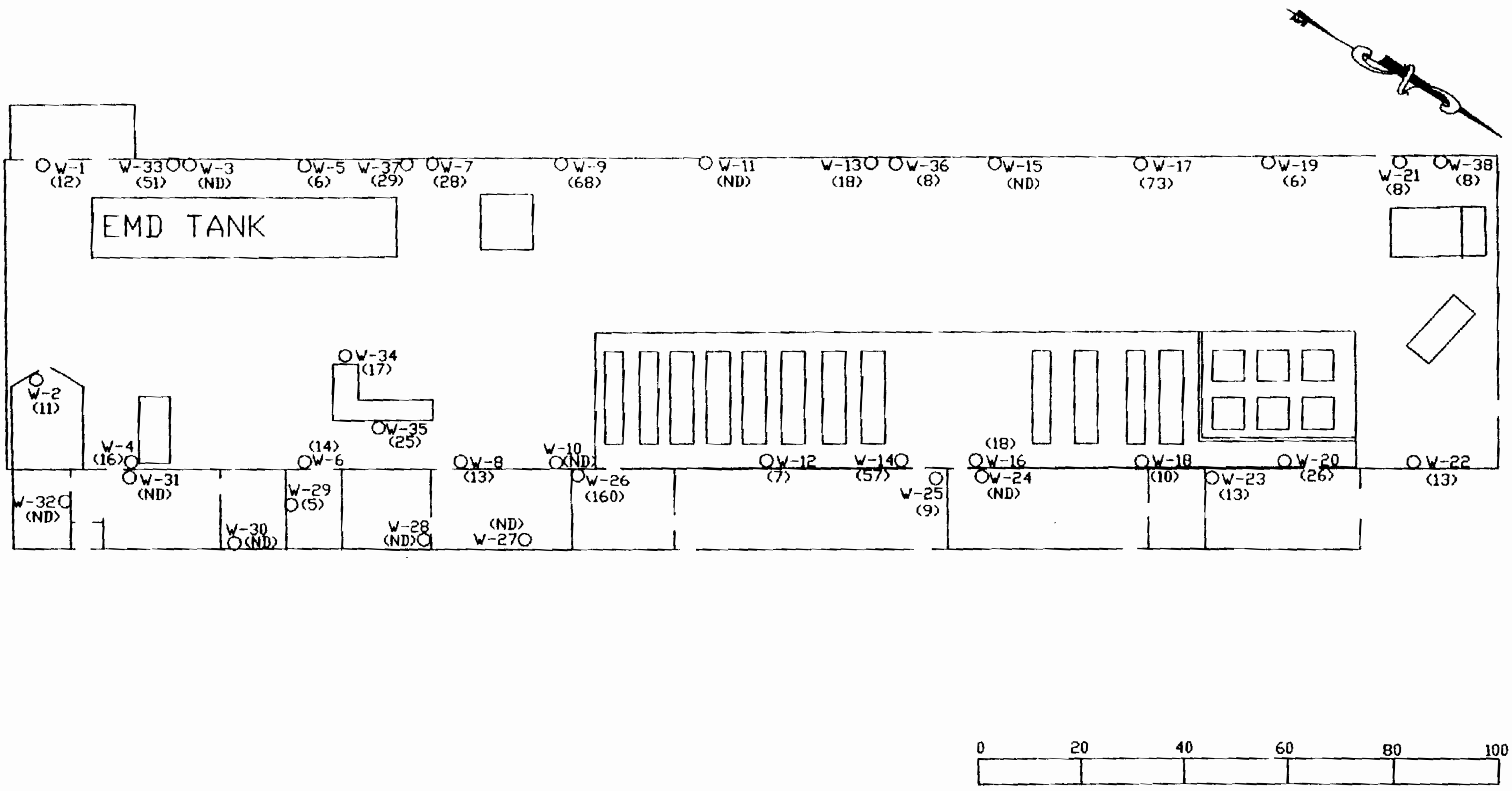
PREPARED FOR
NYSDEC

ERM-Northeast
Environmental Resources Management
DATE
FIGURE
6-30

levels of lead contamination. These samples were collected adjacent to the former EMD vat and contained lead levels of 3840 mg/Kg and 5150 mg/Kg, respectively.

Arsenic was detected in several wipe samples at concentrations higher than 30 mg/Kg/wipe (see Figure 6-31). These samples: W-9, W-14, W-17, W-26, and W-33 were collected from various areas, including: the plant wall, atop a metal electric control box, the exterior of a small production vat, and the exterior of an exhaust fan ductwork. DUST-7 contained the highest level of arsenic for all dust samples collected, 250 mg/Kg. This sample was collected adjacent to the processing vats on the former production floor (see Figure 6-32). Sample DUST-7 also exhibited the highest level for lead and the third highest concentration for chromium contamination.

Based upon the overall results from the Phase II building samples and the previously collected EPA building samples (submitted to NYSDEC April 3, 1991), most of the floors, walls and equipment inside Plant 2 is contaminated with chromium and lead.



LEGEND

W-2 (11)	○	WIPE SAMPLE ARSENIC CONCENTRATION IN (ug\L)

NOTES

1) THE FIGURE WAS ADAPTED FROM A BUILDING PLAN PROVIDED BY THE USEPA AND FROM 'VAN DER HORST PLANT NO. 2 SAMPLE LOCATION PLAN' PREPARED BY MILLARD & MAC KAY ON OCTOBER 24, 1991.

2) SAMPLING LOCATIONS WERE MEASURED FROM FIXED LANDMARKS BY ERM AND PLOTTED ON THE BASE MAP BY SCALING THE DISTANCES. THESE LOCATIONS SHOULD BE CONSIDERED ACCURATE TO THE DEGREE IMPLIED BY THE METHOD USED.

TITLE

VAN DER HORST PLANT #2
ARSENIC CONCENTRATIONS
IN WIPE SAMPLES

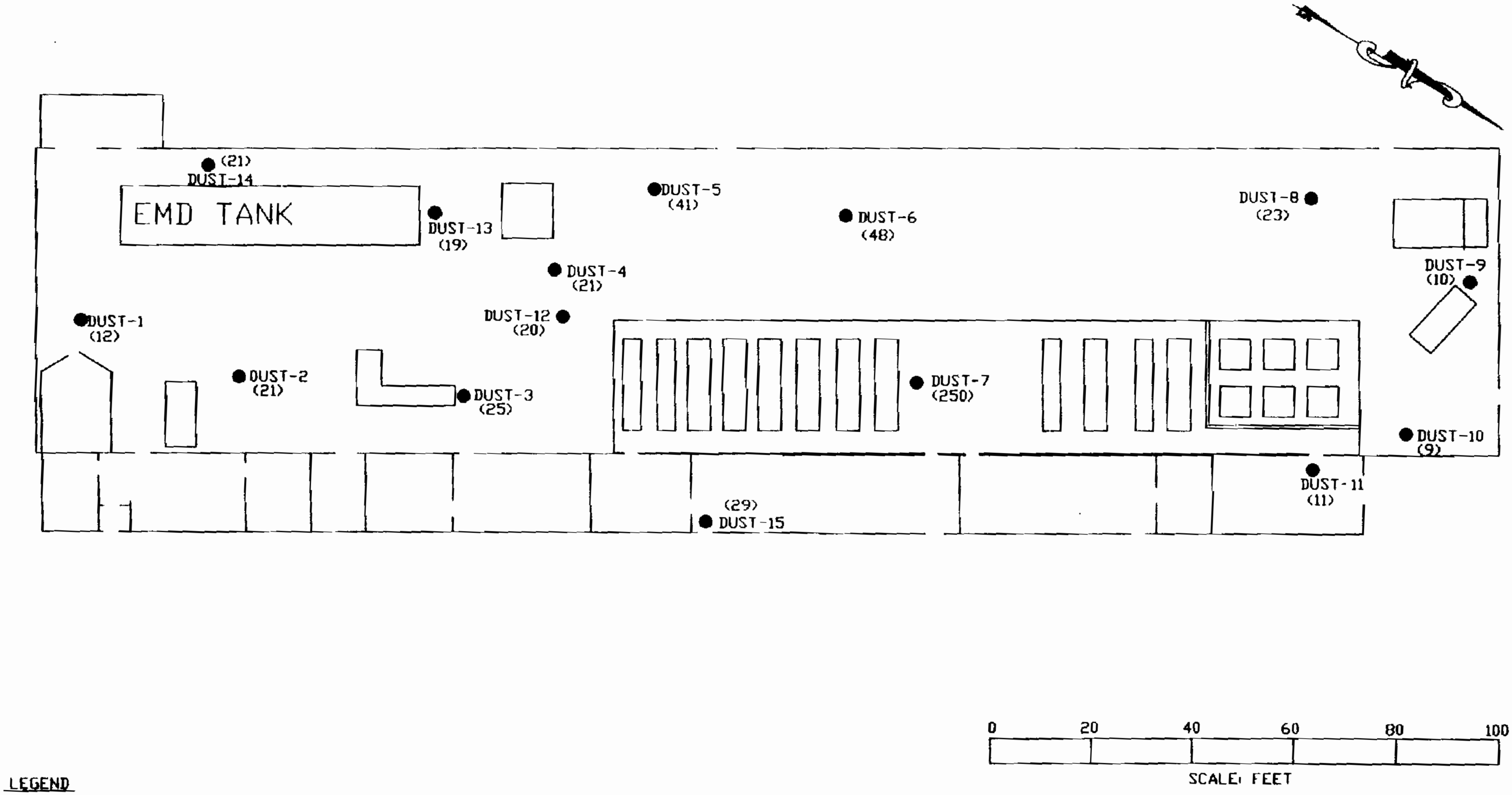
PREPARED FOR

NYSDEC

ERM-Northeast
Environmental Resources Management

DATE

FIGURE
6-3]



LEGEND

DUST-12 ● DUST SAMPLING LOCATION
(752) ARSENIC CONCENTRATION IN (UG\L)

NOTES

1) THE FIGURE WAS ADAPTED FROM A BUILDING PLAN PROVIDED BY THE USEPA AND FROM 'VAN DER HORST PLANT NO. 2 SAMPLE LOCATION PLAN' PREPARED BY MILLARD & MAC KAY ON OCTOBER 24, 1991.

2) SAMPLING LOCATIONS WERE MEASURED FROM FIXED LANDMARKS BY ERM AND PLOTTED ON THE BASE MAP BY SCALING THE DISTANCES. THESE LOCATIONS SHOULD BE CONSIDERED ACCURATE TO THE DEGREE IMPLIED BY THE METHOD USED.

TITLE
VAN DER HORST PLANT #2
ARSENIC CONCENTRATIONS
IN DUST SAMPLES

PREPARED FOR
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ERM-Northeast
Environmental Resources Management

DATE

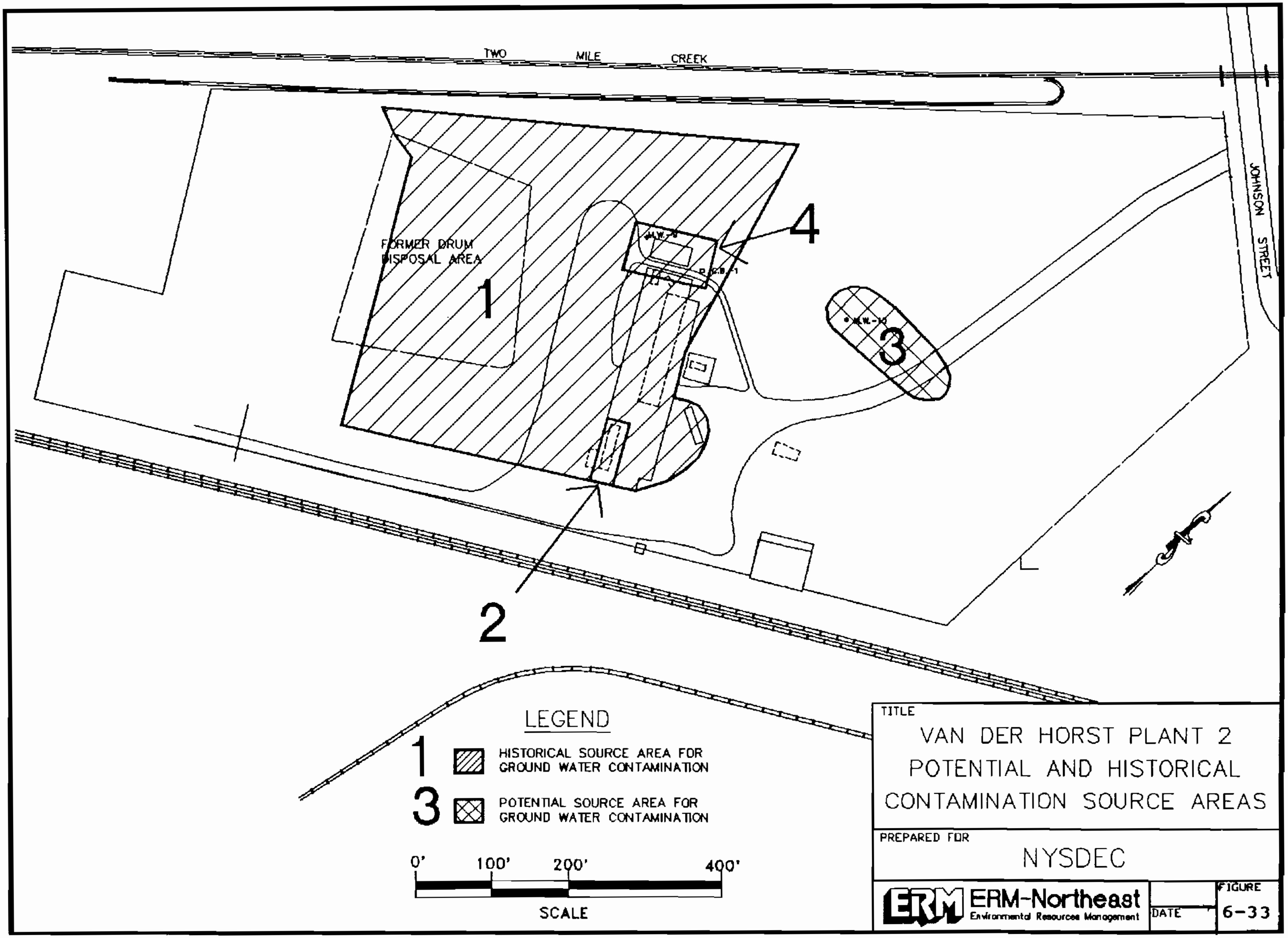
FIGURE
6-32

6.2.7 Catch Basin

A single sediment sample, CB-1, was collected from a catch basin that intercepts a drain running from a former wax dipping vat, inside the plant building (see Figure 2-6). Outflow from the catch basin is believed to flow into Two Mile Creek. The analysis of sample CB-1 indicates that the catch basin, and most likely the outflow drain, contains elevated levels of chromium, mercury, arsenic, barium and lead. However, the location of the drain line and its terminus have not been determined. Therefore, the extent and direction of the contamination migration from the vat, drain, or alleged creek outfall have not been determined.

6.3 Potential Sources of Contamination

In the context of this discussion, a source area is a deposit of contaminated soil or waste that appears to be an origin of contamination to either the ground water, surface water or air; and is an area where one or more of the indicator chemicals was measured at a concentration above the cleanup level determined in the risk assessment. Based on this definition of a source, all surface and subsurface soil with chromium concentrations greater than 50 ppm would be considered a source area. Historical and potential source areas are presented in Figure 6-34. Subsurface



TITLE

VAN DER HORST PLANT 2
POTENTIAL AND HISTORICAL
CONTAMINATION SOURCE AREAS

PREPARED FOR

NYSDEC

ERM-Northeast
Environmental Resources Management

DATE

FIGURE 6-33

soil profiles are located on Figure 6-9 and illustrated on Figures 6-10 and 6-11.

Within the chromium contamination source areas are regions which are believed to be the sources for most of the ground water contamination at the site. These regions contain chromium levels which exceed 1000 ppm and are associated with historical plant operations which have led to these high concentrations. Contamination regions of this nature are referred to as "historical contaminant source areas". Three historical contaminant source areas have been identified at the Plant 2 site. These areas have been labeled Areas 1, 2, and 3 respectively and are shown on Figure 6-33. A fourth potential source area is suspected in the subsurface soil at or upgradient of monitoring well MW-10, due to the elevated chromium concentrations detected in the ground water from this well. Since the limited number of samples from this location did not indicate subsurface soil contamination, the area is considered a "Potential Source Area" and is shown as area No. 3 on Figure 6-33.

Historical Source Area No. 1 covers an area of approximately 5 acres. The chromium concentration in many surface soil samples collected from this source area exceeded 1000 ppm, the highest being 9690 ppm from surface soil sample DD-1 (Figure 6-1). Chromium concentrations measured in samples collected below ground surface at this source area ranged from 13,100 ppm at 2 to 4 feet below ground surface to 8 ppm at 10 to 12 feet below ground surface.

The lead concentrations were also elevated in many of the soil samples collected from this area. Surface soil sample SS-18 had the highest lead concentration detected, 1450 ppm (see Figure 6-4). Lead concentrations in subsurface soil ranged from 615 ppm for B-24 (2'-4') to 14.3 ppm for B-11A (10'-12'). Based upon a comparison of the chromium and lead concentrations detected at ground surface to the concentrations measured in the subsurface, it appears that the inorganics at this source area are concentrated near the ground surface. This comparison also indicates that chromium has a more wide spread distribution.

Historical Source No. 2 is an area of approximately 200 square feet, located near the southwest corner of the plant building, and in the vicinity of monitoring wells MW-20 and the MW-5. The concentration of chromium measured in subsurface soil sample MW-20 (18'-20') was 1420 ppm. This indicates that a portion of the chromium contamination at Source No. 2 is below the average surface level of the ground water table, which is approximately 12 feet below grade. During the Phase I RI, monitoring well MW-5S exhibited the highest concentration of chromium in the ground water samples, 1500 ppm. During the Phase II RI MW-20 exhibited the second highest value for chromium in the ground water samples, 1680 ppm. The area where these wells are located is adjacent to a former processing tank. Therefore, it is believed that the adjacent vat leaked plating solution into the ground water aquifer and became a contributing source of contamination.

The limits of Potential Source Area No. 3 have not been defined. This area is believed to be a source of contamination since chromium and lead concentrations detected in ground water from monitoring well MW-10S have been higher than levels detected in upgradient wells during both phases of the RI. The chromium concentration detected in MW-10S during the Phase II sampling was 827 ug/L, while upgradient wells MW-6S, MW-13S, and MW-1S exhibited levels of 66 ug/L, 58 ug/L and 68 ug/L respectively. Surface soil samples in the vicinity of MW-10S do not appear to be a contributing factor to the contamination, total chromium concentrations of surface soil samples in the area of MW-10S do not exceed 40 ppm. Chromium concentrations in subsurface soil samples obtained from MW-10S, 12 ppm at 0-2' and 7.6 ppm at 10'-12', are not indicative of a contaminant source area. However, the elevated chromium levels in the shallow ground water appear to indicate that a potential source of ground water contamination exists in the subsurface below or slightly upgradient of MW-10S.

The Phase II RI ground water results indicated a fourth source area, Historical Source Area No. 4., at or upgradient of monitoring well MW-9. The sample obtained from MW-9 exhibited the highest level of chromium detected in any well during the entire RI, 10,100 ppb. However, QA validation has indicated that this value was estimated due to the presence of matrix interference during sample analysis. A chromium concentration of 296 ppb was detected in the ground water sample obtained from MW-9 during the Phase I RI. The elevated levels of chromium appear to indicate that Source No. 4 is located in the subsurface soil beneath or upgradient of MW-9. No subsurface soil samples were collected for laboratory analysis from MW-9, and this source area has not been delineated. However, the sediment sample obtained from an upgradient catch basin exhibited a chromium concentration of 43,000 ppm. It is suspected that the contamination in the catch basin is a contributing factor in the elevated levels of chromium detected in the ground water from MW-9.

7.0 SUMMARY AND CONCLUSIONS

7.1 Summary

This section summarizes the results of the Phase I and II Remedial Investigations. Data from both studies have been collectively used in delineating the extent of soil, catch basin sediment, building surface interior, surface water, stream sediment and ground water contamination. Specifically, this section focuses on the results presented in Sections 5.0 and 6.0, since those sections provide the findings and interpretations of the study and are based on the data presented in preceding sections.

7.1.1 Risk Assessment Overview

The public health risk assessment concluded that under current conditions there are carcinogenic effects from chromium in fugitive dust emissions. Under future conditions, if no remedial action is taken, the carcinogenic effects include chromium in fugitive dust emissions and arsenic, benzene, and beryllium in ground water. Additionally, the risk assessment concluded that noncarcinogenic effects under future conditions include chromium and lead in ground water.

Based on the environmental risk assessment, no adverse effects to sensitive environmental resources are expected to occur as a result of the site contaminants. However, several of the contaminants found in sediment and surface water samples collected from Two Mile Creek may be impacting benthic and aquatic life in this creek.

7.1.2 Delineation of Contamination and Potential Sources

Surface Soil

Based on surface soil samples collected during the entire RI, it appears that the area of arsenic, barium, chromium and lead contaminated surface soil includes:

- Most of the surface soil within the fenced-in confines of the former on-site drum disposal area; and,
- An area outside the fence; approximately 200 feet beyond the fence, encompassing the plant building to the east, north and south.

The area of chromium contaminated soil surface was delineated by the 50 ppm cleanup level recommended in the final risk assessment for Plant No. 2. Additional site-specific soil cleanup levels for arsenic and lead were set at 35 ppm and 500 ppm, respectively.

Subsurface Soil

Chromium concentrations greater than 50 mg/Kg were detected in on-site subsurface soil in the same general area as the surface contamination but at a lesser areal extent (see Figure 6-1 and 6-8). No concentrations of 50 ppm or over were detected in off-site subsurface soil samples.

The vertical extent of contamination in unsaturated subsurface soils was found to extend from ground level to at least eight feet below grade in some areas beneath the former drum disposal area. The typical pattern of chromium concentrations in these areas was:

- High levels of chromium near the ground surface;
- Decreasing chromium concentrations with depth.

Chromium concentrations in saturated soils were also elevated in one on-site area, beneath monitoring well MW-20. The extent of elevated chromium levels in this area has not been defined. Saturated soil with chromium concentrations that are several orders of magnitude greater than what is present in the ground water is a potential source of ground water contamination. The typical pattern of chromium concentrations in this well and adjacent soil borings was:

- Low or moderate levels of chromium near the ground surface;
- Decreasing chromium concentrations with depth; and
- Increasing chromium levels near the water table.

Catch Basin

A sediment sample was collected from a catch basin that intercepts a drain running from a former wax dipping vat inside the plant to Two Mile Creek. This sample indicated that the drain contains elevated levels of chromium, mercury, arsenic, barium and lead. Since the drain leading from the catch basin has not been located the extent or direction of migration of the contamination in the vat, drain, or alleged creek outfall have not been determined. However, since this catch basin is located upgradient of MW-9 and MW-9 exhibited the highest level of chromium in groundwater for the entire RI, there is a potential that contaminants from the catch basin may be contributing to the elevated levels of ground water contamination detected in this well.

Creek Sediment

Many sediment samples from Two Mile Creek contained elevated concentrations of chromium and cadmium. All sediment samples had chromium concentrations with values exceeding 50 ppm. Therefore, it is believed that chromium concentrations in the creek sediment were attributable to the former activities at the plant facility.

During the Phase I RI, cadmium was detected in one creek sediment sample at a concentration above 3 ppm. Further sediment sampling and analysis during the Phase II RI indicated that five (5) additional samples exhibited cadmium levels exceeding 3 ppm. Based on the results of the inorganic analysis and the fact that the stream is situated adjacent to a number of major roadways, it is possible that the source of cadmium contamination is located off-site. Further sampling of the creek bed sediments is recommended to establish typical background levels of cadmium.

Surface Water

Lead, cadmium and manganese were the elements detected in surface water from Two Mile Creek during both phases of the RI sampling program. Thus, it appears that the surface water in Two Mile Creek may have been impacted by the operations at the Plant 2 facility. However, further investigation is recommended to assess whether sediment contamination has contributed to the surface water contamination or if an off-site source was responsible. Further study is also recommended to determine if the detected concentrations are above NYSDEC Standards and Guidance Values.

Ground Water

Chromium, arsenic, lead, manganese, benzene, and beryllium are considered to be the principle ground water contaminants. Benzene, toluene, and xylene were detected separately and in combination in many of the deep and shallow wells sampled during the Phase I and II RIs. The levels of contamination of these compounds in ground water appeared to indicate that volatile contamination was the result of off-site sources, possibly due to a formerly operated oil refinery located adjacent to the site.

Chromium contamination levels detected in the deep and shallow monitoring wells appear to indicate that most of the contamination was likely derived from an on-site source. All but two shallow wells exhibited chromium levels above 50 ppb, MW-5S and MW-16S. The extent of the chromium plume in the shallow monitoring wells appears to extend outside the existing monitoring well network. Only three deep wells exhibited contamination levels over 50 ppb; two on-site, MW-5D and MW-10D, and one off-site, MW-8D. Since all on-site wells downgradient of MW-5D and MW-10D had chromium levels below 50 ppb it appears as if the contaminant plume for the deep wells is well delineated on-site. Further investigations are recommended to delineate the off-site extent of the contaminant plume in the shallow aquifer downgradient of the site.

Lead contamination in the ground water samples exceeded the NYSDEC standard of 25 ppb in all shallow monitoring wells. Two shallow wells, MW-10S and MW-9, with levels exceeding 1000 ppb are located on-site, in vicinity of the plant building. Concentrations of lead levels exceeding the NYSDEC standard were also detected in nine of the twelve deep wells tested. There appear to be at least five sources for the lead contamination in ground water: 1) an off-site upgradient source impacting well pods MW-6 and MW-13; 2) an undefined source beneath or upgradient of monitoring Well MW-9; 3) an undefined source area beneath or upgradient of well pod MW-10; 4) an undefined source area beneath or upgradient of well pod MW-4; and, 5) the fenced-in former drum disposal area. MW-9 and MW-10S had the highest levels of lead detected in the shallow wells during the Phase II RI, 6380 ppb and 1670 ppb respectively. MW-10D had the highest level of lead detected in the deep wells during the Phase II RI. Based on the Phase I and II ground water sample results it appears as if the extent of the chromium plume in the shallow and deep monitoring wells extends outside the existing monitoring well network. Further investigations are recommended to delineate the off-site extent of the contaminant plume in the aquifers downgradient of the site.

Arsenic was detected in all (18) of the ground water samples obtained from the shallow monitoring wells. Seventeen of those wells exhibited arsenic concentrations above the NYSDEC Class GA standard of 25 ppb. Five of the deep wells also had arsenic levels over 25 ppb. MW-10S and MW-10D exhibited the highest levels of arsenic in both shallow and deep wells, 179 ppb and 93 ppb, respectively. It appears as if the subsurface materials beneath or upgradient of the MW-10 well pod are a potential source of arsenic contamination. However, further subsurface soil and ground water sampling are recommended to confirm and/or delineate the source area.

Building Interior Surfaces

Chromium, lead and arsenic were detected in the wipe and dust samples collected inside the plant building and are considered the primary interior contaminants. Elevated levels of these contaminants were found near process vats and ventilation ducts, however, a number of samples obtained from the building walls also exhibited high concentrations of inorganics.

Fifteen samples of various materials, including pipe insulation elbows and floor tiles, were obtained from numerous locations inside the facility and analyzed for asbestos content. Asbestos containing fibers were detected in all but two of the samples collected. In most of the samples the asbestos content was approximately 40% of the total sample by volume.

Based upon the overall results from the Phase II building interior samples and the previously collected EPA building samples (submitted to NYSDEC April 3, 1991), most of the floors, walls and equipment inside Plant 2 are contaminated with chromium and lead. Additionally, many of the insulated pipe joints and elbows are covered with asbestos containing materials.

Areas of Soil Contamination

Three historic source areas (Areas 1, 2 and 4) were identified during the review of data from Phases I and II of the RI. These source areas were locales where specific plant activities and disposal practices have been identified as the cause of surface and subsurface soil contamination. All areas contain at least one subsurface soil sample which had a chromium concentration exceeding 1000 mg/Kg.

Historical Source Area 1 is located inside the fenced-in former drum disposal area and extends east, to the plant building. This encompasses an area from the flood control berm adjacent to Two Mile Creek to the south side of the plant building, approximately 5 acres. One subsurface soil sample in this area had a chromium concentration of 13,100 ppm, or about 1.3 percent.

The second source area, Historical Source Area 2, is located adjacent and underneath a production vat that was formerly used in a chromium plating process in the plant. The vat is believed to have leaked during plant operations. One saturated subsurface soil sample from this area had a chromium concentration of 1420 mg/Kg. Area 2 is believed to be the primary source of ground water contamination at the site. Ground water from Area 2 monitoring well MW-20 had a chromium concentration of 1680 ug/L.

Historical Source Area 4 is located in the subsurface soil beneath or upgradient of monitoring well MW-9. Chromium concentrations in the ground water obtained from this well exceeded 10,000 ppb. Therefore, it is suspected that subsurface soil in the vicinity of this well is contributing to the elevated contamination levels. Since no subsurface soils were analyzed from this location, further investigation is recommended to delineate this potential source area. However, a sediment sample collected from a nearby catch basin exhibited a chromium concentration of 43,000 ppm. The location of the catch basin is upgradient of MW-9 and the elevated chromium levels may be contributing to the concentrations found in the well.

One Potential Source Area (Area 3) was identified during the Phase II RI. This area was identified primarily from the analytical results of ground water samples and is located where limited soil samples were collected.

Potential Source Area 3 is located in the subsurface soil beneath or upgradient of monitoring well MW-10. Chromium concentrations in the ground water obtained from MW-10S during the Phase II RI exceeded 800 ppb. Therefore, it is suspected that subsurface soil in the vicinity of this well is contributing to the elevated contamination levels. Two subsurface soil samples were collected from this location during the Phase I RI. The analytical results did not indicate elevated contaminant levels in the subsurface soil. Therefore, further investigation also is recommended to delineate this potential source area.

7.2 Conclusions

This section summarizes: 1) the limitations of the RI data; and 2) recommendations for the initial phase of the remedial action program. The conclusions presented with regard to these two items are based upon the information presented in previous sections.

7.2.1 Limitations

The findings of this study are based upon explorations, field measurements and analyses which are subject to certain limitations. These limitations are summarized below:

Explorations and Measurements

The geologic profiles presented and described herein are intended to convey trends in subsurface conditions. The boundaries between strata are approximate and have been developed by interpretations of widely spaced explorations.

Ground water level readings have been made in the monitoring wells at times and under conditions stated on the field reports. These data have been reviewed and interpretations have been made. However, note that fluctuations in the ground water level will occur due to variations in rainfall and other factors occurring at the time of measurement.

Surveying the elevation of test borings/monitoring wells was done by others using optical survey techniques. These data were used in developing conclusions made in this report. Should variations become evident, it will be necessary to reevaluate the findings of this report.

Analyses

The analyses and conclusions submitted in this report are based in part on samples tested by others, and are contingent upon their validity. Fluctuations of contaminant levels, types and migration paths may occur due to seasonal fluctuations, temperature variations, ground water fluctuations and other factors.

Use of Report

This report was prepared exclusively for the NYSDEC for specific application to the Van Der Horst Plant No. 2 site in accordance with generally accepted engineering practice. No other warranty, expressed or implied, is made.

7.2.2 Recommendations for Future Work

Although the Phase I and II RIs provided additional information regarding the physical characteristics of the study area and the contaminants of interest, some additional study will be required to further evaluate site conditions and collect the necessary data for the remedial action and remedial design programs. Some recommended studies for the initial phase of the remedial action program are summarized below:

1) The horizontal extent of total chromium ground water contamination needs to be further delineated with additional shallow monitoring wells northwest of the site. This work is necessary to estimate the volume of ground water that is contaminated, so that treatment/disposal alternatives can be evaluated. The limit of chromium contamination in the deep wells is presently fairly well defined.

2) Based on the soil classification descriptions and slug test data it is believed that the aquifer characteristics at Plant 2 are significantly different from those encountered at Plant 1. Therefore, the data generated during the pumping test at Plant 1 cannot be used

accurately to represent the Plant 2 aquifer conditions and properties. A shallow aquifer pumping test is recommended for Plant 2 in order to obtain data concerning aquifer storage, hydraulic conductivity and transmissivity. These data will help determine the ground water flow velocity at the site and will be incorporated into a ground water model, which is also recommended. The pumping test drawdown and capture area will be used to evaluate the response of the aquifer to pumping. This, in turn, will assist in determining the potential measures required to remediate the ground water contamination.

3) Following the chromium plume delineation and aquifer testing, a detailed ground water modeling effort is needed to evaluate various pump and treat remedial alternatives. This effort will include ground water flow simulations which will be designed to optimize the recovery of contaminated ground water. The following factors will be evaluated during modeling:

- Numbers of recovery wells;
- Recovery well locations; and
- Recovery well pumping rates.

4) Further definition, horizontally and vertically, of the areas of inorganic subsurface soil contamination is required to determine remedial action methodologies and cleanup costs. The extent of contamination in unsaturated soil cannot be accurately estimated due to the lack of samples obtained for analysis. Furthermore, no limits have been determined for the vertical extent of chromium contamination in the saturated soil. The limits of chromium contamination in saturated soil are particularly important, since this soil is in direct contact with ground water and is believed to be the primary source of ground water contamination at the site.

5) The delineation of the suspected source areas beneath MW-10 and MW-9 is required to determine the origin and extent of contamination contributing to the elevated levels of inorganics in these wells. This is also required to determine remedial action methodologies and cleanup costs.

7.2.3 Recommended Remedial Action Objectives

The remedial action objectives are contingent upon current and future local use of ground water and the potential for the contamination to migrate to the public water supply.

Public water supply information has been collected by the NYSDEC during a residential well survey. The results, combined with USGS records, indicate that local withdrawal of ground water is presently not taking place. However, assuming that there is some future exposure path for the contaminated ground water, the following remedial action objectives have been developed:

- Remediate identified areas of contaminated surface and subsurface soil to limit future migration of chromium, lead and barium;
- Remediate identified areas of contaminated stream sediment to limit future migration of chromium and contamination of the stream surface water;
- Remediate ground water to acceptable risk levels for chromium, lead and volatile organics;
- Locate and remediate the drain leading from Plant 2 to Two Mile Creek of residual contamination; and,
- Remediate the on-site building structures, including the demolition of the plant buildings, if necessary.

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