REMEDIAL INVESTIGATION

AND

FEASIBILITY STUDY

FOR THE

GORICK C & D LANDFILL

KIRKWOOD (T), BROOME (C), NEW YORK

VOLUME I REMEDIAL INVESTIGATION

NYSDEC SITE NO. 7-04-019
WORK ASSIGNMENT NO. D002340-5

Prepared for:

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
50 Wolf Road, Albany, New York

Thomas C. Jorling, Commissioner

DIVISION OF HAZARDOUS WASTE REMEDIATION

Michael J. O'Toole, Jr., P.E. – Director

URS Consultants, Inc.

282 Delaware Avenue
Buffalo, New York 14202

JANUARY 1992

1256

Remedial Investigation

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1. INTRODUCTION

1.1 Purpose of Report

The purpose of this Remedial Investigation (RI) report is to present, summarize, and provide interpretation and conclusions on data gathered during the RI activities at the Gorick C&D Landfill, Town of Kirkwood, Broome County, New York. RI activities, which began on July 26, 1990 (when the initial work authorization was received from NYSDEC), have included preparation for field activities, completion of first and second phase field activities, and report preparation. The first phase of field activities, which were performed from September through December 1990, included: site air and radiation monitoring; a soil gas survey; geophysical surveys; installation of soil borings and monitoring wells; monitoring of elevations of groundwater and surface water; sampling and chemical analysis of surface water, groundwater, sediment, soil, and waste; hydraulic conductivity testing; geotechnical analyses; and a Habitat-Based Assessment. The second phase of field activities, which were performed in June and July 1991, included: the installation of piezometers and additional monitoring wells; a test trenching program; sampling and chemical analysis of groundwater, surface water, sediment, surface soil, and waste; and further monitoring of groundwater and surface water elevations. The second phase was necessary in order to further characterize the site, to clarify questions raised about the site after the first phase, to provide enough information for completion of the RI, and to allow recommendations to be made and supported in the Feasibility Study (FS).

The RI provides information for characterization of the physical, geological, hydrogeological, chemical, and environmental factors unique to the Gorick Landfill site. This report presents data that help define the source, nature, and extent of contamination, providing a basis for the FS. The FS will identify and develop remedial alternatives, which, based on

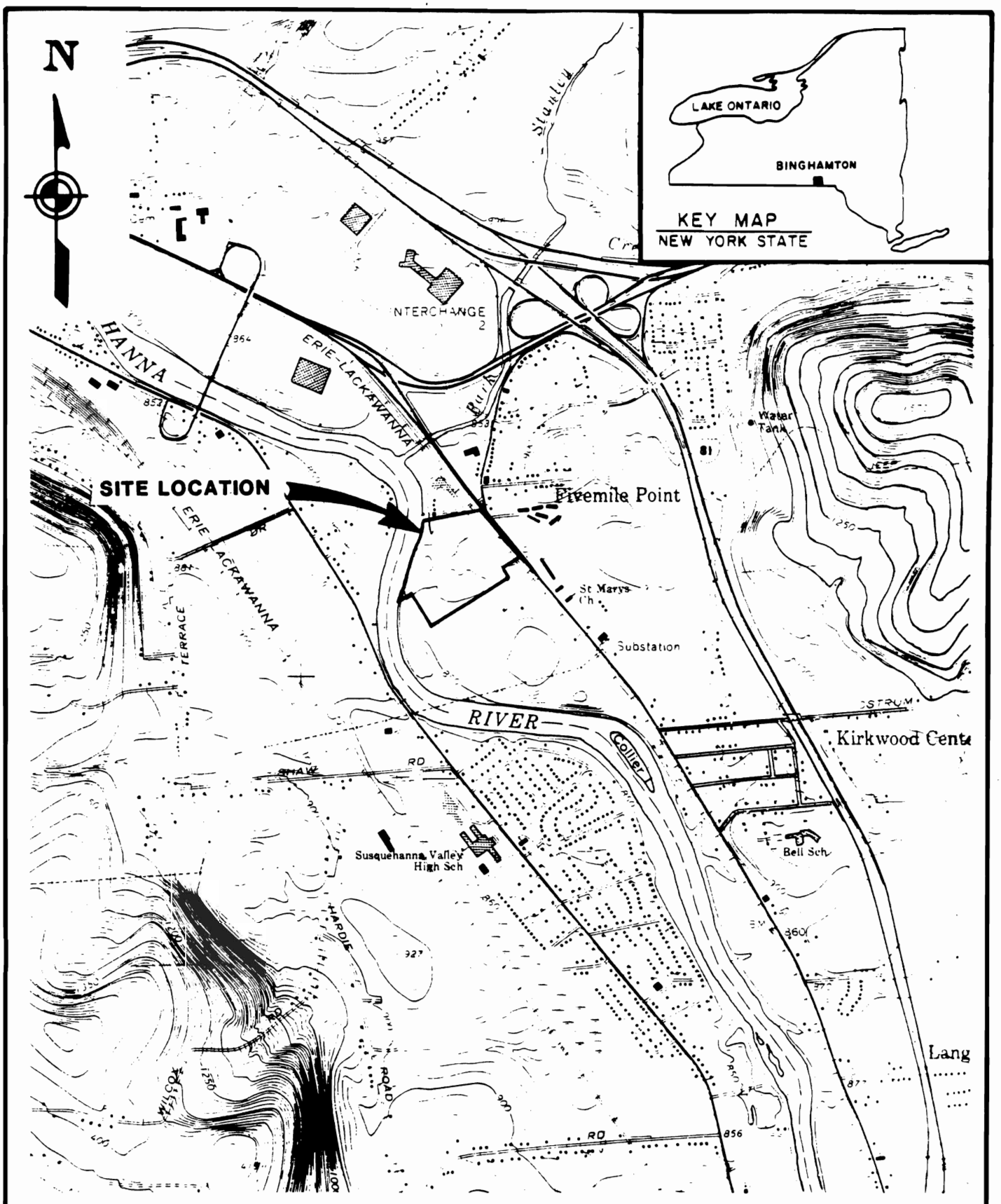
the potential risks identified in this RI, will be protective of human health and the environment. These alternatives will then be evaluated to lead to the selection of a preferred alternative and development of a conceptual design for this alternative.

1.2 Background

1.2.1 Site Description

The Gorick Landfill is located on a 35-acre tract of land in the Town of Kirkwood, Broome County, New York. The site lies approximately 5 miles southeast of Binghamton, off NY Route 11, near Fivemile Point. The Gorick Landfill site location is shown in Figure 1-1; a site plan is presented in Figure 1-2.

Although irregularly shaped, the site may be viewed as roughly square, measuring about 1,000 feet per side. The original, gentle grade was to the west, toward the Susquehanna River. Landfilling has been carried out in a series of two distinct fill episodes. These have created two stepped plateaus above the floodplain of the river. The floodplain of the Susquehanna River, as used here, is simply the valley floor adjacent to the river that is subject to periodic overflow, without specification of a frequency-of-flooding limit (e.g., 100-year floodplain). The floodplain is evident here from the type of surface soils and vegetation present. During much of the year the floodplain lies only 3 to 5 feet above the water surface. However, during the Phase II field activities (June to July 1991) the floodplain lay approximately 7 feet above the water surface, due to low river conditions. The lower plateau, approximately 10 feet above the floodplain, extends around the north and west sides of the site. The edge of this plateau is abrupt, but well vegetated and of indeterminate composition. The upper plateau, approximately 10 feet higher than the lower, covers over half the site, and meets the grade of Route 11 along the eastern edge of the property.



SOURCE

USGS, BINGHAMTON EAST, N.Y, QUADRANGLE
7.5 MINUTE SERIES (1976)

0 1000 2000 FT.

URS CONSULTANTS, INC.	GORICK LANDFILL SITE LOCATION MAP	FIGURE 1-1

A-3614

1=200 1/7/92

N

LINK FLIGHT SIMULATION COMPANY

RIVER

FLOW

SUSQUEHANNA

TOWN WELL No.3

TOWN WELL No.1

TOWN WELL No.2

EL. 855±

TANKS

TANKS

TANKS

CONRAIL

RAILROAD

KIRKWOOD

PARKWAY

(RTE. 11)

APARTMENT COMPLEX

KIRKWOOD WATER TREATMENT PLANT

AMERICAN PIPE & PLASTIC

FLOOD ENCROACHMENT LINE

844

854

864

LEGEND

—••— ✳ APPROXIMATE 100-YEAR FLOOD ENCROACHMENT LINE (ELEV. 853.5±)

✳ SOURCE:
U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (TOWN OF KIRKWOOD, BROOME COUNTY: FLOOD BOUNDARY AND FLOODWAY MAP - 6/1/77)

NOTES:

1. MAPPING BASE IS FROM AERIAL PHOTOGRAPHY DATED APRIL 1, 1990 AND COMPILED BY LOCKWOOD MAPPING, ROCHESTER, NEW YORK.
2. PROPERTY LINES SHOWN ARE APPROXIMATE, FOR REFERENCE ONLY, AND SHOULD NOT BE USED FOR CONVEYANCE OF REAL PROPERTY. PROPERTY LINES WERE INTERPOLATED FROM A TAX MAP PREPARED BY BROOME COUNTY, NEW YORK.

0 100 200
SCALE IN FEET

CC-2058

SITE PLAN

URS CONSULTANTS, INC.

FIGURE 1-2

The edge of the upper plateau, except for the side facing Route 11, is also abrupt, but unvegetated, and composed largely of construction and demolition debris, including wood, concrete, assorted metal objects, roofing paper, etc.

The surface of the landfill is sparsely vegetated in many areas, with a large quantity of demolition debris strewn about. These include a crane, approximately 20 rusted storage tanks (with a capacity of several thousand gallons each, and generally with at least one of their ends cut open or removed), piles of hospital beds, I-beams, and other materials.

The site is bordered on the east by Conrail railroad tracks and on the west by the Susquehanna River. Immediately north of the site is a warehouse of the Link Flight Simulation Corporation, and four private residences. To the south, across a small access road serving three water wells belonging to the Town of Kirkwood, is the American Pipe and Plastics (AP&P) factory, where PVC piping is manufactured.

The three Town of Kirkwood municipal water wells are located on a 5-acre parcel owned by the Town on the floodplain adjacent to, and about 300 feet southwest of, the landfill. The well pumphouses are built upon an embankment of clean fill, which elevates them about 15 feet above the floodplain, and 3.5 feet above the 100-year flood elevation of the river (approximately 853 to 854 feet above mean sea level, per the U.S. Army Corps of Engineers). The wells have two discharge lines. One line runs under the floodplain west of the landfill to a fire hydrant on an adjoining property. The primary pipeline runs under and along the southern boundary of the site to the Kirkwood Water Treatment Plant. The treatment plant, from which water is pumped to customers in the Town of Kirkwood's Water Districts No. 3 and 4, is located just outside the southeast corner of the landfill. Supplemental water is purchased from the City of Binghamton on an as-needed basis, primarily to maintain adequate reservoir levels.

The Susquehanna River Valley runs southeast-northwest in this area, among hills that rise 700-800 feet above the river. The valley in the region of the landfill is approximately one mile wide.

Landfill construction has displaced an intermittent stream (termed the "drainage stream" in this report) to its present course along the landfill's southern and western borders. At the southwest corner of the landfill, non-contact cooling water from the AP&P plant enters the stream. Another surface water body, a small lake, is located in an abandoned gravel mine approximately 200 feet south of the landfill (on property owned by Five Mile Point Development Co., Inc.). The lake has no apparent connection to any other surface water body. To the north of the Link Warehouse, Park Creek runs into the Susquehanna.

Besides the Town of Kirkwood's well field, groundwater is withdrawn from at least four locations near the landfill. Two hundred feet south of the landfill, American Pipe and Plastics has a groundwater well for non-contact cooling water (approximate capacity 300 gpm). Approximately one-quarter of a mile to the west (across the Susquehanna) is one of the Town of Conklin's four drinking water wells (approximate capacity 250 gpm). Also across the Susquehanna, approximately one-half mile to the west, located on the Conklin Sports Park driving range (west of Route 7), is a well used for watering of grass on the driving range (approximate capacity 350 gpm). Additionally, immediately north of the landfill and along the Susquehanna behind the Link Warehouse, are two private residential wells (Figure 1-3 or 1-4). The more southern of these two wells is not presently in use. However, the more northern of these residential wells is reportedly being used for domestic purposes (Ref. 30).

Known wells on the Conklin side of the Susquehanna River are discussed above, but a community well survey was not done on that side of the river. Such a survey was not considered necessary because the presence of the river and the Kirkwood Town wells made it very unlikely

1=200 1/9/92

N

APPROX. LOCATIONS

MW-11I

MW-11S

LINK FLIGHT SIMULATION COMPANY

MW-14D
P-14S
MW-14 I

RIVER

854

P-13

MW-7S

SG-4
SG-4B
MW-6D
MW-6I
MW-6S

844

854

MW-8S

B-11

P-15

TANKS

MW-20
MW-5D
MW-5S
MW-5I

FLOW

GS-12

TANKS

MW-9S

GS-9A
GS-9B

GS-16A
GS-16B

MW-35
MW-36

B-10A

GS-11

SG-2A
TOWN WELL No.3
SG-2
GS-8A
GS-8B
TOWN WELL No.1
TOWN WELL No.2

MW-33
MW-32
MW-31
MW-41
MW-4S
GS-10
MW-37

OB-1
OB-1A

MW-34
VO-3

MW-10S

SG-3A
SG-3
GS-7
MW-3S

VO-1

VO-4

VO-5

GS-14A
GS-14B

SUSQUEHANNA

II-35

MW-12D
MW-12S

GS-15A
GS-15B

APP-N

APP-S

GS-3

10-33

KIRKWOOD

CONRAIL

PARKWAY

RAILROAD

RTE. 11

MW-1S

APARTMENT COMPLEX

GS-13

16-24

MW-2S

15-15

TANKS

AMERICAN PIPE & PLASTIC

GS-1

B-3A

14-21

GS-2

KIRKWOOD WATER TREATMENT PLANT

LEGEND

- MONITORING WELL INSTALLED BY URS CONSULTANTS (1990)
- EXISTING MONITORING WELL INSTALLED BY LAKE ENGINEERING (1988)
- WELL INSTALLED BY UNITED STATES GEOLOGICAL SOCIETY (1984)
- WELL INSTALLED BY UNITED STATES GEOLOGICAL SOCIETY (1984) (ABANDONED)
- WELL INSTALLED BY GROUND WATER ASSOCIATES (1981)
- WELL INSTALLED BY GROUND WATER ASSOCIATES (1984)
- PRIVATE RESIDENTIAL WELL (ABANDONED)
- PRIVATE RESIDENTIAL WELL (REPORTEDLY IN USE)
- SOIL BORING BY URS CONSULTANTS (1990)
- STREAM GAUGE
- PVC FACTORY WELL
- SOIL BORING (EXISTING)
- MONITORING WELL INSTALLED BY URS CONSULTANTS (1991)
- EXISTING MONITORING WELL INSTALLED BY PRATT AND WOLFF (1986)
- PIEZOMETERS BY URS CONSULTANTS (1991)

NOTES:

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0 100 200
SCALE IN FEET

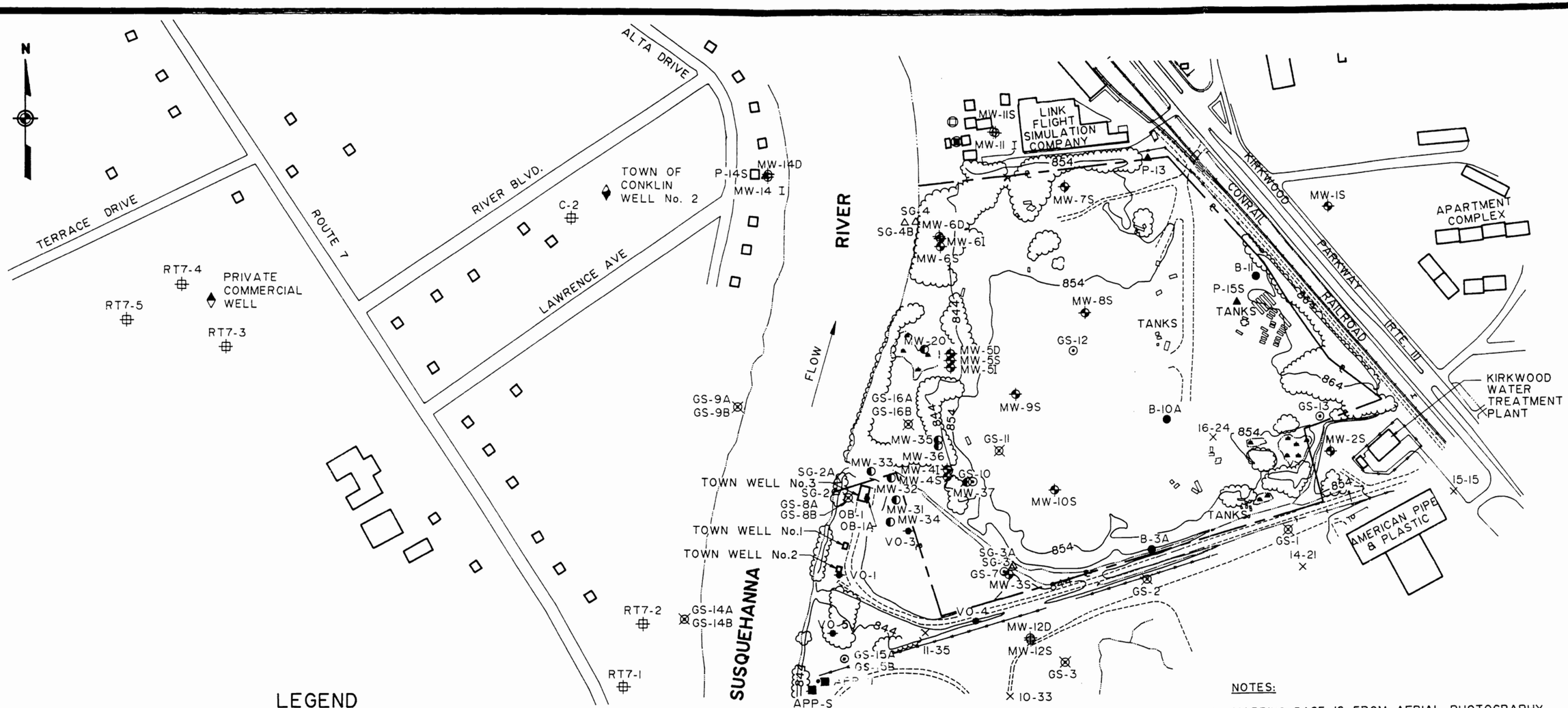
BORING AND WELL LOCATIONS

URS CONSULTANTS, INC.

FIGURE 1-3

CC-2031B

1=400 1/9/92



LEGEND

- MONITORING WELL INSTALLED BY URS CONSULTANTS (1990)
- MONITORING WELL INSTALLED BY URS CONSULTANTS (1991)
- EXISTING MONITORING WELL INSTALLED BY LAKE ENGINEERING (1988)
- EXISTING MONITORING WELL INSTALLED BY PRATT AND WOLFF (1986)
- WELL INSTALLED BY UNITED STATES GEOLOGICAL SURVEY (1984)
- WELL INSTALLED BY UNITED STATES GEOLOGICAL SURVEY (1984) (ABANDONED)
- WELL INSTALLED BY GROUND WATER ASSOCIATES (1981)
- WELL INSTALLED BY GROUND WATER ASSOCIATES (1984)
- SOIL BORING BY URS CONSULTANTS (1990)
- PIEZOMETERS BY URS CONSULTANTS (1991)
- STREAM GAUGE
- PVC FACTORY WELL
- SOIL BORING (PRE-1990)
- PRIVATE COMMERCIAL WELL (APPROXIMATE LOCATION)
- TOWN OF CONKLIN WELL (APPROXIMATE LOCATION)
- PRIVATE RESIDENTIAL WELL (APPROXIMATE LOCATION) (ABANDONDED)
- PRIVATE RESIDENTIAL WELL (APPROXIMATE LOCATION) (REPORTEDLY IN USE)
- PRIVATE RESIDENCES AND OTHER PROPERTIES

NOTES:

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300 0 300

SCALE IN FEET

BORING & WELL LOCATIONS

URS CONSULTANTS, INC.

FIGURE 1-4

CC-2031A

that the landfill could impact residential wells, with their low pumping rates, on the Conklin side of the river. Additionally, this contamination possibility was checked by monitoring wells placed on the Conklin side of the river.

1.2.2 Site History

Aerial photography shows that, as late as 1955, the Gorick site and surrounding lands were cultivated. It is known that the Gorick Landfill site was mined for gravel prior to its use as a dump, and that in 1964 Alfred and Stephanie Gorick purchased the land from L.G. DeFelice and Son, Inc. Several engineering reports published for the Town indicate that Gorick had begun dumping there in 1959. Aerial photography from April 1965, however, shows no evidence of dumping up to that time.

In March 1965, the Broome County Health Department issued a permit to Alfred Gorick to establish a refuse disposal area at the site. Because the site was to be for the use of Gorick's construction company only, and because the waste to be disposed of was purported to be mostly non-decomposable demolition debris, the landfill was exempted from daily compaction and cover requirements. The record indicates that Gorick initially intended to reclaim the site by filling the gravel mine with stable fill, and then to offer the property for commercial development.

In 1970, the Town of Kirkwood requested that its consulting engineer, Vernon O. Shumaker, evaluate portions of the property, along with several other properties within the town, as potential sites for municipal water wells. Four wells were drilled at various locations on the Gorick property. Only one, near the river, showed sufficient yield to be worth further investigation. [None of these wells could be located during the RI field activities.] In 1973, Shumaker reported that the water at the Gorick site contained relatively high concentrations of metals, and that treatment would be too expensive for the site to be

economically developed. Shumaker recommended that the site no longer be considered a potential potable water source.

In May 1975, after at least three reports of potential permit violations, including the dumping of cinders and fly-ash (unidentified source) and the placement of refuse on the floodplain between the landfill and the Susquehanna River, Gorick's permit to operate the landfill was revoked. A new permit application was requested by the Broome County Department of Health (BCDOH). Among other requirements, the new permit (December 1975) called for monthly cover, and prohibited dumping on the intermediate regional floodplain of the Susquehanna River. [This floodplain was described by the U.S. Army Corps of Engineers (USACE) in a 1969 report prepared for the Broome County legislature.]

Due to industrial growth, Kirkwood's water supply in 1975 proved incapable of meeting fire codes. Shumaker therefore recommended that a new source of municipal water be developed at the Gorick site, and that any necessary treatment facilities for the removal of iron and manganese be constructed. In 1977, the Town purchased from Gorick approximately five acres of land on which to construct two production wells. Town Wells No. 1 and 2, and a pumping plant (with a greensand filter for the oxidation and removal of metals) were completed in July 1977.

By 1980, iron and manganese deposits in the well screen and sandpack had reduced the capacity of Town Well No. 2 to 10 percent of its original capacity of 1,000 gpm, forcing the Town to consider installation of an additional production well and development of treatment facilities for the removal of metals from the existing wells. In December 1981, as part of a pilot study of the Vyredox System for removal of excess metals from groundwater, 5 monitoring wells (V01 to V05) were installed. Groundwater samples were taken from both the monitoring wells and the Town wells. In May 1981, trichloroethene (TCE) and 1,2-dichloroethene (1,2-DCE) were detected at 1.6 ppb and 1.3 ppb, respectively, in the distribution system

for Town Wells No. 1 and 2. [It is not clear whether these detections were made as part of the aforementioned study.] Although well below the United States Environmental Protection Agency (USEPA) Maximum Contaminant Levels (MCLs) in effect at that time (50 ppb for each of these compounds), these concentrations caused the Town in 1982 to institute a program of regular testing for volatile organic compounds (VOCs).

Concern grew among New York State and local officials that the Gorick Landfill was the source of the VOC contamination in the Town wells. Therefore, in 1983, NYSDEC requested that Gorick apply for a permit to operate the landfill under Part 360 regulations for solid waste disposal facilities. Gorick's application, in September 1983, was deemed incomplete, and no subsequent addition of information to the application proved to be acceptable to the agency.

Well No. 3, with twice the design capacity (2,000 gallons per minute) of either Well No. 1 or No. 2, was constructed in February 1984, adjacent to Wells No. 1 and 2.

In November 1984, at the suggestion of BCDOH, the New York State Department of Health (NYSDOH) adopted 10 NYCRR 102.3 IIIA - rules and regulations specifically prohibiting certain activities within the area of the Town of Kirkwood's wells. [The regulations had been drafted by the Town and submitted to NYSDOH via BCDOH.] These activities prohibited, among other things, disposal of construction and demolition debris within 400 feet of the Town wells. Although in fact debris appears to have been dumped within the 400-foot radius, monthly inspection reports from 1984 to the present by the Town of Kirkwood have indicated that this law has not been violated. A letter from BCDOH to NYSDEC, dated June 22, 1983, did state that material was disposed of within the 400-foot limitation, but this predated the rule adoption, and may have been partly responsible for its drafting.

After rejection of one of Gorick's revised Part 360 applications in April 1986, NYSDEC determined that the landfill lay over the Endicott-Johnson City sole-source aquifer, causing the case to fall under the NYSDEC Landfill and Sensitive Aquifers Policy. The State informed Gorick that the stringent new requirements of Part 360 made granting of an operating permit very unlikely. The State recommended, in correspondence with Gorick, that the landfill be formally closed.

By late 1983, in cooperation with the Town of Kirkwood, the United States Geological Survey (USGS) had installed 13 wells in the vicinity of the landfill as part of a modeling study of groundwater flow in the area. As part of the growing concern among State and local officials about the effect of the Gorick site on groundwater quality, 8 of these wells were transferred at the end of the study in 1985 to the ownership of the Town for use in a quarterly sampling and analytical program. This study, undertaken jointly by the Town and NYSDEC in late 1986 and early 1987, included sampling the USGS wells and analysis of the samples for VOCs and leachate indicator parameters. When NYSDEC personnel visited the site on October 29, 1986, to begin sampling for this study, it was noted that wells No. 11A and B could not be found, having been buried by fill, and that Well No. 12 had been found partially buried. [Wells No. 11A and B were found and officially sealed March 17, 1988. Well No. 12 was exposed and protected.] When finally sampled, on February 9, 1987, the first round of analysis showed significant detections only in USGS Well No. 12 (45 ppb TCE and 48 ppb trans-1,2-DCE).

Because of these concentrations the landfill was, in November 1987, classified by NYSDEC as a suspected inactive hazardous waste site (Class 2a). The State required that Gorick develop a Remedial Investigation and Feasibility Study (RI/FS) for the site or become liable for all resultant cleanup costs. In an August 1988 letter from his attorney to the State, Gorick admitted to having allowed NYSDOT to dump a significant quantity of yellow paint at the landfill, but was unable to remember any other sources

of hazardous waste that might have been dumped there. However, in his December 1988 deposition, Mr. Gorick did not admit to NYSDOT paint dumping. When asked if containers of paint had been disposed of at the landfill, Mr. Gorick replied, "No".

In 1988, 11 ppb TCE was detected in Town Well No. 3. This contravened the interim NYSDOH standard of 10 ppb for TCE (prior to the adoption of a stricter 5 ppb standard in 1989) and required that the well be shut down. Well No. 1, which had been shut down since the installation of Well No. 3, was re-activated, but soon its concentration of TCE also appeared to increase. The Town therefore sought, and was granted (in May 1988) a New York State Pollution Discharge Elimination System (NYSPDES) permit to pump Well No.3 into the Susquehanna River. This pumping served as hydraulic protection to Well No. 1 from contaminants originating at the landfill. The Town also began studies leading to the purchase and installation later that year of an air stripper for emergency removal of TCE. The air stripper, with a maximum flow rate of 1,000 gpm, and designed to treat feed water with up to 100 ppb of TCE, was placed on line to treat water from the Town wells. Upon installation of the stripper, the discharge to the Susquehanna River was stopped. Well No. 3 then resumed pumping at half capacity. The raw water was processed through the air stripper into the Town's distribution system.

Gorick's ongoing noncompliance with NYSDEC regulations governing solid waste disposal facilities led in 1987 and 1988 to the installation, by the Town of Kirkwood, of 8 monitoring wells (designated as No. 20 and Nos. 31-37), between the landfill and the Town wells, as part of investigations designed to determine the effect of the landfill on groundwater quality. The installation of Wells No. 31-37 and the first round of sampling of all 8 of these wells was delayed due to difficulties in obtaining an easement from Gorick for the sampling. When finally collected and analyzed in August 1988, samples from Wells No. 35 and 36, at the toe of the landfill, showed concentrations of 88 and 430 ppb,

respectively, of TCE. Total VOC concentrations in these wells were 152 and 600 ppb, respectively.

In November 1988, Gorick was issued a cease-and-desist order to stop all activities at the landfill. Dumping was stopped, but the owner retained the right to enter the site to remove tanks and other objects on the landfill surface. This activity continues intermittently to the present.

In February 1989, based upon Gorick's August 1988 admission of paint dumping in the letter from his lawyer to NYSDEC, and on analyses of the samples taken from Wells No. 35 and 36, the site was reclassified to a "Class 2" inactive hazardous waste site, indicating that the disposal of hazardous waste at the site had been confirmed. Gorick replied to the State's requests for an RI work plan with one that was unacceptable to NYSDEC. In May 1989, therefore, the site was referred to the New York State Superfund for remediation, and in November 1989, URS Consultants was awarded the contract to perform the RI/FS for the site.

1.2.3 Previous Investigations

The results of all previous analyses for organic groundwater contamination, for which records could be obtained by URS, are summarized in Appendix L. The results were obtained from the files of NYSDEC; the Town of Kirkwood and its consulting engineer, Lake Engineering (since 1979); and BCDOH.

The earliest known investigation of the site was conducted by Vernon O. Shumaker, consulting engineer, in 1970. This investigation was initiated by the Town of Kirkwood as a part of its "Improvements to Water District No. 3" program. The results of this study, and an additional one by the same firm in 1973, were used in selecting the present location of the Kirkwood water wells.

In December 1981, as part of a demonstration of a proposed treatment process for removal of iron and manganese from groundwater (the Vyredox System), 5 observation wells (VO1 through VO5) were installed around Kirkwood Town Wells No. 1 and 2. These wells were then sampled for the presence of various contaminants. Three of these wells, VO1, VO3, and VO4, remain intact.

As a result of the above detections, the Town of Kirkwood instituted a program to monitor contamination of the Town well water (Ref. 6). Although no regular series of lab reports or formal summary of results exists at this time, those memos and reports that do exist indicate that VOC concentrations in Wells No. 1 and 2 have remained below 5 ppb (except when Well No. 3 was shut down, as noted below).

An investigation of the aquifer system that supplies water to the well fields in the Towns of Kirkwood and Conklin was conducted by USGS in 1983. A total of 19 observation wells were installed as a part of the investigation. Thirteen (13) of these wells were installed on or near the Gorick Landfill. Only 6 of these 13 wells (GS7, 10, 12, 13, 15A and 15B) remain (Figure 1-3). Well GS12 is intact but not safely accessible. It was partially buried by fill, then uncovered and surrounded by a 5-foot diameter concrete conduit. As new fill was placed around the conduit, additional sections were added, so that the well now exists at the bottom of a 15-foot deep manhole. Access to GS12 has been provided in the past by two iron rungs in the mouth of the manhole; these reach to about 10 feet above the bottom. Groundwater samples were collected and analyzed from wells G7, 10, 12, and 13 in 1986 and 1987 as part of an investigation by the Town and NYSDEC of the landfill's effect on groundwater in the area. Results of this sampling led, in November 1987, to the classification of the Gorick Landfill as a "suspected inactive hazardous waste site."

As concern for identifying the source of the contaminants in the Town wells grew, attention shifted to the American Pipe and Plastics factory. Investigations by NYSDEC of the AP&P discharge to the Susquehanna, which flows via the drainage stream between the landfill and the Town wells, occurred intermittently after 1983 when significant VOC contamination of the effluent (over 300 ppb total VOCs) was first detected. It was determined at that time that the source of the contamination was process equipment within the factory. Waters from this equipment have subsequently been both recycled within the factory and discharged to the local treatment plant. Effluent discharged to the Susquehanna is now restricted to non-contact cooling water. Analysis of the effluent since that time has shown low levels of TCE, DCE, and toluene. The current AP&P NYSPDES permit requires monitoring of flow, temperature, and pH only, not of VOCs.

In 1987 and 1988, the Town of Kirkwood contracted Lake Engineering of Binghamton, New York, to supervise the installation of 8 additional monitoring wells (No. 20 and Nos. 31 through 37). The wells were installed between the landfill and the Kirkwood well field at locations and depths chosen by NYSDEC to determine the effect of the landfill on the groundwater entering the wells. Four (4) of the monitoring wells (Nos. 31-34) were installed in a semicircle between the landfill and the well field. The remaining wells were installed along the toe of the landfill. These wells were sampled in August 1988. Wells No. 36 and 35 at the toe of the landfill showed total VOC concentrations of 600 ppb and 152 ppb, respectively, while Well No. 31, near the Town wells, showed a total VOC concentration of 146 ppb. These results led to the reclassification of the site to a Class 2 "known" inactive hazardous waste site, in February 1989. Code 6 NYCRR Part 375 defines a Class 2 site as "a site at which hazardous waste constitutes a significant threat to the environment."

In early 1988, the level of TCE detected in Town Well No. 3 rose from less than 8 ppb to 12 ppb. Since that level was greater than the

current MCL of 10 ppb allowed by NYSDOH, the Town notified its water customers and began a weekly monitoring program of TCE concentrations in Wells No. 1 and No. 3. Well No. 3 was taken off line when TCE levels reached 16 ppb, and was replaced with Well No. 1. TCE concentration in the output of Well No. 1, which previously had remained at 3 ppb or below, then rose to 8 ppb, suggesting that Well No. 3 had been providing hydraulic protection from contamination for Well No. 1. To continue to provide that protection, Well No. 3 was reactivated, but with its output directed to the Susquehanna River.

In February 1989, an air stripping column was installed at the water treatment plant (WTP) to remove TCE. Provision was made to pump from Well No. 3 to the WTP, and Well No. 1 became a backup well. However, since the WTP air stripper has a design capacity of only 1,000 gpm (currently operated at 1,200 gpm±), the Town lost available capacity. In order to replace that capacity, a new stripping column, designed for 2,000 gpm, is being installed to handle the output of Well No. 3. Upon startup of that unit, expected in the fourth quarter of 1991, the Town will again have a total capacity of 3,000 gpm. This will restore the flexibility that existed prior to the discovery of TCE in the wells.

Sampling and analysis for TCE in the influent and effluent to the Town's air stripper continues on a regular (bi-monthly) basis. Raw water from Well No. 3 has shown a decrease in TCE concentration to single-digit (ppb) levels since that time.

1.3 Report Organization

This RI report has been organized in a format consistent with Chapter 3 of USEPA's Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (USEPA Interim Final, October 1988). Appendices, as listed in the Table of Contents, are bound separately. The

following descriptions summarize each section of the report. Sections 1 through 7 are part of this report (Volume I).

- Section 1: Introduction; site description and history; previous investigations; report organization.
- Section 2: Description of the remedial investigation field activities.
- Section 3: Description of site, climate, demography, regional and site-specific hydrology, geology, and hydrogeology.
- Section 4: Nature and extent of contamination based on the results of the site investigation.
- Section 5: New York State Standards, Criteria, and Guidance Values (SCGs).
- Section 6: Baseline risk assessment, including both environmental and public health evaluation.
- Section 7: Summary and conclusions.

2. SUMMARY OF REMEDIAL INVESTIGATION FIELD ACTIVITIES

During the two phases of RI field activities at the Gorick Landfill site, the approved project plans were completed except where deviations were necessitated by site conditions. All significant deviations from protocol or the sampling program were approved in advance by the NYSDEC Project Manager or his representative. Applicable project plans developed by URS for this investigation include the Work Plan, Field Sampling Plan (FSP), Quality Assurance Project Plan (QAPP), Site-Specific Health and Safety Plan (HASP), and Addendum to the Project Management Work Plan. The field work for the first investigation phase of this project was performed from August through December 1990. The second phase of field activities was performed from June through July 1991.

2.1 Surveying and Mapping

A topographic map of the Gorick C&D Landfill was prepared for use as a base map during the RI/FS. The map was drawn to a scale of 1 inch equals 100 feet, with a contour interval of 2 feet. Mapping was performed using aerial photography with surveyed ground control. Field surveys were conducted to create a grid system for locational control during site investigation activities (particularly surface geophysical studies and air/soil screening), and to establish the exact locations and elevations of all groundwater monitoring wells and other field data points. Vertical control was set using the National Geodetic Vertical Datum of 1929, and horizontal control was referenced to the New York State Plane Coordinate System. Actual horizontal closure was 1:96,000 unadjusted, and primary vertical control was $\pm$0.05 feet (allowable closure error of 0.078 feet). All surveying was performed by URS under the supervision of a New York State-Licensed Land Surveyor.

2.2 Radiological and Air Survey

In August 1990, prior to the start of site activities, a survey for airborne volatile organic contaminants and surface radiation levels was performed by URS personnel at the site. The purpose of the survey was to assess the minimum level of personal protection required by workers on site, and to gather preliminary data on the extent of contamination.

Volatile organics concentrations were measured in the breathing zone (approximately 3 feet above the ground surface) and at ground level using a photoionization detector (HNu Model PI101). Radiation levels were measured at the same heights and locations using a Ludlum survey meter. Measurements were taken on a 100 x 100-foot grid over the site. No readings above background levels for VOCs or radiation were found at any point on site.

As part of the second phase investigation, all of the monitoring wells to be sampled were also monitored for levels of VOCs (using a PID), H_2S, and methane or explosive gases (using an explosimeter). This was done by immediately monitoring the air trapped in the well casing when the cap was first removed. Results are shown in Table 2-1. All levels were at background, except for 1 ppm volatiles recorded with the PID in wells 34 and 36. This indicates that the landfill does not appear to be generating much gas (methane) or volatiles, at least in the zone immediately above the water table which the shallow wells would best monitor.

2.3 Soil Gas Survey

A soil gas survey was performed during the period from September 11 through September 19, 1990, by a specialty subcontractor, Target Environmental Services, under the direction of URS. The results of the soil-gas survey are presented in Section 4.1.1. The report by Target Environmental Services is presented in Appendix A.

TABLE 2-1

GORICK LANDFILL
PHASE II
MONITORING WELL HEADSPACE DATA

LOCATION	PID (1)	H2S (1)	LEL (2)
MW-1S	0	0	0
MW-2S	0	0	0
MW-3S	0	0	0
MW-4S	0	0	0
MW-4I	0	0	0
MW-5S	0	0	0
MW-5I	0	0	0
MW-5D	0	0	0
MW-6S	0	0	0
MW-6I	0	0	0
MW-6D	0	0	0
MW-7S	0	0	0
MW-8S	0	0	0
MW-9S	0	0	0
MW-10S	0	0	0
MW-11S	0	0	0
MW-11I	0	0	0
MW-12S	0	0	0
MW-12D	0	0	0
MW-14I	0	0	0
MW-14D	0	0	0
MW-31	0	0	0
MW-32	0	0	0
MW-33	0	0	0
MW-34	1.0	0	0
MW-35	0	0	0
MW-36	1.0	0	0
Vent holes S of MW-9 & MW-10	*	0	0

* - There was some slow HNU response at some vent holes indicating moisture interference.

(1)- All concentrations are expressed in ppm.

(2)- Concentrations expressed in percent of the lower explosive limit.

Samples of soil gas were collected and analyzed for VOCs. The purpose of the survey was to help delineate any organic contamination in the groundwater beneath the site (since portions of the VOCs in contaminated groundwater should volatilize into the soil air above the groundwater, and thus be detectable in soil gas samples) and to assist in optimizing the location for soil borings and monitoring wells placed to monitor for contaminants.

Samples of soil gas were collected from the soil at a depth of 2 to 5 feet, depending upon the depth to which the steel drive rod could penetrate. Five-foot depths were planned, but were not always possible due to buried debris. Once the hole had been made with the drive rod, the sampling probe was inserted to the full depth of the hole and sealed from the atmosphere with putty. One volume of air was removed from the system to eliminate ambient air from the sample, then a second volume, consisting of the soil gas, was withdrawn from the hole and placed in a self-sealing vial by injecting the sample through the rubberized cap. Samples were then analyzed in the field trailer or in Target's Maryland laboratory using a Photovac 10-S-70 gas chromatograph equipped with a photoionization detector. These instruments were calibrated three times daily for TCE, trans-1,2-dichloroethene, benzene, toluene, m- and p-xylene, and o-xylene.

The sampling locations were chosen in a two-stage process. Initially, the framework of a 100 x 100-foot grid was laid out over the site by URS surveyors. Target then located and sampled every second point on the proposed grid for a total of 69 sample points. This scheme was used at the suggestion of NYSDEC to reduce the number of locations for sampling. Upon receiving the results of this sampling, additional sampling locations were chosen to surround the points at which VOCs had been detected. Additionally, all points in the 100 by 100-foot grid between the toe of the landfill and the Susquehanna River, or the Kirkwood well field, were sampled to attempt to delineate any VOCs flowing from

beneath the landfill. This second stage consisted of 27 additional points. Thus, a total of 96 locations were sampled.

2.4 Geophysical Survey

A geophysical survey was performed on September 12, 1990, by Weston Geophysical Corporation, under supervision of URS. The results of the survey are presented in Section 3.7.3. The report issued by Weston Geophysical is included as Appendix B.

The survey was performed to delineate the edge of fill on the eastern side of the property where it was only imprecisely known from surface topography. The survey used seismic refraction profiling and terrain conductivity data to locate structural changes in the subsurface. These changes may be interpreted to indicate boundaries between fill and native materials.

Three geophysical traverses were laid out by URS approximately perpendicular to the assumed landfill boundary. The traverses varied in length from 250 to 400 feet. Seismic refraction profiling was performed along these traverses using a Betsy "seisgun" to generate shock waves (seismic energy). A series of 24-channel geophones was laid along each traverse with spacings of 10 or 20 feet. These were then connected to a digital seismic data-acquisition system (designed and manufactured by Weston Geophysical) to record the shockwaves as they travelled through the ground. Various characteristics of the recorded seismic waves are interpreted to yield information about the structure of the ground through which they have travelled. Of greatest importance to the interpretation is the speed with which each type of wave arrives at each geophone. This velocity has been shown to be positively related to the density of the material through which the wave travels.

Terrain conductivity data were also acquired along each traverse to supplement the seismic refraction data. The conductivity measurements were made with a Geonics EM-31 terrain conductivity meter. This instrument senses the electrical conductivity of the ground, which may be interpreted to indicate subsurface conditions.

The combination of the two subsurface investigation methods makes possible a more confident assessment of subsurface conditions than either method alone.

2.5 Subsurface Drilling Program/Monitoring Well Installation

2.5.1 Phase I

Soil borings and monitoring wells were constructed at the site during the first phase of the RI to directly evaluate subsurface conditions. Conditions evaluated include: stratigraphy, physical and chemical soil properties, hydrogeologic properties, groundwater flow direction and magnitude, and groundwater quality. Twenty (20) borings were advanced at 13 locations. Fourteen (14) of these borings were completed as stainless-steel monitoring wells. Shallow monitoring wells were installed at 10 locations: 2 in assumed upgradient locations, 4 downgradient, and 4 within the landfill itself. Intermediate-depth monitoring wells were installed at 3 downgradient locations, and a deep monitoring well at one downgradient location. The intermediate and deep monitoring wells were "nested" with shallow wells at each location where they were installed. Due to encountering zones where groundwater was insufficient to install monitoring wells, 3 additional boreholes (B-3A, B-10A, and B-11) were drilled, and then abandoned and grouted. Boring logs for these borings may be found in Appendix C. Drilling difficulties (e.g., obstructions which could not be drilled through [MW-7S and MW-9S], or flooding [MW-5I]) forced the abandonment and relocation (by approximately 10 to 20 feet) of three additional boreholes. These

attempts were not included in Appendix C, since they were superseded by the successful borings at the respective locations. All logged borings and well locations are shown in Figures 1-3 and 1-4.

All borings and monitoring wells were installed in accordance with the procedures specified in the FSP and QAPP, except where field conditions necessitated alternative measures.

To make possible continuous sampling within the deep boring (MW-5D), 4-inch spin casing was used in place of hollow-stem augering for the last 10 feet of borehole advancement. [This helped to control the heaving sands which were causing great difficulties while using the hollow-stem augers.] This monitoring well was set through the spin casing after an attempt was made, unsuccessfully, to drill to the planned well depth with hollow-stem augers. In addition, due to difficulties in pumping the originally planned "Pure Gold" bentonite slurry with the equipment provided when it was mixed to manufacturer's specifications, a pure bentonite slurry was used in place of the "Pure Gold" slurry after the first two wells (MW-7S and MW-1S) were installed.

Monitoring well MW-7S was originally intended to be a sidegradient or downgradient well situated in natural material north of the fill. However, this boring penetrated 13 feet of fill before encountering natural materials. Therefore, this well was placed beneath fill. It was determined, that, contrary to what was initially believed, fill extends all the way (or very near) to the northern property line of the site.

The remaining three wells located in fill (MW-8S, MW-9S and MW-10S) were located for the following reasons: MW-8S was placed adjacent to soil gas survey point No. 92, where 1.2 ppb TCE had been detected (Appendix A); MW-9S was installed approximately midway between USGS Well No. 12 and Lake Engineering wells No. 35 and 36 (all three of which had been found to contain elevated levels of TCE and other volatile organic compounds in

samples collected in 1987 and 1988); and MW-10S was initially placed east of its ultimate location to obtain the widest distribution of wells on the fill surface. MW-10S, however, ultimately had to be moved west of its proposed location due to the presence of a till ridge encountered at shallow depth during the boring at the initial location. [See Section 3.7.4.] The fill here was only 4 feet thick and no water-bearing materials were found above the till. This first borehole was grouted closed and is now labelled B-10A.

Wells MW-1S and MW-2S were intended to be upgradient wells. Originally planned to be located on site, as close to the railroad tracks as practicable, the location of MW-1S was moved, after consultation with NYSDEC, to the east of Route 11 on the lawn of the Kirkwood Manor Apartments. This location change was made because it was feared that the railroad might have unduly altered the groundwater chemistry, and that the initially planned location would not represent true upgradient conditions. However, at the new MW-1S location, only 6 inches of water-bearing material was encountered. Again, after consultation between NYSDEC and URS, it was decided to install a well at this location. MW-2S was placed, as originally intended, adjacent to the Town's water treatment plant. Approximately 2 feet of saturated material was found at this location.

The location of MW-3S was moved when a till ridge, similar to that later found at the initial location of MW-10S (see above), was encountered at the planned location. This first borehole was advanced to 46 feet below grade and no significant water-bearing materials were found. It was then labelled B-3A and the hole was grouted closed.

Well cluster MW-4 was located approximately midway between Well No. 37 and the cluster of Wells No. 35 and 36 (Figure 1-3). This well cluster was intended to provide an effective screening for any contaminant plume leaving the main section of the landfill and travelling towards the Kirkwood Town wells.

Well clusters MW-5 and MW-6 are located along the toe of the landfill between the landfill and the Susquehanna River to provide additional contaminant plume delineation and groundwater elevation measurements. MW-5 was located adjacent to soil-gas survey point No. 79, where 2.1 ppb of toluene had been detected (Appendix A).

In an attempt to locate a productive and representative upgradient well location (due to the problems associated with MW-1S, above), one final boring, B-11, was advanced. This hole was bored at the eastern property boundary, close to the railroad tracks, but in undisturbed material. Unfortunately, no water-bearing formation was encountered here to a depth of 22 feet, so the boring was abandoned.

Continuous split-spoon samples were taken to the maximum depth of drilling at each location. Soil samples from the split-spoons were examined, described, and classified by the URS Geologist in accordance with procedures described in the FSP. Subsequent borings at locations where nested wells were installed (e.g., MW-5I and MW-5S) were not split-spoon sampled. After installation, each of the monitoring wells was developed by bailing or pumping (with a peristaltic, inertial, and/or centrifugal pump) and surging. The wells were considered developed when the groundwater indicator parameters of pH, specific conductance, and temperature had stabilized, and consistent turbidity readings of less than 50 NTUs had been achieved. Attaining consistent turbidity values of less than 50 NTUs was not possible for wells MW-1S, MW-2S, MW-4S, MW-4I, and MW-5D, even after extended development (up to 700 gallons each from several of them). Therefore, after NYSDEC concurrence was obtained for each well, further development was halted when it was deemed possible to obtain a sufficiently clear sample for metals and VOC analysis. The data generated from the drilling program are included as Appendix C (soil boring logs), Appendix D (monitoring well installation reports), Appendix E (well development logs), and Appendix F (well locations and elevations).

In addition to these new wells, existing wells (see Section 1.2) were used where possible. The remaining Vyredox wells (VO1, VO3, and VO4), USGS wells (GS7, 10, 12, 13, 15A, and 15B) and the 8 monitoring wells installed by the Town of Kirkwood (20 and 31 through 37) were used during this RI for taking of water levels (to determine flow). Plus, those wells with locking caps were sampled for water quality (Kirkwood Wells 31-36).

2.5.2 Phase II

During the second phase of field activities, 7 additional groundwater monitoring wells and 3 water table piezometers were installed to allow further evaluation of subsurface conditions and water quality beneath and near the site. The 7 monitoring wells consisted of a shallow and deep nested pair south of the site (No. 12), a shallow and intermediate nested pair north of the site (No. 11), a deep well added to the existing MW-6 cluster, and an intermediate and deep nested pair on the opposite (west) side of the Susquehanna River from the landfill (No. 14). Two piezometers were installed by themselves on the site, both upgradient of the landfill area. The third piezometer was installed with the nested well pair across the river (see Figure 1-3).

Monitoring well MW-6D was added to the MW-6I, -6S cluster. This well was installed to monitor for deep migration of contaminants towards the Susquehanna River from the site, similar to the function of MW-5D. A till packer test was conducted at the bottom of the borehole, in an attempt to determine the hydraulic conductivity of the till, to aid in determining its competence as a confining layer against downward movement of contaminants. The till packer test involved the positioning and inflation of a packer (inflatable bladder) within the till unit. The inflation of the packer within the borehole serves to segregate the till from the overlying sand and gravel aquifer, in order to accurately test the hydraulic conductivity of the till unit. After the packer is inflated, a metered amount of water is pumped down the borehole and into

the till unit through the packer over a measured time interval. Results of the packer test are discussed in Section 3.8.5. Similarly to the Phase I drilling of MW-5D, 4-inch spin casing had to be used from 20 feet to the bottom of MW-6D's borehole to control severe sand blow-in (heaving). The well was then set through the spin casing.

MW-11S and MW-11I were installed to provide additional groundwater flow information, and to monitor for shallow and intermediate groundwater contamination to the north of the site, in an attempt to bound the contaminant plume to the north. The location of this pair was originally planned to be more to the east, just behind the Link Warehouse, but was moved approximately 100 feet to the west due to difficulties in gaining access to the Link property.

MW-12S and MW-12D were installed to provide additional groundwater flow information and water quality data to the south of the site; and yet downgradient of the AP&P plant. This well pair was intended as an attempt to bound the contaminant plume south of the landfill.

MW-14I and MW-14D were installed to provide monitoring points across the Susquehanna River in the intermediate and deep aquifer zones, in order to determine if landfill contaminants cross under the river towards the Conklin municipal well in response to pumping. Piezometer P-14S was nested with the MW-14 wells to monitor the relationship between the water table and river level to help show whether flow is always toward the river from the Conklin side, or whether it sometimes reverses towards the Conklin municipal well under the influence of heavy pumping.

Piezometer P-13S was originally planned to be located off site to the northeast along the railroad tracks to monitor the water table configuration northeast of the landfill. However, since access was not possible for the original location, the location of P-13S was moved southeast approximately 200 feet to just inside the site boundary near the

northeast corner of the landfill. This location provides necessary information on the water table configuration in the area of the northeast corner of the site.

Piezometer P-15S was installed on site in the till material, near the eastern edge of the landfill, to monitor the water level east of the landfill within the till. This location was selected to provide a better transitional measurement of water elevation near the east side of the landfill. [Only MW-1S and MW-2S, which have water elevations much higher than the remaining wells, were located east of the landfill previously.) P-15S was installed during the test trenching program. A 2-inch PVC screen (10 feet in length) and riser were set in the open excavation of trench No. 1. [See log of TP-1 in Appendix Q.] The trench was then backfilled around the piezometer with a backhoe, using the material that had been excavated from the trench.

Continuous split-spoon samples were taken to the maximum depth of drilling for each nested group. MW-6D was only sampled below the maximum depth of MW-6I, since it had been sampled and logged during Phase I. However, continuous sampling below MW-6I's depth was not possible in this borehole due to severe sand blow-in. In this instance, examination of drill cuttings and rate of drilling were used to complete the boring log where a suitable split-spoon sample could not be obtained. Soil samples from the split-spoons were examined, described, and classified by the URS geologist in accordance with the procedure described in the FSP.

After installation, each of the monitoring wells was developed by pumping and surging and/or hand bailing. Wells were considered developed when the groundwater indicator parameters of pH, specific conductance, and temperature had stabilized, and turbidity readings of less than 50 NTUs were achieved. Attaining consistent turbidity values of less than 50 NTUs was not possible for MW-14D, MW-12D, and MW-6D, even after extended development. Therefore, with NYSDEC concurrence, development of these

wells was stopped after removal of 700 gallons of water. The data generated from the second phase of the drilling program are included in Appendix C (soil boring logs), Appendix D (monitoring well installation reports), Appendix E (well development logs), and Appendix F (well locations and elevations), along with the data from the first phase.

2.6 Geotechnical Sampling

As part of the field investigation, representative soil samples were obtained for geotechnical analysis. The sample locations and analyses performed are outlined in Table 3-3. All sampling was done in accordance with the URS Work Plan (July 1990) and the URS Addendum to the Project Management Work Plan (May 1991). The laboratory analyses were performed by Empire Soils Investigations, Inc. The results of these analyses are presented in Appendix I.

During the first phase of the investigation a total of 15 geotechnical samples were collected from selected boreholes at varying depths in order to determine various physical properties of the materials encountered during the drilling program (i.e., grain size distribution, moisture content, and Atterberg limits). Factors governing sample selection were: changes in material type; screened interval of monitoring wells; and the geographic distribution of the borings. Due to the granular nature and lack of cohesiveness of most materials encountered during drilling, no undisturbed (Shelby tube) sample could be collected. A Shelby tube sample was attempted in the till unit at location B-11, but due to the high gravel content of this unit the sampler was distorted, resulting in an unusable sample. Similar attempts were also made during the second phase of the investigation at locations MW-6D, MW-12D, and P-13, but with the same result.

The main goal of the second phase geotechnical sampling was to evaluate the hydraulic conductivity of the till unit. However, since an

undisturbed sample of the till could not be obtained with Shelby tubes, a split-spoon sample was acquired at P-13 and subjected to laboratory permeability testing. The results of these tests are discussed in Section 3.8.5. Additional grain size analysis was conducted on several till samples, and results are included in Table 3-3.

2.7 Hydraulic Conductivity Testing

Hydraulic conductivity testing of water-bearing formations beneath the Gorick Landfill consisted of slug-testing the monitoring wells installed at the site. Slug-testing is performed by dropping a stainless-steel "slug" (a bar on a cord) into the well to displace the water column upwards by the volume of the slug, and electronically monitoring the return of water to static conditions over time. Monitoring is done with a pressure transducer to give a graph of water level versus time. This rate of return to static water level is directly proportional to the hydraulic conductivity of the formation screened. A second slug test is performed when the slug is pulled out of the well, now depressing the water level in the well relative to the static level. Again, the rate of return to static water level is monitored with the pressure transducer. The second test is used as a check on the first.

The aquifer, or water-bearing formation, in which all monitoring wells at the Gorick Landfill are screened is unconfined. Therefore, all slug test results were interpreted using the Bouwer and Rice method for unconfined or leaky confined aquifers (1976). The method is valid for wells that fully or partially penetrate such an aquifer. The results of the slug tests are given in Appendix H and discussed in Section 3.8.4.

In-situ permeability testing (packer test) was performed in the till at the bottom of the MW-6D borehole. Results of the packer test are discussed in Section 3.8.5.

2.8 Test Pitting/Trenching

Soil borings made within the fill area during the first phase of the RI provided insufficient information concerning the nature and depth of waste material disposed of at the site, particularly as concerns the source of VOC contaminants in the groundwater beneath the landfill. Therefore, test pits/trenches were excavated during the second phase in an effort to more accurately characterize the fill material, check for the presence of hazardous waste, and determine fill depth.

It was planned to excavate 3-5 pits in each of three areas at the site. Two of these areas are in the fill (upper and lower plateaus) and the third area was just east of the fill, downgradient of the railroad near the center of the eastern boundary of the site, where approximately 20 rusted storage tanks are lying on the ground. Some of these tanks have had their ends cut open or removed. During the second-phase field work, however, time allowed for the number of test pits and area covered to be expanded from what had been planned. Twenty eight (28) test pits/trenches were dug using a CAT-215 (or CAT-225) backhoe. Figure 2-1 shows the approximate locations of the test pits and trenches.

The actual test pit/trench locations were primarily selected by the NYSDEC onsite representative. The test pits were dug down either to the water table, the natural material, or to the full reach of the backhoe (approximately 21 feet for the 215, and 23 feet for the 225), whichever was reached first. Each test pit was logged by a URS geologist for stratigraphic and waste characterization purposes. In order to protect the workers and to monitor for contaminants, constant volatile organics screening was performed with a PID (HNu) during excavation.

The pits/trenches were monitored closely while excavating for visible evidence of contamination. Where either visible contamination or elevated PID readings were detected, samples were taken for volatile

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LEGEND

- TEST PIT/ TRENCH

NOTES:

1. MAPPING BASE IS FROM AERIAL PHOTOGRAPHY DATED APRIL 1, 1990 AND COMPILED BY LOCKWOOD MAPPING, ROCHESTER, NEW YORK.
2. PROPERTY LINES SHOWN ARE APPROXIMATE, FOR REFERENCE ONLY, AND SHOULD NOT BE USED FOR CONVEYANCE OF REAL PROPERTY. PROPERTY LINES WERE INTERPOLATED FROM A TAX MAP PREPARED BY BROOME COUNTY, NEW YORK.

TEST TRENCH LOCATIONS

URS CONSULTANTS, INC.

FIGURE 2-1

CC-2230

organics analysis. Three (3) waste samples were collected during the trenching program. One groundwater sample was also collected from a sand seam within the till materials, downgradient of the tank area, during excavation of the trench in this area. This sample was taken to determine whether any volatiles contamination could be found in the groundwater immediately downgradient of the tank area. Samples collected during the trenching program are discussed in Section 2.10.

During the course of the trenching program, 4 partially full or full drums were encountered. They were overpacked into 5 containers (since one drum split), labeled according to which trench they had been removed from, and staged on site in the compound next to the decontamination pad area for eventual disposal.

All material removed from each test pit/trench, except the drums above, was backfilled into the test pit/trench as soon as the excavation and screening of the pit/trench was completed.

2.9 Habitat-Based Assessment

An assessment of the landfill vicinity as habitat for flora and fauna was performed during field activities in accordance with Step 1 of the Division Technical and Administrative Guidance Document for Conducting Environmental Risk Assessment at Hazardous Waste Sites (NYSDEC, December 28, 1989) (Ref. 19). Results of this assessment are presented in Section 3.5.

The purpose of the Habitat-Based Assessment is to identify potential impacts of the landfill on non-human populations in the area. Step 1 of this process includes identification of ecological communities and cover-types within a one-half mile radius of the landfill, and characterization of the area as habitat for fish and wildlife species. Special resources,

including wetlands, critical habitats, and endangered or threatened species must also be identified.

2.10 Environmental Sampling

The purpose of the environmental sampling program is to produce a data base adequate to characterize the site and to assist in the evaluation of its current impact upon public health and the environment. To produce this data base, a number of environmental samples of the various materials potentially affected were collected. These included surface water, groundwater, soil, and sediments. Leachate and associated waste samples were also obtained from two locations. The samples are detailed below according to sampled media. Descriptions and other information pertaining to the samples are presented in Appendix J. All environmental sampling locations are shown in Figure 2-2.

(a) Soils: A total of 11 soil samples were collected during the first phase, and 3 additional soil samples were collected during second-phase activities.

Six (6) subsurface soil boring samples collected during the first phase were submitted for chemical analysis. They were collected from the 6 soil boring locations (i.e., well cluster locations) that were located outside of the fill area. The samples were selected at each location based on organic vapor analysis (using the PID) and visual screening by the URS geologist. The samples were obtained using split-spoon samplers. Two of the locations (MW-1S and MW-2S) are upgradient of the landfill, and the remaining four locations (MW-3, 4, 5, and 6) are downgradient.

Five (5) shallow probe soil (SPS) samples collected during the first phase were submitted for chemical analysis. Each was

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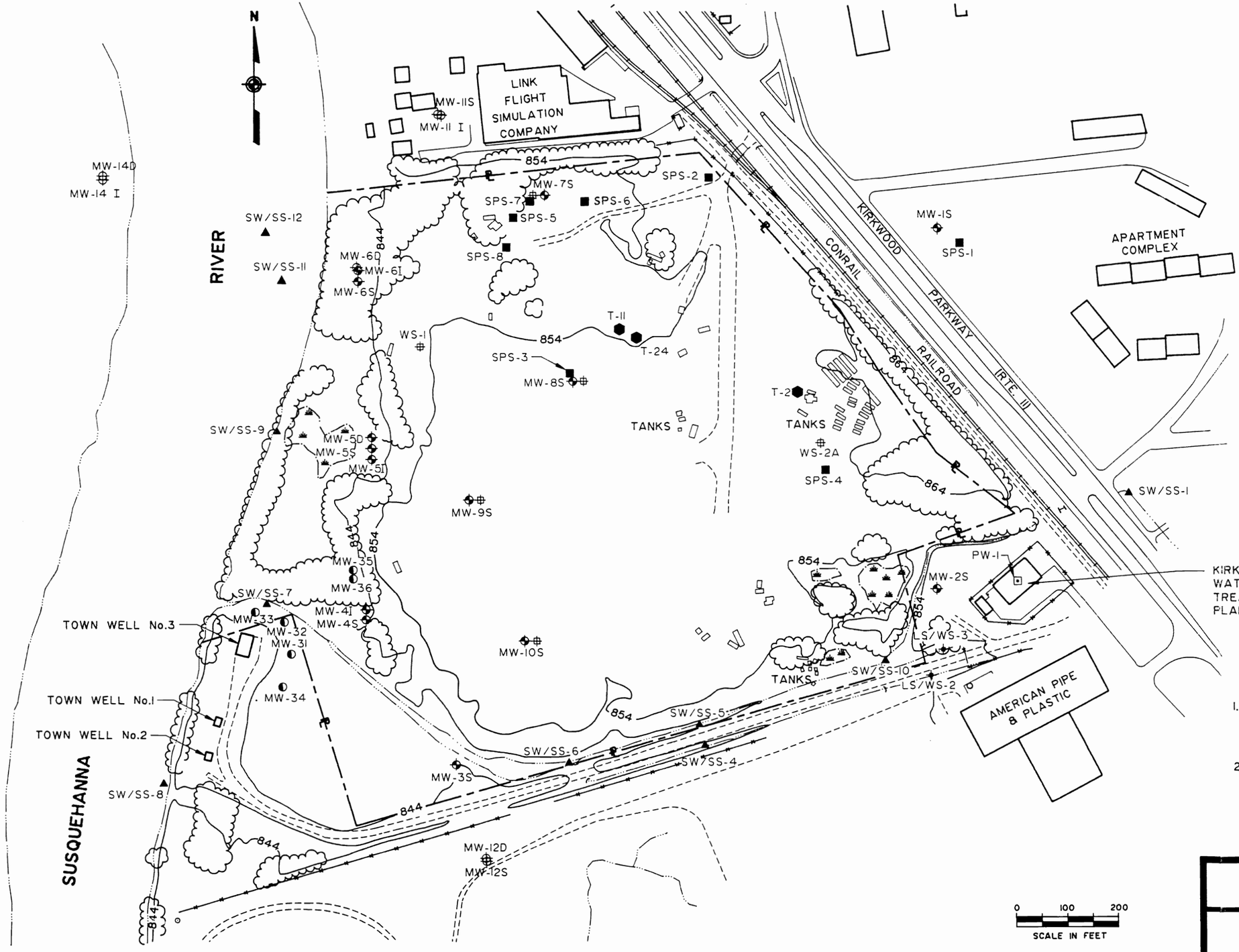

LEGEND

- MONITORING WELL; INSTALLED BY URS ALSO SOIL BORING SAMPLE LOCATION, EXCEPT AT MW-7S, MW-8S, MW-9S AND MW-10S WHERE WASTE SAMPLES WERE COLLECTED (1990)
- MONITORING WELL; INSTALLED BY URS (1991)
- EXISTING MONITORING WELL INSTALLED BY LAKE ENGINEERING
- SURFACE WATER AND STREAM SEDIMENT SAMPLE
- WASTE SAMPLE
- LEACHATE SEEP SAMPLE AND WASTE SAMPLE
- SHALLOW PROBE SOIL SAMPLE
- POTABLE WATER SAMPLE
- TEST PIT / TRENCH

NOTES:

1. MAPPING BASE IS FROM AERIAL PHOTOGRAPHY DATED APRIL 1, 1990 AND COMPILED BY LOCKWOOD MAPPING, ROCHESTER, NEW YORK.
2. PROPERTY LINES SHOWN ARE APPROXIMATE, FOR REFERENCE ONLY, AND SHOULD NOT BE USED FOR CONVEYANCE OF REAL PROPERTY. PROPERTY LINES WERE INTERPOLATED FROM A TAX MAP PREPARED BY BROOME COUNTY, NEW YORK.

ENVIRONMENTAL SAMPLING LOCATIONS

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FIGURE 2-2

CC-2030A

collected with a precleaned stainless-steel bucket auger. Material was collected from the surface to a maximum depth of 10 inches. Three of the locations were selected based on elevated soil gas measurements. The fourth location was at the landfill entrance (for health risk assessment purposes). The fifth location (SPS-1) was intended to represent background soil conditions, unimpacted by the landfill.

An additional 3 shallow probe soil (SPS) samples were submitted for chemical analysis during the second-phase investigation. The locations of SPS-6, SPS-7 and SPS-8, all in the vicinity of MW-7S and the first-phase sampling point SPS-5, were selected during the second-phase field work by the NYSDEC onsite representative in preference to the planned locations (in the Second Phase Work Plan) near the tank area (SPS-6), in the southern portion of the fill area (SPS-7), and in the vicinity of the apartment complex across Route 11, east of the site (SPS-8). The new locations were selected by NYSDEC based on a recommendation from NYSDOH, since SPS-5 had shown the greatest contamination (primarily with polyaromatic hydrocarbons) of the first-phase shallow probe soil samples. There had also been a soil gas hit for TCE in that area. At the instruction of NYSDEC, analysis of these samples was changed to TCL volatiles and semivolatiles only, rather than the more extensive full TCL analysis scheduled in the Work Plan.

(b) Leachate: Two leachate samples were collected during the first phase of this investigation and submitted for chemical analysis. Waste samples (in this case the material in the seep area through which the leachate is flowing) were also taken at each of these seep locations. [These two sample pairs, LS/WS-2 and LS/WS-3, were numbered in sequence with

surface water/stream sediment sample pairs, as replacements for samples SW/SS-2 and SW/SS-3, which were not taken.] Because of the locations of these samples on tributaries to the drainage stream, they are actually indicative of background conditions of the stream (Figure 2-2).

(c) Waste: Eight (8) waste samples were collected during the first-phase investigation. Four (4) of these samples were collected as a composite of the fill material in each of 4 individual borings through the fill material. These borings were completed as monitoring wells (MW-7S, MW-8S, MW-9S, and MW-10S). Two (2) samples were collected from the surface of the landfill in areas of elevated PID readings or surface discoloration (WS-1 and WS-2A). The remaining 2 samples (WS-2, WS-3) were taken in conjunction with the leachate seep samples, and are not actually samples of landfill waste. [See Section (b) above.]

Only 7 of the 8 samples were considered as waste when collected. The boring sample from MW-7S was collected and submitted for chemical analysis as a soil sample. It was subsequently included with waste samples in Table 4-3 (Section 4.2) after receipt of the analytical results, which confirmed the boring log classification of the material as waste. For this reason, waste indicator parameters (e.g., corrosivity and ignitability) were neither requested nor obtained for this sample.

Three (3) additional waste samples were submitted for volatile analysis during the second round investigation. These samples were collected during the trenching program, from two test pits northwest of MW-8S. Three waste samples were taken from test pit #11 (TP11). One of these, TP2-11-1, was analyzed for

Target Compound List volatiles (TCL VOCs). The other, TP2-11-2, taken from resin traces found in TP11 was analyzed for toxicity characteristic leaching procedure volatiles (TCLP VOCs). The third was composited from three drums from TP11 and suspected of containing grease. It was analyzed using infrared spectroscopy to confirm that these drums contained grease. A fourth sample, TP2-24-1, was taken from a drum found in TP24. This sample was analyzed for TCL VOCs.

Fewer waste samples were collected than had been outlined in the second-phase work plan because these were the only areas of obvious contamination or elevated PID readings that were discovered during the trenching activities.

(d) Surface Water/Stream Sediments: Surface water and stream sediments were collected at 8 locations adjacent to the Gorick Landfill during the first phase. Two (2) of the samples were from the banks of the Susquehanna River: SW/SS-8 was upstream of the site, and SW/SS-9 was located midway along the site, opposite well cluster MW-5. The remaining samples, SW/SS-10, SW/SS-6 and SW/SS-7, were taken at various locations along the drainage stream and its tributaries. Samples SW/SS-4 and LS/WS-2 (not included in these 8 samples) were collected on the AP&P effluent stream. SW/SS-1 was collected on the drainage stream across Route 11 from the site. LS/WS-3 (not included in these 8 samples) was collected in the drainage swale from the storm drain around the Kirkwood Water Treatment Plant. The locations of these 4 sample pairs make them representative of conditions upstream of the landfill. The sediment samples were taken at the same locations as the surface water samples. All first-phase surface water/sediment samples were analyzed for the full TCL list of parameters.

During the second phase of the investigation, 3 additional surface water/stream sediment samples were collected, but for VOC analysis only. One was a resample of first-round location SW/SS-8. The other two, SW/SS-11 and SW/SS-12, were taken downstream of the landfill to evaluate the quantity of volatile contaminants reaching the river from the landfill.

(e) Groundwater: Groundwater samples from 20 monitoring wells were collected and submitted for full TCL chemical analysis during the first phase. These wells include the 14 first-phase monitoring wells installed by URS, and six (6) existing monitoring wells (Nos. 31 - 36, Lake Engineering series). Town of Kirkwood Well No. 3 was also sampled (Sample ID: GL-PW-1), but analyzed for TCL volatile organics only.

Groundwater sampling during the second phase included a resampling of all wells sampled in the first phase, and initial sampling of the 7 monitoring wells installed during the second phase. Second-phase groundwater samples were analyzed for TCL volatiles only, except for MW-4S and MW-4I, which were also analyzed for total phenols. [Elevated phenol levels had been detected in these 2 wells in the first round of sampling.]

All laboratory analyses were performed according to the latest Analytical Services Protocol (ASP), by IEA Laboratories of Monroe, Connecticut, certified by NYSDOH under its Environmental Laboratory Approval Program (ELAP). All quality assurance/quality control (QA/QC) procedures specified in the QAPP (URS, July 1990) were followed. All data were subjected to a rigorous QA review by URS before acceptance (Appendix R). Environmental sample descriptions are given in Appendix J. Analytical data are presented in Tables 4-1 through 4-7.

3. PHYSICAL CHARACTERISTICS OF THE STUDY AREA

3.1 Physiographic Setting and Surface Drainage

The Gorick Landfill is located within the Susquehanna River Valley of the Appalachian Plateau, a glaciated plateau (in this region) of moderate relief. The glaciation has produced a landscape of well rounded, rolling hills. Elevations range from 1,600 feet above mean sea level (msl) on the hilltops along the river to 840 feet msl on the valley floor, which is typically broad and flat.

A portion of the Gorick Landfill is located within the 100-year floodplain of the Susquehanna River. In this vicinity the 100-year flood plain is the area below an elevation of 853 to 854 feet msl (Ref. 27). The approximate boundaries of the floodplain for the site are illustrated in Figure 1-2. Drainage from the highlands east of the site to the Susquehanna River is handled by Park Creek to the north of the landfill and by a drainage ditch on the south side of the landfill. This southern drainage ditch is an unnamed natural, intermittent stream rerouted during the excavation of sand and gravel that predated the landfill activities at the site. The drainage ditch also receives discharge water from the American Pipe and Plastics factory, as well as from the storm drains around the Kirkwood Water Treatment Plant, making the stream nearly perennial below this point.

3.2 Climate

Information on the climate of the Kirkwood/Binghamton area was obtained from the National Oceanic and Atmospheric Administration report (Ref. 14) for the Edwin A. Link Field (the local municipal airport), 10 miles north-northwest of, and 700 feet higher in elevation than Binghamton. This airport, lying approximately 12 miles from the site, is the nearest reporting weather station to the landfill. Climatological

data for the period of 1950 to 1989, including monthly mean values for precipitation, temperature, windspeed, and wind direction, are presented in Table 3-1.

According to the NOAA report: "Most of the precipitation in the Binghamton area derives from moisture laden air transported from the Gulf of Mexico and cyclonic systems moving northward along the Atlantic Coast. The annual rainfall is rather evenly distributed over the year... and comes mostly in the form of thunderstorms. Annual snowfall is around 50 inches in Binghamton. Most of the snow falls during the normal winter months. The area is subject to much cloudiness and winter snow flurries. Furthermore, the combination of a valley location and surrounding hills produces numerous advection fogs which also reduce the amount of sunshine received." A completed tabulation of normal, mean, and extreme values of climatologic data is presented in Appendix M.

3.3 Demography and Land Use

The Town of Kirkwood has changed in the past 50 years from a rural, agricultural community to a more suburban, industrial one. Areal photography from the 1930s to the 1950s shows the majority of the land near the landfill site to be cultivated. Today, there is no cropland in the area. Several large industries (IBM, Link Flight Simulation, Frito-Lay, Endicott-Johnson Shoes, American Pipe and Plastics) are among the major employers in the area.

Housing in Kirkwood comprises a mix of apartment complexes, subdivisions, and single-family home development. The population of the town has increased only marginally (7%) in the past 20 years from 5,687 in 1970 to 6,096 in 1990. The majority of the residents are middle income. There is no evidence of any major new development occurring in the area.

TABLE 3-1

MONTHLY MEAN CLIMATIC DATA

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Precipitation (in)	2.54	2.33	2.94	3.07	3.19	3.60	3.48	3.35	3.32	3.00	3.04	2.92	36.78
Temperature (°F)	21.2	22.4	31.4	44.3	55.2	64.3	68.9	67.2	59.8	49.1	37.9	26.2	45.7
Wind Speed (mph)	11.6	11.6	11.8	11.5	10.1	9.3	8.4	8.3	8.8	9.8	10.9	11.3	10.3
Wind Direction	WSW	SSE	NW	WNW	NNW	NNW	WSW	SSW	SSW	WSW	NNW	WSW	WSW

Source: National Oceanic and Atmospheric Administration (1989)

Two major highways, U.S. Interstate 81 and N.Y. Route 17, join in the Binghamton area. They lie less than one mile east of the site.

Most commercial development has occurred in the portion of the town north of the site. Automobile-related businesses, restaurants, hotels, etc. have developed along the two miles of Route 11 between the City of Binghamton and the site. The large industries exist on private tracts scattered off the arterial and collector highways. To the south of the landfill, the land is much less developed, with an abundance of single-family homes and open fields.

3.4 Soils

Soils found in and around the Gorick Landfill were formed in glacial material deposited during the Pleistocene glaciation. This material consists of stratified and unstratified glacial drift. In addition to these glacial deposits, recent flood plain deposits of silt and fine sand exist along the western edge of the landfill.

The United States Department of Agriculture Soil Conservation Service (USDA SCS) has mapped four different soil series at the site (Ref. 2). They are as follows:

Chenango gravelly loam, 5-15% slope
Howard gravelly loam, 5-15% slope
Middlebury silt loam, 0-5% slope
Tioga silt loam, 0-5% slope

The Chenango and Howard series consists of deep, well drained, medium-textured gravelly soils. These soils are extensive on valley floors and terraces and form a complex in the area. As reported in the Soil Survey for Broome County, these soils are classified as GC, GM, or GW using the Unified Soil Classification System (USCS). These soils may be

found on the eastern edge of the landfill. The soils of this group are the principal source of sand and gravel for Broome County.

The Middlebury silt loam series consists of deep, moderately well drained silty soils formed in alluvium. These soils are on floodplains of rivers and smaller streams throughout the county and generally are flooded annually. The USCS classification for this series is ML.

The Tioga silt loam series consists of deep, well-drained, medium-textured soils that formed in recent deposits on floodplains. The soils are considered a good source of topsoil in the county. The USCS classification of this soil is ML. This group may be found in the vicinity of the Kirkwood well field and MW-3S. The Tioga and Middlebury series are within the same soil category, with the Middlebury representing the wetter sequence. Mottling occurs within the upper two feet of this profile.

All soils described above are listed by USDA SCS (Ref. 2) as having coefficients of permeability ranging from 4×10^{-4} cm/sec. to 4×10^{-3} cm/sec. In general, soils of medium to high permeability overlie the regional aquifer (situated beneath the valley floor), while soils of low permeability mantle the adjacent hillsides, promoting runoff to the valley floor soils. Most runoff infiltrates the higher permeability soils of the valley floor, contributing to aquifer recharge (Ref. 1).

The area classified on the USDA soil maps as "Gravel Pit" was most likely Chenango and Howard soils previously, underlain by outwash and gravel deposits.

3.5 Ecology

The landfill is surrounded by a variety of ecological communities. Residential and commercial development has occurred primarily on the lower

slopes of the valley walls--above the flood plains, but below the higher, steeper slopes. Mature plant and animal communities remain at the higher elevations and both within and near the Susquehanna River.

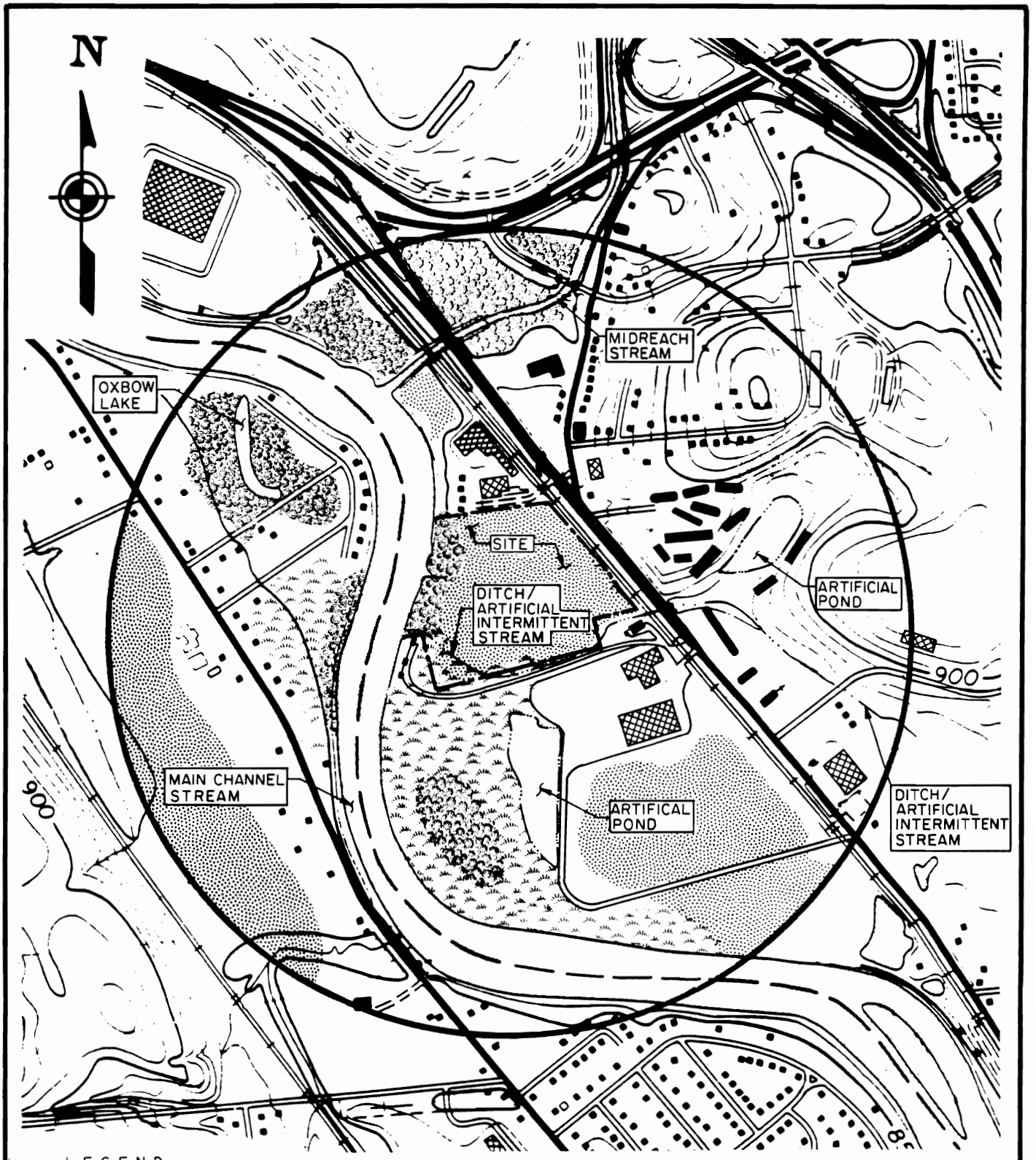
The community type names discussed below are based as closely as possible on published NYSDEC references: "Ecological Communities of New York State" (Reschke, New York Natural Heritage Program, NYSDEC, 1990) (Ref. 9), and "Freshwater Wetlands Maps and Classification Regulations", 6 NYCRR Part 664 (Ref. 7).

3.5.1 Covertypes

Covertypes identified during field activities within a one-half mile radius of the site are identified on Figure 3-1, and described below.

1. Successional Communities - The entire surface of the landfill, as well as the vacant lots and unused areas of industrial properties nearby, is covered by growth of invasive plant species. These species rapidly colonize abused and abandoned land, have high light requirements, but are short-lived. Canopy species of successional communities generally do not replicate themselves, giving way to taller invasive species or slower-growing, shade tolerant species of a more stable community. The nature of a successional community is dependent upon those species present prior to the disturbance, and the length of time since the disturbance, among other factors.

   Such areas are "successional old field communities" (Ref. 9). Herbaceous invasive species dominate these areas. Goldenrod, teasel, and evening primrose are the most common identified. Woody growth is infrequent, but, where present, meets the criteria of invasive species presented above. Woody species



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ECOLOGICAL COVERTYPES WITHIN 1/2 MILE RADIUS OF GORICK LANDFILL

FIGURE 3-1

A-3644

identified include: eastern cottonwood (Populus deltoides), black locust (Robinia pseudoaccacia), Ailanthus species (sp.), paper birch (Betula papyrifera), big-tooth aspen (Populus grandidentata), quaking aspen (Populus tremuloides) and staghorn sumac (Rhus typhina).

2. Riparian Communities - The banks of the Susquehanna River are dominated by two natural community types. Both appear stable and relatively free of significant, recent disturbance. Some small areas of cultural development also exist along the river banks.

A. Silver Maple - Ash Swamp (Ref. 9): The floodplain of the river, where not disturbed by man, contains excellent examples of this community type. Silver maple (Acer saccharinum) dominates, with over 80% representation. Green and white ash (Fraxinus pennsylvanica and F. americana, respectively) make up the majority of the remainder. Along the toe of the landfill, the community appears to have been disturbed. The silver maples appear to be approximately 20 years old. The remainder of the community on this side of the river (especially north of Park Creek) has reached maturity, the trees being uniformly greater than 100 feet tall, several feet in diameter, and widely spaced. There is abundant standing and fallen deadwood. Cinnamon fern (Osmunda cinnamomea) is a common understory species in the moister areas, but where the ground is higher and drier, goldenrod (Solidago sp.) appears to dominate. A smaller area of this community occurs on the western side of the river.

The New York Natural Heritage Program ranking of this community type (G3G4 S2S3) (Ref. 9) indicates that it is apparently not secure in New York State, although not in immediate danger of extirpation. It is, however, apparently secure on a world-wide basis.

B. Seasonally Wet Meadow: The second distinct riparian community type in the landfill area occurs mostly south and west of the landfill. This community lacks the hydrophytic vegetation (e.g., cattails) and hummocky growth that are characteristic of the "Wet Meadow" (Ref. 7) community type. It is here an open grassland that extends from openings in the silver maple-ash swamp near the landfill onto the property south of the site. It also occurs on the western shore of the river. It occurs on freely draining mineral soil that appears to be seasonally flooded by the Susquehanna. Grasses and goldenrod dominate, with isolated boxelder (Acer negundo), red osier dogwood (Cornus stolonifera), grape (Vitis sp.), and raspberry (Rubus sp.). The community is accompanied by a uniform line of mature silver maples along the river bank. As the river appears to be meandering towards the town wells, it is not clear whether they were planted as bank stabilization, or are naturally occurring. In the area immediately east (in front) of the Kirkwood town wells, this community is kept mowed.

3. Riverine Communities - Three streams or rivers occur in the landfill area: the drainage creek running south of the landfill; Park Creek, north of the Link Flight Simulation Co. warehouse; and the Susquehanna River.

A. Ditch/Artificial Intermittent Stream (Ref. 9): The drainage creek is apparently an intermittent stream as it flows beneath Route 11 and around the southern boundary of the landfill. It is frequently only a few inches deep and no more than a few feet wide. The stream bed is discolored orange and black in some locations. Occasional reedgrass (Phragmites sp.) and cattails (Typha sp.) occur on its banks. Submergent vegetation is infrequent.

At the southwest corner of the landfill, the creek is joined by the effluent stream of the AP&P plant. Prior to this confluence, the effluent stream is rapidly flowing, slightly deeper and narrower than the drainage creek, warm, and crowded with submergent vegetation. After the confluence, the channel widens as it flows through a bend strewn with landfill debris. Submergent and floating vegetation, including duckweed (Lemna minor), is abundant, and the banks of the stream are lined with muskrat dens. Small fish and at least two species of snail exist in the stream, although fish are able to enter the stream only when flooding of the Susquehanna River impacts the channel. This is due to the presence of a small fall in the stream (during average flow conditions), just upstream of its confluence with the Susquehanna.

B. Midreach Stream (Ref. 9): Park Creek, in the vicinity of the landfill, is slow-moving and cobble-bottomed. It is a class "D" water body. The stream has a well defined pattern of pool, riffle, and run sections in this area, and erosion is lateral, affecting only the stream banks and not the bed. There is no apparent

emergent or submergent vegetation. The channel is moderately well shaded.

C. Main Channel Stream (Ref. 9): The Susquehanna River is the major riverine community in the area. Although a broad river (250 to 350 feet wide in the vicinity of the landfill), it is fast-moving and apparently shallow. This class of stream is characterized by clearly defined meanders (which are advancing towards the Town of Kirkwood's well field, indicating erosion of the banks in that direction) and an absence of distinct riffle areas. In the vicinity of the landfill, the Susquehanna River is a class "A" water body.

Fish surveys carried out on the Susquehanna by the NYSDEC Bureau of Fish and Wildlife in 1989 and 1990, several miles downstream of Binghamton in Tioga County, give an indication of fish species likely to inhabit the river near the landfill. Table 3-2 lists the species captured in these surveys. It is possible that some species are under represented, or not represented at all, because they are not susceptible to electroshocking, gillnetting or trapnetting, and thus have not been collected in the surveys. There are, therefore, potentially many more species of minnow and darter and, perhaps other genera in the river than are recorded here (Ref. 20).

These surveys indicate that the Susquehanna, despite development along its banks, is a valuable habitat for many species of fish.

TABLE 3-2
SUMMARY OF FISH POPULATION SURVEY
SUSQUEHANNA RIVER, TIOGA COUNTY

SPECIES NAME	NUMBER OF OBSERVATIONS	
	1989	1990
Walleye	9	6
Yellow perch	24	11
Black crappie	24	4
White crappie	20	3
Largemouth bass	2	0
Smallmouth bass	71	17
Longear sunfish	1	0
Bluegill	66	40
Pumpkinseed sunfish	41	16
Redbreast sunfish	14	8
Rock bass	115	43
Channel catfish	151	108
Brown bullhead	2	4
Yellow bullhead	2	3
Shorthead redhorse	6	1
Northern hogsucker	3	0
White sucker	5	8
Quillback	9	28
Fallfish	1	2
Carp	20	31
Tiger muskellunge	0	1
Northern pike	3	1
TOTAL:	589	335

4. Lacustrine Communities - Two manmade lakes and one natural lake occur in the landfill area.

Both manmade lakes are "artificial ponds" (Ref. 9). The gravel mine lake is oligotrophic, but, due to the fines content of the bottom fill, does not have the characteristic clarity of such a lake. It is also monomictic. This means that stratification will occur only under ice cover in the winter, the shallow depth and exposure to the wind preventing it during warmer months. The likelihood of any fish population existing in this lake, and the value of the lake as habitat, is low due to its lack of connection to other surface water. Canada geese were observed landing on it during their fall migration.

The lake at the Carriage House Apartments is fed by runoff from the adjacent hills. The entry point of this water to the lake is a wetland of shrubs (e.g., red osier dogwood) and sedges (Carex sp.) of a few thousand square feet. The water of the lake is turbid. The banks are lined with an intermittent band of hydrophytic vegetation, both herbaceous and woody. This includes dogwood, staghorn sumac, grape, young eastern cottonwood, cattails, and reedgrass. The lake is frequented by a flock of ducks of two species (domestic and mallard, as well as several mature, mixed offspring). Fish populations are not likely, unless introduced.

The small natural lake, located across the Susquehanna River from the site, appears to be an oxbow lake--a former meander of the Susquehanna that was long ago cut off from the river. As such, and because it is surrounded by significant tree growth, it may be assumed to be subject to eutrophication, with limited dissolved oxygen at certain times of the year.

5. Cultural Communities - This category contains all areas actively maintained by man, including roads and roadsides, parking lots and buildings. The railroad right-of-way bordering the site to the east was seen during RI field activities to be maintained by spraying with herbicides. As habitat, the most important of these communities are mowed lawns and residential yards. Though the area was once largely agricultural (as late as the 1950s), there appear to be no croplands there today. Fauna of these areas would be limited to the smaller species which either tolerate the presence of, or co-exist well with, man.

3.5.2 Regulated Wetlands

Three NYSDEC-regulated wetlands occur within a two-mile radius of the site. These are shown in Figure 3-2. They are Class II or III wetlands. According to the NYSDEC classification scheme, wetlands are grouped in categories I, II, III, or IV based upon, among other factors, ecological associations, hydrologic and pollution control features, distribution, and location. Copies of the classification sheets of the three wetlands in the landfill area are presented in Appendix O. None of the wetlands shown in Figure 3-2 is connected by surface water to the Gorick site.

No NYSDEC-regulated wetlands occur along the river for 9 miles downstream of the site, nor are any other special resources known along this stretch of the river

3.5.3 Rare Species

The longear sunfish (Lepomis megalotis), detected once in the fish surveys summarized in Table 3-2 (several miles downstream of the site), is a NYS Threatened Species, although it is not included on any federal

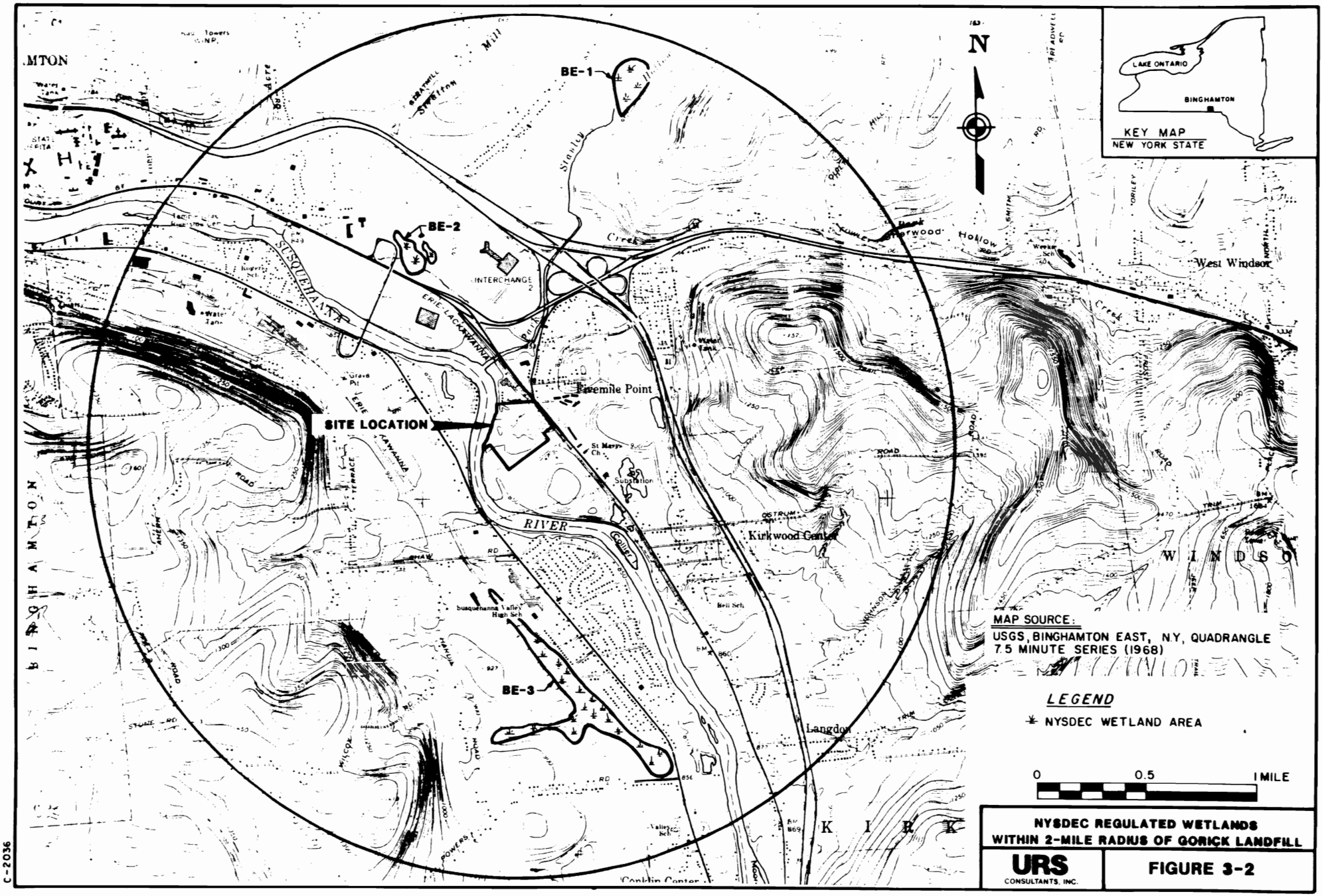
BE-1
BE-2
BE-3
SITE LOCATION
INTERCHANGE 2
SUSQUEHANNA
ERIE-LACKAWANNA
Broome Point
Kirkwood Gantry
Langdon
West Windsor
BINGHAMTON
KIRKWOOD
WINDSOR
RIVER
N
LAKE ONTARIO
BINGHAMTON
KEY MAP
NEW YORK STATE
MAP SOURCE:
USGS, BINGHAMTON EAST, N.Y. QUADRANGLE
7.5 MINUTE SERIES (1968)
LEGEND
NYSDEC WETLAND AREA
0
0.5
1 MILE
NYSDEC REGULATED WETLANDS
WITHIN 2-MILE RADIUS OF GORICK LANDFILL
URS
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FIGURE 3-2
C-2036

lists. According to the NYSDEC Natural Heritage Program, no federal or state endangered, threatened, or special-concern species is known to occur in the vicinity of the landfill (Ref. 22).

3.6 Surface Water Hydrology and Water Usage

3.6.1 Site Drainage

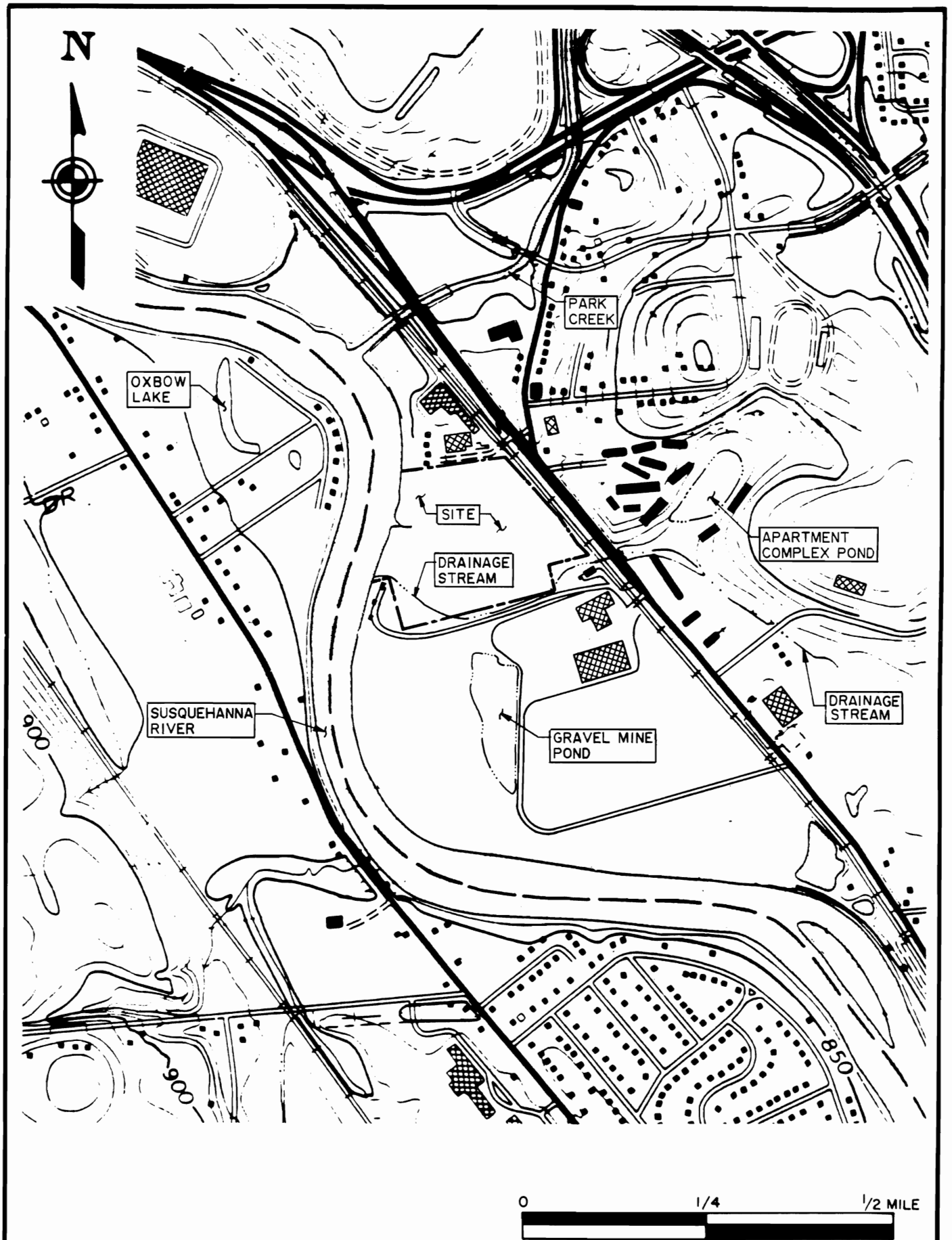
Surface water features in the vicinity of the landfill are shown in Figure 3-3.

All streams in the area are tributaries to the Susquehanna River. To the north of the site, and the Link Flight Simulation Company warehouses, is Park Creek. This is a flat-bottomed stream, approximately 30 feet wide and one to two feet deep, joining the Susquehanna from the northeast, with a very low gradient. Its headwaters lie near the hamlet of West Windsor, several miles northeast of the site.

Several small lakes and ponds lie on and above the floodplain of the Susquehanna. In the vicinity of the landfill the most prominent is an oxbow lake on the western side of the Susquehanna. It forms a "C" approximately 50 feet wide and 500 feet long and is a stagnant waterbody, without apparent connection to the Susquehanna.

Two hundred feet to the south of the site is an abandoned gravel pit which has become ponded. Approximately 3 acres in size, but reportedly only about 4 feet deep, this pond has no apparent connection to any permanent surface water feature. It appears, since it is situated in a low-lying area of the river's floodplain, to be fed by groundwater and surface runoff.

Across Route 11 from the site, near the Carriage House Apartments, is another small pond, about 2.5 acres in size. This lake, which was



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SURFACE WATER FEATURES IN VICINITY OF GORICK LANDFILL

FIGURE 3-3

A-3645

created during construction of the apartment complex in the 1970s, is apparently tributary to the small intermittent stream that runs under Route 11 and along the south side of the landfill into the Susquehanna. The depth of the lake is not known, but is probably less than 10 feet.

The intermittent stream, or "drainage stream", originates several hundred yards to the south and east of the site. It flows north, parallel to Route 11, before going under it (via culvert) towards the landfill. The stream once flowed, according to aerial photography, through the area now occupied by the American Pipe and Plastics plant. It appears, however, to have been displaced by the construction of the plant, the gravel pits, the access road to the town wells, and the landfill. It now flows along the southern side of the landfill and is joined at the southwest corner by a drainage ditch carrying cooling water effluent from the AP&P plant. It then flows northwest in an initially wide, but then increasingly deeper and narrower channel, into the Susquehanna. The stream appears to drain about 100 acres of land east of the site and Route 11, including most of the area south and a little east of the Carriage Hill Apartments. The area north of these apartments drains to Park Creek.

Apart from the drainage stream, the landfill site itself has no pronounced drainage patterns, channels, or bodies of standing water. One small marsh, about one-tenth of an acre in size and approximately a foot deep, lies in an unfilled remnant of the former gravel excavation in the site's southeast corner. The pond appears permanent. Other than this pond, incident precipitation appears to infiltrate the fill, or run off over the surface to the surrounding areas.

The Susquehanna River periodically rises onto the floodplain on which the toe of the landfill lies. The floodplain, in the area of the landfill, is separated from the river by a 6- to 10-foot high berm. This berm is presumed to be a natural levee, not a man-made feature (Ref. 29). When the river floods, however, the water enters this area via the

drainage stream outlet channel. When the river subsides, a large quantity of ponded water is left behind on the floodplain to infiltrate or evaporate.

3.6.2 Stream Hydrology

Data on the flow and discharge of the Susquehanna River near the landfill have been obtained from the National Weather Service and USGS gaging stations at Conklin. These are located adjacent to one another, slightly more than 4 miles upstream of the landfill site. The river at that point drains an area of 2,232 square miles. The average discharge, as recorded by the USGS gage from 1914 to 1989, is 3,579 cubic feet per second (CFS). The maximum discharge during that time, 61,600 cfs, occurred in March 1936. The minimum discharge, 85 cfs, occurred in October 1964 (Ref. 15). Figure 3-3.1 shows the elevation of the river surface at the Conklin gaging station during the first-phase RI investigation activities at the landfill, as provided by the National Weather Service.

During the first phase field activities (September through December, 1990) at the landfill, the river experienced one major and several minor floods. The major flood occurred during the night of October 23, 1990. That night, the Kirkwood area received over 2 inches of rain. By the following morning, the river had risen more than 8 feet. All wells located below the toe of the landfill were submerged. Water levels in all monitoring wells (except MW-1S, MW-2S and GS-13) rose by a similar amount (approximately 6-7 feet) within the next 24 hours. During the second phase activities (June through July, 1991) the level of the river was quite low. Its level varied by less than 1.25 feet during this period.

Early in the first phase of the remedial investigation, a staff gage was installed by URS on the Susquehanna River adjacent to Town Well No. 3. It was destroyed by flooding on October 23 and 24, 1990, before it could

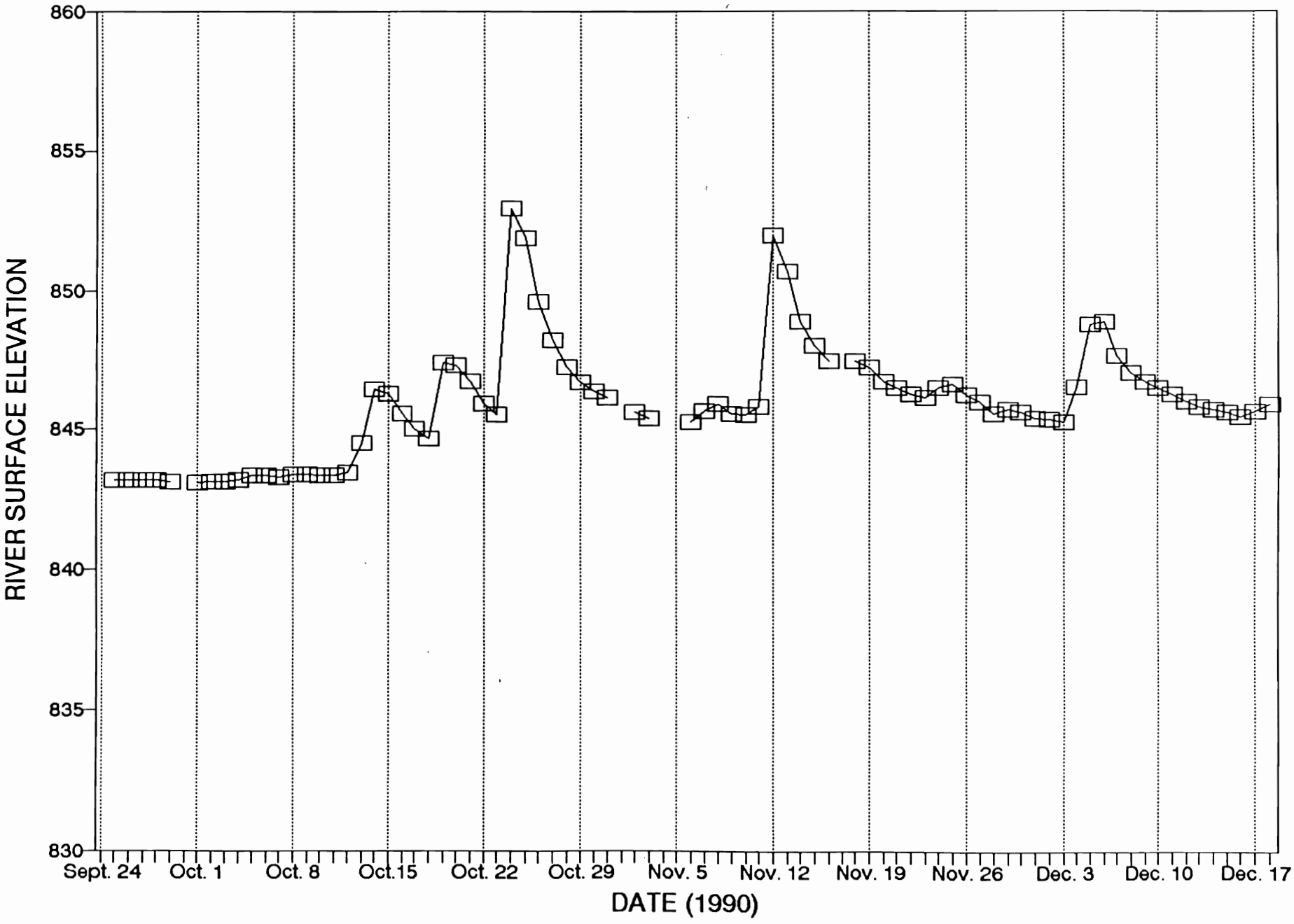

RIVER SURFACE ELEVATIONS
AT CONKLIN GAGING STATION
RIVER SURFACE ELEVATION
860
855
850
845
840
835
830
Sept. 24
Oct. 1
Oct. 8
Oct.15
Oct. 22
Oct. 29
Nov. 5
Nov. 12
Nov. 19
Nov. 26
Dec. 3
Dec. 10
Dec. 17
DATE (1990)

FIGURE 3-3.1

be surveyed. The readings obtained from it are therefore meaningless (since they cannot be referenced to a known elevation). A replacement gage (SG-2) was later installed and surveyed, and several water surface elevation readings were obtained from it during the first phase. The data from this gage were utilized in the preparation of the water table contour maps from the first-phase investigation (Figure 3-12, Section 3.8.3), since river height is very important to an understanding of the groundwater flow regime at this site.

In order to better determine the relationship between river elevation and groundwater surface elevations, three additional stream gages were installed during the second-phase investigation. Gage SG-2A was installed to replace stream gage SG-2 (installed during the first phase), because low-water conditions during the second phase of the RI made SG-2 unusable. It was installed in the same area (behind Town Well #3) as SG-2. Stream gage SG-4 was installed just north of MW-6S, to monitor how much the river elevation dropped across the site. However, the river level dropped enough during the second phase to make SG-4 unusable. Therefore, stream gage SG-4B was installed further out in the river from SG-4 to be used as a low-water gage. The stream gages were read frequently during the second phase of the investigation to allow a better understanding of the river-groundwater relationship. This will be discussed further in the groundwater flow section (Section 3.8.3).

3.6.3 Water Usage

The City of Binghamton has water intakes on the Susquehanna River approximately 4 miles downstream of the landfill at the Tomkins Street bridge. These intakes draw 12 to 13 million gallons per day, providing potable water for up to 100,000 people in the City of Binghamton and in neighboring communities.

The major groundwater user in the landfill area, though, is the Town of Kirkwood, utilizing wells on the property immediately adjacent to the landfill. These wells pumped an average of 1.1 million gallons per day in 1990, supplying water to 5,000 to 6,000 people, as well as numerous industrial customers. Approximately three quarters of the town's water is used by industry (Ref. 24).

A number of other groundwater wells are located in the vicinity of the landfill. The Town of Conklin, on the opposite side of the river from the Town of Kirkwood, maintains one of its four municipal wells less then one-quarter mile northwest of the landfill. The other three Conklin wells are located at significant distances from the landfill elsewhere in the town. This well (designated Well No. 2, Water District No. 2) pumps approximately 160 gallons per minute (when active) from the alluvial aquifer, but has a maximum capacity of approximately 250 gpm. The total withdrawal averages between 35,000 and 60,000 gallons per day when in use. This well is infrequently used due to its high iron content and relatively low yield. It serves as an auxiliary to the town's higher-yielding wells, but may soon be used even less frequently because of improvements to the rest of the well field (new air stripper). Approximately 2,500 people are served by the town's 4 wells (Ref. 23).

There are potentially one or two residences still using private wells in the Town of Conklin within several thousand feet of the landfill, but on the opposite side of the Susquehanna River (Ref. 23).

The American Pipe and Plastics (APP) plant maintains 2 groundwater wells several hundred feet south of the Kirkwood wells. The water from these wells is used for non-contact cooling water inside the plant. Only one well (APP-N) is currently used (Figure 1-3). This well is the ultimate source of the effluent stream of cooling water discharged by the plant to the Susquehanna (Section 3.6.1). APP-N reportedly draws from 150

to 190 gallons per minute nearly 24 hours a day, seven days per week. The well is screened 30 to 50 feet below grade.

Although most of the residents in the landfill area are now on municipal water, one residence immediately north of the landfill still reportedly maintains a private groundwater well. BCDOH has no data on the depth or water quality of this well. Two homes immediately north of the landfill have switched from private wells to Town water since 1988.

3.7 Geology

Information presented in this section was obtained from a review of available geological reports and from data gathered during the URS field investigation. A large portion of the existing data for the site was compiled by USGS through its hydrogeological study of the area (Ref. 4).

3.7.1 Regional Geology

The Gorick Landfill is situated within the Susquehanna River Valley of the glaciated Appalachian Plateau. The valley was deepened and widened by glacial erosion and subsequently partially filled with unconsolidated valley-fill deposits, deposited by ice and meltwater streams flowing from the receding ice margin. These outwash deposits of sands and gravels are thickest along the valley axis, tapering to a negligible thickness toward the valley walls. It is these thick deposits of sand and gravel that constitute the Endicott-Johnson City Aquifer from which the majority of the local communities' water supplies are drawn. The Town of Kirkwood well field is situated within this Endicott-Johnson City aquifer (Ref. 1). Postglacial silts, sands, gravels and modern floodplain deposits now partly cover these outwash sands and gravels in the low-lying areas adjacent to the Susquehanna River.

The outwash deposits in most places are underlain by glacial till, a heterogeneous mixture of silt, sand, and gravel. Till also thinly covers the top of the bedrock hills that form the valley walls, and may reach a thickness of 100 feet in small mounds on the valley floor (Ref. 4). Discontinuous lacustrine deposits of sand and silt are found between the outwash and till in this area, ranging from 20 to 100 feet thick. A survey of over 2,000 wells in the Binghamton area revealed that the average till thickness is 60 feet, with a maximum thickness of 250 feet encountered three miles east of the landfill in West Windsor (Ref. 28). These thick deposits of till are typically found on the south slopes of hills that have substantial relief (greater than 300 feet). Terrain composed of these thick deposits of till has been termed "till shadow hills".

Bedrock underlying this area is predominantly shale of Upper Devonian Age for at least the upper 400 feet. It has been uplifted, and dips south with a gradient of approximately 40 feet per mile. The bedrock has no significant primary permeability, but fractures and bedding planes allow some storage and movement of water. In general, bedrock wells are sufficiently productive only for individual households in the Kirkwood-Conklin area (Ref. 4).

3.7.2 Previous Investigations

Previous investigations of the geologic character of the Gorick Landfill site were conducted to assess groundwater hydrology and chemical quality. Geological information obtained from these investigations were incorporated with the geology data base established from the RI drilling program to provide a comprehensive assessment of the site geology. A synopsis of these previous studies is included below. Boring logs from these investigations may be found in Appendix K. [Groundwater analytical data from previous investigations may be found in Appendix L.]

In 1970, the consulting engineering firm of Vernon O. Shumaker conducted an investigation adjacent to the site for the Town of Kirkwood, as a part of the Town's Improvements to Water District No. 3 program (Ref. 10 and 11), looking for potential municipal well field sites. The results of this study (4 wells drilled on the Gorick site) were used in selecting the present location of the Kirkwood municipal water wells.

In December 1981, 5 observation wells were installed around Kirkwood Town Wells No. 1 and No. 2 as part of the proposed treatment process to remove iron and manganese from the groundwater. Four (4) of these wells remain intact, and were utilized during the RI for water level monitoring (VO series in Figure 1-3).

An investigation of the aquifer system that supplies water to the well fields in the Towns of Kirkwood and Conklin was conducted by USGS in 1983 (Ref. 4). A total of 19 observation wells were installed as a part of the investigation. Thirteen (13) of these wells were installed in the vicinity of the landfill. Only 6 of these wells remain (GS series in Figure 1-3), while the rest have been formally abandoned and plugged. Boring logs from these wells have been used together with soil borings completed during this investigation to prepare geologic cross-sections of the site (Figures 3-6 through 3-11). The cross-section locations are shown on Figure 3-5.

In 1988, the Town of Kirkwood contracted Lake Engineering, of Binghamton, New York, to install 7 monitoring wells (Nos. 31-37) adjacent to the Gorick Landfill site (Ref. 6). The wells were installed between the landfill and the Kirkwood well field to determine the direction and extent of contaminant migration in the vicinity of the production wells. Wells No. 31-36 from this series were sampled as a part of the RI groundwater sampling program and as a means of gathering additional site water table data.

3.7.3 Geophysical Survey

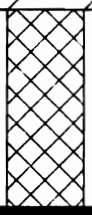
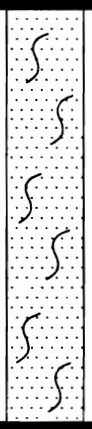
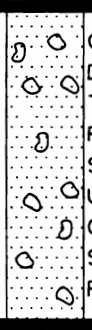
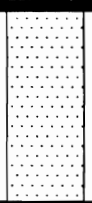
The eastern edge of fill was estimated, by the geophysical survey, to be as shown in Figure 4-2. Because of the nature of the fill material, much of this determination was based upon a combination of terrain conductivity and seismic refraction data. The fill material acted as an insulator, preventing the geophones from sensing the reflected seismic energy in the lower, denser layers. Seismic refraction techniques, therefore, were unsuccessful in defining the depth and geometry of the lower boundary between the fill and the underlying material. The terrain conductivity and seismic refraction data correlated well, however, and showed the edge of fill to be abrupt and distinct, except where the fill area approaches the eastern edge of the property (GPT, Figure 4-2). Here the signal is erratic, possibly due to the large quantity of surficial scrap metal (abandoned tanks) nearby, and thus the edge is not well determined.

3.7.4 Site Stratigraphy

During the RI, 18 soil borings were installed to various depths, ranging from 12 to 82 feet, in and around the site. The boring logs are presented in Appendix C. Boring logs from previous investigations pertinent to the site are presented in Appendix K.

Figure 3-4 is a generalized stratigraphic column for the site, constructed from the results of the boring program and previous investigations. The principal stratigraphic units depicted in this figure are; the fine sand and silt unit (floodplain deposits); the sand and gravel, and sand units below the fill, which together constitute the alluvial aquifer being studied; and the basal till unit. In addition to these principle deposits, a kame terrace deposit, composed of gravel, silt, sand and traces of clay was identified east of the site (MW-1 and MW-2). This deposit can be termed a terrace (ice-contact), similar in

1"=10' 1/8/92

HYDROGEOLOGIC UNIT	STRATIGRAPHIC UNIT	STRATIGRAPHIC PROFILE	MATERIAL DESCRIPTION	HYDROGEOLOGIC PROPERTIES	GEOLOGIC ORIGIN	RANGE OF UNIT THICKNESS (FT.)
—	FILL		FILL MATERIAL INCLUDING; METAL, WOOD, CONCRETE, BRICK AND PLASTIC. TYPICAL CONSTRUCTION DEMOLITION DEBRIS.	VERY HETEROGENEOUS MATERIAL & THUS WIDELY VARYING K VALUES	MAN EMPLACED	0-24
—	FINE SAND & SILT (FLOOD PLAIN DEPOSITS)		GRAY TO BROWN, STRATIFIED FINE SAND AND SILT, FEW PEAT SEAMS. USCS CLASSES ARE SM, SP-SM, ML, AND CL. FLOOD PLAIN DEPOSIT, DISCONTINOUS ACROSS SITE.	NO MEASURED VALUES OF PERMEABILITY OBTAINED, BUT PROBABLY ON ORDER OF 10^{-4} cm/sec (REF.3)	RECENT DEPOSITS OF RIVER ALLUVIUM	0-14
AQUIFER	SAND & GRAVEL		GRAY TO BROWN, MEDIUM DENSE TO DENSE, MEDIUM TO COARSE SILTY SAND AND FINE TO COARSE GRAVEL WITH SOME SILT AND TRACE CLAY. USCS CLASSES ARE GW, GM, OR SM. SOME COBBLES IN LOWER PORTION OF UNIT	K $\approx 10^{-2}$ cm/s PART OF THE ENDICOTT-JOHNSON CITY AQUIFER	GLACIAL OUTWASH DEPOSITS	0-54
	SAND		GRAY TO BROWN; LOOSE TO MEDIUM DENSE, FINE TO MEDIUM SAND, TRACE TO SOME SILT AND CLAY. USCS CLASS SW-SM, DISCONTINUOUS UNIT.	K $\approx 10^{-2}$ cm/s PART OF THE ENDICOTT-JOHNSON CITY AQUIFER	GLACIAL OUTWASH OR GLACIO-LACUSTRINE DEPOSITS	0-46
—	TILL		LIGHT BROWN TO GRAY, MEDIUM DENSE TO VERY DENSE, COMPACT SANDY SILT WITH TRACE TO SOME CLAY AND GRAVEL. USCS CLASS SC, SM, ML OR GM.	K $\approx 10^{-7}$ cm/s (LABORATORY PERMEABILITY) PROBABLE AQUITARD	GLACIAL TILL OR ICE CONTACT DEPOSITS (KAME TERRACES)	UNKNOWN

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GENERALIZED STATIGRAPHIC COLUMN

FIGURE 3-4

composition to the basal till found on the valley floor. This deposit can also be considered a till, but showing signs of some stratification, draping the valley sidewalls. In places, this kame terrace has slumped off the hillside, forming slump deposits of till materials on the south and east sides of the landfill. These slump deposits occasionally overlay the edges of the valley fill aquifer below. Across most of the site, fill covers all of these strata. Results of grain size analysis of the stratigraphic units encountered during the boring program are presented in Table 3-3. All geotechnical laboratory analytical results, including grain size distributions, moisture content, Atterberg limits, and laboratory permeabilities, are presented in Appendix I. The results of the field investigation, together with those of previous investigations, were used to construct a series of 6 stratigraphic cross-sections depicting site stratigraphy. Cross-section locations are shown on Figure 3-5. The cross-sections are shown on Figures 3-6, 3-7, 3-8, 3-9, 3-10, and 3-11.

Each of the stratigraphic units encountered may be described as follows (from shallowest to deepest):

(a) Fill: The fill at the Gorick Landfill site is the topmost unit encountered in the borings. It is composed of typical construction and demolition debris: wood, metal, concrete, bricks, plastic, etc. A total of 6 borings, 4 of which were completed as monitoring wells (MW-7S, MW-8S, MW-9S and MW-10S), were advanced through the fill material. One of the borings (P-13) was completed as a piezometer to monitor the water table in the northeast corner of the site. Only three (3) fill borings were originally proposed for the Phase I drilling program. Due, however, to the previously unknown northern extent of the fill material, MW-7S (originally proposed as a downgradient well) also happened to be drilled through the fill unit. The remaining fill boring, B-10A, was the original location for MW-10S, but the boring encountered till very close beneath the landfill (part of the till ridge that is discussed below) and thus did

TABLE 3-3
SUMMARY OF GRAIN SIZE ANALYSES

ID # & Depth	Total % Gravel (1)	Total % Sand	% Fines Silt	% Fines Clay	Total % Fines	USCS Class*	Material Description
MW-1S 36-38'	22.7	28.9	32.4	16.0	48.4	SC-SM	Silty sand, some gravel (kame terrace)
MW-1S 54-56'	33.9	38.2	17.0	10.9	27.9	SC	Gravelly sand, some silt (kame terrace)
MW-2S 6-8'	1.1	87.4	7.8	3.7	11.5	SW-SM	Sand
MW-3S 2-4'	0.0	5.0	71.9	23.1	95.0	CL	Clayey silt (flood plain deposit)
MW-4I 34-36'	51.8	38.0	6.9	3.3	10.2	GW-GM	Sand and Gravel
MW-5D 60-62'	45.3	31.9	20.2	2.6	22.8	GM	Sand and Gravel
MW-5D 68-70'	16.2	22.4	52.7	8.7	61.4	ML	Sandy silt, some gravel (basal till)
MW-6I 12-14'	53.8	37.8	6.5	1.9	8.4	GW-GM	Sand and Gravel
MW-6I 22-24'	0.0	89.1	7.4	3.5	10.9	SP-SM	Sand
MW-7S 18-20'	79.5	17.6	1.7	1.2	2.9	GP	Sand and Gravel
MW-7S 30-32'	48.9	35.9	11.6	3.6	15.2	GM	Sand and Gravel

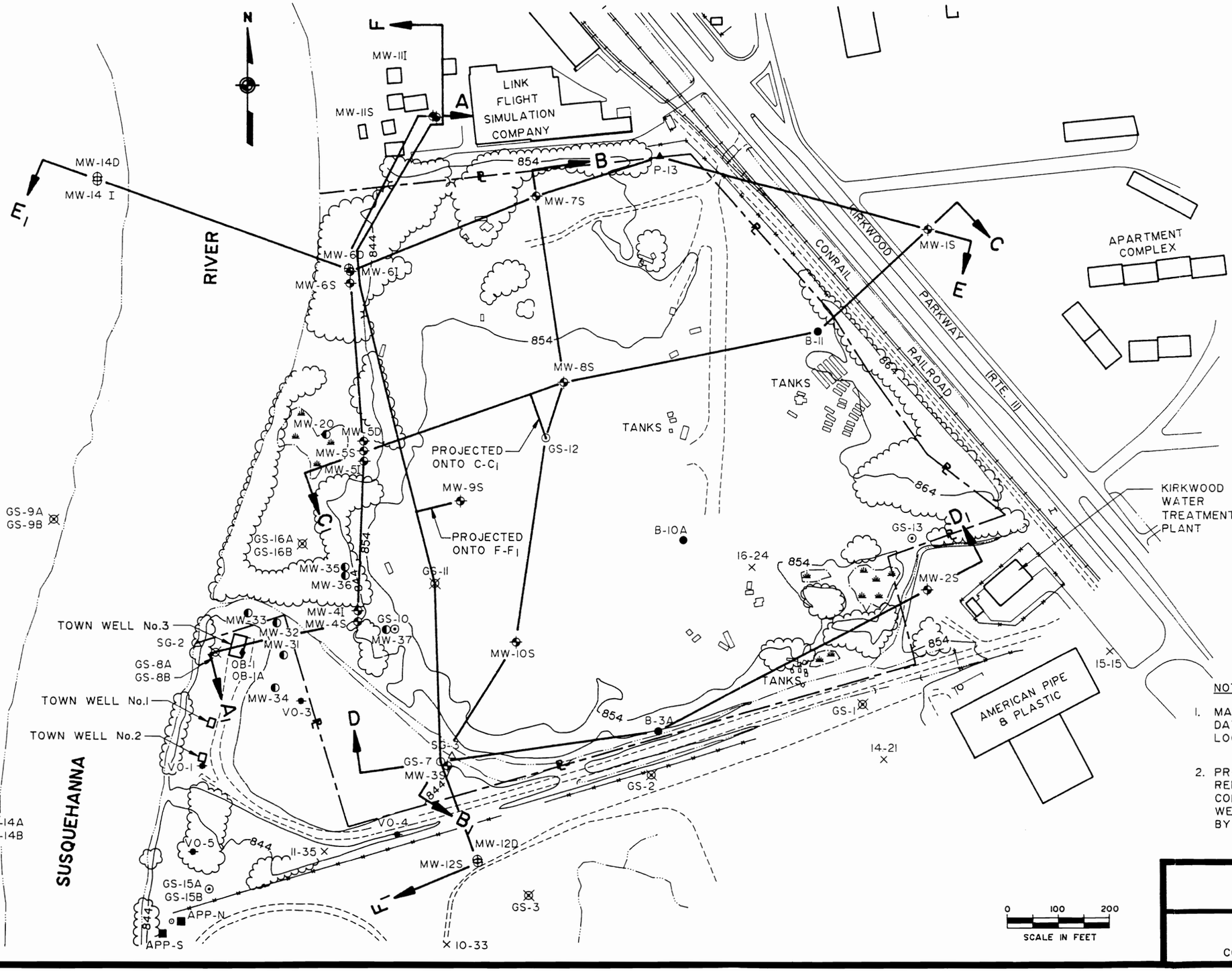
TABLE 3-3
SUMMARY OF GRAIN SIZE ANALYSES

ID # & Depth	Total % Gravel (1)	Total % Sand	% Fines Silt	% Fines Clay	Total % Fines	USCS Class*	Material Description
MW-8S 26-28'	59.5	32.8	5.4	2.3	7.7	GW-GM	Sand and Gravel
MW-10S 18-20'	26.6	60.8	9.4	3.2	12.6	SM	Sand
MW-10S 28-30'	16.5	32.0	41.6	9.9	51.5	ML	Sandy silt, some gravel (basal till)
B-11 8-10'	45.2	23.6	24.8	6.4	31.2	GM	Sandy and silty gravel (kame terrace)
MW-12D 42-44'	20.3	38.0	29.4	12.3	41.7	SM	Silty sand, some gravel and clay (basal till)
MW-12D 45-46'	18.5	36.6	29.6	15.3	44.9	SM	Silty sand, some gravel and clay (basal till)
P-13 23-25'	3.8	27.8	55.9	12.5	68.4	ML	Silt, some sand, little clay, trace gravel (kame terrace)
Test Pit #2 28" Depth	8.7	16.4	48.8	26.1	74.9	ML	Silt, some clay and sand, trace gravel (kame terrace)

(1) Up to a maximum of 3".
* All non-plastic fines are assumed ML for classification purposes.

RI-TAB.3-3/35232A

1=200 10/28/91



LEGEND

- MONITORING WELL INSTALLED BY URS CONSULTANTS (1990)
- EXISTING MONITORING WELL INSTALLED BY LAKE ENGINEERING (1988)
- WELL INSTALLED BY UNITED STATES GEOLOGICAL SURVEY (1984)
- WELL INSTALLED BY UNITED STATES GEOLOGICAL SURVEY (1984) (ABANDONED)
- WELL INSTALLED BY GROUND WATER ASSOCIATES (1981)
- WELL INSTALLED BY GROUND WATER ASSOCIATES (1984)
- SOIL BORING BY URS CONSULTANTS (1990)
- STREAM GAUGE
- PVC FACTORY WELL
- SOIL BORING (PRE-1990)

NOTES:

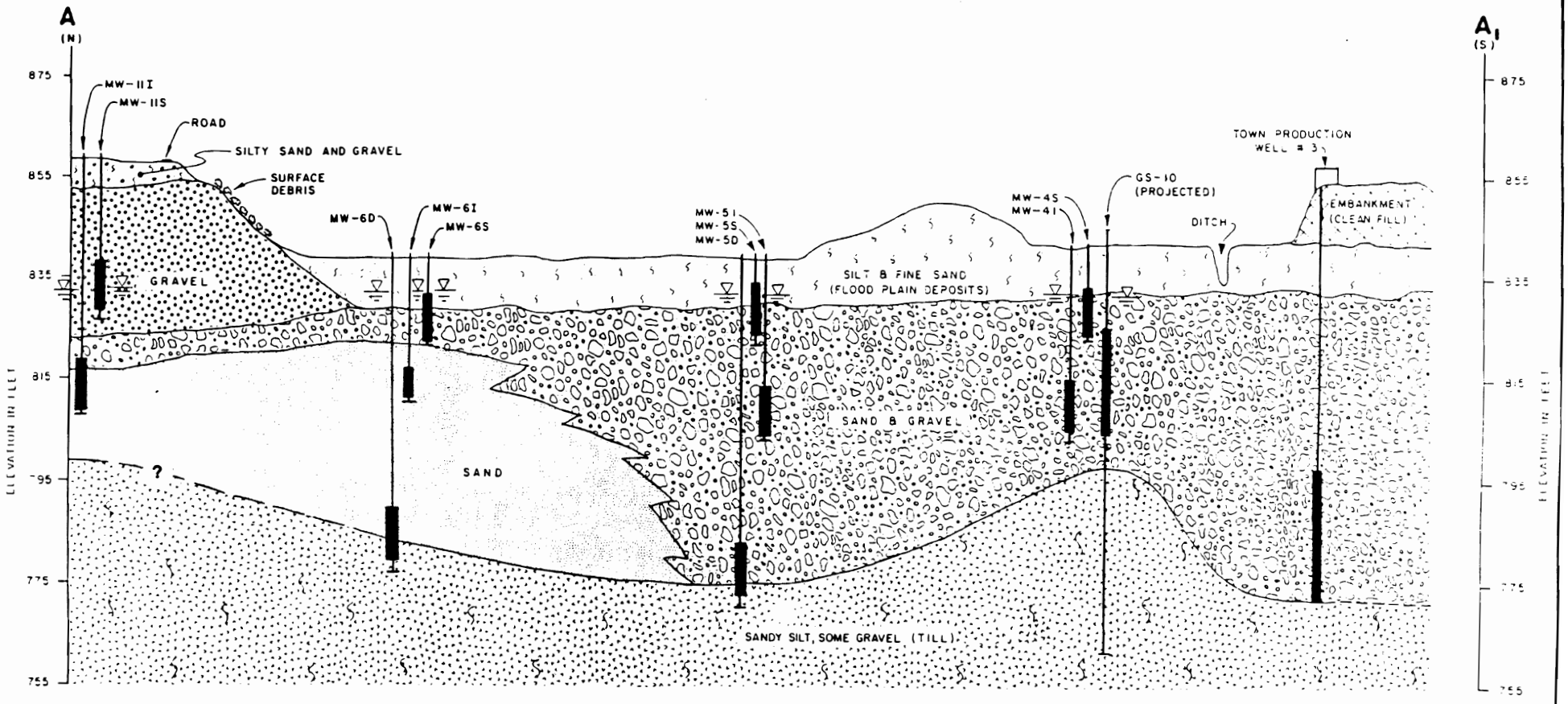
1. MAPPING BASE IS FROM AERIAL PHOTOGRAPHY DATED APRIL 1, 1990 AND COMPILED BY LOCKWOOD MAPPING, ROCHESTER, NEW YORK.
2. PROPERTY LINES SHOWN ARE APPROXIMATE, FOR REFERENCE ONLY, AND SHOULD NOT BE USED FOR CONVEYANCE OF REAL PROPERTY. PROPERTY LINES WERE INTERPOLATED FROM A TAX MAP PREPARED BY BROOME COUNTY, NEW YORK.

GEOLOGIC CROSS SECTION LOCATION MAP

URS CONSULTANTS, INC.

FIGURE 3-5

CC-2033A



MW-5S — BORING AND MONITORING WELL NUMBER

WATER LEVEL ELEVATION (7/10/91)

SCREENED INTERVAL OF MONITORING WELL

BOTTOM OF BORING

HORIZONTAL SCALE

0 100 200 FT

NOTE

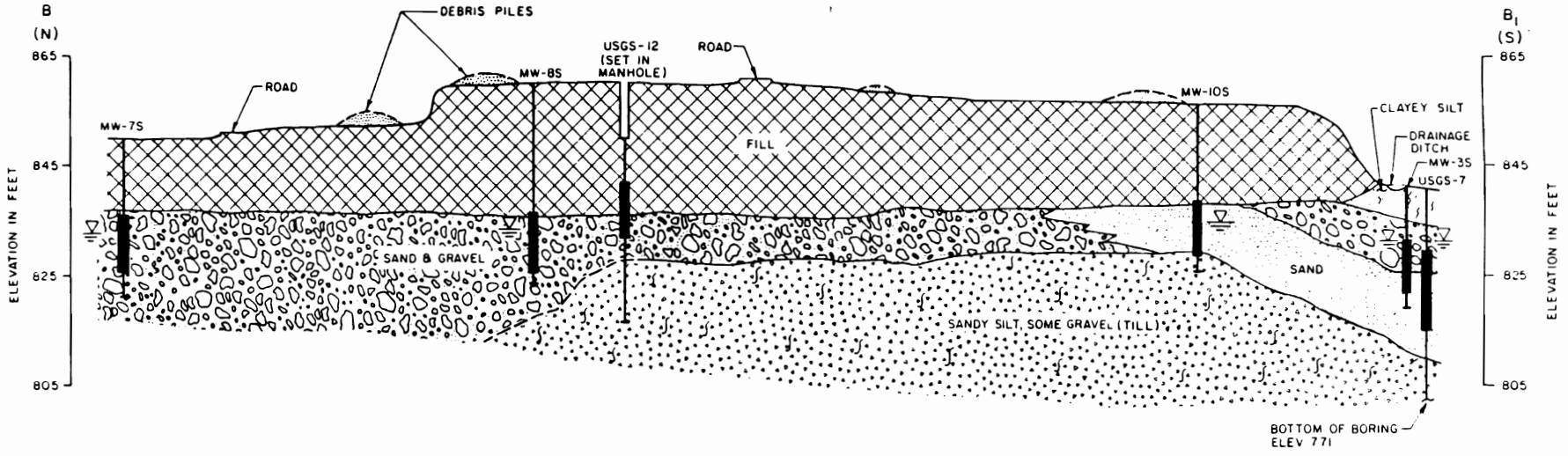
GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUNTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARD ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.

GORICK LANDFILL
GEOLOGIC CROSS SECTION A-A_1

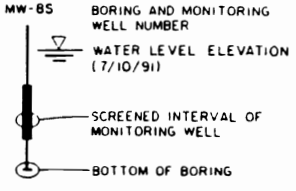
URS CONSULTANTS INC

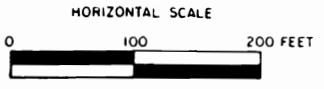
FIGURE 3-6

C-2032/a



NOTE
GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUNTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARD ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.





GORICK LANDFILL
GEOLOGIC CROSS SECTION B-B$_1$

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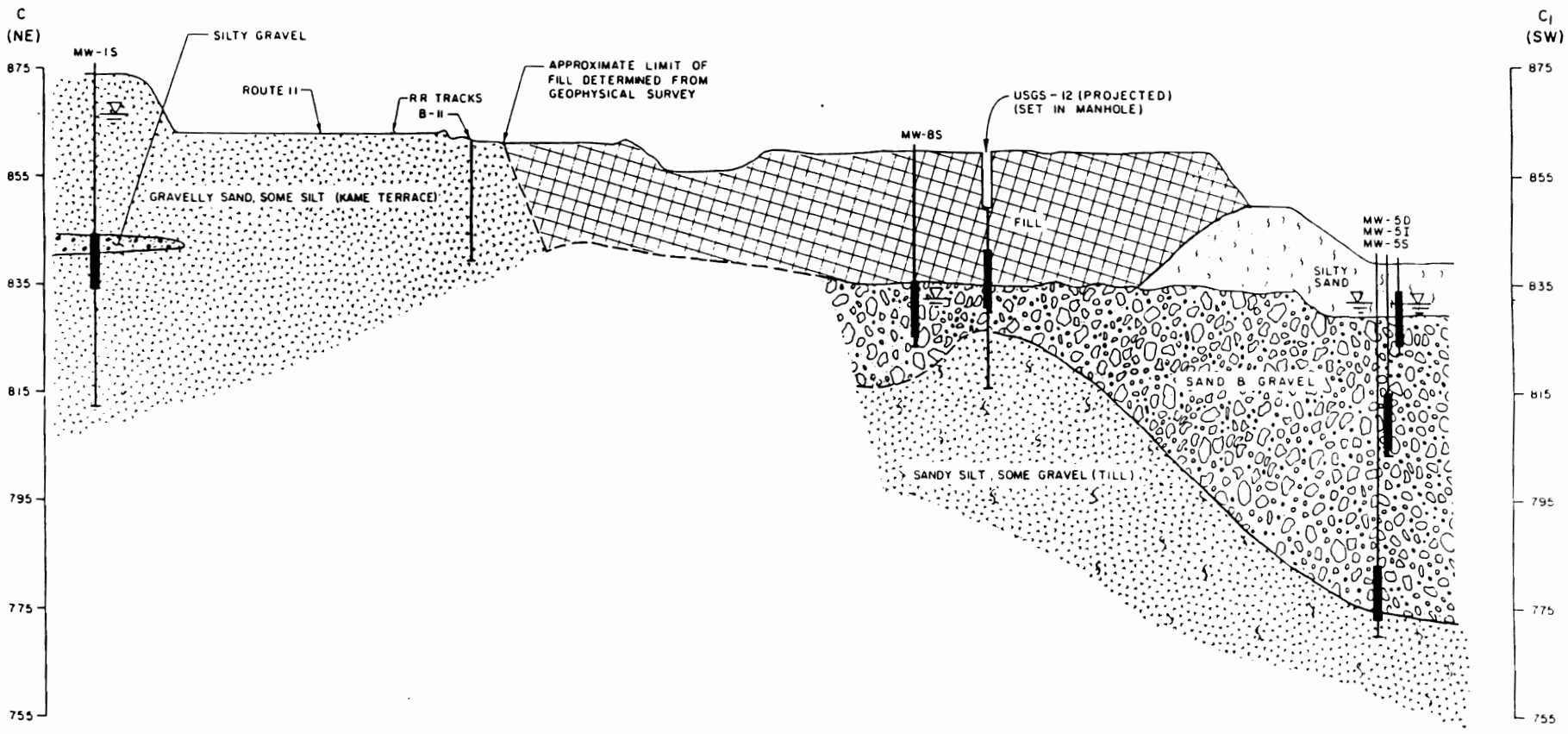
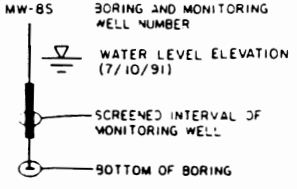
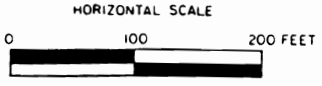
FIGURE 3-7

C-2027



NOTE
GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUNTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARD ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.



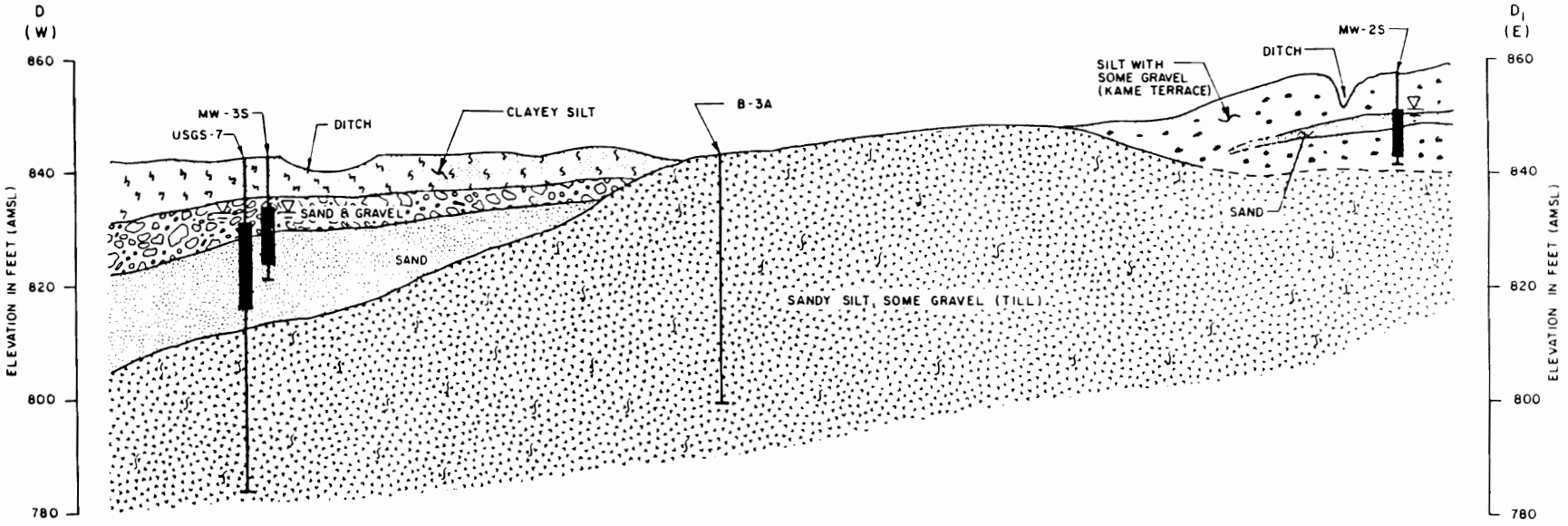


GORICK LANDFILL
GEOLOGIC CROSS SECTION C-C'

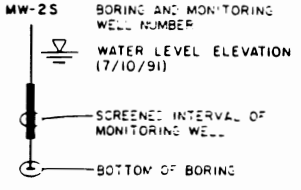
URS CONSULTANTS INC

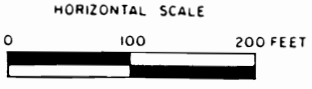
FIGURE 3-8

C-2016



NOTE
GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUNTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARD ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.



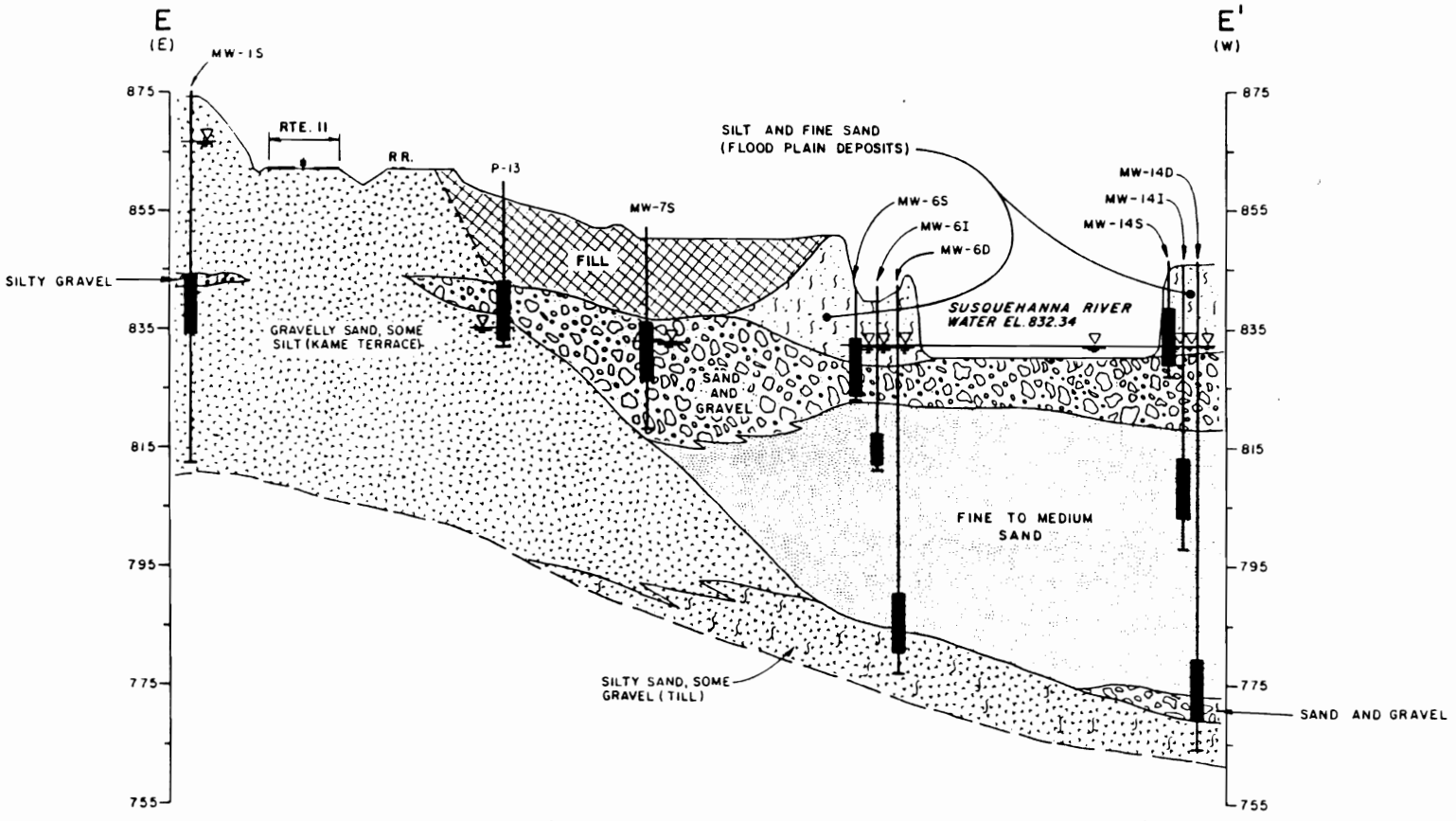


GORICK LANDFILL
GEOLOGIC CROSS SECTION D-D$_1$

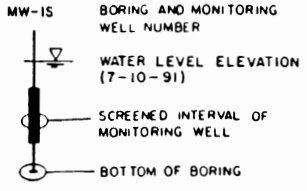
URS CONSULTANTS INC

FIGURE 3-9

C-2056



NOTE
GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUNTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARD ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN

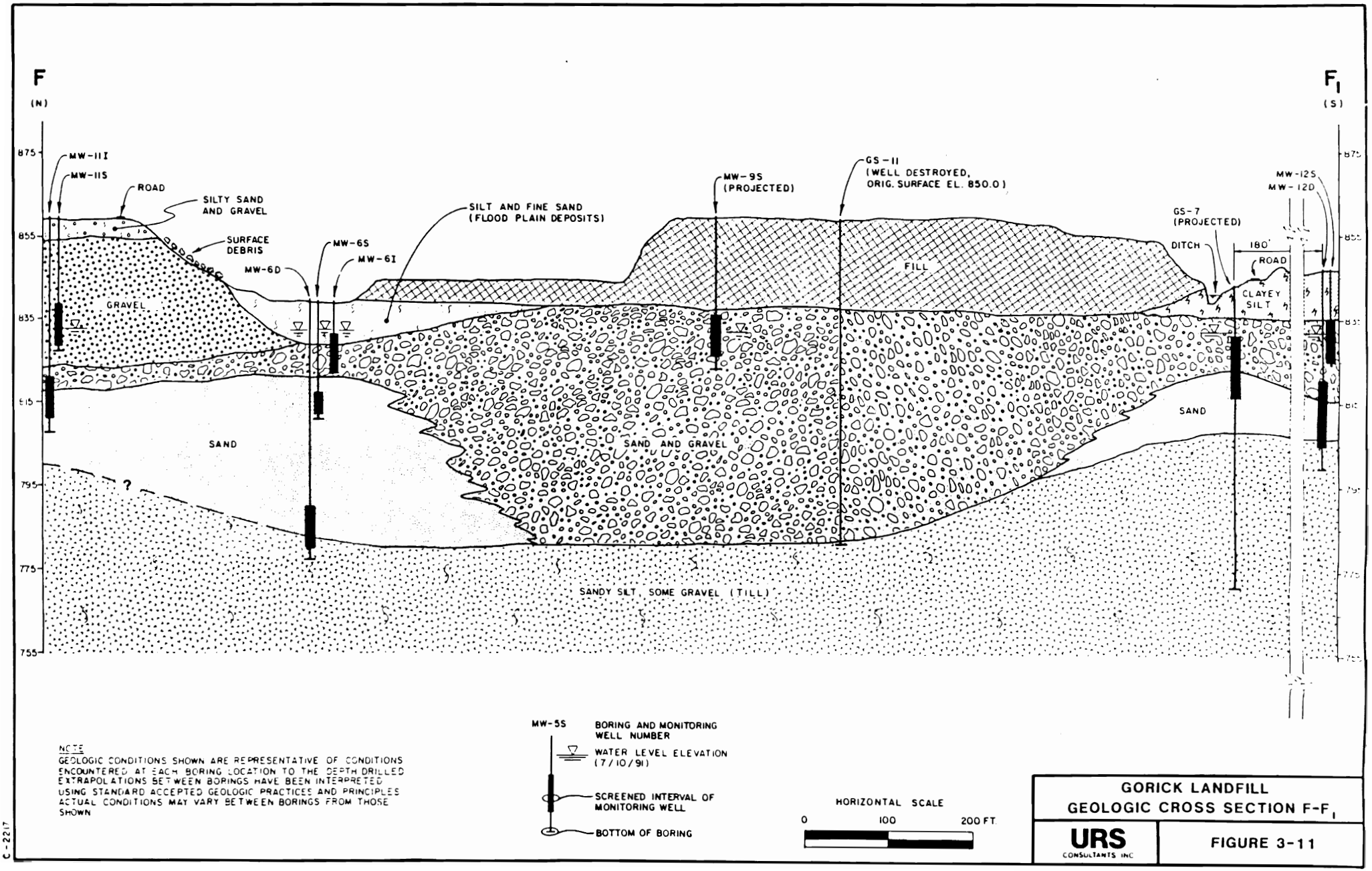


GORICK LANDFILL
GEOLOGIC CROSS SECTION E-E'

URS CONSULTANTS INC

FIGURE 3-10

C-2357



NOTE
GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUNTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARD ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.

MW-5S — BORING AND MONITORING WELL NUMBER
WATER LEVEL ELEVATION (7/10/91)
SCREENED INTERVAL OF MONITORING WELL
BOTTOM OF BORING

HORIZONTAL SCALE
0 100 200 FT

GORICK LANDFILL
GEOLOGIC CROSS SECTION F-F$_1$

URS CONSULTANTS INC

FIGURE 3-11

C-2217

not reach a saturated zone suitable for completion of a monitoring well. Therefore, the proposed fill well was moved approximately 400 feet southwest to the present location of MW-10S.

The northern limit of the fill has now been shown to extend to the northern property line. This has been verified by the boring program as well as by field observations. The eastern limit of the fill was determined by the surface geophysical survey (Section 3.7.3), and the southern and western limits appear to be the steep slopes (escarpments) at the edges of the fill "plateau." The fill unit may be divided into a major, higher fill plateau-like feature (three-quarters of the fill area) and a lower, less conspicuous plateau in the northern part of the site. A boring in this northern portion of the fill (MW-7S) encountered 13 feet of fill material. Phase II boring P-13, further north and east from MW-7S and near the property line, verified the existence of fill material in the northeast corner of the site, encountering 15 feet of fill. The 4 borings advanced on the higher portion of the fill, MW-8S, MW-9S, MW-10S, and B-10A, revealed fill thicknesses of 24, 22, 18, and 5 feet, respectively. The elevations of the bottom of the fill (based on this and on previous investigations) seem to indicate that the base of the gravel excavation prior to filling was relatively flat across the northern and western portions of the site, presumably due to downward excavation to the approximate position of the water table. The base of fill is much higher in the southeastern portion of the site. This probably is caused by the till ridge (or mound) being closer to the surface in that area. For comparison purposes, the borings at MW-7S, MW-8S, MW-9S, and MW-10S all showed base of fill elevations between 835.7 and 838.4 feet msl, while B-10A showed base of fill at 856 feet msl with a corresponding decrease in fill thickness (Figures 3-7 and 3-8). The approximate extent of fill on site is shown on Figure 4-2.

During the second-phase investigation, the fill was also investigated by excavating test pits or trenches. Twenty eight (28) test

pits/trenches were excavated as discussed in Section 2. The locations of all test pits are shown on Figure 2-1 and their logs are given in Appendix Q. The test pits ranged in depth from 11.5 to 23.5 feet. Fill was excavated through to the base of fill in 11 of the test pits. Thickness of fill in these pits ranged from 3 to 17 feet. Fill thickness from the test pit/trenching program is shown on Figure 4-2.

The waste encountered during the test pit excavations was typically construction-demolition debris, including: wood, rebar, concrete, metal, cinderblock, tires, brick, wire, plastic sheeting, tree stumps, roofing, pipes, asphalt, wallboard, bottles, etc. This debris was typically embedded in a dark gray silty, fine sand soil matrix, but quantities of material which was described as dark gray to black, cindery fine sand (foundry-ash-like material) was also often found. Numerous crushed and relatively intact drums were found in 9 of the test pits at varying depths. [See logs in Appendix Q.] Samples were taken from some of these drums for analysis (Section 4.2). Several logs also note evidence of intermediate cover layers within the fill.

(b) Fine Sand and Silt Unit: The surficial unit outside of the fill areas and closer to the Susquehanna River is a floodplain deposit. It is described as a brown to gray, very soft to stiff, clayey or sandy silt, with thin fine sand seams, and sometimes thin peat seams. It occurs adjacent to the river at the lower elevations and lies directly over the sand and gravel aquifer. These deposits, which are relatively recent in origin, were deposited by floodwaters overtopping the river channel and spreading onto the floodplain. This causes a decreased sediment-carrying capacity in the water, so that relatively fine-grained sediments are deposited. Thicknesses encountered ranged from 6 feet at MW-3S to 12 feet at MW-12D on the landfill side of the river, but deposits were 14 feet thick at MW-14D, across the Susquehanna. USCS classifications for this unit are typically ML to SM. A grain size analysis of this unit from the depth interval of 2 to 4 feet at MW-3S showed 5 percent sand, 71.9 percent

silt, and 23.1 percent clay (Table 3-3), making this particular sample CL (USCS classification). The floodplain unit is shown well in cross-section on Figure 3-6.

(c) Sand and Gravel, and Sand Units: The highly permeable sediments of the aquifer present beneath the landfill comprise two units: a gray to brown, medium dense to dense, medium to coarse grained sand and coarse gravel with some silt; and a brown to gray, loose to medium dense, fine to medium grained sand with traces of silt, clay, and gravel. This latter unit, described as a sand in Figure 3-4, occurs discontinuously across the site. The deposit appears to rest either directly on or close to the top of the till unit, and may be partially what USGS refers to as "lacustrine sands and silts". Thicknesses encountered ranged from 8 to 46 feet. The sand unit appears to underlie the northern portion of the site but is absent beneath the eastern and southern portion of the site, where the till ridge (described below) is found.

Soil borings advanced during the second phase of the investigation better defined the vertical extent of the sand unit. Over 38 feet of this material was encountered at MW-6D, and 46 feet was logged at MW-14D.

The outwash sand and gravel is, however, the unit from which the Town of Kirkwood wells principally draw water. This sand and gravel unit also pinches out beneath the southeast and eastern portions of the site, but was 54 feet thick at MW-5D on the western edge of the site. The thickness of this unit on the Conklin side of the Susquehanna (at MW-14D) was much less, only 14 feet thick, but overlay the sand unit discussed above. This sand and gravel unit classifies as USCS GW-GM, GP, or GM material, whereas, the sand unit classifies as SW-SM, SP-SM, or SM material. The grain size analysis (Table 3-3) shows that the sand and gravel unit is composed of an average 56.5 percent gravel, with a range of 45 to 80 percent; 32.3 percent sand, with a range of 18 to 38 percent; 8.7

percent silt, with a range of 2 to 20 percent; and 2.5 percent clay, with a range of 1 to 4 percent. The combined percentage of fines averages 11.2 percent, with a range of 3 to 23 percent. The sand unit is more homogeneous, with gravel ranging from 0 to 27 percent, sand from 61 to 89 percent, silt from 7 to 9 percent, and clay from 3 to 4 percent. The combined percentage of fines in the sand ranged from 11 to 13 percent.

Thin gravel and sand deposits, 2 to 3 feet thick, were encountered during this investigation in deposits along the valley sidewall (monitoring wells MW-1S and MW-2S). They are probably kame deposits, or, in the case of MW-2, possibly a recent fluvial deposit in a buried stream bed. They do not appear to be in good hydraulic connection with the sand and gravel aquifer in the valley bottom (Figures 3-8, 3-9).

(d) Till: The outwash and "lacustrine sand and silts" deposits are underlain by till. The till may be described as a light brown to gray, medium dense to very dense, compact silt with some sand and gravel, and a trace to some clay. The USCS classification for the till ranges from SC or ML, to SC-SM, to GM. The grain size distribution for representative samples (Table 3-3), showed an average of 20.6 percent gravel, with a range of 4 to 45 percent; 29 percent sand, with a range of 16 to 38 percent, 37 percent silt, with a range of 17 to 56 percent; and 13 percent clay, with a range of 6 to 26 percent. The combined percentage of fines averaged 50 percent, with a range of 28 to 75 percent. Thin sand seams have been noted within this unit (e.g., MW-1S, B-11A, GS-3).

The till can be differentiated into two types based upon structure: a basal till and a till "terrace". The basal till is situated on the valley floor, underlying the aquifer. The till terrace (kame terrace) occupies the valley sidewalls, east of the site. Compositionally, the two types are similar, although the terrace deposits contained more gravel in some instances. The till terrace is likely a

ice-contact deposit, whereas the basal till was deposited directly beneath the glacial tongue that once occupied the valley.

The boring program for this investigation confirmed the presence of a till ridge, or mound, on the southern portion of the site (Figure 3-9). This deposit appears to be the northern extension of the till mound that exists south of the site. Excavation of a former north-south trending sand and gravel terrace on the western half of the site (approximately from MW-5 to MW-10) during the operation of the gravel pit, exposed the till mound in the vicinity of B-3A as shown in Figure 3-9 (Ref. 4). A till thickness of at least 60 feet was shown east of the site, at MW-1S on the valley sidewall (Figure 3-8). GS-1, shown on Figure 3-5, and located near the AP&P facility, found till from 10 feet to 76 feet below the surface, where it was then underlain by fine sands to 95 feet, and then till again to termination of the boring at 96 feet. This latter boring indicates that the "till mound" south of the site may be another type of glacial feature instead. Till mounds are typically superposed over bedrock, not stratified deposits (glaciers typically remove these deposits prior to till deposition). It is possible that this "till mound" is instead a kame deposit or slump feature of the till deposits draping the valley sidewall.

The depth to "till" varies considerably at the Gorick site. At MW-1S, on the valley side wall, till was found at 5 feet below a sandy silt topsoil unit. At MW-2S, in the southeastern corner of the site, till was found at the surface, while MW-12D to the south found it at 40 feet. MW-5D, west of the landfill near the river, found till at 69 feet. Boring GS-14B, on the opposite side of the river, encountered till at 90 feet. To the north of the site, at boring MW-11I, the probable top of till was encountered at 50 feet, but this was not certain, as the boring was terminated before confirmation of the till contact. A contour map of the top of till elevations is presented as Figure 3-12.

1=400 10/31/91

N

TERRACE DRIVE

ROUTE 7

RIVER BLVD.

LAWRENCE AVE

ALTA DRIVE

TOWN OF CONKLIN WELL No. 2

C-2

RT7-4

PRIVATE COMMERCIAL WELL

RT7-5 (768.0)

RT7-3 (770.4)

RT7-2

RT7-1

P-14S (769.1)

MW-14D

MW-14I

RIVER

FLOW

SUSQUEHANNA

GS-9A

GS-9B

GS-16A

GS-16B

GS-14A

GS-14B (757.0)

TOWN WELL No.3

TOWN WELL No.1

TOWN WELL No.2

SG-2A

SG-2B

GS-8A

GS-8B

OB-1

OB-4

VO-1

VO-5

VO-4

SG-3A

SG-3B

GS-7 (810.6)

MW-3S

GS-15A

GS-15B

APP-N

APP-S

MW-11S

MW-11I (808.9)

LINK FLIGHT SIMULATION COMPANY

SG-4A

SG-4B

MW-6D (779.6)

MW-6I

MW-6S

MW-7S

MW-8S

MW-20

MW-5D (774.9)

MW-5I

MW-5S

MW-9S

GS-11 (792.0)

GS-10 (800.0)

MW-33

MW-35

MW-36

MW-4D

MW-4I

MW-4S

MW-32

MW-37

MW-31

MW-34

MW-10S (829.4)

GS-12 (828.7)

B-3A (842.0)

MW-12D

MW-12S

GS-3 (803.0)

GS-2 (827.0)

GS-1 (836.0)

14-21

P-13 (836.9)

B-11 (857.4)

P-15S

TANKS

B-10A (855.7)

16-24 (850.8)

MW-2S

GS-13 (842.4)

15-15 (825.4)

MW-1S (869.0)

APARTMENT COMPLEX

KIRKWOOD

CONRAIL

PARKWAY

RAILROAD

RTE. 11

KIRKWOOD WATER TREATMENT PLANT

AMERICAN PIPE & PLASTIC

10-33

II-35

860

850

840

830

820

810

800

790

780

770

760

LEGEND

- MONITORING WELL INSTALLED BY URS CONSULTANTS (1990)
- MONITORING WELL INSTALLED BY URS CONSULTANTS (1991)
- EXISTING MONITORING WELL INSTALLED BY LAKE ENGINEERING (1988)
- EXISTING MONITORING WELL INSTALLED BY PRATT AND WOLFF (1986)
- WELL INSTALLED BY UNITED STATES GEOLOGICAL SURVEY (1984)
- WELL INSTALLED BY UNITED STATES GEOLOGICAL SURVEY (1984) (ABANDONED)
- WELL INSTALLED BY GROUND WATER ASSOCIATES (1981)
- WELL INSTALLED BY GROUND WATER ASSOCIATES (1984)
- SOIL BORING BY URS CONSULTANTS (1990)
- PIEZOMETERS BY URS CONSULTANTS (1991)
- STREAM GAUGE
- PVC FACTORY WELL
- SOIL BORING (PRE-1990)
- PRIVATE COMMERCIAL WELL (APPROXIMATE LOCATION)
- TOWN OF CONKLIN WELL (APPROXIMATE LOCATION)
- PRIVATE RESIDENTIAL WELL (APPROXIMATE LOCATION) (ABANDONED)
- (827.0) ELEVAION OF TOP OF TILL (FT., MSL) FROM BORING
- —760 TOP OF TILL CONTOUR ELEVATION

NOTES:

1. MAPPING BASE IS FROM AERIAL PHOTOGRAPHY DATED APRIL 1, 1990 AND COMPILED BY LOCKWOOD MAPPING, ROCHESTER, NEW YORK.
2. PROPERTY LINES SHOWN ARE APPROXIMATE, FOR REFERENCE ONLY, AND SHOULD NOT BE USED FOR CONVEYANCE OF REAL PROPERTY. PROPERTY LINES WERE INTERPOLATED FROM A TAX MAP PREPARED BY BROOME COUNTY, NEW YORK.

300 0 300

SCALE IN FEET

TOP OF TILL CONTOUR MAP

URS CONSULTANTS, INC.

FIGURE 3-12

CC-2352

These depths to "till" seem to confirm the conceptual site picture as being fill, or floodplain deposits close to the river, overlying a valley-fill sand and gravel aquifer, which is thickest (60 feet plus) close to the river, and pinches out to the east towards the valley sidewall and to the southeast towards the "till ridge or mound." There may be additional aquifer below portions of the "till ridge", which is expected to be continuous with the valley-fill aquifer.

3.8 Hydrogeology

3.8.1 Previous Investigations

The most extensive previous investigation of the hydrogeological character of the area of the Gorick Landfill site was conducted by USGS in 1983 and concluded in 1984 as part of an overall study of the aquifer system in the Kirkwood-Conklin area. The study included installation of 19 observation wells, monitoring of groundwater temperatures and levels, aquifer tests, and development of a simulation model (using MODFLOW) to investigate the site.

Stated objectives of the study were to (1) quantify the hydraulic properties that determine the rate of river infiltration to the aquifer, (2) identify the sources of recharge to the aquifer, and (3) delineate the well-field catchment areas (Ref. 4). Major conclusions of this study were that:

1. Estimated well-field catchment area was 250 acres for the Kirkwood well field.

2. Groundwater budgets (from steady-state simulations) showed 58 percent of the groundwater withdrawn by the Kirkwood well field to be derived from the Susquehanna River (via induced

infiltration) during periods of low river stage and low recharge. At higher stages, this percentage would decrease.

3. Accuracy of estimates from 1 and 2 above, are very sensitive to riverbed hydraulic conductivity. Study estimated from piezometer testing that riverbed thickness was 2 feet, and the hydraulic conductivity was 0.2 feet per day (7×10^{-5} cm/sec). However, estimates of percentage of water derived from the river can vary from 10 to 70 percent, depending on this hydraulic conductivity value (letter to David Camp, of NYSDEC, from Robin Brown, of USGS, November 7, 1990).

4. Horizontal and vertical hydraulic conductivities of the sand and gravel in the calibrated model range from 50 to 10,000 feet per day (2×10^{-2} to 3.5 cm/sec) and 1.0 to 80 feet per day (4×10^{-4} to 3×10^{-2} cm/sec), respectively.

5. Groundwater levels change with river stage (responding within a few days to river stage changes). Thus, they are highest in late fall, winter and spring, and lowest in summer and early fall.

6. During low river stage periods, the landfill's contribution to the Kirkwood well field was established to be 5 percent. The river contributed 58 percent, and the Conklin and Kirkwood sides of the river were contributing 32 percent and 5 percent of the flow, respectively.

Subsequent additions to this study have been made by USGS at the request of NYSDEC, 1990. A particle-tracking routine was added to the computer code for tracking of particles originating in the landfill. The result was that, based on steady-state, low-flow simulations, any particles originating in the landfill flowed largely straight down to the

water table, proceeded downwards to the intermediate zone of the aquifer, and then were pulled directly toward the pumping well (Town Well #3). The model thus showed that contamination due to prior activities would predominate in the aquifer zone in which the Kirkwood production well was screened, since the well dominates the flow in this area. Based on these model results, URS changed the proposed locations of MW-3S and MW-4 just prior to installation. The screened intervals for the intermediate depth wells were also changed to better intersect the predicted flow paths.

3.8.2 Groundwater Monitoring Network

During the first phase of the field investigation, 14 monitoring wells were installed to monitor water quality upgradient, within, and downgradient of the landfill. Four (4) fill wells were installed, 2 wells were installed upgradient, and 8 were installed downgradient at 4 locations. Seven (7) additional monitoring wells were installed during the second phase. One well was added to an existing downgradient cluster; 4 sidegradient wells were installed, 2 to the north and 2 to the south of the site; and 2 wells were installed on the opposite side of the Susquehanna River from the landfill. Three (3) piezometers were also installed during the second phase, two on site north and east of the landfill and one on the opposite side of the river. Hydraulic conductivity values were measured at each of these locations (with the exception of MW-1S, MW-14D, P-13, and P-15), and water levels were frequently taken during both phases to determine flow patterns beneath the site. The existing wells at the site were also monitored in an attempt to better define the site's hydrogeology.

3.8.3 Groundwater Flow Patterns

Groundwater elevations were measured in the monitoring wells several times weekly during the field activities, as well as at stream gages 2, 2A, 3, 3A, 4, and 4B to record water surface elevations in the Susquehanna

River and the drainage stream (Figure 1-3). All data obtained from these measurements are presented in Appendix N.

During the first phase of the RI (mid-September to mid-December, 1990), water level measurements in the new and existing monitoring wells were taken at frequent intervals. During this period, water levels in most of the wells fluctuated widely. [See hydrographs for representative wells, in Figures 3-15 through 3-18.] Water levels in MW-1S, on the valley sidewall, varied 2.52 feet during the period, while those in MW-2S varied only 0.87 feet. Water levels at MW-5 and MW-6 varied 4 to 5 feet, but were not measured for as long a period as the other wells due to their later installation dates. MW-7S varied 9 feet, with a 7-foot fluctuation occurring immediately following the flood event on October 23 and 24, 1990. During this same flood event, MW-1S rose only 0.60 feet and MW-2S rose 0.66 feet. GS-15A and B, close to the river, varied nearly 9 feet during the field program. The fluctuation in river stage during this period can be seen in Figure 3-3.1 to be approximately 9 feet also.

Water table and surface water deviations were monitored closely during the second phase of activities to provide a data base on the dynamic relationship between the river stage and the water table. The water table elevation data also served to illustrate the seasonal variations in the flow beneath the site (by comparison to the first-phase measurements taken in the late fall and early winter). All new and existing monitoring wells, as well as previously existing wells on the Conklin side of the river located during the second phase, were utilized for water level measurements. Water levels (water table and river surface) gradually dropped during the monitoring period, as would be expected during this time of year due to dry weather. The amount of water level variance in wells situated near the valley sidewalls (MW-2S and MW-1S) was much less than in those set in the aquifer proper (closer to the river), reaffirming that the wells on the valley sidewalls are not well connected to the alluvial aquifer. The water table in the aquifer wells

(e.g., MW-6S) declined over one foot during the second phase, while in MW-2S it dropped by only 0.21 feet.

The magnitude of these water level fluctuations may be used to look at aquifer response to stage changes in the river. The wells closer to the river respond quickly to river stage changes and in similar amounts in many cases (e.g., MW-7S, GS-15A & B). Also, the depth of the well does not appear to have much effect, as MW-5S, MW-5I and MW-5D have almost identical hydrographs (see Figure 3-16). This is as expected, however, for highly permeable aquifers underlain by a confining layer (the till), have predominantly horizontal flow, and consequently little vertical head loss. The wells on the valley sidewall (MW-1S and MW-2S, probable kame deposits) do not appear to respond readily to river stage. This also is as expected, since the wells are located well above the river level and in units which are not as well connected to the alluvial aquifer.

This interrelationship between the river stage and the aquifer beneath the landfill shows that the water table frequently rises into the fill unit, partly due to increased river stage, and partly due to increased recharge to the water table from precipitation percolating through the relatively porous landfill surface (and its flat nature, allowing little runoff). Indeed, a water balance using the HELP model (Hydrologic Evaluation of Landfill Performance), shows approximately 35 to 40 percent of the annual precipitation on the landfill surface recharges the aquifer. This amounts to approximately 12 to 15 inches of water per year, or roughly 6 to 7.5 million gallons of recharge directly through the landfill. This infiltrated water and water backing up into the fill allows leaching of the "soluble" constituents in the landfill into the groundwater.

Regional groundwater flow through the alluvial aquifer in this area is from the valley sidewalls towards the Susquehanna River, but bending towards the north, which is the direction of flow for the Susquehanna

River in this area. The aquifer is part of the Endicott-Johnson City aquifer system which is situated within the Susquehanna River Basin and occupies the Susquehanna and Chenango River valleys. The glacial outwash sand and gravel (valley-fill deposits) constituting the aquifer are concentrated on the river valley floors, thinning as they meet the valley sidewalls. Depths of as much as 200 feet of glacial drift are present along the valley axis (Ref. 1). Superimposed on the regional groundwater flow, are the withdrawal effects by the operation of the Town wells and the American Pipe and Plastics well. These large-capacity wells create a groundwater sink, and thus locally alter the regional flow pattern.

Table 3-4 summarizes the withdrawal of groundwater by Town Well No. 3. This well runs at, or very near, a constant rate of 1,000 gallons per minute while pumping. The well usually runs nearly continuously, except for scheduled maintenance periods (Ref. 29). However, this pattern varies from year to year and the amount of water demand, particularly from industrial clients. The well catchment area and ultimate source of water for this well (well field) have been previously discussed in Section 3.8.1. The American Pipe and Plastics well reportedly runs nearly continually, pumping from 150 to 190 gallons per minute.

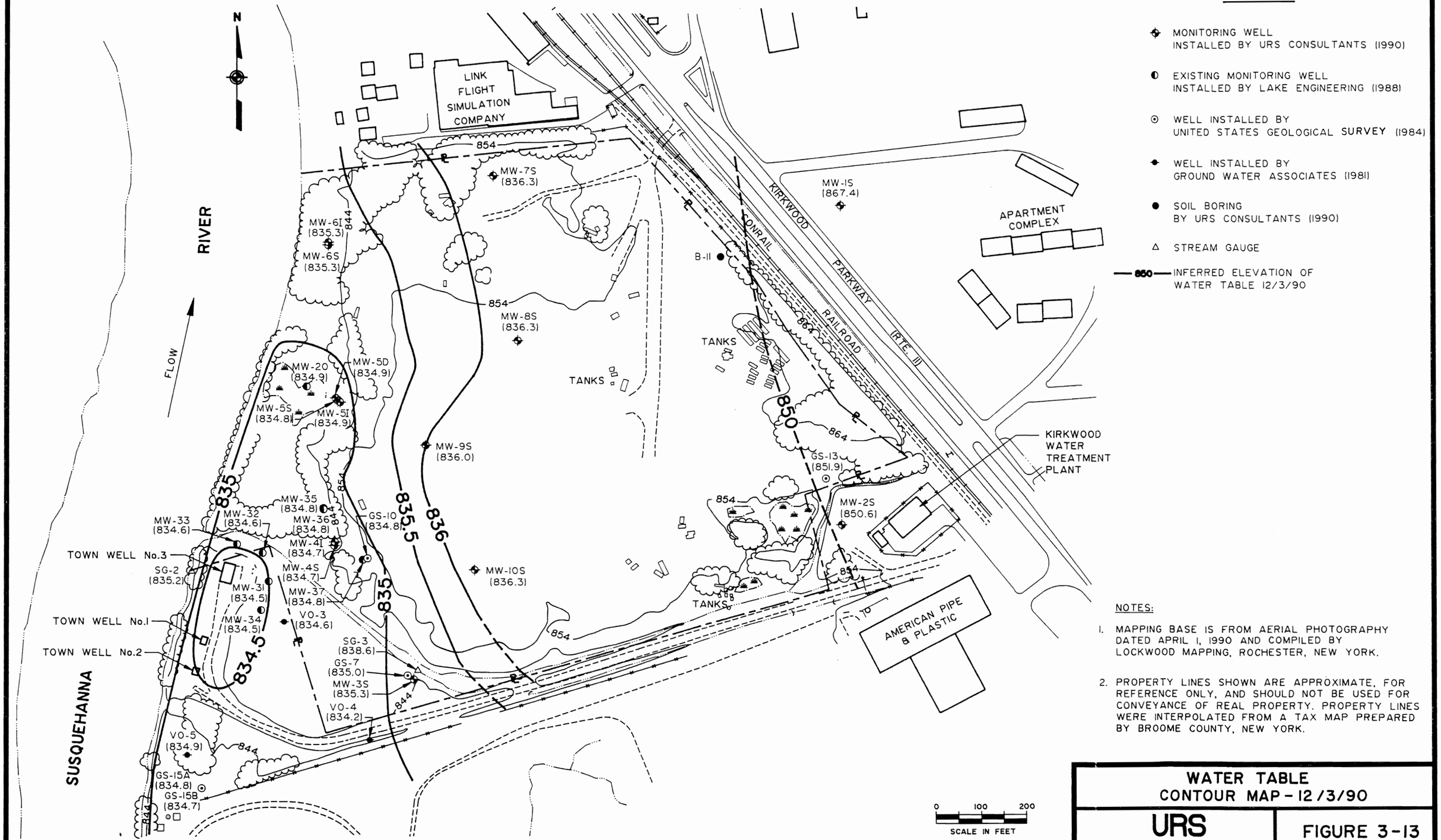
A water table contour map was constructed with the groundwater elevations obtained from the shallow monitoring wells on December 3, 1990. This contour map is shown in Figure 3-13. At that time, both Town Well No. 3 and the AP&P well were operating. The contours show that flow is basically from east of the site towards the Susquehanna River, but that once it proceeds approximately two-thirds of the way across the site, it bends south and flows towards Town Well No. 3. Additionally, the Susquehanna River is contributing flow (influent) or recharge to the well as the cone of depression intersects the river. This is evidenced by MW-33 having a lower water table elevation than is shown by the staff gage (SG-2). Note that the drainage along the south side of the landfill lies above the water table, since SG-3 shows a water surface elevation over 3

TABLE 3-4

VOLUME OF WATER PUMPED BY TOWN OF KIRKWOOD WELL #3

Month	Volume Water Pumped (gal)	Time On (%)
July 1991	41,960,000	NA
June	42,065,000	NA
May	41,696,000	NA
April	35,615,000	NA
March	36,267,000	NA
February	30,177,000	NA
January 1991	32,309,000	NA
December 1990	29,567,000	NA
November	28,860,000	67
October	32,191,000	72
September	28,059,000	65
August	33,890,000	76
July	35,500,000	80
June	39,170,000	91
May	37,475,000	84
April	36,505,000	85
March	35,800,000	80
February	31,460,000	78
January 1990	37,510,000	84
December 1989	37,580,000	84

1=200 4/2/91



LEGEND

- MONITORING WELL INSTALLED BY URS CONSULTANTS (1990)
- EXISTING MONITORING WELL INSTALLED BY LAKE ENGINEERING (1988)
- WELL INSTALLED BY UNITED STATES GEOLOGICAL SURVEY (1984)
- WELL INSTALLED BY GROUND WATER ASSOCIATES (1981)
- SOIL BORING BY URS CONSULTANTS (1990)
- STREAM GAUGE
- 850 INFERRED ELEVATION OF WATER TABLE 12/3/90

NOTES:

1. MAPPING BASE IS FROM AERIAL PHOTOGRAPHY DATED APRIL 1, 1990 AND COMPILED BY LOCKWOOD MAPPING, ROCHESTER, NEW YORK.
2. PROPERTY LINES SHOWN ARE APPROXIMATE, FOR REFERENCE ONLY, AND SHOULD NOT BE USED FOR CONVEYANCE OF REAL PROPERTY. PROPERTY LINES WERE INTERPOLATED FROM A TAX MAP PREPARED BY BROOME COUNTY, NEW YORK.

0 100 200
SCALE IN FEET

WATER TABLE CONTOUR MAP - 12/3/90

URS CONSULTANTS, INC.

FIGURE 3-13

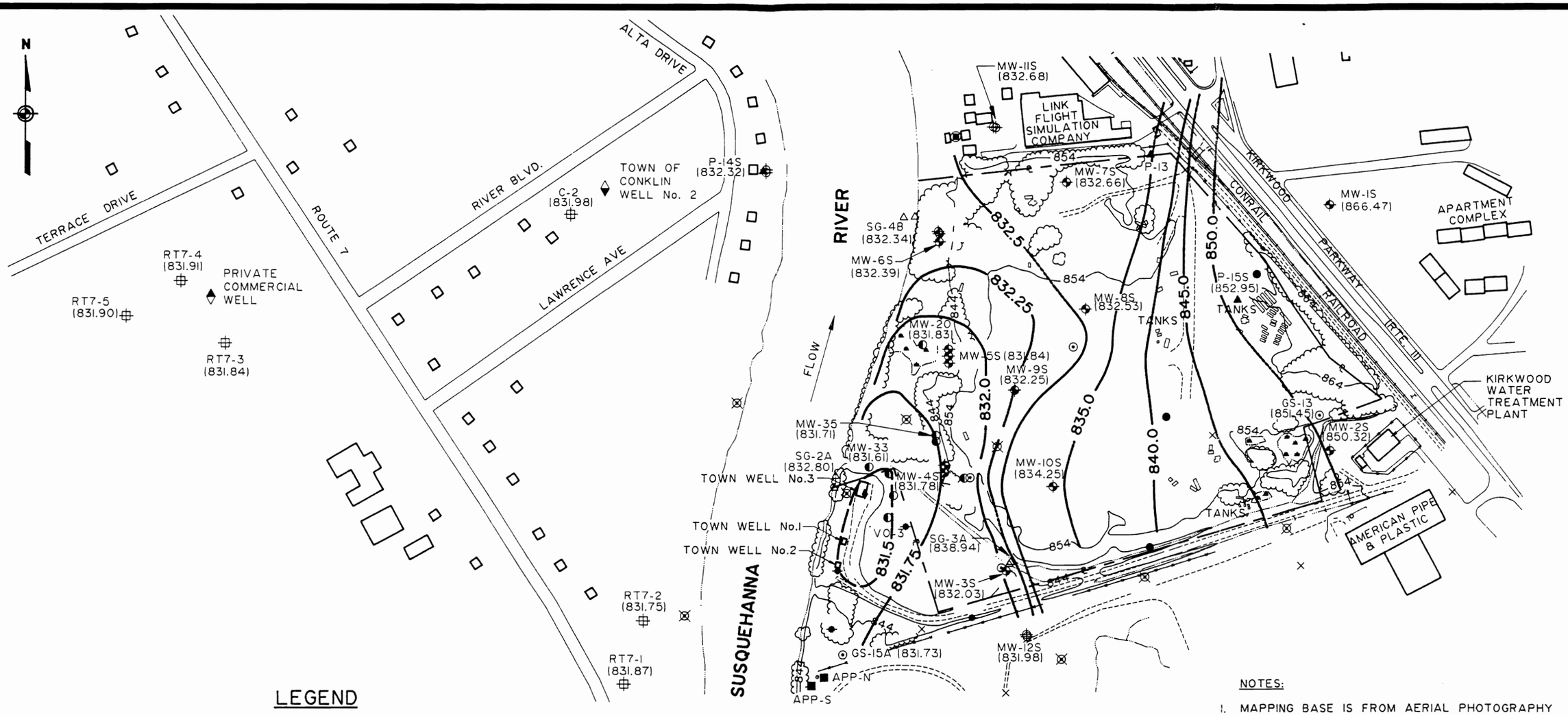
CC-2066

feet higher than MW-3S, and 2 feet higher than MW-10S. Percolation to the water table from this perched drainage may cause a long, narrow groundwater mound to form beneath this drainage, thereby inhibiting shallow flow beneath the drainage channel (perpendicular to the channel). It appears that some groundwater from the northern portions of the site flows to the Susquehanna River, rather then being pulled into the Town well.

A second-phase water table contour map was constructed with the elevations obtained on July 10, 1991 (Figure 3-14). The configuration of the water table is very similar to that shown for December 3, 1990, except that general water levels near the river are approximately 3 feet lower. Flow in the northwest corner of the site is towards the river and to the aquifer under the river, but most flow is towards Town Well No. 3, including the Susquehanna River. The river is again influent next to most of the site. However, a comparison of water levels in MW-6S to the river surface elevation adjacent (at Staff Gage 4/4A) shows that the groundwater is higher than the river in this portion of the site (Table 3-4A). Therefore, flow is from the northwest portion of the site to the river (and to the aquifer under the river) for at least part of the year. A comparison of river stage (SG 2/2A) versus MW-33 is also shown in Table 3-4A. For this well, located close to Town Well No. 3, flow is consistently towards the well from the river.

The Susquehanna River typically drops approximately 0.4 feet across the site (between the two staff gages). This distance is approximately 800 feet. On July 10, 1991, the river dropped 0.46 feet between the two staff gages. On the same day, MW-6's water level was 0.05 feet higher than the river at SG4A. Assuming a uniform gradient in the river between the staff gages, the river elevation would be equal to the groundwater elevation in MW-6S approximately 90 feet south of MW-6S. From this point south, the river is above the water table and thus influent to the site. North of this point, the site is influent to the river. This situation,

1=400 10/29/91



LEGEND

- MONITORING WELL INSTALLED BY URS CONSULTANTS (1990)
- MONITORING WELL INSTALLED BY URS CONSULTANTS (1991)
- EXISTING MONITORING WELL INSTALLED BY LAKE ENGINEERING (1988)
- EXISTING MONITORING WELL INSTALLED BY PRATT AND WOLFF (1986)
- WELL INSTALLED BY UNITED STATES GEOLOGICAL SURVEY (1984)
- WELL INSTALLED BY UNITED STATES GEOLOGICAL SURVEY (1984) (ABANDONED)
- WELL INSTALLED BY GROUND WATER ASSOCIATES (1981)
- WELL INSTALLED BY GROUND WATER ASSOCIATES (1984)
- SOIL BORING BY URS CONSULTANTS (1990)
- PIEZOMETERS BY URS CONSULTANTS (1991)
- STREAM GAUGE
- PVC FACTORY WELL
- SOIL BORING (PRE-1990)
- PRIVATE COMMERCIAL WELL (APPROXIMATE LOCATION)
- TOWN OF CONKLIN WELL (APPROXIMATE LOCATION)
- PRIVATE RESIDENTIAL WELL (APPROXIMATE LOCATION) (ABANDONED)
- —831.5— INFERRED ELEVATION OF WATER TABLE 7/10/91.
- (831.98) MEASURED WATER LEVEL ELEVATION (7/10/91)(FT.)

NOTES:

1. MAPPING BASE IS FROM AERIAL PHOTOGRAPHY DATED APRIL 1, 1990 AND COMPILED BY LOCKWOOD MAPPING, ROCHESTER, NEW YORK.
2. PROPERTY LINES SHOWN ARE APPROXIMATE, FOR REFERENCE ONLY, AND SHOULD NOT BE USED FOR CONVEYANCE OF REAL PROPERTY. PROPERTY LINES WERE INTERPOLATED FROM A TAX MAP PREPARED BY BROOME COUNTY, NEW YORK.

300 0 300

SCALE IN FEET

WATER TABLE CONTOUR MAP - 7/10/91

URS CONSULTANTS, INC.

FIGURE 3-14

CC-2351

FIGURE 3-15
MONITORING WELL MW-2S

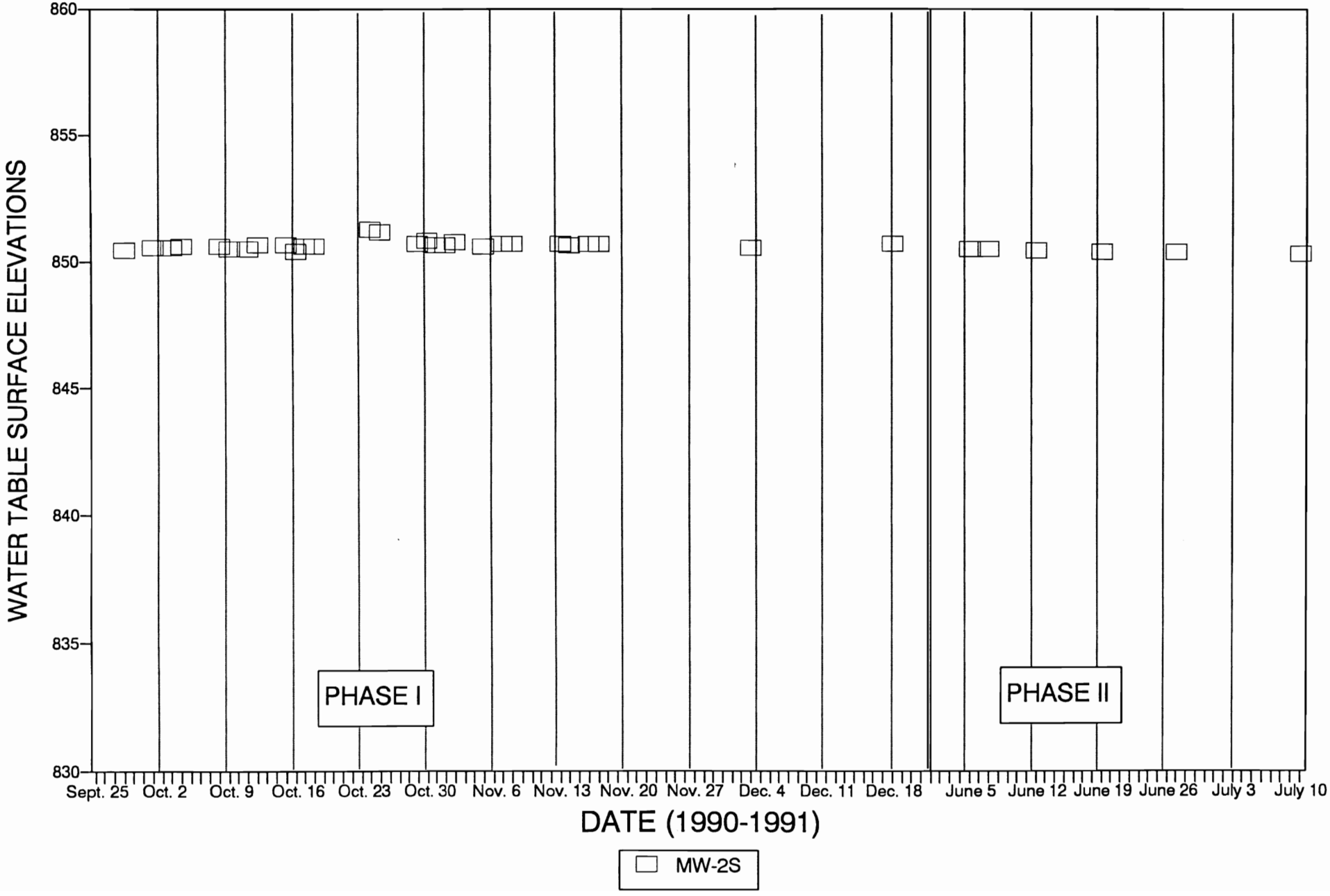


FIGURE 3-16
MONITORING WELLS MW-5S,5I,5D

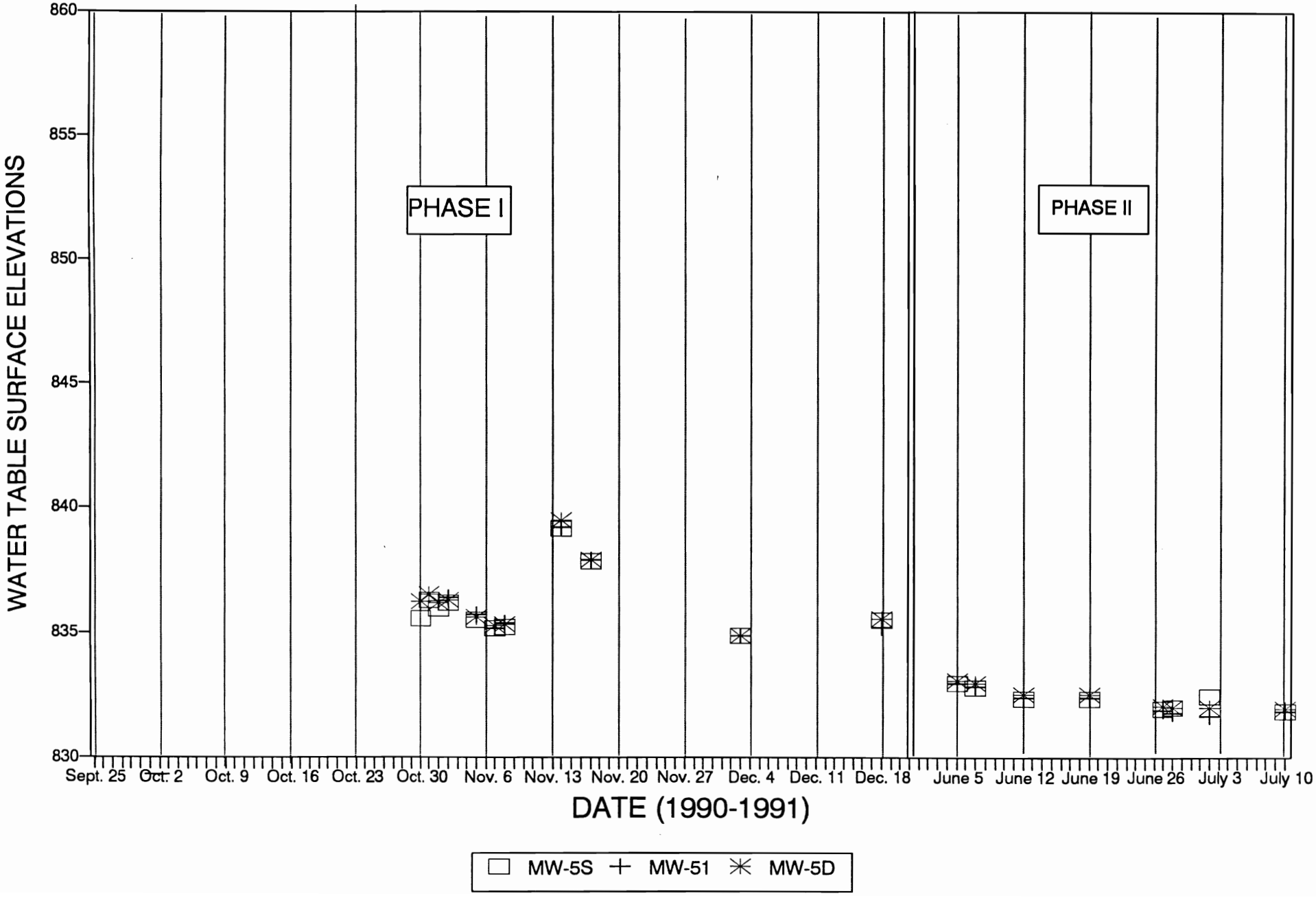


FIGURE 3-17
MONITORING WELLS MW-6S,6I,6D

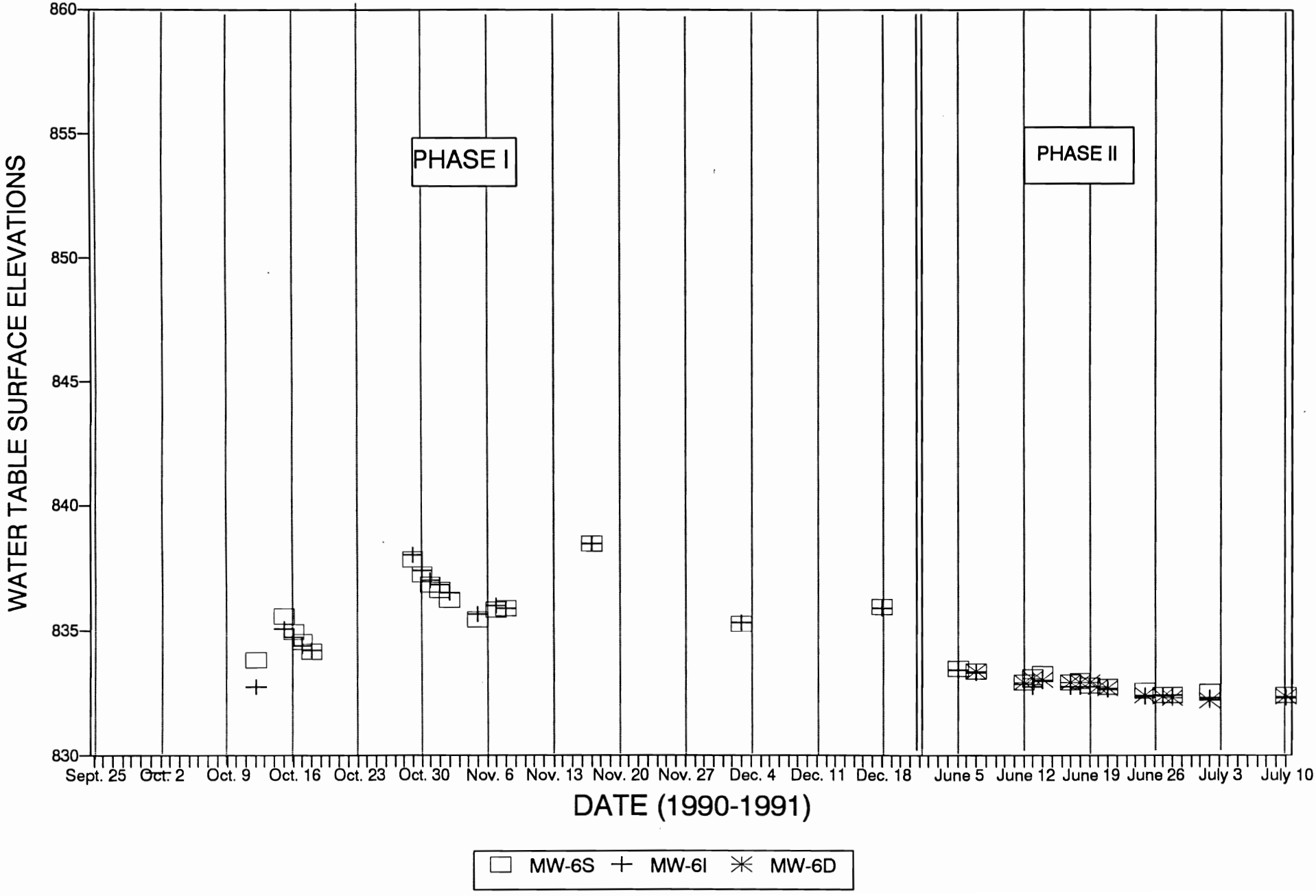


FIGURE 3-18
MONITORING WELL MW-7S

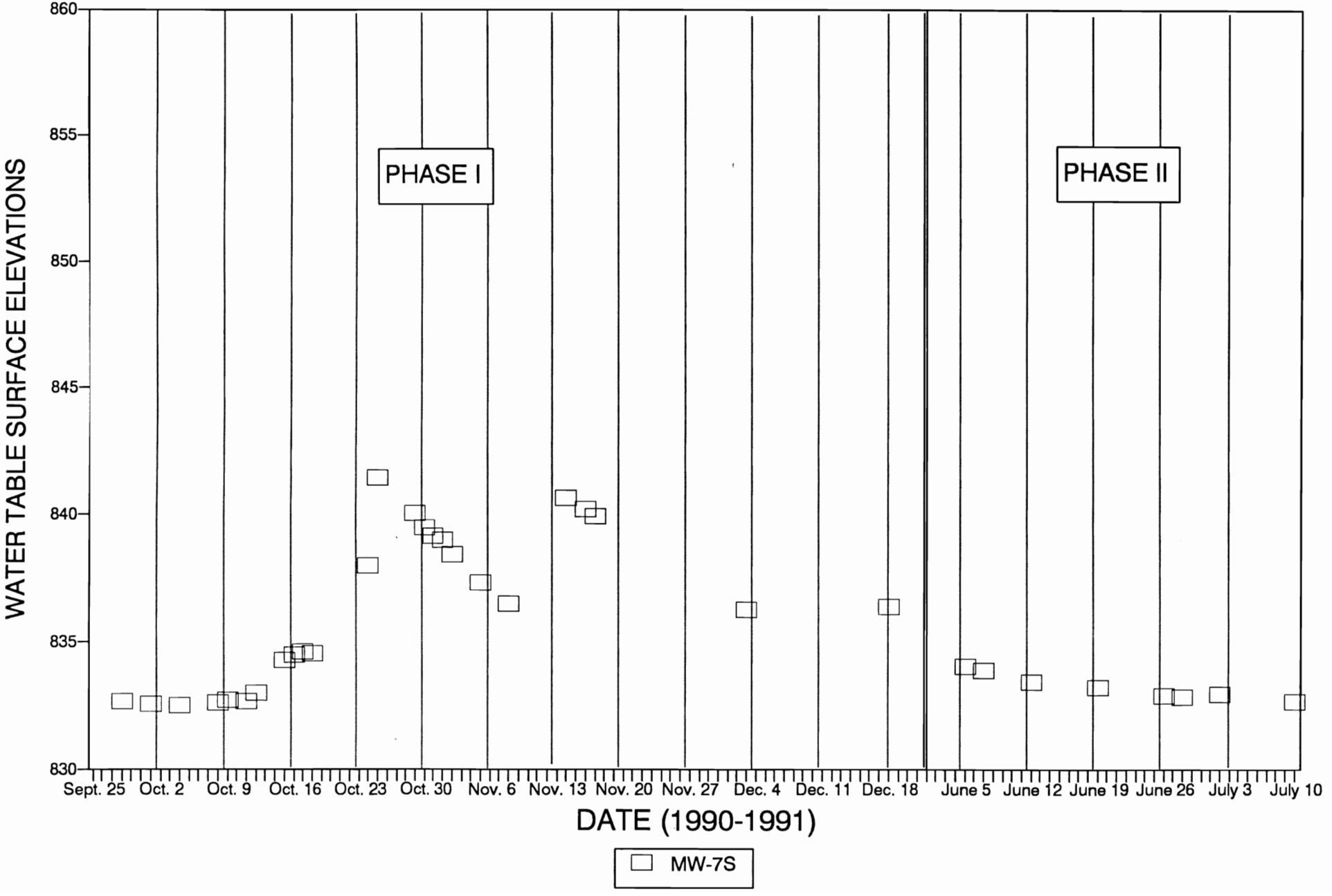


TABLE 3-4A

RIVER SURFACE vs. GROUNDWATER ELEVATIONS

DATE	MW-6S vs. SG 4/4B (ft)	MW-33 vs. SG 2A (ft)
6/5/91	0.02	-.93
6/7/91	-0.01	-1.03
6/12/91	0.09	-1.00
6/13/91	0.07	-1.10
6/14/91	0.02	-1.30
6/17/91	0.17	-1.18
6/18/91	0.07	
6/19/91	0.06	-1.19
6/21/91	0.01	
6/25/91	0.16	-1.06
6/28/91	0.07	-1.09
7/2/91	0.29	-1.12
7/10/91	0.05	-1.19
9/4/91	0.01	

- Negative numbers indicate that the river surface elevation is higher than the groundwater surface elevation.

SG - Staff gage

35232A/TAB-3-4A

however, is slightly complicated by the fact that the groundwater table slopes towards Town Well No. 3., thus reducing this 90 foot distance to some smaller value. Basically, though, the portion of the site north of MW-6S appears to have groundwater flow to the river, for at least a portion of the year. The portion of the site south of MW-6S does not contribute flow to the river for much of the year (because of the Town wells), but takes water from the river instead.

Flow Gradients

Horizontal flow gradients were calculated for several areas of the site based on the water-table contour map for December 3, 1990. The gradients are as follows:

MW-1S to MW-7S = 0.0410 ft/ft
MW-7S to MW-6S = 0.0025 ft/ft
MW-2S to MW-3S = 0.0150 ft/ft
MW-6S to #35 = 0.0008 ft/ft
MW-10S to MW-4S = 0.0061 ft/ft
(Projected Horizontally)

These figures indicate that fairly steep flow gradients characterize flow off the valley sidewall (MW-1S to MW-7S), and across the till ridge (MW-2S to MW-3S), but the gradients flatten out considerably in the aquifer (e.g., MW-7S to MW-6S and MW-10S to MW-4S). This is expected, however, since the highly permeable aquifer needs only a low gradient to flow, whereas much higher gradients are needed to allow flow in the finer-grained tills. Additionally, note that gradients steepen closer to Town Well No. 3 (as the cone of depression steepens), and that flow through the aquifer seems to occur more readily parallel to the river than perpendicular to it. This latter statement comes from the observation that the gradient from MW-6S to MW-35 is much lower than the gradients perpendicular to the river.

Vertical flow gradients, which were calculated for most of the nested wells at the site, are shown in Table 3-5. The gradients are all very low and range from a maximum downward gradient of 0.08 ft/ft to a maximum upward gradient of 0.02 ft/ft, both of which occur in MW-6S/6I. Note that gradients seem to oscillate back and forth between upwards and downwards, apparently adjusting to changes in river stage. However, the low vertical flow gradients in these wells at the site seem to indicate that flow is predominantly horizontal in this aquifer. Also of note is the pattern of vertical gradients in well nests MW-5 and MW-6, both of which are triple well nests. The water level in the intermediate well is typically lowest of the three nested wells, thus showing downward flow from above and upward flow from below into the intermediate zone. This helps to confirm that the Town pumping wells take most water from the intermediate zones of the aquifer.

No well nests are installed on the side of the landfill away from the river to monitor vertical gradients. It is expected, however, that the flow is downwards (a recharge area) on the valley sidewalls.

3.8.4 Hydraulic Conductivity

Hydraulic conductivity values for each of the monitoring wells installed, plus wells 33 through 36, GS-15A, and GS-15B were obtained by slug tests. These hydraulic conductivity values correspond to the horizontal conductivity of the aquifer in the screened interval. Values of hydraulic conductivity, K, obtained are presented in Table 3-6. In general, the hydraulic conductivity of the aquifer materials tested was high. The calculated values varied from a low of 4.6×10^{-4} to over 6×10^{-2} cm/sec, with the majority of values falling within the 10^{-2} cm/sec range. Several monitoring wells had such a high hydraulic conductivity that the rate of water level recovery was too fast for the datalogger to record. A hydraulic conductivity value of greater than 6.0×10^{-2} cm/sec is assumed for these wells.

TABLE 3-5

VERTICAL GRADIENTS IN GROUNDWATER AT WELL CLUSTERS

Phase I

WELL #:	SCREEN MIDPOINT ELEVATION
MW-4S	828.1
MW-4I	810.1
MW-5S	828.7
MW-5I	809.6
MW-5D	777.9
MW-6S	827.5
MW-6I	814.1
GS-15A	823.5
GS-15B	791.0

BETWEEN WELLS #:	4S-4I	5S-5I	5I-5D	5S-5D	6S-6I	15A-15B
ELEVATION DIFFERENCE BETWEEN SCREEN MIDPOINTS (FT)	18.0	19.1	31.7	50.8	13.4	32.5
DATE: Sept. 25						0.0025
Sept. 28						0.0012
Oct. 1						0.0018
Oct. 3						0.0018
Oct. 4						0.0022
Oct. 8						0.0015
Oct. 9						-0.0037
Oct. 11						0.0012
Oct. 12					0.0799	0.0009
Oct. 15					0.0388	0.0003
Oct. 16					0.0142	0.0012
Oct. 17					0.0157	0.0009
Oct. 18					-0.0045	0.0015
Oct. 25						0.0003
Oct. 29					-0.0127	0.0065
Oct. 30				-0.0124	-0.0104	0.0040
Oct. 31				-0.0045	-0.0134	0.0034
Nov. 1				-0.0047	-0.0142	0.0028
Nov. 2		-0.0120	0.0035	-0.0024	-0.0216	-0.0006
Nov. 5		-0.0110	0.0035	-0.0020	-0.0172	0.0006
Nov. 7	-0.0006		-0.0035	-0.0022	-0.0104	
Nov. 8	0.0089	-0.0079	0.0009	-0.0024	0.0030	-0.0003
Nov. 13	0.0050					
Nov. 14	0.0128	-0.0021	-0.0091	-0.0065		0.0025
Nov. 16	0.0006					0.0006
Nov. 17	0.0006	-0.0016	-0.0013	-0.0014	-0.0030	0.0025
Dec. 3	-0.0006	-0.0016	0.0003	-0.0004	-0.0037	0.0031
Dec. 18	0.0006	0.0147	-0.0028	0.0037	0.0030	0.0022

NOTE: DOWNWARD GRADIENTS ARE CALCULATED AS POSITIVE

TABLE 3-5 (Continued)

VERTICAL GRADIENTS IN GROUNDWATER AT WELL CLUSTERS
Phase II

WELL #:	SCREEN MIDPOINT ELEVATION
MW-4S	828.1
MW-4I	810.1
MW-5S	828.7
MW-5I	809.6
MW-5D	777.9
MW-6S	827.5
MW-6I	814.1
MW-6D	784.7
GS-15A	823.5
GS-15B	791.0

BETWEEN WELLS #:		4S-4I	5S-5I	5I-5D	5S-5D	6S-6I	6I-6D	6S-6D	15A-15B
ELEVATION DIFFERENCE BETWEEN SCREEN MIDPOINTS (FT)		18.0	19.1	31.7	50.8	13.4	29.4	42.8	32.5
DATE:	June 5	0.0013	-0.0009	-0.0041	-0.0028	0.0045	-0.0278		0.0037
	June 7	0.0013	-0.0009	-0.0041	-0.0028	0.0052	-0.0024	0.0000	0.0025
	June 12	0.0014	-0.0009	-0.0041	-0.0028	0.0045	-0.0020	0.0000	0.0025
	June 13					0.0269	-0.0105	0.0012	
	June 14					0.0201	-0.0020	0.0049	
	June 17					0.0142	-0.0065	0.0000	
	June 18					0.0164	-0.0061	0.0009	
	June 19	0.0009	-0.0009	-0.0035	-0.0025	0.0067	-0.0061	-0.0021	0.0015
	June 20								
	June 21					0.0067	-0.0010	0.0014	
	June 24								
	June 25	0.0014				0.0157	-0.0017	0.0037	0.0025
	June 26								
	June 27	0.0005	0.0004	-0.0050	-0.0029	0.0005	0.0017	0.0013	
	June 28	0.0014	0.0089	-0.0066	-0.0002	0.0000	0.0027	0.0017	0.0022
	July 1								
	July 2	-0.0042	0.0341	-0.0101	0.0088	0.0114	0.0048	0.0073	
	July 10	0.0009	0.0009	-0.0035	-0.0017	0.0049	-0.0010	0.0013	0.0018

NOTE: DOWNWARD GRADIENTS ARE CALCULATED AS POSITIVE

TABLE 3-5 (Continued)

VERTICAL GRADIENTS IN GROUNDWATER
AT WELL CLUSTERS
Phase II

WELL #:	SCREEN MIDPOINT ELEVATION
MW-11S	833.5
MW-11I	815.7
MW-12S	831.0
MW-12D	813.2
P-14S	833.0
MW14-I	808.3
MW14-D	774.1

BETWEEN WELLS #:		11S-11I	12S-12D	P-14S - 14I	14I-14D	P-14S - 14D
ELEVATION DIFFERENCE BETWEEN SCREEN MIDPOINTS (FT)		17.8	17.8	24.7	34.2	58.9
DATE:	June 5					
	June 7					
	June 12			0.0041	0.0067	0.0056
	June 13					
	June 14			0.0097	-0.0009	0.0036
	June 17		0.0102	-0.0111	0.0085	0.0003
	June 18		0.0062	-0.0045	0.0117	0.0049
	June 19		0.0062	0.0020		
	June 20		0.0119	0.0070		
	June 21		0.0338	0.0041	0.0012	0.0024
	June 24	-0.0093	0.0341	0.0050	0.0038	0.0043
	June 25		0.0063	0.0050	0.0038	0.0043
	June 26		0.0068			
	June 27	0.0035				
	June 28		-0.0021	0.0096	0.0020	0.0052
	July 1					
	July 2	-0.0012	0.0506	0.0042	0.0056	0.0050
	July 10	0.0018	-0.0011	0.0062	0.0032	0.0045

NOTE: DOWNWARD GRADIENTS ARE CALCULATED AS POSITIVE

TABLE 3-6
HYDRAULIC CONDUCTIVITY TESTING RESULTS

Well I.D. Number	Screened Interval (Feet Below Surface)	Geologic Unit	Hydraulic Conductivity (1)		Assumed Hydraulic Conductivity (cm/sec) ("Best Value")
			Slug In (cm/sec)	Slug Out (cm/sec)	
2-S	6.0-16.0	Sand	7.1×10^{-3}	1.2×10^{-2}	1.2×10^{-2}
3-S	9.0-19.0	Sand & Gravel	1.5×10^{-3}	1.2×10^{-3}	1.5×10^{-3}
4-S	9.0-19.0	Sand & Gravel	1.3×10^{-2}	8.9×10^{-3}	1.3×10^{-2}
4-I	26.2-36.2	Sand & Gravel	**	**	$\geq 6 \times 10^{-2}$
5-S	5.5-15.5	Sand & Gravel	9.3×10^{-3}	6.1×10^{-3}	9.3×10^{-3}
5-I	24.5-34.5	Sand & Gravel	**	**	$\geq 6 \times 10^{-2}$
5-D	56.0-66.0	Sand & Gravel	**	**	$\geq 6 \times 10^{-2}$
6-S	7.0-17.0	Sand & Gravel	5.3×10^{-3}	3.0×10^{-3}	5.3×10^{-3}
6-I	22.7-27.7	Sand	**	**	$\geq 6 \times 10^{-2}$
6-D	50.0-60.0	Sand	1.2×10^{-2}	1.1×10^{-2}	1.2×10^{-2}
7-S	14.0-24.0	Sand & Gravel	**	**	$\geq 6 \times 10^{-2}$
8-S	24.0-34.0	Gravel, Some Sand	8.8×10^{-3}	--	8.8×10^{-3}
9-S	23.0-33.0	Sand & Gravel	1.1×10^{-2}	1.7×10^{-2}	1.1×10^{-2}
10-S	17.6-27.6	Sand	1.8×10^{-3}	2.9×10^{-2}	2.9×10^{-2}
11-S (2)	20.5-30.5	Gravel, Trace Sand	--	5.8×10^{-2}	5.8×10^{-2}
11-I (2)	38.2-48.2	Sand & Gravel	5.0×10^{-4}	9.0×10^{-4}	5.0×10^{-4}

TABLE 3-6 (Cont'd.)

Well I.D. Number	Screened Interval (Feet Below Surface)	Geologic Unit	Hydraulic Conductivity (1)		Assumed Hydraulic Conductivity (cm/sec) ("Best Value")
			Slug In (cm/sec)	Slug Out (cm/sec)	
12-S (2)	11.0-21.0	Sand & Gravel	5.8×10^{-2}	**	5.8×10^{-2}
12-D (2)	26.0-41.0	Sand & Gravel	4.6×10^{-4}	4.3×10^{-4}	4.6×10^{-4}
P-14 (2)	8.0-18.0	Sandy Silt/Sand & Gravel	--	5.1×10^{-2}	5.1×10^{-2}
14-I (2)	32.5-42.5	Silty Sand	1.6×10^{-3}	1.3×10^{-3}	1.6×10^{-3}
#33	52-67	Sand & Gravel	3.7×10^{-3}	1.5×10^{-2}	3.7×10^{-3}
#34	53-68	Sand & Gravel	9.7×10^{-3}	8.5×10^{-3}	9.7×10^{-3}
#35	12-22	Sand & Gravel	4.0×10^{-3}	5.2×10^{-3}	4.0×10^{-3}
#36	53-68	Sand & Gravel	**	**	$\geq 6 \times 10^{-2}$
GS-15A	20-25	Sand & Gravel	8.5×10^{-3}	1.2×10^{-2}	8.5×10^{-3}
GS-15B	50-60	Sand & Gravel	2.0×10^{-2}	2.6×10^{-2}	2.0×10^{-2}

** Well recovery data too rapid to allow reasonable interpretation.
-- Not done, or not interpreted as screen straddles the water table.
(1) Calculated by methods of Bouwer and Rice, 1976.
(2) Well installed in second phase of field investigation.

Note - No usable information was obtained from the testing of MW-1S or MW-14D.

Specific properties of each unit are discussed below:

(a) Fill: The hydrogeologic characteristics of this unit are not known, since fill is typically very heterogeneous. Often, fill is loosely compacted and thus very permeable as would be expected for construction and demolition-type fill material. Varying hydraulic conductivities in the fill is probable, but based upon the type of fill materials present, a relatively high K value could be expected.

(b) Fine Sand and Silt: This floodplain deposit lies directly over the sand and gravel unit in low-lying areas along the Susquehanna River. The water table frequently lies within this unit. Therefore, the water table wells, such as MW-5S and MW-6S, are screened across the contact between the floodplain deposits and the underlying sand and gravel unit. Slug tests done in these wells will largely reflect the hydraulic conductivity of the coarser sand and gravel unit, rather than in the finer-grained floodplain deposit. Hydraulic conductivity in this unit is probably on the order of 10^{-4} cm/sec (Ref. 3).

(c) Sand and Gravel: This unit represents the majority of water bearing sediments (the valley-fill aquifer) present beneath the Gorick Landfill site. The hydraulic conductivity of this unit ranged from 4.6×10^{-4} cm/sec to greater than 6×10^{-2} cm/sec. The medium value was 1.4×10^{-2} cm/sec, and the geometric mean is 1.2×10^{-2} cm/sec.

The porosity of these materials may be estimated from the porosity of similar well sorted sands and gravels, which has been found to range from 20-35 percent (Ref. 25).

(d) Kame Terrace Sand: Measurements of hydraulic conductivity of this unit at MW-2S showed 1.2 x 10^{-2} cm/sec. The porosity of similar sands has been found to range from 25-50 percent (Ref. 3).

(e) Till: No wells were completed in this unit to allow hydraulic conductivity testing. However, the vertical hydraulic conductivity was estimated to be on the order of 10^{-7} cm/sec, based on laboratory analysis of a sample obtained during the second phase of the investigation. It is expected that this unit will provide good protection from contamination to the underlying shale bedrock. A further discussion of the hydraulic conductivity of the till unit is included below.

3.8.5 Glacial Till Hydraulic Conductivity

One of the objectives of the second phase of field activities was to determine the hydraulic conductivity of the till unit underlying the sand and gravel aquifer. This information was sought to determine the suitability of the till unit as an aquitard.

Attempts to quantify the hydraulic conductivity of the till unit included sampling of the unit during drilling (utilizing Shelby tubes, 3-inch split-spoon samplers, and till core barrel samplers) and an in-situ hydraulic conductivity test (packer test) within the till unit.

The till packer test was conducted at MW-6D. Due to a sand heave problem at this location, spin casing was used in place of hollow-stem augering. The spin casing was advanced to 61.6 feet, 5.2 feet into the till unit. In an attempt to retrieve an undisturbed sample of the till (after unsuccessful Shelby-tube attempts) a 3-inch core till barrel was advanced to 63.5 feet. The packer test was conducted within the core hole (62.5-63.5 feet). The results of the test indicated a material of

relatively high horizontal hydraulic conductivity (10^{-3} cm/sec). However, this value is probably not reasonable for the hydraulic conductivity of the till. The washing action of the spin casing and core barrel may have disrupted the in-place density of materials by dislodging the fines from the till matrix, exposing a coarse gravel which was present in the till at this location (as observed in the core sample). Another possible scenario for this high a value could be a hydraulic connection between the drill casing and the overlaying highly productive aquifer along the outside of the casing.

An undisturbed sample of till was obtained from boring P-13 at the 23- to 25-foot interval by means of a 3-inch split-spoon sampler. This material physically resembled the till that was observed beneath the sand and gravel aquifer at MW-5D and MW-6D. Laboratory permeability testing on this sample indicated a value of 1.26×10^{-7} cm/sec [See Appendix I.]

Based on the laboratory permeability of the till sample, on the high content of fine-grained material in the till samples analyzed (Table 3-3), on its density, on the probable thickness of the unit (based on regional information), and on the fact that it is everywhere present beneath the site, the till unit should provide a good barrier to downward vertical movement of contaminants beneath the landfill. The till unit is assisted in this by the predominantly horizontal nature of flow in the sand and gravel aquifer above this till unit.

4. NATURE AND EXTENT OF CONTAMINATION

4.1 Soils

The evaluation of the soil matrix at the Gorick Landfill utilized data gathered from the soil gas survey and from the analysis of surficial and subsurface soil samples collected as part of the environmental sampling program.

4.1.1 Soil Gas Survey

The results of the soil gas survey are shown in Figure 4-1; the report of the specialty subcontractor, Target Environmental, of Columbia, Maryland, is included as in Appendix A. The soil gas survey was largely ineffective in identifying contamination beneath the site, however. Although a few areas did show elevated VOC levels in the soil gas, many areas of contaminated groundwater (identified by groundwater monitoring) did not show elevated soil gas concentrations. This may be due to the limited depth of sampling (2-5 feet) versus the depth to water (usually over 15 feet).

One area of elevated soil gas concentrations was found between MW-7S and MW-8S (Figure 2-2). TCE was detected here at concentrations of up to 1.7 ppb at 4 grid locations. TCE was also found at 1.3 ppb at two other locations along the southern and southeastern borders of the fill (Figure 4-1).

Toluene was the only other contaminant detected during the soil gas survey, being detected at concentrations of up to 2.1 ppb in four samples collected at widely spaced locations across the property.

Several vent holes were noted on the surface of the landfill at the onset of winter (i.e., at the end of the first phase of the field

1:200 9/25/91

LEGEND

- • SOIL GAS SAMPLE LOCATION; NO DETECTIONS
- O SOIL GAS SAMPLE LOCATION; CONCENTRATION (ppb); COMPOUND DETECTED

NOTES:

1. MAPPING BASE IS FROM AERIAL PHOTOGRAPHY DATED APRIL 1, 1990 AND COMPILED BY LOCKWOOD MAPPING, ROCHESTER, NEW YORK.
2. PROPERTY LINES SHOWN ARE APPROXIMATE, FOR REFERENCE ONLY, AND SHOULD NOT BE USED FOR CONVEYANCE OF REAL PROPERTY. PROPERTY LINES WERE INTERPOLATED FROM A TAX MAP PREPARED BY BROOME COUNTY, NEW YORK.

SOIL GAS SURVEY

URS CONSULTANTS, INC.

FIGURE 4-1

CC-2112A

investigation), when the warm, humid vapors emitting from them condensed and became visible. High, erratic PID readings were noted, but were largely discounted because of the high humidity of the vapors and their lack of correlation with the soil gas survey, which had detected no organics in these areas. When monitored again during the second phase, there was some slow HNu response, but this was discounted as moisture interference due to the high humidity. The vent holes did not register on the explosimeter, which can be used to detect methane. However, the sensitivity of this instrument is much less than for the PID (i.e., 50 ppm of methane would register as only one percent of the lower explosive limit).

The results of the soil gas survey were used as the basis for choosing the locations for several environmental samples and monitoring wells. Surface soil samples SPS-3, SPS-4, and SPS-5 were taken at soil gas grid locations No. 92, 11, and 86, respectively. Surface water/stream sediment sample pair SW/SS-5 was collected near grid location No. 18. Monitoring wells MW-5, MW-7S, and MW-8S were installed near locations No. 79, 86, and 92, respectively (Figure 2-2 and 4-1).

4.1.2 Subsurface Soil Sampling

Subsurface soil samples were taken from the borings made at MW-1S, MW-2S, MW-3S, MW-4S, MW-5D, and MW-6S (Figure 2-2). All six samples were collected from borings placed outside the fill. MW-1S and MW-2S are upgradient of the landfill, based on the groundwater flow, while the remainder are downgradient. Analytical results are shown in Table 4-1. [Note that all tables in this chapter are presented at the end of the chapter for the convenience of the reader.]

Volatile organics were detected at trace levels in three samples, MW-2S, MW-4S, and MW-5D. The compounds detected and their maximum concentrations were chloroform (1 ppb), 2-butanone (2 ppb), 1,1,1-

trichloroethane (7 ppb), TCE (3 ppb), toluene (0.6 ppb), styrene (1 ppb), and total xylenes (5 ppb). All compounds but total xylenes were found at only a single location. The borings for downgradient well MW-4S and upgradient well MW-2S had the greatest number of verified detections (three VOCs detected in each soil sample).

No semivolatile compounds were found in any of the samples, except at MW-6S where three semivolatile compounds were detected at low levels: pyrene (47 ppb), di-n-octylphthalate (48 ppb), and di-n-butylphthalate (54 ppb). Pesticides and PCBs were also not detected in any of the samples, except at MW-5D where one pesticide, delta-BHC (5.5 ppb), was found.

Subsurface soil samples were analyzed for twenty-three (23) metals. Twenty (20) of these were detected at various levels in the soil samples, while three (3) metals were not detected in any of the samples. Those not detected were antimony, mercury, and thallium. Concentrations of the other metals fall within the ranges considered normal in eastern U.S. soils (Ref. 5). No soil sample appeared to be significantly higher in metals concentrations than any other.

Cyanide was not detected in any of the soil boring samples. Phenols were detected in four of the six samples, the highest concentration (total phenols) being 1.53 ppb at MW-6S.

From these results, it appears that there has been no significant contamination of the subsoil downgradient of the fill. Low levels of semivolatiles are, however, present near MW-6. These compounds are assumed to be derived from the fill and to have migrated to this vicinity over time, probably via groundwater. This sample also showed higher than normal levels of phenols, ammonia, Total Kjeldahl Nitrogen (TKN) and Total Organic Carbon (TOC). At least part of these higher than average concentrations, especially the ammonia, TKN, and TOC, may be due to the

floodplain origin of this sample, with its high content of silt and organic matter, rather than to any landfill contamination.

4.1.3 Surface Soil Sampling

Five (5) surface soil samples were collected during the first phase. Material was collected from a depth of 2 to 10 inches using a stainless-steel bucket auger. Sample SPS-1 was collected off site, uphill of the landfill across Route 11, to serve as a background sample. The other four samples were collected on site (Figure 2-2). Samples SPS-3, SPS-4, and SPS-5 were collected at locations where VOC soil gas detections for toluene or TCE had occurred. SPS-2 was collected near the entrance to the landfill for health risk assessment purposes. Three additional surface soil samples were collected during the second phase using a stainless-steel trowel. SPS-6, SPS-7, and SPS-8 were collected in the area near SPS-5 (which had the highest concentration of semivolatiles of the five first-phase SPS samples). The locations of SPS-6, SPS-7, and SPS-8 were selected during the second-phase fieldwork, with the concurrence of the NYSDEC onsite representative, to change the locations proposed in the work plan. The parameters for which the second-phase surface soil samples were analyzed were reduced to the TCL volatiles and TCL semivolatiles (from the full TCL) at the instruction of NYSDEC. Analytical results for all surface soil samples are shown in Table 4-2.

No significant VOC contamination was detected in any of the first-phase surface soil samples, although trace concentrations of one or two compounds were detected in two of the five samples (TCE at SPS-3 [5 ppb], and total xylenes at SPS-2 [2 ppb] and SPS-3 [4 ppb]). Up to four volatiles were detected in the second-phase surface soil samples. Toluene was detected in all 3 of the samples: 3 ppb in SPS-6; 8 ppb in SPS-7; and 97 ppb in SPS-8. Chlorobenzene was detected in SPS-6 at 0.7 ppb and SPS-8 at 9 ppb. Methylene chloride and carbon tetrachloride were detected in SPS-8 only, at concentrations of 11 ppb and 43 ppb, respectively. The

concentrations of VOCs at SP-8 are higher than would be expected, given the shallow depth at which the sample was taken, and the volatile nature of the contaminants.

Semivolatile organic compounds were detected in all first and second-phase samples at widely varying concentrations. Of the 21 semivolatiles detected, most were polycyclic aromatic hydrocarbons (PAHs), with phthalates being the remainder of the detected semivolatiles. Concentrations of semivolatiles were highest at SPS-7, in the northern part of the landfill, adjacent to the location of MW-7S, where the highest concentrations of semivolatiles in the subsurface waste samples were also found. SPS-5, 6, and 8, which also had high concentrations of PAHs, were located in the northern part of the landfill near SPS-7. These PAHs are likely derived from foundry wastes (combustion by-products) characteristic of the northern portion of the site (the usual matrix material for wastes in this portion).

Twenty (20) semivolatiles were detected at SPS-7, with a total concentration of 288,000 ppb. However, due to the high concentrations found, several compounds showed concentrations which exceeded the linear range of calibration (for analysis). The sample was, therefore, diluted and reanalyzed. Upon reanalysis, the same 20 compounds were detected (one was rejected by URS, however) with a total concentration of 384,000 ppb. Twenty-one (21) semivolatiles were also detected in SPS-5, with an aggregate concentration of approximately 24,000 ppb. SPS-6 was found to contain 19 semivolatiles, totaling 22,000 ppb. SPS-8 had 15 semivolatile compounds detected, with a total concentration of 56,000 ppb. The background sample, SPS-1, had 7 detections of semivolatiles with a total concentration of 256 ppb. The cleanest sample for semivolatiles was SPS-2, taken by the entrance gate. This sample contained only two semivolatiles totaling only 13 ppb. The remaining two samples (SPS-3 and SPS-4), taken from soil gas "hot spots", showed up to 16 different compounds, but the total concentration in each was less than 2,000 ppb.

Pesticides were detected in three of the five (5) first-phase surface soil samples, with the highest pesticide levels found in the background sample, SPS-1. This is probably due to spraying on the Kirkwood Manor Apartments property over the years. The sample taken at the entrance to the landfill also showed the presence of pesticides, as did SPS-5. 4,4'-DDE was found at SPS-1 (380 ppb), SPS-2 (33 ppb), and SPS-5 (15 ppb). 4,4'-DDT was found at SPS-1 (150 ppb). At SPS-5, 4,4'-DDD, 4,4'-DDT, and alpha-chlordane were also detected at low concentrations. No PCBs were detected in any of the first-phase samples. Pesticides and PCBs were not analyzed for in the second-phase samples.

Metals detected at onsite locations in the first-phase shallow soil samples were at levels essentially equal to levels detected off site, with the exception of zinc and lead at SPS-5. Zinc was detected at 177,000 ppb, and lead was detected at 136,000 ppb. These levels are roughly two and four times higher, respectively, than the background sample for the same elements. Note, however, that of the four remaining samples, the background sample, SPS-1, had the highest zinc and lead concentrations. Second-phase samples were not analyzed for metals.

These results show that the surface soil sample collected near the entrance gate (SPS-2), in relatively undisturbed material, was less contaminated than the sample collected as background from across Route 11 (SPS-1). The remaining seven samples all reveal some contamination of the onsite surface soils, with the greatest amount of contamination found at SPS-7, in the northern part of the landfill. This contamination on the surface of the landfill is likely due to inadequate and/or poorly placed intermediate cover, allowing fill to appear at the surface.

4.2 Waste Sampling

A map delineating the approximate fill area of the site is presented in Figure 4-2. This area was sampled in three different ways during the

1:200 10/8/91

LEGEND

- APPROXIMATE AREA OF FILL
- GPT No. — GEOPHYSICAL TRANSECT LINE
- MONITORING WELL INSTALLED BY URS CONSULTANTS (1990)
- WELL INSTALLED BY UNITED STATES GEOLOGICAL SURVEY (1984)
- SOIL BORING BY URS CONSULTANTS (1990)
- PIEZOMETERS BY URS CONSULTANTS (1991)
- TEST TRENCH BY URS CONSULTANTS (1991)
- (13') APPROXIMATE CURRENT DEPTH OF FILL AT BORING/WELL OR TEST PIT/ TRENCH LOCATION

NOTES:

1. MAPPING BASE IS FROM AERIAL PHOTOGRAPHY DATED APRIL 1, 1990 AND COMPILED BY LOCKWOOD MAPPING, ROCHESTER, NEW YORK.
2. PROPERTY LINES SHOWN ARE APPROXIMATE, FOR REFERENCE ONLY, AND SHOULD NOT BE USED FOR CONVEYANCE OF REAL PROPERTY. PROPERTY LINES WERE INTERPOLATED FROM A TAX MAP PREPARED BY BROOME COUNTY, NEW YORK.

FILL BOUNDARY MAP

URS CONSULTANTS, INC.

FIGURE 4-2

CC-2073/B

first phase: (a) composite waste samples were collected from borings at MW-7, MW-8, MW-9, and MW-10, all drilled through fill; (b) discrete surficial waste samples were taken, one sample in the northwest part of the fill area (WS-1), and one in the eastern part (WS-2A); and, (c) surficial waste samples were collected in conjunction with the leachate seep samples taken just outside the southeast corner of the filled area.

Volatile organics were detected in only one of the first-phase waste samples, the composite waste sample collected from the boring at MW-7. Six VOCs were detected, with the highest concentration being TCE at 18 ppb. The remaining compounds were the 4 BTEX (benzene, toluene, ethylbenzene, xylene) compounds, often indicative of oil or gasoline products, and tetrachloroethane.

A wide range of semivolatile compounds (26 different compounds detected) was found in the first-phase waste samples at widely varying concentrations. PAHs were the predominant compounds found, but various phenols and phthalates were also present, along with dibenzofuran. The highest concentrations were found in the composite waste sample from MW-7S. Seventeen (17) semivolatile compounds, mostly PAHs, were detected at levels as high as 620,000 ppb (fluoranthene) in this sample. The total semivolatiles concentration is 4,090,000 ppb (0.41% by weight). Total concentrations of semivolatiles in the other composite waste samples obtained from the borings were also high, but were one to two orders of magnitude less than the concentrations found at MW-7S. The other types of waste samples had much lower levels of semivolatiles detected. The two leachate seep samples (the waste/soil portion of the seep) each had 6 compounds detected, but at total levels not exceeding 2,200 ppb. The two remaining samples, WS-1 and WS-2A, taken from areas of obvious discoloration or suspect composition, showed a wider range of compounds, but total semivolatiles were only 9,055 ppb and 987 ppb, respectively.

Pesticides were found in three of the four composite waste samples from the soil borings, but in none of the other waste samples. No PCBs were found in any of the waste samples. The greatest number of pesticides, five, was detected in the waste sample at MW-9, at a total concentration of 335 ppb. Three pesticides were found at MW-10, with a total concentration of 1,031 ppb. [DDT showed a concentration of 950 ppb.] 4,4'-DDD was the only pesticide detected at MW-7, at 140 ppb.

Concentrations of metals were relatively uniform in the waste samples, but were elevated over general levels in the surface soils for several metals, including: arsenic, barium, copper, mercury, and selenium. This is as expected in a C&D landfill, however, since there are typically a great quantity of metallic objects disposed of. The composite waste samples generally show the highest levels of metals, especially lead and zinc. WS-7 also showed an elevated level of barium compared to the other waste samples. Also of note is the arsenic level (66,000 ppb) in WS-1, taken from the northwest portion of the landfill in a fine gray material at the surface. The concentration of arsenic at WS-1 is five to ten times higher than the other waste or surface soil samples.

Phenols were detected in six of the eight first-phase waste samples. They were detected at 8.9 ppb at MW-7S, and at less than 2 ppb elsewhere on site. No phenols were detected in surface waste samples at either WS-1 or WS-2A, but they were detected in all composite waste and leachate seep samples. Cyanide was detected only in the sample from MW-7S, at a concentration of 630 ppb.

The first-phase waste samples were tested for RCRA characteristics (corrosivity, ignitability, reactivity, and EP toxicity). Results are shown in Table 4-3. Based on these results, none of the samples would be classified as hazardous waste. The waste sample from MW-7S, however, was inadvertently not analyzed for RCRA characteristics. However, by looking at the TCL results, and comparing them to the RCRA characteristics and

TCLP hazardous waste criteria, it appears that this sample would also not be classified as "hazardous". Most of the semivolatiles found in the sample are not regulated under the EP-Toxicity (or TCLP) standards.

4.2.1 Trenching Program

A trenching program was conducted during the second phase activities, in an attempt to determine the location of the source of groundwater VOC contamination. As part of this program, waste samples were taken where there was visual evidence of significant contamination or elevated HNu readings. One groundwater samples was also taken from a trench where a sand seam in the kame terrace deposits preferentially carried groundwater in these relatively low permeability sediments. It was hoped that this sample would help localize the contaminant source by checking the tank area for contamination (upgradient of this trench). These samples were analyzed only for TCL or TCLP volatiles, since the first-phase results had indicated VOCs (in groundwater) as the biggest problem at the site. Trenching was limited to the northern half of the landfill where the predominant source of VOC contamination was expected to be. Greater depth to water, due to higher surface elevations in the southern portion, made trenching to the water table more difficult. Thus, preference was given to northern portions of the fill Trenching locations were selected by the onsite NYSDEC representative. The analytical results of the waste samples are shown in Table 4-3.

Three waste samples were taken during the trenching problem. Sample TP-2-11-1, taken from T-11, was soil which contained some blackish-brown resin and had a sweet acetone-like odor. Sample TP-2-11-2, also taken from T-11, was a sample of the resin alone. Sample TP-2-21-1 was taken from a drum found in T-24. This material was a blue and white solid with a lacquer odor. In addition to the three samples analyzed for volatiles, a fourth sample, TP-2-11-3 was taken. TP-2-11-3 was taken from three drums found in T-11. (A fourth drum of similar material was found in T-

12). This sample was sent for unified spectroscopy analysis which confirmed that it was a grease.

Two of the three second-phase waste samples analyzed showed high levels of volatile compounds. Seven (7) compounds were detected at TP-2-11-1, these ranged from 8,000 ppb (tetrachloroethane) to 90,000 ppb (4-methyl-2-pentanone). The other 5 volatiles detected in this sample were: benzene, toluene, chloroebenzene, ethylbenzene, and total xylenes. The total volatiles concentrations for TP-2-11-1 was approximately 2,532,000 ppb (0.25%). Only 3 compounds were detected at TP-2-24-1, but at higher levels: ethylbenzene at 970,000 ppb; toluene at 1,700,000 ppb; and total xylenes at 4,800,000 ppb. Total volatiles concentration for TP-2-24-1 was 7,470,000 (0.75%). No compounds were detected in TP-2-11-2, which was analyzed only for TCLP volatiles. Results of the one groundwater sample, TP-3-1, are discussed with other groundwater results in Section 4.5.3.1.

Five drums were removed from the ground during the trenching program and over packed (four drums represented by sample TP-2-11-3, one represented by sample (TP-2-24-1). These drums were resampled during December 1991, in order to provide further information required for classification for disposal.

A significant finding of the trenching program was that the landfill contains significant quantities of materials more typical of industrial wastes (i.e., foundry wastes and drums, both full and empty), than construction and demolition debris. None of these wastes tested as characteristic hazardous waste (per 6NYCRR Part 371), however.

4.3 Surface Water and Sediment

As part of the first-phase investigation, 8 surface water samples were collected from the drainage stream and the Susquehanna River (Figure 2-2). Stream sediments were collected from these same 8 sampling

locations. Samples SW/SS-8 and SW/SS-9 were collected upstream of and adjacent to the landfill on the Susquehanna River. Sample SW/SS-1 was collected from the drainage stream upstream of the landfill; SW/SS-10, SW/SS-5, and SW/SS-6 were taken from the stream adjacent to the site; and SW/SS-7 was collected downstream from the fill.

Leachate seep/waste samples LS/WS-2 and LS/WS-3 (the only LS/WS sample pairs designated) were collected at points of apparent groundwater discharge (seepage) to channels on either side of the access road serving the Town wells. These channels are both tributaries to the drainage stream. The "leachate", however, does not come from the site, so that these two sample pairs are equivalent to upstream surface water/stream sediment samples on the drainage stream. The leachate seep results will be discussed in this report along with the surface water results, since the seeps are tributary to the drainage stream adjacent to the landfill. SW/SS-4, collected from the same ditch as LS/WS-2, is also an upstream sample for the drainage.

Three surface water/stream sediment samples were collected from the Susquehanna River during the second-phase investigation (Figure 2-2). SW/SS-8 was a resample taken at the approximate location of the first phase SS/SW-8, upstream of the landfill and of the confluence with the drainage stream. SW/SS-11 and SW/SS-12 were taken downstream of the landfill. Low water conditions allowed these samples to be taken from much further out in the river than the Phase I SW/SS samples were taken. All second-phase surface water samples were analyzed for VOCs only.

4.3.1 Surface Water Sampling

Drainage Stream

Analytical results for all surface water samples are shown in Table 4-4 and Table 4-6 (Leachate Seeps). The results show that no significant

surface water contamination is occurring, but some slightly elevated contaminant levels do occur.

Eight (8) surface water samples were collected in this drainage (6 SW samples, 2 LS samples). In 5 samples, no VOCs were detected, while the other three contained only trace levels of VOCs. Toluene was detected at 2 ppb in three of the four upstream samples (SW-4, LS-2, LS-3); methylene chloride was found at 2 ppb at LS-3. No VOCs appear in the samples collected either adjacent to, or downstream of, the fill.

The only semivolatile compound present in any upstream sample was bis(2-ethylhexyl)phthalate. It was detected at low levels (less than 6 ppb) in 3 of the 4 upstream samples: SW-1, LS-2 and LS-3. Two other semivolatile compounds, not found in upstream samples, were found at trace levels adjacent to the site: 3 ppb of benzoic acid at SW-10 and 17 ppb of butylbenzylphthalate at SW-6. Bis(2-ethylhexyl)phthalate was also present, in levels comparable to those in upstream samples, in all adjacent and downstream samples.

No pesticides or PCBs were found in any of the drainage stream samples.

Some of the metals were found upstream at unexpectedly high concentrations. Most notably, zinc was detected in SW-1 at 2,180 ppb, two orders of magnitude more concentrated than in any other water sample collected. Aluminum, iron, lead and cyanide concentrations were also elevated in SW-1 compared to most of the other drainage stream samples, although not to the same degree (1,000 ppb, 1,570 ppb, 5.3 ppb and 12.8 ppb, respectively). The downstream samples did not show any notable metals enrichment or anomalous values. It should be noted, however, that the drainage stream derives much of its water from the cooling water effluent flow from the AP&P plant. This effluent is derived from groundwater pumped from the AP&P wells adjacent to the river. Thus,

cooling water return flow will greatly dilute any landfill seepage entering this drainage, whether by surface water or groundwater.

Phenols (6 ppb at SW-5 and 5 ppb at SW-7) were detected at low levels adjacent to and downstream of the site, but were not found upstream. It is possible these originate in the fill, since phenols were found in the waste samples.

Susquehanna River

No VOCs were detected in first-phase sample SW-8, or in the second phase SW-8 resample, upstream of the landfill and of the confluence with the drainage stream (Table 4-4). Trace levels of methylene chloride (2 ppb) and toluene (1 ppb) were, however, detected in the first-phase sample SW-9, taken from the river adjacent to the site (downstream from the confluence with the drainage stream). No volatiles were detected in the second-phase samples, SW-11 or SW-12, downstream of the landfill opposite the groundwater well with the second highest VOC concentrations, MW-6I, and at low flow conditions in the river.

Only two semivolatile compounds were detected in the first phase Susquehanna River surface water samples: butylbenzylphthalate and bis(2-ethylhexyl)phthalate. These two compounds were detected at trace levels in similar concentrations at both upstream and downstream locations. Phthalates are common lab contaminants, making this is possible explanation for their presence. Note that bis(2-ethylhexyl)phthalate was found at similar concentrations in all surface water samples.

No pesticides, PCBs, or phenols were found in either first-phase river sample. Concentrations of metals and indicator parameters were also similar in both samples.

Surface Water Summary

Analytical results from the surface water sampling seem to indicate that the landfill is having, at most, a minimal impact on the quality of the surrounding surface water. The absence of volatiles in SW-11 and SW-12, downstream of the northern site boundary (including the northern portion of the site, where the highest groundwater contaminant concentrations have generally been found), helps to confirm this.

4.3.2 Sediment Sampling

Drainage Stream

Analytical results for the sediment samples, taken with the surface water samples discussed above, are shown in Table 4-5. The two "sediment" samples taken at the leachate seep locations, WS-2 and WS-3, have already been discussed in Section 4.2, along with the waste sample results, but for clarity will also be included here.

No volatile organic compounds were detected in any of the drainage stream sediment samples. However, 24 different semivolatile compounds were detected at widely varying concentrations. At least one semivolatile compound was detected in all samples. However, concentrations of total semivolatiles ranged from a low of 25 ppb to a high of 5,215 ppb (5.2 ppm). The semivolatiles found were predominantly PAHs, but phthalates were also found.

Semivolatiles were found in all upstream sediments. SS-1 showed 8 semivolatile compounds at a total concentration of 294 ppb. WS-3 showed 6 at a total concentration of 219 ppb. Samples SS-4 and WS-2 both had higher contaminant levels (seven semivolatiles for 2,905 ppb total, and six for 2,127 ppb total, respectively) than the other two upstream samples, but in both cases the contaminant(s) of highest concentration

were phthalates, which were also detected in the associated laboratory method blanks.

Semivolatiles were detected in greater numbers and concentrations in two of the sediment samples collected adjoining the fill. Sample SS-6 showed 15 semivolatile compounds, with a total concentration of 5,215 ppb, and SS-10 showed 18 compounds for 3,615 ppb total. Samples SS-5 and SS-7, collected adjoining to and downstream of the fill, respectively, showed lower semivolatile contaminant levels than the upstream samples. Note however, that SS-7 was taken upstream of the confluence with the river, in an area where erosion of sediments, rather than deposition, is taking place.

No pesticides or PCBs were found in any of the sediment samples.

Metals occurred in drainage stream sediments at concentrations similar to those found in surrounding subsoils. A slight metals enrichment over the other sediments was noted in SS-4 and SS-5. However, since SS-4 is located upstream of the site, this enrichment is probably of no significance. Cyanide was detected upstream in SS-1 at 22.3 ppb (and in the surface water at SW-1), and downstream, in SS-7, at 70.2 ppb. Between these locations, however, no cyanide was detected. Phenols were present in all the drainage stream sediment samples at concentrations of between 0.7 ppb (WS-3) and 6.6 ppb (WS-2). No upstream-to-downstream pattern is apparent. Whether phenols can be attributed to the landfill, therefore, remains unknown. [Waste samples showed phenols.]

In summary, the landfill appears to be having at most a minor impact on the sediments in the drainage channel adjacent to the site. It is possible that at least part of the semivolatiles predominant in the sediments, most of which are PAHs, are derived from runoff from Route 11, rather than from the landfill, since they are common contaminants associated with highways.

Susquehanna River

No VOCs were detected in the first-phase upstream or downstream Susquehanna sediment samples, SS-8 and SS-9, respectively. Five (5) volatile compounds were found in the second-phase stream sediment samples at trace levels. SS-12 showed 3 volatile compounds. Toluene was found in the SS-8 resample at 7 ppb, and SS-12 at 2 ppb. Total xylenes were also found in the SS-8 resample and SS-12 at 3 ppb and 1 ppb, respectively. 4-methyl-2-pentanone and chlorobenzene were found in the upstream sample only, at 12 ppb and 1 ppb, respectively. Methylene chloride was found only in SS-12, at a concentration of 2 ppb. Acetone was detected in all 3 of the second-phase SS samples, but was rejected due to blank contamination. None of the VOC contaminants of concern (TCE or 1,2-DCE) was found in any sample. Note that only VOCs were analyzed for in the second-phase samples.

Semivolatiles were detected in both the upstream and downstream first-phase samples, but at very low levels. [Concentrations were estimated all compounds detected, since they were below the quantitation limits.] Semivolatiles were found in slightly greater number and quantity in sample SS-9 (5 compounds totaling 596 ppb), collected adjacent to the site, than in SS-8 (2 compounds for 113 ppb, total), taken upstream of the site. All semivolatiles found were PAHs.

No pesticides or PCBs were found in either the upstream or downstream first-phase sample.

Metals were detected in the first-phase samples in concentrations similar to those found in the surrounding subsoils, and at generally lower concentrations then found in the drainage stream sediments. It is interesting to note, however, that while downstream metals concentrations were not very high, they are all slightly elevated over those in the upstream sample, with the single exception of lead. No phenols were

present in either location, but cyanide was found in downstream sample SS-9 at 31 ppb (comparable to the cyanide level of 22.3 ppb found in SS-1, upstream of the site in the drainage stream).

In summary, these results indicate that the landfill may be having a minor impact on the sediments in the Susquehanna River (and thus also to the river water), principally with semivolatiles and possibly metals. However, groundwater flow data does indicate that TCE and other landfill contaminants probably migrate to the river from at least a portion of the site during certain times of the year. Since they were not detected, it is reasonable to assume they are quickly diluted to non-detectable levels.

4.4 Leachate Seeps/Waste Samples

A field survey prior to sampling indicated that there were no observable leachate outbreaks from the landfill, however, two leachate seep/waste sample pairs were collected from areas upgradient of the filled area (Figure 2-2). These two sample pairs were taken from tributaries to the drainage stream which lie on either side of the road south of the landfill. Sample LS/WS-3 was collected north of the road in an area of orange soil discoloration. Sample LS/WS-2 was collected beneath the effluent discharge pipe emanating from the American Pipe and Plastic Factory, south of the access road. An orange surface discoloration was noted here also. Waste samples were, in this case, the material over which the leachate was flowing. These sample pairs were therefore considered previously with the other surface water/stream sediment samples in Section 4.3.

4.5 Groundwater

4.5.1 Previous Investigations

Numerous studies and sampling of groundwater in the vicinity of the Gorick C&D Landfill have been completed prior to the present study. [See Site History in Section 1.2.2.] A summary of all analytical results from previous investigations obtained (and compiled) by URS is included as Appendix L.

In 1981, relatively low levels (1-2 ppb) of volatile organic compounds [trichlorothene (TCE), 1,2-dichloroethene (1,2-DCE)] were detected in the Kirkwood Town Well No. 1 (Figure 2-1). Periodic groundwater monitoring instituted as a result of this discovery led to the detection of low levels (1-10 ppb) of TCE in Town Well No. 3 in 1986. This in turn led to the inclusion of existing USGS wells No. 10, 11A, 11B, 12, and 13 in a quarterly monitoring program instituted by NYSDEC. Of this suite of wells, No. 10 is situated at the western edge of the fill (approximately 350 feet east of the Kirkwood production wells), Nos. 12 and 11A and B are situated within the fill, and No. 13 is on the eastern side of the fill (upgradient). Elevated levels of TCE and 1,2-DCE (45 ppb and 48 ppb, respectively) were detected in USGS Well No. 12 in February 1987.

In order to establish a definitive correlation between the VOC contamination of the Town of Kirkwood wells and the Gorick Landfill, 8 monitoring wells (Well No. 20, and Nos. 31-37) were installed in 1987 and 1988 (Figure 1-3). All of these wells (with the exception of Wells No. 35 and 37) are screened near the base of the aquifer, as are the Town production wells. Sampling of Wells Nos. 31-37 in August 1988 revealed significant concentrations of TCE (468 ppb) and 1,2-dichloroethene (170 ppb) in monitoring well No. 36. High concentrations of these contaminants (TCE-175 ppb) were also detected in the shallow well (No. 35) of this well

pair. Lower levels (47-93 ppb) of these same contaminants were detected in Well No. 31.

Extensive analysis of groundwater from Town Well No. 3 was conducted during the period of July 1987 to late 1988. TCE concentrations ranged up to 44 ppb, with most detections being under 10 ppb.

In summary, previous investigations have led to the belief that the Gorick Landfill had adversely affected the quality of the groundwater in the Town of Kirkwood well field. Since this was the main objective of these earlier studies, the scope of the investigations was limited to the small portion of the landfill near the Town wells.

The sampling and analysis completed during this remedial investigation of the Gorick Landfill is described in the following sections. The present study provides a broader base for determining the role of the landfill in contamination of the groundwater in the Town wells and the alluvial aquifer.

4.5.2 First Phase Investigation

Twenty (20) groundwater samples were collected during the first-phase environmental sampling (Figure 2-2). These consisted of 14 samples obtained from stainless-steel monitoring wells installed by URS during this investigation, and 6 obtained from existing PVC wells installed in 1987 and 1988 by Lake Engineering (Nos. 31-36, referenced above).

Wells sampled during this round were screened in three different levels of the alluvial aquifer: (a) shallow (intersecting the water table), (b) intermediate, and (c) deep (at the base of the aquifer). The water quality of all three horizons were very different, one from the other. They will therefore be discussed separately at first, and then

summarized collectively. Results of all analysis of groundwater samples are shown in Table 4-7.

4.5.2.1 Shallow Monitoring Wells

Eleven (11) samples were collected from wells screened in the uppermost portion of the aquifer. These wells were constructed so that their screens intersect the water table. Four (4) of these wells (MW-7S, MW-8S, MW-9S and MW-10S) are located within the fill, but screened below the fill material (i.e., not hydraulically isolated from the fill material). Five shallow wells are situated downgradient of the landfill (MW-3S, MW-4S, MW-5S, MW-6S, and MW-35) and two are positioned upgradient of it (MW-1S and MW-2S), although they may not be representative of water quality within the principal groundwater aquifer present beneath the landfill (Section 3.8.3) (Locations, see Figure 2-2).

Upgradient water quality in the two shallow groundwater wells (MW-1S and MW-2S) was generally very good. Note that both of the upgradient wells were screened at shallow depths, across permeable lenses, but neither of the well borings encountered the very permeable sand and gravel aquifer present beneath most of the landfill. Therefore, as shown in Chapter 3, direct hydraulic connection between these wells and the groundwater beneath and downgradient of the fill is unlikely.

The groundwater samples obtained from the two upgradient wells contained no VOCs, pesticides, PCBs, or phenols, and only one semivolatile was found: 28 ppb of di-n-butylphthalate in MW-2S. It is not clear whether the presence of this compound in an upgradient well is significant or not. Phthalates are common lab contaminants, but this compound was detected in only 2 of the 20 groundwater samples, which does not appear to be the result of a laboratory problem. Additionally, MW-2S is sidegradient to the AP&P facility, which is a possible source of

phthalates. However, it is the only organic compound found here and doesn't seem to fit contamination from AP&P.

No significant concentrations of metals were found in either upgradient well, although levels of metals were generally higher in MW-2S than in MW-1S. Levels of iron and manganese are higher than New York State Standards, Criteria, and Guidance Values (SCGs) for drinking water. Indicator parameters for both wells show a similar pattern, with MW-2S more concentrated than MW-1S, but nothing at concentrations which might cause concern. MW-2S does have higher than expected levels of BOD, COD and chlorides, but these are probably related to the well's shallow depth, and possibly to its proximity to Route 11 (road salting, etc.).

All four wells located within the fill area, MW-7S, MW-8S, MW-9S, and MW-10S, are screened immediately below the fill. These wells generally showed contamination only by VOCs, metals, and the indicator parameters.

Various levels of 4 chlorinated solvents were detected in 3 of the 4 fill wells (MW-7S, MW-8S and MW-9S). (No VOCs were found in MW-10S). TCE and 1,2-DCE constituted approximately 99 percent of the chlorinated solvents detected in the three wells. Concentrations of these compounds were greatest at MW-8S (130 ppb of TCE, and 58 ppb of 1,2-DCE), but MW-9S (33 ppb of TCE, and 14 ppb of 1,2-DCE) and MW-7S (2 ppb of TCE, and 8 ppb of 1,2-DCE) nevertheless showed significant levels.

No semivolatiles, pesticides, PCBs or phenols were detected in any of the fill wells.

As expected, given the nature of the fill, metals concentrations were in general greater in the fill wells than in the upgradient wells, particularly for barium, calcium, chromium, iron, magnesium, manganese, potassium, sodium, and zinc. The other metals detected were not

significantly higher than upgradient levels. The concentration of aluminum was lower than upgradient levels. Note that while downgradient lead levels were in general not higher than upgradient, the level in MW-7S was higher than anywhere else in the study area. Additionally, many of the indicator parameters, such as COD, TOC, sulfate, and TDS, are also significantly elevated over upgradient levels.

Downgradient of the landfill, the 5 shallow wells (MW-3S, MW-4S, MW-5S, MW-6S and MW-35) showed that shallow groundwater VOC contamination was significantly lower than levels in the fill wells (except in MW-10S, which showed no VOCs). The VOCs detected were, as elsewhere, almost exclusively chlorinated solvents, mostly TCE and 1,2-DCE. Trace levels of toluene were also detected in some of the wells. Contaminant concentrations appeared to decrease southward towards the Town wells, but not enough sampling points were utilized to make this pattern certain. MW-6S contained three compounds for a total concentration of 16 ppb. MW-5S and MW-35 contained two compounds each, for total concentrations of 12 and 13 ppb, respectively. MW-4S had total concentrations of 3 ppb, and MW-3S was clear of VOCs. Interestingly, neither MW-3S or MW-4S showed any TCE or 1,2-DCE; only in those wells north of MW-4S, were these compounds detected. Additionally, the concentrations of TCE and 1,2-DCE in the three other downgradient shallow wells were very consistent. TCE was detected between 7 and 9 ppb in all three wells, while 1,2-DCE was between 5 and 6 ppb.

No semivolatile organic compounds, pesticides, or PCBs were found in any of the shallow downgradient wells, except for a single detection of bis(2-ethylhexyl)phthalate at 3 ppb in well MW-3S. However, since most other detections of this compound in the groundwater samples have been rejected due to lab blank contamination, this is probably not significant.

Metals concentrations downgradient, although still generally higher than in upgradient wells, are significantly lower than those measured in

the fill wells, with few exceptions. Notably, iron was anomalously high (16,200 ppb) in MW-5S, while total phenols were detected at their greatest concentration for any aqueous sample (12 ppb) in MW-4S.

The indicator parameters do not show a clear pattern for the downgradient wells versus the upgradient wells, but the downgradient wells are significantly lower for these parameters than the fill wells.

4.5.2.2 Intermediate-Depth Monitoring Wells

Samples were collected from three newly installed wells that monitor the intermediate zone of the aquifer, MW-4I, MW-5I, and MW-6I. All three of these wells are located downgradient of the landfill (Figure 2-2).

VOCs, primarily TCE, 1,2-DCE, and 1,1,1-trichloroethane, were detected at their maximum groundwater concentrations (at MW-6I) in the intermediate-depth wells (Table 4-7). At MW-6I, 140 ppb of TCE was detected, as was 78 ppb of 1,2-DCE, and 31 ppb of 1,1,1-trichloroethane. At MW-5I and MW-4I, 110 and 29 ppb of TCE was detected, respectively, 64 and 22 ppb of 1,2-DCE, and 6 and 1 ppb of 1,1,1-trichloroethane. Trace levels of other VOCs were also detected in one or more of the intermediate well samples (at concentrations of 3 ppb or less); 1,1-dichloroethene, 1,1-dichloroethane, benzene, tetrachloroethane, and toluene. Similarly to the apparent shallow well water contamination pattern, the concentration of these compounds seems to decrease from north to south, towards the Town wells.

No semivolatile organics were found in any of the intermediate wells, except for a single occurrence of bis(2-ethylhexyl)phthalate at 6 ppb in the sample from MW-4I. However, since most detections of this compound in other groundwater samples were rejected due to laboratory blank contamination, this is probably not significant.

No pesticides or PCBs were found in any of the intermediate wells.

The concentrations of most metals in the intermediate wells were significantly lower than the levels encountered in the shallow fill wells. Phenols appeared in MW-4I at 0.009 ppm. Cyanide was also found in MW-4I (20.4 ppb), which is located downgradient of MW-10S, the only fill well in which it was detected (at 28.9 ppb).

The indicator parameters did not show much of a decrease from the fill wells to the intermediate wells. It is difficult to discern a pattern in the large variation in concentrations of indicator parameters in the intermediate wells.

It is noteworthy that, in these intermediate wells, the concentrations of most common metals (e.g., calcium, sodium, magnesium, etc.) and indicator parameters are considerably higher than those found in the shallow wells nested with them, although the pattern is slightly more complex for MW-5I.

4.5.2.3 Deep Monitoring Wells

Six (6) groundwater samples were collected from monitoring wells screened at, or very near, the base of the aquifer (similar portion of the aquifer as Town Well No. 3 is screened in). Five (5) of these deep wells (Nos. 31-34, 36) were installed in a 1987-1988 investigation. Wells No. 31 through 34 are very closely spaced around Town Well No. 3, while No. 36 is nested with the shallow well, Well No. 35. MW-5D, which was installed as part of the Phase I investigation, is nested with MW-5S and MW-5I. All these deep wells are installed downgradient of the landfill (Figure 2-2). A sample of the water withdrawn from the aquifer by Town Well #3 was also collected during the first phase of the remedial investigation. This sample was analyzed for VOCs only.

VOCs were detected in five of the six deep monitoring wells, and in the sample from Town Well No. 3, designated PW-1. No VOCs were detected in monitoring well MW-34 (the most southerly of the deep wells). As in the samples from the upper two horizons of the aquifer, TCE and 1,2-DCE constituted most of the contamination. VOC concentrations in the groundwater samples from the two deep wells installed near the toe of the landfill, (MW-5D and MW-36), were 85 ppb of TCE and 52 ppb of 1,2-DCE in MW-36, and 49 ppb of TCE and 29 ppb of 1,2-DCE in MW-5D. Other VOC compounds were also found at trace levels (up to 3 ppb each): 1,1,1-trichloroethane, total xylenes, and toluene. The increasing pattern of the TCE and 1,2-DCE levels towards the Town wells for these two deep wells is contrary to the pattern tentatively shown in the shallow and intermediate wells, in which VOC levels decreased towards the Town wells.

The concentrations of VOCs in the deep wells surrounding Town Well No. 3 increase towards the north and the river. Well MW-34, the southernmost well, was clean. Well MW-31, just to the north, contained TCE and 1,2-DCE at concentrations of 2 ppb each. Well MW-32, north of MW-31, showed 5 ppb of TCE and 4 ppb of 1,2-DCE. Well MW-33, furthest to the north, showed TCE at 21 ppb, 1,2-DCE at 18 ppb, and 1,1,1-trichloroethane at 3 ppb. The sample of the Town of Kirkwood drinking water, PW-1, before treatment, contained 4 ppb of TCE and 3 ppb of 1,2-DCE. This distribution of VOCs around the Town well is important in determining more precisely where the VOCs are coming from, since with radial flow to the well, it tends to show the VOCs to be coming from the north and northeast, and not from the southeast.

No semivolatiles were detected in the deep wells, except for 3 ppb of di-n-butylphthalate, in MW-32. Most of the bis(2-ethyhexyl)phthalate detections have been rejected due to laboratory blank contamination, but this compound has not been rejected. Its significance, therefore, is unknown. Since it is downgradient of the AP&P factory, so it may be significant that this compound was detected also in MW-2S. Note that the

semivolatiles data for MW-36 was rejected due to non-compliance with ASP, and therefore semivolatiles data for this well are unavailable.

No pesticides, PCBs, or phenols were detected in any of the deep groundwater samples.

Metal concentrations in the deep portion of the aquifer are not significantly different from those in the upper zones, although the wide range of concentrations for some of the parameters makes it difficult to tell in some cases. There is also, an apparent trend of decreasing concentrations of metals with distance from the landfill towards the Town wells. In the vertical dimension, as shown by the triple well nest at MW-5, metals concentrations were higher in the shallow well than the intermediate, but no clear pattern was evident when comparing the intermediate well sample to the water sample from the deep well. Many of the metals increased from intermediate to deep (e.g., calcium, iron, magnesium) to their highest level, in any but the fill wells, while others decreased (e.g., barium, potassium, sodium).

Indicator parameters for the samples from MW-5D and MW-36 showed a general increase over upgradient levels (e.g., TDS, sulfates), but are usually lower than in the fill wells, thus showing the effects of dilution. The deep wells, MW-31 through MW-34, showed an even lower impact, especially in MW-34, the southernmost one, which shows levels equal to, or in some cases lower than, the upgradient wells. Vertically, the pattern at MW-5 shows that the indicator parameters do not change significantly from intermediate to deep, since many parameters are virtually equal to the concentrations in MW-5I (e.g., bicarbonate, COD, TDS, alkalinity).

4.5.3 Second Phase Investigation

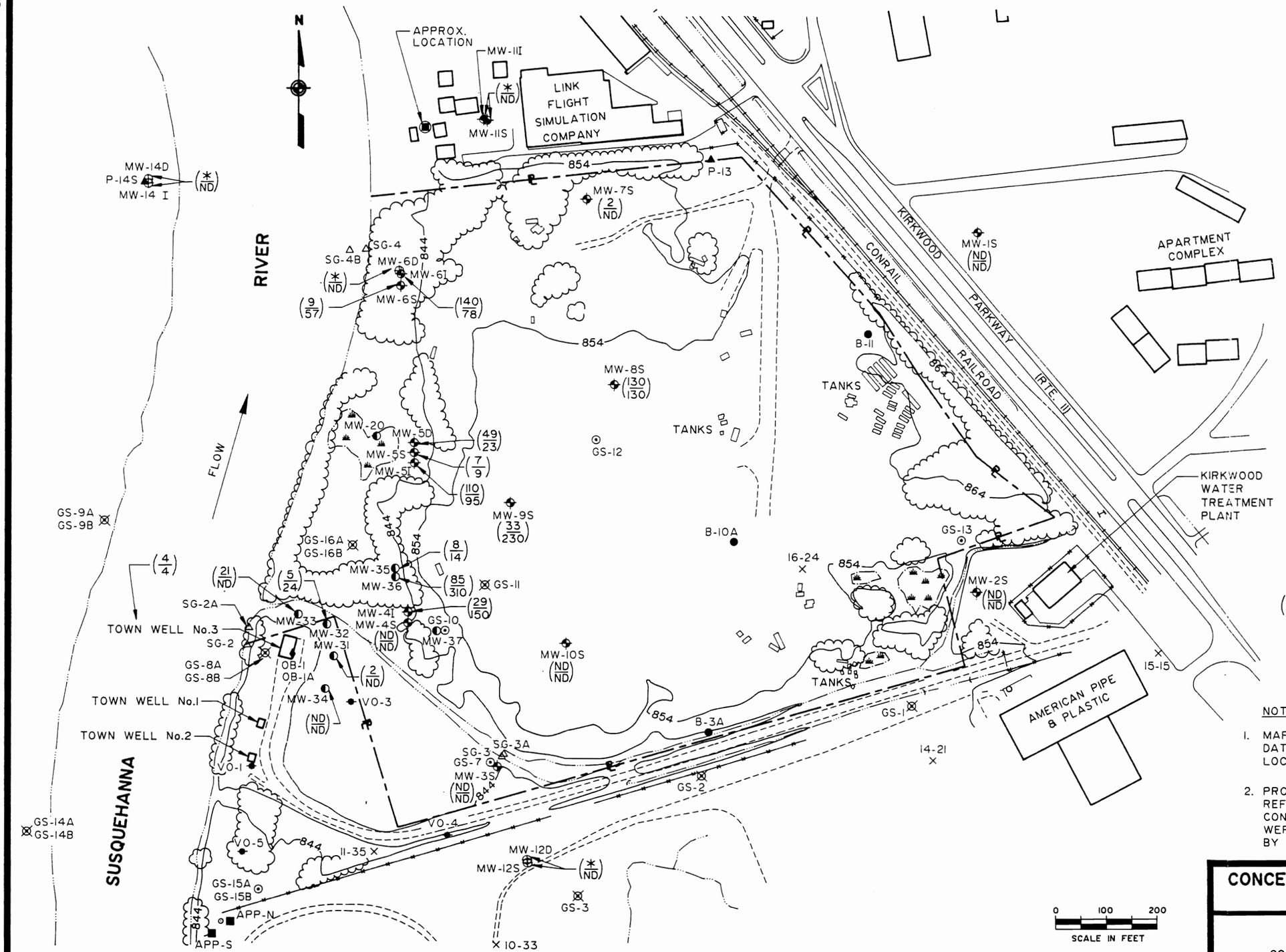
Twenty-seven (27) monitoring wells were sampled during the second-phase investigation. Twenty-one (21) samples were taken from the stainless-steel monitoring wells installed by URS (14 in 1990-first phase, 7 in 1991-second phase). Six (6) samples were obtained from monitoring wells No. 31-36, installed by Lake Engineering in 1987 and 1988. A groundwater sample was taken from test pit No. 2. Raw water from Kirkwood Town Well No. 3 was also sampled (Figure 2-2). Analytical results for the groundwater samples are found in Table 4-7 and a comparison with first-phase results is shown in Table 4-8. All groundwater samples were analyzed for VOCs only, in response to the first-phase findings. However, MW-4S and MW-4I were also analyzed for total phenols due to their detection here in the first place. Concentrations of TCE and 1,2-DCE found in both monitoring phases in all monitoring wells are shown on Figures 4-3 and 4-4, respectively.

4.5.3.1 Shallow Monitoring Wells

Fourteen (14) shallow groundwater samples were collected. Thirteen (13) of these were from wells screened in the uppermost portion of the aquifer. The other shallow groundwater sample, TP-3-1, was collected from water collecting at the bottom of Test Pit No. 2. MW-7S, MW-8S, MW-9S, and MW-10S are located within the fill area. They are screened below the fill, but are not hydraulically isolated from it. TP-3-1 is located downgradient from the area where tank shells had been deposited on the surface, but upgradient of the fill. MW-3S, MW-4S, MW-5S, MW-6S, and MW-35 are located downgradient of the landfill. MW-12S is located sidegradient of the landfill to the south, while MW-11S is located sidegradient of the landfill to the north (Figure 2-2).

Shallow upgradient water showed some contamination in the second-phase samples, as compared to the first phase when both MW-1S and MW-2S

1=200 10/28/91



LEGEND

- MONITORING WELL INSTALLED BY URS CONSULTANTS (1990)
- EXISTING MONITORING WELL INSTALLED BY LAKE ENGINEERING (1988)
- WELL INSTALLED BY UNITED STATES GEOLOGICAL SURVEY (1984)
- WELL INSTALLED BY UNITED STATES GEOLOGICAL SURVEY (1984) (ABANDONED)
- WELL INSTALLED BY GROUND WATER ASSOCIATES (1981)
- WELL INSTALLED BY GROUND WATER ASSOCIATES (1984)
- PRIVATE RESIDENTIAL WELL (ABANDONED)
- SOIL BORING BY URS CONSULTANTS (1990)
- STREAM GAUGE
- PVC FACTORY WELL
- SOIL BORING (PRE-1990)
- MONITORING WELL INSTALLED BY URS CONSULTANTS (1991)
- EXISTING MONITORING WELL INSTALLED BY PRATT AND WOLFF (1986)
- PIEZOMETERS BY URS CONSULTANTS (1991)

(58/70) (FIRST PHASE CONCENTRATION / SECOND PHASE CONCENTRATION)
ALL CONCENTRATIONS ARE EXPRESSED IN µg/l (MICROGRAMS/LITER).
ND=NOT DETECTED
* =WELL NOT INSTALLED UNTIL SECOND PHASE

NOTES:

1. MAPPING BASE IS FROM AERIAL PHOTOGRAPHY DATED APRIL 1, 1990 AND COMPILED BY LOCKWOOD MAPPING, ROCHESTER, NEW YORK.
2. PROPERTY LINES SHOWN ARE APPROXIMATE, FOR REFERENCE ONLY, AND SHOULD NOT BE USED FOR CONVEYANCE OF REAL PROPERTY. PROPERTY LINES WERE INTERPOLATED FROM A TAX MAP PREPARED BY BROOME COUNTY, NEW YORK.

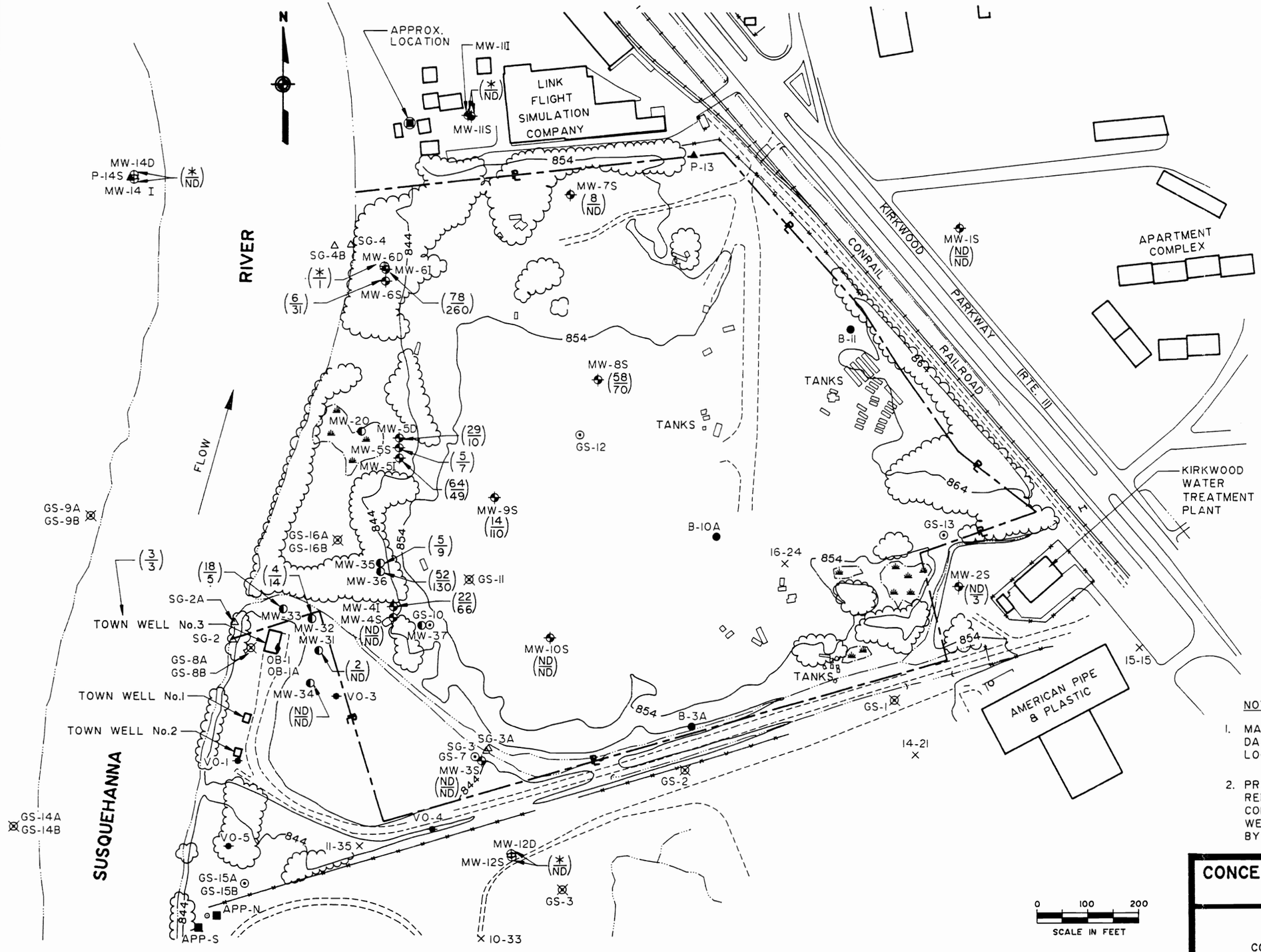
CONCENTRATION OF TRICHLOROETHENE IN GROUNDWATER

URS CONSULTANTS, INC.

FIGURE 4-3

CC-2228A

1:200 10/28/91



LEGEND

- MONITORING WELL INSTALLED BY URS CONSULTANTS (1990)
- EXISTING MONITORING WELL INSTALLED BY LAKE ENGINEERING (1988)
- WELL INSTALLED BY UNITED STATES GEOLOGICAL SURVEY (1984)
- WELL INSTALLED BY UNITED STATES GEOLOGICAL SURVEY (1984) (ABANDONED)
- WELL INSTALLED BY GROUND WATER ASSOCIATES (1981)
- WELL INSTALLED BY GROUND WATER ASSOCIATES (1984)
- PRIVATE RESIDENTIAL WELL (ABANDONED)
- SOIL BORING BY URS CONSULTANTS (1990)
- STREAM GAUGE
- PVC FACTORY WELL
- SOIL BORING (PRE-1990)
- MONITORING WELL INSTALLED BY URS CONSULTANTS (1991)
- EXISTING MONITORING WELL INSTALLED BY PRATT AND WOLFF (1986)
- PIEZOMETERS BY URS CONSULTANTS (1991)

(58/70) (FIRST PHASE CONCENTRATION / SECOND PHASE CONCENTRATION)
ALL CONCENTRATIONS ARE EXPRESSED IN µg/l (MICROGRAMS/LITER).
ND=NOT DETECTED
* =WELL NOT INSTALLED UNTIL SECOND PHASE

NOTES:

1. MAPPING BASE IS FROM AERIAL PHOTOGRAPHY DATED APRIL 1, 1990 AND COMPILED BY LOCKWOOD MAPPING, ROCHESTER, NEW YORK.
2. PROPERTY LINES SHOWN ARE APPROXIMATE, FOR REFERENCE ONLY, AND SHOULD NOT BE USED FOR CONVEYANCE OF REAL PROPERTY. PROPERTY LINES WERE INTERPOLATED FROM A TAX MAP PREPARED BY BROOME COUNTY, NEW YORK.

CONCENTRATION OF 1,2-DICHLOROETHENE IN GROUNDWATER

URS CONSULTANTS, INC.

FIGURE 4-4

CC-2229

were clear of volatiles. The second-round MW-1S sample contained 44 ppb of acetone (rejected in first round). Note, however, that the cap hinge on MW-1S was found broken during the second phase, so this well was not secure against possible tampering. MW-2S contained trace amounts of 1,2-DCE (total) and toluene. No volatiles were detected at TP-3-1, the upgradient test pit sampling point.

Groundwater results from the fill wells on the landfill during the second phase were as follows: no volatiles detected at MW-7S, as compared to 8 ppb 1,2-DCE and 2 ppb TCE during the first phase. As in the first phase, no volatiles were detected at MW-10S. While the concentrations of individual compounds were sometimes higher and sometimes lower, the total amount of volatiles detected in MW-8S and MW-9S were higher in the second phase than they had been in the first phase. For MW-8S, 1,1-dichloroethane dropped from 1 ppb to non-detected while 1,2-DCE was 70 ppb, up from 58 ppb in the first phase. TCE remained the same at 130 ppb. For MW-9S, 1,1,1-trichloroethane was not detected, as compared to 2 ppb in the first phase. 1,2-DCE and TCE were both detected in at significantly higher concentrations than in the first round of sampling: 110 ppb as compared to 14 ppb, and 230 ppb as compared to 33 ppb, respectively.

At 2 of the 5 downgradient shallow wells, MW-3S and MW-4S, no volatiles were detected in either the first or second phase. In general, the VOC concentrations were higher in the second phase than in the first phase for MW-5S, MW-6S, and MW-35, but the pattern was generally the same as in the first phase. MW-6S showed significant increases, however, with 1,2-DCE at 31 ppb compared to 6 ppb; 1,1,1-trichloroethane at 13 ppb compared to 1 ppb; and TCE at 57 ppb compared to 9 ppb.

At the two new sidegradient shallow wells, MW-12S to the south and MW-11S to the north, no volatiles were detected.

The second-round sampling basically confirmed the results of the first round in the shallow wells, but showed also that no shallow VOC contamination is found in the monitoring wells to the north or south of the site. Additionally, contamination at the water table is not a good indicator of contamination in the intermediate zones. Phenols detected in MW-4S in the first round of sampling were not detected during the second round.

4.5.3.2 Intermediate-Depth Monitoring Wells

Five (5) intermediate-depth monitoring wells were sampled during the second-phase investigation. Three (3) of these; MW-4I, MW-5I, and MW-6I, are located downgradient of the landfill. One well, MW-11I, is sidegradient of the landfill to the north. The other intermediate-depth well, MW-14I, is located on the opposite side of the Susquehanna River from the landfill, roughly across from the northern boundary of the site (Figure 2-2).

At both offsite intermediate wells, MW-11I and MW-14I, no volatiles were detected. MW-4I had fewer compounds detected than in the first phase, but the compounds detected, 1,2-DCE and TCE, were found in greater concentrations. 1,2-DCE and TCE were found at 66 ppb and 150 ppb respectively, as compared to 22 ppb and 29 ppb in the first-phase samples. Phenols were not detected in MW-4I during the second round. At MW-5I, levels of VOCs found in the second round were slightly reduced from the first round. The total concentration of detected volatiles in MW-5I was 149 ppb in the second phase as compared to 181 ppb in the first phase. At MW-6I, 2 volatiles were detected in the second phase which had not been found in the first phase: toluene at 2 ppb and benzene at 4 ppb. Otherwise, the two rounds had similar results, although levels generally rose during the second round. The total concentration of detected volatiles for MW-6I was 411 ppb in the second phase as compared to 257 ppb in the first phase.

MW-4I, MW-5I, and MW-6I each contained more volatile compounds and in greater concentrations than their corresponding shallow wells during both the first and second phases of this investigation. Of these three wells, MW-6I showed the greatest amount of contamination during both phases, with 1,2-DCE, TCE, and 1,1,1-trichloroethane (TCA) being the major contaminants. In the second phase, MW-4I had the second greatest contamination and MW-5I was the least contaminated of the 3 wells. This was the opposite of the first phase, where MW-5I was more contaminated than MW-4I. 1,2-DCE and TCE were the major contaminants in both MW-4I and MW-5I in both phases. These were joined by TCA to make up the primary contaminant constituents in MW-6I.

Similar to the shallow wells results, intermediate-well sampling during the second phase basically confirmed the first-round results. The intermediate zone of the aquifer is the most affected by contamination, primarily by TCE, 1,2-DCE, and to a lesser extent TCA. [The intermediate-depth well placed north of the site, MW-11I, did not show any contamination.] This intermediate zone is the one most affected because it is the zone most affected by pumping from the Town wells.

4.5.3.3 Deep Monitoring Wells

Nine (9) monitoring wells in the deep portion of the aquifer and raw water from Town Well No. 3 were sampled during the second phase. All the deep wells are downgradient of the landfill except for MW-12D, which is sidegradient to the south, and MW-14D, which is across the river from the site (Figure 2-2).

The sample from Town of Kirkwood Well No. 3 (PW-1A) showed the same concentrations of 1,2-DCE and TCE as in the first phase: 3 ppb and 4 ppb, respectively. Two (2) additional volatiles, usually associated with chlorination, were also detected in the second phase: dibromochloromethane at 3 ppb and bromoform at 2 ppb.

At MW-31 no volatiles were detected, compared with trace amounts of 1,2-DCE, TCE, and toluene in the first phase. At MW-34 no volatiles were detected in either the first or second phase.

MW-32 again showed 1,2-DCE and TCE, but in higher concentrations than in the first phase: 14 ppb compared to 4 ppb, and 24 ppb compared to 5 ppb, respectively.

The only volatile detected in MW-33 was 1,2-DCE at 5 ppb. This was lower than the 18 ppb detected in the first phase. TCE, which was found in MW-33 in the first phase at 21 ppb, was not detected in the second phase.

In general, the pattern of volatile organics contamination in the wells surrounding Town Well #3 was similar to that found during the first phase. MW-32 and MW-33, the two wells to the north and closer to the river, showed volatiles contamination, while MW-34 remained clean. The sample from MW-31, which had some trace contamination in the first phase, was clean in the second phase. In the first phase, water in MW-33 had been more contaminated than that in MW-32. While this has reversed in the second-phase samples, the general pattern of the two more northwestern of these wells showing volatiles contamination, with the two more southeastern wells being less contaminated with volatiles, has held. Again, using the radial flow pattern to the Town Well No. 3, this points to contamination originating to the north or northeast, and not the east or southeast.

The two deep wells near the toe of the fill, MW-5D and MW-36, again contained 1,2-DCE and TCE. Neither sample contained 1,1,1-trichloroethane, which had been present in trace amounts in both in the first-phase samples. In MW-5D, 1,2-DCE and TCE appeared in lower concentrations than in the first phase and lower than those in MW-5I, screened above this well. In well MW-36, contamination with 1,2-DCE and TCE was higher than

in the first-phase sample: 130 ppb compared to 52 ppb, and 310 ppb compared to 85 ppb, respectively. Well MW-36 had higher levels of VOC contamination than any other second-phase monitoring well..

At MW-6D, the new downgradient deep well, the following compounds were detected: 1,2-DCE (1 ppb); vinyl chloride (7 ppb); 1,1,1-trichloroethane (33 ppb); and benzene (0.8 ppb). No TCE was detected in MW-6D. However, vinyl chloride was only detected here and in MW-36, both deep wells.

The deep well sidegradient of the fill to the south showed no volatiles contamination. The only volatiles found in MW-14D, the deep well across the river, was benzene at a concentration of 2 ppb, and acetone at 97 ppb.

The deep wells had similar results in the second round to those of the first round. Significant VOC contamination is evident downgradient of the landfill, but at reduced levels from that found in the intermediate zone of the aquifer. No contamination was found south of the site in MW-12D, screened at approximately the same depth as Town Well No. 3.

4.5.4 Contaminant Flow in Groundwater

Based upon the results of the first and second phases of RI activities at the Gorick C&D Landfill, the landfill is contaminating the groundwater downgradient of the site with volatile organic compounds, principally TCE, 1,2-DCE, and 1,1,1-trichloroethane, and, to a lesser extent, metals. VOCs are moving westwards towards the Susquehanna River and southwestward towards the Kirkwood Town wells from the landfill. Based on the distribution of the contaminants in the monitoring wells, the contaminants appear to lie within the north central portion of the landfill.

The highest VOC concentrations have, in general, been detected in wells screened in the intermediate zone of the aquifer, with the exception of the deep well MW-36, which has shown the highest VOC concentrations (TCE at 310 ppb). VOC levels generally decrease towards the Town wells. The zone from which most of the Town's water is derived is the most impacted by the landfill. The downgradient shallow wells show generally similar VOC concentrations to each other, concentrations much reduced from those in the intermediate wells. A definite correlation between VOC concentrations in the shallow wells versus the intermediate wells has not been shown (e.g., MW-4S has had no VOCs detected, while MW-4I is significantly contaminated). Note that shallow wells in the southern portion of the landfill site, MW-3S, MW-4S, MW-10S, and MW-12S showed no VOC contamination. The shallow well north of the site, MW-11S, also showed no VOC contamination. The deep wells show VOC levels generally lower than the intermediate wells (except for MW-36), but higher than in the shallow wells. The deep wells around the Town well showed lower levels of VOCs than wells farther away (due to dilution from "clean" water pumped from other radial directions), but their increasing trend in concentration from south to north helps to show that the VOC source lies to the north and northeast (i.e., the landfill). The landfill as the source of the VOC contamination is confirmed by the second sampling round, which showed no VOC contamination north of the site (MW-11S and MW-11I), to the east (MW-1S and MW-2S), or to the south (MW-12S and MW-12D). Additionally, no VOC contamination was detected in the Susquehanna River, west of the site. Therefore, since fill wells show VOCs under the site and monitoring wells show contamination downgradient of the landfill, the landfill must be the source. Where in the landfill this source lies, however, is a very difficult question. All of the contamination in the groundwater to-date can be accounted for by just a few (2-3) barrels of TCE or an equivalent amount of TCE-contaminated soil. This small an amount of material will be very difficult to find in a fill area of over 18 acres.

The two predominant VOC compounds, TCE and 1,2-DCE, appear to move as one plume. They are generally both found together in the contaminated wells, but the concentration of 1,2-DCE is generally in the range of two-thirds the TCE concentration. This implies that the two contaminants probably originate at the same place, or that the 1,2-DCE found at the site is present as a degradation product of the TCE.

Contaminant loadings to the Susquehanna via groundwater are very low. No surface water samples from the Susquehanna contained any TCE or 1,2-DCE, however, despite the fact that the downstream samples were collected from the river opposite the second most contaminated well, MW-6I. Additionally, the sediment samples did not reveal any TCE or 1,2-DCE contamination. The Susquehanna River is influent to the site along most of the site's west boundary for the vast majority of the year. This is due to the pumping of the Town's wells, inducing infiltration of the river for recharge of the aquifer. Therefore, only a portion of the site from approximately MW-6 north has groundwater flow to the river. This increases, however, when the Town's wells are shut down for maintenance or for lowered usage. It is assumed that no TCE or other landfill contaminants were found in either the surface water or sediments due to dilution by the river to non-detectable concentrations.

To a lesser extent, the landfill is contributing metals to the downgradient groundwater, but these are mostly iron and manganese, which are quickly diluted to background levels by the large amounts of groundwater present in this alluvial aquifer. Note that the upgradient wells also have high levels of iron and manganese.

TABLE 4-1: SUBSURFACE SOIL ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		MW-1S	MW-2S	MW-3S	MW-4S	MW-5D	MW-6
COLLECTION DATE		9/24/90	9/19/90	10/8/90	11/6/90	10/12/90	10/10/90
PARAMETER	TYPE						
Chloromethane	VOC						
Bromomethane	VOC						
Vinyl Chloride	VOC						
Chloroethane	VOC						
Methylene Chloride	VOC		R		R	R	
Acetone	VOC	R	R	R	R	R	R
Carbon Disulfide	VOC						
1,1-Dichloroethene	VOC						
1,1-Dichloroethane	VOC						
1,2-Dichloroethene (Total)	VOC						
Chloroform	VOC		1 J				
1,2-Dichloroethane	VOC						
2-Butanone	VOC		R		2J	R	
1,1,1-Trichloroethane	VOC				7		
Carbon Tetrachloride	VOC						
Vinyl Acetate	VOC						
Bromodichloromethane	VOC						
1,2-Dichloropropane	VOC						
cis-1,3-Dichloropropene	VOC						
Trichloroethene	VOC					3 J	
Dibromochloromethane	VOC						
1,1,2-Trichloroethane	VOC						
Benzene	VOC						
trans-1,3-Dichloropropene	VOC						
Bromoform	VOC						
4-Methyl-2-Pentanone	VOC						
2-Hexanone	VOC						
Tetrachloroethene	VOC						
1,1,2,2-Tetrachloroethane	VOC						
Toluene	VOC				0.6 J	R	
Chlorobenzene	VOC						
Ethylbenzene	VOC						
Styrene	VOC		1 J				
Total Xylenes	VOC		5			0.9 J	

All results reported in µg/kg (ppb) unless otherwise stated.

Only detected results are reported.

J-Indicates the result is less than the sample quantitation limit but greater than zero.

R-Analyte rejected due to blank contamination.

TABLE 4-1: SUBSURFACE SOIL ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		MW-1S	MW-2S	MW-3S	MW-4S	MW-5D	MW-6
COLLECTION DATE		9/24/90	9/19/90	10/8/90	11/6/90	10/12/90	10/10/90
PARAMETER	TYPE						
Phenol	SEMI						
bis(2-Chloroethyl)ether	SEMI						
2-Chlorophenol	SEMI						
1,3-Dichlorobenzene	SEMI						
1,4-Dichlorobenzene	SEMI						
Benzyl Alcohol	SEMI						
1,2-Dichlorobenzene	SEMI						
2-Methylphenol	SEMI						
Bis(2-chloroisopropyl)ether	SEMI						
4-Methylphenol	SEMI						
n-Nitroso-di-n-propylamine	SEMI						
Hexachloroethane	SEMI						
Nitrobenzene	SEMI						
Isophorone	SEMI						
2-Nitrophenol	SEMI						
2,4-Dimethylphenol	SEMI						
Benzoic Acid	SEMI						
Bis(2-chloroethoxy)methane	SEMI						
2,4-Dichlorophenol	SEMI						
1,2,4-Trichlorobenzene	SEMI						
Naphthalene	SEMI						
4-Chloroaniline	SEMI						
Hexachlorobutadiene	SEMI						
4-Chloro-3-methylphenol	SEMI						
2-Methylnaphthalene	SEMI						
Hexachlorocyclopentadiene	SEMI						
2,4,6-Trichlorophenol	SEMI						
2,4,5-Trichlorophenol	SEMI						
2-Chloronaphthalene	SEMI						
2-Nitroaniline	SEMI						
Dimethylphthalate	SEMI						
Acenaphthylene	SEMI						
2,6-Dinitrotoluene	SEMI						
3-Nitroaniline	SEMI						
Acenaphthene	SEMI						
2,4-Dinitrophenol	SEMI						

All results reported in µg/kg (ppb) unless otherwise stated.

Only detected results are reported.

TABLE 4-1: SUBSURFACE SOIL ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		MW-1S	MW-2S	MW-3S	MW-4S	MW-5D	MW-6
COLLECTION DATE		9/24/90	9/19/90	10/8/90	11/6/90	10/12/90	10/10/90
PARAMETER	TYPE						
4-Nitrophenol	SEMI						
Dibenzofuran	SEMI						
2,4-Dinitrotoluene	SEMI						
Diethylphthalate	SEMI						
4-Chlorophenyl-phenyl Ether	SEMI						
Fluorene	SEMI						
4-Nitroaniline	SEMI						
4,6-Dinitro-2-methylphenol	SEMI						
n-Nitrosodiphenylamine	SEMI						
4-Bromophenyl-phenyl Ether	SEMI						
Hexachlorobenzene	SEMI						
Pentachlorophenol	SEMI						
Phenanthrene	SEMI						
Anthracene	SEMI						
Di-n-butylphthalate	SEMI		R				54 J
Fluoranthene	SEMI						
Pyrene	SEMI						47 J
Butylbenzylphthalate	SEMI						
3,3'-Dichlorobenzidine	SEMI						
Benzo(a)anthracene	SEMI						
Chrysene	SEMI						
bis(2-Ethylhexyl)phthalate	SEMI	R	R	R		R	R
Di-n-octylphthalate	SEMI			R			48 J
Benzo(b)fluoranthene	SEMI						
Benzo(k)fluoranthene	SEMI						
Benzo(a)pyrene	SEMI						
Indeno(1,2,3-cd)pyrene	SEMI						
Dibenz(a,h)anthracene	SEMI						
Benzo(g,h,i)perylene	SEMI						

All results reported in µg/kg (ppb) unless otherwise stated.

Only detected results are reported.

J-Indicates the result is less than the sample quantitation limit but greater than zero.

R-Analyte rejected due to blank contamination.

TABLE 4-1: SUBSURFACE SOIL ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		MW-1S	MW-2S	MW-3S	MW-4S	MW-5D	MW-6
COLLECTION DATE		9/24/90	9/19/90	10/8/90	11/6/90	10/12/90	10/10/90
PARAMETER	TYPE						
alpha-BHC	PST						
beta-BHC	PST						
delta-BHC	PST					5.5 J	
gamma-BHC (Lindane)	PST						
Heptachlor	PST						
Aldrin	PST						
Heptachlor Epoxide	PST						
Endosulfan I	PST						
Dieldrin	PST						
4,4'-DDE	PST						
Endrin	PST						
Endosulfan II	PST						
4,4'-DDD	PST						
Endosulfan Sulfate	PST						
4,4'-DDT	PST						
Methoxychlor	PST						
Endrin Ketone	PST						
alpha-Chlordane	PST						
gamma-Chlordane	PST						
Toxaphene	PST						
Aroclor-1016	PCB						
Aroclor-1221	PCB						
Aroclor-1232	PCB						
Aroclor-1242	PCB						
Aroclor-1248	PCB						
Aroclor-1254	PCB						
Aroclor-1260	PCB						

All results reported in µg/kg (ppb) unless otherwise stated.

Only detected results are reported.

J-Indicates the result is less than the sample quantitation limit but greater than zero.

TABLE 4-1: SUBSURFACE SOIL ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		MW-1S	MW-2S	MW-3S	MW-4S	MW-5D	MW-6
COLLECTION DATE		9/24/90	9/19/90	10/8/90	11/6/90	10/12/90	10/10/90
PARAMETER	TYPE						
Aluminum	MCP	13500*	11700*	11500	7710*	11000	12400
Antimony	MCP						
Arsenic	MCP	6.2	7.5	7.6 S*	4.7 N*	3.7*	3.6*
Barium	MCP	67.4	63.2	102	52.9	71	70.1
Beryllium	MCP	0.76 B	0.67 B	0.68 B	0.33 B	0.82 B	0.76 B
Cadmium	MCP	0.74 B	1.2	0.8 B			0.53 B
Calcium	MCP	1360	1300	939 B	664 B*	549 B	110 B
Chromium	MCP	17.1	15.9	15.7	11.5*	15.7	17.5
Cobalt	MCP	12.3	10.7	12.9	7.2 B	8 B	9.7 B
Copper	MCP	24 N	33.8 N	26.8	10.2*	15	16.4
Iron	MCP	30000	29500	30800	16700*	19200	21500
Lead	MCP	12.9	13.6*	11.5*	10.1*	8.9*	10.8*
Magnesium	MCP	4440	3860	3340	2290	2880	3340
Manganese	MCP	684 N*	410 N*	1200 N	373	281	540
Mercury	MCP						
Nickel	MCP	26	23.7	26.9	15.5	20	21.1
Potassium	MCP	1500	1270	1220	342 B	873 B	1020 B
Selenium	MCP						0.23 B
Silver	MCP						0.77 B
Sodium	MCP	235B	225 B	140 B	173 B	169 B	205 B
Thallium	MCP						
Vanadium	MCP	15.3	16.9	16	9.6	15.8	16.8
Zinc	MCP	74.5*	70.2*	71.3	45.6	56.2	64
Cyanide	MCP						
Phenols	MCP		0.66	0.594		0.4	1.53
Ammonia, as N	MISC			7.92	23.8	19.8	107
Total Kjeldahl Nitrogen, as N	MISC	2.31	2.97	202	530	12.6	1000
Nitrate-Nitrogen	MISC	1.23	2.52			0.821	2.51
TOC	MISC	2010	1140	1470	3240	8310	11200
pH Units	MISC	6.65	7.42	6.72	5.97	5.48	6.05
Moisture (%)	MISC	10	12	17.3	21.3	25	28.5

All results reported in mg/kg (ppm) unless otherwise st ated.

Only detected results are reported.

B-Value is less than quantitation limit but greater than the instrument detection limits.

N-Spike recoveries not within QC limits.

*-Duplicate analysis not within QC limits.

S-Value determined by method of standard addition (M SA).

TABLE 4-2: SURFACE SOIL ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		SPS-1	SPS-2	SPS-3	SPS-3re	SPS-4	SPS-5
COLLECTION DATE		9/26/90	9/26/90	9/26/90	9/26/90	9/28/90	9/28/90
PARAMETER	TYPE						
Chloromethane	VOC				NA		
Bromomethane	VOC				NA		
Vinyl Chloride	VOC				NA		
Chloroethane	VOC				NA		
Methylene Chloride	VOC		R	R	NA	R	R
Acetone	VOC	R	R	R	NA	R	R
Carbon Disulfide	VOC				NA		
1,1-Dichloroethene	VOC				NA		
1,1-Dichloroethane	VOC				NA		
1,2-Dichloroethene (Total)	VOC				NA		
Chloroform	VOC				NA		
1,2-Dichloroethane	VOC				NA		
2-Butanone	VOC				NA		
1,1,1-Trichloroethane	VOC				NA		
Carbon Tetrachloride	VOC				NA		
Vinyl Acetate	VOC				NA		
Bromodichloromethane	VOC				NA		
1,2-Dichloropropane	VOC				NA		
cis-1,3-Dichloropropene	VOC				NA		
Trichloroethene	VOC			5 J	NA		
Dibromochloromethane	VOC				NA		
1,1,2-Trichloroethane	VOC				NA		
Benzene	VOC				NA		
trans-1,3-Dichloropropene	VOC				NA		
Bromoform	VOC				NA		
4-Methyl-2-Pentanone	VOC				NA		
2-Hexanone	VOC				NA		
Tetrachloroethene	VOC				NA		
1,1,2,2-Tetrachloroethane	VOC				NA		
Toluene	VOC				NA		
Chlorobenzene	VOC				NA		
Ethylbenzene	VOC				NA		
Styrene	VOC				NA		
Total Xylenes	VOC		2 J	4 J	NA		

All results reported in µg/kg (ppb) unless otherwise stated.

Only detected results are reported.

NA-Not Analyzed

J-Indicates the result is less than the sample quantitation limit but greater than zero.

R-Analyte rejected due to blank contamination.

re-Sample reanalyzed.

NA-Not analyzed.

TABLE 4-2: SURFACE SOIL ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		SPS-1	SPS-2	SPS-3	SPS-3re	SPS-4	SPS-5
COLLECTION DATE		9/26/90	9/26/90	9/26/90	9/26/90	9/28/90	9/28/90
PARAMETER	TYPE						
Phenol	SEMI						
bis(2-Chloroethyl)ether	SEMI						
2-Chlorophenol	SEMI						
1,3-Dichlorobenzene	SEMI						
1,4-Dichlorobenzene	SEMI						
Benzyl Alcohol	SEMI						
1,2-Dichlorobenzene	SEMI						
2-Methylphenol	SEMI						
Bis(2-chloroisopropyl)ether	SEMI						
4-Methylphenol	SEMI						
n-Nitroso-di-n-propylamine	SEMI						
Hexachloroethane	SEMI						
Nitrobenzene	SEMI						
Isophorone	SEMI						
2-Nitrophenol	SEMI						
2,4-Dimethylphenol	SEMI						
Benzoic Acid	SEMI	R	R	R	R	R	R
Bis(2-chloroethoxy)methane	SEMI						
2,4-Dichlorophenol	SEMI						
1,2,4-Trichlorobenzene	SEMI						
Naphthalene	SEMI				8J		82 JD
4-Chloroaniline	SEMI						
Hexachlorobutadiene	SEMI						
4-Chloro-3-methylphenol	SEMI						
2-Methylnaphthalene	SEMI			8 J	9J		37 JD
Hexachlorocyclopentadiene	SEMI						
2,4,6-Trichlorophenol	SEMI						
2,4,5-Trichlorophenol	SEMI						
2-Chloronaphthalene	SEMI						
2-Nitroaniline	SEMI						
Dimethylphthalate	SEMI						
Acenaphthylene	SEMI	12 J		57 J	67J	19 J	39 JD
2,6-Dinitrotoluene	SEMI						
3-Nitroaniline	SEMI						
Acenaphthene	SEMI						190 JD
2,4-Dinitrophenol	SEMI						

All results reported in µg/kg (ppb) unless otherwise stated.

re-Sample reanalyzed.

Only detected results are reported.

D-Indicates the compound was analyzed at a secondary dilution factor.

J-Indicates the result is less than the sample quantitation limit but greater than zero.

R-Analyte rejected due to blank contamination.

TABLE 4-2: SURFACE SOIL ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		SPS-1	SPS-2	SPS-3	SPS-3re	SPS-4	SPS-5
COLLECTION DATE		9/26/90	9/26/90	9/26/90	9/26/90	9/28/90	9/28/90
PARAMETER	TYPE						
4-Nitrophenol	SEMI						
Dibenzofuran	SEMI				3J		93 JD
2,4-Dinitrotoluene	SEMI						
Diethylphthalate	SEMI	R	R	R	R	R	
4-Chlorophenyl-phenyl Ether	SEMI						
Fluorene	SEMI						210 JD
4-Nitroaniline	SEMI						
4,6-Dinitro-2-methylphenol	SEMI						
n-Nitrosodiphenylamine	SEMI						
4-Bromophenyl-phenyl Ether	SEMI						
Hexachlorobenzene	SEMI						
Pentachlorophenol	SEMI						
Phenanthrene	SEMI			93 J	110 J	47 J	1700 D
Anthracene	SEMI	7 J		27 J	30 J	30 J	480 JD
Di-n-butylphthalate	SEMI	R	R	R	R	R	R
Fluoranthene	SEMI	69 J	7 J	240 J	270 J	160 J	2700 D
Pyrene	SEMI	50 J	6 J	250 J	310 J	150 J	2600 D
Butylbenzylphthalate	SEMI			7 J	9 J	5 J	22 JD
3,3'-Dichlorobenzidine	SEMI						
Benzo(a)anthracene	SEMI			160 J	200 J	86 J	1300 D
Chrysene	SEMI			180 J	220 J	110 J	1400 D
bis(2-Ethylhexyl)phthalate	SEMI	R	R	R	R	R	7700 BD
Di-n-octylphthalate	SEMI	R		R	R	20 J	90 JD
Benzo(b)fluoranthene	SEMI	80 J		370	540	280 J	3100 D
Benzo(k)fluoranthene	SEMI	12 J		55 J	64 J	20 J	430 JD
Benzo(a)pyrene	SEMI	26 J		160 J	210 J	51 J	1300 D
Indeno(1,2,3-cd)pyrene	SEMI			65 J	77 J		350 JD
Dibenz(a,h)anthracene	SEMI						110 JD
Benzo(g,h,i)perylene	SEMI			58 J	50J		310 JD

All results reported in µg/kg (ppb) unless otherwise stated.

Only detected results are reported.

D-Indicates the compound was analyzed at a secondary dilution factor.

J-Indicates the result is less than the sample quantitation limit but greater than zero.

B-The compound is detected in the associated method blank.

R-Analyte rejected due to blank contamination.

re-Sample reanalyzed.

TABLE 4-2: SURFACE SOIL ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		SPS-1	SPS-2	SPS-3	SPS-3re	SPS-4	SPS-5
COLLECTION DATE		9/26/90	9/26/90	9/26/90	9/26/90	9/28/90	9/28/90
PARAMETER	TYPE						
alpha-BHC	PST				NA		
beta-BHC	PST				NA		
delta-BHC	PST				NA		
gamma-BHC (Lindane)	PST				NA		
Heptachlor	PST				NA		
Aldrin	PST				NA		
Heptachlor Epoxide	PST				NA		
Endosulfan I	PST				NA		
Dieldrin	PST				NA		
4,4'-DDE	PST	380	33		NA		15 J
Endrin	PST				NA		
Endosulfan II	PST				NA		
4,4'-DDD	PST				NA		51
Endosulfan Sulfate	PST				NA		
4,4'-DDT	PST	150			NA		30
Methoxychlor	PST				NA		
Endrin Ketone	PST				NA		
alpha-Chlordane	PST				NA		17 J
gamma-Chlordane	PST				NA		
Toxaphene	PST				NA		
Aroclor-1016	PCB				NA		
Aroclor-1221	PCB				NA		
Aroclor-1232	PCB				NA		
Aroclor-1242	PCB				NA		
Aroclor-1248	PCB				NA		
Aroclor-1254	PCB				NA		
Aroclor-1260	PCB				NA		

All results reported in µg/kg (ppb) unless otherwise stated.

re-Sample reanalyzed.

Only detected results are reported.

NA-Not Analyzed

J-Indicates the result is less than the sample quantitation limit but greater than zero.

TABLE 4-2: SURFACE SOIL ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		SPS-1	SPS-2	SPS-3	SPS-3re	SPS-4	SPS-5
COLLECTION DATE		9/26/90	9/26/90	9/26/90	9/26/90	9/28/90	9/28/90
PARAMETER	TYPE						
Aluminum	MCP	13900*	12100	12000*	NA	12100	10400
Antimony	MCP				NA		
Arsenic	MCP	5.5	8.1	9.7 S	NA	6.3	5.3
Barium	MCP	76.2	58.6	69	NA	44.9	138
Beryllium	MCP	0.86 B	0.64 B	0.65 B	NA	0.69B	0.57B
Cadmium	MCP	0.56 B	0.61 B	0.59 B	NA	0.74B	0.85B
Calcium	MCP	362 B	1300	20700	NA	378B	14700
Chromium	MCP	14	14.3	13.6	NA	13.3	13.4
Cobalt	MCP	8.2 B	10.3 B	10.9	NA	8.2B	9.9
Copper	MCP	15.9 N	20.4 N	18.7 N	NA	24.0 N	25.7 N
Iron	MCP	22400	25400	27200	NA	23600	24200
Lead	MCP	31.4 S*	16.9*	26.9*	NA	18*	136*
Magnesium	MCP	2610	3520	4430	NA	2920	4710
Manganese	MCP	643 N*	497 N*	525 N*	NA	320 N*	504
Mercury	MCP				NA		
Nickel	MCP	17.2	21.7	23.1	NA	18.9	22.1
Potassium	MCP	941 B	993 B	1240	NA	888B	1020
Selenium	MCP	0.25 B			NA	0.43B	
Silver	MCP				NA		
Sodium	MCP	242 B	247 B	222 B	NA	187B	193B
Thallium	MCP				NA		
Vanadium	MCP	16.4	14.4	15.1	NA	14.3	13.4
Zinc	MCP	67.4*	61.6*	66.7*	NA	54.3*	177*
Cyanide	MCP				NA		
Phenols	MCP			0.771	NA		
Ammonia, as N	MISC	136	6.27	3.41	NA	42.7	13.8
Total Kjeldahl Nitrogen, as N	MISC	648	416	472	NA	737	409
Nitrate-Nitrogen	MISC	2.19	0.71	1.12	NA	1.00	0.576
TOC	MISC	27800	3210	5740	NA	8490	5990
pH Units	MISC	5.25	6.31	7.87	NA	5.79	7.97
Moisture (%)	MISC	16	10	9	NA	15	11

All results reported in mg/kg (ppm) unless otherwise stated.

Only detected results are reported.

NA-Not Analyzed

B-Value is less than quantitation limit but greater than instrument detection limit.

N-Spike recovery not within QC limits.

S-Value determined by method of standard addition (MSA).

*-Duplicate analysis not within control limits.

TABLE 4.2: SURFACE SOILS ANALYTICAL RESULTS
PHASE II

SAMPLE-ID		SPS-6	SPS-7	SPS-7 DL	SPS-8
COLLECTION DATE		6/28/91	6/28/91	6/28/91	6/28/91
PARAMETER	TYPE				
Chloromethane	VOC			NA	
Bromomethane	VOC			NA	
Vinyl Chloride	VOC			NA	
Chloroethane	VOC			NA	
Methylene Chloride	VOC			NA	11
Acetone	VOC	R	R	NA	R
Carbon Disulfide	VOC			NA	
1,1-Dichloroethene	VOC			NA	
1,1-Dichloroethane	VOC			NA	
1,2-Dichloroethene (Total)	VOC			NA	
Chloroform	VOC			NA	
1,2-Dichloroethane	VOC			NA	
2-Butanone	VOC			NA	
1,1,1-Trichloroethane	VOC			NA	
Carbon Tetrachloride	VOC			NA	43
Vinyl Acetate	VOC			NA	
Bromodichloromethane	VOC			NA	
1,2-Dichloropropane	VOC			NA	
cis-1,3-Dichloropropene	VOC			NA	
Trichloroethene	VOC			NA	
Dibromochloromethane	VOC			NA	
1,1,2-Trichloroethane	VOC			NA	
Benzene	VOC			NA	
trans-1,3-Dichloropropene	VOC			NA	
Bromoform	VOC			NA	
4-Methyl-2-Pentanone	VOC			NA	
2-Hexanone	VOC			NA	
Tetrachloroethene	VOC			NA	
1,1,2,2-Tetrachloroethane	VOC			NA	
Toluene	VOC	3 J	8	NA	97
Chlorobenzene	VOC	0.7 J		NA	9
Ethylbenzene	VOC			NA	
Styrene	VOC			NA	
Total Xylenes	VOC			NA	

All results in μg/kg (ppb).
Only detected results are reported.
NA - Not Analyzed

J - Indicates the result is less than sample quantitation limit but greater than zero.
R - Analyte rejected due to blank contamination.

TABLE 4.2: SURFACE SOILS ANALYTICAL RESULTS
PHASE II

SAMPLE-ID		SPS-6	SPS-7	SPS-7 DL	SPS-8
COLLECTION DATE		6/28/91	6/28/91	6/28/91	6/28/91
PARAMETER	TYPE				
Phenol	SEMI				
Bis(2-Chloroethyl) Ether	SEMI				
2-Chlorophenol	SEMI				
1,3-Dichlorobenzene	SEMI				
1,4-Dichlorobenzene	SEMI				
Benzyl Alcohol	SEMI				
1,2-Dichlorobenzene	SEMI				
2-Methylphenol	SEMI				
Bis(2-Chloroisopropyl) Ether	SEMI				
4-Methylphenol	SEMI				
N-Nitroso-di-n-Propylamine	SEMI				
Hexachloroethane	SEMI				
Nitrobenzene	SEMI				
Isophorone	SEMI				
2-Nitrophenol	SEMI				
2,4-Dimethylphenol	SEMI				
Benzoic Acid	SEMI				
Bis(2-chloroethoxy)Methane	SEMI				
2,4-Dichlorophenol	SEMI				
1,2,4-Trichlorobenzene	SEMI				
Naphthalene	SEMI	270 J	5000	6300 D	
4-Chloroaniline	SEMI				
Hexachlorobutadiene	SEMI				
4-Chloro-3-Methylphenol	SEMI				
2-Methylnaphthalene	SEMI	200 J	2400	3000 JD	
Hexachlorocyclopentadiene	SEMI				
2,4,6-Trichlorophenol	SEMI				
2,4,5-Trichlorophenol	SEMI				
2-Chloronaphthalene	SEMI				
2-Nitroaniline	SEMI				
Dimethylphthalate	SEMI				
Acenaphthylene	SEMI	62 J			
2,6-Dinitrotoluene	SEMI				
3-Nitroaniline	SEMI				

All results reported in μg/kg (ppb).
Only detected results are reported.

J – Indicates the result is less than sample quantitation limit but greater than zero.
DL – Sample analyzed at a secondary dilution.
D – Compound analyzed at a secondary dilution.

TABLE 4.2: SURFACE SOILS ANALYTICAL RESULTS
PHASE II

SAMPLE-ID		SPS-6	SPS-7	SPS-7 DL	SPS-8
COLLECTION DATE		6/28/91	6/28/91	6/28/91	6/28/91
PARAMETER	TYPE				
Acenaphthene	SEMI	290 J	7500	9900 D	600 J
2,4-Dinitrophenol	SEMI				
4-Nitrophenol	SEMI				
Dibenzofuran	SEMI	210 J	6300	8300 D	390 J
2,4-Dinitrotoluene	SEMI				
Diethylphthalate	SEMI				
4-Chlorophenyl-Phenyl Ether	SEMI				
Fluorene	SEMI	340 J	8200	10000 D	
4-Nitroaniline	SEMI				
4,6-Dinitro-2-Methylphenol	SEMI				
N-Nitrosodiphenylamine	SEMI				
4-Bromophenyl-Phenyl Ether	SEMI				
Hexachlorobenzene	SEMI				
Pentachlorophenol	SEMI				
Phenanthrene	SEMI	2800	41000 E	55000 D	6600
Anthracene	SEMI	640 J	18000	18000 D	1900
Di-n-Butylphthalate	SEMI	R	R	R	R
Fluoranthene	SEMI	3800	49000 E	58000 D	11000
Pyrene	SEMI	3200	29000	50000 D	8800
Butylbenzylphthalate	SEMI		180 J	200 JD	
3,3'-Dichlorobenzidine	SEMI				
Benzo(a)Anthracene	SEMI	1800	30000	38000 D	5500
Chrysene	SEMI	2000	27000	34000 D	5600
Bis(2-Ethylhexyl)Phthalate	SEMI	2300 B	2700 B	R	2900 B
Di-n-Octyl Phthalate	SEMI		340 J	370 JD	
Benzo(b)Fluoranthene	SEMI	850	13000	21000 D	2500
Benzo(k)Fluoranthene	SEMI	520 J	7500	18000 D	2100
Benzo(a)Pyrene	SEMI	1500	34000 E	41000 D	5300
Indeno(1,2,3-cd)Pyrene	SEMI	630 J	3400	6500 D	1700 J
Dibenz(a,h)Anthracene	SEMI	140 J	700 J	1200 JD	390 J
Benzo(g,h,i)Perylene	SEMI	480 J	2500	5500 D	1100 J

All results reported in μg/kg (ppb).
Only detected results are reported.

B - Analyte detected in associated method blank.
J - Indicates the result is less than sample quantitation limit but greater than zero.
E - Compound concentration exceeds the linear range of calibration.
R - Analyte rejected due to blank contamination.
DL - Sample analyzed at a secondary dilution.
D - Compound analyzed at a secondary dilution.

TABLE 4-3: WASTE ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		WS-1	WS-2A	WS-2	WS-3	WS-7S	MW-WS-8	MW-WS-9	MW-WS-10
COLLECTION DATE		9/28/90	9/28/90	12/4/90	12/3/90	9/20/90	10/29/90	10/31/90	11/1/90
PARAMETER	TYPE								
Chloromethane	VOC								
Bromomethane	VOC								
Vinyl Chloride	VOC								
Chloroethane	VOC								
Methylene Chloride	VOC	R	R		R	R	R		
Acetone	VOC	R	R		R	R	R	R	R
Carbon Disulfide	VOC								
1,1-Dichloroethene	VOC								
1,1-Dichloroethane	VOC								
1,2-Dichloroethene (Total)	VOC								
Chloroform	VOC								
1,2-Dichloroethane	VOC								
2-Butanone	VOC					R			
1,1,1-Trichloroethane	VOC								
Carbon Tetrachloride	VOC								
Vinyl Acetate	VOC								
Bromodichloromethane	VOC								
1,2-Dichloropropane	VOC								
cis-1,3-Dichloropropene	VOC								
Trichloroethene	VOC					18			
Dibromochloromethane	VOC								
1,1,2-Trichloroethane	VOC								
Benzene	VOC					2J			
trans-1,3-Dichloropropene	VOC								
Bromoform	VOC								
4-Methyl-2-Pentanone	VOC								
2-Hexanone	VOC								
Tetrachloroethene	VOC					6			
1,1,2,2-Tetrachloroethane	VOC								
Toluene	VOC					3J			
Chlorobenzene	VOC								
Ethylbenzene	VOC					4J			
Styrene	VOC								
Total Xylenes	VOC					15			

All results reported in µg/kg (ppb) unless otherwise stated.

Only detected results are reported.

J-Indicates the result is less than the sample quantitation limit but greater than zero.

R-Analyte rejected due to blank contamination.

TABLE 4-3: WASTE ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		WS-1	WS-2A	WS-2	WS-3	WS-7S	MW-WS-8	MW-WS-9	MW-WS-10
COLLECTION DATE		9/28/90	9/28/90	12/4/90	12/3/90	9/20/90	10/29/90	10/31/90	11/1/90
PARAMETER	TYPE								
Phenol	SEMI								
bis(2-Chloroethyl)ether	SEMI								
2-Chlorophenol	SEMI								
1,3-Dichlorobenzene	SEMI								
1,4-Dichlorobenzene	SEMI								
Benzyl Alcohol	SEMI								
1,2-Dichlorobenzene	SEMI								
2-Methylphenol	SEMI								
Bis(2-chloroisopropyl)ether	SEMI								
4-Methylphenol	SEMI								
n-Nitroso-di-n-propylamine	SEMI								
Hexachloroethane	SEMI								
Nitrobenzene	SEMI								
Isophorone	SEMI			50 J					
2-Nitrophenol	SEMI								
2,4-Dimethylphenol	SEMI								
Benzoic Acid	SEMI	R	R	200 J	120 J				
Bis(2-chloroethoxy)methane	SEMI								
2,4-Dichlorophenol	SEMI								
1,2,4-Trichlorobenzene	SEMI								
Naphthalene	SEMI		6 J	22 J		86000 J	150 J		2700 J
4-Chloroaniline	SEMI								
Hexachlorobutadiene	SEMI								
4-Chloro-3-methylphenol	SEMI								
2-Methylnaphthalene	SEMI	7 J				44000 J			1100 J
Hexachlorocyclopentadiene	SEMI								
2,4,6-Trichlorophenol	SEMI								
2,4,5-Trichlorophenol	SEMI								
2-Chloronaphthalene	SEMI								
2-Nitroaniline	SEMI								
Dimethylphthalate	SEMI						430 JD		
Acenaphthylene	SEMI	180 J	22 J						
2,6-Dinitrotoluene	SEMI								
3-Nitroaniline	SEMI								
Acenaphthene	SEMI	14 J				82000 J	500 JD		4300
2,4-Dinitrophenol	SEMI								

All results reported in µg/Kg (ppb) unless otherwise stated.

Only detected results are reported.

J-Indicates the result is less than the sample quantitation limit but greater than zero.

R-Analyte rejected due to blank contamination.

D-Indicates compounds were analyzed at a secondary dilution factor.

TABLE 4-3: WASTE ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		WS-1	WS-2A	WS-2	WS-3	WS-7S	MW-WS-8	MW-WS-9	MW-WS-10
COLLECTION DATE		9/28/90	9/28/90	12/4/90	12/3/90	9/20/90	10/29/90	10/31/90	11/1/90
PARAMETER	TYPE								
4-Nitrophenol	SEMI								
Dibenzofuran	SEMI	9 J				66000 J	310 JD		4000J
2,4-Dinitrotoluene	SEMI								
Diethylphthalate	SEMI	R	R		19 J				
4-Chlorophenyl-phenyl Ether	SEMI								
Fluorene	SEMI	25 J				120000	480 JD		6300
4-Nitroaniline	SEMI								
4,6-Dinitro-2-methylphenol	SEMI								
n-Nitrosodiphenylamine	SEMI								
4-Bromophenyl-phenyl Ether	SEMI								
Hexachlorobenzene	SEMI								
Pentachlorophenol	SEMI								
Phenanthrene	SEMI	440.0 J	60 J	45 J	15 J	610000	5000 D	1700	39000
Anthracene	SEMI	110 J	28 J			200000	1100 D	350 J	8100
Di-n-butylphthalate	SEMI	R	R	1700 B					
Fluoranthene	SEMI	1600	180 J		21 J	620000	8600 D	3000	41000
Pyrene	SEMI	1500	140 J	110 J	21 J	580000	4500 D	1200 J	28000
Butylbenzylphthalate	SEMI	8 J	5 J						2300 J
3,3'-Dichlorobenzidine	SEMI								
Benzo(a)anthracene	SEMI	730	76 J			320000	3200 D	1300 J	19000
Chrysene	SEMI	1000	120 J			290000	3600 D	1400 J	21000
bis(2-Ethylhexyl)phthalate	SEMI	R	R	R	R		R	23000 B	
Di-n-octylphthalate	SEMI	5 J	7 J	R	R				
Benzo(b)fluoranthene	SEMI	1900	270 J		23 J	430000	5100 D		20000
Benzo(k)fluoranthene	SEMI	200 J	18 J			58000 J	550 JD	1800	2900 J
Benzo(a)pyrene	SEMI	690	55 J			240000	2800 D	1100 J	14000
Indeno(1,2,3-cd)pyrene	SEMI	340 J				170000	2100 D	700 J	9600
Dibenz(a,h)anthracene	SEMI	77 J				44000 J	1200 D		6300
Benzo(g,h,i)perylene	SEMI	220 J				130000	2300 D	560 J	9000

All results reported in µg/kg (ppb) unless otherwise stated.

Only detected results are reported.

J-Indicates the result is less than the sample quantitation limit but greater than zero.

B-The compound is detected in the associated method blank.

R-Analyte rejected due to blank contamination.

D-Indicates compounds were analyzed at a secondary dillution factor.

TABLE 4-3: WASTE ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		WS-1	WS-2A	WS-2	WS-3	WS-7S	MW-WS-8	MW-WS-9	MW-WS-10
COLLECTION DATE		9/28/90	9/28/90	12/4/90	12/3/90	9/20/90	10/29/90	10/31/90	11/1/90
PARAMETER	TYPE								
alpha-BHC	PST								
beta-BHC	PST								
delta-BHC	PST								
gamma-BHC (Lindane)	PST								
Heptachlor	PST								
Aldrin	PST								
Heptachlor Epoxide	PST								
Endosulfan I	PST								
Dieldrin	PST							28 J	
4,4'-DDE	PST							41	63
Endrin	PST								
Endosulfan II	PST								
4,4'-DDD	PST					140 J			18J
Endosulfan Sulfate	PST								
4,4'-DDT	PST							160	950
Methoxychlor	PST								
Endrin Ketone	PST								
alpha-Chlordane	PST							44 J	
gamma-Chlordane	PST							62J	
Toxaphene	PST								
Aroclor-1016	PCB								
Aroclor-1221	PCB								
Aroclor-1232	PCB								
Aroclor-1242	PCB								
Aroclor-1248	PCB								
Aroclor-1254	PCB								
Aroclor-1260	PCB								

All results reported in µg/kg (ppb) unless otherwise stated.

Only detected results are reported.

J-Indicates the result is less than the sample quantitation limit but greater than zero.

TABLE 4-3: WASTE ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		WS-1	WS-2A	WS-2	WS-3	WS-7S	MW-WS-8	MW-WS-9	MW-WS-10
COLLECTION DATE		9/28/90	9/28/90	12/4/90	12/3/90	9/20/90	10/29/90	10/31/90	11/1/90
PARAMETER	TYPE								
Aluminum	MCP	4290*	13100*	11800	8110	7280*	10800*	8030*	9100*
Antimony	MCP								
Arsenic	MCP	66.1	8.7	26.7 N	20.1 N	11.5	14.7 N*	16.7 N*	7.9 N*
Barium	MCP	173	68.6	146	128	1600	139	146	290
Beryllium	MCP	1.4	0.66 B			0.77 B	0.46 B	0.47 B	0.32 B
Cadmium	MCP	0.40 B	0.96			2.2	0.83 B	0.53 B	0.94 B
Calcium	MCP	1550	826 B	1980 B	1090 B	18200	23600*	22500*	41900*
Chromium	MCP	7.2	15.6	17	10.8	18.6	23.1*	15.4*	20.9*
Cobalt	MCP	4.7 B	10.9	11.7 B	7 B	6.4 B	12	7.1 B	6.8 B
Copper	MCP	27.8 N	23.9 N	52.3	13.8	41.8 N	64.4*	21*	39.3*
Iron	MCP	4870	29200	34200	21000	22600	24800	16900	20200
Lead	MCP	15.1*	19.2*	25.3 N*	14.5 N*	363*	165*	206*	472*
Magnesium	MCP	366 B	3540	3070	1970	3440	4990	4450	7390
Manganese	MCP	32.4 N*	553 N*	1210 N*	418 N*	403 N*	901	415	473
Mercury	MCP	0.63				0.12	0.25	R	0.28
Nickel	MCP	10.6	22.1	20.9	12.8 B	19.7	25.6	16.6	16.4
Potassium	MCP	1010 B	959	988 B	647 B	668 B	1240	697 B	1160
Selenium	MCP	7.7					1.2 N	1.0 BN	
Silver	MCP								
Sodium	MCP	271 B	180 B	431 B	394 B	269 B	367 B	360 B	354 B
Thallium	MCP	0.71 B							
Vanadium	MCP	42.7	17.1	16.2 B	12.8 B	13.5	24.2	14.1	19.6
Zinc	MCP	20.3*	73.6*	88.7	46.3	915	289	220	482
Cyanide	MCP					0.63			
Phenols	MCP	0.351		6.6	.695	8.9	1.1	1.41	1.92

All results reported in mg/kg (ppm) unless otherwise stated.

Only detected results are reported.

***-Duplicate analysis not within QC limits.**

N-Spike recovery not within QC limits.

B-Values less than quantitation limits but greater than instrument selection limits.

R-Analyte rejected due to blank contamination.

TABLE 4-3: WASTE ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		WS-1	WS-2A	WS-2	WS-3	WS-7S	MW-WS-8	MW-WS-9	MW-WS-10
COLLECTION DATE		9/28/90	9/28/90	12/4/90	12/3/90	9/20/90	10/29/90	10/31/90	11/1/90
PARAMETER	TYPE								
Corrosivity (as pH)	MISC	NC	NC	NC	NC	NA	NC	NC	NC
Reactive Cyanide (mg/kg)	MISC					NA			
Ignitability (deg. F)	MISC	N	N	N	N	NA	N	N	N
Reactive Sulfide (mg/kg)	MISC			35.7	47.2	NA	51.8	62.9	83.9
Sulfur (%)	MISC	.40	.021			NA	.040	.092	.18
Chlorine (mg/kg)	MISC					NA	377	.30%	182
Ash Weight (%)	MISC	63.29	47.58			NA	71.66	68.86	60.46
Heat of Combustion (BTU/lb)	MISC					NA		506	
EP Tox - Arsenic	MCP	134*	22*			NA			
EP Tox - Barium	MCP	1050	310	602	524	NA	149B	173B	186B
EP Tox - Cadmium	MCP	3.6 B	3.1 B			NA		2.1B	
EP Tox - Chromium	MCP			5.9 B	8.9 B	NA			
EP Tox - Lead	MCP	38.9*		72.1	51.2	NA	34.9	90.6	122
EP Tox - Mercury	MCP					NA			
EP Tox - Selenium	MCP	58.4				NA			
EP Tox - Silver	MCP					NA			
EP Tox - Lindane	PEST					NA			
EP Tox - Endrine	PEST					NA			
EP Tox - Methoxyclor	PEST					NA			
EP Tox - Toxaphene	PEST					NA			
EP Tox - 2,4-D	HERB					NA			
EP Tox - Silvex	HERB					NA			

All results reported in µg/l (ppb) unless otherwise stated.

Only detected results are reported.

*-Duplicate analysis not within QC limits.

B-Values less than quantitation limits but greater than instrument selection limits.

N - Non-Reactive

NA - Not Analyzed

NC - Non-Corrosive

TABLE 4.3: WASTE ANALYTICAL RESULTS
PHASE II

SAMPLE-ID		TP2-11-1	TP2-11-2	TP2-24-1
COLLECTION DATE		6/12/91	6/12/91	6/13/91
PARAMETER	TYPE		TCLP	
Chloromethane	VOC		NA	
Bromomethane	VOC		NA	
Vinyl Chloride	VOC			
Chloroethane	VOC		NA	
Methylene Chloride	VOC	R	NA	R
Acetone	VOC	R	NA	R
Carbon Disulfide	VOC		NA	
1,1-Dichloroethene	VOC			
1,1-Dichloroethane	VOC		NA	
1,2-Dichloroethene (Total)	VOC		NA	
Chloroform	VOC			
1,2-Dichloroethane	VOC			
2-Butanone	VOC	R	R	
1,1,1-Trichloroethane	VOC		NA	
Carbon Tetrachloride	VOC			
Vinyl Acetate	VOC		NA	
Bromodichloromethane	VOC		NA	
1,2-Dichloropropane	VOC		NA	
cis-1,3-Dichloropropene	VOC		NA	
Trichloroethene	VOC			
Dibromochloromethane	VOC		NA	
1,1,2-Trichloroethane	VOC		NA	
Benzene	VOC	21000 J		
trans-1,3-Dichloropropene	VOC		NA	
Bromoform	VOC		NA	
4-Methyl-2-Pentanone	VOC	990000 B	NA	
2-Hexanone	VOC		NA	
Tetrachloroethene	VOC	8800 J		
1,1,2,2-Tetrachloroethane	VOC		NA	
Toluene	VOC	550000	NA	1700000 B
Chlorobenzene	VOC	34000 J		
Ethylbenzene	VOC	58000	NA	970000
Styrene	VOC		NA	
Total Xylenes	VOC	870000	NA	4800000 B

All results in μg/kg (ppb) except for TCLP in μg/l (ppb).
Only detected results are reported.
B - Value is less than quantitation limit but greater than instrument detection limit.
J - Indicates the result is less than sample quantitation limit but greater than zero.
R - Analyte rejected due to blank contamination.

TABLE 4-4: SURFACE WATER ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		SW-1	SW-4	SW-5	SW-6	SW-7	SW-8	SW-9	SW-9re	SW-10
COLLECTION DATE		12/4/90	12/4/90	12/4/90	12/3/90	12/3/90	12/3/90	12/3/90	12/3/90	12/4/90
PARAMETER	TYPE									
Chloromethane	VOC								NA	
Bromomethane	VOC								NA	
Vinyl Chloride	VOC								NA	
Chloroethane	VOC								NA	
Methylene Chloride	VOC			R				2 J	NA	
Acetone	VOC	R	R	R		R	R	R	NA	
Carbon Disulfide	VOC								NA	
1,1-Dichloroethene	VOC								NA	
1,1-Dichloroethane	VOC								NA	
1,2-Dichloroethene (Total)	VOC								NA	
Chloroform	VOC								NA	
1,2-Dichloroethane	VOC								NA	
2-Butanone	VOC								NA	
1,1,1-Trichloroethane	VOC								NA	
Carbon Tetrachloride	VOC								NA	
Vinyl Acetate	VOC								NA	
Bromodichloromethane	VOC								NA	
1,2-Dichloropropane	VOC								NA	
cis-1,3-Dichloropropene	VOC								NA	
Trichloroethene	VOC								NA	
Dibromochloromethane	VOC								NA	
1,1,2-Trichloroethane	VOC								NA	
Benzene	VOC								NA	
trans-1,3-Dichloropropene	VOC								NA	
Bromoform	VOC								NA	
4-Methyl-2-Pentanone	VOC								NA	
2-Hexanone	VOC								NA	
Tetrachloroethene	VOC								NA	
1,1,2,2-Tetrachloroethane	VOC								NA	
Toluene	VOC		2 J					1 J	NA	
Chlorobenzene	VOC								NA	
Ethylbenzene	VOC								NA	
Styrene	VOC								NA	
Total Xylenes	VOC								NA	

All results reported in µg/l (ppb) unless otherwise stated.

re-Sample reanalyzed.

Only detected results are reported.

J-Indicates the result is less than the sample quantitation limit but greater than zero.

NA-Not Analyzed

R-Analyte rejected due to blank contamination.

TABLE 4-4: SURFACE WATER ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		SW-1	SW-4	SW-5	SW-6	SW-7	SW-8	SW-9	SW-9re	SW-10
COLLECTION DATE		12/4/90	12/4/90	12/4/90	12/3/90	12/3/90	12/3/90	12/3/90	12/3/90	12/4/90
PARAMETER	TYPE									
Phenol	SEMI								DR	
bis(2-Chloroethyl)ether	SEMI								DR	
2-Chlorophenol	SEMI								DR	
1,3-Dichlorobenzene	SEMI								DR	
1,4-Dichlorobenzene	SEMI								DR	
Benzyl Alcohol	SEMI								DR	
1,2-Dichlorobenzene	SEMI								DR	
2-Methylphenol	SEMI								DR	
Bis(2-chloroisopropyl)ether	SEMI								DR	
4-Methylphenol	SEMI								DR	
n-Nitroso-di-n-propylamine	SEMI								DR	
Hexachloroethane	SEMI								DR	
Nitrobenzene	SEMI								DR	
Isophorone	SEMI								DR	
2-Nitrophenol	SEMI								DR	
2,4-Dimethylphenol	SEMI								DR	
Benzoic Acid	SEMI								DR	3 J
Bis(2-chloroethoxy)methane	SEMI								DR	
2,4-Dichlorophenol	SEMI								DR	
1,2,4-Trichlorobenzene	SEMI								DR	
Naphthalene	SEMI								DR	
4-Chloroaniline	SEMI								DR	
Hexachlorobutadiene	SEMI								DR	
4-Chloro-3-methylphenol	SEMI								DR	
2-Methylnaphthalene	SEMI								DR	
Hexachlorocyclopentadiene	SEMI								DR	
2,4,6-Trichlorophenol	SEMI								DR	
2,4,5-Trichlorophenol	SEMI								DR	
2-Chloronaphthalene	SEMI								DR	
2-Nitroaniline	SEMI								DR	
Dimethylphthalate	SEMI								DR	
Acenaphthylene	SEMI								DR	
2,6-Dinitrotoluene	SEMI								DR	
3-Nitroaniline	SEMI								DR	
Acenaphthene	SEMI								DR	
2,4-Dinitrophenol	SEMI								DR	

- All results reported in µg/l (ppb) unless otherwise stated.

Only detected results are reported.

J-Indicates the result is less than the sample quantitation limit but greater than zero.

re-Sample Reanalyzed.

DR-Data review indicates this data is non compliant with ASP.

TABLE 4-4: SURFACE WATER ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		SW-1	SW-4	SW-5	SW-6	SW-7	SW-8	SW-9	SW-9re	SW-10
COLLECTION DATE		12/4/90	12/4/90	12/4/90	12/3/90	12/3/90	12/3/90	12/3/90	12/3/90	12/4/90
PARAMETER	TYPE									
4-Nitrophenol	SEMI								DR	
Dibenzofuran	SEMI								DR	
2,4-Dinitrotoluene	SEMI								DR	
Diethylphthalate	SEMI								DR	
4-Chlorophenyl-phenyl Ether	SEMI								DR	
Fluorene	SEMI								DR	
4-Nitroaniline	SEMI								DR	
4,6-Dinitro-2-methylphenol	SEMI								DR	
n-Nitrosodiphenylamine	SEMI								DR	
4-Bromophenyl-phenyl Ether	SEMI								DR	
Hexachlorobenzene	SEMI								DR	
Pentachlorophenol	SEMI								DR	
Phenanthrene	SEMI								DR	
Anthracene	SEMI								DR	
Di-n-butylphthalate	SEMI								DR	
Fluoranthene	SEMI								DR	
Pyrene	SEMI								DR	
Butylbenzylphthalate	SEMI				17		10 J	13	DR	
3,3'-Dichlorobenzidine	SEMI								DR	
Benzo(a)anthracene	SEMI								DR	
Chrysene	SEMI								DR	
bis(2-Ethylhexyl)phthalate	SEMI	3 J	R	4 J	4 J	3 J	5 J	5 J	DR	2 J
Di-n-octylphthalate	SEMI								DR	
Benzo(b)fluoranthene	SEMI								DR	
Benzo(k)fluoranthene	SEMI								DR	
Benzo(a)pyrene	SEMI								DR	
Indeno(1,2,3-cd)pyrene	SEMI								DR	
Dibenz(a,h)anthracene	SEMI								DR	
Benzo(g,h,i)perylene	SEMI								DR	

All results reported in µg/l (ppb) unless otherwise stated.

R-Analyte rejected due to blank contamination.

Only detected results are reported.

J-Indicates the result is less than the sample quantitation limit but greater than zero.

re-Sample Reanalyzed.

DR-Data review indicates this data is non compliant with ASP.

TABLE 4-4: SURFACE WATER ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		SW-1	SW-4	SW-5	SW-6	SW-7	SW-8	SW-9	SW-9re	SW-10
COLLECTION DATE		12/4/90	12/4/90	12/4/90	12/3/90	12/3/90	12/3/90	12/3/90	12/3/90	12/4/90
PARAMETER	TYPE									
alpha-BHC	PST								NA	
beta-BHC	PST								NA	
delta-BHC	PST								NA	
gamma-BHC (Lindane)	PST								NA	
Heptachlor	PST								NA	
Aldrin	PST								NA	
Heptachlor Epoxide	PST								NA	
Endosulfan I	PST								NA	
Dieldrin	PST								NA	
4,4'-DDE	PST								NA	
Endrin	PST								NA	
Endosulfan II	PST								NA	
4,4'-DDD	PST								NA	
Endosulfan Sulfate	PST								NA	
4,4'-DDT	PST								NA	
Methoxychlor	PST								NA	
Endrin Ketone	PST								NA	
alpha-Chlordane	PST								NA	
gamma-Chlordane	PST								NA	
Toxaphene	PST								NA	
Aroclor-1016	PCB								NA	
Aroclor-1221	PCB								NA	
Aroclor-1232	PCB								NA	
Aroclor-1242	PCB								NA	
Aroclor-1248	PCB								NA	
Aroclor-1254	PCB								NA	
Aroclor-1260	PCB								NA	

All results reported in µg/l (ppb) unless otherwise stated.

re-Sample reanalyzed.

Only detected results are reported.

NA-Not Analyzed

TABLE 4-4: SURFACE WATER ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		SW-1	SW-4	SW-5	SW-6	SW-7	SW-8	SW-9	SW-9re	SW-10
COLLECTION DATE		12/4/90	12/4/90	12/4/90	12/3/90	12/3/90	12/3/90	12/3/90	12/3/90	12/4/90
PARAMETER	TYPE									
Aluminum	MCP	1000	71.8 B	630	141 B	179 B	95 B	85.9 B	NA	1680
Antimony	MCP								NA	
Arsenic	MCP			1.1 B					NA	1.1 B
Barium	MCP								NA	28.5 B
Beryllium	MCP								NA	
Cadmium	MCP								NA	
Calcium	MCP	15800	20700	18400	41900	26600	21400	21200	NA	18300
Chromium	MCP								NA	
Cobalt	MCP								NA	
Copper	MCP								NA	
Iron	MCP	1570 N	80.2 B	1090 N	494 N	300 N	217 N	278 N	NA	1850
Lead	MCP	5.3							NA	1.2 BW
Magnesium	MCP	3100 B	3440 B	3410 B	10500	5580	2530 B	2530 B	NA	3510 B
Manganese	MCP	81.1 N	539	105 N	310 N	166 N	22.5 N	23.8 N	NA	139
Mercury	MCP								NA	
Nickel	MCP								NA	
Potassium	MCP	2820 B	758 B	2510 B	2450 B	1130 B	1120 B	1250 B	NA	3420 B
Selenium	MCP								NA	
Silver	MCP								NA	
Sodium	MCP	13700	8610	12400	21900	12600	4290 B	4240 B	NA	14700
Thallium	MCP								NA	
Vanadium	MCP			9.6 B					NA	
Zinc	MCP	2180		19.6 B		12.2 B			NA	14.9 B
Cyanide	MCP	12.8 N				42.2 N	28.3 N		NA	
Phenols (mg/l)	MCP			0.006		0.005			NA	

All results reported in µg/l (ppb) unless otherwise stated.

Only detected results are reported.

W - Post-digestion spike outside of QC limits.

N - Spike recovery not within QC limits.

B - Value less than quantitation limit, but greater than instrument detection limit.

re-Sample reanalyzed.

NA-Not analyzed.

* - Duplicate analysis not within QC limits.

TABLE 4-4: SURFACE WATER ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		SW-1	SW-4	SW-5	SW-6	SW-7	SW-8	SW-9	SW-9re	SW-10
COLLECTION DATE		12/4/90	12/4/90	12/4/90	12/3/90	12/3/90	12/3/90	12/3/90	12/3/90	12/4/90
PARAMETER	TYPE									
Bicarbonate	MISC	33.9	47.2	37.1	73.2	61	58.6	57.7	NA	35.5
BOD	MISC	NA	4.53	21.1	10.8	10.5	2.41	9.27	NA	27.2
COD	MISC	25.3		22.2	10.3				NA	22.2
Chloride	MISC	37.9	23.1	41.2	49.8	34	8	7.70	NA	39.8
Hardness	MISC	52.4	65.2	66	146	97.8	64.2	68.8	NA	59.8
Ammonia, as N	MISC	0.13	0.07					0.141	NA	0.06
Total Kjeldahl Nitrogen, as N	MISC	1.26	0.277	0.728	0.772	0.567	0.742	0.70	NA	0.841
Alkalinity	MISC	33.9	47.3	37.1	73.4	61.2	58.8	57.9	NA	35.5
Acidity	MISC	15.4	13.9	11.7	12.7	8.20	5.90	4.70	NA	12.7
Nitrate-Nitrogen	MISC	0.28	0.297	0.232	0.192	0.239	0.676	0.675	NA	0.272
Phosphate	MISC								NA	
Oil and Grease	MISC		0.96						NA	1.92
TOC	MISC	7.71	1.02	6.33	4.31	1.95	2.26	1.98	NA	8.17
TSS	MISC	24		16.9	5.5	8	1.2	1.10	NA	23.9
TDS	MISC	145	115	136	236	146	81.4	74.5	NA	161
Sulfate	MISC	22.6	16.8	13.3	47	43	13.6	9.96	NA	14.2
Sulfide	MISC	3.1	2.65	1.75				1.3	NA	4
pH (field)	MISC	6.53	6.58	6.55	5.85	5.50	7.24	7.43	NA	6.20
Dissolved Oxygen (field)	MISC	4.7	5.6	8.2	7.0	7.9	9.6	9.6	NA	5.4
Spec. Conductivity (umho/cm) (field)	MISC	240	220	360	450	200	170	120	NA	250
Temperature (Deg. C) (field)	MISC	4.8	15.8	5.1	12	8.5	1.0	3.5	NA	NT

All results reported in mg/l (ppm) unless otherwise stated.

Only detected results are reported.

*-Duplicate analysis not within QC limits.

W-Post-digestion spike outside QC limits.

N-Spike recovery not within QC limits.

NA-Not Analyzed

NT-Not Taken

TABLE 4.4: SURFACE WATER ANALYTICAL RESULTS
PHASE II

SAMPLE-ID		SW-8	SW-11	SW-12
COLLECTION DATE		6/28/91	6/28/91	6/28/91
PARAMETER	TYPE			
Chloromethane	VOC			
Bromomethane	VOC			
Vinyl Chloride	VOC			
Chloroethane	VOC			
Methylene Chloride	VOC			
Acetone	VOC			
Carbon Disulfide	VOC			
1,1-Dichloroethene	VOC			
1,1-Dichloroethane	VOC			
1,2-Dichloroethene (Total)	VOC			
Chloroform	VOC			
1,2-Dichloroethane	VOC			
2-Butanone	VOC			
1,1,1-Trichloroethane	VOC			
Carbon Tetrachloride	VOC			
Vinyl Acetate	VOC			
Bromodichloromethane	VOC			
1,2-Dichloropropane	VOC			
cis-1,3-Dichloropropene	VOC			
Trichloroethene	VOC			
Dibromochloromethane	VOC			
1,1,2-Trichloroethane	VOC			
Benzene	VOC			
trans-1,3-Dichloropropene	VOC			
Bromoform	VOC			
4-Methyl-2-Pentanone	VOC			
2-Hexanone	VOC			
Tetrachloroethene	VOC			
1,1,2,2-Tetrachloroethane	VOC			
Toluene	VOC			
Chlorobenzene	VOC			
Ethylbenzene	VOC			
Styrene	VOC			
Total Xylenes	VOC			

All results in µg/l (ppb).
Only detected results are reported.

TABLE 4-5: STREAM SEDIMENT ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		SS-1	SS-4	SS-5	SS-6	SS-7	SS-8	SS-9	SS-10
COLLECTION DATE		12/4/90	12/4/90	12/4/90	12/3/90	12/3/90	12/3/90	12/3/90	12/4/90
PARAMETER	TYPE								
Chloromethane	VOC								
Bromomethane	VOC								
Vinyl Chloride	VOC								
Chloroethane	VOC								
Methylene Chloride	VOC	R		R	R	R	R		R
Acetone	VOC	R		R	R	R	R		R
Carbon Disulfide	VOC								
1,1-Dichloroethene	VOC								
1,1-Dichloroethane	VOC								
1,2-Dichloroethene (Total)	VOC								
Chloroform	VOC								
1,2-Dichloroethane	VOC								
2-Butanone	VOC								
1,1,1-Trichloroethane	VOC								
Carbon Tetrachloride	VOC								
Vinyl Acetate	VOC								
Bromodichloromethane	VOC								
1,2-Dichloropropane	VOC								
cis-1,3-Dichloropropene	VOC								
Trichloroethene	VOC								
Dibromochloromethane	VOC								
1,1,2-Trichloroethane	VOC								
Benzene	VOC								
trans-1,3-Dichloropropene	VOC								
Bromoform	VOC								
4-Methyl-2-Pentanone	VOC								
2-Hexanone	VOC								
Tetrachloroethene	VOC								
1,1,2,2-Tetrachloroethane	VOC								
Toluene	VOC								
Chlorobenzene	VOC								
Ethylbenzene	VOC								
Styrene	VOC								
Total Xylenes	VOC								

All results reported in µg/kg (ppb).

Only detected results are reported.

J-Indicates the result is less than the sample quantitation limit but greater than zero.

R-Analyte rejected due to blank contamination.

TABLE 4-5: STREAM SEDIMENT ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		SS-1	SS-4	SS-5	SS-6	SS-7	SS-8	SS-9	SS-10
COLLECTION DATE		12/4/90	12/4/90	12/4/90	12/3/90	12/3/90	12/3/90	12/3/90	12/4/90
PARAMETER	TYPE								
Phenol	SEMI								
bis(2-Chloroethyl)ether	SEMI								
2-Chlorophenol	SEMI								
1,3-Dichlorobenzene	SEMI								
1,4-Dichlorobenzene	SEMI								
Benzyl Alcohol	SEMI								
1,2-Dichlorobenzene	SEMI								
2-Methylphenol	SEMI								
Bis(2-chloroisopropyl)ether	SEMI								
4-Methylphenol	SEMI								
n-Nitroso-di-n-propylamine	SEMI								
Hexachloroethane	SEMI								
Nitrobenzene	SEMI								
Isophorone	SEMI		72 J						
2-Nitrophenol	SEMI								
2,4-Dimethylphenol	SEMI								
Benzoic Acid	SEMI	67 J	150 J	25 J		84 J			320 J
Bis(2-chloroethoxy)methane	SEMI								
2,4-Dichlorophenol	SEMI								
1,2,4-Trichlorobenzene	SEMI								
Naphthalene	SEMI				79 J				28 J
4-Chloroaniline	SEMI								
Hexachlorobutadiene	SEMI								
4-Chloro-3-methylphenol	SEMI								
2-Methylnaphthalene	SEMI								
Hexachlorocyclopentadiene	SEMI								
2,4,6-Trichlorophenol	SEMI								
2,4,5-Trichlorophenol	SEMI								
2-Chloronaphthalene	SEMI								
2-Nitroaniline	SEMI								
Dimethylphthalate	SEMI								
Acenaphthylene	SEMI								50 J
2,6-Dinitrotoluene	SEMI								
3-Nitroaniline	SEMI								
Acenaphthene	SEMI				130 J				
2,4-Dinitrophenol	SEMI								

All results reported in µg/kg (ppb).

Only detected results are reported.

J-Indicates the result is less than the sample quantitation limit but greater than zero.

TABLE 4-5: STREAM SEDIMENT ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		SS-1	SS-4	SS-5	SS-6	SS-7	SS-8	SS-9	SS-10
COLLECTION DATE		12/4/90	12/4/90	12/4/90	12/3/90	12/3/90	12/3/90	12/3/90	12/4/90
PARAMETER	TYPE								
4-Nitrophenol	SEMI								
Dibenzofuran	SEMI				74 J				30 J
2,4-Dinitrotoluene	SEMI								
Diethylphthalate	SEMI		27 J						27 J
4-Chlorophenyl-phenyl Ether	SEMI								
Fluorene	SEMI				130 J				37 J
4-Nitroaniline	SEMI								
4,6-Dinitro-2-methylphenol	SEMI								
n-Nitrosodiphenylamine	SEMI								
4-Bromophenyl-phenyl Ether	SEMI								
Hexachlorobenzene	SEMI								
Pentachlorophenol	SEMI	78 J							
Phenanthrene	SEMI	12 J	36 J		820			94 J	350 J
Anthracene	SEMI				180 J				78 J
Di-n-butylphthalate	SEMI	R	570 B	R	92 J				
Fluoranthene	SEMI	29 J			870	100 J	70 J	180 J	610 J
Pyrene	SEMI	36 J	50 J		500	70 J	43 J	98 J	490 J
Butylbenzylphthalate	SEMI	25 J							
3,3'-Dichlorobenzidine	SEMI								
Benzo(a)anthracene	SEMI				460				280 J
Chrysene	SEMI	19 J			440 J			94 J	310 J
bis(2-Ethylhexyl)phthalate	SEMI	R	2000 B	R	R	R	R	R	R
Di-n-octylphthalate	SEMI	R		R					R
Benzo(b)fluoranthene	SEMI	28 J			620			130 J	430 J
Benzo(k)fluoranthene	SEMI								48 J
Benzo(a)pyrene	SEMI				340 J				230 J
Indeno(1,2,3-cd)pyrene	SEMI				260 J				130 J
Dibenz(a,h)anthracene	SEMI								57 J
Benzo(g,h,i)perylene	SEMI				220 J				110 J

All results reported in µg/kg (ppb).

R-Analyte rejected due to blank contamination.

Only detected results are reported.

J-Indicates the result is less than the sample quantitation limit but greater than zero.

B-The compound is detected in the associated method blank.

TABLE 4-5: STREAM SEDIMENT ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		SS-1	SS-4	SS-5	SS-6	SS-7	SS-8	SS-9	SS-10
COLLECTION DATE		12/4/90	12/4/90	12/4/90	12/3/90	12/3/90	12/3/90	12/3/90	12/4/90
PARAMETER	TYPE								
alpha-BHC	PST								
beta-BHC	PST								
delta-BHC	PST								
gamma-BHC (Lindane)	PST								
Heptachlor	PST								
Aldrin	PST								
Heptachlor Epoxide	PST								
Endosulfan I	PST								
Dieldrin	PST								
4,4'-DDE	PST								
Endrin	PST								
Endosulfan II	PST								
4,4'-DDD	PST								
Endosulfan Sulfate	PST								
4,4'-DDT	PST								
Methoxychlor	PST								
Endrin Ketone	PST								
alpha-Chlordane	PST								
gamma-Chlordane	PST								
Toxaphene	PST								
Aroclor-1016	PCB								
Aroclor-1221	PCB								
Aroclor-1232	PCB								
Aroclor-1242	PCB								
Aroclor-1248	PCB								
Aroclor-1254	PCB								
Aroclor-1260	PCB								

All results reported in µg/kg (ppb).

Only detected results are reported.

TABLE 4-5: STREAM SEDIMENT ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		SS-1	SS-4	SS-5	SS-6	SS-7	SS-8	SS-9	SS-10
COLLECTION DATE		12/4/90	12/4/90	12/4/90	12/3/90	12/3/90	12/3/90	12/3/90	12/4/90
PARAMETER	TYPE								
Aluminum	MCP	13500	7330	15600	8780	11000	5740	8600	7660
Antimony	MCP								
Arsenic	MCP	5.7 N	6.2 N	9.6 N	5.6 N	4.0 N	2.6 BN	3.0 N	4.5 N
Barium	MCP	71.8	166	81.8	79.6	73.7	38.2 B	63.6	88.7
Beryllium	MCP	0.61 B	0.32 B	0.88 B	0.42 B	0.68 B	0.25 B	0.41 B	0.36 B
Cadmium	MCP								
Calcium	MCP	1620	1730	1560	1220 B	1340	765 B	932 B	1380 B
Chromium	MCP	17.8	11.4	21.6	15.5	16	8.6	12.0	12.9
Cobalt	MCP	7.9 B	9.4 B	14.2	9 B	9.4 B	5.0 B	8.6 B	8.5 B
Copper	MCP	19.6	129	21.4	26.4	20.1	9.8	13.6	18.3
Iron	MCP	22800	18100	33400	22300	20700	11000	18100	19600
Lead	MCP	19.9 NS*	20.6 NS*	19 NS*	21 NS*	13.5 N*	7.0 N*	6.8 N*	19 NS*
Magnesium	MCP	2730	2250	5590	2790	3130	1630	2490	2130
Manganese	MCP	452 N*	14100 N*	808 N*	869 N*	629 N*	277 N*	549 N*	1590 N*
Mercury	MCP								
Nickel	MCP	18.5	17.4	30.5	17.4	21.2	10.5	14.3	14.9
Potassium	MCP	1320	706 B	1680	722 B	965 B	667 B	796 B	744 B
Selenium	MCP								
Silver	MCP								
Sodium	MCP	243 B	206 B	222 B	263 B	192 B	142 B	204 B	269 B
Thallium	MCP								
Vanadium	MCP	22.8	9.4 B	18.3	11.2 B	12.7	7.4 B	11.1 B	12.1 B
Zinc	MCP	63.6	109	85.3	111	85.2	35.9	60.6	95.1
Cyanide	MCP	22.3 N				70.2 N		31.0 N	
Phenols (mg/L)	MCP	1.77	5	1.62	3.50	1.93			3.81
Ammonia, as N	MISC	25.2	54.7	4.70	31.7	152	18.7	53.2	180
Total Kjeldahl Nitrogen, as N	MISC	1080	1570	1130	798	1180	685	786	2250
Nitrate-Nitrogen	MISC	2			0.786				
TOC	MISC	10100	28100	3280	9390	16200	7530	7470	44000
pH Units	MISC	7.0	7.96	7.23	7.50	7.57	7.52	6.99	7.28
Moisture (%)	MISC	25.1	42.4	19.9	33	42.5	29.2	33.7	68.2

All results reported in mg/kg (ppm) unless otherwise noted.

Only detected results are reported.

B-Value is less than quantitation limit but greater than instrument detection limit.

N-Spike recovery not within QC limits.

S-Value determined by method of standard addition (MSA).

*-Duplicate analysis not within QC limits.

TABLE 4.5: STREAM SEDIMENT ANALYTICAL RESULTS
PHASE II

SAMPLE-ID		SS-8	SS-11	SS-12
COLLECTION DATE		6/28/91	6/28/91	6/28/91
PARAMETER	TYPE			
Chloromethane	VOC			
Bromomethane	VOC			
Vinyl Chloride	VOC			
Chloroethane	VOC			
Methylene Chloride	VOC			2 J
Acetone	VOC	R	R	R
Carbon Disulfide	VOC			
1,1-Dichloroethene	VOC			
1,1-Dichloroethane	VOC			
1,2-Dichloroethene (Total)	VOC			
Chloroform	VOC			
1,2-Dichloroethane	VOC			
2-Butanone	VOC			
1,1,1-Trichloroethane	VOC			
Carbon Tetrachloride	VOC			
Vinyl Acetate	VOC			
Bromodichloromethane	VOC			
1,2-Dichloropropane	VOC			
cis-1,3-Dichloropropene	VOC			
Trichloroethene	VOC			
Dibromochloromethane	VOC			
1,1,2-Trichloroethane	VOC			
Benzene	VOC			
trans-1,3-Dichloropropene	VOC			
Bromoform	VOC			
4-Methyl-2-Pentanone	VOC	12 B		
2-Hexanone	VOC			
Tetrachloroethene	VOC			
1,1,2,2-Tetrachloroethane	VOC			
Toluene	VOC	7		2 J
Chlorobenzene	VOC	1 J		
Ethylbenzene	VOC			
Styrene	VOC			
Total Xylenes	VOC	3 J		1 J

All results in μg/kg (ppb).
Only detected results are reported.

B – Analyte detected in associated method blank.
J – Indicates the result is less than sample quantitation limit but greater than zero.
R – Analyte rejected due to blank contamination.

TABLE 4-6: LEACHATE SEEP ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		LS-2	LS-2re	LS-3
COLLECTION DATE		12/4/90	12/4/90	12/4/90
PARAMETER	TYPE			
Chloromethane	VOC		NA	
Bromomethane	VOC		NA	
Vinyl Chloride	VOC		NA	
Chloroethane	VOC		NA	
Methylene Chloride	VOC	R	NA	2J
Acetone	VOC	R	NA	
Carbon Disulfide	VOC		NA	
1,1-Dichloroethene	VOC		NA	
1,1-Dichloroethane	VOC		NA	
1,2-Dichloroethene (Total)	VOC		NA	
Chloroform	VOC		NA	
1,2-Dichloroethane	VOC		NA	
2-Butanone	VOC		NA	
1,1,1-Trichloroethane	VOC		NA	
Carbon Tetrachloride	VOC		NA	
Vinyl Acetate	VOC		NA	
Bromodichloromethane	VOC		NA	
1,2-Dichloropropane	VOC		NA	
cis-1,3-Dichloropropene	VOC		NA	
Trichloroethene	VOC		NA	
Dibromochloromethane	VOC		NA	
1,1,2-Trichloroethane	VOC		NA	
Benzene	VOC		NA	
trans-1,3-Dichloropropene	VOC		NA	
Bromoform	VOC		NA	
4-Methyl-2-Pentanone	VOC		NA	
2-Hexanone	VOC		NA	
Tetrachloroethene	VOC		NA	
1,1,2,2-Tetrachloroethane	VOC		NA	
Toluene	VOC	2J	NA	2J
Chlorobenzene	VOC		NA	
Ethylbenzene	VOC		NA	
Styrene	VOC		NA	
Total Xylenes	VOC		NA	

All results reported in μg/l (ppb) unless otherwise stated.

Only detected results are reported.

J-Indicates the result is less than the sample quantitation limit but greater than zero.

RE-Sample Reanalyzed.

NA-Not Analyzed.

TABLE 4-6: LEACHATE SEEP ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		LS-2	LS-2re	LS-3
COLLECTION DATE		12/4/90	12/4/90	12/4/90
PARAMETER	TYPE			
Phenol	SEMI			
bis(2-Chloroethyl)ether	SEMI			
2-Chlorophenol	SEMI			
1,3-Dichlorobenzene	SEMI			
1,4-Dichlorobenzene	SEMI			
Benzyl Alcohol	SEMI			
1,2-Dichlorobenzene	SEMI			
2-Methylphenol	SEMI			
Bis(2-chloroisopropyl)ether	SEMI			
4-Methylphenol	SEMI			
n-Nitroso-di-n-propylamine	SEMI			
Hexachloroethane	SEMI			
Nitrobenzene	SEMI			
Isophorone	SEMI			
2-Nitrophenol	SEMI			
2,4-Dimethylphenol	SEMI			
Benzoic Acid	SEMI			
Bis(2-chloroethoxy)methane	SEMI			
2,4-Dichlorophenol	SEMI			
1,2,4-Trichlorobenzene	SEMI			
Naphthalene	SEMI			
4-Chloroaniline	SEMI			
Hexachlorobutadiene	SEMI			
4-Chloro-3-methylphenol	SEMI			
2-Methylnaphthalene	SEMI			
Hexachlorocyclopentadiene	SEMI			
2,4,6-Trichlorophenol	SEMI			
2,4,5-Trichlorophenol	SEMI			
2-Chloronaphthalene	SEMI			
2-Nitroaniline	SEMI			
Dimethylphthalate	SEMI			
Acenaphthylene	SEMI			
2,6-Dinitrotoluene	SEMI			
3-Nitroaniline	SEMI			
Acenaphthene	SEMI			
2,4-Dinitrophenol	SEMI			

All results reported in µg/l (ppb) unless otherwise stated.

Only detected results are reported.

re-Sample reanalyzed.

TABLE 4-6: LEACHATE SEEP ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		LS-2	LS-2re	LS-3
COLLECTION DATE		12/4/90	12/4/90	12/4/90
PARAMETER	TYPE			
4-Nitrophenol	SEMI			
Dibenzofuran	SEMI			
2,4-Dinitrotoluene	SEMI			
Diethylphthalate	SEMI			
4-Chlorophenyl-phenyl Ether	SEMI			
Fluorene	SEMI			
4-Nitroaniline	SEMI			
4,6-Dinitro-2-methylphenol	SEMI			
n-Nitrosodiphenylamine	SEMI			
4-Bromophenyl-phenyl Ether	SEMI			
Hexachlorobenzene	SEMI			
Pentachlorophenol	SEMI			
Phenanthrene	SEMI			
Anthracene	SEMI			
Di-n-butylphthalate	SEMI			
Fluoranthene	SEMI			
Pyrene	SEMI			
Butylbenzylphthalate	SEMI			
3,3'-Dichlorobenzidine	SEMI			
Benzo(a)anthracene	SEMI			
Chrysene	SEMI			
bis(2-Ethylhexyl)phthalate	SEMI	1J	R	6J
Di-n-octylphthalate	SEMI			
Benzo(b)fluoranthene	SEMI			
Benzo(k)fluoranthene	SEMI			
Benzo(a)pyrene	SEMI			
Indeno(1,2,3-cd)pyrene	SEMI			
Dibenz(a,h)anthracene	SEMI			
Benzo(g,h,i)perylene	SEMI			

All results reported in µg/l (ppb) unless otherwise stated.

Only detected results are reported.

J-Indicates the result is less than the sample quantitation limit but greater than zero.

R-Analyte rejected due to blank contamination.

re-Sample reanalyzed.

TABLE 4-6: LEACHATE SEEP ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		LS-2	LS-2re	LS-3
COLLECTION DATE		12/4/90	12/4/90	12/4/90
PARAMETER	TYPE			
alpha-BHC	PST		NA	
beta-BHC	PST		NA	
delta-BHC	PST		NA	
gamma-BHC (Lindane)	PST		NA	
Heptachlor	PST		NA	
Aldrin	PST		NA	
Heptachlor Epoxide	PST		NA	
Endosulfan I	PST		NA	
Dieldrin	PST		NA	
4,4'-DDE	PST		NA	
Endrin	PST		NA	
Endosulfan II	PST		NA	
4,4'-DDD	PST		NA	
Endosulfan Sulfate	PST		NA	
4,4'-DDT	PST		NA	
Methoxychlor	PST		NA	
Endrin Ketone	PST		NA	
alpha-Chlordane	PST		NA	
gamma-Chlordane	PST		NA	
Toxaphene	PST		NA	
Aroclor-1016	PCB		NA	
Aroclor-1221	PCB		NA	
Aroclor-1232	PCB		NA	
Aroclor-1242	PCB		NA	
Aroclor-1248	PCB		NA	
Aroclor-1254	PCB		NA	
Aroclor-1260	PCB		NA	

All results reported in µg/l (ppb) unless otherwise stated.

Only detected results are reported.

NA-Not Analyzed.

TABLE 4-6: LEACHATE SEEP ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		LS-2	LS-2re	LS-3
COLLECTION DATE		12/4/90	12/4/90	12/4/90
PARAMETER	TYPE			
Aluminum	MCP	127 B	NA	84.1 B
Antimony	MCP		NA	
Arsenic	MCP	3.2 B	NA	4.2 B
Barium	MCP	137B	NA	232
Beryllium	MCP		NA	
Cadmium	MCP		NA	
Calcium	MCP	37300	NA	39000
Chromium	MCP		NA	
Cobalt	MCP		NA	
Copper	MCP		NA	
Iron	MCP	3190	NA	2210 N
Lead	MCP	3.2 B	NA	
Magnesium	MCP	11800	NA	12400
Manganese	MCP	2300	NA	1820 N
Mercury	MCP		NA	
Nickel	MCP		NA	
Potassium	MCP	1580 B	NA	1930 B
Selenium	MCP		NA	
Silver	MCP		NA	
Sodium	MCP	36500	NA	40800
Thallium	MCP		NA	
Vanadium	MCP		NA	
Zinc	MCP		NA	11.4 B
Cyanide	MCP		NA	
Phenols (mg/l)	MCP		NA	

All results reported in µg/l (ppb) unless otherwise stated.

Only detected results are reported.

NA-Not Analyzed.

B-Value is less than quantitation limit but greater than instrument detection limit.

N-Spike recovery not within QC Limits.

re-Sample reanalyzed.

TABLE 4-6: LEACHATE SEEP ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		LS-2	LS-2re	LS-3
COLLECTION DATE		12/4/90	12/4/90	12/4/90
PARAMETER	TYPE			
Bicarbonate	MISC	87.7	NA	89.4
BOD	MISC	18.1	NA	4.53
COD	MISC	16.3	NA	
Chloride	MISC	105	NA	135
Hardness	MISC	153	NA	172
Ammonia, as N	MISC	0.12	NA	
Total Kjeldahl Nitrogen, as N	MISC	0.578	NA	0.68
Alkalinity	MISC	87.7	NA	89.4
Acidity	MISC	61.9	NA	50.6
Nitrate-Nitrogen	MISC		NA	
Phosphate	MISC		NA	
Oil and Grease	MISC	0.279	NA	
TOC	MISC	2.55	NA	1.37
TSS	MISC	80.1	NA	9.90
TDS	MISC	298	NA	336
Sulfate	MISC	30.2	NA	22.8
Sulfide	MISC	1.75	NA	1.30
pH (field)	MISC	6.27	NA	6.20
Dissolved Oxygen (field)	MISC	3.9	NA	3.3
Spec. Conductivity (umho/cm) (field)	MISC	560	NA	700
Temperature (Deg. C) (field)	MISC	10.6	NA	8.0

All results reported in mg/l (ppm) unless otherwise stated.

Only detected results are reported.

NA-Not Analyzed.

re-Sample reanalyzed.

TABLE 4-7: GROUNDWATER ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		ARAR	MW-1S	MW-2S	MW-2Sre	MW-3S	MW-4S	MW-4I	MW-4Ire	MW-5S	MW-5Sre	MW-5I	MW-5Ire	MW-5D	MW-5Dre	MW-6S
COLLECTION DATE		VALUE	12/7/90	12/5/90	12/5/90	12/5/90	12/4/90	12/4/90	12/4/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/7/90
PARAMETER	TYPE															
Chloromethane	VOC	5			NA				NA		NA		NA		NA	
Bromomethane	VOC	5			NA				NA		NA		NA		NA	
Vinyl Chloride	VOC	2			NA				NA		NA		NA		NA	
Chloroethane	VOC	5			NA				NA		NA		NA		NA	
Methylene Chloride	VOC	5	R		NA		R		NA	R	NA	R	NA	R	NA	R
Acetone	VOC	5	R		NA	R		R	NA		NA	R	NA	R	NA	
Carbon Disulfide	VOC	50			NA				NA		NA		NA		NA	
1,1-Dichloroethene	VOC	5			NA				NA		NA		NA		NA	
1,1-Dichloroethane	VOC	5			NA				NA		NA	0.9 J	NA		NA	
1,2-Dichloroethene (Total)	VOC	5			NA			22	NA	5	NA	64	NA	29	NA	6
Chloroform	VOC	7			NA				NA		NA		NA		NA	
1,2-Dichloroethane	VOC	5			NA				NA		NA		NA		NA	
2-Butanone	VOC	50			NA				NA		NA		NA		NA	
1,1,1-Trichloroethane	VOC	5			NA			1 J	NA		NA	6	NA	3 J	NA	1 J
Carbon Tetrachloride	VOC	5			NA				NA		NA		NA		NA	
Vinyl Acetate	VOC	5			NA				NA		NA		NA		NA	
Bromodichloromethane	VOC	50			NA				NA		NA		NA		NA	
1,2-Dichloropropane	VOC	5			NA				NA		NA		NA		NA	
cis-1,3-Dichloropropene	VOC	5			NA				NA		NA		NA		NA	
Trichloroethene	VOC	5			NA			29	NA	7	NA	110	NA	49	NA	9
Dibromochloromethane	VOC	50			NA				NA		NA		NA		NA	
1,1,2-Trichloroethane	VOC	5			NA				NA		NA		NA		NA	
Benzene	VOC	0.7			NA			2 J	NA		NA		NA		NA	
trans-1,3-Dichloropropene	VOC	5			NA				NA		NA		NA		NA	
Bromoform	VOC	50			NA				NA		NA		NA		NA	
4-Methyl-2-Pentanone	VOC	50			NA				NA		NA		NA		NA	
2-Hexanone	VOC	50			NA				NA		NA		NA		NA	
Tetrachloroethene	VOC	5			NA				NA		NA		NA		NA	
1,1,2,2-Tetrachloroethane	VOC	5			NA				NA		NA		NA		NA	
Toluene	VOC	5			NA		1 J	2 J	NA		NA		NA		NA	
Chlorobenzene	VOC	5			NA				NA		NA		NA		NA	
Ethylbenzene	VOC	5			NA				NA		NA		NA		NA	
Styrene	VOC	5			NA				NA		NA		NA		NA	
Total Xylenes	VOC	5			NA				NA		NA		NA	2 J	NA	

All results reported in µg/l (ppb).

Only detected results are reported.

J-Indicates the result is less than the sample quantitation limit but greater than zero.

R-Analyte rejected due to blank contamination.

NA - Not Analyzed

ND - Not Detectable

See Table 5-2 for explanations, qualifications to ARAR values

TABLE 4-7: GROUNDWATER ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		ARAR	MW-1S	MW-2S	MW-2Sre	MW-3S	MW-4S	MW-4I	MW-4Ire	MW-5S	MW-5Sre	MW-5I	MW-5Ire	MW-5D	MW-5Dre	MW-6S
COLLECTION DATE		VALUE	12/7/90	12/5/90	12/5/90	12/5/90	12/4/90	12/4/90	12/4/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/7/90
PARAMETER	TYPE															
Phenol	SEMI	1														
bis(2-Chloroethyl)ether	SEMI	1														
2-Chlorophenol	SEMI	1														
1,3-Dichlorobenzene	SEMI	5														
1,4-Dichlorobenzene	SEMI	4.7														
Benzyl Alcohol	SEMI	50														
1,2-Dichlorobenzene	SEMI	4.7														
2-Methylphenol	SEMI	1														
Bis(2-chloroisopropyl)ether	SEMI	5														
4-Methylphenol	SEMI	1														
n-Nitroso-di-n-propylamine	SEMI	50														
Hexachloroethane	SEMI	5														
Nitrobenzene	SEMI	5														
Isophorone	SEMI	50														
2-Nitrophenol	SEMI	1														
2,4-Dimethylphenol	SEMI	1														
Benzoic Acid	SEMI	50														
Bis(2-chloroethoxy)methane	SEMI	5														
2,4-Dichlorophenol	SEMI	1														
1,2,4-Trichlorobenzene	SEMI	5														
Naphthalene	SEMI	10														
4-Chloroaniline	SEMI	5														
Hexachlorobutadiene	SEMI	5														
4-Chloro-3-methylphenol	SEMI	1														
2-Methylnaphthalene	SEMI	5														
Hexachlorocyclopentadiene	SEMI	5														
2,4,6-Trichlorophenol	SEMI	1														
2,4,5-Trichlorophenol	SEMI	1														
2-Chloronaphthalene	SEMI	5														

All results reported in µg/l (ppb).

Only detected results are reported.

re - Sample reanalyzed

See Table 5-2 for explanations, qualifications to ARAR values

TABLE 4-7: GROUNDWATER ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		ARAR	MW-1S	MW-2S	MW-2Sre	MW-3S	MW-4S	MW-4I	MW-4Ire	MW-5S	MW-5Sre	MW-5I	MW-5Ire	MW-5D	MW-5Dre	MW-6S
COLLECTION DATE		VALUE	12/7/90	12/5/90	12/5/90	12/5/90	12/4/90	12/4/90	12/4/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/7/90
PARAMETER	TYPE															
2-Nitroaniline	SEMI	5														
Dimethylphthalate	SEMI	50														
Acenaphthylene	SEMI	50														
2,6-Dinitrotoluene	SEMI	5														
3-Nitroaniline	SEMI	5														
Acenaphthene	SEMI	20														
2,4-Dinitrophenol	SEMI	1														
4-Nitrophenol	SEMI	1														
Dibenzofuran	SEMI	50														
2,4-Dinitrotoluene	SEMI	5														
Diethylphthalate	SEMI	50														
4-Chlorophenyl-phenyl Ether	SEMI	5														
Fluorene	SEMI	50														
4-Nitroaniline	SEMI	5														
4,6-Dinitro-2-methylphenol	SEMI	1														
n-Nitrosodiphenylamine	SEMI	50														
4-Bromophenyl-phenyl Ether	SEMI	5														
Hexachlorobenzene	SEMI	0.35														
Pentachlorophenol	SEMI	1														
Phenanthrene	SEMI	50														
Anthracene	SEMI	50														
Di-n-butylphthalate	SEMI	50		28												
Fluoranthene	SEMI	50														
Pyrene	SEMI	50														
Butylbenzylphthalate	SEMI	50														
3,3'-Dichlorobenzidine	SEMI	5														
Benzo(a)anthracene	SEMI	0.002														
Chrysene	SEMI	0.002														
bis(2-Ethylhexyl)phthalate	SEMI	50	R	R	R	R	3 J	6 J	R	R	R	R	R		R	R

All results reported in µg/l (ppb).

Only detected results are reported.

J-Indicates the result is less than the sample quantitation limit but greater than zero.

R-Analyte rejected due to blank contamination

re - Sample reanalyzed

See Table 5-2 for explanations, qualifications to ARAR values

TABLE 4-7: GROUNDWATER ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		ARAR	MW-1S	MW-2S	MW-2Sre	MW-3S	MW-4S	MW-4I	MW-4Ire	MW-5S	MW-5Sre	MW-5I	MW-5Ire	MW-5D	MW-5Dre	MW-6S
COLLECTION DATE		VALUE	12/7/90	12/5/90	12/5/90	12/5/90	12/4/90	12/4/90	12/4/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/7/90
PARAMETER	TYPE															
Di-n-octylphthalate	SEMI	50														
Benzo(b)fluoranthene	SEMI	0.002														
Benzo(k)fluoranthene	SEMI	0.002														
Benzo(a)pyrene	SEMI	ND														
Indeno(1,2,3-cd)pyrene	SEMI	0.002														
Dibenz(a,h)anthracene	SEMI	50														
Benzo(g,h,i)perylene	SEMI	50														

See Table 5-2 for explanations, qualifications to ARAR values

re - Sample reanalyzed

All results reported in µg/l (ppb).

Only detected results are reported.

TABLE 4-7: GROUNDWATER ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		ARAR	MW-1S	MW-2S	MW-2Sre	MW-3S	MW-4S	MW-4I	MW-4Ire	MW-5S	MW-5Sre	MW-5I	MW-5Ire	MW-5D	MW-5Dre	MW-6S
COLLECTION DATE		VALUE	12/7/90	12/5/90	12/5/90	12/5/90	12/4/90	12/4/90	12/4/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/7/90
PARAMETER	TYPE															
alpha-BHC	PST	ND			NA				NA		NA		NA		NA	
beta-BHC	PST	ND			NA				NA		NA		NA		NA	
delta-BHC	PST	ND			NA				NA		NA		NA		NA	
gamma-BHC (Lindane)	PST	ND			NA				NA		NA		NA		NA	
Heptachlor	PST	ND			NA				NA		NA		NA		NA	
Aldrin	PST	ND			NA				NA		NA		NA		NA	
Heptachlor Epoxide	PST	ND			NA				NA		NA		NA		NA	
Endosulfan I	PST	5			NA				NA		NA		NA		NA	
Dieldrin	PST	ND			NA				NA		NA		NA		NA	
4,4'-DDE	PST	ND			NA				NA		NA		NA		NA	
Endrin	PST	ND			NA				NA		NA		NA		NA	
Endosulfan II	PST	5			NA				NA		NA		NA		NA	
4,4'-DDD	PST	ND			NA				NA		NA		NA		NA	
Endosulfan Sulfate	PST	5			NA				NA		NA		NA		NA	
4,4'-DDT	PST	ND			NA				NA		NA		NA		NA	
Methoxychlor	PST	35			NA				NA		NA		NA		NA	
Endrin Ketone	PST	5			NA				NA		NA		NA		NA	
alpha-Chlordane	PST	0.1			NA				NA		NA		NA		NA	
gamma-Chlordane	PST	0.1			NA				NA		NA		NA		NA	
Toxaphene	PST	ND			NA				NA		NA		NA		NA	
Aroclor-1016	PCB	0.1			NA				NA		NA		NA		NA	
Aroclor-1221	PCB	0.1			NA				NA		NA		NA		NA	
Aroclor-1232	PCB	0.1			NA				NA		NA		NA		NA	
Aroclor-1242	PCB	0.1			NA				NA		NA		NA		NA	
Aroclor-1248	PCB	0.1			NA				NA		NA		NA		NA	
Aroclor-1254	PCB	0.1			NA				NA		NA		NA		NA	
Aroclor-1260	PCB	0.1			NA				NA		NA		NA		NA	

All results reported in µg/l (ppb).

Only detected results are reported.

ND - Not Detectable

NA - Not Analyzed

re-Sample reanalyzed

See Table 5-2 for explanations, qualifications to ARAR values

TABLE 4-7: GROUNDWATER ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		ARAR	MW-1S	MW-2S	MW-2Sre	MW-3S	MW-4S	MW-4I	MW-4Ire	MW-5S	MW-5Sre	MW-5I	MW-5Ire	MW-5D	MW-5Dre	MW-6S
COLLECTION DATE		VALUE	12/7/90	12/5/90	12/5/90	12/5/90	12/4/90	12/4/90	12/4/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/7/90
PARAMETER	TYPE															
Aluminum	MCP		355	1330	NA	95.8 B	160 B	53.3 B	NA	52.3 B	NA		NA		NA	95.9 B
Antimony	MCP	3			NA				NA		NA		NA		NA	
Arsenic	MCP	25		1.9 B	NA				NA	11.6	NA	2.2 B	NA	5.8 B	NA	1.9 B
Barium	MCP	1000	23.3 B	45.4 B	NA	46B	66.4 B	39.9 B	NA	109 B	NA	104 B	NA	82.4 B	NA	63.4 B
Beryllium	MCP	3			NA				NA		NA		NA		NA	
Cadmium	MCP	10			NA				NA		NA		NA		NA	
Calcium	MCP		34700	32900	NA	43800	17500	135000	NA	28900	NA	142000	NA	174000	NA	65900
Chromium	MCP	50	6.7B*	5.3 B*	NA	12.9*			NA		NA		NA		NA	
Cobalt	MCP				NA		6.9 B	9.8 B	NA		NA		NA		NA	
Copper	MCP	200			NA				NA		NA		NA		NA	
Iron	MCP	300	557	1950	NA	173	129 N	863 N	NA	16200	NA	1100	NA	22000	NA	2180
Lead	MCP	25		4.3 BW	NA				NA		NA		NA		NA	
Magnesium	MCP	35000	4850B	10300	NA	9110	3380 B	30000	NA	5100	NA	20200	NA	44700	NA	9150
Manganese	MCP	300	317	798	NA	358	165 N	9130 N	NA	1800	NA	4340	NA	3950	NA	942
Mercury	MCP	2			NA				NA		NA		NA		NA	
Nickel	MCP		9.6B		NA	8.2 B	28.8 B	14.8 B	NA		NA		NA		NA	
Potassium	MCP		4820B	2460 B	NA	2590 B	638 B	6530	NA	1520 B	NA	40100	NA	4470 B	NA	2610 B
Selenium	MCP	10			NA				NA		NA		NA		NA	
Silver	MCP	50			NA				NA		NA		NA		NA	
Sodium	MCP	20000	13700	23400	NA	19400	9950	44700	NA	8460	NA	33700	NA	20200	NA	7840
Thallium	MCP	4			NA				NA		NA		NA		NA	
Vanadium	MCP				NA				NA		NA		NA		NA	
Zinc	MCP	300			NA		28.8	20.7	NA	14B	NA		NA	12.7 B	NA	
Cyanide	MCP	100			NA			20.4 N	NA		NA		NA		NA	
Phenols (mg/l)	MCP	.001			NA		.012	.009	NA		NA		NA		NA	

All results reported in µg/l (ppb) unless otherwise noted.

Only detected results are reported.

B-Value is less than quantitation limit but greater than instrument detection limit.

N-Spike recovery not within QC limits.

NA-Not Analyzed

*-Duplicate analysis not within QC limits.

W-Post digestion spike not within QC limits.

See Table 5-2 for explanations, qualifications to ARAR values

TABLE 4-7: GROUNDWATER ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		ARAR	MW-1S	MW-2S	MW-2Sre	MW-3S	MW-4S	MW-4I	MW-4Ire	MW-5S	MW-5Sre	MW-5I	MW-5Ire	MW-5D	MW-5Dre	MW-6S
COLLECTION DATE		VALUE	12/7/90	12/5/90	12/5/90	12/5/90	12/4/90	12/4/90	12/4/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/7/90
PARAMETER	TYPE															
Bicarbonate	MISC		119	102	NA	69.4	9	267	NA	304	NA	286	NA	285	NA	108
BOD	MISC		1	16.8	NA	20.4	9.87	8.13	NA	2	NA	3	NA	2	NA	1
COD	MISC			19.3	NA	10.3		49.2	NA	13.3	NA	22.3	NA	22.3	NA	
Chloride	MISC		8	67.8	NA	25.2	27.4	73	NA	52.5	NA	37.4	NA	37.9	NA	11
Hardness	MISC		100	143	NA	154	69.6	662	NA	551	NA	624	NA	650	NA	192
Ammonia, as N	MISC	2	.086		NA			0.042	NA	1.66	NA	0.42	NA	0.25	NA	0.262
Total Kjeldahl Nitrogen, as N	MISC		.921	0.533	NA	0.748	0.486	0.913	NA	2.17	NA	2.70	NA	2.21	NA	3.12
Alkalinity	MISC		131	102	NA	69.4	9	267	NA	304	NA	286	NA	285	NA	108
Acidity	MISC			86.9	NA	74.8	183	175	NA	142	NA	164	NA	61.7	NA	94.3
Nitrate-Nitrogen	MISC			0.745	NA	0.837	0.118		NA		NA		NA		NA	
Phosphate	MISC			0.15	NA				NA		NA		NA		NA	
Oil and Grease	MISC				NA				NA		NA		NA		NA	
TOC	MISC		.928	0.916	NA	1.58	0.939	11.1	NA	3.97	NA	4.72	NA	3.68	NA	2.65
TSS	MISC		6.10	112	NA		47.9	6.4	NA		NA	31	NA	55.6	NA	9.40
TDS	MISC		200	223	NA	261	156	1010	NA	835	NA	1036	NA	1037	NA	322
Sulfate	MISC	250	27.9	27.5	NA	111	64	421	NA	300	NA	451	NA	469	NA	131
Sulfide	MISC	.050			NA		1.3		NA		NA		NA		NA	1
pH (field)	MISC		9.45	6.40	NA	6.36	5.48	6.75	NA	6.33	NA	6.70	NA	6.62	NA	6.17
Conductivity (umho/cm)(field	MISC		300	300	NA	450	220	1340	NA	370	NA	1250	NA	1550	NA	480
Temperature (Deg. C) (field)	MISC		10.8	10.6	NA	13.1	6.1	6.9	NA	9.6	NA	8.9	NA	9.4	NA	8.5

All results reported in mg/l (ppm) unless otherwise noted.
Only detected results are reported.
GV-Guideline Value

NA-Not Analyzed
See Table 5-2 for explanations, qualifications to ARAR values

TABLE 4-7: GROUNDWATER ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		ARAR	MW-6I	MW-6Ire	MW-7S	MW-8S	MS-8Sre	MW-9S	MW-10S	W-10Sr	MW-31	MW-32	MW-33	MW-34	MW-35	MW-36	MW-36re	PW-1
COLLECTION DATE		VALUE	12/7/90	12/7/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/5/90	12/5/90	12/5/90	12/5/90	12/5/90	12/5/90	12/5/90	12/7/90
PARAMETER	TYPE																	
Chloromethane	VOC	5		NA			NA			NA							NA	
Bromomethane	VOC	5		NA			NA			NA							NA	
Vinyl Chloride	VOC	2		NA			NA			NA							NA	
Chloroethane	VOC	5		NA			NA			NA							NA	
Methylene Chloride	VOC	5		NA	R	R	NA	R	R	NA		R					NA	
Acetone	VOC	5	R	NA	R	R	NA	R	R	NA	R		R		R	R	NA	R
Carbon Disulfide	VOC	50		NA			NA			NA							NA	
1,1-Dichloroethene	VOC	5	3 J	NA		1 J	NA			NA							NA	
1,1-Dichloroethane	VOC	5	3 J	NA			NA			NA			0.8 J				NA	
1,2-Dichloroethene (Total)	VOC	5	78	NA	8	58	NA	14		NA	2 J	4 J	18		5	52	NA	3 J
Chloroform	VOC	7		NA			NA			NA							NA	
1,2-Dichloroethane	VOC	5		NA			NA			NA							NA	
2-Butanone	VOC	50		NA			NA			NA							NA	
1,1,1-Trichloroethane	VOC	5	31	NA			NA	2 J		NA			3 J			2 J	NA	
Carbon Tetrachloride	VOC	5		NA			NA			NA							NA	
Vinyl Acetate	VOC	5		NA			NA			NA							NA	
Bromodichloromethane	VOC	50		NA			NA			NA							NA	
1,2-Dichloropropane	VOC	5		NA			NA			NA							NA	
cis-1,3-Dichloropropene	VOC	5		NA			NA			NA							NA	
Trichloroethene	VOC	5	140	NA	2 J	130	NA	33		NA	2 J	5	21		8	85	NA	4 J
Dibromochloromethane	VOC	50		NA			NA			NA							NA	
1,1,2-Trichloroethane	VOC	5		NA			NA			NA							NA	
Benzene	VOC	0.7		NA			NA			NA							NA	
trans-1,3-Dichloropropene	VOC	5		NA			NA			NA							NA	
Bromoform	VOC	50		NA			NA			NA							NA	
4-Methyl-2-Pentanone	VOC	50		NA			NA			NA							NA	
2-Hexanone	VOC	50		NA			NA			NA							NA	
Tetrachloroethene	VOC	5	2 J	NA			NA			NA							NA	
1,1,2,2-Tetrachloroethane	VOC	5		NA			NA			NA							NA	
Toluene	VOC	5		NA			NA			NA	1 J					1 J	NA	
Chlorobenzene	VOC	5		NA			NA			NA							NA	
Ethylbenzene	VOC	5		NA			NA			NA							NA	
Styrene	VOC	5		NA			NA			NA							NA	
Total Xylenes	VOC	5		NA			NA			NA							NA	

All results reported in µg/l (ppb).

Only detected results are reported.

J-Indicates the result is less than the sample quantitation limit but greater than zero.

B-The compound is detected in the association method blank.

R-Analyte rejected due to blank contamination.

NA - Not Analyzed

ND - Not Detectable

* - Proposed standards

See Table 5-2 for explanations, qualifications to ARAR values

TABLE 4-7: GROUNDWATER ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		ARAR	MW-6I	MW-6Ire	MW-7S	MW-8S	MS-8Sre	MW-9S	MW-10S	W-10Sr	MW-31	MW-32	MW-33	MW-34	MW-35	MW-36	MW-36re	PW-1
COLLECTION DATE		VALUE	12/7/90	12/7/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/5/90	12/5/90	12/5/90	12/5/90	12/5/90	12/5/90	12/5/90	12/7/90
PARAMETER	TYPE																	
Phenol	SEMI	1														DR	DR	NA
bis(2-Chloroethyl)ether	SEMI	1														DR	DR	NA
2-Chlorophenol	SEMI	1														DR	DR	NA
1,3-Dichlorobenzene	SEMI	5														DR	DR	NA
1,4-Dichlorobenzene	SEMI	4.7														DR	DR	NA
Benzyl Alcohol	SEMI	50														DR	DR	NA
1,2-Dichlorobenzene	SEMI	4.7														DR	DR	NA
2-Methylphenol	SEMI	1														DR	DR	NA
Bis(2-chloroisopropyl)ether	SEMI	5														DR	DR	NA
4-Methylphenol	SEMI	1														DR	DR	NA
n-Nitroso-di-n-propylamine	SEMI	50														DR	DR	NA
Hexachloroethane	SEMI	5														DR	DR	NA
Nitrobenzene	SEMI	5														DR	DR	NA
Isophorone	SEMI	50														DR	DR	NA
2-Nitrophenol	SEMI	1														DR	DR	NA
2,4-Dimethylphenol	SEMI	1														DR	DR	NA
Benzoic Acid	SEMI	50														DR	DR	NA
Bis(2-chloroethoxy)methane	SEMI	5														DR	DR	NA
2,4-Dichlorophenol	SEMI	1														DR	DR	NA
1,2,4-Trichlorobenzene	SEMI	5														DR	DR	NA
Naphthalene	SEMI	10														DR	DR	NA
4-Chloroaniline	SEMI	5														DR	DR	NA
Hexachlorobutadiene	SEMI	5														DR	DR	NA
4-Chloro-3-methylphenol	SEMI	1														DR	DR	NA
2-Methylnaphthalene	SEMI	5														DR	DR	NA
Hexachlorocyclopentadiene	SEMI	5														DR	DR	NA
2,4,6-Trichlorophenol	SEMI	1														DR	DR	NA
2,4,5-Trichlorophenol	SEMI	1														DR	DR	NA
2-Chloronaphthalene	SEMI	5														DR	DR	NA

All results reported in µg/l (ppb).

Only detected results are reported.

See Table 5-2 for explanations, qualifications to ARAR values

re - Sample reanalyzed

NA-Not analyzed

DR-Data review indicates this data is non-compliant with ASP.

TABLE 4-7: GROUNDWATER ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		ARAR	MW-6I	MW-6Ire	MW-7S	MW-8S	MS-8Sre	MW-9S	MW-10S	W-10Sr	MW-31	MW-32	MW-33	MW-34	MW-35	MW-36	MW-36re	PW-1
COLLECTION DATE		VALUE	12/7/90	12/7/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/5/90	12/5/90	12/5/90	12/5/90	12/5/90	12/5/90	12/5/90	12/7/90
PARAMETER	TYPE																	
2-Nitroaniline	SEMI	5														DR	DR	NA
Dimethylphthalate	SEMI	50														DR	DR	NA
Acenaphthylene	SEMI	50														DR	DR	NA
2,6-Dinitrotoluene	SEMI	5														DR	DR	NA
3-Nitroaniline	SEMI	5														DR	DR	NA
Acenaphthene	SEMI	20														DR	DR	NA
2,4-Dinitrophenol	SEMI	1														DR	DR	NA
4-Nitrophenol	SEMI	1														DR	DR	NA
Dibenzofuran	SEMI	50														DR	DR	NA
2,4-Dinitrotoluene	SEMI	5														DR	DR	NA
Diethylphthalate	SEMI	50														DR	DR	NA
4-Chlorophenyl-phenyl Ether	SEMI	5														DR	DR	NA
Fluorene	SEMI	50														DR	DR	NA
4-Nitroaniline	SEMI	5														DR	DR	NA
4,6-Dinitro-2-methylphenol	SEMI	1														DR	DR	NA
n-Nitrosodiphenylamine	SEMI	50														DR	DR	NA
4-Bromophenyl-phenyl Ether	SEMI	5														DR	DR	NA
Hexachlorobenzene	SEMI	0.35														DR	DR	NA
Pentachlorophenol	SEMI	1														DR	DR	NA
Phenanthrene	SEMI	50														DR	DR	NA
Anthracene	SEMI	50														DR	DR	NA
Di-n-butylphthalate	SEMI	50									3 J					DR	DR	NA
Fluoranthene	SEMI	50														DR	DR	NA
Pyrene	SEMI	50														DR	DR	NA
Butylbenzylphthalate	SEMI	50														DR	DR	NA
3,3'-Dichlorobenzidine	SEMI	5														DR	DR	NA
Benzo(a)anthracene	SEMI	0.002														DR	DR	NA
Chrysene	SEMI	0.002														DR	DR	NA
bis(2-Ethylhexyl)phthalate	SEMI	50	R	R	R	R	R	R	R	R	R	R	R	R	R	DR	DR	NA

All results reported in µg/l (ppb).

Only detected results are reported.

J-Indicates the result is less than the sample quantitation limit but greater than zero.

R-Analyte rejected due to blank contamination

See Table 5-2 for explanations, qualifications to ARAR values

DR-Data review indicates this data is non compliant with ASP.

re - Sample reanalyzed

NA-Not analyzed

TABLE 4-7: GROUNDWATER ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		ARAR	MW-6I	MW-6Ire	MW-7S	MW-8S	MS-8Sre	MW-9S	MW-10S	W-10Sr	MW-31	MW-32	MW-33	MW-34	MW-35	MW-36	MW-36re	PW-1
COLLECTION DATE		VALUE	12/7/90	12/7/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/5/90	12/5/90	12/5/90	12/5/90	12/5/90	12/5/90	12/5/90	12/7/90
PARAMETER	TYPE																	
Di-n-octylphthalate	SEMI	50														DR	DR	NA
Benzo(b)fluoranthene	SEMI	0.002														DR	DR	NA
Benzo(k)fluoranthene	SEMI	0.002														DR	DR	NA
Benzo(a)pyrene	SEMI	ND														DR	DR	NA
Indeno(1,2,3-cd)pyrene	SEMI	0.002														DR	DR	NA
Dibenz(a,h)anthracene	SEMI	50														DR	DR	NA
Benzo(g,h,i)perylene	SEMI	50														DR	DR	NA

All results reported in µg/l (ppb).

Only detected results are reported.

ND-Not Detectable

See Table 5-2 for explanations, qualifications to ARAR values

re - Sample reanalyzed

DR-Data review indicates this data is non compliant with ASP.

NA-Not analyzed

TABLE 4-7: GROUNDWATER ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		ARAR	MW-6I	MW-6Ire	MW-7S	MW-8S	MS-8Sre	MW-9S	MW-10S	W-10Sr	MW-31	MW-32	MW-33	MW-34	MW-35	MW-36	MW-36re	PW-1
COLLECTION DATE		VALUE	12/7/90	12/7/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/5/90	12/5/90	12/5/90	12/5/90	12/5/90	12/5/90	12/5/90	12/7/90
PARAMETER	TYPE																	
alpha-BHC	PST	ND		NA			NA			NA							NA	NA
beta-BHC	PST	ND		NA			NA			NA							NA	NA
delta-BHC	PST	ND		NA			NA			NA							NA	NA
gamma-BHC (Lindane)	PST	ND		NA			NA			NA							NA	NA
Heptachlor	PST	ND		NA			NA			NA							NA	NA
Aldrin	PST	ND		NA			NA			NA							NA	NA
Heptachlor Epoxide	PST	ND		NA			NA			NA							NA	NA
Endosulfan I	PST	5		NA			NA			NA							NA	NA
Dieldrin	PST	ND		NA			NA			NA							NA	NA
4,4'-DDE	PST	ND		NA			NA			NA							NA	NA
Endrin	PST	ND		NA			NA			NA							NA	NA
Endosulfan II	PST	5		NA			NA			NA							NA	NA
4,4'-DDD	PST	ND		NA			NA			NA							NA	NA
Endosulfan Sulfate	PST	5		NA			NA			NA							NA	NA
4,4'-DDT	PST	ND		NA			NA			NA							NA	NA
Methoxychlor	PST	35		NA			NA			NA							NA	NA
Endrin Ketone	PST	5		NA			NA			NA							NA	NA
alpha-Chlordane	PST	0.1		NA			NA			NA							NA	NA
gamma-Chlordane	PST	0.1		NA			NA			NA							NA	NA
Toxaphene	PST	ND		NA			NA			NA							NA	NA
Aroclor-1016	PCB	0.1		NA			NA			NA							NA	NA
Aroclor-1221	PCB	0.1		NA			NA			NA							NA	NA
Aroclor-1232	PCB	0.1		NA			NA			NA							NA	NA
Aroclor-1242	PCB	0.1		NA			NA			NA							NA	NA
Aroclor-1248	PCB	0.1		NA			NA			NA							NA	NA
Aroclor-1254	PCB	0.1		NA			NA			NA							NA	NA
Aroclor-1260	PCB	0.1		NA			NA			NA							NA	NA

All results reported in µg/L (ppb).

Only detected results are reported.

NA - Not Analyzed

ND - Not Detectable

See Table 5-2 for explanations, qualifications to ARAR values

TABLE 4-7: GROUNDWATER ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		ARAR	MW-6I	MW-6Ire	MW-7S	MW-8S	MS-8Sre	MW-9S	MW-10S	W-10Sr	MW-31	MW-32	MW-33	MW-34	MW-35	MW-36	MW-36re	PW-1
COLLECTION DATE		VALUE	12/7/90	12/7/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/5/90	12/5/90	12/5/90	12/5/90	12/5/90	12/5/90	12/5/90	12/7/90
PARAMETER	TYPE																	
Aluminum	MCP			NA	78B	45.8 B	NA	278	573	NA	102 B	851	184 B	103 B	232		NA	NA
Antimony	MCP	3		NA			NA			NA							NA	NA
Arsenic	MCP	25		NA	1.2 B	2.2 B	NA	2.3 B	2.1 B	NA		1.1 B				2B	NA	NA
Barium	MCP	1000	131 B	NA	80.9 B	91.9 B	NA	66.3 B	127 B	NA	22.1 B	26.8 B	34.9 B	16.9 B	52.4 B	94.3 B	NA	NA
Beryllium	MCP	3		NA			NA			NA							NA	NA
Cadmium	MCP	10		NA			NA			NA							NA	NA
Calcium	MCP		104000	NA	175000	226000	NA	148000	374000	NA	18200	18700	52600	13500	39400	65900	NA	NA
Chromium	MCP	50		NA		68.8*	NA	34.9*	65.0*	NA					5.2 B*	6.3 B*	NA	NA
Cobalt	MCP			NA			NA			NA					4.4 B		NA	NA
Copper	MCP	200		NA		9B	NA		12.2 B	NA							NA	NA
Iron	MCP	300	1720	NA	1340	5940	NA	4410	1560	NA	1180	1240	321	315	1440	323	NA	NA
Lead	MCP	25		NA	28.4 S	1.6 B	NA	9.3 BS	6.4 BS	NA		1.5 BW					NA	NA
Magnesium	MCP	35000	20400	NA	24000	45800	NA	24800	132000	NA	2930 B	3210 B	13300	2640 B	5700	2180 B	NA	NA
Manganese	MCP	300	4570	NA	1970	8840	NA	3400	2410	NA	249	204	647	50.2	619	651	NA	NA
Mercury	MCP	2		NA			NA			NA							NA	NA
Nickel	MCP		8.1 B	NA		27.8 B	NA	22.8 B	37.8 B	NA					8.6 B		NA	NA
Potassium	MCP		3940 B	NA	6510	9080	NA	7040	21000	NA	3330 B	2160 B	1750 B	2890 B	2480 B	107000	NA	NA
Selenium	MCP	10		NA			NA			NA							NA	NA
Silver	MCP	50		NA			NA			NA							NA	NA
Sodium	MCP	20000	29300	NA	29700	51300	NA	21000	88500	NA	5670	4100 B	18200	8260	12500	71800	NA	NA
Thallium	MCP	4		NA			NA			NA							NA	NA
Vanadium	MCP			NA			NA			NA							NA	NA
Zinc	MCP	300		NA	78.9	12.6 B	NA	16.8 B	35.5	NA					13.9 B		NA	NA
Cyanide	MCP	100		NA			NA		28.9	NA			14				NA	NA
Phenols (mg/l)	MCP	.001		NA			NA			NA							NA	NA

All results reported in µg/l (ppb) unless otherwise noted.

Only detected results are reported.

B-Value is less than quantitation limit but greater than instrument detection limit

N-Spike recovery not within QC limits.

NA-Not Analyzed

*-Duplicate analysis not within QC limits.

S-Value determined by method of standard addition.

See Table 5-2 for explanations, qualifications to ARAR values

TABLE 4-7: GROUNDWATER ANALYTICAL RESULTS

PHASE I

SAMPLE-ID		ARAR	MW-6I	MW-6Ire	MW-7S	MW-8S	MS-8Sre	MW-9S	MW-10S	W-10Sr	MW-31	MW-32	MW-33	MW-34	MW-35	MW-36	MW-36re	PW-1
COLLECTION DATE		VALUE	12/7/90	12/7/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/6/90	12/5/90	12/5/90	12/5/90	12/5/90	12/5/90	12/5/90	12/5/90	12/7/90
PARAMETER	TYPE																	
Bicarbonate	MISC		197	NA	408	467	NA	323	637	NA	167	206	74.7	63.4	48.3	288	NA	NA
BOD	MISC		1	NA	3	7	NA	4	3	NA	21.3	7.20	18.3	10.5	16.8	16.8	NA	NA
COD	MISC		16.3	NA	52.2	43.2	NA	46.2	64.2	NA	16.3	16.3			16.3	31.2	NA	NA
Chloride	MISC		40.7	NA	50.6	73.1	NA	35	55.7	NA	47.8	65.6	44.7	50.9	25.2	113	NA	NA
Hardness	MISC		350	NA	619	840	NA	459	1640	NA	352	487	191	103	114	718	NA	NA
Ammonia, as N	MISC	2	0.244	NA	0.10	0.42	NA	0.26	0.08	NA	0.09	0.14	0.060		0.06	0.15	NA	NA
Total Kjeldahl Nitrogen, as N	MISC		2.60	NA	0.983	2.0	NA	2.42	1.82	NA	0.551	0.776	0.799	0.393	0.905	0.824	NA	NA
Alkalinity	MISC		197	NA	408	467	NA	323	638	NA	167	206	74.7	63.4	48.3	288	NA	NA
Acidity	MISC		113	NA	143	202	NA	147	481	NA	34.4	196	47.2	26.9	68.3	190	NA	NA
Nitrate-Nitrogen	MISC			NA			NA		3.05	NA			0.131	0.580			NA	NA
Phosphate	MISC			NA	0.74		NA		0.24	NA					0.59		NA	NA
Oil and Grease	MISC			NA	1.70		NA	1.70		NA		1.60	0.840				NA	NA
TOC	MISC		3.90	NA	8.41	7.43	NA	5.92	17	NA	3.21	4.1	4.29	1.4	1.56	5.66	NA	NA
TSS	MISC		3.60	NA	270	30.3	NA	111	164	NA	7.30	14.5	15.5		417	47.4	NA	NA
TDS	MISC		592	NA	863	1255	NA	736	2580	NA	547	763	312	209	218	1050	NA	NA
Sulfate	MISC	250	207	NA	250	196	NA	242	1170	NA	221	340	112	27.6	76.6	430	NA	NA
Sulfide	MISC	.050		NA			NA			NA							NA	NA
pH (field)	MISC		6.44	NA	6.87	6.66	NA	6.85	7.07	NA	7.27	7.06	6.59	7.00	6.32	11.95	NA	NA
Conductivity (umho/cm)(field	MISC		670	NA	1180	1950	NA	1200	2600	NA	380	110	500	110	340	1375	NA	NA
Temperature (Deg. C) (field)	MISC		8.2	NA	13.4	12.3	NA	10.6	16.4	NA	6.2	6.8	6.5	5.8	7.8	9.8	NA	NA

All results reported in mg/l (ppm) unless otherwise noted.
Only detected results are reported.
GV-Guideline Value

NA-Not Analyzed
See Table 5-2 for explanations, qualifications to ARAR values

TABLE 4.7: GROUNDWATER ANALYTICAL RESULTS
PHASE II

SAMPLE-ID		MW-1S	MW-2S	MW-3S	MW-4S	MW-4I	MW-5S	MW-5I	MW-5D	MW-6S	MW-6I
COLLECTION DATE		6/28/91	6/27/91	6/26/91	6/27/91	6/27/91	6/27/91	6/27/91	6/27/91	6/27/91	6/27/91
PARAMETER	TYPE										
Chloromethane	VOC										
Bromomethane	VOC										
Vinyl Chloride	VOC										
Chloroethane	VOC										
Methylene Chloride	VOC										
Acetone	VOC	44					R	R	R	R	R
Carbon Disulfide	VOC										
1,1-Dichloroethene	VOC										4 J
1,1-Dichloroethane	VOC									2 J	6 J
1,2-Dichloroethene (Total)	VOC		3 J			66	7	49	10	31	260
Chloroform	VOC										
1,2-Dichloroethane	VOC										
2-Butanone	VOC										
1,1,1-Trichloroethane	VOC							5		13	57
Carbon Tetrachloride	VOC										
Vinyl Acetate	VOC										
Bromodichloromethane	VOC										
1,2-Dichloropropane	VOC										
cis-1,3-Dichloropropene	VOC										
Trichloroethene	VOC					150	9	95	23	57	78
Dibromochloromethane	VOC										
1,1,2-Trichloroethane	VOC										
Benzene	VOC										4 J
trans-1,3-Dichloropropene	VOC										
Bromoform	VOC										
4-Methyl-2-Pentanone	VOC										
2-Hexanone	VOC										
Tetrachloroethene	VOC										
1,1,2,2-Tetrachloroethane	VOC										
Toluene	VOC		1 J								2 J
Chlorobenzene	VOC										
Ethylbenzene	VOC										
Styrene	VOC										
Total Xylenes	VOC										
Total Phenols (mg/l)	MCP	NA	NA	NA			NA	NA	NA	NA	NA

All results in μg/l (ppb),
unless otherwise noted.
Only detected results are reported.
NA - Not Analyzed

J - Indicates the result is less than sample quantitation limit
but greater than zero.
R - Analyte rejected due to blank contamination.

TABLE 4.7: GROUNDWATER ANALYTICAL RESULTS
PHASE II

SAMPLE-ID		MW-6D	MW-7S	MW-8S	MW-9S	MW-10S	MW-11S	MW-11I	MW-12S	MW-12D
COLLECTION DATE		6/27/91	6/26/91	6/28/91	6/28/91	6/28/91	6/28/91	6/28/91	7/11/91	7/11/91
PARAMETER	TYPE									
Chloromethane	VOC									
Bromomethane	VOC									
Vinyl Chloride	VOC	7 J								
Chloroethane	VOC									
Methylene Chloride	VOC									
Acetone	VOC	R								
Carbon Disulfide	VOC									
1,1-Dichloroethene	VOC									
1,1-Dichloroethane	VOC									
1,2-Dichloroethene (Total)	VOC	1 J		70	110					
Chloroform	VOC									
1,2-Dichloroethane	VOC									
2-Butanone	VOC									
1,1,1-Trichloroethane	VOC	33								
Carbon Tetrachloride	VOC									
Vinyl Acetate	VOC									
Bromodichloromethane	VOC									
1,2-Dichloropropane	VOC									
cis-1,3-Dichloropropene	VOC									
Trichloroethene	VOC			130	230					
Dibromochloromethane	VOC									
1,1,2-Trichloroethane	VOC									
Benzene	VOC	0.8 J								
trans-1,3-Dichloropropene	VOC									
Bromoform	VOC									
4-Methyl-2-Pentanone	VOC									
2-Hexanone	VOC									
Tetrachloroethene	VOC									
1,1,2,2-Tetrachloroethane	VOC									
Toluene	VOC									
Chlorobenzene	VOC									
Ethylbenzene	VOC									
Styrene	VOC									
Total Xylenes	VOC									
Total Phenols (mg/l)	MCP	NA	NA	NA	NA	NA	NA	NA	NA	NA

All results in µg/l (ppb),
unless otherwise noted.
Only detected results are reported.
NA - Not Analyzed

J - Indicates the result is less than sample quantitation limit
but greater than zero.
R - Analyte rejected due to blank contamination.

TABLE 4.7: GROUNDWATER ANALYTICAL RESULTS
PHASE II

SAMPLE-ID		MW-14I	MW-14D	MW-31	MW-32	MW-33	MW-34	MW-35	MW-36	PW-1A	TP3-1
COLLECTION DATE		6/28/91	6/28/91	6/26/91	6/26/91	6/26/91	6/26/91	6/27/91	6/27/91	6/27/91	6/10/91
PARAMETER	TYPE										
Chloromethane	VOC										
Bromomethane	VOC										
Vinyl Chloride	VOC								6 J		
Chloroethane	VOC										
Methylene Chloride	VOC										
Acetone	VOC		97						R	R	R
Carbon Disulfide	VOC										
1,1-Dichloroethene	VOC										
1,1-Dichloroethane	VOC										
1,2-Dichloroethene (Total)	VOC				14	5		9	130	3 J	
Chloroform	VOC										
1,2-Dichloroethane	VOC										
2-Butanone	VOC										
1,1,1-Trichloroethane	VOC										
Carbon Tetrachloride	VOC										
Vinyl Acetate	VOC										
Bromodichloromethane	VOC										
1,2-Dichloropropane	VOC										
cis-1,3-Dichloropropene	VOC										
Trichloroethene	VOC				24			14	310	4 J	
Dibromochloromethane	VOC									3 J	
1,1,2-Trichloroethane	VOC										
Benzene	VOC		2 J								
trans-1,3-Dichloropropene	VOC										
Bromoform	VOC									2 J	
4-Methyl-2-Pentanone	VOC										
2-Hexanone	VOC										
Tetrachloroethene	VOC										
1,1,2,2-Tetrachloroethane	VOC										
Toluene	VOC										
Chlorobenzene	VOC										
Ethylbenzene	VOC										
Styrene	VOC										
Total Xylenes	VOC										
Total Phenols (mg/l)	MCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

All results in µg/l (ppb), unless otherwise noted.
Only detected results are reported.
NA - Not Analyzed

J - Indicates the result is less than sample quantitation limit but greater than zero.
R - Analyte rejected due to blank contamination.

TABLE 4.8: GROUNDWATER ANALYTICAL RESULTS COMPARISON
PHASE I AND II

SAMPLE-ID		MW-1S		MW-2S		MW-3S		MW-4S		MW-4I		MW-5S		MW-5I	
COLLECTION DATE		12/7/90	6/28/91	12/5/90	6/27/91	12/5/90	6/26/91	12/4/90	6/27/91	12/4/90	6/27/91	12/6/90	6/27/91	12/6/90	6/27/91
PARAMETER	TYPE														
Chloromethane	VOC														
Bromomethane	VOC														
Vinyl Chloride	VOC														
Chloroethane	VOC														
Methylene Chloride	VOC	R						R							
Acetone	VOC	R	44			R				R		R	R	R	R
Carbon Disulfide	VOC													R	
1,1-Dichloroethene	VOC														
1,1-Dichloroethane	VOC													0.9 J	
1,2-Dichloroethene (Total)	VOC				3 J					22	66	5	7	64	49
Chloroform	VOC														
1,2-Dichloroethane	VOC														
2-Butanone	VOC														
1,1,1-Trichloroethane	VOC									1 J				6	5
Carbon Tetrachloride	VOC														
Vinyl Acetate	VOC														
Bromodichloromethane	VOC														
1,2-Dichloropropane	VOC														
cis-1,3-Dichloropropene	VOC														
Trichloroethene	VOC									29	150	7	9	110	95
Dibromochloromethane	VOC														
1,1,2-Trichloroethane	VOC														
Benzene	VOC									2 J					
trans-1,3-Dichloropropene	VOC														
Bromoform	VOC														
4-Methyl-2-Pentanone	VOC														
2-Hexanone	VOC														
Tetrachloroethene	VOC														
1,1,2,2-Tetrachloroethane	VOC														
Toluene	VOC				1 J					2 J					
Chlorobenzene	VOC														
Ethylbenzene	VOC														
Styrene	VOC														
Total Xylenes	VOC														
Total Phenols (mg/l)	MCP		NA		NA		NA	0.012		0.009			NA		NA

All results in µg/l (ppb),
unless otherwise noted.
Only detected results are reported.
R - Analyte rejected due to
blank contamination.
NA - Not Analyzed

J - Indicates the result is less than sample quantitation limit
but greater than zero.

TABLE 4.8: GROUNDWATER ANALYTICAL RESULTS COMPARISON
PHASE I AND II

SAMPLE-ID		MW-5D		MW-6S		MW-6I		MW-6D		MW-7S		MW-8S		MW-9S	
COLLECTION DATE		12/6/90	6/27/91	12/7/90	6/27/91	12/7/90	6/27/91	*	6/27/91	12/6/90	6/26/91	12/6/90	6/28/91	12/6/90	6/28/91
PARAMETER	TYPE														
Chloromethane	VOC														
Bromomethane	VOC														
Vinyl Chloride	VOC								7 J	R		R		R	
Chloroethane	VOC									R		R		R	
Methylene Chloride	VOC														
Acetone	VOC	R	R	R	R	R	R		R						
Carbon Disulfide	VOC	R													
1,1-Dichloroethene	VOC					3 J	4 J					1 J			
1,1-Dichloroethane	VOC				2 J	3 J	6 J								
1,2-Dichloroethene (Total)	VOC	29	10	6	31	78	260		1 J	8		58	70	14	110
Chloroform	VOC														
1,2-Dichloroethane	VOC														
2-Butanone	VOC														
1,1,1-Trichloroethane	VOC	3 J		1 J	13	31	57		33					2 J	
Carbon Tetrachloride	VOC														
Vinyl Acetate	VOC														
Bromodichloromethane	VOC														
1,2-Dichloropropane	VOC														
cis-1,3-Dichloropropene	VOC														
Trichloroethene	VOC	49	23	9	57	140	78			2 J		130	130	33	230
Dibromochloromethane	VOC														
1,1,2-Trichloroethane	VOC														
Benzene	VOC						4 J		0.8 J						
trans-1,3-Dichloropropene	VOC														
Bromoform	VOC														
4-Methyl-2-Pentanone	VOC														
2-Hexanone	VOC														
Tetrachloroethene	VOC					2 J									
1,1,2,2-Tetrachloroethane	VOC														
Toluene	VOC						2 J								
Chlorobenzene	VOC														
Ethylbenzene	VOC														
Styrene	VOC														
Total Xylenes	VOC	2 J													
Total Phenols (mg/l)	MCP		NA		NA		NA		NA		NA		NA		NA

All results in µg/l (ppb), unless otherwise noted.
Only detected results are reported.
R - Analyte rejected due to blank contamination.
NA - Not Analyzed

J - Indicates the result is less than sample quantitation limit but greater than zero.

* - Well not installed until Phase II.

TABLE 4.8: GROUNDWATER ANALYTICAL RESULTS COMPARISON PHASE I AND II

SAMPLE-ID		MW-10S		MW-11S		MW-11I		MW-12S		MW-12D		MW-14D		MW-14I	
COLLECTION DATE		12/6/90	6/28/91	*	6/28/91	*	6/28/91	*	7/11/91	*	7/11/91	*	6/28/91	*	6/28/91
PARAMETER	TYPE														
Chloromethane	VOC														
Bromomethane	VOC														
Vinyl Chloride	VOC	R													
Chloroethane	VOC	R													
Methylene Chloride	VOC														
Acetone	VOC												97		
Carbon Disulfide	VOC														
1,1-Dichloroethene	VOC														
1,1-Dichloroethane	VOC														
1,2-Dichloroethene (Total)	VOC														
Chloroform	VOC														
1,2-Dichloroethane	VOC														
2-Butanone	VOC														
1,1,1-Trichloroethane	VOC														
Carbon Tetrachloride	VOC														
Vinyl Acetate	VOC														
Bromodichloromethane	VOC														
1,2-Dichloropropane	VOC														
cis-1,3-Dichloropropene	VOC														
Trichloroethene	VOC														
Dibromochloromethane	VOC														
1,1,2-Trichloroethane	VOC														
Benzene	VOC												2 J		
trans-1,3-Dichloropropene	VOC														
Bromoform	VOC														
4-Methyl-2-Pentanone	VOC														
2-Hexanone	VOC														
Tetrachloroethene	VOC														
1,1,2,2-Tetrachloroethane	VOC														
Toluene	VOC														
Chlorobenzene	VOC														
Ethylbenzene	VOC														
Styrene	VOC														
Total Xylenes	VOC														
Total Phenols (mg/l)	MCP		NA		NA		NA		NA		NA		NA		NA

All results in µg/l (ppb), unless otherwise noted.
Only detected results are reported.
R - Analyte rejected due to blank contamination.
NA - Not Analyzed

J - Indicates the result is less than sample quantitation limit but greater than zero.

* - Well not installed until Phase II.

TABLE 4.8: GROUNDWATER ANALYTICAL RESULTS COMPARISON
PHASE I AND II

SAMPLE-ID		MW-31		MW-32		MW-33		MW-34		MW-35		MW-36		PW-1A		TP3-1
COLLECTION DATE		12/5/90	6/26/91	12/5/90	6/26/91	12/5/90	6/26/91	12/5/90	6/26/91	12/5/90	6/27/91	12/5/90	6/27/91	12/7/90	6/27/91	6/10/91
PARAMETER	TYPE															
Chloromethane	VOC															
Bromomethane	VOC															
Vinyl Chloride	VOC												6 J			
Chloroethane	VOC															
Methylene Chloride	VOC			R												
Acetone	VOC	R				R				R		R	R	R	R	R
Carbon Disulfide	VOC															
1,1-Dichloroethene	VOC															
1,1-Dichloroethane	VOC					0.8 J										
1,2-Dichloroethene (Total)	VOC	2 J		4 J	14	18	5			5	9	52	130	3 J	3 J	
Chloroform	VOC															
1,2-Dichloroethane	VOC															
2-Butanone	VOC															
1,1,1-Trichloroethane	VOC					3 J						2 J				
Carbon Tetrachloride	VOC															
Vinyl Acetate	VOC															
Bromodichloromethane	VOC															
1,2-Dichloropropane	VOC															
cis-1,3-Dichloropropene	VOC															
Trichloroethene	VOC	2 J		5	24	21				8	14	85	310	4 J	4 J	
Dibromochloromethane	VOC														3 J	
1,1,2-Trichloroethane	VOC															
Benzene	VOC															
trans-1,3-Dichloropropene	VOC															
Bromoform	VOC														2 J	
4-Methyl-2-Pentanone	VOC															
2-Hexanone	VOC															
Tetrachloroethene	VOC															
1,1,2,2-Tetrachloroethane	VOC															
Toluene	VOC	1 J										1 J				
Chlorobenzene	VOC															
Ethylbenzene	VOC															
Styrene	VOC															
Total Xylenes	VOC															
Total Phenols (mg/l)	MCP		NA		NA		NA		NA		NA		NA	NA	NA	NA

All results in µg/l (ppb), unless otherwise noted.
Only detected results are reported.
R - Analyte rejected due to blank contamination.
NA - Not Analyzed

J - Indicates the result is less than sample quantitation limit but greater than zero.

5. NEW YORK STATE STANDARDS, CRITERIA AND GUIDANCE VALUES

New York State Standards, Criteria, and Guidance Values (SCGs) for the Gorick site are identified in Table 5-1. Based upon the SCGs identified in this table, chemical-specific SCGs are developed in Table 5-2 (for groundwater, surface water and soil/waste), Table 5-3 (calculated values for surface water), and Table 5-4 (calculated values for stream sediments). The SCGs for each medium sampled in the first and second phases of the RI are discussed in the following sections. All tables for this section are presented at the end of the section.

5.1 Groundwater SCGs

New York State lists standards for groundwater within the NYSDEC Division of Water Technical and Operational Guidance Series (TOGS) (1.1.1) Ambient Water Quality Standards and Guidance Values (September, 1990). This document includes New York State Department of Health Standards for Primary and Unspecified Organic Contaminants. Revised groundwater regulations for New York State are included in 6NYCRR, Parts 700-705, effective September 1, 1991. Federal SCGs for the site include the Safe Drinking Water Act and the Clean Water Act.

The chemical-specific SCGs developed for groundwater are presented in Table 5-2. Table 5-5 presents a summary of the exceedances from the first and second rounds of sampling. Four classes of compounds exceeded the SCGs in one or more of the first-round samples: VOCs, primarily chlorinated solvents; metals; total phenols; and sulfate and sulfides. The second-phase groundwater samples were analyzed for volatiles (all samples) and total phenols (only MW-4S and MW-4I). Second-phase groundwater samples exceeded SCGs for 7 of the VOC compounds.

During the first phase, both TCE and 1,2-DCE concentrations exceeded

SCGs in 12 of the 21 wells sampled, 1,1,1-trichloroethane exceeded SCGs in two wells (MW-5I and MW-6I), and benzene in one well (MW-4I). All first-phase exceedances occurred on site or downgradient of the fill. Sample PW-1 of the Town's raw drinking water did not exceed any VOC SCGs.

SCGs were exceeded for both TCE and 1,2-DCE in 11 of the 28 second-phase wells sampled. SCGs were exceeded in 10 of these wells for both TCE and 1,2-DCE in both rounds of sampling (MW-4I, MW-5S, MW-5I, MW-5D, MW-6S, MW-6I, MW-8S, MW-9S, MW-35 and MW-36). SCGs were exceeded for 1,1,1-trichloroethane in 3 wells (MW-6S, MW-6I, and MW-6D); for benzene in 3 wells (MW-6I, MW-6D and MW-14D); for vinyl chloride in 2 wells (MW-6D and MW-36); for 1,1-dichloroethane in one well (MW-6I); and for acetone in one well (MW-14D). Most of these latter exceedances were not as consistent (in both rounds) as for TCE and 1,2-DCE. Sample PW-1A of the water from Kirkwood's Town Well No. 3 did not have any SCG exceedances.

5.2 Soil/Fill SCGs

No New York State SCGs exist for soil or fill. The State utilizes existing Federal regulations including the Toxic Substances Control Act (TSCA) regulations for PCBs, and RCRA hazardous waste characterizations. No PCBs were found at the site, and none of the samples analyzed as waste could be classified as hazardous.

5.3 Surface Water SCGs

New York State establishes SCGs for surface waters according to stream classifications. The Susquehanna River in the vicinity of the site is a Class A stream, which is suitable, with treatment, for drinking, culinary or food processing purposes, and any other usages.

Class A SCGs include the NYSDEC TOGS (1.1.1) cited above, and the

revised surface water regulations contained in 6NYCRR, Parts 700-705, effective September 1, 1991, as well as the Federal Clean Water Act and Safe Drinking Water Act. Chemical-specific values derived from these documents for Class A waters are presented in Tables 5-2 and 5-3 for both human health and aquatic life concerns. Table 5-6 shows first-round results for surface water. Note that the only two exceedances of SCGs in both upstream and downstream Susquehanna samples were: bis(2-ethylhexyl)phthalate, and butylbenzyl-phthalate. Both compounds were detected at similar levels in both the upstream and downstream samples. The only other exceedances were: sulfide, an indicator of anaerobic organic decomposition in the downstream sample SW-9; and total cyanide in the upstream location SW-8.

In the three second-phase Class A surface water (Susquehanna River) samples, which were analyzed for volatiles only, no compounds were detected, and therefore no SCG exceedances occurred.

The drainage stream is considered to be a Class D water body, whose best usage is for fishing and recreation. Fish are expected to survive in such a water, but not to propagate. SCGs developed for this stream are from the NYSDEC TOGS (1.1.1) and the revised surface water regulations exclusively. Clean Water Act guidelines will not be applied here because at low flow conditions at least half of the flow of this stream is supplied by non-contact cooling water being discharged by the AP&P plant. In the first-phase drainage stream samples, SCG exceedances occurred for iron and/or manganese at all locations. Total phenols exceeded SCGs adjacent to and downstream of the site. Zinc was found to be in excess of SCGs at one sampling location on the drainage stream upstream of the site. No samples of Class D surface water were taken in the second phase of the RI.

5.4 Sediment SCGs

Sediment cleanup criteria have been developed in accordance with documents provided by the NYSDEC Division of Fish and Wildlife, mainly the document, "Clean-up Criteria for Aquatic Sediments", December 1989. This document details the methodology for determining acceptable levels of non-polar (i.e., relatively insoluble in water) or non-ionic organic compounds in aquatic sediments. The document is based upon a briefing document presented by USEPA to its Science Advisory Board in February 1989. Synopses of preliminary methods for determining cleanup criteria for other classes of compounds (i.e., polar organics and metals), based upon other papers and sources, are also presented in the NYSDEC document. Phenolic compounds, although polar, are conservatively grouped with non-polar compounds for the purposes of this method, because of their importance, and because they do not readily ionize at pHs near neutral.

Sediment cleanup criteria for the first-phase samples are presented in Table 5-4. The methodology used in calculating these criteria is discussed below, in Section 5.4.1. Criteria exceedances (Table 5-7) occurred adjacent to the site in both the Susquehanna River and in the drainage stream. These exceedances were limited to three PAHs: chrysene, benzo(b)fluoranthene and benzo(a)pyrene. Many of the compounds detected could not be considered, however, because they were polar. Preliminary methods of determining cleanup criteria for polar organic chemicals and metals are identified in the NYSDEC document, but their performance is beyond the scope of this investigation. Sediment cleanup criteria could not be developed for the second-phase sediment samples (analyzed for VOCs only), since no analysis was carried out for total organic carbon (TOC), which is needed for the calculations. The extent of contamination in these samples is discussed in Section 4.3.2.

5.4.1 Sediment Cleanup Criteria Calculation

The cleanup criteria for non-polar organics are developed based upon the degree to which the chemicals are released from the sediment into the interstitial (pore) water of the sediment. This can best be predicted by the fraction of organic carbon (OC) in the sediment, and the octanol/water partition coefficient, Kow, for the particular chemical.

The octanol/water partition coefficient is defined as the ratio of a chemical's concentration in the octanol phase to its concentration in the aqueous phase of a two-phase octanol/water system. Values of Kow may be interpreted to represent the tendency of the chemical to partition itself between an organic phase (i.e., the octanol) and an aqueous phase of a two-phase organic/water system.

The organic phase, in this case the stream sediment, is modeled by the amount of organic carbon present in the sediment. Given this parameter and the Kow for a contaminant, it is possible to predict the concentration of the contaminant that will result in water at equilibrium with sediment containing that contaminant. Such water is the pore water in the sediment.

The cleanup criterion is the concentration of the chemical in the sediment, which, for its Kow and its total organic carbon concentration (TOC), causes the pore water to exceed the appropriate Ambient Water Quality Standard/Guidance Value (AWQS/GV) for that chemical. For this site, the AWQS/GVs are the NYS Surface Water Standards for Class A and D waters (TOGS 1.1.1, 1990).

The calculations are made as follows (Cleanup Criteria for Aquatic Sediments, December 1989):

$$\text{Sediment Criterion, SC (ug/g OC)} = (\text{AWQS/GV}) * \text{Kow} * \frac{1\ \text{Kg}}{1000\ \text{g OC}}$$

AWQS/GV: The Ambient Water Quality Standard/Guidance Value, used as the basis for the sediment criterion for the specific non-polar organic chemical (ug/l),

Kow: The octanol-water partition coefficient for the given chemical (unitless),

OC: The fraction of organic carbon in the soil, expressed as a decimal.

$\frac{1\ \text{Kg}}{1000\ \text{g OC}}$: Unit conversion factor

This equation yields the permissible concentration (SC) of the given chemical per gram organic carbon in the sediment. To obtain the criterion for the sediment in question, the sediment criterion obtained above is multiplied by the number of grams per kilogram of organic carbon in the sediment:

$$\text{Site-Specific sediment criterion, (ug/Kg)} = \text{SC} * \text{OC} * \frac{1000\ \text{g}}{1\ \text{Kg}}$$

5.5 Sample Quantitation Limits

Table 5-8 presents the sample quantitation limits (SQLs) for parameters and samples analyzed in the first and second phases of the RI. The range displayed by the SQLs for the majority of samples of a given matrix is shown. The SQLs for the anomalous samples are listed alongside.

TABLE 5-1
NEW YORK STATE STANDARDS, CRITERIA AND GUIDANCE VALUES FOR THE GORICK LANDFILL SITE

ITEM	CITATION	DESCRIPTION
Federal Groundwater Standards		
Safe Drinking Water Act		
Primary Drinking Water Standards	40 CFR 141	Water standards for public water supplies
Secondary Drinking Water	40 CFR 143	Water standards for public water supplies
Protection of Underground Sources of Drinking Water	40 CFR 149	Review of projects affecting sole source aquifer
Clean Water Act	40 CFR 304	Water quality criteria for drinking water
RCRA	40 CFR 264	Groundwater monitoring requirements
New York State Groundwater Standards		
NYSDEC Groundwater Quality Standards	TOGS 1.1.1 Sept. 25, 1990	Groundwater standards and guidance values for NYS groundwater
	6NYCRR Parts 700 through 705, effective 9/91	Groundwater and surface water standards
NYSDOH MCLs, Public Water Supplies	10 NYCRR Subpart 5-1	Water standards for drinking water Maximum Contaminant Levels
NYSDOH Standards, Sources of Water Supplies	10 NYCRR 170	Water standards for water supply sources
Standards for Owners and Operators of Hazardous Waste TSD Facilities	6 NYCRR Parts 360 and 373	Site closure and groundwater monitoring

TABLE 5-1 (Continued)
NEW YORK STATE STANDARDS, CRITERIA AND GUIDANCE VALUES FOR THE GORICK LANDFILL SITE

ITEM	CITATION	DESCRIPTION
Federal Surface Water Standards		
Clean Water Act	40 CFR 304	Water quality criteria for fish and drinking water
Regulation of Activities Affecting Water of the US	33 CFR 320-329	Corps of Engineers Regulations for wetlands and navigable waters
Executive Order on Protection of Wetlands	Order #11990 40 CFR 6 Appendix A	Required for consideration during remedial actions that may impact wetlands
Executive Order on Floodplain Management	Order #11988 40 CFR 6 Appendix A	Required for consideration of remedial actions that impact floodplains
Fish and Wildlife		
Coordination Act Improvement Act Conservation Act	16 USC 661 16 USC 742 16 USC 2901	Regulates remedial actions that may affect wetlands

TABLE 5-1 (Continued)
NEW YORK STATE STANDARDS, CRITERIA AND GUIDANCE VALUES FOR THE GORICK LANDFILL SITE

ITEM	CITATION	DESCRIPTION
New York State Surface Water Standards		
NYSDEC Surface Water Quality Standards	TOGS 1.1.1 Sept. 25, 1990	Surface water standards and guidance values for NYS surface water
NYSDEC Surface Water Quality Standards	6 NYCRR Parts 700 through 705, effective 9/91	Standards for surface water quality
Use and Protection of Waters	6 NYCRR 608	Permit requirements for constructing docks or dams and excavation or placement of fill
Use and Protection of Freshwater Wetlands	6 NYCRR 662-665	Permit requirements for disturbance to freshwater wetlands
SPDES	TOGS 1.2.1 TOGS 1.3.1-7	Discharge of treatment system effluent
Health-based standards for surface water		Health Risk Assessment performed during RI
Federal Soil Standards		
Toxicity Characteristic Rule	Toxicity Characteristic Rule 40 CFR 261	Regulations for Classifications of Hazardous Waste
RCRA	40 CFR 264	For treatment, storage, disposal of RCRA wastes

TABLE 5-1 (Continued)
NEW YORK STATE STANDARDS, CRITERIA AND GUIDANCE VALUES FOR THE GORICK LANDFILL SITE

ITEM	CITATION	DESCRIPTION
New York Soil Standards		
Method of partition coefficients and toxicity data for subsurface soil		Using NYS Class GA groundwater standards and the partition coefficient method to calculate the equilibrium concentration of a compound in soil
Health-based standards for surface soils		Health Risk Assessment during RI
Standards for Owners and Operators of Hazardous Waste TSD Facilities	6 NYCRR Parts 360 and 373	Site closure
Federal Sediment Standards		
Clean Water Act	CWA Section 404 40 CFR 230.10	Provides protection of wetlands and other aquatic habitats; discusses disposal of dredged material
Army Corps of Engineers		Evaluates permit applications for above
USEPA		Evaluates permit applications for above
New York State Sediment Standards		
NYSDEC Division of Fish & Wildlife Sediment Criteria		Sediment criteria formula may be appropriate for developing cleanup levels

TABLE 5-1 (Continued)
NEW YORK STATE STANDARDS, CRITERIA AND GUIDANCE VALUES FOR THE GORICK LANDFILL SITE

ITEM	CITATION	DESCRIPTION
Federal Air Standards		
Clean Air Act		
National Ambient Air Quality Standards	40 CFR 50	Air Standards
National Emissions Standards for Hazardous Air Pollutants	40 CFR 61	For asbestos and wet dust, beryllium, vinyl chloride, benzene, etc. Includes standards for tank storage.
New York State Air Standards		
Division of Air	6 NYCRR Part 200, 201, 211, 212, 257	Division of air general provisions permits and certificates and air quality standard
Division of Air	Air Guide 1	Guidelines for control of toxic ambient air contaminants
Health-based standards for air		Health Risk Assessment performed by RI

TABLE 5-1 (Continued)
NEW YORK STATE STANDARDS, CRITERIA AND GUIDANCE VALUES FOR THE GORICK LANDFILL SITE

ITEM	CITATION	DESCRIPTION
Additional Federal Considerations		
OSHA	29 CFR 1904 1910 1226	Worker safety at hazardous waste sites
Standards applicable to generators of hazardous waste	40 CFR 262	Waste excavation, removal, treatment and disposal
Standard applicable to transporters of hazardous waste	40 CFR 263	For transporters of hazardous waste
Land disposal restrictions	40 CFR 268	Treatment standards for final deposition of hazardous wastes
Additional New York State Considerations		
Waste Transporter Permits	6 NYCRR Part 364	For transporters of hazardous waste
Hazardous Waste Manifest System	6 NYCRR Part 372	For generators transporters and facilities
Hazardous Waste TSD facilities	6 NYCRR Part 373	For treatment, storage, and disposal facilities

TABLE 5-2
Chemical-Specific Standards, Criteria and Guidance Values
GORICK LANDFILL

Parameter	Class	Groundwater		Class A Surface Water				Class D Surface Water		Soil, Waste	
				Human		Aquatic					
		SCG Value (ug/L)	Source	SCG Value (ug/L)	Source	SCG Value (ug/L)	Source	SCG Value (ug/L)	Source	SCG Value (ug/L)	Source
Chloromethane	VOC	5	A	5	A						
Bromomethane	VOC	5	C	50	F						
Vinyl Chloride	VOC	2	A	0.3	A					200	TCLP
Chloroethane	VOC	5	C	50	F						
Methylene Chloride	VOC	5	A	5	A						
Acetone	VOC	50	D	50	F						
Carbon Disulfide	VOC	50	D	50	F						
1,1-Dichloroethene	VOC	5	A	0.07	A	11,000	B			700	TCLP
1,1-Dichloroethane	VOC	5	A	5	A						
1,2-Dichloroethene (total)	VOC	5	C	5	A						
Chloroform	VOC	7	G	7	G	1,200	B			6000	TCLP
1,2-Dichloroethane	VOC	5	A	0.8	A	20,000	B			500	TCLP
2-Butanone (or MEK)	VOC	50	D	50	F					200,000	TCLP
1,1,1-Trichloroethane	VOC	5	A	5	A						
Carbon Tetrachloride	VOC	5	A	0.4	A,B	35,000	B			500	TCLP
Vinyl Acetate	VOC	50	D	50	F						
Bromodichloromethane	VOC	50	A	50	A						
1,2-Dichloropropane	VOC	5	A	5	A						
Cis-1,3-dichloropropene	VOC	5	C	87	B	200	B				
Trichloroethene	VOC	5	A	2.7	B	11	A	11	A	500	TCLP
Dibromochloromethane	VOC	50	A	50	A						
1,1,2-Trichloroethane	VOC	5	A	0.6	A,B	9,400	B				
Benzene	VOC	0.7	G	0.7	A	6	A	6	A	500	TCLP
Trans-1,3-dichloropropene	VOC	5	C	87	B	200	B				
Bromoform	VOC	50	A	50	A						
4-Methyl-2-pentanone	VOC	50	D	50	F						
2-Hexanone	VOC	50	A	50	A						
Tetrachloroethene	VOC	5	A	0.7	A	1	A	1	A	700	TCLP
1,1,2,2-Tetrachloroethane	VOC	5	A	0.17	B	50	B				
Toluene	VOC	5	A	5	A	17,000	B				
Chlorobenzene	VOC	5	A	20	A	5	A	50	A	100,000	TCLP
Ethylbenzene	VOC	5	A	5	A	32,000	B				
Styrene	VOC	5	A	50	A						
Total Xylenes	VOC	5	A	5	A						

TABLE 5-2
Chemical-Specific Standards, Criteria and Guidance Values
GORICK LANDFILL

Parameter	Class	Groundwater		Class A Surface Water				Class D Surface Water		Soil, Waste	
				Human		Aquatic					
		SCG Value (ug/L)	Source	SCG Value (ug/L)	Source	SCG Value (ug/L)	Source	SCG Value (ug/L)	Source	SCG Value (ug/L)	Source
Phenol	SEMI	1	A(P)	1	A(P)	5	A(UP)	5	A(UP)		
Bis(2-chloroethyl)ether	SEMI	1	A	0.03	A						
2-Chlorophenol	SEMI	1	A(P)	1	A(P)	1	A(CP)	1	A(CP)		
1,3-Dichlorobenzene	SEMI	5	A	20	A	5	A(2)	50	A(2)		
1,4-Dichlorobenzene	SEMI	4.7	A(1)	30	A	5	A(2)	50	A(2)	7500	TCLP
Benzyl Alcohol	SEMI	50	D	50	F						
1,2-Dichlorobenzene	SEMI	4.7	A(1)	50	F	5	A(2)	50	A(2)		
2-Methylphenol	SEMI	1	A(P)	1	A(P)	5	A(UP)	5	A(UP)	200,000	TCLP
Bis(2-chloroisopropyl) ether	SEMI	5	C	50	F						
4-Methylphenol	SEMI	1	A(P)	1	A(P)	5	A(UP)	5	A(UP)	200,000	TCLP
N-Nitroso-di-n-propylamine	SEMI	50	D	50	F						
Hexachloroethane	SEMI	5	C	1.9	B	540	B			3000	TCLP
Nitrobenzene	SEMI	5	A	30	A	27,000	B			2000	TCLP
Isophorone	SEMI	50	A	50	A	117,000	B				
2-Nitrophenol	SEMI	1	A(P)	1	A(P)	5	A(UP)	5	A(UP)		
2,4-Dimethylphenol	SEMI	1	A(P)	1	A(P)	5	A(UP)	5	A(UP)		
Benzoic Acid	SEMI	50	D	50	F						
Bis(2-chloroethoxy) methane	SEMI	5	C	50	F						
2,4-Dichlorophenol	SEMI	1	A(P)	0.3	A	1	A	1	A		
1,2,4-Trichlorobenzene	SEMI	5	A	10	A	5	A	50	A		
Naphthalene	SEMI	10	A	10	A						
4-Chloroaniline	SEMI	5	C	50	F						
Hexachlorobutadiene	SEMI	5	A	0.5	A	1	A	10	A	500	TCLP
4-Chloro-3-methylphenol	SEMI	1	A(P)	1	A(P)	1	A(CP)	1	A(CP)		
2-Methylnaphthalene	SEMI	5	C	50	F						
Hexachlorocyclopentadiene	SEMI	5	A	1	A	0.45	A	4.5	A		
2,4,6-Trichlorophenol	SEMI	1	A(P)	1	A(P)	1	A(CP)	1	A(CP)	2000	TCLP
2,4,5-Trichlorophenol	SEMI	1	A(P)	1	A(P)	1	A(CP)	1	A(CP)	400,000	TCLP
2-Chloronaphthalene	SEMI	5	A	10	A	1,600	B				
2-Nitroaniline	SEMI	5	C	50	F						
Dimethyl Phthalate	SEMI	50	A	50	A	3	B				
Acenaphthylene	SEMI	50	D	50	F						
2,6-Dinitrotoluene	SEMI	5	A	0.07	A						
3-Nitroaniline	SEMI	5	C	50	F						
Acenaphthene	SEMI	20	A	20	A	500	B				
2,4-Dinitrophenol	SEMI	1	A(P)	1	A(P)	5	A(UP)	5	A(UP)		
4-Nitrophenol	SEMI	1	A(P)	1	A(P)	5	A(UP)	5	A(UP)		
Dibenzofuran	SEMI	50	D	50	F						

TABLE 5-2
Chemical-Specific Standards, Criteria and Guidance Values
GORICK LANDFILL

Parameter	Class	Groundwater		Class A Surface Water				Class D Surface Water		Soil, Waste	
				Human		Aquatic					
		SCG Value (ug/L)	Source	SCG Value (ug/L)	Source	SCG Value (ug/L)	Source	SCG Value (ug/L)	Source	SCG Value (ug/L)	Source
2,4-Dinitrotoluene	SEMI	5	C	50	F					130	TCLP
Diethylphthalate	SEMI	50	A	50	A	3	B				
4-Chlorophenyl-phenylether	SEMI	5	C	50	F						
Fluorene	SEMI	50	A	50	A						
4-Nitroaniline	SEMI	5	C	50	F						
4,6-Dinitro-2-methylphenol	SEMI	1	A(P)	1	A(P)	5	A(UP)	5	A(UP)		
N-nitrosodiphenylamine	SEMI	50	A	4.9	B						
4-Bromophenyl Phenyl Ether	SEMI	5	C	50	F						
Hexachlorobenzene	SEMI	0.35	A	.00072	B					130	TCLP
Pentachlorophenol	SEMI	1	A(P)	1	A(P)	0.4	A	1	A(CP)	100,000	TCLP
Phenanthrene	SEMI	50	A	50	A						
Anthracene	SEMI	50	A	50	A						
Di-n-butylphthalate	SEMI	50	A	50	A	3	B				
Fluoranthene	SEMI	50	A	42	B	3,900	B				
Pyrene	SEMI	50	A	50	A						
Butylbenzylphthalate	SEMI	50	A	50	A	3	B				
3,3'-Dichlorobenzidine	SEMI	5	C	0.02	B						
Benzo(a)anthracene	SEMI	0.002	A	0.002	A						
Chrysene	SEMI	0.002	A	0.002	A						
bis(2-ethyl hexyl)phthalate	SEMI	50	A	4	A	0.6	A				
Di-n-octyl Phthalate	SEMI	50	A	50	A	3	B				
Benzo(b)fluoranthene	SEMI	0.002	A	0.002	A						
Benzo(k)fluoranthene	SEMI	0.002	A	0.002	A						
Benzo(a)pyrene	SEMI	ND	A	0.002	A	0.0012	A	.0012	A		
Indeno(1,2,3-cd)Pyrene	SEMI	0.002	A	0.002	A						
Dibenz(a,h)anthracene	SEMI	50	D	50	F						
Benzo(g,h,i)perylene	SEMI	50	D	50	F						
Pyridine	SEMI	50	A	50	A					5000	TCLP

TABLE 5-2
Chemical-Specific Standards, Criteria and Guidance Values
GORICK LANDFILL

Parameter	Class	Groundwater		Class A Surface Water				Class D Surface Water		Soil, Waste	
				Human		Aquatic					
		SCG Value (ug/L)	Source	SCG Value (ug/L)	Source	SCG Value (ug/L)	Source	SCG Value (ug/L)	Source	SCG Value (ug/L)	Source
alpha-BHC	PST	ND	A	9.2E-3	B(2)	0.01	A(2)	2	A(2)		
beta-BHC	PST	ND	A	0.02	A(2)	0.01	A(2)	2	A(2)		
delta-BHC	PST	ND	A	0.02	A(2)	0.01	A(2)	2	A(2)		
gamma-BHC (Lindane)	PST	ND	A	0.02	A(2)	0.01	A(2)	2	A(2)	400	TCLP
Heptachlor	PST	ND	A	0.009	A(3)	0.001	A(3)	0.001	A(3)	8	TCLP(3)
Aldrin	PST	ND	A	7.4E-5	B	0.001	A(4)	0.001	A(4)		
Heptachlor Epoxide	PST	ND	A	0.009	A(3)	0.001	A(3)	0.001	A(3)	8	TCLP(3)
Endosulfan I	PST	5	C	50	F	0.009	A(5)	0.22	A(5)		
Dieldrin	PST	ND	A	7.1E-5	B	0.001	A(4)	0.001	A(4)		
4,4'-DDE	PST	ND	A	0.01	A(6)	0.001	A(6)	0.001	A(6)		
Endrin	PST	ND	A	0.2	A	0.002	A	0.001	A	20	TCLP
Endosulfan II	PST	5	C	50	F	0.009	A(5)	0.22	A(5)		
4,4'-DDD	PST	ND	A	0.01	A(6)	0.001	A(6)	0.001	A(6)		
Endosulfan Sulfate	PST	5	C	50	F	0.009	A(5)	0.22	A(5)		
4,4'-DDT	PST	ND	A	0.01	A(6)	0.001	A,B(6)	0.001	A(6)		
Methyoxychlor	PST	35	A	35	A	0.03	A,B			10,000	TCLP
Endrin Ketone	PST	5	C	50	F						
alpha-Chlordane	PST	0.1	A(7)	4.6E-4	B(7)	0.002	A(7)	0.002	A(7)	30	TCLP(7)
gamma-Chlordane	PST	0.1	A(7)	4.6E-4	B(7)	0.002	A(7)	0.002	A(7)	30	TCLP(7)
Toxaphene	PST	ND	A	0.005	A	0.0002	B	1.6	A	500	TCLP
2,4-D	HERB	4.4	A	100	A					10,000	TCLP
2,4,5-TP	HERB	0.26	A	10	A					1000	TCLP
Aroclor-1016	PCB	0.1	A(8)	0.01	A(8)	0.001	A(8)	0.001	A(8)		
Aroclor-1221	PCB	0.1	A(8)	0.01	A(8)	0.001	A(8)	0.001	A(8)		
Aroclor-1232	PCB	0.1	A(8)	0.01	A(8)	0.001	A(8)	0.001	A(8)		
Aroclor-1242	PCB	0.1	A(8)	0.01	A(8)	0.001	A(8)	0.001	A(8)		
Aroclor-1248	PCB	0.1	A(8)	0.01	A(8)	0.001	A(8)	0.001	A(8)		
Aroclor-1254	PCB	0.1	A(8)	0.01	A(8)	0.001	A(8)	0.001	A(8)		
Aroclor-1260	PCB	0.1	A(8)	0.01	A(8)	0.001	A(8)	0.001	A(8)		

TABLE 5-2
Chemical-Specific Standards, Criteria and Guidance Values
GORICK LANDFILL

Parameter	Class	Groundwater		Class A Surface Water				Class D Surface Water		Soil, Waste	
				Human		Aquatic					
		SCG Value (ug/L)	Source	SCG Value (ug/L)	Source	SCG Value (ug/L)	Source	SCG Value (ug/L)	Source	SCG Value (ug/L)	Source
Aluminum	MCP					100	A				
Antimony	MCP	3	A	3	A	1,600	B				
Arsenic	MCP	25	A	50	A	190.0	A	360	A	5000	TCLP
Barium	MCP	1000	A	1000	A,B					100,000	TCLP
Beryllium	MCP	3	A	3	A	5.3	B				
Cadmium	MCP	10	A	10	A,B	CALC	A	CALC	A	1000	TCLP
Calcium	MCP										
Chromium	MCP	50	A,E	50	A,E	CALC	A	CALC	A	5000	TCLP
Cobalt	MCP					5	A	110	A		
Copper	MCP	200	A	200	A	CALC	A	CALC	A		
Iron	MCP	300	A(9)	300	A	300	A	300	A		
Lead	MCP	25	A	50	A,B	CALC	A	CALC	A	5000	TCLP
Magnesium	MCP	35000	A	35,000	A						
Manganese	MCP	300	A(9)	300	A						
Mercury	MCP	2	A	0.14	B	0.012	B			200	TCLP
Nickel	MCP			1.3E-7	B	CALC	A	CALC	A		
Potassium	MCP										
Selenium	MCP	10	A,E	10	A,B	1.0	A			1000	TCLP
Silver	MCP	50	A	50	A,B	0.1	A	CALC	A	5000	TCLP
Sodium	MCP	20000	A								
Thallium	MCP	4	A	4	A	8	A	20	A		
Vanadium	MCP					14	A	190	A		
Zinc	MCP	300	A	300	A	30	G	CALC	A		
Total Cyanide	MCP	100	A	100	A	5.2	A,B	22	A		
Total Phenols	MCP	1	A	1	A	1	A(P)	1, 5	A(CP,UP)		

TABLE 5-2
Chemical-Specific Standards, Criteria and Guidance Values
GORICK LANDFILL

Parameter	Class	Groundwater		Class A Surface Water				Class D Surface Water		Soil, Waste	
				Human		Aquatic					
		SCG Value (ug/L)	Source	SCG Value (ug/L)	Source	SCG Value (ug/L)	Source	SCG Value (ug/L)	Source	SCG Value (ug/L)	Source
Ammonia-Nitrogen	MISC	2000	A	2,000	A	CALC	A				
Total Kjeldahl Nitrogen	MISC										
Moisture	MISC										
TOC	MISC										
Bicarbonate, as CaCO3	MISC										
BOD	MISC										
COD	MISC										
Hardness, as CaCO3	MISC										
Alkalinity, as CaCO3	MISC										
Acidity, as CaCO3	MISC										
NO3-N	MISC	10,000	A	10,000	A,B						
NO2-N	MISC	10,000	A	100/20	A(10)						
Phosphate	MISC										
Oil & Grease	MISC										
TSS	MISC										
TDS	MISC										
Sulfate	MISC	250,000	A	250,000	A						
Sulfide	MISC	50	A	50	A	2	A				

NOTES:

(1) Applies to the sum of 1,4- and 1,2-dichlorobenzene.
(2) Applies to the sum of all isomers.
(3) Applies to Heptachlor and Heptachlor Epoxide.
(4) Applies to the sum of Aldrin and Dieldrin.
(5) Applies to Endosulfan.
(6) Applies to DDD, DDE, and DDT.
(7) Applies to Chlordane.
(8) Applies to total PCBs.
(9) Standard for the sum of iron and manganese is 500 ppb.
(10) 100 ppb for warm water fisheries; 20 ppb for cold water fisheries.

(P) Phenolic compound. Standard is for total phenols.
(CP) Phenolic compound. Standard is for total chlorinated phenols.
(UP) Phenolic compound. Standard is for total unchlorinated phenols.
CALC Calculated values. See following tables for values.

SOURCES:
A - New York State DEC water quality standards and guidance values, TOGS 1.1.1, September 1990.
B - Clean Water Act guidelines
C - Chapter I, New York Sanitary Code, Subpart 5-1, Principle Organic Contaminant
D - Chapter I, New York Sanitary Code, Subpart 5-1, Unspecified Organic Contaminant
E - United States EPA Drinking Water standards
F - 6 NYCRR 701.15(e): individual organic chemical
G - 6 NYCRR 703.5, effective 9/1/91
TCLP - EPA Toxicity Characteristic Rule, replaces EP Toxicity characteristic rules (40 CFR 261)

ABBREVIATIONS:
VOC - Volatile Organic Compound
SEMI - Semivolatile Organic Compound
PST - PCBs/Pesticides
TAL - Target Analyte List
MISC - Miscellaneous

TABLE 5-3
CALCULATED SURFACE WATER SCGs
FOR AQUATIC HEALTH CONCERNS

SAMPLE-ID		SW-1	SW-4	SW-5	SW-6	SW-7	SW-8	SW-9	SW-10
PARAMETER	TYPE	Class D	Class D	Class D	Class D	Class D	Class A	Class A	Class D
Cadmium	MCP	1.89	2.42	2.45	6.01	3.82	0.80	0.85	2.20
Chromium	MCP	1023	1223	1236	2367	1705	144	152	1140
Copper	MCP	9.64	11.85	11.98	25.32	17.36	8.10	8.59	10.92
Lead	MCP	36.45	48.07	48.82	133.39	80.32	1.84	2.01	43.09
Nickel	MCP	1129	1333	1345	2459	1814	68	72	1248
Silver	MCP	1.34	1.94	1.99	7.78	3.91	0.1(1)	0.1(1)	1.68
Zinc	MCP	67.68	81.45	82.29	161.26	114.84	30(1)	30(1)	75.69
These standards are based upon:									
Hardness (mg/l)	MISC	52.4	65.2	66	146	97.8	64.2	68.8	59.8
Ammonia (as N)	MISC	13	26	13	NA	NA	3.7	9.3	NA
This standard is based upon:									
Temperature (Degrees C)	MISC	4.8	15.8	5.1	12	8.5	1.0	3.5	NT
pH	MISC	6.53	6.58	6.55	5.85	5.5	7.24	7.43	6.2

All units are in ug/l (ppb) unless noted.

NT - Tempetature not obtained due to instrument malfunction.

Metals standards apply to acid-soluble forms only.

NA - Ammonia standards not defined for pH < 6.5

(1) - Non-calculated values.

These standards are derived from formulas contained in NYSDEC TOGS 1.1.1, September 1990.

TABLE 5-4

Sediment Cleanup Criteria for SS-1 (1)

Sample Specific Class D Stream Sediment SCGs

Organic Carbon = 1.010%

Parameters Detected in Class D Sediments (7)	AWQS/GV (μg/L) (2)	LOG Kow (3)	Kow	Sediment Criterion (μg/gOC) (4)	Site Specific Criterion (μg/kg) (5)	Detected Conc. (μg/kg) (6)
Isophorone	117,000	1.70	50	5,860	59,200	
Acenaphthene	500	4.33	21,400	10,700	108,000	
Pentachlorophenol	1	5.01	102,000	102	1,030	78
Fluoranthene	3,900	5.33	214,000	835,000	8,430,000	29
Benzo(a)Pyrene	0.0012	6.04	1,100,000	1.3	13	
Total Phenol	1	2.75 (1)	562	0.6	6	1.77

1. Based on "Cleanup Criteria for Aquatic Sediments" , NYSDEC Division of Fish and Wildlife, 1989.
2. AWQS/GV = Ambient Water Quality Standard/Guidance Value, NYSDEC TOGS 1.1.1, September, 1990
3. EPA Treatability Manual, Vol. I, EPA 600/2/-82-001a, 1983.
4. Sediment Criterion = AWQS/GV x Kow x 0.001
5. Site Specific Criterion = Sediment Criterion x Organic Carbon x 1000
6. Only detected results are reported.
7. Criteria were calculated for detected, nonpolar organic compounds for which AWQS/GVs exist. Only these compounds are listed here.

TABLE 5-4

Sediment Cleanup Criteria for SS-4 (1)

Sample Specific Class D Stream Sediment SCGs

Organic Carbon = 2.810%

Parameters Detected in Class D Sediments (7)	AWQS/GV (μg/L) (2)	LOG Kow (3)	Kow	Sediment Criterion (μg/gOC) (4)	Site Specific Criterion (μg/kg) (5)	Detected Conc. (μg/kg) (6)
Isophorone	117,000	1.70	50	5,860	165,000	72
Acenaphthene	500	4.33	21,400	10,700	301,000	
Pentachlorophenol	1	5.01	102,000	102	2,870	
Fluoranthene	3,900	5.33	214,000	835,000	23,500,000	
Benzo(a)Pyrene	0.0012	6.04	1,100,000	1.3	37	
Total Phenol	1	2.75 (1)	562	0.6	16	5

1. Based on "Cleanup Criteria for Aquatic Sediments", NYSDEC Division of Fish and Wildlife, 1989.
2. AWQS/GV = Ambient Water Quality Standard/Guidance Value, NYSDEC TOGS 1.1.1, September, 1990.
3. EPA Treatability Manual, Vol. I, EPA 600/2/-82-001a, 1983.
4. Sediment Criterion = AWQS/GV x Kow x 0.001
5. Site Specific Criterion = Sediment Criterion x Organic Carbon x 1000
6. Only detected results are reported.
7. Criteria were calculated for detected nonpolar organic compounds for which AWQS/GVs exist. Only these compounds are listed here.

TABLE 5-4

Sediment Cleanup Criteria for SS-5 (1)

Sample Specific Class D Stream Sediment SCGs

Organic Carbon = 0.328%

Parameters Detected in Class D Sediments (7)	AWQS/GV (μg/L) (2)	LOG Kow (3)	Kow	Sediment Criterion (μg/gOC) (4)	Site Specific Criterion (μg/kg) (5)	Detected Conc. (μg/kg) (6)
Isophorone	117,000	1.70	50	5,860	19,200	
Acenaphthene	500	4.33	21,400	10,700	35,100	
Pentachlorophenol	1	5.01	102,000	102	335	
Fluoranthene	3,900	5.33	214,000	835,000	2,740,000	
Benzo(a)Pyrene	0.0012	6.04	1,100,000	1.3	4	
Total Phenol	1	2.75 (1)	562	0.6	2	1.62

1. Based on "Cleanup Criteria for Aquatic Sediments", NYSDEC Division of Fish and Wildlife, 1989.
2. AWQS/GV = Ambient Water Quality Standard/Guidance Value, NYSDEC TOGS 1.1.1, September, 1990.
3. EPA Treatability Manual, Vol. I, EPA 600/2/-82-001a, 1983.
4. Sediment Criterion = AWQS/GV x Kow x 0.001
5. Site Specific Criterion = Sediment Criterion x Organic Carbon x 1000
6. Only detected results are reported.
7. Criteria were calculated for detected, nonpolar organic compounds for which AWQS/GVs exist. Only these compounds are listed here.

TABLE 5-4

Sediment Cleanup Criteria for SS-6 (1)

Sample Specific Class D Stream Sediment SCGs

Organic Carbon = 0.939%

Parameters Detected in Class D Sediments (7)	AWQS/GV (μg/L) (2)	LOG Kow (3)	Kow	Sediment Criterion (μg/gOC) (4)	Site Specific Criterion (μg/kg) (5)	Detected Conc. (μg/kg) (6)
Isophorone	117,000	1.70	50	5,860	55,000	
Acenaphthene	500	4.33	21,400	10,700	100,000	130
Pentachlorophenol	1	5.01	102,000	102	958	
Fluoranthene	3,900	5.33	214,000	835,000	7,840,000	870
Benzo(a)Pyrene	0.0012	6.04	1,100,000	1.3	12	340
Total Phenol	1	2.75 (1)	562	0.6	5	3.5

1. Based on "Cleanup Criteria for Aquatic Sediments", NYSDEC Division of Fish and Wildlife, 1989.
2. AWQS/GV = Ambient Water Quality Standard/Guidance Value, NYSDEC TOGS 1.1.1, September, 1990.
3. EPA Treatability Manual, Vol. I, EPA 600/2/-82-001a, 1983.
4. Sediment Criterion = AWQS/GV x Kow x 0.001
5. Site Specific Criterion = Sediment Criterion x Organic Carbon x 1000
6. Only detected results are reported.
7. Criteria were calculated for detected, nonpolar organic compounds for which AWQS/GVs exist. Only these compounds are listed here.

TABLE 5-4

Sediment Cleanup Criteria for SS-7 (1)

Sample Specific Class D Stream Sediment SCGs

Organic Carbon = 1.620%

Parameters Detected in Class D Sediments (7)	AWQS/GV (μg/L) (2)	LOG Kow (3)	Kow	Sediment Criterion (μg/gOC) (4)	Site Specific Criterion (μg/kg) (5)	Detected Conc. (μg/kg) (6)
Isophorone	117,000	1.70	50	5,860	95,000	
Acenaphthene	500	4.33	21,400	10,700	173,000	
Pentachlorophenol	1	5.01	102,000	102	1,650	
Fluoranthene	3,900	5.33	214,000	835,000	13,500,000	100
Benzo(a)Pyrene	0.0012	6.04	1,100,000	1.3	21	
Total Phenol	1	2.75 (1)	562	0.6	9	1.93

1. Based on "Cleanup Criteria for Aquatic Sediments" , NYSDEC Division of Fish and Wildlife, 1989.
2. AWQS/GV = Ambient Water Quality Standard/Guidance Value, NYSDEC TOGS 1.1.1, September, 1990
3. EPA Treatability Manual, Vol. I, EPA 600/2/-82-001a, 1983.
4. Sediment Criterion = AWQS/GV x Kow x 0.001
5. Site Specific Criterion = Sediment Criterion x Organic Carbon x 1000
6. Only detected results are reported.
7. Criteria were calculated for detected, nonpolar organic compounds for which AWQS/GVs exist. Only these compounds are listed here.

TABLE 5-4

Sediment Cleanup Criteria for SS-8 (1)

Sample Specific Class A Stream Sediment SCGs

Organic Carbon = 0.753%

Parameters Detected in Class A Sediments (7)	AWQS/GV (μg/L) (2)	LOG Kow (3)	Kow	Sediment Criterion (μg/gOC) (4)	Site Specific Criterion (μg/kg) (5)	Detected Conc. (μg/kg) (6)
Phenanthrene	50	4.46	28,800	1,440	10,800	
Fluoranthene	42	5.33	214,000	8,990	67,700	70
Pyrene	50	5.32	209,000	10,500	79,100	43
Chrysene	0.002	5.61	407,000	0.8	6	
Benzo(b)Fluoranthene	0.002	6.57	3,720,000	7.4	56	
Total Phenol	1	2.75 (1)	562	0.6	4	

1. Based on "Cleanup Criteria for Aquatic Sediments" , NYSDEC Division of Fish and Wildlife, 1989.
2. AWQS/GV = Ambient Water Quality Standard/Guidance Value, NYSDEC TOGS 1.1.1, September, 1990.
3. EPA Treatability Manual, Vol. I, EPA 600/2/-82-001a, 1983.
4. Sediment Criterion = AWQS/GV x Kow x 0.001
5. Site Specific Criterion = Sediment Criterion x Organic Carbon x 1000
6. Only detected results are reported.
7. Criteria were caculated for detected, nonpolar organic compounds for which AWQS/GVs exist. Only these compounds are listed here.

TABLE 5-4

Sediment Cleanup Criteria for SS-9 (1)

Sample Specific Class A Stream Sediment SCGs

Organic Carbon = 0.747%

Parameters Detected in Class A Sediments (7)	AWQS/GV (μg/L) (2)	LOG Kow (3)	Kow	Sediment Criterion (μg/gOC) (4)	Site Specific Criterion (μg/kg) (5)	Detected Conc. (μg/kg) (6)
Phenanthrene	50	4.46	28,800	1,440	10,800	94
Fluoranthene	42	5.33	214,000	8,990	67,200	180
Pyrene	50	5.32	209,000	10,500	78,400	98
Chrysene	0.002	5.61	407,000	0.8	6	94
Benzo(b)Fluoranthene	0.002	6.57	3,720,000	7.4	56	130
Total Phenols	1	2.75 (1)	562	0.6	4	

1. Based on "Cleanup Criteria for Aquatic Sediments", NYSDEC Division of Fish and Wildlife, 1989.
2. AWQS/GV = Ambient Water Quality Standard/Guidance Value, NYSDEC TOGS 1.1.1, September, 1990.
3. EPA Treatability Manual, Vol. I, EPA 600/2/-82-001a, 1983.
4. Sediment Criterion = AWQS/GV x Kow x 0.001
5. Site Specific Criterion = Sediment Criterion x Organic Carbon x 1000
6. Only detected results are reported.
7. Criteria were calculated for detected, nonpolar organic compounds for which AWQS/GVs exist. Only these compounds are listed here.

TABLE 5-4

Sediment Cleanup Criteria for SS-10 (1)

Sample Specific Class D Stream Sediment SCGs

Organic Carbon = 4.400%

Parameters Detected in Class D Sediments (7)	AWQS/GV (μg/L) (2)	LOG Kow (3)	Kow	Sediment Criterion (μg/gOC) (4)	Site Specific Criterion (μg/kg) (5)	Detected Conc. (μg/kg) (6)
Isophorone	117,000	1.70	50	5,860	258,000	
Acenaphthene	500	4.33	21,400	10,700	471,000	
Pentachlorophenol	1	5.01	102,000	102	4,490	
Fluoranthene	3,900	5.33	214,000	835,000	36,700,000	610
Benzo(a)Pyrene	0.0012	6.04	1,100,000	1.3	58	230
Total Phenol	1	2.75 (1)	562	0.6	25	3.81

1. Based on "Cleanup Criteria for Aquatic Sediments", NYSDEC Division of Fish and Wildlife, 1989.
2. AWQS/GV = Ambient Water Quality Standard/Guidance Value, NYSDEC TOGS 1.1.1, September, 1990.
3. EPA Treatability Manual, Vol. I, EPA 600/2/-82-001a, 1983.
4. Sediment Criterion = AWQS/GV x Kow x 0.001
5. Site Specific Criterion = Sediment Criterion x Organic Carbon x 1000
6. Only detected results are reported.
7. Criteria were calculated for detected, nonpolar organic compounds for which AWQS/GVs exist. Only these compounds are listed here.

TABLE 5 - 5
PHASE I
GROUNDWATER SCG EXCEEDANCES

SAMPLE-ID		SCG	MW-1S	MW-2S	MW-3S	MW-4S	MW-4I	MW-5S	MW-5I	MW-5D	MW-6S	MW-6I
COLLECTION DATE		VALUE	12/7/90	12/5/90	12/5/90	12/4/90	12/4/90	12/6/90	12/6/90	12/6/90	12/7/90	12/7/90
PARAMETER	TYPE											
Vinyl Chloride	VOC	2										
Acetone	VOC	50										
1,1-Dichloroethane	VOC	5										
1,2-Dichloroethene (total)	VOC	5					22	5	64	29	6	78
1,1,1-Trichloroethane	VOC	5							6			31
Trichloroethene	VOC	5					29	7	110	49	9	140
Benzene	VOC	0.7					2					
Chromium	MCP	50										
Iron	MCP	300	557	1950			863	16200	1100	22000	2180	1720
Lead	MCP	25										
Magnesium	MCP	35000								44700		
Manganese	MCP	300	317	798	358		9130	1800	4340	3950	942	4570
Sodium	MCP	20000		23400			44700		33700	20200		29300
Phenols (mg/l)	MCP	.001				0.012	0.009					
Sulfate (mg/l)	MISC	250					421	300	451	469		
Sulfide (mg/l)	MISC	.050				1.3					1	

All results reported in µg/l (ppb) unless otherwise noted.
Only detected results exceeding SCG values are reported.

TABLE 5 - 5 (continued)
PHASE I
GROUNDWATER SCG EXCEEDANCES

SAMPLE-ID		SCG	MW-7S	MW-8S	MW-9S	MW-10S	MW-31	MW-32	MW-33	MW-34	MW-35	MW-36
COLLECTION DATE		VALUE	12/6/90	12/6/90	12/6/90	12/6/90	12/5/90	12/5/90	12/5/90	12/5/90	12/5/90	12/5/90
PARAMETER	TYPE											
Vinyl Chloride	VOC	2										
Acetone	VOC	50										
1,1-Dichloroethane	VOC	5										
1,2-Dichloroethene (total)	VOC	5	8	58	14				18		5	52
1,1,1-Trichloroethane	VOC	5										
Trichloroethene	VOC	5		130	33			5	21		8	85
Benzene	VOC	0.7										
Chromium	MCP	50		68.8		65		4100				
Iron	MCP	300	1340	5940	4410	1560	1180	1240	321	315	1440	323
Lead	MCP	25	28.4									
Magnesium	MCP	35000		45800		132000						
Manganese	MCP	300	1970	8840	3400	2410			647		619	651
Sodium	MCP	20000	29700	51300	21000	88500		4100B				71800
Phenols (mg/l)	MCP	.001										
Sulfate (mg/l)	MISC	250				1170		340				430
Sulfide (mg/l)	MISC	.050										

All results reported in µg/l (ppb) unless otherwise noted.

Only detected results exceeding SCG values are reported.

TABLE 5 - 5 (continued)
PHASE II
GROUNDWATER SCG EXCEEDANCES

SAMPLE-ID		SCG	MW-4I	MW-5S	MW-5I	MW-5D	MW-6S	MW-6I
COLLECTION DATE		VALUE	6/28/91	6/28/91	6/28/91	6/28/91	6/28/91	6/28/91
PARAMETER	TYPE							
Vinyl Chloride	VOC	2						
Acetone	VOC	50						
1,1-Dichloroethane	VOC	5						6
1,2-Dichloroethene (total)	VOC	5	66	7	49	10	31	260
1,1,1-Trichloroethane	VOC	5					13	57
Trichloroethene	VOC	5	150	9	95	23	57	78
Benzene	VOC	0.7						4

All results reported in µg/l (ppb).
Only detected results exceeding SCG values are reported.

TABLE 5 - 5 (continued)
PHASE II
GROUNDWATER SCG EXCEEDANCES

SAMPLE-ID		SCG	MW-6D	MW-8S	MW-9S	MW-14D	32	35	36
COLLECTION DATE		VALUE	6/28/91	6/29/91	6/29/91	6/29/91	6/27/91	6/28/91	6/28/91
PARAMETER	TYPE								
Vinyl Chloride	VOC	2	7						6
Acetone	VOC	50				97			
1,1-Dichloroethane	VOC	5							
1,2-Dichloroethene (total)	VOC	5		70	110		14	9	130
1,1,1-Trichloroethane	VOC	5	33						
Trichloroethene	VOC	5		130	230		24	14	310
Benzene	VOC	0.7	0.8			2			

All results reported in μg/l (ppb).
Only detected results exceeding SCG values are reported.

TABLE 5-6
PHASE I
SURFACE WATER SCG EXCEEDANCES

SAMPLE-ID		Human SCG	Aquatic SCG	Aquatic SCG	SW-1	SW-4	SW-5	SW-6	SW-7	SW-8	SW-9	SW-10
COLLECTION DATE		VALUE	VALUE	VALUE	12/4/90	12/4/90	12/4/90	12/3/90	12/3/90	12/3/90	12/3/90	12/4/90
PARAMETER	TYPE	Class A	Class A	Class D	Class D	Class D	Class D	Class D	Class D	Class A	Class A	Class D
Butylbenzyl phthalate	SEMI	50	3*							10	13	
bis(2-Ethylhexyl)phthalate	SEMI	4	0.6							5	5	
Iron	MCP	300	300	300	1570		1090	494				1850
Manganese	MCP	300				539		310				
Zinc	MCP	300	30	c	2180							
Cyanide	MCP	100	5.2	22					42.2	28.3		
Phenols	MCP	1	1	1			6		5			
Sulfides (mg/L)	MCP	0.05	0.002									

All results reported in ug/l (ppb) unless otherwise noted.

Only detected results exceeding SCG values are reported.

c – Calculated value – See Table 5-3.

* – Federal Clean Water Act guidelines for total phthalate esters.

TABLE 5-7

EXCEEDANCES OF SEDIMENT CLEANUP CRITERIA

Parameter	Site-Specific Criterion	SS-6	SS-9	SS-10
Chrysene	6		94	
Benzo(b)fluoranthene	56		130	
Benzo(a)pyrene	12(SS-6) 58(SS-10)	340		230
All results expressed in μg/kg (ppb)				

TABLE 5-8
SAMPLE QUANTITATION LIMITS
PHASE I

MATRIX:		WATER (1)	SOIL (2)
SAMPLE ID:		ALL	ALL
PARAMETER	TYPE	RANGE (ppb)	RANGE (ppb)
Chloromethane	VOC	10	11 - 31
Bromomethane	VOC	10	11 - 31
Vinyl Chloride	VOC	10	11 - 31
Chloroethane	VOC	10	11 - 31
Methylene Chloride	VOC	5	6 - 16
Acetone	VOC	10	11 - 31
Carbon Disulfide	VOC	5	6 - 16
1,1-Dichloroethene	VOC	5	6 - 16
1,1-Dichloroethane	VOC	5	6 - 16
1,2-Dichloroethene (Total)	VOC	5	6 - 16
Chloroform	VOC	5	6 - 16
1,2-Dichloroethane	VOC	5	6 - 16
2-Butanone	VOC	10	11 - 31
1,1,1-Trichloroethane	VOC	5	6 - 16
Carbon Tetrachloride	VOC	5	6 - 16
Vinyl Acetate	VOC	10	11 - 31
Bromodichloromethane	VOC	5	6 - 16
1,2-Dichloropropane	VOC	5	6 - 16
cis-1,3-Dichloropropene	VOC	5	6 - 16
Trichloroethene	VOC	5	6 - 16
Dibromochloromethane	VOC	5	6 - 16
1,1,2-Trichloroethane	VOC	5	6 - 16
Benzene	VOC	5	6 - 16
trans-1,3-Dichloropropene	VOC	5	6 - 16
Bromoform	VOC	5	6 - 16
4-Methyl-2-Pentanone	VOC	10	11 - 31
2-Hexanone	VOC	10	11 - 31
Tetrachloroethene	VOC	5	6 - 16
1,1,2,2-Tetrachloroethane	VOC	5	6 - 16
Toluene	VOC	5	6 - 16
Chlorobenzene	VOC	5	6 - 16
Ethylbenzene	VOC	5	6 - 16
Styrene	VOC	5	6 - 16
Total Xylenes	VOC	5	6 - 16

1 - Includes surface water, ground water and leachate seeps.

2 - Includes surficial soils, subsurface soils and wastes.

TABLE 5-8
SAMPLE QUANTITATION LIMITS
PHASE I

MATRIX:		WATER (1)	SOIL (2)			
SAMPLE ID:		ALL	ALL	WITH THESE EXCEPTIONS:		
				MW-WS-7	MW-WS-9	MW-WS-10
PARAMETER	TYPE	RANGE (ppb)	RANGE (ppb)			
Phenol	SEMI	10 - 15	360 - 790	87000	1600	4300
bis(2-Chloroethyl)ether	SEMI	10 - 15	360 - 790	87000	1600	4300
2-Chlorophenol	SEMI	10 - 15	360 - 790	87000	1600	4300
1,3-Dichlorobenzene	SEMI	10 - 15	360 - 790	87000	1600	4300
1,4-Dichlorobenzene	SEMI	10 - 15	360 - 790	87000	1600	4300
Benzyl Alcohol	SEMI	10 - 15	360 - 790	87000	1600	4300
1,2-Dichlorobenzene	SEMI	10 - 15	360 - 790	87000	1600	4300
2-Methylphenol	SEMI	10 - 15	360 - 790	87000	1600	4300
Bis(2-chloroisopropyl)ether	SEMI	10 - 15	360 - 790	87000	1600	4300
4-Methylphenol	SEMI	10 - 15	360 - 790	87000	1600	4300
n-Nitroso-di-n-propylamine	SEMI	10 - 15	360 - 790	87000	1600	4300
Hexachloroethane	SEMI	10 - 15	360 - 790	87000	1600	4300
Nitrobenzene	SEMI	10 - 15	360 - 790	87000	1600	4300
Isophorone	SEMI	10 - 15	360 - 790	87000	1600	4300
2-Nitrophenol	SEMI	10 - 15	360 - 790	87000	1600	4300
2,4-Dimethylphenol	SEMI	10 - 15	360 - 790	87000	1600	4300
Benzoic Acid	SEMI	50 - 74	1800 - 3800	420000	7900	21000
Bis(2-chloroethoxy)methane	SEMI	10 - 15	360 - 790	87000	1600	4300
2,4-Dichlorophenol	SEMI	10 - 15	360 - 790	87000	1600	4300
1,2,4-Trichlorobenzene	SEMI	10 - 15	360 - 790	87000	1600	4300
Naphthalene	SEMI	10 - 15	360 - 790	87000	1600	4300
4-Chloroaniline	SEMI	10 - 15	360 - 790	87000	1600	4300
Hexachlorobutadiene	SEMI	10 - 15	360 - 790	87000	1600	4300
4-Chloro-3-methylphenol	SEMI	10 - 15	360 - 790	87000	1600	4300
2-Methylnaphthalene	SEMI	10 - 15	360 - 790	87000	1600	4300
Hexachlorocyclopentadiene	SEMI	10 - 15	360 - 790	87000	1600	4300
2,4,6-Trichlorophenol	SEMI	10 - 15	360 - 790	87000	1600	4300
2,4,5-Trichlorophenol	SEMI	50 - 74	1800 - 3800	420000	7900	21000
2-Chloronaphthalene	SEMI	10 - 15	360 - 790	87000	1600	4300
2-Nitroaniline	SEMI	50 - 74	1800 - 3800	420000	7900	21000
Dimethylphthalate	SEMI	10 - 15	360 - 790	87000	1600	4300
Acenaphthylene	SEMI	10 - 15	360 - 790	87000	1600	4300
2,6-Dinitrotoluene	SEMI	10 - 15	360 - 790	87000	1600	4300
3-Nitroaniline	SEMI	50 - 74	1800 - 3800	420000	7900	21000
Acenaphthene	SEMI	10 - 15	360 - 790	87000	1600	4300
2,4-Dinitrophenol	SEMI	50 - 74	1800 - 3800	420000	7900	21000

1 - Includes surface water, ground water and leachate seeps.

2 - Includes surficial soils, subsurface soils and wastes.

TABLE 5-8
SAMPLE QUANTITATION LIMITS
PHASE I

MATRIX:		WATER (1)	SOIL (2)			
SAMPLE ID:		ALL	ALL	WITH THESE EXCEPTIONS:		
				MW-WS-7	MW-WS-9	MW-WS-10
PARAMETER	TYPE	RANGE (ppb)	RANGE (ppb)			
4-Nitrophenol	SEMI	50 - 74	1800 - 3800	420000	7900	21000
Dibenzofuran	SEMI	10 - 15	360 - 790	87000	1600	4300
2,4-Dinitrotoluene	SEMI	10 - 15	360 - 790	87000	1600	4300
Diethylphthalate	SEMI	10 - 15	360 - 790	87000	1600	4300
4-Chlorophenyl-phenyl Ether	SEMI	10 - 15	360 - 790	87000	1600	4300
Fluorene	SEMI	10 - 15	360 - 790	87000	1600	4300
4-Nitroaniline	SEMI	50 - 74	1800 - 3800	420000	7900	21000
4,6-Dinitro-2-methylphenol	SEMI	50 - 74	1800 - 3800	420000	7900	21000
n-Nitrosodiphenylamine	SEMI	10 - 15	360 - 790	87000	1600	4300
4-Bromophenyl-phenyl Ether	SEMI	10 - 15	360 - 790	87000	1600	4300
Hexachlorobenzene	SEMI	10 - 15	360 - 790	87000	1600	4300
Pentachlorophenol	SEMI	50 - 74	1800 - 3800	420000	7900	21000
Phenanthrene	SEMI	10 - 15	360 - 790	87000	1600	4300
Anthracene	SEMI	10 - 15	360 - 790	87000	1600	4300
Di-n-butylphthalate	SEMI	10 - 15	360 - 790	87000	1600	4300
Fluoranthene	SEMI	10 - 15	360 - 790	87000	1600	4300
Pyrene	SEMI	10 - 15	360 - 790	87000	1600	4300
Butylbenzylphthalate	SEMI	10 - 15	360 - 790	87000	1600	4300
3,3'-Dichlorobenzidine	SEMI	20 - 29	730 - 1600	170000	3300	8600
Benzo(a)anthracene	SEMI	10 - 15	360 - 790	87000	1600	4300
Chrysene	SEMI	10 - 15	360 - 790	87000	1600	4300
bis(2-Ethylhexyl)phthalate	SEMI	10 - 15	360 - 790	87000	1600	4300
Di-n-octylphthalate	SEMI	10 - 15	360 - 790	87000	1600	4300
Benzo(b)fluoranthene	SEMI	10 - 15	360 - 790	87000	1600	4300
Benzo(k)fluoranthene	SEMI	10 - 15	360 - 790	87000	1600	4300
Benzo(a)pyrene	SEMI	10 - 15	360 - 790	87000	1600	4300
Indeno(1,2,3-cd)pyrene	SEMI	10 - 15	360 - 790	87000	1600	4300
Dibenz(a,h)anthracene	SEMI	10 - 15	360 - 790	87000	1600	4300
Benzo(g,h,i)perylene	SEMI	10 - 15	360 - 790	87000	1600	4300

1 - Includes surface water, ground water and leachate seeps.

2 - Includes surficial soils, subsurface soils and wastes.

TABLE 5-8
SAMPLE QUANTITATION LIMITS
PHASE I

MATRIX:		WATER (1)	SOIL (2)		
SAMPLE ID:		ALL	ALL	WITH THESE EXCEPTIONS:	
				GL-SPS-1	MW-WS-7
PARAMETER	TYPE	RANGE (ppb)	RANGE (ppb)		
alpha-BHC	PST	0.050 - 0.056	8.8 - 21.0	48	210
beta-BHC	PST	0.050 - 0.056	8.8 - 21.0	48	210
delta-BHC	PST	0.050 - 0.056	8.8 - 21.0	48	210
gamma-BHC (Lindane)	PST	0.050 - 0.056	8.8 - 21.0	48	210
Heptachlor	PST	0.050 - 0.056	8.8 - 21.0	48	210
Aldrin	PST	0.050 - 0.056	8.8 - 21.0	48	210
Heptachlor Epoxide	PST	0.050 - 0.056	8.8 - 21.0	48	210
Endosulfan I	PST	0.050 - 0.056	8.8 - 21.0	48	210
Dieldrin	PST	0.10 - 0.11	18.0 - 42.0	96	420
4,4'-DDE	PST	0.10 - 0.11	18.0 - 42.0	96	420
Endrin	PST	0.10 - 0.11	18.0 - 42.0	96	420
Endosulfan II	PST	0.10 - 0.11	18.0 - 42.0	96	420
4,4'-DDD	PST	0.10 - 0.11	18.0 - 42.0	96	420
Endosulfan Sulfate	PST	0.10 - 0.11	18.0 - 42.0	96	420
4,4'-DDT	PST	0.10 - 0.11	18.0 - 42.0	96	420
Methoxychlor	PST	0.50 - 0.56	88.0 - 210.0	480	2100
Endrin Ketone	PST	0.10 - 0.11	18.0 - 42.0	96	420
alpha-Chlordane	PST	0.50 - 0.56	88.0 - 210.0	480	2100
gamma-Chlordane	PST	0.50 - 0.56	88.0 - 210.0	480	2100
Toxaphene	PST	1.0 - 1.1	180.0 - 420.0	960	4200
Aroclor-1016	PCB	0.50 - 0.56	88.0 - 210.0	480	2100
Aroclor-1221	PCB	0.50 - 0.56	88.0 - 210.0	480	2100
Aroclor-1232	PCB	0.50 - 0.56	88.0 - 210.0	480	2100
Aroclor-1242	PCB	0.50 - 0.56	88.0 - 210.0	480	2100
Aroclor-1248	PCB	0.50 - 0.56	88.0 - 210.0	480	2100
Aroclor-1254	PCB	1.0 - 1.1	180.0 - 420.0	960	4200
Aroclor-1260	PCB	1.0 - 1.1	180.0 - 420.0	960	4200
2,4-D	HERB	1.0	N.A.: REPORTED		
Silvex	HERB	0.1	AS WATER		

1 - Includes surface water, ground water and leachate seeps.

2 - Includes surficial soils, subsurface soils and wastes.

TABLE 5-8 (continued)
SAMPLE QUANTITATION LIMITS
PHASE II

MATRIX		WATER (1)	SOIL (2)			
SAMPLE-ID		ALL	ALL	WITH THESE EXCEPTIONS:		
PARAMETER	TYPE	RANGE(ppb)	RANGE(ppb)	TP2-11-1	TP2-11-2 (3)	TP2-24-1
Chloromethane	VOC	10-20	10-12	78000		97000
Bromomethane	VOC	10-20	10-12	78000		97000
Vinyl Chloride	VOC	10-20	10-12	78000	10000	97000
Chloroethane	VOC	10-20	10-12	78000		97000
Methylene Chloride	VOC	5-10	5-6	39000		49000
Acetone	VOC	10-20	10-12	78000		97000
Carbon Disulfide	VOC	5-10	5-6	39000		49000
1,1-Dichloroethene	VOC	5-10	5-6	39000	5000	49000
1,1-Dichloroethane	VOC	5-10	5-6	39000		49000
1,2-Dichloroethene (Total)	VOC	5-10	5-6	39000		49000
Chloroform	VOC	5-10	5-6	39000	5000	49000
1,2-Dichloroethane	VOC	5-10	5-6	39000	5000	49000
2-Butanone	VOC	10-20	10-12	78000	10000	97000
1,1,1-Trichloroethane	VOC	5-10	5-6	39000		49000
Carbon Tetrachloride	VOC	5-10	5-6	39000	5000	49000
Vinyl Acetate	VOC	10-20	10-12	78000		97000
Bromodichloromethane	VOC	5-10	5-6	39000		49000
1,2-Dichloropropane	VOC	5-10	5-6	39000		49000
cis-1,3-Dichloropropene	VOC	5-10	5-6	39000		49000
Trichloroethene	VOC	5-10	5-6	39000	5000	49000
Dibromochloromethane	VOC	5-10	5-6	39000		49000
1,1,2-Trichloroethane	VOC	5-10	5-6	39000		49000
Benzene	VOC	5-10	5-6	39000	5000	49000
trans-1,3-Dichloropropene	VOC	5-10	5-6	39000		49000
Bromoform	VOC	5-10	5-6	39000		49000
4-Methyl-2-Pentanone	VOC	10-20	10-12	78000		97000
2-Hexanone	VOC	10-20	10-12	78000		97000
Tetrachloroethene	VOC	5-10	5-6	39000	5000	49000
1,1,2,2-Tetrachloroethane	VOC	5-10	5-6	39000		49000
Toluene	VOC	5-10	5-6	39000		49000
Chlorobenzene	VOC	5-10	5-6	39000	5000	49000
Ethylbenzene	VOC	5-10	5-6	39000		49000
Styrene	VOC	5-10	5-6	39000		49000
Total Xylenes	VOC	5-10	5-6	39000		49000

1-Includes surface water and groundwater.

2-Includes surficial soils and wastes.

3-Analyzed for TCLP volatiles, all others analyzed for TCL volatiles.

TABLE 5-8 (continued)
SAMPLE QUANTITATION LIMITS
PHASE II

MATRIX		SOIL (1)
SAMPLE-ID		ALL
PARAMETER	TYPE	RANGE(ppb)
Phenol	SEMI	680-3500
bis(2-Chloroethyl)ether	SEMI	680-3500
2-Chlorophenol	SEMI	680-3500
1,3-Dichlorobenzene	SEMI	680-3500
1,4-Dichlorobenzene	SEMI	680-3500
Benzyl Alcohol	SEMI	680-3500
1,2-Dichlorobenzene	SEMI	680-3500
2-Methylphenol	SEMI	680-3500
Bis(2-Chloroisopropyl) Ether	SEMI	680-3500
4-Methylphenol	SEMI	680-3500
N-Nitroso-di-n-Propylamine	SEMI	680-3500
Hexachloroethane	SEMI	680-3500
Nitrobenzene	SEMI	680-3500
Isophorone	SEMI	680-3500
2-Nitrophenol	SEMI	680-3500
2,4-Dimethylphenol	SEMI	680-3500
Benzoic Acid	SEMI	3300-17000
Bis(2-chloroethoxy)Methane	SEMI	680-3500
2,4-Dichlorophenol	SEMI	680-3500
1,2,4-Trichlorobenzene	SEMI	680-3500
Naphthalene	SEMI	680-3500
4-Chloroaniline	SEMI	680-3500
Hexachlorobutadiene	SEMI	680-3500
4-Chloro-3-Methylphenol	SEMI	680-3500
2-Methylnaphthalene	SEMI	680-3500
Hexachlorocyclopentadiene	SEMI	680-3500
2,4,6-Trichlorophenol	SEMI	680-3500
2,4,5-Trichlorophenol	SEMI	3300-17000
2-Chloronaphthalene	SEMI	680-3500
2-Nitroaniline	SEMI	3300-17000
Dimethylphthalate	SEMI	680-3500
Acenaphthylene	SEMI	680-3500
2,6-Dinitrotoluene	SEMI	680-3500
3-Nitroaniline	SEMI	3300-17000

1-Includes surficial soils.

TABLE 5-8 (continued)
SAMPLE QUANTITATION LIMITS
PHASE II

MATRIX		SOIL (1)
SAMPLE-ID		ALL
PARAMETER	TYPE	RANGE(ppb)
Acenaphthene	SEMI	680-3500
2,4-Dinitrophenol	SEMI	3300-17000
4-Nitrophenol	SEMI	3300-17000
Dibenzofuran	SEMI	680-3500
2,4-Dinitrotoluene	SEMI	680-3500
Diethylphthalate	SEMI	680-3500
4-Chlorophenyl-Phenyl Ether	SEMI	680-3500
Fluorene	SEMI	680-3500
4-Nitroaniline	SEMI	3300-17000
4,6-Dinitro-2-Methylphenol	SEMI	3300-17000
N-Nitrosodiphenylamine	SEMI	680-3500
4-Bromophenyl-Phenyl Ether	SEMI	680-3500
Hexachlorobenzene	SEMI	680-3500
Pentachlorophenol	SEMI	3300-17000
Phenanthrene	SEMI	680-3500
Anthracene	SEMI	680-3500
Di-n-Butylphthalate	SEMI	680-3500
Fluoranthene	SEMI	680-3500
Pyrene	SEMI	680-3500
Butylbenzylphthalate	SEMI	680-3500
3,3'-Dichlorobenzidine	SEMI	1400-7100
Benzo(a)Anthracene	SEMI	680-3500
Chrysene	SEMI	680-3500
Bis(2-Ethylhexyl)Phthalate	SEMI	680-3500
Di-n-Octyl Phthalate	SEMI	680-3500
Benzo(b)Fluoranthene	SEMI	680-3500
Benzo(k)Fluoranthene	SEMI	680-3500
Benzo(a)Pyrene	SEMI	680-3500
Indeno(1,2,3-cd)Pyrene	SEMI	680-3500
Dibenz(a,h)Anthracene	SEMI	680-3500
Benzo(g,h,i)Perylene	SEMI	680-3500

1-Includes surficial soils.

6. BASELINE HEALTH RISK ASSESSMENT

6.1 Introduction

6.1.1 Objectives and Scope

The public health risk assessment (HRA) presented in this chapter is an analysis of the potential adverse health effects caused by the release of contaminants from the Gorick Landfill site in the absence of remedial measures. As such, it may be classified as a no-action, or "baseline" health risk assessment (HRA). This baseline HRA addresses both current and reasonably foreseeable future uses of the Gorick Landfill site.

The following baseline risk assessment must be regarded as an integral part of the RI and FS for the Gorick Landfill site. It utilizes data and information provided by the site characterization activities of the RI, and in turn generates an assessment of human health risk which serves as one of the principal criteria for determining whether, and to what degree, remedial action may be required at the site as discussed in the FS.

This baseline HRA for the Gorick site is a qualitative characterization of risk. In general, this qualitative evaluation identifies exposure pathways and potentially exposed populations, and assesses the toxicity of contaminants of potential concern. In particular, the HRA includes the following major steps:

1. Selection of Chemicals of Potential Concern
2. Exposure Assessment
3. Toxicity Assessment
4. Risk Characterization

6.1.2 Site Background

The Gorick Landfill was used for disposal of construction and demolition debris from approximately 1965 to 1988, although there are reports that dumping could have begun as early as 1959.

The site is bordered on the east by Conrail railroad tracks and on the west by the Susquehanna River. A warehouse for the Link Flight Simulation Corporation and four private residences are located near the northern boundary of the site. The Town of Kirkwood Water Treatment Plant and the Town's three water supply wells are located near the site's southern boundary.

The Town of Kirkwood is the major groundwater user in the landfill area. An average of 1.1 million gallons of water per day is supplied to town residents. Analysis has shown that water supplied by these wells is contaminated with trichlorethylene and other volatile organic compounds.

Two stepped plateaus have been created on site by landfilling activities. Demolition and construction debris is exposed on the edge of the upper plateau. The surface of the landfill is sparsely vegetated and strewn with a large quantity of demolition debris.

The site is not currently being used. However, the former operator visited the site on one occasion during the RI to remove debris. Trespassing is possible, since the existing fence does not fully enclose the site, and no other security measures are being implemented to restrict access. Trespassing is thought to be minimal, however, since the site is not known to be used for any recreational purposes (e.g., fishing or hunting), nor is it a common route of pedestrian traffic.

6.2 Nature and Extent of Contamination

6.2.1 Previous Investigations

Volatile organics were first detected near the site in 1981. These were found in observation wells installed around the Town of Kirkwood Wells No. 1 and 2, as well as in the Town wells themselves. Observation wells installed by USGS at or near the landfill were sampled in 1986 and 1987. The results of this sampling led to the classification of the Gorick Landfill as a "suspected inactive hazardous waste site" (Class 2a). Additional observation wells were installed by the Town of Kirkwood in 1988. VOC concentrations of 600 and 152 ppb were detected in wells at the toe of the landfill, and a VOC concentration of 153 ppb was detected near the Town wells. In response to these findings, the site was reclassified as a "known" inactive hazardous waste site (Class 2). In 1988, the concentration of TCE was detected above the MCL in Town Well No. 3, which caused the Town to shut down this well. However, the Town has since installed an air stripper to remove TCE from the groundwater. The concentration of TCE in the raw water has generally decreased in Well No. 3 over the past two years.

6.2.2 Present Investigation

The nature and extent of contamination at the Gorick Landfill site was discussed in Chapter 4 of the RI report. This section, which is based upon Chapter 4, includes a summary discussion of each medium sampled during the RI.

Soil

Contaminants were detected in all onsite surface soil samples. The primary contaminants in these samples were PAHs. There was no significant concentration of volatiles or pesticides detected on site, with the

possible exception of somewhat elevated VOCs at SPS-8. PCBs were not detected. Only two metals, zinc and lead, were detected at levels appreciably above background. The greatest amount of contamination was detected at SPS-7. This surficial soil contamination probably results from fill that was inadequately covered and has become exposed. There appears to be no significant contamination of subsurface soils downgradient of the fill.

Waste

Samples taken in fill were predominantly contaminated by PAHs. Volatiles (TCE and BTEX) and pesticides were also detected at lesser levels. Metals (arsenic, barium, copper, mercury, and selenium) were elevated above average values for surface soils reported in the literature. A waste grease sample and a drum sample taken from test pit excavations were highly contaminated with BTEX compounds and/or 4-methyl-2-pentanone, tetrachlorethane, and chlorobenzene.

Surface Water and Sediment

Analytical results from surface water sampling indicate that the landfill is having, at most, a minimal impact on the quality of the surrounding surface water.

The landfill also appears to be having, at most, a minor impact on the sediments in the drainage channel adjacent to the site and in the Susquehanna River. Contaminants found are mainly semivolatiles (especially PAHs).

Groundwater

The landfill appears to be contaminating the groundwater downgradient of the site with volatile organic compounds, principally

trichloroethylene (TCE), 1,2-dichloroethylene (1,2-DCE), and 1,1,1-trichloroethane. To a lesser extent, the landfill is contributing metals to the downgradient groundwater, but contamination results mainly from iron and manganese, which are quickly diluted to upgradient concentrations by the large amounts of groundwater present in the aquifer. Phenols in MW-4S and MW-4I exceeded standards in the first-phase samples. However, phenols were not detected in wells located in fill. [Waste samples did show phenols.] Even though this well nest is downgradient of the site, phenols may not be attributable to the landfill. No phenols were detected in the second-phase samples for MW-4S and MW-4I.

VOCs appear to be moving northwestward toward the Susquehanna River, at least at certain times of the year, and towards the Kirkwood Town wells (in response to pumping) from the landfill. Data show that the landfill is the source of VOC contamination migrating toward the Town wells, since VOC contamination is not found to the north. south, or east of the site or in the Susquehanna River upstream of the site. Groundwater flow directions thus indicate that the landfill is the source.

6.3 Chemicals of Potential Concern

Data from all media were evaluated to identify chemicals of potential concern for the Gorick Landfill. The first step in the selection process was to determine which chemicals were attributable to the site. For instance, chemicals considered attributable to background sources (e.g., phenols in groundwater) were eliminated from consideration. Additional criteria utilized to select chemicals of potential concern included the following:

- Frequency of detection and concentration
- Toxicity
- Comparison with SCGs
- Mobility, persistence, and bioaccumulation

Based on these criteria, chemicals of potential concern were selected as discussed below.

6.3.1 Groundwater

Chemicals of potential concern in groundwater include 1,2-DCE, TCE, and 1,1,1-trichloroethane. Other organic compounds were detected infrequently and at low concentrations. Iron and manganese are the only metals that are found at significantly greater concentrations than background and above groundwater standards. These metals are expected to be rapidly diluted downgradient of the site and are not considered toxic metals, therefore, they were not considered chemicals of concern.

6.3.2 Soil/Waste

Chemicals of potential concern for soil/waste include primarily those chemicals detected in the surface soil samples, since the potential for exposure is limited to contact with surface contamination. Chemicals of concern in surface soil/waste include naphthalene, 2-methylnaphthalene, acenaphthylene, acenaphthene, dibenzofuran, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, butylbenzylphthalate, benzo(a) anthracene, chrysene, bis(2-ethylhexyl)phthalate, di-n-octylphthalate, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, benzo(g,h,i)perylene, and lead. All these chemicals of potential concern in soil/waste are PAHs, except for dibenzofuran, butylbenzylphthalate, bis(2-ethylhexyl)phthalate, di-n-octylphthalate and lead.

6.3.3 Surface Water and Sediments

There are no chemicals of potential concern for surface water since the landfill is having, at most, a minimal impact upon water quality. Chemicals of potential concern in sediments include naphthalene,

acenaphthylene, acenaphthene, dibenzofuran, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, and benzo(g,h,i)perylene. All these chemicals are PAHs, except for dibenzofuran. These chemicals are similar to chemicals of potential concern in soil; however, in general, the concentration and frequency of detections are lower in sediments than in soil. [It should be noted that although contaminants of concern have been identified in sediments, sediment contamination is not discussed in subsequent sections pertaining to human health risk since exposure to sediments is not considered a pathway of concern for humans.]

6.4 Exposure Assessment

The purpose of this exposure assessment is to identify potential exposure pathways and exposed populations. The assessment discusses exposure under both existing and potential future use conditions. The following sections are predicated on the assumption that site conditions remain as they are into the foreseeable future.

6.4.1 Exposure Pathways

An exposure pathway is the mechanism by which an individual or population is exposed to contaminants at or originating from a site. Each pathway includes: a source of contamination; a medium (e.g., groundwater) by which the contaminants might move from their place of deposition to an environmental or human receptor; a human or environmental receptor; and a likely route of exposure (e.g., ingestion).

A. Current Land Use

1. Groundwater - Residents of the Town of Kirkwood are currently utilizing, as a source of potable water, groundwater from 3

wells (only 2 currently usable) located approximately 100 to 300 feet southwest of the landfill. Contamination has been detected in these Town wells. This probably originated from the Gorick Landfill site. These wells supply water to approximately 5,000 to 6,000 residents of the Town. A residential well is found just north of the site. It is apparently still in use. This well is not likely to be contaminated by the landfill, however, based on second-phase sampling results north of the site.

2. Soil/Waste - Local residents or workers in the nearby industrial facilities could be exposed to site contamination by trespassing on site. All exposures would result from direct contact with the soil/waste, and subsequent incidental ingestion or dermal adsorption of contaminants. Such exposure is expected to be infrequent, since the site is not known to be used for recreational purposes (e.g., hunting) or to be on a common route of pedestrian traffic. The exposure frequency would be conservatively estimated to be 50 days per year.

B. Future Use

1. Groundwater - Groundwater from the Town wells is expected to remain a source of drinking water for Town residents into the foreseeable future.

2. Soil/Waste - If the site were utilized for commercial, industrial, or residential development, exposure frequency would be expected to increase. This exposure frequency could be as high as 365 days per year. However, there are no known plans for such development of the site.

6.4.2 Exposure Concentrations

The exposure concentration is the concentration of a chemical of potential concern at the point where it comes into contact with a receptor. Exposure concentrations are not quantified in this study. They are, however, discussed in general below.

A. Groundwater

TCE contamination has been monitored in the Town wells since 1981. The highest reported TCE concentration in these wells was 35 ppb in Well No. 3 (May 1988). Raw water from Well No. 3 has decreased to single-digit (ppb) levels in recent years.

B. Soil/Waste

Exposure concentration for soil/waste is the actual concentration detected in surface soil or waste. In general, the average concentration from all samples of surface soil and waste for each chemical of potential concern is used in the risk assessment. However, since risk will not be quantified in this baseline HRA, these average concentrations have not been computed.

6.5 Toxicity Assessment

The chemicals of potential concern identified at the Gorick Landfill site may be categorized by their relative health risks. Risks are divided into carcinogenic and noncarcinogenic effects, with noncarcinogenic chemicals further subdivided into chronic and subchronic categories. USEPA has defined toxicity constants to be used in evaluating these risks.

For evaluating carcinogenic risk from exposure to contaminants, a slope factor (SF) has been established. The SF is a plausible upper-bound

estimate of the probability of a response per unit intake of a chemical over a lifetime. SFs are developed for oral intake and inhalation routes of exposure.

For evaluating noncarcinogenic effects from exposure to contaminants, the toxicity constants used are the reference dose (RfD) and reference concentration (RfC). Specific values are developed for chronic and subchronic RfDs and RfCs.

Chronic RfDs are derived from the No-Observed-Adverse-Effect-Level (NOAEL) for the critical toxic effect, and modified by application of uncertainty factors, reflecting the type of study on which the values are based. RfDs are used to estimate risk from oral or dermal routes of exposure.

Chronic RfCs are derived in a similar fashion, but are based upon studies of inhalation exposure. For this reason, calculation of RfCs is more complex, and therefore RfCs are available for fewer chemicals.

Subchronic values for RfD and RfC are derived in the same fashion as the chronic values when suitable less-than-lifetime studies are available.

6.5.1 Carcinogenic Effects

Table 6-1 summarizes toxicity information for potentially carcinogenic chemicals found in samples collected at the Gorick Landfill site. For each of these compounds, the following information is provided:

1. Weight of evidence for carcinogenicity expresses the degree of confidence relating to exposure to a given chemical and the likelihood that the chemical causes cancer in humans. This weight of evidence is based upon the following USEPA classification system:

TABLE 6-1

TOXICITY VALUES: POTENTIAL CARCINOGENIC EFFECTS

CHEMICAL	SLOPE FACTORS (mg/kg-day)^-1		WEIGHT-OF-EVIDENCE		TUMOR SITE		REFERENCE / SOURCE		DATE RECORDED INHAL/ORAL
	INHALATION	ORAL	INHALATION	ORAL	INHALATION	ORAL	INHALATION	ORAL	
Benzo(a)anthracene (a)	6.10E+00	1.15E+01	B2	B2	Respiratory	Stomach	SPHEM	SPHEM	1986
Benzo(a)pyrene	6.10E+00	1.15E+01	B2	B2	Respiratory	Stomach	SPHEM	SPHEM	1986
Benzo(b)fluoranthene (a)	6.10E+00	1.15E+01	B2	B2	Respiratory	Stomach	SPHEM	SPHEM	1986
Benzo(k)fluoranthene (a)	6.10E+00	1.15E+01	B2	B2	Respiratory	Stomach	SPHEM	SPHEM	1986
Bis(2-ethylhexyl)phthalate	ND	1.40E-02	B2	B2	NA	Liver	IRIS	IRIS	5-90
Butylbenzylphthalate	NA	NA	NA	C	NA	NA	HEAST	IRIS	4-FY90/2-89
Chrysene (a)	6.10E+00	1.15E+01	B2	B2	Respiratory	Stomach	SPHEM	SPHEM	1986
Dibenzo(a,h)anthracene (a)	6.10E+00	1.15E-01	B2	B2	Respiratory	Stomach	SPHEM	SPHEM	1986
Indeno(1,2,3-cd)pyrene (a)	6.10E+00	1.15E+01	B2	B2	Respiratory	Stomach	SPHEM	SPHEM	1986
Lead	NA	NA	B2	B2	NA	NA	IRIS	IRIS	2-89
Trichloroethene	1.70E-02	1.10E-02	B2	B2	Lung	Liver	HEAST	HEAST	4-FY90

Notes:

NA - Not applicable.

IRIS - Integrated Risk Information System. Date indicates last update by EPA. Access to IRIS was March, April 1991.

HEAST - Health Effects Summary Tables. Date indicates quarter and fiscal year for which table was published.

SPHEM - Superfund Public Health Evaluation Manual, USEPA 1986.

a - Toxicity values for Benzo(a)pyrene were used for all carcinogenic PAHs when data were otherwise unavailable.

ND - Not determined.

Group A-Human Carcinogen

This category indicates that there is sufficient evidence from epidemiological studies to support a causal association between an agent and cancer in humans.

Group B-Probable Human Carcinogen

This category generally indicates that there is at least limited evidence from epidemiological studies of carcinogenicity to humans (Group B1) or that, in the absence of positive data on humans, there is sufficient evidence of carcinogenicity in animals (Group B2).

Group C-Possible Human Carcinogen

This category indicates that there is limited evidence of carcinogenicity in animals in the absence of positive human data.

Group D-Not Classified

This category indicates that there were no data to evaluate or that the evidence for carcinogenicity in humans and in animals was inadequate.

Group E-No Evidence of Carcinogenicity to Humans

This category indicates that there is no evidence of carcinogenicity in at least two adequate animal tests in different species or in both epidemiological and animal studies.

2. Slope factor, or cancer potency factor, represents a plausible upper-bound estimate of the probability of a response per unit intake of a chemical over a lifetime. This slope factor allows the calculation of the incremental lifetime cancer risk associated with exposure to the chemical at a known or estimated dosage. Table 6-1 provides separate slope factors, where applicable and available, for oral and inhalation routes of exposure. [In the absence of published slope factors for dermal routes of exposure, the oral slope factor is applied to estimate cancer risk associated with dermally adsorbed chemical doses.]

3. References, including source(s) and date(s), are provided to indicate the basis for identified slope factors.

4. Tumor site, i.e., type of cancer upon which the slope factor and weight of evidence are based.

6.5.2 Noncarcinogenic Effects

Unlike carcinogenic compounds, noncarcinogenic compounds are thought to have threshold dosage levels below which adverse effects are not expected. This section provides information concerning these threshold levels.

Table 6-2 summarizes toxicity information for the noncarcinogenic chemicals which were detected at the Gorick Landfill site. [Note that some chemicals have both carcinogenic and noncarcinogenic effects, and are therefore listed in both Table 6-1 and Table 6-2.] For each of the chemicals in Table 6-2, the following information is provided separately for oral and inhalation routes of exposure, where appropriate:

TABLE 6-2

TOXICITY VALUES: POTENTIAL NONCARCINOGENIC EFFECTS

CHEMICAL	TOXICITY VALUES (mg/kg-day)				CRITICAL EFFECT				REF/SOURCE				DATE RECORDED
	SUBCHRONIC		CHRONIC		SUBCHRONIC		CHRONIC		SUBCHRONIC		CHRONIC		
	INHALATION Rfc	ORAL Rfd	INHALATION Rfc	ORAL Rfd	INHALATION Rfc	ORAL Rfd	INHALATION Rfc	ORAL Rfd	INHALATION Rfc	ORAL Rfd	INHALATION Rfc	ORAL Rfd	Inhal/Oral
Acenaphthene	ND	6.00E-01	ND	6.00E-02	NA	Hepatotoxicity	NA	Hepatotoxicity	HEAST	HEAST	HEAST	IRIS	4-FY90/FY91
Acenaphthylene (a)	ND	4.00E-02	ND	4.00E-03	NA	Decreased BW	NA	Decreased BW	HEAST	HEAST	HEAST	HEAST	4-FY90
Anthracene	ND	3.00E+00	ND	3.00E-01		Decreased BW		Decreased BW	HEAST	HEAST	HEAST	IRIS	4-FY90/FY91
Benzo(g,h,i)perylene (a)		4.00E-02		4.00E-03		Decreased BW		Decreased BW	HEAST	HEAST	HEAST	HEAST	4-FY90
Bis(2-ethylhexyl)phthalate (b)	ND	2.00E-02	ND	2.00E-02	NA	Liver	NA	Liver	HEAST	HEAST	HEAST	IRIS	4-FY90/9-89
Dibenzofuran	Data inadequate for quantitative risk assessment (HEAST)												
cis-1,2-Dichloroethene	ND	1.00E-01	ND	1.00E+02	NA	Blood	NA	Blood	HEAST	HEAST	HEAST	IRIS	4-FY90/1-89
Di-n-octylphthalate	ND	2.00E-02	ND	2.00E-02	NA	Kidney,Liver	NA	Kidney,Liver	HEAST	HEAST	HEAST	HEAST	4-FY90
Fluoranthene	ND	4.00E-01	ND	4.00E-02	NA	Liver	NA	Liver	HEAST	HEAST	HEAST	IRIS	FY91
Fluorene	ND	4.00E-01	ND	4.00E-02	NA	Liver	NA	Liver	HEAST	HEAST	HEAST	IRIS	FY91
Lead (b)	ND	ND	ND	ND	NA	NA	CNS	CNS	HEAST	HEAST	HEAST	IRIS	4-FY90/2-91
2-Methylnaphthalene (a)		4.00E-02		4.00E-03		Decreased BW		Decreased BW	HEAST	HEAST	HEAST	HEAST	4-FY90
Naphthalene	ND	4.00E-02	ND	4.00E-03	NA	Decreased BW	NA	Decreased BW	HEAST	HEAST	HEAST	HEAST	4-FY90
Phenanthrene (a)		4.00E-02		4.00E-03		Decreased BW		Decreased BW	HEAST	HEAST	HEAST	HEAST	4-FY90
Pyrene	ND	3.00E-01	ND	3.00E-02	NA	Kidney	NA	Kidney	HEAST	HEAST	HEAST	HEAST	4-FY90
1,1,1-Trichloroethane	3.00E+00	9.00E-01	3.00E-01	9.00E-02	Liver	Liver	Liver	Liver	HEAST	HEAST	HEAST	IRIS	4-FY90/9-90

a - Toxicity values based on Oral Rfd for naphthalene (HEAST 4-FY90).

b - Refer to Table 6-21 for carcinogenic effects.

IRIS - Integrated Risk Information System. Date indicates when last updated by EPA. Access to IRIS was March, April and August 1991.

HEAST - Health Effects Summary Tables. Date indicates quarter and fiscal year for which table was published.

BW - Body Weight

CNS - Central Nervous System.

ND - Not Determined.

NA - Not Applicable.

1. Toxicity Value, expressed in mg/kg/day for noncarcinogenic chemicals, generally identified the threshold dosage level below which adverse health effects are not expected. The most common and preferred criterion for expressing potency is the reference dose (Rfd), which is an estimate of the average daily exposure level below which significant, adverse non-carcinogenic health effects are not expected.

2. Source(s) of dose-response data.

3. Date(s) of source information.

4. Critical Effect expresses the end point of adverse response (e.g., liver damage) associated with the exposure to noncarcinogenic chemicals.

6.5.3 Chemicals for Which No Values Are Available

Some chemicals, although identified as being chemicals of potential concern at the Gorick Landfill site, lack published toxicity values. These chemicals include one carcinogen (butylbenzylphthalate), one noncarcinogen (dibenzofuran), and one substance with both carcinogenic and noncarcinogenic effects (lead).

6.5.4 Toxicity Profiles

For each contaminant, a toxicity profile has been prepared that summarizes physical and chemical as well as toxicological information. Various sources were consulted for this information, and citations are given where appropriate. These profiles are presented in Appendix P.

6.6 Risk Characterization

6.6.1 Method of Analysis

The following sections describe the carcinogenic and noncarcinogenic risks posed by the Gorick Landfill site under current conditions, (i.e., in the absence of any additional remedial measures).

In accordance with USEPA policy, the toxic effects of noncarcinogens are not considered possible unless the threshold level of exposure for the chemical is exceeded. As a result, a range of exposures exists from zero to some finite value that can be tolerated with essentially no adverse effects. Evaluation of noncarcinogenic risk involves the comparison of the exposure level (or dose) to the estimated threshold level (toxicity value). The term used to make this comparison is the "Hazard Index": which is defined as:

$$\text{Hazard Index} = \frac{\text{Exposure Level (Intake or Adsorbed Dose) (mg/kg/day)}}{\text{Toxicity Value (mg/kg/day)}}$$

According to USEPA, a concern for potential non-carcinogenic health effects exists when the Hazard Index exceeds unity (1.0).

The effects of carcinogens are referred to as "nonthreshold", because there is believed to be essentially no level that does not pose a probability, however small, of causing cancer, (i.e., no dose is totally risk-free). Carcinogenic risk is expressed as the incremental lifetime cancer risk, (i.e., the probability of developing cancer over a 70-year lifetime) that could be experienced by an individual or population exposed to carcinogenic contaminants at the Gorick Landfill site. It is calculated by the following equation:

$$\text{Cancer Risk} = \text{Exposure Level (mg/kg/day)} \times \text{Slope Factor (mg/kg/day)}^{-1}$$

Incremental lifetime cancer risk is dimensionless. A risk of 1.0E-06 for example, indicates that an individual would incur an additional risk of 0.000001 (or 1 in one million) due to his/her exposure to contaminants at a given site. Alternatively, out of a population of one million persons so exposed, this risk would indicate that one person, on average, would contract cancer due to such exposure.

Through its National Oil and Hazardous Substances Pollution Contingency Plan (NCP), USEPA has established acceptable exposure levels for known or suspected carcinogens that are to be used to establish remedial action objectives. The acceptable exposure levels are concentration levels that represent a lifetime cancer risk of 1.0E-06 to 1.0E-04.

As shown in the above equations, health risk is a function of both human exposure and chemical toxicity. Toxicity values for chemicals of potential concern are presented in Section 6.5. Exposure levels are discussed qualitatively in Section 6.4. Since exposure levels have not been quantified, risk is discussed only qualitatively below.

6.6.2 Carcinogenic Risk

A. Ingestion of Groundwater

Risk via this exposure pathway is considered the most significant risk at the site since 5,000 to 6,000 people are affected by groundwater contamination. Carcinogenic risk associated with groundwater results almost entirely from the presence of TCE. Recent analytical results have indicated that the TCE concentrations have decreased in the Town wells. However, there have been numerous exceedances of the MCL of 5 ug/l (ppb) for TCE in recent years. Consequently, groundwater contamination should be considered a threat to human health in the absence of remediation. Since Town wells are expected to be used to supply drinking water to Town

residents for the foreseeable future, and although air strippers are being installed as an interim remedial measure to protect the water supply, the threat to human health may remain unless further remedial measures are undertaken.

B. Ingestion of Soil

The absolute risk associated with soil ingestion is expected to be comparable to ingestion of groundwater. However, risk associated with this pathway is considered to be much less significant than the ingestion of groundwater, because the population potentially exposed via this pathway is expected to be very small. Carcinogenic risk is almost exclusively attributable to carcinogenic PAHs, since the PAHs are more prevalent than other compounds and because the slope factor for PAHs is much higher than for the other compounds detected in soil. Generally, children are considered at greater risk via the ingestion of soil route because their average rate of ingestion is expected to be higher; however, trespassing on site by young children age 0-6 is considered even less likely than by older children or adults. Risk via ingestion of soil would increase in the future only if the site were used for residential or commercial development. There are no known plans for such development of this site.

C. Dermal Contact with Soil

Dermal contact with soil is the pathway that is expected to contribute least to the overall cancer risk. As with soils ingestion, PAHs are the major contributors to risk via dermal contact. However, exposure levels are expected to be lower, particularly since PAHs are not readily adsorbed by skin tissue.

6.6.3 Chronic Health Effects

A. Ingestion of Groundwater

Both 1,2-DCE and 1,1,1-trichloroethane have been found in excess of their respective MCLs in onsite wells. Only 1,2-DCE has been detected in the Town wells. Based on data collected to date, the hazard index for ingestion of groundwater is not expected to exceed the acceptable level of one.

B. Ingestion of Soil

PAHs are the major contributors to the index for soil ingestion. However, this hazard index is not expected to exceed the acceptable level of one, even under the assumption of development of the site in the future.

C. Dermal Contact with Soil

PAHs are the major contributors to the hazard index for dermal contact with soil. The hazard index for dermal contact is not expected to exceed the acceptable value of one even under the assumption of future site development.

6.7 Summary and Conclusions

The three major pathways of human exposure to contaminants from the Gorick Landfill site are ingestion of groundwater, ingestion of surficial soil/waste, and dermal contact with surficial soil/waste. Risk associated with human exposure to contaminants in soil and groundwater is limited to cancer risk. Chronic health effects (resulting from exposure to contaminants in groundwater and surficial soil/waste) are not a concern, since the chronic hazard index is expected to be below the USEPA

acceptable value of one. Cancer risk associated with ingestion of groundwater is almost entirely a result of TCE contamination. Cancer risk associated with ingestion and dermal contact with soil is almost entirely a result of PAH contamination. Although the absolute risk of ingestion of groundwater and ingestion of soil are expected to be comparable, groundwater is considered a much more significant health threat, since the population potentially exposed to groundwater contamination is much larger than the population potentially exposed to the soil contaminants. Dermal contact with soil is considered less significant than ingestion of soil, since the intake level for this pathway is expected to be less than for the ingestion pathway.

PAHs present in surficial soil/waste at the site represent a potential cancer risk. However, the elevated levels of PAHs in surface soils in the northern part of the landfill are not linked to the groundwater problem, and are not classified as a hazardous waste. Therefore, remediation cannot be addressed under the inactive hazardous waste remedial program. Consequently, the FS will concentration on options addressing groundwater remediation.

6.8 Environmental Impact

As has been discussed, the major pathway presenting a potential threat to humans is the groundwater pathway. With respect to aquatic animals, however, the groundwater pathway presents a potential threat only during the limited periods when groundwater appears to be influent to the Susquehanna River. [Aquatic animals of primary concern are those fish species listed in Table 3-2.] No substantial threat to terrestrial species exists from the groundwater pathway.

The only potential threat to aquatic species that will be examined here is that associated with surface water and river sediments. In looking at the potential impact to aquatic animals in the vicinity of the

landfill, SCGs of both surface water and sediment were reviewed. As shown in Table 5-6, surface water SCG exceedances occur for 2 organic compounds and 2 metals, in addition to cyanide, phenols, and sulfide. Sediment cleanup criteria exceedances occur for 3 organics, all PAHs (Table 5-7).

The most apparently serious exceedances are the metals in the water. The potential threat from this source may be dismissed, however, on two counts: (1) Analysis for metals was carried out on unfiltered samples. This means that a certain portion of the metals detected in the water column samples were those existing in association with suspended sediments or organic material. It is possible that levels of dissolved metals alone (the species responsible for toxicity) may not have exceeded surface water SCGs. (2) The highest values occurred at SW-1, upstream of the site. In the case of zinc, this upstream site was the only place where SCGs for zinc were exceeded.

PAH levels, although exceeding SCGs, are relatively low. Concentrations of the two phthalates detected are also relatively low. None of these compounds is acutely toxic, although some are carcinogenic and may bioaccumulate. In any case, it is not possible to determine long-term effects of these substances at such low concentrations.

Sulfides, probably attributable to decomposition of organic materials, are not considered to be responsible for any serious environmental impact.

Cyanide and phenols, both of which can occur naturally, have varying levels of toxicity, cyanide being several times more toxic than phenols. Again, however, levels are low, and long-term effects at these levels are difficult to quantify. It is noteworthy that, since TCL chlorinated phenols were not detected at this site, the phenolic fraction measured as total phenols was the less toxic non-chlorinated fraction.

It is possible that terrestrial animals living in the landfill vicinity may also be at risk because of contamination caused by the landfill. The nature of the risk to such animals is expected to be virtually the same as that posed to humans living in the vicinity of the site.

7. SUMMARY AND CONCLUSIONS

The Remedial Investigation for the Gorick Landfill site was intended to characterize the physical, geological, hydrogeological, chemical, and environmental factors unique to the site. This, in turn, allows a definition of the source, nature, and extent of contamination at the site so that a Feasibility Study can be performed to determine and evaluate various alternatives for the remediation of the site. To accomplish this, a two-phased investigation was carried out during 1990 and 1991. The conclusions reached about the site are summarized below:

- The general geologic picture of the site is a construction-demolition debris landfill that has been placed in an old gravel pit, next to the Susquehanna River. Site stratigraphy is fill or floodplain deposits overlying a highly productive valley-fill aquifer (sands and gravels), which in turn overlies a thick till deposit. Below the till, shale bedrock is reported, which may be used for domestic wells.

- The fill is mostly construction and demolition debris. Quantities of a "foundry-ash-like" material, however, were found in various places. Numerous drums are found within the fill, but most are crushed and appear empty. A few were found full of grease and "blue and white solid (lacquer ?)." Trace residues of a blackish-brown resin type waste were also found in one test pit. This resin type waste and the black/white solid material contained significant quantities of organic solvents, but not TCE or the other organic compounds found in significant quantities in the groundwater.

- The sand and gravel aquifer has a hydraulic conductivity of 10^{-2} cm/sec and ranges in thickness from absent on the east

side of the site to approximately 60 feet near the Susquehanna River.

- The till unit underlying the sand and gravel aquifer appears to be a competent aquitard and should prevent significant downward migration of contaminants to the bedrock.

- Groundwater flow in the area is from east of the site towards the Susquehanna River. Superposed on this flow is the cone of depression formed by the combined pumping of the Town of Kirkwood's well field and the constant 150 to 190 gpm withdrawal by the AP&P well. These wells form a groundwater sink for most of the groundwater in the area. The source of much of this water is induced infiltration from the Susquehanna River.

- A USGS modeling study completed in 1986 predicts that at low flow, 58 percent of the pumped water is from the Susquehanna River (induced infiltration), 32 percent from the Conklin side of the river, 5 percent from beneath the landfill, and 5 percent from the remaining portion of the Kirkwood side of the river. However, extreme sensitivity of the model to the estimated riverbed conductivity causes this prediction to be open to question (i.e., the Susquehanna's contribution ranges from 10 to 70 percent when varying the riverbed conductivity one order of magnitude in either direction).

- Due to pumping withdrawals by the Town of Kirkwood and the AP&P plant, the Susquehanna River does not receive groundwater flow from much of the site for much of the year. Instead, induced infiltration causes the river to flow towards the site. The exception is the northwest portion of the site,

from approximately MW-6S north, where the flow is from the site to the river and the aquifer under the river for at least part of the year. However, groundwater inflows to the river are not expected to be large because of the flat gradients. Additionally, flow may partially resume towards the river, and aquifer under the river, during those periods when the Kirkwood wells are shut down during maintenance or slow periods for water demand.

- The landfill are is a recharge area for the valley-fill aquifer. Due to the poor vegetative growth on its surface and its relatively flat surface, with only minor amounts of rainfall running off the surface, approximately 12 to 15 inches of precipitation flow through it as recharge to the valley-fill aquifer. This amounts to approximately 6 to 7.5 million gallons of recharge per year.

- Groundwater flow in the aquifer is predominantly horizontal and dominated by the large withdrawals of water from the intermediate depths of the aquifer, where the pumping well screens are located. These withdrawals from the intermediate zones act to draw water, and thus contamination, downwards from the water table into the intermediate zones.

- Groundwater frequently contacts the fill as high river levels during flooding or higher flow periods cause groundwater to back up under and into the fill. Heavy rains, with attendant high recharge rates to the water table, can also contribute to the water table rising into the fill. This impacts the spread of landfill contaminants by allowing contaminants to more readily move into the groundwater.

- Surface soils on the site are contaminated with polynuclear aromatic hydrocarbons (PAHs), but no hazardous wastes were identified. These surface soils containing elevated levels of PAHs seem to be concentrated in the northern section of the landfill. The PAHs may have been derived from a variety of sources, but foundry wastes asphalt, and combustion by-products are most likely. The waste is inadequately covered in most areas of the site. Debris is scattered across the site.

- The site is not causing significant surface water contamination, nor were the sediments in the river or the drainage ditch found to be significantly contaminated.

- Significant groundwater contamination exists beneath the fill and downgradient of the landfill. The contaminants found were largely volatile organics [predominantly trichloroethene (TCE), 1,2-dichloroethene (1,2-DCE), and 1,1,1-trichloroethane (TCA)], but some metals were also migrating. TCE, 1,2-DCE, and TCA levels ranged up to 310 ug/l, 260 ug/l, and 57 ug/l, respectively. The monitoring wells completed in the intermediate depths of the aquifer generally showed the most contamination, due to the Town wells drawing mainly from these intermediate depths, and thus drawing contamination down into this zone.

- Water table contamination was not a good indicator of contamination at depth.

- VOC contamination generally decreases towards the Town wells (because of dilution), but samples of the raw water from Town Well No. 3 showed 4 ug/l TCE and 3 ug/l 1,2-DCE during both

events. Previous sampling has shown TCE levels up to 35 ug/l in Town Well No. 3.

- Sampling has shown no VOC contamination north, east, or south of the site in either the shallow or intermediate depths of the aquifer. Sampling of the Susquehanna River showed no VOCs, nor did sampling in MW-14I and MW-14D reveal landfill-related contaminants. Therefore, the landfill must be the source of the VOC contamination. Based on the distribution of VOCs in the monitoring wells, the source area of VOC contamination appears to lie within the north central portion of the landfill.

- The quantitative health risk assessment concluded that there are three major potential pathways of human exposure to contaminants at the site: groundwater ingestion, ingestion of surficial soil/waste, and dermal contact with surficial soil/waste. The human risks are limited to cancer risks (mainly from TCE in the groundwater, and PAHs in the surface soil), since chronic noncarcinogenic health effects are not a concern. The health impact from the surface soil is based on general long-term exposure. The groundwater ingestion route is expected to be the most significant health threat. However, the existing air stripper, installed as an Interim Remedial Measure at the Kirkwood Water Treatment Plant, is reducing the health risk resulting from groundwater ingestion to an acceptable level.

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