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# REVISED FINAL REMEDIAL INVESTIGATION REPORT

# VOLUME 1
# AND
# REMEDIAL INVESTIGATION ADDENDUM

# VIRGIN ISLAND CHEMICAL SITE
# ST. CROIX, U.S. VIRGIN ISLANDS

**Prepared for :**

## BERLEX LABORATORIES INC.
## PHARMACIA & UPJOHN

**PROJECT No. 003-6016**

**OCTOBER 2000**

303359

# REVISED FINAL REMEDIAL INVESTIGATION REPORT

**Virgin Island Chemical Site**
**St. Croix, U.S. Virgin Islands**

**VOLUME I**
**TEXT, TABLES, AND FIGURES**
**AND**
**REMEDIAL INVESTIGATION ADDENDUM**

*Prepared For:*

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**October 2000**

DISTRIBUTION:

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1 Copy – Berlex Laboratories, Inc.
1 Copy – Pharmacia & Upjohn
1 Copy – VIDPNR
2 Copies – Golder Associates Inc.

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October 6, 2000

Project No.: 003-6016

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RE: REVISED FINAL REMEDIAL INVESTIGATION REPORT, VOLUME I
VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

Dear Ms. Kwan:

On behalf of Berlex Laboratories, Inc. and Pharmacia & Upjohn, Golder Associates Inc. (Golder) is pleased to provide four (4) copies of the Revised Final Remedial Investigation (RI) Report, Volume I, for the Virgin Island Chemical Site located in St. Croix, U.S. Virgin Islands. This Revised Final RI Report consists of Volume I of the Final RI Report prepared by McLaren/Hart in February 2000, with the following revisions:

- Incorporation of the RI Addendum submitted by Golder in July 2000 and revised based on USEPA's comments dated August 1, 2000. As we discussed, the RI Addendum is appended in its entirety to this Report. The text of the Revised Final RI Report has been modified to reference the RI Addendum and the associated field activities and results;
- Revisions to the text (e.g., Executive Summary, Section 6.0) to reflect the recently revised calculations for the Human Health Risk Assessment (HHRA);
- Modifications to the text regarding analytical results for acetone and methylene chloride, consistent with the language presented by Golder in the Draft FS Report. The figures portraying acetone and methylene chloride plumes at the Site (i.e., Figures 4-14. 4-15, and 4-17 in the Final RI Report) have been removed; and,
- Where appropriate, sections of the Revised Final RI Report that have not materially changed from the Final RI Report remain attributed to McLaren/Hart. The remainder of the Report is unattributed.

As we discussed, Golder will submit the final HHRA (i.e., Appendix J of the RI Report) under separate cover following EPA's review of the revised text for the Uncertainty Section. The final HHRA will be submitted in a format for direct insertion into the existing Volume II binder.

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If you have any questions, please do not hesitate to contact Terry Grimmer of Berlex (510-262-5495), Bill Gierke of P&U (616-833-2017), or either of the undersigned.

Very truly yours,

GOLDER ASSOCIATES INC.

Susan A. Sciarratta, P.E.
Project Manager

P. Stephen Finn, C.Eng.
Principal

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Enclosures

cc: Terry Grimmer, Berlex Laboratories
William Gierke, Pharmacia & Upjohn
Syed Syedali, VIDPNR

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### List of Acronyms

| | |
|---|---|
| AET | apparent effects threshold |
| amsl | above mean sea level |
| AOC | Administrative Order on Consent |
| ARARS | applicable or relevant and appropriate requirements |
| AST | aboveground storage tank |
| BEHP | bis(2-ethylhexyl)phthalate |
| Berlex | Berlex Laboratories, Inc. |
| bgs | below ground surface |
| BRA | Baseline Risk Assessment |
| BSAF | Biota-Sediment Accumulation Factor |
| BTEX | benzene, toluene, ethylbenzene, and xylene |
| Caribe | Caribe Chemical Company |
| CDM Federal | CDM Federal Programs Corporation |
| CEC | cation exchange capacity |
| CERCLA | Comprehensive Environmental Response, Compensation, & Liability Act |
| CHS | CHS Holding Corporation |
| CHS, Inc. | Charles H. Steffey, Inc. |
| CLP | Contract Laboratory Program |
| COC | constituent of concern |
| Cooper | Cooper Laboratories, Inc. |
| COPC | chemical of potential concern |
| COPEC | chemicals of potential ecological concern |
| Cy | cubic yard |
| DAF | Dilution Attenuation Factor |
| DO | dissolved oxygen |
| DQO | data quality objective |
| EPA | U.S. Environmental Protection Agency |
| ERL | Effects Range - Low |
| ERM | Effects Range - Median |
| ESI | Enviro-Sciences, Inc. |
| FID | flame ionization detector |
| G&M | Geraghty & Miller, Inc. |
| GC | gas chromatograph |
| gpd | gallons per day |
| gpm | gallons per minute |
| HHRA | Human Health Risk Assessment |
| HLA | Harding Lawson Associates |
| Houston Chemical | Houston Chemical Industries, Inc. |
| HAS | hollow-stem auger |
| Inland | Inland Chemical Company |
| Island Chemical | Island Chemical Company |

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## List of Acronyms (continued)

| | |
|---|---|
| LEL | Lowest Effect Level |
| LOAEL | Lowest Observed Adverse Effects Level |
| MCL | Maximum Contaminant Level |
| MCLG | Maximum Contaminant Level Goal |
| McLaren/Hart | McLaren/Hart, Inc. |
| MDL | method detection limit |
| MGW | migration to groundwater |
| MOE | Ministry of the Environment |
| MS | mass spectrometer |
| msl | mean sea level |
| NCP | National Contingency Plan |
| NOAA | National Oceanic and Atmospheric Administration |
| NOAEL | No Observed Adverse Effects Level |
| NPL | National Priorities List |
| NUS | Halliburton NUS Environmental Corporation |
| PA | Preliminary Assessment |
| PCB | polychlorinated biphenyl |
| Phillip | Phillip Brothers Chemicals, Inc. |
| PID | photoionization detector |
| Pierrel | Pierrel America, Inc. |
| POLREP | Pollution Reports |
| ppb | parts per billion |
| ppm | parts per million |
| PRP | potentially responsible party |
| PVC | polyvinyl chloride |
| QA/QC | quality assurance/quality control |
| QG | quinidine gluconate |
| QS | quinine sulphate |
| RAO | remedial action objective |
| RBC | risk-based concentration |
| RCRA | Resource Conservation and Recovery Act |
| redox | reduction/oxidation |
| RI/FS | Remedial Investigation/ Feasibility Study |
| RPD | relative percent difference |
| RSD | relative standard deviation |
| SCS | Soil Conservation Service |
| SEL | Severe Effects Level |
| SERA | Screening Ecological Risk Assessment |
| SI | Site Investigation |
| SSL | Soil Screening Level |
| SVOC | semivolatile organic compound |
| TAL | Target Analyte List |

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## List of Acronyms (continued)

| | |
|---|---|
| TCC | Target Compound List |
| TCE | trichloroethene |
| TDS | total dissolved solids |
| TEX | toluene, ethylbenzene, and total xylenes |
| TIC | top of inner casing |
| TOC | total organic carbon |
| TpOC | top of outer casing |
| TTAL | Treatment Technique Action Level |
| UCL | Upper Confidence Level |
| USGS | U.S. Geological Survey |
| VICHEM | Virgin Island Chemical |
| VIDPNR | Virgin Islands Department of Planning and Natural Resources |
| VIPA | Virgin Islands Port Authority |
| VOC | volatile organic compound |
| WAPA | Water and Power Authority |
| WIDNRSQC | Wisconsin Department of Natural Resources Sediment Quality Criteria |

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# EXECUTIVE SUMMARY

## ENVIRONMENTAL SETTING

The Virgin Island Chemical (VICHEM) Site (hereinafter referred to as the "VICHEM Site" or "the Site") is an approximate 32-acre property located on Plot 13Q of Estate Bethlehem Middle Works off of Melvin Evans Highway in the south-central portion of St. Croix in the U.S. Virgin Islands. The Site is in a lowland valley portion of the River Gut, an intermittent stream which bounds a part of the Site and eventually drains to the Caribbean Sea. Several commercial and industrial facilities surround the VICHEM Site.

## SITE GEOLOGY/HYDROGEOLOGY

The soil is regionally classified as a clay loam with slopes of two to five percent. The VICHEM Site is underlain by the Alluvium, which is approximately 85 feet thick and consists of a heterogeneous overburden comprised of brown and gray clay-rich sediments with lesser and varying amounts of silt and fine sand. Entrained within the clay-rich matrix are lenses of gravels and sands. These lenses are localized and are not uniformly continuous throughout the Site. The gravel and sand lenses are zones of higher hydraulic conductivity and could act as preferential pathways for groundwater flow. Underlying the Alluvium is the Kingshill Limestone, which is the principal water-bearing deposit. The Kingshill is described as being comprised of a white to light gray and brown stiff clay, with lesser amounts of sand. The texture appears to be loosely consolidated, although rock chips were observed in the drill cuttings during the field investigation.

The groundwater underlying the Site flows predominantly to the south.

## SITE HISTORY/OPERATIONS

The VICHEM Site was purchased in 1968 and a variety of pharmaceutical production operations under a number of different corporate entities ensued until 1982. The specific timeframes for these operations were uncertain.

Several key site structures/features are illustrative of the facility layout. The process area consisted of reactors, overhead condenser systems, distillation columns, and a centrifuge/dryer building. Spills were channeled from the process area into the process pit, an 8,000-gallon underground concrete structure. The tank farm that previously consisted of twenty-one 8,000-gallon tanks currently holds ten 8,000-gallon tanks. There also were two laboratories (process and analytical) and a cobble-filled pit located below a concrete pad west of the warehouse (laboratory pit). Two storm drains, the Central Storm Drain and the Southern Storm Drain, channel surface runoff from the Site to the River Gut.

## REGULATORY HISTORY/PREVIOUS REMEDIAL ACTIONS

The initial interface with environmental regulatory agencies occurred in 1982. Between 1984 and 1989, several investigations were conducted on behalf of Berlex Laboratories, Inc. (Berlex) and focused on six areas of potential environmental concern:

- Laboratory and Warehouse Building;
- AST Area;

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- Former Process Pit;
- Loading Dock and Former Laboratory Pit Area;
- Soil Beneath Concrete Pad Near Aboveground Storage Tanks (ASTs); and
- Concrete Storage Pad.

Additional investigative activities have continued through 2000.

During the regulatory process, several remedial activities were conducted by both the U.S. Environmental Protection Agency (EPA) and Berlex. These activities included onsite treatment of impacted soil, onsite stabilization of the Former Process Pit, drum removals, and offsite disposal of the AST contents.

The VICHEM Site was placed on the National Priorities List (NPL) on January 18, 1994. On October 6, 1994, EPA entered into an Administrative Order on Consent (AOC), Index No. II CERCLA-94-0401, with Berlex, one of the Respondents to the AOC. The AOC required the performance of a Remedial Investigation/Feasibility Study (RI/FS) at the Site.

## REMEDIAL INVESTIGATION SCOPE

The primary objective of the RI was to collect the data needed to adequately support a Baseline Risk Assessment (BRA), both human health and ecological, and to provide a basis on which a subsequent, cost-effective, remedial action plan will be recommended. During the four phases of work, the following specific data requirements were addressed:

- background concentrations of constituents in surface soil through sampling and analysis;
- nature and extent of potential surface and subsurface soil impacts onsite through sampling and analysis;
- nature and extent of potential groundwater impacts onsite/offsite through monitoring well installation and sampling and analysis;
- Site-specific geologic and hydrogeologic conditions through lithologic evaluation, water level measurements, etc.; and
- nature and extent of potential soil/sediment impacts in the Gut System (i.e., River, Bethlehem, and Fairplains Guts) through sampling and analysis.

## REMEDIAL INVESTIGATION RESULTS

*Soil*

Various metals were detected in the onsite surface soil samples at concentrations above the background screening criteria (two times the average background level). As an additional screening mechanism, these soils were compared to either EPA's Soil Screening Levels (SSLs) with a DAF of 20 or RBCs (See Section 4.3.1.1). A small number of volatile organic compounds VOCs and SVOCs were detected in the surface soil samples. Pentachlorophenol and isophorone were detected above the SSL for migration to groundwater (MGW). However, pentachlorophenol was only detected once above the SSL and was not detected in groundwater therefore, this compound is not considered to be a concern. Isophorone was not identified as a

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surface soil concern in the HHRA and does not significantly increase incremental carcinogenic/non-carcinogenic risk for exposure to groundwater. Arsenic, iron and manganese were also detected in several samples above the MGW SSL. These metals were further evaluated in the HHRA and identified as potential COCs for surface soil at the Site (along with chromium, vanadium, and zinc). However, based on the results of the HHRA, these compounds are not considered to be a health concern.

VOCs, SVOCs, and metals detected in subsurface soil samples were compared to EPA's SSLs for the migration to groundwater pathway. Based on this comparison and the groundwater data collected during the RI, metals and SVOCs are not considered to be a significant concern. The predominant constituents impacting subsurface soil in the AST Area are ethylbenzene and xylenes. The potentially-impacted subsurface soil encompasses an area between Tanks 3 and 10, existing mainly onsite. The zone of impacts is conservatively assumed to encompass a 20-foot interval at approximately 5 to 25 feet below ground surface (bgs). The vertical extent of the potentially-impacted soil is assumed to extend to the water table interface (approximately 25 feet bgs).

Acetone and methylene chloride were detected in the quality control (QC) samples associated with the AST Area samples. The apparent acetone and methylene chloride detections are due to elevated dilution factors and blank contamination. Acetone and methylene chloride should not be considered site-related constituents.

While concentrations of chloroform were not detected above the SSL of 600 ppb (maximum concentration of chloroform was 410 ppb), this constituent has been included as a COC. It is assumed that an approximate 400 $ft^2$ area of subsurface soil in the Former Process Pit (within the vicinity of MW-2) is impacted with chloroform. The predominant zone of impacts is conservatively assumed to encompass a 5-foot interval at approximately 20 to 25 feet bgs.

*Groundwater*

The following VOCs were detected above the federal Maximum Contaminant Levels (MCLs) in groundwater: ethylbenzene, xylenes, and chloroform.

Onsite groundwater quality in the AST Area is impacted predominantly by ethylbenzene and xylenes. Impacts have been delineated through MW-8 (vertical extent) and MW-10 (lateral extent).

Onsite groundwater quality in the Former Process Pit is impacted predominantly by chloroform. Impacts have been delineated through various sampling points: MW-7, MW-12, MW-14, and GWPP-27A (vertical extent) and MW-11, MW-13, and GWPP-14 (lateral extent). Further investigations in Spring 2000 confirmed that deep groundwater, both within the alluvium and the Kingshill Formation, is not impacted by chloroform.

Toluene was identified as a potential concern in the HHRA. However, this constituent was not detected above its MCL and, therefore, is not considered a concern.

Isophorone, 2,4-dimethylphenol, and 2-methylphenol were identified as a potential concern in the HHRA. However, it was determined that these constituents do not significantly increase incremental carcinogenic/non-carcinogenic risk for exposure to groundwater.

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Eight metals, antimony, arsenic, barium, chromium, iron, lead, manganese, and vanadium, were identified as being a potential concern in the human health risk evaluation. However, these compounds were not considered COCs at the Site based on such factors as "one-time" exceedances, no exceedances above MCLs, or exceedances of secondary MCLs.

Chloroform was not detected in any offsite wells, indicating that chloroform does not appear to be migrating offsite into local production wells. Other VOCs (i.e., ethylbenzene, xylenes) were not detected in any of the existing offsite groundwater wells.

*Gut System*

Several metals were detected at the upstream reference location (RG-2) in the River Gut. The distribution of these metals were generally variable throughout the Gut System. However, an increase in the concentration of certain metals were noted at several locations within the River Gut and at one location in the Bethlehem Gut. These elevated concentrations in the River Gut are likely the result of the depositional nature of the locations. Subsurface soil samples from the River Gut were analyzed and two VOCs and two SVOCs were detected sporadically. Several metals also were detected at various concentrations; however, none were detected above EPA SSLs.

**FATE AND TRANSPORT**

Although the potential for migration of VOCs of potential concern toward public supply wells exists, reduced pumping of offsite production wells, and natural attenuation of dissolved constituents will likely prevent future offsite migration. The VOCs observed at the VICHEM Site are known to attenuate by natural processes.

**BASELINE RISK ASSESSMENT RESULTS**

Based on the exposure assumptions utilized in developing risk estimates, the hypothetical industrial/commercial occupational exposure to groundwater under a future land use scenario is the only pathway that presents cumulative risk estimates, for both the RME and CT receptors, in excess of EPA's target risk range. Concentrations of chloroform in groundwater are responsible for the majority of this risk.

Onsite surface soil and soil/sediment in the Gut System demonstrated carcinogenic risks for the adult industrial worker in excess of $10^{-6}$ associated primarily with ingestion of arsenic in soils.

Estimated risks for adult and pre-adolescent trespassers and construction workers are at or below the EPA target of $10^{-6}$ risk.

The RME risk estimates for potential future residential groundwater use exceeded the EPA target risk range for the adult and the child receptors. For both residential scenarios, the COPCs which contributed to the majority of risk are chloroform and arsenic. Both adult and child residential RME HIs exceeded 1. Ingestion and inhalation of chloroform contributed to the majority of the risk and hazard for the residential groundwater use scenario. Ingestion of arsenic, iron, and manganese also contributed to the risk and hazard estimates.

The Screening Ecological Risk Assessment (SERA) focused on the drainage channels adjacent and downstream of the Site including the River Gut (which serves as the northeastern and southeastern Site boundary), Bethlehem Gut, and Fairplains Gut. The SERA was developed

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utilizing data obtained through a surface soil/sediment sampling program conducted within the three drainage channels.

In general, aluminum exposure may potentially impact herbivorous, insectivorous, and piscivorous wildlife foraging in the River, Bethlehem, and Fairplains Guts. Aluminum and several other constituents of potential ecological concern (COPECs), identified for plants, measured adjacent to or downstream of the Site were found at similar or lower concentrations to that measured at the upstream reference location (RG-2). This suggests that the COPECs have been transported from upgradient sources. Historical (1986) and current (1997) data for soil collected from the Central and Southern Storm Drains suggest that several metals (e.g., aluminum, manganese, and zinc) may have been historically discharged to downstream areas of the River Gut (near sample location RG-13).

The potential contribution of aluminum has decreased over the years, as evidenced by the substantial reduction in concentrations measured in 1997, as compared to 1986. In addition, the aluminum concentrations measured in soil from the storm drains collected in 1997 were similar to that measured in soil collected from the River Gut upstream of the drain discharge points. Therefore, there is unlikely a current onsite source of aluminum to the River Gut. The Bethlehem Gut, which contained the second highest concentration of aluminum, also is a potential source of exposure in the Fairplains Gut. A bauxite plant is located in close proximity to the Site and serves as a likely source of the aluminum concentrations detected onsite and offsite. Furthermore, the aluminum concentrations in soil within the guts were within the range of concentrations found worldwide.

The concentrations of manganese and zinc were elevated in soil collected in 1997 in the storm drains. These concentrations, if discharged to the gut, would result in minimal to negligible risk to ecological receptors in the drainage channels.

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# 1.0 INTRODUCTION

## 1.1 PURPOSE AND SCOPE

The Virgin Island Chemical (VICHEM) Site (hereinafter referred to as the "VICHEM Site" or "the Site") is an approximate 32-acre property located on Plot 13Q of Estate Bethlehem Middle Works off of Melvin Evans Highway in St. Croix, U.S. Virgin Islands. Previous investigations at the Site have indicated that soil (onsite) and groundwater (onsite and offsite) are potentially impacted; the sources of which are related to the production operations and waste disposal/storage practices performed by a former pharmaceutical products manufacturing facility.

The VICHEM Site was placed on the National Priorities List (NPL) on January 18, 1994. On October 6, 1994, the U.S. Environmental Protection Agency – Region II (EPA) entered into an Administrative Order on Consent (AOC), Index No. II CERCLA-94-0401, with Berlex Laboratories, Inc. (Berlex), one of the Respondents to the AOC. Pursuant to Section 106(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, 42 U.S.C. §9606(a), the AOC requires the performance of a Remedial Investigation/Feasibility Study (RI/FS) at the Site.

The purpose of the RI/FS process is to gather sufficient information to support an informed risk management decision regarding which remedy appears to be the most appropriate for a given site. The RI serves as the mechanism for collecting data to characterize site conditions; to determine the nature of the waste; to assess the potential risk to human health and/or the environment; and to conduct treatability testing, as necessary, to evaluate the potential performance and cost of the treatment technologies that are being considered. The FS serves as the mechanism for the development, screening, and detailed evaluation of remedial action alternatives. The various steps, or phases, of the RI/FS process are briefly described below:

- *Scoping* – the initial planning phase of the RI/FS, beginning with the collection of existing data from previous investigations such as the Preliminary Assessment (PA) and Site Investigation (SI).

- *Site Characterization* – performance of the field investigation, definition of the nature and extent of impacts, identification of applicable or relevant and appropriate requirements (ARARs), and development of the baseline risk assessment (BRA).

- *Development and Screening of Alternatives* – identification of remedial action objectives (RAOs); identification of potential treatment, resource recovery, and containment technologies that will satisfy the RAOs; screening of the technologies based on their effectiveness, implementability, and cost; assembly of the technologies into alternatives; and screening of the alternatives.

- *Treatability Investigations* – bench- or pilot-scale testing to assess the feasibility of a technology.
- *Detailed Analysis of Alternatives* – further refinement of the alternatives, analysis of the alternatives with respect to EPA's nine evaluation criteria, and comparison of the alternatives against each other.

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The RI and FS are conducted concurrently so that data collected during the RI influences the development of remedial alternatives in the FS, which in turn affects the data needs and scope of treatability studies and additional field investigations.

The purpose of this report is to document the results of the RI performed by Harding Lawson Associates (HLA) and McLaren/Hart, Inc. (McLaren/Hart), on behalf of Berlex, at the VICHEM Site. This RI Report has been prepared to fulfill the requirements of the AOC, and is consistent with EPA's document entitled *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final* (EPA 1988) and the National Contingency Plan (NCP).

## 1.2 REPORT ORGANIZATION

The remainder of this report contains descriptions and results of the activities performed during all phases of the RI. Brief summaries of the remaining sections are presented below.

- Section 2.0 summarizes data and information with regards to the physical setting, past operations, and previous investigative activities at the VICHEM Site.
- Section 3.0 summarizes the locations, methods, and media involved in the various phases of the RI field investigation.
- Section 4.0 presents the results of the RI field investigation.
- Section 5.0 presents the results of the constituent fate and transport analysis.
- Section 6.0 summarizes the results of the Human Health Risk Assessment (HHRA) and the Screening Ecological Risk Assessment (SERA).
- Section 7.0 summarizes the results of the RI and presents the conclusions reached based on those results.
- The RI Addendum summarizes activities related to the decommissioning of former production well P-1 and additional sampling.

The following appendices also are included in this RI Report:

- Appendix A – Zoning Information;
- Appendix B – Water Use Survey Results;
- Appendix C – Rainfall Summary;
- Appendix D – Historic Sampling Summary;
- Appendix E – EPA 1989 Action Memorandum Site Inventory;
- Appendix F – Soil Boring Logs;
- Appendix G – Monitoring Well Construction Diagrams;
- Appendix H – QA/QC Summary Packages and Checklists;
- Appendix I – Hydrogeological Information;
- Appendix J – Human Health Risk Assessment; and
- Appendix K – Screening Ecological Risk Assessment.

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# 2.0 SITE BACKGROUND AND PHYSICAL SETTING

## 2.1 SITE DESCRIPTION

### 2.1.1 Location

The VICHEM Site is located on Plot 13Q of Estate Bethlehem Middle Works in the south-central portion of St. Croix in the U.S. Virgin Islands (see Figure 2-1). Consisting of approximately 32 acres, it is situated approximately 6.1 miles equidistant from two major towns: Frederiksted to the west and Christiansted to the east. Site access is via Route 66 which traverses the island east and west. Geographically, the Site is located in the southwest portion (17° 42′ 35″ north latitude and 64° 47′ 26″ west longitude) of the Christiansted, Virgin Islands, U.S. Geographical Survey (USGS) 7.5 minute topographic quadrangle.

Over half of the VICHEM Site is covered by buildings and/or process equipment. The surrounding area is predominantly industrial with the Henry Rohlsen Airport (formerly known as the Alexander Hamilton Airport) situated approximately 1,500 feet south of the Site. The VICHEM Site is bordered to the north and east by an intermittent stream, the River Gut, which originates north of the Site and discharges to the Caribbean Sea. Numerous businesses are located adjacent to the Site, including some on the opposite side of the River Gut. The south-southwest boundary of the VICHEM Site abuts Route 66, while an undeveloped lot exists to the west-northwest.

### 2.1.2 Physical Features

The VICHEM Site was developed during the early 1970's and is currently abandoned and overgrown with heavy vegetation. Several structures remain onsite, including (see Figure 2-2):

- laboratory/warehouse building which housed analytical laboratories, restrooms, storage room, dryer area, and worker cafeteria;
- maintenance building which housed two boilers, refrigeration units, air compressors, and maintenance shop;
- nine aboveground storage tanks (ASTs) identified as T-3 through T-11, an unlabeled AST, and eleven concrete pads at former AST locations;
- production area which housed a centrifuge and dryer building;
- stainless-steel reactor area;
- glass reactor area;
- loading dock (former location of laboratory pit);
- concrete storage pad adjacent to the loading dock and next to the scalehouse;
- cooling towers;
- generator building;
- generator and fire pump building;
- two production wells (P-1 and P-2) originally used for process water and for the fire fighting system; and
- one 250,000-gallon fire water AST.

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Two storm drains are located onsite. The Central Storm Drain runs beneath the paved area between the laboratory and maintenance buildings. The Southern Storm Drain, where observed, is a concrete-lined depression along the southern wall of the maintenance building and the edge of the reactor area. Both storm drains discharge to the River Gut.

### 2.1.3 Surrounding Land/Water Use

The principal land use surrounding the VICHEM Site is a mix of commercial and industrial. The St. Croix Prison at Golden Grove is approximately 0.25 miles northwest of the Site. Two residential properties, Upper Bethlehem and Golden Grove, are located approximately 0.33 miles north and 0.75 miles northwest of the Site, respectively. A concrete batch plant (Charlie's Concrete Company) and two automobile repair shops (Fix-It-Right Transmission and King's Automotive/Auto Body) are located east-northeast of the Site, on the opposite side of the River Gut, while two paving companies (Virgin Islands Paving Company and Meridian Engineering Company/Virgin Islands Asphalt Products Company) are located north-northwest of the Site and across the River Gut. The south-southwest boundary of the VICHEM Site abuts Route 66, while a water service company (Cariño's Water Service) and an undeveloped lot exist to the west and northwest, respectively. Figure 2-3 depicts the Site and surrounding area.

Based on discussions with representatives of the Virgin Islands Department of Planning and Natural Resources (VIDPNR), the Site is currently zoned as I-2 (Light Industry). A map depicting current zoning for the Site and surrounding area is presented in Appendix A. Future zoning for the area is uncertain at this time. VIDPNR has indicated that a draft zoning plan for the island has been developed for future land use and is currently under review by the local government.

The Virgin Islands Water and Power Authority (WAPA) has indicated that potable water for the island is primarily supplied through both municipal well water and desalinization plants. Additionally, some residences have private cisterns and roof-catchment systems to capture and containerize precipitation. However, WAPA does not routinely update their water use files on a per household basis, so specific information on potable water use is uncertain. A water use survey was conducted by McLaren/Hart in October 1998 to collect information (construction details, pumping rates, general water use) on wells located in the vicinity (within a ¼- to ½-mile radius) of the VICHEM Site. Data was collected through interviews with well owners; review of historical information; and discussions with personnel from the Virgin Islands Port Authority (VIPA), WAPA, and VIDPNR. Specific information collected during the survey is provided in Appendix B. Survey results indicated that water from several offsite wells in the area of the VICHEM Site are currently being used for light industrial purposes. However, water is not being extracted from these wells on a constant or continual basis. Additionally, several local plant operations have been entirely shut down or severely decreased. Therefore, offsite pumping influences that may have affected onsite groundwater flow conditions in the past, or wells that could have historically been affected by Site impacts, currently no longer exist to the same extent. Future potable water use in the area is unknown.

## 2.2 ENVIRONMENTAL SETTING

### 2.2.1 Topography and Drainage

The VICHEM Site is located in the southern lowland valley portion of the River Gut, the largest intermittent stream on St. Croix (Geraghty & Miller, Inc. [G&M] 1983). The River Gut encompasses a drainage area of approximately 11 square miles. The Site falls entirely within the

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100-year floodplain of the River Gut, as mapped by the Federal Emergency Management Agency (see Figure 2-4). In the vicinity of the Site, the River Gut extends across the southern plain of St. Croix, and at its confluence with the Bethlehem Gut (located approximately 800 feet to the southeast of the Site), it becomes the Fair Plains Gut. All of the stream channels in the drainage basin are identified as intermittent. The River Gut drains to the Caribbean Sea, via the Fair Plains Gut and Manning Bay, located approximately one mile southeast of the Site. Low hills to the east and southwest of the Site rise to elevations of approximately 150 to 200 feet above mean sea level (amsl). Surface water drainage from these elevated areas recharge the River and Bethlehem Guts.

The land surface elevation at the Site ranges from approximately 30 feet amsl in the southwestern portion of the Site to approximately 40 feet amsl in the northeastern portion. The land surface bordering the east-northeast Site boundary slopes steeply downward approximately 12 to 15 feet into the River Gut. An earthen berm partially separates the AST Area in the western portion of the Site from the remainder of the area. On the western side of the berm, runoff drains from southwest to northeast. Surface drainage in the eastern portion of the Site is controlled by the buildings, concrete paved areas, and two storm drains (Central Storm Drain and Southern Storm Drain) that channel runoff to the River Gut along the southeastern Site boundary.

### 2.2.2 Climate/Meteorology

St. Croix's climate is tropical marine. The average annual temperature is 78 °F, and the temperature variation is minor from season to season. The average annual rainfall is 44 inches, with winter being the driest period. May and August through November are the wettest periods, coinciding with tropical disturbances that can produce as much as 18 inches of precipitation within 48 hours (USGS 1992). Mean monthly rainfall, as measured at the Henry Rohlsen Airport from 1951 to 1980, ranges from less than 2 inches in March to greater than 5 inches in September. Only approximately 3% of the precipitation reaches the water table, due to high losses by evapotranspiration enhanced by brief intermittent showers. The winds (tradewinds) typically blow out of the northeast (Robison 1972) and are fairly constant at 10 to 20 miles per hour.

Precipitation data was obtained (measured at the Henry Rohlsen Airport) for time periods beginning two weeks prior to, and through the completion of, major field events (i.e., where water levels and/or groundwater samples were being collected) conducted as part of the RI by HLA and McLaren/Hart. Rainfall amounts for these periods are summarized in Appendix C.

### 2.2.3 Soil

According to the 1970 Soil Survey of the U.S. Virgin Islands, as performed by the U.S. Department of Agriculture's Soil Conservation Service (SCS), the entire VICHEM Site lies on Coamo clay loam with slopes of two to five percent. The Coamo series consists of gently sloping, deep, well-drained soils over volcanic and limestone rocks. These soils formed sediments derived from the rocks they overlay and, therefore, occur as alluvial fans and terraces. Soils range in texture from sand to clay. A typical profile has an approximately 8-inch thick surface layer consisting of very dark, grayish-brown, clay loam containing rock fragments. The subsoil is a very dark, grayish- to yellowish-brown clay, also containing rock fragments. The substratum begins at a depth of approximately two feet and consists of a yellowish- to dark yellowish-brown, friable, calcareous clay loam stratified with sand and gravel.

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### 2.2.4 Regional Geology and Hydrogeology

Numerous studies of the geology and hydrogeology of St. Croix have been conducted by the USGS (Robison 1972; Gonzales, S. and Rodriguez del Rio, F. 1987; and Graves 1995). G&M (1983) conducted a comprehensive study of groundwater conditions in St Croix, consisting of an extensive literature review of well records and geologic reports as well as aquifer testing and sampling. Below is a summary of the regional geology and hydrogeology based on the extensive literature available.

#### *2.2.4.1 Regional Geology*

St. Croix is composed of rocks of Cretaceous to Pliocene Age. Structurally, the island is basically derived of fault-blocked ridges paralleling northeast to southwest. Superimposed on these structures is a northeast- to southwest-trending, trough-like sedimentary basin. The older volcaniclastic and igneous intrusive rocks outcrop in the northern and eastern highland areas of the island. The central basin is underlain by more recent strata including, in ascending order, the Jealousy Formation and the Kingshill Limestone. This central basin is as much as 7,000 feet thick (G&M 1983). Recent alluvial deposits (Alluvium) blanket the Kingshill Limestone. This RI Report focuses on the Kingshill and the Alluvium since these formations underlie the VICHEM Site and are the strata that are utilized for water supply in the vicinity of the Site.

The Kingshill Limestone consists of a carbonate sequence of variable texture and composition. The interbedded lithologies of the Kingshill have been reported to have a maximum thickness of 600 feet. The lithology of the Kingshill has been described as three dominant rock types: (1) sandy to conglomerate marl composed of terrigeneous material and calcareous skeletal debris; (2) indurated chalks of pelagic origin; and (3) calcareous sandstones (calcarenite). The chalks and marls are the dominant lithology types of the Kingshill. The more permeable calcarenite is more predominant in the southeastern portion of the central valley (G&M 1983).

Recent alluvial deposits mantle much of the area underlain by the Kingshill Limestone. The maximum thickness of the Alluvium is estimated to be approximately 100 feet at the mouth of the River Gut. The Alluvium is composed mostly of montmorillonite clay of low permeability. In certain locations, it is difficult to distinguish the alluvial clay from the underlying marl of the Kingshill. Interbedded with the clays are thin (two to four feet) lenses of terrigeneous sand and gravel. The coarse material is more prevalent in the river valleys, but the layers of coarse material are isolated and limited in horizontal extent (G&M 1983).

#### *2.2.4.2 Regional Hydrogeology*

The Kingshill Limestone is considered the principal water-bearing deposit on St. Croix and is the principal aquifer in the Barren Spot, Concordia, and Negro Bay well fields. Its water-bearing characteristics vary due to its lack of uniformity. The maximum saturated thickness of the Kingshill is 200 feet, and in some areas where the entire formation is screened, it can yield as much as 100 gallons per minute (gpm). Well fields throughout St Croix that tap the Kingshill produce 20,000 to 300,000 gallons per day (gpd), with most individual wells yielding less than 30 gpm. In general, however, the Kingshill is a poor-producing formation due to its fine-grained texture and high total dissolved solids (TDS) and chloride content. The transmissivity of the Kingshill Limestone is highly variable ranging, from 22 to 30,000 gpd/foot (Gonzales, S. and Rodriguez del Rio, F. 1987). The potentiometric surface of the Kingshill indicates a horizontal flow potential predominantly to the south, towards the Caribbean Sea, in the southern plain of St. Croix, as mapped by the USGS (Gonzales, S. and Rodriguez del Rio, F. 1987). To the north, in

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the vicinity of Christiansted, the horizontal potential for groundwater flow in the Kingshill is to the northeast.

The Alluvium is tapped by many private and public supply wells and is the principal aquifer in the Fair Plains, Golden Grove, and Adventure well fields. Like the Kingshill, yields within the Alluvium are highly variable. Due to the stratigraphic nature of the Alluvium, and the associated hydraulic conductivity contrasts between the horizontal and vertical planes (i.e., horizontal hydraulic conductivity is greater than vertical hydraulic conductivity), the Alluvium behaves like a confined or semiconfined aquifer. This is especially prevalent in the deeper deposits, where the shallow, coarser material found near the River Gut may exhibit unconfined properties. Pumping tests conducted by G&M (1987) concluded that the Fair Plains Alluvium exhibits a specific capacity of 1.5 to 3.4 gpm/foot, a transmissivity of 8,000 gpd/foot, and a storage coefficient of 0.004 (indicative of confined conditions).

### 2.2.5 Ecology

St. Croix is composed of numerous terrestrial ecosystem types. Each of the ecosystems are either climate-controlled, controlled by the Caribbean Sea, and/or controlled by human activity. HLA completed an assessment of the VICHEM Site in 1994 which included the identification of potential areas of ecological concern, exposure pathways, and receptors. The results of this phase of work are discussed in HLA's document entitled *Draft Technical Memorandum Pathways Analysis Report and Phase I Baseline Risk Assessment Summary* (HLA 1995a). Additionally, an ecological survey was conducted by McLaren/Hart during Phase III of the RI field investigation. The results of this survey are discussed in detail in the SERA (summarized in Section 6.0).

## 2.3 SITE HISTORY

The information discussed in this section was obtained from the following, existing documents prepared by EPA, Halliburton NUS Environmental Corporation (NUS) – an EPA contractor, and Enviro-Sciences, Inc. (ESI) and HLA – previous consultants to Berlex:

- *Progress Report* (ESI 1984);
- *Addendum to Progress Report* (ESI 1985a);
- *RCRA Enforcement* (EPA 1985);
- *RCRA Enforcement, Final Report* (EPA 1986);
- *Project Summary for Island Chemical Company, Inc.* (ESI 1986);
- *Attachment, Site Description for Island Chemical Company* (ESI 1987a);
- *Removal Evaluation and Site Investigation Preliminary Report* (EPA 1989a);
- *Final Draft Site Inspection Report* (NUS 1991); and
- *Draft Remedial Investigation Work Plan* (HLA 1994).

### 2.3.1 Site Ownership and Use

#### *2.3.1.1 Ownership*

Charles H. Steffey, Inc. (CHS, Inc.) purchased the VICHEM Site in 1968. At some point prior to 1969, CHS, Inc. changed its name to CHS Holding Corporation (CHS). On May 1, 1969, CHS entered into a 30-year lease of the property with Houston Chemical Industries, Inc. (Houston Chemical).

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On March 20, 1972, Houston Chemical assigned the lease to Caribe Chemical Company (Caribe), a wholly-owned subsidiary of Houston Chemical. Caribe operated the facility and subsequently became known as Pierrel America, Inc. (Pierrel), when Pierrel International, S.A. acquired all the shares of Caribe in 1971. On June 30, 1978, Pierrel assigned the ground lease to Cooper Laboratories, Inc. (Cooper). On July 21, 1978, Cooper incorporated Island Chemical Company (Island Chemical) as its subsidiary to assume production activities at the facility. On October 30, 1979, Cooper assigned the lease to its subsidiary, Island Chemical. On November 1, 1979, Cooper sold 100% of its Island Chemical stock to Berlex.

Berlex sold Island Chemical's assets and assigned the lease for the Site to the VICHEM Company on September 14, 1984. VICHEM subsequently subleased portions of the Site to various entities, including U.S. Resources and Chemicals, Inc. and VIAG Fuels, Inc. St. Croix Security Kennels also was present onsite for an unspecified period of time.

The Site ceased operations in 1982 and is currently unoccupied. CHS maintains ownership of the Site.

#### *2.3.1.2 Use*

During the majority of the facility's active life, it was utilized for the manufacture and blending of pharmaceutical products. However, the specific timeframes for the operation of the manufacturing processes are uncertain. Berlex reportedly used the facility to produce quinidine gluconate (QG) for the production of quinine. VICHEM produced benzyl acetate by reacting benzyl chloride with acetic acid. VICHEM also began producing benzyl salicylate. In 1984, U.S. Resources and Chemicals, Inc. and VIAG Fuels, Inc. utilized the facility to conduct an alcohol dehydration operation. During the 1984 to 1985 timeframe, kennels for 20 to 30 guard and attack dogs were present onsite.

Caribe manufactured pharmaceutical chemicals (primarily phenacetin, ethoxyquin, and quinidine) at the Site continuously from 1969 until at least 1975. Production increased after Pierrel acquired Caribe in 1971.

In late 1980, Island Chemical began production of a pilot-size batch for quinidine. Subsequently, Island Chemical also used the plant to reclaim this chemical. Developmental pilot production and reclamation of quinidine was conducted by Island Chemical from late 1980 until the end of 1982. The process used by Island Chemical, after acquisition by Berlex, consisted of the conversion of quinine to quinidine and involved neutralization, oxidation, and reduction. At several steps in the process, toluene and reclaimed toluene were used. Toluene was recovered at every step, and stored and reused when the process was rerun. By the end of 1982, the facility was permanently closed.

Illustrative of the facility layout were the operations depicted on Figure 2-5. The process facility was set up for batch and semi-continuous pharmaceutical products manufacturing.

The process area, east of the maintenance and utility building, consisted of two, open-bay reactor areas and a centrifuge/dryer building. The six reactors were either glass-lined or stainless-steel and were agitated, jacketed, and contained overhead condenser systems. Four of these reactors were equipped with distillation columns. The centrifuge/dryer building contained various centrifuges, dryers, filters, and grinding equipment.

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West of the main building was the tank farm, containing fourteen 8,000-gallon tanks. Four of these tanks contained ethanol and one tank contained diesel fuel, which was used to fuel the alcohol dehydration process operated onsite. The remaining ASTs in the tank farm were empty. Historically, these tanks also contained benzene, toluene, ethylbenzene, and xylene (BTEX).

Two laboratories were present at the facility. An analytical laboratory was maintained to test raw materials and to conduct in-process and final product testing. A process laboratory also was present for product development functions, primarily the small-scale duplication of steps in the process to work out problems and test improvements.

Wastes drained from the laboratories to a cobble-filled tank/pit located below a concrete pad west of the warehouse. This pit was connected via a 4-inch diameter, polyvinyl chloride (PVC) pipe to a second cobble-filled pit near the fence. However, during excavation activities conducted in the area by ESI in 1985, this pit could not be located.

Spills in the process area were channeled to an 8,000-gallon underground concrete pit (process pit). The spilled liquids were collected in the pit and reportedly reprocessed or recycled. The pit was connected to a storm drain via a 4-inch diameter, PVC pipe. The storm drain was constructed of 55-gallon steel drums that had been welded end to end. Surface runoff from the concrete pad between the maintenance building and the laboratory was channeled to this drain via three inlets.

Septic tanks were used for all sanitary wastes. According to available information, no process or laboratory drains were connected to the septic system.

### 2.3.2 Regulatory History

The initial interface with environmental regulatory agencies occurred in October 1982. Island Chemical notified EPA of its pending closure and offsite removal of waste materials, including such excess chemicals as xylene and toluene. At that time, EPA assigned Island Chemical a Resource Conservation and Recovery Act (RCRA) identification number, VID80651095. Prior to this activity, Island Chemical had been operating as a small quantity generator.

In connection with Berlex's sale of Island Chemical to VICHEM in 1984, Island Chemical investigated and addressed certain environmental impacts present at the Site.

Site studies were initiated in September and October 1984. ESI, on behalf of Island Chemical, conducted Site investigative work (see Section 2.3.3) and remedial activities (see Section 2.3.4). During this time, ESI met with representatives of VIDPNR to discuss their proposed concept for remediation. Additionally, in December 1984, ESI presented the clean-up program and forwarded investigative results to EPA. In April 1985, ESI submitted an onsite treatment plan to EPA. EPA was notified in May 1985 that the implementation of the ESI-proposed onsite treatment plan would begin in June 1985.

On September 9, 1985, EPA's Surveillance and Monitoring Branch conducted a RCRA compliance evaluation and sampling inspection at the request of EPA's Solid Waste Branch to support and verify the decontamination and removal of toluene- and pyridine-impacted soil from the Site (EPA 1985). The scope of the inspection was to conduct sampling and analysis, confirm onsite treatment of soil by Island Chemical, and assess overall compliance with RCRA.

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ESI notified EPA via correspondence dated February 7, 1986 that their proposed scope of work for the onsite cleanup at the Site had been completed. On March 13, 1986, EPA's Surveillance and Monitoring Branch conducted a RCRA enforcement inspection at the request of EPA's Solid Waste Branch (EPA 1986). The objective of this inspection was to gather information to determine the facility's compliance with applicable RCRA regulations. The scope of this inspection included (1) review of the facility's history; (2) inspection of the facility; and (3) sampling of stream sediments, the laboratory waste pit, and one onsite production well. Follow-up correspondence from ESI to EPA dated April 21, 1986 provided additional information regarding onsite clean-up activities as described in the February 7, 1986 correspondence.

Between May 1986 and April 1987, discussions and meetings between Berlex, EPA, and VIDPNR representatives occurred regarding the scope of a RI at the Site. Subsequently, ESI submitted a work plan to address the scope of work necessary to complete the RI (ESI 1987b).

Parallel with the development of the work plan, EPA and Berlex attempted to finalize an AOC for the implementation of the RI. AOC discussions occurred during the March 1987 to November 1988 timeframe.

During March and November 1988, EPA's Response and Prevention Branch conducted well sampling and analysis at the nearby Fair Plains wells, a major source of drinking water on the island at the time.

In January 1989, EPA conducted a PA and removal evaluation of the Site and concluded that Site conditions warranted a high priority for an inspection (EPA 1989a). EPA subsequently determined that a removal action was necessary to abate the potential threat of releases of hazardous substances from drums and other containers onsite.

VICHEM informed EPA via correspondence dated March 1, 1989 of additional clean-up activities conducted at the Site subsequent to EPA's January 1989 inspection. On March 13, 1989, EPA issued Notice Letters to the following Potentially Responsible Parties (PRPs): Berlex, Island Chemical, CHS, VICHEM Company, and VIAG Fuels, Inc. On August 8, 1989, an Action Memorandum was signed by EPA's Acting Regional Administrator for the performance of the aforementioned removal action at the Site.

EPA prepared Pollution Reports (POLREPs) as a result of their PA and removal action evaluation conducted in January 1989. A total of 30 POLREPs were prepared by EPA between February 1989 and October 1991. The POLREPs documented Site clean-up operations, including onsite/offsite treatment and/or recycling. The work was conducted by EPA and its contractors.

Coincident with EPA's removal action was the performance of a SI in February 1991 by NUS.

The Site was proposed for inclusion on the NPL in January 1994. On October 6, 1994, an AOC for a Site RI/FS was issued to Island Chemical, CHS, and Berlex. Island Chemical and Berlex executed the AOC.

HLA was retained by Berlex in 1993 to implement the technical requirements of the AOC. The following major technical deliverables (final versions) were prepared by HLA:

- *Draft Remedial Investigation Work Plan* dated August 5, 1994;
- *Draft Data Summary Report* dated August 15, 1995;
- *Draft Phase II Remedial Investigation Work Plan* dated November 21, 1995;

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- *Draft Supplemental Data Summary Report* dated September 13, 1996; and
- *Draft Remedial Investigation Work Plan Addendum – Phase III* dated June 20, 1997.

McLaren/Hart was retained by Berlex in 1997 to complete the remaining phases of the RI at the VICHEM Site. The following major technical deliverables were prepared by McLaren/Hart:

- *Review of the Sediment Sampling Program* dated November 13, 1997;
- *Additional Remedial Investigation Field Activities* dated March 3, 1998;
- *Technical Memoranda (Phase III Groundwater, Soil, and Gut Investigations)* dated June 19, 1998;
- *Supplemental Remedial Investigation (Phase IV RI)* dated August 12, 1998;
- *Clarifications to Supplemental Remedial Investigation dated August 12, 1998* dated August 24, 1998; and
- *Field Modifications During Supplemental Remedial Investigation (Phase IV RI)* dated November 20, 1998.

In July 2000, Golder Associates Inc. (Golder) took over responsibility of the VICHEM Project. With the assistance of former McLaren/Hart personnel, Golder completed and submitted the *Remedial Investigation Addendum* in July 2000. The RI Addendum is included with this Revised Final RI Report.

### 2.3.3 Previous Investigations

The majority of this section has been excerpted from HLA's *Draft Remedial Investigation Work Plan* dated August 5, 1994.

The following six areas of potential environmental concern were identified through previous work performed by ESI and NUS:

- Area A - Laboratory and Warehouse Building;
- Area B – Aboveground Tank Farm;
- Area C - Former Process Pit;
- Area D - Loading Dock and Former Laboratory Pit and Drain Area;
- Area E - Soil Beneath Concrete Pad Near ASTs; and
- Area F - Concrete Storage Pad.

The results of the previous work performed at the Site are described below. Figure D-1 and Table D-1, representing the potential areas of concern, along with a tabulated summary of the analytical results collected from each area (Tables D-2 through D-7), is presented in Appendix D.

#### *2.3.3.1 Area A – Laboratory and Warehouse Building*

Based on the inspection report generated by a representative of the Government of the Virgin Islands on May 17, 1983, no hazardous waste was present in this area when Island Chemical ceased operations. On January 31, 1989, EPA responded to a complaint and found approximately 400 drums containing various materials and wastes in the laboratory and warehouse. A list of the chemicals found in these drums is presented in Appendix E. This EPA-generated list was completed during the Site's occupation by the VICHEM Company. Between March 1989 and April 1991, EPA contractors removed the drums and waste. Activities associated with the removal action are further discussed in Section 2.3.4.

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Based on available information, the only samples collected from this area were used for waste classification. No environmental samples were collected.

### *2.3.3.2 Area B – Aboveground Tank Farm*

Between October 25 and November 2, 1982, Island Chemical analyzed samples from four ASTs (identified as Tanks 7, 8, 9, and 13) to identify their contents. Toluene, xylene, para-phenetidine, and 9-fluorenone were identified.

Description

The tank farm is located along the northwestern Site boundary. According to available information, twenty 8,500-gallon ASTs were originally located in this farm. Six tanks were reportedly sold locally in the 1980s. At the time Island Chemical acquired the Site, the following substances were present in the ASTs:

- Approximately 6,900 gallons of xylene mixed with p-phenetidine were left by a previous operator. After the plant shutdown, this material was shipped to Phillip Brothers Chemicals, Inc. (Phillip) in New York for sale. Because the sale was not completed, and no other purchaser was found, the material was manifested as a hazardous waste and shipped to Inland Chemical Company (Inland) in Puerto Rico for burning.

- Xylene waste from the ASTs, under previous ownership, was shipped to Phillip.

- According to the February 7, 1983 Island Chemical in-house memorandum regarding waste disposition, all benzophenone/toluene solutions were shipped to Inland for burning.

Based on liquid samples collected from nine of the ASTs by ESI on March 12, 1986 (see Table D-2 in Appendix D), the tanks contained the following liquids:

- Tank 4 contained a solution of benzoquinone and fluorenone;
- Tanks 7, 8, and 14 contained solutions of benzophenone and fluorenone with traces of volatile organic compounds (VOCs);
- Tanks 9 and 13 contained p-phenetidine (the solution in Tank 9 included 10.9% aromatics);
- Tanks 10 and 11 contained hydroxyfuranocoumarin; and
- Tank 12 contained a mixture of hydroxyfuranocoumarin and p-phenetidine.

At the time of the EPA inspection (January 1989), 14 ASTs were present. Four of the tanks were filled with ethanol. The other ten were empty.

According to EPA's POLREP No. 2, dated June 7, 1989, EPA visited the Site on May 25, 1989. At that time, the first four tanks contained ethanol and the fifth tank contained diesel fuel.

Four tanks were apparently removed and one was relocated sometime between 1990 and 1994. Ten tanks remain onsite in the tank farm.

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Previous Investigations

Between September 11 and October 28, 1984, ESI completed 12 test pit trenches at the Site. Three of the trenches, identified as Trenches 1, 2, and 3, were located near the tank farm. Soil samples from the trenches were screened in the field for VOCs using a portable flame ionization detector (FID). Based on these results, ESI concluded that the entire area between and in front of Tanks 8 and 9 was impacted with toluene that escaped from Tank 8 (ESI 1987b). One soil sample, identified as T8-1, was analyzed for toluene, pyridine, QG, and quinine sulfate (QS). Three of these compounds were detected in the sample: toluene at 694 parts per million (ppm), QG at 274 ppm, and QS at 101 ppm. A hard clay layer was reported beneath the excavated material. ESI collected one sample, identified as T8-2, from the clay. The sample was analyzed for the same four parameters. Toluene, pyridine, and QS were not detected; however, ESI did not report the method detection limit. QG was detected at 47 ppm. A summary of the soil and liquid samples collected from this area is presented on Table D-2 of Appendix D.

### *2.3.3.3 Area C – Former Process Pit*

The Former Process Pit consisted of an 8,000-gallon (ESI 1987a) or 17,000-gallon (EPA 1985) underground concrete pit located in the central portion of the Site. The pit received waste water from spills (ESI 1987a) and cooling water from production operations (EPA 1985). During plant operations, the contents of the pit were sampled to determine if any product had been released. The water was then reused in the system (ESI 1987a) or, if the sample results were negative, the waste water was discharged through the Central Storm Drain (EPA 1985). The Central and Southern Storm Drains exited the Site via a drain line constructed of drums, which had the tops and bottoms removed and were welded end to end.

Wastes generated from the pit, including water and sludge as well as drums and soil used to construct the two storm drains, were removed from the Site on December 2, 1985. This waste was included in an offsite shipment of 192 drums (see Section 2.3.4). One line, presumably the Central Storm Drain, was replaced with 10-inch diameter, PVC pipe (ESI 1987a).

ESI collected samples from the Former Process Pit on June 14 and July 19, 1985. The pit was then abandoned and sealed with concrete later in 1985 (EPA 1989a). On February 28, 1991, NUS collected a sediment sample from the Central Storm Drain. Based on the description by NUS in their 1991 report, the sample was located at the connection between the Former Process Pit and the Central Storm Drain. A summary of the samples collected by ESI and NUS is presented on Table D-3 of Appendix D.

### *2.3.3.4 Area D – Loading Dock and Former Laboratory Pit and Drain Area*

Description

Area D is located to the north of the warehouse. It consists of the Loading Dock Area and drains leading towards the River Gut. The Former Laboratory Pit was located beneath the loading dock. It consisted of a cobble-filled pit that received wastes drained from the laboratory (ESI 1987a). The cobble-filled pit beneath the loading dock was connected to a second pit near the fenceline by a 4-inch diameter, PVC pipe. According to ESI, former facility personnel reported that, prior to construction of the loading dock, the laboratory pit was open. During the rainy season, the pit occasionally overflowed and discharged to the River Gut. The pit was later filled and the area covered by the loading dock (ESI 1987a). It is unknown as to exactly how the laboratory drain was redirected to the pit near the fence. However, the 4-inch PVC drain, as well as a 55-gallon

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drum drain near the fenced storage pad and leading to the River Gut, were noted during the 1991 NUS SI.

ESI reported a clay layer underneath the stone-filled pit and soil in the Loading Dock Area. ESI did not state the depth to, or the thickness of, the clay layer. However, because ESI soil borings were reportedly drilled to a depth of 4 to 8 feet below ground surface (bgs), it is presumed that the clay is less than 8 feet bgs in this area. ESI noted that the underlying clay material had probably prevented downward percolation since the FID readings for the clay samples were "low"; as well as the materials being "highly volatile" (ESI 1987a).

Previous Investigations

On or about September 17, 1984, ESI excavated a trench, identified as Trench No. 9, in this area. During the excavation, the PVC pipe was ruptured and a release of pyridine was reported. ESI noted that a strong pyridine odor was prevalent during the excavation and sampling period (ESI 1987a). Surface samples, identified as D-1 through D-5, were collected and analyzed for toluene, pyridine, QG, and QS. Pyridine and QG were detected in three of the samples, while QS was only detected in one sample.

On September 18 and 19, 1984, ESI completed 22 soil borings throughout the Loading Dock Area in an effort to locate and investigate the laboratory drain. The borings were drilled to field-selected depths ranging from 4 to 8 feet bgs. Soil samples were screened in the field for VOCs using a FID. ESI collected four soil samples for analysis of VOCs. In October 1984, ESI returned to the Site and completed 18 additional soil borings in the area. ESI collected two soil samples for analysis of toluene and pyridine, and nine additional samples for analysis of toluene, pyridine, VOCs, and oil & grease.

On September 9, 1985, EPA collected four composite samples from the area for analysis of purgeable and non-volatile organic priority pollutants. Results indicated that several phthalates and toluene were present in the soil samples.

On March 13, 1986, EPA returned to the Site to collect additional samples. ESI obtained splits of the EPA samples for independent analysis. One sample, identified as 085252, was collected from the River Gut sediments at the discharge point of the laboratory drain. Two other samples, identified as 085284 and 085285, were collected from the Loading Dock Area. Several metals and di-n-octylphthalate were detected in the samples.

On February 28, 1991, NUS collected two samples from this area. Sample SED2 (and duplicate sample SED4) was collected from the River Gut at the laboratory drain discharge point. Sample S1 was collected from the Former Laboratory Pit near the center of the Loading Dock Area. Results were generally consistent with the data collected by EPA in 1986, with the exception of several pesticides being detected at estimated concentrations. A summary of the samples collected from this area is presented on Table D-4 of Appendix D.

#### *2.3.3.5 Area E – Soil Beneath Concrete Pad Near ASTs*

A concrete pad, constructed of seven slabs, is located in the northern corner of the Site. During the investigation in late September 1984, ESI completed three trenches, identified as Trench 4, 6, and 7, along the edge of the concrete pad near the ASTs. ESI noted evidence of impacted soil in Trench 4, adjacent to and beneath the third slab. ESI collected five soil samples from the area and submitted them for analysis of toluene. Analytical results are summarized on Table D-5 in

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Appendix D. Although toluene was not detected, ESI noted that the samples were held for three weeks before analysis. This period exceeded analytical holding times. The conditions under which the samples were held are unknown. ESI noted that the time lag could have accounted for the difference between field readings and laboratory analytical results (ESI 1984).

#### *2.3.3.6 Area F – Concrete Storage Pad*

A concrete storage pad is located north of the Laboratory and Warehouse Building. The pad was used for drum storage of raw materials when the facility was operating. Miscellaneous debris was observed on the pad during HLA's July 1993 inspection.

#### *2.3.3.7 Storm Drains and River Gut*

Two storm drains are located onsite. The Central Storm Drain runs beneath the paved area between the laboratory and maintenance buildings. The Southern Storm Drain, where observed, is a concrete-lined depression along the southern wall of the maintenance building and the edge of the reactor area. Both drains discharge to the River Gut.

According to ESI, the two storm drain lines were excavated and replaced between June 6 and 15, 1985 (ESI 1987a). The old lines were constructed of 55-gallon drums that were welded together end to end. According to ESI, the drums from one line contained an oily sludge; however ESI did not specify which line.

The drums that formed the drains were later placed in containers for disposal. One line was reportedly replaced with a 10-inch diameter, PVC pipe by ESI.

The River Gut borders the northeastern-southeastern Site boundary. Several drain lines reportedly discharged from the Site to the River Gut. Samples were collected from the drains and from the River Gut by ESI, EPA, and NUS. Analytical results for these samples, as well as the results for a background soil sample collected by NUS, are summarized on Table D-6 in Appendix D.

On June 7, 1985, ESI collected two soil samples, identified as "Drain Line #1" and "Drain Line #2." Although information regarding the actual sample locations is not available, it is presumed that these samples were collected from the drains that discharged to the River Gut. The two samples were split and submitted for laboratory analysis. Based on available information, one laboratory analyzed "Drain Line #1" for BTEX and "Drain Line #2" for VOCs. The second laboratory apparently only analyzed the two samples for toluene. Toluene was detected in both samples at concentrations ranging from 140 ppm to 5,600 ppm. Chloroform and methylene chloride were reported in "Drain Line #2" at 68 ppm and 1,260 ppm, respectively; these VOCs were not analyzed for in "Drain Line #1". Other VOCs including benzene, carbon tetrachloride, ethylbenzene, and xylenes were detected at concentrations ranging from 0.1 ppm to 10 ppm.

On February 19, 1986, ESI collected sediment samples from 11 locations along the River Gut. The samples were submitted for analysis of metals, cyanide, phenols, and VOCs. Several metals including cadmium, chromium, copper, lead, and zinc were detected in the samples. Cadmium was detected in samples G-6 and G-7 at 1.0 ppm and 2.4 ppm, respectively. Cadmium was not detected in any other Gut sample. Chromium, copper, lead, and zinc were detected in all of the Gut samples. With one exception, the concentrations of these metals were lowest in sample G-4 and highest in sample G-11. Chromium was detected at concentrations ranging from 12 ppm in sample G-4 to 41.1 ppm in sample G-11; copper was detected at concentrations ranging from

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25.3 ppm in G-4 to 69.7 ppm in G-11; lead concentrations ranged from 13.2 ppm in G-4 to 46.7 ppm in G-7; and zinc concentrations ranged from 37.1 ppm in G-4 to 871 ppm in G-11. None of the other parameters analyzed were reportedly detected in the River Gut sediment samples.

The laboratory also reported results of a leachate generated from a composite of samples from locations G-6 and G-7. Barium and lead were reported in this sample at concentrations of 1.2 ppm and 0.24 ppm, respectively.

On March 13, 1986, EPA collected three sediment samples from the River Gut. ESI obtained split samples for independent analysis. EPA analyzed the three sediment samples for VOCs, semivolatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls (PCBs), metals, and dioxins. The ESI split samples were analyzed for VOCs, SVOCs, and PCBs. Results reported by EPA and by ESI's laboratory were inconsistent. In the background sample, identified as 085251, EPA reported butylbenzylphthalate, di-n-octylphthalate, and several metals at relatively low concentrations. ESI's laboratory reported all of the parameters analyzed as undetected. In sample 085252, collected near the discharge point of the laboratory pit, EPA reported di-n-octylphthalate and several metals at relatively low concentrations. The only substance reported by ESI's laboratory in this sample was methylene chloride (flagged as a possible laboratory-induced constituent). In sample 085253, collected near the discharge point of the process pit drain, EPA reported xylenes, several SVOCs, and several metals at relatively low concentrations. ESI's laboratory only reported chloroform, ethylbenzene, and toluene. The reason for the discrepancies between the data reported by EPA and ESI's laboratory are unknown.

On February 28, 1991, NUS collected three sediment samples from the River Gut, two sediment samples from the storm drains, and one background soil sample near the VIPA well field located west of the Site. Sample SED1 was located in the Gut approximately 500 feet downstream from the Site. Sample SED2 (and duplicate sample SED4) was located in the Gut near the discharge point of the loading dock surface and laboratory pit drains. Sample SED3 was collected in the Gut near the upstream property boundary. Samples SED5 and SED6 were collected from the Central and Southern Storm Drains, respectively.

The samples collected by NUS were analyzed for VOCs, SVOCs, pesticides/PCBs, and metals. Neither VOCs nor SVOCs were detected in the three samples collected from the River Gut. One VOC, 2-butanone (methyl ethyl ketone), was detected in the two sediment samples from the storm drains and in the background sample. The only other VOCs reported were xylene in the two storm drain samples and trichloroethene in the background sample, all of which were reported at estimated concentrations below the method detection limits (MDLs). Several SVOCs and pesticides were detected in the two samples from the storm drains, all at estimated concentrations below MDLs. Metals were detected in all of the samples collected by NUS. Chromium, copper, lead, and zinc were generally detected at concentrations similar to those reported by ESI for the samples collected from the River Gut on February 19, 1986. Antimony, arsenic, and nickel were reported at relatively low concentrations by EPA. These metals were not reported by ESI. Several other metals, apparently not previously analyzed, also were detected including aluminum, barium, calcium, iron, magnesium, manganese, potassium, sodium, and vanadium.

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#### *2.3.3.8 Groundwater*

In October 1990, EPA prepared the document entitled *Compendium of Well Water Data Collected at the Virgin Island Chemical Company by the EPA (1986-1990).* The compendium summarizes chloroform concentrations detected in selected wells during five sampling events between March 13, 1986 and June 25, 1990. This data is summarized with other available information on Table D-7 in Appendix D. Excluding the first sample from the onsite monitoring well, chloroform concentrations were below the federal Maximum Contaminant Level (MCL) of 80 parts per billion (ppb) for trihalomethanes.

### 2.3.4 Previous Remedial Actions

Remedial actions have previously been implemented at the facility by both Island Chemical and EPA, under the authority of their Removal Action Program. The information provided in this section has been consolidated and extracted from HLA's *Draft Remedial Investigation Work Plan* dated August 5, 1994.

#### *2.3.4.1 Island Chemical/Berlex Remedial Activities*

During the period from 1980 through 1982, when Island Chemical operated under Berlex, the only wastes regularly generated were those stemming from the process and analytical laboratories. Reported waste volumes exceeded no more than a few gallons per quarter (ESI 1985b).

Island Chemical discovered hazardous materials had been left onsite by the previous occupant. This material was analyzed and removed it from the Site in 1982 and 1983. Waste removal actions are summarized on Table D-8 in Appendix D.

Between November 27, 1982 and February 1, 1983, Island Chemical removed 26,748 gallons of toluene and 6,946 gallons of xylene from the facility for offsite disposal. These waste liquids were shipped via eight bulk tanker loads to Inland.
Following closure of the facility, a representative of the Government of the Virgin Islands inspected the Site on May 17, 1983. According to the inspection report, no hazardous waste was present onsite at that time.

During limited investigative and remedial activities performed by ESI onsite, various wastes were generated including a total of 192 drums that were shipped offsite to Chem-Waste Management, Inc. in Emelle, Alabama on December 2, 1985.

Area A – Laboratory and Warehouse Building

On January 31, 1989, EPA responded to a complaint and found approximately 400 drums containing various materials and wastes in the laboratory and warehouse. Between March 1989 and April 1991, EPA contractors removed the drums and waste.

Area B – Aboveground Tank Farm

ESI excavated impacted soil between Tanks 8 and 9 to a depth of approximately one foot. According to ESI, the excavated soil and the contents of Tank 8 were placed in 55-gallon drums and placed in the warehouse. Between June 6 and July 3, 1985, ESI placed the contents of the eight drums containing toluene-impacted soil on drying trays. The trays were placed in the dryer

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building at 42 °C. ESI collected soil samples in the dryer approximately every two weeks between June 14 and August 7, 1985. Reported results indicated that toluene concentrations in the soil decreased from a maximum of 1,500 ppm in June to 0.66 ppm in August. EPA collected two composite samples from the dryer on September 9, 1985. Toluene was detected at 0.46 ppm to 0.56 ppm. SVOCs were detected at higher concentrations including benzophenone at 15,000 ppm.

Area D – Loading Dock and Former Laboratory Pit and Drain Area

In June 1985, ESI remediated impacted soil in this area. The method used to treat the soil appeared to have been a form of biodegradation. During the treatment program, pyridine concentrations were monitored through sample collection and analysis on June 14, July 1, July 17, and August 7, 1985. Reported pyridine concentrations fluctuated throughout this period.

Area E – Soil Beneath Concrete Pad Near ASTs

ESI excavated approximately four cubic yards (cy) of soil from this area. The excavation was backfilled with clean soil.

#### *2.3.4.2 EPA Remedial Activities*

A variety of wastes were apparently generated by operators of the facility subsequent to Island Chemical between 1986 and 1989. On January 31, 1989, EPA's Response and Prevention Branch conducted a PA and removal evaluation at the Site. This work was in response to a request from Mr. George Pavlou, the Associate Director of Enforcement Programs. At the time of the PA and removal evaluation, EPA identified three areas of concern: (1) laboratory (main building); (2) drum storage warehouse (main building); and (3) grounds outside the building, including the reactor and centrifuge.

Phase I Removal Activities

Phase I removal activities are documented in EPA's POLREPs No. 2 through 13. Activities included relocation of drums to the warehouse, opening and sampling containers, and sampling the fire water tank.

First Fuming Drum Emergency Response Action

On May 9, 1990, EPA performed an emergency response action following a report of a fuming drum. The drum was identified as No. 29, located in the rear of the warehouse. The response action was completed by May 12, 1990. Activities associated with the emergency response action are summarized in EPA's POLREP No. 14 and included mobilization, securing the fuming drum, stabilization of the drum with a lime-based cement as an absorbent/neutralizer, and demobilization from the Site.

Phase II Removal Activities

Phase II removal activities performed by EPA between June 15 and July 10, 1990 are documented in POLREPs No. 15 through 19. Activities included obtaining bids for waste classification analyses, lab packing and drum segregation, drum crushing, and remote detonation of several containers. As part of this action, EPA sampled groundwater from wells identified as VIPA and WAPA on June 25, 1990.

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Second Fuming Drum Emergency Response Action

On July 25, 1990, EPA performed a second emergency response action following a report of a fuming drum. The drum was identified as No. 22 and contained benzyl chloride. The response action was completed on July 27, 1990, when this drum and two other drums containing benzyl chloride were stabilized using lime and the bungs were replaced. Activities associated with this emergency response action are summarized in EPA POLREP No. 20.

Phase III Removal Activities

Between August 6 and November 8, 1990, EPA performed Phase III activities as documented in POLREPs No. 21 and 22. Work included additional sampling and preparation of disposal arrangements.

Response to Vandalism

Between July 27 and November 9, 1990, the Site was vandalized and various materials and equipment to be used for final removal activities were stolen. The local police were notified and EPA returned to the Site on November 11, 1990 to upright overturned drums, repair damage, and inventory equipment. These activities are summarized in POLREP No. 23.

Final Phase Removal

Final disposition of the waste generated is summarized in EPA POLREP No. 30. According to EPA, clean-up activities were completed by April 1991 and all waste was removed from the Site by October 24, 1991. A summary of the disposition of the waste streams is presented on Table D-9 in Appendix D.

## 2.4 NATURE OF PROBLEM

The presence and distribution of Site-related constituents, combined with their toxicity and the potential for these constituents to migrate, is the main reason for performing this RI/FS. Previous investigations and removal actions indicated that sources of impacts were present at the VICHEM Site. In general, toluene and pyridine (chemicals used by many of the occupants) represented the largest volume releases at the Site. Because remedial actions were performed to remove some of these identified source areas, the levels of Site-related constituents in the various media (i.e., groundwater, soil onsite and in the River Gut), as compared to the levels detected during previous Site investigations, have been reduced.

The design of the RI field investigation focused on determining the nature and extent of impacts in the various media and collecting the environmental data needed to assess the risk to receptors associated with exposure to constituents in the media. Constituents that have been detected include VOCs, SVOCs, and metals. These constituents are present at concentrations that pose a potential risk to human health and/or environmental receptors.

# 3.0 SCOPE OF REMEDIAL INVESTIGATION

This section describes the locations, methods, and media involved during all phases of the RI field investigation at the VICHEM Site. Work was conducted in accordance with the following EPA-approved documents:

- *Draft Remedial Investigation Work Plan* (HLA 1994);
- *Draft Phase II Remedial Investigation Work Plan* (HLA 1995b);
- *Additional Requested Information, Proposed Site Activities* (HLA 1996b);
- *Draft Remedial Investigation Work Plan Addendum – Phase III* (HLA 1997);
- *Supplemental Remedial Investigation (Phase IV RI)* (McLaren/Hart 1998c);
- *Clarifications to Supplemental Remedial Investigation dated August 12, 1998* (McLaren/Hart 1998d); and,
- *Production Well P-1 Abandonment/Replacement,* January 19, 2000 (McLaren/Hart, 2000).

In addition, the following EPA documents, as well as other applicable guidance documents, were utilized: *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final* (EPA 1988) and *Region II CERCLA Quality Assurance Manual, Revision 1* (EPA 1989b). On behalf of EPA, CDM Federal Programs Corporation (CDM Federal) conducted oversight of the various phases of field work. The Phase I, Phase II, and preliminary Phase III (June 1997) field investigations were performed by HLA. The remainder of the Phase III and all of the Phase IV work was performed by McLaren/Hart. Figure 3-1 depicts the Site areas of concern investigated during Phases I through IV of the RI. Figure 3-2 depicts the locations of all samples collected during the RI.

The primary objective of the RI was to collect the data needed to adequately support a BRA (both human health and ecological) and to provide a basis on which a subsequent, cost-effective remedial action plan will be recommended. During the four phases of work, the following specific data requirements were addressed:

- background concentrations of constituents in surface soil;
- nature and extent of potential surface and subsurface soil impacts onsite;
- nature and extent of potential groundwater impacts onsite/offsite;
- Site-specific geologic and hydrogeologic conditions; and
- nature and extent of potential soil/sediment impacts in the Gut System (i.e., River, Bethlehem, and Fair Plains Guts).

The data collected during these activities are the basis for the conclusions in this RI Report.

## 3.1 SOIL INVESTIGATION

### 3.1.1 Purpose and Scope

Surface and subsurface soil samples were collected at the VICHEM Site during the four phases of the RI field investigation to evaluate the lithology, to define the soil geophysical/geochemical properties, and to determine the nature and extent of potential soil impacts across the Site. Based on the results from previous investigations (summarized in Section 2.3.3), several areas of concern were identified. Initial soil data was collected during the Phase I investigation (January 1995) to evaluate the extent of soil impacts in the following areas: AST Area, Soil Beneath

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Concrete Pad Near ASTs, Former Laboratory Pit Area, and Former Process Pit Area. The results of the Phase I investigation identified several data gaps that existed in the soil near Tanks 8 and 9 in the AST Area. During the Phase II investigation (May 1996), several soil borings were completed near these tanks to delineate potentially-impacted soil. The soil sampling portion of the Phase III Investigation (June 1997, September/October 1997, December 1997, and March/April 1998) focused on the investigation of soil in the Former Drum Areas and the Former Laboratory Pit Area; further delineation of impacted soil in the AST Area and Former Process Pit Area; preliminary evaluation of potentially-applicable technologies (i.e., soil vapor extraction, bioventing) for the AST Area; and evaluation of background soil samples. Shelby tube samples were collected during the Phase IV field investigation to further evaluate potential treatment technologies for soil in the Former Process Pit Area. However, these samples were lost during shipment to the laboratory. These samples were not re-collected due to time constraints and lack of available drilling materials.

### 3.1.2 Locations and Methods

The surface and subsurface soil sampling program was performed at the VICHEM Site between January 1995 and October 1998. Below is a summary of the methodologies used to collect the samples in each area of the Site. A tabulated summary of the soil samples collected during the four phases of the RI is presented in Table 3-1. Soil boring logs are presented in Appendix F.

#### *3.1.2.1 AST Area*

Soil samples were collected in the AST Area during the Phase I, Phase II, and Phase III field investigations. A total of 22 soil borings were completed in this area, with samples collected at various depth intervals, and a total of 7 surface soil samples were collected. Figure 3-3 depicts the sample locations for the AST Area.

Phase I Investigation - January/February 1995

Two soil borings (SBB-1 and SBE-1) were completed in the AST Area during the Phase I field investigation. Using hollow-stem auger (HSA) drilling methods to advance the borings, continuous split-spoon soil samples were collected at two-foot intervals from the ground surface to the water table interface at each boring location. Upon opening each split-spoon, the stratigraphy was logged and the soil was screened for the presence of organic vapors using a photoionization detector (PID). A soil sample was then collected from each two-foot interval and placed directly into a laboratory-prepared glass container. These samples were kept in an iced cooler until selected samples were submitted for laboratory analysis. A portion of the soil remaining in each split-spoon was placed in a resealable bag and a field headspace screening was taken using the PID.

One surface soil sample and two subsurface soil samples were collected for analysis at each location: one from directly above the water table interface and one from the sample interval with the highest PID reading or visual staining (if a PID reading/staining was not observed, the sample interval was field-determined based on lithology). A total of three subsurface soil samples and two surface soil samples were collected for analysis of Target Compound List (TCL) VOCs, TCL SVOCs, TCL pesticides/PCBs, and Target Analyte List (TAL) metals following Contract Laboratory Program (CLP)-approved methodologies.

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Phase II Investigation - May 1996

Additional samples were collected during the Phase II investigation to further delineate potentially-impacted surface and subsurface soil in the AST Area. A total of 5 surface soil samples were collected and 7 soil borings were completed to the top of the water table, with subsurface soil samples collected at various depth intervals. The surface soil samples (SBB-4, SBB-6, SBB-11, SBB-16, and SBB-17) and soil borings (SBB-2, SBB-4, SBB-6, SBB-11, SBB-15, SBB-16, and SBB-17) were collected using the same HSA procedures described above. The sampling rationale followed the same protocols used during the Phase I investigation with two subsurface soil samples collected from each boring location. The intermediate depths chosen were based upon historical analytical results. Samples were analyzed for TCL VOCs.

Phase III Investigation - June 1997, September/October 1997, and December 1997

Further soil delineation in the AST Area was completed during the Phase III investigation under three separate mobilizations to the Site. Four soil borings (SBAST-1 through SBAST-4) were completed during the first Phase III mobilization (June 1997). These borings were installed using the HSA techniques previously described. The sampling rationale followed the same protocols previously employed with two subsurface soil samples collected from each boring location. Samples were analyzed for TCL VOCs, TCL SVOCs, and TAL metals.

Three additional soil borings were installed during the September/October 1997 event at approximately 20 feet to the west (SBAST-5), 20 feet to the northwest (SBAST-6), and 20 feet to the north (SBAST-7) of previous soil boring location SBB-17. These borings were installed using the HSA techniques described above. Although the sampling rationale followed the same procedures used previously for collection of subsurface soil samples, the screening procedures differed. An onsite field gas chromatograph (GC) was utilized to screen samples for toluene, ethylbenzene, and total xylenes (TEX). Two subsurface soil samples were submitted for analysis: one from directly above the water table interface and one from the sample that exhibited the highest overall concentration of TEX compounds (based on the GC results). These samples were analyzed for TCL VOCs, TCL SVOCs, and TAL metals.

Soil borings SBAST-10 through SBAST-13 were completed in December 1997 at locations onsite and offsite to the north, west, and south of Tanks 8 and 9. Continuous split-spoon samples were not collected for screening purposes during this effort. Instead, discrete-depth sample intervals were selected based on previous analytical data and the expected depth of impacted soil. Soil was screened with an onsite GC for TEX compounds. The subsurface soil sample containing the highest overall concentration of TEX compounds, as well as the sample from the interval directly above the water table, were submitted for analysis of TCL VOCs.

Shelby tube samples were collected from two soil borings (SBAST-8 and SBAST-9) within the AST Area during the September/October 1997 field event. These two tubes were driven to a depth of 6 to 8 feet bgs (SBAST-8) and 8 to 10 feet bgs (SBAST-9). The samples were analyzed for geochemical/geotechnical parameters (grain size, moisture content, total organic carbon [TOC], porosity, Atterberg limits, and hydraulic conductivity) to preliminarily evaluate the applicability of soil vapor extraction as a feasible technology for remediation of impacted soil. Additionally, two subsurface soil samples were collected at the same locations and depths for analysis of biological parameters (total heterotrophic plate count, hydrocarbon utilizer bacteria count, TOC, moisture content, alkalinity, iron, ammonia, sulfate, sulfide, nitrate, nitrite, and ortho phosphate) to preliminarily evaluate the applicability of bioventing as a potentially-feasible technology for impacted soil in the AST Area.

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### *3.1.2.2 Former Process Pit Area*

Soil borings were installed in the Former Process Pit Area during Phase I, Phase III, and Phase IV of the RI field investigation. Monitoring well MW-2 was drilled during the Phase II investigation, but soil samples were not collected during well installation. A total of 20 soil borings were completed during the implementation of the RI and a total of one surface soil sample and 91 subsurface soil samples were collected for analysis. Figure 3-4 depicts the sample locations for this area.

Phase I Investigation - January/February 1995

Soil boring SBC-1 was completed in the Former Process Pit Area during the Phase I investigation. This boring was drilled using the HSA techniques previously described. During drilling, a layer of relatively low permeability soil was encountered above the water table at approximately 20 to 20.5 feet bgs. Monitoring well MW-2 was originally planned to be installed at this location, but HLA raised concerns to EPA that puncturing the low permeability layer for purposes of well installation could provide a conduit for constituents, if present, to reach the groundwater. In consultation with EPA, a decision was made to forgo the installation of the well at that time. Because the well was not installed, additional soil samples were collected to provide supplementary data on soil quality conditions. Samples were analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, and TAL metals.

Phase III Investigation - December 1997 and March/April 1998

Six soil borings (SBPP-1 through SBPP-6) were completed in December 1997 to evaluate the extent of potential chloroform impacts to soil in the Former Process Pit Area and to identify a source of continuing impacts to groundwater in the area. With the exception of SBPP-6 (one sample collected), two soil samples were collected from each boring: one from directly above the water table and one from an intermediate depth ranging from 8 to 13 feet bgs. Based on a review of historical information and field observations, it was determined that the process pit extended from approximately 8 to 12 feet bgs. Intermediate depths were sampled to determine if a release of contents or seepage occurred through the pit. Samples were analyzed for TCL VOCs.

The source of chloroform impacts to groundwater was further investigated during March and April 1998 using a Geoprobe with direct-push drilling techniques. At each soil boring location, a large bore-drive point sampler was driven to the top of the desired sample depth. Soil samples were then collected by driving an acetate tube that measured 2 inches in diameter and 4 feet in length. After opening the acetate liner, a PID reading was taken. If the sample indicated an elevated reading on the PID, or if there was visual evidence of staining, a sample was collected for analysis of acetone, methylene chloride, TEX compounds, and chloroform using an onsite gas chromatograph/mass spectrometer (GC/MS) for VOCs using EPA Method 8260M.

Subsurface soil samples were collected from discrete-depth intervals at twelve soil boring locations (SBPP-7 through SBPP-10, SBPP-13, SBPP-15, SBPP-22, SBPP-23, SBPP-26, SBPP-27, SBPP-32, and SBOR-1) during the March/April 1998 mobilization. In addition, a sample was collected from SBPP-13 (22 to 24 feet bgs) for TOC analysis. The extent of sampling and the determination of the specific sample collection locations were determined and adjusted in the field in consultation with CDM Federal and EPA, based on the analytical data provided by the onsite GC/MS analysis.

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Phase IV Investigation - October 1998

Limited sampling was conducted in the Former Process Pit Area during the Phase IV investigation to evaluate remedial alternatives. Shelby tube samples were collected to determine geophysical/geochemical parameters (hydraulic conductivity, grain size, etc.), but these samples were lost during shipment. Additional sample collection to replace the lost samples was not possible due to time constraints and lack of available drilling materials.

### *3.1.2.3 Former Laboratory Pit Area*

A total of 8 soil borings were completed in the Former Laboratory Pit Area during the Phase I and Phase III mobilizations. The locations of these borings are depicted on Figure 3-5. A total of 6 surface soil samples and 14 subsurface soil samples were collected for analysis.

Phase I - January/February 1995

Six soil borings (SBD-1 through SBD-3 and SBF-1 through SBF-3) were completed in the Former Laboratory Pit Area during the Phase I investigation. The borings were completed using HSA drilling techniques and soil was screened using a PID. Similar to other areas onsite, one surface soil sample and two subsurface soil samples were collected for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, and TAL metals.

Phase III - December 1997

Two soil borings (SBLP-1 and SBLP-2) were completed in December 1997 to investigate the potential for impacted soil stemming from previous site operations in the Former Laboratory Pit Area. The sampling rationale followed the same procedures used in the other areas onsite with two subsurface soil samples collected at each boring location. The intermediate depths chosen were based upon historical analytical results. Samples were analyzed for TCL VOCs.

### *3.1.2.4 Former Drum Areas*

A total of 8 soil borings were completed in the Former Drum Areas during the Phase I and Phase III mobilizations. The locations of these borings are depicted on Figure 3-6. A total of 2 surface soil samples and 16 subsurface soil samples were collected for analysis.

Phase I - January/February 1995

Two soil borings (SBC-2 and SBD-4) were installed in this area during the Phase I investigation. The borings were completed using HSA drilling techniques and soil was screened using a PID. Similar to other areas onsite, one surface soil sample and two subsurface soil samples were collected for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, and TAL metals.

Phase III – June 1997

Three former drum areas were tentatively identified through an EPA-documented aerial photograph dated February 13, 1971. Based on this information, subsurface soil samples were collected from soil borings during the preliminary Phase III investigation in each of the three areas. The following borings were completed:

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- three soil borings (SB238D-1 through SB238D-3) at the suspected former location of 238 drums;
- two soil borings (SB64D-1 and SB64D-2) at the suspected former location of 64 drums; and
- one soil boring (SB8D-1) at the suspected former location of 8 drums.

These soil borings were completed to investigate the possible presence of additional sources within the three former drum areas.

The soil borings were drilled using the HSA techniques and sampling rationale followed in the AST Area. Two subsurface soil samples were collected from each boring location and analyzed for TCL VOCs, TCL SVOCs, and TAL metals. A total of 12 subsurface soil samples were collected for analysis.

#### *3.1.2.5 Storm Drains*

Samples in and around the Central and Southern Storm Drains were collected during the Phase III investigation (September/October 1997). The program consisted of soil borings and subsurface soil sampling along the Central Storm Drain and surface soil sampling within the Central and Southern Storm Drains. Figure 3-6 depicts the sample locations.

During the excavation of the former Central Storm Drain, which was constructed of 55-gallon drums welded end to end, elevated PID field screening results were reported. As requested by EPA, one soil boring was to be completed at the approximate location of the elevated reading. However, historical information did not indicate the exact location of this reading. Therefore, a total of 3 borings (SBCSD-1 through SBCSD-3) were installed along the Central Storm Drain at an approximate 40-foot spacing. The soil borings were drilled using the HSA techniques and the sampling rationale followed in the AST Area. Two subsurface soil samples from each boring location were analyzed for TCL VOCs, TCL SVOCs, and TAL metals. A total of 6 soil samples were collected for analysis.

Two sediment samples were collected from each of the onsite storm drains (SDSSD-1 and SDSSD-2 in the Southern Storm Drain and SDCSD-2 and SDCSD-3 in the Central Storm Drain) during the Phase III investigation (September/October 1997) to characterize the conditions and potential impacts in both drains. SDCSD-1, SDCSD-4, and SDCSD-5 were not collected, as originally scoped in the work plan, due to insufficient sample volume.

The storm drains only contain water during flooding conditions and do not support aquatic biota. Therefore, these storm drains were characterized as terrestrial environments and samples collected from these locations were evaluated as surface soils. These samples were collected according to the procedures used to collect surface soil samples in the Gut System (described below in Section 3.3). Samples were analyzed for TCL SVOCs, TAL metals, TOC, total solids, grain size, pH, reduction/oxidation (redox) potential, alkalinity, and specific conductance.

#### *3.1.2.6 Onsite Background Locations*

Three surface soil samples (B-1 through B-3), as shown on Figure 3-2, were collected during the Phase III investigation (September/October 1997) from onsite areas that had not been visibly impacted by previous Site operations. These samples were collected to evaluate background surface soil concentrations. Samples were collected from the 0- to 6-inch interval and analyzed for TCL VOCs, TCL SVOCs, and TAL metals. A lithologic description of these samples is presented on Table 3-2.

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## 3.2 GROUNDWATER INVESTIGATION

### 3.2.1 Purpose and Scope

Groundwater data was collected during all four phases of the RI. The data was used to formulate a Site conceptual model based on the following information:

- geologic conditions at the Site;
- hydrogeologic properties of the underlying aquifer (both shallow and deep);
- flow direction(s) in the shallow and deep portions of the water-bearing zone; and,
- nature and extent (horizontal and vertical) of groundwater impacts onsite and offsite.

As part of the initial groundwater investigation (Phase I), several activities were performed to evaluate groundwater quality and flow directions in the shallow and deep portions of the underlying aquifer. These activities included monitoring well installation, rehabilitation of existing monitoring wells, well survey, water level measurements, and groundwater sampling.

Based on an evaluation of the results of the Phase I investigation, several objectives were established as part of the Phase II groundwater investigation. These objectives included an evaluation of the following: nature and extent of impacted groundwater near MW-1 (AST Area), groundwater quality in the vicinity of the Former Process Pit Area, and direction of shallow groundwater flow. The scope of the investigation included installation of additional monitoring wells, water level measurements (manual and automatic), groundwater sampling, and well survey.

After an assessment of the Phase II investigation findings, EPA requested that additional data be collected to characterize the lateral and vertical extent of TEX impacts in the AST Area and to characterize groundwater quality, hydraulic properties, and direction of groundwater flow in the shallow and deep portions of the underlying aquifer.

To address these data gaps, the following activities were initially performed as part of the Phase III investigation: installation of temporary shallow wells and a permanent shallow monitoring well in the AST area; installation of three additional deep monitoring wells; slug testing; water level measurements; groundwater sample collection; and video surveying of the onsite production wells.

The activities outlined above were completed by HLA and McLaren/Hart during the June 1997, September/October 1997, December 1997, and January 1998 mobilizations. Upon completion of these events, EPA determined that additional data was needed to characterize the vertical and lateral extent of chloroform impacts in the Former Process Pit Area and to evaluate onsite groundwater quality. In March 1998, McLaren/Hart completed the Phase III investigation by implementing a Geoprobe sampling event and collecting additional Site-wide groundwater samples.

Throughout the various phases of RI field work, EPA raised concerns regarding both the vertical and horizontal impacts to groundwater. To address EPA's concerns and complete the RI field investigation, McLaren/Hart implemented a Phase IV investigation in October 1998. As part of this investigation, McLaren/Hart performed the following activities: vertical screening and installation of shallow and deep monitoring wells, packer testing of onsite production well P-1, collection of manual and automatic water level measurements, sampling of select onsite and

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offsite wells, and acquisition of local production well and precipitation information. The Phase IV field work concluded following the abandonment and replacement of former production well P-1, and associated groundwater sampling to confirm whether groundwater in the deep aquifer was impacted with chloroform.

### 3.2.2 Locations and Methods

#### *3.2.2.1 Phase I Investigation - January/February/May 1995*

As part of the initial groundwater investigation, several activities were performed including monitoring well installation, rehabilitation of existing monitoring wells, well survey, manual water level measurements, and groundwater sampling.

Monitoring Well Installation

Four shallow monitoring wells (MW-1, MW-3, MW-4, and MW-5) were installed during the Phase I investigation to evaluate groundwater quality in the shallow aquifer in the areas of potential concern identified during previous investigations (see Section 2.3.3). These wells were installed in the AST Area (MW-1), near the Central Storm Drain (MW-3), in the Former Laboratory Pit Area (MW-4), and adjacent to the warehouse/laboratory building (MW-5). The locations of these monitoring wells are depicted on Figure 3-7 and construction details are listed on Table 3-3. Monitoring well construction diagrams are presented in Appendix G. Monitoring well MW-2 was not installed during this investigation, due to a layer of low permeable soil encountered above the water table during the completion of soil boring SBC-1 (see Section 3.1.2.2 for detailed explanation).

The four monitoring wells were constructed using steam-cleaned 10-foot lengths of 4-inch diameter, Schedule 40, flush-jointed, threaded PVC. The screen sections consisted of 0.020-inch, factory-slotted pipe that was installed approximately 5 feet above and 5 feet below the water table.

The monitoring wells were installed by drilling to a depth of 5 feet below the encountered water table. The wells were completed to a total depth ranging from 27.5 to 33 feet bgs. Upon reaching the desired depth, the screen and riser were inserted through the HSAs to the bottom of the borehole. After pulling the auger back out of the hole to expose the annulus, #2 morie sand was slowly poured through the augers into the annulus around the lower portion of the screen. This process continued until approximately 2 feet of sand accumulated above the screen interval. After installation of the sand pack, approximately 1 to 2 feet of bentonite pellets were poured into the hole. After allowing the bentonite to hydrate, the remaining annular space was filled with a bentonite/concrete slurry, via tremie pipe, to approximately 3 feet bgs. Pre-mixed concrete was emplaced over the slurry and a steel protective casing, with locking cap, was set approximately 2 feet into the concrete mixture. After allowing the slurry and concrete to cure, the wells were developed by pumping, surging, and/or bailing until the wells were clear of fines.

Rehabilitation of Existing Monitoring Wells

The two production wells, P-1 and P-2 (as shown on Figure 3-7), were modified in February 1995 to facilitate access and provide security. The pumps were removed from the wells, upon which the wells were patch-welded. Water tight plugs were not placed on the tops of the wells since the wells did not contain inner casings. Each well was equipped with a locking steel cap. The wells

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were sounded and then redeveloped until they were clear of fines. Construction details for the production wells are listed in Table 3-3.

Well Survey

Horizontal and vertical control was established for each of the four newly-installed monitoring wells and the two existing production wells by a licensed surveyor. Elevations surveyed included the inner and outer casings and ground elevations with respect to mean sea level (msl). A mark was placed on the inner casing of the four new monitoring wells (where the elevation was measured) for future water level measurements.

Manual Water Level Measurements

Water level measurements were collected from the four newly-installed monitoring wells and the two production wells onsite. Water levels were measured in each well using an oil/water interface probe and/or an electronic water level indicator with respect to the survey marks at the top of the inner casing in each well.

During the Phase I investigation, a total of 5 rounds of water level measurements were collected during the February and May 1995 groundwater sampling events (discussed below). The measurements were collected on the following dates and are presented in Table 3-4:

- February 14, 1995;
- May 8, 1995;
- May 9, 1995;
- May 10, 1995; and
- May 11, 1995.

Groundwater Sampling (2 rounds)

Groundwater samples were collected from the four newly-installed monitoring wells during two separate events: February and May 1995. The following procedures were used during both sampling events. Before groundwater sampling commenced, certain protocols were followed to ensure that samples collected were representative of the formation in which the well was screened. Each well was opened and static water level measurements were collected from either the top of inner casing (TIC) or the top of outer casing (TpOC). In addition, the total depth of the well was measured relative to TIC or TpOC. Once these measurements were recorded, the standing water in the well was calculated by multiplying the linear feet of water by the surface area of the well casing.

The wells were purged a minimum of three well volumes using a dedicated, PVC bailer. Groundwater samples were collected using dedicated, Teflon bailers and were placed on ice and submitted for analysis of TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, TAL metals (filtered and unfiltered), and pyridine.

### *3.2.2.2 Phase II Investigation - May 1996*

Based on an evaluation of the results from the Phase I investigation, several activities were performed during the Phase II investigation to further characterize onsite groundwater quality. The scope of work included installation of additional monitoring wells, water level measurements (manual and automatic), groundwater sampling, and well survey.

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Monitoring Well Installation

Two additional monitoring wells, MW-2 and MW-6, were installed and developed during the Phase II investigation in May 1996 using the procedures outlined in Section 3.2.2.1 (Phase I Investigation). MW-2 was installed to evaluate the shallow aquifer in the Former Process Pit Area. MW-6 was installed at the location of soil boring SBB-17 to further evaluate groundwater impacts in the AST Area. This location was chosen since soil samples from this boring exhibited the highest PID readings during field soil screening. The locations of the monitoring wells are depicted on Figure 3-7. Both wells were installed across the encountered water table to depths of 29 and 27 feet bgs for MW-2 and MW-6, respectively. The construction details for these wells are presented in Table 3-3. Monitoring well construction diagrams are included in Appendix G.

Well Survey

Horizontal and vertical control was established for the two newly-installed monitoring wells. Survey elevations included the inner and outer casings and ground elevations (in msl). A mark was placed on the inner casing of the two new monitoring wells (where the elevation was measured) for future water level measurements.

Manual Water Level Measurements

Water level measurements were collected from onsite shallow monitoring wells using the procedures outlined in Section 3.2.2.1 (Phase I Investigation). The measurements were collected on the following dates and are presented in Table 3-4:

- May 29, 1996;
- May 30, 1996;
- June 16, 1996;
- June 17, 1996; and
- June 18, 1996.

Automatic Water Level Measurements

Automatic water level recorders (TUBERs) were installed in monitoring wells MW-1, MW-3, MW-4, and MW-5 between April 26, 1996 and June 18, 1996. The TUBERs were set to record water level measurements at 6-hour intervals. However, the TUBERs malfunctioned and no water level measurements were collected during this period.

Groundwater Sampling

Groundwater samples were collected from the newly-installed monitoring wells (MW-2 and MW-6) during the Phase II investigation. The samples were collected using the procedures outlined in Section 3.2.2.1 (Phase I Investigation), with the exception of the dissolved metals samples being filtered in the laboratory rather than in the field. Groundwater samples were analyzed for TCL VOCs. Additionally, the sample from MW-2 was analyzed for TCL SVOCs, TCL pesticides/PCBs, TAL metals (total and dissolved), and pyridine.

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### *3.2.2.3 Phase III Investigation - September/October 1997, December 1997, March/April 1998*

The following activities were initially performed as part of the Phase III investigation: installation of temporary shallow wells and a permanent shallow well in the AST Area, installation of three additional deep monitoring wells, slug testing, water level measurements, groundwater sample collection, and video surveying of the onsite production wells.

During the June 1997, September/October 1997, December 1997, and January 1998 mobilizations, HLA and McLaren/Hart completed the activities outlined above. Upon completion of these events, it was determined that additional data was needed to characterize the horizontal and vertical extent of chloroform impacts in the Former Process Pit Area and to evaluate onsite groundwater quality. In March 1998, McLaren/Hart completed the Phase III investigation by implementing a Geoprobe sampling program and collecting additional Site-wide groundwater samples.

Installation of Temporary Wells

Five temporary wells (TW-1 through TW-5) were installed offsite in the vicinity of existing monitoring well MW-6 during the September/October 1997 mobilization to assess the horizontal extent of TEX impacts in the shallow overburden offsite and to the west of the AST Area. The locations of these wells are shown on Figure 3-8. HSA drilling methods were used to install the wells. Soil samples were collected to log the stratigraphy and to determine the depth to the water table interface. Construction details are listed on Table 3-3. Well construction diagrams are included in Appendix G.

The total depths of the wells ranged from 29 to 32 feet bgs. Wells were constructed of steam-cleaned 2-inch diameter, Schedule 40, PVC riser pipe and 0.020-inch well screen. The well screens were 10 feet in length and were positioned across the water table. Upon reaching the desired depth, the screen and riser were inserted through the HSAs to the bottom of the borehole. After pulling the augers back out of the hole to expose the annulus, a #1/#2 morie sand was slowly poured through the augers into the annulus around the lower portion of the screen. This process continued until approximately 2 feet of sand accumulated above the screen interval. After installation of the sand pack, approximately 1 to 2 feet of bentonite pellets were poured into the hole. After allowing the bentonite to hydrate, the natural formation was allowed to collapse around the well.

After installation, each well was developed until the water was clear of fines. In addition, the wells were surveyed horizontally and vertically. A groundwater sample was then collected from each well and screened onsite for TEX compounds using a portable GC. Initially, three wells were installed: approximately 35 feet west (TW-1), 50 feet west-northwest (TW-2), and 50 feet northwest (TW-3) of monitoring well MW-6. Based on the groundwater sample results, two additional temporary wells (TW-4 and TW-5) were installed to delineate the horizontal extent of groundwater impacts. TW-4 was installed 50 feet west of TW-1 (i.e., 85 feet west of SBB-17) and TW-5 was installed 50 feet northwest of TW-3 (i.e., 100 feet northwest of SBB-17). Under EPA oversight and in accordance with the EPA-approved Work Plan (HLA 1997), all temporary wells were subsequently abandoned at the completion of the Phase III investigation by cutting the PVC pipe off at the ground surface and filling the well with a bentonite/cement slurry.

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Installation of Shallow Permanent Well

Three rounds of water level measurements (see Table 3-5) were collected from the five temporary wells to determine the groundwater flow direction in the shallow overburden within the AST Area. Along with the analytical data from these wells, this information was used to determine the downgradient extent of groundwater impacts. In consultation with EPA and CDM Federal, it was determined that the local groundwater flow potential in the AST Area was to the north (see Figure 3-8). Therefore, one shallow monitoring well (MW-10) was installed adjacent to TW-5 during the September/October 1997 mobilization. The lithology was characterized through the drill cuttings. The total depth of monitoring well MW-10, which was screened across the water table, was 32 feet bgs. The well was constructed of 4-inch diameter, Schedule 40, PVC riser pipe and well screen (10-foot length). The well was advanced, installed, and developed using the procedures outlined in Section 3.2.2.1 (Phase I Investigation). Construction details for this well are listed on Table 3-3. The monitoring well construction diagram is provided in Appendix G.

Installation of Deep Monitoring Wells

Three double-cased deep monitoring wells were installed during the December 1997 mobilization to evaluate the vertical extent of groundwater impacts at the Site. Deep monitoring wells MW-7, MW-8, and MW-9 were installed adjacent to existing shallow monitoring wells MW-2 (Former Process Pit Area), MW-6 (AST Area), and MW-4 (Former Laboratory Pit Area), respectively. Figure 3-7 depicts the monitoring well locations. Initially, a 12-inch diameter pilot boring was advanced using mud-rotary drilling methods. A mud tub, set up at the drilling location, was partially filled with potable water. The driller then circulated water through the drilling tools and mud tub, adding bentonite-based drilling mud to create a viscous drilling fluid. Once the mud reached an adequate consistency, the borehole was advanced to a depth of 5 feet below the water table (as defined by the water level of the adjacent shallow monitoring well). During drilling, the fluid circulated through the drill rods and up to the ground surface through the annular space of the boring. Cuttings from the boring were entrained in the drilling fluid and rose to the surface and were separated, to the extent possible, in the mud pan. The lithology was characterized from the drill cuttings.

Upon reaching the desired depth, an 8-inch diameter, steel outer casing was grouted in place to reduce the potential for cross-contamination during deeper drilling. After allowing the grout to set, a Hydropunch[7] sampler was used to collect groundwater samples at 10-foot intervals in each boring. When the targeted sample was reached, the Hydropunch[7] sampler, equipped with a disposable screen, was attached to the drill rods and set at the bottom of the boring. The sampler was then driven approximately 4 feet into the formation. An electronic water level indicator was then lowered inside the drill rods to verify that no water had infiltrated into the sample (e.g., the seal was intact). The sleeve was then retracted two feet, exposing the screen to the formation. After allowing sufficient time for groundwater to enter into the drill rods, a sample was collected using a disposable, PVC bailer.

The samples were analyzed onsite for TEX compounds using a portable GC. Samples were collected at 10-foot intervals until all individual compounds were found at concentrations below their respective federal MCL in two consecutive samples. After delineating the vertical extent of impacts, a 4-inch diameter, Schedule 40, PVC monitoring well was installed at a depth of 10 feet below the last sample interval. Upon reaching the desired depth, the screen and riser were inserted into the borehole to the bottom of the boring. After inserting the screen and riser, a #1 morie sand was poured slowly through a tremie pipe into the annulus until approximately 2 feet of sand accumulated above the screen interval. After installation of the sand pack, approximately

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1 to 2 feet of bentonite pellets were poured into the hole. After allowing the bentonite to hydrate, the remaining annular space was filled with a bentonite/concrete slurry, via tremie pipe, to approximately 3 feet bgs. Pre-mixed concrete was emplaced over the slurry and a steel protective casing, with locking cap, was set approximately 2 feet into the concrete mixture. After allowing the slurry and concrete to cure, the wells were developed by pumping, surging, and/or bailing until the wells were clear of fines. The total depth of the wells ranged from 73 to 74 feet bgs. Well screens were 10 feet in length. The construction details for these wells are listed on Table 3-3. Monitoring well construction diagrams are provided in Appendix G.

Groundwater Sampling (2 Rounds)

Two rounds of groundwater samples were collected at the Site (January and March 1998) from the existing and newly-installed monitoring wells (MW-1 through MW-10), as well as the two onsite production wells (P-1 and P-2), to assess Site-wide groundwater quality. The following procedures were used during both sampling events. Before groundwater sampling commenced, certain protocols were followed to ensure that samples collected were representative of the formation in which the well was screened. Each well was opened and static water level measurements were collected from either the TIC or TpOC. In addition, the total depth of the well was measured relative to the TIC or TpOC. Once these measurements were taken, the standing water in the well was calculated by multiplying the linear feet of water by the surface area of the well casing.

A low-flow purging/sampling technique was utilized during both rounds, with purge/sample collection rates of approximately 0.5 liters/minute. Field data for temperature, pH, specific conductance, redox potential, dissolved oxygen (DO), and turbidity were collected every three to five minutes during purging. Upon stabilization of field parameters, a groundwater sample was collected from each well and submitted for analysis of TCL VOCs, TCL SVOCs, TAL metals, and pyridine. Field parameter readings for the January and March 1998 groundwater sampling events (measurements taken at time of sample collection) are presented in Table 3-6.

Manual Water Level Measurements

Several rounds of water level measurements were collected from the onsite monitoring/production wells, as well as accessible offsite wells in the vicinity of the Site, to evaluate groundwater flow directions in both the shallow and deep water-bearing zones in the study area. Measurements were collected during the following time periods using an electronic water level indicator and are presented in Table 3-4:

- September 12, 1997;
- September 19, 1997;
- September 25, 1997;
- October 1, 1997;
- January 1998 (during groundwater sampling); and
- March 1998 (during groundwater sampling).

Automatic Water Level Measurements

Continuous water levels were recorded in select onsite wells to monitor water level fluctuations over a nine-week time period. A Telog9 automated water level recorder was installed in wells MW-2, MW-6, MW-7, MW-8, and P-2 on January 16, 1998, and water levels were continuously collected through March 23, 1998.



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Aquifer Testing and Measurement

During the December 1997 and January 1998 mobilizations, slug tests were conducted in monitoring wells MW-2 (shallow) and MW-7 (deep) to estimate the horizontal hydraulic conductivity of the aquifer underlying the Site. The slug tests were performed by using a PVC slug to displace a known volume of water in each well. The inserted slug caused an instantaneous change in the water level that was continuously logged as it recovered to its static level. Falling and rising head tests (measuring the recovery after inserting and removing the slug from the well) were conducted. To record the rate of rise and fall of the water level, a pressure transducer and electronic data logger were used. The data logger recorded the recovery of the water level by logging the hydraulic head (in feet, as measured by the transducer) at preset time intervals until the water level in the well recovered to or near its initial static level. Water level data were collected by the data logger on a logarithmic sampling schedule to ensure accurate measurement of the early, rapid water level change.

Video Surveying

A downhole video survey was conducted in the onsite production wells (P-1 and P-2) during the September/October 1997 mobilization to determine the depth of the screen interval in each well and to evaluate the integrity of the wells. Two types of lenses were used during the video survey: an axial lens that showed the axis of the borehole and a radial lens that showed the sidewall of the borehole. The radial lens could be rotated 360 degrees. The axial lens was used to identify gross changes in conditions (i.e., water table), while the radial lens was used for detailed inspections (i.e., cracks in casing, slotted or screened intervals).

Geoprobe Investigation

Investigation of the vertical and horizontal extent of groundwater impacts in the Former Process Pit Area, specifically chloroform, was further evaluated during the March/April 1998 mobilization using several different Geoprobe techniques.

Several locations were selected for collection of both subsurface soil and groundwater samples. At these locations, the depth to the water table was determined by examining the soil in the acetate liner. The large bore sampler was then driven to a depth of 3 to 5 feet below the determined water table depth and a dedicated, ¾-inch PVC screen and riser were inserted into the borehole. Samples were collected using either a dedicated PVC bailer or through dedicated Teflon tubing, fitted with a decontaminated check valve.

Several points were sampled for groundwater only. At these points, the depth to the water table was estimated based on water level information from adjacent borings. Two methods were used to collect samples from these points: a PVC screen and riser (described above) or a Hydropunch[7] sampler. The following procedures were used to sample with the Hydropunch[7]. An expendable point was placed at the bottom of the initial Geoprobe sampling rod. Upon reaching the desired depth, the Geoprobe rods were then retracted 2 feet, exposing the screen to the formation. After allowing sufficient time for groundwater to enter into the rods, a sample was collected using either a dedicated PVC bailer or through dedicated Teflon tubing, fitted with a decontaminated check valve.

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Twenty-eight groundwater samples (GWPP-7 through GW-17, GWPP-19 through GWPP-21, GWPP-23 through GWPP-35, and GWOR-1) were collected and analyzed by an onsite GC/MS for acetone, methylene chloride, TEX compounds, and chloroform using EPA Method 8260. The locations of these samples (excluding GWPP-34 as shown on Figure 3-8) are shown on Figure 3-9.

#### *3.2.2.4 Phase IV Investigation - October 1998*

As part of the Phase IV investigation, McLaren/Hart performed the following activities: vertical screening and installation of shallow and deep monitoring wells, packer testing of P-1, collection of manual and automatic water level measurements, sampling of select onsite and offsite wells, and acquisition of local production well and precipitation information.

Vertical Screening

Four vertical screening points (GWPP27A, GWPP29A, GWPP-36, and GWPP-37) were installed as part of the Phase IV investigation to provide groundwater data within the Former Process Pit Area, specifically in the downgradient direction of groundwater flow and in the direction of possible offsite production well pumping influences (see Figure 3-9 for locations). A fifth vertical screening point, GWPP-14A, was eliminated as part of the program. Several attempts were made to complete this point, but intermixed zones of gravel and clay were encountered, causing a loss of circulation in the rods. This vertical screening point was located in an area where previous groundwater sampling (via Geoprobe screening points) at the top of the water table had revealed trace amounts to non-detect levels of chloroform. In addition, the vertical screening of point GWPP-27A (source area) indicated no deep impacts, even though the highest concentration of chloroform detected onsite was at that location at a shallower depth. Based on this information, McLaren/Hart concluded that deeper chloroform impacts were not likely. This conclusion was concurred by EPA and CDM Federal.

The four screening points were installed using the mud rotary and Hydropunch[7] techniques described during the installation of the deep monitoring wells during the Phase III Investigation (Section 3.2.2.3). A 6-inch diameter boring was installed at each point using mud rotary drilling techniques. Depending on the location and work sequence, discrete-depth samples were collected on the average of 15- to 20-foot intervals, and sometimes up to 40-foot intervals. Split-spoon samples were collected at each vertical screening point location, at various depths, to aid in the evaluation of the lithology and to identify a good water-bearing zone for groundwater sampling. Temporary wells that were set to collect a groundwater sample at the various vertical screening point locations consisted of a 10-foot screen interval, sand pack to approximately 2 feet above the top of the screen, and an approximate 2-foot bentonite slurry seal. The wells were allowed to sit overnight and were purged (at least one well volume) before sampling.

The original field investigation approach assumed that a competent rock (e.g., point where refusal would be met by the drill rig) would be encountered at approximately 100 feet. This assumption was based on information provided in HLA's July 1997 work plan, and the video log of production wells P-1 and P-2 taken during the Phase III investigation. However, during the Phase IV investigation, it was discovered that Site conditions were not consistent with what was originally anticipated. During the drilling of the first vertical screening point, GWPP-29A, the drill rig did not meet refusal at 100 feet bgs. Instead, drilling continued to approximately 154 feet bgs, the maximum footage of rods brought to the Site by the drillers. Evaluation of split-spoon samples collected during drilling indicated a distinct change in lithology at approximately 90 feet. The lithology beyond this point was characterized by a very light brown, silty clay with zones of

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weathered rock. This was confirmed at the other vertical screening point locations at approximately the same depth given the change in topography between points. In addition, McLaren/Hart consulted with an individual (Bruce Green) who is knowledgeable about the geology/hydrogeology of St. Croix. He confirmed the presence of this zone, which is identified as the Kingshill Limestone. Most nearby production wells are screened in this water-bearing unit. In addition, he indicated that competent bedrock (where refusal might be met) was at depths greater than approximately 1,500 feet bgs. Therefore, to stay consistent with the original goal of collecting a groundwater sample at the top of bedrock, a sample was collected at the top of the Kingshill, as well as at least one sample being collected 20 to 40 feet within the formation.

Groundwater samples from the vertical screening points were collected using a decontaminated Teflon bailer and analyzed by an onsite GC/MS for acetone, methylene chloride, TEX compounds, and chloroform. In addition, confirmation samples were collected from GWPP-36 (82 to 85 feet bgs) and GWPP-37 (124 to 134 feet bgs) and analyzed for TCL VOCs by an offsite laboratory.

Installation of Monitoring Wells

Four monitoring wells (MW-11 through MW-14) were installed during the Phase IV investigation (see Figure 3-7 for locations). These wells were installed using the mud rotary drilling techniques described in Section 3.2.2.3. MW-11 (40 feet bgs) and MW-12 (147 feet bgs) are located in the vicinity of vertical screening point GWPP-29A. MW-13 (40 feet bgs) and MW-14 (134 feet bgs) are located in the vicinity of vertical screening point GWPP-37. Monitoring wells MW-12 (from GWPP-29A) and MW-14 (from GWPP-37) were converted from screening points to monitoring wells by reaming the borehole from 6 inches to 8 inches in diameter. The deep monitoring wells (MW-12 and MW-14) were not double-cased since groundwater samples collected vertically down to depth at these two locations exhibited concentrations well below MCLs. These wells were constructed and developed using the techniques described in Section 3.2.2.3. The well construction details are listed in Table 3-3. The monitoring well construction diagrams are included in Appendix G.

Packer Testing

Packer testing was conducted at onsite production well P-1 to evaluate the possibility that the slots identified in the video log at approximately 60 to 70 feet bgs could be a means for groundwater to enter the well and affect the overall groundwater quality at that measuring point. If this was the case, concentrations measured during previous sampling events had the potential of not being indicative of the screen interval of the well, which was approximately 3 feet into the top of Arock≅.

The packer assembly, approximately 11 feet in length, was lowered into the well so that the submersible pump extending from the bottom of the assembly was positioned at approximately 95 feet bgs. Therefore, the packer isolated the 80- to 90-foot zone. A data logger, with transducers, was used to measure continuous water levels above and below the packer assembly. At first, the submersible pump below the packer was allowed to run at approximately 3 gpm for at least 20 minutes. Manual water level measurements above the packer indicated no change in the water level. After approximately 20 minutes, the pump rate was lowered and a sample was collected from the discharge line for analysis by the onsite GC/MS and total dissolved solids (by an offsite laboratory). The pump was then turned off and the submersible pump lowered in the production well above the packer was allowed to run for the same time period and purge rate (around 1 gpm at first and increased to 3 gpm within 10 minutes). Manual water level

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measurements above the packer indicated an approximate 2-foot drawdown in the water level when pumping at 3 gpm. After approximately 20 minutes, the pump turned off. It was discovered that the Teflon tubing attached to the pump had come off. Due to the number of cords and lines in the well from the packer (transducers, submersible pumps, etc.), attempts to sample the zone above the packer via bailer were unsuccessful. Finally, the packer assembly was deflated and all equipment was pulled from the production well. Once the well was clear, a bailer was slowly lowered to the top of the water table and a groundwater sample was collected. Although there was probably some mixing of the water when the packer assembly was pulled from the well, McLaren/Hart felt that sampling the very top of the water was still representative of groundwater above the packer zone. To be conservative, one casing volume was purged from the production well and an additional groundwater sample was collected (similar to a Aregular≅ groundwater sample from the well). This course of action was approved by EPA and CDM Federal.

Manual Groundwater Level Measurements

A round of water level measurements was collected on the first day of the field investigation (October 5, 1998) from the existing onsite monitoring/production wells (MW-1 through MW-10 and P-1 through P-2) and from select offsite production/supply wells (Charlie=s Concrete #1 and #2, VIPA #1 and #2, WAPA [later discovered to be Fairplains #9], USGS, Carr=s, Meridian #2, and Zenon #1). With the exception of Carr=s and Charlie=s Concrete #1 and #2 (due to the difficulty in obtaining access to the wells and coordinating the removal of pumps in order to collect measurements), an additional round of water level measurements were collected from the above-mentioned wells, as well as the newly-installed monitoring wells (MW-11 through MW-14), at the conclusion of the investigation on October 21, 1998. No major storm events took place during the field investigation; therefore, additional rounds of water level measurements did not take place during the Phase IV investigation. Water level measurements are included in Table 3-4.

Automatic Groundwater Level Measurements

Continuous water levels were recorded in select onsite wells to monitor water level fluctuations. A Telog® automated water level recorder was installed in MW-7, MW-8, MW-9, P-1, and P-2 during the timeframe of the investigation. To gain access to the wells, Telogs® were removed from certain wells during packer testing and groundwater sample collection. Upon completion of the Phase IV field investigation, Telogs® were installed in MW-12 and MW-14, the two newly-installed deep monitoring wells, with measurements recorded between October 21 1998 and November 23, 1998.

Groundwater Sampling (Onsite Wells)

Groundwater samples were collected from several onsite wells during the Phase IV investigation to assess groundwater quality in and around the Former Process Pit Area. The following existing and newly-installed wells were sampled: MW-2 (sampled twice), MW-3, MW-7, MW-11 (pre- and post-development), MW-12, MW-13, and MW-14. Before groundwater sampling commenced, certain protocols were followed to ensure that samples collected were representative of the formation in which the well was screened. Each well was opened and static water level measurements were collected from either the TIC or TpOC. In addition, the total depth of the well was measured relative to the TIC or TpOC. Once these measurements were taken, the standing water in the well was calculated by multiplying the linear feet of water by the surface area of the well casing.

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A low-flow purging/sampling technique was utilized during both rounds, with purge/sample collection rates of approximately 0.5 liters/minute. Field data (see Table 3-6 for final measurements) for temperature, pH, specific conductance, redox potential, DO, and turbidity were collected every three to five minutes during purging. Upon stabilization of field parameters, a groundwater sample was collected from each well. These samples were analyzed by an onsite GC/MS for acetone, methylene chloride, TEX compounds, and chloroform using EPA Method 8260M. In addition, confirmation samples were collected from MW-2 and MW-11 and submitted for offsite analysis of TCL VOCs. Groundwater samples were collected from wells MW-2, MW-7, MW-11, MW-13, and GWPP-27A (110 to 120 feet bgs) for analysis of the suite of bioremediation parameters listed in Section 3.1.2.1 (Phase III Investigation).

Groundwater Sampling (Offsite Wells)

Groundwater samples were collected from the following offsite production/supply wells in the vicinity of the Site and analyzed by the onsite GC/MS (same parameters and analytical method used for onsite wells):

- Charlie=s Concrete #1 and #2 (2 wells);
- VIPA #1 and #2 (2 wells); and
- Fairplains #9 (1 well).

In addition, a confirmation sample was collected from Fairplains #9 and submitted for offsite analysis of TCL VOCs.

With the aid of VIDPNR and WAPA, the Fairplains wells were located during the field investigation. This well field, located near the Site, consists of three wells designated as Fairplains #7, #8, and #9. WAPA personnel indicated that Fairplains #7 (formerly referred to as Zenon #2 in McLaren/Hart correspondence) was destroyed by Zenon Construction (well covered by debris and other material) and no longer existed. Fairplains #8 is located within a locked pump house on Zenon=s property and was inaccessible. Due to the fact that Fairplains #8 is at a similar depth to Fairplains #9 (verified by well specifications received from WAPA during the field investigation - total depth of Fairplains #8 is 83 feet bgs while Fairplains #9 is 75 feet bgs), as well as in close proximity to each other, further attempts to access and sample Fairplains #8 were not undertaken. Fairplains #9 (formerly referred to as WAPA in McLaren/Hart correspondence) was sampled.

Construction Details/Pumping Information (Offsite Wells)

Construction details and pumping information was obtained for offsite wells in the vicinity of the Site. These wells included the following:

- Charlie's Concrete #1 and #2 (2 wells);
- VIPA #1 and #2 (2 wells);
- Cariño's Water Service (1 well);
- Fairplains Well Field (9 wells);
- Negro Bay Well Field (10 wells);
- Meridian Engineering #1 and #2 (2 wells);
- USGS wells near intersection of East Airport Road and Melvin Evans Highway (2 wells);
- Carr's (1 well); and

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- Zenon Construction #1 (1 well).

The information was collected through interviews with Site owners, review of historical documents, and discussions with regulatory agencies. The water use survey results are included in Appendix B.

Abandonment/Replacement of Former Production Well P-1

The activities associated with the abandonment of P-1 and installation of replacement well MW-15, which were conducted between January and March 2000, are fully described in the RI Addendum included in this Report.

## 3.3 GUT SYSTEM INVESTIGATION

### 3.3.1 Purpose and Scope

The VICHEM Site is bordered to the north and east by an intermittent stream, the River Gut, which originates north of the Site and merges with the Bethlehem Gut, approximately 800 feet southeast (downstream) of the Site, to become the Fair Plains Gut. Prior to the RI field investigation, samples had been collected from the River Gut by ESI (1986), EPA (1986), and NUS (1991). Analytical results for these samples are summarized and discussed in Section 2.3.3. Varying concentrations of metals were reported during the three sampling events.

Soil and sediment samples were collected by McLaren/Hart during the Phase III investigation in the River, Bethlehem, and Fair Plains Guts. The main objective of the sampling event was to determine the nature and extent of current potential impacts within the three drainage channels due to previous Site-related operations and to assess the risks, if any, to human health and the environment. The River Gut, Bethlehem Gut, and upstream areas of the Fair Plains Gut only contain water during flooding conditions, and do not support aquatic biota. Therefore, these intermittent drainage channels were characterized as terrestrial environments and samples collected from locations within these Guts were considered as soil. Downstream sections of the Fair Plains Gut are continuously inundated and were characterized as estuarine water environments. Therefore, samples collected from locations within these sections of the Fair Plains Gut were considered as sediment. In addition to collecting samples, a qualitative biological survey of flora and fauna was conducted to identify types of species present and to assess any evidence of stress to the environment.

### 3.3.2 Locations and Methods

The Gut System sampling program and biological survey were conducted in September and October 1997. Sample locations within the River Gut (15 total surface soil samples labeled as RG-2 through RG-16), Bethlehem Gut (2 surface soil samples labeled as BG-1 and BG-2), and Fair Plains Gut (total of 4 samples labeled as FPG-1 and FPG-2 for surface soil and FPG-3 and FPG-4 for sediment) are depicted on Figure 3-10 and are described in Table 3-7. In addition to the surface soil samples collected in the River Gut, three soil borings (SBRG-1 through SBRG-3 as shown on Figure 3-2) also were completed, with subsurface soil samples collected at various depth intervals ranging from 2 to 14 feet.

Surface soil/sediment samples within the three drainage channels were collected from the 0- to 6-inch interval using either a decontaminated, stainless-steel trowel or a hand auger. Sampling was conducted in the true soils or sediments found in the Guts. Where road gravel had washed into

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the drainage feature, the gravel was carefully brushed away, allowing access to the underlying soils. At each sample location, the surface soil/sediment was transferred to a decontaminated, stainless-steel bowl where the material was thoroughly homogenized and subsequently placed in the appropriate sample container(s) for shipment to an offsite laboratory. Samples were submitted for analysis of TCL SVOCs, TAL metals, TOC, particle grain size, pH, redox potential, percent moisture, and specific conductance. Physical parameters including DO, temperature, pH, and specific conductance were recorded in aquatic environments at the time of sample collection using a HORIBA U-10 instrument. Soils in the terrestrial environments were categorized using a Munsell color chart.

Soil borings were completed using a tripod and were screened using an onsite GC for TEX compounds. The samples were collected using the same rationale followed previously. Two subsurface soil samples were collected from each soil boring (total of 6 samples): one from the depth interval showing the highest concentration of TEX compounds and one from the interval directly above the water table. With the exception of VOCs, the subsurface soil was homogenized in a decontaminated, stainless-steel bowl before filling the appropriate sample containers for shipment to an offsite laboratory. Samples were submitted for analysis of TCL VOCs, TCL SVOCs, and TAL metals.

## 3.4 LABORATORY ANALYSES/DATA VALIDATION

Offsite laboratory chemical analyses were performed by Pace Analytical Laboratory of St. Rose, Louisiana and were conducted in accordance with EPA Level IV requirements, including data validation and quality assurance/quality control (QA/QC) requirements. Onsite GC and GC/MS analyses were performed by McLaren/Hart's mobile laboratory and were conducted in accordance with EPA Level III requirements. All data was validated in accordance with EPA Region II protocols. The data validation packages are presented in Appendix H.

Offsite geotechnical/geochemical analyses were performed by Raytheon Environmental Services Laboratory of Boothwyn, Pennsylvania.

## 3.5 QUALITY ASSURANCE/QUALITY CONTROL

The primary objective in instituting QC procedures is to ensure that staff collect and record data in a uniform manner and that data are of consistently high quality. Data are thus more likely to be accurate and can be interpreted with a high degree of confidence.

### 3.5.1 Controlling Documents

In order to collect and record data in a uniform manner, controlling documents that described and specified QA/QC procedures for the overall field investigation were prepared and/or used. The documents used to guide and direct procedures throughout the four investigative phases are listed in the beginning of Section 3.0. The EPA-approved work plans developed for the various phases of field activities specified and described all QA, QC, analytical, data management, and reporting procedures for the investigation. In addition, data quality objectives (DQOs) were established for field and analytical data using the DQO levels defined by EPA. For this investigation, field measurements such as pH, temperature, conductivity, turbidity, DO, redox potential, water levels, ground surveying, and PID measurements were considered DQO Level I data. Geotechnical/geochemical analyses and onsite laboratory analyses were considered DQO Level III data. Chemical analyses provided by the offsite laboratory, and subsequently validated in accordance with EPA Region II protocols, were considered DQO Level IV data.



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By providing a framework for sample collection, decontamination, field QC, sample identification, chain-of-custody and sample handling procedures, the controlling documents help to ensure that high quality data are collected and that data comparability is enhanced.

### 3.5.2 Media Sampling

Execution of all phases of the RI followed the procedures specified in the EPA-approved work plans for the VICHEM Site, with the exception of the field changes noted throughout Section 3.0. Laboratory analyses were conducted in accordance with the DQO requirements described above, including data validation and QC requirements. HLA and McLaren/Hart followed the work plan requirements in the collection of all field QC samples (i.e., trip blanks, field blanks, equipment rinsates, and duplicates).

### 3.5.3 Field Quality Control Procedures

All data was collected as specified in the various EPA-approved work plans. Field measurements were performed in accordance with procedures outlined in the plans. All monitoring instruments were calibrated either before each use, at the beginning of each field day, or at the frequency specified for each procedure. All sampling equipment that came in contact with sample media was decontaminated (unless disposable equipment was used), as specified in the work plans, before each sample was collected.

All sample collection, chain-of-custody, and sample shipping procedures were carried out as specified in the work plans. As part of the sample collection and analysis effort, field QC samples were prepared to monitor the performance of the analytical laboratories (both onsite and offsite), and to check on field sampling procedures. A description of each QC sample type and QC sample results is discussed in Section 3.5.5.

### 3.5.4 Data Validation

The purpose of validating data is to allow the data user to interpret and use the data with varying degrees of confidence, depending on how the data are qualified (e.g., unqualified, estimated, or rejected). Chemical data was validated in accordance with EPA Region II protocols. The validation process involved review for compliance with holding times, instrument calibration, method and laboratory blanks, instrument tuning and performance data, and constituent quantification. Results of duplicate, matrix spike, and other QC samples were used to assess precision and accuracy of the analytical data and potential matrix effects. Data qualifiers were applied, where required, so that the qualitative and/or quantitative reliability of the results could be assessed. Validation findings are included in Appendix H as part of the data validation package for each sample delivery group.

### 3.5.5 Data Evaluation

As part of the overall data review, the results of field QC samples were examined so that effect of field procedures on data quality could be evaluated. Field QC samples included duplicate samples, trip blanks, and equipment rinsates. In addition, sampling personnel collected sufficient volume for the offsite laboratory to analyze matrix spike and matrix spike duplicate samples.

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*3.5.5.1 Trip Blanks*

Aqueous trip blanks were provided by the laboratory and accompanied each cooler with an aqueous VOC sample. The trip blanks served as an evaluation of contamination generated from sample containers or contamination occurring during the shipping and laboratory storage process. Table 3-8 presents a summary of the constituents detected in the trip blanks analyzed during the Phase III and Phase IV investigations. The trip blanks showed detectable levels of four VOCs. In general, these constituents were detected at significantly greater concentrations in the environmental samples, when they were detected, signifying that the quality of the data should not be adversely impacted. However, the presence of acetone and methylene chloride in most of the trip blanks (as well as the associated laboratory blanks) indicates a possible problem with either the method or water used to prepare the trip blanks, or the method or containers used to ship the samples, or laboratory contamination.

*3.5.5.2 Field Blanks*

Field blanks (equipment rinsates) are generally collected to examine the effectiveness of equipment decontamination procedures. Samples were obtained by running laboratory-supplied water over sampling equipment after it had been decontaminated. Field blanks were collected from decontaminated soil, sediment, and groundwater sampling equipment. Positive field blank results are presented in Table 3-9. In general, one or more of the field blanks contained trace levels of eight VOCs, three SVOCs, and various inorganics. The results are not expected to affect data quality, as these constituents either were not found, or were found at significantly higher levels (at least 10 times higher), in the environmental samples.

*3.5.5.3 Precision, Accuracy, Representativeness, Comparability, Completeness, Precision*

Precision

Precision is the evaluation of the reproducibility of a measurement. Precision is estimated by the analysis of duplicate samples and the calculation of relative percent difference (RPD) or relative standard deviation (RSD).

This project involved both the collection of field duplicates and the creation of laboratory duplicates. Field duplicates serve as an indicator of overall precision, from sample collection through laboratory analysis. Laboratory duplicates focus on precision of the analytical method.

Table 3-10 presents RPD calculations for the sample/duplicate pairs collected during the four phases of RI field activities and illustrates that several analytes do not agree within validation RPD criteria, particularly for the soil samples. Out-of-criteria RPDs for field duplicates may be due to sample matrix and not necessarily sampling or analytical technique. However, for the majority of analytes, field and laboratory duplicate RPD and RSD criteria were met, indicating that the data can be considered precise. Where laboratory duplicate criteria were not met, results were flagged J-estimated, as appropriate.

Accuracy

Accuracy is the measure of bias in a system. It is the degree of agreement of a measurement with an accepted reference or true value. Accuracy for this project was estimated from the analysis of QC samples whose true values are known (surrogate or matrix spikes) and was expressed as percent recovery.

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For most analytes, surrogate and matrix spike recovery criteria were met, indicating that the majority of the data can be considered accurate. Where recovery criteria were not met, results were flagged J-estimated or R-rejected, as appropriate.

Representativeness and Comparability

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population at a sampling point, process condition, or environmental condition. Comparability expresses the confidence with which one data set can be compared to another. Representativeness and comparability are qualitative objectives that were met by following standard operating procedures for sample collection and analysis.

Completeness

Completeness is the measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions.

The completeness of the data is based on the number of valid data points divided by the number of total data points. The following percentages of data completeness were calculated for the RI field investigation:

- VOCs: 99.18% of offsite laboratory data and 100% for onsite laboratory data;
- SVOCs: 99.18%; and
- Metals: 94.71%.

These data completeness goals achieved the completeness goal of 95%.

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# 4.0 REMEDIAL INVESTIGATION RESULTS

## 4.1 SITE GEOLOGY

Numerous soil borings and monitoring wells were drilled and installed at the VICHEM Site to confirm that the area is underlain by the stratified Alluvium deposits. Soil Boring Logs and Monitoring Well Construction Diagrams are provided in Appendix F and G, respectively. Lithologic data collected during all phases of the RI indicate that the geology at the Site consists of a heterogeneous overburden consisting of brown and gray clay-rich sediments with lesser and varying amounts of silt and fine sands. Entrained within the clay-rich matrix are lenses of gravels and sands. These lenses are localized and are not uniformly continuous throughout the Site. The gravel and sand lenses are zones of higher hydraulic conductivity and could act as preferential pathways for groundwater flow. To facilitate an understanding of the geologic conditions at the Site, and to depict the intervals in which various soil borings have been advanced and well screens installed, a generalized geologic cross section was been developed. The line of cross-section (a northwest-southeast transect through the Site) is shown on Figure 4-1 and the cross-section (A-AN) is shown on Figure 4-2.

During the Phase IV field investigation (October 1998), four deep soil borings (GWPP-27A, GWPP-29A, GWPP-36, and GWPP-37) were advanced to depths ranging from 107 to 147 feet bgs. At each of these locations, the Kingshill was encountered at depths ranging from approximately 80 to 90 feet bgs. This formation is described as being comprised of a white to light gray and brown stiff clay, with lesser amounts of sand. The texture appears to be loosely consolidated, although rock chips were observed in the drill cuttings. The borehole drilling was advanced with a tricone roller bit by hydraulic rotary techniques. This drilling method is not capable of advancing through tightly consolidated, massive limestone.

## 4.2 SITE HYDROGEOLOGY

In order to evaluate groundwater flow, the water level data collected during the various phases of the RI were tabulated (see Table 3-4), including the most recent round of water levels collected in November 1999. Since the water level data have fluctuated at the Site throughout the various phases of the RI, constant monitoring conducted with transducer/data logger equipment (Telog™) also were tabulated and are presented in Appendix I. Figures 4-3 through 4-7 depict water table surface elevation contours and horizontal flow potentials in the "shallow" zone (wells screened with approximately 40 feet of land surface). Figures 4-8 through 4-10 depict the "deep" potentiometric surface (wells screened greater than 50 feet but less than 100 feet bgs). Both the "shallow" and "deep" zones are either entirely screened ("shallow" zone) or primarily screened ("deep" zone) within the Alluvium. Only two onsite monitoring wells (MW-12 and MW-14) are screened entirely within the Kingshill. Therefore, groundwater contour maps were not developed from these wells.

The RI water-level data, as depicted in Figures 4-3 through 4-7 suggests that the "shallow" zone, which reflects water table conditions, has a predominantly southern horizontal flow potential. Localized changes in flow potential have been observed to the north, as depicted on Figure 3-8, which was derived from temporary well points. However, Figures 4-3 and 4-4 each depicts the horizontal component of groundwater flow in a predominantly southern direction toward MW-3, while Figure 4-5 depicts a more southeasterly flow direction toward MW-5. Figures 4-6 and 4-7 reflect the addition of monitoring wells MW-11 and MW-13 in the "shallow" zone. Monitoring wells MW-11 and MW-13 each exhibit a relatively low water-level elevation, therefore

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influencing the horizontal component of groundwater flow potential by an increase in hydraulic gradient as compared to water-level elevations presented on Figures 4-3 and 4-4, respectively. Figures 4-3 and 4-4, which depict groundwater flow to the south are derived from site-wide monitoring wells that exhibit water-level differences across the site of about 1 to 3 feet. Whereas, Figure 3-8 depicts a 0.06 foot water-level difference over a very localized area, resulting in a local flow potential to the north; however, such a small variation could be attributed to a local vertical gradient.

Water level obtained during Spring 2000 is shown in Table 1 of the RI Addendum. Selected water level data for the shallow and deep alluvium were contoured, as shown in Figures 1 through 3 of the RI Addendum. The contours indicate a south-southeastern horizontal flow component in both zones.

The depth to the water table, as reflected in the "shallow" zone wells (MW-1 through MW-6, MW-10, MW-11, and MW-13) ranges from approximately 8.8 feet bgs at MW-4 (November 30, 1999) to 29.3 feet bgs at MW-13 (October 21, 1998). The depth to water, water-level elevation, and local direction of groundwater flow will fluctuate seasonally, with changes in precipitation and evapotranspiration. In addition, the heterogeneity of the subsurface materials will affect the rate of groundwater infiltration (*i.e.*, recharge). All of these complex factors will affect the horizontal component of shallow groundwater flow potential. The water level elevation (as measured on October 21, 1998) ranges from approximately 8.98 feet bgs at MW-11 to approximately 10.78 feet bgs at MW-5. Based on the data collected, the average horizontal hydraulic gradient in this zone (as derived from Figures 4-4 through 4-7) is approximately 0.01 feet/feet. The hydraulic conductivity of this zone, as derived from the slug test at monitoring well MW-2 (see Appendix I) is 3.19 feet/day (23.86 gpd/feet$^2$).

Site wells in the "deep" zone include MW-7 through MW-9, P-1, and P-2. The RI data suggests that the "deep" zone potentiometric surface exhibits a similar southern horizontal groundwater flow potential as observed in the "shallow" zone (based on the RI data). Figures 4-8 and 4-9 depict different horizontal flow potentials because in October 1998 (Figure 4-9) the VIPA wells were not pumping. Figure 4-10 depicts the groundwater flow potential based on measurements collected from onsite wells only; a southern flow direction is evident. The average horizontal hydraulic gradient in this zone (as derived from Figures 4-8 and 4-9) is approximately 0.007 feet/feet. The hydraulic conductivity of this zone, as derived from the slug test at monitoring well MW-7 (see Appendix I) is 7.0 feet/day (52.36 gpd/feet$^2$). Although the "deep" zone is hydraulically connected to the "shallow" zone, a vertical gradient exists between these two zones, suggesting that the "deep" zone is marginally confined as a result of the stratigraphic layering of the Alluvium. This is substantiated by observations made during the development of "deep" monitoring well MW-9, during which no drawdown was observed in the adjacent "shallow" monitoring well, MW-4. There are four well clusters at the Site that have a well screened in the "shallow" zone and a deeper well screened in either the "deep" zone or even deeper in the Kingshill. At each of the well clusters, a downward hydraulic flow potential exists (as measured on October 21, 1998). The vertical gradient ranges from 0.010 feet/feet to 0.043 feet/feet, and averages 0.02 feet/feet.

Slug tests were conducted at MW-6, MW-8, MW-11, MW-12, and MW-15 (i.e., the replacement well for former production well P-1) on February 9-10, 2000. The resulting values for hydraulic conductivity for the shallow zone ranged from 0.90-18.14 feet/day; for the deep zone ranged from 2.73-5.65 feet/day, and was 2.65 feet/day in the Kingshill Formation (see RI Addendum).

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During the Phase III investigation, the groundwater levels at the Site appeared to be influenced by the pumping of offsite production wells. The results of the Telog9 monitoring (i.e., continuous water level monitoring) before the Summer of 1998 (see Appendix I), indicate the effects of a pumping influence as evidenced by the cyclical (i.e., diurnal) water level fluctuations shown on the hydrographs for monitoring wells MW-7, MW-8, and P-2. Nearby wells in service at that time included the VIPA production wells located approximately 1,000 feet to the northwest of the Site, WAPA production wells to the north and south, and various private water supply wells located on adjacent or nearby properties to the northeast, east, and southeast (i.e., Virgin Islands Paving, Charlie's Concrete, and Zenon Construction). The hydraulic influence to the northwest was likely the result of the pumping of the two VIPA wells. Pumping influences to the south may have been caused by active WAPA or private supply wells in that area. Hydrographs (Appendix I) of "shallow" onsite monitoring wells, as well as onsite production well P-2, distinctly show the effects of offsite pumping influences.

Continuous water level measurements were obtained during the Phase IV field investigation from the following wells: MW-7 through MW-9, MW-12, MW-14, P-1, and P-2 (see Appendix I). As described in Appendix B (Water Use Survey Results), several nearby supply wells that had been in constant use during initial phases of the RI are not currently operating in the same continuous manner as they had been in the past. The change in pumping of nearby supply wells is evident from water level data obtained from onsite monitoring wells. A comparison of the hydrographs for wells MW-7, MW-8, and P-2 derived during the Phase III and Phase IV field efforts demonstrates that there currently are no consistent diurnal fluctuations in Site groundwater levels resulting from steady pumping of nearby wells. The result of less nearby pumping stresses in the future (if current conditions continue) will be a more consistent groundwater flow gradient to the southeast.

## 4.3 SOIL

Soil sampling was conducted at the Site in various areas to fully assess the types and concentrations of constituents present in the surface and subsurface, and to determine the extent and magnitude of potential soil impacts at the Site. Soil sampling was conducted during Phase I, Phase II, and Phase III of the RI. The concentrations of constituents detected in the soil samples collected during the RI are summarized in Tables 4-1 through 4-13. For ease of review, only constituents detected at least once in the soil and their measured concentrations are presented in the summary tables.

### 4.3.1 Surface Soil

Surface soil samples were collected from the AST Area, Former Process Pit Area, Former Laboratory Pit Area, Former Drum Areas, and Storm Drains. For the purposes of this RI, surface soils are considered as samples collected from the 0- to 2-foot bgs interval.

#### *4.3.1.1 Screening Criteria*

Background

Background surface soil samples were collected from three locations onsite. These samples were collected from the 0- to 6-inch interval and analyzed for TCL VOCs, TCL SVOCs, and TAL metals. A summary of the analytical results is presented on Table 4-1.

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The background metals concentrations measured in these samples were used as comparison criteria for surface soil samples collected in the potential areas of concern. It is assumed that any detection of an organic constituent in surface soil is not naturally-occurring. For metals, the results were compared to two times the average background concentrations. Average concentrations were calculated using all four background samples. An average of B-1 and its duplicate was used for that data point. For non-detects, one-half the sample quantitation limit was used as a proxy concentration for a given constituent detected one or more times in the sample. To determine an overall background surface soil concentration, an average of the three samples was calculated (see Table 4-1). Two times the average background concentration was used as the screening criteria for onsite surface soil samples (referred to within this section as "the background screening criteria").

Soil Screening Levels (SSLs) and Risk-Based Concentrations (RBCs)

As a secondary screening mechanism for inorganics and a primary screening mechanism for organics, the surface soil samples were compared to EPA's SSLs for inhalation, ingestion and migration to groundwater (MGW) with a dilution attenuation factor (DAF) of 20 to evaluate potential risks to human health. The DAF of 20 was determined in consultation with EPA. Several compounds, including aluminum, cobalt, copper, magnesium, and mercury do not have established SSLs. In these cases, RBCs were used as comparison criteria. In addition, the ingestion SSL for beryllium and the inhalation SSL for chromium were replaced with updated RBCs. These RBCs were calculated using the most recent available toxicity data. Finally, certain compounds including calcium, magnesium, potassium, and sodium are considered to be essential nutrients of soil and therefore do not have established SSLs or RBCs. The comparison of soil data to the table of SSLs and RBCs is consistent with the methodology used during the screening process in the HHRA.

#### *4.3.1.2 AST Area*

Seven surface soil samples and one duplicate were collected in the AST Area during the RI. Sample depths ranged from 0 to 1 feet bgs, 0 to 2 feet bgs, and 1.5 to 2 feet bgs. Samples were analyzed for TCL VOCs, TCL SVOCs (SBB-1 and SBE-1 only), and TAL metals (SBB-1 and SBE-1 only). A summary of detected concentrations in AST Area surface soil samples is presented on Table 4-2.

Toluene was detected in two samples (SBB-4 and SBB-17) at an estimated concentration of 2 ppb in both samples. Ethylbenzene and total xylenes were detected in most of the surface soil samples and ranged in concentrations from 2 to 6 ppb and 1 to 30 ppb, respectively. These samples are located in the vicinity of Tanks 8 and 9. These detections can be attributed to the liquids historically contained in these tanks. Trichloroethene (TCE) and bis(2-ethylhexyl)phthalate (BEHP) were detected at estimated concentrations of 1 ppb and 94 ppb, respectively, in sample SBE-1. As a screening mechanism, constituents were compared to inhalation, ingestion, and MGW SSLs. No VOCs or SVOCs were detected above their respective SSLs.

Several metals were detected above the background screening criteria (included in parentheses) on SBB-1, its duplicate, and SBE-1. These compounds include:

- *Aluminum* - ranging from 23,000 to 28,200 ppm (21,760 ppm);
- *Antimony* - detection of 0.54 ppm (0.49 ppm);
- *Barium* - ranging from 197 to 268 ppm (134.8 ppm);

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- *Beryllium* - ranging from 0.30 to 0.58 ppm (0.02 ppm);
- *Cadmium* - ranging from 2.8 to 4 ppm (0.66 ppm);
- *Cobalt* - ranging from 29.6 to 31.7 ppm (18.3 ppm);
- *Iron* – ranging from 32,100 to 37,000 ppm (31,933 ppm);
- *Lead* – detection of 89.9 ppm (19.6 ppm);
- *Nickel* - ranging from 16.8 to 24.7 ppm (14.7 ppm);
- *Manganese* - ranging from 1,860 to 2,100 ppm (959 ppm);
- *Sodium* – detection of 702 ppm (644 ppm); and
- *Vanadium* - ranging from 109 to 110 ppm (89 ppm).

As noted in Section 4.3.1.1, an additional screening mechanism was used to compare all sample results to either SSLs or RBCs. Iron (detected at the concentrations noted above) and manganese (ranging from 1,860 ppm to 2,100 ppm) were detected above the RBCs of 23,000 ppm and 1,600 ppm, respectively. These constituents are further evaluated in the HHRA. No other metals were detected above the secondary screening criteria.

#### *4.3.1.3 Former Process Pit Area*

Only one surface soil sample, SBC-1 collected from 0 to 1 feet bgs, was collected in the Former Process Pit Area. This sample was analyzed for TCL VOCs, TCL SVOCs, and TAL metals. The summary of detections in this sample is presented on Table 4-3.

Total xylenes were detected in the sample at an estimated concentration of 1 ppb while BEHP was detected at 440 ppb. As a screening mechanism, these compounds were compared to inhalation, ingestion, and MGW SSLs with no exceedances noted.

Several metals were detected above the screening criteria (included in parentheses) including:

- *Aluminum* - 22,000 ppm (21,760 ppm);
- *Cadmium* - 3.5 ppm (0.66 ppm);
- *Cobalt* - 18.9 ppm (18.3 ppm);
- *Sodium* - 2,430 ppm (644 ppm);
- *Nickel* - 16.2 ppm (14.7 ppm); and,
- *Vanadium* - 112 ppm (89.3 ppm).

As an additional screening mechanism, metals concentrations were compared to SSLs and RBCs (See Section 4.3.1.1). Although not above background, iron (31,400 ppm) was detected above the ingestion SSL of 23,000 ppm. Iron is further evaluated in the HHRA. No other metals were detected above the secondary screening criteria.

#### *4.3.1.4 Former Laboratory Pit Area*

Six surface soil samples (SBD-1 through SBD-3 and SBF-1 and SBF-3) were collected in the Former Laboratory Pit Area. All samples were collected from 0 to 1 feet bgs, with the exception of SBD-2 and SBD-3 which were collected from 0 to 2 feet bgs. The samples were analyzed for TCL VOCs, TCL SVOCs, and TAL metals. A summary of detected concentrations in the Former Laboratory Pit Area surface soil samples is presented on Table 4-4.

Two VOCs were detected in these samples: carbon disulfide (estimated 1 ppb in SBF-3 and estimated 2 ppb in SBD-1 and SBD-2) and total xylenes (estimated 2 ppb in SBD-3). Three

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phthalates, BEHP (two times ranging from 170 ppb and 720 ppb), butylbenzylphthalate (once at 490 ppb), and di-n-octylphthalate (once at 120 ppb) were detected. Additionally, pentachlorophenol (estimated 1,900 ppb) was detected in SBF-3. As a screening mechanism, these constituents were compared to inhalation, ingestion, and MGW SSLs. Of the VOCs and SVOCs, only pentachlorophenol exceeded a SSL (MGW at 30 ppb). This constituent was not detected in the subsurface soil at this location (See Section 4.3.2.3). Additionally, pentachlorophenol was not detected in groundwater across the Site.

Metal concentrations were compared to the background screening criteria. Several metals were detected above their applicable background screening criteria (in parentheses) included:

- *Cadmium* - six times ranging from 1.1 to 6.4 ppm (0.66 ppm);
- *Beryllium* - five times ranging from 0.21 to 0.44 ppm (0.02 ppm);
- *Nickel* - four times ranging from 15.6 to 26.9 ppm (14.7 ppm);
- *Vanadium* - four times ranging from 98.1 to 116 ppm (89 ppm);
- *Chromium* – one time at 30.4 ppm (23.6 ppm);
- *Cobalt* – one time at 18.9 ppm (18.3 ppm);
- *Copper* – two times ranging from 62.2 to 141 ppm (61.5 ppm);
- *Iron* – one time at 63,400 ppm (31,933 ppm); and
- *Manganese* – one time at 976 ppm (959 ppm).

The metals also were compared to SSLs and RBCs (See Section 4.3.1.1) as a secondary screening mechanism. Of the detected metals, arsenic (ranging from 0.95 to 0.96 ppm) and iron (ranging from 23,500 to 63,400 ppm) exceeded the secondary screening criteria. These constituents will be further evaluated in the HHRA.

#### *4.3.1.5 Former Drum Areas*

Two surface soil samples (SBC-2 and SBD-4) was collected in the Former Drum Areas. These samples were collected from 0 to 1 feet bgs and analyzed for TCL VOCs, TCL SVOCs, and TAL metals. A summary of detections is presented on Table 4-5.

Several organics including carbon disulfide (3 ppb in SBC-2), 1,1-dichloroethene (1 ppb in SBC-2), toluene (10 to 12 ppb), total xylenes (2 ppb in each sample), BEHP (75 to 200 ppb), butylbenzylphthalate (120 ppb), and di-n-butylphthalate (32 to 57 ppb) were detected in the two samples. All constituents were qualified as estimated concentrations. SSLs for ingestion, inhalation, and MGW were used as comparison criteria for the detected VOCs and SVOCs. No organic constituents were noted above their respective SSLs.

Metal concentrations were compared to the background screening criteria. Several metals were detected above their applicable background screening criteria (in parentheses) included:

- *Aluminum* – detection of 25,000 ppm (21,760 ppm);
- *Antimony* – detection of 1.3 ppm (0.49 ppm);
- *Barium* – detection of 274 ppm (134.8 ppm);
- *Beryllium* – 0.34 to 0.44 ppm (0.02 ppm);
- *Cadmium* – 3 to 3.4 ppm (0.66 ppm);
- *Chromium* – detection of 28.1 ppm (23.6 ppm);
- *Cobalt* – detection of 20.5 ppm (18.3 ppm);
- *Iron* – 26,300 to 37,300 ppm (31,933 ppm);



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- *Lead* – detection of 31.2 ppm (19.6 ppm);
- *Magnesium* – detection of 13,900 ppm (10,820 ppm);
- *Manganese* – detection of 1,040 ppm (959 ppm);
- *Mercury* – detection of 0.33 ppm (0.30 ppm);
- *Nickel* – 15.6 to 17.6 ppm (14.7 ppm);
- *Sodium* – detection of 1,510 ppm (644 ppm); and
- Vanadium – detection of 155 ppm (no background exists).

These metals also were compared to SSLs and RBCs (See Section 4.3.1.1) as a secondary screening mechanism. Iron (26,300 and 37,300 ppm) was detected above its screening level of 23,000 ppm. This constituent will be further evaluated in the HHRA. No other metals were detected above the secondary screening criteria.

#### *4.3.1.6 Central and Southern Storm Drains*

Two surface soil samples each were collected from the Central Storm Drain (SDCSD-1 and SDCSD-2) and Southern Storm Drain (SDSSD-1 and SDSSD-2). These samples were collected from a depth of 0 to 1 foot bgs and were analyzed for TCL SVOCs and TAL metals. A summary of detections in these samples is presented on Table 4-6.

Central Storm Drain

One SVOC, BEHP at 7,800 ppb, was detected in sample SDCSD-2. This result was well below the ingestion, inhalation, and MGW SSLs for BEHP. No other SVOCs were detected in the Central Storm Drain samples.

Metals were initially screened against the background screening criteria. Ten metals were detected above the criteria (in parentheses) including:

- *Arsenic* - ranging from 3.7 to 8.8 ppm (1.64 ppm);
- *Cadmium* - 3.9 ppm in both samples (0.66 ppm);
- *Chromium* - 32 ppm in SDCSD-2 (23.6 ppm);
- *Copper* - ranging from 121 to 280 ppm (61.5 ppm);
- *Iron* - 58,800 ppm in SDCSD-2 (31,933 ppm);
- *Lead* - ranging from 25.4 to 35.2 ppm (19.6 ppm);
- *Nickel* - 23.5 ppm in SDCSD-2 (14.7 ppm);
- *Selenium* - 0.94 ppm in SDCSD-2 (0.82 ppm);
- *Silver* - ranging from 1.2 to 1.5 ppm (0.15 ppm); and
- *Sodium* - ranging from 675 to 659 ppm (644 ppm).

The metal concentrations also were screened against SSLs and RBCs (See Section 4.3.1.1). Of these metals, arsenic, (ranging from 3.7 ppm to 8.1 ppm) and iron (detected at 58,800 ppm) exceeded the secondary screening criteria. The exceeded screening criteria for these constituents are 0.4 ppm (ingestion) for arsenic and 23,000 ppm (ingestion) for aluminum. These constituents will be further evaluated in the HHRA.

Southern Storm Drain

One SVOC, isophorone, was detected in both SDSSD-1 (estimated 320 ppb) and SDSSD-2 (2,500 ppb). SSLs for ingestion, inhalation, and MGW were used as a comparison criteria for this

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SVOC. Isophorone exceeded its MGW SSL of 500 ppb in SDSSD-2. The potential risk to human health from this constituent will be addressed the HHRA.

Metal concentrations were screened against the background screening criteria. Two metals, cadmium (0.72 ppm in SDSSD-2) and silver (ranging from 0.92 ppm to 0.98 ppm), were detected above their applicable screening criteria (0.66 and 0.15 ppm, respectively).

As an additional screening mechanism, these metals were compared to SSLs and RBCs (see Section 4.3.1.1). Arsenic was detected at 0.81 ppm in SDSSD-1 and 0.87 ppm in SDSSD-2, which is above the secondary screening criteria for ingestion (0.4 ppm). This constituent will be further evaluated in the HHRA.

### 4.3.2 Subsurface Soil

Subsurface soil samples were collected from the AST Area, Former Process Pit Area, Former Laboratory Pit Area, Former Drum Areas, and Central Storm Drain. For the purposes of this RI, subsurface soils are identified as samples collected below 2 feet bgs.

The subsurface soil samples were screened against EPA's MGW SSLs with a DAF of 20. Site-specific background subsurface soil data was not collected.

#### *4.3.2.1 AST Area*

Table 4-7 presents a summary of the constituents detected in the subsurface soil samples collected at the AST Area during the Phase I, Phase II, and Phase III investigations. Samples were analyzed for TCL VOCs during all three phases and additionally analyzed for TCL SVOCs and TAL metals during the Phase I investigation and portions of the Phase III investigation.

Five SVOCs were detected in the samples collected during the various investigations. No exceedances above the MGW SSLs were noted. In addition, numerous metals were detected at wide-ranging concentrations. Cyanide was detected above the screening level (40 ppm) at three locations (ranging in concentration from 47.3 to 60.2 ppm).

A total of 13 VOCs were detected in the subsurface soils collected in the AST Area. Since TEX impacts to groundwater were a concern at the AST Area, sampling focused on delineation of a potential soil source of impacts. TEX was detected at varying depths in samples collected from numerous soil boring locations.

Toluene was detected at concentrations ranging from 2 ppb (estimated) to 1,000 ppb. The highest concentration of toluene was detected in SBB-1 at a depth of 6 to 8 feet bgs. Ethylbenzene was detected at concentrations ranging from 7 ppb (estimated) to 320,000 ppb. Ethylbenzene was detected at depths ranging from 6 to 24 feet bgs. Total xylenes were detected at concentrations ranging from 2 ppb (estimated) to 2,000,000 ppb. The highest concentration of both total xylenes and ethylbenzene was detected at location SBB-17. Monitoring well MW-6 is co-located with this sample.

Acetone and methylene chloride results are discussed separately in Section 4.3.2.6.

The remaining VOCs were only detected sporadically in subsurface soil: tetrachloroethene (twice at concentrations ranging from 1 to 2 ppb - estimated), TCE (once at 17 ppb), benzene (once at 1 ppb – estimated), 1,1-dichloroethene (twice at concentrations ranging from 3 to 6 ppb –

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estimated), 4-methyl-2-pentanone (twice at concentrations ranging from 8 to 10 ppb), 2-butanone (three times at concentrations ranging from 2 to 24 ppb), 2-hexanone (twice at concentrations ranging from 2 to 3 ppb), and chloroform (once at 47 ppb).

Table 4-8 presents the results from the geochemical/geotechnical and biological analyses performed on samples collected at two locations (SBAST-8 and SBAST-9) within the AST Area. This data will be more fully evaluated in the FS when evaluating potentially applicable technologies for Site remediation.

Based on the subsurface soil samples collected in this area, there are potential impacts associated with ethylbenzene and total xylenes. MGW SSLs (DAF of 20) were used to define the area of impacted soil which is located in the area between Tanks 3 and 10, existing mainly onsite (location SBB-17 is at the fenceline). The predominant zone of impacts is conservatively assumed to encompass a 20-foot interval at approximately 5 to 25 feet bgs. The extent of soil impacts has been characterized through the subsurface soil sampling program. Figure 4-11 depicts the estimated horizontal extent of impacted soil in the AST Area, based on exceedances of ethylbenzene and total xylenes above the MGW SSLs. The vertical extent of impacts is assumed to extend to the water table interface (approximately 25 feet bgs), since any active remediation completed would probably only encompass the vadose zone. Soil within the groundwater table would be treated through the groundwater remediation program, if such a program were to be implemented.

#### *4.3.2.2 Former Process Pit Area*

Table 4-9 presents a summary of the constituents detected in the subsurface soil samples collected from the one soil boring completed during the Phase I investigation (analyzed for TCL VOCs, TCL SVOCs, and TAL metals), and from the six soil borings completed during the Phase III investigation (analyzed for a select list of VOCs by the onsite GC). In addition, Table 4-10 presents the results of the Geoprobe subsurface soil sampling program (analyzed for selected VOCs) that took place during the Phase III investigation. One SVOC, BEHP, was detected at varying depths in the soil boring completed during the Phase I investigation. Numerous metals also were detected at varying concentrations at this boring location. No SVOCs or metals exceeded the MGW SSLs.

Since chloroform impacts to groundwater were a concern at the Former Process Pit, sampling focused on delineation of a potential soil source of impacts. The following summarizes the detections of chloroform in this area, and the associated location and depth interval:

| Soil Boring Location | Depth Interval (feet bgs) | Concentration (ppb) |
|---|---|---|
| SBPP-1 | 25-27 | 86 |
| SBPP-2 | 10-12 | 130 |
| SBPP-3 | 8-10 | 11 |
| SBPP-4 | 21-23 | 11 |
| SBPP-5 | 22-24 | 160 (35 - duplicate) |
| SBPP-23 | 20-22 | 230 |
| SBPP-23 | 22-24 | 414 |
| SBPP-23 | 24-26 | 332 |
| SBPP-27 | 16-18 | 181 |
| SBPP-32 | 24-26 | 151 |

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No other VOCs were detected at concentrations above MGW SSLs. The TOC content in the sample collected at location SBPP-13 (depth of 22 to 24 feet bgs) was 355 mg/kg (see Table 4-8).

As noted above, chloroform was not detected at concentrations above the MGW SSL of 600 ppb in subsurface soil. Chloroform in this area of the Site is assumed to be associated with the Former Process Pit. The pit was either an 8,000-gallon (according to EIS) or 17,000-gallon (according to EPA) underground concrete pit located in this portion of the Site. The Former Process Pit was used to collect wastewater from spills and cooling water from product operations. It was reportedly abandoned and sealed with concrete in 1985. During Geoprobe sampling, a large concrete monolith was not encountered below the surface.

However, McLaren/Hart and Berlex have recently conducted discussions with former Site workers. Based on their descriptions of the location of the Former Process Pit, it is believed that this Pit was never actually filled in with concrete. During the Phase III Investigation, a hollow concrete vault (measured to be approximately 21.5' x 7.7' x 7.0') was discovered in the vicinity of MW-2. This vault is believed to be the Former Process Pit.

Although no samples were collected directly below the suspected Former Process Pit, several soil and groundwater samples were collected immediately adjacent to the Pit on all sides. Soil borings SBPP-13, SBPP-15, SBPP-23 and SBPP-26 flanked the Pit on either side. These samples did not indicate concentrations of chloroform above the MGW SSL of 600 ppb.

#### *4.3.2.3 Former Laboratory Pit Area*

Table 4-11 presents a summary of the constituents detected in the subsurface soil samples collected from the six soil borings completed during the Phase I investigation (SBD-1 through SBD-3 and SBF-1 through SBF-3), and the two soil borings installed during the Phase III investigation (SBLP-1 and SBLP-2) in the Former Laboratory Pit Area.

Three VOCs were detected in the subsurface soil samples collected from this area. Carbon disulfide was detected at 2 ppb at two locations during the Phase I investigation and total xylenes were detected at four locations (ranging from 2 to 3 ppb) were detected during the Phase III investigation. Two SVOCs, BEHP (seven times ranging from 32 to 98 ppb) and di-n-butylphthalate (once at 33 ppb) were detected during the Phase I investigation. All detected constituents were qualified as estimated concentrations. No VOCs or SVOCs were detected above MGW SSLs.

Acetone and methylene chloride results are discussed separately in Section 4.3.2.6.

Additionally, numerous metals were detected at wide-ranging concentrations during the Phase I investigation (samples were not analyzed for metals during the Phase III investigation). No metals were detected above the established MGW SSLs.

#### *4.3.2.4 Former Drum Areas*

Table 4-12 presents a summary of the constituents detected in the subsurface soil samples collected from the eight soil borings (SBC-2, SBD-4, SB8-1, SB64-1 and SB64-2, and SB238-1 through SB238-3) located in the three Former Drum Areas. Six VOCs and three SVOCs were detected in the subsurface soil samples collected at varying depths. However, no organics were detected at concentrations above MGW SSLs.

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In addition, numerous metals were detected at wide-ranging concentrations. Of these metals, only cadmium was detected at one location (SB64D-1) at a concentration of 10.1 ppm which is above the established MGW SSL of 8 ppm. No other metals were detected above the MGW SSLs.

#### *4.3.2.5 Central Storm Drain*

Table 4-13 presents a summary of the constituents detected in the subsurface soil samples collected from the three borings (SBCSD-1 through SBCSD-3) completed adjacent to the Central Storm Drain. Four VOCs (ethylbenzene, 2-butanone, toluene, and total xylenes) and three SVOCs (diethylphthalate, di-n-octylphthalate, and BEHP) were detected. No organics were detected above MGW SSLs.

Numerous metals were detected in the samples collected from the soil borings. However, concentrations did not exceed MGW SSLs at any location.

#### *4.3.2.6 Acetone and Methylene Chloride Results*

Historical data from the RI, as presented in Tables 4-7 through 4-13, indicate detections of acetone and methylene chloride in several locations including the AST Area and Former Laboratory Pit Area. Where data validation reports were available, a review of these data by Golder Associates revealed that methylene chloride is not present in groundwater or soil, and that acetone detections are limited to low levels.

Methylene chloride concentrations previously reported in Site soil samples are artifacts resulting from blank contamination (laboratory method blanks, field blanks, and trip blanks) and do not represent field conditions. Therefore, methylene chloride is not considered a Constituent of Concern (COC) for the Site. A detailed explanation follows:

- In past data validation reports, blank action levels were not properly calculated. The blank action levels must include trip blanks and field blanks in addition to method blanks. Previous data validators attempted to isolate samples by method blanks and did not use the other quality control (QC) blanks in calculating action levels. Since methylene chloride and acetone are common laboratory contaminants, it is inappropriate to rely on one method blank for assessing potential contamination.

- Previously, blank action levels were not applied correctly. Many soil and groundwater samples were highly diluted due to concentrations of other constituents in the sample matrix. In such cases, the data validator must adjust the blank action levels by the dilution factor. Since this was not done, blank contaminants were erroneously reported as detected constituents in these samples.

- Previously, results attributable to blank contamination were not properly qualified. In accordance with USEPA Region II data validation Standard Operating Procedures (USEPA 1996), results that are attributable to blank contamination should be qualified as non-detect ("U") and treated as such. Results below the sample quantitation limits (SQLs) should be changed to the SQL and qualified as U. Results above the SQL are not changed and are qualified as U. In either case, the constituent should have appropriately been considered as undetected in the sample.

The methylene chloride and acetone data presented in this Report showed results below the Contract Required Quantitation Limit that were neither changed to the SQL nor correctly



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qualified. Qualifiers of "BJ", "B" or simply "J" were used rather than the correct qualifier, which is "U." Acetone was detected in thirteen samples at concentrations ranging from 17 ppb to 580 ppb. However, these data are below the soil screening level and acetone should therefore not be considered a COC for the Site. Regardless, the inclusion or exclusion of acetone and methylene chloride data does not materially affect the HHRA results.

## 4.4 GROUNDWATER

The concentrations of constituents detected in groundwater samples collected during the RI are summarized on Tables 4-14 through 4-22. Groundwater sampling was conducted during all four phases of the RI. For ease of review, only constituents detected at least once in the groundwater are presented in the summary tables.

### 4.4.1 Maximum Contaminant Levels

The Safe Drinking Water Act, as amended in 1986, requires EPA to publish Maximum Contaminant Level Goals (MCLGs) for constituents that may have an adverse effect on the health of persons and that are known or anticipated to occur in public water systems. MCLGs are set at a level that no known or anticipated adverse effects on the health of persons occur and that allow an adequate margin of safety. At the same time EPA publishes an MCLG, which is a non-enforceable health goal, it also must promulgate a National Primary Drinking Water Regulation that includes either a MCL or a required treatment technique action level (TTAL). A TTAL may only be set if it is not economically or technologically feasible to ascertain the level of a constituent. A MCL must be set as close to the MCLG as feasible with the use of the best available technology, treatment techniques, cost, and other criteria as appropriate.

### 4.4.2 Onsite Groundwater Quality

Groundwater sampling was conducted at the Site to fully assess the types and concentrations of constituents present in the underlying aquifer, and to determine the extent and magnitude of groundwater impacts in the shallow and deep water-bearing zones at the Site. Onsite and offsite wells were sampled periodically during all four phases of the RI. In addition, discrete-depth groundwater samples were collected using a Geoprobe and Hydropunch sampler during the Phase III and Phase IV investigations.

For the purposes of evaluating the groundwater analytical data for the Site and assessing the extent of groundwater impacts, MCLs (where in existence) were used for comparison purposes.

#### *4.4.2.1 VOCs*

Twelve VOCs were detected in the groundwater samples collected from the onsite wells and the Geoprobe sample locations during the various phases of the RI. The constituents included:

- acetone
- benzene
- 2-butanone
- carbon disulfide
- chloroform
- chloromethane
- ethylbenzene
- methylene chloride
- toluene
- trichloroethene
- vinyl chloride
- xylenes (total)

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A summary of the detected constituents found in the onsite wells from Phases I through IV is presented in Table 4-14. In addition, Table 4-15 presents the results of the Geoprobe and Hydropunch groundwater sampling (analyzed for selected VOCs by an onsite GC/MS), Table 4-16 presents a summary of the TEX field screening results (using an onsite GC) from samples collected during the installation of the temporary and deep monitoring wells, and Table 4-17 presents a summary of confirmation samples (analyzed by an offsite laboratory) collected during the Phase III and Phase IV investigations.

In the AST Area, ethylbenzene and xylenes were detected above their MCLs (700 ppb and 10,000 ppb, respectively) in temporary wells TW-1 and TW-3, and in monitoring wells MW-1 and MW-6. The concentrations of ethylbenzene (ranging from 720 ppb to 20,000 ppb) and xylenes (ranging from 2,000 ppb to 86,000 ppb) in MW-1 have changed considerably during the sampling events. These changes in concentrations may be potential effects of off-Site pumping influences and dilution effects as a result of major storm events. It should be noted that the higher concentrations have been detected during recent sampling events (i.e. January and March 1998) and have been used in depicting the extent of groundwater impacts (Figures 4-12 and 4-13). The highest concentrations of both constituents were detected in MW-6 (23,000 ppb for ethylbenzene and 110,000 ppb for xylenes). MW-6 is co-located with soil boring SBB17, the location with the highest concentration of TEX compounds in the subsurface soil.

Refer to Section 4.3.2.6 for a general discussion of reported detections of acetone and methylene chloride in groundwater.

MCLs were not exceeded in MW-8 (deep monitoring well in this area), MW-10 (shallow monitoring well locally downgradient of this area) or GWPP-34 (Geoprobe point regionally downgradient of this area). Based on a review of the Site history and analytical information, the shallow groundwater in the AST area is impacted by ethylbenzene/xylenes. These impacts can be attributed to liquids contained in Tanks 8 and 9 (ethylbenzene/xylenes) and possible previous Site operations. The lateral and vertical extent of impacts in the AST Area has been delineated through MW-8 (vertical extent) and MW-10 & GWPP-34 (lateral extent).

Based on groundwater samples collected during the well of March 6, 2000 (see RI Addendum) ethylbenzene and total xylenes were detected above MCLs in monitoring wells MW-1 and MW-6. No constituents were detected in deep monitoring well MW-8 or in off-site monitoring well MW-10.

The predominant zone of impacts in the AST Area is a 15-foot interval at approximately 18 to 33 feet bgs. The horizontal extent of ethylbenzene/xylenes impacts has been delineated through the temporary/monitoring well and Geoprobe sampling program. Figures 4-12 and 4-13 depict the areal extent of xylenes and ethylbenzene, respectively, in the shallow groundwater in the AST Area. The "localized downgradient" (west-northwest) extent of impacts has been delineated as evidenced by non-detect concentrations in samples collected from temporary wells TW-2, TW-4, and TW-5, as well as shallow monitoring well MW-10. Likewise, the Geoprobe samples collected in and around the vicinity of the Former Process Pit (as well as the monitoring wells in this general area) indicate that ethylbenzene/xylenes are not migrating to the east and south (the regional downgradient direction).

Chloroform was detected above its MCL (80 ppb) in MW-2 and at numerous Geoprobe sample locations in the vicinity of this monitoring well (all located in the area of the Former Process Pit). McLaren/Hart collected groundwater from a small zone of perched water (6 to 12 feet bgs) as well as shallow groundwater (20 to 37 feet bgs). The highest concentration of chloroform

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detected was at location GWPP-27 (in the shallow groundwater zone) at a concentration of 4,000 ppb. The highest detection of chloroform in the perched zone was 1,200 ppb at location GWPP-15.

During the Phase IV investigation, vertical screening points were installed using a Hydropunch sampler in the source area (GWPP-27), in the direction of predominant groundwater flow, and in the direction of potential offsite pumping influences. The depths of these samples ranged from 20 to 154 feet bgs. Neither the Hydropunch screening samples nor deep monitoring well samples (MW-7, MW-12, and MW-14) exhibited concentrations of chloroform above the MCL.

This analytical data verifies that the shallow groundwater (depths ranging from approximately 20 to 35 feet bgs) in this area is impacted by chloroform. The highest, and most notable, concentrations (above 1,000 ppb) included GWPP-15 (8- to 10-foot depth), GWPP-23 (22- to 27-foot depth), GWPP-27 (24- to 29-foot depth), GWPP-31 (22- to 27-foot depth), and MW-2 (18.9- to 28.2-foot depth). The predominant zone of chloroform impacts is a 15-foot interval at approximately 20 to 35 feet bgs. In addition, a perched water zone from approximately 6 to 12 feet bgs was encountered during Geoprobe groundwater sampling with chloroform concentrations above the MCL.

The horizontal extent of chloroform impacts has been delineated through the Geoprobe sampling program. A chloroform iso-concentration map is shown on Figure 4-14. Migration from the source area, toward the south and parallel to groundwater flow, is evident. Chloroform concentrations decrease from the Former Process Pit to levels below 5 ppb in all downgradient directions, as shown by the results from monitoring wells MW-11 and MW-13, and Geoprobe location GWPP-14.

Groundwater samples were collected during the week of March 6, 2000 (see RI Addendum. Chloroform was detected in MW-2 and MW-11 at concentrations well below the MCL. Chloroform was not detected in the following wells: MW-3, MW-13, MW-7, MW-12, and MW-14. Newly installed well MW-15 exhibited an estimated chloroform concentration of 9.4 ppb, which is well below the MCL and much lower than concentrations previously observed in adjacent former production wells P-1 (the location of MW-15 is depicted in Figures 1 through 3 of the RI Addendum). The results of these samples confirmed that deep groundwater, both within the Alluvium and the Kingshill Formation, is not impacted by chloroform. Detections in MW-15 likely resulted from historic cross-contamination caused by the construction of P-1.

The vertical extent of chloroform impacts is conservatively assumed to extend to a depth of approximately 50 feet bgs, which is the midpoint between 35 feet bgs and the top of the screened interval in monitoring well MW-7 (64 feet bgs), where chloroform was detected below its MCL. Chloroform was not detected above the MCL in samples deeper than 33 feet bgs.

The chloroform in this area of the Site may be attributable to the Former Process Pit. The pit was either an 8,000-gallon (according to ESI) or 17,000-gallon (according to EPA) underground concrete structure located in this portion of the Site. The Former Process Pit was used to collect waste water from spills and cooling water from product operations. It was reportedly abandoned and sealed with concrete in 1985. However, during Geoprobe sampling, a large concrete monolith was not encountered below the surface.

However, McLaren/Hart and Berlex have recently conducted discussions with former Site workers. Based on their descriptions of the location of the Former Process Pit, it is believed that this Pit was never actually filled in with concrete. During the Phase III Investigation, a hollow

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concrete vault (measured to be approximately 21.5' x 7.7' x 7.0') was discovered in the vicinity of MW-2. This vault is believed to be the Former Process Pit.

MCLs were not exceeded for the following VOCs: benzene, toluene, TCE, and vinyl chloride. Benzene was only detected in MW-3 (2 out of 4 sampling rounds) at a concentration of 0.1 ppb (estimated) during both rounds. Generally, toluene was detected at higher concentrations at locations where ethylbenzene and xylenes exceeded their respective MCLs (i.e., MW-1 and MW-6). TCE was only detected in MW-3 (1 out of 4 sampling rounds) at a concentration of 0.1 ppb (estimated). Vinyl chloride was only detected in MW-10 (1 out of 2 sampling rounds) at a concentration of 0.2 ppb (estimated). These constituents are not considered to be a significant concern at the Site.

Although 2-butanone, carbon disulfide, and chloromethane do not have established MCLs, these constituents were each detected during only one sampling event. 2-Butanone was detected in MW-9 (0.8 ppb [estimated]). Carbon disulfide was only detected in MW-2 (130 ppb), and chloromethane was detected in MW-1 (2 ppb).

There were no MCL exceedances in the Laboratory Pit Area (MW-4 and MW-9) or the Former Drum Areas (MW-3 and MW-5); therefore, these areas are not considered to be a current significant source of groundwater impacts at the Site.

#### 4.4.2.2 SVOCs

Eight SVOCs were detected in the groundwater samples collected from the onsite wells during the various phases of the RI. The analytes included:

| | |
|---|---|
| BEHP | di-n-butyl-phthalate |
| 4-chloroaniline | isophorone |
| 2,4-dimethylphenol | 2-methylphenol |
| phenol | 4-methylphenol |

A summary of the detected constituents is presented in Table 4-18. There are no established MCLs for the aforementioned constituents.

A number of SVOCs were detected in MW-1 and MW-6, both located in the AST Area. Concentrations in these wells were notably higher than in other monitoring wells onsite. Since ethylbenzene and xylenes concentrations in these two wells exceeded MCLs, potential impacts associated with SVOCs are believed to exist within the VOC extent of impacts in this area. SVOCs were not detected in the downgradient shallow monitoring well (MW-10). Therefore, it is believed that the downgradient extent of potential impacts in the shallow water-bearing zone in the AST Area has been delineated.

In evaluating the data collected from the deep monitoring wells (MW-7 through MW-9 and P-1 through P-2) during January and March 1998, no SVOCs were detected. Therefore, it is believed that the vertical extent of potential SVOC impacts in the deep water-bearing zone has been delineated.

SVOCs were not detected in the shallow monitoring wells MW-10 and MW-5. Therefore, it is believed that the downgradient extent of potential impacts in the shallow water-bearing zone in the AST Area (through MW-10) has been delineated.

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Two SVOCs were detected in monitoring well MW-2 (Former Process Pit). BEHP was detected once out of four sampling events in MW-2 (estimated at 2 ppb). Concentrations of BEHP also were noted in the associated blank sample at a concentration of 5 ppb for this analyte; therefore, concentrations in onsite wells are not likely indicative of Site-related impacts. Di-n-butyl-phthalate also was detected in MW-2, but it was only detected once out of three sampling events (estimated at 0.4 ppb).

Three SVOCs were detected at low concentrations in MW-3 over the course of four sampling events. Detections were sporadic (4-chloroaniline detected twice, BEHP detected once and also in the associated laboratory blank, and phenol detected twice). These constituents were found only sporadically at low concentrations in monitoring wells MW-2 and MW-3. Therefore, it is believed that the southeastern extent of potential impacts in the shallow water-bearing zone has been adequately delineated.

BEHP was detected once out of four sampling events in MW-4 (estimated at 11 ppb). Concentrations of BEHP also were noted in the associated blank sample for this analyte; therefore, concentration in onsite wells are not likely indicative of Site-related impacts. No SVOCs were detected in MW-5. This data aids in the delineation of the eastern extent of potential SVOC impacts.

Based on a preliminary evaluation of the data, it appears that a potential COC, isophorone, may impact the groundwater underlying the Site. However, these impacts exist within the same areas as the VOCs detected above MCLs. A detailed evaluation of isophorone and its potential risk to human health is presented in the HHRA (Appendix J).

#### *4.4.2.3 Metals*

Numerous metals were detected in the groundwater samples collected from the onsite wells during the various phases of the RI. A summary of the detected constituents is presented in Table 4-19. It should be noted that MCL exceedances discussed below consist of a comparison against the primary MCLs which are enforceable standards; secondary MCLs are not federally enforceable but are intended as guidelines only.

Metals were detected above MCLs in monitoring wells MW-5, MW-6, and MW-10. Lead was detected above its TTAL of 15 ppb twice out of four sampling events in MW-5. Concentrations were only slightly above the action level (17 ppb and 20.3 ppb during February 1995 and May 1995, respectively). Lead was not detected during the last two rounds of sampling (January and March 1998). Antimony was detected above its MCL (6 ppb) once out of two sampling events in MW-6. Detected at 6.2 ppb, this concentration was only slightly above the standard. Lead was detected above the TTAL once out of two sampling events in MW-10, at a concentration of 50.7 ppb.

In general, concentrations of lead and antimony were only slightly above the MCLs in monitoring wells MW-5 and MW-6. Lead was not detected in monitoring wells MW-1 and MW-6 (located hydraulically upgradient of MW-10) during the March 1998 sampling event; therefore, the higher concentration of lead found in MW-10 during the same round may not be Site-related. In summary, these immobile constituents are not considered to pose a significant concern (as compared to concentrations of VOCs).

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### 4.4.3 Onsite Production Wells

Two production wells (P-1 and P-2) were modified during the Phase I investigation to facilitate access and provide security. The pump was removed from P-1 and P-2 was patch-welded. Steel locking caps were placed on both wells. The wells were then developed and sounded. Well P-1 was determined to be approximately 98 feet bgs and well P-2 was determined to be approximately 96 feet bgs. However, the construction details and integrity of wells were unavailable.

During the Phase III investigation, the integrity and screen intervals were evaluated using a video television camera. Based on the results of the survey, both production wells are constructed of a 6-inch, steel casing from the surface into the bedrock (98 feet at P-1 and 93 feet at P-2). A bedrock borehole extends approximately one to three feet below the bottom of the casing in each well. A screened interval was not encountered along the entire length of the casing in either well. It was speculated that water potentially could be entering production well P-1 from the unconsolidated overburden aquifer via a series of rough slots cut into the casing between 63 and 78 feet. No slots or cracks were found in production well P-2.

Packer testing was conducted at onsite production well P-1 to evaluate the possibility that the slots identified in the video log at approximately 60 to 70 feet bgs could be a means for groundwater to enter the well and affect the overall groundwater quality at that measuring point. During the execution of the packer test, it was determined that the slots were open to the formation and groundwater was entering the well from those points.

In order to characterize all intervals of the groundwater in the well, the three samples from P-1 (above the packer, below the packer, and a "regular" composite sample) were collected and analyzed by the onsite GC/MS for selected VOCs. The results for these samples are presented on Table 4-20.

Chloroform, methylene chloride, toluene, and xylenes were detected in these samples. However, none of the results exceeded MCLs.

In Spring 2000, well P-1 was abandoned and replaced by MW-15. The results of the related field activity is described fully in the RI Addendum.

### 4.4.4 Offsite Groundwater Quality

During the Phase IV investigation, groundwater samples were collected from selected offsite production wells in the vicinity of the Site to define concentrations of chloroform in the deep overburden. The wells sampled included Charlie's Concrete #1 and #2, VIPA #1 and #2, and Fairplains #9 (formerly referred to as WAPA). These wells were analyzed by the onsite GC/MS for selected VOCs. The results of these samples are presented in Table 4-21.
Chloroform was not detected in any of the offsite wells. Only one VOC, xylene (1 ppb - estimated in VIPA #2), was detected. These results indicate that chloroform does not appear to be migrating offsite into the local production wells.

### 4.4.5 Groundwater Biological Properties

Table 4-22 presents the results from the groundwater samples analyzed for biological parameters at selected locations. This data will be more fully evaluated in the FS when evaluating potentially applicable technologies for Site remediation.

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## 4.5 GUT SYSTEM

### 4.5.1 Surface Soil/Sediment

The Gut System sampling program was conducted during the Phase III investigation. Sample locations were collected within the River Gut (RG-2 through RG-16), Bethlehem Gut (BG-1 and BG-2), and Fairplains Gut (FPG-1 through FPG-4). The objective of the sampling program was to characterize surface soils and sediments within the three drainage channels to evaluate the presence of constituents that may be Site-related. These samples were analyzed for TCL SVOCs, TAL metals, TOC, particle grain size, pH, redox potential, percent moisture, and specific conductance. A summary of results for these samples are presented in Table 4-23.

Sample location RG-2 served as an upstream reference location. Several metals were detected at this location (average of RG-2 and RG-2[duplicate] is included in parentheses): aluminum (16,600 ppm), arsenic (0.57 ppm), chromium (17.8 ppm), copper (47.5 ppm), iron (28,850 ppm), manganese (635 ppm), vanadium (75 ppm), and zinc (202 ppm). The distribution of these constituents were generally variable throughout the Gut System. However, an increase in several constituents was noted at locations RG-9 (aluminum at 15,400 ppm, manganese at 708 ppm, and zinc at 155 ppm) and RG-13 (aluminum at 14,400 ppm, manganese at 560 ppm, and zinc at 174 ppm) within the River Gut and location BG-1 (aluminum at 15,400 ppm and manganese at 534 ppm) in the Bethlehem Gut. These elevated concentrations in the River Gut are likely the result of the depositional nature of the locations.

### 4.5.2 Subsurface Soil Samples

Table 4-24 presents a summary of the constituents detected in the subsurface soil samples collected from the three soil borings (SBRG-1 through SBRG-3) completed during the Phase III investigation adjacent to the Central Storm Drain.

The subsurface soil samples will be screened against the SSLs for MGW with a DAF of 20. The DAF of 20 was determined as the most appropriate criteria in consultation with EPA. No Site-specific background subsurface soil data is available.

Two VOCs (toluene and 2-butanone) and two SVOCs (fluorene and butylbenzylphthalate) were detected sporadically in the samples. Several metals including aluminum, arsenic, barium, cadmium, calcium, chromium, cobalt, copper, iron, magnesium, manganese, nickel, potassium, selenium, sodium, vanadium and zinc were detected at various concentrations. No organic or inorganic compounds were detected above screening levels.

# 5.0 CONSTITUENT FATE AND TRANSPORT

The transport and fate of constituents in the environment is largely a function of their physical properties, the physical properties of the surrounding matrix, the physical conditions to which they are subjected, and chemical factors. Because hazardous properties of constituents may be altered by various environmental factors, it is helpful to understand the behavior of released constituents in the environment to assess the potential for exposure to them.

The groundwater and soil COCs were identified through the HHRA and SERA (discussed in Section 6.0). Ultimately, the need for any remediation will be driven by the Site-specific risks established through these two risk evaluations.

This section focuses on the Site-specific groundwater COCs since groundwater represents the most significant potential pathway of concern to human health. The Site-specific COCs for groundwater (identified in the HHRA and discussed in Section 6.0) include VOCs[1] (ethylbenzene, xylenes, chloroform, and toluene), SVOCs (isophorone, 2,4-dimethylphenol, and 2-methylphenol), and metals (antimony, arsenic, barium, chromium, iron, lead, manganese, and vanadium). The SVOCs and metals were identified as COCs; however, their extent at the Site is minimal and sporadic. The VOCs are the primary COCs due to their extent at the Site and the relatively high concentrations in which they where detected. Dissolved constituents in groundwater can volatilize and can potentially be in contact (dermal, inhalation, and ingestion) with users of groundwater. Therefore, the fate and transport analysis will focus on the relatively mobile VOCs.

## 5.1 TRANSPORT PROCESSES IN GROUNDWATER

The transport of VOCs in groundwater is controlled by many variables. The physical and chemical properties of acetone, methylene chloride, ethylbenzene, xylenes, and chloroform are summarized in Table 5-1 (toluene not included since it was not detected above the MCL in groundwater). Solubility and sorption are the most important constituent properties affecting leaching and groundwater transport. The moderate to high solubility of these five VOCs and the relatively low sorption coefficient (Log $K_{oc}$) of these constituents indicate that they will tend to dissolve and move with groundwater, and will only partially adsorb to aquifer materials.

The physical properties that will affect the flux of constituents in groundwater are advection and hydrodynamic dispersion (Freeze, R and Cherry, J. 1979). Advection is the component of solute movement attributed by groundwater flow. Section 4.2 (Site Hydrogeology) describes the complexity of groundwater flow at the Site and the influence that more permeable strata can have on groundwater flow. Table 5-2 provides the groundwater velocity derived using the following equation by Darcy:

$$V_s = (Ki)/n$$

[1] See discussion of acetone and methylene chloride in Section 4.3.2.6 and in RI Addendum, which concludes that neither acetone nor methylene chloride should be considered a COC for this site.



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where,

$V_s$ = seepage velocity (feet/day);
K = aquifer hydraulic conductivity (feet/day);
i = hydraulic gradient (feet/feet); and
n = effective bulk porosity (unitless).

The seepage velocity (through the Darcy equation) of groundwater in the shallow zone is 0.09 feet/day (32.9 feet/year). The process of hydrodynamic dispersion occurs as a result of chemical mixing and molecular diffusion. The flux of constituents by hydrodynamic dispersion is small relative to advection. As a contaminant solute migrates in water, it undergoes a myriad of chemical and biological reactions that serve to attenuate its migration. As discussed above, adsorption is one of the most influential constituent concentration-altering mechanisms. Table 5-2 provides calculated constituent velocities by factoring in the retardation of each specific volatile COC. Retardation rates ranged from as low as 1.00 for acetone to 4.81 for xylenes. Factoring in retardation, the constituent transport velocities were calculated by the following equation (see Table 5-2):

$$V_t = V_s/Rd$$

where,

$V_t$ = pollutant transport rate (feet/day); and
Rd = retardation coefficient (unitless).

Acetone moves at the same rate as groundwater; whereas xylenes move at a rate of 0.02 feet/day (7.3 feet/year). Other key factors that serve to attenuate the migration of VOCs are volatilization, biotransformation (microbial synthesis), and chemical degradation. Although not quantitatively addressed in the RI, these factors also play a key role in the attenuation of the volatile COCs.

## 5.2 TRANSPORT PROCESSES IN SOIL

Solubility in water, area rainfall characteristics (which affect fluctuations in the groundwater levels), tendency to bind to soil and organic carbon, type of soil (particle size distribution, clay content, fraction of organic carbon, and permeability), and depth to groundwater are all significant factors in determining the potential for constituents to be carried from soil to groundwater. The nature of the soils significantly affects transport within soil. Clays exhibit adsorptive behavior, while organic matter is capable of both adsorption and absorption.

In the aquifer, dilution by groundwater further reduces concentrations. This reduction in concentration is expressed by a DAF. EPA's Soil Screening Guidance (EPA 1996) addresses the possibility of constituents leaching into groundwater at concentrations exceeding their respective groundwater cleanup standards (MCLs). SSLs (at a DAF of 20) were used to assess potential impacts to groundwater associated with surface and subsurface soil concentrations at the Site.

## 5.3 FATE AND TRANSPORT CONCERNS

The most significant fate and transport concern at the VICHEM Site is the potential movement of dissolved constituents towards offsite production wells. The October 1998 sampling of the nearby wells (Charlie's #1, Charlie's #2, VIPA #1, VIPA #2, and Fairplains #9) demonstrates that

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the Site groundwater volatile COCs are not currently impacting those wells. Additionally, the sampling of Cariño's well by VIDPNR and CDM Federal in March 1998 also indicates that onsite groundwater impacts are not currently affecting this well. The movement of groundwater onsite has been influenced by nearby pumping. Groundwater tends to flow toward a pumping well because of the hydraulic gradient it exerts. Pumping influences near the Site have exhibited a greater influence on the deep zone (because the production wells are screened in the deep zone), where COCs have either not been detected or exist at concentrations well below the MCLs. As documented in Appendix B, nearby production wells have reduced pumping. This is evident on the hydrographs (see Appendix I). It appears that recent reductions in pumping has been beneficial with respect to influences on groundwater flow in the area. However, future pumping activities within the Site vicinity are unknown and will need to be routinely evaluated. The volatile COCs observed at the Site are known to attenuate by natural processes. The potential for natural attenuation of the volatile COCs will be evaluated more fully in the FS through modeling.

As discussed in Section 4.1, lithologic data indicates that the Site geology consists of a heterogeneous overburden with lenses of gravels and sands. These lenses are localized and are not uniformly continuous throughout the Site. However, these gravel and sand lenses are zones of higher hydraulic conductivity and could act as preferential pathways for groundwater flow.

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# 6.0 BASELINE RISK ASSESSMENT RESULTS

The primary purpose of the BRA is to provide a quantitative and qualitative understanding of the actual and potential risks to human health and the environment posed by a site if no further remediation or institutional controls are applied. The BRA for the VICHEM Site includes both a HHRA and a SERA. The conclusions drawn from these two assessments will be used to determine whether further remediation is necessary at the Site and to form the basis for establishing clean-up goals if remediation is necessary.

## 6.1 HUMAN HEALTH RISK ASSESSMENT

A HHRA (Appendix J) was conducted for the VICHEM Site in accordance with the EPA-approved *Draft Remedial Investigation Work Plan* (HLA 1994), the AOC for the Site, and EPA risk assessment guidance documents including:

- *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part A - Interim Final* (EPA 1989);
- *Guidance for Data Useability in Risk Assessments* (EPA 1990a);
- *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part A, Supplemental Guidance "Standard Default Exposure Factors"* (EPA 1991a);
- *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part B, Development of Risk-Based Preliminary Remediation Goals - Interim* (EPA 1991b);
- *Dermal Exposure Assessment: Principles and Applications* (EPA 1992a);
- *Supplemental Guidance to RAGS: Calculating the Concentration Term* (EPA 1992b);
- *Exposure Factors Handbook, Volumes I - III: General Factors - Review Draft* (EPA 1996a);
- *Exposure Factors Handbook, Volumes I-III* (EPA, 1997);
- *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments - Interim* (EPA 1998); and
- Other federal or regional EPA documents, as appropriate.

The risk assessment was performed to provide an analysis of the potential Site-related health risks to human receptors to: (1) evaluate the need for future response actions; (2) provide a basis for assessing concentrations of hazardous substances that may remain onsite without adversely affecting human health; and (3) provide a basis for comparing potential health impacts of various remedial action alternatives and technologies.

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### 6.1.1 Chemicals of Potential Concern

The HHRA evaluated the potential human health risks associated with exposure to chemicals of potential concern (COPCs) detected in groundwater, soil, and soil/sediment samples that were collected during the four phases of the RI. The maximum concentrations of constituents detected in these media were used in a screening process to develop a focused list of COPCs for evaluation in the risk assessment.

The following COPCs were identified for each of the media evaluated:

- *Groundwater (Onsite Monitoring/Production Wells)*

| | |
|---|---|
| Acetone | Antimony |
| Chloroform | Arsenic |
| Ethylbenzene | Barium |
| Methylene chloride | Chromium (total) |
| Toluene | Iron |
| Xylenes | Lead |
| 2,4-Dimethylphenol | Manganese |
| Isophorone | Vanadium |
| 2-Methylphenol | |

- *Groundwater (Offsite Production Wells)*

  No COPCs identified

- *Soil/Sediment in Gut System*

| | |
|---|---|
| Aluminum | Iron |
| Arsenic | Manganese |
| Chromium (total) | Vanadium |

- *Surface Soil*

| | |
|---|---|
| Arsenic | Manganese |
| Chromium (total) | Vanadium |
| Iron | Zinc |

- *Subsurface Soil*

  No COPCs identified

No COPCs were identified for direct contact with subsurface soil at the Site. Consequently, no potential health risks are identified for the inhalation, ingestion, or dermal contact of constituents detected in this medium under a current or future land use scenario. In addition to evaluating the potential for risk associated with direct contact of constituents in subsurface soil, the same data were also compared to EPA's SSLs to determine if concentrations could adversely impact groundwater through leaching. This evaluation is discussed in detail in Section 4.0.

The following constituents were detected at concentrations above the criteria: ethylbenzene and total xylenes. Although the maximum concentration of chloroform (410 ppb) did not exceed the

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SSL of 600 ppb, this constituent was included as a COPC for the purposes of this evaluation. Two inorganics also were found at concentrations above the SSLs. Cadmium was detected in one sample at 10.1 ppm, slightly above the SSL of 8 ppm, and cyanide was detected in three samples ranging in concentration from 47.3 to 60.2 ppm, exceeding the SSL of 40 ppm (based upon a DAF of 20). Cyanide exceeded the SSL (20 DAF) in three of eighteen samples. One sample was validated and detected at a concentration of 51.7 ppm. In one additional subsurface soil boring, at two different depths, cyanide was estimated and qualified with "spike recovery not within control limit" (concentrations = 47.3 ppm and 60.2 ppm). For comparison purposes, an average of cyanide concentrations in site subsurface soil results in concentration of 9.3 ppm, which is below the SSL. Additionally, cyanide was not detected in any other site media including groundwater. It should also be noted that a comparison with direct contract risk-based values was performed for cyanide. The Region III RBC for soil ingestion based upon a residential scenario is 160 ppm. The direct contact SSL for soil ingestion is 1600 ppm. None of the cyanide concentrations detected exceed these risk-based values. The soil to groundwater and direct contact SSLs were used as a comparison level for cyanide, however, as cyanide is rarely encountered at the site, was not detected in groundwater, and was not used in historical site processes, it was not retained as a COPC in the HHRA.

Likewise, although cadmium was detected across most of the Site, it was only found at a concentration slightly above the SSL at one location; hence, it is not considered a COPC. Therefore, subsurface soil is considered a medium of concern regarding the potential for impact to groundwater and the following constituents are noted as COPCs for the Site: chloroform, ethylbenzene, and total xylenes. This list of constituents is consistent with the VOCs presented in the list of COPCs identified for onsite groundwater.

### 6.1.2 Exposure Pathways and Potentially-Exposed Populations

The potential exposure pathways of ingestion, inhalation, and dermal absorption via contact with the COPCs in groundwater, soils, and sediments were evaluated for completeness. For an exposure pathway to be complete, it must have four elements: (1) a source and mechanism for chemical release; (2) an environmental transport medium (*e.g.*, air, water, soil); (3) a point of potential human contact with the medium; and (4) a route of uptake for the chemical at the contact point (*e.g.*, inhalation, ingestion, dermal contact).

Considering the current and future anticipated land use scenarios proposed for the VICHEM Site (*i.e.*, industrial), several exposure pathways were identified for evaluation. Potential human receptor populations were evaluated for each pathway and either ruled out or included in the risk assessment. This evaluation identified the following possible exposure pathways:

- *Current Land Use*

  - Residential (child/adult) exposure to groundwater via six offsite wells was considered. No COPCs were identified for the groundwater collected from these offsite wells in the immediate vicinity of the Site; therefore, current residential exposure to groundwater was not evaluated further.

  - Trespasser (pre-adolescent/adult) exposure to COPCs in surface soil/sediment collected from the Site and the Gut System was evaluated. Exposure to COPCs via incidental ingestion, dermal contact, and inhalation of particulates was evaluated for these receptors.

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- *Future Land Use*

- Industrial/commercial (adult) exposure was considered for future industrial use of the Site. This pathway examined exposure to COPCs in groundwater, surface soil, and sediment via ingestion, inhalation of VOCs (groundwater) and particulates (soil and sediment), and dermal contact.

- Construction at the Site was considered to be a plausible future exposure scenario. This pathway evaluated the adult construction worker's exposure to COPCs in surface soil, subsurface soil (up to 12 feet bgs), and soil/sediment in the Gut System via incidental ingestion, dermal contact, and inhalation of particulates. Exposure to groundwater was not evaluated for this receptor since groundwater at the Site is generally encountered at depths between 18 and 20 feet bgs. Since construction activities are not anticipated to occur at such depths, exposure to groundwater was not considered. In addition, although subsurface soil was examined for this receptor, no COPCs were identified in this medium and no risk estimates were developed. In addition to evaluating the potential for risk associated with direct contact of constituents in subsurface soil, the same data also was compared to EPA's SSLs to determine if concentrations could adversely impact groundwater through migration (leaching). The results of this evaluation are discussed in Section 4.0.

- An offsite residential scenario was evaluated for potential future exposure to COPCs in groundwater. Currently, there are no COPCs in the offsite wells. However, EPA and VIDPNR have raised concerns regarding the uncertainties associated with future land use/development in the vicinity of the Site and the potential for COPCs in onsite groundwater to migrate offsite. Therefore, future exposure to COPCs in groundwater via ingestion, inhalation, and dermal contact was quantified for an adult and child resident. Specifically, a future adult and child resident were evaluated for potential exposure to COPCs in groundwater via ingestion of well water, dermal contact while showering/bathing, and inhalation of VOCs while showering/bathing.

### 6.1.3 Health Risk Estimate

Based on the identification of sources, pathways, and receptors, estimates of human health risk were developed for exposure of the above-noted receptor populations to COPCs in media associated with complete or hypothetically-complete exposure pathways. Estimates of human uptake were calculated using the 95$^{th}$ upper confidence limit (95$^{th}$ UCL) of lognormally transformed datasets or maximum detected concentrations in any instance where the UCL exceeded the maximum. The estimated carcinogenic risks and noncarcinogenic hazards were compared to EPA guidelines and generally-accepted target risk levels. Carcinogenic risks falling within the target range of $1 \times 10^{-6}$ to $1 \times 10^{-4}$ and noncarcinogenic hazards less than 1 were considered to be below the statutory threshold.

The result of this evaluation concluded that most of the chemicals detected in groundwater, soil, and sediment are not associated with an excess health risk for the current or future land use scenarios evaluated. Tables 6-1 and 6-2 present carcinogenic risk estimates and Tables 6-3 and 6-4 present noncarcinogenic hazard indices for the exposure pathways evaluated.

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*Current Land Use*

Based on the inactive status of the VICHEM Site, current land use scenarios evaluated exposure to onsite surface soil and soil/sediment in the Gut System for an adult and pre-adolescent trespasser. The cancer risk estimates presented are associated with exposure to arsenic and chromium, which are the only carcinogenic COPCs identified in onsite surface soil and soil/sediment in the Gut System. In addition to these two constituents, noncancer hazards were evaluated for vardium and iron in surface soil and soil/sediment; manganese and zinc in surface soil, and aluminum in soil/sediment. These risk estimates are discussed below.

Adult Trespasser

For the adult trespasser, reasonable maximum exposure (RME) to COPCs in surface soil resulted in a carcinogenic risk estimate (total of all pathways) of $1 \times 10^{-6}$, which equals the lower end of EPA's benchmark range. This receptor's exposure to COPCs detected in the soil/sediment in the Gut System are below EPA's target risk range ($3 \times 10^{-7}$). The cumulative risk for this receptor (total of all pathways and media) is $1 \times 10^{-6}$.

Because RME risk estimates for surface soil were near the $10^{-6}$ benchmark, central tendency (CT) risks were evaluated for this receptor. Average risks were less than $10^{-6}$ for surface soil ($1 \times 10^{-7}$) exposures. CT risks were not calculated for the soil/sediment in the Gut System because RME risks were less than $1 \times 10^{-6}$.

Noncancer hazard estimates for the RME receptor were less than the target level of 1 for exposure to COPCs in onsite surface soil and soil/sediment in the Gut System with an overall cumulative HI of 0.007. Because the RME noncancer HIs were less than 1, the CT receptor was not evaluated.

Pre-Adolescent Trespasser

None of the individual pathway (*i.e.*, ingestion, dermal contact, and inhalation) risk estimates nor the cumulative RME risk estimate of $5 \times 10^{-7}$ associated with exposure to onsite surface soil evaluated for the pre-adolescent trespasser exceed EPA's target risk range. The CT receptor was not evaluated for this scenario.

Carcinogenic risk estimates calculated for exposure to COPCs in soil/sediment in the Gut System were less than EPA's target risk range at $1 \times 10^{-7}$ for the RME receptor.

The pre-adolescent trespasser's overall cancer risk estimate (contact with COPCs in onsite surface soil and Gut System soil/sediment via ingestion, inhalation, and dermal pathways) is $7 \times 10^{-7}$ which is less than $10^{-6}$. The cumulative carcinogenic risk estimate derived for the CT receptor was less than EPA's target risk range.

Individual noncancer hazard estimates were less than the target level of 1 for pre-adolescent trespasser exposure to COPCs in onsite surface soil and soil/sediment in the Gut System. The overall HI across all media and exposure routes is 0.075. The CT receptor was not evaluated.

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*Future Land Use*

Considering the current and anticipated future industrial zoning classification of the VICHEM Site, future land use scenarios evaluated exposure to COPCs in groundwater, surface soil, and soil/sediment in the Gut System for an adult industrial/commercial worker. In addition, a future construction scenario was evaluated for direct contact exposure with COPCs in surface soil. Subsurface soil was not evaluated for the construction worker because no COPCs were identified in this medium. However, the potential risk associated with leaching of constituents via groundwater migration through subsurface soil was evaluated by comparing concentrations to EPA's SSLs. The results of this evaluation are discussed in Section 4.0. Finally, an offsite resident was evaluated for direct contact (dermal contact, ingestion) with COPCs and inhalation of COPCs in groundwater.

Exposure to groundwater was evaluated for the onsite industrial worker, assuming this receptor would use groundwater from an onsite well for potable and non-potable purposes. The pathways evaluated for exposure to COPCs in groundwater included ingestion, dermal contact, and inhalation of VOCs. Offsite residential exposure to groundwater was evaluated based on the future potential for COPCs in onsite groundwater to migrate to offsite wells. The pathways evaluated include exposure to COPCs in groundwater via ingestion of groundwater from the tap, and dermal contact and inhalation while showering (adult) or taking a bath (child). For the purpose of the HHRA, it was assumed that current onsite groundwater concentrations were representative of future offsite concentrations. This is highly conservative as COPC concentrations will likely decrease over time due to natural attenuation and degradation. As previously discussed, exposure to groundwater was not considered for the construction worker.

Like current land use scenarios, the cancer risk estimates presented for surface soil and soil/sediment in the Gut System are associated with exposure to arsenic and chromium which are the only carcinogenic COPCs identified in these media. In addition to these two elements, noncancer hazards were evaluated for aluminum (soil/sediment), iron (surface soil and soil/sediment), manganese (surface soil and soil/sediment), vanadium (surface soil and soil/sediment), and zinc (surface soil). These risk estimates are discussed below.

Industrial/Commercial Worker

The hypothetical industrial/commercial worker receptor was evaluated for potential risk associated with exposure to COPCs in groundwater, surface soil, and soil/sediment collected in the Gut System. The cumulative RME risk estimate of $9 \times 10^{-4}$ exceeds the target range of $1 \times 10^{-6}$ to $1 \times 10^{-4}$. The majority of the potential risk is associated with exposure to COPCs in groundwater. In particular, inhalation of volatilized chloroform and exposure to chloroform and arsenic via ingestion and dermal contact (with chloroform) account for most of the cumulative risk for this medium. Onsite surface soil exposures for the RME exceed the lower end of EPA's target range with estimates of $3 \times 10^{-6}$. Exposure to the Gut System soil/sediment yielded a risk estimate of $6 \times 10^{-7}$, less than the EPA benchmark risk range.

CT risk estimates for the industrial onsite worker also are greater than the upper end of EPA's target risk range. The cumulative risk estimate for this receptor is $2 \times 10^{-4}$ which, like the RME, is comprised almost entirely of risk associated with exposure to COPCs in groundwater. Again, inhalation of volatilized chloroform contributes essentially all of this risk with an associated cancer risk estimate of $2 \times 10^{-4}$. Surface soil and soil/sediment risk estimates for the CT receptor had cumulative pathway risk estimates of $5 \times 10^{-7}$ and $1 \times 10^{-7}$, respectively

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For the RME receptor, the only noncarcinogenic hazards exceeding 1 are associated with exposure to COPCs in groundwater. The majority of this hazard estimate is associated with inhalation of volatilized chloroform with a HQ of 330. The cumulative ingestion HQs yields a hazard quotient of 3.5. Target organ HIs are 330 for liver/kidney, 0.058 for decreased hair proteins, 0.073 for skin, 1.2 for CNS, 0.10 for blood effects, 0.58 for liver/heart/pancreas, 0.071 for lung effects, and 0.006 for GI tract.

Evaluation of the CT receptor provided similar results as the RME (cumulative groundwater HI values greater than 1 since inhalation of chloroform is responsible for most of the noncancer risk and inhalation rates were not varied between the two receptors. Exposures to surface soil and soil/sediment in the Gut System did not generate noncancer hazard estimates greater than the EPA's target benchmark.

Construction Worker

The total risk estimate is associated with exposure to arsenic in surface soil and soil/sediment for the construction worker ($9 \times 10^{-7}$) which is less than EPA's target risk range. This results indicates no significant risk for this receptor under the future construction scenario evaluated. Direct contact exposure to subsurface soil was not evaluated since there were no COPCs identified in this media.

Ingestion noncancer hazard estimates for the RME and CT presented for the construction worker were slightly greater than one for ingestion of onsite surface soils. No individual COPC was greater than one, but the cumulative HI was 1.8, indicating a slight potential for adverse health effects. The total CT HI was 0.25.

Adult Resident

The adult offsite resident was evaluated for potential risk associated with exposure to COPCs in groundwater. The cumulative RME risk estimate, $8 \times 10^{-4}$, exceeds the EPA target risk range. The majority of the potential risk comes from chloroform via ingestion and inhalation, and arsenic via the ingestion pathway. The CT estimate for this scenario is $9 \times 10^{-5}$, and falls within the EPA's target risk range.

For the noncarcinogenic evaluation, the cumulative RME hazard of 250 exceeded the acceptable level of 1. Exposure via inhalation and ingestion contributed to the majority of the hazard. Specifically, individual HIs for inhalation of chloroform (250) and the ingestion of chloroform (2.8), iron (1.1), and manganese (2.7) in groundwater all exceeded 1. Target pathway HIs exceeding 1 are liver/kidney (250), CNS, (2.8), and liver/hear/pancreas (1.2).

The cumulate CT hazard across groundwater was 82, to which chloroform (1.7), manganese (1.5), and iron (0.65) each contributed via the ingestion pathway, and chloroform contributed the majority via inhalation (78). Target pathway HIs exceeding 1 are liver/kidney (79), and CNS (1.6).

Child Resident

The child offsite resident risk estimates exceeded the EPA target risk range, at $4 \times 10^{-4}$. Major contributing COPCs were similar to those for the adult scenario. The CT risk estimate was also calculated, and fell just within the EPA target risk range at $1 \times 10^{-4}$.

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For the noncarcinogenic evaluation, the total HI RME estimate was 600. COPCs contributing to the majority of hazard were chloroform via ingestion (8.3) and inhalation (580), manganese via ingestion (7.7), and iron via ingestion (3.2). Pathway-specific HIs that exceeded 1 included liver/kidney (590), CNS (8.0) and liver/heart/pancreas (3.3). The total HI CT estimate was 190.

### 6.1.4 Risk Characterization Summary

As previously discussed, based on the exposure assumptions utilized in developing risk estimates, the hypothetical industrial/commercial occupational exposure to groundwater under a future land use scenario is the only pathway that presents cumulative risk estimates, for both the RME and CT receptors, in excess of EPA's target risk range. Concentrations of chloroform in groundwater are responsible for the majority of this risk.

Onsite surface soil and soil/sediment in the Gut System demonstrated carcinogenic risks for the adult industrial worker in excess of $10^{-6}$ associated primarily with ingestion of arsenic in soils.

Estimated risks for adult and pre-adolescent trespassers and construction workers are at or below the EPA target of $10^{-6}$ risk.

The RME risk estimates for potential future residential groundwater use exceeded the EPA target risk range for both the adult and the child receptors. For both residential scenarios, the COPCs which contributed to the majority of risk are chloroform and arsenic. Both adult and child residential RME HIs exceeded 1. Ingestion and inhalation of chloroform contributed to the majority of the risk and hazard for the residential groundwater use scenario. Ingestion of arsenic, iron, or manganese also contributed to the risk or hazard estimates.

## 6.2 SCREENING ECOLOGICAL RISK ASSESSMENT

A SERA (Appendix K) was conducted for the VICHEM Site in accordance with the EPA-approved *Draft Remedial Investigation Work Plan Addendum – Phase III* (HLA 1997) and the correspondence dated November 13, 1997 submitted by McLaren/Hart to EPA. The SERA focused on the drainage channels adjacent and downstream of the Site including the River Gut (which serves as the northeastern and southeastern Site boundary), Bethlehem Gut, and Fairplains Gut. The SERA was developed utilizing data obtained through a surface soil/sediment sampling program conducted within the three drainage channels during Phase III of the RI.

The objective of the sampling program was to characterize surface soil/sediment within the drainage channels to determine the presence of Site-related constituents of potential ecological concern (COPECs). The constituent concentrations measured were used to evaluate the potential for adverse effects to ecological receptors inhabiting or foraging within the three drainage channels. The River Gut, Bethlehem Gut, and upstream areas of the Fairplains Gut only contain water during flooding conditions, and do not support aquatic biota. Therefore, these intermittent drainage channels were characterized as terrestrial environments and samples collected from locations within these Guts were considered as soil. Downstream sections of the Fairplains Gut are continuously inundated and were characterized as estuarine water environments. Therefore, samples collected from locations within these sections of the Fairplains Gut were considered as sediment. In addition to collecting samples, a qualitative biological survey of flora and fauna was conducted to identify types of species present and to assess any evidence of stress to the environment.

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This SERA was structured utilizing the standard paradigm for risk assessment, as outlined in the *Environmental Evaluation Manual of Risk Assessment Guidance for Superfund* (EPA 1989d); *Framework for Ecological Risk Assessments* (EPA 1992); and *Guidelines for Ecological Risk Assessment* (EPA 1998b).

The following ecological receptors were evaluated in the SERA:

- plant community in the guts;
- herbivorous wildlife communities (e.g., goats and Jamaican fruit bats [*Artibeus jamaicensis*]) inhabiting the guts;
- insectivorous wildlife communities (e.g., spotted sandpiper [*Actitis macularia*]) inhabiting the guts;
- benthic macroinvertebrate community in the Fairplains Gut; and
- piscivorous wildlife (e.g., great blue heron [*Ardea herodias*]) community in the Fairplains Gut.

At the request of EPA and the National Oceanic and Atmospheric Association (NOAA), a supplemental evaluation was conducted for surface soil collected within the River Gut, Bethlehem Gut, and upstream portions of the Fairplains Gut. The constituent concentrations measured in soil were compared to sediment screening benchmarks to identify the potential for impacts to macroinvertebrate communities that may be established in the future during prolonged periods of surface water inundation.

A summary of the SERA results for each of the above endpoint receptors is presented below.

*Plant Community*

Potential constituent effects on the terrestrial plant community onsite were evaluated using chemical toxicity data and biological surveys. The soil concentrations measured in the River, Bethlehem, and Fairplains Guts were compared to phytotoxicity benchmarks. Phytotoxicity benchmarks, compiled from open literature, represent chronic toxicity thresholds for growth or production of vascular plants for constituents in soil (Efroymson et al. 1997). A qualitative evaluation of species composition and diversity, as well as the presence of visible plant stress, also were conducted during the Phase III RI survey.

The constituent screening evaluation identified aluminum, chromium, manganese, mercury, selenium, vanadium, and zinc as COPECs for the plant community inhabiting the drainage channels. These constituents were all found at similar or higher concentrations at the upstream reference location (RG-2). The maximum concentration of COPECs detected in the Gut system were less than 2X background concentrations measured onsite (except mercury and selenium). These non Site-related COPECs, as identified in laboratory toxicity tests, have the potential to cause adverse impacts, such as a reduction in seedling establishment, shoot growth, or general plant growth, to various plant species. However, the physicochemical properties of the soil (e.g., high pH, elevated TOC, high oxidation conditions, and high cation exchange capacity (CEC) may decrease bioavailability of the metals and thus decrease potential impacts to plants. Furthermore, the plants inhabiting these drainage channels are more likely affected by the regrading and reshaping maintenance activities conducted, similar to that conducted during the Spring of 1997.

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*Benthic Macroinvertebrate Community*

Due to the presence of saline waters, constituent concentrations measured in sediment collected from the Fairplains Gut were compared to NOAA Effects Range-Low (ERL) and Effects Range-Median (ERM) values (Long et al. 1995). If ERLs and ERMs were unavailable, Ontario Ministry of the Environment (MOE) Lowest Effects Levels (LELs) and Severe Effects Levels (SELs) (Persaud et al. 1993), Apparent Effects Thresholds (AET) (Fitchko 1987), or Wisconsin Department of Natural Resources Sediment Quality Criteria (WIDNRSQC) (Geisy and Hoke 1990) were used for the screening process. Constituent concentrations in excess of these screening benchmarks are identified as COPECs and may potentially impact benthic macroinvertebrates inhabiting the location.

Based on the results of the screening evaluation, benthic macroinvertebrates inhabiting the aquatic environment of the Fairplains Gut (sample locations FPG-3 and FPG-4) would not be impacted from constituents found in the sediment. The screening evaluation revealed that constituents measured in sediment were below sediment screening benchmarks (e.g., ERLs and LELs).

*Herbivorous Wildlife*

To evaluate the potential risks to herbivorous wildlife, domesticated goats (a common resident near the Site) and the Jamaican fruit bat were selected as representative species for this trophic level. The fruit bat is the only native herbivorous mammalian resident of the island (Bill Knowles, VIDPNR, personal communication 1998). Point estimates of exposure were calculated from the ingestion of plants and surface soil at each location. Constituent concentrations in plants were estimated using regression models or soil-plant uptake factors (Baes et al. 1984, Sample et al. 1995, and Sample et al. 1997) and the concentrations measured in surface soil at each location.

The total exposure estimate was calculated for each location and for the entire gut (95% UCL on the mean exposure estimate), since wildlife forage over a large territory. The total exposures were then compared to literature-derived ecotoxicological benchmarks. Chronic No Observed Adverse Effects Levels (NOAELs) and Lowest Observed Adverse Effects Levels (LOAELs) were derived using chronic toxicity thresholds from mammalian toxicity tests. Greater weight was given to data from long-term feeding studies that included reproductive endpoints.

Constituents were identified as COPECs for each receptor if the exposure was in excess of the NOAEL. This suggests that there may be a potential for adverse impacts (i.e., reproductive effects) from the constituent in surface soil or vegetation. Exceedence of the estimated LOAEL evaluates the significance and potential for adverse effects that may occur from chemical exposure.

The screening process identified the following constituents as COPECs for goats (constituents in italics represents COPECs identified at background locations):

- River Gut - *aluminum* and *vanadium*;
- Bethlehem Gut - *aluminum* and *vanadium*; and
- Fairplains Gut - *aluminum* and *vanadium*.

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The screening process identified the following constituents as COPECs for fruit bats (constituents in italics represent COPECs identified at background locations):

- River Gut - *aluminum* and selenium (sample locations RG-10 and RG-13 only);
- Bethlehem Gut - *aluminum*; and
- Fairplains Gut - *aluminum* and selenium (sample location FPG-1 only).

Of the above-listed COPECs, estimated aluminum exposure to goats was in excess of the LOAEL at all sample locations. The greatest exceedence of the LOAEL, and thus the greatest potential for an adverse effect, occurred at the upstream reference location in the River Gut (RG-2). Therefore, a reduction in offspring growth for individual goats may potentially result from exposure to aluminum in surface soil at all locations within the three drainage channels. In contrast, exposure to Jamaican fruit bats did not exceed the LOAEL at any location in the three drainage channels. Therefore, bats would unlikely be at risk from foraging on fruit in the riparian habitat of the guts.

*Insectivorous Wildlife*

To evaluate the potential risks to insectivorous wildlife within the guts, spotted sandpipers were selected as a representative species for this trophic level. Concentrations in aquatic and terrestrial benthic macroinvertebrates were predicted using soil-to-worm uptake factors or simple regression models (Sample et. al. 1997) and the concentrations measured in surface soil/sediment at each location. The total exposure estimates were then compared to literature-derived ecotoxicological benchmarks derived from avian toxicity studies.

The screening process identified the following constituents as COPECs (constituents in italics represent COPECs identified at background locations and constituents underlined represent COPECs identified throughout the gut [i.e., exposure from 95% UCL or average soil concentration exceeded NOAELs]):

- River Gut - *aluminum*, *barium*, cadmium (RG-13 only), *chromium*, *lead*, mercury, selenium (sample location RG-13 only), thallium (sample location RG-14 only), *vanadium*, and *zinc*;
- Bethlehem Gut - *aluminum*, *barium*, *chromium*, *lead*, *vanadium*, and *zinc*; and
- Fairplains Gut - *aluminum*, *chromium*, *lead*, *vanadium*, and *zinc*.

Baruim, cadmium, chromium, mercury, selenium, vanadium, and zinc exposures were less than the LOAELs, and would therefore unlikely impact sandpipers foraging in the drainage channels. Aluminum exposure (at all locations) and lead exposure (at three locations in the River Gut and in the Bethlehem Gut) were predicted in excess of the LOAEL. Therefore, there is a potential for reproductive effects on sandpipers from foraging on invertebrates in the drainage channels. However, the low bioavailability of aluminum and lead in the soil matrix will likely reduce the potential exposure and subsequent impacts. It must be noted that the predicted aluminum exposure also was likely overestimated by using a soil-to-worm uptake factor of 1. Therefore, potential for impacts described in this assessment are likely much less than predicted.

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*Piscivorous Wildlife*

To evaluate the potential risks to piscivorous wildlife foraging in Fairplains Gut, great blue herons were selected as a representative species for this trophic level. Inorganic biota-sediment accumulation factors (BSAFs) for fish are not available. Therefore, concentrations in forage fish were predicted using soil-to-worm uptake factors or simple regression models (Sample et. al. 1997) and the concentrations measured in sediment within the Fairplains Gut. The total exposure estimate was then compared to literature-derived ecotoxicological benchmarks.

The screening evaluation identified aluminum and zinc as COPECs for herons foraging in the Fairplains Gut. Aluminum was the only COPEC that exceeded the LOAEL benchmark, suggesting a potential impact to herons consuming fish in the gut. Zinc exposure was only 12% of the LOAEL and would, therefore, unlikely impact herons. Because this evaluation was extremely conservative in nature (i.e., using conservative uptake factors for fish and limited home range), the potential impact from aluminum to herons and other piscivorous wildlife would likely be much lower than that identified in this assessment.

*Supplemental Evaluation*

Per EPA and NOAA=s request, the concentrations measured in soil collected from the River Gut, Bethlehem Gut, and upstream sections of the Fairplains Gut were compared to sediment screening benchmarks (MOE, LELs, and SELs) to identify the potential for impacts to macroinvertebrate communities that may be established in the future during prolonged periods of surface water inundation.

The screening evaluation identified the following COPECs within each drainage channel (italics represents COPECs identified at background locations):

- River Gut - cadmium, chromium, *copper, iron, manganese,* mercury, and *zinc*;
- Bethlehem Gut - *copper, iron*, and *manganese*; and
- Fairplains Gut – *copper.*

Copper, iron, manganese, and zinc were observed at their highest concentration at the upstream reference location (RG-2). This indicates that these COPECs are from upgradient sources and are not Site-related. However, concentrations of zinc also slightly exceeded the LEL benchmark at sample location RG-13, downgradient of the Central Storm Drain that contained elevated concentrations of zinc. The probability of the potential for impact to invertebrates is likely to be minimal since the concentrations of these COPECs only slightly exceeded the LEL benchmark. Furthermore, the concentrations of these constituents were only a small fraction of the SELs. Therefore, the COPECs identified in the drainage channels would unlikely impact benthic macroinvertebrate communities in the future.

*Conclusions*

In general, aluminum exposure may potentially impact herbivorous, insectivorous, and piscivorous wildlife foraging in the River, Bethlehem, and Fairplains Guts. Aluminum and several other COPECs (identified for plants) measured adjacent to or downstream of the Site were found at similar or lower concentrations to that measured at the upstream reference location (RG-2). This suggests that the COPECs have been transported from upgradient sources. Historical (1986) and current (1997) data for soil collected from the Central and Southern Storm

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Drains suggest that several metals (e.g., aluminum, manganese, and zinc) may have been historically discharged to downstream areas of the River Gut (near sample location RG-13).

The potential contribution of aluminum has decreased over the years, as evidenced by the substantial reduction in concentrations measured in 1997, as compared to 1986. In addition, the aluminum concentrations measured in soil from the storm drains collected in 1997 were similar to that measured in soil collected from the River Gut upstream of the drain discharge points. Therefore, there is unlikely a current onsite source of aluminum to the River Gut. The Bethlehem Gut, which contained the second highest concentration of aluminum, also is a potential source of exposure in Fairplains Gut.

Furthermore, the aluminum concentrations in soil within the guts were within the range of concentrations found worldwide (10,000 to 60,000 ppm [Jackson 1964]; average = 71,300 ppm [Vinogradov 1959]). The NOAA National Status and Trends Program also identified estuarine sediments in the Gulf of Mexico ranging from 1,400 to 113,558 ppm for aluminum (average = 47,220 ppm for 351 samples) (NOAA 1988).

The concentrations of manganese and zinc were elevated in soil collected in 1997 in the storm drains. These concentrations, if discharged to the gut, would result in minimal to negligible risk to ecological receptors in the drainage channels.

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# 7.0 REMEDIAL INVESTIGATION CONCLUSIONS

## SOIL RESULTS

Various metals were detected in the onsite surface soil samples at concentrations above the background screening criteria (two times the average background level). As an additional screening mechanism, these soils were compared to either SSLs with a DAF of 20 or RBCs (See Section 4.3.1.1). A small number of volatile organic compounds VOCs and SVOCs were detected in the surface soil samples. Pentachlorophenol and isophorone were detected above the SSL for migration to groundwater (MGW). However, pentachlorophenol was only detected once above the SSL and was not detected in groundwater therefore, this compound is not considered to be a concern. Isophorone was not identified as a COPC in onsite surface soil. Arsenic, iron, and manganese were also detected in several samples above the MGW SSL. These metals were further evaluated in the HHRA and identified as potential COCs for surface soil at the Site (along with chromium, vanadium, and zinc). However, based on the results of the HHRA, these compounds are not considered to be a health concern.

All subsurface soil samples were compared to EPA's Soil Screening Levels for the migration to groundwater pathway. Based on this comparison and the groundwater data collected during the RI, metals are not considered to be a significant concern. Cadmium was only detected in one sample above the SSL and cyanide was detected in three samples. However, these compounds were detected only slightly above the SSL and were not widely detected across the Site, they were not considered COCs.

The predominant constituents impacting subsurface soil in the AST Area are ethylbenzene and xylenes. The potentially-impacted subsurface soil encompasses an area between Tanks 3 and 10, existing mainly onsite. The zone of impacts is conservatively assumed to encompass a 20-foot interval at approximately 5 to 25 feet below ground surface (bgs). The vertical extent of the potentially-impacted soil is assumed to extend to the water table interface (approximately 25 feet bgs).

Refer to the discussion in Section 4.3.2.6 concerning acetone and methylene chloride results in soil and groundwater.

While concentrations of chloroform were not detected above the SSL of 600 ppb (maximum concentration of chloroform was 410 ppb), this constituent has been included as a COC. It is assumed that an approximate 400 $ft^2$ area of subsurface soil in the Former Process Pit (within the vicinity of MW-2) is impacted with chloroform. The predominant zone of impacts is conservatively assumed to encompass a 5-foot interval at approximately 20 to 25 feet bgs.

In the FS, the following constituents will be fully assessed for the need for remediation: ethylbenzene, total xylenes, and chloroform.

## GROUNDWATER RESULTS

The following VOCs were detected above the federal Maximum Contaminant Levels (MCLs) in groundwater: ethylbenzene, xylenes, and chloroform.

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Onsite groundwater quality in the AST Area is impacted predominantly by ethylbenzene and xylenes. Impacts have been delineated through MW-8 (vertical extent) and MW-10 (lateral extent).

Onsite groundwater quality in the Former Process Pit is impacted predominantly by chloroform. Impacts have been delineated through various sampling points: MW-7, MW-12, MW-14, MW-15, and GWPP-27A (vertical extent) and MW-11, MW-13, and GWPP-14 (lateral extent).

Toluene was identified as a potential concern in the HHRA. However, this constituent was not detected above its MCL and, therefore, is not considered a concern.

Isophorone, 2,4-dimethylphenol, and 2-methylphenol were identified as potential concerns in the HHRA. However, it was determined that these constituents do not significantly increase incremental carcinogenic/non-carcinogenic risk for exposure to groundwater.

Eight metals, antimony, arsenic, barium, chromium, iron, lead, manganese, and vanadium, were identified as being a potential concern in the human health risk evaluation. However, as noted below, these compounds were not considered COCs at the Site.

*Antimony*: Out of four sampling rounds, antimony was only detected once above its MCL at MW-6 (concentration of 6.2 ppb).

*Arsenic, Barium, and Chromium*: A cumulative risk estimate (total of all pathways) was identified for exposure to arsenic in groundwater. However, the cumulative risk estimate is still within EPA's target risk range (1.0E-06 to 1.0E-04). Additionally, these constituents were not detected above MCLs in samples collected at the Site.

*Lead*: Lead was detected above the Treatment Technique Action Level (TTAL) of 15 ppb in two monitoring wells: MW-5 and MW-10. Out of four sampling rounds, lead in MW-5 was above the TTAL during the first two rounds only (concentration range of 17 to 20.3 ppb in 1995). Lead was not detected in this well during the two rounds of sampling conducted in 1998. Likewise, out of two rounds of sampling conducted in 1998, lead was not detected in MW-10 during the first round but was found at 50.7 ppm during the second round. This well is located hydraulically upgradient of the Site and locally downgradient of the Aboveground Storage Tank (AST) Area. Lead has not exceeded the TTAL in the monitoring wells located within the AST source area.

*Iron, Manganese, and Vanadium*: Cumulative noncancer risk estimates were within the target range of 0.1 to 10 for these three constituents. Additionally, only a secondary MCL (non-enforceable) exist for iron and manganese, while no criteria exists for vanadium .

Chloroform was not detected in any offsite wells, indicating that chloroform does not appear to be migrating offsite into local production wells. Offsite groundwater quality has not been impacted by other VOCs (i.e., ethylbenzene, xylenes) as they were not detected in any of the offsite wells.

**GUT SYSTEM RESULTS**

Several metals were detected at the upstream reference location (RG-2) in the River Gut. The distribution of these metals were generally variable throughout the Gut System. However, an increase in the concentration of certain metals were noted at several locations within the River Gut and at one location in the Bethlehem Gut. These elevated concentrations in the River Gut are likely the result of the depositional nature of the locations. Subsurface soil samples from the

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River Gut were analyzed and two VOCs and two SVOCs were detected sporadically. Several metals also were detected at various concentrations; however, none were detected above EPA Soil Screening Levels.

**FATE AND TRANSPORT**

Although the potential for migration of VOCs of potential concern toward public supply wells exists, reduced pumping of offsite production wells, and natural attenuation of dissolved constituents will likely prevent future offsite migration. The VOCs observed at the VICHEM Site are known to attenuate by natural processes.

**BASELINE RISK ASSESSMENT RESULTS**

Based on the exposure assumptions utilized in developing risk estimates, the hypothetical industrial/commercial occupational exposure to groundwater under a future land use scenario is the only pathway that presents cumulative risk estimates, for both the RME and CT receptors, in excess of EPA's target acceptable range. Concentrations of chloroform in groundwater are responsible for the majority of this risk.

Onsite surface soil and soil/sediment in the Gut System demonstrated carcinogenic risks for the adult industrial worker in excess of $10^{-6}$ for ingestion at $2 \times 10^{-6}$; however, this risk estimate is within EPA's acceptable range of $10^{-6}$ to $10^{-4}$. This risk was associated primarily with ingestion of arsenic in soils.

Estimated risks for adult and pre-adolescent trespassers and construction workers are at or below the EPA target of $10^{-6}$ risk.

The RME risk estimates for potential future residential groundwater use exceeded the EPA range for the adult and child receptors. For both residential scenarios, the COPCs which contributed to the majority of risk is chloroform. Both adult and child residential RME HIs exceeded 1 (255 and 600, respectively). Ingestion and inhalation of chloroform contributed to virtually all of the risk and hazard for the residential groundwater use scenario. Ingestion of arsenic, iron, and manganese also contributed slightly to the risk and hazard estimates.

The Screening Ecological Risk Assessment (SERA) focused on the drainage channels adjacent and downstream of the Site including the River Gut (which serves as the northeastern and southeastern Site boundary), Bethlehem Gut, and Fairplains Gut. The SERA was developed utilizing data obtained through a surface soil/sediment sampling program conducted within the three drainage channels.

In general, aluminum exposure may potentially impact herbivorous, insectivorous, and piscivorous wildlife foraging in the River, Bethlehem, and Fairplains Guts. Aluminum and several other constituents of potential ecological concern (COPECs), identified for plants, measured adjacent to or downstream of the Site were found at similar or lower concentrations to that measured at the upstream reference location (RG-2). This suggests that the COPECs have been transported from upgradient sources. Historical (1986) and current (1997) data for soil collected from the Central and Southern Storm Drains suggest that several metals (e.g., aluminum, manganese, and zinc) may have been historically discharged to downstream areas of the River Gut (near sample location RG-13).

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The potential contribution of aluminum has decreased over the years, as evidenced by the substantial reduction in concentrations measured in 1997, as compared to 1986. In addition, the aluminum concentrations measured in soil from the storm drains collected in 1997 were similar to that measured in soil collected from the River Gut upstream of the drain discharge points. Therefore, there is unlikely a current onsite source of aluminum to the River Gut. The Bethlehem Gut, which contained the second highest concentration of aluminum, also is a potential source of exposure in the Fairplains Gut. A bauxite plant is located in close proximity to the Site and serves as a likely source of the aluminum concentrations detected onsite and offsite. Furthermore, the aluminum concentrations in soil within the guts were within the range of concentrations found worldwide.

The concentrations of manganese and zinc were elevated in soil collected in 1997 in the storm drains. These concentrations, if discharged to the gut, would result in minimal to negligible risk to ecological receptors in the drainage channels.

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## REFERENCES


Baes, C.F. III, R.D. Sharp, A.L. Sjoreen, and R.W. Shor. (1984). *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides Through Agriculture.* ORNL-5786, Oak Ridge National Laboratory, Oak Ridge, TN.

Diaz, P.L. et al. (1993). *Water Resources Data Puerto Rico and the U.S. Virgin Islands Water Year 1992*, U.S.G.S. Water-Data Report PR-92-1.

Dobrin, M.B. (1976). *Introduction to Geophysical Prospecting.* McGraw-Hill Book Company.

Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. (1997). *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects in Terrestrial Plants: 1997 Revision.* ES/ER/TM-85/R3.

Enviro-Science, Inc. (ESI). (1984). *Progress Report for Island Chemical Company/Chemical Contamination,* October.

ESI. (1985a). *Addendum to Progress Report, Island Chemical Company, Inc. (Berlex), St. Croix, Virgin Islands*, April.

ESI. (1985b). *Report Concerning Small Quantity Generator Status of Island Chemical*, May.

ESI. (1986). *Project Summary for Island Chemical Company, Inc. St. Croix, Virgin Islands,* April.

ESI. (1987a). Attachment, Site Description for Island Chemical Company. *St. Croix, Virgin Islands*, April.

ESI. (1987b). *Remedial Investigation Work Plan for Island Chemical Company, St. Croix, U.S. Virgin Islands,* April.

Fitchko, J. (1987). *Criteria for Contaminated Soil/Sediment Cleanup.* Pudvan Publishing Company, Northbrook, Illinois.

Freeze, R.A. and Cherry, J.A. (1979). *Groundwater.* Prentice-Hall, Inc., Englewood Cliffs, NJ.

Geisy, J.F. and R.A. Hoke. (1990). Freshwater Sediment Quality Criteria: Toxicity Bioassessment. *In.* Baudo, R.J., J. Giesy, and H. Muntau (eds). *Sediments: Chemistry and Toxicity of In-Place Pollutants.* Lewis Publishers, Boca Raton, Florida. pp. 265-348.

Geraghty & Miller, Inc. (1983). *Report on the Current Groundwater Conditions in the U.S. Virgin Islands,* April.


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Gonzalez, S. T, (1987), *Steady-State Simulation of Groundwater Flow Conditions in the Kingshill Aquifer, St. Croix, U.S. Virgin Islands,* U.S.G.S. Water Resources Investigations Report 89-4085, July.

Graves, R.P. (1995). *Hydrogeology of South-Central St. Croix, U.S. Virgin Islands,* U.S.G.S. Water-Resources Investigations Report 93-4162.

Harding Lawson Associates (HLA). (1994). *Draft Remedial Investigation Work Plan*, August.

HLA. (1995a). *Draft Data Summary Report,* August.

HLA. (1995b). *Draft II Remedial Investigation Work Plan,* November.

HLA. (1996a). *Draft Supplemental Data Summary Report,* September.

HLA. (1996b). *Additional Requested Information, Proposed Site Activities..*

HLA. (1997). *Draft Remedial Investigation Work Plan Addendum – Phase III,* June.

Jackson, M.L. (1964). Chemical Composition of soils. *In* Bear, F.E., ed., Chemistry of the soil [2d ed.]: New York, Reinhold Publishing Corp., p. 71-141.

Knowles, B. (1999). Personal Communication with Bill Knowles from the VIDPNR and Lisa Baron from McLaren/Hart, Inc. (January 6, 1999).

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. (1995). AIncidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments.≅ *Environ. Manage.* 19(1):81-97.

McLaren Hart, Inc. (1997). *Review of the Sediment Sampling Program,* November.

McLaren/Hart, Inc. (1998a). *Additional Remedial Investigation Field Activities*, March.

McLaren/Hart, Inc. (1998b). *Technical Memoranda (Phase III Groundwater, Soil, and Gut Investigations)*, June.

McLaren/Hart, Inc. (1998c). *Supplemental Remedial Investigation (Phase IV RI)*, August.

McLaren/Hart, Inc. (1998d). *Clarifications to Supplemental Remedial Investigation,* August.

McLaren/Hart, Inc. (1998e). *Field Modifications During Supplemental Remedial Investigation (Phase IV RI),* November.

Montgomery, et al. (1991). *Groundwater Chemicals Desk Reference.*

303459

NUS Corporation, a Halliburton Company. (1991). *Final Draft Site Inspection Report, Island Chemical Company/VI Chemical, St. Croix, U.S. Virgin Islands,* September.

Persaud, D., R. Jaagumagi and A. Hayton. (1993). AGuidelines for the Protection and Management of Aquatic Sediment Quality in Ontario.≅ *Ontario Ministry of the Environment,* Water Resources Branch, Watershed Management Section, Ontario, Canada. March.

Robison, T.M. (1972). *Groundwater in Central St. Croix, U.S. Virgin Islands*. U.S.G.S. Open File Report, Caribbean District, .

Sample, B.E., M.S. Aplin, R.A. Efroymson, G.W. Suter II, and C.J.E Welsh. (1997). "Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants." ORNL/TM-13391, Oak Ridge4 National Laboratory, Oak Ridge, TN.

Schacklette, H.T. and J.G. Boerngen. (1984). Elemental Concentrations in Soils and Other Surficial Materials of the Conterminous United States. U.S. Geological Survey Professional Paper 1270.

U.S. Environmental Protection Agency Sample, B.E., M.S. Aplin, R.A. Efroymson, G.W. Suter II, and C.J.E Welsh. (1997). "Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants." ORNL/TM-13391, Oak Ridge4 National Laboratory, Oak Ridge, TN.

EPA. (1985). *RCRA Enforcement, Berlex Laboratories, St. Croix, U.S Virgin Islands*. VID980651095, September.

EPA. (1986). *RCRA Enforcement- Final Report, Berlex Laboratories, St. Croix, U.S Virgin Islands*. VID980651095.

EPA. (1988). *RI/FS Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final*. EPA/540/6-89/004, October.

EPA. (1989a). *Preliminary Assessment, Removal Evaluation and Funding Authorization Request for a CERCLA Removal Action at the Virgin Island Chemical Company, Inc., St. Croix, U.S. Virgin Islands – ACTION MEMORANDUM,* August.

EPA. (1989b). *Region II CERCLA Quality Assurance Manual, Revision I,* December.

EPA. (1989c). *Environmental Evaluation Manual of Risk Assessment Guidance for Superfund,* Volume I, Human Health Evaluation, Part A. [EPA/540/1-89/002]

EPA, Region III. (1990a). *Field Filtration for Monitoring Well Groundwater Samples Requiring Metals Analysis, Bullentin No. QAD009,* April.

EPA. (1990b). *Guidance for Data Usability in Risk Assessments.*

303460

EPA. (1990c). *Compendium of Well Water Data Collected at the Virgin Island Chemical Company by the EPA,* October.

EPA. (1991a). *Final Pollution Report, USEPA Region II Response and Prevention Branch,* October.

EPA. (1991b). *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual, Part B, Development of Risk-based Preliminary Remediation Goals – Interim.*

EPA. (1991c). *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual, "Standard Default Exposure Factors".*

EPA. (1992a). *Framework for Ecological Risk Assessment.* [EPA/630/R-92/001]

EPA. (1992b). *Dermal Exposure Assessment: Principles and Applications.*

EPA. Region II (1996a). 2: *Island Chemical Company. In*: Coastal Hazardous Waste Site Review/ Island Chemical Company.

EPA. (1996b). *Exposure Factor Handbook.*

EPA. (1996c). *Soil Screening Guidance: User's Guide.* [EPA/540/R-96/018].

EPA. (1998a). *Guidelines for Ecological Risk Assessment.* EPA/630/R-95/002F. Risk Assessment Forum , U.S. Environmental Protection Agency, Washigton, D.C., April.

EPA. (1998b). *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual, Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments – Interim.*

Vinogradov, A.P. (1959). The geochemistry of rare and dispersed chemical elements in soils [2d ed., revised and enlarged]: New York, Consultants Bureau Enterprises, 209 p.



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**Table 3-1**
**Soil Sampling Summary**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| Location | PHASE I | PHASE II | PHASE III | | | |
|---|---|---|---|---|---|---|
| | January/February 1995 | May 1996 | June 1997 | September/October 1997 | December 1997 | March/April 1998 |
| AST Area | *Soil Borings*<br>SBB-1, SBE-1<br>*Surface Soil Samples*<br>SBB-1, SBE-1 | *Soil Borings*<br>SBB-2, SBB-4, SBB-6, SBB-11, SBB-15 thru SBB-17<br>*Surface Soil Samples*<br>SBB-4, SBB-6, SBB-11, SBB-16, SBB-17 | *Soil Borings*<br>SBAST-1 thru SBAST-4 | *Soil Borings*<br>SBAST-5 thru SBAST-7<br>*Shelby Tube Samples*<br>SBAST-8, SBAST-9 | *Soil Borings*<br>SBAST-10 thru SBAST-13 | -- |
| Former Process Pit Area | *Soil Borings*<br>SBC-1<br>*Surface Soil Samples*<br>SBC-1 | -- | -- | -- | *Soil Borings*<br>SBPP-1 thu SBPP6 | *Soil Borings*<br>SBPP-7 thru SBPP-10, SBPP-13, SBPP-15, SBPP-22, SBPP-23, SBPP-26, SBPP-27, SBPP-32, SBOR-1<br>*Shelby Tube Samples*<br>SBPP-13 |
| Former Laboratory Pit Area | *Soil Borings*<br>SBD-1 thru SBD-3, SBF-1 thru SBF-3<br>*Surface Soil Samples*<br>SBD-1 thru SBD-3, SBF-1 thru SBF-3 | -- | -- | -- | *Soil Borings*<br>SBLP-1 thru SBLP-2 | -- |
| Former Drum Areas | *Soil Borings*<br>SBC-2, SBD-4<br>*Surface Soil Samples*<br>SBC-2, SBD-4 | -- | *Soil Borings*<br>SB238D-1 thru SB238D-3, SB64D-1 and SB64D-2, SB8D-1 | -- | -- | -- |
| Storm Drains | -- | -- | -- | *Soil Borings*<br>SBCSD-1 thru SBCSD-3<br>*Surface Soil Samples*<br>SDSSD-1 and SDSSD-2, SDCSD-2 and SDCSD-3 | -- | -- |
| River Gut | -- | -- | -- | *Soil Borings*<br>SBRG-1 thru SBRG-3<br>*Surface Soil Samples*<br>RG-2 thru RG-16 | -- | -- |
| Bethlehem Gut | -- | -- | -- | *Surface Soil Samples*<br>BG-1 and BG-2 | -- | -- |
| Fair Plains Gut | -- | -- | -- | *Surface Soil Samples*<br>FPG-1 and FPG-2<br>*Sediment Samples*<br>FPG-3 and FPG-4 | -- | -- |
| Onsite Background Locations | -- | -- | -- | *Surface Soil Samples*<br>B-1 thru B-3 | -- | -- |

-- Soil borings/sampling not completed in this area during this phase.

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**Table 3-2**
**Lithologic Description - Background Surface Soil Samples**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| Sample ID | Description of Sample |
|---|---|
| BG-1 | Light brown CLAY, fine sand, trace gravel |
| BG-2 | Medium brown silty CLAY, some sand, trace gravel |
| BG-3 | Medium brown CLAY, little-trace sand, trace gravel |



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**Table 3-3**
**Well Construction Details**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| Well ID | Construction Date | Total Depth (ft bgs) | Screened Interval (ft bgs) | Survey Elevations | | |
|---|---|---|---|---|---|---|
| | | | | Ground (ft msl) | TOC (ft msl) | TIC (ft msl) |
| *Onsite Wells* | | | | | | |
| MW-1 | 2/3/95 | 33 | 23-33 | 29.41 | 31.54 | 31.36 |
| MW-2 | 5/30/96 | 28.2 | 18.9-28.2 | 29.51 | 32.08 | 31.53 |
| MW-3 | 2/2/95 | 28.5 | 18.5-28.5 | 28.69 | 30.82 | 30.59 |
| MW-4 | 1/26/95 | 28 | 18-28 | 27.13 | 28.82 | 28.63 |
| MW-5 | 2/1/95 | 27.5 | 17.5-27.5 | 26.65 | 29.15 | 28.89 |
| MW-6 | 5/31/96 | 26.7 | 17.4-26.7 | 30.20 | 33.20 | 32.17 |
| MW-7 | 12/6/97 | 74 | 64-74 | 29.37 | 31.71 | 31.38 |
| MW-8 | 12/7/97 | 73 | 63-73 | 30.27 | 32.69 | 32.49 |
| MW-9 | 12/5/97 | 74 | 64-74 | 26.78 | 30.19 | 29.96 |
| MW-10 | 10/3/97 | 32 | 22-32 | 32.01 | 34.78 | 34.76 |
| MW-11 | 10/17/98 | 40 | 30-40 | 38.17 | 40.86 | 39.54 |
| MW-12 | 10/10/98 | 147 | 137-147 | 38.46 | 41.21 | 39.57 |
| MW-13 | 10/17/98 | 40 | 30-40 | 38.38 | 41.05 | 40.03 |
| MW-14 | 10/14/98 | 134 | 124-134 | 38.44 | 40.89 | 39.29 |
| MW-15 | 1/31/00 | 98 | 88-98 | 37.80 | 38.97 | 38.37 |
| P-1 | NA | 98 * | NA | 38.00 | 39.80 | NA |
| P-2 | NA | 96 * | NA | 29.55 | 30.38 | NA |
| TW-1 | 9/17/97 | 29 | 19-29 | 30.43 | 33.47 | NA |
| TW-2 | 9/16/97 | 26 | 16-26 | 31.10 | 34.92 | NA |
| TW-3 | 9/18/97 | 29 | 19-29 | 31.53 | 34.99 | NA |
| TW-4 | 9/19/97 | 32 | 22-32 | 30.61 | 33.22 | NA |
| TW-5 | 9/20/97 | 30 | 20-30 | 32.14 | 36.29 | NA |
| *Offsite Wells* | | | | | | |
| VIPA #1 | NA | 120 | Open Hole | 34.82 | 36.36 | NA |
| VIPA #2 | NA | 120 | Open Hole | 35.06 | 36.53 | NA |
| Fairplains #9 (WAPA) | NA | 64.12 * | NA | 27.58 | 29.27 | NA |
| USGS | NA | 51.44 * | NA | 17.57 | 20.71 | NA |
| Charlie's #1 | 1996 | 59.19 * | Open Hole | 28.14 | 28.62 | NA |
| Charlie's #2 | 1989 | 53.83 * | Open Hole | 27.13 | 27.20 | NA |
| Carr's | NA | 34.19 * | Open Hole | 28.49 | 29.08 | NA |
| Meridian #1 (VIAPCO #1) | NA | NA | NA | 33.49 | 33.57 | NA |
| Meridian #2 (VIAPCO #2) | NA | 80.13 * | NA | 35.02 | 36.63 | NA |
| Zenon #1 | NA | 55 * | Open Hole | 27.50 | 28.54 | NA |
| Fairplains #7 (Zenon #2) | NA | 12.62 * | NA | 24.34 | 24.98 | NA |

* - measured from top of outer casing
ft bgs - feet below ground surface
ft msl - feet mean sea level

TOC - top of outer casing
TIC - top of inner casing
NA - not available

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## Table 3-4
## Groundwater Elevations
## Virgin Island Chemical Site
## St. Croix, U.S. Virgin Islands

| Well ID | Reference Point Elevations | | | February 14, 1995 | | May 8, 1995 | | May 9, 1995 | | May 10, 1995 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | GS (ft msl) | TOC (ft msl) | TIC (ft msl) | Depth to Water | Water Elevation | Depth to Water | Water Elevation | Depth to Water | Water Elevation | Depth to Water | Water Elevation |
| *Onsite Wells* | | | | | | | | | | | |
| MW-1 | 29.41 | 31.54 | 31.36 | 27.18 | 4.18 | 27.10 | 4.26 | 27.09 | 4.27 | 26.68 | 4.68 |
| MW-2 | 29.51 | 32.08 | 31.53 | NI | - | NI | - | NI | - | NI | - |
| MW-3 | 28.69 | 30.82 | 30.59 | 25.71 | 5.09 | 26.52 | 4.28 | 26.54 | 4.26 | 24.47 | 6.33 |
| MW-4 | 27.13 | 28.82 | 28.63 | 24.35 | 4.28 | 24.43 | 4.20 | 24.44 | 4.19 | 23.85 | 4.78 |
| MW-5 | 26.65 | 29.15 | 28.89 | 24.63 | 4.20 | 24.74 | 4.09 | 24.76 | 4.07 | 20.58 | 8.25 |
| MW-6 | 30.20 | 33.20 | 32.17 | NI | - | NI | - | NI | - | NI | - |
| MW-7 | 29.37 | 31.71 | 31.38 | NI | - | NI | - | NI | - | NI | - |
| MW-8 | 30.27 | 32.69 | 32.49 | NI | - | NI | - | NI | - | NI | - |
| MW-9 | 26.78 | 30.19 | 29.96 | NI | - | NI | - | NI | - | NI | - |
| MW-10 | 32.01 | 34.78 | 34.76 | NI | - | NI | - | NI | - | NI | - |
| MW-11 | 38.17 | 40.86 | 39.54 | NI | - | NI | - | NI | - | NI | - |
| MW-12 | 38.46 | 41.21 | 39.57 | NI | - | NI | - | NI | - | NI | - |
| MW-13 | 38.38 | 41.05 | 40.03 | NI | - | NI | - | NI | - | NI | - |
| MW-14 | 38.44 | 40.89 | 39.29 | NI | - | NI | - | NI | - | NI | - |
| P-1 | 38.00 | 39.80 | NA | 35.20 | 2.80 | 36.83 | 2.97 | 36.81 | 2.99 | 36.75 | 3.05 |
| P-2 | 29.55 | 30.38 | NA | 22.65 | 6.90 | 26.58 | 3.80 | 26.53 | 3.85 | 26.35 | 4.03 |
| *Offsite Wells* | | | | | | | | | | | |
| VIPA #1 | 34.82 | 36.36 | NA | NI | - | NI | - | NI | - | NI | - |
| VIPA #2 | 35.06 | 36.53 | NA | NI | - | NI | - | NI | - | NI | - |
| Fairplains #9 (WAPA) | 27.58 | 29.27 | NA | NI | - | NI | - | NI | - | NI | - |
| USGS | 17.57 | 20.71 | NA | NI | - | NI | - | NI | - | NI | - |
| Charlie's #1 | 28.14 | 28.62 | NA | NI | - | NI | - | NI | - | NI | - |
| Charlie's #2 | 27.13 | 27.20 | NA | NI | - | NI | - | NI | - | NI | - |
| Carr's | 28.49 | 29.08 | NA | NI | - | NI | - | NI | - | NI | - |
| Meridian #1 (VIAPCO #1) | 33.49 | 33.57 | NA | NI | - | NI | - | NI | - | NI | - |
| Meridian #2 (VIAPCO #2) | 35.02 | 36.63 | NA | NI | - | NI | - | NI | - | NI | - |
| Zenon #1 | 27.50 | 28.54 | NA | NI | - | NI | - | NI | - | NI | - |

GS - Ground surface
TOC - Top of outer casing
TIC - Top of inner casing
NI - Well not installed yet
NM - Not measured

* - Water levels were influenced by a heavy rainstorm on 9/15-16/97.

- Depth to water measured in feet from reference point.
- Reference and water elevations measured in feet mean sea level.
- Bold, italicized elevations are measurements that are assumed to be influenced by pumping and were not used in depicting groundwater flow directions.



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**Table 3-4**
**Groundwater Elevations**
**Virgin Island Chemical Site**
**St. Croix, U.S. Virgin Islands**

| Well ID | Reference Point Elevations | | | May 11, 1995 | | May 29, 1996 | | May 30, 1996 | | June 16, 1996 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | GS (ft msl) | TOC (ft msl) | TIC (ft msl) | Depth to Water | Water Elevation | Depth to Water | Water Elevation | Depth to Water | Water Elevation | Depth to Water | Water Elevation |
| *Onsite Wells* | | | | | | | | | | | |
| MW-1 | 29.41 | 31.54 | 31.36 | 26.23 | 5.13 | 24.72 | 6.64 | 24.62 | 6.74 | 25.12 | 6.24 |
| MW-2 | 29.51 | 32.08 | 31.53 | NI | - | NI | - | NI | - | 24.86 | 6.67 |
| MW-3 | 28.69 | 30.82 | 30.59 | 21.97 | 8.83 | 23.13 | 7.67 | 23.16 | 7.64 | 23.87 | 6.93 |
| MW-4 | 27.13 | 28.82 | 28.63 | 23.12 | 5.51 | 21.91 | 6.72 | 21.83 | 6.80 | 21.89 | 6.74 |
| MW-5 | 26.65 | 29.15 | 28.89 | 20.89 | 7.94 | 21.17 | 7.66 | 21.21 | 7.62 | 22.32 | 6.51 |
| MW-6 | 30.20 | 33.20 | 32.17 | NI | - | NI | - | NI | - | NM | - |
| MW-7 | 29.37 | 31.71 | 31.38 | NI | - | NI | - | NI | - | NI | - |
| MW-8 | 30.27 | 32.69 | 32.49 | NI | - | NI | - | NI | - | NI | - |
| MW-9 | 26.78 | 30.19 | 29.96 | NI | - | NI | - | NI | - | NI | - |
| MW-10 | 32.01 | 34.78 | 34.76 | NI | - | NI | - | NI | - | NI | - |
| MW-11 | 38.17 | 40.86 | 39.54 | NI | - | NI | - | NI | - | NI | - |
| MW-12 | 38.46 | 41.21 | 39.57 | NI | - | NI | - | NI | - | NI | - |
| MW-13 | 38.38 | 41.05 | 40.03 | NI | - | NI | - | NI | - | NI | - |
| MW-14 | 38.44 | 40.89 | 39.29 | NI | - | NI | - | NI | - | NI | - |
| P-1 | 38.00 | 39.80 | NA | 36.71 | 3.09 | NI | - | 36.38 | 3.42 | 36.41 | 3.39 |
| P-2 | 29.55 | 30.38 | NA | 26.38 | 4.00 | NI | - | 26.30 | 4.06 | 26.80 | 3.56 |
| *Offsite Wells* | | | | | | | | | | | |
| VIPA #1 | 34.82 | 36.36 | NA | NI | - | NI | - | NI | - | NI | - |
| VIPA #2 | 35.06 | 36.53 | NA | NI | - | NI | - | NI | - | NI | - |
| Fairplains #9 (WAPA) | 27.58 | 29.27 | NA | NI | - | NI | - | NI | - | NI | - |
| USGS | 17.57 | 20.71 | NA | NI | - | NI | - | NI | - | NI | - |
| Charlie's #1 | 28.14 | 28.62 | NA | NI | - | NI | - | NI | - | NI | - |
| Charlie's #2 | 27.13 | 27.20 | NA | NI | - | NI | - | NI | - | NI | - |
| Carr's | 28.49 | 29.08 | NA | NI | - | NI | - | NI | - | NI | - |
| Meridian #1 (VIAPCO #1) | 33.49 | 33.57 | NA | NI | - | NI | - | NI | - | NI | - |
| Meridian #2 (VIAPCO #2) | 35.02 | 36.63 | NA | NI | - | NI | - | NI | - | NI | - |
| Zenon #1 | 27.50 | 28.54 | NA | NI | - | NI | - | NI | - | NI | - |

GS - Ground surface
TOC - Top of outer casing
TIC - Top of inner casing
NI - Well not installed yet
NM - Not measured

* - Water levels were influenced by a heavy rainstorm on 9/15-16/97.
- Depth to water measured in feet from reference point.
- Reference and water elevations measured in feet mean sea level.
- Bold, italicized elevations are measurements that are assumed to be influenced by pumping and were not used in depicting groundwater flow directions.



303466

## Table 3-4
## Groundwater Elevations
## Virgin Island Chemical Site
## St. Croix, U.S. Virgin Islands

| Well ID | Reference Point Elevations | | | June 17, 1996 | | June 18, 1996 | | September 12, 1997 | | September 19, 1997 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | GS (ft msl) | TOC (ft msl) | TIC (ft msl) | Depth to Water | Water Elevation | Depth to Water | Water Elevation | Depth to Water | Water Elevation | Depth to Water* | Water Elevation* |
| *Onsite Wells* | | | | | | | | | | | |
| MW-1 | 29.41 | 31.54 | 31.36 | 25.26 | 6.10 | 25.00 | 6.36 | 22.81 | 8.73 | 22.55 | 8.99 |
| MW-2 | 29.51 | 32.08 | 31.53 | 24.88 | 6.65 | 24.86 | 6.67 | 23.22 | 8.31 | 22.48 | 9.05 |
| MW-3 | 28.69 | 30.82 | 30.59 | 23.71 | 7.09 | 23.67 | 7.13 | 23.48 | 7.34 | 22.29 | 8.53 |
| MW-4 | 27.13 | 28.82 | 28.63 | 21.81 | 6.82 | 21.83 | 6.80 | 20.19 | 8.63 | 19.61 | 9.21 |
| MW-5 | 26.65 | 29.15 | 28.89 | 22.40 | 6.43 | 22.40 | 6.43 | 20.99 | 8.16 | 19.96 | 9.19 |
| MW-6 | 30.20 | 33.20 | 32.17 | 26.20 | 5.97 | 25.89 | 6.28 | 23.14 | 9.03 | 23.06 | 9.11 |
| MW-7 | 29.37 | 31.71 | 31.38 | NI | - | NI | - | NI | - | NI | - |
| MW-8 | 30.27 | 32.69 | 32.49 | NI | - | NI | - | NI | - | NI | - |
| MW-9 | 26.78 | 30.19 | 29.96 | NI | - | NI | - | NI | - | NI | - |
| MW-10 | 32.01 | 34.78 | 34.76 | NI | - | NI | - | NI | - | NI | - |
| MW-11 | 38.17 | 40.86 | 39.54 | NI | - | NI | - | NI | - | NI | - |
| MW-12 | 38.46 | 41.21 | 39.57 | NI | - | NI | - | NI | - | NI | - |
| MW-13 | 38.38 | 41.05 | 40.03 | NI | - | NI | - | NI | - | NI | - |
| MW-14 | 38.44 | 40.89 | 39.29 | NI | - | NI | - | NI | - | NI | - |
| P-1 | 38.00 | 39.80 | NA | 36.55 | 3.25 | 36.45 | 3.35 | 33.70 | 6.10 | 33.56 | 6.24 |
| P-2 | 29.55 | 30.38 | NA | 27.04 | 3.32 | 26.35 | 4.01 | 23.17 | 7.21 | 22.64 | 7.74 |
| *Offsite Wells* | | | | | | | | | | | |
| VIPA #1 | 34.82 | 36.36 | NA | NI | - | NI | - | 31.71 | ***4.65*** | 30.06 | ***6.30*** |
| VIPA #2 | 35.06 | 36.53 | NA | NI | - | NI | - | 28.81 | 7.72 | 36.18 | ***0.35*** |
| Fairplains #9 (WAPA) | 27.58 | 29.27 | NA | NI | - | NI | - | 23.86 | 5.41 | 22.98 | 6.29 |
| USGS | 17.57 | 20.71 | NA | NI | - | NI | - | 21.35 | ***-0.64*** | 20.60 | ***0.11*** |
| Charlie's #1 | 28.14 | 28.62 | NA | NI | - | NI | - | 29.92 | ***-1.30*** | 20.02 | 8.60 |
| Charlie's #2 | 27.13 | 27.20 | NA | NI | - | NI | - | 20.65 | 6.55 | 20.06 | 7.14 |
| Carr's | 28.49 | 29.08 | NA | NI | - | NI | - | 22.12 | 6.96 | 21.68 | 7.40 |
| Meridian #1 (VIAPCO #1) | 33.49 | 33.57 | NA | NI | - | NI | - | NM | - | NM | - |
| Meridian #2 (VIAPCO #2) | 35.02 | 36.63 | NA | NI | - | NI | - | 28.41 | 8.22 | 27.64 | 8.99 |
| Zenon #1 | 27.50 | 28.54 | NA | NI | - | NI | - | 23.02 | 5.52 | 22.64 | 5.90 |

GS - Ground surface
TOC - Top of outer casing
TIC - Top of inner casing
NI - Well not installed yet
NM - Not measured

* - Water levels were influenced by a heavy rainstorm on 9/15-16/97.

- Depth to water measured in feet from reference point.
- Reference and water elevations measured in feet mean sea level.
- Bold, italicized elevations are measurements that are assumed to be influenced by pumping and were not used in depicting groundwater flow directions.



303467

## Table 3-4
## Groundwater Elevations
## Virgin Island Chemical Site
## St. Croix, U.S. Virgin Islands

| Well ID | Reference Point Elevations | | | September 25, 1997 | | October 1, 1997 | | January 10, 1998 | | March 25, 1998 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | GS (ft msl) | TOC (ft msl) | TIC (ft msl) | Depth to Water | Water Elevation | Depth to Water | Water Elevation | Depth to Water | Water Elevation | Depth to Water | Water Elevation |
| *Onsite Wells* | | | | | | | | | | | |
| MW-1 | 29.41 | 31.54 | 31.36 | 22.42 | 9.12 | 22.54 | 9.00 | 21.52 | 10.02 | 23.78 | 7.76 |
| MW-2 | 29.51 | 32.08 | 31.53 | 22.78 | 8.75 | 22.57 | 8.96 | 22.05 | 9.48 | 23.87 | 7.66 |
| MW-3 | 28.69 | 30.82 | 30.59 | 22.74 | 8.08 | 22.98 | 7.84 | 22.10 | 8.72 | 24.05 | 6.77 |
| MW-4 | 27.13 | 28.82 | 28.63 | 19.82 | 9.00 | 19.90 | 8.92 | 19.01 | 9.81 | 20.58 | 8.24 |
| MW-5 | 26.65 | 29.15 | 28.89 | 20.32 | 8.83 | 20.46 | 8.69 | 19.50 | 9.65 | 22.48 | 6.67 |
| MW-6 | 30.20 | 33.20 | 32.17 | 22.98 | 9.19 | 22.43 | 9.74 | 22.26 | 9.91 | 24.80 | 7.37 |
| MW-7 | 29.37 | 31.71 | 31.38 | NI | - | NI | - | 22.26 | 9.45 | 24.76 | 6.95 |
| MW-8 | 30.27 | 32.69 | 32.49 | NI | - | NI | - | 23.05 | 9.64 | 25.78 | 6.91 |
| MW-9 | 26.78 | 30.19 | 29.96 | NI | - | NI | - | 20.43 | 9.53 | 22.49 | 7.47 |
| MW-10 | 32.01 | 34.78 | 34.76 | NI | - | NI | - | 24.70 | 10.06 | 23.44 | 11.34 |
| MW-11 | 38.17 | 40.86 | 39.54 | NI | - | NI | - | NI | - | NI | - |
| MW-12 | 38.46 | 41.21 | 39.57 | NI | - | NI | - | NI | - | NI | - |
| MW-13 | 38.38 | 41.05 | 40.03 | NI | - | NI | - | NI | - | NI | - |
| MW-14 | 38.44 | 40.89 | 39.29 | NI | - | NI | - | NI | - | NI | - |
| P-1 | 38.00 | 39.80 | NA | 33.63 | 6.17 | NM | - | 33.01 | 6.79 | 33.88 | 5.92 |
| P-2 | 29.55 | 30.38 | NA | 22.94 | 7.44 | NM | - | 21.52 | 8.86 | 23.44 | 6.94 |
| *Offsite Wells* | | | | | | | | | | | |
| VIPA #1 | 34.82 | 36.36 | NA | 30.56 | ***5.80*** | NM | - | NM | - | NM | - |
| VIPA #2 | 35.06 | 36.53 | NA | 38.42 | ***-1.89*** | NM | - | NM | - | NM | - |
| Fairplains #9 (WAPA) | 27.58 | 29.27 | NA | 23.22 | 6.05 | NM | - | NM | - | NM | - |
| USGS | 17.57 | 20.71 | NA | 20.88 | ***-0.17*** | NM | - | NM | - | NM | - |
| Charlie's #1 | 28.14 | 28.62 | NA | 20.98 | 7.64 | NM | - | NM | - | NM | - |
| Charlie's #2 | 27.13 | 27.20 | NA | 19.92 | 7.28 | NM | - | NM | - | NM | - |
| Carr's | 28.49 | 29.08 | NA | 21.92 | 7.16 | NM | - | NM | - | NM | - |
| Meridian #1 (VIAPCO #1) | 33.49 | 33.57 | NA | NM | - | NM | - | NM | - | NM | - |
| Meridian #2 (VIAPCO #2) | 35.02 | 36.63 | NA | 28.20 | 8.43 | NM | - | NM | - | NM | - |
| Zenon #1 | 27.50 | 28.54 | NA | 22.94 | 5.60 | NM | - | NM | - | NM | - |

GS - Ground surface
TOC - Top of outer casing
TIC - Top of inner casing
NI - Well not installed yet
NM - Not measured

* - Water levels were influenced by a heavy rainstorm on 9/15-16/97.

- Depth to water measured in feet from reference point.
- Reference and water elevations measured in feet mean sea level.
- Bold, italicized elevations are measurements that are assumed to be influenced by pumping and were not used in depicting groundwater flow directions.

## Table 3-4
## Groundwater Elevations
## Virgin Island Chemical Site
## St. Croix, U.S. Virgin Islands

| Well ID | Reference Point Elevations | | | October 5, 1998 | | October 21, 1998 | | November 30, 1999 | |
|---|---|---|---|---|---|---|---|---|---|
| | GS (ft msl) | TOC (ft msl) | TIC (ft msl) | Depth to Water | Water Elevation | Depth to Water | Water Elevation | Depth to Water | Water Elevation |
| *Onsite Wells* | | | | | | | | | |
| MW-1 | 29.41 | 31.54 | 31.36 | 20.45 | 11.09 | 20.96 | 10.58 | 12.85 | 18.51 |
| MW-2 | 29.51 | 32.08 | 31.53 | *20.45* | *11.63* | 21.33 | *10.75* | 13.89 | 17.64 |
| MW-3 | 28.69 | 30.82 | 30.59 | *19.61* | *11.21* | 21.37 | 9.45 | 14.10 | 16.72 |
| MW-4 | 27.13 | 28.82 | 28.63 | 17.52 | 11.30 | 18.26 | 10.56 | 10.30 | 18.33 |
| MW-5 | 26.65 | 29.15 | 28.89 | 17.79 | 11.36 | 18.37 | 10.78 | 11.21 | 17.68 |
| MW-6 | 30.20 | 33.20 | 32.17 | *21.85* | 11.35 | 21.64 | 10.53 | 13.55 | 18.62 |
| MW-7 | 29.37 | 31.71 | 31.38 | 22.69 | 9.02 | 22.9 | 8.81 | 18.83 | 12.88 |
| MW-8 | 30.27 | 32.69 | 32.49 | 22.44 | 10.25 | 22.81 | 9.88 | 16.70 | 15.79 |
| MW-9 | 26.78 | 30.19 | 29.96 | *20.46* | 9.73 | 20.26 | *9.93* | 15.23 | 14.73 |
| MW-10 | 32.01 | 34.78 | 34.76 | 24.01 | 10.77 | 24.13 | 10.65 | 16.00 | 18.76 |
| MW-11 | 38.17 | 40.86 | 39.54 | NI | - | 31.88 | *8.98* | 25.26 | 15.60 |
| MW-12 | 38.46 | 41.21 | 39.57 | NI | - | 32.28 | *8.93* | 27.55 | 13.66 |
| MW-13 | 38.38 | 41.05 | 40.03 | NI | - | 31.96 | *9.09* | 24.86 | 16.19 |
| MW-14 | 38.44 | 40.89 | 39.29 | NI | - | 31.42 | *9.47* | 25.67 | 13.62 |
| P-1 | 38.00 | 39.80 | NA | 32.85 | 6.95 | 32.77 | *7.03* | 30.20 | 9.60 |
| P-2 | 29.55 | 30.38 | NA | 21.15 | 9.23 | 21.23 | 9.15 | 16.25 | 14.13 |
| *Offsite Wells* | | | | | | | | | |
| VIPA #1 | 34.82 | 36.36 | NA | 27.97 | 8.39 | 27.98 | 8.38 | NM | - |
| VIPA #2 | 35.06 | 36.53 | NA | 25.25 | 11.28 | 25.23 | 11.30 | NM | - |
| Fairplains #9 (WAPA) | 27.58 | 29.27 | NA | 21.19 | 8.08 | 21.52 | 7.75 | NM | - |
| USGS | 17.57 | 20.71 | NA | 17.17 | *0.40* | 17.62 | *-0.05* | NM | - |
| Charlie's #1 | 28.14 | 28.62 | NA | 19.06 | *9.08* | NM | - | NM | - |
| Charlie's #2 | 27.13 | 27.20 | NA | 17.63 | 9.57 | NM | - | NM | - |
| Carr's | 28.49 | 29.08 | NA | 20.14 | 8.94 | NM | - | NM | - |
| Meridian #1 (VIAPCO #1) | 33.49 | 33.57 | NA | NM | - | NM | - | NM | - |
| Meridian #2 (VIAPCO #2) | 35.02 | 36.63 | NA | 25.43 | 11.20 | 25.18 | 11.45 | NM | - |
| Zenon #1 | 27.50 | 28.54 | NA | 21.00 | *6.50* | 23.78 | *3.72* | NM | - |

GS - Ground surface
TOC - Top of outer casing
TIC - Top of inner casing
NI - Well not installed yet
NM - Not measured

* - Water levels were influenced by a heavy rainstorm on 9/15-16/97.

- Depth to water measured in feet from reference point.
- Reference and water elevations measured in feet mean sea level.
- Bold, italicized elevations are measurements that are assumed to be influenced by pumping and were not used in depicting groundwater flow directions.

303469

## Table 3-5
## Groundwater Elevations - Temporary Wells
## Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands

| Well ID | Reference Elevation | Reference Point | 9/26/97 | | 9/27/97 | | 10/1/97 | |
|---|---|---|---|---|---|---|---|---|
| | | | Depth to Water | Water Elevation | Depth to Water | Water Elevation | Depth to Water | Water Elevation |
| TW-1 | 33.47 | TOC | 24.36 | 9.11 | 24.31 | 9.16 | 24.32 | 9.15 |
| TW-2 | 34.92 | TOC | 25.80 | 9.12 | 25.79 | 9.13 | 25.78 | 9.14 |
| TW-3 | 34.99 | TOC | 25.84 | 9.15 | 25.84 | 9.15 | 25.80 | 9.19 |
| TW-4 | 33.22 | TOC | 24.08 | 9.14 | 24.06 | 9.16 | 24.06 | 9.16 |
| TW-5 | 36.29 | TOC | 27.18 | 9.11 | 27.19 | 9.10 | 27.20 | 9.09 |

Depth to water measured in feet from reference point.
Reference and water elevations measured in feet mean sea level.
TOC - top of outer casing

303470

**Table 3-6**
**Field Parameters from Groundwater Sampling Events**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

*January 1998 Groundwater Sampling Event*

| Well ID | Date | pH (unitless) | Conductivity (uS/cm) | Turbidity (NTUs) | Temperature (deg. C) | ORP (mV) | DO (mg/L) | DTW (feet) |
|---|---|---|---|---|---|---|---|---|
| MW-1 | 1/9/98 | 6.92 | 1.07 | NA | 28.4 | -284 | NA | 23.4 |
| MW-2 | 1/13/98 | 6.53 | 5.08 | 4 | 28.9 | -237 | 0.53 | 22.3 |
| MW-3 | 1/11/98 | 6.96 | 2.19 | 16 | 29.5 | -302 | 1.06 | 22.5 |
| MW-4 | 1/9/98 | 7.01 | 1.05 | NA | 28.7 | -298 | 60 | 18.9 |
| MW-5 | 1/12/98 | 7.2 | 2.31 | 2 | 27.3 | -280 | 1.01 | 19.7 |
| MW-6 | 1/13/98 | 6.28 | 1.88 | 1 | 28.4 | -153 | 0.66 | 22.3 |
| MW-7 | 1/13/98 | 6.64 | 2.35 | 5 | 29.7 | -144 | 0.65 | 23.9 |
| MW-8 | 1/14/98 | 6.89 | 1.98 | 24 | 28.8 | NA | 0.53 | 23.4 |
| MW-9 | 1/12/98 | 7.23 | 2.18 | 19 | 29.9 | -156 | 0.34 | 21.5 |
| MW-10 | 1/11/98 | 6.96 | 1.7 | 8 | 28.7 | -321 | 0.96 | 25 |
| P-1 | 1/10/98 | 7.04 | 1.99 | 1 | 28.8 | -267 | 0.97 | 33 |
| P-2 | 1/10/98 | 7.25 | 2.45 | 3 | 29 | -262 | 0.86 | 21.6 |

*March 1998 Groundwater Sampling Event*

| Well ID | Date | pH (unitless) | Conductivity (uS/cm) | Turbidity (NTUs) | Temperature (deg. C) | ORP (mV) | DO (mg/L) | DTW (feet) |
|---|---|---|---|---|---|---|---|---|
| MW-1 | 3/26/98 | 6.54 | 1.83 | 4 | 34 | -245.6 | 0.24 | 24.5 |
| MW-2 | 3/25/98 | 6.75 | 4.71 | NA | 36 | 126.6 | 1.41 | 23.4 |
| MW-3 | 3/24/98 | 6.58 | 1.72 | NA | 33.8 | 33.7 | 0.36 | 24.2 |
| MW-4 | 3/23/98 | 6.84 | 1.85 | 9 | 35.5 | NA | 0.57 | 20.6 |
| MW-5 | 3/24/98 | 7.24 | 1.65 | NA | 29 | 29.1 | 0.83 | 22.3 |
| MW-6 | 3/26/98 | 6.53 | 1.77 | 1 | 32.9 | -162.2 | 0.18 | 24.4 |
| MW-7 | 3/25/98 | 6.93 | 2.32 | 12 | 30.8 | 50.3 | 0.1 | 24.8 |
| MW-8 | 3/26/98 | 6.77 | 2.14 | 8 | 30 | -65.7 | 0.04 | 25.8 |
| MW-9 | 3/25/98 | 6.96 | 2.36 | NA | 30.5 | 41.6 | 0.11 | 22.7 |
| MW-10 | 3/27/98 | 6.61 | 1.3 | 5.2 | 28.4 | 62.5 | 0.82 | 26.4 |
| P-1 | 3/29/98 | 6.75 | 1.97 | 2 | 29.8 | 4.1 | 0.38 | 33.9 |
| P-2 | 3/27/98 | 6.86 | 2.95 | 10 | 29.2 | 4.6 | 0.28 | 23.4 |

*October 1998 Groundwater Sampling Event*

| Well ID | Date | pH (unitless) | Conductivity (uS/cm) | Turbidity (NTUs) | Temperature (deg. C) | ORP (mV) | DO (mg/L) | DTW (feet) |
|---|---|---|---|---|---|---|---|---|
| MW-2 | 10/8/98 | 7.91 | 1.52 | NA | NA | NA | 0.36 | NA |
| MW-2 | 10/20/98 | 6.86 | 1.99 | 0 | 31.2 | NA | 0.02 | NA |
| MW-3 | 10/15/98 | 6.47 | 2.27 | 119 | 31.1 | NA | 0.3 | 21.1 |
| MW-7 | 10/8/98 | 7.91 | 2.53 | 435 | NA | NA | 0.37 | 28.4 |
| MW-11 | 10/20/98 | 7.01 | 2.45 | 15 | 34.1 | NA | 4.5 | 32.2 |
| MW-12 | 10/19/98 | 6.8 | 2.59 | 12 | 28.2 | NA | 1.7 | 33.2 |
| MW-13 | 10/20/98 | 6.88 | 2.31 | 21 | 33.6 | NA | 1.8 | 32 |
| MW-14 | 10/19/98 | 6.92 | 3.45 | 55 | 28.3 | NA | 1.7 | 30.6 |

ORP - oxidation/reduction potential
DO - dissolved oxygen
DTW - depth to water
NA - not available due to equipment malfunction

## Table 3-7
## Description of Gut System Sample Locations
## Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands

| Sample ID | Description of Sample Location |
|---|---|
| RG-2 | approximately 200 feet upstream of Meridian Engineering (upstream reference sample) |
| RG-3 | approximately 100 feet downstream of Meridian Engineering (background sample) |
| RG-4 | downstream of asphalt operations conducted through Meridian Engineering and approximately 25 feet upstream of abandoned railroad bridge (background sample) |
| RG-5 | southwestern stream bank in depositional areas of stream bed, approximately 100 feet upstream of Site boundary and just downstream of abandoned railroad bridge (background sample) |
| RG-6 | approximately 100 feet downstream of abandoned railroad bridge at outfall of surface drainage feature originating along northern Site boundary |
| RG-7 | depositional areas of stream bed upstream of former laboratory discharge drain |
| RG-8 | depositional areas of stream bed below former laboratory drain |
| RG-9 | depositional areas of stream bed approximately 100 feet downstream of location RG-8 |
| RG-10 | fill material on northeastern side of stream bank, where waste material was visually identified during the Phase I investigation |
| RG-11 | depositional areas of stream bed approximately 50 feet upstream of Central Storm Drain discharge point |
| RG-12 | depositional areas of stream bed where Central Storm Drain discharges to River Gut |
| RG-13 | depositional areas of stream bed where Southern Storm Drain discharges to River Gut |
| RG-14 | depositional areas of stream bed approximately 200 feet downstream of RG-13 (adjacent to Charlie=s Concrete Company) |
| RG-15 | sediment deposits approximately 300 feet downstream of RG-14 |
| RG-16 | sediment deposits on upstream side of sheet piling installed in River Gut stream channel and downstream of Site (approximately 300 feet downstream of RG-15 and 400 feet upstream of River Gut's confluence with Bethlehem Gut) |
| BG-1 | approximately 50 feet directly upstream from confluence of River Gut and Bethlehem Gut |
| BG-2 | Approximately 1,000 feet upstream from confluence of River Gut and Bethlehem Gut |
| FPG-1 | below confluence of River and Bethlehem Guts (in upland area, just upstream of location of permanently-standing water) |
| FPG-2 | approximately 300 feet downstream of FPG-1 and 50 feet upstream of sewage treatment plant outfall |
| FPG-3 | approximately 125 feet downstream of FPG-2 and 75 feet downstream of sewage treatment plant outfall |
| FPG-4 | mouth of Manning Bay on upstream side of berm across mouth of Fair Plains Gut |



303472

## Table 3-8
## Trip Blank Sampling Summary
## Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands

| SAMPLE ID | TB061197 | TB061297 | TB061697 | TB061797 | TB061897 | TB091897 | TB091997 | TB092297 | TB092397 | TB092497 |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | 11-Jun-97 | 12-Jun-97 | 16-Jun-97 | 17-Jun-97 | 18-Jun-97 | 18-Sep-97 | 19-Sep-97 | 22-Sep-97 | 23-Sep-97 | 24-Sep-97 |
| ANALYTE | | | | | | | | | | |
| Methylene Chloride | 1 BJ | 2 BJ | 1 BJ | 2 BJ | 1 BJ | 4 BJ | 25 B | 27 B | 4 BJ | 3 BJ |
| Acetone | 10 U | 10 U | 10 U | 10 U | 10 U | 11 B | 14 B | 110 B | 10 U | 7 BJ |
| Carbon Disulfide | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Toluene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |

| SAMPLE ID | TB092697 | TB093097 | TB120397 | TB120897 | TB120997 | TB010998 | TB011298 | TB011398 | TB011498 | TB032398 |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | 26-Sep-97 | 30-Sep-97 | 03-Dec-97 | 08-Dec-97 | 09-Dec-97 | 09-Jan-98 | 12-Jan-98 | 13-Jan-98 | 14-Jan-98 | 23-Mar-98 |
| ANALYTE | | | | | | | | | | |
| Methylene Chloride | 4 BJ | 5 BJ | 8 BJ | 3 BJ | 6 BJ | 3 B | 2 B | 3 B | 2 B | 6 BU |
| Acetone | 10 U | 6 BJ | 10 | 100 | 11 BJ | 2 BJ | 2 BJ | 2 BJ | 2 BJ | 7 BU |
| Carbon Disulfide | 10 U | 10 U | 10 U | 10 U | 10 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Toluene | 10 U | 10 U | 1 J | 10 U | 10 U | 1 U | 1 U | 1 U | 1 U | 1 U |

| SAMPLE ID | TB032398 RE | TB032498 | TB032498 RE | TB032698 | TB032798 | TB100998 | TB101198 | TB101398 | TB102098 |
|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | 23-Mar-98 | 24-Mar-98 | 24-Mar-98 | 26-Mar-98 | 27-Mar-98 | 09-Oct-98 | 11-Oct-98 | 13-Oct-98 | 20-Oct-98 |
| ANALYTE | | | | | | | | | |
| Methylene Chloride | 5 BU | 2 BU | 1 BJU | 1 BJU | 1 BJU | 5 U | 5 U | 5 U | 5 U |
| Acetone | 5 BU | 12 BU | 7 BU | 5 BU | 7 BU | 10 U | 190 | 10 U | 10 U |
| Carbon Disulfide | 0.2 J | 0.3 J | 0.2 J | 0.1 J | 0.1 J | NA | NA | NA | 5 U |
| Toluene | 1 U | 1 U | 1 U | 1 U | 1 U | 5 U | 5 U | 5 U | 5 U |

Notes:
All results reported in ug/l.
B - Analyte detected n associated laboratory blank.
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
RE - Sample reanalyzed.
NA - Not analyzed.



303473

**Table 3-9**
**Field Blank (Rinsate) Sampling Summary**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| SAMPLE ID | RB061197 | RB061297 | RB061697 | RB061797 | RB061897 | FB091897 | FB091997 | FB092297 | FB092397 | FB092497 | FB092697 | FB093097 | FB120397 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | 11-Jun-97 | 12-Jun-97 | 16-Jun-97 | 17-Jun-97 | 18-Jun-97 | 18-Sep-97 | 19-Sep-97 | 22-Sep-97 | 23-Sep-97 | 24-Sep-97 | 26-Sep-97 | 30-Sep-97 | 03-Dec-97 |
| ANALYTE | | | | | | | | | | | | | |
| *Volatile Organics* | | | | | | | | | | | | | |
| Chloromethane | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Methylene Chloride | 1 BJ | 1 BJ | 1 BJ | 2 BJ | 2 BJ | 6 BJ | 4 BJ | 14 B | 4 BJ | 4 BJ | 3 BJ | 5 BJ | 6 BJ |
| Acetone | 10 U | 10 U | 10 U | 76 | 10 U | 62 B | 64 B | 39 B | 22 B | 40 B | 190 B | 92 B | 98 |
| 2-Butanone | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 11 | 4 J | 10 U | 10 U |
| Trichloroethene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Toluene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 1 J |
| Ethylbenzene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Xylene(total) | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 3 J | 3 J | 10 U |
| *Semivolatile Organics* | | | | | | | | | | | | | |
| Dimethylphthalate | 11 U | 12 U | 11 U | 11 U | 11 U | 10 U | 11 U | 3 J | 10 U | 10 U | 10 U | 10 U | NA |
| Diethylphthalate | 11 U | 12 U | 2 J | 6 J | 2 J | 10 U | 11 U | 10 U | 10 U | 1 J | 10 U | 2 J | NA |
| bis(2-Ethylhexyl)phthalate | 11 U | 22 | 2 J | 4 J | 2 BJ | 10 U | 4 BJ | 3 J | 1 J | 10 U | 10 U | 1 BJ | NA |
| *Metals* | | | | | | | | | | | | | |
| Aluminum | 6.1 B | 2.7 U | 9.2 B | 42.6 B | 13.7 B | 17.8 B | 86.2 B | 102 B | 15.3 B | 5 B | 8.7 B | 129 B | NA |
| Antimony | 2 U | 2 U | 2 U | 2 U | 2 U | 11.5 B | 2 U | 2 U | 2 U | 2 U | 6 B | 2 U | NA |
| Arsenic | 1.3 U | 1.3 U | 1.3 U | 1.3 U | 1.3 U | 1.3 U | 1.3 U | 1.3 U | 1.3 U | 1.3 U | 1.3 U | 1.3 U | NA |
| Barium | 0.57 B | 0.54 B | 0.46 B | 1.1 B | 2 B | 1.4 B | 2.3 B | 2.3 B | 1.4 B | 1.2 B | 1.3 B | 1.8 B | NA |
| Beryllium | 0.14 B | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | NA |
| Cadmium | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | NA |
| Calcium | 2380 B | 1880 B | 1720 B | 6490 | 3910 B | 1550 B | 13000 J | 16200 J | 2590 B | 1810 B | 565 B | 11500 J | NA |
| Chromium | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 2.5 B | 0.5 B | 0.38 B | 0.2 U | 0.2 U | 0.26 B | 0.24 B | NA |
| Cobalt | 0.22 B | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | NA |
| Copper | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 1.5 U | 82.8 | 2.5 B | 1.5 U | 1.5 U | 1.5 U | 1.8 B | 2 B | NA |
| Iron | 15.1 U | 15.1 U | 15.1 U | 43.4 B | 15.1 U | 69.2 B | 15.1 U | 15.1 U | 15.1 U | 15.1 U | 27.8 B | 15.1 U | NA |
| Lead | 1.1 U | 1.1 U | 1.1 U | 1.1 U | 1.1 U | 1.1 U | 1.1 U | 1.1 U | 1.1 U | 1.1 U | 1.1 U | 1.1 U | NA |
| Magnesium | 57.4 B | 51 B | 50.7 B | 153 B | 146 B | 48.5 B | 335 B | 443 B | 59.1 B | 42.9 B | 15.7 B | 348 B | NA |
| Manganese | 1.1 B | 0.94 B | 0.73 B | 6 B | 3.7 B | 7.2 B | 9.9 B | 12.4 B | 2.6 B | 1.6 B | 1 B | 11.4 B | NA |
| Mercury | 0.2 UN | 0.2 UN | 0.2 UN | 0.2 UN | 0.2 UN | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | 0.2 U | NA |
| Nickel | U | 0.7 U | 0.7 U | 0.7 U | 0.7 U | 3.6 B | 0.7 U | 0.7 U | 0.7 U | 0.7 U | 0.7 U | 0.7 U | NA |
| Potassium | 60 B | 38.7 B | 24 B | 85.3 B | 59.1 B | 90.3 B | 131 B | 175 B | 60.4 B | 29.6 B | 15.7 B | 100 B | NA |
| Selenium | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 J | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | 2.5 U | NA |
| Silver | 0.6 U | 0.6 U | 0.6 U | 0.6 U | 0.6 U | 0.6 U | 0.6 U | 0.6 U | 0.6 U | 0.6 U | 0.6 U | 0.6 U | NA |
| Sodium | 9940 E | 111 BE | 47.5 BE | 202 BE | 335 BE | 352 B | 175 B | 128 B | 119 B | 42.6 B | 219 B | 804 B | NA |
| Thallium | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U | 2.2 U | NA |
| Vanadium | 0.94 B | 0.74 B | 0.81 B | 0.43 B | 0.62 B | 0.95 B | 1.6 B | 1.4 B | 1.6 B | 1 B | 1.4 B | 1.6 B | NA |
| Zinc | 37.5 | 35 | 31 | 115 | 61.7 | 166 | 381 | 452 | 46.6 | 42.8 | 5.4 B | 432 | NA |
| Cyanide | 12 B | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 8 B | 5 U | NA |

Notes:
All results reported in ug/l.
U = Analyte was not detected above the referenced reporting limit.
J = Indicates an estimated value
B (metals) = Result is between the instrument detection limit (IDL) and the contract required detection limit (CRDL)
B (organics) = Analyte detected in associated laboratory blank sample.
D = Quanitated at a dilution
N = Spike recovery not within control limits.
E (organics) = Estimated value
E (metals) = Estimated due to the presence of interference.
* = Duplicate analysis not within control limits.
NA = Not analyzed
Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.



303474

**Table 3-9**
**Field Blank (Rinsate) Sampling Summary**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| SAMPLE ID | FB120897 | FB120997 | FB010998 | FB011098 | FB011097 DL | FB011198 | FB011298 | FB011398 | FB011498 | FB032398 | FB032398 DL | FB032398 RE | FB032498 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | 08-Dec-97 | 09-Dec-97 | 09-Jan-98 | 10-Jan-98 | 10-Jan-98 | 11-Jan-98 | 12-Jan-98 | 13-Jan-98 | 14-Jan-98 | 23-Mar-98 | 23-Mar-98 | 23-Mar-98 | 24-Mar-98 |
| ANALYTE | | | | | | | | | | | | | |
| *Volatile Organics* | | | | | | | | | | | | | |
| Chloromethane | 10 U | 10 U | 1 U | 1 U | 5 U | 1 U | 1 U | 1 U | 1 U | 1 U | 40 U | 40 U | 20 U |
| Methylene Chloride | 3 BJ | 1 BJ | 10 B | 2 B | 11 BD | 8 B | 11 B | 10 B | 10 B | 1 BJU | 52 BDJU | 17 BJU | 26 BJU |
| Acetone | 120 | 310 E | 3 BJ | 320 BE | 380 BD | 3 BJ | 3 BJ | 4 BJ | 4 BJ | 930 BEJ | 960 BDU | 880 BU | 640 BU |
| 2-Butanone | 10 U | 10 U | 5 U | 1 J | 5 U | 5 U | 5 U | 0.3 J | 0.7 J | 4 J | 200 U | 200 U | 100 U |
| Trichloroethene | 10 U | 10 U | 0.2 J | 1 U | 5 U | 1 U | 1 U | 1 U | 1 U | 1 U | 40 U | 40 U | 20 U |
| Toluene | 10 U | 10 U | 0.3 J | 1 U | 5 U | 0.2 J | 1 U | 1 U | 1 U | 1 U | 40 U | 40 U | 20 U |
| Ethylbenzene | 10 U | 10 U | 1 U | 0.2 J | 5 U | 1 U | 1 U | 1 U | 1 U | 1 U | 40 U | 40 U | 20 U |
| Xylene(total) | 10 U | 10 U | 1 U | 1 | 0.9 DJ | 0.2 J | 0.4 J | 0.3 J | 0.6 J | 1 U | 40 U | 40 U | 20 U |
| *Semivolatile Organics* | | | | | | | | | | | | | |
| Dimethylphthalate | NA | NA | 5 U | 5 U | NA | 5 U | 5 U | 5 U | 5 U | 5 U | NA | NA | 5 U |
| Diethylphthalate | NA | NA | 2 J | 5 U | NA | 1 J | 2 J | 5 U | 2 J | 5 U | NA | NA | 3 J |
| bis(2-Ethylhexyl)phthalate | NA | NA | 3 BJ | 10 B | NA | 5 B | 3 BJ | 9 B | 3 BJ | 6 J | NA | NA | 93 EJ |
| *Metals* | | | | | | | | | | | | | |
| Aluminum | NA | NA | 90.2 B* | 18.5 B* | NA | NA | 23.5 B* | 50.7 B* | 53.9 B* | 559 EJ | NA | NA | 184 BE |
| Antimony | NA | NA | 2.2 U | 2.2 U | NA | NA | 2.2 U | 2.2 U | 2.2 U | 2.2 U | NA | NA | 2.2 U |
| Arsenic | NA | NA | 1.4 U | 1.4 U | NA | NA | 1.4 U | 1.4 U | 1.4 U | 1.4 U | NA | NA | 1.4 U |
| Barium | NA | NA | 1.5 B | 1.1 B | NA | NA | 1.9 B | 1.7 B | 1.8 B | 3.3 B | NA | NA | 1.5 B |
| Beryllium | NA | NA | 0.1 U | 1 U | NA | NA | 0.1 U | 0.1 U | 0.1 U | 0.1 U | NA | NA | 0.1 U |
| Cadmium | NA | NA | 0.1 U | 0.1 U | NA | NA | 0.1 U | 0.1 U | 0.1 U | 0.1 U | NA | NA | 0.1 U |
| Calcium | NA | NA | 1390 BE* | 344 BE* | NA | NA | 1290 BE* | 2150 BE* | 2080 BE* | 3000 B | NA | NA | 2190 B |
| Chromium | NA | NA | 0.4 U | 0.4 U | NA | NA | 0.4 U | 0.7 B | 0.4 U | 0.4 U | NA | NA | 0.4 U |
| Cobalt | NA | NA | 0.3 U | 0.3 U | NA | NA | 0.3 U | 0.3 U | 0.3 U | 0.3 U | NA | NA | 0.3 U |
| Copper | NA | NA | 7 B | 11.1 B | NA | NA | 16.7 B | 4.9 B | 13.2 B | 4.8 B | NA | NA | 2.3 B |
| Iron | NA | NA | 1120 * | 6.8 U* | NA | NA | 94.1 B* | 858 * | 72.6 B* | 64.4 B | NA | NA | 6.8 U |
| Lead | NA | NA | 3.1 | 16.8 | NA | NA | 16.5 | 2.6 B | 1.1 U | 2.4 B | NA | NA | 1.1 U |
| Magnesium | NA | NA | 42.4 B* | 23.2 B* | NA | NA | 40.4 B* | 61.2 B* | 65 B* | 103 B | NA | NA | 89.7 B |
| Manganese | NA | NA | 4.2 B* | 4.8 B* | NA | NA | 7 B* | 8.4 B* | 6.9 B* | 7.4 B | NA | NA | 6.9 B |
| Mercury | NA | NA | 0.2 U | 0.2 U | NA | NA | 0.2 U | 0.2 U | 0.2 U | 0.2 U | NA | NA | 0.2 U |
| Nickel | NA | NA | 11.3 B | 1 U | NA | NA | 1 U | 19.9 B | 1 U | 1 U | NA | NA | 1 U |
| Potassium | NA | NA | 58.5 B | 42.7 B | NA | NA | 54.3 B | 49.4 B | 85.5 B | 63 BE | NA | NA | 91.1 BE |
| Selenium | NA | NA | 2 U | 2 U | NA | NA | 2 U | 2 U | 2 U | 2 U | NA | NA | 2 U |
| Silver | NA | NA | 0.7 U | 0.7 U | NA | NA | 0.7 U | U | 0.7 U | 0.7 U | NA | NA | 0.7 U |
| Sodium | NA | NA | 290 B | 408 B | NA | NA | 289 B | 279 B | 296 B | 1030 B | NA | NA | 801 B |
| Thallium | NA | NA | 1.6 U | 1.6 U | NA | NA | 1.6 U | 1.6 U | 1.6 U | 0.8 UW | NA | NA | 0.8 UW |
| Vanadium | NA | NA | 0.2 U | 0.2 U | NA | NA | 0.2 U | 0.22 B | 0.2 U | 0.2 U | NA | NA | 0.56 B |
| Zinc | NA | NA | 19.7 B* | 0.7 U* | NA | NA | 41.9 * | 76.8 * | 17.6 B* | 61.8 EJ* | NA | NA | 46.9 EJ* |
| Cyanide | NA | NA | 5 UN | 5 UN | NA | NA | 5 UN | 5 UN | 5 UN | 5 U | NA | NA | 5 U |

Notes:
All results reported in ug/l.
U = Analyte was not detected above the referenced reporting limit.
J = Indicates an estimated value
B (metals) = Result is between the instrument detection limit (IDL) and the contract required detection limit (CRDL)
B (organics) = Analyte detected in associated laboratory blank sample.
D = Quanitated at a dilution
N = Spike recovery not within control limits.
E (organics) = Estimated value
E (metals) = Estimated due to the presence of interference.
* = Duplicate analysis not within control limits.
NA = Not analyzed
Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.

303475

**Table 3-9**
**Field Blank (Rinsate) Sampling Summary**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| SAMPLE ID | FB032498DL | FB032498 RE | FB032498 RE2 | FB032598 | FB032698 | FB032698 DL | FB032698 RE | FB032798 | FB032998 | FB032998 DL | FB033098 | FB040498 | FB101198 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SAMPLE DATE** | 24-Mar-98 | 24-Mar-98 | 24-Mar-98 | 25-Mar-98 | 26-Mar-98 | 26-Mar-98 | 26-Mar-98 | 27-Mar-98 | 29-Mar-98 | 29-Mar-98 | 30-Mar-98 | 04-Apr-98 | 11-Oct-98 |
| **ANALYTE** | | | | | | | | | | | | | |
| *Volatile Organics* | | | | | | | | | | | | | |
| Chloromethane | NA | 20 U | 0.8 J | 1 U | 1 U | 5 U | 5 U | 1 U | 1 U | 2 U | 10 U | 10 U | 5 U |
| Methylene Chloride | NA | 10 BJU | 1 BJU | 4 BU | 0.7 BJU | 7 BDJU | 2 BDJU | 7 B | 1 BJU | 2 BDJU | 10 U | 10 U | 5 U |
| Acetone | NA | 490 BU | 400 BEJ | 12 BU | 160 BEJ | 180 BDU | 180 BDU | 4 BJU | 140 BE | 150 BD | 25 U | 25 U | 16000 ED |
| 2-Butanone | NA | 100 U | 5 U | 5 U | 5 U | 25 U | 25 U | 5 U | 5 U | 10 U | NA | NA | NA |
| Trichloroethene | NA | 20 U | 1 U | 1 U | 1 U | 5 U | 5 U | 1 U | 1 U | 2 U | NA | NA | NA |
| Toluene | NA | 20 U | 0.1 J | 0.1 J | 0.5 J | 0.6 DJ | 0.6 DJ | 0.5 J | 1 U | 0.3 DJ | 10 U | 10 U | 5 U |
| Ethylbenzene | NA | 20 U | 1 U | 1 U | 0.2 J | 5 U | 5 U | 0.5 J | 0.7 J | 0.7 DJ | 5 U | 5 U | 5 U |
| Xylene(total) | NA | 20 U | 1 U | 1 U | 0.8 J | 5 U | 5 U | 2 | 3 | 3 | 5 U | 5 U | 5 U |
| *Semivolatile Organics* | | | | | | | | | | | | | |
| Dimethylphthalate | NA | NA | NA | 5 U | 5 U | NA | NA | 5 U | 5 U | NA | NA | NA | NA |
| Diethylphthalate | NA | NA | NA | 2 J | 5 U | NA | NA | 5 U | 14 | NA | NA | NA | NA |
| bis(2-Ethylhexyl)phthalate | 100 DJ | NA | NA | 12 BU | 8 BU | NA | NA | 5 BU | 12 BU | NA | NA | NA | NA |
| *Metals* | | | | | | | | | | | | | |
| Aluminum | NA | NA | NA | 55 BE | 85 BE | NA | NA | 233 EJ | 83 BE | NA | NA | NA | NA |
| Antimony | NA | NA | NA | 2.2 U | 2.2 U | NA | NA | 2.2 U | 2.2 U | NA | NA | NA | NA |
| Arsenic | NA | NA | NA | 1.4 U | 1.4 U | NA | NA | 1.4 U | 1.4 U | NA | NA | NA | NA |
| Barium | NA | NA | NA | 1.5 B | 1.7 B | NA | NA | 4.6 B | 3 B | NA | NA | NA | NA |
| Beryllium | NA | NA | NA | 0.1 U | 0.1 U | NA | NA | 0.1 U | 0.1 U | NA | NA | NA | NA |
| Cadmium | NA | NA | NA | 0.1 U | 0.1 U | NA | NA | 0.1 U | 0.1 U | NA | NA | NA | NA |
| Calcium | NA | NA | NA | 1530 B | 3710 B | NA | NA | 3150 B | 5650 | NA | NA | NA | NA |
| Chromium | NA | NA | NA | 0.4 U | 0.4 U | NA | NA | 0.4 U | 0.42 B | NA | NA | NA | NA |
| Cobalt | NA | NA | NA | 0.3 U | 0.3 U | NA | NA | 0.3 U | 0.3 U | NA | NA | NA | NA |
| Copper | NA | NA | NA | 2.8 B | 7.5 B | NA | NA | 4.8 B | 8.6 B | NA | NA | NA | NA |
| Iron | NA | NA | NA | 8.7 B | 6.8 U | NA | NA | 6.8 U | 10.7 B | NA | NA | NA | NA |
| Lead | NA | NA | NA | 2.6 B | 1.1 U | NA | NA | 2.1 B | 1.1 U | NA | NA | NA | NA |
| Magnesium | NA | NA | NA | 79 B | 111 B | NA | NA | 128 B | 184 B | NA | NA | NA | NA |
| Manganese | NA | NA | NA | 1.6 B | 3.9 B | NA | NA | 8.3 B | 6.6 B | NA | NA | NA | NA |
| Mercury | NA | NA | NA | 0.27 | 0.2 U | NA | NA | 0.2 U | 0.2 U | NA | NA | NA | NA |
| Nickel | NA | NA | NA | 1 U | 1 U | NA | NA | 1 U | 1 U | NA | NA | NA | NA |
| Potassium | NA | NA | NA | 57.5 BE | 80.5 BE | NA | NA | 87.8 BE | 101 BE | NA | NA | NA | NA |
| Selenium | NA | NA | NA | 2 U | 2.4 B | NA | NA | 2 U | 2 U | NA | NA | NA | NA |
| Silver | NA | NA | NA | 0.7 U | 0.7 U | NA | NA | 0.7 U | 0.79 B | NA | NA | NA | NA |
| Sodium | NA | NA | NA | 993 BE | 815 B | NA | NA | 1360 B | 947 B | NA | NA | NA | NA |
| Thallium | NA | NA | NA | 0.8 UW | 0.8 UW | NA | NA | 0.8 U | 0.8 UW | NA | NA | NA | NA |
| Vanadium | NA | NA | NA | 0.2 U | 0.2 U | NA | NA | 1.6 B | 0.69 B | NA | NA | NA | NA |
| Zinc | NA | NA | NA | 24.2 EJ* | 58.2 EJ* | NA | NA | 71.2 EJ* | 132 EJ* | NA | NA | NA | NA |
| Cyanide | NA | NA | NA | 5 U | 5 U | NA | NA | 5 U | 5 U | NA | NA | NA | NA |

Notes:
All results reported in ug/l.
U = Analyte was not detected above the referenced reporting limit.
J = Indicates an estimated value
B (metals) = Result is between the instrument detection limit (IDL) and the contract required detection limit (CRDL)
B (organics) = Analyte detected in associated laboratory blank sample.
D = Quanitated at a dilution
N = Spike recovery not within control limits.
E (organics) = Estimated value
E (metals) = Estimated due to the presence of interference.
* = Duplicate analysis not within control limits.
NA = Not analyzed
Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.

303476

**Table 3-10**
**Relative Percent Difference Values for Sample Duplicate Pairs**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| Compound | Sample B-1 (0'-.5') | Duplicate B-1 (0'-.5') | RPD |
|---|---|---|---|
| Aluminum | 12200 | 10100 | 18.8% |
| Barium | 35.8 | 31.3 | 13.4% |
| Cadmium | 0.23 | 0.12 | 62.9% |
| Calcium | 81700 | 65900 | 21.4% |
| Chromium | 12 | 9.8 | 20.2% |
| Cobalt | 12 | 9.3 | 25.4% |
| Copper | 31.5 | 25.6 | 20.7% |
| Iron | 19500 | 14900 | 26.7% |
| Lead | 11.5 | 10.8 | 6.3% |
| Magnesium | 7010 | 5430 | 25.4% |
| Manganese | 603 | 484 | 21.9% |
| Mercury | 0.13 | 0.14 | -7.4% |
| Nickel | 8.8 | 7 | 22.8% |
| Potassium | 1970 | 1800 | 9.0% |
| Sodium | 393 | 345 | 13.0% |
| Vanadium | 50.4 | 39 | 25.5% |

| Compound | Sample SBPP-5 | Duplicate SBPP-5 | RPD |
|---|---|---|---|
| Chloroform | 160 | 35 | 128.2% |

| Compound | Sample GWPP-29A | Duplicate GWPP-29A | RPD |
|---|---|---|---|
| Chloroform | 44 | 44 | 0.0% |
| Ethylbenzene | 720 | 750 | -4.1% |

| Compound | Sample MW-1 (5/9/95) | Duplicate MW-1 (5/9/95) | RPD |
|---|---|---|---|
| Chloromethane | 2 | 2 | 0.0% |
| Ethylbenzene | 110 | 110 | 0.0% |
| Xylenes (total) | 3 | 4 | -28.6% |
| bis(2-Ethylhexyl)phthalate | 11 | 3 | 114.3% |
| Aluminum | 1330 | 7890 | -142.3% |
| Arsenic | 3.9 | 3.4 | 13.7% |
| Barium | 181 | 177 | 2.2% |
| Beryllium | 1.4 | 1.6 | -13.3% |
| Calcium | 44900 | 39800 | 12.0% |
| Iron | 1590 | 9980 | -145.0% |
| Lead | 3.8 | 2.8 | 30.3% |
| Magnesium | 31200 | 28900 | 7.7% |
| Manganese | 1560 | 1450 | 7.3% |
| Potassium | 1260 | 1700 | -29.7% |
| Sodium | 397000 | 349000 | 12.9% |
| Vanadium | 42.4 | 55 | -25.9% |
| Zinc | 21.6 | 77.9 | -113.2% |

| Compound | Sample MW-2 (3/25/98) | Duplicate MW-2 (3/25/98) | RPD |
|---|---|---|---|
| Chloroform | 2400 | 1900 | 23.3% |
| Aluminum | 720 | 264 | 92.7% |
| Barium | 68.7 | 63.9 | 7.2% |
| Calcium | 78600 | 72800 | 7.7% |
| Chromium | 14.6 | 12.4 | 16.3% |
| Copper | 8.4 | 4.7 | 56.5% |
| Iron | 227 | 101 | 76.8% |
| Magnesium | 70900 | 66900 | 5.8% |
| Manganese | 118 | 120 | -1.7% |
| Potassium | 3740 | 3380 | 10.1% |
| Silver | 1.4 | 1.3 | 7.4% |
| Sodium | 585000 | 744000 | -23.9% |
| Vanadium | 63.4 | 34.1 | 60.1% |
| Zinc | 196 | 177 | 10.2% |

| Compound | Sample SBB-1 (0'-1') | Duplicate SBB-1 (0'-1') | RPD |
|---|---|---|---|
| Ethylbenzene | 4 | 4 | 0.0% |
| Xylenes (total) | 25 | 24 | 4.1% |
| Aluminum | 23300 | 28200 | -19.0% |
| Barium | 197 | 268 | -30.5% |
| Beryllium | 0.32 | 0.58 | -57.8% |
| Cadmium | 2.8 | 3.1 | -10.2% |
| Calcium | 17800 | 12200 | 37.3% |
| Chromium | 19.9 | 21.9 | -9.6% |
| Cobalt | 29.6 | 31.7 | -6.9% |
| Copper | 54.5 | 58.4 | -6.9% |
| Iron | 32100 | 37000 | -14.2% |
| Lead | 3.4 | 7.1 | -70.5% |
| Magnesium | 7260 | 7760 | -6.7% |
| Manganese | 1860 | 2100 | -12.1% |
| Nickel | 19.2 | 24.7 | -25.1% |
| Potassium | 4180 | 4330 | -3.5% |
| Sodium | 575 | 702 | -19.9% |
| Vanadium | 109 | 110 | -0.9% |
| Zinc | 72.7 | 3620 | -192.1% |

| Compound | Sample SBRG-1 (12'-14') | Duplicate SBRG-1 (12'-14') | RPD |
|---|---|---|---|
| Aluminum | 13800 | 11600 | 17.3% |
| Arsenic | 0.52 | 1.3 | -85.7% |
| Barium | 114 | 114 | 0.0% |
| Cadmium | 0.18 | 0.16 | 11.8% |
| Chromium | 25 | 15.9 | 44.5% |
| Cobalt | 13.1 | 13.8 | -5.2% |
| Iron | 25900 | 2110 | 169.9% |
| Lead | 2.1 | 2.8 | -28.6% |
| Magnesium | 6990 | 4630 | 40.6% |
| Manganese | 673 | 544 | 21.2% |
| Nickel | 10.7 | 8.1 | 27.7% |
| Potassium | 1270 | 933 | 30.6% |
| Sodium | 858 | 604 | 34.7% |
| Vanadium | 88 | 78.6 | 11.3% |

| Compound | Sample MW-2 (6/18/96) | Duplicate MW-2 (6/18/96) | RPD |
|---|---|---|---|
| Methylene chloride | 56 | 73 | -26.4% |
| Chloroform | 470 | 590 | -22.6% |
| Di-n-butylphthalate | 0.4 | 0.4 | 0.0% |
| Barium | 136 | 131 | 3.7% |
| Beryllium | 0.13 | 0.1 | 26.1% |
| Cadmium | 0.54 | 0.44 | 20.4% |
| Calcium | 54400 | 56200 | -3.3% |
| Copper | 12.5 | 8.6 | 37.0% |
| Iron | 3530 | 3440 | 2.6% |
| Lead | 2.7 | 2.2 | 20.4% |
| Magnesium | 38900 | 39300 | -1.0% |
| Manganese | 785 | 722 | 8.4% |
| Potassium | 9320 | 9500 | -1.9% |
| Sodium | 907000 | 928000 | -2.3% |
| Vanadium | 62.9 | 59 | 6.4% |
| Zinc | 34.5 | 36.4 | -5.4% |

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**Table 3-10**
**Relative Percent Difference Values for Sample Duplicate Pairs**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| Compound | Sample SBAST-3 (18'-20') | Duplicate SBAST-3 (18'-20') | RPD |
|---|---|---|---|
| Acetone | 60 | 43 | 33.0% |
| Toluene | 6 | 5 | 18.2% |
| 1,1-Dichloroethene | 6 | 3 | 66.7% |
| 2-Butanone | 2 | 2 | 0.0% |
| 2-Hexanone | 3 | 2 | 40.0% |
| Aluminum | 9930 | 9400 | 5.5% |
| Barium | 89.1 | 82 | 8.3% |
| Cadmium | 0.71 | 0.69 | 2.9% |
| Calcium | 4000 | 3760 | 6.2% |
| Chromium | 17.8 | 18.9 | -6.0% |
| Cobalt | 15.8 | 11.8 | 29.0% |
| Copper | 37.6 | 34.5 | 8.6% |
| Iron | 25500 | 23700 | 7.3% |
| Lead | 2.5 | 1.9 | 27.3% |
| Magnesium | 5010 | 4620 | 8.1% |
| Nickel | 9.6 | 8.6 | 11.0% |
| Potassium | 949 | 953 | -0.4% |
| Sodium | 395 | 399 | -1.0% |
| Vanadium | 119 | 119 | 0.0% |

| Compound | Sample MW-1 (2/16/95) | Duplicate MW-1 (2/16/95) | RPD |
|---|---|---|---|
| Toluene | 5 | 4 | 22.2% |
| Ethylbenzene | 750 | 720 | 4.1% |
| Xylenes (total) | 2100 | 2000 | 4.9% |
| 2,4-Dimethylphenol | 30 | 22 | 30.8% |
| 4-Methylphenol | 40 | 48 | -18.2% |
| Isophorone | 0.6 | 0.7 | -15.4% |
| Aluminum | 656 | 693 | -5.5% |
| Arsenic | 4.4 | 7.7 | -54.5% |
| Barium | 145 | 138 | 4.9% |
| Calcium | 49800 | 47900 | 3.9% |
| Iron | 640 | 678 | -5.8% |
| Magnesium | 34400 | 32900 | 4.5% |
| Manganese | 1450 | 1380 | 4.9% |
| Potassium | 2350 | 2310 | 1.7% |
| Selenium | 24.2 | 19.6 | 21.0% |
| Sodium | 432000 | 406000 | 6.2% |
| Vanadium | 33.3 | 34.1 | -2.4% |

| Compound | Sample MW-2 (1/13/98) | Duplicate MW-2 (1/13/98) | RPD |
|---|---|---|---|
| Methylene chloride | 170 | 240 | -34.1% |
| Acetone | 440 | 250 | 55.1% |
| Chloroform | 1500 | 1400 | 6.9% |
| Aluminum | 51.1 | 39.9 | 24.6% |
| Barium | 67.3 | 59.6 | 12.1% |
| Calcium | 76200 | 65700 | 14.8% |
| Chromium | 10.8 | 9.3 | 14.9% |
| Cobalt | 0.32 | 0.34 | -6.1% |
| Copper | 8 | 10.3 | -25.1% |
| Lead | 10.6 | 11.1 | -4.6% |
| Magnesium | 65200 | 58600 | 10.7% |
| Manganese | 56.4 | 50.7 | 10.6% |
| Potassium | 3500 | 3020 | 14.7% |
| Sodium | 648000 | 585000 | 10.2% |
| Vanadium | 30.9 | 27.7 | 10.9% |

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**Table 4-1**
**Surface Soil Sampling Summary - Background**
**Island Chemical Site, St. Croix, U.S. Virgin Islands**

| SAMPLE ID<br>SAMPLE DATE<br>SAMPLE INTERVAL (ft bgs) | B-1<br>14-Sep-97<br>0-0.5 | B-1<br>14-Sep-97<br>Duplicate | B-2<br>14-Sep-97<br>0-0.5 | B-3<br>14-Sep-97<br>0-0.5 | Average<br>Background<br>Cocentration | 2X Average<br>Background<br>Cocentration |
|---|---|---|---|---|---|---|
| ANALYTE | | | | | | |
| *Semivolatile Organics (in ug/kg)* | | | | | | |
| Isophorone | 370 U | 390 U | 210 J | 310 J | - | - |
| *Metals (in mg/kg)* | | | | | | |
| Aluminum | 12200 | 10100 | 9790 | 11700 | 10880 | 21760 |
| Antimony | 0.45 UN | 0.47 UN | 0.53 UN | 0.49 UN | 0.25 | 0.49 |
| Arsenic | 0.29 U | 0.76 BJ | 1.3 BJ | 0.7 BJ | 0.82 | 1.64 |
| Barium | 35.8 B | 31.3 B | 49.7 B | 119 | 67.4 | 134.8 |
| Beryllium | 0.02 U | 0.02 U | 0.03 U | 0.02 U | 0.01 | 0.02 |
| Cadmium | 0.23 B | 0.12 B | 0.04 B | 0.77 B | 0.33 | 0.66 |
| Calcium | 81700 * | 65900 * | 80700 * | 42400 * | 65633 | 131267 |
| Chromium | 12 | 9.8 | 10.9 | 13.6 | 11.8 | 23.6 |
| Cobalt | 12 | 9.3 B | 6.6 B | 10.2 B | 9.2 | 18.3 |
| Copper | 31.5 EJ | 25.6 EJ | 19.7 EJ | 44 EJ | 30.8 | 61.5 |
| Iron | 19500 | 14900 | 11900 | 18800 | 15967 | 31933 |
| Lead | 11.5 J | 10.8 J | 3.1 J | 15.2 J | 9.8 | 19.6 |
| Magnesium | 7010 | 5430 | 4620 | 5390 | 5410 | 10820 |
| Manganese | 603 NJ | 484 NJ | 398 NJ | 497 NJ | 480 | 959 |
| Mercury | 0.13 | 0.14 | 0.14 | 0.18 | 0.15 | 0.30 |
| Nickel | 8.8 B | 7 B | 6.5 B | 7.7 B | 7.4 | 14.7 |
| Potassium | 1970 EJ | 1800 EJ | 3290 EJ | 2570 EJ | 2582 | 5163 |
| Selenium | 0.87 B* | 0.59 U* | 0.66 U* | 0.62 U* | 0.41 | 0.82 |
| Silver | 0.13 U | 0.14 U | 0.16 U | 0.15 U | 0.07 | 0.15 |
| Sodium | 393 BE | 345 BE | 232 BE | 365 BE | 322 | 644 |
| Thallium | 0.49 U | 0.52 U | 0.58 U | 0.54 U | 0.27 | 0.54 |
| Vanadium | 50.4 | 39 | 29.5 | 59.7 | 44.6 | 89 |
| Zinc | 106 *R | 96.7 *R | 45.8 *R | 127 *R | NU | NU |
| Cyanide | 0.55 UN | 0.57 UN | 0.65 UN | 0.6 UN | 0.30 | 0.60 |

- - Not Applicable
ft bgs - feet below ground surface
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
R - QC indicates that data is unusable. Analyte may or may not be present.
B - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
* - Duplicate analysis not within control limits.
E - Estimated due to the presence of interference.
N - Spike recovery not within control limits.
NU - Zinc data was determined to be unusable. No average background cocentration is available.

303479

**Table 4-2**
**Surface Soil Sampling Summary - AST Area**
**Island Chemical Site, St. Croix, U.S. Virgin Islands**

| SAMPLE ID | | | | | SBB-1 | SBB-1 | SBE-1 | SBB-4 | SBB-6 | SBB-11 | SBB-16 | SBB-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | | | | 31-Jan-95 | 31-Jan-95 | 19-Jan-95 | 29-May-96 | 29-May-96 | 30-May-96 | 28-May-96 | 29-May-96 |
| SAMPLE INTERVAL (ft bgs) | | | | | 0-1 | Duplicate | 0-2 | 1.5-2 | 1.5-2 | 1.5-2 | 1.5-2 | 1.5-2 |
| ANALYTE | 2X Average Background Concentration | *Soil Screening Levels* Ingestion | Inhalation | MGW (DAF = 20) | | | | | | | | |
| *Volatile Organics (in ug/kg)* | | | | | | | | | | | | |
| Acetone | - | 7,800,000 | 100,000,000 | 16,000 | 12 U | 12 U | 12 U | 12 UJ | 2 J | 13 UJ | 11 U | 12 U |
| Toluene | - | 16,000,000 | 650,000 | 12,000 | 12 U | 12 U | 12 U | 2 J | 11 U | 13 U | 11 U | 2 J |
| Ethylbenzene | - | 7,800,000 | 400,000 | 13,000 | 4 J | 4 J | 12 U | 5 J | 11 U | 2 J | 6 J | 2 J |
| Xylenes (total) | - | 160,000,000 | 460,000 | 20,000 | 25 | 24 B | 12 U | 28 | 1 J | 7 J | 30 | 7 J |
| Trichloroethene | - | 58,000 | 5,000 | 60 | 12 U | 12 U | 1 J | 12 U | 11 U | 13 U | 11 U | 12 U |
| *Semivolatile Organics (in ug/kg)* | | | | | | | | | | | | |
| Bis(2-ethylhexyl)phthalate | - | 46,000 | 31,000,000 | 3,600,000 | 410 U | 390 U | 94 J | NA | NA | NA | NA | NA |
| *Metals (in mg/kg)* | | | | | | | | | | | | |
| Aluminum | 21,760 | 78,000[1] | - | - | ***23300 *J*** | ***28200 *J*** | 16900 * | NA | NA | NA | NA | NA |
| Antimony | 0.49 | 31 | - | 5 | 0.34 NR | 0.33 NR | ***0.54 BJW*** | NA | NA | NA | NA | NA |
| Arsenic | 1.64 | 0.4 | 750 | 29 | 0.27 NR | 1.5 NR | 1.7 U | NA | NA | NA | NA | NA |
| Barium | 134.8 | 5,500 | 690,000 | 1,600 | ***197*** | ***268*** | 60.1 | NA | NA | NA | NA | NA |
| Beryllium | 0.02 | 160[2] | 1,300 | 63 | ***0.32*** | ***0.58*** | ***0.3*** | NA | NA | NA | NA | NA |
| Cadmium | 0.66 | 78 | 1,800 | 8 | ***2.8 N*J*** | ***3.1 N*J*** | ***4 **** | NA | NA | NA | NA | NA |
| Calcium | 131,267 | - | - | - | 17800 | 12200 | 35200 * | NA | NA | NA | NA | NA |
| Chromium | 23.6 | 390 | 720[2] | 38 | 19.9 J | 21.9 *J | 17.5 * | NA | NA | NA | NA | NA |
| Cobalt | 18.3 | 4,700[1] | - | - | ***29.6*** | ***31.7*** | 16.8 | NA | NA | NA | NA | NA |
| Copper | 61.5 | 3,100[1] | - | - | 54.5 N*J | 58.4 N*J | 43.4 | NA | NA | NA | NA | NA |
| Iron | 31,933 | 23,000[1] | - | - | ***32100 *J*** | ***37000 *J*** | ***32200 **** | NA | NA | NA | NA | NA |
| Lead | 19.6 | 400 | - | - | 3.4 NS*J | 7.1 N*J | ***89.9*** | NA | NA | NA | NA | NA |
| Magnesium | 10,820 | - | - | - | 7260 | 7760 | 7920 * | NA | NA | NA | NA | NA |
| Manganese | 959 | 1,600[1] | - | - | ***1860*** | ***2100*** | 791 | NA | NA | NA | NA | NA |
| Mercury | 0.30 | 23[1] | - | - | 0.29 | 0.12 U | 0.11 U | NA | NA | NA | NA | NA |
| Nickel | 14.7 | 1,600 | 13,000 | 130 | ***19.2 *J*** | ***24.7 *J*** | ***16.8*** | NA | NA | NA | NA | NA |
| Potassium | 5,163 | - | - | - | 4180 | 4330 | 1470 | NA | NA | NA | NA | NA |
| Selenium | 0.82 | 390 | - | 5 | 0.34 NWR | 3.3 NR | 3 NR | NA | NA | NA | NA | NA |
| Sodium | 644 | - | - | - | 575 B | ***702 B*** | 358 B | NA | NA | NA | NA | NA |
| Vanadium | 89.3 | 550 | - | 6,000 | ***109 NJ*** | ***110 NJ*** | 88 * | NA | NA | NA | NA | NA |
| Zinc | ** | 23,000 | - | 12,000 | 72.7 E*J | 3620 E*J | 555 | NA | NA | NA | NA | NA |
| Cyanide | 0.60 | 1,600 | - | 40 | 1.2 NR | 1.2 NR | 1.1 U | NA | NA | NA | NA | NA |

ft bgs - feet below ground surface
1 - The RBC has been used in the absence of established SSL
2 - The RBC which is based on most recent toxicity data has been substituted in place of the SSL
SSL - Soil Screening Level
MGW - Migration to Groundwater
RBC - Risk Based Concentration
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
R - QC indicates that data is unusable. Analyte may or may not be present.
S - Determined by Method of Standard Additions.
B (organics) - Analyte detected in associated laboratory blank.
B (inorganics) - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
* - Duplicate analysis not within control limits.

***702*** - denotes concentration above background levels.

575 - denotes concentration above lowest of SSLs only

***109*** - denotes concentration above lowest of SSLs and background levels

E - Estimated due to the presence of interference.
N - Spike recovery not within control limits.
W - GFAA post-digest spike out of control limits.
- - Not Applicable
^ - Metals results compared to average of onsite background levels
** - Background concentrations for Zinc are unavailable. Data was determined to be unusable.

Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.

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**Table 4-3**
**Surface Soil Sampling Summary - Former Process Pit Area**
**Island Chemical Site, St. Croix, U.S. Virgin Islands**

| SAMPLE ID | | | | | SBC-1 |
|---|---|---|---|---|---|
| SAMPLE DATE | | | | | 27-Jan-95 |
| SAMPLE INTERVAL (ft bgs) | | | | | 0-1 |
| ANALYTE | 2X Average Background Concentration | *Soil Screening Levels* | | | |
| | | Ingestion | Inhalation | MGW (DAF = 20) | |
| ***Volatile Organics (in ug/kg)*** | | | | | |
| Xylenes (total) | - | 160,000,000 | 460,000 | 200,000 | 1 J |
| ***Semivolatile Organics (in ug/kg)*** | | | | | |
| Bis(2-ethylhexyl)phthalate | - | 46,000 | 31,000,000 | 3,600,000 | 440 |
| ***Metals (in mg/kg)*** | | | | | |
| Aluminum | 21,760 | 78,000[1] | - | - | *22200 *J* |
| Antimony | 0.49 | 31 | - | 5 | 0.42 BJN |
| Arsenic | 1.64 | 0.4 | 750 | 29 | 0.27 NR |
| Barium | 134.8 | 5,500 | 690,000 | 1,600 | 119 |
| Cadmium | 0.66 | 78 | 1,800 | 8 | *3.5 N*J* |
| Calcium | 131,267 | - | - | - | 37500 |
| Chromium | 23.6 | 390 | 720[2] | 38 | 22.6 *J |
| Cobalt | 18.3 | 4,700[1] | - | - | *18.9* |
| Copper | 61.5 | 3,100[1] | - | - | 54.8 N*J |
| Iron | 31,933 | 23,000[1] | - | - | 31400 *J |
| Magnesium | 10,820 | - | - | - | 9000 |
| Manganese | 959 | 1,600[1] | - | - | 812 |
| Mercury | 0.30 | 23[1] | - | - | 0.15 |
| Nickel | 14.7 | 1,600 | 13,000 | 130 | *16.2 *J* |
| Potassium | 5,163 | - | - | - | 2720 |
| Selenium | 0.82 | 390 | - | 34 | 0.34 NWR |
| Sodium | 644 | - | - | - | *2430* |
| Vanadium | 89.3 | 550 | - | 6,000 | *112 NJ* |
| Zinc | ** | 23,000 | - | 12,000 | 5790 E*J |
| Cyanide | 0.60 | 1600 | - | 40 | 1.2 NR |

ft bgs - feet below ground surface
1 - The RBC has been used in the absence of established SSL
2 - The RBC which is based on most recent toxicity data has been substituted in place of the SSL
SSL - Soil Screening Level
MGW - Migration to Groundwater
RBC - Risk Based Concentration
J - Estimated value.
R - QC indicates that data is unusable. Analyte may or may not be present.
B (inorganics) - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
* - Duplicate analysis not within control limits.
E - Estimated due to the presence of interference.
N - Spike recovery not within control limits.

*702* - denotes concentration above background levels.

575 - denotes concentration above lowest of SSLs only

*109* - denotes concentration above lowest of SSLs and background levels

W - GFAA post-digest spike out of control limits.
- - Not Applicable
^ - Metals results compared to average of onsite background levels
** - Background concentrations for Zinc are unavailable. Data was determined to be unusable.

303481

Table 4-4

**Surface Soil Sampling Summary - Former Laboratory Pit Area**
**Island Chemical Site, St. Croix, U.S. Virgin Islands**

| SAMPLE ID | | | | | SBD-1 | SBD-2 | SBD-3 | SBF-1 | SBF-2 | SBF-3 |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | | | | 25-Jan-95 | 19-Jan-95 | 20-Jan-95 | 03-Feb-95 | 03-Feb-95 | 24-Jan-95 |
| SAMPLE INTERVAL (ft bgs) | | | | | 0-1 | 0-2 | 0-2 | 0-1 | 0-1 | 0-1 |
| ANALYTE | 2X Average Background Concentration | *Soil Screening Levels* Ingestion | Inhalation | MGW (DAF = 20) | | | | | | |
| *Volatile Organics (in ug/kg)* | | | | | | | | | | |
| Carbon Disulfide | - | 7,800,000 | 720,000 | 32,000 | 2 J | 2 J | 11 U | NA | NA | 1 J |
| Xylenes (total) | - | 160,000,000 | 460,000 | 200,000 | 11 U | 12 U | 2 J | NA | NA | 11 UJ |
| *Semivolatile Organics (in ug/kg)* | | | | | | | | | | |
| Bis(2-ethylhexyl)phthalate | - | 46,000 | 31,000,000 | 3,600,000 | 170 J | 410 U | 370 U | NA | NA | 720 |
| Butylbenzylphthalate | - | 16,000,000 | 930,000 | 930,000 | 360 U | 410 U | 370 U | NA | NA | 490 |
| Di-n-octylphthalate | - | 1,600,000 | 10,000,000 | 10,000,000 | 360 U | 410 U | 120 J | NA | NA | 380 U |
| Pentachlorophenol | - | 3,000 | - | 30 | 360 U | 410 U | 370 U | NA | NA | 1900 J |
| *Metals (in mg/kg)* | | | | | | | | | | |
| Aluminum | 21,760 | 78,000[1] | - | - | 16100 * | 18400 * | 12800 * | 14200 | 16300 | 17300 *J |
| Antimony | 0.49 | 31 | - | 5 | 0.31 UWJ | 0.35 UWJ | 0.32 MWJ | 0.46 BJNW | 0.39 BJN | 0.32 NR |
| Arsenic | 1.64 | 0.4 | 750 | 29 | 1.2 U | 1.5 U | 0.67 U | 0.96 BJ | 0.95 BJW | 0.25 NR |
| Barium | 134.8 | 5,500 | 690,000 | 1,600 | 132 | 98.3 | 99.7 | 63.2 | 95.2 | 112 |
| Beryllium | 0.02 | 160[2] | 1,300 | 63 | *0.35* | *0.37* | *0.38* | 0.21 U | *0.31* | *0.21 B* |
| Cadmium | 0.66 | 78 | 1,800 | 8 | *2.8* * | *1.9* * | *1.7* * | *1.1* | *1.3* | *6.4 N*J* |
| Calcium | 131,267 | - | - | - | 84500 * | 60600 * | 21900 * | 119000 * | 101000 * | 60000 |
| Chromium | 23.6 | 390 | 720[2] | 38 | 19.8 * | 22.1 * | 20.4 * | 14.8 *J | 21.4 *J | *30.4 *J* |
| Cobalt | 18.3 | 4,700[1] | - | - | 16.1 | *18.9* | 15.4 | 10.4 B | 13.3 | 17.6 |
| Copper | 61.5 | 3,100[1] | - | - | 45.1 | 51.7 | *62.2* | 28.7 | 40 | *141 N*J* |
| Iron | 31,933 | 23,000[1] | - | - | 25400 * | 26700 * | 23600 * | 18100 | 23500 | *63400 *J* |
| Lead | 19.6 | 400 | - | - | 6.8 | 5.9 | 5.4 | 5.3 S | 4.8 S | 3 NS*J |
| Manganese | 959 | 1,600[1] | - | - | *976* | 842 | 589 | 489 | 601 | 888 |
| Magnesium | 10,820 | - | - | - | 8540 * | 7530 * | 6250 * | 6830 | 6730 | 7480 |
| Mercury | 0.30 | 23[1] | - | - | 0.26 | 0.15 | 0.13 | 0.11 U | 0.24 | 0.27 |
| Nickel | 14.7 | 1,600 | 13,000 | 130 | *15.6* | *18.2* | *20.5* | 11.4 | 13.2 | *26.9 *J* |
| Potassium | 5,163 | - | - | - | 1940 | 2090 | 1280 | 1240 | 1970 | 2530 |
| Selenium | 0.82 | 390 | - | 5 | 3.1 NR | 3.5 NR | 3.2 NR | 3.1 NWR | 3.1 NR | 0.32 NR |
| Sodium | 644 | - | - | - | 557 B | 558 B | 497 B | 556 B | 491 B | 385 B |
| Vanadium | 89.3 | 550 | - | 6,000 | *99.4* * | *116* * | *98.1* * | 48.7 | 89.1 | *99.2 NJ* |
| Zinc | ** | 23,000 | - | 12,000 | 89.5 | 66.3 | 56.7 | 87.9 EJ | 178 EJ | 479 E*J |
| Cyanide | 0.60 | 1,600 | - | 40 | 1.1 UJ | 1.2 UJ | 1.1 UJ | 1.1 UJ | 1.1 UJ | 1.1 NR |

ft bgs - feet below ground surface

1 - The RBC has been used in the absence of established SSL

2 - The RBC which is based on most recent toxicity data has been substituted in place of the SSL

SSL - Soil Screening Level

MGW - Migration to Groundwater

RBC - Risk Based Concentration

U - Material analyzed for but not detected. The number is the minimum quantitation limit.

J - Estimated value.

R - QC indicates that data is unusable. Analyte may or may not be present.

S - Determined by Method of Standard Additions.

B (inorganics) - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).

* - Duplicate analysis not within control limits.

E - Estimated due to the presence of interference.

*702* - denotes concentration above background levels.

575 - denotes concentration above lowest of SSLs only

*109* - denotes concentration above lowest of SSLs and background levels

N - Spike recovery not within control limits.

W - GFAA post-digest spike out of control limits.

M - Duplicate injection precision not met.

- - Not Applicable

^ - Metals results compared to average of onsite background levels

** - Background concentrations for Zinc are unavailable. Data was determined to be unusable.

NA - Not Analyzed

303482

# Table 4-5
## Surface Soil Sampling Summary - Former Drum Areas
## Island Chemical Site, St. Croix, U.S. Virgin Islands

| SAMPLE ID | | | | | SBC-2 | | SBD-4 |
|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | | | | 31-Jan-95 | | 27-Jan-95 |
| SAMPLE INTERVAL (ft bgs) | | | | | 0-1 | | 0-1 |
| ANALYTE | 2X Average Background Concentration | *Soil Screening Levels* Ingestion | Inhalation | MGW (DAF = 20) | | | |
| ***Volatile Organics (in ug/kg)*** | | | | | | | |
| Carbon Disulfide | - | 7,800,000 | 720,000 | 32,000 | 3 | J | 14 U |
| 1,1-Dichloroethene | - | - | 2,300,000 | 2,300,000 | 1 | J | 14 U |
| Toluene | - | 16,000,000 | 650,000 | 12,000 | 10 | J | 12 J |
| Xylenes (total) | - | 160,000,000 | 460,000 | 200,000 | 2 | J | 2 J |
| ***Semivolatile Organics (in ug/kg)*** | | | | | | | |
| Bis(2-ethylhexyl)phthalate | - | 46,000 | 31,000,000 | 3,600,000 | 200 | J | 75 J |
| Butylbenzylphthalate | - | 16,000,000 | 930,000 | 930,000 | 120 | J | 460 U |
| Di-n-butylphthalate | - | 7,800,000 | 2,300,000 | 2,300,000 | 57 | J | 32 J |
| ***Metals (in mg/kg)*** | | | | | | | |
| Aluminum | 21,760 | 78,000[1] | - | - | 14700 | * | ***25000 J*** |
| Antimony | 0.49 | 31 | - | 5 | ***1.3*** | ***WJ*** | 0.4 NR |
| Barium | 134.8 | 5,500 | 690,000 | 1,600 | 112 | | ***274*** |
| Beryllium | 0.02 | 160[2] | 1,300 | 63 | ***0.34*** | | ***0.44*** |
| Cadmium | 0.66 | 78 | 1,800 | 8 | ***3*** | * | ***3.4 N*J*** |
| Calcium | 131,267 | - | - | - | 71800 | * | 65200 |
| Chromium | 23.6 | 390 | 720[2] | 38 | 18.9 | * | ***28.1 *J*** |
| Cobalt | 18.3 | 4,700[1] | - | - | 12.4 | | ***20.5*** |
| Copper | 61.5 | 3,100[1] | - | - | 50.9 | | 57.1 N*J |
| Iron | 31,933 | 23,000[1] | - | - | 26300 | * | ***37300 *J*** |
| Lead | 19.6 | 400 | - | - | ***31.2*** | | 3.5 N*J |
| Magnesium | 10,820 | - | - | - | 7650 | * | ***13900*** |
| Manganese | 959 | 1,600[1] | - | - | 689 | | ***1040*** |
| Mercury | 0.30 | 23[1] | - | - | 0.27 | | ***0.33*** |
| Nickel | 14.7 | 1,600 | 13,000 | 130 | ***15.6*** | | ***17.6 *J*** |
| Potassium | 5,163 | - | - | - | 2460 | | 1640 |
| Selenium | 0.82 | 390 | - | 5 | 3.1 | NR | 4 NR |
| Sodium | 644 | - | - | - | 416 | B | ***1510*** |
| Vanadium | 89.3 | 550 | - | 6,000 | 65.6 | * | ***155 NJ*** |
| Zinc | ** | 23000 | - | 12000 | 182 | | 59 E*J |

ft bgs - feet below ground surface
1 - The RBC has been used in the absence of established SSL
2 - The RBC which is based on most recent toxicity data has been substituted in place of the SSL
SSL - Soil Screening Level
MGW - Migration to Groundwater
RBC - Risk Based Concentration
J - Estimated value.
* - Duplicate analysis not within control limits.
N - Spike recovery not within control limits.
R - QC indicates that data is unusable. Analyte may or may not be present.
B (inorganics) - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
W - GFAA post-digest spike out of control limits.
- - Not Applicable
^ - Metals results compared to average of onsite background levels
** - Background concentrations for Zinc are unavailable. Data was determined to be unusable.

***702*** - denotes concentration above background levels.

575 - denotes concentration above lowest of SSLs only

***109*** - denotes concentration above lowest of SSLs and background levels

303483

**Table 4-6**
**Surface Soil Sampling Summary - Storm Drains**
**Island Chemical Site, St. Croix, U.S. Virgin Islands**

| SAMPLE ID | | | | | Central Storm Drain | | Southern Storm Drain | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | | | | SDCSD-2 | SDCSD-3 | SDSSD-1 | SDSSD-2 |
| SAMPLE INTERVAL (ft bgs) | | | | | 07-Oct-97 | 07-Oct-97 | 07-Oct-97 | 07-Oct-97 |
| | | | | | 0-1 | 0-1 | 0-1 | 0-1 |
| ANALYTE | 2X Average Background Concentration | *Soil Screening Levels* | | | | | | |
| | | Ingestion | Inhalation | MGW (DAF = 20) | | | | |
| *Semivolatile Organics (in ug/kg)* | | | | | | | | |
| Bis(2-ethylhexyl)phthalate | - | 46,000 | 31,000,000 | 3,600,000 | 7800 DJ | 1800 U | 370 U | 380 U |
| Isophorone | - | 670,000 | 4,600,000 | 500 | 510 U | 460 U | 320 J | 2500 |
| *Metals (in mg/kg)* | | | | | | | | |
| Aluminum | 21,760 | 78,000[1] | - | - | 8390 | 8890 | 14600 | 13500 |
| Arsenic | 1.64 | 0.4 | 750 | 29 | ***8.8*** | ***8.7*** | 0.81 B | 0.87 B |
| Barium | 134.8 | 5,500 | 690,000 | 1,600 | 70.3 | 44 B | 68.9 | 59.2 |
| Cadmium | 0.66 | 78 | 1,800 | 8 | ***3.9*** | ***3.9*** | 0.52 B | ***0.72 B*** |
| Calcium | 131,267 | - | - | - | 76900 J | 56300 J | 56400 J | 53600 J |
| Chromium | 23.6 | 390 | 720[2] | 38 | ***32*** | 22.7 | 13.9 | 14.6 |
| Cobalt | 18.3 | 4,700[1] | - | - | 9.4 BJ | 7.5 BJ | 10 BJ | 9.4 BJ |
| Copper | 61.5 | 3,100[1] | - | - | ***280 J*** | ***121 J*** | 30.7 J | 35.2 J |
| Iron | 31,933 | 23,000[1] | - | - | ***58800*** | 19700 | 19100 | 18800 |
| Lead | 19.6 | 400 | - | - | ***35.2*** | ***25.4*** | 3.9 | 7.3 |
| Magnesium | 10,820 | - | - | - | 4090 | 4840 | 5870 | 6170 |
| Manganese | 959 | 1,600[1] | - | - | 595 J | 311 J | 503 J | 494 J |
| Nickel | 14.7 | 1,600 | 13,000 | 130 | ***23.5*** | 14.5 | 9 B | 8.3 B |
| Potassium | 5,163 | - | - | - | 838 B | 1060 B | 3650 | 3400 |
| Selenium | 0.82 | 390 | - | 5 | ***0.94 BJ*** | 0.69 UJ | 0.57 UJ | 0.58 UJ |
| Silver | 0.15 | 390 | - | 34 | ***1.5 B*** | ***1.2 B*** | ***0.98 B*** | ***0.92 B*** |
| Sodium | 644 | - | - | - | ***675 B*** | ***659 B*** | 373 B | 453 B |
| Vanadium | 89.3 | 550 | - | 6,000 | 34.3 | 39.5 | 52.1 | 50.1 |
| Zinc | ** | 23,000 | - | 12,000 | 336 | 346 | 40.5 R | 74.4 |
| *Geochemical/Geotechnical Parameters* | | | | | | | | |
| Grain Size: gravel/sand (%) | - | NE | NE | NE | 66.3 | 71.2 | 28.7 | 42.9 |
| silt (%) | - | NE | NE | NE | 19.3 | 14.7 | 28.1 | 21.8 |
| clay (%) | - | NE | NE | NE | 14.5 | 14.1 | 43.2 | 35.3 |
| Alkalinity (mg/kg) | - | NE | NE | NE | 758 | 636 | 544 | 456 |
| Redox Potential (no units) | - | NE | NE | NE | 206 | 190 | 211 | 207 |
| pH (no units) | - | NE | NE | NE | 7.54 | 7.81 | 7.83 | 7.71 |
| Specific Conductance (umhos) | - | NE | NE | NE | 123 | 87.9 | 104 | 120 |
| Total Organic Carbon (mg/kg) | - | NE | NE | NE | 48500 | 45400 | 35400 | 41700 |
| Total Solids (mg/l) | - | NE | NE | NE | 62.1 | 70.5 | 88.3 | 85.6 |

ft bgs - feet below ground surface
1 - The RBC has been used in the absence of established SSL
2 - The RBC which is based on most recent toxicity data has been substituted in place of the SSL
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
D - Analyte quantitated on a diluted sample
R - QC indicates that data is unusable. Analyte may or may not be present.
B - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
^ - Metals results compared to average of onsite background levels
** - Background concentrations for Zinc are unavailable. Data was determined to be unusable.
- - Not Applicable
NE - None established

***702*** - denotes concentration above background levels.

575 - denotes concentration above lowest of SSLs only

***109*** - denotes concentration above lowest of SSLs and background levels

303484

**Table 4-7**
**Subsurface Soil Sampling Summary - AST Area**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| SAMPLE ID | | SBB-1 | SBB-1 | SBB-2 | SBB-2 | SBB-4 | SBB-4 | SBB-4 |
|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 31-Jan-95 | 31-Jan-95 | 22-May-96 | 22-May-96 | 29-May-96 | 29-May-96 | 29-May-96 |
| SAMPLE INTERVAL (ft bgs) | | 6-8 | 24-26 | 20-22 | 22-24 | 10-12 | 12-14 | 20-22 |
| ANALYTE | SSL - MGW (DAF=20) | | | | | | | |
| *Volatile Organics (in ug/kg)* | | | | | | | | |
| Acetone | 16,000 | ***19,000 J*** | 12 U | 1,100 J | 31,000 UJ | 73,000 UJ | ***100,000*** | 73,000 UJ |
| Methylene Chloride | 20 | 8,300 U | 12 U | 1,500 U | 31,000 U | ***12,000 BJ*** | ***11,000 BJ*** | ***11,000 BJ*** |
| Toluene | 12,000 | 1,000 J | 12 U | 1,500 U | 31,000 U | 73,000 UJ | 71,000 UJ | 73,000 UJ |
| Ethylbenzene | 13,000 | ***57,000*** | 10 J | 1,800 | ***32,000*** | ***150,000*** | ***100,000*** | ***170,000*** |
| Xylenes (total) | 190,000 (1) | ***310,000 BE*** | 46 B | 9,600 | 150,000 | 140,000 | ***630,000*** | ***980,000*** |
| Benzene | 30 | 8,300 U | 12 U | 1,500 U | 31,000 U | 73,000 UJ | 71,000 UJ | 73,000 UJ |
| Tetrachloroethene | 60 | 8,300 U | 12 U | 1,500 U | 31,000 U | 73,000 UJ | 71,000 UJ | 73,000 UJ |
| Trichloroethene | 60 | 8,300 U | 12 U | 1,500 U | 31,000 U | 73,000 UJ | 71,000 UJ | 73,000 UJ |
| 1,1-Dichloroethene | 60 | 8,300 U | 12 U | 1,500 U | 31,000 U | 73,000 UJ | 71,000 UJ | 73,000 UJ |
| 4-Methyl-2-pentanone | NE | 8,300 U | 12 U | 1,500 U | 31,000 U | 73,000 UJ | 71,000 UJ | 73,000 UJ |
| 2-Butanone | NE | 8,300 U | 12 U | 1,500 U | 31,000 U | 73,000 UJ | 71,000 UJ | 73,000 UJ |
| 2-Hexanone | NE | 8,300 UJ | 12 UJ | 1,500 U | 31,000 U | 73,000 UJ | 71,000 UJ | 73,000 UJ |
| Chloroform | 600 | 8,300 U | 12 U | 1,500 U | 31,000 U | 73,000 UJ | 71,000 UJ | 73,000 UJ |
| *Semivolatile Organics (in ug/kg)* | | | | | | | | |
| Bis(2-Ethylhexyl)phthalate | 3,600,000 | 550 B | 410 U | NA | NA | NA | NA | NA |
| Phenol | 100,000 | 410 U | 410 U | NA | NA | NA | NA | NA |
| 2-Methylnapthalene | NE | 410 U | 410 U | NA | NA | NA | NA | NA |
| Fluorene | 560,000 | 410 U | 410 U | NA | NA | NA | NA | NA |
| Phenanthrene | NE | 410 U | 410 U | NA | NA | NA | NA | NA |
| *Metals (in mg/kg)* | | | | | | | | |
| Aluminum | NE | 26400 *J | 17600 *J | NA | NA | NA | NA | NA |
| Antimony | 5 | 0.39 NR | 0.35 NR | NA | NA | NA | NA | NA |
| Arsenic | 29 | 0.3 NR | 0.27 NR | NA | NA | NA | NA | NA |
| Barium | 1,600 | 111 | 87.4 | NA | NA | NA | NA | NA |
| Beryllium | 63 | 0.35 | 0.36 | NA | NA | NA | NA | NA |
| Cadmium | 8 | 3.8 N*J | 3 N*J | NA | NA | NA | NA | NA |
| Calcium | NE | 35400 | 6550 | NA | NA | NA | NA | NA |
| Chromium | 38 | 27.2 *J | 28.2 *J | NA | NA | NA | NA | NA |
| Cobalt | NE | 18.7 | 16.4 | NA | NA | NA | NA | NA |
| Copper | NE | 1.4 NR | 1.2 NR | NA | NA | NA | NA | NA |
| Iron | NE | 39500 *J | 33100 *J | NA | NA | NA | NA | NA |
| Lead | NE | 1.8 NW*UJ | 2.8 N*J | NA | NA | NA | NA | NA |
| Magnesium | NE | 10800 | 7070 | NA | NA | NA | NA | NA |
| Manganese | NE | 739 | 545 | NA | NA | NA | NA | NA |
| Mercury | 2 | 0.16 | 0.12 U | NA | NA | NA | NA | NA |
| Nickel | 130 | 18.9 *J | 18.1 *J | NA | NA | NA | NA | NA |
| Potassium | NE | 2520 | 1130 B | NA | NA | NA | NA | NA |
| Selenium | 5 | 0.39 NWR | 0.35 NWR | NA | NA | NA | NA | NA |
| Sodium | NE | 2140 | 1220 B | NA | NA | NA | NA | NA |
| Vanadium | 6,000 | 165 NJ | 162 NJ | NA | NA | NA | NA | NA |
| Zinc | 12,000 | 76.3 E*J | 53.6 E*J | NA | NA | NA | NA | NA |
| Cyanide | 40 | ***60.2 N*J*** | ***47.3 N*J*** | NA | NA | NA | NA | NA |

Bold, italicized print denotes concentration above SSL.

SSL - Soil Screening Level
MGW - Migration to Groundwater
DAF - Dilution Attenuation Factor
NE - None established
NA - Not Analyzed
ft bgs - feet below ground surface
(1) No Soil Screening Level (SSL) has been established for total xylenes, so the most conservative value (o-xylene at 190,000) has been used for screening purposes
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
D - Analyte quantitated at a dilution
J - Estimated value.
R - QC indicates that data is unusable. Analyte may or may not be present.
B (organics) - Analyte detected in associated laboratory blank.
B (inorganics) - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
* - Duplicate analysis not within control limits.
E (organics) - Exceeded calibration range of instrument.
E (inorganics) - Estimated due to the presence of interference.
N - Spike recovery not within control limits.
W - GFAA post-digest spike out of control limits.
- - Not Applicable
Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.

**Table 4-7**
**Subsurface Soil Sampling Summary - AST Area**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| SAMPLE ID | | SBB-6 | SBB-6 | SBB-6 | SBB-11 | SBB-11 |
|---|---|---|---|---|---|---|
| SAMPLE DATE | | 29-May-96 | 29-May-96 | 29-May-96 | 30-May-96 | 30-May-96 |
| SAMPLE INTERVAL (ft bgs) | | 12-14 | 22-24 | 26-28 | 14-16 | 20-22 |
| ANALYTE | SSL - MGW (DAF=20) | | | | | |
| *Volatile Organics (in ug/kg)* | | | | | | |
| Acetone | 16,000 | 89 DJ | 11 UJ | 12 UJ | 310 J | 360 J |
| Methylene Chloride | 20 | 12 U | 11 U | 12 U | 61 UJ | 1,500 U |
| Toluene | 12,000 | 12 U | 11 U | 12 U | 61 U | 700 J |
| Ethylbenzene | 13,000 | 12 U | 11 U | 12 U | 16 J | ***58,000 DJ*** |
| Xylenes (total) | 190,000 (1) | 12 U | 2 J | 2 J | 150 | ***320,000 D*** |
| Benzene | 30 | 12 UR | 11 UJ | 12 UR | 61 U | 1,500 U |
| Tetrachloroethene | 60 | 12 U | 11 U | 12 U | 61 U | 1,500 U |
| Trichloroethene | 60 | 12 U | 11 U | 12 U | 61 U | 1,500 U |
| 1,1-Dichloroethene | 60 | 12 UJ | 11 UJ | 12 UJ | 61 UJ | 1,500 U |
| 4-Methyl-2-pentanone | NE | 12 U | 11 U | 12 U | 8 J | 1,500 UJ |
| 2-Butanone | NE | 12 UR | 11 UJ | 12 UR | 24 J | 1,500 U |
| 2-Hexanone | NE | 12 U | 11 U | 12 U | 61 U | 1,500 U |
| Chloroform | 600 | 12 U | 11 U | 12 U | 61 U | 1,500 U |
| *Semivolatile Organics (in ug/kg)* | | | | | | |
| Bis(2-Ethylhexyl)phthalate | 36,000,000 | NA | NA | NA | NA | NA |
| Phenol | 100,000 | NA | NA | NA | NA | NA |
| 2-Methylnapthalene | NE | NA | NA | NA | NA | NA |
| Fluorene | 560,000 | NA | NA | NA | NA | NA |
| Phenanthrene | NE | NA | NA | NA | NA | NA |
| *Metals (in mg/kg)* | | | | | | |
| Aluminum | NE | NA | NA | NA | NA | NA |
| Antimony | 5 | NA | NA | NA | NA | NA |
| Arsenic | 29 | NA | NA | NA | NA | NA |
| Barium | 1,600 | NA | NA | NA | NA | NA |
| Beryllium | 63 | NA | NA | NA | NA | NA |
| Cadmium | 8 | NA | NA | NA | NA | NA |
| Calcium | NE | NA | NA | NA | NA | NA |
| Chromium | 38 | NA | NA | NA | NA | NA |
| Cobalt | NE | NA | NA | NA | NA | NA |
| Copper | NE | NA | NA | NA | NA | NA |
| Iron | NE | NA | NA | NA | NA | NA |
| Lead | NE | NA | NA | NA | NA | NA |
| Magnesium | NE | NA | NA | NA | NA | NA |
| Manganese | NE | NA | NA | NA | NA | NA |
| Mercury | NE | NA | NA | NA | NA | NA |
| Nickel | 130 | NA | NA | NA | NA | NA |
| Potassium | NE | NA | NA | NA | NA | NA |
| Selenium | 5 | NA | NA | NA | NA | NA |
| Sodium | NE | NA | NA | NA | NA | NA |
| Vanadium | 6,000 | NA | NA | NA | NA | NA |
| Zinc | 12,000 | NA | NA | NA | NA | NA |
| Cyanide | 40 | NA | NA | NA | NA | NA |

Bold, italicized print denotes concentration above SSL.

SSL - Soil Screening Level
MGW - Migration to Groundwater
DAF - Dilution Attenuation Factor
NE - None established
NA - Not Analyzed
ft bgs - feet below ground surface
(1) No Soil Screening Level (SSL) has been established for total xylenes, so the most conservative value (o-xylene at 190,000) has been used for screening purposes
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
R - QC indicates that data is unusable. Analyte may or may not be present.
D - Analyte quantitated at a dilution
Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.

**Table 4-7**
**Subsurface Soil Sampling Summary - AST Area**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| SAMPLE ID | | SBB-15 | SBB-15 | SBB-15 | SBB-16 | SBB-16 |
|---|---|---|---|---|---|---|
| SAMPLE DATE | | 28-May-96 | 28-May-96 | 28-May-96 | 28-May-96 | 28-May-96 |
| SAMPLE INTERVAL (ft bgs) | | 12-14 | 16-18 | 22-24 | 14-16 | 22-24 |
| ANALYTE | SSL - MGW (DAF=20) | | | | | |
| *Volatile Organics (in ug/kg)* | | | | | | |
| Acetone | 16,000 | 12 U | 82 J | 220 J | 580 J | 100 J |
| Methylene Chloride | 20 | 12 U | 12 U | 12 U | 66 U | 12 U |
| Toluene | 12,000 | 12 U | 12 U | 12 U | 66 U | 12 U |
| Ethylbenzene | 13,000 | 26 | 12 U | 12 U | 85 | 12 U |
| Xylenes (total) | 190,000 (1) | 4 J | 4 J | 4 J | 150 | 5 J |
| Benzene | 30 | 12 U | 12 U | 12 U | 66 U | 12 U |
| Tetrachloroethene | 60 | 12 UR | 12 UJ | 12 UR | 66 UR | 12 UR |
| Trichloroethene | 60 | 12 U | 12 U | 12 U | 66 U | 12 U |
| 1,1-Dichloroethene | 60 | 12 UJ | 12 UJ | 12 UJ | 66 UJ | 11 UJ |
| 4-Methyl-2-pentanone | NE | 12 U | 12 U | 12 U | 66 U | 12 U |
| 2-Butanone | NE | 12 UR | 12 UJ | 12 UR | 66 UR | 12 UR |
| 2-Hexanone | NE | 12 U | 12 U | 12 U | 66 U | 12 U |
| Chloroform | 600 | 12 U | 12 U | 12 U | 66 U | 12 U |
| *Semivolatile Organics (in ug/kg)* | | | | | | |
| Bis(2-Ethylhexyl)phthalate | 36,000,000 | NA | NA | NA | NA | NA |
| Phenol | 100,000 | NA | NA | NA | NA | NA |
| 2-Methylnapthalene | NE | NA | NA | NA | NA | NA |
| Fluorene | 560,000 | NA | NA | NA | NA | NA |
| Phenanthrene | NE | NA | NA | NA | NA | NA |
| *Metals (in mg/kg)* | | | | | | |
| Aluminum | NE | NA | NA | NA | NA | NA |
| Antimony | 5 | NA | NA | NA | NA | NA |
| Arsenic | 29 | NA | NA | NA | NA | NA |
| Barium | 1,600 | NA | NA | NA | NA | NA |
| Beryllium | 63 | NA | NA | NA | NA | NA |
| Cadmium | 8 | NA | NA | NA | NA | NA |
| Calcium | NE | NA | NA | NA | NA | NA |
| Chromium | 38 | NA | NA | NA | NA | NA |
| Cobalt | NE | NA | NA | NA | NA | NA |
| Copper | NE | NA | NA | NA | NA | NA |
| Iron | NE | NA | NA | NA | NA | NA |
| Lead | NE | NA | NA | NA | NA | NA |
| Magnesium | NE | NA | NA | NA | NA | NA |
| Manganese | NE | NA | NA | NA | NA | NA |
| Mercury | NE | NA | NA | NA | NA | NA |
| Nickel | 130 | NA | NA | NA | NA | NA |
| Potassium | NE | NA | NA | NA | NA | NA |
| Selenium | 5 | NA | NA | NA | NA | NA |
| Sodium | NE | NA | NA | NA | NA | NA |
| Vanadium | 6,000 | NA | NA | NA | NA | NA |
| Zinc | 12,000 | NA | NA | NA | NA | NA |
| Cyanide | 40 | NA | NA | NA | NA | NA |

Bold, italicized print denotes concentration above SSL.

SSL - Soil Screening Level
MGW - Migration to Groundwater
DAF - Dilution Attenuation Factor
NE - None established
NA - Not Analyzed
ft bgs - feet below ground surface
(1) No Soil Screening Level (SSL) has been established for total xylenes, so the most conservative value (o-xylene at 190,000) has been used for screening purposes
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
R - QC indicates that data is unusable. Analyte may or may not be present.
D - Analyte quantitated at a dilution
Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.

**Table 4-7**
**Subsurface Soil Sampling Summary - AST Area**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| SAMPLE ID | | SBB-17 | SBB-17 | SBE-1 | SBAST-1 | SBAST-1 |
|---|---|---|---|---|---|---|
| SAMPLE DATE | | 29-May-96 | 29-May-96 | 19-Jan-95 | 13-Jun-97 | 13-Jun-97 |
| SAMPLE INTERVAL (ft bgs) | | 14-16 | 20-22 | 20-22 | 8-10 | 26-28 |
| ANALYTE | SSL - MGW (DAF=20) | | | | | |
| *Volatile Organics (in ug/kg)* | | | | | | |
| Acetone | 16,000 | 73,000 UJ | 68,000 UJ | 14 UJ | 150 J | 40 J |
| Methylene Chloride | 20 | ***11,000 BJ*** | ***23,000 BJ*** | 12 U | 9 U | 9 U |
| Toluene | 12,000 | 73,000 UJ | 68,000 UJ | 12 U | 8 J | 7 J |
| Ethylbenzene | 13,000 | ***320,000*** | ***270,000*** | 12 U | 12 U | 12 U |
| Xylenes (total) | 190,000 (1) | ***2,000,000 EJ*** | ***1,600,000 EJ*** | 12 U | 12 U | 12 U |
| Benzene | 30 | 73,000 UJ | 68,000 UJ | 12 U | 12 U | 12 U |
| Tetrachloroethene | 60 | 73,000 UJ | 68,000 UJ | 12 U | 12 U | 12 U |
| Trichloroethene | 60 | 73,000 UJ | 68,000 UJ | 12 U | 12 U | 12 U |
| 1,1-Dichloroethene | 60 | 73,000 UJ | 68,000 UJ | 12 U | 12 U | 12 U |
| 4-Methyl-2-pentanone | NE | 73,000 UJ | 68,000 UJ | 12 U | 12 U | 12 U |
| 2-Butanone | NE | 73,000 UJ | 68,000 UJ | 12 U | 12 U | 12 U |
| 2-Hexanone | NE | 73,000 UJ | 68,000 UJ | 12 U | 12 U | 12 U |
| Chloroform | 600 | 73,000 UJ | 68,000 UJ | 12 U | 12 U | 12 U |
| *Semivolatile Organics (in ug/kg)* | | | | | | |
| Bis(2-Ethylhexyl)phthalate | 36,000,000 | NA | NA | 380 U | 410 U | 400 U |
| Phenol | 100,000 | NA | NA | 380 U | 410 U | 400 U |
| 2-Methylnapthalene | NE | NA | NA | 380 U | 410 U | 400 U |
| Fluorene | 560,000 | NA | NA | 380 U | 410 U | 400 U |
| Phenanthrene | NE | NA | NA | 380 U | 410 U | 400 U |
| *Metals (in mg/kg)* | | | | | | |
| Aluminum | NE | NA | NA | 12700 * | 13000 | 9200 |
| Antimony | 5 | NA | NA | 0.88 B | 0.48 UN | 0.45 UN |
| Arsenic | 29 | NA | NA | 0.29 U | 0.31 UN | 0.29 UN |
| Barium | 1,600 | NA | NA | 99.5 | 81.9 * | 173 * |
| Beryllium | 63 | NA | NA | 0.34 | 0.02 UN | 0.02 UN |
| Cadmium | 8 | NA | NA | 1.7 * | 0.8 BJ* | 0.66 BJ* |
| Calcium | NE | NA | NA | 4970 * | 8460 * | 3790 * |
| Chromium | 38 | NA | NA | 12.9 * | 20.6 | 19.2 |
| Cobalt | NE | NA | NA | 13.6 | 14.4 J | 13.1 J |
| Copper | NE | NA | NA | 1.2 UJ | 48.5 J* | 31.4 J* |
| Iron | NE | NA | NA | 24800 * | 27800 | 24100 |
| Lead | NE | NA | NA | 3.4 | 3 JN* | 1.9 JN* |
| Magnesium | NE | NA | NA | 5360 * | 6720 | 4570 |
| Manganese | NE | NA | NA | 858 | 617 R | 1410 R |
| Mercury | NE | NA | NA | 0.14 | 0.12 U | 0.12 U |
| Nickel | 130 | NA | NA | 16 | 9.8 JN | 9.5 JN |
| Potassium | NE | NA | NA | 936 B | 2200 JE | 1040 BE |
| Selenium | 5 | NA | NA | 3.3 NR | 0.6 UN | 0.56 UN |
| Sodium | NE | NA | NA | 908 B | 2980 R | 479 BR |
| Vanadium | 6,000 | NA | NA | 108 * | 112 * | 125 * |
| Zinc | 12,000 | NA | NA | 45.4 | 62.7 R | 109 R |
| Cyanide | 40 | NA | NA | ***51.7*** | 0.62 U | 0.59 U |

Bold, italicized print denotes concentration above SSL.

SSL - Soil Screening Level
MGW - Migration to Groundwater
DAF - Dilution Attenuation Factor
NE - None established
NA - Not Analyzed
ft bgs - feet below ground surface
(1) No Soil Screening Level (SSL) has been established for total xylenes, so the most conservative value (o-xylene at 190,000) has been used for screening purposes
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
R - QC indicates that data is unusable. Analyte may or may not be present.
B (organics) - Analyte detected in associated laboratory blank.
B (inorganics) - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
* - Duplicate analysis not within control limits.
E (organics) - Exceeded calibration range of instrument.
E (inorganics) - Estimated due to the presence of interference.
N - Spike recovery not within control limits.
D - Analyte quantitated at a dilution
Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.

**Table 4-7**
**Subsurface Soil Sampling Summary - AST Area**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| SAMPLE ID | | SBAST-2 | SBAST-2 | SBAST-3 | SBAST-3 | SBAST-3 |
|---|---|---|---|---|---|---|
| SAMPLE DATE | | 13-Jun-97 | 13-Jun-97 | 14-Jun-97 | 14-Jun-97 | 14-Jun-97 |
| SAMPLE INTERVAL (ft bgs) | | 8-10 | 30-32 | 18-20 | Duplicate | 22-24 |
| ANALYTE | SSL - MGW (DAF=20) | | | | | |
| *Volatile Organics (in ug/kg)* | | | | | | |
| Acetone | 16,000 | 230 D | 17 J | 60 J | 43 J | 98 J |
| Methylene Chloride | 20 | ***390 BDJ*** | 11 U | 7 U | 7 U | 9 U |
| Toluene | 12,000 | 9 J | 11 U | 6 J | 5 J | 5 J |
| Ethylbenzene | 13,000 | ***34,000 DEJ*** | 11 U | 12 U | 12 U | 11 U |
| Xylenes (total) | 190,000 (1) | 12 U | 11 U | 12 U | 12 U | 11 U |
| Benzene | 30 | 12 U | 11 U | 1 J | 12 U | 11 U |
| Tetrachloroethene | 60 | 12 U | 11 U | 1 J | 12 U | 11 U |
| Trichloroethene | 60 | 17 | 11 U | 12 U | 12 U | 11 U |
| 1,1-Dichloroethene | 60 | 12 U | 11 U | 6 J | 3 J | 11 U |
| 4-Methyl-2-pentanone | NE | 12 U | 11 U | 12 U | 10 J | 11 U |
| 2-Butanone | NE | 12 U | 11 U | 2 J | 2 J | 11 U |
| 2-Hexanone | NE | 12 U | 11 U | 3 J | 2 J | 11 U |
| Chloroform | 600 | 12 U | 11 U | 12 U | 12 U | 11 U |
| *Semivolatile Organics (in ug/kg)* | | | | | | |
| Bis(2-Ethylhexyl)phthalate | 36,000,000 | 380 U | 370 U | 380 U | 380 U | 370 U |
| Phenol | 100,000 | 90 J | 370 U | 380 U | 380 U | 370 U |
| 2-Methylnapthalene | NE | 380 J | 370 U | 380 U | 380 U | 370 U |
| Fluorene | 560,000 | 230 J | 370 U | 380 U | 380 U | 370 U |
| Phenanthrene | NE | 370 J | 370 U | 380 U | 380 U | 370 U |
| *Metals (in mg/kg)* | | | | | | |
| Aluminum | NE | 7700 | 15900 | 9930 | 9400 | 15400 |
| Antimony | 5 | 0.42 UN | 0.44 UN | 0.45 UN | 0.42 UN | 0.43 UN |
| Arsenic | 29 | 0.27 UN | 0.82 BJN | 0.46 BJN | 0.27 UN | 0.44 BJN |
| Barium | 1,600 | 108 * | 169 * | 89.1 * | 82 * | 134 * |
| Beryllium | 63 | 0.02 UN | 0.02 UN | 0.02 UN | 0.02 UN | 0.02 UN |
| Cadmium | 8 | 0.56 BJ* | 0.91 BJ* | 0.71 BJ* | 0.69 BJ* | 0.85 BJ* |
| Calcium | NE | 8190 * | 6190 * | 4000 * | 3760 * | 6470 * |
| Chromium | 38 | 11.6 | 28.4 | 17.8 | 18.9 | 22.4 |
| Cobalt | NE | 18.2 J | 18.6 J | 15.8 J | 11.8 J | 16.8 J |
| Copper | NE | 39.4 J* | 53.5 J* | 37.6 J* | 34.5 J* | 52.9 J* |
| Iron | NE | 19200 | 33300 | 25500 | 23700 | 32400 |
| Lead | NE | 2.4 JN* | 3.6 JN* | 2.5 JN* | 1.9 JN* | 3.5 JN* |
| Magnesium | NE | 4660 | 7730 | 5010 | 4620 | 7860 |
| Manganese | NE | 1410 R | 1110 R | 728 R | 658 R | 756 R |
| Mercury | NE | 0.12 U | 0.11 U | 0.12 U | 0.12 U | 0.11 U |
| Nickel | 130 | 9.8 JN | 13.9 JN | 9.6 JN | 8.6 JN | 12.5 JN |
| Potassium | NE | 1670 JE | 2130 JE | 949 BE | 953 BE | 1310 JE |
| Selenium | 5 | 0.53 UN | 0.55 UN | 0.56 UN | 0.53 UN | 0.54 UN |
| Sodium | NE | 497 BJE | 1290 JE | 395 BJE | 399 BE | 916 BJE |
| Vanadium | 6,000 | 81 * | 136 * | 119 * | 119 * | 124 * |
| Zinc | 12,000 | 36.8 R | 61.4 R | 50.6 R | 123 R | 49.5 R |
| Cyanide | 40 | 0.58 U | 0.55 U | 0.57 U | 0.58 U | 0.56 U |

Bold, italicized print denotes concentration above SSL.

SSL - Soil Screening Level
MGW - Migration to Groundwater
DAF - Dilution Attenuation Factor
NE - None established
ft bgs - feet below ground surface
(1) No Soil Screening Level (SSL) has been established for total xylenes, so the most conservative value (o-xylene at 190,000) has been used for screening purposes
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
R - QC indicates that data is unusable. Analyte may or may not be present.
B (organics) - Analyte detected in associated laboratory blank.
B (inorganics) - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
* - Duplicate analysis not within control limits.
E (organics) - Exceeded calibration range of instrument.
E (inorganics) - Estimated due to the presence of interference.
N - Spike recovery not within control limits.
D - Analyte quantitated at a dilution
Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.

**Table 4-7**
**Subsurface Soil Sampling Summary - AST Area**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| SAMPLE ID | | SBAST-4 | SBAST-4 | SBAST-5 | SBAST-5 | SBAST-6 | SBAST-6 |
|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 14-Jun-97 | 14-Jun-97 | 22-Sep-97 | 22-Sep-97 | 22-Sep-97 | 22-Sep-97 |
| SAMPLE INTERVAL (ft bgs) | | 6-8 | 22-24 | 20-22 | 22-24 | 20-22 | 22-24 |
| ANALYTE | SSL - MGW (DAF=20) | | | | | | |
| *Volatile Organics (in ug/kg)* | | | | | | | |
| Acetone | 16,000 | 11 U | 32 J | 86 U | 27 U | 28 U | 18 U |
| Methylene Chloride | 20 | 14 U | 7 U | 18 U | 16 U | 16 U | 16 U |
| Toluene | 12,000 | 11 U | 5 BJ | 12 U | 11 U | 11 U | 12 U |
| Ethylbenzene | 13,000 | 11 U | 12 U | 75 | 130 | 11 U | 12 U |
| Xylenes (total) | 190,000 (1) | 11 U | 12 U | 130 | 1,000 | 3 J | 12 U |
| Benzene | 30 | 11 U | 12 U | 12 U | 11 U | 11 U | 12 U |
| Tetrachloroethene | 60 | 11 U | 2 J | 12 U | 11 U | 11 U | 12 U |
| Trichloroethene | 60 | 11 U | 12 U | 12 U | 11 U | 11 U | 12 U |
| 1,1-Dichloroethene | 60 | 11 U | 12 U | 12 U | 11 U | 11 U | 12 U |
| 4-Methyl-2-pentanone | NE | 11 U | 12 U | 12 U | 11 U | 11 U | 12 U |
| 2-Butanone | NE | 11 U | 12 U | 12 U | 11 U | 11 U | 12 U |
| 2-Hexanone | NE | 11 U | 12 U | 12 U | 11 U | 11 U | 12 U |
| Chloroform | 600 | 11 U | 47 | 12 U | 11 U | 11 U | 12 U |
| *Semivolatile Organics (in ug/kg)* | | | | | | | |
| Bis(2-Ethylhexyl)phthalate | 36,000,000 | 370 U | 390 U | 380 U | 410 U | 370 U | 390 U |
| Phenol | 100,000 | 370 U | 390 U | 380 U | 410 U | 370 U | 390 U |
| 2-Methylnapthalene | NE | 370 U | 390 U | 380 U | 410 U | 370 U | 390 U |
| Fluorene | 560,000 | 370 U | 390 U | 380 U | 410 U | 370 U | 390 U |
| Phenanthrene | NE | 370 U | 390 U | 380 U | 410 U | 370 U | 390 U |
| *Metals (in mg/kg)* | | | | | | | |
| Aluminum | NE | 9760 | 11900 | 6520 | 7260 | 7510 | 7850 |
| Antimony | 5 | 0.48 UN | 0.49 UN | 0.47 U | 0.49 U | 0.45 U | 0.48 U |
| Arsenic | 29 | 0.31 UN | 0.32 UN | 0.73 BJ | 0.93 BJ | 0.52 BJ | 0.92 BJ |
| Barium | 1,600 | 63.3 * | 56.7 * | 74.5 | 59.2 | 103 | 151 |
| Beryllium | 63 | 0.02 UN | 0.02 UN | 0.02 U | 0.02 U | 0.02 U | 0.02 U |
| Cadmium | 8 | 0.57 * | 0.72 BJ* | 0.02 U | 0.02 U | 0.11 B | 0.1 B |
| Calcium | NE | 4510 * | 5010 * | 2830 R | 3260 R | 3530 R | 3760 R |
| Chromium | 38 | 12.5 | 24.4 | 12.6 | 10.1 | 9.1 | 10.4 |
| Cobalt | NE | 12.1 J | 11 BJ | 8.8 B | 7.3 B | 15.1 | 15.9 |
| Copper | NE | 34.4 J* | 41.1 J* | 21.9 EJ | 20.3 EJ | 27.6 EJ | 32.7 EJ |
| Iron | NE | 20700 | 26200 | 14200 | 13700 | 17400 | 17100 |
| Lead | NE | 1.6 JN* | 1.8 JN* | 1.8 J | 1.2 J | 2.3 J | 2.7 J |
| Magnesium | NE | 4440 | 6590 | 3240 | 3230 | 4190 | 3920 |
| Manganese | NE | 553 R | 469 R | 404 NJ | 484 NJ | 811 NJ | 1340 NJ |
| Mercury | NE | 0.11 U | 0.12 U | 0.11 U | 0.12 U | 0.11 U | 0.1 U |
| Nickel | 130 | 8.1 BJN | 9.1 BJN | 5.6 B | 4.7 B | 8.4 B | 8.4 B |
| Potassium | NE | 1340 JE | 1080 BE | 672 BE | 673 BE | 691 BE | 795 BE |
| Selenium | 5 | 0.6 UN | 0.61 UN | 1.4 * | 0.62 U* | 0.57 U* | 0.6 U* |
| Sodium | NE | 1300 JE | 1060 BJE | 480 BE | 538 BE | 541 BE | 839 BE |
| Vanadium | 6,000 | 73.8 * | 103 * | 63.6 | 54.8 | 72.5 | 79.4 |
| Zinc | 12,000 | 34.2 R | 47.6 R | 21.4 R | 22.4 R | 27 R | 27 R |
| Cyanide | 40 | 0.55 U | 0.58 U | 0.69 BN | 0.58 UN | 0.56 UN | 0.59 UN |

Bold, italicized print denotes concentration above SSL.

SSL - Soil Screening Level
MGW - Migration to Groundwater
DAF - Dilution Attenuation Factor
NE - None established
ft bgs - feet below ground surface
(1) No Soil Screening Level (SSL) has been established for total xylenes, so the most conservative value (o-xylene at 190,000) has been used for screening purposes
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
R - QC indicates that data is unusable. Analyte may or may not be present.
B (organics) - Analyte detected in associated laboratory blank.
B (inorganics) - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
* - Duplicate analysis not within control limits.
E (inorganics) - Estimated due to the presence of interference.
N - Spike recovery not within control limits.
D - Analyte quantitated at a dilution
Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.

**Table 4-7**
**Subsurface Soil Sampling Summary - AST Area**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| SAMPLE ID | | SBAST-7 | SBAST-7 | SBAST-10 | SBAST-11 | SBAST-11 |
|---|---|---|---|---|---|---|
| SAMPLE DATE | | 18-Sep-97 | 18-Sep-97 | 08-Dec-97 | 08-Dec-97 | 08-Dec-97 |
| SAMPLE INTERVAL (ft bgs) | | 20-22 | 22-24 | 18-20 | 28-30 | 30-32 |
| ANALYTE | SSL - MGW (DAF=20) | | | | | |
| *Volatile Organics (in ug/kg)* | | | | | | |
| Acetone | 16,000 | 87 U | 600 U | 11 U | 12 U | 12 U |
| Methylene Chloride | 20 | 21 U | 16 U | 14 U | 12 U | 23 U |
| Toluene | 12,000 | 13 U | 12 U | 11 U | 2 J | 12 U |
| Ethylbenzene | 13,000 | 13 U | 12 U | 11 U | 12 U | 12 U |
| Xylenes (total) | 190,000 (1) | 13 U | 12 U | 1 J | 12 U | 12 U |
| Benzene | 30 | 13 U | 12 U | 11 U | 12 U | 12 U |
| Tetrachloroethene | 60 | 13 U | 12 U | 11 U | 12 U | 12 U |
| Trichloroethene | 60 | 13 U | 12 U | 11 U | 12 U | 12 U |
| 1,1-Dichloroethene | 60 | 13 U | 12 U | 11 U | 12 U | 12 U |
| 4-Methyl-2-pentanone | NE | 13 U | 12 U | 11 U | 12 U | 12 U |
| 2-Butanone | NE | 13 U | 12 U | 11 U | 12 U | 12 U |
| 2-Hexanone | NE | 13 U | 12 U | 11 U | 12 U | 12 U |
| Chloroform | 600 | 13 U | 12 U | 11 U | 12 U | 12 U |
| *Semivolatile Organics (in ug/kg)* | | | | | | |
| Bis(2-Ethylhexyl)phthalate | 36,000,000 | 420 U | 400 U | NA | NA | NA |
| Phenol | 100,000 | 420 U | 400 U | NA | NA | NA |
| 2-Methylnapthalene | NE | 420 U | 400 U | NA | NA | NA |
| Fluorene | 560,000 | 420 U | 400 U | NA | NA | NA |
| Phenanthrene | NE | 420 U | 400 U | NA | NA | NA |
| *Metals (in mg/kg)* | | | | | | |
| Aluminum | NE | 9180 | 8850 | NA | NA | NA |
| Antimony | 5 | 0.51 UN | 0.49 U | NA | NA | NA |
| Arsenic | 29 | 0.45 BJ | 1.6 BJ | NA | NA | NA |
| Barium | 1,600 | 77 | 95 | NA | NA | NA |
| Beryllium | 63 | 0.03 U | 0.02 U | NA | NA | NA |
| Cadmium | 8 | 0.08 B | 0.12 B | NA | NA | NA |
| Calcium | NE | 32600 * | 4010 * | NA | NA | NA |
| Chromium | 38 | 13.4 | 15.1 | NA | NA | NA |
| Cobalt | NE | 9.9 B | 11.5 B | NA | NA | NA |
| Copper | NE | 30.1 ER | 31.5 ER | NA | NA | NA |
| Iron | NE | 18400 | 20600 | NA | NA | NA |
| Lead | NE | 2.2 J | 1.7 J | NA | NA | NA |
| Magnesium | NE | 4800 | 4110 | NA | NA | NA |
| Manganese | NE | 482 NJ | 718 NJ | NA | NA | NA |
| Mercury | NE | 0.12 U | 0.12 U | NA | NA | NA |
| Nickel | 130 | 6.9 B | 7 B | NA | NA | NA |
| Potassium | NE | 894 BE | 794 BE | NA | NA | NA |
| Selenium | 5 | 0.63 U* | 0.61 U* | NA | NA | NA |
| Sodium | NE | 705 BE | 759 BE | NA | NA | NA |
| Vanadium | 6,000 | 73.1 | 95.3 | NA | NA | NA |
| Zinc | 12,000 | 27.9 R | 29.9 R | NA | NA | NA |
| Cyanide | 40 | 0.62 UN | 0.61 U | NA | NA | NA |

Bold, italicized print denotes concentration above SSL.

SSL - Soil Screening Level
MGW - Migration to Groundwater
DAF - Dilution Attenuation Factor
NE - None established
NA - Not Analyzed
ft bgs - feet below ground surface
(1) No Soil Screening Level (SSL) has been established for total xylenes, so the most conservative value (o-xylene at 190,000) has been used for screening purposes
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
R - QC indicates that data is unusable. Analyte may or may not be present.
B (inorganics) - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
* - Duplicate analysis not within control limits.
E (inorganics) - Estimated due to the presence of interference.
N - Spike recovery not within control limits.
D - Analyte quantitated at a dilution
Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.

**Table 4-7**
**Subsurface Soil Sampling Summary - AST Area**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| SAMPLE ID | | SBAST-12 | SBAST-12 | SBAST-12 | SBAST-13 | SBAST-13 |
|---|---|---|---|---|---|---|
| SAMPLE DATE | | 09-Dec-97 | 09-Dec-97 | 09-Dec-97 | 08-Dec-97 | 08-Dec-97 |
| SAMPLE INTERVAL (ft bgs) | | 18-20 | 22-24 | Duplicate | 18-20 | 24-26 |
| ANALYTE | SSL - MGW (DAF=20) | | | | | |
| *Volatile Organics (in ug/kg)* | | | | | | |
| Acetone | 16,000 | 180 U | 30 U | 30 U | 160 U | 30 U |
| Methylene Chloride | 20 | 16 U | 26 U | 19 U | 55 U | 19 U |
| Toluene | 12,000 | 12 U | 12 U | 12 U | 11 J | 6 J |
| Ethylbenzene | 13,000 | 12 U | 12 U | 12 U | 7 J | 12 U |
| Xylenes (total) | 190,000 (1) | 12 U | 12 U | 12 U | 11 J | 12 U |
| Benzene | 30 | 12 U | 12 U | 12 U | 55 U | 12 U |
| Tetrachloroethene | 60 | 12 U | 12 U | 12 U | 55 U | 12 U |
| Trichloroethene | 60 | 12 U | 12 U | 12 U | 55 U | 12 U |
| 1,1-Dichloroethene | 60 | 12 U | 12 U | 12 U | 55 U | 12 U |
| 4-Methyl-2-pentanone | NE | 12 U | 12 U | 12 U | 55 U | 12 U |
| 2-Butanone | NE | 12 U | 12 U | 12 U | 55 U | 12 U |
| 2-Hexanone | NE | 12 U | 12 U | 12 U | 55 U | 12 U |
| Chloroform | 600 | 12 U | 12 U | 12 U | 55 U | 12 U |
| *Semivolatile Organics (in ug/kg)* | | | | | | |
| Bis(2-Ethylhexyl)phthalate | 36,000,000 | NA | NA | NA | NA | NA |
| Phenol | 100,000 | NA | NA | NA | NA | NA |
| 2-Methylnapthalene | NE | NA | NA | NA | NA | NA |
| Fluorene | 560,000 | NA | NA | NA | NA | NA |
| Phenanthrene | NE | NA | NA | NA | NA | NA |
| *Metals (in mg/kg)* | | | | | | |
| Aluminum | NE | NA | NA | NA | NA | NA |
| Antimony | 5 | NA | NA | NA | NA | NA |
| Arsenic | 29 | NA | NA | NA | NA | NA |
| Barium | 1,600 | NA | NA | NA | NA | NA |
| Beryllium | 63 | NA | NA | NA | NA | NA |
| Cadmium | 8 | NA | NA | NA | NA | NA |
| Calcium | NE | NA | NA | NA | NA | NA |
| Chromium | 38 | NA | NA | NA | NA | NA |
| Cobalt | NE | NA | NA | NA | NA | NA |
| Copper | NE | NA | NA | NA | NA | NA |
| Iron | NE | NA | NA | NA | NA | NA |
| Lead | NE | NA | NA | NA | NA | NA |
| Magnesium | NE | NA | NA | NA | NA | NA |
| Manganese | NE | NA | NA | NA | NA | NA |
| Mercury | NE | NA | NA | NA | NA | NA |
| Nickel | 130 | NA | NA | NA | NA | NA |
| Potassium | NE | NA | NA | NA | NA | NA |
| Selenium | 5 | NA | NA | NA | NA | NA |
| Sodium | NE | NA | NA | NA | NA | NA |
| Vanadium | 6,000 | NA | NA | NA | NA | NA |
| Zinc | 12,000 | NA | NA | NA | NA | NA |
| Cyanide | 40 | NA | NA | NA | NA | NA |

Bold, italicized print denotes concentration above SSL.

SSL - Soil Screening Level
MGW - Migration to Groundwater
DAF - Dilution Attenuation Factor
NE - None established
NA - Not Analyzed
ft bgs - feet below ground surface
(1) No Soil Screening Level (SSL) has been established for total xylenes, so the most conservative value (o-xylene at 190,000) has been used for screening purposes
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
D - Analyte quantitated at a dilution
Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.

## Table 4-8
## Geochemical/Geotechnical and Biological Parameters - AST and Former Process Pit Areas
## Virgin Island Chemical Site, St. Croix, U.S. Virgin Isnalds

| | | AST Area | | | | Process Pit Area |
|---|---|---|---|---|---|---|
| **SAMPLE ID** | | SBAST-8 | SBAST-8 | SBAST-9 | SBAST-9 | SBPP-13 |
| **SAMPLE DATE** | | 24-Sep-97 | 24-Sep-97 | 24-Sep-97 | 24-Sep-97 | 31-Mar-98 |
| **SAMPLE INTERVAL (ft bgs)** | | 6-8 | 8-10 | 8-10 | 10-12 | 22-24 |
| **ANALYTE** | **Units** | | | | | |
| *Geochemical/Geotechnical Parameters* | | | | | | |
| Grain Size: Gravel | % | 11 | NM | 13 | NM | NM |
| Sand | % | 40 | NM | 32 | NM | NM |
| Silt or Clay | % | 49 | NM | 45 | NM | NM |
| Moisture Content | % | 17 | 17 | 13 | 17 | NM |
| Total Organic Carbon | mg/kg | 5900 | 1650 | 23000 | 2790 | 355 |
| Porosity | mg/l | 0.38 | NM | 0.32 | NM | NM |
| Atterberg Limits - Liquid Limit | none | 40 | NM | 50 | NM | NM |
| Atterberg Limits - Plastic Limit | none | 17 | NM | 19 | NM | NM |
| Atterberg Limits - Plasticity Index | none | 23 | NM | 31 | NM | NM |
| Hydraulic Conductivity | cm/s | $6.1x10^{-8}$ | NM | $2.9x10^{-7}$ | NM | NM |
| *Biological Parameters* | | | | | | |
| Total Populations (mean) | cfu/gm (DSW) | NM | 1800 | NM | 31000 | NM |
| Degrader Populations (mean) | cfu/gm (DSW) | NM | 200 | NM | 10000 | NM |
| Alkalinity (total) | mg/kg | NM | 1350 | NM | 998 | NM |
| Iron | mg/kg | NM | 20500 | NM | 14800 | NM |
| Ammonia | mg/kg | NM | ND | NM | ND | NM |
| Nitrite | mg/kg | NM | ND | NM | ND | NM |
| Nitrate | mg/kg | NM | ND | NM | ND | NM |
| Ortho phosphate | mg/kg | NM | 133 | NM | 97.8 | NM |
| Sulfate | mg/kg | NM | ND | NM | ND | NM |
| Sulfide | mg/kg | NM | ND | NM | ND | NM |

ft bgs - feet below ground surface
NM - Not Measured
ND - Not Detected
cfu/gm (DSW) = colony forming units per gram of dry soil weight

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**Table 4-9**
**Subsurface Soil Sampling Summary - Former Process Pit Area**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| SAMPLE ID | | SBC-1 | SBC-1 | SBC-1 |
|---|---|---|---|---|
| SAMPLE DATE | | 27-Jan-95 | 27-Jan-95 | 27-Jan-95 |
| SAMPLE INTERVAL (ft bgs) | | 16-18 | 18-20 | 20-22 |
| ANALYTE | SSL - MGW (DAF=20) | | | |
| *Volatile Organics (in ug/kg)* | | | | |
| Toluene | 12,000 | 10 J | 9 J | 15 |
| Xylenes (total) | 190,000 (1) | 11 U | 12 U | 2 J |
| *Semivolatile Organics (in ug/kg)* | | | | |
| Bis(2-ethylhexyl)phthalate | 3,600,000 | 54 J | 97 J | 55 J |
| *Metals (in mg/kg)* | | | | |
| Aluminum | NE | 12900 *J | 12400 *J | 20600 *J |
| Barium | 1,600 | 98.3 | 128 | 101 |
| Beryllium | 63 | 0.02 | 0.15 B | 0.5 |
| Cadmium | 8 | 1.5 N*J | 1.6 N*J | 2.1 N*J |
| Calcium | NE | 7490 | 6680 | 133000 |
| Chromium | 38 | 8.8 *J | 11.1 *J | 30.1 *J |
| Cobalt | NE | 11 B | 12.1 B | 12.5 |
| Copper | NE | 27.9 N*J | 35.1 N*J | 38.4 N*J |
| Iron | NE | 19700 *J | 21800 *J | 22400 *J |
| Lead | NE | 0.12 N*UJ | 0.66 MN*UJ | 4.5 NS*J |
| Magnesium | NE | 4730 | 4790 | 9290 |
| Manganese | NE | 672 | 902 | 604 |
| Mercury | 2 | 0.14 | 0.14 | 0.28 |
| Nickel | 130 | 10.4 *J | 12.9 *J | 21.8 *J |
| Potassium | NE | 729 B | 597 B | 3370 |
| Sodium | NE | 1210 | 1050 B | 510 B |
| Vanadium | 6,000 | 78.9 NJ | 93.1 NJ | 73.8 NJ |
| Zinc | 12,000 | 35.1 E*J | 37.1 E*J | 61.6 E*J |

Bold, italicized print denotes concentration above SSL.

SSL - Soil Screening Level
MGW - Migration to Groundwater
DAF - Dilution Attenuation Factor
NE - None established
ft bgs - feet below ground surface
(1) No Soil Screening Level (SSL) has been established for total xylenes, so the most conservative value (o-xylene at 190,000) has been used for screening purposes
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
S - Determined by Method of Standard Additions.
B (inorganics) - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
* - Duplicate analysis not within control limits.
E - Estimated due to the presence of interference.
N - Spike recovery not within control limits.
M - Duplicate injection precision not met.
- - Not Applicable
Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.

**Table 4-9**
**Subsurface Soil Sampling Summary - Former Process Pit Area**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| SAMPLE ID | | SBPP-1 | SBPP-1 | SBPP-2 | SBPP-2 |
|---|---|---|---|---|---|
| SAMPLE DATE | | 03-Dec-97 | 03-Dec-97 | 03-Dec-97 | 03-Dec-97 |
| SAMPLE INTERVAL (ft bgs) | | 11-13 | 25-27 | 10-12 | 23-25 |
| ANALYTE | SSL - MGW (DAF=20) | | | | |
| *Volatile Organics (in ug/kg)* | | | | | |
| Acetone | 19,000 | 4700 EJ | 120 UJ | 110 UJ | 12 U |
| Ethylbenzene | 13,000 | 12 UJ | 12 UJ | 12 UJ | 12 U |
| Methylene Chloride | 20 | 19 UJ | 19 UJ | 22 UJ | 22 U |
| Toluene | 12,000 | 12 UJ | 12 UJ | 12 UJ | 12 U |
| Xylenes (total) | 190,000 (1) | 2 J | 2 J | 12 UJ | 2 J |
| Chloroform | 600 | 12 UJ | 86 J | 130 J | 12 U |

| SAMPLE ID | | SBPP-3 | SBPP-3 | SBPP-4 | SBPP-4 | SBPP-4 |
|---|---|---|---|---|---|---|
| SAMPLE DATE | | 03-Dec-97 | 03-Dec-97 | 03-Dec-97 | 03-Dec-97 | 03-Dec-97 |
| SAMPLE INTERVAL (ft bgs) | | 8-10 | 24-26 | 8-10 | 21-23 | Duplicate |
| ANALYTE | SSL - MGW (DAF=20) | | | | | |
| *Volatile Organics (in ug/kg)* | | | | | | |
| Acetone | 19,000 | 12 UJ | 12 UJ | 62 UJ | 12 UJ | 13 UJ |
| Ethylbenzene | 13,000 | 12 UJ | 12 UJ | 12 UJ | 12 UJ | 13 UJ |
| Methylene Chloride | 20 | 42 U | 37 UJ | 32 UJ | 27 UJ | 41 UJ |
| Toluene | 12,000 | 12 UJ | 12 UJ | 12 UJ | 12 UJ | 13 UJ |
| Xylenes (total) | 190,000 (1) | 2 J | 1 J | 1 J | 12 U | 2 J |
| Chloroform | 600 | 11 J | 12 UJ | 12 UJ | 11 J | 13 UJ |

| SAMPLE ID | | SBPP-5 | SBPP-5 | SBPP-5 | SBPP-6 |
|---|---|---|---|---|---|
| SAMPLE DATE | | 10-Dec-97 | 10-Dec-97 | 10-Dec-97 | 10-Dec-97 |
| SAMPLE INTERVAL (ft bgs) | | 18-20 | 22-24 | Duplicate | 28-30 |
| ANALYTE | SSL - MGW (DAF=20) | | | | |
| *Volatile Organics (in ug/kg)* | | | | | |
| Acetone | 19,000 | 12 U | 12 U | 13 U | 12 U |
| Ethylbenzene | 13,000 | 12 U | 12 U | 13 U | 12 U |
| Methylene Chloride | 20 | 19 U | 16 U | 18 U | 15 U |
| Toluene | 12,000 | 12 U | 12 U | 13 U | 12 U |
| Xylenes (total) | 190,000 (1) | 12 U | 12 U | 2 J | 12 U |
| Chloroform | 600 | 12 U | 160 | 35 | 12 U |

SSL - Soil Screening Level
MGW - Migration to Groundwater
DAF - Dilution Attenuation Factor
NE - None established
NA - Not Analyzed
ft bgs - feet below ground surface
(1) No Soil Screening Level (SSL) has been established for total xylenes, so the most conservative value (o-xylene at 190,000) has been used for screening purposes
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
E - Exceeds calibration range of instrument.
Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.

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## Table 4-10
## Geoprobe Subsurface Soil Sampling Summary - Former Process Pit Area
## Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands

| SAMPLE ID | | SBPP-7 | SBPP-7 | SBPP-7 | SBPP-7 | SBPP-7 | SBPP-7 | SBPP-8 | SBPP-8 | SBPP-8 | SBPP-8 | SBPP-8 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 27-Mar-98 | 27-Mar-98 | 27-Mar-98 | 27-Mar-98 | 27-Mar-98 | 27-Mar-98 | 27-Mar-98 | 27-Mar-98 | 27-Mar-98 | 27-Mar-98 | 27-Mar-98 |
| SAMPLE INTERVAL (ft bgs) | | 4-6 | 12-14 | 15-17 | 20-22 | 22-24 | 24-26 | 4-6 | 10-12 | 16-18 | 20-22 | 22-24 |
| ANALYTE | SSL - MGW (DAF=20) | | | | | | | | | | | |
| Acetone | 16,000 | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U | 1250 U | 1250 U | 1250 U | 1250 U | 1250 U |
| Ethylbenzene | 13,000 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| Methylene Chloride | 20 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| Toluene | 12,000 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| m&p-Xylene | 200,000 (1) | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U |
| o-Xylene | 190,000 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| Chloroform | 600 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |

| SAMPLE ID | | SBPP-9 | SBPP-9 | SBPP-9 | SBPP-9 | SBPP-9 |
|---|---|---|---|---|---|---|
| SAMPLE DATE | | 30-Mar-98 | 30-Mar-98 | 30-Mar-98 | 30-Mar-98 | 30-Mar-98 |
| SAMPLE INTERVAL (ft bgs) | | 4-6 | 10-12 | 16-18 | 20-22 | 22-24 |
| ANALYTE | SSL - MGW (DAF=20) | | | | | |
| Acetone | 16,000 | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U |
| Ethylbenzene | 13,000 | 500 U | 500 U | 500 U | 500 U | 500 U |
| Methylene Chloride | 20 | 500 U | 500 U | 500 U | 500 U | 500 U |
| Toluene | 12,000 | 500 U | 500 U | 500 U | 500 U | 500 U |
| m&p-Xylene | 200,000 (1) | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U |
| o-Xylene | 190,000 | 500 U | 500 U | 500 U | 500 U | 500 U |
| Chloroform | 600 | 500 U | 500 U | 500 U | 500 U | 500 U |

| SAMPLE ID | | SBPP-10 | SBPP-10 | SBPP-10 | SBPP-10 | SBPP-10 | SBPP-10 | SBPP-10 | SBPP-10 | SBPP-10 |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 30-Mar-98 | 30-Mar-98 | 30-Mar-98 | 30-Mar-98 | 30-Mar-98 | 30-Mar-98 | 30-Mar-98 | 30-Mar-98 | 30-Mar-98 |
| SAMPLE INTERVAL (ft bgs) | | 4-6 | 10-12 | 16-18 | 20-22 | 22-24 | 24-26 | 26-28 | 28-30 | 30-32 |
| ANALYTE | SSL - MGW (DAF=20) | | | | | | | | | |
| Acetone | 16,000 | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U |
| Ethylbenzene | 13,000 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| Methylene Chloride | 20 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| Toluene | 12,000 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| m&p-Xylene | 200,000 (1) | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U |
| o-Xylene | 190,000 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| Chloroform | 600 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |

Concentrations presented in ug/l

SSL - Soil Screening Level
MGW - Migration to Groundwater
DAF - Dilution Attenuation Factor
ft bgs - feet below ground surface
(1) No Soil Screening Level (SSL) has been established for m&p xylenes, so the most conservative value (p-xylene at 200,000) has been used for screening purposes
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.

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## Table 4-10
## Geoprobe Subsurface Soil Sampling Summary - Former Process Pit Area
## Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands

| SAMPLE ID | | SBPP-13 | SBPP-13 | SBPP-13 | SBPP-13 | SBPP-13 | SBPP-13 | SBPP-13 | SBPP-13 | SBPP-13 | SBPP-15 | SBPP-15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 31-Mar-98 | 31-Mar-98 | 31-Mar-98 | 31-Mar-98 | 31-Mar-98 | 31-Mar-98 | 31-Mar-98 | 31-Mar-98 | 31-Mar-98 | 02-Apr-98 | 02-Apr-98 |
| SAMPLE INTERVAL (ft bgs) | | 4-6 | 10-12 | 16-18 | Duplicate | 20-22 | 22-24 | 24-26 | 26-28 | 28-30 | 5-7 | 10-12 |
| ANALYTE | SSL - MGW (DAF=20) | | | | | | | | | | | |
| Acetone | 16,000 | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U |
| Ethylbenzene | 13,000 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| Methylene Chloride | 20 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| Toluene | 12,000 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| m&p-Xylene | 200,000 (1) | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U |
| o-Xylene | 190,000 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| Chloroform | 600 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |

| SAMPLE ID | | SBPP-22 | SBPP-22 | SBPP-22 | SBPP-22 | SBPP-22 |
|---|---|---|---|---|---|---|
| SAMPLE DATE | | 03-Apr-98 | 03-Apr-98 | 03-Apr-98 | 03-Apr-98 | 03-Apr-98 |
| SAMPLE INTERVAL (ft bgs) | | 1-3 | 5-7 | 7.5-9.5 | 10-12 | 12-14 |
| ANALYTE | SSL - MGW (DAF=20) | | | | | |
| Acetone | 16,000 | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U |
| Ethylbenzene | 13,000 | 500 U | 500 U | 500 U | 500 U | 500 U |
| Methylene Chloride | 20 | 500 U | 500 U | 500 U | 500 U | 500 U |
| Toluene | 12,000 | 500 U | 500 U | 500 U | 500 U | 500 U |
| m&p-Xylene | 200,000 (1) | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U |
| o-Xylene | 190,000 | 500 U | 500 U | 500 U | 500 U | 500 U |
| Chloroform | 600 | 500 U | 500 U | 500 U | 500 U | 500 U |

| SAMPLE ID | | SBPP-23 | SBPP-23 | SBPP-23 | SBPP-23 | SBPP-23 | SBPP-23 | SBPP-23 | SBPP-23 | SBPP-23 |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 04-Apr-98 | 04-Apr-98 | 04-Apr-98 | 04-Apr-98 | 04-Apr-98 | 04-Apr-98 | 04-Apr-98 | 04-Apr-98 | 04-Apr-98 |
| SAMPLE INTERVAL (ft bgs) | | 6-8 | 8-10 | 10-12 | 16-18 | 20-22 | 22-24 | 24-26 | 26-28 | 28-30 |
| ANALYTE | SSL - MGW (DAF=20) | | | | | | | | | |
| Acetone | 16,000 | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U |
| Ethylbenzene | 13,000 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| Methylene Chloride | 20 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| Toluene | 12,000 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| m&p-Xylene | 200,000 (1) | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U |
| o-Xylene | 190,000 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| Chloroform | 600 | 500 U | 500 U | 500 U | 500 U | 220 J | 410 J | 330 J | 500 U | 500 U |

Concentrations presented in ug/l

SSL - Soil Screening Level
MGW - Migration to Groundwater
DAF - Dilution Attenuation Factor
ft bgs - feet below ground surface
(1) No Soil Screening Level (SSL) has been established for m&p xylenes, so the most conservative value (p-xylene at 200,000) has been used for screening purposes
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.



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## Table 4-10
## Geoprobe Subsurface Soil Sampling Summary - Former Process Pit Area
## Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands

| SAMPLE ID | | SBPP-26 | SBPP-26 | SBPP-26 | SBPP-26 | SBPP-27 | SBPP-27 | SBPP-27 | SBPP-27 |
|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 05-Apr-98 | 05-Apr-98 | 05-Apr-98 | 05-Apr-98 | 05-Apr-98 | 05-Apr-98 | 05-Apr-98 | 05-Apr-98 |
| SAMPLE INTERVAL (ft bgs) | | 6-8 | 8 (saturated) | 8-10 | 10-12 | 4-6 | 10-12 | 16-18 | 22-24 |
| ANALYTE | SSL - MGW (DAF=20) | | | | | | | | |
| Acetone | 16,000 | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U |
| Ethylbenzene | 13,000 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| Methylene Chloride | 20 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| Toluene | 12,000 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| m&p-Xylene | 200,000 (1) | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U |
| o-Xylene | 190,000 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| Chloroform | 600 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 180 J | 500 U |

| SAMPLE ID | | SBPP-32 | SBPP-32 | SBPP-32 | SBPP-32 | SBPP-32 | SBPP-32 |
|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 07-Apr-98 | 07-Apr-98 | 07-Apr-98 | 07-Apr-98 | 07-Apr-98 | 07-Apr-98 |
| SAMPLE INTERVAL (ft bgs) | | 4-6 | 10-12 | 16-18 | 24-26 | 26 (saturated) | 27-28 |
| ANALYTE | SSL - MGW (DAF=20) | | | | | | |
| Acetone | 16,000 | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U |
| Ethylbenzene | 13,000 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| Methylene Chloride | 20 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| Toluene | 12,000 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| m&p-Xylene | 200,000 (1) | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U |
| o-Xylene | 190,000 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| Chloroform | 600 | 500 U | 500 U | 500 U | 150 J | 500 U | 500 U |

| SAMPLE ID | | SBOR-1 | SBOR-1 | SBOR-1 | SBOR-1 | SBOR-1 | SBOR-1 | SBOR-1 | SBOR-1 |
|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 01-Apr-98 | 01-Apr-98 | 01-Apr-98 | 01-Apr-98 | 01-Apr-98 | 01-Apr-98 | 01-Apr-98 | 01-Apr-98 |
| SAMPLE INTERVAL (ft bgs) | | 2-4 | 4-6 | 10-12 | 14-16 | 20-22 | 22-24 | 24-26 | 26-28 |
| ANALYTE | SSL - MGW (DAF=20) | | | | | | | | |
| Acetone | 16,000 | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U | 1200 U |
| Ethylbenzene | 13,000 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| Methylene Chloride | 20 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| Toluene | 12,000 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| m&p-Xylene | 200,000 (1) | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U | 1000 U |
| o-Xylene | 190,000 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |
| Chloroform | 600 | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U | 500 U |

Concentrations presented in ug/l

SSL - Soil Screening Level
MGW - Migration to Groundwater
DAF - Dilution Attenuation Factor
ft bgs - feet below ground surface
(1) No Soil Screening Level (SSL) has been established for m&p xylenes, so the most conservative value (p-xylene at 200,000) has been used for screening purposes
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.



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## Table 4-11
## Subsurface Soil Sampling Summary - Former Laboratory Pit Area
## Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands

| SAMPLE ID | | SBD-1 | SBD-1 | SBD-2 | SBD-3 | SBF-1 | SBF-1 |
|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 25-Jan-95 | 25-Jan-95 | 19-Jan-95 | 20-Jan-95 | 03-Feb-95 | 03-Feb-95 |
| SAMPLE INTERVAL (ft bgs) | | 12-14 | 22-24 | 19-21 | 17-19 | 13-15 | 20-22 |
| ANALYTE | SSL - MGW (DAF=20) | | | | | | |
| *Volatile Organics (in ug/kg)* | | | | | | | |
| Acetone | 16,000 | 36 BJ | 24 UJ | 39 UJ | 19 UJ | NA | NA |
| Xylenes (total) | 190,000 (1) | 12 U | 11 U | 11 UJ | 11 U | NA | NA |
| Carbon Disulfide | 32,000 | 12 U | 11 U | 2 J | 11 U | NA | NA |
| *Semivolatile Organics (in ug/kg)* | | | | | | | |
| Bis(2-ethylhexyl)phthalate | 3,600,000 | 52 J | 36 J | 64 J | 370 U | NA | NA |
| Di-n-butylphthalate | 2,300,000 | 400 U | 380 U | 33 J | 370 U | NA | NA |
| *Metals (in mg/kg)* | | | | | | | |
| Aluminum | NE | 13400 * | 16300 * | 10700 * | 9350 * | 19200 | 21700 |
| Antimony | 5 | 0.46 BW | 0.45 BJW | 0.48 BJW | 0.32 UWJ | 0.31 NR | 0.34 NR |
| Arsenic | 29 | 0.8 U | 0.33 U | 0.66 U | 0.4 U | 1.5 BJ | 1.2 BJ |
| Barium | 1,600 | 187 | 121 | 131 | 140 | 110 | 122 |
| Beryllium | 63 | 0.34 | 0.24 | 0.26 | 0.3 | 0.31 | 0.46 |
| Cadmium | 8 | 3.5 * | 3.4 * | 2.6 * | 1.6 * | 1.4 | 2 |
| Calcium | NE | 14700 * | 5820 * | 5700 * | 4640 * | 9900 * | 7950 * |
| Chromium | 38 | 25.4 * | 19.9 * | 19.9 * | 18 * | 15.9 *J | 31.4 *J |
| Cobalt | NE | 23 | 15.2 | 16 | 12.2 | 11.1 | 21.4 |
| Copper | NE | 50.4 | 50.4 | 47.7 | 39.7 | 39.9 | 61.7 |
| Iron | NE | 32700 * | 33200 * | 27400 * | 25000 * | 24600 | 38500 |
| Lead | NE | 4.7 | 2.9 | 4 | 3.9 | 2.7 | 5 |
| Magnesium | NE | 7320 * | 6700 * | 5480 * | 4340 * | 5780 | 10300 |
| Manganese | NE | 2070 | 940 | 755 | 1020 | 542 | 1120 |
| Mercury | 2 | 0.14 | 0.11 U | 0.13 | 0.14 | 0.11 U | 0.25 |
| Nickel | 130 | 20.9 | 22.6 | 16.7 | 14.7 | 15.8 | 21.3 |
| Potassium | NE | 1250 | 1000 B | 985 B | 602 B | 1230 | 1120 B |
| Sodium | NE | 1200 B | 1120 B | 780 B | 610 B | 1360 | 1790 |
| Thallium | 40 | 0.65 U | 0.62 U | 0.61 U | 0.62 U | 0.59 U | 0.65 U |
| Vanadium | 6,000 | 194 * | 157 * | 141 * | 137 * | 105 | 138 |
| Zinc | 12,000 | 50.3 | 59.3 | 50.5 | 56.7 | 42.1 EJ | 70.7 EJ |

Bold, italicized print denotes concentration above SSL.

SSL - Soil Screening Level
MGW - Migration to Groundwater
DAF - Dilution Attenuation Factor
NE - None established
NA - Not Analyzed
ft bgs - feet below ground surface
(1) No Soil Screening Level (SSL) has been established for total xylenes, so the most conservative value (o-xylene at 190,000) has been used for screening purposes
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
R - QC indicates that data is unusable. Analyte may or may not be present.
B (organics) - Analyte detected in associated laboratory blank.
B (inorganics) - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
* - Duplicate analysis not within control limits.
E - Estimated due to the presence of interference.
N - Spike recovery not within control limits.
W - GFAA post-digest spike out of control limits.
- - Not Applicable
Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.

3034499

## Table 4-11
## Subsurface Soil Sampling Summary - Former Laboratory Pit Area
## Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands

| SAMPLE ID | | SBF-2 | SBF-2 | SBF-3 | SBF-3 | SBLP-1 | SBLP-1 | SBLP-2 | SBLP-2 |
|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 24-Jan-95 | 24-Jan-95 | 24-Jan-95 | 24-Jan-95 | 09-Dec-97 | 09-Dec-97 | 09-Dec-97 | 09-Dec-97 |
| SAMPLE INTERVAL (ft bgs) | | 12-15 | 18-20 | 12-15 | 18-20 | 8-10 | 15-17 | 8-10 | 13-15 |
| ANALYTE | SSL - MGW (DAF=20) | | | | | | | | |
| *Volatile Organics (in ug/kg)* | | | | | | | | | |
| Acetone | 16,000 | 26 UJ | 29 UJ | 96 BJ | 38 UJ | NA | NA | NA | NA |
| Xylenes (total) | 190,000 (1) | 11 U | 12 U | 12 U | 11 U | 3 J | 3 J | 3 J | 2 J |
| Carbon Disulfide | 32,000 | 11 U | 12 U | 2 J | 11 U | 12 U | 12 U | 12 U | 12 U |
| *Semivolatile Organics (in ug/kg)* | | | | | | | | | |
| Bis(2-ethylhexyl)phthalate | 3,600,000 | 58 | 98 J | 65 J | 32 J | NA | NA | NA | NA |
| Di-n-butylphthalate | 2,300,000 | 350 U | 380 U | 370 U | 370 U | NA | NA | NA | NA |
| *Metals (in mg/kg)* | | | | | | | | | |
| Aluminum | NE | 15500 *J | 18600 *J | 18800 *J | 14700 *J | NA | NA | NA | NA |
| Antimony | 5 | 0.3 NR | 0.33 NR | 0.31 NR | 0.31 NR | NA | NA | NA | NA |
| Arsenic | 29 | 1.7 NR | 0.26 NR | 1.2 NR | 0.25 NR | NA | NA | NA | NA |
| Barium | 1,600 | 153 | 95.9 | 177 | 56.3 | NA | NA | NA | NA |
| Beryllium | 63 | 0.36 | 0.36 | 0.36 | 0.05 U | NA | NA | NA | NA |
| Cadmium | 8 | 2.6 N*J | 3.5 N*J | 3 N*J | 2.9 N*J | NA | NA | NA | NA |
| Calcium | NE | 9870 | 6480 | 25000 | 9520 | NA | NA | NA | NA |
| Chromium | 38 | 18.7 *J | 28.3 *J | 19.6 *J | 25.3 *J | NA | NA | NA | NA |
| Cobalt | NE | 16 | 17.5 | 17.8 | 12.3 | NA | NA | NA | NA |
| Copper | NE | 52.2 N*J | 57.3 N*J | 56.1 N*J | 42 N*J | NA | NA | NA | NA |
| Iron | NE | 29500 *J | 39500 *J | 33900 *J | 31900 *J | NA | NA | NA | NA |
| Lead | NE | 3.3 N*J | 1.2 NW*UJ | 3.2 N*J | 0.29 NW*UJ | NA | NA | NA | NA |
| Magnesium | NE | 6200 | 7570 | 7870 | 6520 | NA | NA | NA | NA |
| Manganese | NE | 915 | 646 | 1240 | 385 | NA | NA | NA | NA |
| Mercury | NE | 0.13 | 0.14 | 0.11 U | 0.11 U | NA | NA | NA | NA |
| Nickel | 130 | 15.4 *J | 19.2 *J | 17.3 *J | 13.6 *J | NA | NA | NA | NA |
| Potassium | NE | 1090 | 1050 B | 1380 | 855 B | NA | NA | NA | NA |
| Sodium | NE | 1140 | 1290 | 1450 | 731 B | NA | NA | NA | NA |
| Thallium | 40 | 0.58 U | 0.63 | 0.61 U | 0.6 U | NA | NA | NA | NA |
| Vanadium | 6,000 | 144 NJ | 171 NJ | 172 NJ | 151 NJ | NA | NA | NA | NA |
| Zinc | 12,000 | 48.5 E*J | 58.5 E*J | 60.5 E*J | 54.6 E*J | NA | NA | NA | NA |

Bold, italicized print denotes concentration above SSL.

SSL - Soil Screening Level
MGW - Migration to Groundwater
DAF - Dilution Attenuation Factor
NE - None established
NA - Not Analyzed
ft bgs - feet below ground surface
(1) No Soil Screening Level (SSL) has been established for total xylenes, so the most conservative value (o-xylene at 190,000) has been used for screening purposes
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
R - QC indicates that data is unusable. Analyte may or may not be present.
B (organics) - Analyte detected in associated laboratory blank.
B (inorganics) - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
* - Duplicate analysis not within control limits.
E - Estimated due to the presence of interference.
N - Spike recovery not within control limits.
W - GFAA post-digest spike out of control limits.
- - Not Applicable
Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.

303500

## Table 4-12
## Subsurface Soil Sampling Summary - Former Drum Areas
## Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands

| SAMPLE ID | | SBC-2 | SBC-2 | SBD-4 | SBD-4 | SB8D-1 | SB8D-1 |
|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 31-Jan-95 | 31-Jan-95 | 27-Jan-95 | 27-Jan-95 | 13-Jun-97 | 13-Jun-97 |
| SAMPLE INTERVAL (ft bgs) | | 20-22 | 24-26 | 14-16 | 20-22 | 14-16 | 18-20 |
| ANALYTE | SSL - MGW DAF=20 | | | | | | |
| *Volatile Organics (in ug/kg)* | | | | | | | |
| Acetone | 16,000 | 39 UJ | 50 UJ | 16 UJ | 23 UJ | 12 U | 25 J |
| Ethylbenzene | 13,000 | 12 U | 12 U | 12 U | 12 U | 12 U | 12 U |
| Tetracholoroethene | 60 | 12 U | 12 U | 12 U | 12 U | 12 U | 12 U |
| Trichloroethene | 60 | 12 U | 12 U | 12 U | 12 U | 12 U | 12 U |
| Toluene | 12,000 | 9 J | 15 | 13 | 9 J | 12 U | 12 U |
| Xylenes (total) | 190,000 (1) | 2 J | 3 J | 2 J | 12 U | 12 U | 12 U |
| *Semivolatile Organics (in ug/kg)* | | | | | | | |
| Bis(2-ethylhexyl)phthalate | 3,600,000 | 48 J | 54 J | 47 J | 120 J | 390 U | 410 U |
| Butylbenzylphthalate | 930,000 | 390 U | 380 U | 380 U | 390 U | 390 U | 410 U |
| Di-n-butylphthalate | 2,300,000 | 47 J | 36 J | 380 U | 34 J | 390 U | 410 U |
| *Metals (in mg/kg)* | | | | | | | |
| Aluminum | NE | 11700 * | 9980 * | 18000 J | 13000 *J | 9610 | 7720 |
| Arsenic | 29 | 0.34 U | 0.91 U | 1.6 NR | 0.26 NWR | 0.31 UN | 0.32 UN |
| Barium | 1600 | 106 | 67.8 | 44.1 B | 105 | 122 * | 37.1 B* |
| Beryllium | 63 | 0.33 | 0.36 | 0.37 | 0.24 | 0.02 UN | 0.02 UN |
| Cadmium | 8 | 1.9 * | 2 * | 3.1 N*J | 2.2 N*J | 0.54 BJ* | 0.71 BJ* |
| Calcium | NE | 12100 * | 5680 * | 6450 | 6350 | 12500 * | 4030 * |
| Chromium | 38 | 18.8 * | 18.6 * | 24.1 *J | 18.9 *J | 14.3 | 28.6 |
| Cobalt | NE | 15.2 | 12.6 | 8.1 B | 15.9 | 10.3 BJ | 11.5 BJ |
| Copper | NE | 47.8 | 47.1 | 39.9 N*J | 34.6 N*J | 29.3 J* | 29.4 J* |
| Iron | NE | 20800 * | 24500 * | 31300 *J | 26800 *J | 18400 | 26700 |
| Lead | NE | 3.9 | 3.2 | 2 UN*J | 1.9 N*J | 2.4 NJ* | 2.2 NJ* |
| Magnesium | NE | 6290 * | 5110 * | 7700 | 5140 | 3790 | 3730 |
| Manganese | NE | 291 | 354 | 216 | 1100 | 868 R | 121 R |
| Mercury | 2 | 0.14 | 0.12 U | 0.14 | 0.28 | 0.12 U | 0.12 U |
| Nickel | 130 | 12.5 | 14.1 | 11.6 *J | 17.1 *J | 7.1 BJN | 8.5 BJN |
| Potassium | NE | 1250 | 1040 B | 1190 | 919 B | 848 BE | 820 BE |
| Silver | 34 | 1.2 U | 1.2 U | 1.2 U | 1.2 U | 0.89 BJN | 0.15 UN |
| Sodium | NE | 965 B | 586 B | 1660 | 775 B | 770 BEJ | 398 BEJ |
| Vanadium | 6,000 | 90 * | 131 * | 131 NJ | 126 NJ | 82.2 * | 166 * |
| Zinc | 12,000 | 45.8 | 50.6 | 51.2 E*J | 43.5 E*J | 28.7 R | 34.3 R |

Bold, italicized print denotes concentration above SSL.

SSL - Soil Screening Level
MGW - Migration to Groundwater
DAF - Dilution Attenuation Factor
NE - None established
- - Not Applicable
ft bgs - feet below ground surface
(1) No Soil Screening Level (SSL) has been established for total xylenes, so the most conservative value (o-xylene at 190,000) has been used for screening purposes
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
R - QC indicates that data is unusable. Analyte may or may not be present.
B (inorganics) - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
* - Duplicate analysis not within control limits.
E - Estimated due to the presence of interference.
N - Spike recovery not within control limits.
Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.

303501

**Table 4-12**
**Subsurface Soil Sampling Summary - Former Drum Areas**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| SAMPLE ID | | SB64D-1 | SB64D-1 | SB64D-2 | SB64D-2 |
|---|---|---|---|---|---|
| SAMPLE DATE | | 16-Jun-97 | 16-Jun-97 | 16-Jun-97 | 16-Jun-97 |
| SAMPLE INTERVAL (ft bgs) | | 10-12 | 22-24 | 10-12 | 20-22 |
| ANALYTE | SSL - MGW DAF=20 | | | | |
| *Volatile Organics (in ug/kg)* | | | | | |
| Acetone | 16,000 | 20 J | 21 | 28 | 15 J |
| Ethylbenzene | 13,000 | 12 U | 12 U | 5 J | 12 U |
| Tetracholoroethene | 60 | 12 U | 12 U | 2 J | 12 U |
| Trichloroethene | 60 | 12 U | 12 U | 12 U | 12 U |
| Toluene | 12,000 | 12 U | 12 U | 5 BJ | 12 U |
| Xylenes (total) | 190,000 (1) | 12 U | 12 U | 12 U | 12 U |
| *Semivolatile Organics (in ug/kg)* | | | | | |
| Bis(2-ethylhexyl)phthalate | 3,600,000 | 81 J | 390 U | 370 U | 380 U |
| Butylbenzylphthalate | 930,000 | 400 U | 390 U | 370 U | 380 U |
| Di-n-butylphthalate | 2,300,000 | 400 U | 390 U | 370 U | 380 U |
| *Metals (in mg/kg)* | | | | | |
| Aluminum | NE | 9870 | 11100 | 8710 | 9420 |
| Arsenic | 29 | 0.3 UN | 0.31 UN | 0.27 UN | 0.52 BJN |
| Barium | 1600 | 65 * | 88.3 * | 52.8 * | 185 * |
| Beryllium | 63 | 0.02 UN | 0.02 UN | 0.02 UN | 0.02 UN |
| Cadmium | 8 | ***10.1*** * | 0.81 BJ* | 0.59 BJ* | 0.74 BJ* |
| Calcium | NE | 7760 * | 4750 * | 4620 * | 4110 * |
| Chromium | 38 | 14 | 30.3 | 13.2 | 25.2 |
| Cobalt | NE | 22.3 N | 11.4 BJ | 11 J | 13.6 J |
| Copper | NE | 104 * | 36.8 * | 30.3 J* | 39.4 J* |
| Iron | NE | 20000 | 28600 | 20600 | 26900 |
| Lead | NE | 21.3 N* | 2.2 N* | 1.7 NJ* | 2.4 NJ* |
| Magnesium | NE | 3940 | 5340 | 3410 | 4430 |
| Manganese | NE | 638 R | 526 R | 570 R | 557 R |
| Mercury | 2 | 0.12 U | 0.12 U | 0.11 U | 0.12 U |
| Nickel | 130 | 9.7 N | 8.7 BJN | 6.3 BJN | 8.9 JN |
| Potassium | NE | 1130 BE | 1530 EJ | 961 BE | 1430 EJ |
| Silver | 34 | 0.52 BN | 0.14 UN | 0.12 UN | 0.13 UN |
| Sodium | NE | 1270 E | 783 BEJ | 1110 EJ | 572 BE |
| Vanadium | 6,000 | 77.9 * | 138 * | 89.5 * | 138 * |
| Zinc | 12,000 | 7830 EN | 107 R | 90.1 R | 67.7 R |

Bold, italicized print denotes concentration above SSL.

SSL - Soil Screening Level
MGW - Migration to Groundwater
DAF - Dilution Attenuation Factor
NE - None established
- - Not Applicable
ft bgs - feet below ground surface
(1) No Soil Screening Level (SSL) has been established for total xylenes, so the most conservative value (o-xylene at 190,000) has been used for screening purposes
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
R - QC indicates that data is unusable. Analyte may or may not be present.
B (inorganics) - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
* - Duplicate analysis not within control limits.
E - Estimated due to the presence of interference.
N - Spike recovery not within control limits.
Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.

303502

## Table 4-12
## Subsurface Soil Sampling Summary - Former Drum Areas
## Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands

| SAMPLE ID | | SB238D-1 | SB238D-1 | SB238D-2 | SB238D-2 | SB238D-3 | SB238D-3 |
|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 17-Jun-97 | 17-Jun-97 | 17-Jun-97 | 17-Jun-97 | 18-Jun-97 | 18-Jun-97 |
| SAMPLE INTERVAL (ft bgs) | | 4-6 | 24-26 | 10-12 ** | 20-22 | 8-10 *** | 26-28 |
| ANALYTE | SSL - MGW DAF=20 | | | | | | |
| *Volatile Organics (in ug/kg)* | | | | | | | |
| Acetone | 16,000 | 16 R | 23 R | 12 U | 23 R | 10 U | 10 J |
| Ethylbenzene | 13,000 | 12 U | 12 U | 12 U | 12 U | 10 U | 12 U |
| Tetracholoroethene | 60 | 2 J | 12 U | 2 J | 2 J | 2 J | 12 U |
| Trichloroethene | 60 | 1 J | 12 U | 12 U | 12 U | 10 U | 12 U |
| Toluene | 12,000 | 5 U | 12 U | 5 U | 5 U | 5 U | 12 U |
| Xylenes (total) | 190,000 (1) | 2 J | 12 U | 2 J | 12 U | 10 U | 12 U |
| *Semivolatile Organics (in ug/kg)* | | | | | | | |
| Bis(2-ethylhexyl)phthalate | 3,600,000 | 340 U | 380 U | 410 U | 410 U | 680 U | 390 U |
| Butylbenzylphthalate | 930,000 | 340 U | 380 U | 410 U | 410 U | 680 U | 390 U |
| Di-n-butylphthalate | 2,300,000 | 340 U | 380 U | 410 U | 410 U | 680 U | 390 U |
| *Metals (in mg/kg)* | | | | | | | |
| Aluminum | NE | 17400 | 8720 | 14100 | 9730 | 7390 | 8290 |
| Arsenic | 29 | 0.75 BJN | 0.33 BJN | 0.29 UN | 0.31 UN | 0.25 UN | 0.73 BN |
| Barium | 1600 | 60.5 * | 62.8 * | 94.6 * | 54.7 * | 79.6 * | 88.8 * |
| Beryllium | 63 | 0.02 UN | 0.02 UN | 0.02 UN | 0.02 UN | 0.02 UN | 0.02 UN |
| Cadmium | 8 | 0.77 BJ* | 0.62 BJ* | 0.66 BJ* | 0.56 BJ* | 0.47 BJ* | 0.54 BJ* |
| Calcium | NE | 68700 * | 3780 * | 31400 * | 16100 * | 4450 * | 3700 * |
| Chromium | 38 | 14.5 | 21.3 | 19 | 15.4 | 11.5 | 19.4 |
| Cobalt | NE | 11.3 J | 9.8 BJ | 11.8 NJ | 10.8 BJ | 9.4 J | 12 J |
| Copper | NE | 36.3 J* | 37.4 J* | 41.2 J* | 35.4 J* | 29.3 J* | 31.9 J* |
| Iron | NE | 27400 | 24400 | 24100 | 18500 | 18100 | 20900 |
| Lead | NE | 4.7 NJ* | 1.9 NJ* | 2.6 NJ* | 2.7 NJ* | 1.9 NJ* | 2 NJ* |
| Magnesium | NE | 8120 | 4460 | 6380 | 4670 | 4360 | 4360 |
| Manganese | NE | 658 R | 253 R | 403 R | 197 R | 553 R | 376 R |
| Mercury | 2 | 0.1 U | 0.12 U | 0.12 U | 0.12 U | 0.1 U | 0.12 U |
| Nickel | 130 | 9.3 JN | 7.5 BJN | 9 JN | 6.9 BJN | 6.3 BJN | 6.7 BN |
| Potassium | NE | 1290 EJ | 1120 BE | 1630 EJ | 1090 BE | 985 EJ | 865 EJ |
| Silver | 34 | 0.83 BJN | 0.14 UN | 0.25 BJN | 0.14 UN | 0.12 UN | 0.12 UN |
| Sodium | NE | 970 BE | 361 BE | 1460 EJ | 642 BE | 418 BE | 722 BE |
| Vanadium | 6,000 | 57.4 * | 126 * | 83.7 * | 92.9 * | 73.3 * | 99.4 * |
| Zinc | 12,000 | 63.7 R | 43.9 R | 167 R | 429 R | 51.3 R | 32.9 R |

Bold, italicized print denotes concentration above SSL.
** - Sample SB238D-2 was collected at a depth of 16-18 ft bgs for metals.
*** - Sample SB238D-3 was collected at a depth of 8-12 ft bgs for metals.

SSL - Soil Screening Level
MGW - Migration to Groundwater
DAF - Dilution Attenuation Factor
NE - None established
(1) No Soil Screening Level (SSL) has been established for total xylenes, so the most conservative value (o-xylene at 190,000) has been used for screening purposes
- - Not Applicable
ft bgs - feet below ground surface
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
R - QC indicates that data is unusable. Analyte may or may not be present.
B (inorganics) - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
* - Duplicate analysis not within control limits.
E - Estimated due to the presence of interference.
N - Spike recovery not within control limits.
W - GFAA post-digest spike out of control limits.

303503

## Table 4-13
## Subsurface Soil Sampling Summary - Storm Drains
## Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands

| | | Central Storm Drain | | | | | |
|---|---|---|---|---|---|---|---|
| SAMPLE ID | | SBCSD-1 | SBCSD-1 | SBCSD-2 | SBCSD-2 | SBCSD-3 | SBCSD-3 |
| SAMPLE DATE | | 23-Sep-97 | 23-Sep-97 | 23-Sep-97 | 23-Sep-97 | 23-Sep-97 | 23-Sep-97 |
| SAMPLE INTERVAL (ft bgs) | | 16-18 | 22-24 | 18-20 | 20-22 | 10-12 | 18-20 |
| ANALYTE | SSL - MGW DAF=20 | | | | | | |
| *Volatile Organics (in ug/kg)* | | | | | | | |
| Ethylbenzene | 13,000 | 12 U | 12 U | 12 U | 12 U | 11 U | 6 J |
| 2-Butanone | NE | 12 | 12 U | 12 U | 12 U | 12 U | 12 U |
| Toluene | 12,000 | 1 J | 2 J | 2 J | 2 J | 4 J | 26 |
| Xylenes (total) | 190,000 (1) | 12 U | 12 U | 12 U | 12 U | 1 J | 32 |
| *Semivolatile Organics (in ug/kg)* | | | | | | | |
| Diethylphthalate | 470,000 | 1100 | 400 U | 410 U | 410 U | 370 U | 390 U |
| Di-n-octylphthalate | 10,000,000 | 400 U | 400 U | 410 U | 410 U | 50 J | 390 U |
| Bis(2-ethylhexyl)phthalate | 3,600,000 | 400 U | 400 U | 61 J | 55 J | 370 U | 390 U |
| *Metals (in mg/kg)* | | | | | | | |
| Aluminum | NE | 11500 | 8470 U | 10500 | 10400 | 14000 | 7830 |
| Arsenic | 29 | 0.39 BJ | 0.4 BJ | 0.32 U | 0.71 BJ | 0.54 BJ | 0.31 U |
| Barium | 1,600 | 209 | 22.5 B | 85.3 | 111 | 130 | 45 B |
| Cadmium | 8 | 0.13 B | 0.09 B | 0.08 B | 0.1 | 0.2 B | 0.09 B |
| Calcium | NE | 4460 * | 3280 * | 13300 * | 23000 * | 24800 * | 7030 * |
| Chromium | 38 | 18.3 | 17.6 | 13.2 | 13 | 19.4 | 12.6 |
| Cobalt | NE | 12.9 | 7.4 B | 11 B | 12.3 B | 15.8 | 8.9 B |
| Copper | NE | 41.5 EJ | 29 EJ | 39.7 EJ | 36.1 EJ | 58.9 EJ | 45.5 EJ |
| Iron | NE | 23500 | 18300 | 18700 | 19900 | 25500 | 13500 |
| Lead | NE | 2 J | 0.87 J | 2 J | 2.1 J | 3.7 J | 2.7 J |
| Magnesium | NE | 6370 | 3970 | 5340 | 5510 | 6250 | 3400 |
| Manganese | NE | 724 NJ | 139 NJ | 483 NJ | 1050 NJ | 556 NJ | 101 NJ |
| Mercury | 2 | 0.12 U | 0.12 U | 0.15 | 0.14 | 0.1 U | 0.12 U |
| Nickel | 130 | 10.2 | 6.3 B | 7.9 B | 8 B | 12.5 | 6.8 B |
| Potassium | NE | 1550 EJ | 1080 BE | 1380 EJ | 1430 EJ | 2100 EJ | 645 BE |
| Selenium | 5 | 2.2 * | 0.6 U* | 0.62 U* | 1.9 * | 1.6 * | 0.59 U* |
| Sodium | NE | 1750 EJ | 810 BE | 697 BE | 773 BE | 7150 BE | 933 BE |
| Vanadium | 6,000 | 97 | 71.1 | 72 | 75 | 97.5 | 72.4 |
| Zinc | 12,000 | 35.5 *R | 29 *R | 29.8 *R | 28.8 *R | 50.3 *J | 29.7 *R |
| Cyanide | 40 | 0.6 UN | 0.59 UN | 0.59 UN | 0.62 UN | 0.56 UN | 0.58 BN |

SSL - Soil Screening Level
MGW - Migration to Groundwater
DAF - Dilution Attenuation Factor
NE - None established
ft bgs - feet below ground surface
(1) No Soil Screening Level (SSL) has been established for total xylenes, so the most conservative value (o-xylene at 190,000) has been used for screening purposes

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U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
R - QC indicates that data is unusable. Analyte may or may not be present.
B (inorganics) - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
* - Duplicate analysis not within control limits.
E - Estimated due to the presence of interference.
N - Spike recovery not within control limits.
- - Not Applicable

303504

## TABLE 4-14
## MONITORING/PRODUCTION WELL SAMPLING SUMMARY - VOCs
## VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| SAMPLE ID | | MW-1 | MW-1 | MW-1 | MW-1 | MW-1 | MW-1 |
|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 16-Feb-95 | 16-Feb-95 | 09-May-95 | 09-May-95 | 09-Jan-98 | 26-Mar-98 |
| SAMPLE INTERVAL (ft bgs) | | 23-33 | Duplicate | 23-33 | Duplicate | 23-33 | 23-33 |
| ANALYTE | MCL | | | | | | |
| Chloromethane | NE | 40 U | 40 U | 2 | 2 | 2000 UJ | 2000 UJ |
| Vinyl Chloride | 2 | 40 U | 40 U | 1 U | 1 U | 2000 UJ | 2000 UJ |
| Methylene Chloride | 5 | 80 U | 80 U | 2 U | 2 U | ***4300 BJ*** | 500 BUJ |
| Acetone | NE | 200 R | 200 R | 5 U | 5 U | 7800 BJ | 5100 R |
| Carbon Disulfide | NE | 40 U | 40 U | 1 U | 1 U | 2000 U | 820 UJ |
| Chloroform | 80 | 40 U | 40 U | 1 U | 1 U | 2000 U | 2000 U |
| 2-Butanone | NE | 200 R | 200 R | 5 U | 5 U | 10000 U | 10000 U |
| Trichloroethene | 5 | 40 U | 40 U | 1 U | 1 U | 2000 U | 2000 U |
| Benzene | 5 | 40 U | 40 U | 1 U | 1 U | 2000 U | 2000 U |
| Toluene | 1,000 | 5 J | 4 J | 1 U | 1 U | 440 J | 460 UJ |
| Ethylbenzene | 700 | ***750*** | ***720*** | 110 D | 100 D | ***20000*** | ***18000*** |
| Xylene(total) | 10,000 | 2100 EJ | 2000 EJ | 3 | 4 | ***86000*** | ***80000*** |

| SAMPLE ID | | MW-2 | MW-2 | MW-2 | MW-2 | MW-2 | MW-2 | MW-2 | MW-2 |
|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 18-Jun-96 | 18-Jun-96 | 13-Jan-98 | 13-Jan-98 | 25-Mar-98 | 25-Mar-98 | 10/8/98 | 10/20/98 |
| SAMPLE INTERVAL (ft bgs) | | 18.9-28.2 | Duplicate | 18.9-28.2 | Duplicate | 18.9-28.2 | Duplicate | 18.9-28.2 | 18.9-28.2 |
| ANALYTE | MCL | | | | | | | | |
| Chloromethane | NE | 50 UJ | 50 UJ | 100 UJ | 100 UJ | 100 U | 100 U | NA | NA |
| Vinyl Chloride | 2 | 50 U | 50 U | 100 UJ | 100 UJ | 100 U | 100 U | NA | NA |
| Methylene Chloride | 5 | ***56 BJ*** | ***73 BJ*** | ***170 BJ*** | ***240 BJ*** | 150 BUJ | 35 BUJ | 5 U | 5 U |
| Acetone | NE | 250 R | 250 R | 440 BJ | 250 BJ | 520 BU | 420 BUJ | 73 | 10 U |
| Carbon Disulfide | NE | 50 U | 130 | 100 UJ | 100 UJ | 100 U | 15 UJ | NA | NA |
| Chloroform | 80 | ***470*** | ***590*** | ***1500 J*** | ***1400 J*** | ***2400*** | ***1900*** | ***150*** | ***580*** |
| 2-Butanone | NE | 250 UR | 250 R | 500 UJ | 500 UJ | 500 U | 500 U | NA | NA |
| Trichloroethene | 5 | 150 U | 150 U | 100 UJ | 100 UJ | 100 U | 100 U | NA | NA |
| Benzene | 5 | 150 U | 150 U | 100 U | 100 U | 100 U | 100 U | NA | NA |
| Toluene | 1,000 | 50 U | 50 U | 100 UJ | 100 UJ | 100 U | 100 U | 1 J | 1 J |
| Ethylbenzene | 700 | 50 U | 50 U | 100 UJ | 100 UJ | 100 U | 100 U | 5 U | 5 U |
| Xylene(total) | 10,000 | 50 U | 50 U | 100 UJ | 100 UJ | 100 U | 100 U | 5 U | 5 U |

Concentrations presented in ug/l
Bold, italicized print denotes concentration above the MCL.

Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.

MCL - Maximum Contaminant Level
NE - None established
ft bgs - feet below ground surface
NA - Not Analyzed
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
B - Analyte detected in associated laboratory blank.
R - QC indicates that data is unusable. Analyte may or may not be present.
E - Exceeded calibration range of instrument.
D - Analyte quantitated on a diluted sample



303505

## TABLE 4-14
## MONITORING/PRODUCTION WELL SAMPLING SUMMARY - VOCs
## VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| SAMPLE ID | | MW-3 | MW-3 | MW-3 | MW-3 | MW-3 | MW-4 | MW-4 | MW-4 | MW-4 |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 15-Feb-95 | 11-May-95 | 11-Jan-98 | 24-Mar-98 | 10/15/98 | 14-Feb-95 | 10-May-95 | 09-Jan-98 | 23-Mar-98 |
| SAMPLE INTERVAL (ft bgs) | | 18.5-28.5 | 18.5-28.5 | 18.5-28.5 | 18.5-28.5 | 18.5-28.5 | 18-28 | 18-28 | 18-28 | 18-28 |
| ANALYTE | MCL | | | | | | | | | |
| Chloromethane | NE | 1 U | 1 U | 1 U | 1 U | NA | 1 UJ | 1 U | 1 UJ | 1 U |
| Vinyl Chloride | 2 | 1 U | 1 U | 1 U | 1 U | NA | 1 U | 1 U | 1 UJ | 1 U |
| Methylene Chloride | 5 | 2 U | 2 U | 2 UJ | 0.8 BUJ | 5 U | 2 UJ | 0.4 BJ | 2 UJ | 1 BUJ |
| Acetone | NE | 42 J | 1 U | 21 UJ | 4 R | 96 J | 1 U | 1 U | 2 UJ | 2 BJ |
| Carbon Disulfide | NE | 1 U | 1 U | 1 U | 1 U | NA | 1 U | 1 U | 1 U | 1 U |
| Chloroform | 80 | 1 U | 1 U | 1 U | 1 U | 5 U | 1 U | 1 U | 1 U | 1 U |
| 2-Butanone | NE | 5 R | 5 U | 5 U | 5 U | NA | 5 R | 5 U | 5 U | 5 U |
| Trichloroethene | 5 | 1 U | 1 U | 1 U | 0.1 J | NA | 1 U | 1 U | 1 U | 1 U |
| Benzene | 5 | 1 U | 1 U | 0.1 J | 0.1 J | NA | 1 U | 1 U | 1 U | 1 U |
| Toluene | 1,000 | 1 U | 1 U | 1 U | 1 U | 5 U | 1 U | 1 U | 1 U | 0.1 J |
| Ethylbenzene | 700 | 1 U | 1 U | 1 U | 1 U | 5 U | 1 U | 1 U | 1 U | 1 U |
| Xylene(total) | 10,000 | 1 U | 0.9 J | 1 U | 1 U | 5 U | 1 U | 0.9 J | 0.4 J | 1 U |

| SAMPLE ID | | MW-5 | MW-5 | MW-5 | MW-5 | MW-6 | MW-6 | MW-6 |
|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 15-Feb-95 | 10-May-95 | 12-Jan-98 | 24-Mar-98 | 18-Jun-96 | 13-Jan-98 | 26-Mar-98 |
| SAMPLE INTERVAL (ft bgs) | | 17.5-27.5 | 17.5-27.5 | 17.5-27.5 | 17.5-27.5 | 17.4-26.7 | 17.4-26.7 | 17.4-26.7 |
| ANALYTE | MCL | | | | | | | |
| Chloromethane | NE | 1 UJ | 1 U | 1 U | 1 U | 5000 U | 2000 UJ | 2000 UJ |
| Vinyl Chloride | 2 | 1 U | 1 U | 1 U | 1 U | 5000 U | 2000 U | 2000 U |
| Methylene Chloride | 5 | 6 U | 0.6 BJ | 2 UJ | 1 BUJ | ***6400 BJ*** | ***3400 BJ*** | 680 BUJ |
| Acetone | NE | 1 U | 1 U | 2 UJ | 0.6 R | 25000 R | 5800 BJ | 11000 R |
| Carbon Disulfide | NE | 1 U | 1 U | 1 U | 1 U | 5000 U | 2000 U | 260 UJ |
| Chloroform | 80 | 1 U | 1 U | 1 U | 1 U | 5000 U | 2000 U | 2000 U |
| 2-Butanone | NE | 5 R | 5 U | 5 U | 5 U | 25000 R | 10000 U | 10000 U |
| Trichloroethene | 5 | 1 U | 1 U | 1 U | 1 U | 15000 U | 2000 U | 2000 U |
| Benzene | 5 | 1 U | 1 U | 1 U | 1 U | 15000 U | 2000 U | 2000 U |
| Toluene | 1,000 | 0.1 J | 1 U | 1 U | 1 U | 5000 U | 590 J | 600 UJ |
| Ethylbenzene | 700 | 2 | 1 U | 0.3 J | 1 U | ***23000*** | ***22000*** | ***20000*** |
| Xylene(total) | 10,000 | 5 | 1 U | 1 U | 1 U | ***27000*** | ***110000*** | ***98000*** |

Concentrations presented in ug/l
Bold, italicized print denotes concentration above the MCL.

Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.

MCL - Maximum Contaminant Level
NE - None established
ft bgs - feet below ground surface
NA - Not Analyzed
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
B - Analyte detected in associated laboratory blank.
R - QC indicates that data is unusable. Analyte may or may not be present.

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## TABLE 4-14
## MONITORING/PRODUCTION WELL SAMPLING SUMMARY - VOCs
## VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| SAMPLE ID | | MW-7 | MW-7 | MW-7 | MW-8 | MW-8 | MW-9 | MW-9 | MW-10 | MW-10 |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 13-Jan-98 | 25-Mar-98 | 10/8/98 | 14-Jan-98 | 26-Mar-98 | 12-Jan-98 | 25-Mar-98 | 11-Jan-98 | 27-Mar-98 |
| SAMPLE INTERVAL (ft bgs) | | 64-74 | 64-74 | 64-74 | 63-73 | 63-73 | 64-74 | 64-74 | 22-32 | 22-32 |
| ANALYTE | MCL | | | | | | | | | |
| Chloromethane | NE | 1 UJ | 1 U | NA | 1 UJ | 1 U | 1 U | 1 U | 1 U | 1 U |
| Vinyl Chloride | 2 | 1 UJ | 1 U | NA | 1 UJ | 1 U | 1 U | 1 U | 1 U | 0.2 J |
| Methylene Chloride | 5 | 2 UJ | 0.6 BUJ | 5 U | 2 UJ | 2 BU | 2 UJ | 0.7 BUJ | 2 UJ | 0.8 BUJ |
| Acetone | NE | 2 UJ | 5 BU | 10 U | 2 UJ | 2 R | 1 UJ | 3 BUJ | 1 UJ | 3 BUJ |
| Carbon Disulfide | NE | 1 UJ | 1 U | NA | 1 UJ | 1 U | 1 U | 1 U | 1 U | 0.1 UJ |
| Chloroform | 100 | 4 J | 4 | 5 U | 2 J | 4 | 4 | 4 | 1 U | 1 U |
| 2-Butanone | NE | 5 UJ | 5 U | NA | 5 UJ | 5 U | 0.8 J | 1 U | 5 U | 5 U |
| Trichloroethene | 5 | 1 UJ | 1 U | NA | 1 UJ | 1 U | 1 U | 1 U | 1 U | 1 U |
| Benzene | 5 | 1 U | 1 U | NA | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Toluene | 1,000 | 1 UJ | 13 | 5 U | 1 UJ | 0.2 UJ | 1 U | 1 U | 1 U | 1 U |
| Ethylbenzene | 700 | 1 UJ | 1 U | 5 U | 1 UJ | 17 | 1 U | 1 U | 1 U | 0.8 UJ |
| Xylene(total) | 10,000 | 1 UJ | 0.5 J | 5 U | 1 UJ | 79 | 1 U | 1 U | 1 U | 5 U |

| SAMPLE ID | | MW-11 | MW-11 | MW-12 | MW-13 | MW-14 | P-1 | P-1 | P-2 | P-2 |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 10/17/98 | 10/20/98 | 10/19/98 | 10/20/98 | 10/18/98 | 10-Jan-98 | 29-Mar-98 | 10-Jan-98 | 27-Mar-98 |
| SAMPLE INTERVAL (ft bgs) | | Pre-Develop | 30-40 | 137-147 | 30-40 | 124-134 | Unknown | Unknown | Unknown | Unknown |
| ANALYTE | MCL | | | | | | | | | |
| Chloromethane | NE | NA | NA | NA | NA | NA | 1 U | 1 U | 1 U | 1 U |
| Vinyl Chloride | 2 | NA | NA | NA | NA | NA | 1 U | 1 U | 1 U | 1 U |
| Methylene Chloride | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 4 UJ | 1 BUJ | 3 UJ | 0.7 BUJ |
| Acetone | NE | 10 U | 10 U | 10 U | 10 U | 12 J | 3 UJ | 4 R | 1 UJ | 0.1 BUJ |
| Carbon Disulfide | NE | NA | NA | NA | NA | NA | 1 U | 1 U | 1 U | 1 U |
| Chloroform | 100 | 5 U | 3 J | 5 U | 5 U | 5 U | 75 D | 46 E | 3 | 3 |
| 2-Butanone | NE | NA | NA | NA | NA | NA | 5 U | 5 U | 5 U | 5 U |
| Trichloroethene | 5 | NA | NA | NA | NA | NA | 1 U | 1 U | 1 U | 1 U |
| Benzene | 5 | NA | NA | NA | NA | NA | 1 U | 1 U | 1 U | 1 U |
| Toluene | 1,000 | 5 U | 18 | 5 U | 17 | 5 U | 1 U | 0.5 UJ | 1 U | 1 U |
| Ethylbenzene | 700 | 5 U | 1 J | 5 U | 1 J | 5 U | 1 U | 0.5 UJ | 1 U | 1 U |
| Xylene(total) | 10,000 | 5 U | 1 J | 5 U | 5 U | 5 U | 1 U | 3 U | 1 U | 7 U |

Concentrations presented in ug/l

Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.

MCL - Maximum Contaminant Level
NE - None established
ft bgs - feet below ground surface
NA - Not Analyzed
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
B - Analyte detected in associated laboratory blank.
R - QC indicates that data is unusable. Analyte may or may not be present.
E - Exceeded calibration range of instrument.
D - Analyte quantitated on a diluted sample

303507

# TABLE
## GEOPROBE GROUNDWATER SAMPLING SUMMARY - VOCs
## VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| SAMPLE ID | | GWPP-7 | GWPP-8 | GWPP-9 | GWPP-10 | GWPP-11 | GWPP-12 | GWPP-13 | GWPP-14 | GWPP-15 | GWPP-16 | GWPP-17 | GWPP-19 | GWPP-20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 27-Mar-98 | 27-Mar-98 | 29-Mar-98 | 30-Mar-98 | 29-Mar-98 | 30-Mar-98 | 31-Mar-98 | 01-Apr-98 | 02-Apr-98 | 03-Apr-98 | 03-Apr-98 | 03-Apr-98 | 03-Apr-98 |
| SAMPLE INTERVAL (ft bgs) | | 20-25 | 20-25 | 22-27 | 28-33 | 21-26 | 26-31 | 22-30 | 21-24 | 8-10 | 27-30 | 27-32 | 8-12 | 23-28 |
| ANALYTE | MCL | | | | | | | | | | | | | |
| Toluene | 1,000 | 10 U | 10 U | 100 U | 10 U | 15 | 10 U | 10 U | 10 U | 6 J | 9 J | 10 U | 7 J | 12 |
| Ethylbenzene | 700 | 10 U | 10 U | 100 U | 10 U | 2.4 J | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 3 J | 2 J |
| m&p-Xylene | 10,000 | 20 U | 20 U | 200 U | 20 U | 8.6 J | 20 U | 20 U | 20 U | 20 U | 6 J | 20 U | 9 J | 8 J |
| o-Xylene | 10,000 | 10 U | 10 U | 100 U | 10 U | 6 J | 10 U | 10 U | 10 U | 10 U | 3 J | 10 U | 5 J | 6 J |
| Acetone | NE | 25 U | 25 U | 250 U | 25 U | 25 U | 25 U | 20 U | 25 U | 25 U | 110 | 25 U | 25 U | 25 U |
| Methylene Chloride | 5 | 10 U | 10 U | 100 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chloroform | 80 | 10 U | 10 U | ***330*** | 94 | 74 | 78 | ***157*** | 10 U | ***1200*** | 10 U | 3 J | ***450*** | 7 J |

| SAMPLE ID | | GWPP-21 | GWPP-23 | GWPP-24 | GWPP-25 | GWPP-26 | GWPP-27 | GWPP-27A | GWPP-27A | GWPP-27A | GWPP-27A | GWPP-27A | GWPP-28 | GWPP-29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 03-Apr-98 | 04-Apr-98 | 05-Apr-98 | 05-Apr-98 | 05-Apr-98 | 05-Apr-98 | 10/11/98 | 10/12/98 | 10/13/98 | 10/13/98 | 10/14/98 | 08-Apr-98 | 08-Apr-98 |
| SAMPLE INTERVAL (ft bgs) | | 21-26 | 22-27 | 23-28 | 24-29 | 6-10 | 24-29 | 84-87 | 95-99 | 110-120 | Waste 1 | Waste 2 | 26-31 | 31-34 |
| ANALYTE | MCL | | | | | | | | | | | | | |
| Toluene | 1,000 | 11 | 10 | 9 J | 15 | 3 J | 1000 U | 5 U | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U |
| Ethylbenzene | 700 | 2 J | 10 U | 10 U | 2 J | 10 U | 1000 U | 5 U | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U |
| m&p-Xylene | 10,000 | 7 J | 5 J | 6 J | 8 J | 20 U | 2000 U | 10 U | 10 U | 10 U | 10 U | 10 U | 20 U | 20 U |
| o-Xylene | 10,000 | 5 J | 3 J | 4 J | 5 J | 2 J | 1000 U | 5 U | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U |
| Acetone | NE | 25 U | 25 U | 62 | 25 U | 25 U | 2500 U | 10 U | 10 U | 10 U | 10 U | 10 U | 25 U | 14 JB |
| Methylene Chloride | 5 | 10 U | 10 U | 10 U | 10 U | 10 U | 1000 U | 5 U | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U |
| Chloroform | 80 | 10 U | ***1000*** | 53 | 3 J | 53 | ***3800*** | 5 U | 5 U | 5 U | 15 | 21 | ***230*** | ***96*** |

| SAMPLE ID | | GWPP-29A | GWPP-29A | GWPP-29A | GWPP-29A | GWPP-29A | GWPP-29A | GWPP-29A | GWPP-30 | GWPP-31 | GWPP-32 | GWPP-33 | GWPP-34 | GWPP-35 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 10/8/98 | 10/8/98 | 10/9/98 | 10/11/98 | 10/10/98 | 10/10/98 | 10/10/98 | 09-Apr-98 | 08-Apr-98 | 07-Apr-98 | 09-Apr-98 | 09-Apr-98 | 10-Apr-98 |
| SAMPLE INTERVAL (ft bgs) | | 50-54 | Duplicate | 95-99 | 137-147 | Waste 1 | Waste 2 | Waste 3 | 34-37 | 22-27 | 23-28 | 31-34 | 32-35 | 27-30 |
| ANALYTE | MCL | | | | | | | | | | | | | |
| Toluene | 1,000 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 10 U | 50 U | 10 U | 10 U | 8 J | 5 J |
| Ethylbenzene | 700 | 5 U | 5 U | 5 U | 5 U | 5 U | 3 J | 5 U | 10 U | 50 U | 10 U | 10 U | 10 U | 20 U |
| m&p-Xylene | 10,000 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 | 10 U | 20 U | 100 U | 20 U | 20 U | 7 J | 5 J |
| o-Xylene | 10,000 | 5 U | 5 U | 5 U | 5 U | 5 U | 3 J | 5 U | 10 U | 50 U | 10 U | 10 U | 6 J | 20 U |
| Acetone | NE | 10 U | 10 U | 46 | 10 U | 10 U | 270 E | 10 U | 15 J | 120 U | 25 U | 32 | 25 U | 50 U |
| Methylene Chloride | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 10 U | 50 U | 10 U | 10 U | 10 U | 20 U |
| Chloroform | 80 | 44 | 44 | 5 U | 5 U | 5 U | 5 U | 5 U | 10 U | ***1700*** | 6 J | 63 | 10 U | 29 |

Concentrations presented in ug/l
Bold, italicized print denotes concentration above the MCL.

MCL - Maximum Contaminant Level
NE - None established
ft bgs - feet below ground surface
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
B - Analyte detected in associated laboratory blank.
E - Exceeded calibration range of instrument.
Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.



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TABL[illegible]

## GEOPROBE GROUNDWATER SAMPLING SUMMARY - VOCs
## VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| SAMPLE ID | | GWPP-36 | GWPP-36 | GWPP-37 | GWPP-37 | GWPP-37 | GWPP-37 | GWPP-37 | GWPP-37 | GWPP-37 | GWOR-1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 10/17/98 | 10/16/98 | 10/7/98 | 10/7/98 | 10/7/98 | 10/7/98 | 10/8/98 | 10/15/98 | 10/7/98 | 10-Apr-98 |
| SAMPLE INTERVAL (ft bgs) | | Duplicate | Waste | 35-39 | 45-49 | 70-74 | 80-84 | 97-107 | 124-134 | Waste | 22-29 |
| ANALYTE | MCL | | | | | | | | | | |
| Toluene | 1,000 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 10 U |
| Ethylbenzene | 700 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 10 U |
| m&p-Xylene | 10,000 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 20 U |
| o-Xylene | 10,000 | 5 U | 5 U | 2 J | 5 U | 5 U | 1 J | 2 J | 5 U | 2 J | 10 U |
| Acetone | NE | 10 U | 10 U | 44 | 10 U | 53 | 130 | 10 U | 10 U | 10 U | 25 U |
| Methylene Chloride | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 2 J | 5 U | 10 U |
| Chloroform | 100 | 5 U | 5 U | 5 U | 5 U | 1 J | 5 U | 2 J | 5 U | 2 J | 31 |

| SAMPLE ID | | GWPP-36 | GWPP-36 | GWPP-36 | GWPP-36 | GWPP-36 | GWPP-36 |
|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 10/15/98 | 10/15/98 | 10/15/98 | 10/15/98 | 10/16/98 | 10/17/98 |
| SAMPLE INTERVAL (ft bgs) | | 20-24 | 50-54 | 75-79 | 82-85 | 82-85 | 97-107 |
| ANALYTE | MCL | | | | | | |
| Toluene | 1,000 | 1 J | 1 J | 5 U | 2 J | 5 U | 5 U |
| Ethylbenzene | 700 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| m&p-Xylene | 10,000 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| o-Xylene | 10,000 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Acetone | NE | 66 J | 10 U | 43 J | 10 U | 43 J | 10 U |
| Methylene Chloride | 5 | 5 U | 5 U | 5 U | 3 J | 5 U | 5 U |
| Chloroform | 100 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |

Concentrations presented in ug/l

MCL - Maximum Contaminant Level
NE - None established
ft bgs - feet below ground surface
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.

303509

# TABLE 4-16
## TEX FIELD SCREENING SUMMARY - TEMPORARY/DEEP MONITORING WELLS
## VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| SAMPLE ID | | TW-1 | TW-2 | TW-3 | TW-3 | TW-4 | TW-5 |
|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 17-Sep-97 | 17-Sep-97 | 19-Sep-97 | 19-Sep-97 | 19-Sep-97 | 23-Sep-97 |
| SAMPLE INTERVAL (ft bgs) | | 19-29 | 19-29 | 19-29 | Duplicate | 22-32 | 20-30 |
| ANALYTE | MCL | | | | | | |
| Toluene | 1,000 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Ethylbenzene | 700 | ***8,000 E*** | 5 U | ***720*** | ***750*** | 5 U | 3 J |
| Xylene | 10,000 | ***15,000 E*** | 5 U | 5 U | 5 U | 5 U | 5 U |

| SAMPLE ID | | MW-7 | MW-7 |
|---|---|---|---|
| SAMPLE DATE | | 06-Dec-98 | 06-Dec-98 |
| SAMPLE INTERVAL (ft bgs) | | 46-48 | 60-62 |
| ANALYTE | MCL | | |
| Toluene | 1,000 | 5 U | 5 U |
| Ethylbenzene | 700 | 5 U | 5 U |
| Xylene | 10,000 | 5 U | 5 U |

| SAMPLE ID | | MW-8 | MW-8 |
|---|---|---|---|
| SAMPLE DATE | | 07-Dec-98 | 07-Dec-98 |
| SAMPLE INTERVAL (ft bgs) | | 47-49 | 57-59 |
| ANALYTE | MCL | | |
| Toluene | 1,000 | 5 U | 5 U |
| Ethylbenzene | 700 | 5 U | 5 U |
| Xylene | 10,000 | 30 | 5 U |

| SAMPLE ID | | MW-9 | MW-9 | MW-9 |
|---|---|---|---|---|
| SAMPLE DATE | | 04-Dec-98 | 04-Dec-98 | 05-Dec-98 |
| SAMPLE INTERVAL (ft bgs) | | 40-42 | 50-52 | 60-62 |
| ANALYTE | MCL | | | |
| Toluene | 1,000 | 5 U | 5 U | 5 U |
| Ethylbenzene | 700 | 5 U | 5 U | 5 U |
| Xylene | 10,000 | 140 | 13 | 5 U |

Concentrations presented in ug/l
Bold, italicized print denotes concentration above the MCL.

MCL - Maximum Contaminant Level
ft bgs - feet below ground surface
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
E - Estimated concentration

303510

# TABLE 17
# CONFIRMATION GROUNDWATER SAMPLING RESULTS
# VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| SAMPLE ID: | MW-2 | MW-11 | Fairplains #9 | GWPP36 (82-85) | GWPP37 (124-134) | TB102098 |
|---|---|---|---|---|---|---|
| SAMPLE DATE: | 08-Oct-98 | 20-Oct-98 | 14-Oct-98 | 16-Oct-98 | 15-Oct-98 | 20-Oct-98 |
| SAMPLE INTERVAL | 18.9-28.2 | 30-40 | Unknown | 82-85 | 124-134 | NA |
| ANALYTE: | | | | | | |
| Chloromethane | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Vinyl Chloride | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Methylene Chloride | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Acetone | 10 U | 10.3 A11 | 15.4 A11 | 10 U | 10 U | 10 U |
| Carbon Disulfide | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Chloroform | 125 | 5 U | 5 U | 5 U | 5 U | 5 U |
| 2-Butanone | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Trichloroethene | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Benzene | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Toluene | 5 U | 16.3 | 5 U | 5 U | 5 U | 5 U |
| Ethylbenzene | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Xylene(total) | 5 U | 6.13 | 5 U | 5 U | 5 U | 5 U |

Concentrations presented in ug/l
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
A11 - Analyte is a common solvent. Presence may be an artifact of sampling, transport or analysis.
NA - Not Applicable
Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.

303511

# TABLE 4-18
# MONITORING/PRODUCTION WELL SAMPLING SUMMARY - SVOCs
# VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| SAMPLE ID | | MW-1 | MW-1 | MW-1 | MW-1 | MW-1 | MW-1 |
|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 16-Feb-95 | 16-Feb-95 | 09-May-95 | 09-May-95 | 09-Jan-98 | 26-Mar-98 |
| SAMPLE INTERVAL (ft bgs) | | 23-33 | Duplicate | 23-33 | Duplicate | 23-33 | 23-33 |
| ANALYTE | MCL | | | | | | |
| 2,4-Dimethylphenol | NE | 30 | 22 | 5 U | 5 U | 77 J | 78 J |
| 2-Methylphenol | NE | 5 U | 5 U | 5 U | 5 U | 200 J | 190 |
| 4-Chloroaniline | NE | 5 U | 5 U | 5 U | 5 U | 120 R | 100 U |
| 4-Methylphenol | NE | 40 | 48 | 5 U | 5 U | 120 R | 100 U |
| bis(2-Ethylhexyl)Phthalate | NE | 5 UJ | 5 U | 11 B | 3 BJ | 120 U | 100 U |
| Di-n-butyl-phthalate | NE | 5 U | 5 U | 5 U | 5 U | 120 U | 100 U |
| Isophorone | NE | 0.6 J | 0.7 J | 5 U | 5 U | 54 J | 75 J |
| Phenol | NE | 5 U | 5 U | 5 U | 5 U | 120 R | 100 U |

| SAMPLE ID | | MW-2 | MW-2 | MW-2 | MW-2 | MW-2 | MW-2 |
|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | 18-Jun-96 | 18-Jun-96 | 13-Jan-98 | 13-Jan-98 | 25-Mar-98 | 25-Mar-98 |
| SAMPLE INTERVAL (ft bgs) | | 18.9-28.2 | Duplicate | 18.9-28.2 | Duplicate | 18.9-28.2 | Duplicate |
| ANALYTE | MCL | | | | | | |
| 2,4-Dimethylphenol | NE | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 2-Methylphenol | NE | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 4-Chloroaniline | NE | 20 U | 20 U | 5 U | 5 R | 5 U | 5 U |
| 4-Methylphenol | NE | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| bis(2-Ethylhexyl)Phthalate | NE | 2 BJ | 5 UJ | 6 U | 2 U | 20 BU | 7 BU |
| n-butyl-phthalate | NE | 0.4 J | 0.4 J | 5 U | 5 U | 5 U | 5 U |
| phorone | NE | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| henol | NE | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |

| SAMPLE ID | | MW-3 | MW-3 | MW-3 | MW-3 |
|---|---|---|---|---|---|
| SAMPLE DATE | | 15-Feb-95 | 11-May-95 | 11-Jan-98 | 24-Mar-98 |
| SAMPLE INTERVAL (ft bgs) | | 18.5-28.5 | 18.5-28.5 | 18.5-28.5 | 18.5-28.5 |
| ANALYTE | MCL | | | | |
| 2,4-Dimethylphenol | NE | 5 U | 5 U | 5 U | 5 U |
| 2-Methylphenol | NE | 5 U | 5 U | 5 U | 5 U |
| 4-Chloroaniline | NE | 5 U | 2 J | 11 J | 5 U |
| 4-Methylphenol | NE | 5 U | 5 U | 5 U | 5 U |
| bis(2-Ethylhexyl)Phthalate | NE | 5 U | 42 B | 7 U | 4 UJ |
| Di-n-butyl-phthalate | NE | 5 U | 5 U | 5 U | 5 U |
| Isophorone | NE | 5 R | 5 U | 5 U | 5 U |
| Phenol | NE | 1 J | 0.4 J | 5 U | 5 U |

Concentrations presented in ug/l

MCL - Maximum Contaminant Level
NE - None established
ft bgs - feet below ground surface
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
B - Analyte detected in associated laboratory blank.
R - QC indicates that data is unusable. Analyte may or may not be present.

303512

# TABLE 4-18
# MONITORING/PRODUCTION WELL SAMPLING SUMMARY - SVOCs
# VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| SAMPLE ID | | MW-4 | MW-4 | MW-4 | MW-4 |
|---|---|---|---|---|---|
| SAMPLE DATE | | 14-Feb-95 | 10-May-95 | 09-Jan-98 | 23-Mar-98 |
| SAMPLE INTERVAL (ft bgs) | | 18-28 | 18-28 | 18-28 | 18-28 |
| ANALYTE | MCL | | | | |
| 2,4-Dimethylphenol | NE | 5 U | 5 U | 5 U | 5 U |
| 2-Methylphenol | NE | 5 U | 5 U | 5 U | 5 U |
| 4-Chloroaniline | NE | 5 U | 5 U | 5 R | 5 U |
| 4-Methylphenol | NE | 5 U | 5 U | 5 U | 5 U |
| bis(2-Ethylhexyl)Phthalate | NE | 5 U | 11 B | 5 U | 16 U |
| Di-n-butyl-phthalate | NE | 5 U | 5 U | 5 U | 5 U |
| Isophorone | NE | 5 R | 5 U | 5 U | 5 U |
| Phenol | NE | 5 U | 5 U | 5 U | 5 U |

| SAMPLE ID | | MW-5 | MW-5 | MW-5 | MW-5 |
|---|---|---|---|---|---|
| SAMPLE DATE | | 15-Feb-95 | 10-May-95 | 12-Jan-98 | 24-Mar-98 |
| SAMPLE INTERVAL (ft bgs) | | 17.5-27.5 | 17.5-27.5 | 17.5-27.5 | 17.5-27.5 |
| ANALYTE | MCL | | | | |
| 2,4-Dimethylphenol | NE | 7 U | 5 U | 5 U | 5 U |
| 2-Methylphenol | NE | 7 U | 5 U | 5 U | 5 U |
| 4-Chloroaniline | NE | 7 U | 5 U | 5 R | 5 U |
| 4-Methylphenol | NE | 7 U | 5 U | 5 U | 5 U |
| bis(2-Ethylhexyl)Phthalate | NE | 7 U | 7 B | 29 U | 1 UJ |
| Di-n-butyl-phthalate | NE | 7 U | 5 U | 5 U | 5 U |
| Isophorone | NE | 7 R | 5 U | 5 U | 5 U |
| Phenol | NE | 7 U | 5 U | 5 U | 5 U |

| SAMPLE ID | | MW-6 | MW-6 |
|---|---|---|---|
| SAMPLE DATE | | 13-Jan-98 | 26-Mar-98 |
| SAMPLE INTERVAL (ft bgs) | | 17.4-26.7 | 17.4-26.7 |
| ANALYTE | MCL | | |
| 2,4-Dimethylphenol | NE | 110 J | 28 J |
| 2-Methylphenol | NE | 32 J | 100 U |
| 4-Chloroaniline | NE | 120 R | 100 U |
| 4-Methylphenol | NE | 120 R | 100 U |
| bis(2-Ethylhexyl)Phthalate | NE | 120 U | 100 U |
| Di-n-butyl-phthalate | NE | 120 U | 100 U |
| Isophorone | NE | 47 J | 62 J |
| Phenol | NE | 120 R | 100 U |

Concentrations presented in ug/l

MCL - Maximum Contaminant Level
NE - None established
ft bgs - feet below ground surface
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
B - Analyte detected in associated laboratory blank.
R - QC indicates that data is unusable. Analyte may or may not be present.

303513

# TABLE 4-18
# MONITORING/PRODUCTION WELL SAMPLING SUMMARY - SVOCs
# VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| SAMPLE ID | | MW-7 | MW-7 | MW-8 | MW-8 |
|---|---|---|---|---|---|
| SAMPLE DATE | | 13-Jan-98 | 25-Mar-98 | 14-Jan-98 | 26-Mar-98 |
| SAMPLE INTERVAL (ft bgs) | | 64-74 | 64-74 | 63-73 | 63-73 |
| ANALYTE | MCL | | | | |
| 2,4-Dimethylphenol | NE | 5 U | 5 U | 5 U | 5 U |
| 2-Methylphenol | NE | 5 U | 5 U | 5 U | 5 U |
| 4-Chloroaniline | NE | 5 U | 5 U | 5 R | 5 U |
| 4-Methylphenol | NE | 5 U | 5 U | 5 U | 5 U |
| bis(2-Ethylhexyl)Phthalate | NE | 2 U | 6 BU | 7 U | 5 BU |
| Di-n-butyl-phthalate | NE | 5 U | 5 U | 5 U | 5 U |
| Isophorone | NE | 5 U | 5 U | 5 U | 5 U |
| Phenol | NE | 5 U | 5 U | 5 U | 5 U |

| SAMPLE ID | | MW-9 | MW-9 | MW-10 | MW-10 |
|---|---|---|---|---|---|
| SAMPLE DATE | | 12-Jan-98 | 25-Mar-98 | 11-Jan-98 | 27-Mar-98 |
| SAMPLE INTERVAL (ft bgs) | | 64-74 | 64-74 | 22-32 | 22-32 |
| ANALYTE | MCL | | | | |
| 2,4-Dimethylphenol | NE | 5 U | 5 U | 5 U | 5 U |
| 2-Methylphenol | NE | 5 U | 5 U | 5 U | 5 U |
| 4-Chloroaniline | NE | 5 R | 5 U | 5 R | 5 U |
| 4-Methylphenol | NE | 5 U | 5 U | 5 U | 5 U |
| bis(2-Ethylhexyl)Phthalate | NE | 20 U | 5 U | 22 U | 29 BU |
| Di-n-butyl-phthalate | NE | 5 U | 5 U | 5 U | 5 U |
| Isophorone | NE | 5 U | 5 U | 5 U | 5 U |
| Phenol | NE | 5 U | 5 U | 5 U | 5 U |

| SAMPLE ID | | P-1 | P-1 | P-2 | P-2 |
|---|---|---|---|---|---|
| SAMPLE DATE | | 10-Jan-98 | 29-Mar-98 | 10-Jan-98 | 27-Mar-98 |
| SAMPLE INTERVAL (ft bgs) | | Unknown | Unknown | Unknown | Unknown |
| ANALYTE | MCL | | | | |
| 2,4-Dimethylphenol | NE | 5 U | 5 U | 5 U | 5 U |
| 2-Methylphenol | NE | 5 U | 5 U | 5 U | 5 U |
| 4-Chloroaniline | NE | 5 R | 5 U | 5 R | 5 U |
| 4-Methylphenol | NE | 5 U | 5 U | 5 U | 5 U |
| bis(2-Ethylhexyl)Phthalate | NE | 17 U | 15 BU | 9 U | 5 BU |
| Di-n-butyl-phthalate | NE | 5 U | 5 U | 5 U | 5 U |
| Isophorone | NE | 5 U | 5 U | 5 U | 5 U |
| Phenol | NE | 5 U | 5 U | 5 U | 5 U |

Concentrations presented in ug/l

MCL - Maximum Contaminant Level
NE - None established
ft bgs - feet below ground surface
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
B - Analyte detected in associated laboratory blank.
R - QC indicates that data is unusable. Analyte may or may not be present.

303514

# TABLE 9
## MONITORING/PRODUCTION WELL SAMPLING SUMMARY - METALS
## VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| SAMPLE ID | | | MW-1 | MW-1 | MW-1 | MW-1 | MW-1 | MW-1 |
|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | | 16-Feb-95 | 16-Feb-95 | 09-May-95 | 09-May-95 | 09-Jan-98 | 26-Mar-98 |
| SAMPLE INTERVAL (ft bgs) | | | 23-33 | Duplicate | 23-33 | Duplicate | 23-33 | 23-33 |
| ANALYTE | Primary MCL | Secondary MCL | | | | | | |
| Aluminum | NE | 50-200 | 656 EN*J | 693 EN*J | 1330 N* | 7890 N* | 334 J | 116 BE |
| Antimony | 6 | NE | 1.4 UN | 1.4 UN | 1.4 UW | 1.4 UW | 3.8 B | 2.2 U |
| Arsenic | 50 | NE | 4.4 B | 7.7 B | 3.9 BN | 3.4 BN | 1.4 U | 1.4 U |
| Barium | 2000 | NE | 145 B | 138 B | 181 B | 177 B | 201 | 175 B |
| Beryllium | 4 | NE | 0.2 U | 0.2 NW*UJ | 1.4 N* | 1.6 N* | 0.1 U | 0.10 U |
| Cadmium | 5 | NE | 3.1 U | 3.1 U | 2.4 U | 2.4 U | 0.49 B | 0.10 U |
| Calcium | NE | NE | 49800 EJ | 47900 EJ | 44900 | 39800 | 46500 J | 38600 |
| Chromium | 100 | NE | 4.4 U | 5.2 U | 2.2 U | 7 B | 1.1 B | 1.3 B |
| Cobalt | NE | NE | 9.5 U | 9.5 U | 3.8 U | 5.5 B | 6.3 BJ | 3.6 B |
| Copper | 1300 | NE | 16.7 U | 16.7 U | 13.4 U | 18.7 B | 25.6 | 25.1 |
| Iron | NE | 300 | 640 N*J | 678 N*J | 1590 N* | 9980 N* | 1710 U | 929 |
| Lead | 15 (1) | NE | 1.9 U | 2.7 U | 3.8 W | 2.8 BW | 3.2 U | 1.1 U |
| Magnesium | NE | NE | 34400 ENJ | 32900 EJ | 31200 | 28900 | 29600 J | 28200 |
| Manganese | NE | 50 | 1450 EJ | 1380 ENJ | 1560 | 1450 | 2140 J | 1990 |
| Mercury | 2 | NE | 0.2 U | 0.2 U | 0.44 | 0.2 U | 0.2 U | 0.20 U |
| Nickel | 100 | NE | 13.1 U | 13.1 U | 10.3 U | 14.1 B | 3.9 B | 1.0 U |
| Potassium | NE | NE | 2350 B | 2310 B | 1260 B | 1700 B | 5680 J | 1850 BE |
| Selenium | 50 | NE | 24.2 BJNW | 19.6 BJNW | 1.6 UW | 1.6 UW | 2 BJ | 2.0 U |
| Silver | NE | 100 | 5.1 U | 5.1 U | 3.6 U | 3.6 U | 0.7 U | 0.70 U |
| Sodium | NE | NE | 432000 EJ | 406000 EJ | 397000 | 349000 | 283000 | 283000 |
| Thallium | 2 | NE | 2.7 U | 2.7 U | 2.6 UW | 2.6 UW | 1.6 U | 0.80 UW |
| Vanadium | NE | NE | 33.3 B | 34.1 B | 42.4 B | 55 | 1.7 B | 1.4 B |
| Zinc | NE | 5000 | 31.4 U | 17.8 U | 21.6 | 77.9 | 121 J | 99.9 E*R |
| Cyanide | 200 | NE | 10.0 U | 10.0 U | 10.0 UN | 10.0 UN | 5.0 R | 5.0 U |

Concentrations presented in ug/l

MCL - Maximum Contaminant Level
NE - None established
(1) - Treatment Technique Action Level
ft bgs - feet below ground surface
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
R - QC indicates that data is unusable. Analyte may or may not be present.
S - Determined by Method of Standard Additions.
B - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
* - Duplicate analysis not within control limits.
E - Estimated due to the presence of interference.
N - Spike recovery not within control limits.
W - GFAA post-digest spike out of control limits.

303515

## TABLE 19
## MONITORING/PRODUCTION WELL SAMPLING SUMMARY - METALS
## VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| SAMPLE ID | | | MW-2 | MW-2 | MW-2 | MW-2 | MW-2 | MW-2 |
|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | | 18-Jun-96 | 18-Jun-96 | 13-Jan-98 | 13-Jan-98 | 25-Mar-98 | 25-Mar-98 |
| SAMPLE INTERVAL (ft bgs) | | | 18.9-28.2 | Duplicate | 18.9-28.2 | Duplicate | 18.9-28.2 | Duplicate |
| ANALYTE | Primary MCL | Secondary MCL | | | | | | |
| Aluminum | NE | 50-200 | 2790 UJ | 2580 UJ | 51.1 BJ | 39.9 BJ | 720 EJ | 264 EJ |
| Antimony | 6 | NE | 3.1 UWJ | 3.1 UW | 2.2 U | 2.2 B | 2.2 U | 2.2 U |
| Arsenic | 50 | NE | 1.7 BNJ | 0.80 UJ | 1.4 U | 1.4 U | 1.4 U | 1.4 U |
| Barium | 2000 | NE | 136 B | 131 B | 67.3 B | 59.6 B | 68.7 B | 63.9 B |
| Beryllium | 4 | NE | 0.13 B | 0.10 BWJ | 0.1 U | 0.1 U | 0.10 U | 0.10 U |
| Cadmium | 5 | NE | 0.54 B | 0.44 B | 0.1 U | 0.1 U | 0.10 U | 0.10 U |
| Calcium | NE | NE | 54400 | 56200 | 76200 J | 65700 J | 78600 | 72800 |
| Chromium | 100 | NE | 6.8 BU | 7 BU | 10.8 | 9.3 B | 14.6 | 12.4 |
| Cobalt | NE | NE | 6.7 BU | 5.4 BU | 0.32 BJ | 0.34 BJ | 0.3 U | 0.3 U |
| Copper | 1300 | NE | 12.5 B | 8.6 B | 8 B | 10.3 B | 8.4 B | 4.7 B |
| Iron | NE | 300 | 3530 | 3440 | 7 UJ | 7 UJ | 227 | 101 |
| Lead | 15 (1) | NE | 2.7 BWJ | 2.2 BWJ | 10.6 | 11.1 | 1.1 U | 1.1 U |
| Magnesium | NE | NE | 38900 | 39300 | 65200 J | 58600 J | 70900 | 66900 |
| Manganese | NE | 50 | 785 | 722 | 56.4 J | 50.7 J | 118 | 120 |
| Mercury | 2 | NE | 0.20 U | 0.20 U | 0.2 U | 0.2 U | 0.30 R | 0.28 R |
| Nickel | 100 | NE | 3.7 BU | 3.4 BU | 1 U | 1 U | 1.0 U | 1.0 U |
| Potassium | NE | NE | 9320 EJ | 9500 EJ | 3500 B | 3020 B | 3740 BE | 3380 BE |
| Selenium | 50 | NE | 2.2 BNJ | 0.6 UNWJ | 2 UJ | 2 UJ | 2.0 U | 2.0 U |
| Silver | NE | 100 | 0.40 UNJ | 0.40 UNJ | 0.7 U | 0.7 U | 1.40 B | 1.30 B |
| Sodium | NE | NE | 907000 EJ | 928000 EJ | 648000 | 585000 | 744000 | 702000 |
| Thallium | 2 | NE | 1.1 UNWJ | 1.10 UNWJ | 1.6 U | 1.6 U | 0.80 UW | 0.80 UW |
| Vanadium | NE | NE | 62.9 | 59 | 30.9 B | 27.7 B | 63.4 B | 34.1 B |
| Zinc | NE | 5000 | 34.5 | 36.4 | 169 UJ | 81.7 UJ | 196 E*J | 177 E*J |
| Cyanide | 200 | NE | 5.0 U | 5.0 U | 5.0 R | 5.0 R | 5.0 U | 5.0 U |

Concentrations presented in ug/l

MCL - Maximum Contaminant Level
NE - None established
(1) - Treatment Technique Action Level
ft bgs - feet below ground surface
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
R - QC indicates that data is unusable. Analyte may or may not be present.
B - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
* - Duplicate analysis not within control limits.
E - Estimated due to the presence of interference.
N - Spike recovery not within control limits.
W - GFAA post-digest spike out of control limits.

303516

TABLE 9

## MONITORING/PRODUCTION WELL SAMPLING SUMMARY - METALS
## VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| SAMPLE ID | | | MW-3 | MW-3 | MW-3 | MW-3 | MW-4 | MW-4 | MW-4 | MW-4 |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | | 15-Feb-95 | 11-May-95 | 11-Jan-98 | 24-Mar-98 | 14-Feb-95 | 10-May-95 | 09-Jan-98 | 23-Mar-98 |
| SAMPLE INTERVAL (ft bgs) | | | 18.5-28.5 | 18.5-28.5 | 18.5-28.5 | 18.5-28.5 | 18-28 | 18-28 | 18-28 | 18-28 |
| ANALYTE | Primary MCL | Secondary MCL | | | | | | | | |
| Aluminum | NE | 50-200 | 3340 EN*J | 1270 N* | 71.8 J | 169 BER | 1560 EN*J | 2670 N* | 1150 J | 163 BEJ |
| Antimony | 6 | NE | 1.4 UN | 1.4 UW | 4.3 B | 2.2 U | 1.4 UN | 1.4 UW | 2.2 U | 2.2 U |
| Arsenic | 50 | NE | 5.4 B | 5.4 BN | 2.2 B | 3 B | 1.8 B | 1.5 UN | 1.4 U | 1.4 U |
| Barium | 2000 | NE | 189 B | 125 B | 169 B | 162 B | 131 B | 145 B | 79.4 B | 68.2 B |
| Beryllium | 4 | NE | 0.3 N*U | 0.18 BN | 0.1 U | 0.10 U | 0.60 NW*UJ | 0.24 BN | 0.1 U | 1.00 U |
| Cadmium | 5 | NE | 3.1 U | 2.4 UW | 0.57 B | 0.58 B | 3.10 U | 2.40 U | 0.35 B | 1.00 U |
| Calcium | NE | NE | 148000 EJ | 211000 | 96500 J | 105000 J | 54200 EJ | 53500 | 33400 J | 32600 J |
| Chromium | 100 | NE | 8.2 U | 2.8 B | 0.81 B | 2.1 B | 5.9 U | 2.2 U | 2.3 B | 4.1 B |
| Cobalt | NE | NE | 9.5 U | 3.8 U | 1.7 BJ | 0.35 B | 9.5 U | 8.3 B | 3.2 BJ | 1.6 B |
| Copper | 1300 | NE | 35 | 13.4 U | 6 B | 3.2 B | 23.1 B | 13.4 U | 19.2 B | 6.3 B |
| Iron | NE | 300 | 5140 N*J | 11700 N* | 8320 J | 9490 | 1380 N*J | 2560 N* | 1590 UJ | 224 |
| Lead | 15 (1) | NE | 1.7 U | 1.6 BW | 2.1 U | 1.1 U | 3 U | 2.1 BW | 2.8 U | 6.3 |
| Magnesium | NE | NE | 819000 ENJ | 90500 | 41100 J | 38000 J | 37900 EJ | 36000 | 23100 J | 22400 J |
| Manganese | NE | 50 | 4180 EJ | 5270 | 3370 J | 3570 | 1000 ENJ | 1170 | 1810 J | 1090 |
| Mercury | 2 | NE | 0.2 U | 1.4 | 0.2 U | 0.20 U | 0.20 U | 0.31 | 0.2 U | 0.20 U |
| Nickel | 100 | NE | 21 B | 10.3 U | 2 B | 1.0 B | 21.9 B | 12 B | 7 B | 1.8 B |
| Potassium | NE | NE | 17100 | 26400 | 17900 B | 42800 EJ | 1920 B | 1610 B | 2540 B | 1540 B |
| Selenium | 50 | NE | 20.5 BJN | 16 U | 3.9 BJ | 2.0 U | 1.4 UNWJ | 1.6 UW | 2 UJ | 2.0 U |
| Silver | NE | 100 | 5.1 U | 3.6 U | 0.94 B | 2.20 B | 5.1 U | 3.6 U | 0.7 U | 0.70 U |
| Sodium | NE | NE | 396000 EJ | 348000 | 281000 | 241000 | 388000 EJ | 394000 | 267000 | 291000 |
| Thallium | 2 | NE | 2.7 U | 2.6 UW | 1.6 U | 0.80 U | 2.7 U | 2.6 UW | 1.6 U | 0.80 U |
| Vanadium | NE | NE | 57.1 | 15.3 B | 1.2 B | 0.95 B | 46.6 B | 44.2 B | 20.3 B | 15.4 B |
| Zinc | NE | 5000 | 78.6 | 22.9 | 27 J | 181 E*J | 65.3 | 25.9 | 48.3 J | 97 E*R |
| Cyanide | 200 | NE | 10.0 U | 10.0 UN | 5.0 R | 5.0 U | 10.0 U | 10.0 UN | 5.0 R | 5.0 U |

Concentrations presented in ug/l

MCL - Maximum Contaminant Level
NE - None established
(1) - Treatment Technique Action Level
ft bgs - feet below ground surface
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
R - QC indicates that data is unusable. Analyte may or may not be present.
B - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
* - Duplicate analysis not within control limits.
E - Estimated due to the presence of interference.
N - Spike recovery not within control limits.
W - GFAA post-digest spike out of control limits.

303517

# TABLE
## MONITORING/PRODUCTION WELL SAMPLING SUMMARY - METALS
## VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| SAMPLE ID | | | MW-5 | MW-5 | MW-5 | MW-5 | MW-6 | MW-6 |
|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | | 15-Feb-95 | 10-May-95 | 12-Jan-98 | 24-Mar-98 | 13-Jan-98 | 26-Mar-98 |
| SAMPLE INTERVAL (ft bgs) | | | 17.5-27.5 | 17.5-27.5 | 17.5-27.5 | 17.5-27.5 | 17.4-26.7 | 17.4-26.7 |
| ANALYTE | Primary MCL | Secondary MCL | | | | | | |
| Aluminum | NE | 50-200 | 18500 EN*J | 306 N* | 19.9 BJ | 126 BER | 48.3 J | 337 EJ |
| Antimony | 6 | NE | 1.4 UN | 1.4 UW | 5.2 B | 2.2 U | ***6.2 B*** | 2.2 U |
| Arsenic | 50 | NE | 2.1 B | 1.5 UN | 1.4 U | 1.4 U | 1.4 U | 1.4 U |
| Barium | 2000 | NE | 270 | 162 B | 71.3 B | 65.7 B | 508 | 199 B |
| Beryllium | 4 | NE | 1.30 N*U | 0.15 BN | 0.1 U | 0.19 B | 0.1 U | 0.10 U |
| Cadmium | 5 | NE | 3.80 B | 2.40 U | 0.1 U | 0.23 B | 0.1 U | 0.10 U |
| Calcium | NE | NE | 148000 EJ | 66000 | 40600 J | 31800 J | 45600 J | 47700 |
| Chromium | 100 | NE | 23.8 | 2.2 U | 0.73 B | 2.5 B | 0.7 B | 1.2 |
| Cobalt | NE | NE | 82.5 | 3.8 U | 0.39 BJ | 0.3 U | 6.7 BJ | 4.7 |
| Copper | 1300 | NE | 367 | 13.4 U | 16.8 B | 3.8 B | 27.4 | 32.8 |
| Iron | NE | 300 | 28400 N*J | 339 N* | 31 BJ | 106 | 439 J | 624 |
| Lead | 15 (1) | NE | ***17*** | ***20.3 S*** | 8.7 U | 1.1 U | 1.1 U | 1.1 U |
| Magnesium | NE | NE | 81500 EJ | 52000 | 50200 J | 31500 J | 34900 J | 31600 |
| Manganese | NE | 50 | 14100 ENJ | 108 | 414 J | 222 | 2660 J | 2540 |
| Mercury | 2 | NE | 0.2 UN | 0.20 U | 0.2 U | 0.20 U | 0.2 U | 0.20 U |
| Nickel | 100 | NE | 79.8 | 10.3 U | 1 U | 1.0 U | 2.5 B | 1.0 U |
| Potassium | NE | NE | 4110 B | 1320 B | 7610 J | 1840 BE | 1810 B | 1920 BE |
| Selenium | 50 | NE | 14.0 UNJ | 1.6 UW | 2 UJ | 2.0 U | 2.6 BJ | 2.0 U |
| Silver | NE | 100 | 5.10 U | 3.60 U | 0.7 U | 0.70 U | 0.7 U | 1.00 B |
| Sodium | NE | NE | 349000 EJ | 314000 | 396000 | 275000 | 266000 | 310000 |
| Thallium | 2 | NE | 2.70 U | 2.60 UW | 1.6 U | 0.80 U | 1.6 U | 0.86 B |
| Vanadium | NE | NE | 456 | 30.3 B | 18.5 B | 23.6 B | 1.8 B | 2.6 B |
| Zinc | NE | 5000 | 227 | 20.3 | 21.2 UJ | 60 E*R | 106 J | 289 E*R |
| Cyanide | 200 | NE | 10.0 U | 10.0 UN | 5.0 R | 5.0 U | 5.0 R | 5.0 U |

Concentrations presented in ug/l
Bold, italicized print denotes concentration above the MCL.

MCL - Maximum Contaminant Level
NE - None established
(1) - Treatment Technique Action Level
ft bgs - feet below ground surface
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
R - QC indicates that data is unusable. Analyte may or may not be present.
S - Determined by Method of Standard Additions.
B - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
* - Duplicate analysis not within control limits.
E - Estimated due to the presence of interference.
N - Spike recovery not within control limits.
W - GFAA post-digest spike out of control limits.

303518

## TABLE
## MONITORING/PRODUCTION WELL SAMPLING SUMMARY - METALS
## VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| SAMPLE ID | | | MW-7 | MW-7 | MW-8 | MW-8 | MW-9 | MW-9 |
|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | | 13-Jan-98 | 25-Mar-98 | 14-Jan-98 | 26-Mar-98 | 12-Jan-98 | 25-Mar-98 |
| SAMPLE INTERVAL (ft bgs) | | | 64-74 | 64-74 | 63-73 | 63-73 | 64-74 | 64-74 |
| ANALYTE | Primary MCL | Secondary MCL | | | | | | |
| Aluminum | NE | 50-200 | 72 J | 381 EJ | 231 J | 148 BE | 48.8 BJ | 174 BE |
| Antimony | 6 | NE | 2.2 U | 2.2 U | 3.2 B | 2.2 U | 3.6 B | 2.2 U |
| Arsenic | 50 | NE | 1.4 U | 2 B | 1.4 U | 1.4 U | 1.4 U | 1.4 U |
| Barium | 2000 | NE | 52 B | 54.5 B | 45 B | 57.3 B | 52.2 B | 53.6 B |
| Beryllium | 4 | NE | 0.1 U | 0.10 U | 0.1 U | 0.10 U | 0.1 U | 0.10 U |
| Cadmium | 5 | NE | 0.1 U | 0.10 U | 0.1 U | 0.10 U | 0.1 U | 0.10 U |
| Calcium | NE | NE | 55700 J | 59600 | 51200 J | 69300 | 54400 J | 57000 |
| Chromium | 100 | NE | 1.8 B | 2.4 B | 2.8 B | 2.2 B | 1.2 B | 1.6 B |
| Cobalt | NE | NE | 0.88 BJ | 0.3 U | 2.7 BJ | 0.3 U | 0.37 BJ | 0.3 U |
| Copper | 1300 | NE | 7.9 B | 7.2 B | 6.9 B | 5.5 B | 14.8 B | 4.4 B |
| Iron | NE | 300 | 41 UJ | 214 | 187 J | 41 B | 7 UJ | 91 B |
| Lead | 15 (1) | NE | 1.1 U | 1.1 U | 1.1 U | 1.1 U | 13.1 U | 1.1 U |
| Magnesium | NE | NE | 38600 J | 39900 | 35000 J | 49100 | 37600 J | 40300 |
| Manganese | NE | 50 | 46 J | 39.0 | 55.9 J | 34.8 | 49.4 J | 37.3 |
| Mercury | 2 | NE | 0.51 | 0.48 R | 0.36 | 0.42 | 0.34 | 0.46 R |
| Nickel | 100 | NE | 1 U | 1.0 U | 2.1 B | 1.0 U | 1 U | 1.0 U |
| Potassium | NE | NE | 2160 B | 2310 BE | 1990 B | 2660 BE | 3470 B | 5720 EJ |
| Selenium | 50 | NE | 3.1 BJ | 2.0 U | 2.3 BJ | 2.0 U | 3.7 BJ | 2.0 U |
| Silver | NE | 100 | 0.7 U | 1.9 B | 0.7 U | 0.70 U | 0.7 U | 0.70 U |
| Sodium | NE | NE | 295000 | 342000 | 237000 | 342000 | 322000 | 345000 |
| Thallium | 2 | NE | 1.6 U | 0.80 UW | 1.6 U | 0.80 UW | 1.6 U | 0.80 UW |
| Vanadium | NE | NE | 27.6 B | 30.7 B | 20.5 B | 29.2 B | 27.3 B | 28.8 B |
| Zinc | NE | 5000 | 85.2 UJ | 131 E*J | 175 J | 90.9 E*R | 57.3 UJ | 83.2 E*R |
| Cyanide | 200 | NE | 5.0 R | 5.0 U | 5.0 R | 5.0 U | 5.0 R | 5.0 U |

Concentrations presented in ug/l

MCL - Maximum Contaminant Level
NE - None established
(1) - Treatment Technique Action Level
ft bgs - feet below ground surface
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
R - QC indicates that data is unusable. Analyte may or may not be present.
B - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
* - Duplicate analysis not within control limits.
E - Estimated due to the presence of interference.
W - GFAA post-digest spike out of control limits.

303519

TABLE

# MONITORING/PRODUCTION WELL SAMPLING SUMMARY - METALS
# VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| SAMPLE ID | | | MW-10 | MW-10 | P-1 | P-1 | P-2 | P-2 |
|---|---|---|---|---|---|---|---|---|
| SAMPLE DATE | | | 11-Jan-98 | 27-Mar-98 | 10-Jan-98 | 29-Mar-98 | 10-Jan-98 | 27-Mar-98 |
| SAMPLE INTERVAL (ft bgs) | | | 22-32 | 22-32 | Unknown | Unknown | Unknown | Unknown |
| ANALYTE | Primary MCL | Secondary MCL | | | | | | |
| Aluminum | NE | 50-200 | 110 BJ | 1420 EJ | 34.9 BJ | 43.5 BE | 19.5 BJ | 219 ER |
| Antimony | 6 | NE | 2.2 U | 2.2 U | 2.2 B | 2.2 U | 2.2 B | 2.2 U |
| Arsenic | 50 | NE | 2.9 B | 5.2 B | 1.4 U | 1.4 U | 1.4 U | 1.4 U |
| Barium | 2000 | NE | 229 | 283 | 41.5 B | 39.8 B | 47 B | 74.3 B |
| Beryllium | 4 | NE | 0.1 U | 0.10 U | 0.1 U | 0.10 U | 0.1 U | 0.10 U |
| Cadmium | 5 | NE | 0.1 U | 0.51 B | 0.1 U | 0.10 U | 0.1 U | 0.52 B |
| Calcium | NE | NE | 50000 J | 60600 | 58800 J | 57000 | 48600 J | 72600 |
| Chromium | 100 | NE | 0.84 B | 25.7 | 1.8 B | 3.4 B | 1.6 B | 2.1 B |
| Cobalt | NE | NE | 3.5 BJ | 7.0 B | 0.85 BJ | 0.3 U | 0.3 UJ | 0.57 B |
| Copper | 1300 | NE | 7.5 B | 12.1 B | 8.8 B | 2.8 B | 5.9 B | 23.6 B |
| Iron | NE | 300 | 2800 J | 4640 | 699 J | 982 | 249 J | 10100 |
| Lead | 15 (1) | NE | 7.2 U | ***50.7*** | 2 B | 1.1 U | 8 | 1.1 U |
| Magnesium | NE | NE | 34800 J | 43800 | 42000 J | 40200 | 34700 J | 52900 |
| Manganese | NE | 50 | 2900 J | 3410 | 10.2 BJ | 12.4 B | 131 J | 919 |
| Mercury | 2 | NE | 0.2 U | 0.20 U | 0.29 | 0.35 | 0.21 | 0.20 U |
| Nickel | 100 | NE | 1 U | 16.3 B | 2.2 B | 1.0 U | 1 U | 1.0 U |
| Potassium | NE | NE | 2440 B | 3760 BE | 2130 B | 2450 BE | 2720 B | 2680 BE |
| Selenium | 50 | NE | 2 UJ | 2.0 U | 2 UJ | 2.0 U | 2.9 BJ | 2.0 U |
| Silver | NE | 100 | 0.7 U | 1.60 B | 0.7 U | 0.70 U | 0.7 U | 1.20 B |
| Sodium | NE | NE | 212000 | 301000 | 283000 | 331000 | 395000 | 382000 |
| Thallium | 2 | NE | 1.6 U | 0.80 UW | 1.6 U | 0.80 UW | 1.6 U | 0.80 UW |
| Vanadium | NE | NE | 0.49 B | 5.7 B | 23.8 B | 27.4 B | 32.6 B | 58.6 |
| Zinc | NE | 5000 | 90.5 J | 252 E*R | 65.5 J | 94.4 E*R | 66 J | 101 E*R |
| Cyanide | 200 | NE | 5.0 R | 5.0 U | 5.0 R | 5.0 U | 5.0 R | 5.0 U |

Concentrations presented in ug/l
Bold, italicized print denotes concentration above the MCL.

MCL - Maximum Contaminant Level
NE - None established
(1) - Treatment Technique Action Level
ft bgs - feet below ground surface
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
R - QC indicates that data is unusable. Analyte may or may not be present.
B - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
* - Duplicate analysis not within control limits.
E - Estimated due to the presence of interference.
W - GFAA post-digest spike out of control limits.

303520

# TABLE 4-20
# P-1 PACKER TEST RESULTS - VOCs
# VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| SAMPLE LOCATION | | P-1 | P-1 | P-1 |
|---|---|---|---|---|
| LAB ID | | Deep | Shallow | Composite |
| SAMPLE DATE | | 10/18/98 | 10/18/98 | 10/18/98 |
| ANALYTE | MCL | | | |
| Acetone | NE | 10 U | 10 U | 10 U |
| Methylene Chloride | 5 | 5 U | 1 J | 2 J |
| Chloroform | 80 | 76 | 31 | 38 |
| Toluene | 1,000 | 5 U | 2 J | 2 J |
| Ethylbenzene | 700 | 5 U | 5 U | 5 U |
| m&p-Xylene | 10,000 | 10 U | 2 J | 2 J |
| o-Xylene | (total) | 5 U | 5 U | 5 U |

Concentrations presented in ug/l

MCL - Maximum Contaminant Level
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
Refer to Section 4.3.2.6 for discussion of acetone and methylene chloride results and qualifiers.

303521

# TABLE 4-21
# OFFSITE PRODUCTION/SUPPLY WELLS SAMPLING SUMMARY - VOCs
# VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| SAMPLE LOCATION | | Charlie's #1 | Charlie's #2 | VIPA #1 | VIPA #2 | Fairplains #9 |
|---|---|---|---|---|---|---|
| SAMPLE DATE | | 10/5/98 | 10/5/98 | 10/7/98 | 10/7/98 | 10/14/98 |
| ANALYTE | MCL | | | | | |
| Acetone | NE | 10 U | 10 U | 10 U | 10 U | 10 U |
| Methylene Chloride | 5 | 5 U | 5 U | 5 U | 5 U | 5 U |
| Chloroform | 80 | 5 U | 5 U | 5 U | 5 U | 5 U |
| Toluene | 1,000 | 5 U | 5 U | 5 U | 5 U | 5 U |
| Ethylbenzene | 700 | 5 U | 5 U | 5 U | 5 U | 5 U |
| m&p-Xylene | 10,000 | 10 U | 10 U | 10 U | 1 J | 10 U |
| o-Xylene | (total) | 5 U | 5 U | 5 U | 5 U | 5 U |

303522

# TABLE 4-22
# BIOLOGICAL PARAMETER GROUNDWATER SAMPLING RESULTS
# VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| SAMPLE ID: | MW-2 | MW-7 | MW-11 | MW-13 | GWPP27A |
|---|---|---|---|---|---|
| SAMPLE DATE: | 08-Oct-98 | 08-Oct-98 | 20-Oct-98 | 20-Oct-98 | 20-Oct-98 |
| SAMPLE INTERVAL | 18.9-28.2 | 64-74 | 30-40 | 30-40 | 110-120 |
| ANALYTE: | | | | | |
| Iron | 589 | 1440 | 13500 | 1670 | 18700 |
| Dissolved Iron | 180 | 1450 | 1250 | 156 | 100 U |
| Alkalinity | 578 | 637 | 744 | 597 | 670 |
| Ammonia | 0.05 U | 0.05 U | 0.05 U | 0.05 U | 0.0970 |
| BOD | 10.0 | 2 U | 2.60 | 2 U | 2 U |
| Chloride | 83.4 | 220 | 310 | 322 | 732 |
| COD | 11.3 | 5 U | 9.20 | 11.2 | 5 U |
| Nitrite/Nitrate | 0.05 U | 2.16 | 1.86 | 2.55 | 2.83 |
| Sulfate | 152 | 223 | 222 | 238 | 214 |
| Sulfide | 1 U | 1 U | 1 U | 1 U | 1 U |
| Total Dissolved Solids | 912 | 1510 | 1610 | 1500 | 1990 |
| Total Organic Carbon | 3.40 | 1.90 | 4.40 | 3.80 | 2.00 |
| Total Phosphorus | 0.1 U | 0.171 | 0.132 | 0.112 | 0.930 |
| Total Suspended Solids | 8.0 | 75.0 | 387 | 49.0 | 900 |
| Methane | 8.6 U | 8.6 U | 8.6 U | 8.6 U | 8.6 U |
| Heterotrophic Plate Count | 1190 | 139 | 247000 | 238000 | 1350000 |

Concentrations presented in ug/l

U - Material analyzed for but not detected. The number is the minimum quantitation limit.

303523

# TABLE 23
## SURFACE SOIL/SEDIMENT SAMPLING SUMMARY
## VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| GUT | | River Gut | | | | |
|---|---|---|---|---|---|---|
| SAMPLE ID | | RG-2 | RG-2 (dup) | RG-3 | RG-4 | RG-4 (dup) |
| SAMPLE DATE | | 23-Sep-97 | 23-Sep-97 | 23-Sep-97 | 23-Sep-97 | 23-Sep-97 |
| SAMPLE MATRIX | | Soil | Soil | Soil | Soil | Soil |
| **Analyte** | **SSL - MGW (DAF=10) [a]** | | | | | |
| Aluminum | NE | 15500 | 17700 | 14900 | 14400 | 9210 |
| Antimony | 31 | 0.53 U | 0.52 U | 0.53 U | 0.49 U | 0.53 U |
| Arsenic | 0.4 | ***1.6 BJ*** | 0.34 U | ***0.86 BJ*** | ***1.2 BJ*** | 0.34 U |
| Barium | 5,500 | 70.6 | 89 | 53.8 | 58.4 | 36.3 B |
| Beryllium | 0.1 | 0.03 U | 0.03 U | 0.03 U | 0.02 U | 0.03 U |
| Cadmium | 78 | 0.19 BJ | 0.3 B | 0.31 B | 0.21 B | 0.11 B |
| Calcium | NE | 24500 | 28700 | 39300 | 51000 | 30700 |
| Chromium | 390 | 16.1 | 19.4 | 14.8 | 12 | 8 |
| Cobalt | NE | 14.8 J | 16.8 J | 13.8 J | 12.8 J | 8 BJ |
| Copper | NE | 40.5 J | 54.4 J | 38.8 J | 33 J | 19.6 J |
| Iron | NE | 26800 | 30900 | 27300 | 22700 | 14500 |
| Lead | 400 | 5.9 J | 8.2 J | 4.1 J | 14.1 J | 3.1 J |
| Magnesium | NE | 7650 | 9070 | 8600 | 6920 | 4700 |
| Manganese | NE | 594 J | 675 J | 792 J | 726 J | 445 J |
| Mercury | 23 | 0.13 U | 0.13 U | 0.13 U | 0.33 | 0.19 J |
| Nickel | 1,600 | 9.4 B | 13.8 J | 10.3 B | 9.8 J | 6.1 B |
| Potassium | NE | 2230 J | 3300 J | 1500 J | 1310 J | 754 B |
| Selenium | 390 | 0.68 B | 0.65 U | 0.66 U | 0.61 U | 1 B |
| Silver | 390 | 0.16 U | 0.16 U | 0.16 U | 0.15 U | 0.16 U |
| Sodium | NE | 543 B | 697 B | 525 B | 639 B | 509 B |
| Thallium | NE | 0.58 U | 0.57 U | 0.58 U | 0.54 U | 0.58 U |
| Vanadium | 550 | 69.2 | 81 | 59.6 | 49.2 | 32.7 |
| Zinc | 23,000 | 140 J | 263 J | 54.4 J | 50.8 J | 42.6 J |
| Cyanide | 1,600 | 1.3 U | 1.3 U | 1.3 U | 1.2 U | 1.3 U |

Concentrations presented in mg/kg
Bold, italicized print denotes concentration above screening benchmark.

NE - None Established
U = Material analyzed for but not detected. The number is the minimum quantitation limit.
J = Estimated value.
B = Result is between the instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).

[a] Soil Screening Levels (SSLs) based on soil ingestion pathway (EPA 1996)

303524

TABLE 23

## SURFACE SOIL/SEDIMENT SAMPLING SUMMARY
## VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| GUT | | River Gut | | | | | |
|---|---|---|---|---|---|---|---|
| SAMPLE ID | | RG-5 | RG-6 | RG-7 | RG-8 | RG-9 | RG-10 |
| SAMPLE DATE | | 23-Sep-97 | 23-Sep-97 | 23-Sep-97 | 23-Sep-97 | 23-Sep-97 | 23-Sep-97 |
| SAMPLE MATRIX | | Soil | Soil | Soil | Soil | Soil | Soil |
| **Analyte** | **SSL - MGW (DAF=10) [a]** | | | | | | |
| Aluminum | NE | 11200 | 10500 | 11500 | 10200 | 15400 | 9500 |
| Antimony | 31 | 0.47 U | 0.46 U | 0.53 U | 0.48 U | 0.56 U | 0.52 U |
| Arsenic | 0.4 | ***0.91 BJ*** | 0.36 BJ | ***0.92 BJ*** | 0.31 U | ***1.1 BJ*** | ***1 BJ*** |
| Barium | 5,500 | 43.5 B | 43.5 B | 68 | 53 | 98.5 | 52.6 |
| Beryllium | 0.1 | 0.02 U | 0.02 U | 0.03 U | 0.02 U | 0.03 U | 0.03 U |
| Cadmium | 78 | 0.15 B | 0.13 B | 0.19 B | 0.03 B | 0.32 B | 0.11 B |
| Calcium | NE | 81100 | 57000 | 42900 | 48700 | 56200 | 56700 |
| Chromium | 390 | 14.6 | 14.4 | 13.6 | 10.8 | 20.2 | 13.9 |
| Cobalt | NE | 10.3 BJ | 9.5 BJ | 11 BJ | 8.1 BJ | 14.4 J | 7.4 BJ |
| Copper | NE | 32.9 J | 29.6 J | 34.1 J | 25.1 J | 47.2 J | 23.7 J |
| Iron | NE | 22300 | 19800 | 21100 | 15800 | 27500 | 16000 |
| Lead | 400 | 26.1 J | 11.4 J | 5.9 J | 4.5 J | 6.3 J | 8.2 J |
| Magnesium | NE | 7630 | 6700 | 6040 | 5320 | 8270 | 4610 |
| Manganese | NE | 598 J | 513 J | 531 J | 408 J | 708 J | 431 J |
| Mercury | 23 | 0.13 J | 0.22 J | 0.11 U | 0.19 J | 0.34 J | 0.25 J |
| Nickel | 1,600 | 9.6 J | 10.6 J | 8.2 B | 6.5 B | 12.4 J | 7.6 B |
| Potassium | NE | 1290 J | 1250 J | 1750 J | 1910 J | 3540 J | 1650 J |
| Selenium | 390 | 0.98 B | 0.57 U | 0.66 U | 0.6 U | 0.69 U | 1.1 B |
| Silver | 390 | 0.14 U | 0.14 U | 0.16 U | 0.14 U | 0.17 U | 0.16 U |
| Sodium | NE | 580 B | 474 B | 479 B | 522 B | 668 B | 599 B |
| Thallium | NE | 0.52 U | 0.51 U | 0.58 U | 0.52 U | 0.61 U | 0.57 U |
| Vanadium | 550 | 48.1 | 51.4 | 63.8 | 44.8 | 85.9 | 46.3 |
| Zinc | 23,000 | 67.8 J | 45.9 J | 43.4 J | 34.9 J | 155 J | 44 J |
| Cyanide | 1,600 | 1.2 U | 1.1 U | 1.3 U | 1.2 U | 1.4 U | 1.3 U |

Concentrations presented in mg/kg
Bold, italicized print denotes concentration above sc

NE - None Established
U = Material analyzed for but not detected. The nu
J = Estimated value.
B = Result is between the instrument detection limit

[a] Soil Screening Levels (SSLs) based on soil ingesti

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TAB[illegible]23

# SURFACE SOIL/SEDIMENT SAMPLING SUMMARY
# VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| GUT | | River Gut | | | | | |
|---|---|---|---|---|---|---|---|
| SAMPLE ID | | RG-11 | RG-12 | RG-13 | RG-14 | RG-15 | RG-16 |
| SAMPLE DATE | | 23-Sep-97 | 16-Sep-97 | 16-Sep-97 | 16-Sep-97 | 16-Sep-97 | 16-Sep-97 |
| SAMPLE MATRIX | | Soil | Soil | Soil | Soil | Soil | Soil |
| **Analyte** | **SSL - MGW (DAF=10) [a]** | | | | | | |
| Aluminum | NE | 7680 | 6210 | 14400 | 7220 J | 3500 | 5200 |
| Antimony | 31 | 0.49 U | 0.49 U | 0.47 U | 0.83 U | 0.46 U | 0.53 U |
| Arsenic | 0.4 | 0.38 BJ | ***0.48 BJ*** | ***1.1 BJ*** | ***1.5 BJ*** | 0.3 U | 0.34 U |
| Barium | 5,500 | 50.6 | 47 B | 112 | 36.5 BJ | 23.1 B | 21.6 B |
| Beryllium | 0.1 | 0.02 U | 0.02 U | 0.02 U | 0.04 U | 0.02 U | 0.03 U |
| Cadmium | 78 | 0.05 B | 0.12 B | 0.86 B | 0.04 U | 0.02 U | 0.08 B |
| Calcium | NE | 32000 | 23900 | 57400 | 97500 J | 800000 | 46400 |
| Chromium | 390 | 10.1 | 9.9 | 21.6 | 39 J | 4.7 | 5.9 |
| Cobalt | NE | 6.7 BJ | 6.1 BJ | 11.9 J | 4.9 BJ | 2.2 BJ | 3.1 BJ |
| Copper | NE | 22 J | 18.1 J | 43.8 J | 10.2 BJ | 11.8 J | 19.9 J |
| Iron | NE | 12700 | 12500 | 23100 | 9160 J | 4330 | 5780 |
| Lead | 400 | 3.4 J | 4.7 J | 22.2 J | 3.4 J | 1.6 J | 2.2 J |
| Magnesium | NE | 3590 | 2560 | 6600 | 3190 J | 1600 | 1660 |
| Manganese | NE | 297 J | 313 J | 560 J | 222 J | 173 J | 196 J |
| Mercury | 23 | 0.39 J | 0.11 U | 0.11 U | 0.18 U | 0.11 J | 0.12 U |
| Nickel | 1,600 | 5.6 B | 4.2 B | 11.5 J | 17 J | 1.3 B | 4.2 B |
| Potassium | NE | 1410 J | 1010 B | 3020 J | 706 BJ | 665 B | 803 B |
| Selenium | 390 | 0.62 U | 0.61 U | 1.6 | 1 U | 0.57 U | 0.66 U |
| Silver | 390 | 0.15 U | 0.15 U | 0.14 U | 0.25 U | 0.14 U | 0.16 U |
| Sodium | NE | 329 B | 293 B | 561 B | 215 BJ | 255 B | 492 B |
| Thallium | NE | 0.54 U | 0.54 U | 0.51 U | 0.92 U | 0.51 U | 0.58 U |
| Vanadium | 550 | 44.5 | 53 | 70.2 | 28.6 J | 15 | 17 |
| Zinc | 23,000 | 26.4 J | 39.1 J | 174 J | 21.8 J | 13.6 J | 25.9 J |
| Cyanide | 1,600 | 1.2 U | 1.2 U | 1.2 U | 2 U | 1.1 U | 1.3 U |

Concentrations presented in mg/kg
Bold, italicized print denotes concentration above sc

NE - None Established
U = Material analyzed for but not detected. The nu
J = Estimated value.
B = Result is between the instrument detection limit

[a] Soil Screening Levels (SSLs) based on soil ingesti

303526

TABLE 23

# SURFACE SOIL/SEDIMENT SAMPLING SUMMARY
# VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| GUT | | Bethlehem Gut | | Fairplain Gut | | | |
|---|---|---|---|---|---|---|---|
| SAMPLE ID | | BG-1 | BG-2 | FPG-1 | FPG-2 | FPG-3 | FPG-4 |
| SAMPLE DATE | | 16-Sep-97 | 16-Sep-97 | 16-Sep-97 | 16-Sep-97 | 16-Sep-97 | 16-Sep-97 |
| SAMPLE MATRIX | | Soil | Soil | Soil | Soil | Sediment | Sediment |
| **Analyte** | **SSL - MGW (DAF=10)** [a] | | | | | | |
| Aluminum | NE | 15400 | 3990 | 10200 | 9750 | 9150 | 2770 |
| Antimony | 31 | 0.61 U | 0.43 U | 0.52 U | 0.51 U | 0.62 U | 0.49 U |
| Arsenic | 0.4 | 0.39 U | ***0.43 BJ*** | ***1.4 BJ*** | ***2.8 J*** | ***1.3 BJ*** | ***1.7 B*** |
| Barium | 5,500 | 101 | 63 | 67.4 | 70 | 61.4 B | 8.7 B |
| Beryllium | 0.1 | 0.03 U | 0.02 U | 0.03 U | 0.03 U | 0.03 U | 0.02 U |
| Cadmium | 78 | 0.16 B | 0.02 U | 0.09 B | 0.2 B | 0.05 B | 0.02 U |
| Calcium | NE | 39800 | 19800 | 36600 | 25300 | 17900 | 21300 |
| Chromium | 390 | 19.7 | 4.6 | 13.9 | 13.9 | 13.7 | 3 |
| Cobalt | NE | 11.4 BJ | 5.4 BJ | 8.2 BJ | 8.6 BJ | 9.3 BJ | 3 BJ |
| Copper | NE | 49.3 J | 11.2 J | 33.1 J | 33.2 J | 25.8 J | 6 B |
| Iron | NE | 20400 | 5300 | 14300 | 14800 | 15200 | 4320 |
| Lead | 400 | 12.9 J | 2.4 J | 8.8 J | 5.7 J | 5.6 J | 2.6 J |
| Magnesium | NE | 5380 | 1150 | 3680 | 3670 | 4210 | 1850 |
| Manganese | NE | 534 J | 339 J | 267 J | 332 J | 197 J | 64.6 J |
| Mercury | 23 | 0.14 U | 0.1 U | 0.13 U | 0.12 U | 0.15 U | 0.12 U |
| Nickel | 1,600 | 11.7 B | 3.2 B | 7.7 B | 6.9 B | 7 B | 1.5 B |
| Potassium | NE | 3310 J | 582 B | 2150 J | 1940 J | 2720 J | 493 B |
| Selenium | 390 | 0.76 U | 0.53 U | 1.1 B | 0.63 U | 1.2 B | 0.62 U |
| Silver | 390 | 0.18 U | 0.13 U | 0.16 U | 0.15 U | 0.18 U | 0.15 U |
| Sodium | NE | 660 B | 423 B | 570 B | 887 B | 21100 B | 1110 B |
| Thallium | NE | 0.67 U | 0.47 U | 0.57 U | 0.56 U | 0.68 U | 0.54 U |
| Vanadium | 550 | 68.2 | 29.9 | 54.6 | 56.5 | 69.4 | 16.6 |
| Zinc | 23,000 | 58.7 J | 13.1 J | 39.4 J | 34.2 J | 29.3 J | 12.2 J |
| Cyanide | 1,600 | 1.5 U | 1.1 U | 1.3 U | 1.2 U | 1.5 U | 1.2 U |

Concentrations presented in mg/kg
Bold, italicized print denotes concentration above sc

NE - None Established
U = Material analyzed for but not detected. The nu
J = Estimated value.
B = Result is between the instrument detection limit

[a] Soil Screening Levels (SSLs) based on soil ingesti

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**Table 4-24**
**Subsurface Soil Sampling Summary - River Gut**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| | | River Gut | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | | SBRG-1 | SBRG-1 | SBRG-1 | SBRG-2 | SBRG-2 | SBRG-3 | SBRG-3 |
| SAMPLE DATE | | 30-Sep-97 | 30-Sep-97 | 30-Sep-97 | 26-Sep-97 | 26-Sep-97 | 30-Sep-97 | 26-Sep-97 |
| SAMPLE INTERVAL (ft bgs) | | 6-8 | 12-14 | 12-14 (Duplicate) | 2-4 | 4-6 | 6-8 | 8-10 |
| ANALYTE | SSL MGW DAF=20 | | | | | | | |
| *Volatile Organics (in ug/kg)* | | | | | | | | |
| 2-Butanone | NE | 7 J | 7 J | 12 U | 12 U | 13 U | 19 J | 11 U |
| Toluene | 12,000 | 11 U | 12 U | 12 U | 2 J | 4 J | 2 J | 9 J |
| *Semivolatile Organics (in ug/kg)* | | | | | | | | |
| Fluorene | 560,000 | 380 U | 390 U | 400 U | 58 J | 1,000 | 2,600 J | 400 U |
| Butylbenzylphthalate | 930,000 | 380 U | 390 U | 130 J | 440 U | 350 U | 380 U | 400 U |
| *Metals (in mg/kg)* | | | | | | | | |
| Aluminum | NE | 12700 | 13800 | 11600 | 9910 | 12100 | 11200 | 6620 |
| Arsenic | 29 | 0.3 U | 0.52B BJ | 1.3 BJ | 0.81 BJ | 0.89 BJ | 0.52 BJ | 1.5 BJ |
| Barium | 1,600 | 59.5 | 114 | 114 | 46.9 B | 62.2 | 57.9 | 41.1 B |
| Cadmium | 8 | 0.14 B | 0.18 BJ | 0.16 B | 0.2 B | 0.1 B | 0.26 BJ | 0.02 U |
| Calcium | NE | 33200 | 24200 R | 12900 | 5850 | 25900 | 31700 | 27000 |
| Chromium | 38 | 18.8 | 25 | 15.9 | 12.2 | 16 | 13.3 | 7.5 |
| Cobalt | NE | 9.7 B | 13.1 | 13.8 | 9.8 B | 10.6 B | 10.9 | 7.8 B |
| Copper | NE | 32.4 EJ | 44.5 EJ | 39.9 R | 25.8 EJ | 32.7 EJ | 35.1 EJ | 26.2 EJ |
| Iron | NE | 21800 | 25900 | 2110 | 14200 | 18700 | 19400 | 12200 |
| Lead | NE | 3.7 J | 2.1 J | 2.8 J | 3.7 J | 6.2 J | 3.8 J | 3.9 J |
| Magnesium | NE | 5550 | 6990 | 4630 | 2880 | 3840 | 5100 | 3040 |
| Manganese | NE | 402 NJ | 673 NJ | 544 NJ | 148 NJ | 327 NJ | 440 NJ | 247 NJ |
| Nickel | 130 | 8.9 B | 10.7 | 8.1 B | 6.6 B | 7.8 B | 10.6 | 5.2 B |
| Potassium | NE | 1290 EJ | 1270 EJ | 933 EB | 1060 EB | 1530 EJ | 1460 EJ | 679 EB |
| Selenium | 5 | 0.57 U* | 0.6 U* | 0.6 U* | 0.61 U* | 0.67 U* | 0.53 U* | 1.1 * |
| Sodium | NE | 617 B | 858 B | 604 B | 389 B | 548 B | 411 B | 377 B |
| Vanadium | 6,000 | 77.5 | 88 | 78.6 | 64.8 | 85.3 | 65.8 | 47.2 |
| Zinc | 12,000 | 39.2 *R | 47 *R | 29.9 *R | 25.6 *J | 32.4 *J | 56.3 *R | 22.7 *J |
| Cyanide | 40 | 0.56 U | 0.59 U | 0.59 U | 0.61 U | 0.64 U | 0.52 U | 0.57 U |

SSL - Soil Screening Level
MGW - Migration to Groundwater
DAF - Dilution Attenuation Factor
NE - None established
ft bgs - feet below ground surface
U - Material analyzed for but not detected. The number is the minimum quantitation limit.
J - Estimated value.
R - QC indicates that data is unusable. Analyte may or may not be present.
B (inorganics) - Result is between instrument detection limit (IDL) and Contract Required Detection Limit (CRDL).
* - Duplicate analysis not within control limits.
E - Estimated due to the presence of interference.
N - Spike recovery not within control limits.
- - Not Applicable

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# Table 5-1
## Physical and Chemical Properties of Organic Constituents
## Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands

| Constituent | Molecular Weight (g/mol) | Water Solubility (mg/L 25 °C) | Specific Gravity | Vapor Pressure (mm Hg 25 °C) | Henry's Law Constant (atm-m3/mol) (25 °C) | Diffusivity ($cm_2$/sec) | $K_{oc}$ (mL/g) | Log $K_{ow}$ | Groundwater T 1/2 Low \| High (days) | Soil T 1/2 Low \| High (days) |
|---|---|---|---|---|---|---|---|---|---|---|
| Acetone | 58 | miscible | 0.79 | 2.70E+02 | 3.97E-05 | 0.11498 | 0.37 | -0.24 | 2 - 14 | 1 - 7 |
| Chloroform | 119 | 7,222 - 9,600 | 1.48 | 7.6+01 (20 °C) | 3.20E-03 | 0.08868 | 44 | 1.90 - 1.97 | 56 - 1,825 | 28 - 180 |
| Ethylbenzene | 106 | 152 - 208 | 0.87 | 9.50E+00 | 8.68E-03 | 0.06667 | 95 - 260 | 3.05 - 3.15 | 6 - 228 | 3 - 10 |
| Methylene chloride | 85 | 13,000 - 16,700 | 1.32 | 4.40E+02 | 2.69E-03 | 0.085 | 8.7 | 1.25 - 1.30 | 14 - 56 | 7 - 28 |
| Xylenes (total) | 106 | 162 - 200 | 0.87 | 6.6E+00 - 8.8E+00 | 6.30E-03 | 0.07164 | 128 - 1,580 | 2.77 - 3.20 | 14 - 360 | 7 - 28 |

| | | | |
|---|---|---|---|
| atm-m3/mol | Atmosphere-cubic meters per mole | $K_{ow}$ | Octonal-water partition coefficient |
| °C | Degrees Celcius | mg/L | Milligrams per liter |
| $cm_2$/sec | Square centimeters per second | mL/g | Milliliters per gram |
| g/mol | Grams per mole | mm Hg | Milliliters of mercury |
| $K_{oc}$ | Organic carbon partition coefficient | T 1/2 | Half-life |

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# Table 5-2
## Groundwater and Constituent of Concern Velocities
## Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands

| Site Constants | | | Units | Source |
|---|---|---|---|---|
| Hydraulic Conductivity | K= | 3.19 | feet/day | Site Data |
| Hydraulic Gradient | i= | 0.01 | | Site Data |
| Effective Porosity | Ne= | 0.35 | | Site Data (see Table 4-8) |
| Bulk Density | pb= | 1.44 | g/mL | Introduction to Geophysical Properties (Dobrin 1976) |
| Organic Carbon Content | $f_{oc}$= | 0.003 | | Site Data (see Table 4-8) |
| Separation Coefficient | $K_{oc}$= | | | |
| Acetone | | 0.37 | mg/L | Groundwater Chemicals Desk Reference (Montgomery et. al 1991) |
| Methylene Chloride | | 8.71 | mg/L | Groundwater Chemicals Desk Reference (Montgomery et. al 1991) |
| Ethylbenzene | | 157 | mg/L | Groundwater Chemicals Desk Reference (Montgomery et. al 1991) |
| Xylenes | | 347 | mg/L | Groundwater Chemicals Desk Reference (Montgomery et. al 1991) |
| Chloroform | | 44 | mg/L | Groundwater Chemicals Desk Reference (Montgomery et. al 1991) |

| Calculations | | | |
|---|---|---|---|
| Seepage Velocity | $V_s$= | (K*i)/Ne | feet/day |
| | Kd= | $K_{oc}$*$f_{oc}$ | |
| Retardation Factor | Rd= | 1+(Kd*pb/Ne) | |
| Constituent Transport Velocities | Vt= | Vs/Rd | feet/day |

| RESULTS | $V_s$ (feet/day) | Kd | Rd | $V_t$ (feet/day) |
|---|---|---|---|---|
| Acetone | 0.09 | 0.001 | 1.00 | 0.09 |
| Methylene Chloride | 0.09 | 0.02 | 1.10 | 0.08 |
| Ethylbenzene | 0.09 | 0.42 | 2.72 | 0.03 |
| Xylenes | 0.09 | 0.93 | 4.81 | 0.02 |
| Chloroform | 0.09 | 0.12 | 1.48 | 0.06 |

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**Table 6-1a**
**Carcinogenic Risk Estimates for Current Land Use Exposure Scenario**
**Reasonable Maximum Exposure**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| **Trespasser** | **Adult** | **Pre-adolescent (7 – 12 years)** |
|---|---|---|
| *Risk Estimates for Surface Soil* | | |
| Inhalation of particulates | 5E-09 | 7E-10 |
| Ingestion | 9E-07 | 5E-07 |
| Dermal | 2E-07 | 8E-08 |
| **Subtotal Risk for Surface Soil** | **1E-06** | **5E-07** |
| *Risk Estimates for Sediment in the Gut System* | | |
| Inhalation of particulates | 4E-09 | 5E-10 |
| Ingestion | 2E-07 | 1E-07 |
| Dermal | 5E-08 | 2E-08 |
| **Subtotal Risk for Sediment** | **3E-07** | **1E-07** |
| ***Total Carcinogenic Risk Estimate*** | ***1E-06*** | ***7E-07*** |

**Table 6-1b**
**Carcinogenic Risk Estimates for Current Land Use Exposure Scenario**
**Central Tendency**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| Trespasser | Adult | Pre-adolescent (7 – 12 years) |
|---|---|---|
| *Risk Estimates for Surface Soil* | | |
| Inhalation of particulates | 4E-10 | NE[2] |
| Ingestion | 1E-07 | NE[2] |
| Dermal | 4E-09 | NE[2] |
| **Subtotal Risk for Surface Soil** | **1E-07** | NE[2] |
| *Risk Estimates for Sediment in the Gut System* | | |
| Inhalation of particulates | NE[1] | NE[2] |
| Ingestion | NE[1] | NE[2] |
| Dermal | NE[1] | NE[2] |
| **Subtotal Risk for Sediment** | NE[1] | NE[2] |
| ***Total Carcinogenic Risk Estimate*** | 1E-07 | NE[2] |

1 Because the RME carcinogenic risk estimates did not exceed 1E-06 for sediment in the Gut System, the adult CT receptor was not evaluated.

2. Because the RME carcinogenic risk estimates did not exceed 1E-06 for either medium, the pre-adolescent CT receptor was not evaluated.

NE = not evaluated.

**Table 6-2a**
**Carcinogenic Risk Estimates for Future Land Use Exposure Scenarios**
**Reasonable Maximum Exposure**
**Virgin Island Chemical Site St. Croix, U.S. Virgin Islands**

| | Industrial/Commercial | Construction |
|---|---|---|
| | Adult | Adult |
| *Risk Estimates for Groundwater* | | |
| Inhalation of VOCs | 8E-04 | NE |
| Ingestion | 3E-05 | NE |
| Dermal | 4E-06 | NE |
| **Subtotal Risk for Groundwater** | **9E-04** | **NE** |
| *Risk Estimates for Surface Soil* | | |
| Inhalation of particulate | 2E-08 | 3E-09 |
| Ingestion | 2E-06 | 7E-07 |
| Dermal | 7E-07 | 3E-08 |
| **Subtotal Risk for Surface Soil** | **3E-06** | **7E-07** |
| *Risk Estimates for Sediment in the Gut System* | | |
| Inhalation of particulate | 1E-08 | 2E-09 |
| Ingestion | 4E-07 | 2E-07 |
| Dermal | 2E-07 | 7E-09 |
| **Subtotal Risk for Sediment** | **6E-07** | **2E-07** |
| ***Total Carcinogenic Risk Estimate*** | ***9E-04*** | ***9E-07*** |

NE = Not evaluated. Exposure to groundwater at the Site was not evaluated for the construction worker.



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**Table 6-2b**
**Carcinogenic Risk Estimates for Future Land Use Exposure Scenarios**
**Reasonable Maximum Exposure**
**Virgin Island Chemical Site St. Croix, U.S. Virgin Islands**

| | Resident - Adult | Resident – Child |
|---|---|---|
| *Risk Estimates for Groundwater* | | |
| Inhalation of VOCs | 7E-04 | 3E-04 |
| Ingestion | 1E-04 | 6E-05 |
| Dermal | 3E-06 | 1E-06 |
| **Subtotal Risk for Groundwater** | **8E-04** | **4E-04** |
| *Risk Estimates for Surface Soil* | | |
| Inhalation of particulate | NE | NE |
| Ingestion | NE | NE |
| Dermal | NE | NE |
| **Subtotal Risk for Surface Soil** | **NE** | **NE** |
| *Risk Estimates for Sediment in the Gut System* | | |
| Inhalation of particulate | NE | NE |
| Ingestion | NE | NE |
| Dermal | NE | NE |
| **Subtotal Risk for Sediment** | **NE** | **NE** |
| ***Total Carcinogenic Risk Estimate*** | ***8E-04*** | ***4E-04*** |

NE = Not evaluated. Exposure to surface soil at the Site and sediment in the Gut System was not evaluated for the adult and child resident.

**Table 6-2c**
**Carcinogenic Risk Estimates for Future Land Use Exposure Scenarios**
**Central Tendency**
**Virgin Island Chemical Site St. Croix, U.S. Virgin Islands**

| | Industrial/Commercial | Construction |
|---|---|---|
| | **Adult** | **Adult** |
| *Risk Estimates for Groundwater* | | |
| Inhalation of VOCs | 2E-04 | NE[3] |
| Ingestion | 5E-06 | NE[3] |
| Dermal | 1E-06 | NE[3] |
| **Subtotal Risk for Groundwater** | **2E-04** | **NE[3]** |
| *Risk Estimates for Surface Soil* | | |
| Inhalation of particulate | NE[1] | NE[2] |
| Ingestion | 5E-07 | NE[2] |
| Dermal | 2E-08 | NE[2] |
| **Subtotal Risk for Surface Soil** | **5E-07** | NE[2] |
| *Risk Estimates for Sediment in the Gut System* | | |
| Inhalation of particulate | NE[2] | NE[2] |
| Ingestion | NE[2] | NE[2] |
| Dermal | NE[2] | NE[2] |
| **Subtotal Risk for Sediment** | NE[2] | NE[2] |
| ***Total Carcinogenic Risk Estimate*** | 2E-04 | NE[2] |

NE = Not evaluated.

1. Because the RME carcinogenic risk estimates did not exceed 1E-06 for inhalation of particulates from surface soil, the industrial/commercial CT receptor was not evaluated.
2. Because the RME carcinogenic risk estimates did not exceed 1E-06 for this exposure medium, the industrial/commercial and construction CT receptors were not evaluated.
3. Exposure to groundwater at the Site was not evaluated for the construction worker.

**Table 6-2d**
**Carcinogenic Risk Estimates for Future Land Use Exposure Scenarios**
**Central Tendency**
**Virgin Island Chemical Site St. Croix, U.S. Virgin Islands**

| | Resident - Adult | Resident – Child |
|---|---|---|
| *Risk Estimates for Groundwater* | | |
| Inhalation of VOCs | 7E-05 | 1E-04 |
| Ingestion | 2E-05 | 4E-05 |
| Dermal | 3E-07 | 3E-07 |
| **Subtotal Risk for Groundwater** | **9E-05** | **1E-04** |
| *Risk Estimates for Surface Soil* | | |
| Inhalation of particulate | NE | NE |
| Ingestion | NE | NE |
| Dermal | NE | NE |
| **Subtotal Risk for Surface Soil** | **NE** | **NE** |
| *Risk Estimates for Sediment in the Gut System* | | |
| Inhalation of particulate | NE | NE |
| Ingestion | NE | NE |
| Dermal | NE | NE |
| **Subtotal Risk for Sediment** | **NE** | **NE** |
| ***Total Carcinogenic Risk Estimate*** | ***9E-05*** | ***1E-04*** |

NE = Not evaluated. Exposure to surface soil at the Site and sediment in the Gut System was not evaluated for the adult and child resident.

**Table 6-3a**
**Noncarcinogenic Hazard Estimates for Current Land Use Exposure Scenario**
**Reasonable Maximum Exposure**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| Trespasser | Adult | Pre-adolescent (7 – 12 years) |
|---|---|---|
| *Hazard Estimates for Surface Soil* | | |
| Inhalation of particulates | 7.7E-04 | 6.0E-04 |
| Ingestion | 5.1E-02 | 1.6E-01 |
| Dermal | 1.1E-03 | 2.5E-03 |
| **Subtotal Hazard for Surface Soil[2]** | **5.3E-02** | **1.6E-01** |
| *Hazard Estimates for Sediment in the Gut System* | | |
| Inhalation of particulates | 4.7E-04 | 3.7E-04 |
| Ingestion | 2.4E-02 | 7.5E-02 |
| Dermal | 2.7E-04 | 5.9E-04 |
| **Subtotal Hazard for Sediment[2]** | **2.5E-02** | **7.5E-02** |
| ***Total Noncarcinogenic Hazard Estimate[2]*** | ***7.8E-02*** | ***2.4E-01*** |

See Tables 9.1a and 9.2 of the HHRA (Appendix J) for target organ hazard indices.

**Table 6-3b**
**Noncarcinogenic Hazard Estimates for Current Land Use Exposure Scenario**
**Central Tendency**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| **Trespasser** | **Adult** | **Pre-adolescent (7 – 12 years)** |
|---|---|---|
| *Hazard Estimates for Surface Soil* | | |
| Inhalation of particulates | NE[1] | NE[1] |
| Ingestion | NE[1] | NE[1] |
| Dermal | NE[1] | NE[1] |
| **Subtotal Hazard for Surface Soil[2]** | NE[1] | NE[1] |
| *Hazard Estimates for Sediment in the Gut System* | | |
| Inhalation of particulates | NE[1] | NE[1] |
| Ingestion | NE[1] | NE[1] |
| Dermal | NE[1] | NE[1] |
| **Subtotal Hazard for Sediment[2]** | NE[1] | NE[1] |
| ***Total Noncarcinogenic Hazard Estimate[2]*** | NE[1] | NE[1] |

[1] – Because the RME noncarcinogenic hazard estimates did not exceed 1, the CT adult receptor and the pre-adolescent receptor were not evaluated.

NE = Not Evaluated.

**Table 6-4a**
**Noncarcinogenic Hazard Estimates for Future Land Use Exposure Scenarios**
**Reasonable Maximum Exposure**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| | Industrial/ Commercial | Construction |
|---|---|---|
| | Adult | Adult |
| *Hazard Estimates for Groundwater* | | |
| Inhalation of VOCs | 3.3E+02 | NE |
| Ingestion | 2.7E+00 | NE |
| Dermal | 6.4E-01 | NE |
| **Subtotal Hazard for Groundwater** | **3.3E+02** | **NE** |
| *Hazard Estimates for Surface Soil* | | |
| Inhalation of particulate | 3.7E-03 | 1.6E-02 |
| Ingestion | 1.2E-01 | 1.2E+00 |
| Dermal | 4.5E-03 | 4.5E-03 |
| **Subtotal Hazard for Surface Soil** | **1.3E-01** | **1.2E+00** |
| *Hazard Estimates for Sediment in the Gut System* | | |
| Inhalation of particulate | 2.3E-03 | 9.5E-03 |
| Ingestion | 5.8E-02 | 5.5E-01 |
| Dermal | 1.1E-03 | 1.1E-03 |
| **Subtotal Hazard for Sediment** | **6.1E-02** | **5.6E-01** |
| ***Total Noncarcinogenic Risk Estimate*** | ***3.3E+02*** | ***1.8E+00*** |

NE = Not evaluated. Exposure to groundwater at the Site was not evaluated for the construction worker.

See Tables 9.3a and 9.4a of HHRA (Appendix J) for target organ hazard indices.



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**Table 6-4b**
**Noncarcinogenic Hazard Estimates for Future Land Use Exposure Scenarios**
**Reasonable Maximum Exposure**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| | Resident - Adult | Resident – Child |
|---|---|---|
| *Hazard Estimates for Groundwater* | | |
| Inhalation of VOCs | 2.5E+02 | 5.8E+02 |
| Ingestion | 7.5E+00 | 2.2E+01 |
| Dermal | 3.2E-01 | 6.0E-01 |
| **Subtotal Hazard for Groundwater** | **2.5E+02** | **6.0E+02** |
| *Hazard Estimates for Surface Soil* | | |
| Inhalation of particulate | NE | NE |
| Ingestion | NE | NE |
| Dermal | NE | NE |
| **Subtotal Hazard for Surface Soil** | **NE** | **NE** |
| *Hazard Estimates for Sediment in the Gut System* | | |
| Inhalation of particulate | NE | NE |
| Ingestion | NE | NE |
| Dermal | NE | NE |
| **Subtotal Hazard for Sediment** | **NE** | **NE** |
| ***Total Noncarcinogenic Risk Estimate*** | ***2.5E+02*** | ***6.0E+02*** |

NE = Not evaluated. Exposure to surface soil at the Site and sediment in the Gut System was not evaluated for the adult and child resident.

See Tables 9.5a and 9.6a of the HHRA (Appendix J) for target organic hazard indices.

**Table 6-4c**
**Noncarcinogenic Hazard Estimates for Future Land Use Exposure Scenarios**
**Central Tendency**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| | Industrial/ Commercial | Construction |
|---|---|---|
| | Adult | Adult |
| *Hazard Estimates for Groundwater* | | |
| Inhalation of VOCs | 3.3E+02 | NE[2] |
| Ingestion | 1.6E+00 | NE[2] |
| Dermal | 6.4E-01 | NE[2] |
| **Subtotal Hazard for Groundwater** | **3.3E+02** | **NE[2]** |
| *Hazard Estimates for Surface Soil* | | |
| Inhalation of particulate | NE[1] | 5.8E-03 |
| Ingestion | NE[1] | 2.4E-01 |
| Dermal | NE[1] | 4.5E-04 |
| **Subtotal Hazard for Surface Soil** | NE[1] | **2.5E-01** |
| *Hazard Estimates for Sediment in the Gut System* | | |
| Inhalation of particulate | NE[1] | NE[1] |
| Ingestion | NE[1] | NE[1] |
| Dermal | NE[1] | NE[1] |
| **Subtotal Hazard for Sediment** | NE[1] | NE[1] |
| ***Total Noncarcinogenic Risk Estimate*** | ***3.3E+02*** | ***2.5E-01*** |

NE = Not evaluated.

1. Because the RME noncarcinogenic hazard estimates did not exceed 1 for this exposure medium, the industrial/commercial or construction CT receptors were not evaluated.
2. Exposure to groundwater at the Site was not evaluated for the construction worker.

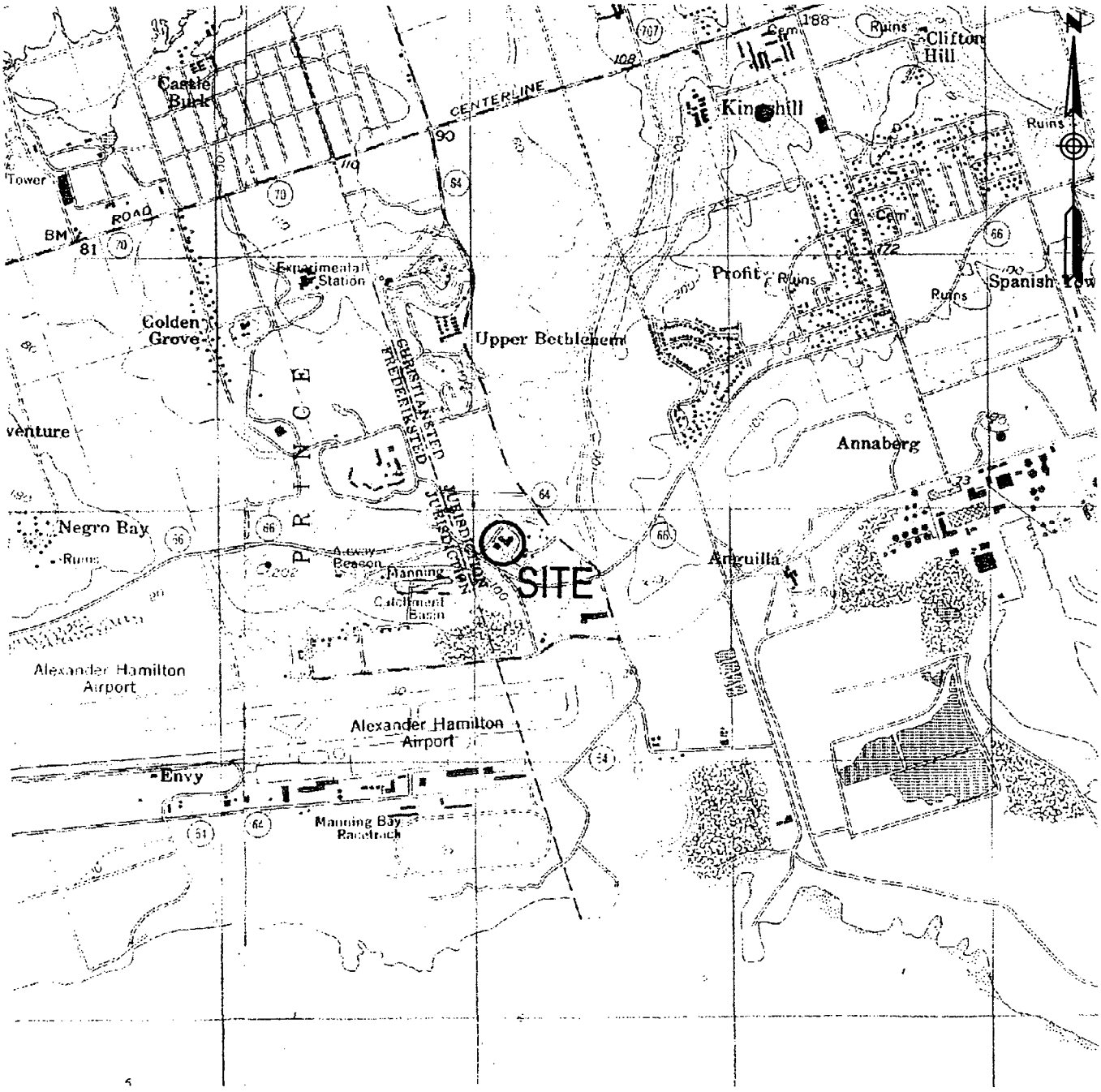
See Tables 9.3b and 9.4b of the HHRA (Appendix J) for target organ hazard indices.

**Table 6-4d**
**Noncarcinogenic Hazard Estimates for Future Land Use Exposure Scenarios**
**Central Tendency**
**Virgin Island Chemical Site, St. Croix, U.S. Virgin Islands**

| | Resident – Adult | Resident – Child |
|---|---|---|
| *Hazard Estimates for Groundwater* | | |
| Inhalation of VOCs | 7.8E+01 | 1.8E+02 |
| Ingestion | 4.3E+00 | 1.3E+01 |
| Dermal | 1.0E-01 | 1.9E-01 |
| **Subtotal Hazard for Groundwater** | **8.2E+01** | **2.0E+02** |
| *Hazard Estimates for Surface Soil* | | |
| Inhalation of particulate | NE | NE |
| Ingestion | NE | NE |
| Dermal | NE | NE |
| **Subtotal Hazard for Surface Soil** | **NE** | **NE** |
| *Hazard Estimates for Sediment in the Gut System* | | |
| Inhalation of particulate | NE | NE |
| Ingestion | NE | NE |
| Dermal | NE | NE |
| **Subtotal Hazard for Sediment** | **NE** | **NE** |
| ***Total Noncarcinogenic Risk Estimate*** | ***8.2E+01*** | ***2.0E+02*** |

NE = Not evaluated. Exposure to surface soil at the Site and sediment in the Gut System was not evaluated for the adult and child resident.

See Tables 9.5b and 9.6b of the HHRA (Appendix J) for target organ hazard indices.




## REFERENCE

1.) MAP TAKEN FROM U.S.G.S. 7.5 MINUTE QUADRANGLE OF CHRISTIANSTED, VIRGIN ISLANDS.

2000 0 2000
scale feet

303543

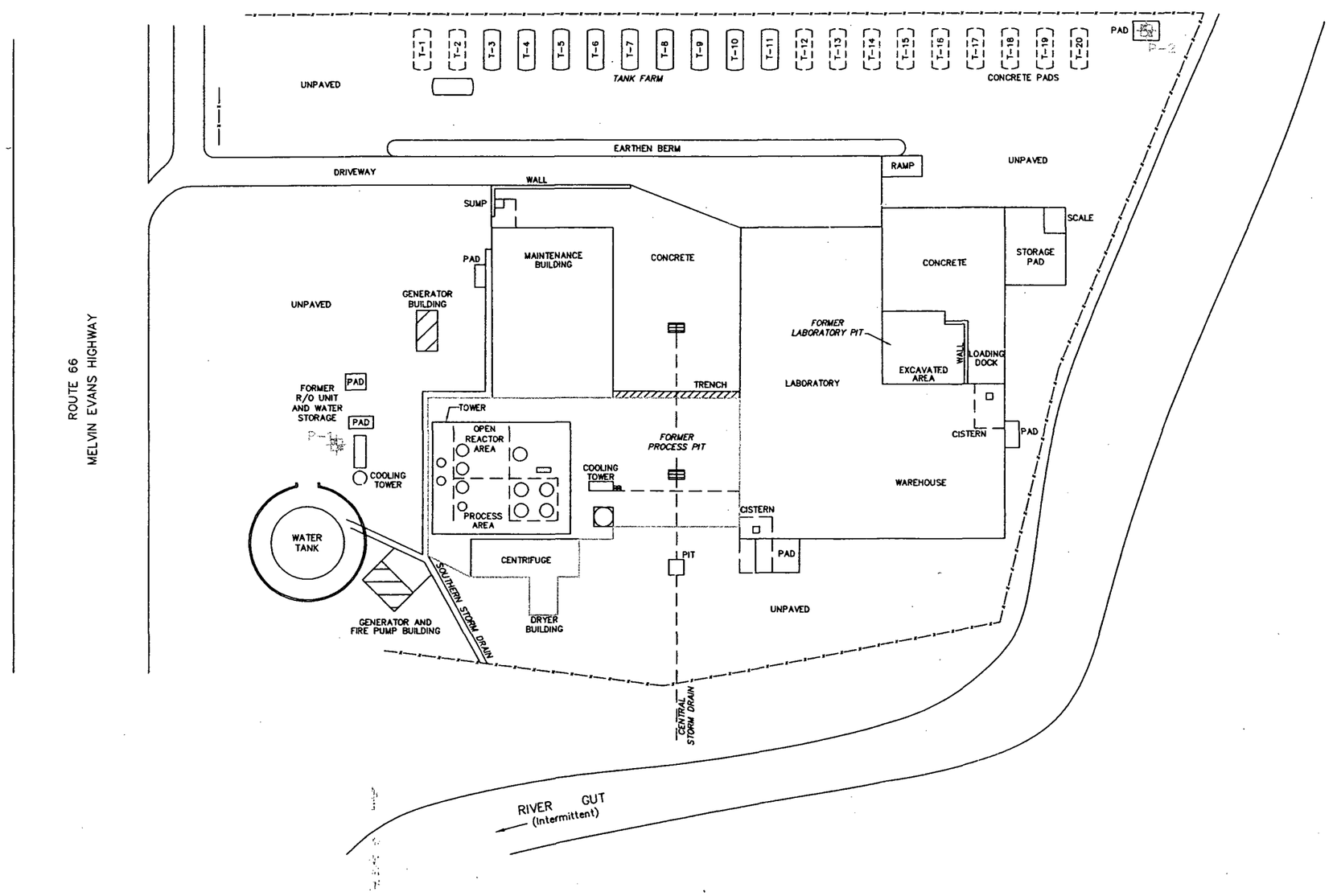
| | | | |
|---|---|---|---|
| JOB No.: | 003-6016 | SCALE: | AS SHOWN |
| CAD BY: | AM | DATE: | 09/22/00 |
| CHK BY: | | FILE No.: | US01-029 |
| REV BY: | | DR SUBTITLE: | 03 |

# SITE LOCATION MAP

Golder Associates

VIRGIN ISLAND CHEMICAL SITE

FIGURE 2-1




LEGEND

- STORMWATER INLET
- EXISTING ABOVEGROUND STORAGE TANK LOCATION
- FORMER ABOVEGROUND STORAGE TANK LOCATION
- PRODUCTION WELL LOCATION

SCALE

60 30 0 60 FEET

| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|
| | | | |

VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS

McLAREN/HART, INC.
WARREN, NEW JERSEY

| DRWN: J.R.F. | CHK'D: A.G. | APP'D: P.K. |
|---|---|---|
| SCALE: AS SHOWN | | DATE: 01/11/99 |

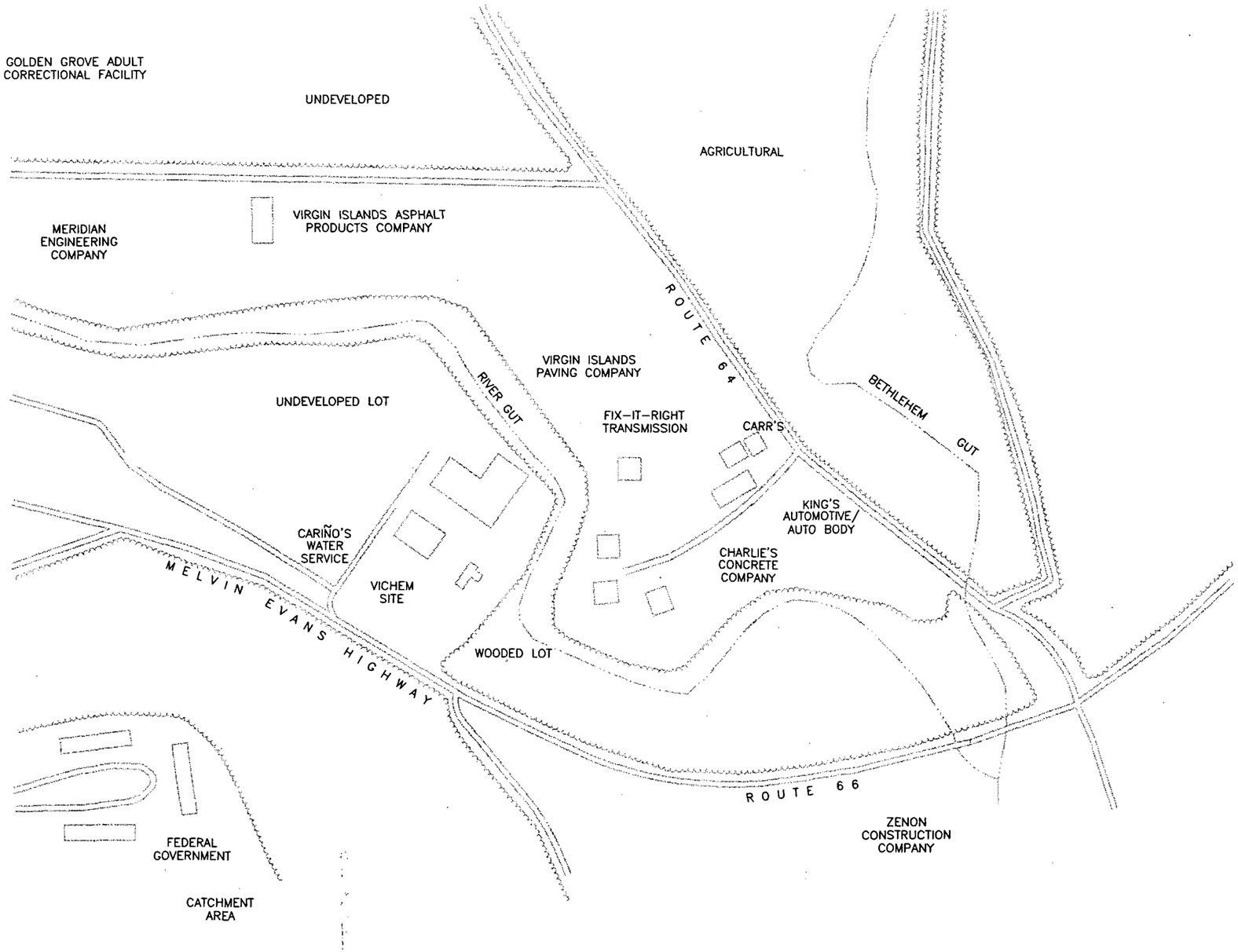
CURRENT SITE FEATURES

FIGURE 2-2

303544

SOURCE: HARDING LAWSON ASSOCIATES

DWG: 87100155 01/11/99




N
W E
S

LEGEND

- BUILDING
- STREAM
- ROAD
- TREE LINE

SCALE

150 75 0 150 FEET

SOURCE: HARDING LAWSON ASSOCIATES

| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|
| | | | |

VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS

McLAREN/HART, INC.
WARREN, NEW JERSEY

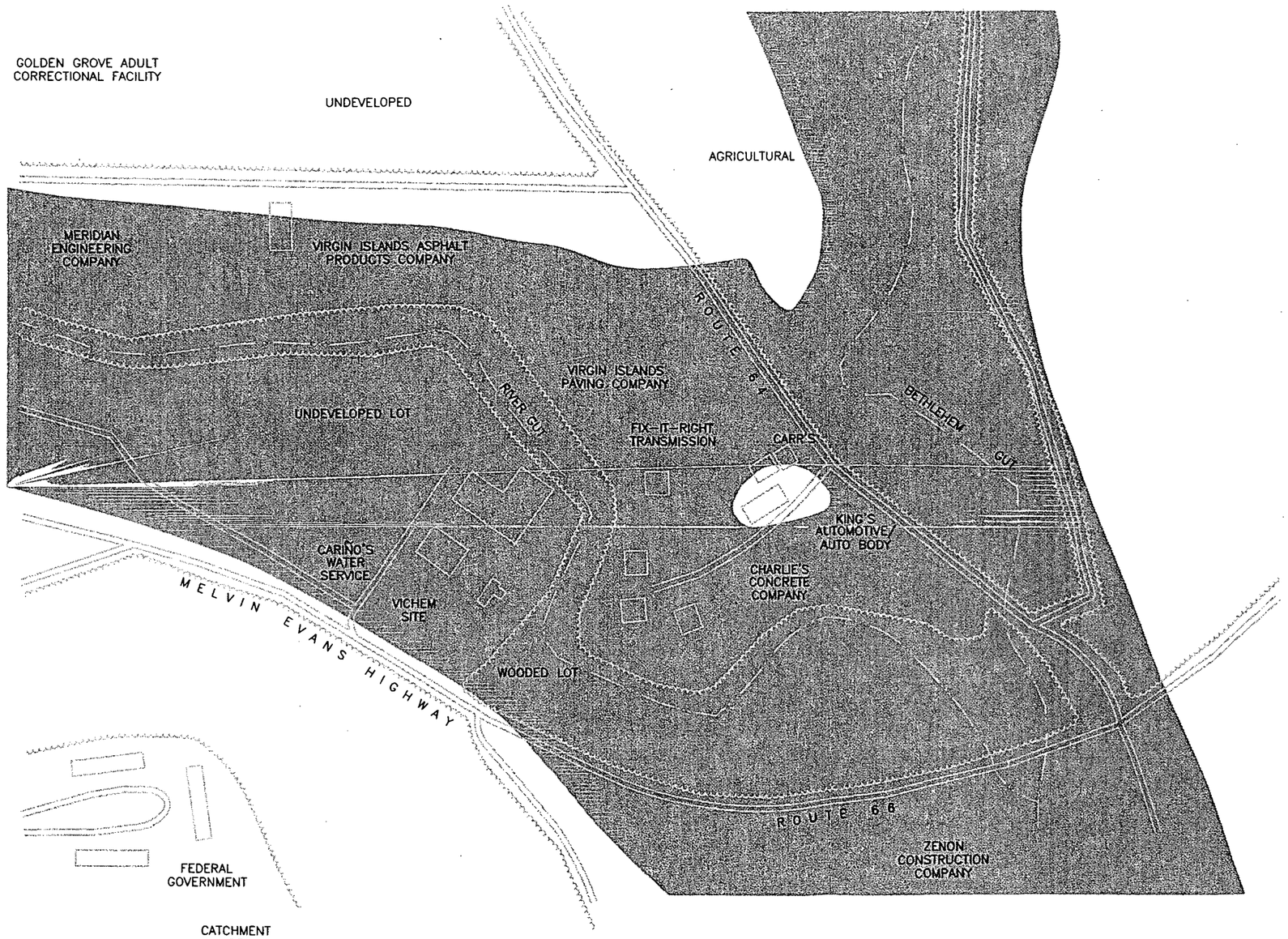
| | | |
|---|---|---|
| DRWN: J.R.F. | CHK'D: A.G. | APP'D: P.K. |
| SCALE: AS SHOWN | | DATE: 01/15/99 |

SITE AREA MAP

FIGURE 2-3

303545

DWG: ST1301B5 05/14/99




SOURCE: HARDING LAWSON ASSOCIATES

DWG: 87100174 05/14/99

N
W E
S

LEGEND

- BUILDING
- STREAM
- ROAD
- TREE LINE
- 100-YEAR FLOODPLAIN AREA

SCALE

150 75 0 150 FEET

| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|
| | | | |

VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS

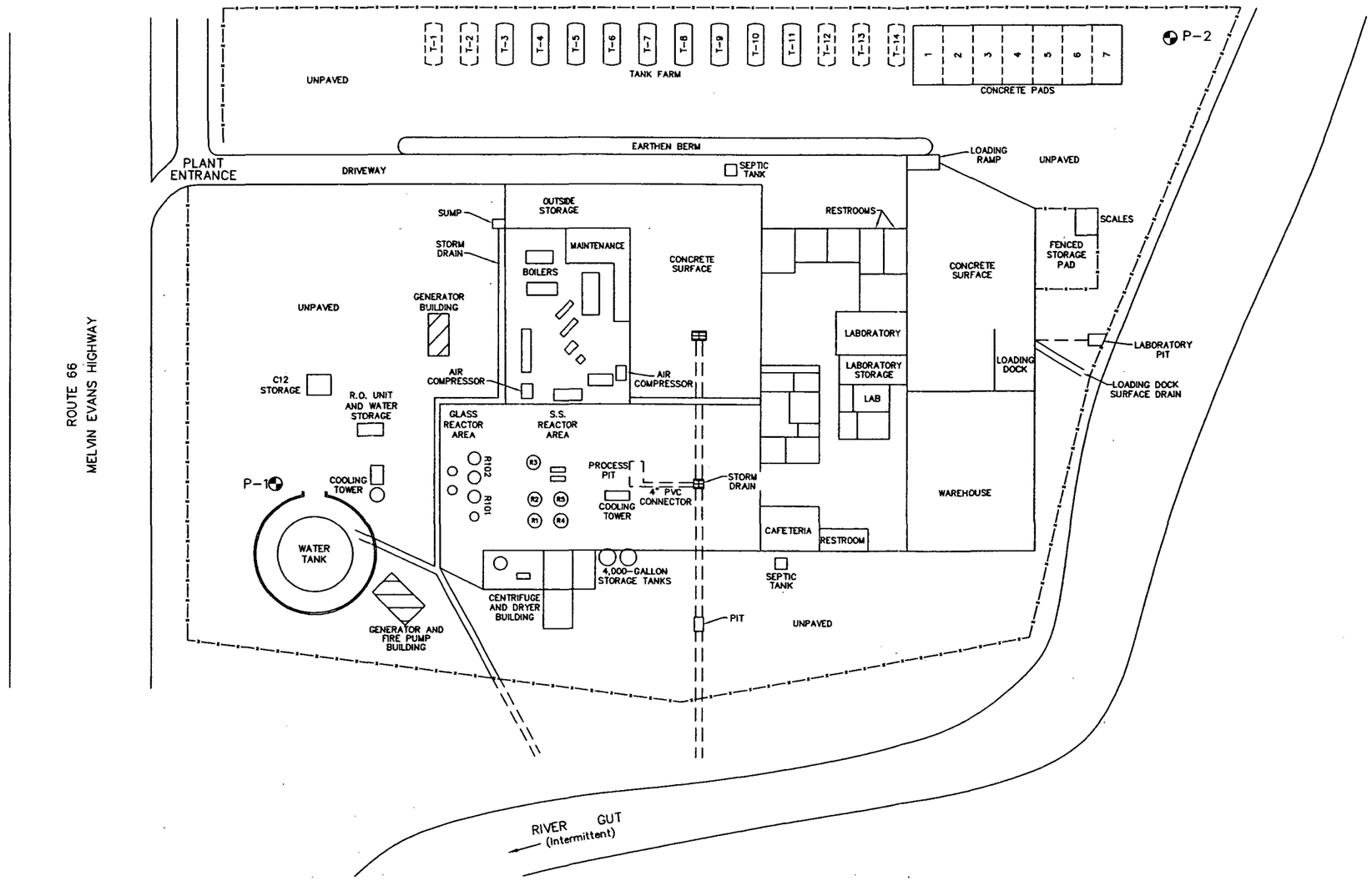
McLAREN/HART. INC.
WARREN, NEW JERSEY

| | | |
|---|---|---|
| DRWN: J.R.F. | CHK'D: A.G. | APP'D: P.K. |
| SCALE: AS SHOWN | | DATE: 03/30/99 |

100-YEAR FLOODPLAIN MAP

FIGURE 2-4

303546




LEGEND

- STORMWATER INLET
- EXISTING ABOVEGROUND STORAGE TANK LOCATION
- FORMER ABOVEGROUND STORAGE TANK LOCATION
- PRODUCTION WELL

SCALE

60 30 0 60 FEET

| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|
| | | | |

# VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS

McLAREN/HART, INC.
WARREN, NEW JERSEY

| | | |
|---|---|---|
| DRWN: J.R.F. | CHK'D: A.G. | APP'D: P.K. |
| SCALE: AS SHOWN | | DATE: 01/11/99 |

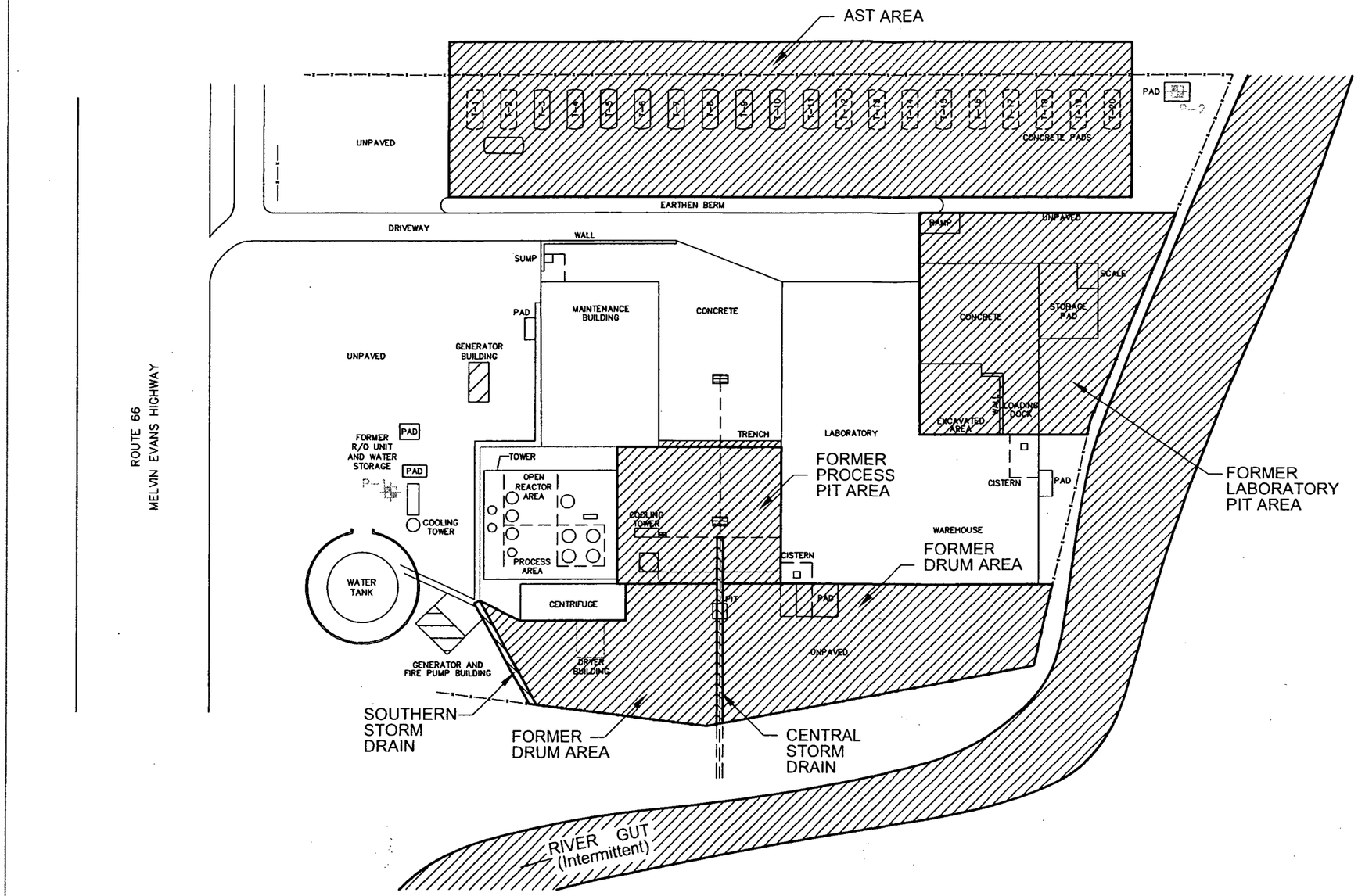
## FORMER SITE LAYOUT MAP

FIGURE 2-5

SOURCE: ENVIRO-SCIENCES, INC.

DWG: 87100161 03/31/99

303547




LEGEND

- STORMWATER INLET
- EXISTING ABOVEGROUND STORAGE TANK LOCATION
- FORMER ABOVEGROUND STORAGE TANK LOCATION
- PRODUCTION WELL LOCATION
- AREA OF CONCERN

SCALE

60 30 0 60 FEET

SOURCE: HARDING LAWSON ASSOCIATES

DWG: 87100181 05/14/99

| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|
| | | | |

VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS

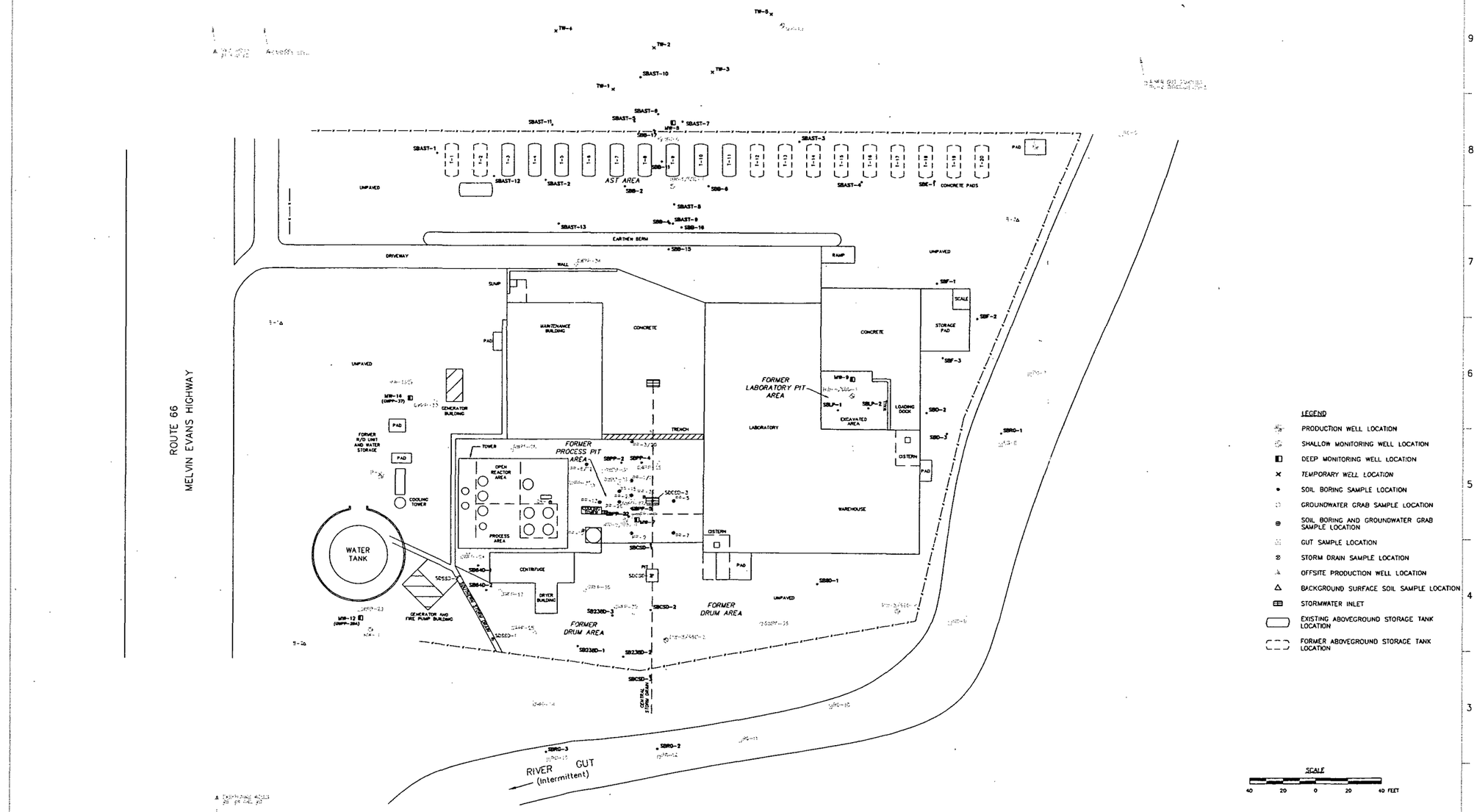
McLAREN/HART, INC.
WARREN, NEW JERSEY

| | | |
|---|---|---|
| DRWN: J.R.F. | CHK'D: A.G. | APP'D: P.K. |
| SCALE: AS SHOWN | | DATE: 03/31/99 |

SITE AREAS OF CONCERN

FIGURE 3-1

303548


ROUTE 66
MELVIN EVANS HIGHWAY
AST AREA
FORMER PROCESS PIT AREA
FORMER LABORATORY PIT AREA
FORMER DRUM AREA
FORMER DRUM AREA
WATER TANK
RIVER GUT (Intermittent)
MAINTENANCE BUILDING
WAREHOUSE
LABORATORY
CONCRETE PADS
EARTHEN BERM
DRIVEWAY
UNPAVED
CONCRETE
STORAGE PAD
LOADING DOCK
EXCAVATED AREA
CISTERN
SCALE
RAMP
WALL
SUMP
TRENCH
TOWER
OPEN REACTOR AREA
PROCESS AREA
CONTRUGE
DRYER BUILDING
GENERATOR BUILDING
COOLING TOWER
GENERATOR AND FIRE PUMP BUILDING
FORMER N/O UNIT AND WATER STORAGE
CENTRAL STORM DRAIN
PAD
PIT
SBAST-1
SBAST-2
SBAST-3
SBAST-4
SBAST-5
SBAST-6
SBAST-7
SBAST-8
SBAST-9
SBAST-10
SBAST-11
SBAST-12
SBAST-13
SBB-1
SBB-2
SBB-3
SBB-4
SBB-5
SBB-6
SBB-7
SBB-8
SBB-9
SBB-10
SBB-11
SBB-12
SBB-13
SBB-14
SBB-15
SBF-1
SBF-2
SBF-3
SBLP-1
SBLP-2
SBO-1
SBO-2
SBO-3
SBRG-1
SBRG-2
SBRG-3
SBPP-1
SBPP-2
SBPP-3
SBPP-4
SBPP-5
SBPP-6
SBPP-7
SBCSD-1
SBCSD-2
SBCSD-3
SBCSD-4
SBCSD-5
SBCSD-6
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SBCSD-32
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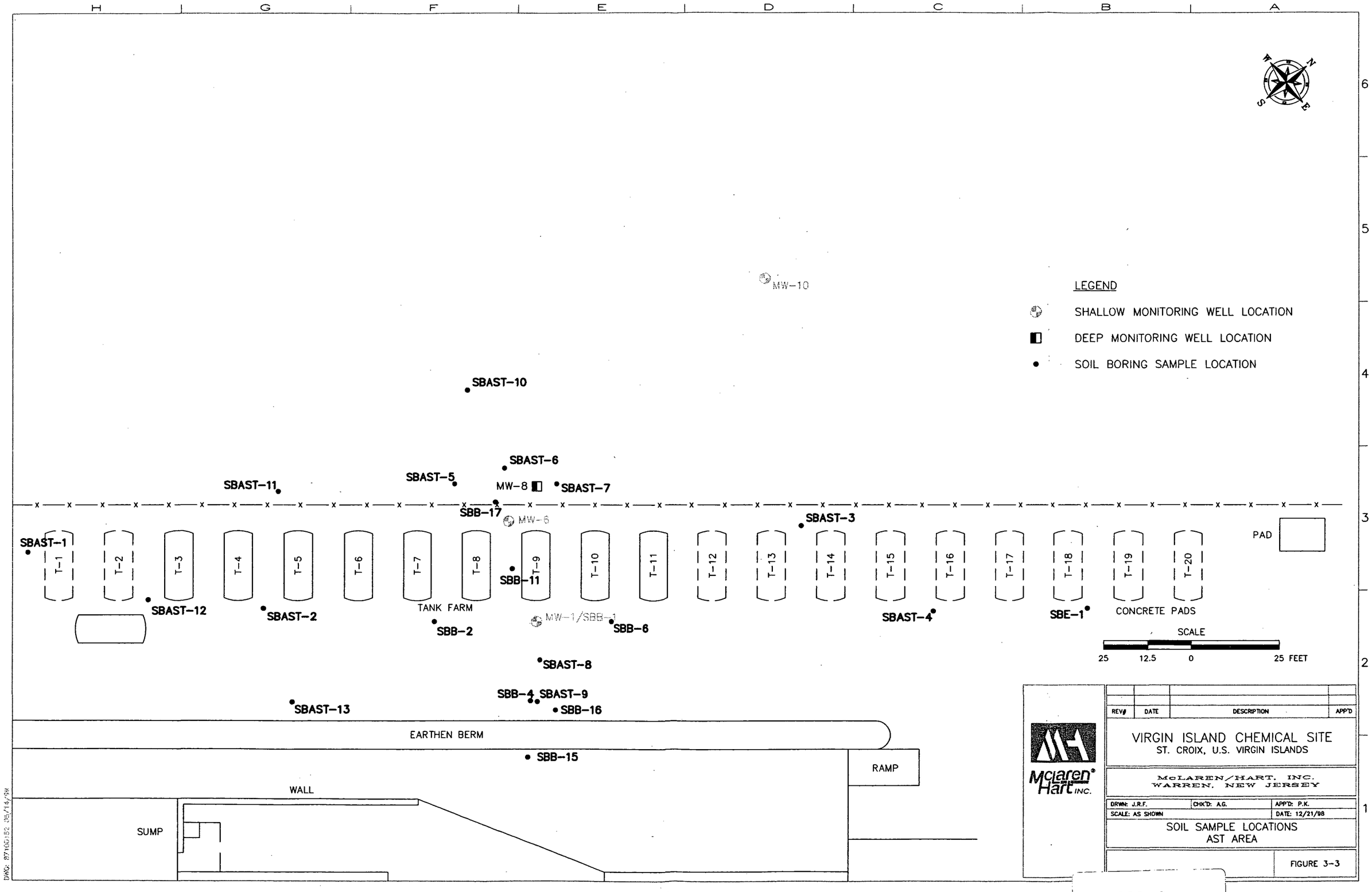
SBCSD-37
SBCSD-38
SBCSD-39
SBCSD-40




LEGEND

- SHALLOW MONITORING WELL LOCATION
- DEEP MONITORING WELL LOCATION
- SOIL BORING SAMPLE LOCATION

| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|
| | | | |

VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS

McLAREN/HART. INC.
WARREN, NEW JERSEY

| | | |
|---|---|---|
| DRWN: J.R.F. | CHK'D: A.G. | APP'D: P.K. |
| SCALE: AS SHOWN | | DATE: 12/21/98 |

SOIL SAMPLE LOCATIONS
AST AREA

FIGURE 3-3

303550

DWG: 87160152 05/14/98

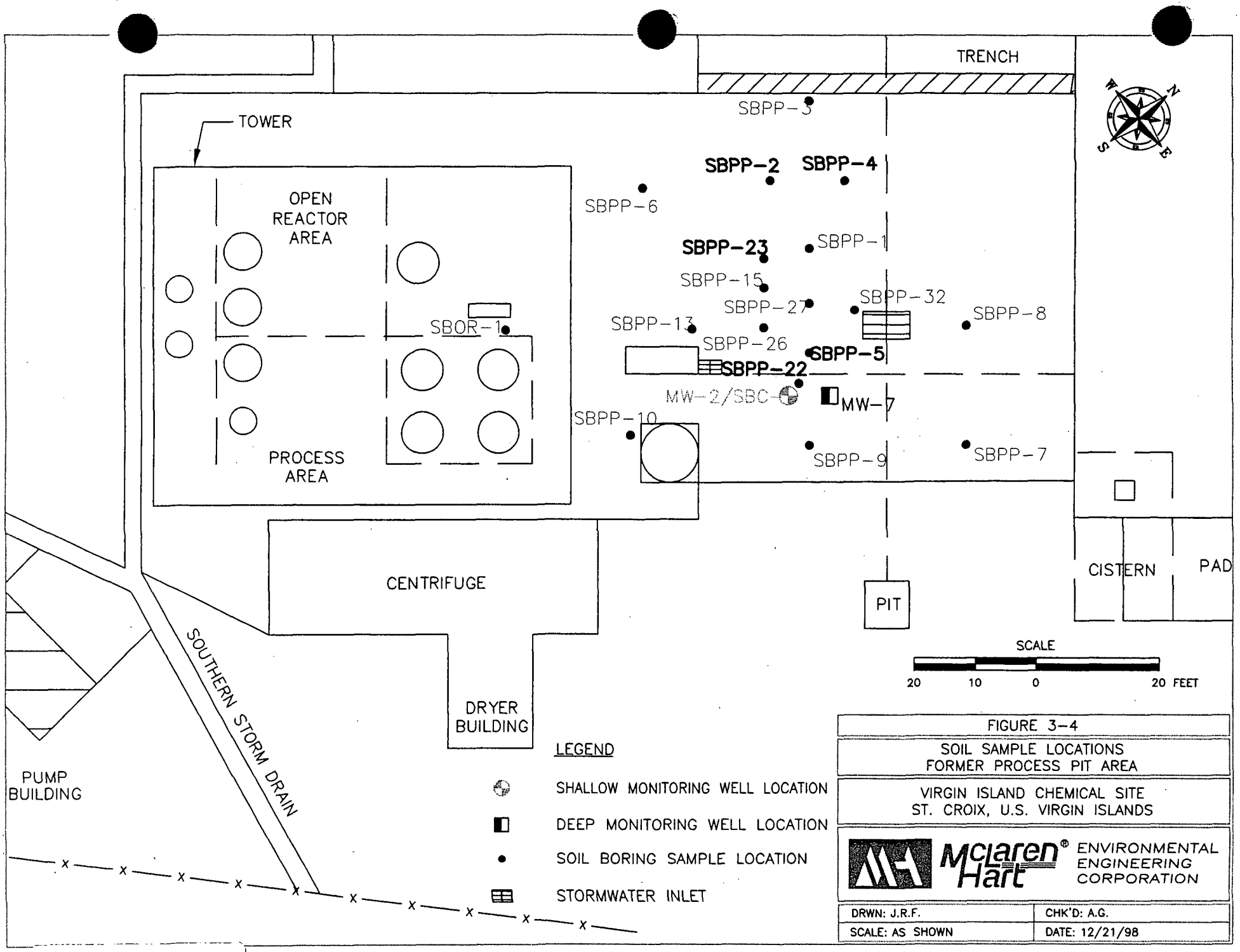



FIGURE 3-4

SOIL SAMPLE LOCATIONS
FORMER PROCESS PIT AREA

VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS

McLaren Hart ENVIRONMENTAL ENGINEERING CORPORATION

| DRWN: J.R.F. | CHK'D: A.G. |
|---|---|
| SCALE: AS SHOWN | DATE: 12/21/98 |

303551

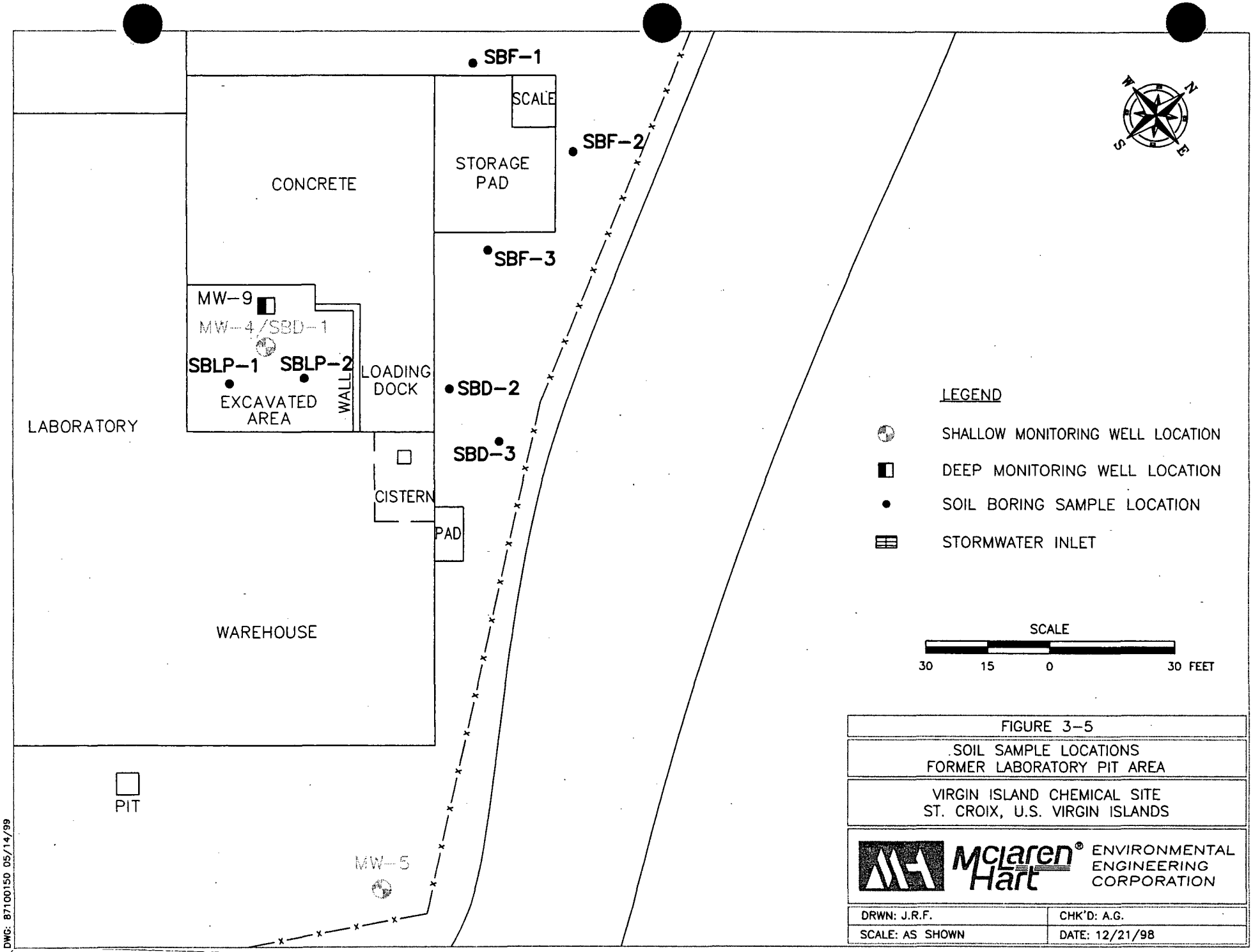



FIGURE 3-5

SOIL SAMPLE LOCATIONS
FORMER LABORATORY PIT AREA

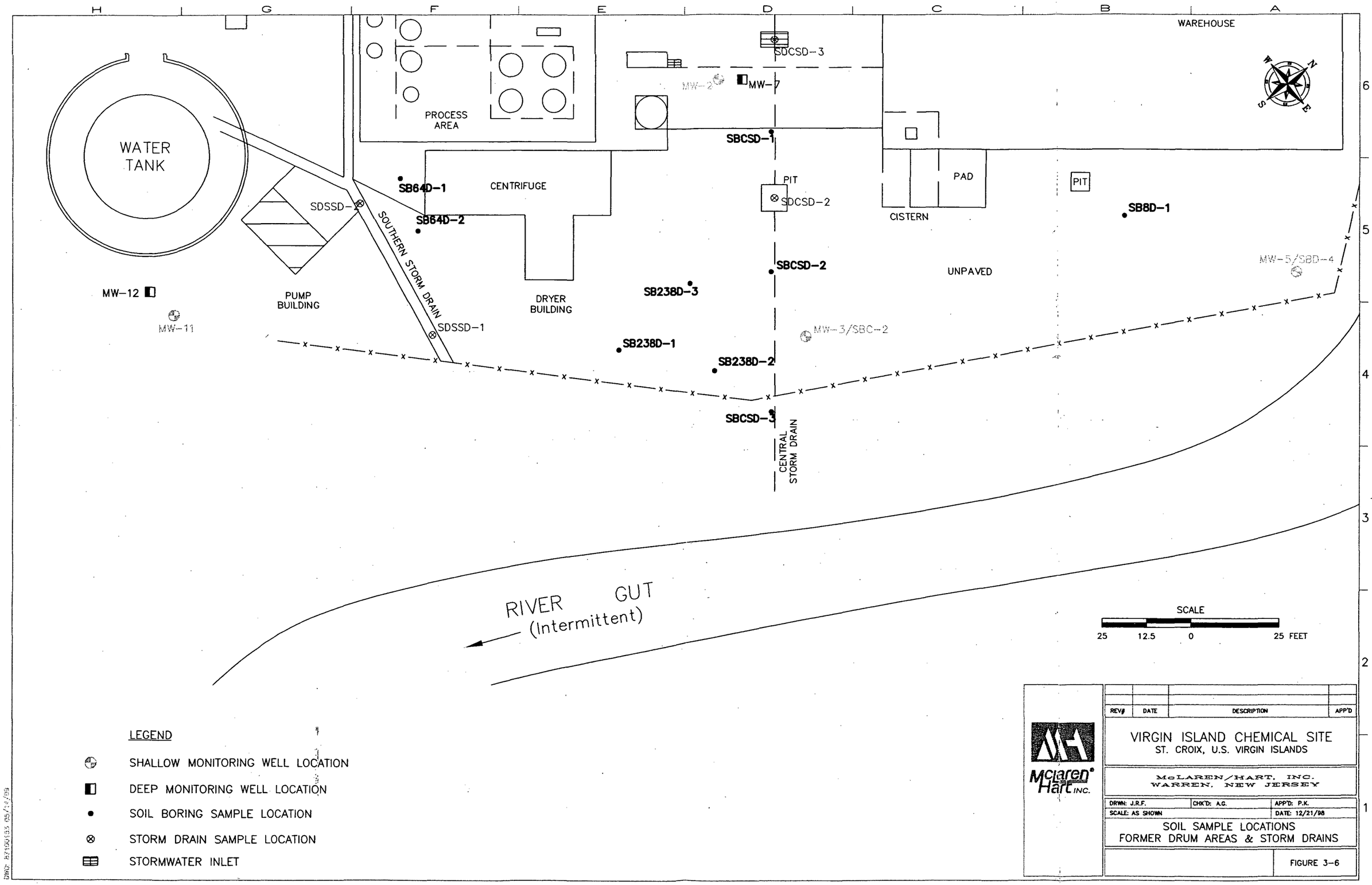
VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS

McLaren Hart ENVIRONMENTAL ENGINEERING CORPORATION

| DRWN: J.R.F. | CHK'D: A.G. |
|---|---|
| SCALE: AS SHOWN | DATE: 12/21/98 |

DWG: 87100150 05/14/99

303552




| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|
| | | | |

VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS

McLAREN/HART, INC.
WARREN, NEW JERSEY

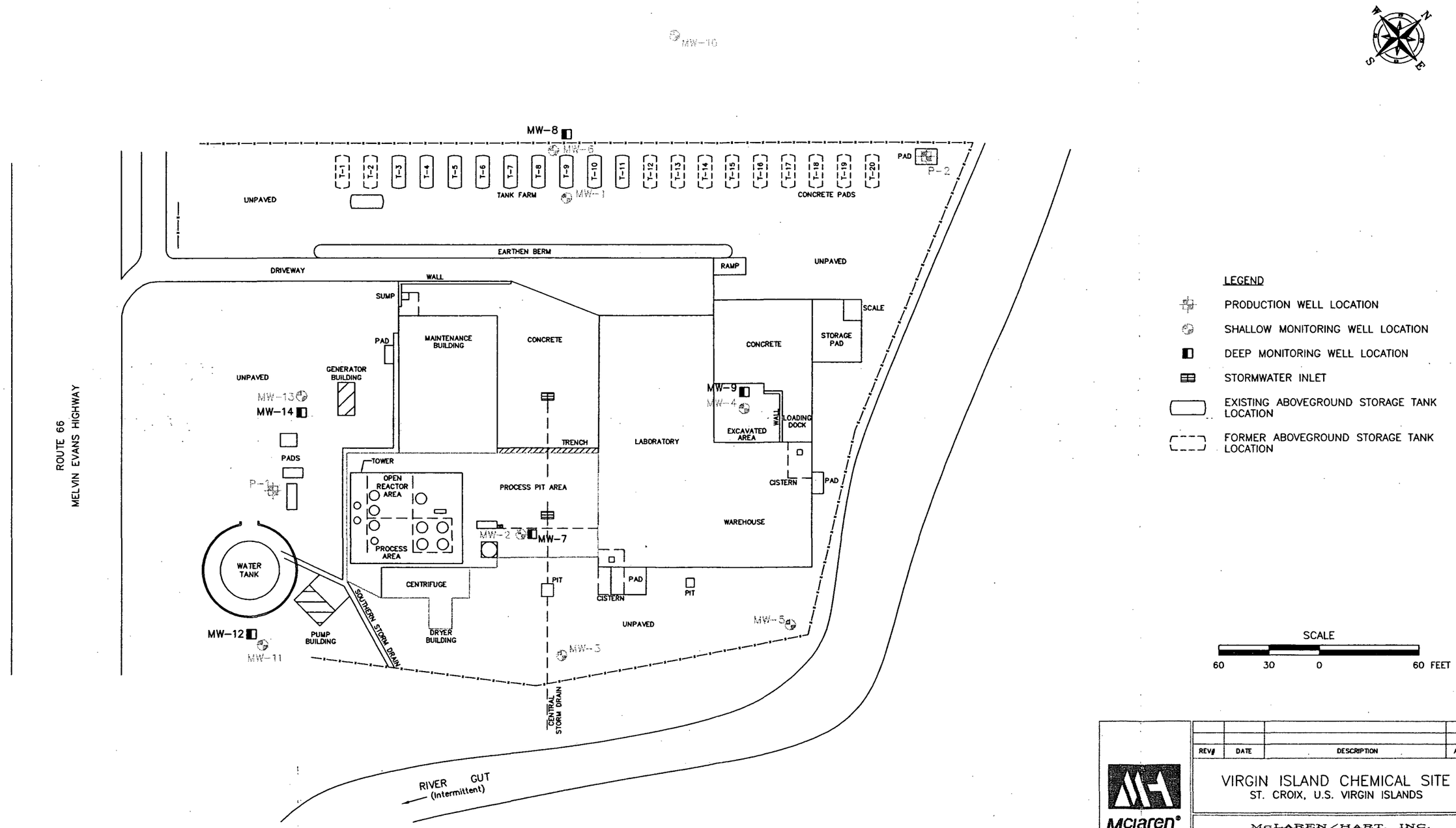
| DRWN: J.R.F. | CHK'D: A.G. | APP'D: P.K. |
|---|---|---|
| SCALE: AS SHOWN | | DATE: 12/21/98 |

SOIL SAMPLE LOCATIONS
FORMER DRUM AREAS & STORM DRAINS

FIGURE 3-6

303553

DWG: 8219A135.DGN/12/09




LEGEND

- PRODUCTION WELL LOCATION
- SHALLOW MONITORING WELL LOCATION
- DEEP MONITORING WELL LOCATION
- STORMWATER INLET
- EXISTING ABOVEGROUND STORAGE TANK LOCATION
- FORMER ABOVEGROUND STORAGE TANK LOCATION

SCALE

60 30 0 60 FEET

SOURCE: HARDING LAWSON ASSOCIATES

| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|
| | | | |

VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS

McLAREN/HART, INC.
WARREN, NEW JERSEY

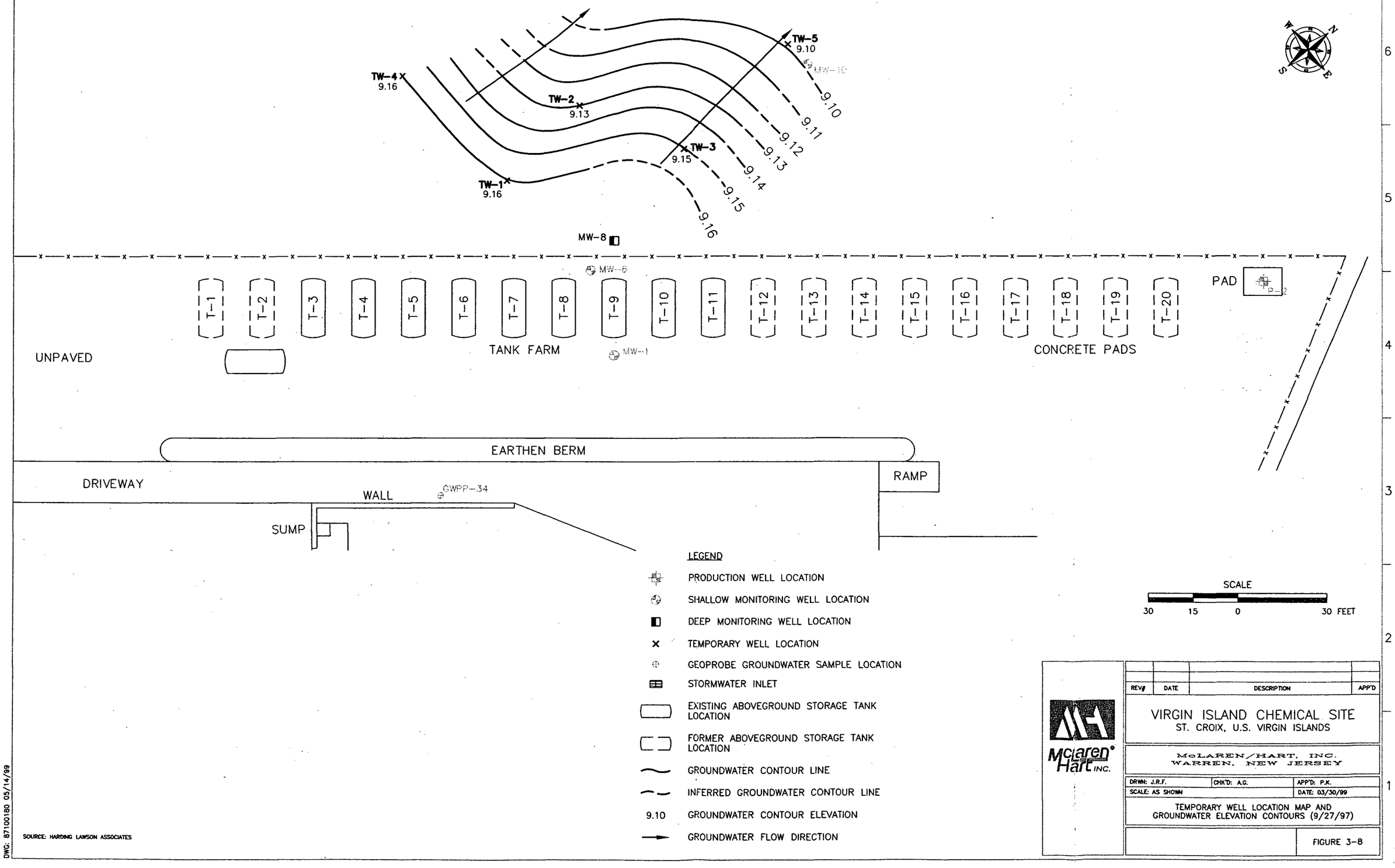
| | | |
|---|---|---|
| DRWN: J.R.F. | CHK'D: A.G. | APP'D: P.K. |
| SCALE: AS SHOWN | | DATE: 01/11/99 |

MONITORING WELL LOCATION MAP

FIGURE 3-7

303554

DWG: 87100154 03/30/99




SOURCE: HARDING LAWSON ASSOCIATES

| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|

# VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS

McLAREN/HART, INC.
WARREN, NEW JERSEY

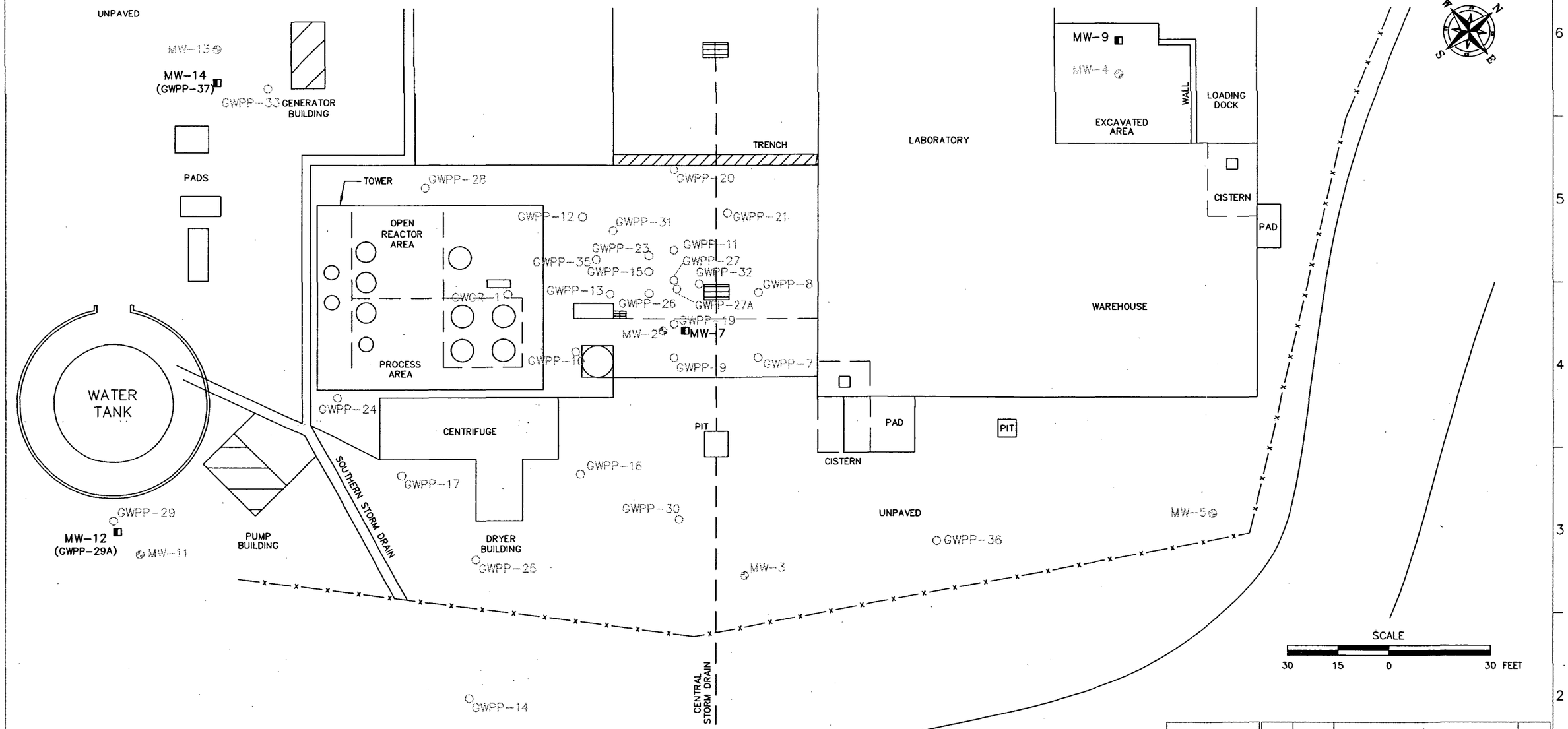
| | | |
|---|---|---|
| DRWN: J.R.F. | CHK'D: A.G. | APP'D: P.K. |
| SCALE: AS SHOWN | | DATE: 03/30/99 |

TEMPORARY WELL LOCATION MAP AND GROUNDWATER ELEVATION CONTOURS (9/27/97)

FIGURE 3-8

DWG: 87100180 05/14/99

303555




LEGEND

- SHALLOW MONITORING WELL LOCATION
- DEEP MONITORING WELL LOCATION
- GROUNDWATER GRAB SAMPLE LOCATION
- STORMWATER INLET

SOURCE: HARDING LAWSON ASSOCIATES

DWG: 87100160 03/30/99

| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|

# VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS

McLAREN/HART, INC.
WARREN, NEW JERSEY

| DRWN: J.R.F. | CHK'D: A.G. | APP'D: P.K. |
|---|---|---|
| SCALE: AS SHOWN | | DATE: 01/11/99 |

## GROUNDWATER SCREENING POINT LOCATION MAP

FIGURE 3-9

303556

H G F E D C B A

6 5 4 3 2 1

ROUTE 64

BETHLEHEM GUT

ROUTE 66

GOLDEN GROVE ADULT CORRECTIONAL FACILITY

MERIDIAN ENGINEERING COMPANY

VIRGIN ISLANDS ASPHALT PRODUCTS COMPANY

RIVER GUT

ABANDONED RAILROAD BRIDGE

SITE BOUNDARY

VIRGIN ISLANDS PAVING COMPANY

MELVIN EVANS HIGHWAY

RG-2
RG-3
RG-4
RG-5
RG-6
BG-2
RG-14
RG-15
RG-16
BG-1
FPG-1
FPG-2
FPG-3
FPG-4

N
W E
S

LEGEND

- BUILDING
- STREAM
- ROAD
- GUT SAMPLE LOCATION

LABORATORY DRAIN

RG-7
RG-8
RG-9
RG-10
RG-11
RG-12
RG-13

CENTRAL STORM DRAIN

SOUTHERN STORM DRAIN

WATER TANK

ENLARGEMENT

SHEET PILING CHECK DAM

FAIRPLAINS GUT

WASTEWATER TREATMENT PLANT

MANGROVE SWAMP AREA

LANDFILL AREA

SAND BAR

MANNING BAY

SCALE

800 400 0 800 FEET

| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|
| | | | |

VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS

McLAREN/HART ENVIRONMENTAL ENGINEERING CORP.
WARREN, NEW JERSEY

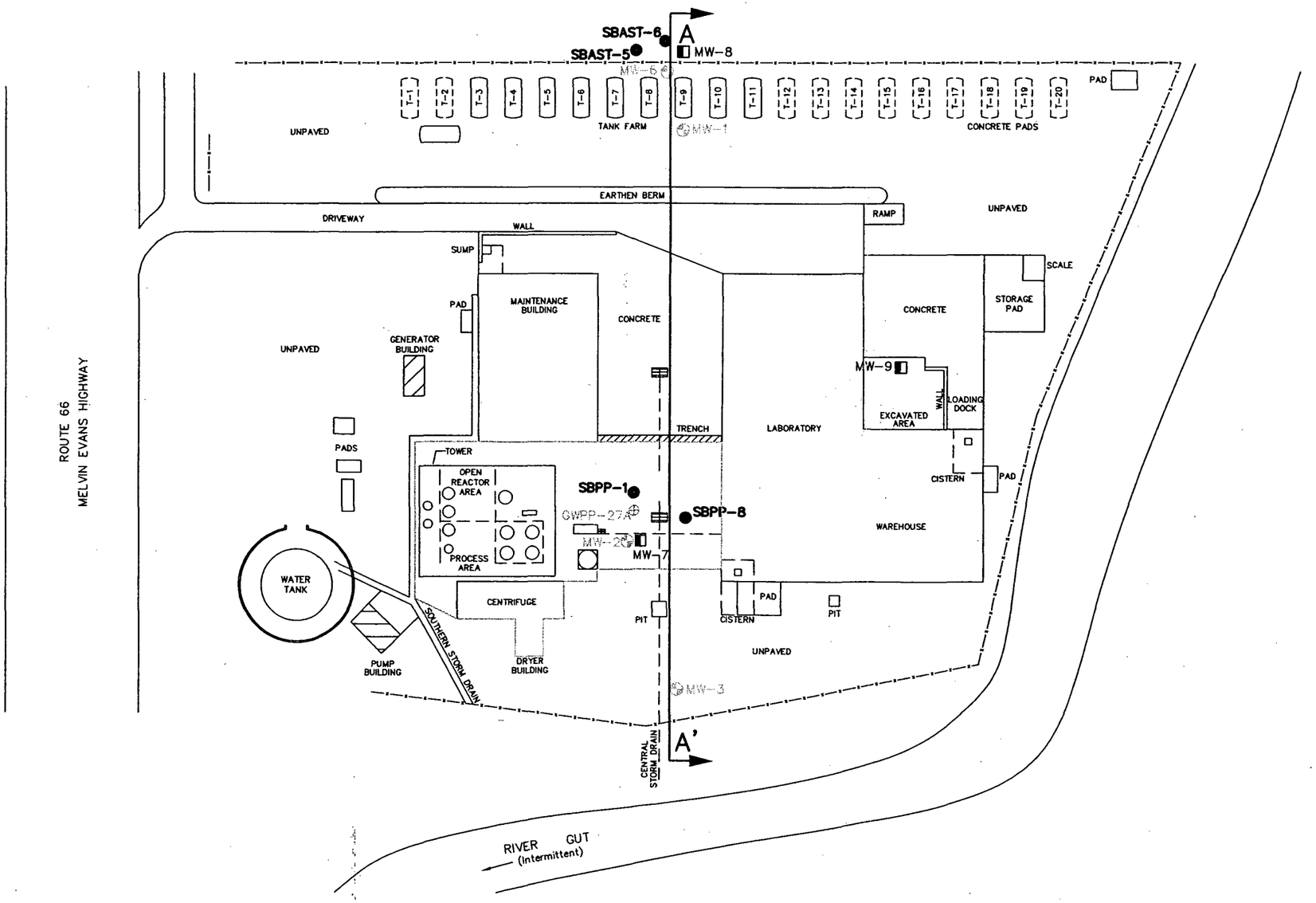
| DRWN: J.R.F. | CHK'D: I.G. | APP'D: C.H. |
|---|---|---|
| SCALE: AS SHOWN | | DATE: 05/12/98 |

GUT SYSTEM SAMPLE LOCATIONS

FIGURE 3-10

DWG: 87100133 03/31/99

303557




LEGEND

- SHALLOW MONITORING WELL LOCATION
- DEEP MONITORING WELL LOCATION
- SOIL BORING SAMPLE LOCATION
- SOIL BORING AND GROUNDWATER GRAB SAMPLE LOCATION
- STORMWATER INLET
- EXISTING ABOVEGROUND STORAGE TANK LOCATION
- FORMER ABOVEGROUND STORAGE TANK LOCATION

SCALE

60 30 0 60 FEET

SOURCE: HARDING LAWSON ASSOCIATES

| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|
| | | | |

VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS

McLAREN/HART, INC.
WARREN, NEW JERSEY

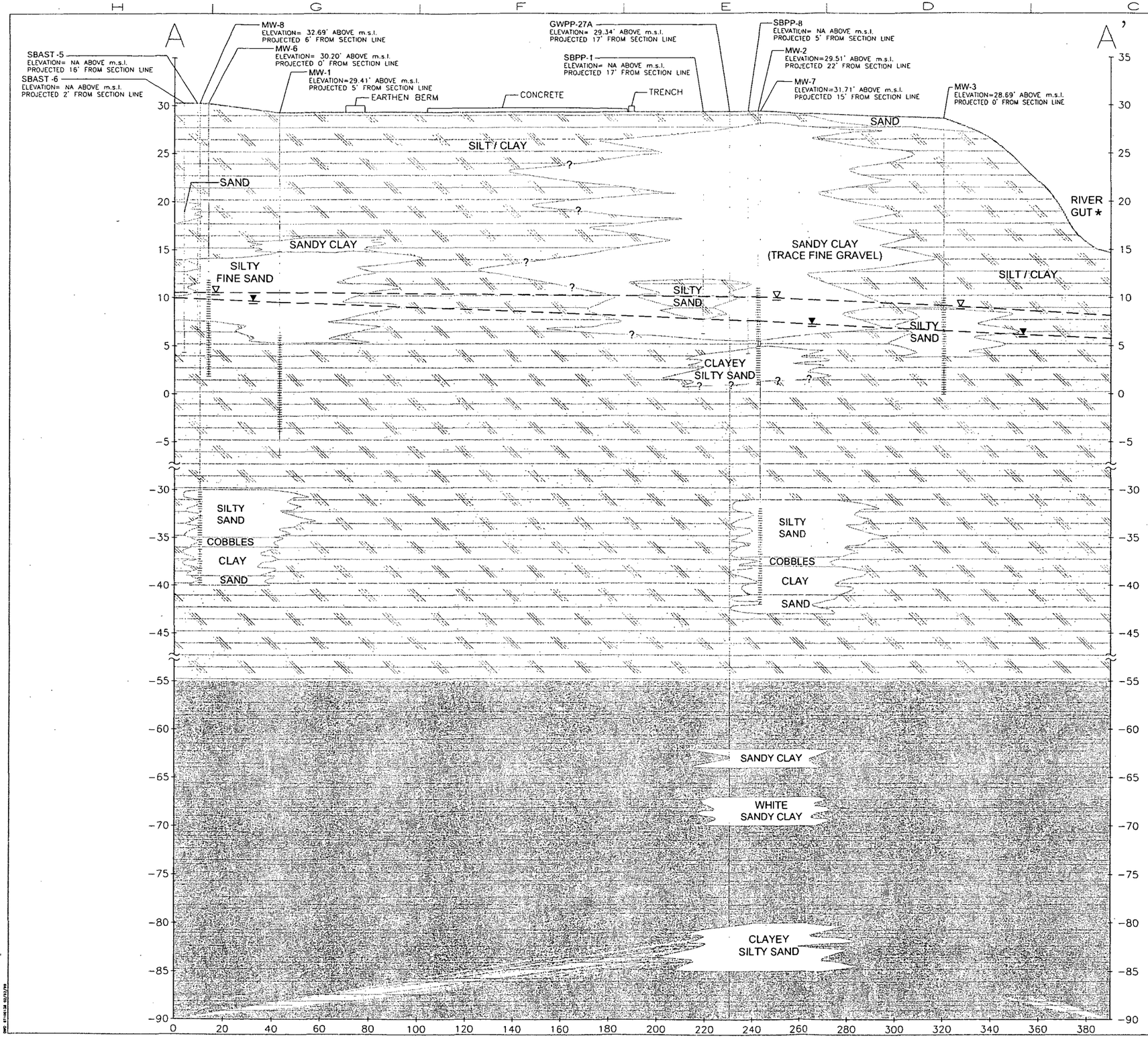
| | | |
|---|---|---|
| DRWN: T.J.G. | CHK'D: A.G. | APP'D: P.K. |
| SCALE: AS SHOWN | | DATE: 06/19/98 |

CROSS-SECTION LOCATION MAP

FIGURE 4-1

303558

DWG: 871001G9 06/19/98




NOTES:

1. SILT / CLAY: APPROXIMATELY EQUAL PARTS SILT AND CLAY, BUT CONTAINING TRACE TO LITTLE SAND OR FINE GRAVEL IN SOME AREAS.
2. SAND: PREDOMINANTLY FINE TO MEDIUM GRAINED, CONTAINING TRACE TO LITTLE FINE GRAVEL IN SOME AREAS.
3. SANDY CLAY: 40–50% SAND, FINE TO MEDIUM, 50–60% CLAY.
4. SILTY SAND: 40–50% SILT, 50–60% FINE TO MEDIUM SAND.
5. CLAYEY SILTY SAND: 20–25% CLAY, 20–25% SILT, 50–60% FINE TO MEDIUM SAND.
6. KINGSHILL FORMATION: WHITE SANDY MARL

LEGEND:

MW-6 MONITORING WELL LOCATION

GROUND SURFACE

WATER TABLE ELEVATION (m.s.l.)

POTENTIOMETRIC SURFACE ELEVATION (m.s.l.)

WELL SCREEN

ALLUVIUM FORMATION (SEE NOTES 1 THROUGH 5)

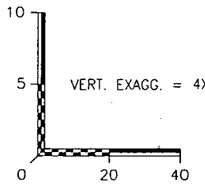
KINGS HILL FORMATION (SEE NOTE 6)

m.s.l.: MEAN SEA LEVEL

b.g.s.: BELOW GROUND SURFACE

*: RIVER GUT ELEVATION IS APPROXIMATE.

WATER LEVEL MEASUREMENTS TAKEN ON 10/21/98.




SCALE IN FEET

| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|
| | | | |

VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS

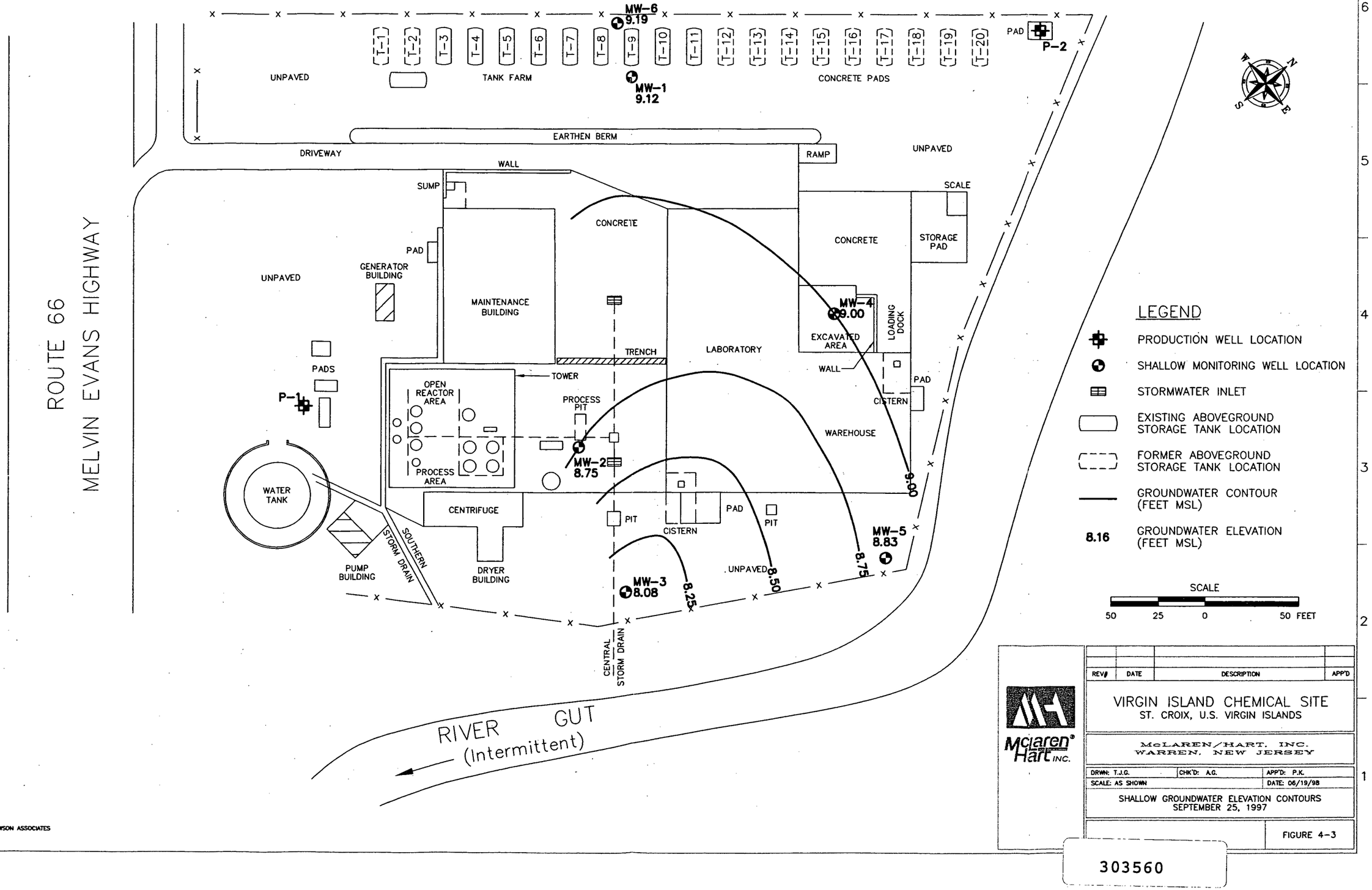
McLAREN/HART ENVIRONMENTAL ENGINEERING CORP
WARREN, NEW JERSEY

| DRWN: J.R.F. | CHK'D: A.G. | APP'D: P.K. |
|---|---|---|
| SCALE: AS SHOWN | | DATE: 06/19/98 |

GEOLOGIC CROSS SECTION A–A'

FIGURE 4–2

303559




SOURCE: HARDING LAWSON ASSOCIATES

DWG: 87100117 05/19/98

| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|

# VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS

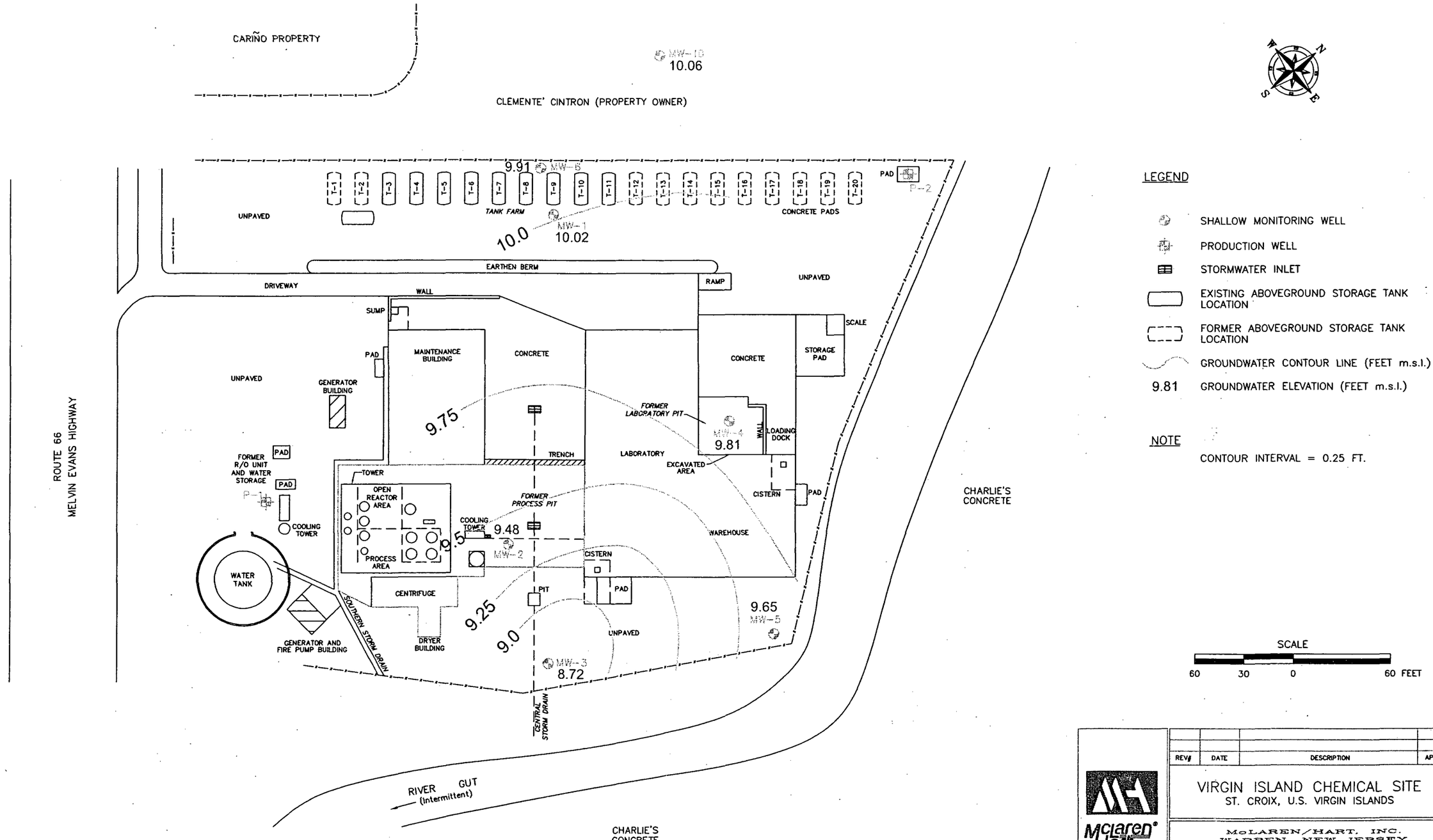
McLAREN/HART, INC.
WARREN, NEW JERSEY

| | | |
|---|---|---|
| DRWN: T.J.G. | CHK'D: A.G. | APP'D: P.K. |
| SCALE: AS SHOWN | | DATE: 06/19/98 |

SHALLOW GROUNDWATER ELEVATION CONTOURS
SEPTEMBER 25, 1997

FIGURE 4-3

303560




LEGEND

- SHALLOW MONITORING WELL
- PRODUCTION WELL
- STORMWATER INLET
- EXISTING ABOVEGROUND STORAGE TANK LOCATION
- FORMER ABOVEGROUND STORAGE TANK LOCATION
- GROUNDWATER CONTOUR LINE (FEET m.s.l.)
- 9.81 GROUNDWATER ELEVATION (FEET m.s.l.)

NOTE

CONTOUR INTERVAL = 0.25 FT.

SCALE

60 30 0 60 FEET

| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|
| | | | |

VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS

McLAREN/HART, INC.
WARREN, NEW JERSEY

| | | |
|---|---|---|
| DRWN: S.F.H. | CHK'D: M.A.S. | APP'D: N.E. |
| SCALE: AS SHOWN | | DATE: 02/17/00 |

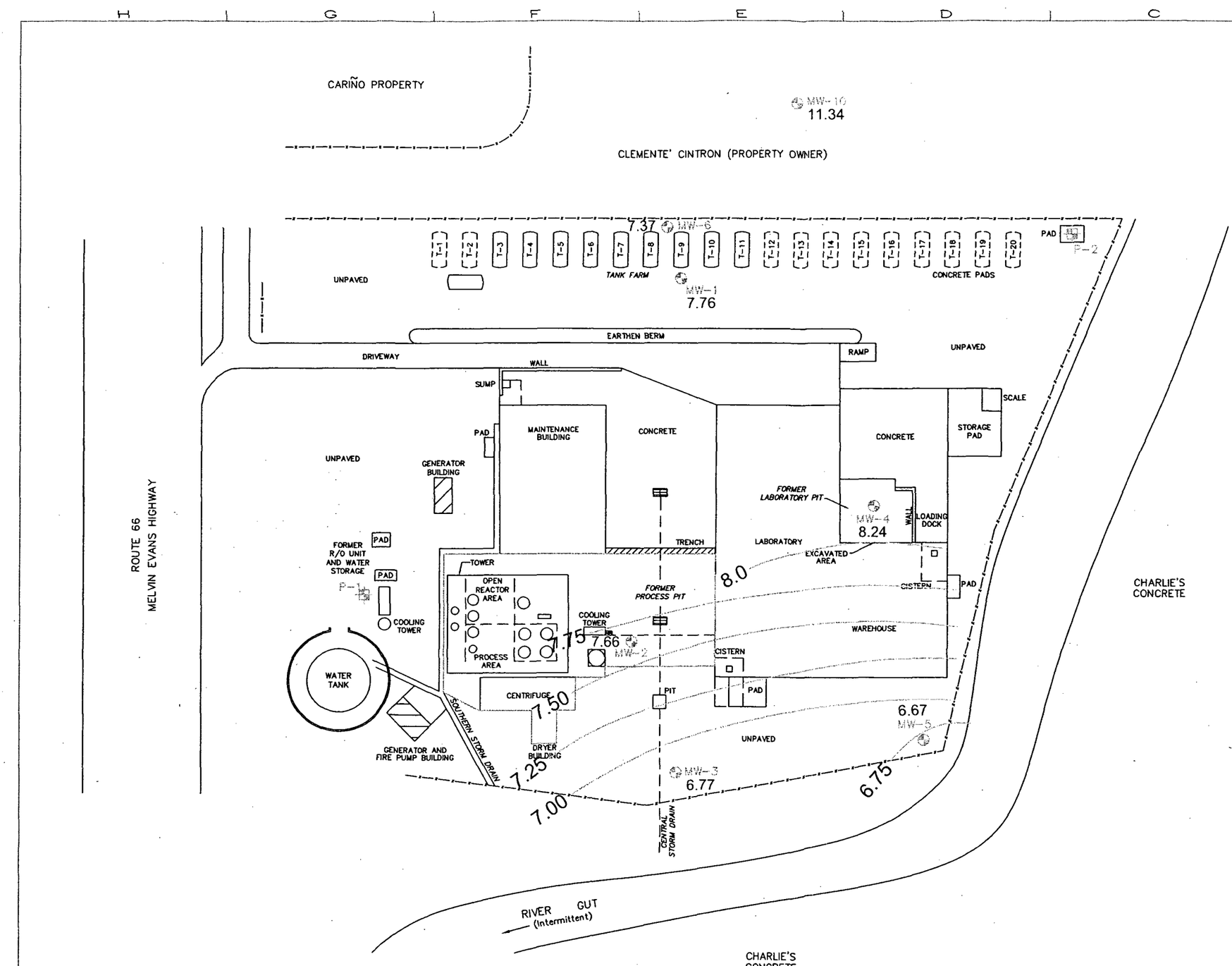
SHALLOW GROUNDWATER ELEVATION CONTOURS
JANUARY 1998

FIGURE 4-4

SOURCE: HARDING LAWSON ASSOCIATES

DWG: 87100199 02/17/00

303561




LEGEND

- SHALLOW MONITORING WELL
- PRODUCTION WELL
- STORMWATER INLET
- EXISTING ABOVEGROUND STORAGE TANK LOCATION
- FORMER ABOVEGROUND STORAGE TANK LOCATION
- GROUNDWATER CONTOUR LINE (FEET m.s.l.)
- 6.67 GROUNDWATER ELEVATION (FEET m.s.l.)

NOTE

CONTOUR INTERVAL = 0.25 FT.

SCALE

60 30 0 60 FEET

SOURCE: HARDING LAWSON ASSOCIATES

DWG: 87100200 02/17/00

| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|
| | | | |

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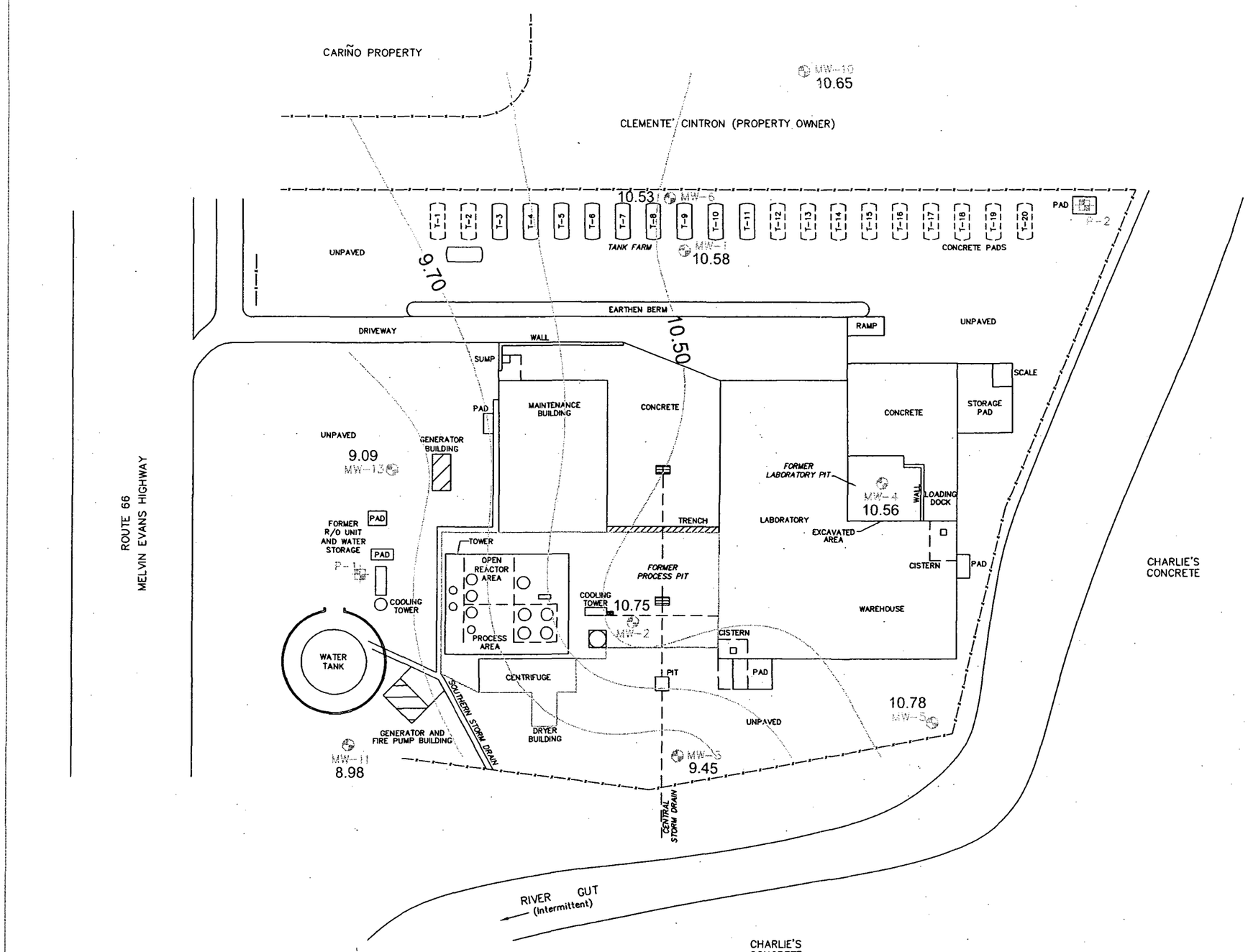
| | | |
|---|---|---|
| DRWN: S.F.H. | CHK'D: M.A.S. | APP'D: N.E. |
| SCALE: AS SHOWN | | DATE: 02/17/00 |

SHALLOW GROUNDWATER ELEVATION CONTOURS
MARCH 1998

FIGURE 4-5

303562




LEGEND

- SHALLOW MONITORING WELL
- PRODUCTION WELL
- STORMWATER INLET
- EXISTING ABOVEGROUND STORAGE TANK LOCATION
- FORMER ABOVEGROUND STORAGE TANK LOCATION
- GROUNDWATER CONTOUR LINE (FEET m.s.l.)
- 10.65 GROUNDWATER ELEVATION (FEET m.s.l.)

NOTE

CONTOUR INTERVAL = 0.40 FT.

SCALE

60 30 0 60 FEET

| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|
| | | | |

VIRGIN ISLAND CHEMICAL SITE
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McLAREN/HART, INC.
WARREN, NEW JERSEY

| | | |
|---|---|---|
| DRWN: S.F.H. | CHK'D: M.A.S. | APP'D: N.E. |
| SCALE: AS SHOWN | | DATE: 02/17/00 |

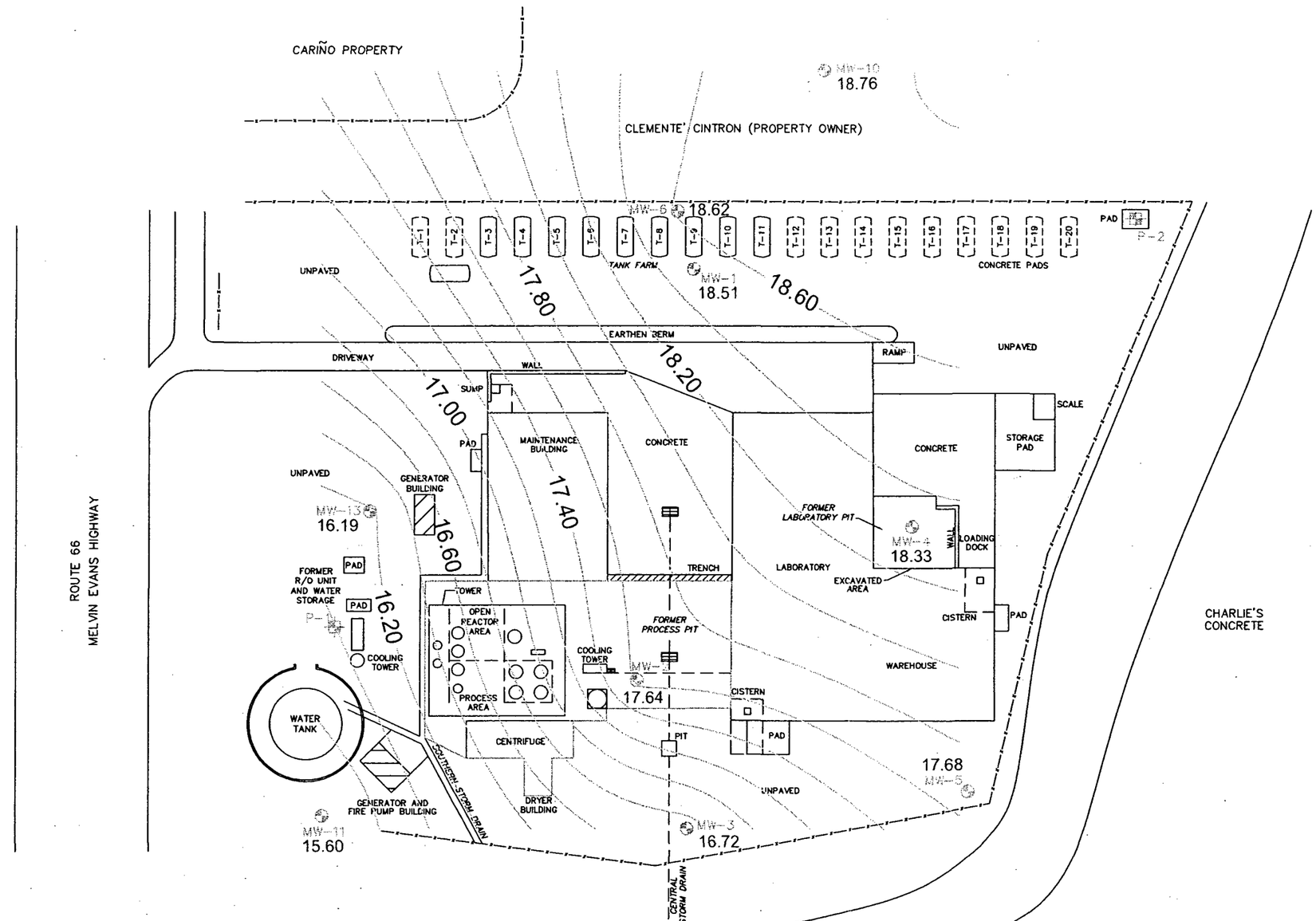
SHALLOW GROUNDWATER ELEVATION CONTOURS
OCTOBER 21, 1998

FIGURE 4-6

303563

SOURCE: HARDING LAWSON ASSOCIATES

DWG: 87100201 02/17/00




LEGEND

- SHALLOW MONITORING WELL
- PRODUCTION WELL
- STORMWATER INLET
- EXISTING ABOVEGROUND STORAGE TANK LOCATION
- FORMER ABOVEGROUND STORAGE TANK LOCATION
- GROUNDWATER CONTOUR LINE (FEET m.s.l.)
- 18.76 GROUNDWATER ELEVATION (FEET m.s.l.)

NOTE

CONTOUR INTERVAL = 0.20 FT.

SCALE

60 30 0 60 FEET

SOURCE: HARDING LAWSON ASSOCIATES

DWG: 87100202 02/17/00

| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|
| | | | |

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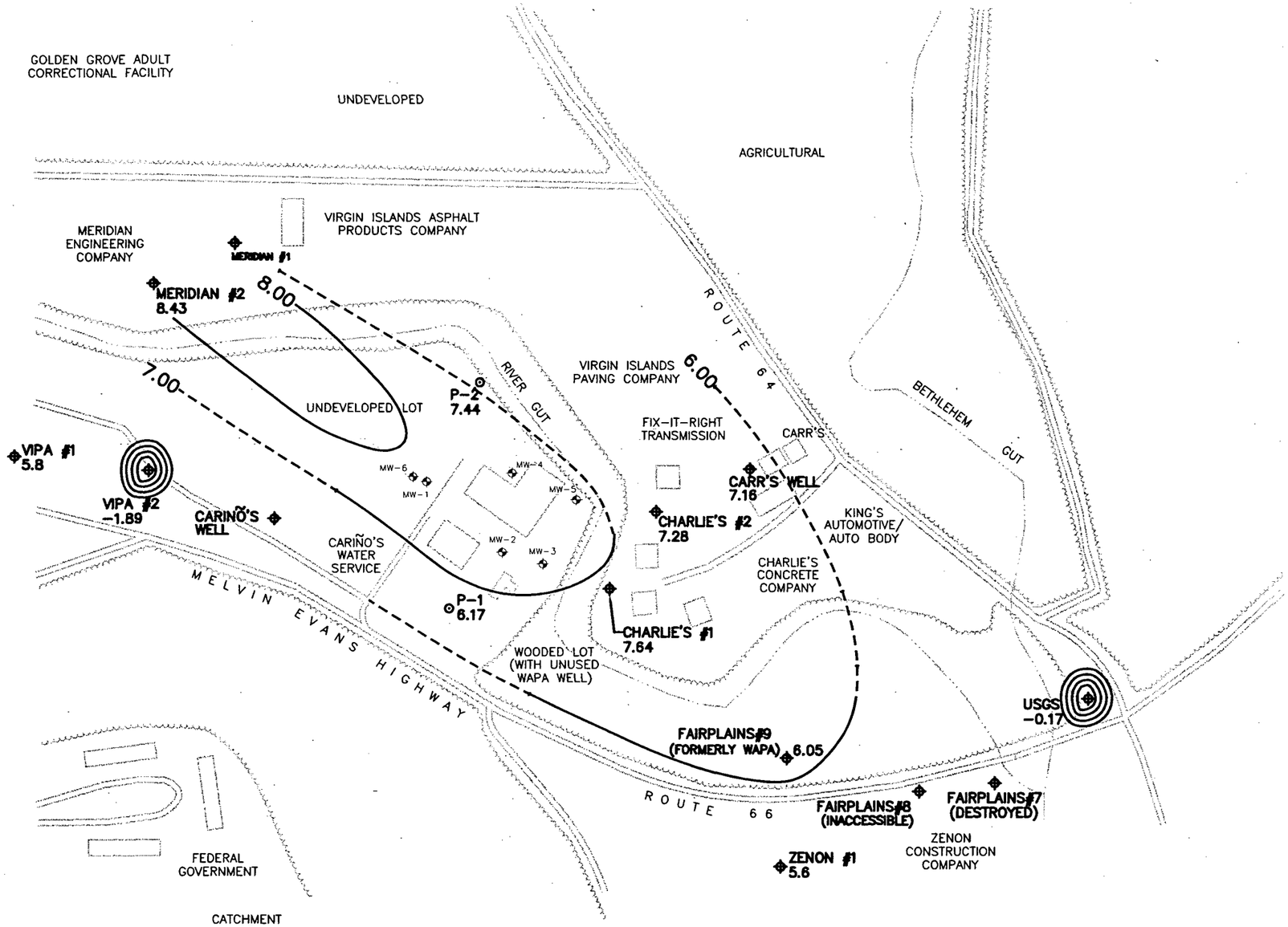
WARREN, NEW JERSEY

| | | |
|---|---|---|
| DRWN: S.F.H. | CHK'D: M.A.S. | APP'D: N.E. |
| SCALE: AS SHOWN | | DATE: 02/17/00 |

SHALLOW GROUNDWATER ELEVATION CONTOURS
NOVEMBER 30, 1999

FIGURE 4-7

303564




LEGEND

- BUILDING
- STREAM
- ROAD
- TREE LINE
- APPROX. LOCATION OF OFFSITE WELLS
- SHALLOW MONITORING WELL LOCATION
- ONSITE PRODUCTION WELL LOCATION
- DEEP MONITORING WELL LOCATION
- GOUNDWATER CONTOUR (FEET MSL)
- INFERRED GOUNDWATER CONTOUR (FEET MSL)
- 7.28 GROUNDWATER ELEVATION (FEET MSL)

SCALE

150 75 0 150 FEET

SOURCE: HARDING LAWSON ASSOCIATES

| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|

VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS

McLAREN/HART, INC.
WARREN, NEW JERSEY

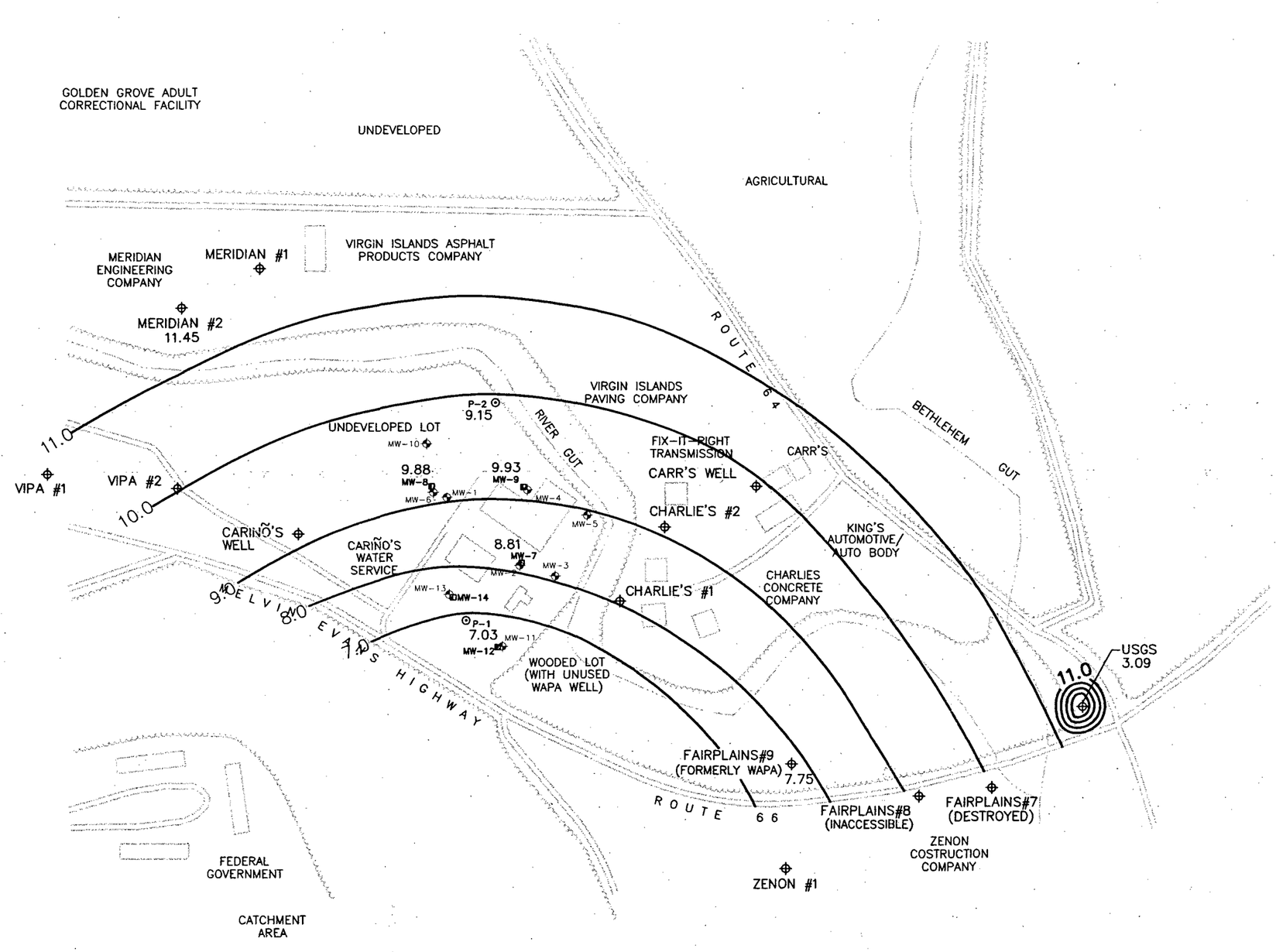
| | | |
|---|---|---|
| DRWN: T.J.G. | CHK'D: A.G. | APP'D: P.K. |
| SCALE: AS SHOWN | | DATE: 02/17/00 |

DEEP GROUNDWATER ELEVATION CONTOURS
SEPTEMBER 25, 1997

FIGURE 4-8

303565

DATE: 02/17/00 12:16:37 PM




LEGEND

- BUILDING
- STREAM
- ROAD
- TREE LINE
- APPROX. LOCATION OF OFFSITE WELLS
- SHALLOW MONITORING WELL LOCATION
- ONSITE PRODUCTION WELL LOCATION
- DEEP MONITORING WELL LOCATION
- GROUNDWATER CONTOUR (FEET MSL)
- 7.75 GROUNDWATER ELEVATION (FEET MSL)

SCALE

150 75 0 150 FEET

SOURCE: HARDING LAWSON ASSOCIATES

| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|

# VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS

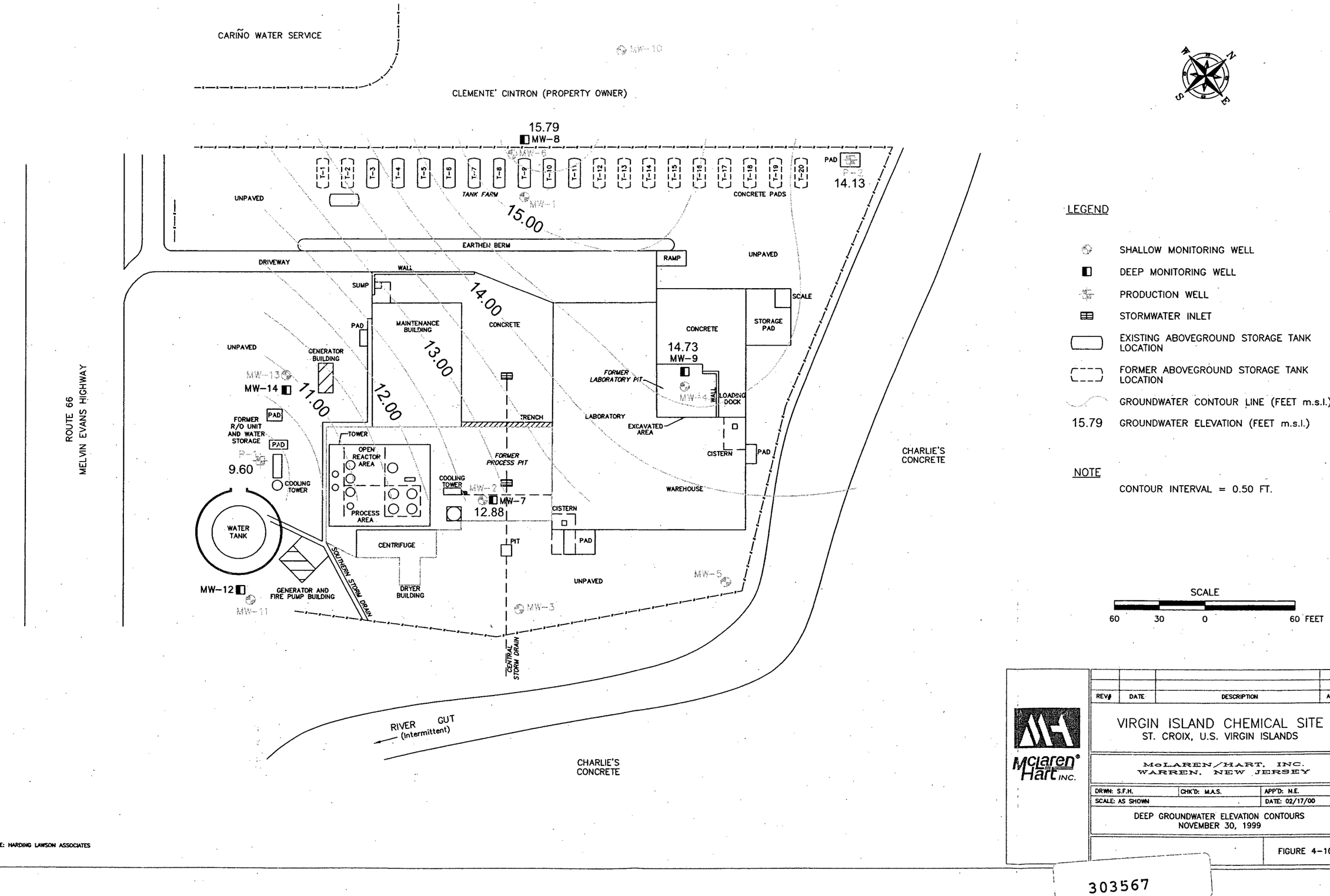
McLAREN/HART, INC.
WARREN, NEW JERSEY

| | | |
|---|---|---|
| DRWN: J.R.F. | CHK'D: A.G. | APP'D: P.K. |
| SCALE: AS SHOWN | | DATE: 02/17/00 |

DEEP GROUNDWATER ELEVATION CONTOURS
OCTOBER 21, 1998

FIGURE 4-9

303566




LEGEND

- SHALLOW MONITORING WELL
- DEEP MONITORING WELL
- PRODUCTION WELL
- STORMWATER INLET
- EXISTING ABOVEGROUND STORAGE TANK LOCATION
- FORMER ABOVEGROUND STORAGE TANK LOCATION
- GROUNDWATER CONTOUR LINE (FEET m.s.l.)
- 15.79 GROUNDWATER ELEVATION (FEET m.s.l.)

NOTE

CONTOUR INTERVAL = 0.50 FT.

SCALE

60 30 0 60 FEET

SOURCE: HARDING LAWSON ASSOCIATES

| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|
| | | | |

VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS

McLAREN/HART, INC.
WARREN, NEW JERSEY

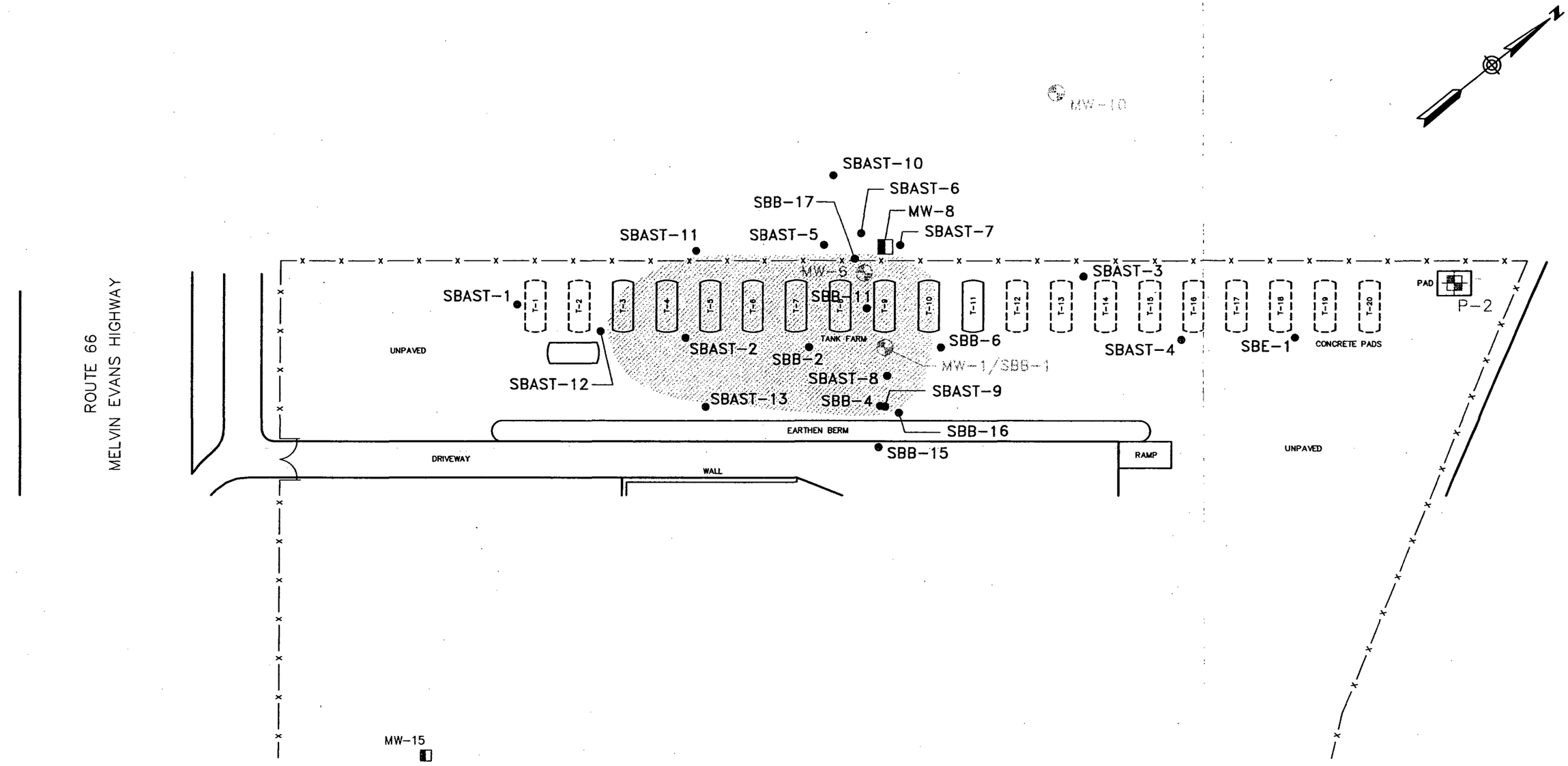
| DRWN: S.F.H. | CHK'D: M.A.S. | APP'D: N.E. |
|---|---|---|
| SCALE: AS SHOWN | | DATE: 02/17/00 |

DEEP GROUNDWATER ELEVATION CONTOURS
NOVEMBER 30, 1999

FIGURE 4-10

DWG: 87100193 02/17/00

303567




## NOTES

1.) SOIL BORING LOCATIONS ARE APPROXIMATE.

2.) SOIL BORINGS SHOWN WITHIN SHADED AREA EXHIBITED DETECTIONS OF ETHYLBENZENE AND XYLENE ABOVE MGW SSLS (DAF=10)

## REFERENCE

1.) DRAWING BASED ON FIGURE 4-11 OF THE R.I. REPORT ENTITLED "ESTIMATED AREAL EXTENT OF IMPACTED SOIL – AST AREA" DATED 2/17/00, PROVIDED BY McLAREN/HART, INC.

## LEGEND

- PRODUCTION WELL LOCATION
- SHALLOW MONITORING WELL LOCATION
- DEEP MONITORING WELL LOCATION
- SOIL BORING SAMPLE LOCATION
- EXISTING ABOVEGROUND STORAGE TANK LOCATION
- FORMER ABOVEGROUND STORAGE TANK LOCATION
- APPROXIMATE AREA OF IMPACTED SOIL ABOVE SSLs

| | | | |
|---|---|---|---|
| JOB No.: | 003-6016 | SCALE: | AS SHOWN |
| CAD BY: | MJS | DATE: | 09/22/00 |
| CHK BY: | | FILE No.: | US01-022 |
| REV BY: | | DR SUBTITLE: | 03 |

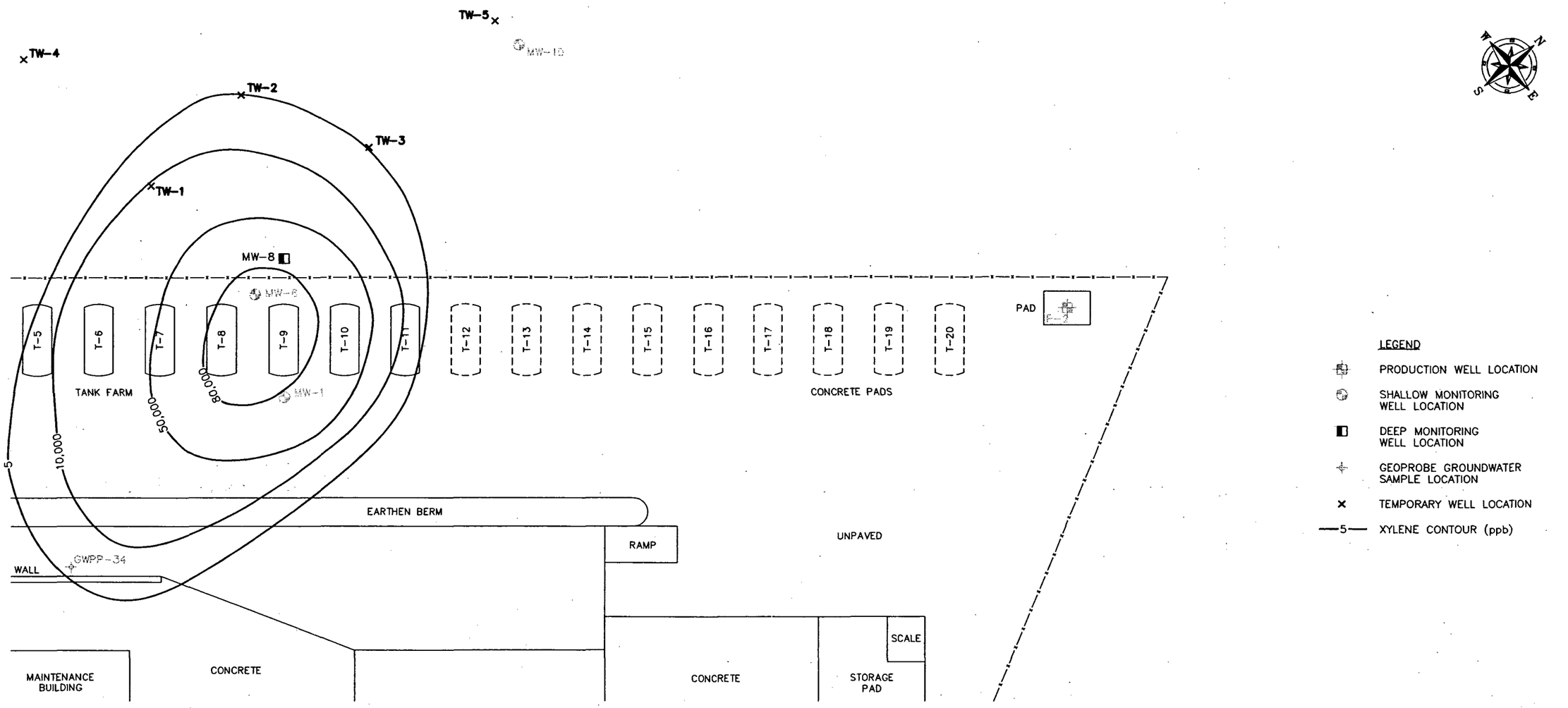
Golder Associates

# ESTIMATED AREAL EXTENT OF IMPACTED SOIL - AST AREA

VIRGIN ISLAND CHEMICAL SITE

FIGURE 4-11

303568




| SAMPLE ID | DEPTH (ft bgs) | CONCENTRATION (ppb) | SAMPLE ID | DEPTH (ft bgs) | CONCENTRATION (ppb) |
|---|---|---|---|---|---|
| MW-1 | 23-33 | TOLUENE – 460 UJ<br>ETHYLBENZENE – ***18,000***<br>XYLENE – ***80,000*** | TW-1* | 19-29 | TOLUENE – 5 U<br>ETHYLBENZENE – ***8,000 E***<br>XYLENE – ***15,000 E*** |
| MW-6 | 17.4-26.7 | TOLUENE – 600 UJ<br>ETHYLBENZENE – ***20,000***<br>XYLENE – ***98,000*** | TW-2* | 19-29 | TOLUENE – 5 U<br>ETHYLBENZENE – 5 U<br>XYLENE – 5 U |
| MW-8 | 63-73 | TOLUENE – 0.2 UJ<br>ETHYLBENZENE – 17<br>XYLENE – 79 | TW-3* | 19-29 | TOLUENE – 5 U<br>ETHYLBENZENE – ***720 J***<br>XYLENE – 5 U |
| MW-10 | 22-32 | TOLUENE – 1 U<br>ETHYLBENZENE – 0.8 UJ<br>XYLENE – 5 U | TW-4* | 22-32 | TOLUENE – 5 U<br>ETHYLBENZENE – 5 U<br>XYLENE – 5 U |
| P-2 | UNKNOWN | TOLUENE – 1 U<br>ETHYLBENZENE – 1 U<br>XYLENE – 7 U | TW-5* | 20-30 | TOLUENE – 5 U<br>ETHYLBENZENE – 3 J<br>XYLENE – 5 U |
| GWPP-34 | 32-35 | TOLUENE – 8<br>ETHYLBENZENE – 10 U<br>XYLENE – 13 | | | |

NOTES:

| | |
|---|---|
| J | ESTIMATED CONCENTRATION |
| U | ANALYTE NOT DETECTED ABOVE REPORTING LIMIT |
| E | ESTIMATED CONCENTRATION |
| ***18,000*** | CONCENTRATION EXCEEDS MCL (ETHYLBENZENE – 700 ppb, XYLENE – 10,000 ppb) |
| * | CONCENTRATIONS FROM TEMPORARY WELLS ARE SCREENING RESULTS FROM ONSITE GC (SEPTEMBER 1997) |

ALL RESULTS ARE FROM MARCH/APRIL 1998 INVESTIGATION EXCEPT SCREENING RESULTS FROM TEMPORARY WELLS (SEPTEMBER 1997)

SOURCE: HARDING LAWSON ASSOCIATES

DWG: 87100166 02/17/99

| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|
| | | | |

# VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS

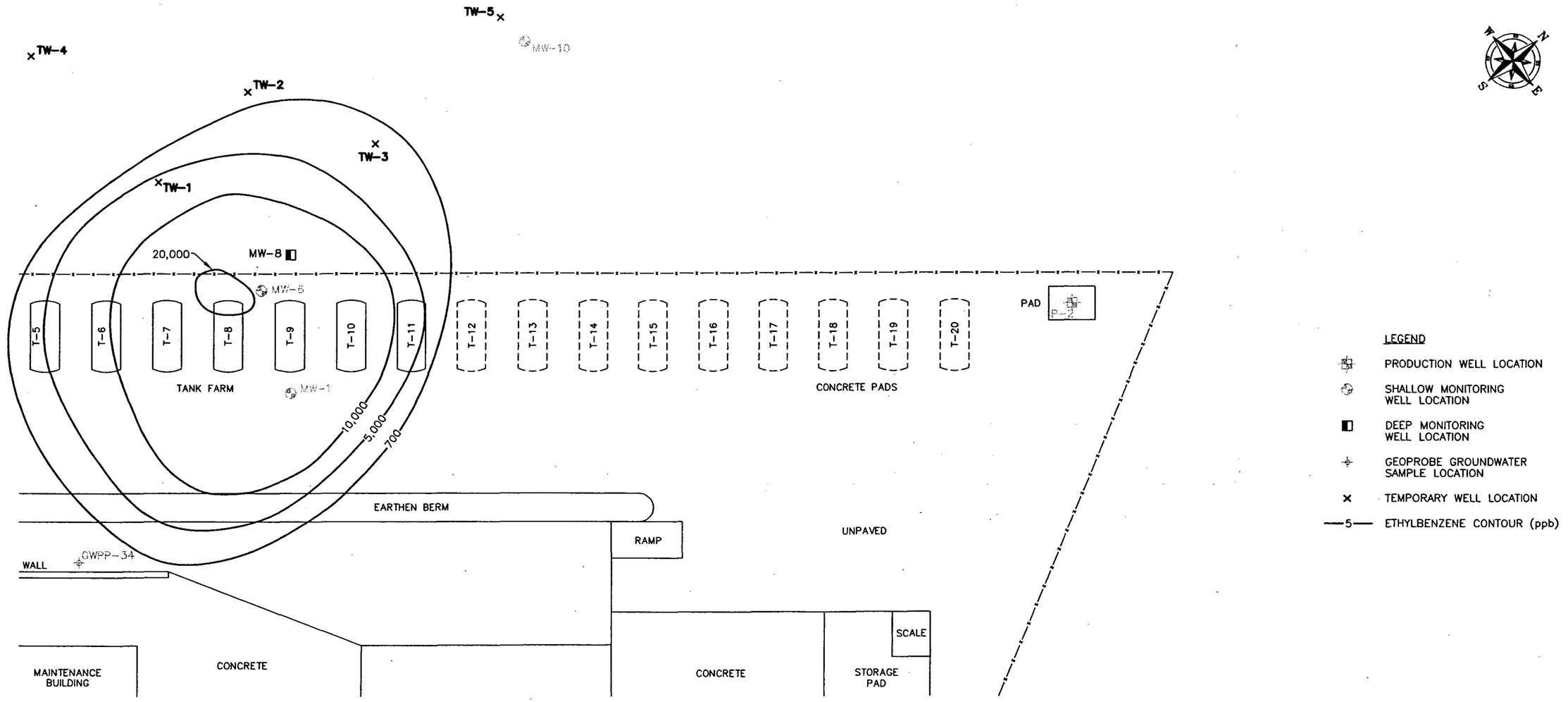
McLAREN/HART, INC.
WARREN, NEW JERSEY

| | | |
|---|---|---|
| DRWN: J.R.F. | CHK'D: A.G. | APP'D: P.K. |
| SCALE: AS SHOWN | | DATE: 02/17/00 |

ESTIMATED AREAL EXTENT OF XYLENE-IMPACTED SHALLOW GROUNDWATER AST AREA

FIGURE 4-12

303569




| SAMPLE ID | DEPTH (ft bgs) | CONCENTRATION (ppb) | SAMPLE ID | DEPTH (ft bgs) | CONCENTRATION (ppb) |
|---|---|---|---|---|---|
| MW-1 | 23-33 | TOLUENE – 460 UJ<br>ETHYLBENZENE – ***18,000***<br>XYLENE – ***80,000*** | TW-1* | 19-29 | TOLUENE – 5 U<br>ETHYLBENZENE – ***8,000 E***<br>XYLENE – ***15,000 E*** |
| MW-6 | 17.4-26.7 | TOLUENE – 600 UJ<br>ETHYLBENZENE – ***20,000***<br>XYLENE – ***98,000*** | TW-2* | 19-29 | TOLUENE – 5 U<br>ETHYLBENZENE – 5 U<br>XYLENE – 5 U |
| MW-8 | 63-73 | TOLUENE – 0.2 UJ<br>ETHYLBENZENE – 17<br>XYLENE – 79 | TW-3* | 19-29 | TOLUENE – 5 U<br>ETHYLBENZENE – ***720 J***<br>XYLENE – 5 U |
| MW-10 | 22-32 | TOLUENE – 1 U<br>ETHYLBENZENE – 0.8 UJ<br>XYLENE – 5 U | TW-4* | 22-32 | TOLUENE – 5 U<br>ETHYLBENZENE – 5 U<br>XYLENE – 5 U |
| P-2 | UNKNOWN | TOLUENE – 1 U<br>ETHYLBENZENE – 1 U<br>XYLENE – 7 U | TW-5* | 20-30 | TOLUENE – 5 U<br>ETHYLBENZENE – 3 J<br>XYLENE – 5 U |
| GWPP-34 | 32-35 | TOLUENE – 8<br>ETHYLBENZENE – 10 U<br>XYLENE – 13 | | | |

SOURCE: HARDING LAWSON ASSOCIATES

NOTES:

| | |
|---|---|
| J | ESTIMATED CONCENTRATION |
| U | ANALYTE NOT DETECTED ABOVE REPORTING LIMIT |
| E | ESTIMATED CONCENTRATION |
| ***18,000*** | CONCENTRATION EXCEEDS MCL (ETHYLBENZENE – 700 ppb, XYLENE – 10,000 ppb) |
| * | CONCENTRATIONS FROM TEMPORARY WELLS ARE SCREENING RESULTS FROM ONSITE GC (SEPTEMBER 1997) |

ALL RESULTS ARE FROM MARCH/APRIL 1998 INVESTIGATION EXCEPT SCREENING RESULTS FROM TEMPORARY WELLS (SEPTEMBER 1997)

| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|
| | | | |

# VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS

McLAREN/HART, INC.
WARREN, NEW JERSEY

| DRWN: J.R.F. | CHK'D: A.G. | APP'D: P.K. |
|---|---|---|
| SCALE: AS SHOWN | | DATE: 02/17/00 |

ESTIMATED AREAL EXTENT OF ETHYLBENZENE-IMPACTED SHALLOW GROUNDWATER AST AREA

FIGURE 4-13

303570

DWG: B7100167 02/17/00

| SAMPLE ID | DEPTH (ft bgs) | CHLOROFORM CONCENTRATION (ppb) |
|---|---|---|
| GWPP-7 | 20-25 | ND |
| GWPP-8 | 20-25 | ND |
| GWPP-9 | 22-27 | *318* |
| GWPP-10 | 28-33 | *94* |
| GWPP-11 | 21-26 | 74 |
| GWPP-12 | 26-31 | 78 |
| GWPP-13 | 22-30 | *157* |
| GWPP-14 | 21-24 | ND |
| GWPP-15 | 8-10 | *1,178* |
| GWPP-16 | 27-30 | ND |
| GWPP-17 | 27-32 | 3 |
| GWPP-19 | 8-12 | *480* |
| GWPP-20 | 23-28 | 7 |
| GWPP-21 | 21-26 | ND |
| GWPP-23 | 22-27 | *1,000* |
| GWPP-24 | 23-28 | 53 |
| GWPP-25 | 24-29 | 3 |
| GWPP-26 | 6-10 | 54 |
| GWPP-27 | 24-29 | *3,994* |
| GWPP-28 | 26-31 | *234* |
| GWPP-29 * | 31-34 | *96* |
| GWPP-30 | 34-37 | ND |
| GWPP-31 | 22-27 | *1,661* |
| GWPP-32 | 23-28 | 6 |
| GWPP-33 * | 31-34 | 63 |
| GWPP-34 | 32-35 | ND |
| GWPP-35 | 27-30 | 29 |
| GWOR-1 | 22-29 | 31 |
| MW-2 | 18.9-28.2 | *2,400* |
| MW-3 | 18.5-28.5 | ND |
| MW-7 | 64-74 | 4 |
| MW-11 | 30-40 | 3J |
| MW-12 | 137-147 | ND |
| MW-13 | 30-40 | ND |
| MW-14 | 124-134 | ND |
| P-1 | UNKNOWN | 46E |

NOTES:

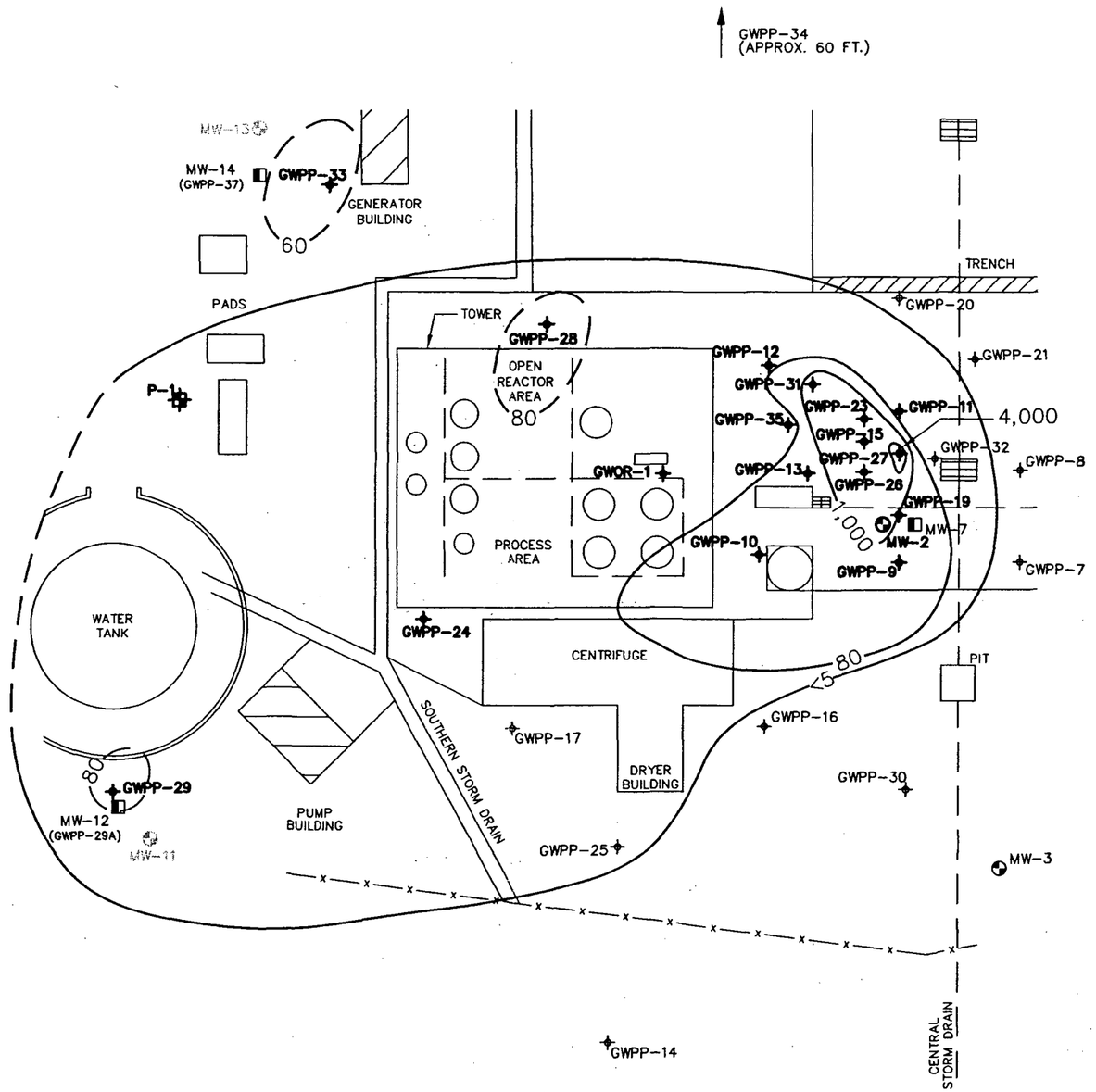
E EXCEEDS CALIBRATION RANGE OF INSTRUMENT

ND NON DETECTED

*1,700* CONCENTRATION EXCEEDS MCL (80 ppb)

* FOR PREPARATION OF PLUME MAP, RESULTS FROM SCREENING POINTS GWPP-29 AND GWPP-33 WERE REPLACED WITH RESULTS FROM MONITORING WELLS MW-11 AND MW-13 RESPECTIVELY. THESE PERMANENT POINTS ARE ASSUMED TO BE MORE REPRESENTATIVE OF ACTUAL GROUNDWATER CONDITIONS.
ALL RESULTS ARE FROM MARCH/APRIL 1998 INVESTIGATION EXCEPT MONITORING WELLS MW-11 THROUGH MW-14 (OCTOBER 1998).

SOURCE: HARDING LAWSON ASSOCIATES




LEGEND

- PRODUCTION WELL LOCATION
- SHALLOW MONITORING WELL LOCATION
- DEEP MONITORING WELL LOCATION
- GEOPROBE GROUNDWATER SAMPLE LOCATION
- −4,000− CHLOROFORM CONTOUR (ppb)

SCALE

30 15 0 30 FEET

| REV# | DATE | DESCRIPTION | APP'D |
|---|---|---|---|

VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS

McLAREN/HART, INC.
WARREN, NEW JERSEY

| DRWN: J.R.F | CHK'D: A.G. | APP'D: P.K. |
|---|---|---|
| SCALE: AS SHOWN | | DATE: 02/17/00 |

ESTIMATED AREAL EXTENT OF CHLOROFORM-IMPACTED GROUNDWATER PROCESS PIT AREA

FIGURE 4-14

DWG: 87100168 02/17/00

303571

**Golder Associates Inc.**

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Fax (856) 616-1874

# REMEDIAL INVESTIGATION ADDENDUM
# VIRGIN ISLAND CHEMICAL SITE
# ST. CROIX, U.S. VIRGIN ISLANDS

Prepared for:

Berlex Laboratories, Inc.
15049 San Pablo Avenue
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Richmond, CA 94804

and

Pharmacia & Upjohn
7171 Portage Road
Kalamazoo, MI 49001

October 2000

Project No.: 003-6016

303572

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| 4.0 | INSTALLATION AND DEVELOPMENT OF MONITORING WELL MW-15 | 3 |
| 5.0 | WATER LEVEL MEASUREMENTS | 4 |
| 6.0 | AQUIFER TESTING AND MEASUREMENT | 4 |
| 7.0 | GROUNDWATER SAMPLING AND RESULTS | 5 |
| 8.0 | INVESTIGATION-DERIVED WASTE | 6 |
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## LIST OF ATTACHMENTS


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| Attachment B | MW-15 Boring and Construction Log |
| Attachment C | Slug Test Data Analysis |
| Attachment D | Groundwater Sampling Forms |
| Attachment E | Data Validation Summary and Laboratory Analytical Package |

# ADDENDUM
# REMEDIAL INVESTIGATION
# VIRGIN ISLAND CHEMICAL SITE
# ST. CROIX, U.S. VIRGIN ISLANDS

## 1.0 INTRODUCTION

This Addendum describes the remedial investigation (RI) field work that was conducted during the period January through March 2000, and associated results for the Virgin Island Chemical Site in St. Croix, U.S. Virgin Islands. RI field work conducted from January through March 2000 included the following tasks:

- Abandonment of Former Production Well P-1;
- Installation of a replacement well MW-15; and,
- Collection of water levels and groundwater samples in selected monitoring wells.

The work was conducted pursuant to the scope of work presented in a letter by McLaren/Hart to USEPA dated January 19, 2000 and as approved by USEPA on January 27, 2000 (see Attachment A). The field and laboratory work was carried out under the direction of McLaren/Hart. In July 2000, Golder Associates (Golder) took over responsibility for the project from McLaren/Hart. Golder has prepared this Addendum with assistance from former McLaren/Hart personnel.

## 2.0 BACKGROUND

Groundwater samples collected from former production well P-1 have historically exhibited concentrations of chloroform near but below the federal Maximum Contaminant Level (MCL)[1] of 100 parts per billion (ppb). Specifically, concentrations have ranged from 38 ppb (October 1998) to 76 ppb (January 1998). During the Phase III field investigation in September/October 1997, a downhole video survey was conducted in P-1 to determine the depth of the screened interval and to evaluate the integrity of the well. Based on the results of the survey, the production well was determined to be constructed of 6-inch steel casing that extends from the surface into the bedrock to a depth of 98 feet below ground surface (bgs). An open borehole extended approximately 1 to

[1] The MCL for total trihalomethanes is 100 ppb. In the 1994 Proposed Rule for Disinfectants and Disinfection By-Products, a total THM number of 80 ppb was proposed. The Final RI Report (McLaren/Hart, 2000) uses a value of 80 ppb as the MCL screening criteria.



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3 feet below the bottom of the casing. A screened interval was not encountered; however, a series of rough slots cut into the casing were identified between 63 and 78 feet bgs. This interval lies within the deep Alluvium. Packer testing was conducted during the Phase IV investigation by McLaren/Hart (October 1998) in order to evaluate the possibility that these rough slots were a means for overburden groundwater to enter the well and affect the overall groundwater quality in this area. The packer test data indicated that the slots were open to the formation and groundwater was entering the well from this interval. On this basis, it was determined that samples from well P-1 may not be representative of bedrock groundwater conditions.

To obtain representative bedrock groundwater data, McLaren/Hart proposed to abandon production well P-1 and install and test a new monitoring well in the bedrock unit (Kingshill Formation). A secondary objective was to collect more recent chemistry and water level data from other site wells.

## 3.0 ABANDONMENT OF FORMER PRODUCTION WELL P-1

Environmental Remediation Technologies (ERTEC) was retained by Berlex and P&U to conduct well abandonment and drilling activities. McLaren/Hart provided direction and oversight to ERTEC during the field activities. On January 25, 2000, ERTEC prepared a thick cement/bentonite grout mixture for placement in the well. Each batch of grout mixture consisted of 25 gallons of water, ¼ bag of bentonite, and 3 bags of cement. The grout was gravity-fed for the first few feet to minimize the release of grout through the fractures of the open borehole into the formation. Subsequently, the grout was placed under pressure with a tremie pipe from the bottom up within the steel well casing. After placement of approximately 240 gallons of grout, the total well depth measured approximately 60 feet bgs. McLaren/Hart and ERTEC determined that the grout was either settling out through the fractures of the open borehole or moving through the rough slots cut into the steel casing and into the open annular space. Therefore, approximately ½-gallon of bentonite pellets were placed in the well and allowed to hydrate overnight to form a seal at depth. On January 26, 2000, grouting was completed by tremie from depth to the ground surface. The grout was pumped until it rose above the well casing. A total of about 340 gallons of grout was used during the abandonment activities. After grouting was completed, the well head was cut to grade.

## 4.0 INSTALLATION AND DEVELOPMENT OF MONITORING WELL MW-15

A new Kingshill Formation monitoring well, designated as MW-15, was installed approximately 18 feet northwest of former production well P-1. Based on the total depth of P-1, as measured during abandonment, MW-15 was drilled and installed to a depth of 98 feet bgs and screened from 88 to 98 feet bgs. This screen interval coincided with the packer-test interval sampled by McLaren/Hart during the 1998 Phase IV field investigation, during which chloroform was detected at a concentration of 76 ppb.

The new monitoring well was constructed in accordance with the procedures outlined in the EPA-approved 1997 *Revised Draft Remedial Investigation Work Plan – Phase III* submitted by Harding Lawson Associates (HLA). Drilling and well installation took place between January 26 and 31, 2000.

A Mobile B-90 drill rig was used to advance an 8-inch diameter borehole by hollow-stem auger drilling techniques. Drill cuttings were continuously screened and logged in 10-foot intervals by McLaren/Hart. The monitoring well was constructed of new, 4-inch diameter, internally threaded, flush joint, Schedule 40 polyvinyl chloride (PVC) well screen and riser. The well screen was 10 feet in length and consisted of 0.020-inch (20-slot) machine-slotted openings. A TEC Minerals Filter Media 2434 sand pack was placed around the well screen and extended two feet above the top of the screen (86 feet bgs). The sand was added while simultaneously retracting the augers; thus allowing the sand to settle into the annular space between the well screen and borehole wall while preventing any significant cave-in. With the bottom of the augers located at the top of the filter pack, a 2-foot layer of bentonite pellets (CETCO Volclay/Puregold 3/8-inch Bentonite Tablets) was added and allowed to hydrate overnight. While slowly and incrementally removing the augers from the borehole, the remaining annular space was tremie-grouted from the top of the bentonite seal to the ground surface with a cement/bentonite grout. The well was finished with a protective locking assembly.

A well construction diagram/boring log for monitoring well MW-15, completed by McLaren/Hart, is provided as Attachment B.

Upon completion, MW-15 was developed by two methods. On February 7, 2000, a large-scale bailer was used (lowered in and out of well with the use of a drill rig) to surge and remove approximately 100 gallons of turbid water from the well. After bailing, a 2-inch diameter

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Grundfos submersible pump was used until the purge waters reached a field-determined stable level of turbidity, pH, specific conductance, and temperature. Approximately 200 gallons of water was pumped during this development period.

A water level measuring point was marked on the PVC riser of monitoring well MW-15 and surveyed, along with establishing the horizontal and vertical control for the well. The location of MW-15, in relation to the existing monitoring wells, is depicted on Figures 1 and 2.

## 5.0 WATER LEVEL MEASUREMENTS

Several rounds of water level measurements were collected from on-Site wells on January 31, March 6, March 28, April 16, April 26, 2000, and May 4, 2000 to evaluate groundwater flow directions in both the shallow and deep water-bearing zones. Measurements were collected using an electronic water level indicator and are presented in Table 1, along with historical water levels for reference. The water table surface elevation contours in the shallow alluvium zone (wells screened at approximately 40 feet below ground surface) for January 31 and March 6, 2000 are depicted on Figures 1 and 2. The water elevation contours in the deep alluvium for March 6, 2000 are depicted on Figure 3.

The water level data for the shallow and deep zones reflects water table conditions with a predominantly south/southeastern horizontal flow component. The Site-wide average hydraulic gradient in the shallow zone is about 0.01 feet/feet, which is comparable to hydraulic gradient values reported in correspondence from McLaren/Hart to USEPA (January 19, 2000).

## 6.0 AQUIFER TESTING AND MEASUREMENT

On February 9 and 10, 2000, rising head slug tests were conducted in monitoring wells MW-6 (shallow), MW-8 (deep), MW-11 (shallow), MW-12 (deep), and MW-15 (deep) to estimate the horizontal hydraulic conductivity of the aquifer zones underlying the Site. The tests were performed by initially using a PVC slug to displace a known volume of water in each well. Following equilibration of the water level, the slug was removed from the well and the resulting recovery in the water level was logged using a pressure transducer and electronic data logger. Water level data were collected by the data logger on a logarithmic sampling schedule to ensure accurate measurement of early, rapid water level changes.

Slug test output analyses are provided in Attachment C. A summary of the slug test data and results is presented in Table 2. AQTESOLV, an analytical program developed by Duffield and Rumbaugh in 1989, was used to compute hydraulic conductivities (K). The Bouwer-Rice and Hvorslev methods for unconfined aquifers were used for shallow wells MW-6 and MW-11. The Cooper-Bredehoeft-Papadopoulos method for confined aquifers was used for the remaining deep wells. The value of K for the shallow zone (MW-6 and MW-11) ranged from 0.90 to 18.14 feet/day, while the K for the deep zone (MW-8 and MW-15) ranged from 2.73 to 5.65 feet/day. The hydraulic conductivity at MW-12, which is screened entirely in the Kingshill Formation, is 2.65 feet/day.

## 7.0 GROUNDWATER SAMPLING AND RESULTS

During the week of March 6, 2000, samples were collected from select monitoring wells to assess the groundwater quality in the two principal areas of concern. Wells MW-1, MW-6, MW-8, and MW-10 were sampled in the Aboveground Storage Tank (AST) Area; and wells MW-2, MW-3, MW-7, and MW-11 through MW-15 were sampled in and downgradient of the Former Process Pit (FPP) Area. Wells MW-11 through MW-14 were included as they had not been sampled for over 12 months. The locations of these wells are shown in Figures 1 through 3.

Static water level measurements and total well depths were measured. McLaren/Hart utilized low flow (minimal drawdown) purging and sampling procedures as outlined in EPA's March 1998 *Groundwater Sampling Procedure – Low Stress Purging and Sampling*. A 2-inch diameter, Grundfos submersible pump was utilized for purging and sampling. Field data for temperature, pH, specific conductance, reduction/oxidation potential (redox), dissolved oxygen (DO), and turbidity were recorded every three to five minutes during purging. After stabilization of the field parameters, groundwater samples were collected directly from the pump discharge line and submitted to Pace Analytical Laboratory (Pace) in St. Rose, Louisiana for analysis of the Site Target Compounds (acetone, chloroform, ethylbenzene, methylene chloride, toluene, total xylenes) and sulfate. Additionally, samples were collected and analyzed on-Site using Chemetrics field test kits for ammonia, DO, ferrous iron, nitrate, nitrite, and sulfide. Samples were collected, preserved, and handled as described in the EPA-approved 1997 *Revised Draft Remedial Investigation Work Plan – Phase III* submitted by HLA. Groundwater sampling forms are provided in Attachment D.



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The validated analytical results from groundwater and quality control samples are summarized in Tables 3 and 4.

In the AST Area, ethylbenzene and total xylenes were detected above MCLs (700 ppb and 10,000 ppb, respectively) in monitoring wells MW-1 and MW-6. These wells are located within the suspected source area. No constituents were detected in deep monitoring well MW-8, also located within the suspected source area. Also, no constituents were detected in offsite monitoring well MW-10.

In the FPP Area, chloroform was detected in shallow monitoring well MW-2 at 37 ppb, and in the downgradient shallow well MW-11 at 40.4 ppb; in both cases well below the MCL. Chloroform was not detected in shallow wells MW-3 or MW-13, nor in deep wells MW-7 (located within the suspected source area), MW-12, and MW-14. Newly-installed monitoring well MW-15 exhibited an estimated chloroform concentration of 9.4 ppb, which is an order of magnitude below the MCL and much lower than concentrations previously observed in adjacent former production well P-1.

The results for quality control samples, trip blanks and equipment rinsates collected during the monitoring event are presented in Table 5. Data validation services were performed by Alpha Environmental Consultants, Inc. of Latham, New York under contract to McLaren/Hart. The validation reports were reviewed by Golder for conformance to USEPA Region II protocol to ensure that qualifiers for blank contamination were properly applied. Trace levels of acetone, methylene chloride, toluene, and total xylenes were detected in QC samples. This blank contamination was addressed during data validation in accordance with USEPA Region II protocols. The data validation summary is provided in Attachment E.

## 8.0 INVESTIGATION-DERIVED WASTE

During the installation of monitoring well MW-15, all drill cuttings and well development water were containerized in 55-gallon drums. The drums were separated by matrix (soil and water) and staged on-Site. Eleven drums of soil cuttings and six drums of water were generated. Composite samples were collected from each matrix and analyzed for Toxicity Characteristic Leaching Procedure (TCLP) volatile organics and the other RCRA hazardous characteristic criteria. Water samples were also analyzed by Pace for acetone, chloroform, ethylbenzene, methylene chloride,

toluene, and total xylenes. The analytical results are provided in Table 6. Concentrations reveal that the soil and water are RCRA non-hazardous and Berlex/P&U therefore propose that they be redeposited on-Site.

## 9.0 CONCLUSIONS

The investigation results provided in this Addendum are supportive of the conclusions reached in the February 2000 Remedial Investigation Report prepared by McLaren/Hart.

Shallow groundwater on-Site is impacted by ethylbenzene and xylenes in the AST area and by chloroform in the FPP area. Shallow groundwater concentrations of chloroform in the FPP "source area", as measured by monitoring well MW-2, have decreased from 2,400 ppb in March 1998 to 37 ppb in March 2000.

Deep groundwater, both within the alluvium and the Kingshill Formation, is not impacted. Chloroform was detected at an estimated concentration of 9.4 ppb in newly installed well MW-15, however, this likely results from historic cross-contamination caused by the construction of the adjacent former Production Well P-1. As such, this concentration, which is an order of magnitude below the MCL, does not accurately represent conditions in the deep aquifer.

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# TABLE 1
## ON-SITE GROUNDWATER ELEVATIONS
## VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS



| Well ID | Reference Point Elevations | | | 2/14/95 Water Elevation | 5/8/95 Water Elevation | 5/9/95 Water Elevation | 5/10/95 Water Elevation | 5/11/95 Water Elevation | 5/29/96 Water Elevation | 5/30/96 Water Elevation | 6/16/96 Water Elevation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | GS (ft msl) | TOC (ft msl) | TIC (ft msl) | | | | | | | | |
| **SHALLOW OVERBURDEN WELLS** | | | | | | | | | | | |
| MW-1 | 29.41 | 31.54 | 31.36 | ***4.18*** | 4.26 | 4.27 | 4.68 | 5.13 | 6.64 | 6.74 | 6.24 |
| MW-2 | 29.51 | 32.08 | 31.53 | NI | NI | NI | NI | NI | NI | NI | 6.67 |
| MW-3 | 28.69 | 30.82 | 30.59 | 4.88 | 4.07 | ***4.05*** | 6.12 | 8.62 | 7.46 | 7.43 | 6.72 |
| MW-4 | 27.13 | 28.82 | 28.63 | 4.28 | 4.20 | ***4.19*** | 4.78 | 5.51 | 6.72 | 6.80 | 6.74 |
| MW-5 | 26.65 | 29.15 | 28.89 | 4.26 | 4.15 | ***4.13*** | 8.31 | 8.00 | 7.72 | 7.68 | 6.57 |
| MW-6 | 30.20 | 33.20 | 32.17 | NI | NI | NI | NI | NI | NI | NI | NM |
| MW-10 | 32.01 | 34.78 | 34.76 | NI | NI | NI | NI | NI | NI | NI | NI |
| MW-11 | 38.17 | 40.86 | 39.54 | NI | NI | NI | NI | NI | NI | NI | NI |
| MW-13 | 38.38 | 41.05 | 40.03 | NI | NI | NI | NI | NI | NI | NI | NI |
| **DEEP OVERBURDEN WELLS** | | | | | | | | | | | |
| MW-7 | 29.37 | 31.71 | 31.38 | NI | NI | NI | NI | NI | NI | NI | NI |
| MW-8 | 30.27 | 32.69 | 32.49 | NI | NI | NI | NI | NI | NI | NI | NI |
| MW-9 | 26.78 | 30.19 | 29.96 | NI | NI | NI | NI | NI | NI | NI | NI |
| **KINGSHILL WELLS** | | | | | | | | | | | |
| MW-12 | 38.46 | 41.21 | 39.57 | NI | NI | NI | NI | NI | NI | NI | NI |
| MW-14 | 38.44 | 40.89 | 39.29 | NI | NI | NI | NI | NI | NI | NI | NI |
| MW-15 | 37.80 | 38.97 | 38.37 | NI | NI | NI | NI | NI | NI | NI | NI |
| P-1 | 38.00 | 39.80 | NA | 4.60 | **2.97** | 2.99 | 3.05 | 3.09 | NM | 3.42 | 3.39 |
| P-2 | 29.55 | 30.38 | NA | 7.73 | 3.80 | 3.85 | 4.03 | 4.00 | NM | 4.08 | 3.58 |

GS - Ground surface
TOC - Top of outer casing
TIC - Top of inner casing
Depth to water measured in feet from reference point.
**Reference and water elevations measured in feet mean sea level.**
NI - Well not installed yet
NM - Not measured
AB - Well abandoned
Values shown in boldface represent maximum values
Values shown in italics represent minimum values
Water elevations taken on 3/28/00, 4/16/00, 4/26/00 during soil vapor extraction / air sparging study. Water levels in MW-1, MW-2, MW-6 may have been affected by active system.

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**TABLE 1**
**ON-SITE GROUNDWATER ELEVATIONS**
**VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS**



| Well ID | Reference Point Elevations GS (ft msl) | TOC (ft msl) | TIC (ft msl) | 6/17/96 Water Elevation | 6/18/96 Water Elevation | 9/12/97 Water Elevation | 9/19/97 Water Elevation | 9/25/97 Water Elevation | 10/1/97 Water Elevation | 1/10/98 Water Elevation | 3/25/98 Water Elevation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **SHALLOW OVERBURDEN WELLS** | | | | | | | | | | | |
| MW-1 | 29.41 | 31.54 | 31.36 | 6.10 | 6.36 | 8.55 | 8.81 | 8.94 | 8.82 | 9.84 | 7.58 |
| MW-2 | 29.51 | 32.08 | 31.53 | ***6.65*** | 6.67 | 8.31 | 9.05 | 8.75 | 8.96 | 9.48 | 7.66 |
| MW-3 | 28.69 | 30.82 | 30.59 | 6.88 | 6.92 | 7.11 | 8.30 | 7.85 | 7.61 | 8.49 | 6.54 |
| MW-4 | 27.13 | 28.82 | 28.63 | 6.82 | 6.80 | 8.44 | 9.02 | 8.81 | 8.73 | 9.62 | 8.05 |
| MW-5 | 26.65 | 29.15 | 28.89 | 6.49 | 6.49 | 7.90 | 8.93 | 8.57 | 8.43 | 9.39 | 6.41 |
| MW-6 | 30.20 | 33.20 | 32.17 | ***5.97*** | 6.28 | 9.03 | 9.11 | 9.19 | 9.74 | 9.91 | 7.37 |
| MW-10 | 32.01 | 34.78 | 34.76 | NI | NI | NI | NI | NI | NI | ***10.06*** | 11.32 |
| MW-11 | 38.17 | 40.86 | 39.54 | NI | NI | NI | NI | NI | NI | NI | NI |
| MW-13 | 38.38 | 41.05 | 40.03 | NI | NI | NI | NI | NI | NI | NI | NI |
| **DEEP OVERBURDEN WELLS** | | | | | | | | | | | |
| MW-7 | 29.37 | 31.71 | 31.38 | NI | NI | NI | NI | NI | NI | 9.12 | ***6.62*** |
| MW-8 | 30.27 | 32.69 | 32.49 | NI | NI | NI | NI | NI | NI | 9.44 | ***6.71*** |
| MW-9 | 26.78 | 30.19 | 29.96 | NI | NI | NI | NI | NI | NI | 9.53 | ***7.47*** |
| **KINGSHILL WELLS** | | | | | | | | | | | |
| MW-12 | 38.46 | 41.21 | 39.57 | NI | NI | NI | NI | NI | NI | NI | NI |
| MW-14 | 38.44 | 40.89 | 39.29 | NI | NI | NI | NI | NI | NI | NI | NI |
| MW-15 | 37.80 | 38.97 | 38.37 | NI | NI | NI | NI | NI | NI | NI | NI |
| P-1 | 38.00 | 39.80 | NA | 3.25 | 3.35 | 6.10 | 6.24 | 6.17 | NM | 6.79 | 5.92 |
| P-2 | 29.55 | 30.38 | NA | ***3.34*** | 4.03 | 7.21 | 7.74 | 7.44 | NM | 8.86 | 6.94 |

GS - Ground surface
TOC - Top of outer casing
TIC - Top of inner casing
Depth to water measured in feet from reference point.
**Reference and water elevations measured in feet mean sea level.**
NI - Well not installed yet
NM - Not measured
AB - Well abandoned
Values shown in boldface represent maximum values
Values shown in italics represent minimum values
Water elevations taken on 3/28/00, 4/16/00, 4/26/00 during soil vapor extraction / air sparging study. Water levels in MW-1, MW-2, MW-6 may have been affected by active system.



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**TABLE 1**
**ON-SITE GROUNDWATER ELEVATIONS**
**VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS**

| Well ID | Reference Point Elevations GS (ft msl) | TOC (ft msl) | TIC (ft msl) | 10/5/98 Water Elevation | 10/21/98 Water Elevation | 11/30/99 Water Elevation | 1/31/00 Water Elevation | 3/6/00 Water Elevation | 3/28/00 Water Elevation | 4/16/00 Water Elevation | 4/26/00 Water Elevation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **SHALLOW OVERBURDEN WELLS** | | | | | | | | | | | |
| MW-1 | 29.41 | 31.54 | 31.36 | 10.91 | 10.40 | **18.51** | 18.02 | 16.76 | 16.76 | 14.77 | 14.38 |
| MW-2 | 29.51 | 32.08 | 31.53 | 11.08 | 10.20 | **17.64** | 16.60 | 15.62 | 14.48 | 13.88 | 13.34 |
| MW-3 | 28.69 | 30.82 | 30.59 | 10.98 | 9.22 | **16.49** | 15.23 | 14.61 | 13.39 | 12.68 | 12.39 |
| MW-4 | 27.13 | 28.82 | 28.63 | 11.11 | 10.37 | **18.33** | 17.33 | 16.42 | 15.21 | 14.48 | -- |
| MW-5 | 26.65 | 29.15 | 28.89 | 11.10 | 10.52 | **17.68** | 16.44 | 15.61 | 14.45 | 13.79 | 13.41 |
| MW-6 | 30.20 | 33.20 | 32.17 | 10.32 | 10.53 | **18.62** | 18.51 | 17.30 | 16.06 | 15.33 | 14.82 |
| MW-10 | 32.01 | 34.78 | 34.76 | 10.75 | 10.63 | **18.76** | 18.37 | 17.26 | 15.95 | 15.26 | -- |
| MW-11 | 38.17 | 40.86 | 39.54 | NI | ***7.66*** | 14.28 | **14.91** | 14.05 | 12.74 | 11.94 | 11.56 |
| MW-13 | 38.38 | 41.05 | 40.03 | NI | ***8.07*** | 15.17 | **15.82** | 14.92 | 13.57 | 12.95 | 12.50 |
| **DEEP OVERBURDEN WELLS** | | | | | | | | | | | |
| MW-7 | 29.37 | 31.71 | 31.38 | 8.69 | 8.48 | **12.55** | 12.52 | 11.08 | 10.99 | 10.30 | 9.73 |
| MW-8 | 30.27 | 32.69 | 32.49 | 10.05 | 9.68 | **15.79** | 15.25 | 12.95 | 13.57 | 12.89 | 11.98 |
| MW-9 | 26.78 | 30.19 | 29.96 | 9.50 | 9.70 | **14.73** | 14.18 | 12.30 | 12.38 | 11.80 | -- |
| **KINGSHILL WELLS** | | | | | | | | | | | |
| MW-12 | 38.46 | 41.21 | 39.57 | NI | ***7.29*** | 12.02 | **13.39** | 11.45 | 11.52 | 10.97 | 9.69 |
| MW-14 | 38.44 | 40.89 | 39.29 | NI | ***7.87*** | **13.62** | 13.49 | 11.48 | 11.54 | 11.02 | 9.72 |
| MW-15 | 37.80 | 38.97 | 38.37 | NI | NI | NI | NI | **9.01** | -- | 7.72 | 7.44 |
| P-1 | 38.00 | 39.80 | NA | 6.95 | 7.03 | **9.60** | AB | AB | AB | AB | AB |
| P-2 | 29.55 | 30.38 | NA | 9.23 | 9.15 | **14.13** | 13.60 | 11.73 | 11.74 | 11.28 | -- |

GS - Ground surface
TOC - Top of outer casing
TIC - Top of inner casing
Depth to water measured in feet from reference point.
**Reference and water elevations measured in feet mean sea level.**
NI - Well not installed yet
NM - Not measured
AB - Well abandoned
Values shown in boldface represent maximum values
Values shown in italics represent minimum values
Water elevations taken on 3/28/00, 4/16/00, 4/26/00 during soil vapor extraction / air sparging study. Water levels in MW-1, MW-2, MW-6 may have been affected by active system.



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# TABLE 1
## ON-SITE GROUNDWATER ELEVATIONS
## VIRGIN ISLAND CHEMICAL SITE, ST. CROIX, U.S. VIRGIN ISLANDS

| Well ID | Reference Point Elevations | | | 5/4/00 Water Elevation | Max Water Elevation | Min Water Elevation | Average Water Elevation |
|---|---|---|---|---|---|---|---|
| | GS (ft msl) | TOC (ft msl) | TIC (ft msl) | | | | |
| **SHALLOW OVERBURDEN WELLS** | | | | | | | |
| MW-1 | 29.41 | 31.54 | 31.36 | 14.26 | **18.51** | ***4.18*** | 9.68 |
| MW-2 | 29.51 | 32.08 | 31.53 | 12.95 | **17.64** | ***6.65*** | 11.00 |
| MW-3 | 28.69 | 30.82 | 30.59 | 12.17 | **16.49** | ***4.05*** | 9.05 |
| MW-4 | 27.13 | 28.82 | 28.63 | 13.89 | **18.33** | ***4.19*** | 9.44 |
| MW-5 | 26.65 | 29.15 | 28.89 | 13.15 | **17.68** | ***4.13*** | 9.58 |
| MW-6 | 30.20 | 33.20 | 32.17 | 14.57 | **18.62** | ***5.97*** | 11.92 |
| MW-10 | 32.01 | 34.78 | 34.76 | 14.49 | **18.76** | ***10.06*** | 14.29 |
| MW-11 | 38.17 | 40.86 | 39.54 | 11.33 | **14.91** | ***7.66*** | 12.31 |
| MW-13 | 38.38 | 41.05 | 40.03 | 12.29 | **15.82** | ***8.07*** | 13.16 |
| **DEEP OVERBURDEN WELLS** | | | | | | | |
| MW-7 | 29.37 | 31.71 | 31.38 | 9.65 | **12.55** | ***6.62*** | 9.98 |
| MW-8 | 30.27 | 32.69 | 32.49 | 11.53 | **15.79** | ***6.71*** | 11.80 |
| MW-9 | 26.78 | 30.19 | 29.96 | 10.72 | **14.73** | ***7.47*** | 11.23 |
| **KINGSHILL WELLS** | | | | | | | |
| MW-12 | 38.46 | 41.21 | 39.57 | 9.66 | **13.39** | ***7.29*** | 10.75 |
| MW-14 | 38.44 | 40.89 | 39.29 | 9.66 | **13.62** | ***7.87*** | 11.05 |
| MW-15 | 37.80 | 38.97 | 38.37 | ***7.27*** | **9.01** | ***7.27*** | 7.86 |
| P-1 | 38.00 | 39.80 | NA | AB | **9.60** | ***2.97*** | 4.99 |
| P-2 | 29.55 | 30.38 | NA | 10.22 | **14.13** | ***3.34*** | 7.62 |

GS - Ground surface
TOC - Top of outer casing
TIC - Top of inner casing
Depth to water measured in feet from reference point.
**Reference and water elevations measured in feet mean sea level.**
NI - Well not installed yet
NM - Not measured
AB - Well abandoned
Values shown in boldface represent maximum values
Values shown in italics represent minimum values
Water elevations taken on 3/28/00, 4/16/00, 4/26/00 during soil vapor extraction / air sparging study. Water levels in MW-1, MW-2, MW-6 may have been affected by active system.

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# Table 2
## Summary of Slug Test Data and Results
## Virgin Island Chemical Site
## St. Croix, U.S. Virgin Islands

| Well ID: | MW-6 | MW-8 | MW-11 | MW-12 | MW-15 |
|---|---|---|---|---|---|
| Test Type: | Rising | Rising | Rising | Rising | Rising |
| ***Monitoring Well Details*** | | | | | |
| Casing Diameter (in) | 4 | 4 | 4 | 4 | 4 |
| Borehole Diameter (in) | 8 | 8 | 8 | 8 | 8 |
| Total Depth (ft)* | 25.8 | 73 | 40 | 147 | 98 |
| Static Depth to Water (ft)* | 14.2 | 17.80 | 24.86 | 27.11 | 28.6 |
| ***Input Parameters*** ** | | | | | |
| $H_o$ (ft) | 2.265 | 2.726 | 2.877 | 2.818 | 2.821 |
| $R_c$ (ft) | 0.167 | 0.167 | 0.167 | 0.167 | 0.167 |
| $R_w$ (ft) | 0.333 | 0.333 | 0.333 | 0.333 | 0.333 |
| D (ft) | 66 | 10 | 15.14 | 10 | 10 |
| L (ft) | 9.3 | 10 | 10 | 10 | 10 |
| H (ft) | 12.5 | 55.2 | 15.14 | 119.89 | 69.4 |
| ***Computed Parameters*** | | | | | |
| T ($ft^2$/min) | 3.20E-02 | 1.90E-02 | 9.90E-03 | 1.84E-02 | 3.92E-02 |
| K (ft/min) | 1.26E-02 | 1.90E-03 | 6.54E-04 | 1.84E-03 | 3.92E-03 |
| K (ft/day) | 1.79E+01 | 2.73E+00 | 9.41E-01 | 2.65E+00 | 5.65E+00 |
| K (cm/s) | 6.30E-03 | 9.49E-04 | 3.32E-04 | 9.19E-04 | 1.96E-03 |

*: Referenced from top of inner casing
**: Analytical Program - AQTESOLV, Duffield and Rumbaugh (1989)
in: inches
ft: feet
$H_o$: Initial drawdown in test well (note: $Y_o$ is recalculated by program based on linearity of graph)
$R_c$: Internal radius of test well casing
$R_w$: Effective radius of test well
D: Saturated aquifer thickness under static conditions
L: Length of test well screen
H: Height of water column in test well under static conditions
$ft^2$/min: square feet per minute
ft/min: feet per minute
ft/day: feet per day
cm/s: centimeters/second
T: Transmissivity as calculated by AQTESOLV program
K: Hydraulic conductivity
K values for MW-6 and MW-11 were taken as geometric average of Hvorslev and Bouwer and Rice analyses (both unconfined solutions).
The Cooper-Bredehoeft-Papadopoulos method for confined aquifers was used to calculate parameters for wells MW-8, MW-12 and MW-15.
The value for K was calculated as the quotient of transmissivity divided by saturated thickness for the wells MW-8, MW-12 and MW-15.

303585

# Table 3
## Groundwater Analytical Results - AST Area
## Virgin Island Chemical Site
## St. Croix, U.S. Virgin Islands

| Client ID: | MW-1 | MW-6 | MW-8 | MW-8 (dup) | MW-10 |
|---|---|---|---|---|---|
| Lab ID | 209600 | 209599 | 209596 | 209597 | 209594 |
| Date Sampled: | 09-Mar-00 | 09-Mar-00 | 08-Mar-00 | 08-Mar-00 | 07-Mar-00 |
| Matrix: | Water | Water | Water | Water | Water |
| *Site Target Compounds (ppb)* | | | | | |
| Acetone | 5000 U | 4000 U | 10 U | 10 U | 10 U |
| Chloroform | 5000 U | 4000 U | 10 U | 10 U | 10 U |
| Ethylbenzene | 19600 | 12400 | 10 U | 10 U | 10 U |
| Methylene chloride | 5000 U | 4000 U | 10 U | 10 U | 10 U |
| Toluene | 5000 U | 4000 U | 10 U | 10 U | 10 U |
| Xylene (total) | 89000 | 60700 | 10 U | 10 U | 10 U |
| *Natural Attenuation Parameters (ppm)* | | | | | |
| Ammonia | 1.1 | 0.7 | 0 | -- | 0.4 |
| Dissolved oxygen | 0 | 0 | 0 | -- | 0 |
| Iron | 0.9 | 3.1 | 0 | -- | 0.1 |
| Nitrate | 0 | 0.04 | 0.65 | -- | 0.5 |
| Nitrite | 0 | 0 | 0.01 | -- | 0.005 |
| Sulfate | 10 U | 47.4 | 74.6 | -- | 286 |
| Sulfide | 0.51 | 0.11 | 0 | -- | 0 |

U: Not detected below method detection limit
J: Estimated value
--: Not collected
ppb: parts per billion
ppm: parts per million
Natural Attenuation parameters, except sulfate, were analyzed in the field using field test kits.

303586

# Table 4
## Groundwater Analytical Results - FPP Area
## Virgin Island Chemical Site
## St. Croix, U.S. Virgin Islands

| Client ID: | MW-2 | MW-3 | MW-7 | MW-11 | MW-12 | MW-13 | MW-14 | MW-15 |
|---|---|---|---|---|---|---|---|---|
| Lab ID | 209595 | 209592 | 209593 | 209590 | 209850 | 209421 | 209851 | 209420 |
| Date Sampled: | 08-Mar-00 | 08-Mar-00 | 08-Mar-00 | 08-Mar-00 | 10-Mar-00 | 07-Mar-00 | 10-Mar-00 | 07-Mar-00 |
| Matrix: | Water | Water | Water | Water | Water | Water | Water | Water |
| ***Site Target Compounds (ppb)*** | | | | | | | | |
| Acetone | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chloroform | 37 | 10 U | 1.5 J | 40.4 | 10 U | 10 U | 10 U | 9.4 J |
| Ethylbenzene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Methylene chloride | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Toluene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Xylene (total) | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| ***Natural Attenuation Parameters (ppm)*** | | | | | | | | |
| Ammonia | 0.7 | 0.4 | 0.3 | 0.1 | 0.4 | 0 | 0 | 0 |
| Dissolved oxygen | 1 | 0.7 | 0.7 | 0 | 0 | 0 | 0.5 | 0 |
| Iron | 0 | 4.6 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nitrate | 0.46 | 0.02 | 1.71 | 0.55 | 1.05 | 2.73 | 2.81 | 1.48 |
| Nitrite | 0.01 | 0 | 0.015 | 0.01 | 0.01 | 0 | 0.015 | 0.02 |
| Sulfate | 151 | 194 | 195 | 243 | 194 | 182 | 207 | 186 |
| Sulfide | 0.02 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

U: Not detected below method detection limit
J: Estimated value
ppb: parts per billion
ppm: parts per million
Natural Attenuation parameters, except sulfate, were analyzed in the field using field test kits.

303587

# Table 5
## Groundwater Analytical Results - Trip Blanks and Equipment Rinsates
## Virgin Island Chemical Site
## St. Croix, U.S. Virgin Islands

| Client ID: | TB030700 | TB030800 | TB031000 | TB031300 | FB030800 | FB030900 | FB031000 | FB031400 |
|---|---|---|---|---|---|---|---|---|
| Lab ID | 209419 | 209591 | 209848 | 2010020 | 209598 | 209846 | 209849 | 2010026 |
| Date Sampled: | 07-Mar-00 | 08-Mar-00 | 10-Mar-00 | 13-Mar-00 | 08-Mar-00 | 09-Mar-00 | 10-Mar-00 | 14-Mar-00 |
| Sample Type: | Trip Blank | Trip Blank | Trip Blank | Trip Blank | Rinsate | Rinsate | Rinsate | Rinsate |
| *Site Target Compounds (ppb)* | | | | | | | | |
| Acetone | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 8.5 J |
| Chloroform | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Ethylbenzene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Methylene chloride | 1.9 J | 1.5 J | 2.1 J | 4.6 UJ | 1.7 J | 3.1 J | 2.4 J | 6 J |
| Toluene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 3.8 J |
| Xylene (total) | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 1.3 J |

U: Not detection below method detection limit
J: Estimated value
ppb: parts per billion

303588

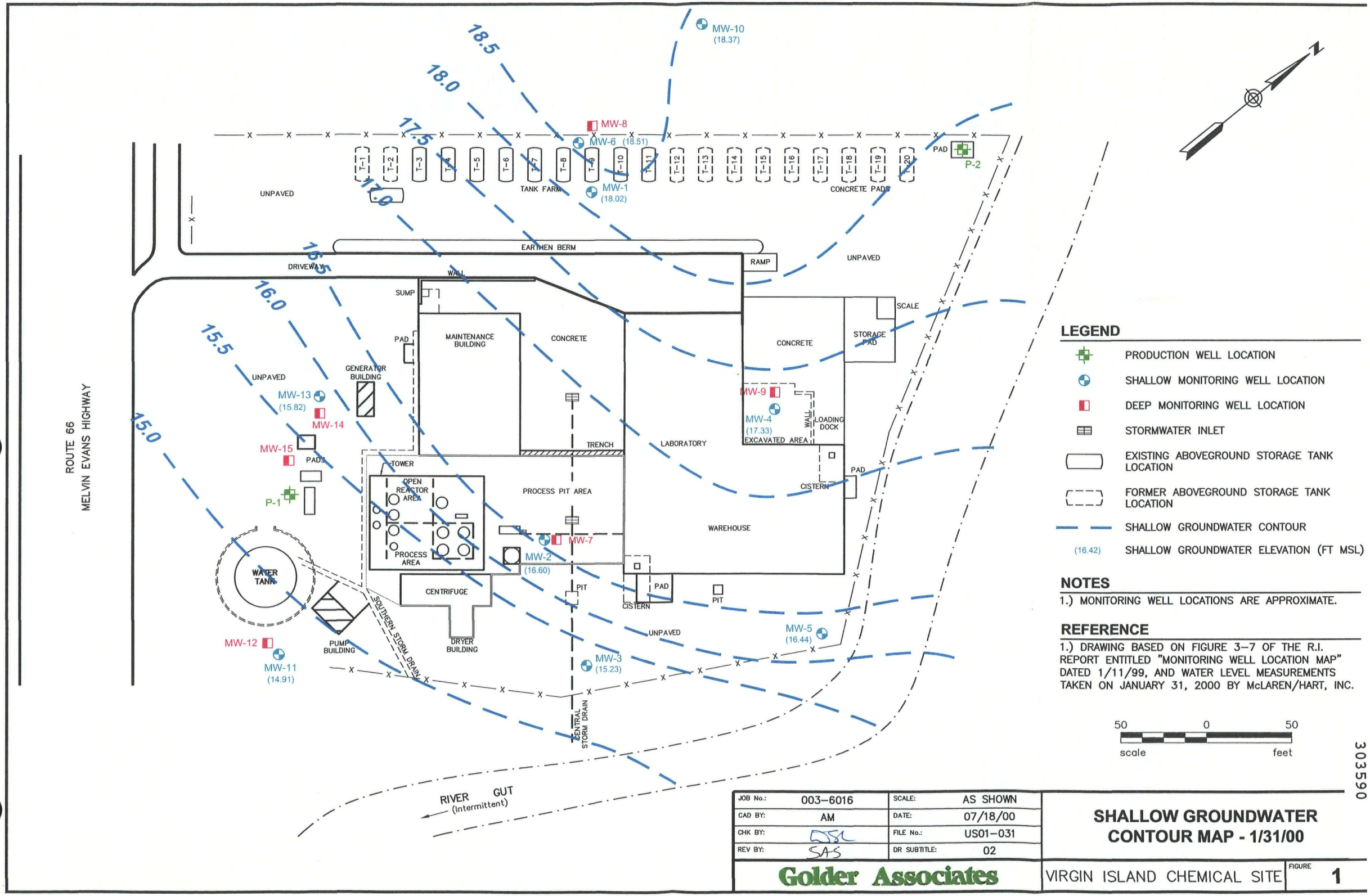
# Table 6
## Investigation Derived Waste Analytical Results
## Virgin Island Chemical Site
## St. Croix, U.S. Virgin Islands

| Client ID: | WCMW15A | WCMW15B | WCMW15C | WCMW15D |
|---|---|---|---|---|
| Lab ID | 2014567 | 2014568 | 2014569 | 2014570 |
| Date Sampled: | 30-Apr-00 | 30-Apr-00 | 30-Apr-00 | 30-Apr-00 |
| Matrix: | Soil | Soil | Soil | Soil |
| *TCLP Volatile Organics (ppm)* | | | | |
| Benzene | 0.05 U | 0.05 U | 0.05 U | 0.05 U |
| 2-Butanone | 0.1 U | 0.1 U | 0.1 U | 0.1 U |
| Carbon tetrachloride | 0.05 U | 0.05 U | 0.05 U | 0.05 U |
| Chlorobenzene | 0.05 U | 0.05 U | 0.05 U | 0.05 U |
| Chloroform | 0.05 U | 0.05 U | 0.05 U | 0.05 U |
| 1,2-Dichloroethane | 0.05 U | 0.05 U | 0.05 U | 0.05 U |
| 1,1-Dichloroethene | 0.05 U | 0.05 U | 0.05 U | 0.05 U |
| Tetrachloroethene | 0.05 U | 0.05 U | 0.05 U | 0.05 U |
| Trichloroethene | 0.05 U | 0.05 U | 0.05 U | 0.05 U |
| Vinyl chloride | 0.1 U | 0.1 U | 0.1 U | 0.1 U |
| *RCRA Characteristics* | | | | |
| pH - Corrosivity (S.U.) | 8.9 | 8.3 | 8.4 | 9.4 |
| Reactive cyanide (ppm) | 25 U | 25 U | 25 U | 25 U |
| Reactive sulfide (ppm) | 50 U | 50 U | 50 U | 50 U |
| Ignitability | No | No | No | No |

| Client ID: | WCMW15WA | WCMW15WB |
|---|---|---|
| Lab ID | 2014476 | 2014477 |
| Date Sampled: | 04-May-00 | 04-May-00 |
| Matrix: | Water | Water |
| *Site Target Compounds (ppb)* | | |
| Acetone | 10 U | 10 U |
| Chloroform | 6.3 J | 1.3 J |
| Ethylbenzene | 10 U | 10 U |
| Methylene chloride | 1.8 J | 1.5 J |
| Toluene | 10 U | 10 U |
| Xylene (total) | 10 U | 10 U |

U: Not detection below method detection limit
J: Estimated value
ppm: parts per million
ppb: parts per billion

303589




## LEGEND

- PRODUCTION WELL LOCATION
- SHALLOW MONITORING WELL LOCATION
- DEEP MONITORING WELL LOCATION
- STORMWATER INLET
- EXISTING ABOVEGROUND STORAGE TANK LOCATION
- FORMER ABOVEGROUND STORAGE TANK LOCATION
- SHALLOW GROUNDWATER CONTOUR
- (16.42) SHALLOW GROUNDWATER ELEVATION (FT MSL)

## NOTES

1.) MONITORING WELL LOCATIONS ARE APPROXIMATE.

## REFERENCE

1.) DRAWING BASED ON FIGURE 3-7 OF THE R.I. REPORT ENTITLED "MONITORING WELL LOCATION MAP" DATED 1/11/99, AND WATER LEVEL MEASUREMENTS TAKEN ON JANUARY 31, 2000 BY McLAREN/HART, INC.

50 0 50
scale feet

303590

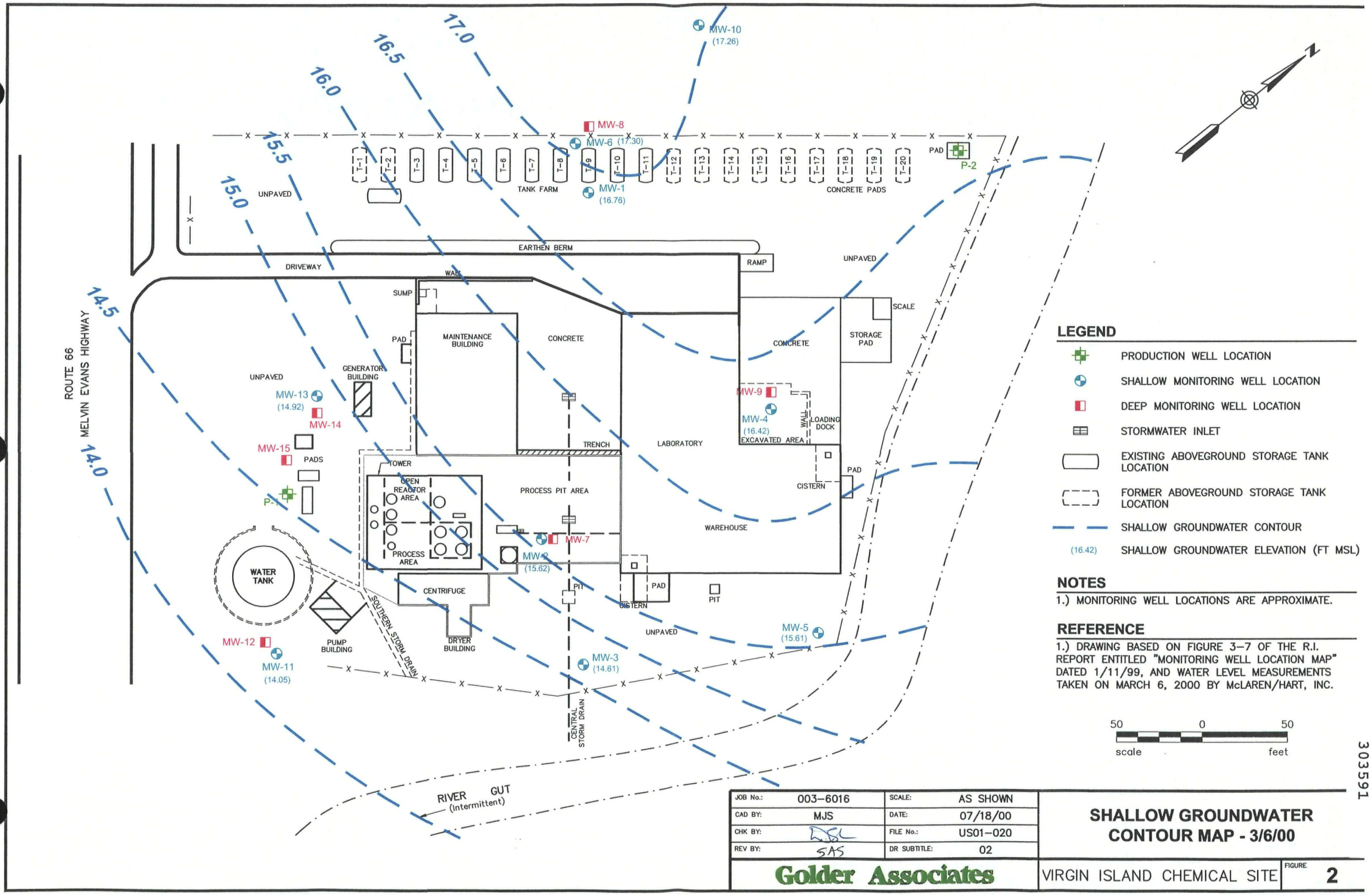
| | | | |
|---|---|---|---|
| JOB No.: | 003-6016 | SCALE: | AS SHOWN |
| CAD BY: | AM | DATE: | 07/18/00 |
| CHK BY: | DSL | FILE No.: | US01-031 |
| REV BY: | SAS | DR SUBTITLE: | 02 |

Golder Associates

# SHALLOW GROUNDWATER CONTOUR MAP - 1/31/00

VIRGIN ISLAND CHEMICAL SITE

FIGURE 1




## LEGEND

- PRODUCTION WELL LOCATION
- SHALLOW MONITORING WELL LOCATION
- DEEP MONITORING WELL LOCATION
- STORMWATER INLET
- EXISTING ABOVEGROUND STORAGE TANK LOCATION
- FORMER ABOVEGROUND STORAGE TANK LOCATION
- SHALLOW GROUNDWATER CONTOUR
- (16.42) SHALLOW GROUNDWATER ELEVATION (FT MSL)

## NOTES

1.) MONITORING WELL LOCATIONS ARE APPROXIMATE.

## REFERENCE

1.) DRAWING BASED ON FIGURE 3–7 OF THE R.I. REPORT ENTITLED "MONITORING WELL LOCATION MAP" DATED 1/11/99, AND WATER LEVEL MEASUREMENTS TAKEN ON MARCH 6, 2000 BY McLAREN/HART, INC.

50 0 50
scale feet

303591

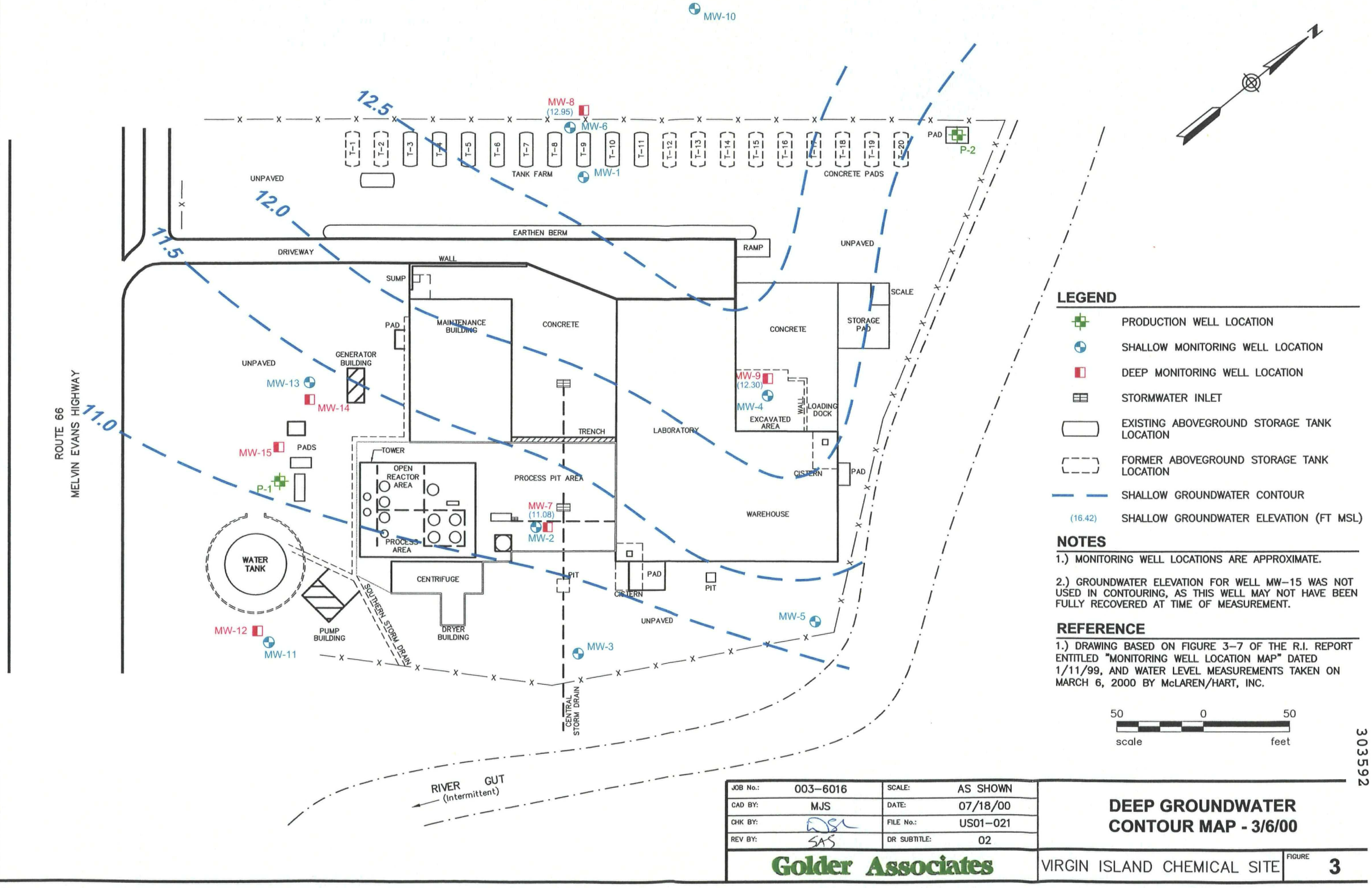
| | | | |
|---|---|---|---|
| JOB No.: | 003–6016 | SCALE: | AS SHOWN |
| CAD BY: | MJS | DATE: | 07/18/00 |
| CHK BY: | DSL | FILE No.: | US01–020 |
| REV BY: | SAS | DR SUBTITLE: | 02 |

**SHALLOW GROUNDWATER CONTOUR MAP - 3/6/00**

Golder Associates

VIRGIN ISLAND CHEMICAL SITE

FIGURE 2




## LEGEND

- PRODUCTION WELL LOCATION
- SHALLOW MONITORING WELL LOCATION
- DEEP MONITORING WELL LOCATION
- STORMWATER INLET
- EXISTING ABOVEGROUND STORAGE TANK LOCATION
- FORMER ABOVEGROUND STORAGE TANK LOCATION
- SHALLOW GROUNDWATER CONTOUR
- (16.42) SHALLOW GROUNDWATER ELEVATION (FT MSL)

## NOTES

1.) MONITORING WELL LOCATIONS ARE APPROXIMATE.

2.) GROUNDWATER ELEVATION FOR WELL MW-15 WAS NOT USED IN CONTOURING, AS THIS WELL MAY NOT HAVE BEEN FULLY RECOVERED AT TIME OF MEASUREMENT.

## REFERENCE

1.) DRAWING BASED ON FIGURE 3-7 OF THE R.I. REPORT ENTITLED "MONITORING WELL LOCATION MAP" DATED 1/11/99, AND WATER LEVEL MEASUREMENTS TAKEN ON MARCH 6, 2000 BY McLAREN/HART, INC.

50 0 50
scale feet

303592

| | | | |
|---|---|---|---|
| JOB No.: | 003-6016 | SCALE: | AS SHOWN |
| CAD BY: | MJS | DATE: | 07/18/00 |
| CHK BY: | DSL | FILE No.: | US01-021 |
| REV BY: | SAS | DR SUBTITLE: | 02 |

Golder Associates

# DEEP GROUNDWATER CONTOUR MAP - 3/6/00

VIRGIN ISLAND CHEMICAL SITE

FIGURE 3

# ATTACHMENT A

# RELEVANT CORRESPONDENCE

303593

McLaren Hart, Inc.

January 19, 2000

Ms. Caroline Kwan
Remedial Project Manager
U.S. Environmental Protection Agency – Region II
Emergency Remedial Response Division
290 Broadway, 20th Floor
New York, New York 10007-1866

**RE: VIRGIN ISLAND CHEMICAL SITE**
**ST. CROIX, U.S. VIRGIN ISLANDS**
**PRODUCTION WELL P-1 ABANDOMENT/REPLACEMENT**

Dear Ms. Kwan:

On behalf of Berlex Laboratories, Inc. (Berlex) and Pharmacia & Upjohn (P&U), McLaren/Hart, Inc. (McLaren/Hart) is submitting this letter to document the procedures to be utilized during the abandonment and replacement of former production well P-1 at the Virgin Island Chemical Site located in St. Croix, U.S. Virgin Islands. Based on McLaren/Hart's discussion with the U.S. Environmental Protection Agency (EPA) and CDM Federal Programs Corporation (CDM Federal) during an August 1999 conference call, and in response to CDM Federal's July 1999 comments on the June 1999 *Draft Final Remedial Investigation Report*, McLaren/Hart is proposing to replace P-1 with a new monitoring well. Historic samples from this former production well have exhibited concentrations of chloroform near the Maximum Contaminant Level (MCL) of 80 parts per billion (ppb). However, based on a video log of this production well, the integrity is questionable due to the series of rough slots cut into the casing between 63 and 78 feet. Additionally, there are no records documenting the presence or integrity of an annular seal. Therefore, it is unknown whether overburden groundwater could be entering this well; thus, affecting constituent concentrations at depth.

The specific scope of work for abandonment and replacement of P-1 is discussed below. Detailed field protocols governing this work (drilling, decontamination, well installation, development, sampling) are presented in the EPA-approved 1997 *Revised Draft Remedial Investigation Work Plan – Phase III.*

Abandonment of Former Production Well

Prior to the drilling and installation of the replacement monitoring well for P-1, the existing well will be sealed with a cement/bentonite grout. The grout mixture will be the same consistency, or thicker, as the well seal for the new monitoring well, and will be emplaced under pressure with a tremie pipe from the bottom up. The grout will be pumped until it rises above the well casing.



25 Independence Boulevard, Warren, New Jersey 07059
908.647.8111 • 908.647.8162 fax • www.mclaren-hart.com

After allowing the grout to set a sufficient amount of time (i.e., overnight), McLaren/Hart will inspect the grout level and, if necessary, place a second lift of grout to compensate for any potential settlement from the initial grout lift. After grouting is complete, the well head will be cut to grade and welded shut.

Installation of New Monitoring Well

A new monitoring well, to be designated as MW-15, will be installed hydraulically upgradient (approximately 10 to 15 feet away to prevent pH [grout] contamination) of former production well P-1 to verify historic groundwater analytical results and to serve as a long-term monitoring point. Based on survey information for the former production well, the total depth is 96 feet below ground surface (bgs) [well is 98 feet deep as measured from the top of the outer casing which is 1.80 feet above ground surface]. Therefore, the new monitoring well will be drilled and installed to a depth of 97 feet bgs and will be screened from 87 to 97 feet bgs. This screen interval also will coincide with the packer-test interval sampled during the Phase IV field investigation in which chloroform was detected at a concentration of 76 ppb below the packer. The new well will be constructed as depicted on Figure 1 and in accordance with the procedures outlined in the EPA-approved 1997 *Revised Draft Remedial Investigation Work Plan – Phase III*.

Using a Mobile B-90 drill rig, an 8-inch diameter borehole will be advanced by hollow-stem auger drilling techniques. However, if auger refusal is encountered before reaching the desired depth, mud rotary techniques will be used to drill the remaining borehole depth. Drill cuttings will be continuously screened and logged in 10-foot intervals by a McLaren/Hart field geologist or engineer. The monitoring well will be constructed of new, 4-inch diameter, internally threaded, flush joint, Schedule 40 polyvinyl chloride (PVC) well screen and riser. The well screen will be 10 feet in length and will consist of 0.020-inch (20-slot) machine-slotted openings. A #10 or #20 Texas Grit (or equivalent) sand pack will be placed around the well screen and extend at least 2 feet above the top of the screen. The sand will be added while simultaneously retracting the augers/rods; thus allowing the sand to settle into the annular space between the well screen and borehole wall while preventing any significant cave-in. With the bottom of the auger/rod located at the top of the filter pack, a 2-foot layer of bentonite pellets will be added and allowed to hydrate overnight. While slowly/incrementally removing the augers/rods from the borehole, the remaining annular space will be tremie-grouted from the top of the bentonite seal to the ground surface with a cement/bentonite grout. The well will be finished with a protective locking assembly.

Upon completion, MW-15 will be developed by either pumping and backwashing with a submersible pump, or by surging with compressed air and an eductor pipe/check-valve system until the purge waters have reached a stable level of turbidity, pH, specific conductance, and temperature. A water level measuring point will be marked on the PVC riser of the new monitoring well and surveyed, along with establishing the horizontal and vertical control for the well.

All drill cuttings and well development water will be containerized in 55-gallon drums. The drums will be separated by matrix (e.g., mud, soil, and water) and staged onsite. A composite sample will be collected for each matrix and analyzed for the Site Target Compounds (acetone, methylene chloride, chloroform, toluene, ethylbenzene, and total xylenes) by Pace Analytical Laboratory (Pace) of St. Rose, Louisiana. Samples will not be analyzed for a full set of Toxicity Characteristic Leaching Procedure (TCLP)/Resource Conservation and Recovery Act (RCRA) parameters since these constituents have been analyzed during previous field efforts with the results indicating non-hazardous material. If the collected samples are classified as RCRA non-hazardous, the materials from the drums will be emptied and spread over the area in the vicinity of the work conducted. RCRA hazardous waste will be staged onsite, pending determination of an appropriate disposal option.

Sampling of New Monitoring Well

At least two weeks after the development of MW-15, this new monitoring well will be sampled for analysis of the Site Target Compounds by Pace. McLaren/Hart will utilize low flow (minimal drawdown) procedures as outlined in EPA's March 1998 *Groundwater Sampling Procedure – Low Stress Purging and Sampling*. A 2-inch diameter Grundfos submersible pump will be utilized for purging and sampling. Field parameter measurements (temperature, specific conductance, pH, dissolved oxygen, reduction/oxidation potential, and turbidity) will be recorded during purging. After stabilization of the field parameters, a groundwater sample will be collected directly from the pump discharge line. The sample will be collected, preserved, and handled as described in the EPA-approved 1997 *Revised Draft Remedial Investigation Work Plan – Phase III*.

Schedule

The work described above will be conducted during the implementation of the Soil Vapor Extraction (SVE)/Air Sparging (AS) pilot-scale study at the Site. Drilling will be performed by Soil Tech Corporation (STC) of Rio Piedras, Puerto Rico. All necessary permits have been obtained. Abandonment of former production well P-1 is scheduled to take place on January 25, 2000. The installation and development of new monitoring well MW-15 will take place from January 26 through 28, 2000. This well will be sampled as part of the baseline sampling for the pilot-scale study during the week of March 6, 2000. Any deviations from this proposed scope during field implementation will be promptly discussed with EPA and/or CDM Federal for concurrence before any changes are executed.

Upon receipt and validation of the analytical results from MW-15, McLaren/Hart will prepare and submit a brief letter report that describes and documents all field activities associated with this phase of work. The letter report will include an updated figure depicting the new monitoring well location, geologic log, well construction diagram, and summary of analytical results.

If you have any questions regarding the proposed scope of work, please do not hesitate to contact either of us at (908) 647-8111.

Very truly yours,

Perry Katz
Principal Environmental Scientist

Norma Eichlin
Supervising Engineer

cc: Terry Grimmer – Berlex Laboratories, Inc.
Kevin Walsh – Pharmacia & Upjohn
Bill Gierke – Pharmacia & Upjohn
Jose Agrelot – ERTEC
Syed Syedali – Virgin Islands Department of Planning and Natural Resources
Pam Philip – CDM Federal Programs Corporation

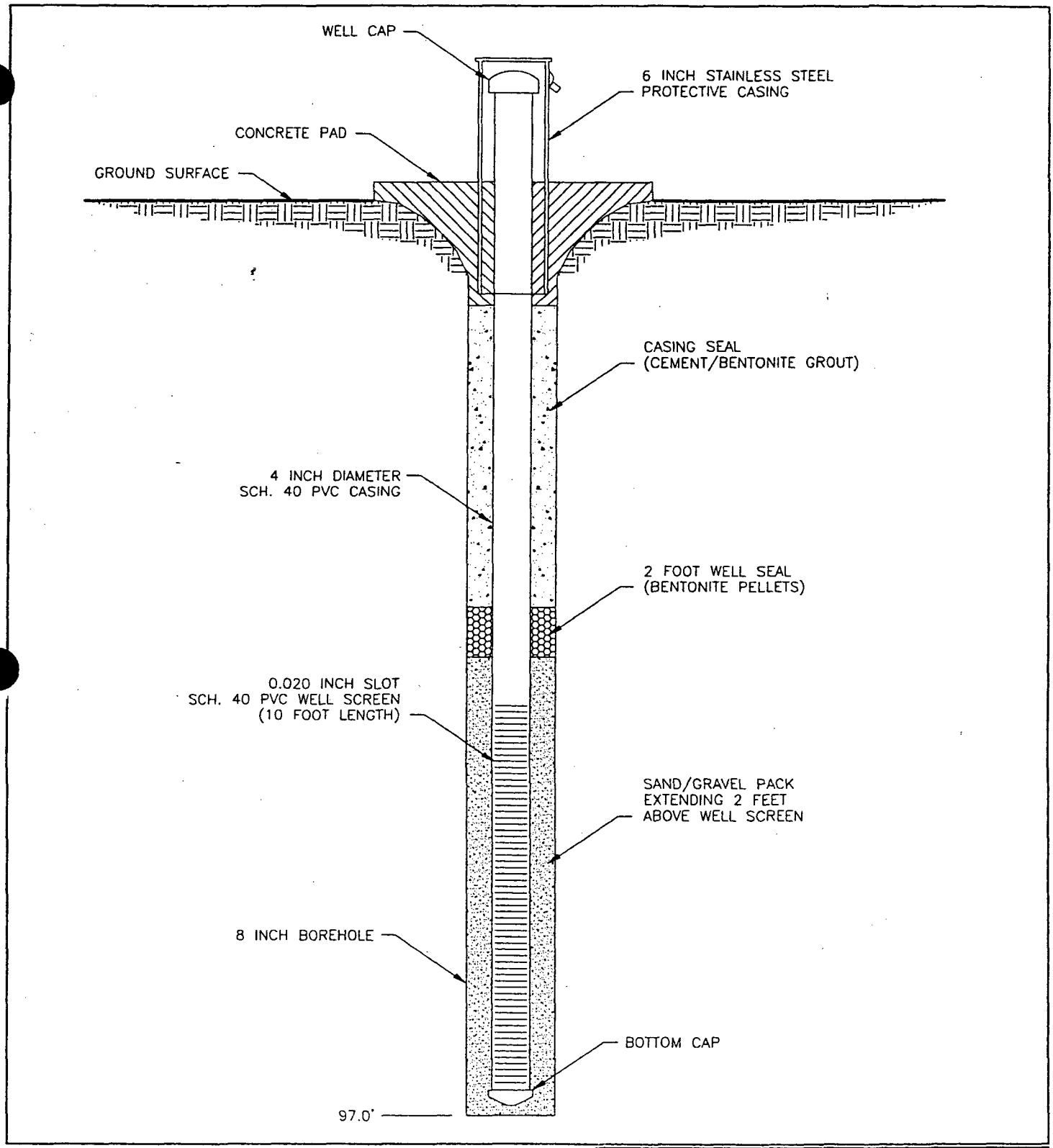



FIGURE 1

MONITORING WELL CONSTRUCTION DIAGRAM

VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLAND

McLaren Hart INC.

| | |
|---|---|
| DRWN: S.F.H. | CHK'D: N.E. |
| SCALE: AS SHOWN | DATE: 01/18/00 |

303598

DWG: 87100198 01/

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
290 BROADWAY
NEW YORK, NY 10007-1866

January 27, 2000

Mr. Perry Katz
McLaren Hart, Inc.
25 Independence Boulevard
Warren, New Jersey 07058

RE: **Virgin Island Chemical Site**
**St. Croix, United States Virgin Islands**

Dear Mr. Katz:

The U.S. Environmental Protection Agency has completed the technical review of the McLaren/Hart Proposal for the Replacement of P1 and the Calculation of Site Specific Dilution Attenuation Factor Virgin Island Chemical Site in St. Croix, United States Virgin Islands.

Below are comments on you above-referenced submittal:

## PRODUCTION WELL P-1 ABANDONMENT/REPLACEMENT-

1. McLaren/Hart's proposal for the replacement/abandonment of P1 is acceptable. However, it should be noted that if mud rotary is used as a contingency drilling method, the monitoring well must be thoroughly developed to remove any residual drilling mud.

2. All Investigation Derived Waste (IDW) composite samples must be analyzed for RCRA characteristics by McLaren/Hart's off site laboratory. During the course of the RI, IDW drums were found to contain RCRA hazardous waste. Therefore, all composite samples must be submitted for the RCRA characteristics analyses.

## CALCULATION OF SITE-SPECIFIC DILUTION ATTENUATION FACTOR-

1. It should be noted that the approach used by McLaren/Hart to calculate the site-specific dilution attenuation factor (DAF) accounts for impermeable surface cover. For SSL calculations, it is typically assumed that an impermeable cover does not exist, based upon the future potential for the building/paved area to be demolished and re-developed with more green space. It should also be noted that the Tank Area is not covered by pavement. The McLaren/Hart calculations begin with the most conservative, published infiltration rate [(6% of annual rainfall (44 in/yr)] and reduce it, by accounting for impermeable cover, to a lower value [4% of annual rainfall], which is still within the published range for infiltration. The DAF would be 7.5, if the impermeable space is not considered in the calculation and the most conservative infiltration value (6%) is used. McLaren/Hart



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should redo the calculation with the consideration for impermeable space removed from the equation.

2. It is noted that the groundwater elevation maps prepared by McLaren/Hart are subject to interpretation; there are still some odd groundwater elevations measurements (e.g. MW10). However, for the purpose of calculating the DAF, it is sufficient to agree with McLaren/Hart that the predominant groundwater flow direction is south to southeast. This is supported by most of the groundwater data and the regional topography.

3. It should be noted that the most recent groundwater elevation maps presented in this submittal indicate a groundwater flow direction (to the south) that differs from what is presented in the Draft Final RI Report, which indicates that shallow groundwater flow is to the southeast. These latest contour maps, which indicate flow to the south, should be included in the Final RI and incorporated into the Feasibility Study.

Please call me if you have any questions.

Sincerely,

Caroline Kwan
Project Manager
Sediments/Caribbean Team

cc: Terry Grimmer-Berlex
Pam Philip-CDM-FPC

# ATTACHMENT B

# MW-15 BORING AND CONSTRUCTION LOG

303601

# MONITORING WELL LOG

McLaren Hart

| BORING NO.: | | PROJECT NAME: | LOCATION SKETCH |
|---|---|---|---|
| MW-15 | | Pharmacia & Upjohn/Berlex | |
| LOCATION: | | SCIENTIST / OFFICE: | |
| Virgin Island Chemical Site | | N. Eichlin/Warren | |

| DRILLING EQUIPMENT: | DRILLING CONTRACTOR / DRILLER: | COMPLETION DATE: | PERMIT NUMBER: |
|---|---|---|---|
| B90 | ERTEC | 1/31/00 | |
| WELL INSTALLED? | DRILLING METHOD / BIT: | SAMPLING METHOD: | |
| YES | Hollow Stem Auger Push Rod | Log of Drill Cuttings | |
| GROUND SURFACE ELEVATION: | STATIC WATER LEVEL: | NOTE: | |
| | | | |

| DEPTH (FT.) | SAMPLE NUMBER | REC. (FT.) | BLOWS /6" | DESCRIPTION | REMARKS | WELL CONSTRUCTION |
|---|---|---|---|---|---|---|
| 1–10 | | | | Medium brown silty CLAY with trace sand. | Grout (0'-84') → | |
| 11–20 | | | | Medium brown silty CLAY intermixed with small and medium size gravel and little sand. | | |
| 21–24 | | | | Medium brown silty CLAY with trace sand/fine gravel. | | |

# MONITORING WELL LOG

McLaren Hart

| BORING NO.: | | PROJECT NAME: | LOCATION SKETCH |
|---|---|---|---|
| MW-15 | | Pharmacia & Upjohn/Berlex | |
| LOCATION: | | SCIENTIST / OFFICE: | |
| Virgin Island Chemical Site | | N. Eichlin/Warren | |

| DRILLING EQUIPMENT: | DRILLING CONTRACTOR / DRILLER: | COMPLETION DATE: | PERMIT NUMBER: |
|---|---|---|---|
| B90 | ERTEC | 1/31/00 | |
| WELL INSTALLED? | DRILLING METHOD / BIT: | SAMPLING METHOD: | |
| YES | Hollow Stem Auger Push Rod | Log of Drill Cuttings | |
| GROUND SURFACE ELEVATION: | STATIC WATER LEVEL: | NOTE: | |
| | | | |

| DEPTH (FT.) | SAMPLE NUMBER | REC. (FT.) | BLOWS /6" | DESCRIPTION | REMARKS | WELL CONSTRUCTION |
|---|---|---|---|---|---|---|
| 25 | | | | | | |
| 26 | | | | | | |
| 27 | | | | | | |
| 28 | | | | | | |
| 29 | | | | | | |
| 30 | | | | | | |
| 31 | | | | Medium brown SILT and SAND. Water | | |
| 32 | | | | | | |
| 33 | | | | | | |
| 34 | | | | | | |
| 35 | | | | | | |
| 36 | | | | | | |
| 37 | | | | | Grout (0'-84') → | |
| 38 | | | | | | |
| 39 | | | | | | |
| 40 | | | | | | |
| 41 | | | | Medium brown SILT and SAND. | | |
| 42 | | | | | | |
| 43 | | | | | | |
| 44 | | | | | | |
| 45 | | | | | | |
| 46 | | | | | | |
| 47 | | | | | | |
| 48 | | | | | | |

# MONITORING WELL LOG

McLaren Hart

| BORING NO.: | | PROJECT NAME: | LOCATION SKETCH |
|---|---|---|---|
| MW-15 | | Pharmacia & Upjohn/Berlex | |
| LOCATION: | | SCIENTIST / OFFICE: | |
| Virgin Island Chemical Site | | N. Eichlin/Warren | |

| DRILLING EQUIPMENT: | DRILLING CONTRACTOR / DRILLER: | COMPLETION DATE: | PERMIT NUMBER: |
|---|---|---|---|
| B90 | ERTEC | 1/31/00 | |
| WELL INSTALLED? | DRILLING METHOD / BIT: | SAMPLING METHOD: | |
| YES | Hollow Stem Auger Push Rod | Log of Drill Cuttings | |
| GROUND SURFACE ELEVATION: | STATIC WATER LEVEL: | NOTE: | |
| | | | |

| DEPTH (FT.) | SAMPLE NUMBER | REC. (FT.) | BLOWS /6" | DESCRIPTION | REMARKS | WELL CONSTRUCTION |
|---|---|---|---|---|---|---|
| 49 – 50 | | | | | | 49 – 50 |
| 51 – 52 | | | | Medium brown SILT and SAND. | | 51 – 52 |
| 53 – 54 | | | | | | 53 – 54 |
| 55 – 56 | | | | | | 55 – 56 |
| 57 – 58 | | | | | Grout (0'-84') → | 57 – 58 |
| 59 – 60 | | | | | | 59 – 60 |
| 61 – 62 | | | | Medium brown SILT and SAND. | | 61 – 62 |
| 63 – 64 | | | | | | 63 – 64 |
| 65 – 66 | | | | | | 65 – 66 |
| 67 – 68 | | | | | | 67 – 68 |
| 69 – 70 | | | | | | 69 – 70 |
| 71 – 72 | | | | Medium brown SILT with some sand and trace gravel (small pieces). | | 71 – 72 |

# MONITORING WELL LOG

McLaren Hart

| BORING NO.: | | PROJECT NAME: | LOCATION SKETCH |
|---|---|---|---|
| MW-15 | | Pharmacia & Upjohn/Berlex | |
| LOCATION: | | SCIENTIST / OFFICE: | |
| Virgin Island Chemical Site | | N. Eichlin/Warren | |

| DRILLING EQUIPMENT: | DRILLING CONTRACTOR / DRILLER: | COMPLETION DATE: | PERMIT NUMBER: |
|---|---|---|---|
| B90 | ERTEC | 1/31/00 | |
| WELL INSTALLED? | DRILLING METHOD / BIT: | SAMPLING METHOD: | |
| YES | Hollow Stem Auger Push Rod | Log of Drill Cuttings | |
| GROUND SURFACE ELEVATION: | STATIC WATER LEVEL: | NOTE: | |

| DEPTH (FT.) | SAMPLE NUMBER | REC. (FT.) | BLOWS /6" | DESCRIPTION | REMARKS | WELL CONSTRUCTION |
|---|---|---|---|---|---|---|
| 73 | | | | | | 73 |
| 74 | | | | | | 74 |
| 75 | | | | | | 75 |
| 76 | | | | | | 76 |
| 77 | | | | | | 77 |
| 78 | | | | | | 78 |
| 79 | | | | | | 79 |
| 80 | | | | | | 80 |
| 81 | | | | Medium brown SILT with some sand and trace gravel (small pieces). | | 81 |
| 82 | | | | | | 82 |
| 83 | | | | | | 83 |
| 84 | | | | | | 84 |
| 85 | | | | | Bentonite (84'-86') | 85 |
| 86 | | | | | | 86 |
| 87 | | | | | #1 Morie Sand (86'-98') | 87 |
| 88 | | | | | | 88 |
| 89 | | | | | | 89 |
| 90 | | | | | | 90 |
| 91 | | | | Medium brown SILT with some sand and trace gravel (small pieces). | 4" Diameter Sch 40 PVC 20 Slot Screen (88-98') | 91 |
| 92 | | | | | | 92 |
| 93 | | | | | | 93 |
| 94 | | | | | | 94 |
| 95 | | | | | | 95 |
| 96 | | | | | | 96 |

# MONITORING WELL LOG

McLaren Hart

| BORING NO.: | | PROJECT NAME: | LOCATION SKETCH |
|---|---|---|---|
| MW-15 | | Pharmacia & Upjohn/Berlex | |
| LOCATION: | | SCIENTIST / OFFICE: | |
| Virgin Island Chemical Site | | N. Eichlin/Warren | |

| DRILLING EQUIPMENT: | DRILLING CONTRACTOR / DRILLER: | COMPLETION DATE: | PERMIT NUMBER: |
|---|---|---|---|
| B90 | ERTEC | 1/31/00 | |
| WELL INSTALLED? | DRILLING METHOD / BIT: | SAMPLING METHOD: | |
| YES | Hollow Stem Auger Push Rod | Log of Drill Cuttings | |
| GROUND SURFACE ELEVATION: | STATIC WATER LEVEL: | NOTE: | |
| | | | |

| DEPTH (FT.) | SAMPLE NUMBER | REC. (FT.) | BLOWS /6" | DESCRIPTION | REMARKS | WELL CONSTRUCTION |
|---|---|---|---|---|---|---|
| 97 – 98 | | | | | | 97 – 98 |

End of Borehole at 98' bgs

Grout
Bentonite
Sand

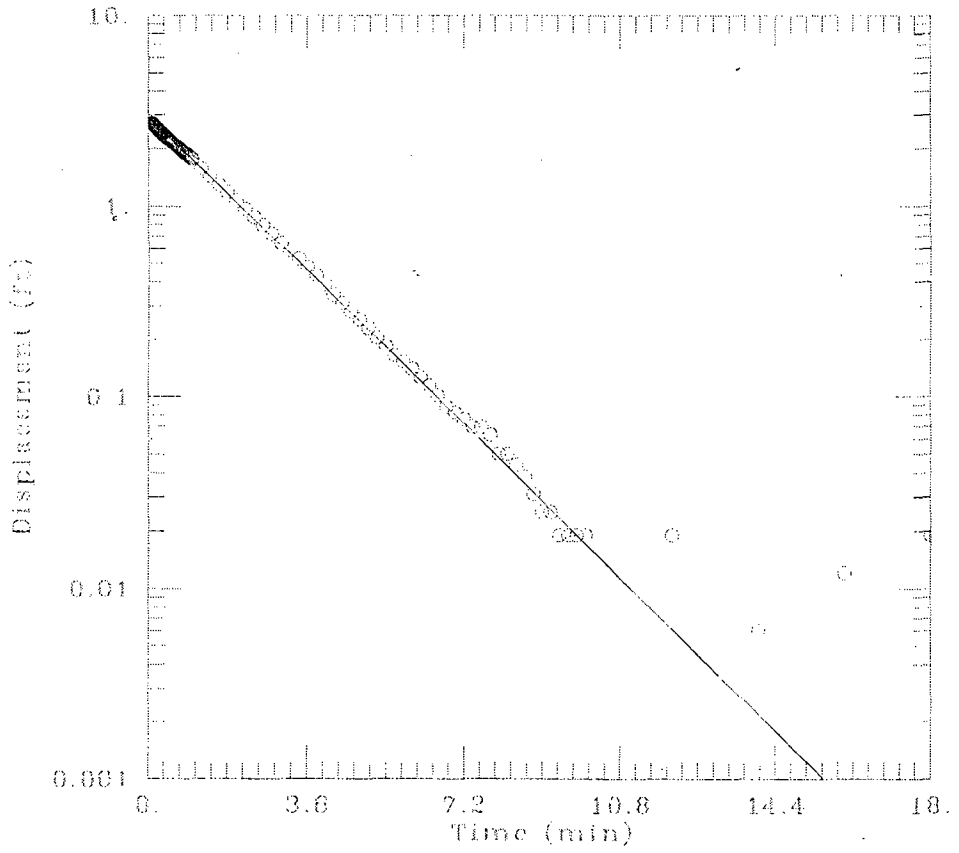
# ATTACHMENT C

# SLUG TEST DATA ANALYSIS

303607

| McLaren/Hart, Inc. | Client: Island Chemical |
|---|---|
| | Location: St. Croix |

# MW-8 Rising Head Slug Test




**DATA SET:**
c:\slug\mw8.dat
03/02/00

**AQUIFER TYPE:**
Unconfined

**SOLUTION METHOD:**
Bouwer-Rice

**TEST DATE:**
2/10/00

**OBS. WELL:**
MW-8

**ESTIMATED PARAMETERS:**
K = 0.00209 ft/min
y0 = 2.915 ft

**TEST DATA:**
H0 = 2.726 ft
rc = 0.167 ft
rw = 0.333 ft
L = 10. ft
b = 66. ft
H = 55.2 ft

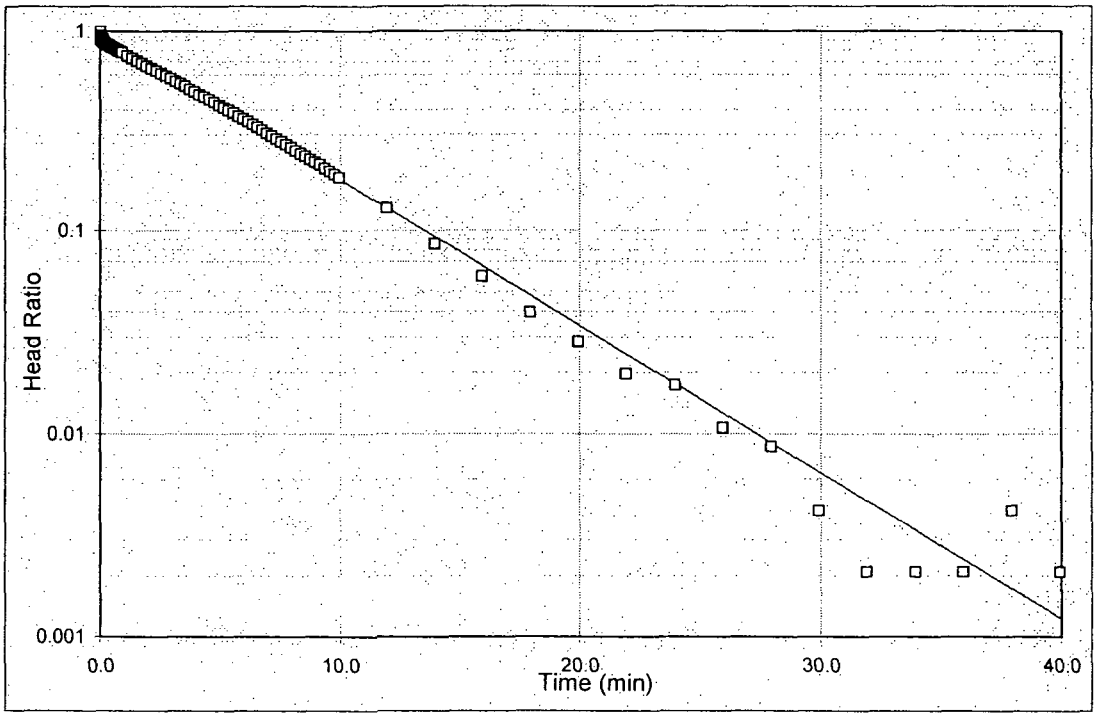
303608

## HVORSLEV SLUG TEST ANALYSIS
## RISING HEAD TEST MW-11

$$K = \frac{r_c^2}{2L_e} \ln \frac{L_e}{R_e} \left[ \frac{\ln\left(\frac{h_1}{h_2}\right)}{(t_1 - t_2)} \right]$$

where:
$r_c$ = casing radius (feet)
$R_e$ = equivalent radius (feet)
$L_e$ = length of screened interval (feet)
$t$ = time (minutes)
$h_t$ = head at time $t$ (feet)

| INPUT PARAMETERS | | RESULTS | |
|---|---|---|---|
| $r_c$ = | 0.17 | | |
| $R_e$ = | 0.33 | | |
| $L_e$ = | 12.0 | K= | 3.51E-04 cm/sec |
| $t_1$ = | 0.00 | K= | 9.94E-01 ft/day |
| $t_2$ = | 40.00 | | |
| $h_{1(t1)}$ = | 0.95 | | |
| $h_{2(t2)}$ = | 0.001 | | |




Project Name: PHARMACIA & UPJOHN / VICHEM / USVI
Project No.: 003-6016
Test Date: 02/10/00

Analysis By: DSL
Checked By: FG
Analysis Date: 7/18/00

303609

## BOUWER AND RICE SLUG TEST ANALYSIS
## RISING HEAD TEST MW-11

$$K = \frac{r_c^2 \ln\left(\frac{L_e}{R_e}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

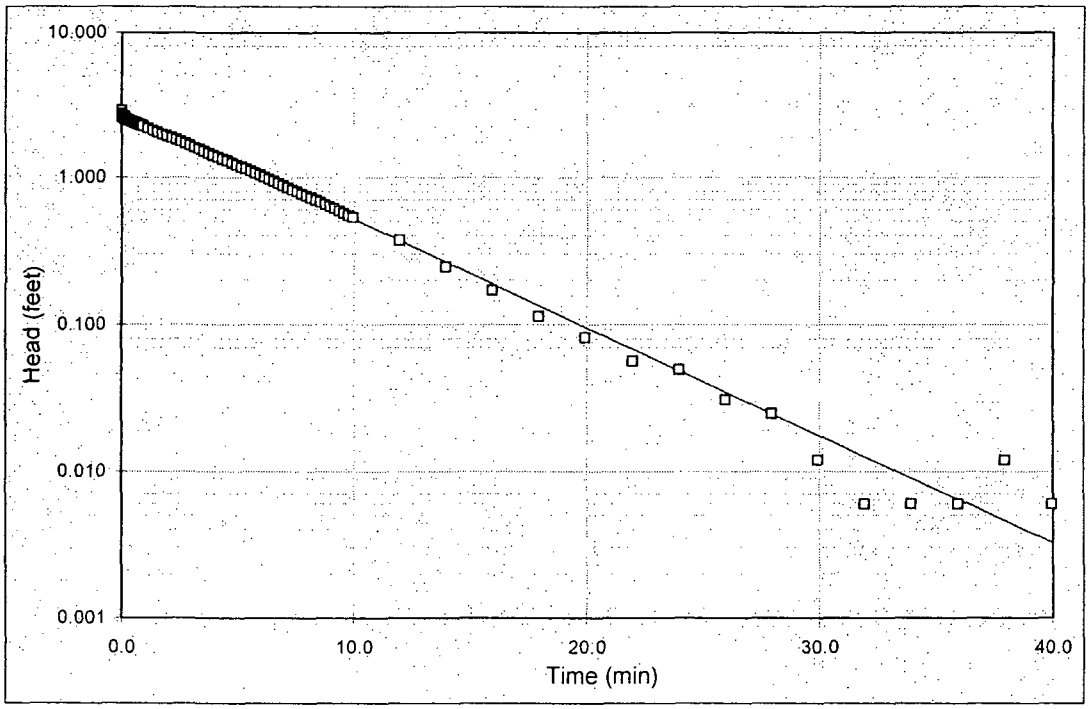
where:

$r_c$ = casing radius (feet);
$R_e$ = effective radius (feet);
$L_e$ = length of screened interval (feet);
$r_w$ = radial distance to undisturbed aquifer (feet)
$y_0$ = initial drawdown (feet)
$y_t$ = drawdown (feet) at time t (minutes)

| INPUT PARAMETERS | |
|---|---|
| $r_c$ = | 0.17 |
| $r_w$ = | 0.33 |
| $L_e$ = | 12 |
| $ln(R_e/r_w)$= | 3.16 |
| $y_0$ = | 2.80 |
| $y_t$ = | 0.003 |
| $t$ = | 40.0 |

**RESULTS**

| | | |
|---|---|---|
| K= | 3.14E-04 | cm/sec |
| K= | 8.89E-01 | ft/day |



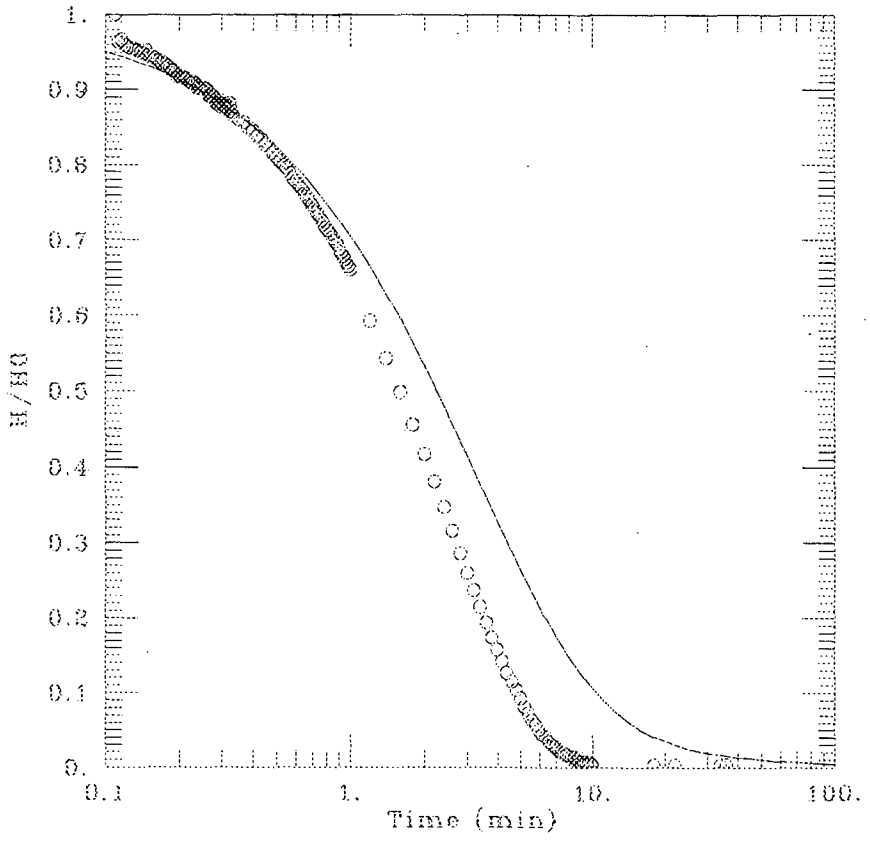

Project Name: PHARMACIA & UPJOHN / VICHEM / USVI
Project No.: 003-6016
Test Date: 02/10/00

Analysis By: DSL
Checked By: FG
Analysis Date: 7/18/00

303610

| McLaren/Hart, Inc. | Client: Island Chemical |
|---|---|
| | Location: St. Croix |

# MW-12 Rising Head Slug Test




**DATA SET:**
c:\slug\mw12.dat
03/03/00

**AQUIFER TYPE:**
Confined

**SOLUTION METHOD:**
Cooper et al.

**TEST DATE:**
2/10/00

**OBS. WELL:**
MW-12

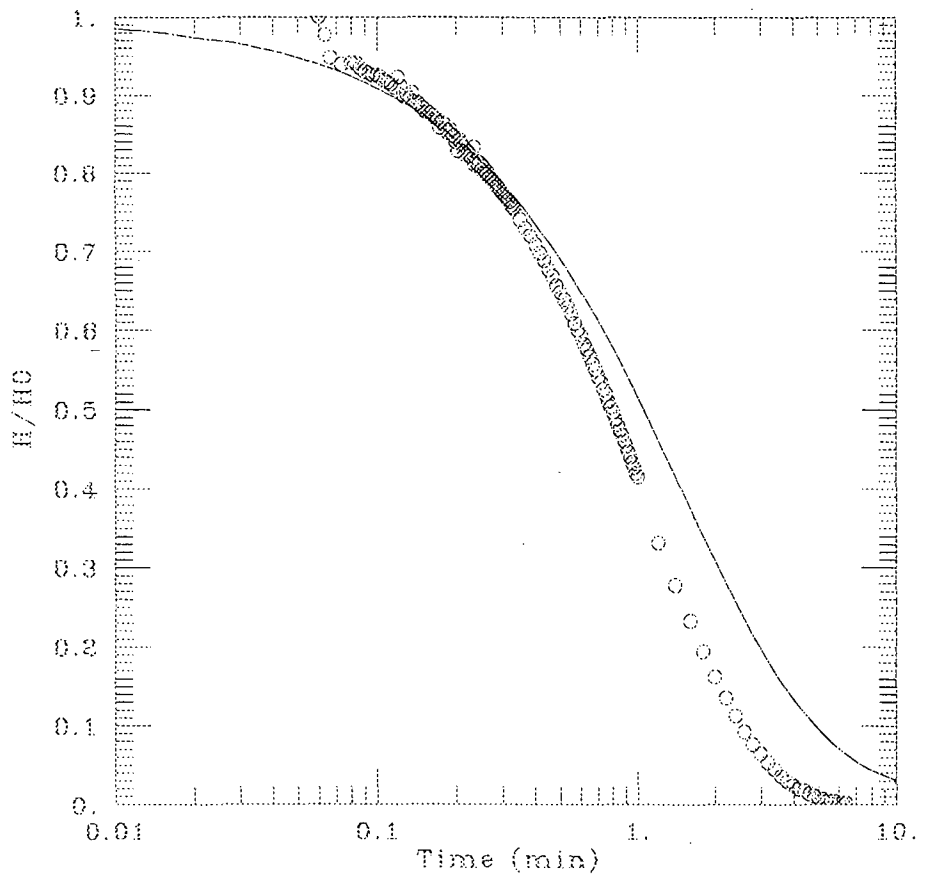
**ESTIMATED PARAMETERS:**
T = 0.01837 $ft^2$/min
S = 0.0001

**TEST DATA:**
H0 = 2.818 ft
rc = 0.167 ft
rw = 0.333 ft

303611

| McLaren/Hart, Inc. | Client: Island Chemical |
|---|---|
| | Location: St. Croix |

# MW-15 Rising Head Slug Test




**DATA SET:**
c:\slug\mw15.dat
03/03/00

**AQUIFER TYPE:**
Confined

**SOLUTION METHOD:**
Cooper et al.

**TEST DATE:**
2/9/00

**OBS. WELL:**
MW-15

**ESTIMATED PARAMETERS:**
T = 0.03924 $ft^2/min$
S = 0.0001

**TEST DATA:**
H0 = 2.821 ft
rc = 0.167 ft
rw = 0.333 ft

303612

# ATTACHMENT D

# GROUNDWATER SAMPLING FORMS

303613

# Pace Analytical

*The Right Chemistry, The Right Solution®*

## CHAIN-OF-CUSTODY / Analytical Request Document

***The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.***

517694

Page: 1 of 1

**Required** Client Information: **Section A**

Company: McLaren/Hart
Address: 2055 Intelligence Blvd.
Virgin, NJ 07059
Phone: 732/417-8111 Fax: 305/671-8162

**Required** Client Information: **Section B**

Report To: Norm Ficklin
Invoice To: Jose Arnett, Exxon
P.O.:
Project Name: Virgin Island Chem. Site
Project Number:

Client Information (Check quote/contract):
Requested Due Date: *TAT:

* Turn around times less than 14 days subject to laboratory and contractual obligations and may result in a Rush Turnaround Surcharge.
Turn Around Time (TAT) in calendar days.

To Be Completed by Pace Analytical and Client **Section C**

Quote Reference:
Project Manager:
Project #:
Profile #:

**Section D** **Required** Client Information:

**SAMPLE ID**
One character per box.
(A–Z, 0–9 / .–)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes

| MATRIX | CODE |
|---|---|
| WATER | WT |
| SOIL | SL |
| OIL | OL |
| WIPE | WP |
| AIR | AR |
| TISSUE | TS |
| OTHER | OT |

| ITEM # | SAMPLE ID | MATRIX CODE | DATE COLLECTED (mm / dd / yy) | TIME COLLECTED (hh:mm a/p) | # Containers | Preservatives: Unpreserved | $H_2SO_4$ | $HNO_3$ | HCl | NaOH | $Na_2S_2O_3$ | Requested Analysis: Site Target Cmp. | Remarks / Lab ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | MW-11 | WT | 3.8.00 | 9:25a | 3 | | | | ✓ | | | ✓ | |
| 2 | TB030800 | WT | 3.8.00 | 8:00a | 2 | | | | ✓ | | | ✓ | |
| 3 | MW-3 | WT | 3.8.00 | 11:15a | 3 | | | | ✓ | | | ✓ | |
| 4 | MW-7 | WT | 3.8.00 | 3:25p | 3 | | | | ✓ | | | ✓ | |
| 5 | MW-10 | WT | 3.7.00 | 7:15p | 3 | | | | ✓ | | | ✓ | |
| 6 | MW-2 | WT | 3.6.00 | 5:08p | 3 | | | | ✓ | | | ✓ | high chloroform conc. likely |
| 7 | MW-8 | WT | 3.6.00 | 6:45p | 3 | | | | ✓ | | | ✓ | |
| 8 | MW-8D | WT | 3.8.00 | 6:15p | 3 | | | | ✓ | | | ✓ | |
| 9 | TB030800 | WT | 3.6.00 | 7:15p | 3 | | | | ✓ | | | ✓ | |
| 10 | MW-6 | WT | 3.9.00 | 9:00a | 3 | | | | ✓ | | | ✓ | high ethylbenzene, xylene, acetone, methylene chloride concentrations |
| 11 | MW-1 | WT | 3.9.00 | 12:10p | 3 | | | | ✓ | | | ✓ | |
| 12 | | | | | | | | | | | | | |

| Sample Condition | | Sample Notes | Item No. | Relinquished By / Company | Date | Time | Accepted By / Company | Date | Time |
|---|---|---|---|---|---|---|---|---|---|
| Temp in °C: | | | | [illegible] McLaren/Hart | 3.9.00 | 1410 | Federal Express | 3/9/00 | 1400 |
| Received on ICE: | Y / N | | | Federal Express | | | | | |
| Sealed Cooler: | Y / N | | | | | | | | |
| Samples Intact: | Y / N | | | | | | | | |

**Additional Comments:**

Site Target Compounds: acetone, methylene chloride, chloroform, toluene, ethylbenzene, total xylenes

**SAMPLER NAME AND SIGNATURE**

PRINT Name of SAMPLER: Norm L. Ficklin
SIGNATURE of SAMPLER: [signature] DATE Signed: (MM / DD / YY) 3.9.00

303614

**SEE REVERSE SIDE FOR INSTRUCTIONS**

# Pace Analytical

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## CHAIN-OF-CUSTODY / Analytical Request Document

***The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.***

517695

Page: 1 of 2

**Required Client Information:** **Section A**

Company: [illegible]

Address: [illegible] INDUSTRIAL BLVD. GLEN, NJ 08827

Phone: [illegible] Fax: [illegible]

**Required Client Information:** **Section B**

Report To: [illegible]

Invoice To: [illegible]

P.O.: [illegible]

Project Name: [illegible]

Project Number: [illegible]

Client Information (Check quote/contract):

Requested Due Date: *TAT:

* Turn around times less than 14 days subject to laboratory and contractual obligations and may result in a Rush Turnaround Surcharge.

Turn Around Time (TAT) in calendar days.

To Be Completed by Pace Analytical and Client **Section C**

Quote Reference:

Project Manager:

Project #:

Profile #:

**Section D** **Required Client Information:**

Valid Matrix Codes

| MATRIX | CODE |
|---|---|
| WATER | WT |
| SOIL | SL |
| OIL | OL |
| WIPE | WP |
| AIR | AR |
| TISSUE | TS |
| OTHER | OT |

| ITEM # | SAMPLE ID (One character per box. (A–Z, 0–9 / ,–) Sample IDs MUST BE UNIQUE) | MATRIX CODE | DATE COLLECTED mm / dd / yy | TIME COLLECTED hh:mm a/p | # Containers | Preservatives: Unpreserved | $H_2SO_4$ | $HNO_3$ | HCl | NaOH | $Na_2S_2O_3$ | Requested Analysis: Site Target Compounds | Remarks / Lab ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | [illegible] B03000 | WT | 3.9.00 | 5:00p | 3 | | | | ✓ | | | ✓ | |
| 2 | T B03100 | WT | 3.10.00 | 11:00a | 2 | | | | ✓ | | | ✓ | |
| 3 | F B03100 | WT | 3.10.00 | 1:30a | 3 | | | | ✓ | | | ✓ | |
| 4 | MW-12 | WT | 3.10.00 | 9:30a | 3 | | | | ✓ | | | ✓ | |
| 5 | MW-14 | WT | 3.10.00 | 10:50a | 3 | | | | ✓ | | | ✓ | |
| 6 | [illegible] -MD-13D | WT | 3.10.00 | 3:25p | 3 | | | | ✓ | | | ✓ | Duplicate sample likely |
| 7 | [illegible] -MD-14D | WT | 3.10.00 | 10:50 | 3 | | | | ✓ | | | ✓ | |
| 8 | MW-15 | WT | 3.7.00 | 4:36p | 1 | ✓ | | | | | | ✓ | |
| 9 | MW-13 | WT | 3.7.00 | 1:55p | 1 | ✓ | | | | | | ✓ | |
| 10 | MW-11 | WT | 3.8.00 | 9:25a | 1 | ✓ | | | | | | ✓ | |
| 11 | MW-3 | WT | 3.8.00 | 11:15a | 1 | ✓ | | | | | | ✓ | |
| 12 | MW-7 | WT | 3.8.00 | 3:25p | 1 | ✓ | | | | | | ✓ | |

| Sample Condition | | Sample Notes | Item No. | Relinquished By / Company | Date | Time | Accepted By / Company | Date | Time |
|---|---|---|---|---|---|---|---|---|---|
| Temp in °C: | | | | [illegible] Method/Hand FEDERAL EXPRESS | 3.13.00 | 1600 | FEDERAL EXPRESS | 3.13.00 | 1600 |
| Received on ICE: | Y / N | | | | | | | | |
| Sealed Cooler: | Y / N | | | | | | | | |
| Samples Intact: | Y / N | | | | | | | | |

**Additional Comments:**

Site Target Compounds: acetone, methylene chloride, chloroform, toluene, ethylbenzene, total xylenes

303615

**SAMPLER NAME AND SIGNATURE**

PRINT Name of SAMPLER: [illegible]

SIGNATURE of SAMPLER: [illegible]

DATE Signed: (MM / DD / YY) 3.10.00

SEE REVERSE SIDE FOR INSTRUCTIONS

# Pace Analytical

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## CHAIN-OF-CUSTODY / Analytical Request Document

***The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.***

517698

**Page:** 1 of 1

**Required Client Information:** **Section A**

| | |
|---|---|
| Company: | McLaren/Hart |
| Address: | 25 Technology Blvd. Building 4, Suite 100 Centennial, CO 80112 |
| Phone: | 303/617-8111 |
| Fax: | 303/617-8162 |

**Required Client Information:** **Section B**

| | |
|---|---|
| Report To: | Noreen Lichlin |
| Invoice To: | Same as above (Carol) |
| P.O. | |
| Project Name: | Virgin Island Gas Site |
| Project Number: | |

Client Information (Check quote/contract):

Requested Due Date: | *TAT:

* *Turn around times less than 14 days subject to laboratory and contractual obligations and may result in a Rush Turnaround Surcharge.*

Turn Around Time (TAT) in calendar days.

To Be Completed by Pace Analytical and Client **Section C**

| | |
|---|---|
| Quote Reference: | |
| Project Manager: | |
| Project #: | |
| Profile #: | |

**Requested Analysis:**

**Section D** **Required Client Information:**

**SAMPLE ID**

One character per box.
(A–Z, 0–9 / ,–)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes

| MATRIX | CODE |
|---|---|
| WATER | WT |
| SOIL | SL |
| OIL | OL |
| WIPE | WP |
| AIR | AR |
| TISSUE | TS |
| OTHER | OT |

| ITEM # | SAMPLE ID | MATRIX CODE | DATE COLLECTED (mm / dd / yy) | TIME COLLECTED (hh: mm a/p) | # Containers | Preservatives: Unpreserved | $H_2SO_4$ | $HNO_3$ | HCl | NaOH | $Na_2S_2O_3$ | Site Target Comp. | Remarks / Lab ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | TB030700 | WT | 3-7-00 | 8:00a | 2 | | | | ✓ | | | ✓ | |
| 2 | MW-15 | WT | 3-7-00 | 0936 | 3 | | | | ✓ | | | ✓ | TMT: by COC 3-13-00 |
| 3 | MW-13 | WT | 3-7-00 | 1355 | 3 | | | | ✓ | | | ✓ | |
| 4 | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | |

| Sample Condition | | Sample Notes | Item No. | Relinquished By / Company | Date | Time | Accepted By / Company | Date | Time |
|---|---|---|---|---|---|---|---|---|---|
| Temp in °C: | | | | Noreen Lichlin / McLaren/Hart | 3-7-00 | 1700 | Federal Express | 3-7-00 | 1700 |
| Received on ICE: | Y / N | | | Federal Express | | | | | |
| Sealed Cooler: | Y / N | | | | | | | | |
| Samples Intact: | Y / N | | | | | | | | |

**Additional Comments:**

Site Target Compounds: Acetone, Methylene Chloride, Chloroform, Toluene, Ethylbenzene, Total Xylenes

**SAMPLER NAME AND SIGNATURE**

PRINT Name of SAMPLER: Noreen L. Lichlin

SIGNATURE of SAMPLER: Noreen L. Lichlin

DATE Signed: (MM / DD / YY) 3-7-00

303616

1

SEE REVERSE SIDE FOR INSTRUCTIONS

# Pace Analytical

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# CHAIN-OF-CUSTODY / Analytical Request Document

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517901

**Page: 2 of 2**

**Required** Client Information: **Section A**

Company: [illegible]

Address: [illegible] INSURANCE FUND (WILTON, NY 12866)

Phone: [illegible] Fax: 518-584-5162

**Required** Client Information: **Section B**

Report To: [illegible]

Invoice To: [illegible]

P.O.:

Project Name: [illegible]

Project Number:

Client Information (Check quote/contract):

Requested Due Date: *TAT:

* Turn around times less than 14 days subject to laboratory and contractual obligations and may result in a Rush Turnaround Surcharge.

Turn Around Time (TAT) in calendar days.

To Be Completed by Pace Analytical and Client **Section C**

Quote Reference:

Project Manager:

Project #:

Profile #:

**Requested Analysis:**

**Section D** **Required** Client Information:

**SAMPLE ID**

One character per box.
(A–Z, 0–9 / .–)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes

| MATRIX | CODE |
|---|---|
| WATER | WT |
| SOIL | SL |
| OIL | OL |
| WIPE | WP |
| AIR | AR |
| TISSUE | TS |
| OTHER | OT |

| ITEM # | SAMPLE ID | MATRIX CODE | DATE COLLECTED (mm / dd / yy) | TIME COLLECTED (hh:mm a/p) | # Containers | Preservatives: Unpreserved | $H_2SO_4$ | $HNO_3$ | HCl | NaOH | $Na_2S_2O_3$ | Analyses | Remarks / Lab ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | MW-10 | WT | 3.7.00 | 7:15p | 1 | ✓ | | | | | | ✓ | |
| 2 | MW-2 | WT | 3.8.00 | 5:08p | 1 | ✓ | | | | | | ✓ | |
| 3 | MW-8 | WT | 3.8.00 | 6:45p | 1 | ✓ | | | | | | ✓ | |
| 4 | MW-6 | WT | 3.7.00 | 7:00a | 1 | ✓ | | | | | | ✓ | |
| 5 | MW-1 | WT | 3.7.00 | 12:10p | 1 | ✓ | | | | | | ✓ | |
| 6 | MW-12 | WT | 3.10.00 | 9:30a | 1 | ✓ | | | | | | ✓ | |
| 7 | MW-14 | WT | 3.10.00 | 10:50a | 1 | ✓ | | | | | | ✓ | |
| 8 | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | |

| Sample Condition | | Sample Notes | Item No. | Relinquished By / Company | Date | Time | Accepted By / Company | Date | Time |
|---|---|---|---|---|---|---|---|---|---|
| Temp in °C: | | | | [illegible] | 3.13.00 | 1600 | FEDEX EXPRESS | 3.13.00 | 1600 |
| Received on ICE: | Y / N | | | FEDEX EXPRESS | | | | | |
| Sealed Cooler: | Y / N | | | | | | | | |
| Samples Intact: | Y / N | | | | | | | | |

**Additional Comments:**

**SAMPLER NAME AND SIGNATURE**

PRINT Name of SAMPLER: NOAH L. EICHLIN

SIGNATURE of SAMPLER: [signature] DATE Signed: (MM / DD / YY) 3.10.00

303617

**SEE REVERSE SIDE FOR INSTRUCTIONS**

Pace Analytical Services, Inc. Form COC01.XLS 12/99

# Pace Analytical

*The Right Chemistry, The Right Solution®*

# CHAIN-OF-CUSTODY / Analytical Request Document

***The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.***

517902

**Page:** | of |

To Be Completed by Pace Analytical and Client

**Required** Client Information: **Section A**

Company: [illegible]

Address: [illegible] Independence Blvd. Ste. [illegible] Cherry Hill, NJ 08057

Phone: [illegible] Fax: 609-627-7162

**Required** Client Information: **Section B**

Report To: Norma Eichun

Invoice To: Joe Agueci, Stes

P.O.:

Project Name: Village Island Chem. Site

Project Number:

Client Information (Check quote/contract):

Requested Due Date: *TAT:

* Turn around times less than 14 days subject to laboratory and contractual obligations and may result in a Rush Turnaround Surcharge.

Turn Around Time (TAT) in calendar days.

**Section C**

Quote Reference:

Project Manager:

Project #:

Profile #:

**Requested Analysis:**

**Section D** **Required** Client Information:

**SAMPLE ID**

One character per box.
(A–Z, 0–9 / .–)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes

| MATRIX | CODE |
|---|---|
| WATER | WT |
| SOIL | SL |
| OIL | OL |
| WIPE | WP |
| AIR | AR |
| TISSUE | TS |
| OTHER | OT |

| ITEM # | SAMPLE ID | MATRIX CODE | DATE COLLECTED (mm / dd / yy) | TIME COLLECTED (hh:mm a/p) | # Containers | Preservatives: Unpreserved | $H_2SO_4$ | $HNO_3$ | HCl | NaOH | $Na_2S_2O_3$ | Some Target Compounds: Sulfides | Remarks / Lab ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | TB031300 | WT | 3-13-00 | 10:00a | 2 | | | | ✓ | | | ✓ | |
| 2 | VST-VMP-1D | WT | 3-13-00 | 10:40a | 3 | | | | ✓ | | | ✓ | Light ends, benzene, methylene chloride, ethylbenzene, + total xylenes |
| 3 | VST-VMP-2D | WT | 3-13-00 | 12:15p | 4 | ✓ | | | ✓ | | | ✓ | ✓ |
| 4 | VST-VMP-20D | WT | 3-13-00 | 12:15p | 3 | | | | ✓ | | | ✓ | |
| 5 | VST-VMP-3D | WT | 3-13-00 | 2:25p | 3 | | | | ✓ | | | ✓ | |
| 6 | VST-VMP-4D | WT | 3-13-00 | 3:55p | 3 | | | | ✓ | | | ✓ | |
| 7 | TB031400 | WT | 3-14-00 | 8:20a | 3 | | | | ✓ | | | ✓ | |
| 8 | FPP-VMP-1D | WT | 3-14-00 | 11:20a | 3 | | | | ✓ | | | ✓ | Flash chlorizon |
| 9 | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | |

| Sample Condition | | Sample Notes | Item No. | Relinquished By / Company | Date | Time | Accepted By / Company | Date | Time |
|---|---|---|---|---|---|---|---|---|---|
| Temp in °C: | | | | [illegible] M. Laufer | 3-14-00 | 11:00 | Federal Express | 3-14-00 | 11:00 |
| Received on ICE: | Y / N | | | Federal Express | 3-15-00 | | | 3-15-00 | |
| Sealed Cooler: | Y / N | | | | | | | | |
| Samples Intact: | Y / N | | | | | | | | |

**Additional Comments:**

Some Target Compounds: acetone, methylene chloride, chloroform, benzene, ethylbenzene, & total xylenes

**SAMPLER NAME AND SIGNATURE**

PRINT Name of SAMPLER: Norma L. Eichun

SIGNATURE of SAMPLER: [signature]

DATE Signed: (MM / DD / YY) 3-14-00

303618

**SEE REVERSE SIDE FOR INSTRUCTIONS**

# GROUNDWATER SAMPLING FORM

McLaren Hart Inc.

Well Number MW-11
State Permit No.
Project Name
Project Number

Sampling Date 3-8-00
Weather ~70°
Sampled by: SC, DE (initials)

## Well Information

Well Type: X Monitor ___Other:
Well Construction X PVC ___Steel ___Other:
Well Diameter 4 inches
Well Screened interval ___ to ___ feet below TIC
Well Depth (ft below TIC) 42.15
Well Headspace Reading (PID/FID)
Water Level (ft below TIC) 25.63
Product Level-if present (ft below TIC)
Well Notes (Odor, well condition, etc.)

Volume of Water in Casing (gallons)

( ) - ( ) * $^2$ * 0.0408 = gallons
Well Depth — Water Level — Well Diameter (in)

## Purging Information

Purge Method: X Low Flow ___NJDEP 3 Well Volume ___Not Purged ___Other:
Pump: X Submersible Pump (2 inch) ___Peristaltic ___Positive displacement ___Other:
Pump intake depth: 37' Purge water discharged to: ___Ground X Drum ___Other:
Tubing: ___ Polypropylene X Teflon-line ___Other: / X New ___Dedicated

| Time (HH:MM) | Temp (°C) | pH (pH units) | D.O. (mg/L) | Cond. (S/m) | Turb (NTU) | DTW (feet) | Rate (ml/min) | ORP mV | SAL % | TDS g/L | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 8:00 | | | | | | 25.61 | | | | | Purge Start |
| 8:05 | 29.06 | 7.11 | 0.78 | 0.258 | 70 | 27.09 | 500 | 12 | 0.13 | 1.64 | Horiba U-22 Environment #05 |
| 8:10 | 28.82 | 7.16 | 0.55 | 0.256 | 1 | 27.09 | 500 | 16 | 0.13 | 1.64 | (ERROR 5+6 on Horiba) |
| 8:15 | 29.41 | 7.14 | 0.62 | ERROR | 13 | 27.09 | 500 | 7 | 0.13 | 2.87 | adjust flow |
| | | | | | | | | | | | - SHUT DOWN DUE TO ERROR |
| 8:45 | | | {NEW METER} | | | | | | | | Re-start New Meter-U22 |
| 8:46 | | | | | | 26.76 | | | | | Horiba U-22 Environment #04 |
| 8:49 | 28.74 | 7.19 | 3.19 | 0.291 | 11 | 26.85 | 500 | 63 | 0.1 | 1.87 | |
| 8:54 | 29.47 | 7.15 | 1.75 | 0.294 | 67 | 27.07 | 500 | 49 | 0.1 | 1.89 | |
| 8:59 | 29.76 | 7.13 | 1.37 | 0.295 | 78 | 27.36 | 500 | 43 | 0.1 | 1.89 | |
| 9:04 | 29.53 | 7.11 | 1.26 | 0.293 | 90 | 27.54 | 500 | 43 | 0.1 | 1.87 | |
| 9:09 | 29.62 | 7.10 | 1.19 | 0.292 | 110 | 27.59 | 500 | 41 | 0.1 | 1.87 | |
| 9:14 | 29.46 | 7.08 | 1.19 | 0.289 | 130 | 27.59 | 500 | 44 | 0.1 | 1.85 | adjust flow from 420 to 500 |
| 9:19 | 29.95 | 7.07 | 1.27 | 0.292 | 130 | 27.60 | 500 | 41 | 0.1 | 1.87 | |
| 9:24 | 29.62 | 7.07 | 1.33 | 0.288 | 132 | 27.60 | 500 | 44 | 0.1 | 1.85 | |
| | | | | | | | | | | | |
| 940 | 29.39 | 7.05 | 1.40 | 0.284 | 210 | 27.64 | 500 | 51 | 0.1 | 1.82 | Post-sampling Measurements |

Total Volume Purged ~35 liters
Water Quality Meter(s) * Horiba U-22 Environment #04

## Sample Information

Groundwater Sample Field ID MW-11 VOA +sulfate 9:25
Sampling Time 9:25 Sampling End Time ___ DTW before Sampling ___
Sampling Method ___ Bailer (type:___) ___Same as Above ___Other:
Sampling Observations

- See Page 2 of 2 for Groundwater Sampling Parameters

303619

# GROUNDWATER SAMPLING FORM

McLaren Hart, Inc.

Well Number MW-12
State Permit No.
Project Name
Project Number

Sampling Date 3-10-00
Weather Sunny ~90°F
Sampled by: SC, NE, DS (initials)

## Well Information

Well Type: X Monitor ___ Other:
Well Diameter 4 inches
Well Depth (ft below TIC) 147
Water Level (ft below TIC) 28.29
Well Notes (Odor, well condition, etc.)

Well Construction X PVC ___ Steel ___ Other:
Well Screened interval 137 to 147 feet below TIC
Well Headspace Reading (PID/FID)
Product Level-if present (ft below TIC)

Volume of Water in Casing (gallons)

( ) - ( ) * ( )$^2$ * 0.0408 = gallons
Well Depth — Water Level — Well Diameter (in)

## Purging Information

Purge Method: X Low Flow ___ NJDEP 3 Well Volume ___ Not Purged ___ Other:
Pump: X Submersible Pump (2 inch) ___ Peristaltic ___ Positive displacement ___ Other:
Pump intake depth: 142 Purge water discharged to: ___ Ground X Drum ___ Other:
Tubing: ___ Polypropylene X Teflon-line ___ Other: / X New ___ Dedicated

| Time (HH:MM) | Temp (°C) | pH (pH units) | D.O. (mg/L) | Cond. (S/m) | Turb (NTU) | DTW (feet) | Rate (ml/min) | ORP mV | SAL % | TDS g/L | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 8:33 | | | | | | 28.20 | | | | | Purge Start |
| 8:37 | 27.23 | 7.10 | 2.47 | 0.393 | 83.0 | 28.76 | 500 | 65 | .2 | 2.53 | |
| 8:42 | 27.42 | 7.03 | 1.11 | 0.401 | 110.0 | 29.11 | 500 | 21 | .21 | 0.57 | |
| 8:47 | 27.58 | 7.03 | 0.69 | 0.399 | 66.9 | 28.82 | 500 | 13 | .20 | 2.56 | |
| 8:52 | 27.83 | 7.04 | 0.67 | 0.399 | 53.5 | 28.88 | 500 | 13 | .2 | 2.56 | |
| 8:57 | 28.00 | 7.04 | 0.63 | 0.399 | 46.1 | 28.92 | 500 | 14 | .2 | 2.55 | 28.92 DTW |
| 9:02 | 27.96 | 7.04 | 0.63 | 0.399 | 47.9 | 28.97 | 500 | 14 | .2 | 2.55 | |
| 9:07 | 27.99 | 7.05 | 0.58 | 0.399 | 31.7 | 28.96 | 500 | 15 | .2 | 2.55 | |
| 9:12 | 28.05 | 7.05 | 0.49 | 0.399 | 22.3 | 28.99 | 500 | 12 | .2 | 2.55 | |
| 9:17 | 28.17 | 7.05 | 0.51 | 0.399 | 15.8 | 29.06 | 500 | 15 | .2 | 2.55 | |
| 9:22 | 28.25 | 7.05 | 0.50 | 0.398 | 17.6 | 29.10 | 500 | 17 | .2 | 2.55 | |
| 9:24 | | | | | | | | | | | Set up to sample |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| 9:35 | 28.03 | 7.06 | 0.40 | 0.397 | 3.1 | 29.23 | 500 | 16 | .2 | 2.54 | Post-sampling Measurements |

Total Volume Purged ~31 liters Water Quality Meter(s) Horiba U-22 Environment #05

## Sample Information

Groundwater Sample Field ID MW-12 9:30 VOA + Sulfate
Sampling Time 9:30 Sampling End Time DTW before Sampling
Sampling Method ___ Bailer (type: ) ___ Same as Above ___ Other:
Sampling Observations

- See Page 2 of 2 for Groundwater Sampling Parameters

303620

# GROUNDWATER SAMPLING FORM

McLaren Hart Inc.

Well Number MW-13
State Permit No.
Project Name
Project Number

Sampling Date 3-7-00
Weather Sunny 85°C
Sampled by: SJNE (initials)

## Well Information

Well Type: X Monitor ___Other:
Well Construction X PVC ___Steel ___Other:
Well Diameter 4 inches
Well Screened interval 30 to 40 feet below TIC
Well Depth (ft below TIC)
Well Headspace Reading (PID/FID)
Water Level (ft below TIC) 25.23
Product Level-if present (ft below TIC) NONE
Well Notes (Odor, well condition, etc.)

Volume of Water in Casing (gallons)

( ) - ( ) * ( )$^2$ * 0.0408 = gallons
Well Depth | Water Level | Well Diameter (in)

## Purging Information

Purge Method: X Low Flow ___NJDEP 3 Well Volume ___Not Purged ___Other:
Pump: X Submersible Pump (2 inch) ___Peristaltic ___Positive displacement ___Other:
Pump intake depth: 35' Purge water discharged to: ___Ground X Drum ___Other:
Tubing: ___Polypropylene X Teflon-line ___Other: / X New ___Dedicated

| Time (HH:MM) | Temp (°C) | pH (pH units) | D.O. (mg/L) | Cond. (S/m) | Turb (NTU) | DTW (feet) | Rate (ml/min) | ORP mV | SAL % | TDS g/L | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 13:06 | | | | | | 25.19 | | | | | Purge Start |
| 13:09 | 29.88 | 6.87 | 2.20 | 0.239 | 290 | 26.14 | 380 | 68 | 0.12 | 1.53 | |
| 13:14 | 30.71 | 6.75 | 1.82 | 0.237 | 120 | 26.36 | 500 | 39 | 0.12 | 1.52 | adjusted flow from 200 |
| 13:19 | 30.72 | 6.76 | 1.70 | 0.236 | 140 | 26.51 | 500 | 44 | 0.11 | 1.51 | |
| 13:24 | 30.50 | 6.78 | 1.69 | 0.233 | 210 | 26.89 | 500 | 48 | 0.11 | 1.49 | |
| 13:29 | 30.37 | 6.79 | 1.62 | 0.233 | 220 | 27.12 | 500 | 52 | 0.11 | 1.49 | |
| 13:34 | 30.03 | 6.80 | 1.53 | 0.231 | 290 | 27.16 | 500 | 55 | 0.11 | 1.48 | |
| 13:39 | 30.32 | 6.81 | 1.60 | 0.233 | 279 | 27.17 | 500 | 54 | 0.11 | 1.50 | |
| 13:44 | 30.68 | 6.81 | 1.61 | 0.235 | 260 | 27.19 | 500 | 51 | 0.11 | 1.51 | |
| 13:49 | 31.44 | 6.81 | 1.58 | 0.236 | 270 | 27.21 | 500 | 50 | 0.11 | 1.51 | |
| | | | | | | | | | | | Set up to Sample |
| 1410 | | | | | | | | | | | Pump off |
| | | | | | | | | | | | Continue Running Test Kit |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| 1410 | 30.37 | 6.79 | 1.47 | 0.227 | 200 | 27.22 | 500 | 63 | 0.11 | 1.45 | Post-sampling Measurements |

Total Volume Purged ~32 liters
Water Quality Meter(s) Horiba U22 Envirosert #05

## Sample Information

Groundwater Sample Field ID MW-13; VOA 13:55; and Sulfate 13:55
Sampling Time 13:55 VOA Sampling End Time DTW before Sampling
Sampling Method ___Bailer (type: ) ___Same as Above ___Other:
Sampling Observations

- See Page 2 of 2 for Groundwater Sampling Parameters

303621

# GROUNDWATER SAMPLING FORM

McLaren Hart Inc.

Well Number MW 14
State Permit No.
Project Name
Project Number

Sampling Date 3-X-00 ABORT
Weather Sunny ~90°
Sampled by: SL, NB (initials)

## Well Information

Well Type: X Monitor ___ Other:
Well Construction X PVC ___ Steel ___ Other:
Well Diameter 4 inches
Well Screened interval 122 to 132 feet below TIC
Well Depth (ft below TIC)
Well Headspace Reading (PID/FID)
Water Level (ft below TIC) 27.17
Product Level-if present (ft below TIC)
Well Notes (Odor, well condition, etc.)

Volume of Water in Casing (gallons)

( ) - ( ) * ( )$^2$ * 0.0408 = gallons
Well Depth — Water Level — Well Diameter (in)

## Purging Information

Purge Method: X Low Flow ___ NJDEP 3 Well Volume ___ Not Purged ___ Other:
Pump: X Submersible Pump (2 inch) ___ Peristaltic ___ Positive displacement ___ Other:
Pump intake depth: 127 Purge water discharged to: ___ Ground X Drum ___ Other:
Tubing: ___ Polypropylene X Teflon-line ___ Other: / X New ___ Dedicated

| Time (HH:MM) | Temp (°__) | pH (pH units) | D.O. (__/__) | Cond. (____) | Turb (____) | DTW (feet) | Rate (ml/min) | | ____ | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 15:04 | | | | | | 27.15 | | | | Purge Start |
| 1548 | | | | | | | | 2 Controllers - | | Pump won't start |
| | | | | | | | | | | |
| | | | | | | | | | | Will Re-Sample when |
| | | | | | | | | | | Different Pump & Length |
| | | | | | | | | | | Arrives. |
| | | | | | | | | | | |
| | | | | | | | | | | |
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| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | Post-sampling Measurements |

Total Volume Purged
Water Quality Meter(s) Horiba U22 Envirosnt #05

## Sample Information

Groundwater Sample Field ID
Sampling Time Sampling End Time DTW before Sampling
Sampling Method ___ Bailer (type:) ___ Same as Above ___ Other:
Sampling Observations

- See Page 2 of 2 for Groundwater Sampling Parameters

303622

# GROUNDWATER SAMPLING FORM

McLaren Hart, Inc.

Well Number MW-14
State Permit No.
Project Name
Project Number

Sampling Date 3-10-00
Weather Sunny ~90°F
Sampled by: SC, NE, DS (initials)

## Well Information

Well Type: X Monitor ___Other:
Well Diameter 4 inches
Well Depth (ft below TIC) 134
Water Level (ft below TIC) 27.94
Well Notes (Odor, well condition, etc.)

Well Construction X PVC ___Steel ___Other:
Well Screened interval 124 to 134 feet below TIC
Well Headspace Reading (PID/FID)
Product Level-if present (ft below TIC)

Volume of Water in Casing (gallons)

( ) - ( ) * ( )$^2$ * 0.0408 = gallons
Well Depth — Water Level — Well Diameter (in)

## Purging Information

Purge Method: X Low Flow ___NJDEP 3 Well Volume ___Not Purged ___Other:
Pump: X Submersible Pump (2 inch) ___Peristaltic ___Positive displacement ___Other:
Pump intake depth: 129' Purge water discharged to: ___Ground X Drum ___Other:
Tubing: ___Polypropylene X Teflon-line ___Other: / X New ___Dedicated

| Time (HH:MM) | Temp (°C) | pH (pH units) | D.O. (mg/L) | Cond. (S/cm) | Turb (NTU) | DTW (feet) | Rate (ml/min) | ORP mV | SAL | TDS | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 10:15 | | | | | | 27.95 | | | | | Purge Start |
| 10:20 | 28.09 | 7.02 | 2.74 | 0.383 | 130.0 | 28.02 | 500 | 66 | .2 | 2.46 | |
| 10:25 | 28.38 | 6.99 | 2.55 | 0.403 | 60.8 | 27.97 | 500 | 49 | .26 | 3.17 | |
| 10 30 | 28.23 | 6.98 | 1.98 | 0.394 | 44.5 | 28.04 | 500 | 51 | .20 | 2.49 | |
| 10 35 | 28.26 | 6.99 | 2.11 | 0.385 | 48.6 | 28.05 | 500 | 52 | .20 | 2.46 | |
| 10 40 | 28.21 | 6.99 | 1.95 | 0.384 | 42.6 | 28.05 | 500 | 54 | .20 | 2.46 | |
| 10 45 | 28.21 | 6.98 | 1.99 | 0.384 | 40.1 | 28.05 | 500 | 57 | .20 | 2.46 | |
| 10:48 | | | | | | | | | | | Set up to Sample |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| 1103 | 28.28 | 6.96 | 1.70 | 0.384 | 16.5 | 28.05 | 500 | 61 | .2 | 2.46 | Post-sampling Measurements |

Total Volume Purged ~24 liters
Water Quality Meter(s) Horiba U-22 Envirent #5

## Sample Information

Groundwater Sample Field ID MW-14 10:50 VOA Sorbate
Sampling Time 1050 Sampling End Time ___ DTW before Sampling ___
Sampling Method ___Bailer (type: ) ___Same as Above ___Other:
Sampling Observations

- See Page 2 of 2 for Groundwater Sampling Parameters

303623

# GROUNDWATER SAMPLING FORM

McLaren Hart Inc.

Well Number MW-15
State Permit No.
Project Name VI CHEM
Project Number

Sampling Date 3-7-00
Weather Sunny ~65°
Sampled by: SC, NE (initials)

## Well Information

Well Type: X Monitor ___Other:
Well Construction X PVC ___Steel ___Other:
Well Diameter 4 inches
Well Screened interval 88 to 98 feet below TIC
Well Depth (ft below TIC) ~98
Well Headspace Reading (PID/FID)
Water Level (ft below TIC) 29.50
Product Level-if present (ft below TIC) NONE
Well Notes (Odor, well condition, etc.) * No Outer Casing Installed Yet.

Volume of Water in Casing (gallons)

( ) - ( ) * ( )$^2$ * 0.0408 = gallons
Well Depth — Water Level — Well Diameter (in)

## Purging Information

Purge Method: X Low Flow ___NJDEP 3 Well Volume ___Not Purged ___Other:
Pump: X Submersible Pump (2 inch) ___Peristaltic ___Positive displacement ___Other:
Pump intake depth: 92' Purge water discharged to: ___Ground X Drum ___Other:
Tubing: ___Polypropylene X Teflon-line ___Other: / X New ___Dedicated

| Time (HH:MM) | Temp (°C) | pH (pH units) | D.O. (mg/L) | Cond. (S/m) | Turb (NTU) | DTW (feet) | Rate (ml/min) | ORP mV | SAL % | TDS g/L | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 7:58 | | | | | | 29.52 | | | | | Purge Start |
| 8:01 | 28.16 | 10.76 | 1.81 | 0.316 | 42 | 29.72 | 500 | -64 | 0.16 | 2.02 | Note pH during development ~8 |
| 8:06 | 28.68 | 10.55 | 1.65 | 0.311 | 50 | 29.75 | 500 | -58 | 0.16 | 1.99 | |
| 8:11 | 28.87 | 10.07 | 1.36 | 0.308 | 62 | 29.74 | 500 | -36 | 0.15 | 1.97 | |
| 8:16 | 28.93 | 9.36 | 1.01 | 0.317 | 81 | 29.70 | 500* | 2 | 0.16 | 2.04 | adjust flow to 500 from 550* |
| 8:21 | 28.92 | 8.76 | 0.89 | 0.325 | 77 | 29.69 | 500 | 25 | 0.16 | 2.10 | |
| 8:26 | 28.85 | 8.50 | 0.74 | 0.333 | 74 | 29.69 | 500 | 39 | 0.17 | 2.13 | |
| 8:31 | 28.91 | 8.41 | 0.79 | 0.335 | 70 | 29.69 | 500 | 44 | 0.17 | 2.14 | |
| 8:36 | 28.94 | 8.28 | 0.71 | 0.337 | 68 | 29.69 | 500 | 48 | 0.17 | 2.16 | air bubbles in tubing from flow through |
| 8:41 | 28.97 | 8.03 | 0.67 | 0.339 | 72 | 29.70 | 500 | 53 | 0.17 | 2.17 | " |
| 8:46 | 28.92 | 7.54 | 0.68 | 0.342 | 77 | 29.70 | 500 | 51 | 0.17 | 2.19 | air bubbles in tubing from flow through |
| 8:51 | 29.00 | 7.45 | 0.76 | 0.343 | 57 | 29.70 | 500 | 50 | 0.17 | 2.19 | |
| 8:56 | 29.09 | 7.32 | 0.80 | 0.346 | 53 | 29.70 | 500 | 48 | 0.17 | 2.21 | |
| 9:01 | 29.48 | 7.29 | 0.80 | 0.345 | 54 | 29.70 | 500 | 42 | 0.17 | 2.21 | |
| 9:02 | | | | | | | | | | | Start Sampling |
| | | | | | | | | | | | * Bottles missing |
| 9:36 | 29.54 | 7.50 | 1.02 | 0.333 | 60 | 29.72 | 500 | 40 | 0.17 | 2.14 | Post-sampling Measurements |

Total Volume Purged ~49 liters Water Quality Meter(s) Horiba U22 Envirosense #05

303624

## Sample Information

Groundwater Sample Field ID MW15 - VOA 9:36 time sampled; 10:49 sulfate
Sampling Time 9:36 Sampling End Time 10:49 DTW before Sampling 29.70
Sampling Method ___Bailer (type: ) X Same as Above ___Other:
Sampling Observations Restart Pump at 10:20 to collect other samples: $CO_2$, DO, $Fe^{+2}$, Sulfide, Sulfate
9:28 pH 7.54; cond 0.336; Turb 36; DO 2.47; Temp 30.16; ORP 36 10:49 Finished Sampling - Sulfate and
- See Page 2 of 2 for Groundwater Sampling Parameters DO = 0.0 ppm; Nitrate 1.48 ppm; Nitrite 0.020 ppm; $CO_2$ 26 ppm
CHEMETRICS Results: $Fe^{+2}$ = 0.0 ppm; Sulfide = 0.0 ppm; Ammonia = 0

# GROUNDWATER SAMPLING FORM

McLaren Hart, Inc.

Well Number MW 10
State Permit No.
Project Name
Project Number

Sampling Date 3-7-00
Weather Sunny, DUSK, 80°
Sampled by: SL, JE (initials)

## Well Information

Well Type: ☒ Monitor ☐ Other:
Well Construction ☒ PVC ☐ Steel ☐ Other:
Well Diameter 4 inches
Well Screened interval 22 to 32 feet below TIC
Well Depth (ft below TIC)
Well Headspace Reading (PID/FID)
Water Level (ft below TIC) 17.58
Product Level-if present (ft below TIC) none
Well Notes (Odor, well condition, etc.)

Volume of Water in Casing (gallons)

( ) - ( ) * ( )$^2$ * 0.0408 = gallons
Well Depth — Water Level — Well Diameter (in)

## Purging Information

Purge Method: ☒ Low Flow ☐ NJDEP 3 Well Volume ☐ Not Purged ☐ Other:
Pump: ☒ Submersible Pump (2 inch) ☐ Peristaltic ☐ Positive displacement ☐ Other:
Pump intake depth: 27' Purge water discharged to: ☐ Ground ☒ Drum ☐ Other:
Tubing: ☐ Polypropylene ☒ Teflon-line ☐ Other: / ☒ New ☐ Dedicated

| Time (HH:MM) | Temp (°C) | pH (pH units) | D.O. (mg/L) | Cond. (S/m) | Turb (NTU) | DTW (feet) | Rate (ml/min) | ORP mV | SAL % | TDS g/L | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1838 | | | | | | 17.61 | | | | | Purge Start 18:38 |
| 1840 | 28.22 | 6.40 | 0.63 | 0.260 | 47 | 18.04 | 500 | 80 | 0.13 | 1.66 | |
| 1845 | 28.99 | 6.48 | 0.48 | 0.258 | 46 | 18.08 | 500 | 55 | 0.13 | 1.65 | |
| 1850 | 29.06 | 6.50 | 0.45 | 0.258 | 46 | 18.08 | 500 | 36 | 0.13 | 1.65 | |
| 1855 | 29.11 | 6.50 | 0.41 | 0.260 | 43 | 18.08 | 500 | 22 | 0.13 | 1.66 | |
| 1900 | 29.23 | 6.50 | 0.33 | 0.257 | 54 | 18.09 | 500 | 6 | 0.13 | 1.65 | |
| 1905 | 29.38 | 6.49 | 0.31 | 0.255 | 58 | 18.09 | 500 | -2 | 0.13 | 1.63 | |
| 1910 | 29.28 | 6.49 | 0.29 | 0.254 | 53 | 18.09 | 500 | -3 | 0.12 | 1.63 | |
| | | | | | | | | | | | |
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| | | | | | | | | | | | |
| 1923 | 29.10 | 6.54 | 0.25 | 0.254 | 74 | 18.10 | 500 | -14 | 0.12 | 1.63 | Post-sampling Measurements |

Total Volume Purged ~22.5 liters
Water Quality Meter(s) Horiba U-22 Conductivity #05

## Sample Information

Groundwater Sample Field ID MW 10 : 1915 VOA + Sulfate
Sampling Time 1915 Sampling End Time 1922 DTW before Sampling
Sampling Method ☐ Bailer (type: ) ☐ Same as Above ☐ Other:
Sampling Observations

- See Page 2 of 2 for Groundwater Sampling Parameters

303625

# GROUNDWATER SAMPLING FORM

McLaren Hart Inc.

Well Number: MW-8
State Permit No.:
Project Name:
Project Number:

Sampling Date: 3-8-00
Weather: Sunny, DUSK ~90°
Sampled by: SC/NE (initials)

## Well Information

Well Type: X Monitor ___Other:
Well Construction ___PVC ___Steel ___Other:
Well Diameter ___ inches
Well Screened interval ___ to ___ feet below TIC
Well Depth (ft below TIC): 74.85
Well Headspace Reading (PID/FID):
Water Level (ft below TIC): 18.03
Product Level-if present (ft below TIC):
Well Notes (Odor, well condition, etc.):

Volume of Water in Casing (gallons)

( ) - ( ) * ( )$^2$ * 0.0408 = ___ gallons
Well Depth - Water Level * Well Diameter (in)

## Purging Information

Purge Method: X Low Flow ___NJDEP 3 Well Volume ___Not Purged ___Other:
Pump: X Submersible Pump (2 inch) ___Peristaltic ___Positive displacement ___Other:
Pump intake depth: 69' Purge water discharged to: ___Ground X Drum ___Other:
Tubing: ___ Polypropylene X Teflon-line ___Other: / X New ___Dedicated

| Time (HH:MM) | Temp (°C) | pH (pH units) | D.O. (mg/L) | Cond. (S/cm) | Turb (NTU) | DTW (feet) | Rate (ml/min) | ORP mV | SAL % | TDS g/L | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 18:06 | | | | | | 17.98 | | | | | Purge Start |
| 18:09 | 27.70 | 7.15 | 3.70 | 0.178 | 25 | 18.05 | 500 | 106 | .1 | 1.14 | 18.05 DTW |
| 18:14 | 27.95 | 7.08 | 2.30 | 0.175 | 16 | 18.60 | 500 | 81 | .1 | 1.12 | adjust flow 600 to 500 |
| 18:19 | 28.10 | 7.07 | 1.85 | 0.173 | 14 | 18.51 | 500 | 58 | .1 | 1.11 | |
| 18:24 | 28.07 | 7.06 | 1.79 | 0.173 | 16 | 18.49 | 500 | 52 | .1 | 1.11 | |
| 18 29 | 28.12 | 7.06 | 1.89 | 0.172 | 15 | 18.49 | 500 | 49 | .1 | 1.10 | |
| 18 34 | 28.14 | 7.05 | 1.90 | 0.172 | 14 | 18.48 | 500 | 45 | .1 | 1.10 | |
| | | | | | | | | | | | Set up to Sample |
| | | | | | | | | | | | |
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| | | | | | | | | | | | |
| 1852 | 27.99 | 7.01 | 1.52 | 0.170 | 00 | 18.64 | 500 | 57 | .1 | 1.09 | Post-sampling Measurements |

Total Volume Purged: ~23 liters
Water Quality Meter(s): Horiba U-22 Environment #04

## Sample Information

Groundwater Sample Field ID: MW-8 18:45 W/ Sulfate AND Duplicate VO.
Sampling Time: 18:45 Sampling End Time: ___ DTW before Sampling: ___
Sampling Method ___ Bailer (type: ) ___Same as Above ___Other:
Sampling Observations:

- See Page 2 of 2 for Groundwater Sampling Parameters

303626

# GROUNDWATER SAMPLING FORM

McLaren Hart, Inc.

Well Number MW-7
State Permit No.
Project Name
Project Number

Sampling Date 3-8-00
Weather Sunny ~98°
Sampled by: JC, NE (initials)

## Well Information

Well Type: X Monitor ___Other:
Well Construction X PVC ___Steel ___Other:
Well Diameter 4 inches
Well Screened interval ____ to ____ feet below TIC
Well Depth (ft below TIC) 73.44
Well Headspace Reading (PID/FID)
Water Level (ft below TIC) 19.92
Product Level-if present (ft below TIC) None
Well Notes (Odor, well condition, etc.)

Volume of Water in Casing (gallons)

( ) - ( ) * ( )$^2$ * 0.0408 = ____ gallons
Well Depth — Water Level — Well Diameter (in)

## Purging Information

Purge Method: X Low Flow ___NJDEP 3 Well Volume ___Not Purged ___Other:
Pump: X Submersible Pump (2 inch) ___Peristaltic ___Positive displacement ___Other:
Pump intake depth: 67' Purge water discharged to: ___Ground X Drum ___Other:
Tubing: ___Polypropylene X Teflon-line ___Other: / X New ___Dedicated

| Time (HH:MM) | Temp (°C) | pH (pH units) | D.O. (mg/L) | Cond. (S/m) | Turb (NTU) | DTW (feet) | Rate (ml/min) | ORP mV | SAL % | TDS g/L | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 14:47 | | | | | | 19.95 | | | | | Purge Start |
| 1449 | 7.14 | 28.94 | 2.56 | 0.260 | 100 | 20.21 | 500 | 9 | .1 | 1.66 | slight oil odor at start |
| 14:54 | 7.11 | 29.18 | 2.02 | 0.262 | 160 | 20.24 | 500 | 10 | .1 | 1.68 | |
| 14:59 | 7.10 | 29.27 | 1.52 | 0.263 | 150 | 20.24 | 500 | 17 | .1 | 1.68 | |
| 15:04 | 7.07 | 29.27 | 1.40 | 0.264 | 120 | 20.25 | 500 | 17 | .1 | 1.69 | |
| 15:09 | 7.03 | 29.08 | 1.53 | 0.264 | 90 | 20.25 | 500 | 18 | .1 | 1.69 | |
| 15:14 | 6.98 | 28.91 | 1.44 | 0.263 | 64 | 20.25 | 500 | 23 | .1 | 1.69 | |
| 15:19 | 6.97 | 28.90 | 1.42 | 0.264 | 54 | 20.25 | 500 | 25 | .1 | 1.69 | |
| 15:24 | 6.96 | 28.88 | 1.38 | 0.264 | 50 | 20.25 | 500 | 28 | .1 | 1.69 | |
| 15:25 | | | | | | | | | | | Set up Start Sampling |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| 1540 | 6.96 | 29.02 | 1.68 | 0.265 | 27 | 20.27 | 500 | 28 | .1 | 1.70 | Post-sampling Measurements |

Total Volume Purged ~33.5 Liters
Water Quality Meter(s) Horiba U-22 Envirosert #04

## Sample Information

Groundwater Sample Field ID MW-7 15:25 VOA + Sulfide
Sampling Time 15:25 Sampling End Time ____ DTW before Sampling ____
Sampling Method ___Bailer (type:____) ___Same as Above ___Other:
Sampling Observations

- See Page 2 of 2 for Groundwater Sampling Parameters

303627

# GROUNDWATER SAMPLING FORM

McLaren Hart Inc.

Well Number MW-6
State Permit No.
Project Name
Project Number

Sampling Date 3-9-00
Weather Sunny ~85°
Sampled by: SL, NE (initials)

## Well Information

Well Type: ☒ Monitor ☐ Other:
Well Construction ☒ PVC ☐ Steel ☐ Other:
Well Diameter 4 inches
Well Screened interval 20 to 30 feet below TIC
Well Depth (ft below TIC) 30.41
Well Headspace Reading (PID/FID)
Water Level (ft below TIC) 15.15
Product Level-if present (ft below TIC)
Well Notes (Odor, well condition, etc.)

Volume of Water in Casing (gallons)

( ) - ( ) * ( )$^2$ * 0.0408 = gallons
Well Depth | Water Level | Well Diameter (in)

## Purging Information

Purge Method: ☒ Low Flow ☐ NJDEP 3 Well Volume ☐ Not Purged ☐ Other:
Pump: ☒ Submersible Pump (2 inch) ☐ Peristaltic ☐ Positive displacement ☐ Other:
Pump intake depth: 25' Purge water discharged to: ☐ Ground ☒ Drum ☐ Other:
Tubing: ☐ Polypropylene ☒ Teflon-line ☐ Other: / ☒ New ☐ Dedicated

| Time (HH:MM) | Temp (°C) | pH (pH units) | D.O. (mg/L) | Cond. (S/m) | Turb (NTU) | DTW (feet) | Rate (ml/min) | ORP mV | SAL | TDS | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 8:06 | | | | | | 15.12 | | | | | Purge Start Slight odor |
| 8:09 | 28.29 | 6.72 | 0.97 | 0.216 | 10 | 15.25 | 500 | -223 | .1 | 138 | |
| 8:14 | 28.49 | 6.73 | 0.52 | 0.218 | 11.4 | 15.24 | 500 | -240 | .11 | 1.40 | |
| 8:19 | 28.69 | 6.74 | 0.38 | 0.219 | 24.9 | 15.25 | 500 | -253 | .11 | 1.40 | |
| 8:24 | 28.94 | 6.73 | 0.37 | 0.219 | 58.6 | 15.26 | 500 | -253 | .11 | 1.40 | Sample is Clear? |
| 8:29 | 28.84 | 6.74 | 0.29 | 0.219 | 83.5* | 15.26 | 500 | -256 | .11 | 1.41 | * Turbidity Flux 53 to 83 |
| 8:34 | 29.07 | 6.74 | 0.28 | 0.219 | 109.0* | 15.27 | 500 | -256 | .11 | 1.40 | |
| 8:39 | 29.09 | 6.73 | 0.27 | 0.219 | 134.0* | 15.27 | 500 | -256 | .11 | 1.40 | Sample is Clear |
| 8:44 | 29.43 | 6.73 | 0.28 | 0.218 | 172.0* | 15.27 | 500 | -255 | .10 | 1.39 | * Turbidity Dropped to |
| * 8:47 | 29.01 | 6.75 | 0.28 | 0.219 | 25.7* | | | -255 | .11 | 1.40 | 24 when taken out of Sunlight |
| 8:49 | 29.07 | 6.74 | 0.26 | 0.220 | 43.0* | 15.27 | 500 | -256 | .11 | 1.41 | |
| 8:54 | 29.10 | 6.74 | 0.27 | 0.220 | 98.0* | 15.27 | 500 | -256 | | | * Sample is Clear, |
| 8:56 | Prepare to Sample | | | | | | | | | | Turbidity Not Reliable |
| | | | | | | | | | | | Effected by Sunlight |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| 910 | 29.20 | 6.77 | 0.24 | 0.220 | 133 | 15.30 | 500 | -256 | .11 | 1.41 | Post-sampling Measurements |

Total Volume Purged ~32 Liters
Water Quality Meter(s) Horiba U22 Envirosense #05

## Sample Information

Groundwater Sample Field ID MW-6 9:00 VO + Sulfate
Sampling Time 9:00 Sampling End Time DTW before Sampling
Sampling Method ☐ Bailer (type: ) ☒ Same as Above ☐ Other:
Sampling Observations Slight odor

- See Page 2 of 2 for Groundwater Sampling Parameters

303628

# GROUNDWATER SAMPLING FORM

McLaren Hart Inc.

Well Number MW-3
State Permit No.
Project Name
Project Number

Sampling Date 3-8-00
Weather Sunny ~90°
Sampled by: SC, NE (initials)

## Well Information

Well Type: Y Monitor ___Other:
Well Construction: Y PVC ___Steel ___Other:
Well Diameter 4 inches
Well Screened interval ___ to ___ feet below TIC
Well Depth (ft below TIC) 31.68
Well Headspace Reading (PID/FID)
Water Level (ft below TIC) 16.18
Product Level-if present (ft below TIC)
Well Notes (Odor, well condition, etc.)

Volume of Water in Casing (gallons)

( ) - ( ) * $^2$ * 0.0408 = gallons
Well Depth | Water Level | Well Diameter (in)

## Purging Information

Purge Method: Y Low Flow ___NJDEP 3 Well Volume ___Not Purged ___Other:
Pump: Y Submersible Pump (2 inch) ___Peristaltic ___Positive displacement ___Other:
Pump intake depth: 26' Purge water discharged to: ___Ground X Drum ___Other:
Tubing: ___ Polypropylene Y Teflon-line ___Other: / X New ___Dedicated

| Time (HH:MM) | Temp (°C) | pH (pH units) | D.O. (mg/l) | Cond. (S/cm) | Turb (NTU) | DTW (feet) | Rate (ml/min) | ORP MV | SALTOS | | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 27 | | | | | | 16.15 | | | | | Purge Start |
| 10 29 | 29.59 | 7.02 | 2.04 | 0.200 | 110 | 16.31 | 360 | -125 | .1 | 1.28 | |
| 10 34 | 30.65 | 7.01 | 1.54 | 0.204 | 93 | 16.31 | 320 | -136 | .1 | 1.31 | |
| 10 39 | 31.19 | 7.02 | 1.61 | 0.207 | 92 | 16.34 | 320 | -135 | .1 | 1.32 | |
| 10 44 | 32.14 | 7.01 | 1.87 | 0.210 | 91 | 16.31 | 320 | -131 | .1 | 1.34 | adjusted flow from 300 to 320 |
| 10.49 | 31.47 | 7.05 | 2.13 | 0.200 | 67 | 16.32 | 320 | -110 | .1 | 1.28 | adjusted flow from 480 to 320 |
| 10 54 | 31.75 | 7.02 | 1.88 | 0.206 | 61 | 16.33 | 320 | -123 | .1 | 1.32 | |
| 10 59 | 32.15 | 7.02 | 2.01 | 0.207 | 61 | 16.32 | 320 | -117 | .1 | 1.32 | |
| 11 04 | 31.97 | 7.03 | 2.14 | 0.205 | 61 | 16.32 | 320 | -112 | .1 | 1.32 | |
| 11 09 | 32.01 | 7.04 | 2.24 | 0.205 | 61 | 16.32 | 320 | -110 | .1 | 1.30 | |
| 11 12 | | | | | | | | | | | Sampling |
| | | | | | | | | | | | |
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| | | | | | | | | | | | |
| 1125 | 31.47 | 7.04 | 2.22 | 0.205 | 61 | 16.34 | 320 | -108 | .1 | 1.34 | Post-sampling Measurements |

Total Volume Purged ~31 liters Water Quality Meter(s) Horiba U-22 Enviro set #04

## Sample Information

Groundwater Sample Field ID MW-3 11:15 VO + Sulfate
Sampling Time 1115 Sampling End Time ___ DTW before Sampling ___
Sampling Method ___ Bailer (type: ) ___Same as Above ___Other:
Sampling Observations

- See Page 2 of 2 for Groundwater Sampling Parameters

303629

# GROUNDWATER SAMPLING FORM

McLaren Hart Inc.

Well Number MW-2
State Permit No.
Project Name
Project Number

Sampling Date 3-8-00
Weather Sunny ~95°
Sampled by: SC, NE (initials)

## Well Information

Well Type: ☑ Monitor ___ Other:
Well Construction ☑ PVC ___ Steel ___ Other:
Well Diameter 4 inches
Well Screened interval ___ to ___ feet below TIC
Well Depth (ft below TIC) 31
Well Headspace Reading (PID/FID)
Water Level (ft below TIC) 15.99'
Product Level-if present (ft below TIC)
Well Notes (Odor, well condition, etc.)

Volume of Water in Casing (gallons)

( ) - ( ) * $^2$ * 0.0408 = gallons
Well Depth | Water Level | Well Diameter (in)

## Purging Information

Purge Method: ☑ Low Flow ___ NJDEP 3 Well Volume ___ Not Purged ___ Other:
Pump: ☑ Submersible Pump (2 inch) ___ Peristaltic ___ Positive displacement ___ Other:
Pump intake depth: 26' Purge water discharged to: ___ Ground ☑ Drum ___ Other:
Tubing: ___ Polypropylene ☑ Teflon-line ___ Other: / ☑ New ___ Dedicated

| Time (HH:MM) | Temp (° C) | pH (pH units) | D.O. (mg/L) | Cond. (S/m) | Turb (NTU) | DTW (feet) | Rate (mL/min) | ORP mV | SAL % | TDS g/L | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 16:00 | | | | | | 15.99' | | | | | Purge Start |
| 16:03 | 29.31 | 6.87 | 1.97 | 0.243 | 35 | 16.21 | 500 | 82 | .1 | 1.56 | |
| ~~16:08~~ | ~~29.31~~ | ~~6.87~~ | ~~1.97~~ | ~~0.243~~ | ~~35~~ | ~~16.21~~ | ~~500~~ | ~~82~~ | ~~.1~~ | ~~1.56~~ | SC |
| 16:08 | 30.11 | 6.86 | 1.92 | 0.245 | 75 | 16.22 | 500 | 43 | .1 | 1.57 | |
| 16:15 | 30.55 | 6.87 | 1.95 | 0.246 | 100 | 16.23 | 500 | 29 | .1 | 1.57 | adj. flow from 400 to 500 |
| 16:18 | 31.18 | 6.85 | 2.07 | 0.249 | 97 | 16.24 | 500 | 36 | .1 | 1.58 | adj. flow from 400 to 500 |
| 16:23 | 30.69 | 6.88 | 2.06 | 0.245 | 140 | 16.26 | 500 | 46 | .1 | 1.57 | air bubbles in the line |
| 16:28 | 30.83 | 6.86 | 2.07 | 0.245 | 180 | 16.26 | 500 | 41 | .1 | 1.57 | |
| 16:36 | 30.19 | 6.86 | 1.99 | 0.241 | 270 | 16.33 | 500 | 55 | .1 | 1.54 | adj. flow @ to 500; difficult, surged pump to get flow to rd - then f |
| 16:38 | 30.25 | 6.84 | 1.86 | 0.240 | 210 | 16.35 | 500 | 47 | .1 | 1.53 | |
| 16:43 | 30.38 | 6.83 | 1.79 | 0.239 | 480 | 16.39 | 500 | 45 | .1 | 1.53 | |
| 16:48 | 30.02 | 6.82 | 1.74 | 0.238 | 270 | 16.44 | 500 | 48 | .1 | 1.52 | air bubbles still in tubing |
| 16:53 | 30.02 | 6.82 | 1.61 | 0.232 | 150 | 16.49 | 500 | 51 | .1 | 1.49 | |
| 16:58 | 30.04 | 6.82 | 1.50 | 0.230 | 140 | 16.48 | 500 | 55 | .1 | 1.47 | |
| 17:03 | 29.98 | 6.82 | 1.42 | 0.227 | 120 | 16.52 | 500 | 58 | .1 | 1.45 | |
| 17:05 | | | | | | | | | | | Set up to Sample |
| 17:22 | 29.99 | 6.84 | 1.57 | 0.243 | 150 | 16.54 | 500 | 51 | .1 | 1.55 | Post-sampling Measurements |

Total Volume Purged ~41 liters
Water Quality Meter(s) Horiba-U22 Environet #04

## Sample Information

Groundwater Sample Field ID MW-2 17:08 w/ + sulfate
Sampling Time 1708 Sampling End Time ___ DTW before Sampling ___
Sampling Method ___ Bailer (type: ) ___ Same as Above ___ Other:
Sampling Observations

- See Page 2 of 2 for Groundwater Sampling Parameters

303630

# GROUNDWATER SAMPLING FORM

McLaren Hart Inc.

Well Number MW-1
State Permit No.
Project Name
Project Number

Sampling Date 3-9-00
Weather Sunny ~90, Humid
Sampled by: SC, DE (initials)

## Well Information

Well Type: ✓ Monitor ___ Other:
Well Construction ✓ PVC ___ Steel ___ Other:
Well Diameter 4 inches
Well Screened interval ___ to ___ feet below TIC
Well Depth (ft below TIC) 33
Well Headspace Reading (PID/FID)
Water Level (ft below TIC) 14.61
Product Level-if present (ft below TIC)
Well Notes (Odor, well condition, etc.)

Volume of Water in Casing (gallons)

( ) - ( ) * $^2$ * 0.0408 = gallons
Well Depth | Water Level | Well Diameter (in)

## Purging Information

Purge Method: ✓ Low Flow ___ NJDEP 3 Well Volume ___ Not Purged ___ Other:
Pump: ✓ Submersible Pump (2 inch) ___ Peristaltic ___ Positive displacement ___ Other:
Pump intake depth: 28' Purge water discharged to: ___ Ground ✓ Drum ___ Other:
Tubing: ___ Polypropylene ✓ Teflon-line ___ Other: / ✓ New ___ Dedicated

| Time (HH:MM) | Temp (°C) | pH (pH units) | D.O. (mg/L) | Cond. (S/m) | Turb (NTU) | DTW (feet) | Rate (ml/min) | ORP mV | SAL % | TDS g/L | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 16 | | | | | | 15.70 | S | | | | Purge Start |
| 11 18 | 28.66 | 6.95 | 0.78 | 0.176 | 10 | 15.78 | 500 | -240 | .08 | 1.13 | Slight oil odor |
| 11 23 | 29.16 | 6.94 | 0.36 | 0.177 | 6.1 | 16.02 | 500 | -264 | .08 | 1.13 | |
| 11 28 | 29.33 | 6.93 | 0.32 | 0.178 | 12.4 | 16.30 | 500 | -269 | .08 | 1.14 | |
| 11 33 | 29.14 | 6.92 | 0.29 | 0.178 | 19.0 | 16.41 | 500 | -276 | .08 | 1.14 | |
| 11 38 | 29.57 | 6.87 | 0.25 | 0.179 | 31.6 | 16.61 | 500 | -281 | .08 | 1.15 | Grayish Black Coloring |
| 11 43 | 29.78 | 6.85 | 0.24 | 0.180 | 120.5 | 16.70 | 500 | -281 | .08 | 1.15 | Sample Collected in Bucket |
| 11 48 | 30.04 | 6.83 | 0.23 | 0.181 | 193.5 | 16.74 | 500 | -282 | .08 | 1.15 | |
| 11 53 | 30.01 | 6.78 | 0.21 | 0.181 | 221.0 | 16.81 | 500 | -284 | .09 | 1.16 | Grayish Black Sample |
| 11 58 | 30.05 | 6.76 | 0.21 | 0.181 | 240.0 | 16.85 | 500 | -284 | .09 | 1.16 | |
| 1203 | 30.06 | 6.75 | 0.21 | 0.180 | 249.0 | 16.87 | 500 | -283 | .09 | 1.15 | |
| 1205 | | | | | | | | | | | Setup to Sample |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| 1224 | 30.02 | 6.77 | 0.29 | 0.183 | 119.0 | 17.15 | 500 | -275 | .09 | 1.18 | Post-sampling Measurements |

Total Volume Purged ~ 34 liters
Water Quality Meter(s) Horiba U-22 Cyclement # 05

## Sample Information

Groundwater Sample Field ID MW-1 1210 VO rSulfate
Sampling Time 1210 Sampling End Time ___ DTW before Sampling ___
Sampling Method ___ Bailer (type: ) ___ Same as Above ___ Other:
Sampling Observations

- See Page 2 of 2 for Groundwater Sampling Parameters

303631

# ATTACHMENT E

## DATA VALIDATION SUMMARY AND LABORATORY ANALYTICAL PACKAGE

303632

ALPHA
ENVIRONMENTAL
CONSULTANTS, INC.
Hydrogeology
Site Assessments
Subsurface Investigation
Petroleum Remediation

April 27, 2000

Ms. Katie Roek
McLaren/Hart, Inc.
25 Independence Blvd.
Warren, New Jersey 07059

Re: Data Validation
Island Chemical Project

Dear Ms. Roek:

The data validation summary for the Island Chemical Project is attached to this letter. The data for Pace Analytical Services, Inc. SDG 201382 were acceptable, with minor issues which are identified in the QA/QC reviews. The data packs did not contain any data that were rejected (R).

If you have any questions concerning the work performed, please contact me at (518) 783-1805. Thank you for the opportunity to assist McLaren/Hart.

Sincerely,
Alpha Environmental Consultants, Inc.

Donald Anné

Donald Anné
Senior Chemist

DCA:dca
attachments

d:\...\aeci\dataval\island\roek3.ltr

303633

1071 Troy-Schenectady Road • Latham, New York 12110 • (518) 783-1805 • FAX (518) 783-1793

ALPHA
ENVIRONMENTAL
CONSULTANTS, INC.
Hydrogeology
Site Assessments
Subsurface Investigation
Petroleum Remediation

**QA/QC Review of Volatiles Data for**
**Pace Analytical Services, Inc.**
**SDG No. 201382**

Prepared by: Don Anné
April 27, 2000

Holding Times: Samples were analyzed within holding times.

GC/MS Tuning and Mass Calibration: All BFB tuning criteria were within control limits.

Initial Calibration: All compounds with contract criteria for %RSDs met those requirements. The RRFs for 1,1,2,2-tetrachloroethane (0.386, 0.417, 0.416, and 0.409) were below the contractual minimum (0.500). No action is taken on two or fewer compounds per calibration outside contract limits as long as %RSDs are not above 40% and RRFs are not below 0.010.

The average RRFs for target compounds were above the allowable minimum (0.050), as required. The %RSD for acetone (31.15%) was above the allowable maximum (30%). Results for acetone should be considered estimates (J).

Continuing Calibration: All compounds with contract criteria for %Ds met those requirements. The RRF50 for 1,1,2,2-tetrachloroethane (0.386) was above the contractual maximum (25%) on 04-06-00 (0406K05.D). The RRF50 for 1,1,2,2-tetrachloroethane (0.428) was above the contractual maximum (25%) on 04-08-00 (0408K02.D). The RRF50 for 1,1,2,2-tetrachloroethane (0.430) was above the contractual maximum (25%) on 04-10-00 (0410K02.D). No action is taken on two or fewer compounds per calibration outside contract limits as long as %Ds are below 40% and RRF50s are above 0.010.

The RRF50s for target compounds were above the allowable minimum (0.050) and %Ds were below the allowable maximum (25%), as required.

Blanks: Method blank 01908B1K16 contained a trace of methylene chloride (13.4 ug/L). Trip blank TRIPBLANK contained a trace of methylene chloride (1.40 ug/L). Trip blank TB033100 contained a trace of methylene chloride (4.30 ug/L). Field blank FB032900 contained a trace of methylene chloride (1.40 ug/L). Field blank FB033000B contained traces of acetone (18.7 ug/L), methylene chloride (2.00 ug/L), and xylene (1.30 ug/L). Field blank FB033000A contained traces of acetone (16.3 ug/L) and methylene chloride (3.60 ug/L). Field blank FB033100B contained traces of acetone (19.8 ug/L) and methylene chloride (2.80 ug/L). Field blank FB033100A contained traces of acetone (20.0 ug/L) and



303634

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methylene chloride (3.00 ug/L).

Results for acetone and methylene chloride less than ten times the highest associated blank should be considered not detected (U) in samples. Results for xylene less than five times the highest associated blank should be considered not detected (U) in samples.

Internal Standard Area Summary: All internal standard areas and retention times for reported results were within control limits.

Surrogate Recovery: All surrogate recoveries were within control limits.

Matrix Spike/Matrix Spike Duplicate: All relative percent differences and percent recoveries for MS/MSD samples in batch 02231 were within QC limits.

Laboratory Control Sample: All percent recoveries for water LCSs in batch 02231 were within QC limits.

Compound ID: Checked compounds were within quantitation limits. All positive hit compounds contained the primary and secondary ions in the mass spectra as specified in the method.



303635

ALPHA
ENVIRONMENTAL
CONSULTANTS, INC.
Hydrogeology
Site Assessments
Subsurface Investigation
Petroleum Remediation

April 5, 2000

Ms. Katie Roek
McLaren/Hart, Inc.
25 Independence Blvd.
Warren, New Jersey 07059

Re: Data Validation
Island Chemical Project

Dear Ms. Roek:

The data validation summaries for the Island Chemical Project are attached to this letter. The data for Pace Analytical SDGs 20902 and 201156 were acceptable, with only minor issues, which are identified in the QA/QC reviews. The data packs did not contain any data that were rejected (R).

If you have any questions concerning the work performed, please contact me at (518) 783-1805. Thank you for the opportunity to assist McLaren/Hart.

Sincerely,
Alpha Environmental Consultants, Inc

Donald Anné

Donald Anné
Senior Chemist

DCA:dca
attachments

d:\...\aeci\dataval\island\roek.ltr

303636

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# Data Validation Acronyms

| | |
|---|---|
| AA | Atomic absorption, flame technique |
| BHC | Hexachlorocyclohexane |
| BFB | Bromofluorobenzene |
| CCB | Continuing calibration blank |
| CCV | Continuing calibration verification |
| CN | Cyanide |
| CRDL | Contract required detection limit |
| CRQL | Contract required quantitation limit |
| CVAA | Atomic adsorption, cold vapor technique |
| DCAA | 2,4-Dichlophenylacetic acid |
| DCB | Decachlorobiphenyl |
| DFTPP | Decafluorotriphenyl phosphine |
| ECD | Electron capture detector |
| FAA | Atomic absorption, furnace technique |
| FID | Flame ionization detector |
| FNP | 1-Fluoronaphthalene |
| GC | Gas chromatography |
| GC/MS | Gas chromatography/mass spectrometry |
| GPC | Gel permeation chromatography |
| Hg | Mercury |
| ICB | Initial calibration blank |
| ICP | Inductively coupled plasma-atomic emission spectrometer |
| ICV | Initial calibration verification |
| IDL | Instrument detection limit |
| IS | Internal standard |
| LCS | Laboratory control sample |
| LCS/LCSD | Laboratory control sample/laboratory control sample duplicate |
| MSA | Method of standard additions |
| MS/MSD | Matrix spike/matrix spike duplicate |
| PID | Photo ionization detector |
| PCB | Polychlorinated biphenyl |
| PCDD | Polychlorinated dibenzodioxins |
| PCDF | Ploychlorinated dibenzofurans |
| PNT | Phenanthrene-d10 |
| QA | Quality assurance |
| QC | Quality control |
| RF | Response factor |
| RPD | Relative percent difference |
| RRF | Relative response factor |
| RRF(number) | Relative response factor at concentration of the number following |
| RT | Retention time |
| RRT | Relative retention time |
| SDG | Sample delivery group |
| TCX | Tetrachloro-m-xylene |
| %D | Percent difference |
| %R | Percent recovery |
| %RSD | Percent relative standard deviation |

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Hydrogeology
Site Assessments
Subsurface Investigation
Petroleum Remediation

**QA/QC Review of Volatiles Data for**
**Pace Analytical Services, Inc.**
**SDG No. 20902**

Prepared by: Don Anné
April 5, 2000

Holding Times: Samples were analyzed within holding times.

GC/MS Tuning and Mass Calibration: All BFB tuning criteria were within control limits.

Initial Calibration: All compounds with contract criteria for %RSDs met those requirements. The RRF for 1,1,2,2-tetrachloroethane (0.490) was below the contractual minimum (0.500) on 03-04-00. No action is taken on two or fewer compounds per calibration outside contract limits as long as %RSDs are below 40% and RRFs are above 0.010.

The average RRFs for target compounds were above the allowable minimum (0.050) and %RSDs were below the allowable maximum (30%), as required.

Continuing Calibration: All compounds with contract criteria for %Ds met those requirements. The RRF50 for 1,1,2,2-tetrachloroethane (0.490) was below the contractual minimum (0.500) on 02-14-00 (0214K04.D). No action is taken on two or fewer compounds per calibration outside contract limits as long as %Ds are below 40% and RRF50s are above 0.010.

The RRF50s for target compounds were above the allowable minimum (0.050) and %Ds were below the allowable maximum (25%), as required.

Blanks: Method and trip blanks reported target compounds as not detected.

Internal Standard Area Summary: All internal standard areas and retention times for reported results were within control limits.

Surrogate Recovery: All surrogate recoveries were within control limits.

Matrix Spike/Matrix Spike Duplicate: All relative percent differences and percent recoveries for the MS/MSD sample in batch 01355 were within QC limits.



303638

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Laboratory Control Sample: All percent recoveries for the water LCS in batch 01355 were within QC limits.

Compound ID: Checked compounds were within quantitation limits. All positive hit compounds contained the primary and secondary ions in the mass spectra as specified in the method.



303639

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Hydrogeology
Site Assessments
Subsurface Investigation
Petroleum Remediation

**QA/QC Review of Volatiles Data for**
**Pace Analytical Services, Inc.**
**SDG No. 201156**

Prepared by: Don Anné
April 5, 2000

Holding Times: Samples were analyzed within holding times.

GC/MS Tuning and Mass Calibration: All BFB tuning criteria were within control limits.

Initial Calibration: All compounds with contract criteria for %RSDs met those requirements. The RRF for 1,1,2,2-tetrachloroethane (0.496) was below the contractual minimum (0.500) on 03-04-00. No action is taken on two or fewer compounds per calibration outside contract limits as long as %RSDs are below 40% and RRFs are above 0.010.

The average RRFs for target compounds were above the allowable minimum (0.050) and %RSDs were below the allowable maximum (30%), as required.

Continuing Calibration: All compounds with contract criteria for RRF50s met those requirements. The %D for 1,2-dichloroethane (31.0%) was above the contractual maximum (25%) on 03-09-00 (0309K02.D). The %D for vinyl chloride (38.6%) was above the contractual maximum (25%) on 03-14-00 (0314K02.D). No action is taken on two or fewer compounds per calibration outside contract limits as long as %Ds are below 40% and RRF50s are above 0.010.

The RRF50s for target compounds were above the allowable minimum (0.050), as required. The %D for acetone (35.2%) was above the allowable maximum (25%) on 03-09-00 (0309K02.D). The %D for acetone (34.6%) was above the allowable maximum (25%) on 03-12-00 (0312K02.D). The %D for acetone (27.6%) was above the allowable maximum (25%) on 03-16-00 (0316K02.D). Results for acetone should be considered estimates (J) in associated samples.

Blanks: Method blank 01908B1K16 contained a trace of methylene chloride (13.4 ug/L). Trip blank TB030700 contained a trace of methylene chloride (1.9 ug/L). Trip blank TB030800 contained a trace of methylene chloride (1.5 ug/L). Trip blank TB031000 contained a trace of methylene chloride (2.1 ug/L). Equipment blank EB030800 contained a trace of



303640

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methylene chloride (1.7 ug/L). Field blank FB030900 contained a trace of methylene chloride (3.1 ug/L). Field blank FB031000 contained a trace of methylene chloride (2.4 ug/L). Field blank FB031400 contained traces of acetone (8.5 ug/L), methylene chloride (6.0 ug/L), toluene (3.8 ug/L), and xylene (1.3 ug/L).

Results for acetone, methylene chloride, and toluene less than ten times the highest associated blank should be considered not detected (U) in samples. Results for xylene less than five times the highest associated blank should be considered not detected (U) in samples.

Internal Standard Area Summary: All internal standard areas and retention times for reported results were within control limits.

Surrogate Recovery: All surrogate recoveries were within control limits.

Matrix Spike/Matrix Spike Duplicate: All relative percent differences and percent recoveries for MS/MSD samples in batches 01745, 01896, and 01908 were within QC limits.

Laboratory Control Sample: All percent recoveries for water LCSs in batches 01745, 01896, and 01908 were within QC limits.

Compound ID: Checked compounds were within quantitation limits. All positive hit compounds contained the primary and secondary ions in the mass spectra as specified in the method.

# Report of Laboratory Analysis

## Pace Analytical Services, Inc.

### Single Sample - Protocol

| | | | |
|---|---|---|---|
| Client ID: | TRIP BLANK | Client: | ERTEC |
| Project: | VIRGIN ISLAND | Site: | None |
| Lab ID: | 206999 | Project No.: | 20902 |
| Description: | None | Matrix: | Water |
| Method: | CLP Volatile Organics | Prep Level: | Water |
| | | Units: | ug/l |
| Prep Factor: | 1 | Leached: | n/a |
| | | Prepared: | |

Sample Qu:
% Moisture: 0
Batch: 01355
Target List: SR615MVWAT
Analyzed: 15-Feb-00 00:06 KC

| CAS Number | Parameter | Dilution | Result | Qu | Reporting Limit | Reg. Limit |
|---|---|---|---|---|---|---|
| 67-64-1 | Acetone (2-Propanone, Dimethyl keto | 1 | ND | | 10.0 | |
| 67-66-3 | Chloroform | 1 | ND | | 10.0 | |
| 100-41-4 | Ethylbenzene | 1 | ND | | 10.0 | |
| 75-09-2 | Methylene chloride (Dichloromethane | 1 | ND | | 10.0 | |
| 108-88-3 | Toluene | 1 | ND | | 10.0 | |
| 1330-20-7 | Xylene (total) | 1 | ND | | 10.0 | |

6 compound(s) reported

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of extract. The Prep Factor accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

2 22 00 17:20:47

# Report of Laboratory Analysis

## Pace Analytical Services, Inc.

### Single Sample - Protocol

| | | | | | |
|---|---|---|---|---|---|
| Client ID: | FPP-AS-1GWGRAB | Client: | ERTEC | | |
| Project: | VIRGIN ISLAND | Site: | None | | |
| Lab ID: | 206998 | Project No.: | 20902 | Sample Qu: | |
| Description: | None | Matrix: | Water | % Moisture: | 0 |
| Method: | CLP Volatile Organics | Prep Level: | Water | Batch: | 01355 |
| | | Units: | ug/l | Target List: | SR615MVWAT |
| Prep Factor: | 1 | Leached: | n/a | Prepared: | Analyzed: 14-Feb-00 23:36 KC |

| CAS Number | Parameter | Dilution | Result | Qu | Reporting Limit | Reg. Limit |
|---|---|---|---|---|---|---|
| 67-64-1 | Acetone (2-Propanone, Dimethyl keto | 1 | ND | | 10.0 | |
| 67-66-3 | Chloroform | 1 | 16.4 | | 10.0 | |
| 100-41-4 | Ethylbenzene | 1 | ND | | 10.0 | |
| 75-09-2 | Methylene chloride (Dichloromethane | 1 | 1.10 J | A11 | 10.0 | |
| 108-88-3 | Toluene | 1 | ND | | 10.0 | |
| 1330-20-7 | Xylene (total) | 1 | ND | | 10.0 | |

**6 compound(s) reported**

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of extract. The Prep Factor accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

2-22-00 17:20:47

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

Pace Analytical Services, Inc.
1000 Riverbend Blvd. Suite E
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

Single Sample - Protocol

Client: ERTEC

Client ID: TB031300 | Site: None

Project: VIRGIN ISLAND | Project No.: 201156 | Sample Qu:

Lab ID: 2010020 | Matrix: Water | % Moisture: n/a

Description: None | Prep Level: Water | Batch: 01908

Method: CLP Volatile Organics | Units: ug/l | Target List: SR615MVWAT

Collected: 13-Mar-00 | Received: 16-Mar-00

Prep Factor: 1 | Leached: n/a | Prepared: | Analyzed: 16-Mar-00 13:00 KCB

| CAS Number | Parameter | Dilution | Result | Qu | Reporting Limit | Reg. Limit |
|---|---|---|---|---|---|---|
| 67-64-1 | Acetone (2-Propanone, Dimethyl keto | 1 | ND | | 10.0 | |
| 67-66-3 | Chloroform | 1 | ND | | 10.0 | |
| 100-41-4 | Ethylbenzene | 1 | ND | | 10.0 | |
| 75-09-2 | Methylene chloride (Dichloromethane | 1 | 4.60 | J ~~U~~ A11 | 10.0 | |
| 108-88-3 | Toluene | 1 | ND | | 10.0 | |
| 1330-20-7 | Xylene (total) | 1 | ND | | 10.0 | |

6 compound(s) reported

~~LAA~~ 000707
no qual of
Trip blank

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of extract. The Prep Factor accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.



3/25/00 16:40:57

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

Pace Analytical Services, Inc.
1000 Riverbend Blvd. Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

## Single Sample - Protocol

| | | | | | |
|---|---|---|---|---|---|
| | | Client: | ERTEC | | |
| Client ID: | FB031400 | Site: | None | | |
| Project: | VIRGIN ISLAND | Project No.: | 201156 | Sample Qu: | |
| Lab ID: | 2010026 | Matrix: | Water | % Moisture: | n/a |
| Description: | None | Prep Level: | Water | Batch: | 01908 |
| Method: | CLP Volatile Organics | Units: | ug/l | Target List: | SR615MVWAT |
| | | Collected: | 14-Mar-00 | Received: | 16-Mar-00 |
| Prep Factor: | 1 | Leached: n/a | Prepared: | Analyzed: | 23-Mar-00 16:37 DET |

| CAS Number | Parameter | Dilution | Result | Qu | Reporting Limit | Reg. Limit |
|---|---|---|---|---|---|---|
| 67-64-1 | Acetone (2-Propanone, Dimethyl keto | 1 | 8.50 J | A11 | 10.0 | |
| 67-66-3 | Chloroform | 1 | ND | | 10.0 | |
| 100-41-4 | Ethylbenzene | 1 | ND | | 10.0 | |
| 75-09-2 | Methylene chloride (Dichloromethane | 1 | 6.00 J | A11 | 10.0 | |
| 108-88-3 | Toluene | 1 | 3.80 J | | 10.0 | |
| 1330-20-7 | Xylene (total) | 1 | 1.30 J | | 10.0 | |

6 compound(s) reported

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of extract. The Prep Factor accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.



3/28/00 16:40:59

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

Pace Analytical Services, Inc.
1000 Riverbend Blvd. Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

## Single Sample - Protocol

Client: ERTEC

Client ID: TB030700 | Site: None

Project: VIRGIN ISLAND | Project No.: 201156 | Sample Qu:

Lab ID: 209419 | Matrix: Water | % Moisture: n/a

Description: None | Prep Level: Water | Batch: 01745

Method: CLP Volatile Organics | Units: ug/l | Target List: SR615MVWAT

Collected: 07-Mar-00 | Received: 08-Mar-00

Prep Factor: 1 | Leached: n/a | Prepared: | Analyzed: 10-Mar-00 19:41 KCB

| CAS Number | Parameter | Dilution | Result | Qu | Reporting Limit | Reg. Limit |
|---|---|---|---|---|---|---|
| 67-64-1 | Acetone (2-Propanone, Dimethyl keto | 1 | ND | | 10.0 | |
| 67-66-3 | Chloroform | 1 | ND | | 10.0 | |
| 100-41-4 | Ethylbenzene | 1 | ND | | 10.0 | |
| 75-09-2 | Methylene chloride (Dichloromethane | 1 | 1.90 J | A11 | 10.0 | |
| 108-88-3 | Toluene | 1 | ND | | 10.0 | |
| 1330-20-7 | Xylene (total) | 1 | ND | | 10.0 | |

*6 compound(s) reported*

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of extract. The Prep Factor accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3.28.00 16:40:59

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

Pace Analytical Services, Inc.
1000 Riverbend Blvd. Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

## Single Sample - Protocol

Client: ERTEC

Client ID: MW-15 | Site: None

Project: VIRGIN ISLAND | Project No.: 201156 | Sample Qu:

Lab ID: 209420 | Matrix: Water | % Moisture: n/a

Description: None | Prep Level: Water | Batch: 01745

Method: CLP Volatile Organics | Units: ug/l | Target List: SR615MVWAT

Collected: 07-Mar-00 | Received: 08-Mar-00

Prep Factor: 1 | Leached: n/a | Prepared: | Analyzed: 10-Mar-00 20:11 KCB

| CAS Number | Parameter | Dilution | Result | Qu | Reporting Limit | Reg. Limit |
|---|---|---|---|---|---|---|
| 67-64-1 | Acetone (2-Propanone, Dimethyl keto | 1 | ND | | 10.0 | |
| 67-66-3 | Chloroform | 1 | 9.40 | J | 10.0 | |
| 100-41-4 | Ethylbenzene | 1 | ND | | 10.0 | |
| 75-09-2 | Methylene chloride (Dichloromethane | 1 | ~~2.00 J UA~~ 1 | 10U | 10.0 | |
| 108-88-3 | Toluene | 1 | ND | | 10.0 | |
| 1330-20-7 | Xylene (total) | 1 | ND | | 10.0 | |

6 compound(s) reported

LAA000707

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of extract. The Prep Factor accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.



3/28/00 16:41:00

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

## Single Sample - Inorganic Parameters

Pace Analytical Services, Inc.
1000 Riverbend Blvd. Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

**Client ID:** MW-15 **Client:** ERTEC

**Project:** VIRGIN ISLAND **Site:** None

**Lab ID:** 209856 **Project No.:** 201156

**Description:** None **Matrix:** Water **%Moisture:** n/a

**Collected:** 3/7/00 **Received:** 3/14/00

| ParameterName | Method | Batch | DF | Result | Qu | Units | Reporting Limit | Prep. | Analysis | Reg. Limit |
|---|---|---|---|---|---|---|---|---|---|---|
| Sulfate | EPA 375.2 | 02155 | 5 | 186. | | mg/l | 50.0 | | 29-Mar-00 12:03 LAK | |

1 parameter(s) reported

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of final sample. PF denotes sample Prep Factor which accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3/30/00 13:23:30

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

Pace Analytical Services, Inc.
1000 Riverbend Blvd. Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

## Single Sample - Protocol

**Client:** ERTEC

**Client ID:** MW-13 **Site:** None

**Project:** VIRGIN ISLAND **Project No.:** 201156 **Sample Qu:**

**Lab ID:** 209421 **Matrix:** Water **% Moisture:** n/a

**Description:** None **Prep Level:** Water **Batch:** 01745

**Method:** CLP Volatile Organics **Units:** ug/l **Target List:** SR615MVWAT

**Collected:** 07-Mar-00 **Received:** 08-Mar-00

**Prep Factor:** 1 **Leached:** n/a **Prepared:** **Analyzed:** 10-Mar-00 20:42 KCB

| CAS Number | Parameter | Dilution | Result | Qu | Reporting Limit | Reg. Limit |
|---|---|---|---|---|---|---|
| 67-64-1 | Acetone (2-Propanone, Dimethyl keto | 1 | ND | | 10.0 | |
| 67-66-3 | Chloroform | 1 | ND | | 10.0 | |
| 100-41-4 | Ethylbenzene | 1 | ND | | 10.0 | |
| 75-09-2 | Methylene chloride (Dichloromethane | 1 | ~~1.80 J UA11~~ | 10U | 10.0 | |
| 108-88-3 | Toluene | 1 | ND | | 10.0 | |
| 1330-20-7 | Xylene (total) | 1 | ND | | 10.0 | |

**6 compound(s) reported**

VAH 0002907

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of extract. The Prep Factor accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3.28.00 16:41:00

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

## Single Sample - Inorganic Parameters

Pace Analytical Services, Inc.
1000 Riverbend Blvd. Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

**Client ID:** MW-13 **Client:** ERTEC

**Project:** VIRGIN ISLAND **Site:** None

**Lab ID:** 209857 **Project No.:** 201156

**Description:** None **Matrix:** Water **%Moisture:** n/a

**Collected:** 3/7/00 **Received:** 3/14/00

| ParameterName | Method | Batch | DF | Result | Qu | Units | Reporting Limit | Prep. | Analysis | Reg. Limit |
|---|---|---|---|---|---|---|---|---|---|---|
| Sulfate | EPA 375.2 | 02155 | 5 | 182. | | mg/l | 50.0 | | 29-Mar-00 12:03 LAK | |

1 parameter(s) reported

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of final sample. PF denotes sample Prep Factor which accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3 30 00 13:23:31

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

Pace Analytical Services, Inc.
1000 Riverbend Blvd. Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

## Single Sample - Protocol

Client: ERTEC

Client ID: MW-11 | Site: None

Project: VIRGIN ISLAND | Project No.: 201156 | Sample Qu:

Lab ID: 209590 | Matrix: Water | % Moisture: n/a

Description: None | Prep Level: Water | Batch: 01745

Method: CLP Volatile Organics | Units: ug/l | Target List: SR615MVWAT

Collected: 08-Mar-00 | Received: 10-Mar-00

Prep Factor: 1 | Leached: n/a | Prepared: | Analyzed: 10-Mar-00 21:12 KCB

| CAS Number | Parameter | Dilution | Result | Qu | Reporting Limit | Reg. Limit |
|---|---|---|---|---|---|---|
| 67-64-1 | Acetone (2-Propanone, Dimethyl keto | 1 | ND | | 10.0 | |
| 67-66-3 | Chloroform | 1 | 40.4 | | 10.0 | |
| 100-41-4 | Ethylbenzene | 1 | ND | | 10.0 | |
| 75-09-2 | Methylene chloride (Dichloromethane | 1 | ~~180 JU~~ 10U | | 10.0 | |
| 108-88-3 | Toluene | 1 | ND | | 10.0 | |
| 1330-20-7 | Xylene (total) | 1 | ND | | 10.0 | |

6 compound(s) reported

KCB 032107

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of extract. The Prep Factor accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3.28.00 16:41:00

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

## Single Sample - Inorganic Parameters

Pace Analytical Services, Inc.
1000 Riverbend Blvd. Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

**Client ID:** MW-11 **Client:** ERTEC

**Project:** VIRGIN ISLAND **Site:** None

**Lab ID:** 209858 **Project No.:** 201156

**Description:** None **Matrix:** Water **%Moisture:** n/a

**Collected:** 3/8/00 **Received:** 3/14/00

| ParameterName | Method | Batch | DF | Result | Qu | Units | Reporting Limit | Prep. | Analysis | Reg. Limit |
|---|---|---|---|---|---|---|---|---|---|---|
| Sulfate | EPA 375.2 | 02155 | 5 | 243. | | mg/l | 50.0 | | 29-Mar-00 12:03 LAK | |

1 parameter(s) reported

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of final sample. PF denotes sample Prep Factor which accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3:30:00 13:23:31

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

Pace Analytical Services, Inc.
1000 Riverbend Blvd. Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

## Single Sample - Protocol

| | | | |
|---|---|---|---|
| | | Client: | ERTEC |
| Client ID: | TB030800 | Site: | None |
| Project: | VIRGIN ISLAND | Project No.: | 201156 |
| Lab ID: | 209591 | Matrix: | Water |
| Description: | None | Prep Level: | Water |
| Method: | CLP Volatile Organics | Units: | ug/l |
| | | Collected: | 08-Mar-00 |
| Prep Factor: | 1 | Leached: | n/a |
| | | Prepared: | |

Sample Qu:
% Moisture: n/a
Batch: 01745
Target List: SR615MVWAT
Received: 10-Mar-00
Analyzed: 11-Mar-00 14:26 KCB

| CAS Number | Parameter | Dilution | Result | Qu | Reporting Limit | Reg. Limit |
|---|---|---|---|---|---|---|
| 67-64-1 | Acetone (2-Propanone, Dimethyl keto | 1 | ND | | 10.0 | |
| 67-66-3 | Chloroform | 1 | ND | | 10.0 | |
| 100-41-4 | Ethylbenzene | 1 | ND | | 10.0 | |
| 75-09-2 | Methylene chloride (Dichloromethane | 1 | 1.50 J | A11 | 10.0 | |
| 108-88-3 | Toluene | 1 | ND | | 10.0 | |
| 1330-20-7 | Xylene (total) | 1 | ND | | 10.0 | |

6 compound(s) reported

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of extract. The Prep Factor accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

Pace Analytical Services, Inc.
1000 Riverbend Blvd, Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

## Single Sample - Protocol

**Client:** ERTEC

**Client ID:** MW-3 **Site:** None

**Project:** VIRGIN ISLAND **Project No.:** 201156 **Sample Qu:**

**Lab ID:** 209592 **Matrix:** Water **% Moisture:** n/a

**Description:** None **Prep Level:** Water **Batch:** 01745

**Method:** CLP Volatile Organics **Units:** ug/l **Target List:** SR615MVWAT

**Collected:** 08-Mar-00 **Received:** 10-Mar-00

**Prep Factor:** 1 **Leached:** n/a **Prepared:** **Analyzed:** 12-Mar-00 12:18 KCB

| CAS Number | Parameter | Dilution | Result | Qu | Reporting Limit | Reg. Limit |
|---|---|---|---|---|---|---|
| 67-64-1 | Acetone (2-Propanone, Dimethyl keto | 1 | ND | | 10.0 | |
| 67-66-3 | Chloroform | 1 | ND | | 10.0 | |
| 100-41-4 | Ethylbenzene | 1 | ND | | 10.0 | |
| 75-09-2 | Methylene chloride (Dichloromethane | 1 | ~~1.10~~ 1.0 | U | 10.0 | |
| 108-88-3 | Toluene | 1 | ND | | 10.0 | |
| 1330-20-7 | Xylene (total) | 1 | ND | | 10.0 | |

6 compound(s) reported

CRW 030707

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of extract. The Prep Factor accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

## Single Sample - Inorganic Parameters

Pace Analytical Services, Inc.
1000 Riverbend Blvd. Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

**Client ID:** MW-3 **Client:** ERTEC

**Project:** VIRGIN ISLAND **Site:** None

**Lab ID:** 209859 **Project No.:** 201156

**Description:** None **Matrix:** Water **%Moisture:** n/a

**Collected:** 3/8/00 **Received:** 3/14/00

| ParameterName | Method | Batch | DF | Result | Qu | Units | Reporting Limit | Prep. | Analysis | Reg. Limit |
|---|---|---|---|---|---|---|---|---|---|---|
| Sulfate | EPA 375.2 | 02155 | 5 | 194. | | mg/l | 50.0 | | 29-Mar-00 12:03 LAK | |

1 parameter(s) reported

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of final sample. PF denotes sample Prep Factor which accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3 30 00 13:23:31

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

Pace Analytical Services, Inc.
1000 Riverbend Blvd, Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

## Single Sample - Protocol

| | | | |
|---|---|---|---|
| | | Client: | ERTEC |
| Client ID: | MW-7 | Site: | None |
| Project: | VIRGIN ISLAND | Project No.: | 201156 |
| Lab ID: | 209593 | Matrix: | Water |
| Description: | None | Prep Level: | Water |
| Method: | CLP Volatile Organics | Units: | ug/l |
| | | Collected: | 08-Mar-00 |
| Prep Factor: | 1 | Leached: | n/a |
| | | Prepared: | |

Sample Qu:
% Moisture: n/a
Batch: 01745
Target List: SR615MVWAT
Received: 10-Mar-00
Analyzed: 11-Mar-00 15:27 KCB

| CAS Number | Parameter | Dilution | Result | Qu | Reporting Limit | Reg. Limit |
|---|---|---|---|---|---|---|
| 67-64-1 | Acetone (2-Propanone, Dimethyl keto | 1 | ND | | 10.0 | |
| 67-66-3 | Chloroform | 1 | 1.50 | J | 10.0 | |
| 100-41-4 | Ethylbenzene | 1 | ND | | 10.0 | |
| 75-09-2 | Methylene chloride (Dichloromethane | 1 | ~~1.40~~ | ~~J~~ U ALL | 10.0 | |
| 108-88-3 | Toluene | 1 | ND | | 10.0 | |
| 1330-20-7 | Xylene (total) | 1 | ND | | 10.0 | |

10U

6 compound(s) reported

UNA 03/20/00

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of extract. The Prep Factor accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3/28/00 16:41:01

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

## Single Sample - Inorganic Parameters

Pace Analytical Services, Inc.
1000 Riverbend Blvd. Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

**Client ID:** MW-7 **Client:** ERTEC

**Project:** VIRGIN ISLAND **Site:** None

**Lab ID:** 209860 **Project No.:** 201156

**Description:** None **Matrix:** Water **%Moisture:** n/a

**Collected:** 3/8/00 **Received:** 3/14/00

| ParameterName | Method | Batch | DF | Result | Qu | Units | Reporting Limit | Prep. | Analysis | | Reg. Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sulfate | EPA 375.2 | 02155 | 5 | 195. | | mg/l | 50.0 | | 29-Mar-00 | 12:03 LAK | |

1 parameter(s) reported

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of final sample. PF denotes sample Prep Factor which accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3/30/00 13:23:31

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

Pace Analytical Services, Inc.
1000 Riverbend Blvd. Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

## Single Sample - Protocol

| | | | |
|---|---|---|---|
| | | Client: | ERTEC |
| Client ID: | MW-10 | Site: | None |
| Project: | VIRGIN ISLAND | Project No.: | 201156 |
| Lab ID: | 209594 | Matrix: | Water |
| Description: | None | Prep Level: | Water |
| Method: | CLP Volatile Organics | Units: | ug/l |
| | | Collected: | 07-Mar-00 |
| Prep Factor: | 1 | Leached: | n/a |
| | | Prepared: | |

Sample Qu:
% Moisture: n/a
Batch: 01745
Target List: SR615MVWAT
Received: 10-Mar-00
Analyzed: 11-Mar-00 15:58 KCB

| CAS Number | Parameter | Dilution | Result | Qu | Reporting Limit | Reg. Limit |
|---|---|---|---|---|---|---|
| 67-64-1 | Acetone (2-Propanone, Dimethyl keto | 1 | ND | | 10.0 | |
| 67-66-3 | Chloroform | 1 | ND | | 10.0 | |
| 100-41-4 | Ethylbenzene | 1 | ND | | 10.0 | |
| 75-09-2 | Methylene chloride (Dichloromethane | 1 | ~~1.20~~ | ~~J U A H~~ 10U | 10.0 | |
| 108-88-3 | Toluene | 1 | ND | | 10.0 | |
| 1330-20-7 | Xylene (total) | 1 | ND | | 10.0 | |

6 compound(s) reported

UAP 000109

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of extract. The Prep Factor accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3/28/00 16:41:01

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

## Single Sample - Inorganic Parameters

Pace Analytical Services, Inc.
1000 Riverbend Blvd, Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

**Client ID:** MW-10 **Client:** ERTEC
**Project:** VIRGIN ISLAND **Site:** None
**Lab ID:** 209861 **Project No.:** 201156
**Description:** None **Matrix:** Water **%Moisture:** n/a
**Collected:** 3/7/00 **Received:** 3/14/00

| ParameterName | Method | Batch | DF | Result | Qu | Units | Reporting Limit | Prep. | Analysis | Reg. Limit |
|---|---|---|---|---|---|---|---|---|---|---|
| Sulfate | EPA 375.2 | 02155 | 5 | 286. | | mg/l | 50.0 | | 29-Mar-00 12:03 LAK | |

1 parameter(s) reported

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of final sample. PF denotes sample Prep Factor which accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3 30 00 13:23:32

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

Pace Analytical Services, Inc.
1000 Riverbend Blvd. Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

**Single Sample - Protocol**

**Client:** ERTEC

**Client ID:** MW-2 **Site:** None

**Project:** VIRGIN ISLAND **Project No.:** 201156 **Sample Qu:**

**Lab ID:** 209595 **Matrix:** Water **% Moisture:** n/a

**Description:** None **Prep Level:** Water **Batch:** 01745

**Method:** CLP Volatile Organics **Units:** ug/l **Target List:** SR615MVWAT

**Collected:** 08-Mar-00 **Received:** 10-Mar-00

**Prep Factor:** 1 **Leached:** n/a **Prepared:** **Analyzed:** 12-Mar-00 12:49 KCB

| CAS Number | Parameter | Dilution | Result | Qu | Reporting Limit | Reg. Limit |
|---|---|---|---|---|---|---|
| 67-64-1 | Acetone (2-Propanone, Dimethyl keto | 1 | ND | | 10.0 | |
| 67-66-3 | Chloroform | 1 | 37.0 | | 10.0 | |
| 100-41-4 | Ethylbenzene | 1 | ND | | 10.0 | |
| 75-09-2 | Methylene chloride (Dichloromethane | 1 | ~~1.20 J UAH~~ | 10 U | 10.0 | |
| 108-88-3 | Toluene | 1 | ND | | 10.0 | |
| 1330-20-7 | Xylene (total) | 1 | ND | | 10.0 | |

6 compound(s) reported

VBA 032107

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of extract. The Prep Factor accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3/28/00 16:41:01

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

## Single Sample - Inorganic Parameters

Pace Analytical Services, Inc.
1000 Riverbend Blvd. Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

**Client ID:** MW-2 **Client:** ERTEC

**Project:** VIRGIN ISLAND **Site:** None

**Lab ID:** 209862 **Project No.:** 201156

**Description:** None **Matrix:** Water **%Moisture:** n/a

**Collected:** 3/8/00 **Received:** 3/14/00

| ParameterName | Method | Batch | DF | Result | Qu | Units | Reporting Limit | Prep. | Analysis | Reg. Limit |
|---|---|---|---|---|---|---|---|---|---|---|
| Sulfate | EPA 375.2 | 02155 | 5 | 151. | | mg/l | 50.0 | | 29-Mar-00 12:03 LAK | |

1 parameter(s) reported

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of final sample. PF denotes sample Prep Factor which accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3-30-00 13:23:32

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

Pace Analytical Services, Inc.
1000 Riverbend Blvd. Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

**Single Sample - Protocol**

| | | | |
|---|---|---|---|
| | | **Client:** ERTEC | |
| **Client ID:** MW-8 | | **Site:** None | |
| **Project:** VIRGIN ISLAND | | **Project No.:** 201156 | **Sample Qu:** |
| **Lab ID:** 209596 | | **Matrix:** Water | **% Moisture:** n/a |
| **Description:** None | | **Prep Level:** Water | **Batch:** 01745 |
| **Method:** CLP Volatile Organics | | **Units:** ug/l | **Target List:** SR615MVWAT |
| | | **Collected:** 08-Mar-00 | **Received:** 10-Mar-00 |
| **Prep Factor:** 1 | **Leached:** n/a | **Prepared:** | **Analyzed:** 11-Mar-00 17:28 KCB |

| CAS Number | Parameter | Dilution | Result | Qu | Reporting Limit | Reg. Limit |
|---|---|---|---|---|---|---|
| 67-64-1 | Acetone (2-Propanone, Dimethyl keto | 1 | ND | | 10.0 | |
| 67-66-3 | Chloroform | 1 | ND | | 10.0 | |
| 100-41-4 | Ethylbenzene | 1 | ND | | 10.0 | |
| 75-09-2 | Methylene chloride (Dichloromethane | 1 | ~~1.10~~ 1 U ALL | 10 U | 10.0 | |
| 108-88-3 | Toluene | 1 | ND | | 10.0 | |
| 1330-20-7 | Xylene (total) | 1 | ND | | 10.0 | |

6 compound(s) reported

VAA 000207

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of extract. The Prep Factor accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3/28/00 16:41:02

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

## Single Sample - Inorganic Parameters

Pace Analytical Services, Inc.
1000 Riverbend Blvd. Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

**Client ID:** MW-8 **Client:** ERTEC
**Project:** VIRGIN ISLAND **Site:** None
**Lab ID:** 209863 **Project No.:** 201156
**Description:** None **Matrix:** Water **%Moisture:** n/a
**Collected:** 3/8/00 **Received:** 3/14/00

| ParameterName | Method | Batch | DF | Result | Qu | Units | Reporting Limit | Prep. | Analysis | Reg. Limit |
|---|---|---|---|---|---|---|---|---|---|---|
| Sulfate | EPA 375.2 | 02155 | 1 | 74.6 | | mg/l | 10.0 | | 29-Mar-00 12:03 LAK | |

1 parameter(s) reported

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of final sample. PF denotes sample Prep Factor which accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3/30/00 13:23:32

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

Pace Analytical Services, Inc.
1000 Riverbend Blvd. Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

## Single Sample - Protocol

Client ID: MW-80 8D 7/13/00
Client: ERTEC
Site: None
Project: VIRGIN ISLAND
Project No.: 201156
Sample Qu:
Lab ID: 209597
Matrix: Water
% Moisture: n/a
Description: None
Prep Level: Water
Batch: 01745
Method: CLP Volatile Organics
Units: ug/l
Target List: SR615MVWAT
Collected: 08-Mar-00
Received: 10-Mar-00
Prep Factor: 1
Leached: n/a
Prepared:
Analyzed: 11-Mar-00 17:58 KCB

| CAS Number | Parameter | Dilution | Result | Qu | Reporting Limit | Reg. Limit |
|---|---|---|---|---|---|---|
| 67-64-1 | Acetone (2-Propanone, Dimethyl keto | 1 | ND | | 10.0 | |
| 67-66-3 | Chloroform | 1 | ND | | 10.0 | |
| 100-41-4 | Ethylbenzene | 1 | ND | | 10.0 | |
| 75-09-2 | Methylene chloride (Dichloromethane | 1 | ND | | 10.0 | |
| 108-88-3 | Toluene | 1 | ND | | 10.0 | |
| 1330-20-7 | Xylene (total) | 1 | ND | | 10.0 | |

6 compound(s) reported

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of extract. The Prep Factor accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3-28-00 16:41:02

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

Pace Analytical Services, Inc.
1000 Riverbend Blvd. Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

Single Sample - Protocol

Client: ERTEC

Client ID: EB030800 (Room F)
Site: None
Project: VIRGIN ISLAND
Project No.: 201156
Sample Qu:
Lab ID: 209598
Matrix: Water
% Moisture: n/a
Description: None
Prep Level: Water
Batch: 01745
Method: CLP Volatile Organics
Units: ug/l
Target List: SR615MVWAT
Collected: 08-Mar-00
Received: 10-Mar-00
Prep Factor: 1
Leached: n/a
Prepared:
Analyzed: 11-Mar-00 18:28 KCB

| CAS Number | Parameter | Dilution | Result | Qu | Reporting Limit | Reg. Limit |
|---|---|---|---|---|---|---|
| 67-64-1 | Acetone (2-Propanone, Dimethyl keto | 1 | ND | | 10.0 | |
| 67-66-3 | Chloroform | 1 | ND | | 10.0 | |
| 100-41-4 | Ethylbenzene | 1 | ND | | 10.0 | |
| 75-09-2 | Methylene chloride (Dichloromethane | 1 | 1.70 J | A11 | 10.0 | |
| 108-88-3 | Toluene | 1 | ND | | 10.0 | |
| 1330-20-7 | Xylene (total) | 1 | ND | | 10.0 | |

6 compound(s) reported

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of extract. The Prep Factor accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.



3/28/00 16:41:02

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

Pace Analytical Services, Inc.
1000 Riverbend Blvd, Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

## Single Sample - Protocol

Client: ERTEC

Client ID: MW-6 | Site: None

Project: VIRGIN ISLAND | Project No.: 201156 | Sample Qu:

Lab ID: 209599 | Matrix: Water | % Moisture: n/a

Description: None | Prep Level: Water | Batch: 01745

Method: CLP Volatile Organics | Units: ug/l | Target List: SR615MVWAT

Collected: 09-Mar-00 | Received: 10-Mar-00

Prep Factor: 1 | Leached: n/a | Prepared: | Analyzed: 12-Mar-00 13:19 KCB

| CAS Number | Parameter | Dilution | Result | Qu | Reporting Limit | Reg. Limit |
|---|---|---|---|---|---|---|
| 67-64-1 | Acetone (2-Propanone, Dimethyl keto | 400 | ND | D6 | 4000 | |
| 67-66-3 | Chloroform | 400 | ND | D6 | 4000 | |
| 100-41-4 | Ethylbenzene | 400 | 12400 | D6 | 4000 | |
| 75-09-2 | Methylene chloride (Dichloromethane | 400 | ND | D6 | 4000 | |
| 108-88-3 | Toluene | 400 | ND | D6 | 4000 | |
| 1330-20-7 | Xylene (total) | 400 | 60700 | D6 | 4000 | |

6 compound(s) reported

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of extract. The Prep Factor accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
*For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.*

3/28/00 16:41:03

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

## Single Sample - Inorganic Parameters

Pace Analytical Services, Inc.
1000 Riverbend Blvd. Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

**Client ID:** MW-6 **Client:** ERTEC

**Project:** VIRGIN ISLAND **Site:** None

**Lab ID:** 209864 **Project No.:** 201156

**Description:** None **Matrix:** Water **%Moisture:** n/a

**Collected:** 3/9/00 **Received:** 3/14/00

| ParameterName | Method | Batch | DF | Result | Qu | Units | Reporting Limit | Prep. | Analysis | | | Reg. Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sulfate | EPA 375.2 | 02155 | 1 | 47.4 | | mg/l | 10.0 | | 29-Mar-00 | 12:03 | LAK | |

1 parameter(s) reported

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of final sample. PF denotes sample Prep Factor which accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3/30/00 13:23:32

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

Pace Analytical Services, Inc.
1000 Riverbend Blvd, Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

## Single Sample - Protocol

Client: ERTEC

Client ID: MW-1 | Site: None

Project: VIRGIN ISLAND | Project No.: 201156 | Sample Qu:

Lab ID: 209600 | Matrix: Water | % Moisture: n/a

Description: None | Prep Level: Water | Batch: 01745

Method: CLP Volatile Organics | Units: ug/l | Target List: SR615MVWAT

Collected: 09-Mar-00 | Received: 10-Mar-00

Prep Factor: 1 | Leached: n/a | Prepared: | Analyzed: 12-Mar-00 14:20 KCB

| CAS Number | Parameter | Dilution | Result | Qu | Reporting Limit | Reg. Limit |
|---|---|---|---|---|---|---|
| 67-64-1 | Acetone (2-Propanone, Dimethyl keto | 500 | ND | D6 | 5000 | |
| 67-66-3 | Chloroform | 500 | ND | D6 | 5000 | |
| 100-41-4 | Ethylbenzene | 500 | 19600 | D6 | 5000 | |
| 75-09-2 | Methylene chloride (Dichloromethane | 500 | ~~500~~ ~~JU~~ ATH | 5000 U | 5000 | |
| 108-88-3 | Toluene | 500 | ND | D6 | 5000 | |
| 1330-20-7 | Xylene (total) | 500 | 89000 | D6 | 5000 | |

6 compound(s) reported

LAT 000107

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of extract. The Prep Factor accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3/28/00 16:41:03

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

## Single Sample - Inorganic Parameters

Pace Analytical Services, Inc.
1000 Riverbend Blvd, Suite F
Saint Rose, LA 70087

Phone: 504 469 0333
Fax: 504 469 0555

**Client ID:** MW-1 **Client:** ERTEC
**Project:** VIRGIN ISLAND **Site:** None
**Lab ID:** 209865 **Project No.:** 201156
**Description:** None **Matrix:** Water **%Moisture:** n/a
**Collected:** 3/9/00 **Received:** 3/14/00

| ParameterName | Method | Batch | DF | Result | Qu | Units | Reporting Limit | Prep. | Analysis | Reg. Limit |
|---|---|---|---|---|---|---|---|---|---|---|
| Sulfate | EPA 375.2 | 02155 | 1 | ND | | mg/l | 10.0 | | 29-Mar-00 12:03 LAK | |

1 parameter(s) reported

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of final sample. PF denotes sample Prep Factor which accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3-30-00 13:23:33

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

Pace Analytical Services, Inc.
1000 Riverbend Blvd. Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

## Single Sample - Protocol

Client: ERTEC

Client ID: FB030900 | Site: None

Project: VIRGIN ISLAND | Project No.: 201156 | Sample Qu:

Lab ID: 209846 | Matrix: Water | % Moisture: n/a

Description: None | Prep Level: Water | Batch: 01908

Method: CLP Volatile Organics | Units: ug/l | Target List: SR615MVWAT

Collected: 09-Mar-00 | Received: 14-Mar-00

Prep Factor: 1 | Leached: n/a | Prepared: | Analyzed: 14-Mar-00 16:42 DET

| CAS Number | Parameter | Dilution | Result | Qu | Reporting Limit | Reg. Limit |
|---|---|---|---|---|---|---|
| 67-64-1 | Acetone (2-Propanone, Dimethyl keto | 1 | ND | | 10.0 | |
| 67-66-3 | Chloroform | 1 | ND | | 10.0 | |
| 100-41-4 | Ethylbenzene | 1 | ND | | 10.0 | |
| 75-09-2 | Methylene chloride (Dichloromethane | 1 | 3.10 J | A11 | 10.0 | |
| 108-88-3 | Toluene | 1 | ND | | 10.0 | |
| 1330-20-7 | Xylene (total) | 1 | ND | | 10.0 | |

6 compound(s) reported

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of extract. The Prep Factor accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3 28 00 16:41:03

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

Pace Analytical Services, Inc.
1000 Riverbend Blvd, Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

Single Sample - Protocol

| | | | |
|---|---|---|---|
| | Client: ERTEC | | |
| Client ID: TB031000 | Site: None | | |
| Project: VIRGIN ISLAND | Project No.: 201156 | Sample Qu: | |
| Lab ID: 209848 | Matrix: Water | % Moisture: | n/a |
| Description: None | Prep Level: Water | Batch: | 01908 |
| Method: CLP Volatile Organics | Units: ug/l | Target List: | SR615MVWAT |
| | Collected: 10-Mar-00 | Received: | 14-Mar-00 |
| Prep Factor: 1 | Leached: n/a | Prepared: | Analyzed: 14-Mar-00 17:14 DET |

| CAS Number | Parameter | Dilution | Result | Qu | Reporting Limit | Reg. Limit |
|---|---|---|---|---|---|---|
| 67-64-1 | Acetone (2-Propanone, Dimethyl keto | 1 | ND | | 10.0 | |
| 67-66-3 | Chloroform | 1 | ND | | 10.0 | |
| 100-41-4 | Ethylbenzene | 1 | ND | | 10.0 | |
| 75-09-2 | Methylene chloride (Dichloromethane | 1 | 2.10 J | A11 | 10.0 | |
| 108-88-3 | Toluene | 1 | ND | | 10.0 | |
| 1330-20-7 | Xylene (total) | 1 | ND | | 10.0 | |

6 compound(s) reported

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of extract. The Prep Factor accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

Pace Analytical Services, Inc.
1000 Riverbend Blvd, Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

## Single Sample - Protocol

**Client:** ERTEC

**Client ID:** FB031000 | **Site:** None

**Project:** VIRGIN ISLAND | **Project No.:** 201156 | **Sample Qu:**

**Lab ID:** 209849 | **Matrix:** Water | **% Moisture:** n/a

**Description:** None | **Prep Level:** Water | **Batch:** 01908

**Method:** CLP Volatile Organics | **Units:** ug/l | **Target List:** SR615MVWAT

**Collected:** 10-Mar-00 | **Received:** 14-Mar-00

**Prep Factor:** 1 | **Leached:** n/a | **Prepared:** | **Analyzed:** 14-Mar-00 17:45 DET

| CAS Number | Parameter | Dilution | Result | Qu | Reporting Limit | Reg. Limit |
|---|---|---|---|---|---|---|
| 67-64-1 | Acetone (2-Propanone, Dimethyl keto | 1 | ND | | 10.0 | |
| 67-66-3 | Chloroform | 1 | ND | | 10.0 | |
| 100-41-4 | Ethylbenzene | 1 | ND | | 10.0 | |
| 75-09-2 | Methylene chloride (Dichloromethane | 1 | 2.40 J | A11 | 10.0 | |
| 108-88-3 | Toluene | 1 | ND | | 10.0 | |
| 1330-20-7 | Xylene (total) | 1 | ND | | 10.0 | |

6 compound(s) reported

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of extract. The Prep Factor accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3 28 00 16:41:04

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

Pace Analytical Services, Inc.
1000 Riverbend Blvd, Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

## Single Sample - Protocol

Client: ERTEC

Client ID: MW-12 | Site: None

Project: VIRGIN ISLAND | Project No.: 201156 | Sample Qu:

Lab ID: 209850 | Matrix: Water | % Moisture: n/a

Description: None | Prep Level: Water | Batch: 01908

Method: CLP Volatile Organics | Units: ug/l | Target List: SR615MVWAT

Collected: 10-Mar-00 | Received: 14-Mar-00

Prep Factor: 1 | Leached: n/a | Prepared: | Analyzed: 14-Mar-00 16:11 DET

| CAS Number | Parameter | Dilution | Result | Qu | Reporting Limit | Reg. Limit |
|---|---|---|---|---|---|---|
| 67-64-1 | Acetone (2-Propanone, Dimethyl keto | 1 | ND | | 10.0 | |
| 67-66-3 | Chloroform | 1 | ND | | 10.0 | |
| 100-41-4 | Ethylbenzene | 1 | ND | | 10.0 | |
| 75-09-2 | Methylene chloride (Dichloromethane | 1 | ~~2.00~~ 1.0 | AII 10U | 10.0 | |
| 108-88-3 | Toluene | 1 | ND | | 10.0 | |
| 1330-20-7 | Xylene (total) | 1 | ND | | 10.0 | |

6 compound(s) reported

UAA 000209

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of extract. The Prep Factor accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3/29/00 16:41:04

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

Pace Analytical Services, Inc.
1000 Riverbend Blvd. Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

## Single Sample - Inorganic Parameters

**Client ID:** MW-12 **Client:** ERTEC
**Project:** VIRGIN ISLAND **Site:** None
**Lab ID:** 209866 **Project No.:** 201156
**Description:** None **Matrix:** Water **%Moisture:** n/a
**Collected:** 3/10/00 **Received:** 3/14/00

| ParameterName | Method | Batch | DF | Result | Qu | Units | Reporting Limit | Prep. | Analysis | Reg. Limit |
|---|---|---|---|---|---|---|---|---|---|---|
| Sulfate | EPA 375.2 | 02155 | 5 | 194. | | mg/l | 50.0 | | 29-Mar-00 12:03 LAK | |

1 parameter(s) reported

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of final sample. PF denotes sample Prep Factor which accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3/30/00 13:23:33

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

Pace Analytical Services, Inc.
1000 Riverbend Blvd, Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

Single Sample - Protocol

Client: ERTEC

Client ID: MW-14 | Site: None

Project: VIRGIN ISLAND | Project No.: 201156 | Sample Qu:

Lab ID: 209851 | Matrix: Water | % Moisture: n/a

Description: None | Prep Level: Water | Batch: 01908

Method: CLP Volatile Organics | Units: ug/l | Target List: SR615MVWAT

Collected: 10-Mar-00 | Received: 14-Mar-00

Prep Factor: 1 | Leached: n/a | Prepared: | Analyzed: 14-Mar-00 18:16 DET

| CAS Number | Parameter | Dilution | Result | Qu | Reporting Limit | Reg. Limit |
|---|---|---|---|---|---|---|
| 67-64-1 | Acetone (2-Propanone, Dimethyl keto | 1 | ND | | 10.0 | |
| 67-66-3 | Chloroform | 1 | ND | | 10.0 | |
| 100-41-4 | Ethylbenzene | 1 | ND | | 10.0 | |
| 75-09-2 | Methylene chloride (Dichloromethane | 1 | ~~1.90 J U A11~~ | 10U | 10.0 | |
| 108-88-3 | Toluene | 1 | ND | | 10.0 | |
| 1330-20-7 | Xylene (total) | 1 | ND | | 10.0 | |

6 compound(s) reported

UAA 000307

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of extract. The Prep Factor accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3/28/00 16:41:04

Pace Analytical™
New Orleans Laboratory

# Report of Laboratory Analysis

## Single Sample - Inorganic Parameters

Pace Analytical Services, Inc.
1000 Riverbend Blvd. Suite F
Saint Rose, LA 70087

Phone: 504.469.0333
Fax: 504.469.0555

**Client ID:** MW-14 **Client:** ERTEC
**Project:** VIRGIN ISLAND **Site:** None
**Lab ID:** 209867 **Project No.:** 201156
**Description:** None **Matrix:** Water **%Moisture:** n/a
**Collected:** 3/10/00 **Received:** 3/14/00

| ParameterName | Method | Batch | DF | Result | Qu | Units | Reporting Limit | Prep. | Analysis | Reg. Limit |
|---|---|---|---|---|---|---|---|---|---|---|
| Sulfate | EPA 375.2 | 02155 | 5 | 207. | | mg/l | 50.0 | | 29-Mar-00 12:03 LAK | |

1 parameter(s) reported

ND denotes Not Detected at or above the adjusted reporting limit.
DF denotes Dilution Factor of final sample. PF denotes sample Prep Factor which accounts for a non-routine sample size.
Reporting Limit is corrected for sample size, dilution and moisture content if applicable.
Qu lists qualifiers. Specific qualifiers are defined at the end of the report.
For moisture results, wet denotes result is not corrected for moisture and n/a denotes not applicable.

3/30/00 13:23:33