PROPOSED PLAN OF REMEDIAL ACTION

SCANNED
MAY 1 2 1999
File # DE1092
1096
B8

PROPOSED BIORETENTION SWALE AREA
DRAVO SHIPYARD
RDC/AMER Property
Wilmington, Delaware

DNREC Project No. DE-1092

FEBRUARY 1999

Department of Natural Resources and Environmental Control
Division of Air and Waste Management
Site Investigation and Restoration Branch

TABLE OF CONTENTS

I. INTRODUCTION **3**

II. SITE DESCRIPTION AND HISTORY **4**

SITE DESCRIPTION 4
SITE HISTORY 4

III. INVESTIGATION RESULTS **4**

IV. INTERIM ACTION **5**

V. REMEDIAL ACTION OBJECTIVES **5**

QUALITATIVE REMEDIAL OBJECTIVES 6
QUANTITATIVE REMEDIAL OBJECTIVES 6

VI. PROPOSED REMEDIAL ACTION PLAN **7**

POTENTIAL REMEDIAL ALTERNATIVES 7
Alternative 1: No Further Action 7
Alternative 2: Containment to Impacted Soils 7
Alternative 3: Complete removal of Impacted Materials. 8

VII. EVALUATION OF REMEDIAL ALTERNATIVES **8**

VIII. PROPOSED REMEDIAL ACTION PLAN **9**

IX. PUBLIC PARTICIPATION **9**

LIST OF FIGURES

Figure 1. Location of the Dravo Shipyard Site in Wilmington, Delaware

Figure 2. Site map showing the temporary storm water control measures at the Harbor Associates and Amer properties

Figure 3. Site map showing approximate locations of soil samples collected during the 1998 Phase I investigation

Figure 4. Site map showing the temporary storm water control measures and soil sampling locations at the Harbor Associates and Amer properties

Figure 5. Proposed Bioretention Swale Design Sheet

LIST OF TABLES

Table 1. Target Compound and Target Analyte List

Table 2. Sampling & Analysis Log

Table 3. PAH Analysis by Immunoassay

Table 4. PCB Analysis by Immunoassay

Table 5. Metals Analysis by XRF

Table 6. PAH Analysis by EPA Method 8310

Table 7. SVOC by EPA Method 8270

Table 8. PCB Analysis

Table 9. TAL Metals

Table 10. TCLP Metals Analysis

Table 11. Soil Re-use Levels

I. INTRODUCTION

In April and June 1998, the Department of Natural Resources and Environmental Control ("DNREC" or "Department") under the authority granted by the Hazardous Substance Cleanup Act ("HSCA") (7 Del. C., Ch. 91) reached an agreement with the Riverfront Development Corporation ("RDC") and Harbor Associates to oversee environmental investigation, remediation activities, and redevelopment activities at a 48 acre portion of the former Dravo Shipyard Site located on Madison Street in Wilmington, Delaware (Figures 1 and 2). The former Dravo Naval Shipyard is scheduled to be redeveloped into a catalogue outlet shopping mall, an exhibition center, and related facilities by the Riverfront Development Corporation of Delaware and Harbor Associates.

In the summer of 1998, surface and subsurface soil sampling was completed on 30 of the 48 acres of this section of the Dravo Shipyard (Figure 3). In September of 1998, DNREC issued a Proposed Plan of Remedial Action for the soil and subsoil for this first Phase or Operable Unit (OU I) which did not include the location of the proposed Bioretention Swale.

The scope of this Proposed Plan of Remedial Action includes the area defined by DNREC as the location of the proposed Bioretention Swale immediately adjacent to the '900 Building' area (Figure 3). The scope of this Proposed Plan of Remedial Action is limited to soil and subsoil for the proposed Bioretention Swale (Operable Unit III).

In the spring or early summer 1999, a Proposed Plan of Remedial Action will be issued for all environmental media in the Phase II area (or Operable Unit II) of the project - the remaining 18 acres - which will also include the groundwater on the entire 48 acre site and the sediments in the Christina River adjacent to the entire site.

This Proposed Plan is issued under provisions of the HSCA and the Regulations Governing Hazardous Substance Cleanup ("Regulations"). It presents the Department's assessment of the potential unacceptable health and environmental risks posed by the soils in the proposed Bioretention Swale and plans for further action. This Proposed Plan does not address the groundwater media. The groundwater media will be included as part of OU II for this 48 acre portion of the Dravo Shipyard site.

The Proposed Plan of Remedial Action also includes a comparison of the remedial alternatives with respect to the following criteria: protection of public health, welfare, and the environment, and compliance with applicable laws and regulations.

The Department will provide public notice and opportunity to comment on the Proposed Plan in accordance with Section 12 of the Regulations. At the conclusion of the comment period, the Department, after review and consideration of the comments received, shall issue a final plan of remedial action, which shall designate the selected remedial action.

II. SITE DESCRIPTION AND HISTORY

Site Description

The former Dravo Shipyard consists of approximately 120 acres, and is located southwest of the City of Wilmington business district. The proposed Bioretention Swale (OU III) will encompasses an area approximately 780 linear feet with four separate Bioretention Swales with an average width of 30 feet. The OU III is located on the eastern portion of the former Dravo Shipyard Site adjacent to the Christina River. The majority of the land area occupied by the former Dravo Shipyard has been investigated and will be or has been addressed under separate proposed plans.

Site History

The entire redevelopment area was historically the site of shipbuilding and other heavy industrial activities. Much of the area was reclaimed from marshland by filling with slag and other industrial waste products. Because of its previous industrial use, soil in the area has been impacted by environmental contaminants, including total petroleum hydrocarbons (TPH), heavy metals (lead, arsenic), polychlorinated biphenyls (PCBs) and polynuclear aromatic hydrocarbons (PAHs).

III. INVESTIGATION RESULTS

A total of three environmental investigations have been performed on the Dravo Shipyard area. In July and November 1997, DNREC performed two Brownfield Preliminary Assessment IIs. Soils throughout the property were found to contain significant amounts of organic and inorganic contaminants from historical operations at levels well above screening benchmarks. Primary contaminants of concern were found to be PAHs and Lead. Results indicated the relatively widespread PAH contamination of the shallow and deep soils in the project area. Toxic Characteristics Leaching Procedures (TCLP) analysis indicated that one surface soil sample exceeded the regulatory level for Lead as a hazardous waste.

In June and July 1998, EA Engineering performed a Phase I investigation of 30 acres of the former Dravo Shipyard, including the location of the proposed Bioretention Swale. A total of 160 samples were collected from the site (Figure 3). Twenty-six of these samples were collected from the proposed Bioretention Swale area, and one additional grab sample was collected after the preliminary stormwater controls were installed (Figure 4). Samples were screened initially by the DNREC – SIRB mobile lab for Carcinogenic polynuclear aromatic hydrocarbons (CaPAH) using Ohmicron immunoassay kits and for Total metals, including arsenic, cadmium, chromium, lead, and mercury using an X-ray fluorescence instrument. Additional volatile and semivolatile screening was performed at DNREC-Division of Water Resources Environmental Services Laboratory (DNREC – ESS) and Envirotech Research, Inc., Edison, New Jersey (Tables 3 - 5).

As a result of the mobile laboratory screening, a total 8 samples collected from the proposed Bioretention Swale were submitted to Lancaster Laboratories and Envirotech Research for confirmatory analysis of select parts of the United States Environmental Protection Agency (US EPA) Target Analyte List (Inorganics) and Target Compound List (Organics) (TAL/TCL)

(Table1). Toxicity Characteristic Leaching Procedure (TCLP) analysis was also performed on selected samples exhibiting high concentrations of inorganics according to the XRF screening. The specific parameters that were requested for laboratory confirmatory analysis are listed in Table 2. EA and DNREC selected samples on the basis of moderate or high screening results.

The laboratory confirmed analytical data for the Bioretention Swale revealed a wide range of analytical results (Tables 6 - 10). According to the site-specific soil reuse levels, a majority of samples exhibited one or more analytes or compounds that exceeded the "B" criterion (Table 11). A few areas exhibited exceedences of "C" criterion following confirmatory fixed laboratory analysis. In the areas where TCLP Analysis was performed, no sample failed the criterion (i.e. hazardous waste as defined by the Resource Recovery and Conservation Act {RCRA} was not present in the proposed Bioretention Swale location).

IV. INTERIM ACTION

During the renovation of the adjacent First USA Riverfront Arts Center, parking lots were improved and constructed on the adjacent Harbor Associates Property. Temporary sediment and stormwater control measures were installed in the location of the proposed Bioretention Swale in order to manage any potential parking lot runoff. These measures were installed to prevent the use of the historic stormwater system. Approximately 5,200 cubic yards of soil and materials were excavated and placed under the area now covered by the 900 Building foundation following the Phase I investigation. A minimum of 3 feet of clean select fill was used to line the trench used as the temporary sediment and stormwater basin.

V. REMEDIAL ACTION OBJECTIVES

According to HSCA regulation 8.4(1), during a remedial investigation, remedial action objectives must be established. For the location of the Proposed Bioretention Swale, soil and subsoil environmental media only, remedial action objectives were designed based on the following factors:

- The Bioretention Swale is intended to improve the quality of storm water collected from the adjacent parking areas and building roofs and will act in place of a sealed historic stormwater system.
- Various chemical constituents have impacted soil in the Bioretention Swale. Based on the nature and extent of the contaminants, arsenic, lead, and PAHs have been identified as the primary contaminants of concern.
- Prevention of contact with soils in the side walls and underlying the Bioretention Swale by human and ecological receptors is a primary concern.
- The surrounding land uses are commercial and industrial.
- The site is bordered by the Christina River without a bulkhead between the site and the River.

Qualitative Remedial Objectives

Based on the above factors, the following qualitative remedial action objectives were developed:

- Mitigate discharge and/or release of sediment and soil contaminants from the Bioretention Swale area to the Christina River.
- Prevent future site users from directly contacting the surface and subsurface soils,
- Prevent future construction workers from directly contacting the surface and subsurface soils,
- Ensure no material exceeding regulatory limits for TCLP remains in place,
- Dispose offsite all material exceeding DNREC decision criteria for onsite reuse.

Quantitative Remedial Objectives

Based on the above qualitative remedial action objectives, the following quantitative remedial action objectives for the soil and subsoil environmental media were developed:

- Prevent release of contaminated sediment from the site to the Christina River in exceedence of the DNREC Uniform Risk Based Remediation Standards (URS) for protection of the environment.
- Prevent human contact with soil having an arsenic concentration greater than 60 mg/Kg.
- Prevent human contact with soil having a lead concentration greater than 400 mg/Kg.
- Prevent human contact with soil having a carcinogenic PAH concentration greater than 1 mg/Kg.
- Prevent human contact with soil having a C5 through C8 Aliphatic Hydrocarbons concentration greater than 100 mg/Kg.
- Prevent human contact with soil having a C9 through C12 Aliphatic Hydrocarbons concentration greater than 1000 mg/Kg.
- Prevent human contact with soil having a C9 through C18 Aliphatic Hydrocarbons concentration greater than 1000 mg/Kg.
- Prevent human contact with soil having a C19 through C36 Aliphatic Hydrocarbons concentration greater than 2500 mg/Kg.
- Prevent human contact with soil having a C9 through C10 Aromatic Hydrocarbons concentration greater than 100 mg/Kg.

The quantitative remedial action objectives are based on the DNREC "Final Draft Remediation Standards Guidance Under the Delaware Hazardous Substance Cleanup Act" (February 1998). These objectives are protective of potential human and environmental receptors.

VI. PROPOSED REMEDIAL ACTION PLAN

Potential Remedial Alternatives

To accomplish the described remedial action objectives, three (3) potential remedial alternatives were reviewed for the soil and subsoil environmental media for the project area. These are listed below and discussed further in the following section:

1. No further Action - Construct the Bioretention Swale in accordance with applicable sediment and stormwater regulations without any additional measures to prevent contaminated soil/sediment discharge.

2. Containment of remaining contaminated soils with the impermeable liner in the side wall and underlying the proposed Bioretention Swale. Removal of any materials which fail TCLP standards (i.e. according to laboratory analysis a sample that fails TCLP is considered a hazardous waste and therefore must be disposed of at a hazardous waste facility) or meet 'Z' site specific criterion.

3. Complete removal of soils exceeding site specific unrestricted reuse criterion.

Alternative 1: No Further Action

Under this alternative, the remaining affected soils within the Bioretention Swale would remain in place without a containment system. Alternative 1 would allow the Bioretention Swale to be constructed in accordance with the Regulations governing DNREC's Sediment and Stormwater Program, not taking into account the presence of the remaining contaminated soils.

Alternative 2: Containment to Impacted Soils

This option involves placing an impermeable liner along the bottom of the Bioretention Swale and along the sides of the Bioretention Swale to effectively cap the remaining contaminated soils. The liner along the bottom would prevent the collected stormwater from infiltrating into the remaining impacted materials underlying the Bioretention Swale. The liner along the side walls would prevent the collected stormwater from contacting the impacted materials in place in the Bioretention Swale. A 2 ft. thick mixture of sand and topsoil would be placed on top of the liner, further isolating the impacted soils from the public, from ecological receptors and from direct contact by rain and uncollected surface water discharge. This alternative would also require that a deed restriction would be placed on the site barring non-residential usage and requiring notification and approval from DNREC prior to any future intrusive activity in the project area.

Alternative 3: Complete removal of Impacted Materials.

This alternative would require the removal of all the affected material (i.e. soils that exceed site specific unrestricted reuse criterion and URS values for protection of the environment) within the proposed Bioretention Swale area. Approximately 12 additional feet off fill materials would be excavated - totaling approximately 30,000 cubic yards of material. Extensive dewatering would be necessary to allow excavation below the encountered groundwater. To allow dewatering to occur, sheet piling would be required to prevent groundwater and river water from entering the excavation area.

VII. EVALUATION OF REMEDIAL ALTERNATIVES

The remedial alternatives were evaluated in accordance with the criteria set forth in the HSCA Regulations. The application of these criteria is as follows:

Protection of public health, welfare and the environment - Alternative 1 does not offer the required protection since the contaminated materials are neither removed nor contained. Alternative 2 mitigates risk to human health and the environment by eliminating the exposure pathway of the impacted materials to both the public to the ecological receptors and subsequently through the prevention of the release of contaminants to the Christina River sediments. Alternative 3 presents an elimination of the source of the risk by the removal of the impacted materials.

Compliance with all applicable local, state and federal laws - Alternative 1 does not comply with all applicable local, state and federal laws as the impacted materials are not removed nor are they contained. A risk of exposure remains to human and ecological receptors from the contaminated materials. Alternatives 2 and 3, if implemented properly, comply with all applicable laws and regulation.

Community acceptance - Alternative 1 is not anticipated to be acceptable to the community. Alternatives 2 and 3 are expected to meet community acceptance. These criteria will be fully evaluated during the public comment period.

Monitoring required - Alternative 1 would require ongoing monitoring to assess if the contaminants of concern are being discharged into the Christina River. Alternative 2 would require additional monitoring if site conditions are altered. Alternative 3 would not require any monitoring since all source materials would be eliminated.

Technical practicability - Alternatives 1 and 2 are technically practicable, although Alternative 1 does not offer protectiveness to the environment. Alternative 3 is not expected to be technically practicable as extensive dewatering and excavation would be required.

Reduction in toxicity, mobility and volume - Alternative 1 would not reduce toxicity, mobility or volume of the contaminated material. The remedial action objectives would not be met since water entering the Bioretention Swale would come in contact with soils exceeding HSCA URS for the protection of human health and the environment. This alternative would not provide a method to mitigate the potential migration of impacted sediment/soil into the Christina River as the collected stormwater discharges. Alternatives 2 and 3 would effectively

reduce or remove the toxicity, mobility and volume of the contaminated soil in the project area.

Long term effectiveness - Alternatives 1 does not offer any long-term effectiveness. Alternative 2 offers long term effectiveness for the life of the Bioretention Swale. Future changes (if any) to site conditions may alter the effectiveness of this remedy. Alternative 3 is a permanent remedy.

Short term effectiveness - Alternatives 1 does not offer this protection. Alternatives 2 and 3 are effective in protecting public health, welfare and the environment in the short term.

VIII. PROPOSED REMEDIAL ACTION PLAN

Based on the above criteria, Alternatives 2 and 3 are considered viable alternatives and offer protection of human health, welfare and the environment.

Alternative 2 (containment of the impacted material with an impermeable liner and use of clean fill) is expected to offer appropriate protectiveness to human health and the environment as a maintained remedial alternative. Alternative 2 meets the stated remedial action objectives. Stormwater will not contact the impacted soils during the tidal fluctuations of groundwater or during average rain event. The mean tide elevation is 3.99 ft, and the discharge of the Bioretention Swale is at elevation 4.3 ft. Stormwater collected within the Bioretention Swale will discharge prior to reaching the top of the liner along the side walls. By preventing the stormwater from contacting the impacted soil materials within the Bioretention Swale, the potential for the migration of the impacted soil/sediment into the river is eliminated. Soils will be further isolated by the placement of a liner to the top of the contaminated soil layer.

Alternative 3 (complete removal of impacted soils) is rejected because it is not expected to be technically practicable to dewater the proposed Bioretention Swale area to the depth that is needed to remove all the fill materials. In addition, the costs to implement Alternative 3 are expected to be prohibitive.

Therefore, the most appropriate remedial action is Alternative 2.

IX. PUBLIC PARTICIPATION

The Department actively solicits public comments or suggestions on the Proposed Plan and welcome opportunities to answers questions. A Public Meeting will be held on Wednesday March 3rd at the Dennison's Girls Club Please direct written comments to:

DNREC Site Investigation and Restoration Branch
Attn: Ann L. Breslin
391 Lukens Drive
New Castle, DE 19720

The comment period begins on Tuesday February 23, 1999 and ends March 14, 1999. Comments and/or requests for a public hearing may be submitted in writing to Ann Breslin by the close of business (4:30 p.m.) on March 14, 1999 at the above referenced address.

Alb:hbg
Alb99004.doc
DE-1092/1096 II B 8

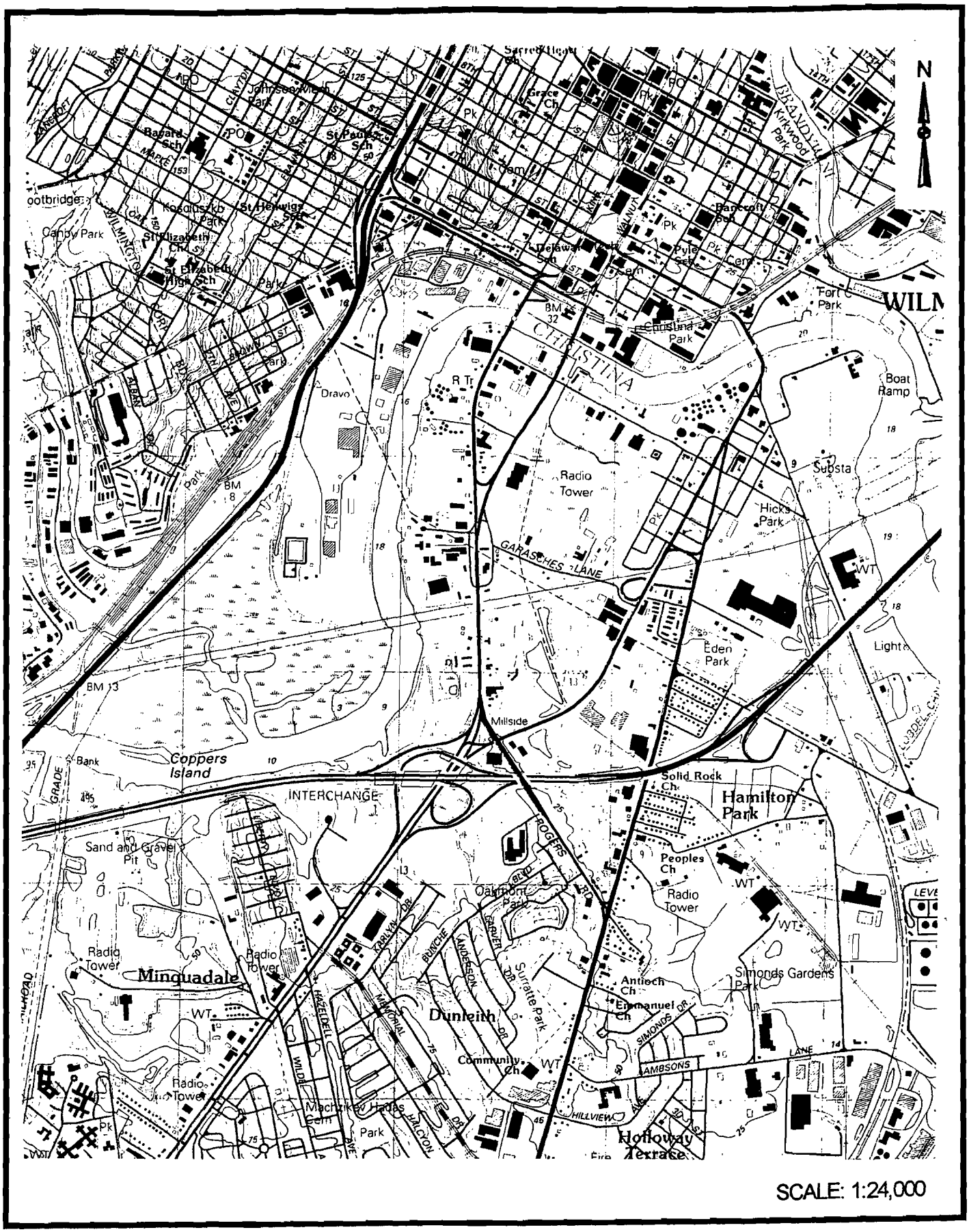
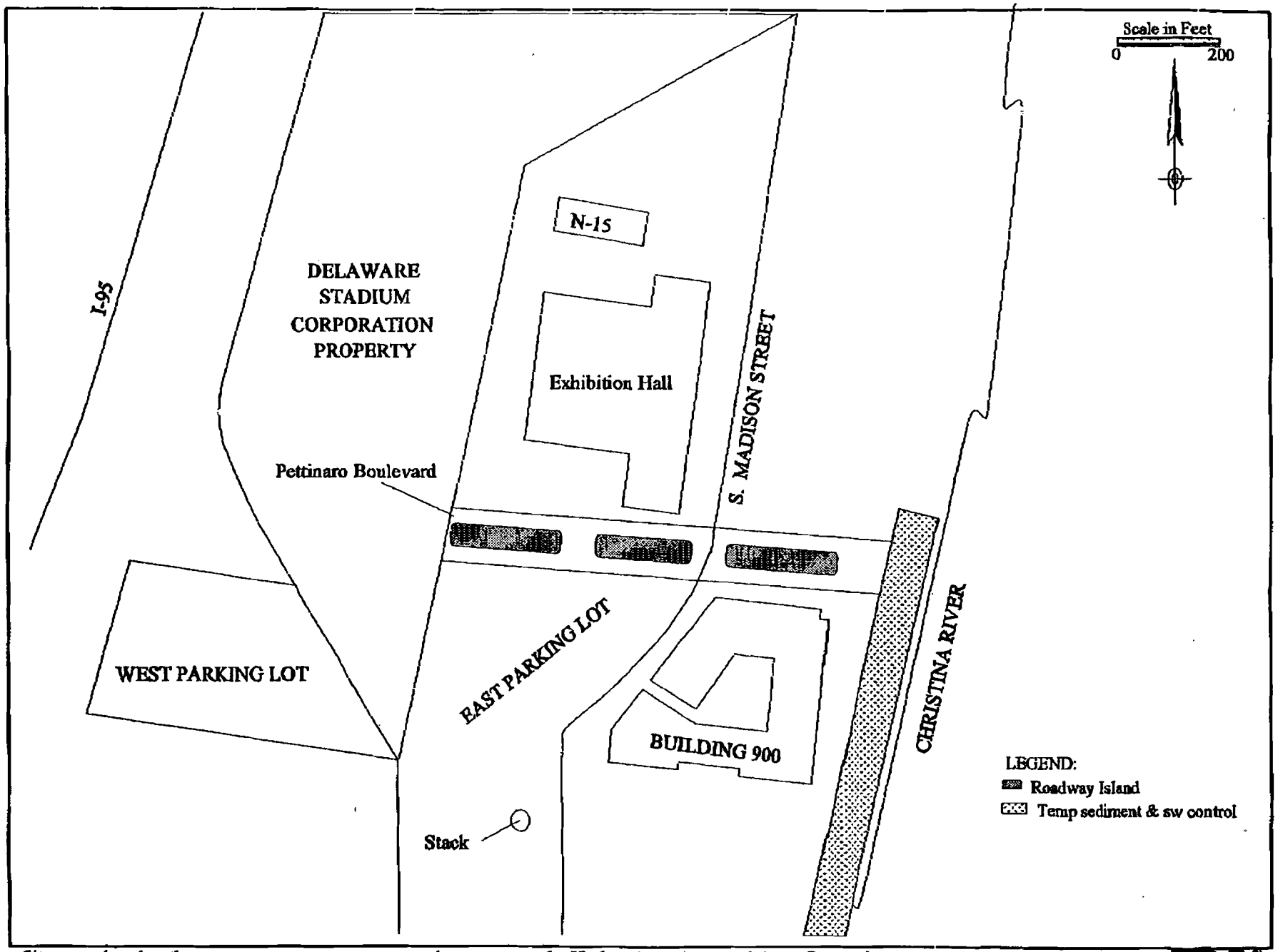


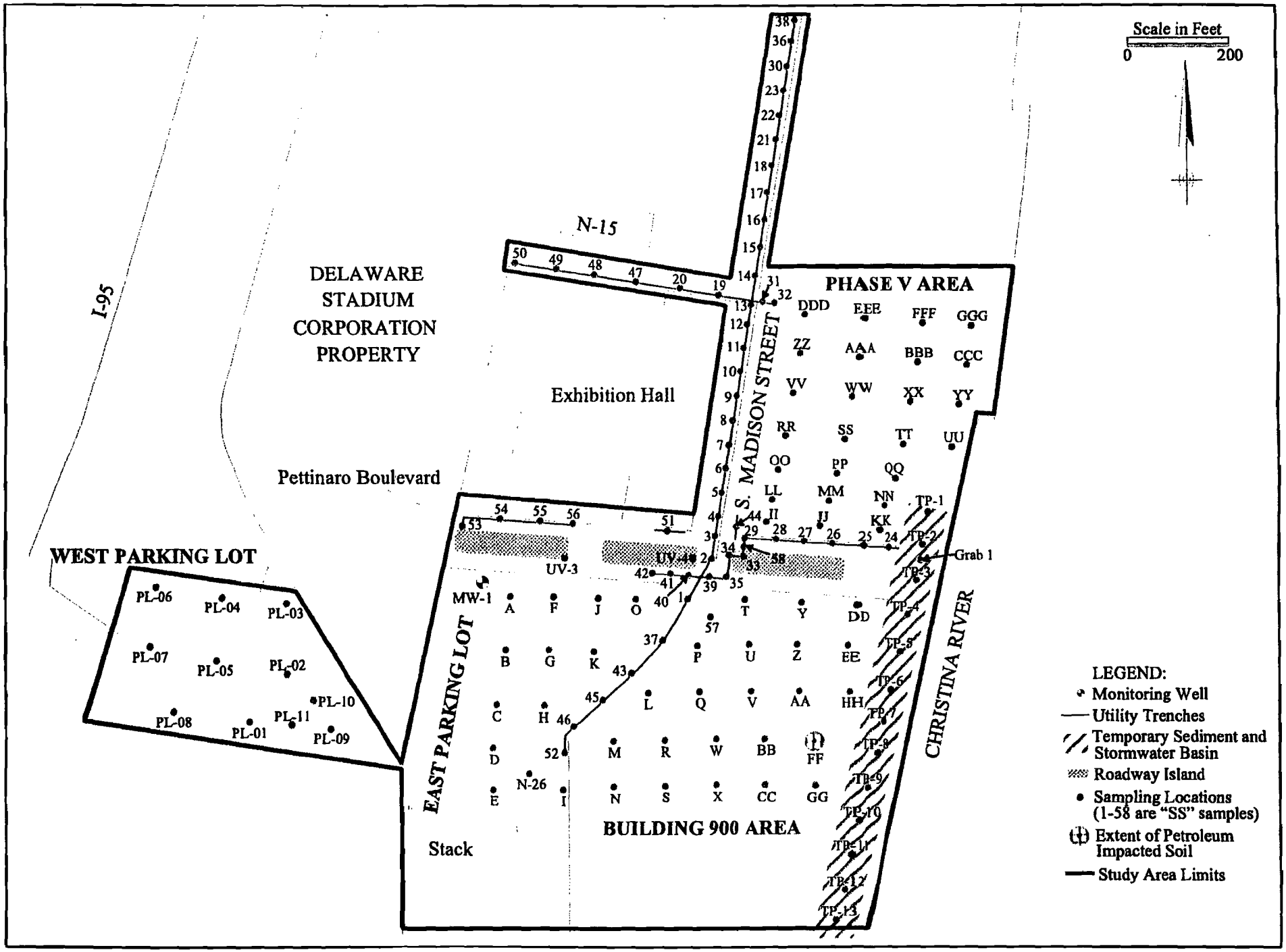
FIGURE 1. Location of the Dravo Shipyard Site in Wilmington, Delaware.

FIGURE 2



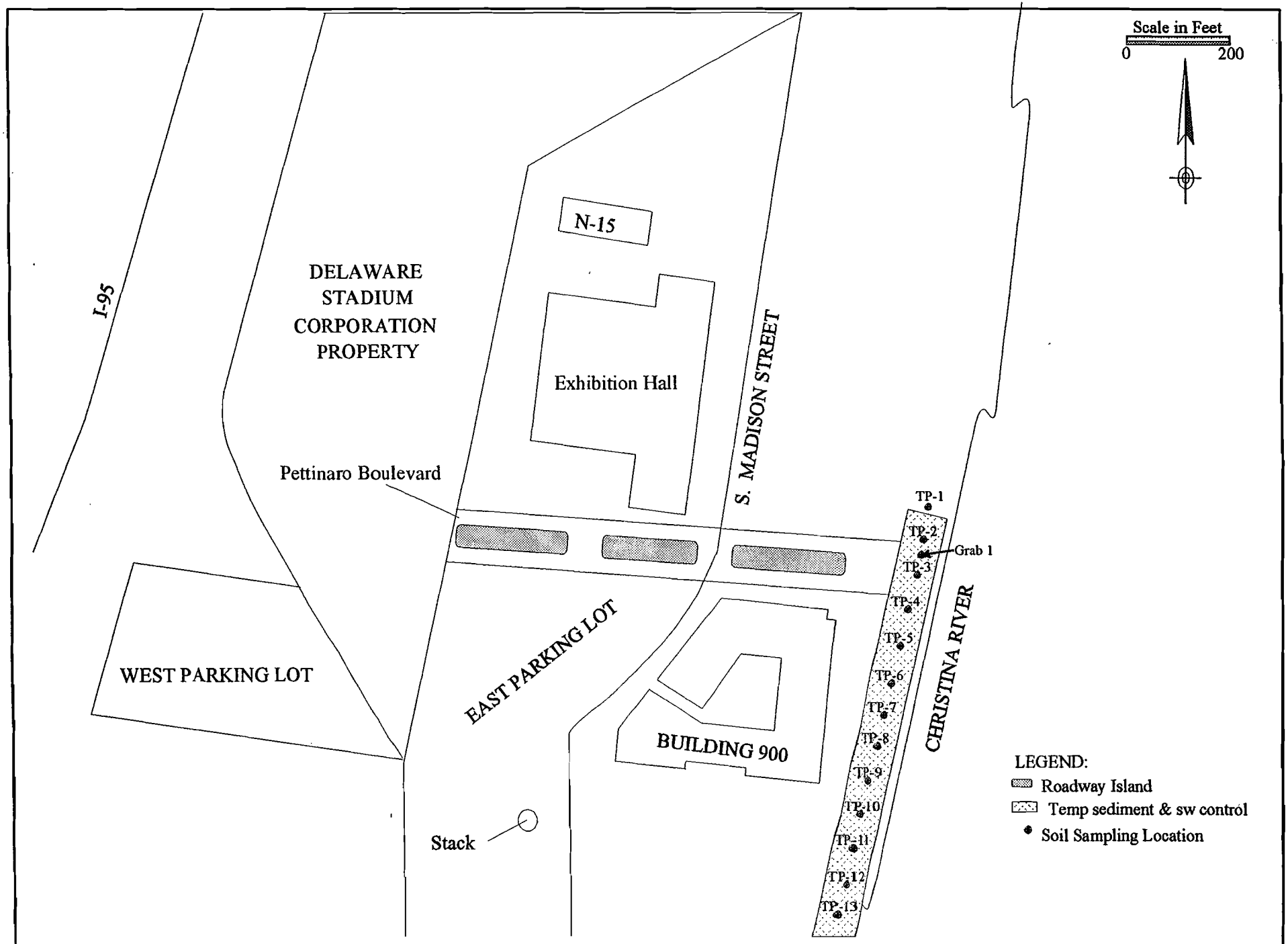
Site map showing the temporary storm water control measures at the Harbor Associates and Amer Properties.

FIGURE 3



Site map showing approximate locations of soil samples collected during the 1998 Phase I investigation.

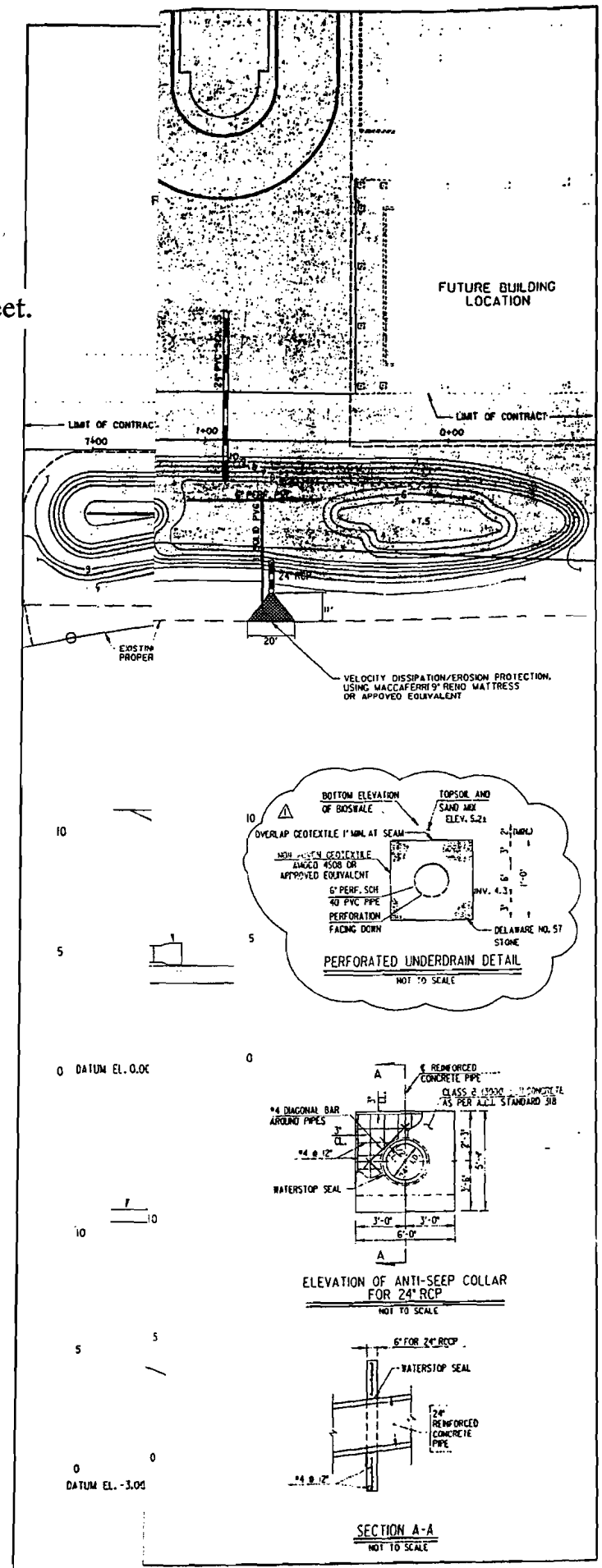
FIGURE 4



Site map showing the temporary storm water control measures and soil sampling locations at the Harbor Associates and Amer Properties.

FIGURE 5

'roposed Bioretention Swale Design Sheet.



EPA United States Environmental Protection Agency **Superfund**

Contract Laboratory Program

Target Compounds and Analytes

CLP laboratories use CLP analytical methods for the isolation, detection, and quantitation of specific target compounds and analytes.

The CLP Target Compound and Target Analyte Lists were originally derived from the EPA Priority Pollutant List. In the years since the inception of the CLP, compounds and analytes have been added to and deleted from this list, based on advances in analytical methods, evaluation of method performance data, and the needs of the Superfund program.

The target compounds and analytes are listed below. Please note that water and soil/sediment quantitation limits apply to the Multi-Media, Multi-Concentration Organic and Multi-Media, Multi-Concentration Inorganic CLP services, while drinking water/groundwater quantitation limits can be obtained through the Low Concentration Organic Service only.

- **Target Compound List (TCL) Volatile Compounds**
- **Target Compound List (TCL) Semivolatile Compounds**
- **Target Compound List (TCL) Pesticides/Aroclors (PCBs)**
- **Target Analyte List (TAL) Metals and Cyanide**

In addition to the quantitation and detection limits, links have been provided for certain compounds/analytes to the Agency for Toxic Substance and Disease Registry's (ATSDR) ToxFAQs Internet site. Data from this site are derived from ATSDR's public health statements and represent the most up to date information at the time of listing. The information is intended to inform the reader about these substances with special emphasis placed on their known effects on human health, while at the same time, acknowledging that there are limitations that exist about long term health outcomes for many of these substances.

More detailed information regarding the human health effects associated with Target Compound List and Target Analyte List substances can be obtained by directly accessing the ATSDR Homepage on the Internet at http://atsdr1.atsdr.cdc.gov:8080.

EXIT EPA *DISCLAIMER: The following links are pointers to other hosts and locations on the Internet. This information is provided as a service; however, the U.S. Environmental Protection Agency does not endorse, approve, or otherwise support the non-EPA sites.*

TARGET COMPOUND LIST (TCL)
VOLATILE COMPOUNDS AND THEIR QUANTITATION LIMITS

COMPOUND	CONTRACT REQUIRED DETECTION LIMITS FOR:		DESCRIPTION

COMPOUND	Drinking/ Ground Water (ug/l)	Water (ug/l)	Soil (ug/kg)	DESCRIPTION
Chloromethane	1	10	10	EXITING EPA
Bromomethane	1	10	10	EXITING EPA
Vinyl Chloride	1	10	10	EXITING EPA
Chloroethane	1	10	10	EXITING EPA
Methylene Chloride	2	10	10	EXITING EPA
Acetone	5	10	10	EXITING EPA
Carbon Disulfide	1	10	10	
1,1-Dichloroethene	1	10	10	EXITING EPA
1,1-Dichloroethane	1	10	10	EXITING EPA
1,2-Dichloroethene (total)	NA	10	10	EXITING EPA
cis-1,2-Dichloroethene	1	NA	NA	EXITING EPA
trans-1,2-Dichloroethene	1	NA	NA	EXITING EPA
Chloroform	1	10	10	EXITING EPA
1,2-Dichloroethane	1	10	10	EXITING EPA
2-Butanone	5	10	10	EXITING EPA
Bromochloromethane	1	NA	NA	
1,1,1-Trichloroethane	1	10	10	EXITING EPA
Carbon Tetrachloride	1	10	10	

Bromodichloromethane	1	10	10	
1,2-Dichloropropane	1	10	10	
cis-1,3-Dichloropropene	1	10	10	
Trichloroethene	1	10	10	
Dibromochloromethane	1	10	10	
1,1,2-Trichloroethane	1	10	10	
Benzene	1	10	10	
trans-1,3-Dichloropropene	1	10	10	
Bromoform	1	10	10	
4-Methyl-2-pentanone	5	10	10	
2-Hexanone	5	10	10	
Tetrachloroethene	1	10	10	
1,2-Dibromoethane	1	NA	NA	
Toluene	1	10	10	
1,1,2,2-Tetrachloroethane	1	10	10	
Chlorobenzene	1	10	10	
Ethylbenzene	1	10	10	
Styrene	1	10	10	
Xylenes (Total)	1	10	10	

1,2-Dibromo-3-chloropropane	1	NA	NA	
1,3-Dichlorobenzene	1	NA	NA	
1,4-Dichlorobenzene	1	NA	NA	
1,2-Dichlorobenzene	1	NA	NA	
1,2,4-Trichlorobenzene	1	NA	NA	

[Top of Page]

TARGET COMPOUND LIST (TCL)
SEMIVOLATILES COMPOUNDS AND THEIR QUANTITATION LIMITS

COMPOUND	CONTRACT REQUIRED DETECTION LIMITS FOR:			DESCRIPTION
	Drinking/ Ground Water (ug/l)	Water (ug/l)	Soil (ug/kg)	
Phenol	5	10	330	
bis(2-Chloroethyl) ether	5	10	330	
2-Chlorophenol	5	10	330	
1,3-Dichlorobenzene	NA	10	330	
1,4-Dichlorobenzene	NA	10	330	
1,2-Dichlorobenzene	NA	10	330	
2-Methylphenol	5	10	330	
2,2'-oxybis(1-Chloropropane)	5	10	330	
4-Methylphenol	5	10	330	
N-Nitroso-di-n-propylamine	5	10	330	
Hexachloroethane	5	10	330	
Nitrobenzene	5	10	330	
Isophorone	5	10	330	
2-Nitrophenol	5	10	330	
2,4-Dimethylphenol	5	10	330	
bis(2-Chloroethoxy) methane	5	10	330	
2,4-Dichlorophenol	5	10	330	
1,2,4-Trichlorobenzene	NA	10	330	
Naphthalene	5	10	330	
4-Chloroaniline	5	10	330	

Hexachlorobutadiene	5	10	330	
4-Chloro-3-methylphenol	5	10	330	
2-Methylnaphthalene	5	10	330	
Hexachlorocyclopentadiene	5	10	330	
2,4,6-Trichlorophenol	5	10	330	
2,4,5-Trichlorophenol	20	25	830	
2-Chloronapthalene	5	10	330	
2-Nitroaniline	20	25	830	
Dimethylphthlate	5	10	330	
Acenaphthylene	5	10	330	
2,6-Dinitrotoluene	5	10	330	
3-Nitroaniline	20	25	830	
Acenaphthene	5	10	330	
2,4-Dinitrophenol	20	25	830	
4-Nitrophenol	20	25	830	
Dibenzofuran	5	10	330	
2,4-Dinitrotoluene	5	10	330	
Diethylphthalate	5	10	330	
4-Chlorophenyl-phenyl ether	5	10	330	
Fluorene	5	10	330	
4-Nitroaniline	20	25	830	
4,6-Dinitro-2-methylphenol	20	25	830	
N-Nitrosodiphenylamine	5	10	330	
4-Bromophenyl-phenyl ether	5	10	330	
Hexachlorobenzene	5	10	330	
Pentachlorophenol	20	25	830	
Phenanthrene	5	10	330	
Anthracene	5	10	330	
Carbazole	NA	10	330	
Di-n-butylphthalate	5	10	330	

Fluoranthene	5	10	330	
Pyrene	5	10	330	
Butylbenzylphthalate	5	10	330	
3,3'-Dichlorobenzidine	5	10	330	
Benzo(a)anthracene	5	10	330	
Chrysene	5	10	330	
bis-(2-Ethylhexyl)phthalate	5	10	330	
Di-n-octylphthalate	5	10	330	
Benzo(b)fluoranthene	5	10	330	
Benzo(k)fluoranthene	5	10	330	
Benzo(a)pyrene	5	10	330	
Indeno(1,2,3-cd)pyrene	5	10	330	
Dibenz(a,h)anthracene	5	10	330	
Benzo(g,h,i)perylene	5	10	330	

[Top of Page]

TARGET COMPOUND LIST (TCL)
PESTICIDES/AROCLORS (PCBS) AND THEIR QUANTITATION LIMITS

COMPOUND	CONTRACT REQUIRED DETECTION LIMITS FOR:			DESCRIPTION
	Drinking/ Ground Water (ug/l)	Water (ug/l)	Soil (ug/kg)	
alpha-BHC	0.01	0.05	1.7	
beta-BHC	0.01	0.05	1.7	

delta-BHC	0.01	0.05	1.7	
gamma-BHC (Lindane)	0.01	0.05	1.7	
Heptachlor	0.01	0.05	1.7	
Aldrin	0.01	0.05	1.7	
Heptachlor epoxide	0.01	0.05	1.7	
Endosulfan I	0.01	0.05	1.7	
Dieldrin	0.02	0.10	3.3	
4,4'-DDE	0.02	0.10	3.3	
Endrin	0.02	0.10	3.3	
Endosulfan II	0.02	0.10	3.3	
4,4'-DDD	0.02	0.10	3.3	
Endosulfan sulfate	0.02	0.10	3.3	
4,4'-DDT	0.02	0.10	3.3	
Methoxychlor	0.10	0.50	17.0	
Endrin ketone	0.02	0.10	3.3	
Endrin aldehyde	0.02	0.10	3.3	
alpha-Chlordane	0.01	0.05	1.7	

gamma-Chlordane	0.01	0.05	1.7	
Toxaphene	1.0	5.0	170.0	
Aroclor-1016	0.20	1.0	33.0	
Aroclor-1221	0.40	2.0	67.0	
Aroclor-1232	0.20	1.0	33.0	
Aroclor-1242	0.20	1.0	33.0	
Aroclor-1248	0.20	1.0	33.0	
Aroclor-1254	0.20	1.0	33.0	
Aroclor-1260	0.20	1.0	33.0	

[Top of Page]

TARGET ANALYTE LIST (TAL)
METALS/CYANIDE AND THEIR DETECTION LIMITS*

ANALYTES	CONTRACT REQUIRED DETECTION LIMITS FOR: WATER (ug/l)	DESCRIPTION
Aluminum	200	
Antimony	60	
Arsenic	10	
Barium	200	
Berylium	5	

Cadmium	5	
Calcium	5000	
Chromium	10	
Cobalt	50	
Copper	25	
Iron	100	
Lead	3	
Magnesium	5000	
Manganese	15	
Mercury	0.2	
Nickel	40	
Potassium	5000	
Selenium	5	
Silver	10	
Sodium	5000	
Thallium	10	
Vanadium	50	
Zinc	20	
Cyanide	10	

*TAL Metal detection limits are expressed as instrument detection limits obtained in pure water. Detection limits for soils are adjusted for the amount of sample analyzed and percent moisture.

[Top of Page]

Table 2
Harbor Associates & Amer Properties
Bioswale Soil Characterization
June 1998
Sampling & Analyses Log

Sample Name	Sample Depth ft	DNREC Screening	Confirmatory Analyses @ Lancaster Laboratories			
			PCB	PAH	TAL Metals	TCLP Metals
TP-1s	6	x		x		
TP-1d	8	x		x		
TP-2s	6	x				
TP-2d	8.5	x				
TP-3s	6	x				
TP-4s	6	x				
TP-5s	6	x				
TP-6s	6	x				
TP-6d	9	x				
TP-7s	6	x				
TP-7d	7	x				
TP-8s	6	x	x	x		
TP-8d	7	x		x		
TP-9s	6	x				
TP-10s	6	x			x	x
TP-10d	7	x			x	x
TP-11s	2	x			x	x
TP-11d	6	x			x	x
TP-12s	6	x				
TP-12d	8.5	x				
TP-13s	6	x				
TP-13d	8.5	x				
Grab #1	soil pile	x			x	x
Total		23	1	4	5	5

Table 3
Harbor Associates & Amer Properties
Bioswale Soil Characterization
DNREC Laboratory Analytical Results
PAH Analyses by Immunoassay
June 1998 - July 1998

Sample ID	Concentration, ppm	Qualifier
TP-IS	>50	Hi
TP-2S	>1 , <50	
TP-3S	>50	Hi
TP-4S	>50	
TP-5S	>50	Hi
TP-6S	>1, <50	
TP-7S	>1, <50	
TP-8S	<1	ND
TP-9S	>1, <50	
TP-10S	<1	
TP-11S	>1, <50	
TP-12S	<1	
TP-13S	<1	
TP-1D	>1, <50	
TP-2D	>1, <50	
TP-3D	<1	
TP-4D	<1	
TP-5D	<1	
TP-6D	<1	
TP-7D	>1, <50	
TP-8D	>50	Hi
TP-9D	<1	
TP-10D	<1	
TP-11D	>1, <50	
TP-12D	<1	
TP-13D	<1	

Table 4
Harbor Associates & Amer Properties
Bioswale Soil Characterization
DNREC Laboratory Analytical Results
PCB Analyses by Immunoassay
June 1998 - July 1998

Sample ID	Concentration, ppm	Qualifier
TP-1S	ND	
TP-2S	ND	
TP-3S	ND	
TP-4S	ND	
TP-5S	ND	
TP-6S	ND	
TP-7S	ND	
TP-8S	ND	
TP-9S	ND	
TP-10S	0.12	ND
TP-11S	0.16	ND
TP-12S	ND	
TP-13S	0.02	ND
TP-1D	ND	
TP-2D	ND	
TP-3D	ND	
TP-4D	ND	
TP-5D	ND	
TP-6D	ND	
TP-7D	ND	
TP-8D	ND	
TP-9D	ND	
TP-10D	0.08	ND
TP-11D	ND	
TP12D	ND	
TP13D	ND	

Table 5
Harbor Associates & Amer Properties
Bioswale Soil Characterization
DNREC Laboratory Analytical Results
Metals Analyses by XRF
June 1998 - July 1998
Concentration in ppm

Elements	TP-1S	TP-2S	TP-3S	TP-4S	TP-5S	TP-6S	TP-7S	TP-8S	TP-9S
Calcium	10134	3716	3003	6994	1274.5	5677	10581	916.9	38124
Vanadium	ND	ND	ND	49.1	30.4	16.9	ND	ND	87
Manganese	746	428	138.6	200	116.6	22.2	798	446.6	3872
Chromium	124.5	85.5	47.3	63.9	44.8	77.2	396	20.2	384.3
Iron	35462	100585	15283	42217	20842.5	28125	49538	15927	92779
Cobalt	163	304	66	173.3	73.4	81	198.7	86	243.3
Nickel	7	47	18	6.7	ND	21	35.5	5.3	2.8
Copper	29.2	506.6	18	25.3	17.5	20	87.2	12.8	294.6
Arsenic	24.3	47.8	1	21.5	5.4	7.9	85.9	1.6	160
Selenium	0.9	3.8	0.08	ND	1.4	0.5	0.3	0.04	1.1
Zinc	148.9	672.8	41.7	64.2	86.6	63	582	28	741.9
Lead	122.8	207.8	13.6	177.9	23.1	8.6	144	16	922
Thallium	ND	ND	ND	ND	ND	ND	ND	0.7	ND
Mercury	ND	ND	4.1	ND	2.3	ND	ND	2.6	ND
Silver	0.3	1.4	0.1	0.5	0.48	0.06	0.7	0.0006	1.1
Cadmium	1	3.8	ND	0.2	ND	0.09	0.1	ND	ND
Antimony	2.6	2.5	1.2	ND	1.3	0.2	4.3	0.9	6.3
Barium	61.7	302	45.8	37.6	13.9	69	141	29	378
SiO5	95.3	89.3	98.1	95	97.7	96.5	93.8	98.2	86.2

Table 5
Harbor Associates & Amer Properties
Bioswale Soil Characterization
DNREC Laboratory Analytical Results
Metals Analyses by XRF
June 1998 - July 1998
Concentration in ppm

Elements	TP-10S	TP-11S	TP-12S	TP-13S	TP-1D	TP-2D	TP-3D*	TP-4D*	TP-5D*
Calcium	3503	2666.3	651159	410832	3948.3	3880			
Vanadium	ND	ND	72.5	ND	23.8	52.5			
Manganese	396	817	362.6	308	354.1	292			
Chromium	ND	ND	6	25.8	45.4	52.8			
Iron	801932	596431	5915	10872.8	27333	27658			
Cobalt	1195	787	192.8	223.2	114.1	152.3			
Nickel	ND	ND	44.4	53.5	18.3	22			
Copper	649	1473	30	31	24.9	3.9			
Arsenic	736.5	1341	10.8	17.2	5.1	2.2			
Selenium	34.9	36.4	0.6	5.8	0.3	ND			
Zinc	502	1988	3.1	16.5	62.5	51			
Lead	259	3005	4.4	20.1	20.6	10.3			
Thallium	ND	ND	ND	ND	ND	ND			
Mercury	ND	ND	11.2	ND	ND	ND			
Silver	0.4	19.9	3.7	ND	ND	ND			
Cadmium	4.6	0.02	ND	0.4	1	ND			
Antimony	14	72.3	3.5	6.3	1	1			
Barium	933	5576.7	55.9	92.9	73.6	63.3			
SiO5	18.9	39.6	34.2	57.7	96.7	96.7			

* DNREC unable to analyze samples TP-3D, TP-4D, and TP-5D

Table 5
Harbor Associates & Amer Properties
Bioswale Soil Characterization
DNREC Laboratory Analytical Results
Metals Analyses by XRF
June 1998 - July 1998
Concentration in ppm

Elements	TP-6D	TP-7D	TP-8D	TP-9D*	TP-10D	TP-11D	TP-12D	TP-13D	Grab-1
Calcium	5333	6205.1	7237.2		1308	7508.4	662639	630681	1677
Vanadium	13.8	48.9	1.7		ND	ND	ND	47	ND
Manganese	713	673	790		697	672	204	154	ND
Chromium	210	326	361		ND	55.3	24.5	24.2	ND
Iron	28045	32148	361		798924	304301	9149	13193	760234
Cobalt	99.5	140.2	40927		696	619.5	139.6	197	ND
Nickel	34.2	24.5	168.1		ND	ND	82.9	59	ND
Copper	41.7	49.2	28.5		598	1539	41.6	31	599
Arsenic	18.3	49.2	66.8		593	991.6	19.1	29.8	603
Selenium	0.9	0.3	53		11.8	38.6	ND	10.6	22.3
Zinc	266	558.2	3.5		589	1387.8	27.2	104.7	1226
Lead	52.3	48.9	461.4		278.3	1189	13.3	196	437
Thallium	ND	ND	ND		ND	ND	ND	ND	90
Mercury	5.4	ND	11.2		ND	ND	ND	21.2	3.4
Silver	0.3	0.3	ND		10.1	4.6	2.9	2.5	2.4
Cadmium	0.4	1	2.2		2.6	ND	ND	0.5	3.7
Antimony	ND	1.3	4.3		12.3	7.5	4.1	0.04	18.7
Barium	44.1	34	78		695.6	1862	44.1	58.7	4202
SiO5	96.5	96	95		19.6	67.9	32.7	35.5	23.1

*DNREC unable to analyze sample TP-9D

Table 6
Harbor Associates and Amer Properties
Bioswale Soil Characterization
Confirmatory Analytical Results
PAH Analyses by EPA Method 8310
June 1998 - July 1998

Concentration, ug/Kg

Constituent	TP-1S	TP-1D	TP-8S	TP-8D
Naphthalene	2,480	1,680	170	<9100
Acenaphthylene	1,260	<6500	<1500	<9100
Acenaphthene	3,330	<6500	<1500	1,550
Fluorene	186	142	15	920
Phenanthrene	1,970	1,520	128	2,000
Anthracene	420	130	24.0	1,320
Flouranthene	3,310	1,290	180	4,690
Pyrene	3,080	990	148	9,480
Benzo(a)anthracene	1,540	381	73	3,030
Chrysene	3,510	790	171	8,360
Benzo(b)flouranthene	1,140	283	53	1,250
Benzo(k)flouranthene	748	183	35	895
Benzo(a)pyrene	1,520	332	67	2,800
Dibenzo(a,h)anthracene	<120	<120	<28	<170
Benzo(g,h,i)perylene	<390	490	<90	<540
Indeno(1,2,3-cd)pyrene	920	<270	46.6	1,220
Total PAH	25,414	8,211	1,111	37,515

TABLE 7
Harbor Associates & Amer Properties
Bioswale Soil Characterization
Confirmatory Analytical Results
SVOC by EPA Method 8270
June 1998 - July 1998

Concentration, ug/Kg

Constituent	TP-IS	TP-1D	TP-8S	TP-8D
2-chlorophenol	<2,000	<400	<370	<2,800
phenol	<2,000	<400	<370	<2,800
2-nitrophenol	<2,000	<400	<370	<2,800
2,4-dimethylphenol	<2,000	<400	<370	<2,800
2,4dichlorophenol	<2,000	<400	<370	<2,800
4-chloro--3-methylphenol	<2,000	<400	<370	<2,800
2,4,6-trichlorophenol	<2,000	<400	<370	<2,800
2,4-dinitrophenol	<6,100	<400	<1,100	<8,400
4-nitrophenol	<5,100	<1,200	<930	<7,000
4,6-dinitrophenol-2-methylphenol	<5,100	<1,000	<930	<7,000
pentachlorophenol	<5,100	<1,000	<370	<7,000
N-nitrosodimethylamine	<2,000	<400	<370	<2,800
bis(2-chloroethyl) ether	<2,000	<400	<370	<2,800
1,3-dichlorobenzene	<2,000	<400	<370	<2,800
1,2-dichlorobenzene	<2,000	<400	<370	<2,800
bis(2-chloroisopropyl) ether	<2,000	<400	<370	<2,800
hexachloroethane	<2,000	<400	<370	<2,800
N-nitrosodi-n-propylamine	<2,000	<400	<370	<2,800
nitrobenzene	<2,000	<400	<370	<2,800
isophorone	<2,000	<400	<370	<2,800
bis(2-chloroethoxy) methane	<2,000	<400	<370	<2,800
1,2,4-trichlorobenzene	<2,000	<400	<370	<2,800
naphthalene	2600	<400	<370	2700
hexachlorobutadiene	<2,000	<400	<370	<2,800
hexachlorocyclopentadiene	<4,000	<800	<750	<5,600
2-chloronaphthalene	<2,000	<400	<370	<2,800
acenaphthylene	960	<400	<370	800
dimethyl phthalate	<2,000	<400	<370	<2,800
2,6-dintirotoluene	<2,000	<400	<370	<2,800
acenaphthene	1700	<400	<370	3600
2,4-dinitrotoluene	<2,000	<400	<370	<2,800
fluorene	1900	<400	<370	3200
4-chlorophenyl phenyl ether	<2,000	<400	<370	<2,800
diethyl phthalate	<2,000	<400	<370	<2,800
1,2-diphenylhydrazine	<2,000	<400	<370	<2,800
N-nitrosodiphenylamine	<2,000	<400	<370	<2,800
4-bromophenyl phenyl ether	<2,000	<400	<370	<2,800
hexachlorobenzene	<2,000	<400	<370	<2,800
phenanthrene	10000	<400	310	4500
anthracene	2400	<400	<370	3400
di-n-butyl phthalate	<2,000	<400	<370	<2,800
fluroanthene	9500	350	350	7700
pyrene	9400	66	82	14000
benzidine	<20,000	<4,000	<3,700	<28,000
butyl benzyl phthalate	<2,000	<400	<370	<2,800
benzo (a)anthracene	3500	<400	46	4900
chrysene	3700	<400	39	4300

TABLE 7
Harbor Associates & Amer Properties
Bioswale Soil Characterization
Confirmatory Analytical Results
SVOC by EPA Method 8270
June 1998 - July 1998

Concentration, ug/Kg

Constituent	TP-IS	TP-1D	TP-8S	TP-8D
3,3- dichlorobenzidine	<4,000	<800	<750	<5600
bis(2-Ethylhexyl)phthalate	<2,000	1500	150	<2,800
di-n-octyl phthalate	<2,000	<400	<370	<2,800
benzo (b) fluorathene	4600	530	500	5200
benzo (k) fluoranthene	2700	<400	<370	3200
benzo (a) pyrene	4000	400	370	5600
Indeno(1,2,3-cd)pyrene	3400	<400	<370	4000
dibenz (ah) anthracene	2600	<400	<370	3500
benzo (ghi) perylene	1900	<400	<370	2100
TENTATIVELY IDENTIFIED COMPOUNDS				
2-Pentanone, 4-hydroxyl-4-methyl	10000	8500	9800	20000
9H- Carbazole				
Athracene, 1-methyl	2900			5000
Unknown, Total	14510	490		24200
11H-Benzo (b) fluorene				1500
11H-Benzo (a) fluorene				
Triphenylene, 2-methyl				
Benzo(ghi)fluoranthene				
11H-Benzo(a)carbazole				
Benzo(c)phenanthrene, 5-methyl				
Benz(a)anthracene, 1-methyl				
5,12-Naphthacenedione	860			
Naphthalene, isomers				
Benzo(k) fluoranthene	530			
Benzo(j) fluoranthene	1600			
Benzo(i) fluoranthene	490			
Indeno(1,2,3-cd) pyrene	530			
Benzo(b)triphenylene	290			
Dibenzo(def,mno)chrysene	270			
Benzo(e) pyrene				2600
Benzo(c)phenanthrene				
Phenanthrene	2620			
Pyrene				2100
Chrysene				
Benz(e)acephenanthrylene				
Dibenzothlopene				
Dibenzofuran	1400			
11,1-Biphenyl				
Total TICs	36,000	8,990	9,800	55,400
Total PAHs (including TICs)	100,860	10,336	11,497	128,100

Table 8
Harbor Associates & Amer Properties
Bioswale Characterization
Confirmatory Analytical Results
PCB Analyses
June 1998 - July 1998

Concentration, ug/Kg

PCBs	TP-8S
PCB-1016	185
PCB-1221	<19
PCB-1232	<19
PCB-1242	<19
PCB-1248	<19
PCB-1254	<19
PBD-1260	200

Table 9
Harbor Associates & Amer Properties
Bioswale Soil Characterization
Confirmatory Analytical Results
TAL Metals
June 1998 - July 1998

Concentration, mg/Kg

Metals	TP-10S	TP-10D	TP-11S	TP-11D	Grab-1
Mercury	0.0101	0.0047	0.39	0.96	0.98
Arsenic	210	220	290	410	234
Lead	220	190	1,330	750	481
Selenium	3.8	2.0	4.1	9.9	6.3
Thallium	7.0	7.0	6.6	3.5	17.3
Aluminum	392	2,310	810	3,070	1,740
Antimony	<140	<140	19	8.4	<240
Barium	360	759	1,950	890	339
Beryllium	<3.5	<3.5	<3.2	<0.72	<6.0
Cadmium	<14	<14	<13	<2.9	<24
Calcium	293	253	367	1,650	1,580
Chromium	<28	<28	4.9	7.1	9.3
Cobalt	10.6	23.5	31.0	18.2	<60
Copper	186	300	397	551	114
Iron	260,000	548,000	319,000	134,000	161,000
Magnesium	61	143	268	422	292
Manganese	24.2	52.8	84.4	174	68
Nickel	<35	<35	<32	1.4	<60
Potassium	1,340	2,080	1,670	1,820	2,050
Silver	2.24	3.2	11.0	5.1	<24
Sodium	504	581	1,250	680	460
Vanadium	25	98	38	39.0	23.5
Zinc	92	273	177	477	230

Table 10
Harbor Associates and Amer Properties
Bioswale Soil Characterization
TCLP Metals Analyses
June 1998 - July 1998

Concentration, mg/L

TCLP Metals	TP-10S	TP-10D	TP-11S	TP-11D	Grab-1
Arsenic	0.040	0.099	0.056	0.047	0.084
Selenium	<0.20	<0.20	<0.20	<0.20	<0.20
Barium	1.72	1.72	4.72	2.61	1.55
Cadmium	<0.010	<0.010	0.0032	0.010	0.035
Chromium	<0.030	<0.030	<0.030	<0.030	0.0196
Lead	<0.10	<0.10	0.36	0.029	0.13
Mercury	<0.00020	<0.00020	0.000058	0.000031	0.000048
Silver	<0.020	<0.020	<0.020	<0.020	<0.020

TABLE 11
Soil Re-Use Levels for
Excavated Material Management, Harbor Associates/RDC Properties, February 1999
(Concentrations in mg/Kg)

Soil Category	A	B *	C	Z **
Contaminant of Concern	Unlimited Contractor Re-Use	Construction Re-Use within Project Area	Re-Use Limited to Under Asphalt, Concrete or Foundations of Buildings in Project Area	Off-Site Treatment or Disposal
Oily Soil or Free Product	none	none	none	Yes
Petroleum Hydrocarbons				**
C5 through C8 Aliphatic Hydrocarbons	100	500	500	
C9 through C12 Aliphatic Hydrocarbons	1000	2500	2500	
C9 through C18 Aliphatic Hydrocarbons	1000	2500	2500	
C19 through C36 Aliphatic Hydrocarbons	2500	5000	5000	
C9 through C10 Aromatic Hydrocarbons	100	500	500	
BTEX	<10	10 to 25	25 to 100	>100
C PAHs	<1	1 to 25	25 to 300	>300
PCBs	<0.5	0.5 to 3	3 to 8	>8
Arsenic	<60	60 to 100	100 to 500	>500
Lead	<400	400 to 1,500	1,500 to 5,000	>5,000

* Requires a Geotextile Marker Fabric of a minimum quality of Amoco ACF 4508 or equivalent as determined by DNREC and a minimum of one foot of clean fill over contaminated soil.

**Above 5,000 ppm for Total TPH in soil.

ALB99013.xls