New York City
Economic Development
Corporation

REMEDIAL ALTERNATIVES REPORT

BARRETTO POINT SITE
BRONX, NEW YORK

REVISED
FINAL DRAFT
REVISION 2

JANUARY 2003

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CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

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REMEDIAL ALTERNATIVES REPORT
BARRETTO POINT SITE
BRONX, NEW YORK

Prepared for

NEW YORK CITY ECONOMIC DEVELOPMENT CORPORATION

and

NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL CONSERVATION

under contract with

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

CLEAN WATER/CLEAN AIR BOND ACT

By

DVIRKA AND BARTILUCCI CONSULTING ENGINEERS

WOODBURY, NEW YORK

JANUARY 2003

REMEDIAL ALTERNATIVES REPORT
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1.0 INTRODUCTION

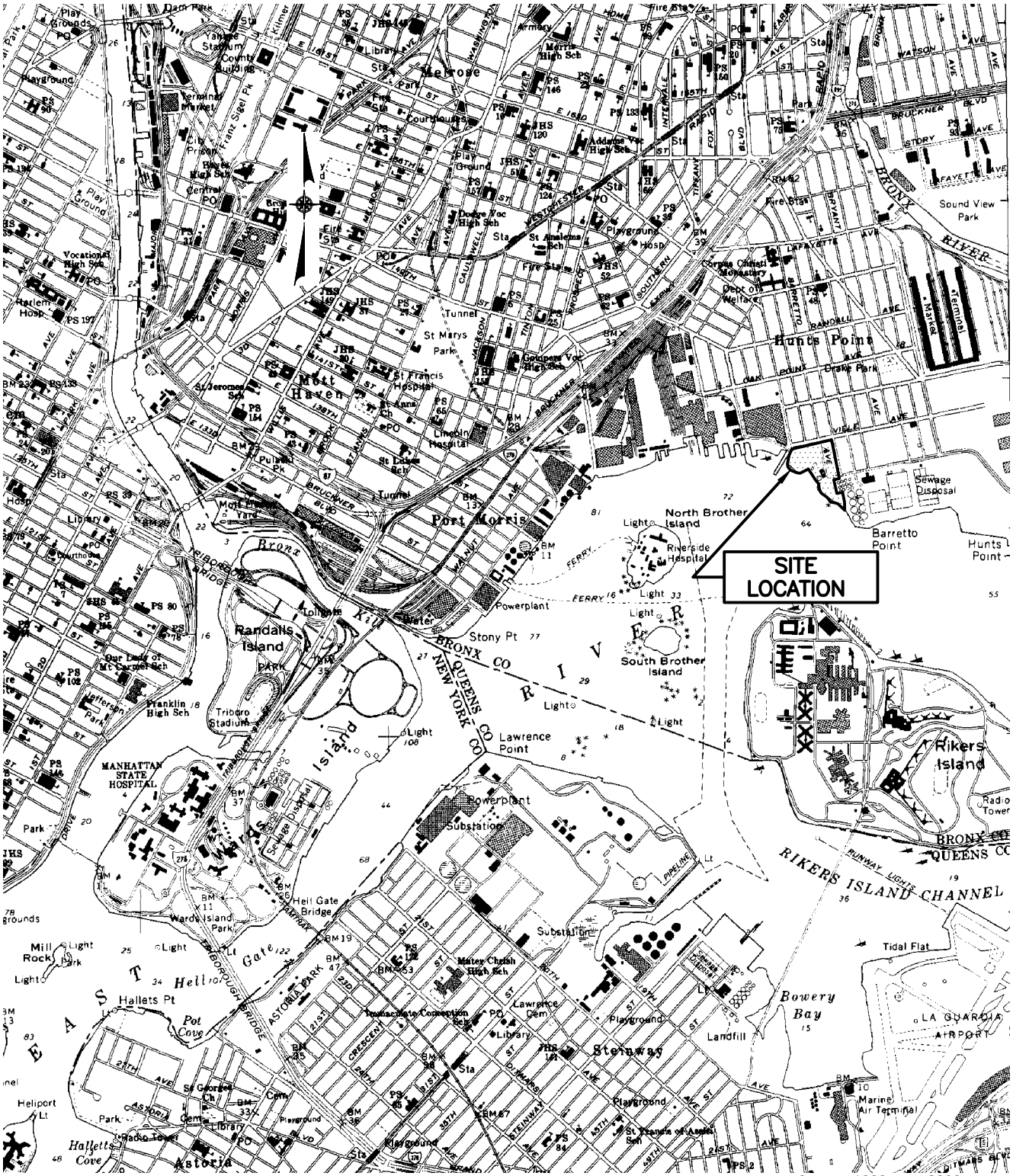
This section describes the purpose of the Remedial Alternatives Report for the Barretto Point Site and provides a description of the site and site background, summary of the site investigation results and risk assessment, definition of the remedial action objectives, and description and approach to the remedial alternatives report.

1.1 Purpose and Site Background

Dvirka and Bartilucci Consulting Engineers (D&B), under contract with the New York City Economic Development Corporation (NYCEDC), was retained to conduct a site investigation and prepare this Remedial Alternatives Report for the Baretto Point Site located in the Hunts Point section of Bronx County (see Figure 1-1). The site investigation and remedial alternatives report (SI/RAR) was conducted in cooperation with the New York City Department of Environmental Protection (NYCDEP) and the New York State Department of Environmental Conservation (NYSDEC). Funding for this SI/RAR was provided by a 75 percent grant from the New York State Department of Environmental Conservation (NYSDEC) under the 1996 Clean Water/Clean Air Bond Act Environmental Restoration Projects Program, with the matching 25 percent funded by the City of New York.

This report was prepared in accordance with the May 1998 Site Investigation/Remedial Alternatives Report Work Plan prepared by TRC Environmental Corporation and approved by NYSDEC as well as NYSDEC Guidance, including Technical and Administrative Guidance Memorandum (TAGM) No. 4058 – Environmental Restoration Projects.

The purpose of the SI/RAR is to assess the nature and extent of contamination that exists at the site, and to evaluate whether, and to what extent, a threat to human health or the environment exists based on planned site use, and to develop and evaluate remediation alternatives that will be protective of human health and the environment, and allow planned use of the site.



SOURCE: N.Y.S.D.O.T. CENTRAL PARK QUADRANGLE

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BARRETTO POINT SITE
BRONX, NEW YORK

SITE LOCATION MAP

Dvirka and Bartilucci
Consulting Engineers
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FIGURE 1-1

The Barretto Point Site is bounded by Viele Avenue to the north, the East River to the south and west, and Manida Street and the Hunts Point Water Pollution Control Plant (HPWPCP) to the east (see Figure 1-2). The site, which includes closed portions of Barretto Street and Ryawa Avenue, is approximately 13 acres in size.

The area surrounding the Barretto Point Site is primarily commercial/industrial in nature, including waste transfer stations, warehouses and the HPWPCP. The nearest residences are located approximately 1,500 feet north of the site.

The site is currently owned by the City of New York. Most of the site was acquired in a 1969 condemnation action, with a small parcel acquired in 1976 by tax foreclosure.

Potable water at the site, and in most of New York City, is provided from reservoirs located in upstate New York. City Water Tunnel No. 2 underlies the southern portion of the site at an unknown depth.

The planned future use of the site comprises a 5-acre park in the northwestern portion of the site (see Figure 1-2), and according to the NYCDEP, the remainder of the site will be held for upgrading of the HPWPCP.

As part of the SI/RAR Work Plan, Sanborn fire insurance maps (1901, 1915, 1950, 1981, 1991, 1992, 1993, 1994, 1995 and 1996) and aerial photographs (1954, 1962, 1978, 1984 and 1992) were reviewed to evaluate historic site uses. Significant features identified by review of these documents are described below.

The earliest available information (1901) shows buildings in the northern portion of the site that were identified as a yacht club in 1915. By 1950, much of the site had been developed for industrial purposes. These uses included a sand and gravel operation in the northwestern portion of the site (including a transformer house along Barretto Street), an asphalt plant at the southwest corner of Barretto Street and Ryawa Avenue, and coal pockets to the west along the East River. In the northeastern portion of the site, industries included a paint and varnish

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RIP RAP BANK PROTECTION

Bronx Coordinate System

SITE LIMITS

PLANNED PARK AREA

BARRETTO STREET

MANIDA STREET

Concrete Sidewalk

Rock

DOLPHINS

RIP RAP BANK PROTECTION

APPROXIMATE BOUNDARY OF PLANNED PARK

Wood Barrier

AREA PLANNED FOR TREATMENT PLANT UPGRADING AND POSSIBLE EXPANSION

Edge of Top Slope

STANDING WATER

Bulkhead (STEEL Sheet Pile Wall)

SLUDGE THICKENER

SLUDGE THICKENER

SLUDGE THICKENER

SLUDGE THICKENER

SLUDGE THICKENER

SLUDGE THICKENER

BUILDING

EAST RIVER

100 0 100

SCALE IN FEET

BARRETTO POINT SITE
BRONX, NEW YORK

SITE PLAN

FIGURE 1-2

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manufacturer, food products manufacturer and iron works. A boat yard was located on the south side of Ryawa Avenue near Barretto Street. The locations of the paint and varnish manufacturer, sand and gravel operation, transformer house, asphalt plant and coal pockets are shown on Figure 1-3.

By 1962, the coal pockets were removed from the site. In addition, the southern and northwestern portions of the site were expanded into the East River, apparently as a result of filling operations. By 1978, of the previously reported structures at the site, only the buildings of the asphalt plant are present, although the facility is reported as not appearing to be operational. The northwestern portion of the site has been expanded further into the East River.

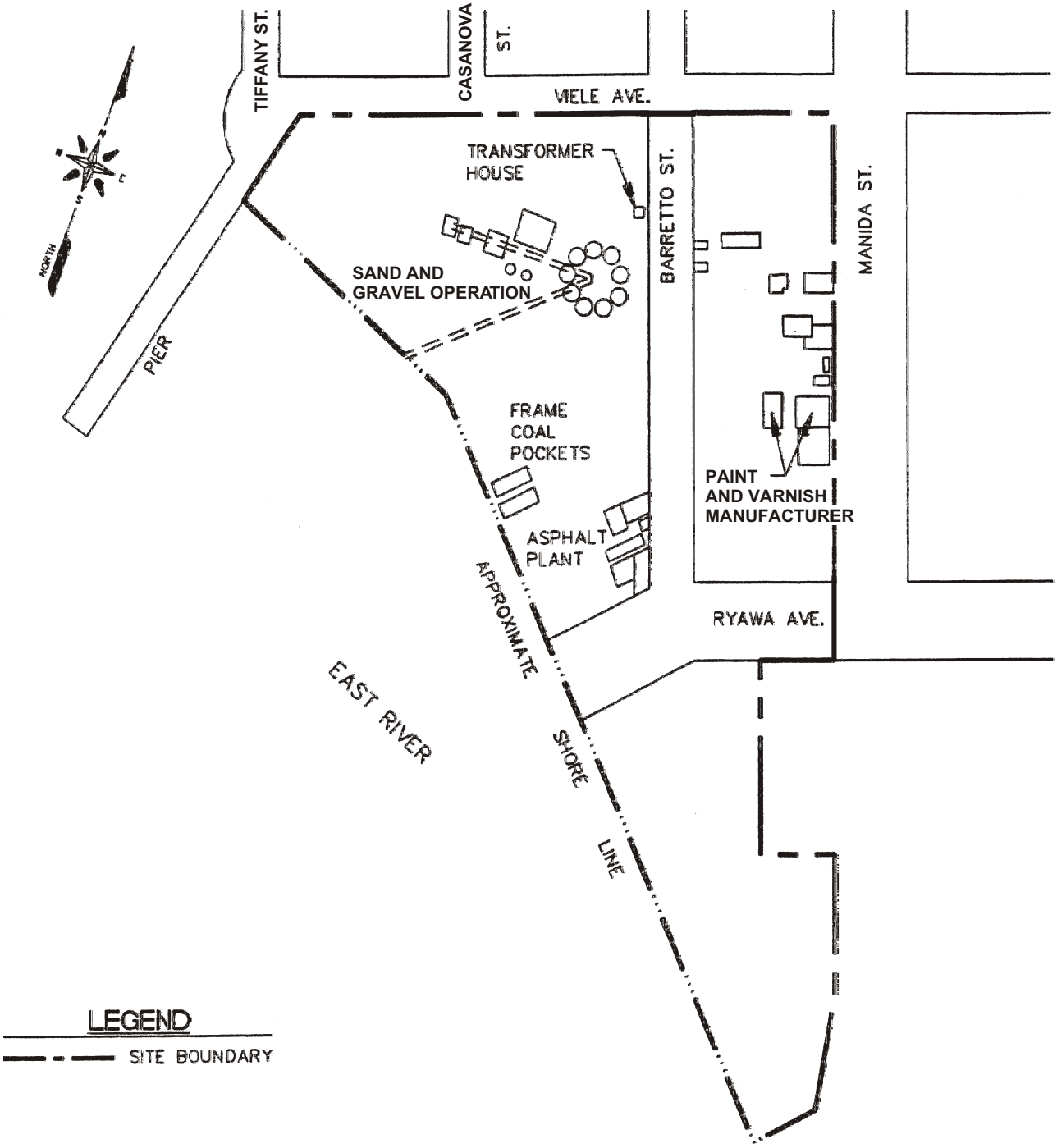
By 1981, a stone yard was constructed at the northeastern corner of Barretto Street and Ryawa Avenue. The asphalt plant buildings are no longer present at the site in 1991.

By 1992, two structures (possibly squatter dwellings) were constructed on the west side of Barretto Street. As many as eight squatter dwellings were observed during site visits conducted in 1998 and 1999. These structures were removed by the NYCDEP in October 1999.

Information obtained from the NYCDEP indicates that the portion of the site south of Ryawa Avenue was utilized as a leaf composting facility during the mid-1990s.

1.2 Site Investigation Results

The following is a summary of the findings and conclusions resulting from the site investigation, and risk and habitat-based assessments conducted for the Baretto Point Site as a function of the media investigated. These findings and conclusions are based on comparison of the investigation results to standards, criteria and guidelines (SCGs) selected for the site. The results of the investigation are described in detail in the Site Investigation Report, dated November 2000.



SOURCE: TRC ENVIRONMENTAL CORPORATION WORK PLAN, MAY 1998

RLA/DWG/BARRETO1616(7/24/00)

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BARRETTO POINT SITE
BRONX, NEW YORK

HISTORIC SITE INFORMATION FROM 1950 AERIAL PHOTOGRAPH

FIGURE 1-3

Surface Features

The predominant surface features at the Barretto Point Site are a large boulder located in the northeastern portion of the site and a large area of ponded water which extends partially across the intersection of Barretto Street and Ryawa Avenue. A smaller area of ponded water exists in the southeastern portion of the site. There are numerous manmade soil berms and construction and demolition (C&D) debris piles consisting of wood, metal, concrete and demolished squatter structures located in the western and southwestern portions of the site

Several abandoned cars are located in the western and southwestern portions of the site. An abandoned truck trailer and pay loader are located in the southern portion of the site. Overgrown vegetation consisting of weeds and tall grass with some developed trees is present over most of the western and southern portions of the site. Areas in the western and southern portions of the site where fill material (e.g., bricks and concrete pieces) is exposed show limited vegetation. Manmade paths were noted along the East River shoreline.

Surface and Subsurface Geology

Based on geologic data obtained during the site investigation, the site is underlain by fill material, native till deposits of glacial origin and weathered bedrock, discussion of which is provided below.

Fill Material

Fill material was encountered in all soil borings and test pits constructed as part of the site investigation. The thickness of fill ranged from approximately 1-foot to greater than 15 feet (maximum reach of the backhoe bucket utilized during the site investigation).

Based on observations made during construction of soil borings, and excavation of test pits and test trenches at the site, the fill material varies in composition. Fill material generally comprises a mixture of sand, silt, gravel and cobbles, with varying amounts of C&D debris. The

C&D material includes brick pieces, concrete pieces, asphalt, cinder blocks, wood (including plywood, small branches, twigs, decomposing lumber, telephone poles and boards), scrap metal, truck and car tires and rims, steel pipes, plastic bags, plastic pipes, cloth, paper, cardboard, aluminum cans and glass fragments. The most abundant type of fill was broken brick, concrete and lumber.

Several distorted and crushed 55-gallon drums and 5-gallon cans with some solid and semi-solid paint residue were encountered in many test pits located in the northeastern portion of the site. The drums and paint cans are likely related to the paint and varnish manufacturing facility formerly located in this area.

One test pit located in the central portion of the site contained fill material consisting of abundant white-gray ash with some slag and crushed cinders mixed with sand and silt. The fill material was encountered at a depth of approximately 9 to 15 feet below grade. This material may have been related to the operation of the coal pockets formerly located in this area.

Till

Beneath the fill material, the site is generally underlain by poorly to moderately compacted till of glacial origin. The till thickness ranges from approximately 6 feet to approximately 20 feet. The till consists of brown, orange, gray and green, fine to medium subrounded sand, silt and fine to coarse gravel with trace amounts of clay. Varying amounts of subrounded to rounded cobbles, 1 to 4-foot boulders, and decomposed weathered rock fragments are also part of the till.

In the western part of the site, the till was not observed above the weathered bedrock. Since the western shoreline was historically extended into the East River, the till may be absent in this area.

Weathered Bedrock

Weathered bedrock was encountered below the till or fill at depths ranging from 14 to 24 feet below ground surface. The weathered bedrock on site was identified as a black-gray mica schist, slightly compacted with areas of dark brown-orange color, which likely can be attributed to oxidation occurring within the saturated zone.

Hydrogeology

Shallow groundwater flow direction in the overburden is predominantly in a southwesterly direction toward the East River. The horizontal gradient across the study area is approximately 0.04 foot per foot (ft/ft).

Tidal range data over a 24-hour period showed water level elevations in the East River adjacent to the site fluctuating approximately 7 feet. Groundwater levels in monitoring wells along the shoreline are influenced by tides in the East River. Water levels in a monitoring well located approximately 550 feet east of the shoreline are not significantly influenced by the tides.

Surface Soil Quality

Surface soil within the area of the planned park has been widely impacted by semivolatile organic compounds (SVOCs), in particular probable carcinogenic polycyclic aromatic hydrocarbons (CaPAHs) and metals at levels exceeding NYSDEC Recommended Soil Cleanup Objectives (RSCOs). While metals exceed the RSCOs, often the exceedances are for metals which are not very toxic (such as iron and zinc), or the exceedances of the more toxic metals (such as lead) are not significant. For the CaPAHs, in particular benzo(a)pyrene and benzo(a,h)anthracene, the exceedances are for the most part significant. Therefore, the primary contaminants of concern in soil in the planned park area are CaPAHs.

Surface soil in the remainder of the site, which is planned to remain in industrial use, also has been impacted by CaPAHs, primarily benzo(a)pyrene, at levels exceeding USEPA Region III

Risk-Based Concentrations (RBCs) for industrial land use. However, with the exception of one surface soil sample in the southern portion of the site, the detected concentrations of CaPAHs only slightly exceeded the RBCs for one or two compounds. The widespread detection of CaPAHs and metals at locations across the site suggests a non-specific source for these contaminants, possibly fill used to develop the site, impacts from historic operations on the site, including an asphalt plant and coal storage facility, and deposition of airborne particulates from off-site.

Subsurface Soil Quality

Subsurface soil within the area of the planned park has been impacted by CaPAHs and metals at levels exceeding NYSDEC RSCOs. Subsurface soil in the remainder of the site, outside the area of the former paint and varnish manufacturer, also has been impacted by CaPAHs and, in one sample arsenic, at levels exceeding both the RSCOs and USEPA Region III RBCs for industrial land use. Significant exceedances of the RBCs were detected only in the vicinity of the former asphalt plant. In general, the concentrations detected in subsurface soil were substantially less than those detected in surface soil, in particular for CaPAHs.

Subsurface soil in the area of the former paint and varnish manufacturing facility has been significantly impacted by volatile organic compounds (VOCs), in particular, ethylbenzene and xylenes, likely due to historic operations and waste disposal on the facility property.

Groundwater Quality

Groundwater in portions of the site along the East River shoreline is slightly impacted by VOCs and SVOCs. Sample results from temporary wells constructed in the area of contaminated soil around the former paint and varnish manufacturing facility show that groundwater in this area has been significantly impacted by VOCs. Since the groundwater is saline and public water supply exists in the vicinity of the site, the use of groundwater as a water supply is extremely unlikely. In addition, soil vapor results show that significant volatilization of contaminants from groundwater is currently not occurring except possibly in the area of the

former paint and varnish manufacturing facility. Contact with groundwater by site occupants or workers is not likely since groundwater is 8 to 18 feet below ground surface, although there may be potential exposure due to future subsurface construction. Potential impacts to the East River by groundwater from the Barretto Point Site are likely minimal due to the low concentrations of contaminants detected in downgradient groundwater samples and the high water flux within the East River.

1.3 Risk Assessment Results

Risks at the Baretto Point Site were evaluated on the basis of the site environmental setting, and information on the nature and extent of contamination obtained during the site investigation. The relevant environmental information is discussed within the context of current and potential human contact with contaminants of concern at potential locations where human exposure could occur without any remedial measures undertaken to mitigate contact with contaminants. The baseline risk assessment and wildlife habitat survey are provided in the Site Investigation Report. The following provides a summary of the findings and conclusions of the baseline risk and wildlife habitat assessments.

1.3.1 Human Health Exposure Assessment

The only current potentially complete pathway for human exposure associated with contamination at the Barretto Point Site is exposure of trespassers to impacted surface soil at the site.

There are organic and inorganic contaminants of potential concern (COPCs) present in all media sampled at the site and in particular in surface soil essentially throughout the site, and in subsurface soil and groundwater in the vicinity of a former paint and varnish manufacturing facility. The following exposure pathways involving COPCs are currently not complete, but potentially could become complete for the following receptors if remediation measures are not implemented:

On-site workers engaged in future construction

- Ingestion, dermal contact and inhalation exposure to VOCs released in the vicinity of the former paint and varnish manufacturing facility.
- Ingestion, dermal contact and inhalation exposure to CaPAHs in surface soil and subsurface soil, including inhalation exposure from fugitive dust.

Future on-site trespassers or users of planned park

- Inhalation exposure to VOCs released in the vicinity of the former paint and varnish manufacturing facility or to CaPAHs released as fugitive dust from open subsurface construction.

Future on-site workers (future Hunts Point Water Pollution Control Plant expansion)

- Dermal contact exposure to CaPAHs in surface soil.
- Inhalation exposure to VOCs released in the vicinity of the former paint and varnish manufacturing facility or to CaPAHs released as fugitive dust from open subsurface construction.

Nearby industrial/commercial establishments

- Inhalation exposure to VOCs released in the vicinity of the former paint and varnish manufacturing facility or to CaPAHs released as fugitive dust from open subsurface construction.

1.3.2 Wildlife Habitat Survey and Assessment

Several CaPAHs are present in surface and subsurface soil at concentrations that exceed cleanup objectives. However, the ecological habitat on-site is low value, largely monotypic and contains areas of visible stress, possibly due to the presence of contaminants. The at-risk ecosystem is common to the New York metropolitan area although somewhat isolated locally. The contaminant concentrations present on-site could result in minor adverse impacts to the plant

and animal communities in this local area. However, given the location and quality of the on-site habitat, the community impacted is small and would not produce unacceptable exposure beyond the evaluated area.

The East River represents a quality estuarine environment that provides a pathway for migratory fish, as well as breeding and feeding opportunities. The area adjacent to the site is protected against all but an east wind and likely provides resting and feeding opportunities for migratory waterfowl and waterbirds, in addition to the nesting mallards on-site. The extent of environmental risk is difficult to infer for the aquatic environment, since this area is well flushed by strong tides and currents, and most CaPAHs readily dissipate under these conditions. It is not likely that the CaPAHs would produce a discernable impact in the aquatic environment.

Although it would not be possible to determine the quantified impact to the environment from the Barretto Point Site, it can be reasonably stated that some sublethal effect is likely manifested in the environment. This impact would not be easily identified because of the great mixing and dilution provided by this environment, and effects from other sources in the vicinity of the site and contributing to the river.

1.4 Remedial Action Objectives

Remedial action objectives are goals developed for the protection of human health and the environment. Definition of these objectives requires an assessment of the contaminants and media of concern, migration pathways, exposure routes and potential receptors. Typically, remediation goals are established based on standards, criteria and guidelines (SCGs) to protect human health and the environment. SCGs for the Barretto Point Site, which were developed as part of the site investigation, include NYSDEC Technical and Administration Guidance Memorandum (TAGM) No. 4046, *Determination of Soil Cleanup Objective and Cleanup Levels (1994*), USEPA Region III Risk Based Concentrations for Industrial Land Use (RBCs), and NYSDEC Technical and Operational Guidance Series (TOGS) (1.1.1), *Ambient Water Quality Standards And Guidance Values and Groundwater Effluent Limitations (1998).* Based on these

SCGs, the results of the site investigation, and the human health risk and wildlife habitat assessments, the remedial action objectives developed for the site are the following:

1. Protection of human health and the environment;
2. Prevention of ingestion, dermal contact and inhalation exposure to contaminated surface and subsurface soil;
3. Reduction of infiltration of precipitation through contaminated soil in the vicinity of the former paint and varnish manufacturing facility and adverse impacts to groundwater; and
4. Prevention of release of contaminants to on-site and off-site ambient air.

In addition to consideration of SCGs to meet the remedial action objectives, Applicable or Relevant and Appropriate Requirements (ARARs) are considered when formulating, screening and evaluating remedial alternatives, and selecting a remedial action. ARARs may be categorized as contaminant-specific, location-specific or action-specific. Federal statutes, regulations and programs may apply to the site where state or local standards do not exist. Potentially applicable contaminant-specific, location-specific and action-specific ARARs for the Barretto Point Site, along with guidance, advisories, criteria, memoranda and other information issued by regulatory agencies to be considered (TBC), are presented in Tables 1-1, 1-2 and 1-3. As a note, many of the NYSDEC ARARs include federal requirements which have been delegated to New York State. Generally, federal ARARs are referenced when state requirements do not exist.

1.5 Remedial Alternatives Report Description

The Technical and Administrative Guidance Memorandum (TAGM) No. 4058 prepared by NYSDEC entitled "Environmental Restoration Projects", describes the remedial alternatives report as a process to identify and evaluate potentially applicable general response actions, combine suitable general response actions into alternatives and evaluate appropriate alternatives in detail, and select an appropriate remedial action plan. The objective of this remedial alternatives report is to meet the goal of this guidance document in a focused concise manner.

Table 1-1

BARRETTO POINT SITE
REMEDIAL ALTERNATIVES REPORT
POTENTIALLY APPLICABLE CHEMICAL-SPECIFIC ARARs/TBCs

Citation/Reference	Title	Applicable Media	Potential ARAR/TBC	Regulatory Agency
6 NYCRR 212	General Process Emission Sources	Air	ARAR	NYSDEC
6 NYCRR 257	Air Quality Standards	Air	ARAR	NYSDEC
6 NYCRR 371	Identification and Listing of Hazardous Waste	Hazardous Waste	ARAR	NYSDEC
6 NYCRR 376	Land Disposal Restrictions	Hazardous Waste	ARAR	NYSDEC
6 NYCRR 700-705	Surface Water and Groundwater Classifications and Standards	Surface Water/ Groundwater	ARAR	NYSDEC
6 NYCRR 750-758	State Pollutant Discharge Elimination System	Wastewater Discharge	ARAR	NYSDEC
TOGS 1.1.1	Ambient Water Quality Standards and Guidance Values	Surface Water/ Groundwater	TBC	NYSDEC
TOGS 1.3.1	Waste Assimilative Capacity Analysis & Allocation for Setting Water Quality Based Effluent Limits	Wastewater Discharge	TBC	NYSDEC
TOGS 1.3.1C	Development of Water Quality Based Effluent Limits for Metals Amendment	Wastewater Discharge	TBC	NYSDEC
TOGS 1.3.2	Toxicity Testing in the SPDES Program	Wastewater Discharge	TBC	NYSDEC
Air Guide No. 1	Guideline for the Control of Toxic Ambient Air Contaminants	Air	TBC	NYSDEC
TAGM HWR-4046	Determination of Soil Cleanup Objectives and Cleanup Levels	Soil	TBC	NYSDEC
RCNY Chapter 19	Use of Public Sewers	Wastewater Discharge	ARAR	NYCDEP

Table 1-2

BARRETTO POINT SITE
REMEDIAL ALTERNATIVES REPORT
POTENTIALLY APPLICABLE LOCATION SPECIFIC ARARs/TBCs

Citation/ Reference	Title	Applicable Media	Potential ARAR/TBC	Regulatory Agency
6 NYCRR 608	Use and Protection of Waters	Surface Water	ARAR	NYSDEC
6 NYCRR 256	Air Quality Classification System	Air	ARAR	NYSDEC
6 NYCRR 885	Freshwater Wetlands Maps and Classification	Wetlands	ARAR	NYSDEC
TOGS 2.1.3	Primary and Principal Aquifer Determinations	Groundwater	TBC	NYSDEC
Executive Order No. 11990	Protection of Wetlands	Wetlands	ARAR	USEPA
N/A	Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites	Hazardous Waste Sites	TBC	NYSDEC

Table 1-3

BARRETTO POINT SITE
REMEDIAL ALTERNATIVES REPORT
POTENTIALLY APPLICABLE ACTION SPECIFIC ARARs/TBCs

Citation/Reference	Title	Applicable Media	Potential ARAR/TBC	Regulatory Agency
6 NYCRR 200	General Provision	Air	ARAR	NYSDEC
6 NYCRR 201	Permits and Registrations	Air	ARAR	NYSDEC
6 NYCRR 211	General Prohibitions	Air	ARAR	NYSDEC
6 NYCRR 212	General Process Emission Sources	Air	ARAR	NYSDEC
6 NYCRR 364	Waste Transporter Permits	Solid/Hazardous Waste	ARAR	NYSDEC
6 NYCRR 370	Hazardous Waste Management System – General	Hazardous Waste	ARAR	NYSDEC
6 NYCRR 372	Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities	Hazardous Waste	ARAR	NYSDEC
6 NYCRR 373	Hazardous Waste Management Facilities	Hazardous Waste	ARAR	NYSDEC
6 NYCRR 375	Inactive Hazardous Waste Disposal Site Remedial Program	Hazardous Waste	ARAR	NYSDEC
6 NYCRR 376	Land Disposal Restrictions	Hazardous Waste	ARAR	NYSDEC
6 NYCRR 617 and 618	State Environmental Quality Review	All Media	ARAR	NYSDEC
6 NYCRR 621	Uniform Procedures	All Media	ARAR	NYSDEC
6 NYCRR 624	Permit Hearing Procedures	All Media	ARAR	NYSDEC
6 NYCRR 650	Qualifications of Operators of Wastewater Treatment Plants	NA	ARAR	NYSDEC
6 NYCRR 663	Freshwater Wetlands – Permit Requirements	Wetlands	ARAR	NYSDEC
6 NYCRR 700-705	Classifications and Standards of Quality and Purity	Surface Water/ Groundwater	ARAR	NYSDEC
6 NYCRR 750-758	State Pollutant Discharge Elimination System	Surface Water/ Groundwater	ARAR	NYSDEC
Air Guide No. 1	Guideline for the Control of Toxic Ambient Air Contaminants	Air	TBC	NYSDEC
Air Guide No. 29	Technical Guidance for Regulating and Permitting Air Emissions from Air Strippers, Soil Vapor Extraction Systems and Cold-Mix Asphalt Units	Air	TBC	NYSDEC

Table 1-3 (continued)

BARRETTO POINT SITE
REMEDIAL ALTERNATIVES REPORT
POTENTIALLY APPLICABLE ACTION SPECIFIC ARARs/TBCs

Citation/Reference	Title	Applicable Media	Potential ARAR/TBC	Regulatory Agency
Air Guide No. 41	Permitting for Landfill Gas Energy Recovery	Air	TBC	NYSDEC
TAGM HWR-4030	Selection of Remedial Actions at Inactive Hazardous Waste Disposal Sites	Hazardous Waste	TBC	NYSDEC
TAGM HWR-4031	Fugitive Dust Suppression and Particulate Monitoring Programs at Inactive Hazardous Waste Sites	Air	TBC	NYSDEC
TAGM HWR-4046	Determination of Soil Cleanup Objectives and Cleanup Levels	Soil	TBC	NYSDEC
N/A	Analytical Services Protocol	All Media	TBC	NYSDEC
TOGS 1.3.1	Waste Assimilative Capacity Analysis and Allocation for Setting Water Quality Based Effluent Limits	Wastewater Discharge	TBC	NYSDEC
TOGS 1.3.1C	Development of Water Quality Based Effluent Limits for Metals Amendment	Wastewater Discharge	TBC	NYSDEC
TOGS 1.3.4	BPJ Methodologies	Wastewater Discharge	TBC	NYSDEC
TOGS 2.1.2	UIR at Groundwater Remediation Sites	Groundwater	TBC	NYSDEC
TOGS 2.1.3	Primary and Principal Aquifer Determinations	Groundwater	TBC	NYSDEC
29 CFR 1910.120	Hazardous Waste Operations and Emergency Response	NA	ARAR	USDOL
40 CFR 122	EPA Administered Permit Programs: The National Pollutant Discharge Elimination System	Wastewater Discharge	ARAR	USEPA

In the initial phase of the remedial alternatives report, the preliminary evaluation of alternatives will consider effectiveness, reliability, implementability and relative costs.

Effectiveness evaluation includes consideration of the following:

- Potential effectiveness of process options in handling the estimated areas or volumes of contaminated media, and meeting the remediation goals identified by the remedial action objectives;
- Potential impacts to human health and the environment during the construction and implementation phase; and
- Proven effectiveness of the process with respect to the contaminants and conditions at the site.

The reliability of the process includes evaluating the dependability of an alternative to meet and achieve the remedial action objectives and the expected lifetime or effectiveness of the alternative.

Implementability includes both the technical and administrative feasibility of utilizing the technology or alternative. Technical feasibility considers such aspects as the ability to comply with SCGs, availability and capacity of treatment, storage and disposal facilities, the availability of equipment and skilled labor to implement the technology, the ability to design, construct and operate the alternative, and acceptability to the regulatory agencies and the public. Administrative feasibility considers institutional factors, such as the ability to obtain necessary permits for on-site or off-site actions, and the ability to restrict land use based on specific remediation measures. Although not specifically addressed in TAGM No. 4058, implementability also considers planned use of the site.

Preliminary costs are considered at this stage of the evaluation process for the purpose of relative cost comparison among the alternatives.

The results of the preliminary evaluation include potentially viable alternatives for the site which will be carried forward for detailed evaluation.

The guidance requires that a remedial alternatives report provide a detailed analysis of the potential remedial alternatives based on consideration of the following evaluation criteria for each alternative.

- Overall protection of human health and the environment after remediation;
- Compliance with standards, criteria and guidelines;
- Short-term effectiveness;
- Long-term effectiveness and permanence;
- Reduction in toxicity, mobility and volume; and
- Feasibility.

In addition to the above-listed criteria, the guidance also indicates that community acceptance will be evaluated by New York State Department of Environmental Conservation once the public comment period on the recommended remedial alternative has concluded. Provided below is a description of each of the criteria.

Overall Protection of Human Health and the Environment

Protection of human health and the environment is evaluated on the basis of estimated reductions in both human and environmental exposure to contaminants for each remedial action alternative. The evaluation focuses on whether a specific alternative achieves adequate protection, and how site risks are eliminated, reduced or controlled through treatment, engineering or institutional controls. An integral part of this evaluation is an assessment of long-term residual risks to be expected after remediation has been completed. Evaluation of the human health and environmental protection factor is generally based, in part, on the findings of a risk assessment. The risk assessment performed for this site incorporates the qualitative estimation of the risk posed by carcinogenic and noncarcinogenic contaminants detected during the site investigation.

Compliance with Standards Criteria and Guidance

Compliance with applicable regulatory standards, criteria and guidelines applies the federal and New York State SCGs identified for the Barretto Point Site to provide both action-specific guidelines for remedial work at the site and contaminant-specific cleanup standards for the alternatives under evaluation. In addition to action-specific and contaminant-specific guidelines, there also are location-specific guidelines that pertain to such issues as restrictions on actions at historic sites. These guidelines and standards are referenced in Section 1.4 of this document, and are considered a minimum performance specification for each remedial action alternative under consideration.

Short-term Effectiveness

Evaluation of short-term effectiveness of each alternative examines health and environmental risks likely to exist during the implementation of a particular remedial action. Principal factors for consideration include the expediency with which a particular alternative can be completed, potential impacts on the nearby community, on-site workers and environment, and mitigation measures for short-term risks required by a given alternative during the necessary implementation period.

Long-term Effectiveness and Permanence

Examination of long-term impacts and effectiveness for each alternative requires an estimation of the degree of permanence afforded by each alternative. To this end, the anticipated service life of each alternative must be estimated, together with the estimated quantity and characterization of residual contamination remaining on-site at the end of this service life. The magnitude of residual risks must also be considered in terms of the amount and concentrations of contaminants remaining following implementation of a remedial action, considering the persistence, toxicity and mobility of these contaminants, and their propensity to bioaccumulate.

This evaluation also includes the adequacy and reliability of controls required for the alternative, if required.

Reduction of Toxicity, Mobility and Volume

Reduction in toxicity, mobility and volume of contaminants is evaluated on the basis of the estimated quantity of contamination treated or destroyed, together with the estimated quantity of waste materials produced by the treatment process itself. Furthermore, this evaluation considers whether a particular alternative will achieve the irreversible destruction of contaminants, treatment of the contaminants or merely removal of contaminants for disposal elsewhere. Reduction of the mobility of the contaminants at the site is also considered in this evaluation.

Feasibility

Evaluation of feasibility examines whether the alternative is suitable for the site based on current and future site conditions. It also considers the difficulty associated with the installation and/or operation of each alternative on-site and the proven or perceived reliability with which an alternative can achieve system performance goals (primarily the SCGs discussed above). The evaluation examines the potential need for future remedial action, the level of oversight required by regulatory agencies and the availability of certain technology resources required by each alternative. Cost evaluations presented in this document estimate the capital, and operation and maintenance (O&M) costs, including monitoring, associated with each remedial action alternative. From these estimates, a total present worth for each option is determined.

1.6 Approach to Remedial Alternatives Report

The approach to this remedial alternatives report will be to evaluate alternatives that will meet the remedial action objectives (RAOs) developed for the site while at the same time consider future use/development of the property. The RAOs, listed in Section 1.4, focus on elimination of contact with contaminated surface and subsurface soil, and reduction of

precipitation through contaminated subsurface soil in the vicinity of the former paint and varnish manufacturing area. Since future use of the property will include a park area (approximately 5 acres) in the northwestern portion of the site and property for industrial purposes for planned upgrading of the Hunts Point Water Pollution Control Plant (approximately 8 acres), the site will be divided into two sections and alternatives for each section initially will be evaluated separately.

In addition, since a portion of the 8 acres to be used for treatment plant upgrading purposes was identified as exhibiting elevated levels of VOCs in the subsurface soil, this area will be further segregated. As discussed previously, the elevated levels of VOCs appear to be the result of improper disposal of waste materials generated at a paint and varnish manufacturing facility formerly located on this portion of the site. Therefore, the two sections of the treatment plant upgrade area will be designated as the former paint and varnish manufacturing facility area and the remaining area of the site. Similarly, since potentially applicable alternatives for the remediation of former paint and varnish manufacturing area will be significantly different than potentially applicable alternatives for the remaining portion of the treatment plant upgrade area, alternatives for these two areas will initially also be evaluated separately. At the conclusion of the initial evaluation for effectiveness, reliability, implementability and relative cost, alternatives may be combined for detailed evaluation.

2.0 SUPPLEMENTAL SOIL INVESTIGATION

2.1 Purpose and Scope of Investigation

The Site Investigation Report identified an area of soil contaminated by volatile organic compounds (VOCs) in the vicinity of a former paint and varnish manufacturing facility. During the site investigation conducted in 2000, delineation of contamination was based on field measurements and observations made during construction of test pits and soil borings. Confirmatory samples for laboratory analysis were collected to verify that the horizontal or vertical limits of contamination had been reached. In order to further chemically characterize the contaminated soils and the extent of contamination to provide data for development of a detailed estimate of the volume of soil requiring remediation, a supplemental soil investigation was conducted in August and October 2002.

As initially designed, the scope of the supplemental investigation included construction of soil borings within the previously identified area of contamination and collection of four soil samples per boring at depths of 3 to 5 feet, 8 to 10 feet, 13 to 15 feet and 18 to 20 feet below ground surface for laboratory analysis of VOCs. Although drilling difficulties were encountered in this area during the initial site investigation, soil borings were selected due to concerns about the potential for off-site migration of vapors released from exposed contaminated soils, such as that which possibly would be generated by excavation of test pits. In August 2002, 25 borings were constructed on a grid pattern within the area of contamination (see Figure 2-1 for locations). Three of the planned borings (SB-24, SB-30 and SB-35) were not constructed due to the presence of a berm located in the southwestern portion of the area.

During construction of the soil borings, the presence of boulders up to approximately 4 feet is size within the shallow subsurface at most of the boring locations limited the depth which could be achieved by the drilling. As a result, it was determined that test pits would be necessary to collect the required data and would be excavated adjacent to 12 previous test pit locations where contamination had been previously detected by field instrumentation and observations to delineate the horizontal and vertical extent of the contamination and to

BARRETTO STREET

MANIDA STREET

Concrete Sidewalk

8' Chain Link Fence

P.L.

TP-17 (15)				
DEPTH	PID	FID	TVOCs	TICs
0–6	0–25	0–10		
6–15	0–30	30–200		
14			26	U

TP-25 (15)				
DEPTH	PID	FID	TVOCs	TICs
0–15	0–3	0–30		
15			19	U

TP-26 (15)				
DEPTH	PID	FID	TVOCs	TICs
0–2	0–5	0		
2–4	5–50	0–20		
4–15	0–5	0		
14			20	U

DISCOLORATION, VERY FAINT PETROLEUM ODOR 2–3'
GROUNDWATER AT 15'

TP-42 (15)		
DEPTH	PID	FID
0–15	0–5	0

TP-39 (16)		
DEPTH	PID	FID
0–16	0–2	0–10

GROUNDWATER AT 16'

TP-23 (4)		
DEPTH	PID	FID
0–2	35–150	–
2–4	1000–1500	50–100

CHEMICAL ODOR 1–2'
PETROLEUM ODOR, STAINING 2–4'
SCRAP METAL/POSSIBLE DRUM 2'

TP-23A (8)		
DEPTH	TVOCs	TICs
4	35,400	1,758,000

SOLVENT ODOR 2–6'

SB-12 (18)				
DEPTH	PID	FID	TVOCs	TICs
0–18	0–3	–		
11–12			15	U

GROUNDWATER AT 18'

SB-14 (12R)			
DEPTH	PID	TVOCs	TICs
3–5	0	24	U
9–9.5	70	38	2237

SB-15 (6R)			
DEPTH	PID	TVOCs	TICs
4–6	0	12	6

SB-16 (7R)			
DEPTH	PID	TVOCs	TICs
4–6	0	7	U

SB-17 (9R)			
DEPTH	PID	TVOCs	TICs
4–6	0	14	31

SB-18 (8R)			
DEPTH	PID	TVOCs	TICs
4–6	1200	13	74

TP-11A (17)		
DEPTH	TVOCs	TICs
12.5	43	6,950

SOLVENT ODOR 9–16'

TP-12 (13)		
DEPTH	PID	FID
0–10	0–5	0–10
10–12	0–50	0–50
12–13	300–500	>1000

PETROLEUM STAINING/ODOR 12–13'

TP-38 (12)				
DEPTH	PID	FID	TVOCs	TICs
0–12	0	0		
11			17	U

GROUNDWATER AT 12'

TP-24 (12)		
DEPTH	PID	FID
0–10	0–20	0–100
10–12	500–1000	>1000

PETROLEUM ODOR, STAINING 10–12'

TP-11 (12)		
DEPTH	PID	FID
0–2	10–50	100–300
2–5	5–10	100
5–8	0–10	0–10
8–11	100–400	50–100
11–12	500–1000	>1000

TRACE TO SLIGHT CHEMICAL ODOR 10–11'
STRONG CHEMICAL ODOR 11–12'

GP-01S (18)		
DEPTH	PID	FID
0–18	300–1500	50–600

GROUNDWATER AT 16'
SLIGHT PETROLEUM ODOR 4–12'
STRONG FUEL OIL ODOR 12–16'
STAINING/SHEEN 16–17'

SB-22 (20)			
DEPTH	PID	TVOCs	TICs
4–6	60	180	40,030
9–10.5	50	108	28,040
14–15.5	990	103	16,490
18–20	30	86	20,660

GROUNDWATER AT 18.5'
SLIGHT SOLVENT ODOR 4–18'

TP-13 (14)		
DEPTH	PID	FID
0–2	100–150	30–50
2–4	50–300	10–20
4–5	50–150	0–10
5–9	5–200	0–10
9–14	50–300	0–40

SLIGHT FUEL ODOR 9–14'
STAINING, CRUSHED DRUM 1–2'

SB-19 (3.5R)			
DEPTH	PID	TVOCs	TICs
3–3.5	90	28	7

GP-02S (10)		
DEPTH	PID	FID
0–2	0–5	0
2–10	25–400	10–100

SLIGHT CHEMICAL ODOR 6–10'

SB-21 (10R)			
DEPTH	PID	TVOCs	TICs
4–6	50	4500	1,553,000
9–10	280	677	70,300

TP-02 (2)			
DEPTH	PID	FID	TVOCs	TICs
0–2	>2000	>1000		
1–2			751,350	1,397,000

STRONG POSSIBLE PAINT THINNER ODOR

TP-01 (3)				
DEPTH	PID	FID	TVOCs	TICs
0–3	1200–>2000	400–>1000	–	
2–3	–	–	U	1,830

VERY STRONG PAINT THINNER ODOR 0–3'

SB-23 (5R)				
DEPTH	PID	TVOCs	TICs	
3–5	30	17	80	

TP-27 (15)				
DEPTH	PID	FID	TVOCs	TICs
0–15	0–5	0		
15			20	U

GROUNDWATER AT 15'

TP-16 (13)		
DEPTH	PID	FID
0–3	5–100	50–100
3–5	25–100	200–400
5–8	50–250	100
8–13	75–1500	100–500

TRACE TO SLIGHT FUEL OIL ODOR 8–13'

SB-20 (5R)			
DEPTH	PID	TVOCs	TICs
4–4.5	100	12	U

TP-09 (6)		
DEPTH	PID	FID
0–4	1–5	50–100
4–6	10–25	300

TRACE CHEMICAL ODOR 4–6'

SB-06 (24)				
DEPTH	PID	FID	TVOCs	TICs
10–12	200–600	0–100		
12–17	300–1000	>1000		
17–24	0–50	0–40		
17–19			900	1,238

SLIGHT CHEMICAL ODOR 10–17'
GROUNDWATER AT 19'

TP-02A (17)		
DEPTH	TVOCs	TICs
11	174,000	1,216,000

SOLVENT ODOR 2–17'

SB-11 (14R)		
DEPTH	PID	FID
0–10	0–5	0–2
10–14	20–40	–

SLIGHT PAINT ODOR 4–14'
POSSIBLE PAINT FLECKS 10–14'

TP-19A (8)		
DEPTH	TVOCs	TICs
4	48,200	710,500

SOLVENT ODOR 3–6'

TP-10A (17.5)		
DEPTH	TVOCs	TICs
4	659,000	5,247,000

SOLVENT ODOR 1–17.5'

TP-10 (2)			
DEPTH	PID	FID	
0–2	>1000	300–500	

STRONG CHEMICAL ODOR 0–2'

TP-14A (11)		
DEPTH	TVOCs	TICs
4	21	20,800

SOLVENT ODOR 1–9'

SB-28 (15R)			
DEPTH	PID	TVOCs	TICs
4–5	110	22	14
9–9.5	180	55	4,650

SB-29 (5R)				
DEPTH	PID	TVOCs	TICs	
4–5	65	31	991	

SB-24

SB-25 (5R)				
DEPTH	PID	TVOCs	TICs	
3–4.5	0–5	85	U	

TP-19 (1)		
DEPTH	PID	FID
0–1	>1000	>1000

VERY STRONG PAINT THINNER ODOR

SB-26 (6R)			
DEPTH	PID	TVOCs	TICs
4–6	300	893	934

PAINT ODOR 4–6'

SB-27 (7R)			
DEPTH	PID	TVOCs	TICs
4–6	0	112	795

TP-14 (5)		
DEPTH	PID	FID
0–2	25–100	10–100
2–5	100–300	100–300

STAINING 2–4'
STRONG TO VERY STRONG FUEL OIL ODOR 2–4'

TP-22 (3)		
DEPTH	PID	FID
0–1	0	0
1–3	150–250	100–200

PETROLEUM ODOR,
STAINING 1–3'

TP-28 (16)		
DEPTH	PID	FID
0–16	0	0–10

GROUNDWATER AT 15'

GP-03S (6R)		
DEPTH	PID	FID
0–6	0–5	1–2

SB-07 (14R)		
DEPTH	PID	FID
0–14	0–10	0

SLIGHT PETROLEUM ODOR AT 12'

TP-21 (3)		
DEPTH	PID	FID
0–3	100–300	>1000

STAINING, STRONG PETROLEUM ODOR 2–3'

TP-37 (7)		
DEPTH	PID	FID
0–2	0–5	10–100
2–3	0–5	100–500
3–5	25–100	200
5–7	1300–1500	700–>1000

SB-30

CONTAINERS 2–3'
PAINT RESIDUE 2–5'
SLIGHT CHEMICAL ODOR 2–7'
STAINING AT 3'

SB-31 (5R)				
DEPTH	PID	TVOCs	TICs	
3–5	200	442	115	

SB-32 (5R)				
DEPTH	PID	TVOCs	TICs	
4–5	105	55	675	

TP-15 (7)		
DEPTH	PID	FID
0–1	0	0
1–2	5–25	100
2–3	25–50	500–1000
3–4	150–250	500
4–7	100–800	>1000

SLIGHT CHEMICAL ODOR 5–6'
TRACE STAINING 2–3'

SB-13 (11R)				
DEPTH	PID	FID	TVOCs	TICs
0–11	0–1	–		
4–6			13	U

SB-33 (6R)				
DEPTH	PID	TVOCs	TICs	
4–6	0	34	407	

SB-34 (4R)				
DEPTH	PID	TVOCs	TICs	
3–4	45	18	798	

TP-29 (15)				
DEPTH	PID	FID	TVOCs	TICs
0–15	0	0		
14			17	U

GROUNDWATER AT 15'

TP-SB10 (17.5)		
DEPTH	TVOCs	TICs
7	52,000	1,165,000

SOLVENT ODOR 2–16.5'

SB-09 (21)		
DEPTH	PID	FID
0–2	0	5
2–8	300–1900	100–350
8–21	0–50	0–5

GROUNDWATER AT 15'
PAINT RESIDUE 0–2',
PAINT THINNER ODOR 0–8'

TP-20A (13)		
DEPTH	TVOCs	TICs
5	113	17,050

SOLVENT ODOR 3–11'

SB-08 (17)		
DEPTH	PID	FID
0–4	0–10	0
4–6	5–50	10
6–17	0–25	0–6

GROUNDWATER AT 16'
PAINT RESIDUE 4–6'

TP-18 (7)		
DEPTH	PID	FID
0–6	5–20	10–100
6–7	500–1000	200

PAINT ODOR, POSSIBLE PAINT
RESIDUE/CONTAINER 6–7'

TP-18A (13)		
DEPTH	TVOCs	TICs
7	57,550	4,770,00

SOLVENT ODOR 5–11'

TP-36 (4)		
DEPTH	PID	FID
0–1	0–5	0–10
1–4	5–15	10–100

SB-35

CRUSHED PAINT CANS 1–4'
PAINT RESIDUE 3–4'

SB-10 (16)		
DEPTH	PID	FID
0–10	0–20	5
10–13	65–300	100–350
13–16	0–5	0–5

MODERATE PAINT ODOR 5–16'

SB-36 (20)			
DEPTH	PID	TVOCs	TICs
4–6	2	105	1,264
9–9.5	>2000	104	293
14–16	520	31	U
18–20	0	5	U

TP-20 (2)		
DEPTH	PID	FID
0–2	2–50	>1000

PAINT ODORS, STAINING,
PAINT RESIDUE 1–2'

SB-37 (20)			
DEPTH	PID	TVOCs	TICs
4–6	180	32	920
9–11	110	31	379
14–16	480	75	1,266
18–20	0	5	U

SB-38 (6R)			
DEPTH	PID	TVOCs	TICs
4–6	0	4	91

TP-30 (8)		
DEPTH	PID	FID
0–1	0	–
1–4	50–100	100–400
4–8	50–550	>1000

TP-30A (12)		
DEPTH	TVOCs	TICs
8	4,246	106,500

SOLVENT ODOR 4–10'

CHEMICAL ODOR 4–8'
CRUSHED 5 GAL CONTAINER 5–6'

TP-33A (10)		
DEPTH	TVOCs	TICs
6	30,800	3,327,000

SOLVENT ODOR 4–8'

TP-33 (5)		
DEPTH	PID	FID
0–3	0–5	>1000*
3–4	10–35	10–30
4–5	–	–

STRONG POSSIBLE PAINT ODOR 4–5' (NO READINGS RECORDED)
CONTAINERS, POSSIBLE PAINT RESIDUE 4–5'
*DECAYING LUMBER IN ZONE

TP-35 (15)		
DEPTH	PID	FID
0–2	25–50	100–>1000*
2–4	50	50
4–5	5–10	200–300
5–10	25–200	>1000*
10–13	5–25	100–600
13–15	0	>1000

GROUNDWATER AT 14'
*DECAYING LUMBER IN ZONE
CRUSHED DRUMS AND PAINT
RESIDUE 2–5'
SLIGHT PAINT THINNER/VARNISH ODOR 2–11'

TP-31 (16)		
DEPTH	PID	FID
0–2	0	0
2–5	10–50	100
5–8	0	100
8–16	0	0–10

GROUNDWATER AT 16'
SLIGHT FUEL ODOR,
DISCOLORED SOIL 2–5'

TP-41 (15)				
DEPTH	PID	FID	TVOCs	TICs
0–15	0	0–10		
14			7	U

TP-32 (15)				
DEPTH	PID	FID	TVOCs	TICs
0–4	0	0–10		
4–6	25–100	10–100		
6–10	10–100	10–100		
10–15	0–10	0		
15			21	237

GROUNDWATER AT 15'
FUEL ODOR, DISCOLORED SOIL 6–10'

TP-32A (6)		
DEPTH	TVOCs	TICs
3	30	17,470

SOLVENT ODOR 2–4'

APPROXIMATE LOCATION OF THE FORMER
PAINT AND VARNISH MANUFACTURING
FACILITY

TP-34 (15)		
DEPTH	PID	FID
0–2	0–25	100
2–6	0–2	200–500*
6–12	0	100
12–15	0	0

GROUNDWATER AT 15'
*DECAYING LUMBER IN ZONE

TP-40 (13)				
DEPTH	PID	FID	TVOCs	TICs
0–1	5–30	100		
1–2	25–30	50–100*		
2–4	50–150	>1000*		
4–5	10–25	>1000*		
5–6	2–10	100–200		
6–7	1–3	0–<10		
7–9	0	100–200		
9–10	5–50	10–20		
10–13	1–2	0–5		
12			58	11

GROUNDWATER AT 13'
*DECAYING LUMBER IN ZONE

LEGEND:

- HISTORIC PROPERTY LINE
- ESTIMATED AREA OF SOIL REQUIRING REMEDIATION
- TEST PIT EXCAVATED IN 2000
- SOIL BORING CONSTRUCTED IN 2000
- TEST PIT EXCAVATED IN 2002
- SOIL BORING CONSTRUCTED IN 2002
- SOIL BORING NOT CONSTRUCTED
- (20) MAXIMUM DEPTH OF TEST PIT/SOIL BORING, 'R' INDICATES REFUSAL
- PID AND FID READINGS IN PARTS PER MILLION
- TVOCs: TOTAL VOLATILE ORGANIC COMPOUNDS, IN MICROGRAMS PER KILOGRAM
- TICs: TOTAL TENTATIVELY IDENTIFIED COMPOUNDS, IN MICROGRAMS PER KILOGRAM

10 5 0 10
SCALE IN FEET

Dvirka and Bartilucci CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

BARRETTO POINT SITE
BRONX, NEW YORK

SUMMARY OF SOIL BORING AND TEST PIT SAMPLE RESULTS FORMER PAINT AND VARNISH MANUFACTURING FACILITY AREA

FIGURE 2–1

chemically characterize the contaminated soils. Test pit excavation was conducted in October 2002.

2.2 Sampling and Analytical Procedures

2.2.1 Soil Borings

The soil borings were constructed using the hollow stem auger drilling method (CME 85 drill rig and 4.25-inch inside diameter augers) by Uni-Tech Drilling Company, Inc. (Uni-Tech) on August 26 through 29, 2002. The augers were decontaminated using steam prior to the initial use on-site, after each boring and before demobilization from the site. Soil samples were collected using decontaminated split spoon samplers. The split spoons were decontaminated using steam prior to the initial use on-site, between samples and before demobilization from the site.

Each split spoon sample was screened for VOCs using an organic vapor analyzer equipped with a photoionization detector (PID) and an organic vapor analyzer equipped with a flame ionization detector (FID). After field screening, the samples were transferred to a laboratory-supplied sample container and immediately placed into an iced cooler for overnight shipment to the laboratory using chain-of-custody procedures.

As approved by the New York State Department of Environmental Conservation (NYSDEC) project manager, where refusal was encountered, a minimum of three attempts were made to complete the boring before moving to the next location. After completion, each boring was backfilled with cuttings and topped with bentonite, if necessary.

2.2.2 Test Pits

The 12 supplemental test pits were excavated by Uni-Tech using a John Deere model 410G backhoe on October 15 through 17, 2002. The backhoe bucket was decontaminated using steam prior to the initial use on-site, between test pits and before demobilization from the site.

Each test pit was excavated until the vertical extent of contamination was determined or the maximum reach of the backhoe (approximately 18 feet) was attained. The extent of contamination was established based on staining, odors and field instrument (PID and FID) readings. In order to verify that VOCs were not migrating off-site, perimeter air monitoring using a PID and an FID was conducted between the excavation and the downwind site boundary during excavation of each test pit. No PID or FID readings above background levels were measured and no odors were noted at any of the downwind site boundary locations.

The excavated soils and ambient air in the vicinity of the test pit were monitored for VOCs using a PID and an FID. Although solvent and paint odors were noted, PID/FID readings greater than 5 parts per million above background were not detected in the breathing zone during excavation of any test pit.

One soil sample was collected from the horizon within each test pit where the greatest contamination was identified based on staining, odors and PID/FID readings. Samples were collected from the interior of the backhoe bucket to eliminate the need for personnel to enter the excavation and to minimize concerns regarding cross-contamination from the equipment. After field measurements, the sample was transferred to a laboratory-supplied sample container and immediately placed into an iced cooler for overnight shipment to the laboratory using chain of custody procedures.

Upon completion of each test pit, it was immediately backfilled with the excavated material in reverse order (last out, first in) and covered with clean soil.

2.2.3 Analytical Procedures

The soil samples collected from the soil borings and test pits were analyzed for VOCs with a library search. All samples were analyzed by Mitkem Corporation utilizing NYSDEC Analytical Services Protocol (ASP) Method 95-1. Mitkem is certified by the New York State Department of Health Environmental Laboratory Approval Program (ELAP) for this analysis.

2.3 Results

The analytical results from the supplemental soil boring samples are summarized in Table 2-1 and the analytical results from the supplemental test pit samples are summarized in Table 2-2. As shown in these tables, the test pit samples contained significantly elevated concentrations of VOCs, predominantly ethylbenzene, xylenes and tentatively identified compounds (TICs). The results from the soil boring samples did not in general correspond to the test pit results, likely due to the collection of samples from specific depths in the soil borings rather than the "worst-case" horizons, and the inability of the drill rig to achieve the depths necessary to reach the greatest contaminant levels.

The analytical results and field observations for the soil samples collected during the initial and supplemental site investigations are summarized on Figure 2-1. Total VOC concentrations, including TICs, in most of the test pit samples exceeded the NYSDEC Recommended Soil Cleanup Objective (RSCO) for total VOCs of 10,000 micrograms per kilogram (ug/kg). Since odors from the soils excavated from the supplemental test pits correspond with significant levels of contamination (greater than total VOCs of 10,000 ug/kg), the presence of odors in the samples collected during the initial and supplemental site investigations were used to evaluate the extent of soil contamination and to estimate the volume of soil to be remediated. The zone in which odors were noted, the depth of any samples collected, and the total VOC and TIC results for each soil boring and test pit in this area from both the initial and supplemental site investigations are summarized in Table 2-3.

The analytical results show that, in general, the upper 2 feet of soil within the area of the former paint and varnish manufacturing facility was not significantly impacted by historic operations at the facility. Elevated levels of VOCs and VOC TICs were detected to depths of up to 18 feet below ground surface in the central portion of the facility area, and in general, the depth of contamination decreased toward the perimeter of the area. A zone of contamination to approximately 11 feet below ground surface, associated with buried waste (wood, paint cans, solidified varnish, plastic and debris), was identified in the southern corner of the area in the

TABLE 2-1
SUPPLEMENTAL SOIL BORING SAMPLE RESULTS
FORMER PAINT AND VARNISH MANUFACTURING AREA
BARRETTO POINT SITE, BRONX, NEW YORK

SAMPLE ID	SB-14	SB-14	SB-15	SB-16	SB-17	Contract Required Detection Limit	Recommended Soil Cleanup Objectives
SAMPLE DEPTH (FT)	3 - 5	9 - 9.5	4 - 6	4 - 6	4 - 6		
SAMPLE TYPE	Soil	Soil	Soil	Soil	Soil		
PERCENT SOLIDS	89	87	87	98	86		
DILUTION FACTOR	1	1	1	1	1		
DATE OF COLLECTION	8/26/02	8/26/02	8/26/02	8/26/02	8/26/02		
UNITS	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Volatile Organics							
Chloromethane	2 J	U	U	U	U	10	--
Bromomethane	U	U	U	U	U	10	--
Vinyl chloride	U	U	U	U	U	10	200
Chloroethane	U	U	U	U	U	10	1,900
Methylene chloride	U	1 JB	1 JB	3 JB	4 JB	10	100
Acetone	16 B	21 B	8 JB	4 JB	6 JB	10	200
Carbon disulfide	U	6 JB	3 JB	U	U	10	2,700
1,1-Dichloroethene	2 J	U	U	U	4 J	10	400
1,1-Dichloroethane	U	U	U	U	U	10	200
1,2-Dichloroethene (total)	U	U	U	U	U	10	300
Chloroform	U	U	U	U	U	10	300
1,2-Dichloroethane	U	U	U	U	U	10	100
2-Butanone	U	U	U	U	U	10	300
1,1,1-Trichloroethane	U	U	U	U	U	10	800
Carbon tetrachloride	U	U	U	U	U	10	600
Bromodichloromethane	U	U	U	U	U	10	--
1,2-Dichloropropane	U	U	U	U	U	10	--
cis-1,3-Dichloropropene	U	U	U	U	U	10	--
Trichloroethene	U	U	U	U	U	10	700
Dibromochloromethane	U	U	U	U	U	10	N/A
1,1,2-Trichloroethane	U	U	U	U	U	10	--
Benzene	U	U	U	U	U	10	60
trans-1,3-Dichloropropene	U	U	U	U	U	10	--
Bromoform	U	U	U	U	U	10	--
4-Methyl-2-pentanone	U	U	U	U	U	10	1,000
2-Hexanone	U	U	U	U	U	10	--
Tetrachloroethene	U	U	U	U	U	10	1,400
1,1,2,2-Tetrachloroethane	U	U	U	U	U	10	600
Toluene	2 J	U	U	U	U	10	1,500
Chlorobenzene	U	U	U	U	U	10	1,700
Ethylbenzene	U	8 J	U	U	U	10	5,500
Styrene	U	U	U	U	U	10	--
Xylene (total)	2 J	2 J	U	U	U	10	1,200
Total VOCs	**24**	**38**	**12**	**7**	**14**		10,000
Total VOC TICs	**U**	**2,237**	**6**	**U**	**31**		10,000

NOTES:
U: Compound analyzed for but not detected.
J: Estimated concentration.
B: Compound detected in the blank as well as the sample.
N/A: Not available.

TABLE 2-1
SUPPLEMENTAL SOIL BORING SAMPLE RESULTS
FORMER PAINT AND VARNISH MANUFACTURING AREA
BARRETTO POINT SITE, BRONX, NEW YORK

SAMPLE ID	SB-18	SB-19	SB-20	SB-21	SB-21	Contract Required Detection Limit	Recommended Soil Cleanup Objectives
SAMPLE DEPTH (FT)	4 - 6	3 - 3.5	4 - 4.5	4 - 6	9 - 10		
SAMPLE TYPE	Soil	Soil	Soil	Soil	Soil		
PERCENT SOLIDS	87	98	100	100	89		
DILUTION FACTOR	1	1	1	1	1		
DATE OF COLLECTION	8/27/02	8/29/02	8/29/02	8/27/02	8/27/02		
UNITS	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Volatile Organics							
Chloromethane	U	U	U	U	U	10	--
Bromomethane	U	U	U	U	U	10	--
Vinyl chloride	U	U	U	U	U	10	200
Chloroethane	U	U	U	U	U	10	1,900
Methylene chloride	3 JB	3 J	2 J	U	U	10	100
Acetone	7 JB	15	8 J	U	31 B	10	200
Carbon disulfide	U	U	U	U	10 JB	10	2,700
1,1-Dichloroethene	3 J	U	U	U	6 J	10	400
1,1-Dichloroethane	U	U	U	U	U	10	200
1,2-Dichloroethene (total)	U	U	U	U	U	10	300
Chloroform	U	U	U	U	U	10	300
1,2-Dichloroethane	U	U	U	U	U	10	100
2-Butanone	U	U	U	U	8 J	10	300
1,1,1-Trichloroethane	U	U	U	U	U	10	800
Carbon tetrachloride	U	U	U	U	U	10	600
Bromodichloromethane	U	U	U	U	U	10	--
1,2-Dichloropropane	U	U	U	U	U	10	--
cis-1,3-Dichloropropene	U	U	U	U	U	10	--
Trichloroethene	U	U	U	U	U	10	700
Dibromochloromethane	U	U	U	U	U	10	N/A
1,1,2-Trichloroethane	U	U	U	U	U	10	--
Benzene	U	1 J	U	U	U	10	60
trans-1,3-Dichloropropene	U	U	U	U	U	10	--
Bromoform	U	U	U	U	U	10	--
4-Methyl-2-pentanone	U	U	U	U	U	10	1,000
2-Hexanone	U	U	U	U	U	10	--
Tetrachloroethene	U	U	U	U	U	10	1,400
1,1,2,2-Tetrachloroethane	U	U	U	U	U	10	600
Toluene	U	3 J	U	U	2 J	10	1,500
Chlorobenzene	U	U	U	U	U	10	1,700
Ethylbenzene	U	1 J	U	2,700	180 D	10	5,500
Styrene	U	U	U	U	U	10	--
Xylene (total)	U	5 J	2 J	**1,800**	440	10	1,200
Total VOCs	**13**	**28**	**12**	**4,500**	**677**		10,000
Total VOC TICs	**74**	**7**	**U**	**1,553,000**	**70,300**		10,000

NOTES:
U: Compound analyzed for but not detected.
J: Estimated concentration.
B: Compound detected in the blank as well as the sample.
N/A: Not available.

TABLE 2-1
SUPPLEMENTAL SOIL BORING SAMPLE RESULTS
FORMER PAINT AND VARNISH MANUFACTURING AREA
BARRETTO POINT SITE, BRONX, NEW YORK

SAMPLE ID	SB-22	SB-22	SB-22	SB-22	SB-23	Contract Required Detection Limit	Recommended Soil Cleanup Objectives
SAMPLE DEPTH (FT)	4 - 6	9 - 10.5	14 - 15.5	18 - 20	3 - 5		
SAMPLE TYPE	Soil	Soil	Soil	Soil	Soil		
PERCENT SOLIDS	98	98	100	98	90		
DILUTION FACTOR	1	1	1	1	1		
DATE OF COLLECTION	8/27/01	8/27/01	8/27/02	8/27/01	8/27/01		
UNITS	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Volatile Organics							
Chloromethane	U	U	U	U	U	10	--
Bromomethane	U	U	U	U	U	10	--
Vinyl chloride	U	U	U	U	U	10	200
Chloroethane	U	U	U	U	U	10	1,900
Methylene chloride	2 JB	2 JB	1 JB	3 JB	1 JB	10	100
Acetone	10 JB	35 B	14 B	15 B	16 B	10	200
Carbon disulfide	1 JB	5 J	2 J	4 JB	U	10	2,700
1,1-Dichloroethene	U	2 J	U	U	U	10	400
1,1-Dichloroethane	U	U	U	U	U	10	200
1,2-Dichloroethene (total)	U	U	U	U	U	10	300
Chloroform	U	U	U	U	U	10	300
1,2-Dichloroethane	U	U	U	U	U	10	100
2-Butanone	U	8 J	4 J	4 J	U	10	300
1,1,1-Trichloroethane	U	U	U	U	U	10	800
Carbon tetrachloride	U	U	U	U	U	10	600
Bromodichloromethane	U	U	U	U	U	10	--
1,2-Dichloropropane	U	U	U	U	U	10	--
cis-1,3-Dichloropropene	U	U	U	U	U	10	--
Trichloroethene	U	U	U	U	U	10	700
Dibromochloromethane	U	U	U	U	U	10	N/A
1,1,2-Trichloroethane	U	U	U	U	U	10	--
Benzene	U	U	U	U	U	10	60
trans-1,3-Dichloropropene	U	U	U	U	U	10	--
Bromoform	U	U	U	U	U	10	--
4-Methyl-2-pentanone	U	U	U	U	U	10	1,000
2-Hexanone	U	U	U	U	U	10	--
Tetrachloroethene	U	U	U	U	U	10	1,400
1,1,2,2-Tetrachloroethane	U	U	U	U	U	10	600
Toluene	U	2 J	1 J	2 J	U	10	1,500
Chlorobenzene	U	U	U	U	U	10	1,700
Ethylbenzene	100	22	52	32	U	10	5,500
Styrene	U	U	U	U	U	10	--
Xylene (total)	67	32	29	26	U	10	1,200
Total VOCs	**180**	**108**	**103**	**86**	**17**		10,000
Total VOC TICs	**40,030**	**28,040**	**16,490**	**20,660**	**80**		10,000

NOTES:
U: Compound analyzed for but not detected.
J: Estimated concentration.
B: Compound detected in the blank as well as the sample.
D: Diluted
N/A: Not available.
: Exceeds Recommended Soil Cleanup Ojectives

TABLE 2-1
SUPPLEMENTAL SOIL BORING SAMPLE RESULTS
FORMER PAINT AND VARNISH MANUFACTURING AREA
BARRETTO POINT SITE, BRONX, NEW YORK

SAMPLE ID	SB-25	SB-26	SB-27	SB-28	SB-28	Contract Required Detection Limit	Recommended Soil Cleanup Objectives
SAMPLE DEPTH (FT)	3 - 4.5	4 - 6	4 - 6	4 - 5	9 - 9.5		
SAMPLE TYPE	Soil	Soil	Soil	Soil	Soil		
PERCENT SOLIDS	92	97	98	95	100		
DILUTION FACTOR	1	1	1	1	1		
DATE OF COLLECTION	8/29/02	8/28/02	8/27/02	8/28/02	8/28/02		
UNITS	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Volatile Organics							
Chloromethane	U	U	U	U	U	10	--
Bromomethane	U	U	U	U	U	10	--
Vinyl chloride	U	U	U	U	U	10	200
Chloroethane	U	U	U	U	U	10	1,900
Methylene chloride	2 J	2 J	2 JB	U	2 J	10	100
Acetone	42	11	100 B	22	9 J	10	200
Carbon disulfide	2 J	U	2 JB	U	U	10	2,700
1,1-Dichloroethene	U	U	U	U	U	10	400
1,1-Dichloroethane	U	U	U	U	U	10	200
1,2-Dichloroethene (total)	U	U	U	U	U	10	300
Chloroform	U	U	U	U	U	10	300
1,2-Dichloroethane	U	U	U	U	U	10	100
2-Butanone	U	U	7 J	U	U	10	300
1,1,1-Trichloroethane	U	U	U	U	U	10	800
Carbon tetrachloride	U	U	U	U	U	10	600
Bromodichloromethane	U	U	U	U	U	10	--
1,2-Dichloropropane	U	U	U	U	U	10	--
cis-1,3-Dichloropropene	U	U	U	U	U	10	--
Trichloroethene	U	U	U	U	U	10	700
Dibromochloromethane	U	U	U	U	U	10	N/A
1,1,2-Trichloroethane	U	U	U	U	U	10	--
Benzene	U	U	U	U	U	10	60
trans-1,3-Dichloropropene	U	U	U	U	U	10	--
Bromoform	U	U	U	U	U	10	--
4-Methyl-2-pentanone	U	U	U	U	U	10	1,000
2-Hexanone	U	U	U	U	U	10	--
Tetrachloroethene	U	U	U	U	U	10	1,400
1,1,2,2-Tetrachloroethane	U	U	U	U	U	10	600
Toluene	2 J	U	U	U	6 J	10	1,500
Chlorobenzene	U	U	U	U	U	10	1,700
Ethylbenzene	23	130	1 J	U	12	10	5,500
Styrene	U	U	U	U	U	10	--
Xylene (total)	14	750 D	U	U	26	10	1,200
Total VOCs	**85**	**893**	**112**	**22**	**55**		10,000
Total VOC TICs	**U**	**934**	**795**	**14**	**4,650**		10,000

NOTES:
U: Compound analyzed for but not detected.
J: Estimated concentration.
B: Compound detected in the blank as well as the sample.
N/A: Not available.

TABLE 2-1
SUPPLEMENTAL SOIL BORING SAMPLE RESULTS
FORMER PAINT AND VARNISH MANUFACTURING AREA
BARRETTO POINT SITE, BRONX, NEW YORK

SAMPLE ID	SB-29	SB-31	SB-32	SB-33	SB-34	Contract Required Detection Limit	Recommended Soil Cleanup Objectives
SAMPLE DEPTH (FT)	4 - 5	3 - 3.5	4 - 5	4 - 6	3 - 4		
SAMPLE TYPE	Soil	Soil	Soil	Soil	Soil		
PERCENT SOLIDS	92	98	100	100	98		
DILUTION FACTOR	1	1	1	1	1		
DATE OF COLLECTION	8/29/02	8/28/02	8/28/02	8/27/02	8/28/02		
UNITS	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Volatile Organics							
Chloromethane	U	U	U	U	U	10	--
Bromomethane	U	U	U	U	U	10	--
Vinyl chloride	U	U	U	U	U	10	200
Chloroethane	U	U	U	U	U	10	1,900
Methylene chloride	3 J	2 J	2 J	1 JB	2 J	10	100
Acetone	9 J	45	15	28 B	U	10	200
Carbon disulfide	U	U	U	1 JB	U	10	2,700
1,1-Dichloroethene	U	U	U	U	U	10	400
1,1-Dichloroethane	U	U	U	U	U	10	200
1,2-Dichloroethene (total)	U	U	U	U	U	10	300
Chloroform	U	U	U	U	U	10	300
1,2-Dichloroethane	U	U	U	U	U	10	100
2-Butanone	U	U	U	4 J	U	10	300
1,1,1-Trichloroethane	U	U	U	U	U	10	800
Carbon tetrachloride	U	U	U	U	U	10	600
Bromodichloromethane	U	U	U	U	U	10	--
1,2-Dichloropropane	U	U	U	U	U	10	--
cis-1,3-Dichloropropene	U	U	U	U	U	10	--
Trichloroethene	U	U	U	U	U	10	700
Dibromochloromethane	U	U	U	U	U	10	N/A
1,1,2-Trichloroethane	U	U	U	U	U	10	--
Benzene	U	1 J	U	U	U	10	60
trans-1,3-Dichloropropene	U	U	U	U	U	10	--
Bromoform	U	U	U	U	U	10	--
4-Methyl-2-pentanone	U	U	U	U	U	10	1,000
2-Hexanone	U	U	U	U	U	10	--
Tetrachloroethene	U	U	U	U	U	10	1,400
1,1,2,2-Tetrachloroethane	U	U	U	U	U	10	600
Toluene	5 J	5 J	U	U	7 J	10	1,500
Chlorobenzene	U	U	U	U	U	10	1,700
Ethylbenzene	2 J	79	7 J	U	1 J	10	5,500
Styrene	U	U	U	U	U	10	--
Xylene (total)	12	310	31	U	8 J	10	1,200
Total VOCs	**31**	**442**	**55**	**34**	**18**		10,000
Total VOC TICs	**991**	**115**	**675**	**407**	**798**		10,000

NOTES:
U: Compound analyzed for but not detected.
J: Estimated concentration.
B: Compound detected in the blank as well as the sample.
N/A: Not available.

TABLE 2-1
SUPPLEMENTAL SOIL BORING SAMPLE RESULTS
FORMER PAINT AND VARNISH MANUFACTURING AREA
BARRETTO POINT SITE, BRONX, NEW YORK

SAMPLE ID	SB-36	SB-36	SB-36	SB-36	SB-37	Contract Required Detection Limit	Recommended Soil Cleanup Objectives
SAMPLE DEPTH (FT)	4 - 6	9 - 9.5	14 - 16	18 - 20	4 - 6		
SAMPLE TYPE	Soil	Soil	Soil	Soil	Soil		
PERCENT SOLIDS	100	94	98	100	100		
DILUTION FACTOR	1	1	1	1	1		
DATE OF COLLECTION	8/28/02	8/28/02	8/28/02	8/28/02	8/28/02		
UNITS	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Volatile Organics							
Chloromethane	U	U	U	U	U	10	--
Bromomethane	U	U	U	U	U	10	--
Vinyl chloride	U	U	U	U	U	10	200
Chloroethane	U	U	U	U	U	10	1,900
Methylene chloride	3 J	3 J	2 J	2 J	1 J	10	100
Acetone	65	59	29	3 J	22	10	200
Carbon disulfide	U	U	U	U	U	10	2,700
1,1-Dichloroethene	U	U	U	U	U	10	400
1,1-Dichloroethane	U	U	U	U	U	10	200
1,2-Dichloroethene (total)	U	U	U	U	U	10	300
Chloroform	U	U	U	U	U	10	300
1,2-Dichloroethane	U	U	U	U	U	10	100
2-Butanone	5 J	6 J	U	U	U	10	300
1,1,1-Trichloroethane	U	U	U	U	U	10	800
Carbon tetrachloride	U	U	U	U	U	10	600
Bromodichloromethane	U	U	U	U	U	10	--
1,2-Dichloropropane	U	U	U	U	U	10	--
cis-1,3-Dichloropropene	U	U	U	U	U	10	--
Trichloroethene	U	U	U	U	U	10	700
Dibromochloromethane	U	U	U	U	U	10	N/A
1,1,2-Trichloroethane	U	U	U	U	U	10	--
Benzene	U	1 J	U	U	U	10	60
trans-1,3-Dichloropropene	U	U	U	U	U	10	--
Bromoform	U	U	U	U	U	10	--
4-Methyl-2-pentanone	U	U	U	U	U	10	1,000
2-Hexanone	U	U	U	U	U	10	--
Tetrachloroethene	U	U	U	U	U	10	1,400
1,1,2,2-Tetrachloroethane	U	U	U	U	U	10	600
Toluene	7 J	8 J	U	U	3 J	10	1,500
Chlorobenzene	U	U	U	U	U	10	1,700
Ethylbenzene	4 J	3 J	U	U	U	10	5,500
Styrene	U	U	U	U	U	10	--
Xylene (total)	21	24	U	U	6 J	10	1,200
Total VOCs	**105**	**104**	**31**	**5**	**32**		10,000
Total VOC TICs	**1,264**	**293**	**U**	**U**	**920**		10,000

NOTES:
U: Compound analyzed for but not detected.
J: Estimated concentration.
B: Compound detected in the blank as well as the sample.
N/A: Not available.

TABLE 2-1
SUPPLEMENTAL SOIL BORING SAMPLE RESULTS
FORMER PAINT AND VARNISH MANUFACTURING AREA
BARRETTO POINT SITE, BRONX, NEW YORK

SAMPLE ID	SB-37	SB-37	SB-37	SB-38		Contract Required Detection Limit	Recommended Soil Cleanup Objectives
SAMPLE DEPTH (FT)	9 -11	14 - 16	18 -20	4 - 6			
SAMPLE TYPE	Soil	Soil	Soil	Soil			
PERCENT SOLIDS	98	92	98	98			
DILUTION FACTOR	1	1	1	1			
DATE OF COLLECTION	8/28/02	8/28/02	8/28/02	8/28/02			
UNITS	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)		(ug/kg)	(ug/kg)
Volatile Organics							
Chloromethane	U	U	U	U		10	--
Bromomethane	U	U	U	U		10	--
Vinyl chloride	U	U	U	U		10	200
Chloroethane	U	U	U	U		10	1,900
Methylene chloride	1 J	2 J	2 J	2 J		10	100
Acetone	26	55	3 J	2 J		10	200
Carbon disulfide	U	U	U	U		10	2,700
1,1-Dichloroethene	U	U	U	U		10	400
1,1-Dichloroethane	U	U	U	U		10	200
1,2-Dichloroethene (total)	U	U	U	U		10	300
Chloroform	U	U	U	U		10	300
1,2-Dichloroethane	U	U	U	U		10	100
2-Butanone	U	7 J	U	U		10	300
1,1,1-Trichloroethane	U	U	U	U		10	800
Carbon tetrachloride	U	U	U	U		10	600
Bromodichloromethane	U	U	U	U		10	--
1,2-Dichloropropane	U	U	U	U		10	--
cis-1,3-Dichloropropene	U	U	U	U		10	--
Trichloroethene	U	U	U	U		10	700
Dibromochloromethane	U	U	U	U		10	N/A
1,1,2-Trichloroethane	U	U	U	U		10	--
Benzene	U	U	U	U		10	60
trans-1,3-Dichloropropene	U	U	U	U		10	--
Bromoform	U	U	U	U		10	--
4-Methyl-2-pentanone	U	U	U	U		10	1,000
2-Hexanone	U	U	U	U		10	--
Tetrachloroethene	U	U	U	U		10	1,400
1,1,2,2-Tetrachloroethane	U	U	U	U		10	600
Toluene	1 J	4 J	U	U		10	1,500
Chlorobenzene	U	U	U	U		10	1,700
Ethylbenzene	U	1 J	U	U		10	5,500
Styrene	U	U	U	U		10	--
Xylene (total)	3 J	6 J	U	U		10	1,200
Total VOCs	**31**	**75**	**5**	**4**			10,000
Total VOC TICs	**379**	**1,266**	**U**	**91**			10,000

NOTES:
U: Compound analyzed for but not detected.
J: Estimated concentration.
B: Compound detected in the blank as well as the sample.
N/A: Not available.

TABLE 2-2
SUPPLEMENTAL TEST PIT SAMPLE RESULTS
FORMER PAINT AND VARNISH MANUFACTURING AREA
BARRETTO POINT SITE, BRONX, NEW YORK

SAMPLE ID	TP-02A	TP-10A	TP-11A	TP-14A	Contract Required Detection Limit	Recommended Soil Cleanup Objectives
SAMPLE DEPTH (FT)	11	4	12.5	4		
ODORS NOTED (FT)	2-17	1-17.5	9-16	1-9		
PERCENT SOLIDS	85	88	91	96		
DILUTION FACTOR	310	1250	1	1		
DATE OF COLLECTION	10/15/02	10/16/02	10/15/02	10/17/02		
UNITS	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Volatile Organics						
Chloromethane	U	U	U	U	10	--
Bromomethane	U	U	U	U	10	--
Vinyl chloride	U	U	U	U	10	200
Chloroethane	U	U	U	U	10	1,900
Methylene chloride	U	U	3 J	2 J	10	100
Acetone	U	U	11	6 J	10	200
Carbon disulfide	U	U	U	U	10	2,700
1,1-Dichloroethene	U	U	U	U	10	400
1,1-Dichloroethane	U	U	U	U	10	200
1,2-Dichloroethene (total)	U	U	U	U	10	300
Chloroform	U	U	U	U	10	300
1,2-Dichloroethane	U	U	U	U	10	100
2-Butanone	U	U	U	U	10	300
1,1,1-Trichloroethane	U	U	U	U	10	800
Carbon tetrachloride	U	U	U	U	10	600
Bromodichloromethane	U	U	U	U	10	--
1,2-Dichloropropane	U	U	U	U	10	--
cis-1,3-Dichloropropene	U	U	U	U	10	--
Trichloroethene	U	U	U	U	10	700
Dibromochloromethane	U	U	U	U	10	N/A
1,1,2-Trichloroethane	U	U	U	U	10	--
Benzene	U	U	U	U	10	60
trans-1,3-Dichloropropene	U	U	U	U	10	--
Bromoform	U	U	U	U	10	--
4-Methyl-2-pentanone	U	U	U	U	10	1,000
2-Hexanone	U	U	U	U	10	--
Tetrachloroethene	U	U	U	U	10	1,400
1,1,2,2-Tetrachloroethane	U	U	U	U	10	600
Toluene	U	U	U	U	10	1,500
Chlorobenzene	U	U	U	U	10	1,700
Ethylbenzene	**34,000**	**69,000**	6 J	3 J	10	5,500
Styrene	U	U	U	U	10	--
Xylene (total)	**140,000**	**590,000**	23	10 J	10	1,200
Total VOCs	**174,000**	**659,000**	**43**	**21**		10,000
Total VOC TICs	**1,216,000**	**5,247,000**	**6,950**	**20,800**		10,000

NOTES:
U: Compound analyzed for but not detected.
J: Estimated concentration.
N/A: Not available.
: Exceeds Recommended Soil Cleanup Ojective

TABLE 2-2
SUPPLEMENTAL TEST PIT SAMPLE RESULTS
FORMER PAINT AND VARNISH MANUFACTURING AREA
BARRETTO POINT SITE, BRONX, NEW YORK

SAMPLE ID	TP-18A	TP-19A	TP-20A	TP-23A	Contract Required Detection Limit	Recommended Soil Cleanup Objectives
SAMPLE DEPTH (FT)	7	4	5	4		
ODORS NOTED (FT)	5-11	3-6	3-11	2-6		
PERCENT SOLIDS	83	87	90	91		
DILUTION FACTOR	125	125	1	125		
DATE OF COLLECTION	10/17/02	10/16/02	10/16/02	10/16/02		
UNITS	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Volatile Organics						
Chloromethane	U	U	U	U	10	--
Bromomethane	U	U	U	U	10	--
Vinyl chloride	U	U	U	U	10	200
Chloroethane	U	U	U	U	10	1,900
Methylene chloride	U	U	2 J	U	10	100
Acetone	**550 J**	U	45	U	10	200
Carbon disulfide	U	U	U	U	10	2,700
1,1-Dichloroethene	U	U	U	U	10	400
1,1-Dichloroethane	U	U	U	U	10	200
1,2-Dichloroethene (total)	U	U	U	U	10	300
Chloroform	U	U	U	U	10	300
1,2-Dichloroethane	U	U	U	U	10	100
2-Butanone	U	U	8 J	U	10	300
1,1,1-Trichloroethane	U	U	U	U	10	800
Carbon tetrachloride	U	U	U	U	10	600
Bromodichloromethane	U	U	U	U	10	--
1,2-Dichloropropane	U	U	U	U	10	--
cis-1,3-Dichloropropene	U	U	U	U	10	--
Trichloroethene	U	U	U	U	10	700
Dibromochloromethane	U	U	U	U	10	N/A
1,1,2-Trichloroethane	U	U	U	U	10	--
Benzene	U	U	U	U	10	60
trans-1,3-Dichloropropene	U	U	U	U	10	--
Bromoform	U	U	U	U	10	--
4-Methyl-2-pentanone	U	U	U	U	10	1,000
2-Hexanone	U	U	U	U	10	--
Tetrachloroethene	U	U	U	U	10	1,400
1,1,2,2-Tetrachloroethane	U	U	U	U	10	600
Toluene	U	U	U	U	10	1,500
Chlorobenzene	U	U	U	U	10	1,700
Ethylbenzene	**18,000**	**8,200**	17	**9,400**	10	5,500
Styrene	U	U	U	U	10	--
Xylene (total)	**39,000**	**40,000**	41	**26,000**	10	1,200
Total VOCs	**57,550**	**48,200**	**113**	**35,400**		10,000
Total VOC TICs	**4,770,000**	**710,500**	**17,050**	**1,758,000**		10,000

NOTES:
U: Compound analyzed for but not detected.
J: Estimated concentration.
N/A: Not available.
: Exceeds Recommended Soil Cleanup Ojective

TABLE 2-2
SUPPLEMENTAL TEST PIT SAMPLE RESULTS
FORMER PAINT AND VARNISH MANUFACTURING AREA
BARRETTO POINT SITE, BRONX, NEW YORK

SAMPLE ID	TP-30A	TP-32A	TP-33A	TP-SB10	Contract Required Detection Limit	Recommended Soil Cleanup Objectives
SAMPLE DEPTH (FT)	8	3	6	7		
ODORS NOTED (FT)	4-10	2-4	4-8	2-16.5		
PERCENT SOLIDS	90	86	91	87		
DILUTION FACTOR	10	1	125	125		
DATE OF COLLECTION	10/17/02	10/17/02	10/17/02	10/16/02		
UNITS	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Volatile Organics						
Chloromethane	U	U	U	U	10	--
Bromomethane	U	U	U	U	10	--
Vinyl chloride	U	U	U	U	10	200
Chloroethane	U	U	U	U	10	1,900
Methylene chloride	33 J	3 J	U	U	10	100
Acetone	63 J	12	U	U	10	200
Carbon disulfide	U	U	U	U	10	2,700
1,1-Dichloroethene	U	U	U	U	10	400
1,1-Dichloroethane	U	U	U	U	10	200
1,2-Dichloroethene (total)	U	U	U	U	10	300
Chloroform	U	U	U	U	10	300
1,2-Dichloroethane	U	U	U	U	10	100
2-Butanone	U	U	U	U	10	300
1,1,1-Trichloroethane	U	U	U	U	10	800
Carbon tetrachloride	U	U	U	U	10	600
Bromodichloromethane	U	U	U	U	10	--
1,2-Dichloropropane	U	U	U	U	10	--
cis-1,3-Dichloropropene	U	U	U	U	10	--
Trichloroethene	U	U	U	U	10	700
Dibromochloromethane	U	U	U	U	10	N/A
1,1,2-Trichloroethane	U	U	U	U	10	--
Benzene	U	U	U	U	10	60
trans-1,3-Dichloropropene	U	U	U	U	10	--
Bromoform	U	U	U	U	10	--
4-Methyl-2-pentanone	U	U	U	U	10	1,000
2-Hexanone	U	U	U	U	10	--
Tetrachloroethene	U	U	U	U	10	1,400
1,1,2,2-Tetrachloroethane	U	U	U	U	10	600
Toluene	U	U	U	U	10	1,500
Chlorobenzene	U	U	U	U	10	1,700
Ethylbenzene	450	3 J	2,800	**10,000**	10	5,500
Styrene	U	U	U	U	10	--
Xylene (total)	**3,700**	12	**28,000**	**52,000**	10	1,200
Total VOCs	**4,246**	**30**	**30,800**	**62,000**		10,000
Total VOC TICs	**106,500**	**17,470**	**3,327,000**	**1,165,000**		10,000

NOTES:
U: Compound analyzed for but not detected.
J: Estimated concentration.
N/A: Not available.
: Exceeds Recommended Soil Cleanup Ojective

TABLE 2-3
SUMMARY OF TEST PIT AND SOIL BORING SAMPLE RESULTS
FORMER PAINT AND BARNISH MANUFACTURING AREA
BARRETTO POINT SITE, BRONX, NEW YORK

LOCATION	ODORS NOTED *	SAMPLE DEPTH *	TVOCs (ug/kg)	TICs (ug/kg)
TP-01	0-3 **	3	U	1,830
TP-02	0-2 **	1-2	751,350	1,397,000
TP-02A	2-17	11	174,000	1,216,000
TP-09	4-6 **	--	--	--
TP-10	0-2 **	--	--	--
TP-10A	1-17.5 **	4	659,000	5,247,000
TP-11	10-12 **	--	--	--
TP-11A	9-16	12.5	43	6,950
TP-12	12-13 **	--	--	--
TP-13	9-14 **	--	--	--
TP-14	2-4 **	--	--	--
TP-14A	1-9	4	21	20,800
TP-15	2-6	--	--	--
TP-16	8-13 **	--	--	--
TP-17	NN	14	25	U
TP-18	6-7 **	--	--	--
TP-18A	5-11	7	57,550	4,770,000
TP-19	0-1 **	--	--	--
TP-19A	3-6	4	48,200	710,500
TP-20	1-2 **	--	--	--
TP-20A	3-11	5	113	17,050
TP-21	2-3 **	--	--	--
TP-22	1-3 **	--	--	--
TP-23	1-4 **	--	--	--
TP-23A	2-6	4	35,400	1,758,000
TP-24	10-12 **	--	--	--
TP-25	NN	15	19	U
TP-26	2-3	14	20	U
TP-27	NN	15	20	U
TP-28	NN	--	--	--
TP-29	NN	14	17	U
TP-30	4-8 **	--	--	--
TP-30A	4-10	8	4,246	106,500
TP-31	2-5	--	--	--
TP-32	6-10	15	21	237
TP-32A	2-4	3	30	17,470
TP-33	4-5 **	--	--	--
TP-33A	4-8	6	30,800	3,327,000
TP-34	NN	--	--	--
TP-35	2-11	--	--	--
TP-36	1-4 **	--	--	--
TP-37	2-7 **	--	--	--
TP-38	NN	11	17	U
TP-39	NN	--	--	--
TP-40	NN	12	58	11
TP-41	NN	14	7	U
TP-42	NN	--	--	--
GP-01S	4-17	--	--	--
GP-02S	6-10 **	--	--	--
GP-03S	NN	--	--	--
SB-06	10-17	17-19	900	1,238
SB-07	12	--	--	--
SB-08	4-6	--	--	--
SB-09	0-8	--	--	--
SB-10	5-16	--	--	--
TP-SB10	2-16.5	7	52,000	1,165,000
SB-11	4-14	--	--	--
SB-12	NN	11-12	15	U
SB-13	NN	4-6	13	U
SB-14	NN	3-5	24	U
		9-9.5	38	2,237
SB-15	NN	4-6	12	6
SB-16	NN	4-6	7	U
SB-17	NN	4-6	14	31
SB-18	NN	4-6	13	74
SB-19	NN	3-3.5	28	7
SB-20	NN	4-4.5	12	U
SB-21	NN	4-6	4,500	1,553,000
		9-10	677	70,300
SB-22	4-18	4-6	180	40,030
		9-10.5	108	28,040
		14-15.5	103	16,490
		18-20	86	20,660
SB-23	NN	3-5	17	80
SB-25	NN	3-4.5	85	U
SB-26	4-6	4-6	893	934
SB-27	NN	4-6	112	795
SB-28	NN	4-5	22	14
		9-9.5	55	4,650
SB-29	NN	4-5	31	991
SB-31	NN	3-5	442	115
SB-32	NN	4-5	55	675
SB-33	NN	4-6	34	407
SB-34	NN	3-4	18	798
SB-36	NN	4-6	105	1,264
		9-9.5	104	293
		14-16	31	U
		18-20	5	U
SB-37	NN	4-6	32	920
		9-11	31	379
		14-16	75	1,266
		18-20	5	U
SB-38	NN	4-6	4	91

* Feet below ground surface
TVOCs: Total volatile organic compounds
TICs: Total tentatively identified compounds
NN: No odors noted
--: No samples collected.

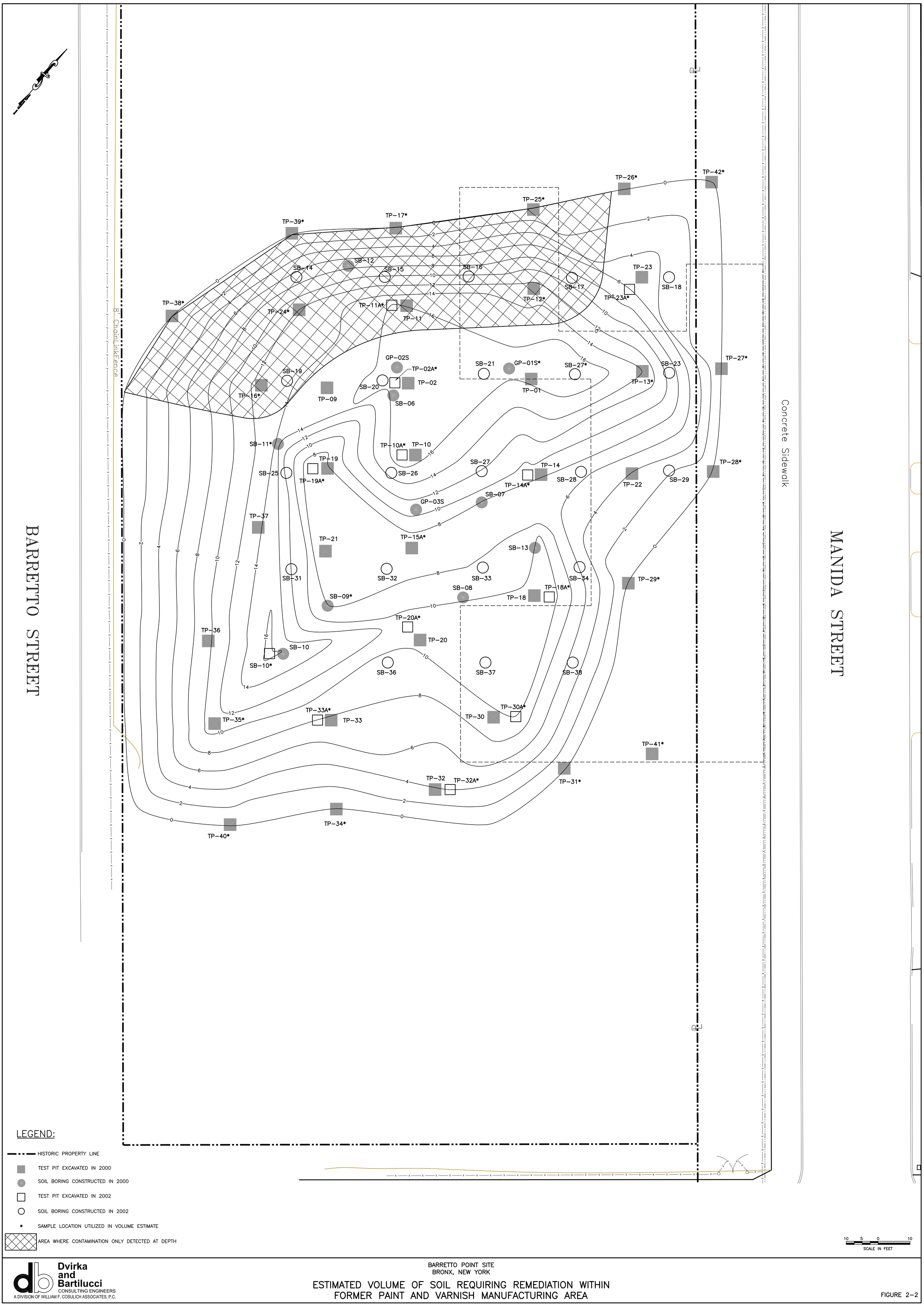
** Represents bottom of test pit or soil boring
U: Undetected
SB-24, SB-30 and SB-35 were not constructed due to the presence of a berm in the southwestern portion of the site.

vicinity of test pits TP-33 and 33A. As a result, much of the subsurface soil in this area will require remediation.

2.4 Volume of Soil Requiring Remediation

The results of the Supplemental Site Investigation were combined with the results of the initial Site Investigation to develop a volume estimate of contaminated soil requiring remediation in the area of the former paint and varnish manufacturing facility, based on standards, criteria and guidelines (SCGs) developed for the Barretto Point Site. Data from 31 test pits and 4 soil borings that provided soil quality information with depth were utilized to develop a contour map showing the estimated depth where total VOCs exceed 10,000 ug/kg, which is illustrated on Figure 2-2. A number of other sample locations were not utilized due to limited information with depth. At the locations that were not utilized, sampling was not performed either due to refusal during soil boring construction or termination of test pit excavation due to the potential for the release of organic vapors. The locations utilized to develop the volume estimate are identified with an "*" on Figure 2-2 and are also highlighted in Table 2-3. The contaminant contour map was utilized to calculate an estimated volume of 9,200 cubic yards of in-place soil requiring remediation. Utilizing a factor of 1.2 to account for volume increase when excavated, the estimated volume of contaminated soil requiring transportation and off-site disposal is 11,000 cubic yards.

Although the above estimate utilizes all pertinent data, as shown on Figure 2-2, there are areas where limited soil quality information exists with depth and the actual remediation volume is likely greater than that estimated above. Of particular note is the area to the west and south of TP-SB-10 where there is limited information with depth due to the presence of a soil berm. In addition, the contaminant contours were developed by linear extrapolation of the data between points and, as a result, the estimated quantity assumes that the depth of contamination increases linearly between points. Since the depth of contamination likely increases more rapidly in some areas, in particular, in the vicinity of the former paint and varnish manufacturing building and near the facility boundary, the volume of soil to be remediated will also increase. For these reasons, it is estimated that the volume will be 25 percent greater than that calculated based on



LEGEND:

- HISTORIC PROPERTY LINE
- TEST PIT EXCAVATED IN 2000
- SOIL BORING CONSTRUCTED IN 2000
- TEST PIT EXCAVATED IN 2002
- SOIL BORING CONSTRUCTED IN 2002
- * SAMPLE LOCATION UTILIZED IN VOLUME ESTIMATE
- AREA WHERE CONTAMINATION ONLY DETECTED AT DEPTH

10 5 0 10
SCALE IN FEET

Dvirka and Bartilucci
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

BARRETTO POINT SITE
BRONX, NEW YORK

ESTIMATED VOLUME OF SOIL REQUIRING REMEDIATION WITHIN FORMER PAINT AND VARNISH MANUFACTURING AREA

FIGURE 2–2

the contaminant contour map. Based on this assumption, the estimated volume of soil to be remediated is approximately 13,800 cubic yards.

As a note, for purposes of estimation, it is assumed that soil within the shaded area on Figure 2-2, extending from south of TP-16 to just north of SB-17, from a depth of 2 to 8 feet below ground surface, will not require remediation based on the analytical results for samples in this area and depth horizon and, as a result, has been excluded from the volume estimate. This assumption reduces the volume estimate by approximately 1,000 cubic yards to 12,800 cubic yards.

Finally, samples will be taken during excavation to determine if all of the contaminated soil exceeding SCGs has been removed from this area. Based on experience, the volume of soil requiring remediation is typically higher than estimated even at sites where extensive investigation has been conducted. In order to account for this likelihood, a 10-percent contingency has been incorporated into the final estimate for a total of 14,100 cubic yards.

In summary the volume estimate for soil remediation is calculated as follows:

- Volume estimate based on linear interpolation of data: 9,200 cubic yards in place
- Ex-situ volume increase by a factor of 1.2: 11,000 cubic yards
- 25 percent increase to account for data limitations resulting from surface and subsurface interference, such as the soil berm and shallow refusal depths: 13,800 cubic yards
- 1,000 cubic yard decrease due to contamination not being detected in the shallow subsurface in the western portion of the former paint and varnish manufacturing area: 12,800 cubic yards
- 10 percent contingency due to likely additional contamination beyond that identified in the site investigation: 14,100 cubic yards

Therefore, the total volume of soil requiring remediation in the area of the former paint and varnish manufacturing facility is estimated to be 14,100 cubic yards.

3.0 DEVELOPMENT AND PRELIMINARY EVALUATION OF ALTERNATIVES

3.1 Introduction

As discussed in Section 1.0, the Barretto Point Site has been divided into two areas based on planned future use of the property. The two areas comprise the planned park area and the treatment plant upgrade area. Due to the elevated levels of volatile organic compounds detected in the vicinity of the former paint and varnish manufacturing facility, the treatment plant upgrade area is further divided to include the former paint and varnish manufacturing area and the remaining area of the site.

Development of general response actions, or preliminary alternatives, applicable for remediation of the site requires identification of the media requiring remediation, volume of media requiring remediation and the contaminants of concern. Planned development of the site is also considered so that the preliminary alternatives selected will accommodate future use of the property. Once identified, general response actions can be developed for the site or portions of the site. In general, response actions, which satisfy remedial objectives for a site, include institutional, isolation, containment, removal or treatment actions. In addition to evaluating these actions, New York State guidance requires the evaluation and comparison of a no-action alternative to the action alternatives. Each response action for each medium of interest must satisfy the remedial action objectives for the site.

The following sections describe the selected general response actions/preliminary alternatives for the identified areas of the site requiring remediation based on planned use, and provide an evaluation of the actions/alternatives based on effectiveness, reliability, implementability and relative cost.

3.2 Description of Remedial Alternatives

3.2.1 Planned Park Area

The Planned Park Area comprises approximately 5 acres in the northwestern portion of the site (see Figure 1-2). As discussed in Section 1.0, the media of concern for this area has been identified as surface and subsurface soil, with surface soil being the most contaminated and of greatest concern. The contaminants of concern are probable carcinogenic polycyclic aromatic hydrocarbons (CaPAHs). The source of the contamination likely results from the fill used to develop the site, impacts from historic operations on the site and deposition of airborne particulates. Due to the potential for exposure to on-site trespassers, on-site workers and future users of the park to the CaPAHs, remediation of the soil in this area is necessary. An evaluation of a remedial alternative that addresses remediation of this area to "pre-release" conditions will be considered. As stated above, a no action alternative also will be evaluated along with the action alternatives. The following are the alternatives to be evaluated for the Planned Park Area (PPA):

Alternative PPA1 - No Action and institutional controls

Alternative PPA2 - Placement of 2 feet of clean soil cover and institutional controls

Alternative PPA3 - Excavation and removal of 2 feet of soil, replacement with clean soil and institutional controls.

Alternative PPA4 - Excavation and removal of all fill material to the water table, native till material or bedrock, whichever is encountered first, and replacement with clean soil.

No action provides no remedial action and depends completely on natural processes for effectiveness. Placement of a clean soil cover soil mitigates the primary potential for contact with contaminated soil based on planned use of the area. Alternative PPA4 provides evaluation of returning this area of the site, to the greatest degree practical, to pre-release conditions through removal of all contaminated fill material. The following provides detailed descriptions of each of the four alternatives for this area.

3.2.1.1 - Alternative PPA1 - No Action and Institutional Controls

This alternative provides no active remediation and relies solely on natural attenuation for remediation of soil contamination. Natural attenuation, as opposed to active remediation, relies entirely on naturally occurring physical, chemical and biological processes (e.g., dilution, dispersion and degradation) to reduce contamination. This alternative would provide placement of institutional/land use controls on the site, such as deed restrictions and covenants to ensure appropriate future use/control of the site that would protect human health and the environment.

Based on the levels of contaminants in the surface soil, institutional controls would essentially prohibit use of the site with fencing around the site to inhibit access. (It should be noted that as an interim remedial measure, New York City Department of Environmental Protection installed a fence around the site early in the site investigation to restrict access to the site.) The existing fence would be maintained to minimize access to the site by trespassers. In addition, the institutional controls would include a requirement that the New York State Department of Environmental Conservation and New York City Department of Environmental Protection be notified prior to the performance of any ground-intrusive activities at the site to ensure proper handling and disposal of contaminated soil. This would include development of a health and safety plan and community air monitoring plan during ground-intrusive activities.

3.2.1.2 - Alternative PPA2 - Placement of 2 Feet of Clean Soil Cover and Institutional Controls

This alternative includes placement of a 24-inch soil cover over the 5-acre planned park area. The soil cover would consist of 18 inches of clean general fill and 6 inches of a vegetative medium comprising topsoil and grass over the surface of the existing site fill to mitigate contact with contaminated soil. Between the remaining fill and the soil cover, a warning barrier constructed of orange plastic fencing will be placed to identify the base of the cover and the top of the contaminated fill. For this alternative, approximately 20,000 cubic yards of material will need to be brought to and placed on the site. The volume of soil required considers compaction of soil during placement of the 2-foot soil cover. Some regrading of the site would be required in order to place the clean soil cover and tie into existing grades surrounding the park area, and

not interfere with construction of the proposed park. Also, additional bank stabilization will be required along the shoreline of the East River. As currently planned, the proposed park includes the construction of a parking area and buildings. Clean soil cover will not be necessary in these areas since contact with contaminated surface soil would be mitigated through the placement of asphalt and/or structures.

Although elevated levels of volatile organic compounds are not expected to be encountered in this area of the site, organic vapor monitoring will be performed during regrading of contaminated soil. Dust suppression and particulate monitoring will be performed in accordance with NYSDEC Division of Hazardous Waste Remediation (DHWR) Technical and Administrative Guidance Memoranda (TAGM) 4031 - Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites. Air monitoring will be performed in accordance with New York State Department of Health (NYSDOH) Community Air Monitoring Plan. On-site workers may be required to conduct work in levels of personal protective equipment higher than Level D (i.e., Level C). Site monitoring will be performed to determine the appropriate levels of personal protective equipment required.

Institutional controls, as described for the no action alternative, are also included as part of this alternative to control use of and activities at the site, and provide information to future construction and maintenance workers with regard to the potential for contact with contaminated subsurface soil. The controls would also ensure that regulatory agencies would be contacted prior to ground intrusive activities and ensure proper handling and disposal of soil. Maintenance of this alternative would include site inspections and repair if necessary, to ensure the integrity and effectiveness of the clean soil cover.

3.2.1.3 - Alternative PPA3 - Excavation and Removal of 2 Feet of Soil, Replacement with Clean Soil and Institutional Controls

Under this alternative, the upper 2 feet of soil would be removed and disposed off-site, and replaced with clean soil (18 inches of general fill and 6 inches of a vegetative growth medium). For the 5-acre area this would include the excavation of approximately 16,000 cubic yards of fill (in place volume) and replacement with approximately 20,000 cubic yards (accounts

for compaction) of clean soil. As discussed with Alternative PPA2, a warning barrier will be placed between the clean soil cover and remaining fill material.

Dust control will be required during excavation of the contaminated soil. Soils may require periodic wetting or other control measures to mitigate dust emissions. During excavation, stockpiled soils will require cover and erosion controls. Dust suppression, and VOC and particulate monitoring will be performed in accordance with NYSDEC and NYSDOH requirements.

Institutional controls, as discussed for Alternatives PPA1 and PPA2, are also included as part of this alternative to control use and activities in this area of the site. Similar to Alternative PPA2, maintenance of this alternative would include site inspections and repair if necessary, to ensure the integrity and effectiveness of the clean soil cover.

3.2.1.4 - Alternative PPA4 - Excavation and Removal of All Fill Material and Replacement with Clean Soil

Alternative PPA4 includes excavation and removal of all fill material to the water table, native till material or bedrock, whichever is encountered first, and replacement with clean soil. Fill depths and depths to the water table vary in this area. Depth to fill in the northern portion of the Planned Park Area was found to a depth of 14 feet (also the depth of the water table). Water was encountered at depths of approximately 10 feet in the southern and western portions of this area. Therefore, for the purposes of determining the volume of fill material it was assumed that 2.5 acres of the site would require removal of fill to 14 feet and 2.5 acres of the site would require removal of fill to 10 feet. For the 5-acre area this would include the excavation of approximately 100,000 cubic yards (in place volume) of soil. All excavated areas would be backfilled with clean soil (120,000 cubic yards accounting for compaction).

As previously stated, elevated levels of volatile organic compounds are not expected to be encountered in this area of the site, however, organic vapor monitoring will be performed during excavation of contaminated soil. Dust control will be required during excavation and will

be performed as described for Alternative PPA2. Dust suppression and particulate monitoring will be performed in accordance with NYSDEC and NYSDOH requirements.

Since the soil in this area of the site would be fully remediated and the potential for contact with contaminated soil would no longer exist, placement of institutional controls would not be necessary for this alternative. In addition, long-term maintenance would not be required.

3.2.2 Former Paint and Varnish Manufacturing Facility Area

The former paint and varnish manufacturing facility was located in the northeastern portion of the site in the currently fenced area bounded by Barretto Street and Manida Street. This area is approximately 0.7 acre in size. The test pit and soil boring programs conducted during the site investigation and supplemental soil investigation characterized this area as a disposal area for the former paint and varnish manufacturing facility. Several crushed 55-gallon drums and 5-gallon cans with some solid and semi-solid paint residue were uncovered during excavation of test pits. Black stained soil, and both petroleum/fuel and chemical odors, such as paint thinners, were noted during the investigation performed in this area. Significantly elevated levels of VOC vapors were measured during intrusive work and results of one shallow subsurface soil sample indicated the presence of total VOCs of 751 ppm.

Fill material in this area, which is similar to the fill material found throughout the site, ranges in thickness from approximately 1 foot to approximately 10 feet. In addition to the materials found in the subsurface believed to be the result of waste disposal from the former paint and varnish manufacturing facility, scrap metal, concrete slabs, crushed brick and asphalt were also noted in subsurface soil samples. As with the other areas of the site, this fill material also contains elevated levels of CaPAHs. Depth to weathered bedrock in this area was determined to be between 16 to 20 feet below ground surface.

The following are the alternatives to be evaluated in detail for the Former Paint and Varnish Manufacturing Facility Area (FPVM):

Alternative FPVM1 - No action and institutional controls

Alternative FPVM2 - Excavation and removal of shallow soil (approximately 3 feet), emission controls, placement of a geomembrane cap and institutional controls

Alternative FPVM3 - Excavation and removal of shallow soil (approximately 1.5 feet), emission controls, placement of an asphalt cap and institutional controls

Alternative FPVM4 - Soil vapor extraction, excavation of shallow soil (approximately 1.5 feet), emission controls, placement of an asphalt cap and institutional controls.

Alternative FPVM5 - Excavation and removal of contaminated soil, emission controls and replacement with clean soil.

Alternative FPVM6 - Excavation and removal of contaminated soil, emission controls and replacement with treatment plant digesters.

With respect to Alternative FPVM4, there are several in-situ treatment technologies, such as soil vapor extraction, chemical oxidation and bioremediation that may be applicable for reducing the levels of VOCs in the soil in this area. None of these technologies would be effective for remediating the waste material found in this area, such as paint wastes and resins. These technologies also may not be effective at reducing the levels of CaPAHs to below SCGs. In addition, large amounts of debris and the heterogeneities of the fill material in this area could significantly impact treatment effectiveness of any in-situ technology. Although the effectiveness of all in-situ technologies would be impacted by the fill material, soil vapor extraction, which involves the extraction of air instead of the injection of materials, may be the most effective at removing a significant amount of the VOCs, thereby reducing the need for emission controls if excavation and removal were implemented later. The high levels of VOCs detected would likely impede the effectiveness of technologies such as chemical oxidation and bioremediation. The following provides detailed descriptions of each of the six alternatives for this area.

3.2.2.1 - Alternative FPVM1 - No Action and Institutional Controls

As described above, this alternative provides no active remediation and relies solely on natural attenuation for remediation of soil contamination. The placement of institutional/land use controls on the site would be the same as those described for the Planned Park Area.

3.2.2.2 - Alternative FPVM2 - Excavation and Removal of Shallow Soil, Placement of a Geomembrane Cap and Institutional Controls

Under this alternative, the first 3 feet of soil would be removed from this area of the site. For the less than 1-acre area, this would include the excavation and off-site disposal of approximately 3,500 cubic yards (in place volume) of soil. Prior to placement of the geomembrane cap, the area would be graded to achieve desired slopes for drainage off the cap. A subsurface drainage system surrounding the cap likely would be required to collect and divert cap runoff to other areas of the site or to the East River. Once the area has been regraded, the cap will be constructed as follows from bottom to top:

- 6-inch soil cover/geomembrane cushion
- 60-mil high density polyethylene liner
- geocomposite drainage layer
- barrier protection layer (minimum 24 inches)
- 6-inch topsoil/vegetative growth medium

The geomembrane cap will mitigate contact with contaminated soil, as well as migration of precipitation through contaminated soil and waste, and impacts to groundwater.

Since significantly elevated levels of volatile organic compounds and odors have been detected in this area, even as shallow as 2 feet below ground surface, it will be necessary to install a temporary vapor control structure or use other suppression measures in the area of excavation in order to mitigate the potential for off-site release of nuisance/contaminated vapors.

As described above, organic vapor monitoring will be performed during excavation of contaminated soil. Dust control will also be required during excavation of the soil. Dust suppression and particulate monitoring will be performed in accordance with NYSDEC and NYSDOH requirements. During excavation, site monitoring would be performed to determine the appropriate levels of personal protective equipment required for site workers.

Institutional controls would need to be placed on the site to maintain the integrity of the cap while controlling the potential for contact with contaminated soil under the cap.

3.2.2.3 - Alternative FPVM3 - Excavation and Removal of Shallow Soil, Placement of an Asphalt Cap and Institutional Controls

This alternative would be similar to Alternative FPVM2, however in lieu of placement of a geomembrane cap and vegetative cover, an asphalt cap will be placed over the area. The asphalt cap will consist of 6 inches of dense graded aggregate subbase, 6 inches asphalt base course and 2 inches of asphalt top course. The asphalt pavement will mitigate contact with contaminated soil and the continued release of contaminants to the groundwater through minimizing infiltration of precipitation through contaminated soil. This cover would also allow for use of this area as a parking area or possibly other purposes as part of redevelopment of the site. Approximately 1,700 cubic yards (in place volume) of contaminated soil would be removed from the upper portion of the area in order to allow for placement of the cap. The area would also need to be graded to promote runoff and the cap would need to be maintained in order to ensure that cracks due to weathering, settlement or traffic are repaired.

Also as noted for Alternative FPVM2, elevated levels of VOCs may be encountered in the shallow subsurface during construction of this alternative, therefore, emission and dust controls will need to be implemented, and air monitoring will be conducted during all remediation activities in accordance with NYSDEC and NYSDOH requirements to ensure the health and safety of on-site workers and the surrounding community.

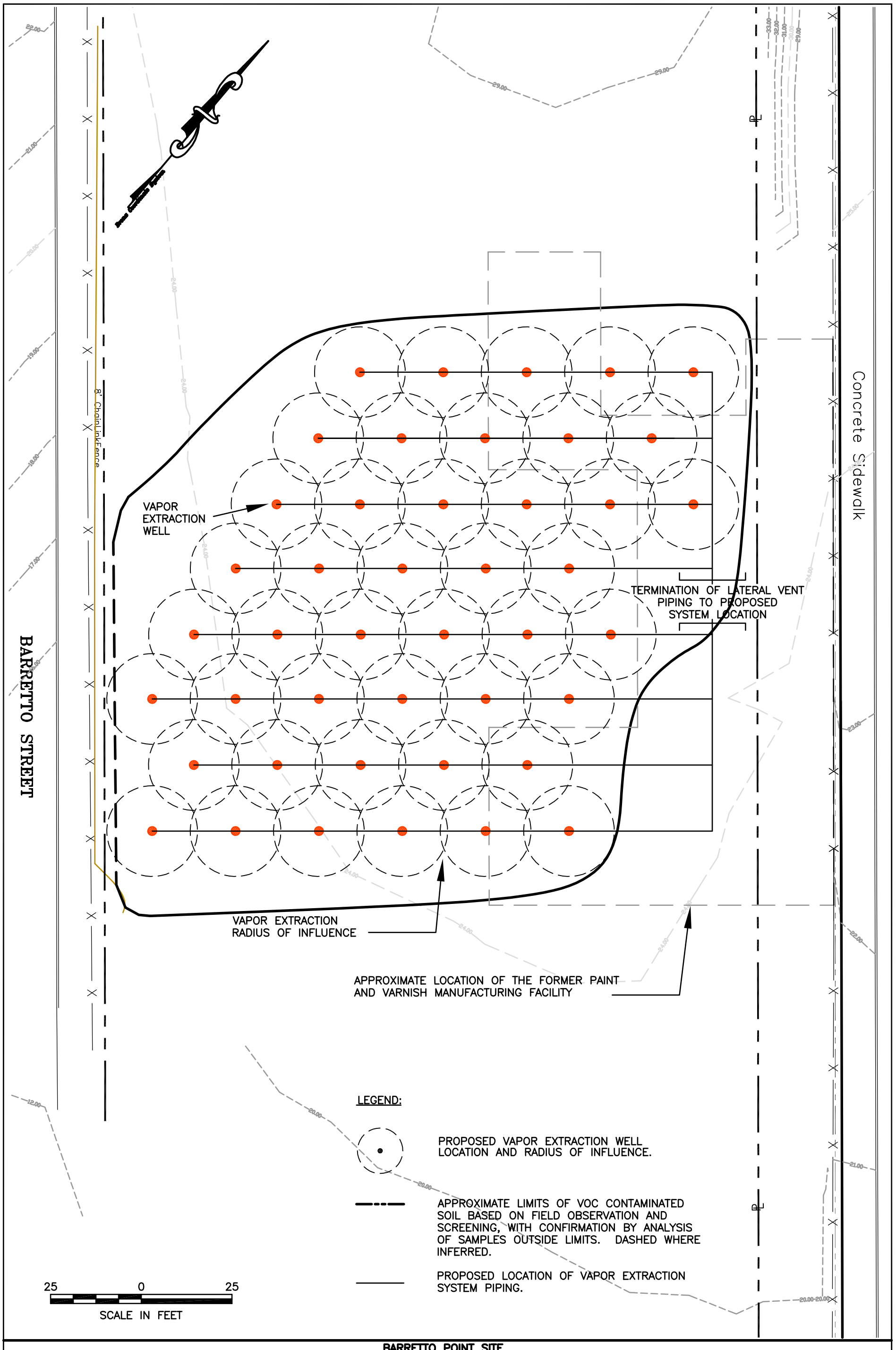
Institutional controls also will be required to control use of and activities at the site, and to ensure maintenance of the asphalt cap and elimination of the potential for contact with contaminated soil beneath the cap.

3.2.2.4 - Alternative FPVM4 - Soil Vapor Extraction, Excavation and Removal of Shallow Soil, Placement of an Asphalt Cap and Institutional Controls

In order to address the elevated levels of VOCs detected in the soil in this area, a soil vapor extraction (SVE) system would be installed as part of this alternative. Soil vapor extraction will include the placement of approximately 44 extraction wells to depths just above the water table (see Figure 3-1). Vapors extracted from the subsurface will be collected and treated with granular activated carbon or catalytic oxidation prior to discharge to the atmosphere. In addition to the vapor extraction wells, the equipment required for the SVE system will include a vacuum blower, piping, instrumentation and controls. All equipment will be housed in an on-site building.

Due to the heterogeneous nature of the fill material and the potential for short circuiting of air through the soil, the radius of influence for the SVE wells is assumed to be small (10 to 15 feet). Placement of an asphalt cap over the site area, similar to that described for Alternative FPVM3, will be necessary to enhance vacuum efficiency and vapor capture zone of the SVE system. This cap will also mitigate the continued release of contaminants to groundwater by elimination of precipitation through contaminated soil and waste. Excavation of the upper 1.5 feet of soil to allow for construction of the asphalt cap and excavation to a depth of 3 feet in trenches to place soil vapor extraction system piping below the cap will be required. A total volume of approximately 2,000 cubic yards (in-place volume) of soil will need to be removed from the site.

Maintenance of the SVE system, including carbon replacement, likely will need to be performed for 3 years. Maintenance of the asphalt cap will be performed as discussed for Alternative FPVM3. Institutional controls will be placed as discussed for Alternatives FPVM2 and FPVM3.



BARRETTO POINT SITE
BRONX, NEW YORK

PROPOSED SOIL VAPOR EXTRACTION WELL LOCATIONS WITH PROPOSED SYSTEM PIPING LAYOUT

Dvirka and Bartilucci
Consulting Engineers
A Division of William F. Cosulich Associates, P.C.

FIGURE 3–1

3.2.2.5 - Alternative FPVM5 - Excavation and Removal of Contaminated Soil and Replacement with Clean Soil

Contaminated soil will be excavated from the approximately 0.7-acre area and disposed off-site. As discussed in Section 2.4 of this report, this would result in excavation of approximately 14,100 cubic yards of contaminated soil. Since the water table is approximately 16 to 18 feet below ground surface in the area of the former paint and varnish manufacturing facility, a portion of the excavation would be in groundwater.

Although the material encountered in this area indicates the presence of significant levels of volatile organic compounds, based on samples analyzed during the site investigation, the soil did not exceed Toxicity Characteristic Leaching Procedure (TCLP) or Resource Recovery Conservation Act (RCRA) limits. In addition, the paint waste is not a RCRA listed waste. Therefore, based on these results, the excavated soil and waste would not be disposed as a hazardous waste. However, in order to account for unforeseen material, it is assumed that 10 percent of the material excavated will be need to be disposed of as a hazardous waste. The excavated area will be backfilled with clean soil.

Sheet piling would be used to reduce the volume of soil requiring excavation, and minimize potential impacts to the surrounding area, including Manida Street. Excavation without sheet piling would result in increasing the area to be excavated by approximately 40 feet on all sides of the excavation in order to ensure slope stability. Sheet piling would need to be secured through the use of such methods as tie backs. In order for the soil to be acceptable for landfill disposal, wet soil removed from the excavation will either be allowed to dry or stabilized with amendments, such as lime, prior to disposal off-site. Excavation below the water table will require dewatering.

Also as noted in the above alternatives, significantly elevated levels of VOC vapors and odors will be encountered during implementation of this alternative, and as a result, emission and dust controls will need to be implemented. Emission controls likely will include the use of a sprung structure with carbon filters over the area of excavation. Although wetting agents or foam suppressants may be suitable, due to the large volume of soil requiring excavation and the

need to use the wetting agents and/or suppressants each time the soil is moved, it is assumed for this alternative that a sprung structure would be required. Air monitoring will be conducted during remediation activities in accordance with NYSDEC and NYSDOH requirements to ensure the health and safety of on-site workers and the surrounding community. For the purposes of this alternative, it is assumed that all work will need to be completed in level B protection.

Since all of the contaminated soil will be removed from this area of the site, no institutional controls will need to be placed on this area of the site and long-term maintenance will not be required.

3.2.2.6 - Alternative FPVM6 - Excavation and Removal of Contaminated Soil and Replacement with Treatment Plant Digesters

This alternative will be essentially completed as discussed for Alternative FPVM5. However, in lieu of backfill of the excavation with clean soil, the remediation will be performed in conjunction with construction of the digesters planned as part of the Hunts Point Water Pollution Control Plant (HPWPCP) upgrade. Similar to Alternative FPVM5, dewatering will be required for soil excavation below the water table. It is assumed that no backfill will be required for this alternative. In addition, no institutional controls will be required for this alternative.

3.2.3 Remaining Site Area

The remaining approximately 7.3 acres of the site has been characterized in a manner similar to the Planned Park Area. Elevated levels of CaPAHs were detected in the soil in this area. Due to the potential for exposure to the CaPAHs to on-site trespassers, on-site workers and future users of this area, remediation of the soil is necessary. In addition to remediation of the soil, an alternative that addresses remediation of this area to "pre-release" conditions will also be considered. A no action alternative will also be evaluated along with the action alternatives. The following are the alternatives to be evaluated for the Remaining Site Area (RSA):

Alternative RSA1 - No action and institutional controls

Alternative RSA2 - Placement of 2 feet of clean soil and institutional controls

Alternative RSA3 - Excavation and removal of 2 feet of soil, replacement with clean soil and institutional controls.

Alternative RSA4 - Excavation and removal of all fill material to the water table, native till material or bedrock, whichever is encountered first, and replacement with clean soil.

These alternatives are similar to the alternatives described in Section 3.2.2.1 for the Planned Park Area. Therefore, the following descriptions for each alternative only include the details relevant to this area of the site.

3.2.3.1 - Alternative RSA1 - No Action and Institutional Controls

This alternative provides no active remediation and relies solely on natural attenuation for remediation of soil contamination. This alternative would also provide placement of institutional/ land use controls on the site to ensure appropriate use of and activities at the site that would protect human health and the environment.

3.2.3.2 - Alternative RSA2 - Placement of 2 Feet of Clean Soil Cover and Institutional Controls

This alternative includes placement of a 24-inch soil cover over the approximately 7.4-acre area. The soil cover would consist of 18 inches of clean general fill and 6 inches of a vegetative medium consisting of topsoil and grass over the surface of the fill to mitigate contact with contaminated soil. This alternative will also include the placement of a warning barrier between the clean soil cover and the contaminated soil. Approximately 30,000 cubic yards (accounts for compaction) of soil will need to be brought to the site, and it is anticipated some regrading of the site would be required in order to ensure proper drainage, tie into existing grades surrounding this area, and planned use of this area prior to placement of the cover. Additional bank stabilization along the shoreline will also be required.

Institutional controls, as described for the no-action alternative, are also included as part of this alternative to control use of and activities at the site, and provide information to future construction workers with regard to the potential for contact to contaminated subsurface soil. Maintenance of this alternative would include site inspections and repair of the cover, if necessary to ensure its integrity and effectiveness.

3.2.3.3 - Alternative RSA3 - Excavation and Removal of 2 Feet of Soil, Replacement with Clean Soil and Institutional Controls

Under this alternative, the upper 2 feet of soil would be removed from this area of the site and disposed off-site. For the approximately 7.4-acre area this would include the excavation of approximately 25,000 cubic yards (in place volume) of soil and replacement with 30,000 cubic yards of clean soil (accounts for compaction). A warning barrier will be placed above the contaminated soil and all excavated areas will be backfilled with clean soil.

Although elevated levels of volatile organic compounds are not expected to be encountered in this area of the site, emission and dust controls will be implemented and air monitoring will be conducted during all remediation activities in accordance with NYSDEC and NYSDOH requirements to ensure the health and safety of on-site workers and the surrounding community.

Institutional controls, as discussed for Alternatives RSA1 and RSA2, also are included as part of this alternative to control use of and activities in this area of the site. Maintenance of the cover would include site inspections and repair of the cover, if necessary.

3.2.3.4 - Alternative RSA4 - Excavation and Removal of All Fill Material, and Replacement with Clean Soil

Alternative RSA4 includes excavation and removal of all fill material to the water table, native till material or bedrock, whichever is encountered first. Thickness of fill material in this area ranges from approximately 1 foot in the northwestern portion of the site to approximately 15 feet on the southeastern portion of the site. Therefore, fill estimates assumed 2 acres of the

northwestern portion of the site has 2 feet of fill material, 1.4 acres in the southern portion of the site has 10 feet of fill material (approximate depth to groundwater) and the remaining 4 acres of the site has 14 feet of fill material requiring excavation and disposal. For the over 7-acre area this would equate to approximately 120,000 cubic yards (in place volume) of soil requiring removal. The excavated areas would be backfilled with clean soil (approximately 150,000 cubic yards accounting for compaction).

There are several active utility lines that are located in this area of the site including gas, water and sewer. There are gas and sewer mains that traverse the southeastern portion of the site to Riker's Island. Water and storm sewer lines are located along Barretto Street and Ryawa Avenue. Depths of the utilities are unknown. Coordination with utility companies and New York City would be required during removal and replacement of the soil around these utilities.

Emission and dust controls will be implemented and air monitoring will be conducted during remediation activities in accordance with NYSDEC and NYSDOH requirements to ensure the health and safety of on-site workers and the surrounding community.

Since this area of the site would be remediated and the potential for contact with contaminated surface or subsurface soil would no longer exist, placement of institutional controls would not be necessary for this alternative nor would maintenance of the remediation measure be necessary.

3.2.4 Groundwater in the Vicinity of the Former Paint and Varnish Manufacturing Area

As discussed in Section 1.0, elevated levels of VOCs have been detected in groundwater in the vicinity of the former paint and varnish manufacturing area. Although groundwater contamination has been detected in this area, it is limited in extent and has not migrated to the river. In addition, groundwater is 15 feet below ground surface in the area of the former paint and varnish manufacturing facility, and since the groundwater is saline, it is not a source of potable water. Therefore, groundwater does not require remediation. However, as part of removal of contaminated soil and bedrock in this area, dewatering will be required. As a result,

there will be the need to address contaminated groundwater as part of soil remediation below the water table. As a result, the following alternatives will be evaluated:

Alternative G1 - No action and institutional controls

Alternative G2 - In situ treatment (oxygen release compounds)

Alternative G3 - Extraction and treatment as part of digester construction

The following is a description of each of these alternatives.

3.2.4.1 - Alternative G1 - No Action and Institutional Controls

As described above, this alternative provides no active remediation and relies solely on natural attenuation for remediation of groundwater. The placement of institutional controls would include groundwater use restrictions to ensure groundwater from the site is not utilized for any purpose.

3.2.4.2 - Alternative G2 - In Situ Treatment (Oxygen Release Compounds)

Oxygen release compounds (ORC®) is a patented formulation of magnesium peroxide that produces a slow and sustained release of molecular oxygen when in contact with soil moisture or groundwater. When in the presence of ORC, microbes degrade groundwater pollutants into by-products, such as carbon dioxide and water. ORC is manufactured as a powder and can be mixed with water for slurry injection, placed in an open excavation or enclosed in specially designed socks for placement in wells.

Based on discussions with a vendor that supplies ORC, it is recommended that a pilot study be performed in the area of highest levels of groundwater contamination to evaluate the effectiveness of the process in reducing the levels of contaminants. The pilot study would include installation of six temporary well points in the test area. Once the injection is completed, groundwater would be monitored for a period of approximately 8 months to determine effectiveness.

If the process were determined to be effective, a full-scale application would be performed. The following represents a conceptual design for this remedial measure. Approximately 130 temporary well points would be installed in an area of approximately 200 by 200 feet. One to two applications would be necessary. Treatment time for the process is estimated to be a total of 5 years, including the pilot study, ORC applications and groundwater monitoring to evaluate treatment effectiveness. For brackish and coastal environments, such as the Barretto Point Site, additional ORC may be necessary due to accelerated release. Final design of the system would reflect the results of the pilot study.

Groundwater monitoring will be conducted to evaluate the effectiveness of ORC process. Four new groundwater monitoring wells (one upgradient, one within the plume area and two downgradient) would be installed for monitoring purposes. Groundwater sampling would include analysis for VOCs, oxygen reduction potential (ORP), pH, dissolved oxygen, ferrous iron, biological oxygen demand and chemical oxygen demand, and would be performed quarterly for the first 3 years and biannually for the next 2 years to evaluate the effectiveness of the treatment.

3.2.4.3 - Alternative G3 - Extraction and Treatment As Part of Soil Excavation

Extraction of the groundwater would be performed as part of the dewatering process during excavation of soil, and bedrock for construction of the digesters. The volume of groundwater requiring extraction depends on the period of time the excavation will need to be open, which is estimated to be approximately 1 year for construction of the digesters. Dewatering over a one-year period should also remove most of the contaminated groundwater in the area of the former paint and varnish manufacturing facility.

Prior to installation of the dewatering system, a pump test will need to be performed to determine the hydraulic characteristics of the overburden and bedrock to design an effective dewatering system, including number of wells, well spacing, pumping rates and contaminant levels.

For this report, without the results of a pump test, a two-dimensional groundwater flow model (MODFLOW) was used to estimate the volume of water requiring removal during dewatering of the excavation of soil and bedrock, and maintenance of the dewatered excavation for a period of 1 year during construction of the digesters. Estimates with regard to the hydraulic conductivities of the till material, weathered bedrock and competent bedrock were developed based on limited results from the site investigation. These hydraulic conductivities, as well as an assumed hydraulic conductivity for the sheet piling, were used as inputs for the model. Based on the results of the modeling, it is assumed that an initial volume of approximately 750,000 gallons of water would need to be removed from the excavation.

Once the initial volume is removed, it is assumed that four wells installed at the four corners of the excavation would extract approximately 4000 gallons per day of water to maintain a dewatered excavation. For the purposes of designing a treatment system, a 10 gallon per minute (gpm) system is assumed to be suitable for this approach. Upon removal, groundwater will be pre-treated above ground and discharged to the New York City sanitary sewer system and the HPWPCP for final treatment. In order to meet discharge limitations for the sewer system, groundwater will need to be treated to reduce elevated levels of VOCs. In addition, treatment of the groundwater for iron and manganese prior to treatment for VOC removal will be required in order to prevent fouling of the air stripping system and ensure effective operation of the remediation system. Based on experience, the treatment process selected to address these contaminants are in the following sequence from influent to effluent: aeration tank; rapid mix/coagulation/plate settler; aeration tower; and liquid phase carbon adsorption. To remove elevated levels of methyl tert butyl ether, it may be necessary to have two aeration towers. Off-gases from the aeration tank and tower will be treated using a thermal oxidizer.

Since it is expected that most of the contaminated groundwater will be removed from this area during dewatering, in particular, over a 1-year period, long-term monitoring of groundwater will not be required as part of this alternative.

Provided below is a preliminary evaluation of these alternatives for effectiveness, reliability, implementability and relative costs. A description of these criteria is provided in Section 1.4.

3.3 Evaluation of Remedial Alternatives

3.3.1 Planned Park Area

Alternative PPA1- No Action and Institutional Controls

Effectiveness

Alternative PPA1, no action, would not meet any of the remedial action objectives which have been established for the Barretto Point Site as discussed in Section 1.4 of this document, since no physical remedial action would be performed. Based on the results of the risk assessment, this area of the site poses a potential threat to human health and the environment, through ingestion, dermal contact and inhalation exposure to CaPAHs in surface and subsurface soil. Maintenance of the existing fencing would discourage, but would not eliminate access to the site by trespassers. This alternative relies solely on natural attenuation, which likely would not be effective due to the persistent nature of the contaminants detected. As a result, this alternative is not effective and would not allow planned use of this area as a park.

Reliability

As stated above, since this alternative relies solely on natural attenuation, it will not be reliable in meeting or achieving the remedial action objectives.

Implementability

This alternative is readily implementable, however, since the no action alternative does not mitigate the potential for contact with, or ingestion or inhalation of CaPAHs in the soil, it

does not meet the minimum remediation criteria from a regulatory perspective and would not allow for this area to be utilized for its intended use.

Cost

The cost for Alternative PPA1 is low (approximately $120,000). The cost does not include any active remediation, but would include maintenance of the existing fence. The cost of this alternative would be significantly lower than the remaining alternatives discussed below.

Alternative PPA2 - Placement of 2 Feet of Clean Soil Cover and Institutional Controls

Effectiveness

Alternative PPA2, placement of 2 feet of clean soil and vegetative cover, would meet the remedial action objectives for the site. It would be effective at mitigating the potential for contact, ingestion and inhalation with contaminated soil through the placement of a cover. However, since it does not remove contaminated soil from the site it may not be as effective as Alternative PPA4, discussed below. Maintenance of the soil cover would be required to ensure the cover's effectiveness. Institutional controls, such as notification of the regulatory agencies, would be necessary to ensure protection of health during intrusive activities that may take place below the soil cover.

Reliability

If maintained properly, this alternative would be reliable in the long-term at meeting the remedial action objectives. The warning barrier placed just below the clean soil cover would provide warning with regard to accidental contact with contaminated soil.

Implementability

All the necessary labor, equipment, materials and supplies for placement of a soil cover are readily available and this alternative would be easy to construct. It is estimated that approximately 20,000 cubic yards of soil (5,000 cubic yards of topsoil and 15,000 cubic yards of clean general fill) would need to be brought to the site for construction of the soil cover, which, based on 30 cubic yard trucks carrying 25 cubic yards of soil, would result in approximately 800 trucks over a 1- to 2-month period (average of about 30 trucks per day). Based on movement of 1,000 cubic yards per day, the likely maximum number of trucks for this alternative, as well as all of the alternatives which involve transport and removal of soil and materials to the site, is approximately 40. Due to the industrial nature of the surrounding area and access roadways, the increase in truck traffic should not cause significant impacts to the surrounding community. Regrading may be necessary to place the clean soil in order to not interfere with planned construction of the park. Regrading may cause generation of dust and may require the implementation of dust controls.

Cost

The cost for Alternative PPA2 would be low to moderate (approximately $1.1 million). The soil needed for construction of the cover is readily available. The cost of this alternative is lower than Alternative PPA3 and significantly lower than Alternative PPA4.

Alternative PPA3- Excavation and Removal of 2 Feet of Soil, Replacement with Clean Soil and Institutional Controls

Effectiveness

Alternative PPA3, excavation and off-site removal of the upper 2 feet of soil and replacement with clean soil and vegetative cover, would meet the remedial action objectives for the site. The potential for ingestion, direct contact or inhalation of contaminated soil is mitigated through the implementation of this alternative and would allow planned use of the area as a park.

Reliability

The reliability of this alternative is similar to Alternative PPA2 and will depend on the long-term maintenance of the cover and the effectiveness of the warning barrier to provide warning with regard to accidental contact.

Implementability

Similar to the above Alternative PPA2, all the necessary equipment, labor, materials and supplies are readily available for excavation and off-site disposal of the soil and replacement with clean soil cover. Excavation of the soil likely will generate dust, and therefore, dust controls will need to be implemented. Approximately 20,000 cubic yards of material would need to be transported off-site and a similar volume of soil would need to be brought to the site for construction of the soil cover, which would produce increased truck traffic in the vicinity of the site (approximately 1,600 trucks over a 2- to 3-month period). However, as discussed above for Alternative PPA2, due to the industrial nature of the site setting and the access roads which would be utilized, the additional truck traffic (average of about 30 trucks per day) is not expected to impact the implementability of this alternative.

Cost

The cost of this alternative would be moderate (approximately $2.4 million). Excavation and off-site disposal of approximately 20,000 cubic yards of soil and placement of a 2-foot soil/vegetative cover would be the most significant cost. The total cost for this alternative would be significantly greater than Alternative PPA1 and more than Alternative PPA2, but substantially less than Alternative PPA4.

Alternative PPA4 - Excavation and Removal of All Fill Material and Replacement with Clean Soil

Effectiveness

Alternative PPA4, excavation and off-site disposal of all contaminated fill material would meet all of the remedial action objectives for the site. Through removal of all contaminated soil, this alternative will eliminate the potential for exposure to contaminated soil.

Reliability

The reliability of this alternative is greater than the alternatives discussed above, since no long-term maintenance is required and no institutional controls are necessary. Removal of all contaminated fill material will ensure protection of human health and the environment.

Implementability

Excavation of unsaturated contaminated soil to depths between 10 and 15 feet, and off-site disposal and replacement with clean soil could be readily performed. The necessary labor, equipment, materials and supplies are commercially available, however, this alternative would result in creation of substantial truck traffic over a relative long period of time. Off-site disposal of over 120,000 cubic yards of contaminated soil and replacement with a similar amount of clean soil would result in over 9,600 trucks over a period of 12 to 15 months (average of about 35 trucks per day). Potential difficulties may arise during excavation with the potential for creation of dust, which would require emission controls.

Cost

The cost of Alternative PPA4 is high (approximately $10.3 million). Excavation and off-site disposal of all contaminated material, over 120,000 cubic yards, is significantly more costly

than the no action (Alternative PPA1), soil cover (Alternative PPA2), and partial excavation and soil cover (Alternative PPA3) options.

3.3.2 Former Paint and Varnish Manufacturing Area

Alternative FPVM1- No Action and Institutional Controls

Effectiveness

Alternative FPVM1, no action, would not meet any of the remedial action objectives which have been established for the Barretto Point Site as discussed in Section 1.4 of this document, since no remedial action would be performed. Based on the results of the risk assessment, this area of the site poses a potential threat to human health and the environment, through dermal contact, ingestion and inhalation exposure to VOCs and CaPAHs in surface soil and subsurface soil. Maintenance of the existing fencing would discourage, but would not eliminate access to the site by trespassers. Impacts to groundwater in this area would also continue resulting from elevated concentrations of VOCs in soil. This alternative relies solely on natural attenuation, which would not be effective due to the persistent nature of the contaminants detected and buried waste in this area. As a result, this alternative is not effective and would impede reuse of this area.

Reliability

As stated above, since this alternative relies solely on natural attenuation, it will not be a reliable alternative in meeting or achieving the remedial action objectives.

Implementability

This alternative is readily implementable. However, since the no action alternative does not alter the potential for contact with, or ingestion or inhalation of VOCs or CaPAHs in the soil,

it does not meet the minimum remediation criteria from a regulatory perspective and would not allow this area to be developed.

Cost

The costs associated with this alternative are low (approximately $120,000). The cost does not include any active remediation, but does include maintenance of the existing fence.

Alternative FPVM2 - Excavation and Removal of Shallow Soil, Placement of a Geomembrane Cap and Institutional Controls

Effectiveness

Alternative FPVM2, excavation and removal of the first 3 feet of soil and placement of a geomembrane liner, would meet the remedial action objectives for the site. It would be effective at mitigating the potential for contact with contaminated soil through the removal of shallow soil and placement of a low permeability barrier. The geomembrane liner will also mitigate migration of precipitation through contaminated soil and contamination of groundwater. However, since it does not remove all of the contaminated soil and waste material from this area, it may not be as effective as Alternatives FPVM5 and FPVM6. Institutional controls and long-term maintenance would need to be implemented to ensure the integrity and effectiveness of the cap. In addition, the cap may limit reuse of the area.

Reliability

If maintained properly and if development is controlled in this area, this alternative should be reliable in the long-term in meeting the remedial action objectives.

Implementability

All the necessary labor, equipment, materials and supplies for shallow soil excavation and construction of the geomembrane cover are readily available, and it would be easy to

construct. It is estimated that approximately 3,500 cubic yards (in place volume) of material would need to be removed from the site and replaced with clean soil over the geomembrane barrier. Based on 30 cubic yard trucks, this would result in approximately 320 trucks over a 3- to 4-month period. Based on the industrial nature of surrounding area and access roadways to the site, the additional truck traffic should not cause significant impacts to the surrounding community. Grading will be necessary in order to direct storm water runoff off the cap. Grading and excavation may cause generation of dust and emissions, and will likely require the implementation of dust and emission controls. In addition, the cap runoff would need to be collected and diverted elsewhere on or off the site.

Cost

The cost for Alternative FPVM2 would be low to moderate (approximately $937,000). The cost of this alternative is comparable to Alternative FPVM3, but significantly lower than Alternatives FPVM5 and FPVM6.

Alternative FPVM3 - Excavation and Removal of Shallow Soil, Placement of an Asphalt Cap and Institutional Controls

Effectiveness

Alternative FPVM3, excavation and off-site disposal of shallow soil and placement of an asphalt cover, would essentially be as effective as Alternative FPVM2 at meeting the remedial action objectives for the site. Placement of an asphalt cover would allow for future use of the site for parking of vehicles or storage of materials and equipment. Similar to the geomembrane, the asphalt cover will mitigate direct contact with and migration of precipitation through contaminated soil and contamination of groundwater. However, since it does not remove all of the contaminated soil from the site it may not be as effective as Alternatives FPVM5 and FPVM6. Institutional controls would be required to limit use of and activities at the site to ensure the integrity of the asphalt cover, and maintenance would be necessary to ensure its effectiveness.

Reliability

If maintained properly, this alternative should be reliable in the long-term at meeting the remedial action objectives.

Implementability

All the necessary labor, equipment, materials and supplies for shallow soil excavation and construction of the asphalt cover are readily available and it would be easy to construct. It is estimated that approximately 1.5 feet of soil (approximately 1,700 cubic yards, in place volume) would need to be excavated and disposed off-site. This, together with material to construct the asphalt cover, would result in about 160 trucks over a 1- to 2-month construction period, which because of the industrial nature of the area and access roadways, should not impact the community. Grading will be necessary in order to direct storm water runoff off the cap. Grading and excavation will likely cause generation of dust and likely require the implementation of dust and emission controls.

Cost

The cost for Alternative FPVM3 would be low to moderate (approximately $600,000). The cost of this alternative is comparable to Alternative FPVM2, but significantly lower than Alternatives FPVM4 and FPVM5.

Alternative FPVM4 - Soil Vapor Extraction, Excavation and Removal of Shallow Soil, Placement of an Asphalt Cap, and Institutional Controls

Effectiveness

Alternative FPVM4, soil vapor extraction with an asphalt cap would meet the remedial action objectives for the area by eliminating contact with contaminated soil and mitigating the infiltration of precipitation through contaminated soil. Although, predesign testing would be required to evaluate an actual radius of influence for the soil vapor extraction system, this

alternative should be effective in reducing VOC contaminant levels. However, the heterogeneity of the fill material can cause channeling and blockage of air, which would reduce the effectiveness of the system. In addition, due to the presence of solid wastes, such as resins and paints in the subsurface, and drums and containers, complete remediation of the subsurface soil would not be achieved with this alternative, and once the system is removed, sources of contamination would likely remain in the subsurface.

Reliability

The reliability of this alternative would need to be demonstrated through the performance of a predesign study and confirmatory soil sampling at the completion of the project. The reliability is also dependant on the maintenance of the asphalt cover.

Implementability

Although difficulties may be encountered during installation of the SVE wells due to subsurface obstructions, since all necessary labor, equipment, materials and supplies for the system are readily available, implementation/construction of this alternative would not be prohibitively difficult. It is estimated that approximately 2,000 cubic yards (in-place volume) would need to be excavated and disposed off-site. This, together with the material for the asphalt cap, would result in about 240 trucks over a 3- to 4-month period. This, in addition to the trucks required for transportation of the SVE system materials, because of the industrial nature of the area and access roadways, should not impact the community

Cost

The cost for this alternative would be comparatively moderate (approximately $2.5 million). Due to the small radius of influence expected in the fill material, a large number of wells would be required to remediate this area. The number of wells and piping to connect the well to the treatment system dictates the sizing of the blower and associated treatment system,

which for this alternative would require substantial equipment. However, the cost for this alternative would be less than the cost for Alternatives FPVM5 and FPVM6.

Alternative FPVM5-Excavation and Removal of Contaminated Soil and Replacement with Clean Soil

Effectiveness

Alternative FPVM5, excavation and off-site disposal of all contaminated soil and waste, would meet all of the remedial action objectives for the site. Through removal of all contaminated soil and waste, this alternative will eliminate the potential for exposure to contamination above groundwater as well as the need for institutional controls.

Reliability

The reliability of this alternative is greater than the alternatives discussed above since no long-term maintenance is required.

Implementability

Excavation of contaminated soil to a depth of up to 20 feet can be readily performed. The necessary labor, equipment, materials and supplies are commercially available. It is estimated that approximately 14,000 cubic yards would need to be excavated and disposed off-site. This would result in approximately 1,100 trucks to remove contaminated soil from the site and transport clean soil to the site over a 4- to 6-month construction period. This would result in an average of 10 trucks per day. Due the industrial nature of the area and access roadways, the number of trucks should not impact the surrounding community. As a result of the potential for significantly elevated levels of VOCs in this area, and potentially off-site release of vapors and odors, emission controls will be necessary. In addition, sheeting in the area of the excavation will be required to minimize removal of additional soil and impacts to the surrounding area created by additional truck traffic.

Cost

The cost of Alternative FPVM5 is high (approximately $4.1 million). Excavation and off-site disposal of all contaminated material is significantly more costly than the no action (Alternative FPVM1), geomembrane cap (Alternative FPVM2) and asphalt cover (Alternative FPVM3) options.

Alternative FPVM6 -Excavation and Removal of Contaminated Soil and Replacement with Treatment Plant Digesters.

The effectiveness, reliability and implementability of Alternative FPVM6 will be the same as described for Alternative FPVM5. The cost for Alternative FPVM6 (approximately $3,700,000) is comparable to Alternative FPVM5. However, since this alternative will not include replacement of the excavation with clean soil, the remediation period would be reduced from 4 to 6 months to 3 to 4 months, and the number of trucks would be reduced from about 1,100 to 560, resulting in less truck traffic (average of 8 trucks per day).

3.3.3 Remaining Site Area

Alternative RSA1-No Action and Institutional Controls

Effectiveness

Alternative RSA1, no action, would not meet any of the remedial action objectives which have been established for the Barretto Point Site, since no remedial action would be performed. The risk assessment indicates that this area of the site poses a potential threat to human health and the environment, through ingestion, dermal contact and inhalation exposure to contaminated soil in this area. Maintenance of the existing fencing would discourage, but would not eliminate access to the site by trespassers. Since this alternative relies solely on natural attenuation, it would likely not be effective due to the persistent nature of the contaminants detected and would not allow for use of this area.

Reliability

This alternative would not be reliable, since it is based solely on natural attenuation and would not meet or achieve the remedial action objectives established for the site.

Implementability

This alternative is readily implementable. However, it does not meet the minimum remediation criteria from a regulatory perspective and would not allow for future use of this area.

Cost

The cost associated with this alternative would be low (approximately $120,000) and would include maintenance of the existing fence.

Alternative RSA2- Placement of 2 Feet of Clean Soil Cover and Institutional Controls

Effectiveness

Alternative RSA2, placement of 2 feet of clean soil and vegetative cover, would meet the remedial action objectives for the site. It would be effective at mitigating the potential for contact, ingestion and inhalation with contaminated soil through the placement of a cover. However, since it does not remove contaminated soil from the site it may not be as effective as Alternative RSA4. Institutional controls and maintenance of the soil/vegetative cover would be necessary to ensure the effectiveness of the cover and protection of human health and the environment. Institutional controls would be necessary to provide notification of regulatory agencies before any intrusive activities below the cover were initiated.

Reliability

If maintained properly, this alternative should be reliable in the long-term at meeting the remedial action objectives. Placement of the warning barrier between the clean soil and contaminated soil would provide the necessary warning to mitigate associated contact with contaminated soil.

Implementability

All the necessary labor, equipment, materials and supplies for placement of a soil cover are readily available and this alternative would be easy to construct. It is estimated that approximately 30,000 cubic yards of soil (22,000 cy of clean general fill and 8,000 cy of topsoil) would need to be brought to the site for construction of the soil cover. This would require approximately 1,200 trucks over a 2- to 3-month period (average of about 25 trucks per day). Due to the industrial nature of the surrounding area and access roadways, the increase in truck traffic should not cause significant impacts to the surrounding community. Grading of the cover likely would be necessary in order to place the clean soil and tie into existing grades along the boundaries of this area, and not interfere with future use of the property.

Cost

The cost for Alternative RSA2 would be moderate (approximately $1.3 million). The soil needed for construction of the cover is readily available. The cost of this alternative is comparable to Alternative RSA3 and significantly lower than Alternative RSA4.

Alternative RSA3- Excavation and Removal of 2 Feet of Soil, Replacement with Clean Soil and Institutional Controls

Effectiveness

Alternative RSA3, excavation and off-site removal of the upper 2 feet of soil and replacement with clean soil and vegetative cover, would meet the remedial action objectives for

the site. The potential for ingestion, direct contact or inhalation of contaminated soil would be mitigated through the implementation of this alternative.

Reliability

The reliability of this alternative, similar to Alternative RSA2, will require long-term maintenance of the cover. The warning barrier placed just below the clean soil cover would provide warning with regard to accidental contact with contaminated soil.

Implementability

Similar to Alternative RSA2, all the necessary equipment, labor, materials and supplies are readily available for excavation and off-site disposal of the soil and replacement with clean soil and vegetative cover. Dust controls would likely be required during excavation. Approximately 30,000 cy of material would need to be transported off-site and a similar volume of soil would need to be brought to the site for construction of the soil cover (approximate total number of trucks of 2,400 with an average of 25 trucks per day over a 4- to 5-month period), which would result in increased truck traffic in the vicinity of the site. Due to the industrial nature of the area surrounding the site and access roadways, additional truck traffic is not expected to cover significant impacts to the surrounding community. Some grading of the site may be necessary to place the soil and not interfere with future use of the site.

Cost

The cost of this alternative would be moderate (approximately $3.1 million). Excavation and off-site disposal of approximately 30,000 cy of soil and placement of a 2-foot soil cover would be the most significant cost. The total cost for this alternative would be greater than Alternative RSA1 and RSA2, but would be substantially less than Alternative RSA4.

Alternative RSA4 - Excavation and Removal of All Fill Material, and Replacement with Clean Soil

Effectiveness

Alternative RSA4, excavation and off-site disposal of all contaminated fill material, would meet all of the remedial action objectives for the site. Through removal of all contaminated soil, this alternative will eliminate the potential for exposure to contamination.

Reliability

Since no long-term maintenance or institutional controls are required, the reliability of this alternative is greater than the alternatives discussed above. Removal of all contaminated fill material will ensure protection of human health and the environment.

Implementability

Excavation of unsaturated contaminated soil to depths up to 14 feet is readily achievable. The necessary labor, equipment, materials and supplies are commercially available. Potential difficulties may arise during excavation and the potential for creation of dust which would require emission controls. It is estimated that approximately 150,000 cubic yards of contaminated soil would need to be removed from the site and 150,000 cubic yards of clean soil will need to be brought to the site. These volumes equate to approximately 12,000 trucks over a 15- to 20-month period (average of about 35 trucks per day). Similar to the above alternatives, due to the industrial nature of the area surrounding the site and access roadways, the additional truck traffic is not expected to impact the implementability of this alternative. Coordination with utility owners will be necessary due to the utility lines that transverse the site that may be impacted during the excavation of contaminated soil.

Cost

The cost of Alternative RSA4 is high (approximately $12.8 million). Excavation and off-site disposal of all contaminated material, is significantly more costly than the no action (Alternative RSA1), soil cover (Alternative RSA2) and partial excavation (Alternative RSA3) options.

3.3.4 Groundwater in the Vicinity of the Former Paint and Varnish Manufacturing Area

Alternative G1-No Action and Institutional Controls

Effectiveness

Alternative G1, no action, would not address contaminated groundwater in the area of the former paint and varnish manufacturing facility. However, since groundwater at the site is saline, depth to water is greater than 15 feet in this area, surface water is not impacted and public water supply exists in the vicinity of the site, there are no current exposure pathways for groundwater. Therefore, this alternative would be effective at protecting human health and the environment as it relates to exposure to contaminants in groundwater. Institutional controls as part of this alternative, such as groundwater use restrictions and notification of regulatory agencies prior to performing activities in the vicinity of groundwater in this area, would aid in ensuring protection of human health.

Reliability

Since this alternative relies on natural attenuation, under existing conditions, contaminants in the groundwater likely will not be significantly reduced. However, if remediation of soil is performed in this area, natural attenuation of groundwater contamination will occur over time.

Implementability

This alternative would be readily implementable.

Cost

There would be no cost associated with this alternative.

Alternative G2 - In Situ Treatment (Oxygen Release Compounds)

Effectiveness

Alternative G2, in-situ treatment of groundwater using oxygen release compounds, will likely be more effective than the no action alternative at reducing the contaminants in groundwater. However, without the results of a pilot study, remediation effectiveness cannot be determined. In addition, it is estimated that a remediation period of 5 years, including implementation of a pilot study, full scale remediation and monitoring, would be required, which would not allow for upgrading of the Hunts Point Water Pollution Control Plant within the proposed construction schedule. The area of the former paint and varnish manufacturing facility is planned for construction of new digesters. Therefore, this alternative would not be effective at remediating groundwater within the required timeframe for future use of the property.

Reliability

The reliability of this alternative would need to be demonstrated through the performance of a pilot study, and if performed on a full scale level, through groundwater monitoring.

Implementability

Implementation of this alternative on a full scale would include the installation of approximately 130 well points in and around the paint/varnish waste disposal area. Installation

of the well points would be difficult due to the nature of the fill material. A minimum of one to two reapplications of the ORC would be required. Although all the materials, supplies, labor and equipment are readily available to implement this alternative, the time period required for this alternative to be effective, approximately 5 years, will not allow for upgrading of the Hunts Point Water Pollution Control Plant/construction of the new digesters within the planned construction schedule.

Cost

The cost of Alternative G2 is moderate to high (approximately $720,000). This cost is comparable to but higher than Alternative G3.

Alternative G3 - Extraction and Treatment As Part of Soil Excavation

Effectiveness

Alternative G3, groundwater extraction during excavation of the contaminated soil and bedrock in the former paint and varnish manufacturing facility area, would be effective for treatment of groundwater. It is assumed that the groundwater would be remediated in the vicinity of the former paint and varnish manufacturing facility during the construction period for the digesters which is approximately 1 year.

Reliability

The reliability of this alternative is greater than the alternatives discussed above, since extraction of the groundwater and above ground treatment is a demonstrated technology in remediating high levels of contaminants in groundwater.

Implementability

Groundwater extraction and treatment is a readily implementable technology. All the necessary labor, equipment, materials and supplies for groundwater extraction and treatment are readily available and this alternative would be easy to construct. Treated groundwater would be discharged to the Hunts Point Water Pollution Control Plant.

Cost

The cost of Alternative G3 is moderate (approximately $610,000). Extraction and treatment above ground during dewatering is more costly than the no action (Alternative G1) and comparable to in-situ treatment using oxygen release compounds (Alternative G2).

3.4 Summary Evaluation of Alternatives

Provided in Tables 3-1, 3-2, 3-3 and 3-4 is a summary of the preliminary evaluation of the remedial alternatives developed for the Barretto Point Site.

With regard to the selection of alternatives to be evaluated further in detail in order to select a remedial plan for the site, of the alternatives identified for the Planned Park Area, three of the alternatives, Alternative PPA1, no action and institutional controls, Alternative PPA2, placement of 2 feet of clean soil cover and institutional controls, and Alternative PPA4, excavation and removal of all fill material and replacement with clean soil, will be considered further. Alternative PPA3 will not be considered further due to the greater cost and no additional benefit compared to Alternative PPA2.

Table 3-1

BARRETTO POINT SITE
REMEDIAL ALTERNATIVES REPORT
SUMMARY OF PRELIMINARY COMPARATIVE EVALUATION OF REMEDIAL ALTERNATIVES
PLANNED PARK AREA

Remedial Alternative		Effectiveness	Reliability	Implementability	Cost	Retained
Alternative PPA1	No action and institutional controls	Low	Low	High (however, will likely not be acceptable to regulatory agencies or the public, and will not allow for planned use of the area)	Low $123,000	Yes (required by alternatives evaluation guidance)
Alternative PPA2	Placement of 2 feet of clean soil cover and institutional controls	Moderate to high	Moderate to high	Moderate to high	Low to moderate $1.1 million	Yes (will allow for planned future use of property)
Alternative PPA3	Excavation and removal of 2 feet of soil, replacement with clean soil and institutional controls	Moderate to high	Moderate to high	Moderate	Moderate $2.4 million	No (no added benefit compared to alternative PPA2 at additional cost)
Alternative PPA4	Excavation and removal of all fill material and replacement with clean soil	High	High	Low to moderate (requires removal of a large volume of soil)	High $10.3 million	Yes (intended to achieve pre-release conditions)

Table 3-2

BARRETTO POINT SITE
REMEDIAL ALTERNATIVES REPORT
SUMMARY OF PRELIMINARY COMPARATIVE EVALUATION OF REMEDIAL ALTERNATIVES
FORMER PAINT AND VARNISH MANUFACTURING FACILITY AREA

Remedial Alternative		Effectiveness	Reliability	Implementability	Cost	Retained
Alternative FPVM1	No action and institutional controls	Low	Low	High (however, will likely not be acceptable to regulatory agencies or the public, and will not allow for planned use of the area)	Low $123,000	Yes (required by alternatives evaluation guidance)
Alternative FPVM2	Excavation and removal of shallow soil, placement of a geomembrane cap and institutional controls	Moderate to high	Moderate to high	Moderate to high	Low to moderate $937,000	Yes (may be applicable if planned use of area is not implemented)
Alternative FPVM3	Excavation and removal of shallow soil, placement of an asphalt cap and institutional controls	Moderate	Low to moderate	Moderate to high	Low to moderate $600,000	No (is not as effective or reliable as FPVM2 at comparable cost)

Table 3-2 (continued)

BARRETTO POINT SITE
REMEDIAL ALTERNATIVES REPORT
SUMMARY OF PRELIMINARY COMPARATIVE EVALUATION OF REMEDIAL ALTERNATIVES
FORMER PAINT AND VARNISH MANUFACTURING FACILITY AREA

Remedial Alternative		Effectiveness	Reliability	Implementability	Cost	Retained
Alternative FPVM4	Soil vapor extraction, excavation and removal of shallow soil, placement of an asphalt cap and institutional temporary controls	Moderate	Moderate	Moderate	Moderate $2.5 million	No (not compatible with planned construction schedule for the area and questionable effectiveness)
Alternative FPVM5	Excavation and removal of contaminated soil and replacement with clean soil	High	High	Low to moderate (requires excavation of a large volume of soil)	High $4.1 million	Yes (intended to achieve pre-release conditions)
Alternative FPVM6	Excavation and removal of contaminated soil and replacement with treatment plant digesters	High	High	Low to moderate (requires excavation of a large volume of soil)	High $3.7 million	Yes (will allow for planned future use of property)

Table 3-3

BARRETTO POINT SITE
REMEDIAL ALTERNATIVES REPORT
SUMMARY OF PRELIMINARY COMPARATIVE EVALUATION OF REMEDIAL ALTERNATIVES
REMAINING SITE AREA

Remedial Alternative		Effectiveness	Reliability	Implementability	Cost	Retained
Alternative RSA1	No action and institutional controls	Low	Low	High (however, will likely not be acceptable to regulatory agencies or the public, and will not allow for planned use of the area)	Low $123,000	Yes (required by alternatives evaluation guidance)
Alternative RSA2	Placement of 2 feet of clean soil cover and institutional controls	Moderate to high	Moderate to high	High to moderate	Low to moderate $1.3 million	Yes (will allow for planned future use of property)
Alternative RSA3	Excavation and removal of 2 feet of soil, replacement with clean soil and institutional controls	Moderate to high	Moderate to high	Moderate	Moderate $3.1 million	No (no added benefit compared to Alternative RSA2 at additional cost)
Alternative RSA4	Excavation and removal of all fill material and replacement with clean soil	High	High	Low (requires removal of a large volume of soil)	High $12.8 million	Yes (intended to achieve pre-release conditions)

Table 3-4

BARRETTO POINT SITE
REMEDIAL ALTERNATIVES REPORT
SUMMARY OF PRELIMINARY COMPARATIVE EVALUATION OF REMEDIAL ALTERNATIVES
GROUNDWATER IN THE VICINITY OF THE FORMER PAINT AND VARNISH MANUFACTURING FACILITY

Remedial Alternative		Effectiveness	Reliability	Implementability	Cost	Retained
Alternative G1	No action and institutional controls	See note 1	See note 1	See note 1	See note 1	Yes (required by guidance and no action for groundwater will be protective of health and the environment if there is no contact with groundwater in this area [groundwater is 15 feet below ground surface])
Alternative G2	In-situ treatment (oxygen release compounds)	Moderate	Moderate	Moderate	Moderate $720,000	Yes (may be applicable if planned use of the area is not implemented)
Alternative G3	Extraction and treatment as part of soil remediation below the water table	High	High	Moderate	Moderate $610,000	Yes (compatible with planned future use of the site)

[1] As discussed in the Site Investigation Report and in Section 3.3.4 of this document, contaminated groundwater at the site does not pose a threat to human health and the environment, and does not require remediation. Treatment of groundwater in this report is being addressed only in the context of the need to dewater the area of the former paint and varnish manufacturing facility to facilitate removal of contaminated soil and weathered bedrock in this area.

Similarly for the Remaining Site Area, since contaminated soil will not be removed from the site, RSA2, placement of 2 feet of clean soil cover and institutional controls, will be as effective and less costly as compared to Alternative RSA3, excavation and removal of 2 feet of soil, replacement with clean soil and institutional controls. Therefore, only alternatives RSA1, no action and institutional controls, RSA2 and RSA4, excavation and removal of all fill material and replacement with clean soil, will be evaluated in detail in the following section for this area.

For the former paint and varnish manufacturing disposal area, Alternatives FPVM5 and FPVM6, excavation and off-site disposal of the contaminated material, will ensure protection of human health and the environment, and if planned use of this area is implemented, Alternative FPVM6 will be the only alternative compatible with this area. If the digesters are not constructed as part of the upgrading of the Hunts Point Water Pollution Control Plant, Alternative FPVM2, excavation and removal of shallow soil, placement of an geomembrane cap and institutional controls, would provide an effective cover for mitigating infiltration of precipitation through the underlying contaminated soil and into groundwater, and isolation of contaminated soil from direct contact. Since Alternative FPVM2 is a more effective and reliable alternative than FPVM3 for this area, excavation and removal of shallow soil, placement of an asphalt cap and institutional controls, Alternative FPVM2 will also be evaluated further. In addition, as required by guidance, Alternative FPVM1, no action with institutional controls, will be evaluated further.

With regard to groundwater, since no action, Alternative G1, is required by guidance, groundwater extraction and treatment, Alternative G3, will be required during excavation of contaminated soil for construction of the treatment plant digesters, and in-situ treatment of groundwater, Alternative G2, may be applicable if soil excavation and dewatering and planned construction is not implemented, all three groundwater alternatives will be evaluated in detail in the following section.

For the detailed evaluation of alternatives, the remaining alternatives for each of the areas of the site as described above can be combined into a single no action alternative and three action alternatives for the entire Barretto Point Site as described below:

Alternative 1 - No action and institutional controls;

Alternative 2 - Placement of 2 feet of clean soil cover and institutional controls in the Planned Park Area and the Remaining Site Area; and excavation and removal of contaminated soil, and extraction and treatment of groundwater as part of soil remediation and replacement with digesters in the Former Paint and Varnish Manufacturing Area;

Alternative 3 - Placement of 2 feet of clean soil cover and institutional controls in the Planned Park Area and the Remaining Site Area; and excavation and removal of contaminated shallow soil, and placement of a geomembrane cap with in-situ treatment of the groundwater in the Former Paint and Varnish Manufacturing Area; and

Alternative 4 - Excavation and removal of all fill material and replacement with clean soil in the Planned Park Area, Former Paint and Varnish Manufacturing Area and Remaining Site Area, and extraction and treatment of groundwater as part of soil remediation in the Former Paint and Varnish Manufacturing Area.

4.0 DETAILED ANALYSIS OF ALTERNATIVES

Provided below is a detailed evaluation of the each of the four site-wide alternatives described in Section 2.0. Based on this detailed evaluation, a remedial plan for the site will be selected for regulatory agency and public comment. In accordance with New York State Department of Environmental Conservation guidance, the following criteria will be addressed in the detailed evaluation of alternatives.

- Threshold Criteria
  - Overall protection of human health and the environment
  - Compliance with applicable regulatory standards, criteria and guidelines
- Balancing Criteria
  - Short-term effectiveness
  - Long-term effectiveness and permanence
  - Reduction of toxicity, mobility and/or volume
  - Feasibility

A description of each of these criteria is provided in Section 1.4 of this document.

Provided below is a comparative analysis of the remedial alternatives to each of the evaluation criteria presented above.

4.1 Overall Protection of Human Health and the Environment

Alternative 1 is not protective of human health and the environment due to the potential for contact with contaminated soil. Although existing fencing would be maintained and security is present at the site, trespassers may still be able to access the site and come into contact with contaminated soil. Human health and environmental risks are greater for this alternative compared to the alternatives discussed below.

Alternative 2 would provide long-term protection of human health and the environment through placement of a clean soil cover over the site to mitigate contact with contaminated soil and removal of highly contaminated soil in the vicinity of the former paint and varnish

manufacturing facility to mitigate impacts on groundwater. Groundwater extraction and treatment during soil excavation will remediate groundwater. Although some contaminated soil will remain on-site, the potential for contact with this soil is minimal due to the presence of a warning barrier below the clean soil cover and institutional controls restricting intrusive activities beneath the warning barrier without proper notification and protection, and proper handling and disposal of contaminated materials. Therefore, for this alternative, the risk to human health and the environment is very low and would allow safe planned use of the site.

Alternative 3 would provide protection of human health and the environment through placement of clean soil over the site and a geomembrane cover over the former paint and varnish manufacturing area to mitigate contact with contaminated soil and continued migration of contaminants through soil to groundwater. Groundwater treatment using oxygen release compounds may reduce levels of volatile and semivolatile organic contaminants in groundwater, however, without removal of the contaminated soil below groundwater in the former paint and varnish manufacturing area, the contaminants in groundwater may not be reduced significantly in the long-term. In addition, for the geomembrane to remain effective in the long-term, it will require maintenance and perhaps replacement in the future. The geomembrane may also limit future use of this area to ensure its protectiveness.

Removal of all fill material on site and extraction and treatment of the groundwater during removal of soil in the former paint and varnish manufacturing area, Alternative 4, would eliminate the potential for contact with any contaminated soil on the site and will remediate groundwater. This alternative would be the most protective of human health and the environment.

Based on this comparative analysis, Alternative 4 would be the most protective of human health and the environment, followed by Alternative 2, which removes all contaminated soil in the former paint and varnish manufacturing area, while also preventing contact with contaminated soil over the remainder of the site. Since Alternative 3 does not remove all of the contaminated soil in the former paint and varnish manufacturing area and may not be effective for remediation of groundwater in the long term, it would not be as protective of human health

and the environment as Alternative 2. Alternative 1 will not be protective of human health and the environment.

4.2 Compliance with Standards, Criteria and Guidelines

Alternative 1 will not be compliant with the standards, criteria and guidelines (SCGs) or remedial action objectives (RAOs) established for the site. Although placement of institutional controls, such as a prohibition on development of the site, and fencing may limit contact with contaminated soil, deterrence of trespassers to the site cannot be guaranteed.

Alternative 2 will be compliant with the SCGs and RAOs established for the site. This alternative will mitigate contact with contaminated soil, remove a significant source of groundwater contamination and remediate groundwater, and through the use of emission controls during remediation, will prevent the release of contaminants to on-site and off-site ambient air.

Similarly, Alternative 3 will be compliant with SCGs and RAOs through mitigation of contact with contaminated soil, however, this alternative will not be as compliant as Alternative 2, since all the contaminated material in the former paint and varnish manufacturing area will not be removed as part of this alternative. In addition, although this alternative includes treatment of the groundwater using oxygen release compounds, volatile and semivolatile organic contaminants in the groundwater may be reduced in the short-term, however, long-term compliance with groundwater SCGs and RAOs may not be achievable, since groundwater will remain in contact with contaminated soil and the source of groundwater contamination will remain on-site. Emission controls used during remediation as part of this alternative will prevent the release of contaminants to on and off-site ambient air.

Through removal of all contaminated fill material on-site, and extraction and treatment of groundwater in the former paint and varnish manufacturing area during soil removal, Alternative 4 will be the most compliant with SCGs and RAOs for the site.

Therefore, Alternative 4 would be the most compliant with the SCGs and RAOs for the site, followed by Alternative 2, which includes removal of all contaminated soil in the former paint and varnish manufacturing area and covering the remaining portions of the site with clean soil. Alternative 3 it is not as compliant as compared to Alternative 2, since it does not remove all of the contaminated soil in the former paint and varnish manufacturing area and allows for a source of groundwater contamination to remain on-site. Alternative 1 is not compliant with the SCGs and RAOs for the site.

4.3 Short-term Effectiveness

Alternative 1 will not have any short-term construction related impacts and can be fully implemented immediately. However, although there are no immediate significant threats to human health and the environment, this alternative will not be effective in the short- or long-term in preventing potential contact with contaminated soil.

Removal of the contaminated surface and subsurface soil, and placement of the clean soil cover associated with Alternative 2 will take approximately 3 to 4 months to complete. Therefore, this alternative will be effective in the short term in eliminating the potential for contact with contaminated soil and waste through placement of the soil cover and removal of contaminated soil in the former paint and varnish manufacturing area. This alternative would also be effective in the short-term with regard to remediation of the groundwater.

Complete implementation of Alternative 2, including design and construction of the digesters, can be completed within approximately 18 months after selection of this alternative and issuance of a Record of Decision by NYSDEC, including design and construction. During implementation of the alternative, emission controls will ensure protection of on-site workers and the surrounding community. As discussed in Section 2.0, it is likely that excavation of the contaminated soil in the vicinity of the former paint and varnish manufacturing facility will require the use of an enclosed structure with carbon filters. With proper implementation of a construction health and safety plan, construction quality assurance/quality control plan and

community air monitoring plan, there will be no adverse impacts on human health and the environment during construction.

Approximately 50,000 cubic yards of clean soil will need to be brought on-site for use in construction of the soil cover and over 14,000 cubic yards of contaminated soil will need to be transported off-site during excavation of the former paint and varnish manufacturing facility waste disposal area. During the soil remediation period of approximately 4 to 6 months, an average of 32 trucks per day will be entering and leaving the site, which will not significantly add to traffic along the major roadways in the vicinity of the site. (Peak number of trucks based on transporting 1,000 cubic yards per day to the site would result in about 40 trucks per day.) No other significant disruption to the surrounding community is expected with implementation of this alternative.

Short-term impacts related to implementation of Alternative 3 are similar to, but not as significant as Alternative 2. Since this alternative does not include removal of all of the contaminated soil within the former paint and varnish manufacturing area (3,000 cy [in place volume] verses 12,000 cy [in place volume] for Alternative 2), the soil remediation period would be less, approximately 3 to 4 months versus 4 to 6 months. This would reduce the peak number of trucks entering and exiting the site from 40 trucks per day to approximately 35 trucks per day over a shorter period. This would allow this alternative to be effective in a shorter period of time than Alternative 2. Emission controls would need to be implemented; however, since the volume of contaminated soil requiring removal is significantly less, the emission controls would not be as significant. The overall alternative could be completed within 12 months, including design and construction. Proper implementation of a construction health and safety plan, construction quality assurance/quality control plan and community air monitoring plan, would result in no adverse impacts to human health and the environment during construction.

Alternative 4 would require the removal of approximately 285,000 cubic yards of material from the site and transportation of approximately 285,000 cubic yards of clean soil to the site. This alternative would have the same short-term impacts as Alternative 2 with respect to removal of contaminated soil from the former paint and varnish manufacturing area; however, it

would have significantly greater impacts with respect to truck traffic in the vicinity of the site. The alternative could be implemented within 3 years of issuance of the Record of Decision by NYSDEC and during this time period there would be approximately 40 trucks per day entering and exiting the site. Other than the impacts to the area caused by the increase in truck traffic to the site, there would not be any other significant impacts on human health and the environment during construction with implementation of emission controls.

Based on this analysis, Alternative 1 would have less short-term impacts, but would be significantly less effective in the short term compared to the remaining alternatives. Since Alternative 3 requires excavation and off-site disposal of a significantly less volume of soil than Alternative 2, and does not require the excavation and off-site disposal of the highly contaminated soil in the former paint and varnish manufacturing area, Alternative 3 would have less short-term impacts and would be more effective in the short term than Alternative 2. Finally, although Alternative 4 would be effective in the short term, due to the very large volume of soil requiring excavation and off-site disposal, and the similar volume of clean fill material required to be placed at the site, Alternative 4 would result in the most significant short-term impacts.

4.4 Long-term Effectiveness and Permanence

Alternative 1 will not provide for long-term effectiveness and permanence, since remediation of the contaminated soil and waste will not occur. Contaminated soil will continue to be potentially accessible, and therefore, risks to human health and the environment will remain at the site.

Alternative 2 is considered an effective long-term and permanent remedial action. The risk posed by the contaminants that remain on site would be minimal, since the remaining contaminated soil will be isolated from direct exposure, provided that the soil cover and institutional controls are properly maintained. Contaminated soil, waste and groundwater in the vicinity of the former paint and varnish manufacturing facility will be removed. The long-term effectiveness of this alternative is high.

The long-term effectiveness and permanence of Alternative 3 is not as high as Alternative 2. Maintenance of the geomembrane cap would be required, and contaminated soil and waste would remain in the former paint and varnish manufacturing area. Although groundwater remediation will be performed through the use of oxygen release compounds, the long-term effectiveness of this technology is uncertain, since the groundwater will remain in contact with contaminated soil below the water table.

Through removal of all contaminated soil and fill material at the site, and groundwater remediation through extraction and treatment during soil removal in the former paint and varnish manufacturing area, Alternative 4 would be very effective in the long term and would be considered a permanent remedy for the site. This alternative would not require the maintenance of covers or placement of institutional controls to ensure long-term effectiveness.

Based on this analysis, Alternative 4 would be the most effective alternative in the long-term followed by Alternative 2. Alternative 3 would not be as effective in the long-term due to the required maintenance of the geomembrane cap and the highly contaminated soil which would remain on the site. Alternative 1 would not be effective and permanent in the long-term.

4.5 Reduction of Toxicity, Mobility or Volume Through Treatment

Alternative 1 will not be effective in reducing the toxicity, mobility or volume of contaminants at the site and as a result, contamination will continue to pose a threat to human health and the environment.

Alternative 2 will reduce the toxicity, mobility and volume of contaminated soil, waste and groundwater at the site through excavation and off-site disposal of approximately 14,000 cubic yards of contaminated soil, and extraction and treatment of approximately 2.5 million gallons of groundwater. Since the highly contaminated soil and waste will be removed from the site and a significant volume of groundwater will be treated, the irreversibility of this alternative is high. In areas where residual contamination will remain, mobility will be mitigated by

placement and maintenance of a clean soil cover, warning barrier and institutional controls in these areas.

Alternative 3 will also reduce the mobility, and to a lesser degree, the toxicity and volume of contaminated soil through removal of approximately 3,500 cubic yards of contaminated soil. Treatment of the groundwater through use of oxygen release compounds would reduce the toxicity, mobility and volume of contaminated groundwater, although not as effectively as groundwater extraction and treatment. Long-term reduction of groundwater contamination is unknown with regard to this alternative. Installation of the geomembrane cover, soil cover, warning barrier and institutional controls will reduce mobility of the remaining residual contamination.

Alternative 4 would be the most effective alternative at reducing the toxicity, mobility and volume of contaminated soil through removal of approximately 285,000 cubic yards of contaminated soil and treatment of approximately 2.5 million gallons of groundwater.

Based on the above comparative analysis, Alternative 4 would be the most effective at reducing the mobility, toxicity and volume of contaminants in soil, waste and groundwater, followed by Alternative 2, which removes 14,000 cubic yards of contaminated soil from the site, and Alternative 3, which removes 3,500 cubic yards of contaminated soil from the site. Alternative 1 will not be effective in reducing the toxicity, mobility or volume of contaminants at the site.

4.6 Feasibility

As discussed in Section 2.0, although Alternative 1 is readily implementable physically, it likely is not implementable from a regulatory agency perspective. This alternative provides for little protection of human health and the environment, and contact with contaminated soil through the placement of fencing and institutional controls. It also does not reduce infiltration of precipitation through waste and contaminated soil in the vicinity of the former paint and varnish

manufacturing facility, and adverse impacts to groundwater. In addition, this alternative will not allow for planned use of the site, and therefore, is not viable.

All of the necessary labor, equipment, materials and supplies for implementation of Alternative 2, placement of a soil cover, excavation and off-site disposal of contaminated soil and waste, and extraction and treatment of groundwater are readily available. Coordination with appropriate regulatory agencies would be necessary, but would not impact implementation. This alternative is very amenable to planned use of the site, since it would allow for construction of a park and upgrading of the Hunts Point Water Pollution Control Plant within the consent order schedule. Therefore, Alternative 2 is feasible.

Similarly, all of the necessary labor, equipment, materials and supplies for implementation of Alternative 3, placement of a soil cover, excavation and off-site disposal of contaminated soil and waste, and placement of a geomembrane cover and treatment of groundwater using oxygen release compounds are readily available. However, this alternative may impact future use of the site. Even if a portion of the site is not utilized for upgrading of the Hunts Point Water Pollution Control Plant, placement of a geomembrane cover in the former paint and varnish manufacturing facility area may restrict development of this area of the site. Since this alternative is not consistent with the current planned use of the site, coordination with regulatory agencies may be more significant than with Alternative 2, in particular, for development in the former paint and varnish manufacturing area. Therefore, Alternative 3 is not as feasible as Alternative 2.

Implementation of Alternative 4 will allow for the least restricted future use of the property. Removal of all contaminated soil to the water table in the planned park area and remaining site area, and removal of all contaminated soil and waste in the former paint and varnish manufacturing area can be completed with readily available labor, equipment, materials and supplies. Coordination with regulatory agencies would be required, but would not impact implementation of this alternative.

The estimated capital costs, and long-term (30-year) operation and maintenance (O&M) present worth costs associated with the all of the alternatives are presented in Table 4-1. A detailed breakdown of each estimate is provided in Appendix A.

The following assumptions were utilized in the preparation of the cost estimates:

- Costs are rounded to the nearest thousand dollars.
- All site work costs (e.g., excavation, backfill, etc.) were estimated using costs obtained from recent bids for remediation projects in the vicinity of the site and Means Site Work Cost Data, experience in construction and adjustment for hazardous site remediation, and discussion with remedial contractors, material suppliers, trucking companies and disposal facilities.
- Present worth of annual operation and maintenance cost based on 30 years at 5 percent interest.

As shown on Table 4-1, the cost of Alternative 4, which includes removal of all fill and contaminated material off-site, is extremely high. Alternative 2, which includes removal of the contaminated soil in the former paint and varnish manufacturing area, and placement of a clean soil cover over the planned park area and the remaining site area, is more costly than Alternative 3, which includes removal of the shallow soil on-site and placement of a geomembrane cover on the former paint and varnish manufacturing area. However, Alternative 2 will provide for greater protection of human health and the environment, and permanence as compared to Alternative 3, and will allow for planned use of the site for a park for the community and upgrading of the Hunts Point Water Pollution Control Plant within the State-mandated timeframe. Alternative 1, which is the lowest cost, is not protective of human health and the environment, and would not allow planned use of the site, and is therefore, not implementable.

A summary of the comparative analysis of the alternatives is provided in Table 4-2.

Table 4-1

BARRETTO POINT SITE
REMEDIAL ALTERNATIVES REPORT
ALTERNATIVES COST SUMMARY

Alternative	Estimated Capital Cost	Estimated Contingency and Engineering Fees	Present Worth of* Annual Operation and Maintenance Cost	Total Estimated Cost Based on Present Worth
1	$0	$0	$123,000	$123,000
2	$4,534,000	$1,133,000	$446,000	$6,169,000
3	$2,254,000	$563,000	$545,000	$3,362,000
4	$21,862,000	$5,465,000	$56,000	$27,383,000

*30 years at 5% interest.

Table 4-2

BARRETTO POINT SITE
REMEDIAL ALTERNATIVES REPORT
SUMMARY OF REMEDIAL ALTERNATIVE COMPARATIVE ANALYSIS

Evaluation Criteria	Alternative 1 – No Action and Institutional Controls	Alternative 2 – Placement of 2 Feet of Clean Soil Cover and Institutional Controls in the Planned Park Area and the Remaining Site Area, and Excavation and Removal of Contaminated Soil, Extraction and Treatment of Groundwater as Part of Soil Excavation and Replacement with Digesters in the Former Paint and Varnish Manufacturing Area	Alternative 3 - Placement of 2 feet of Clean Soil Cover and Institutional Controls in the Planned Park Area and Remaining Site Area, and Placement of a Geomembrane, and In-situ Treatment of The Groundwater in the Former Paint and Varnish Manufacturing Area	Alternative 4 - Excavation and Removal of All Fill Material and Replacement with Clean Soil in the Planned Park Area, Remaining Site Area, and Former Paint and Varnish Manufacturing Area, and Extraction and Treatment of Groundwater as Part of Soil Excavation in the Former Paint and Varnish Manufacturing Area
Protection of Human Health and the Environment	4	2	3	1
Compliance with SCGs	4	2	3	1
Short-term Effectiveness	1	3	2	4
Long-term Effectiveness and Permanence	4	2	3	1
Reduction of Toxicity, Mobility or Volume	4	2	3	1
Feasibility	4	1	3	2
Cost	($123,000)	($6,169,000)	($3,362,000)	($27,383,000)
Total	21	12	17	10

Note: Lowest numerical score is highest ranking.

5.0 RECOMMENDED ALTERNATIVE

Based on the preliminary evaluation of remedial alternatives described in Section 2.0 and the detailed evaluation of alternatives in Section 3.0, Alternative 2, placement of 2 feet of clean soil cover and institutional controls in the Planned Park Area and the Remaining Site Area; and excavation and removal of contaminated soil, and extraction and treatment of groundwater as part of soil remediation and replacement with digesters in the Former Paint and Varnish Manufacturing Area, is recommended for remediation of the Barretto Point Site. Although this alternative ranks slightly lower compared to Alternative 4 with regard to the evaluation criteria, Alternative 4 is four times more costly than Alternative 2 ($6.2 million versus $27 million) and does not provide for significant additional benefits to protection of human health and the environment.

Although both alternatives would allow for planned future development of the site as a park and for upgrading of the Hunts Point Water Pollution Control Plant, Alternative 4 will take a significantly longer period of time to implement (3 years versus 18 months) and is not consistent with the time frame for planned development of the site. Impacts to the surrounding community would also be more significant with Alternative 4 than with Alternative 2 as a result of increased truck traffic in the area of the site over a substantially longer period of time.

Placement of the 2 feet of soil cover as part of Alternative 2 will mitigate the potential for contact with contaminated soil, and removal of waste and contaminated soil in the vicinity of the former paint and varnish manufacturing facility will eliminate the potential for contact with contaminants in this area and remediate a source of groundwater contamination. Extraction and treatment of groundwater as a part of soil excavation will improve groundwater quality at the site and allow safe construction of the digesters. Once installed, the soil cover will require maintenance to ensure the integrity of the cover. The former paint and varnish manufacturing facility area will not require any long-term monitoring or maintenance since all waste and contaminated soil will be removed from this area and disposed off-site.

APPENDIX A

COST ESTIMATE

REMEDIAL ALTERNATIVES

BARRETTO POINT SITE

ALTERNATIVE 1
NO ACTION AND INSTITUTIONAL CONTROLS

COST ESTIMATE

Item	Quantity	Units	Unit Cost	Total
Capital Costs				
				$0
Estimated Capital Cost				**$0**
Contingency and Engineering Fees				
Contingency allowance				$0
Engineering fees				$0
Estimated Contingency and Engineering Fees				**$0**
TOTAL ESTIMATED CAPITAL COST				**$0**
Annual Maintenance Costs				
Fence				
Site inspection	12	Mandays	$500.00	$6,000
Miscellaneous repairs	-	Lump Sum	$2,000.00	$2,000
Annual cost				$8,000
Present worth of annual operation & maintenance cost for 30 yrs (i=5%)				**$123,000**
REMEDIAL ALTERNATIVE 1 TOTAL ESTIMATED COSTS				**$123,000**

BARRETTO POINT SITE

ALTERNATIVE 2
PLACEMENT OF 2 FEET OF CLEAN SOIL COVER
AND INSTITUTIONAL CONTROLS IN THE PLANNED PARK AREA
AND REMAINING SITE AREA AND EXCAVATION AND
REMOVAL OF CONTAMINATED SOIL, EXTRACTION AND TREATMENT
OF GROUNDWATER AS PART OF SOIL EXCAVATION AND REPLACEMENT
WITH DIGESTERS IN THE FORMER PAINT AND VARNISH MANUFACTURING AREA

COST ESTIMATE

Item	Quantity	Units	Unit Cost	Total
Capital Costs				
Mobilization/demobilization*	-	Lump Sum	$300,000	$300,000
Site Preparation				
Clearing and grubbing	13	Acres	$6,000	$78,000
Grading	3,000	CY	$6.00	$18,000
Soil Cover				
Warning barrier	61,000	SQ YD	$0.50	$31,000
Buy/haul/place 18" general fill**	37,000	CY	$15.00	$555,000
Buy/haul/place 6" top soil**	13,000	CY	$25.00	$325,000
Seed, fertilize and mulch	61,000	SQ YD	$1.00	$61,000
Additional Bank Stabilization				
Buy/haul/place rip-rap	1,000	CY	$55.00	$55,000
Excavation of Contaminated Soil				
Drive,remove and salvage sheeting	15,000	SQFT	$45.00	$675,000
Excavation of soil	11,800	CY	$20.00	$236,000
Increase for level B work (assume 75% increase)				$177,000
Transportation and disposal of non hazardous waste/soil	12,700	Ton	$75.00	$953,000
Transportation and disposal of hazardous waste	1,400	Ton	$150.00	$210,000
Emission Controls (sprung structure and carbon filters)	-	Lump Sum	$500,000	$500,000
Pilot and Bench Study (includes pump test)	-	Lump Sum	$25,000	$25,000

BARRETTO POINT SITE

ALTERNATIVE 2
PLACEMENT OF 2 FEET OF CLEAN SOIL COVER
AND INSTITUTIONAL CONTROLS IN THE PLANNED PARK AREA
AND REMAINING SITE AREA AND EXCAVATION AND
REMOVAL OF CONTAMINATED SOIL, EXTRACTION AND TREATMENT
OF GROUNDWATER AS PART OF SOIL EXCAVATION AND REPLACEMENT
WITH DIGESTERS IN THE FORMER PAINT AND VARNISH MANUFACTURING AREA

COST ESTIMATE(continued)

Item	Quantity	Units	Unit Cost	Total
Capital Costs				
Groundwater Extraction and Treatment System				
Installation of 4 extraction wells and pump s (includes soil borings, well construction, well development, well development water disposal, pumps and vaults)	-	Lump Sum	$50,000	$50,000
Aeration tank and blowers	-	Lump Sum	$75,000	$75,000
Thermal oxidizer	-	Lump Sum	$30,000	$30,000
Rapid mix/coagulation/plate settler	-	Lump Sum	$50,000	$50,000
Aeration towers and blowers	-	Lump Sum	$50,000	$50,000
Granular activated carbon filter	-	Lump Sum	$25,000	$25,000
Electric	-	Lump Sum	$5,000	$5,000
Building	-	Lump Sum	$50,000	$50,000
		Estimated Capital Cost		**$4,534,000**
Contingency and Engineering Fees				
Contingency allowance (15%)				$680,000
Engineering fees (10%)***				$453,000
		Estimated Contingency and Engineering Fees		$1,133,000
		TOTAL ESTIMATED CAPITAL COST		**$5,667,000**
Annual Operating and Maintenance Costs				
Cover				
Site inspection	8	Mandays	$500	$4,000
Vegetation maintenance and site materials	-	Lump Sum	$15,000	$15,000
Miscellaneous site work	20	Mandays	$500	$10,000
		Annual cost		$29,000
		Present worth of annual operation & maintenance cost for 30 yrs (i=5%)		**$446,000**

BARRETTO POINT SITE

ALTERNATIVE 2
PLACEMENT OF 2 FEET OF CLEAN SOIL COVER
AND INSTITUTIONAL CONTROLS IN THE PLANNED PARK AREA
AND REMAINING SITE AREA AND EXCAVATION AND
REMOVAL OF CONTAMINATED SOIL, EXTRACTION AND TREATMENT
OF GROUNDWATER AS PART OF SOIL EXCAVATION AND REPLACEMENT
WITH DIGESTERS IN THE FORMER PAINT AND VARNISH MANUFACTURING AREA

COST ESTIMATE (continued)

Item	Quantity	Units	Unit Cost	Total
Groundwater Extraction and Treatment System				
Extraction well pumps (includes service and power costs)	-	Lump Sum	$10,000	$10,000
Treatment system (including service and power)	-	Lump Sum	$10,000	$10,000
Residuals disposal	-	Lump Sum	$5,000	$5,000
System O&M labor	365	Hours	$50.00	$18,000
	Annual cost			**$43,000**
Discharge Monitoring Costs Per Event				
Discharge sampling	1	Mandays	$500	$500
Equipment, materials and supplies	-	Lump Sum	$100	$100
Sample analysis****	1	Samples	$500	$500
	Estimated per event monitoring costs			$1,100
	Costs for one year*****			**$13,000**
	REMEDIAL ALTERNATIVE 2 TOTAL ESTIMATED COSTS			**$6,169,000**

*Includes bonds, insurance, temporary facilities, pre-construction submittals and as built drawings
**Volume accounts for compaction
*** Includes design and construction inspection.
****Sample analysis includes full TCL+30 parameters, TAL metals and cyanide
*****Sampling frequency includes 12 times per year

BARRETTO POINT SITE

ALTERNATIVE 3
PLACEMENT OF 2 FEET OF CLEAN SOIL COVER
AND INSTITUTIONAL CONTROLS IN THE PLANNED PARK AREA
AND REMAINING SITE AREA AND EXCAVATION AND
REMOVAL OF SHALLOW SOIL, PLACEMENT OF A GEOMEMBRANE CAP,
AND IN-SITU TREATMENT OF GROUNDWATER
IN THE FORMER PAINT AND VARNISH MANUFACTURING AREA

COST ESTIMATE

Item	Quantity	Units	Unit Cost	Total
Capital Costs				
Mobilization/demobilization*	-	Lump Sum	$300,000	$300,000
Site Preparation				
Clearing and grubbing	13	Acres	$6,000	$78,000
Grading	3,000	CY	$6.00	$18,000
Soil Cover				
Warning barrier	61,000	SQ YD	$0.50	$31,000
Buy/haul/place 18" general fill**	37,000	CY	$15.00	$555,000
Buy/haul/place 6" top soil**	13,000	CY	$25.00	$325,000
Seed, fertilize and mulch	61,000	SQ YD	$1.00	$61,000
Additional Bank Stabilization				
Buy/haul/place rip-rap	1,000	CY	$55.00	$55,000
Excavation of Contaminated Soil				
Excavation of soil	3,500	CY	$8.00	$28,000
Increase for level C work (assume 25% increase)				$7,000
Transportation and disposal of non hazardous waste	4,000	Ton	$45.00	$180,000
Transportation and disposal of hazardous waste	300	Ton	$150.00	$45,000
Geomembrane Cover				
Buy/haul/place 6 " general fill	700	CY	$15.00	$11,000
Buy/haul/place 60 mil HDPE geomembrai	3,400	SQ YD	$7.00	$24,000
Buy/haul/place geocomposite	3,400	SQ YD	$7.00	$24,000
Buy/haul/place 24" barrier protection laye	2,700	CY	$20.00	$54,000
Buy/haul/place 6" top soil	700	CY	$25.00	$18,000
Seed, fertilize and mulch	3,400	SQ YD	$1.00	$3,000

BARRETTO POINT SITE

ALTERNATIVE 3
PLACEMENT OF 2 FEET OF CLEAN SOIL COVER
AND INSTITUTIONAL CONTROLS IN THE PLANNED PARK AREA
AND REMAINING SITE AREA AND EXCAVATION AND
REMOVAL OF SHALLOW SOIL, PLACEMENT OF A GEOMEMBRANE CAP,
AND IN-SITU TREATMENT OF GROUNDWATER
IN THE FORMER PAINT AND VARNISH MANUFACTURING AREA

COST ESTIMATE(continued)

Item	Quantity	Units	Unit Cost	Total
Capital Costs				
Emission Controls	-	Lump Sum	$15,000	$15,000
Injection well installation	130	wells	$2,000	$260,000
Monitoring well installation	4	wells	$3,000	$12,000
ORC Slurry Injection Cost	3	applications	$50,000	$150,000
		Estimated Capital Cost		**$2,254,000**
Contingency and Engineering Fees				
Contingency allowance (15%)				$338,000
Engineering fees (10%)***				$225,000
		Estimated Contingency and Engineering Fees		$563,000
		TOTAL ESTIMATED CAPITAL COST		**$2,817,000**
Annual Operating and Maintenance Costs				
Cover				
Site inspection	12	Mandays	$500	$6,000
Vegetation maintenance and site materials	-	Lump Sum	$15,000	$15,000
Miscellaneous site work	24	Mandays	$500	$12,000
		Annual cost		$33,000
		Present worth of annual operation & maintenance cost for 30 yrs (i=5%)		**$507,000**

BARRETTO POINT SITE

ALTERNATIVE 3
PLACEMENT OF 2 FEET OF CLEAN SOIL COVER
AND INSTITUTIONAL CONTROLS IN THE PLANNED PARK AREA
AND REMAINING SITE AREA AND EXCAVATION AND
REMOVAL OF SHALLOW SOIL, PLACEMENT OF A GEOMEMBRANE CAP,
AND IN-SITU TREATMENT OF GROUNDWATER
IN THE FORMER PAINT AND VARNISH MANUFACTURING AREA

COST ESTIMATE (continued)

Item	Quantity	Units	Unit Cost	Total
Annual Operating and Maintenance Costs				
Groundwater Monitoring Costs Per Event				
Groundwater sampling	1	Mandays	$500	$500
Purge water disposal	4	Drums	$200	$800
Equipment, materials and supplies	-	Lump Sum	$1,000	$1,000
Sample analysis	4	Samples	$200	$800
	Estimated per event monitoring costs			$3,100
	Present worth of annual groundwater monitoring (5 yrs, i=5%)****			**$38,000**
	REMEDIAL ALTERNATIVE 3 TOTAL ESTIMATED COSTS			**$3,362,000**

*Includes bonds, insurance, temporary facilities, pre-construction submittals and as built drawings
**Volume accounts for compaction
*** Includes design and construction inspection.
****Sample analysis includes volatle organic compounds, ORP,pH,DO,iron,BOD and COD
Sample frequency is quarterly for the first 3 years and biannually for the next 2 years.

BARRETTO POINT SITE

ALTERNATIVE 4
EXCAVATION AND REMOVAL OF ALL FILL MATERIAL IN THE PLANNED PARK AREA, THE FORMER PAINT AND VARNISH MANUFACTURING AREA AND REMAINING SITE AREA AND EXTACTION AND TREATMENT OF GROUNDWATER AS PART OF SOIL REMOVAL IN THE FORMER PAINT AND VARNISH MANUFACTURING AREA

COST ESTIMATE

Item	Quantity	Units	Unit Cost	Total
Capital Costs				
Mobilization/demobilization*	-	Lump Sum	$300,000	$300,000
Site Preparation				
Clearing and grubbing	13	Acres	$6,000	$78,000
Excavation of Contaminated Soil				
Excavation of soil	220,000	CY	$8.00	$1,760,000
Transportation and disposal of non hazardous waste/soil	270,000	Ton	$45.00	$12,150,000
Soil Backfill and Soil/Vegetative Cover				
Buy/haul/place 18" general fill**	257,000	CY	$15.00	$3,855,000
Buy/haul/place 6" top soil**	13,000	CY	$25.00	$325,000
Seed, fertilize and mulch	61,000	SQ YD	$1.00	$61,000
Excavation of Contaminated Soil in Former Paint and Varnish Manufacturing Area				
Drive,remove and salvage sheeting	15,000	SQFT	$45.00	$675,000
Excavation of soil and weathered rock	11,800	CY	$20.00	$236,000
Increase for level B work (assume 75% increase)				$177,000
Transportation and disposal of non hazardous waste/soil	12,700	Ton	$75.00	$953,000
Transportation and disposal of hazardous waste	1,400	Ton	$150.00	$210,000
Replacement with Clean Fill in Former Paint and Varnish Manufacturing Area				
Buy/haul/place general fill	13,400	CY	$15.00	$201,000
Buy/haul/place 6" top soil	700	CY	$25.00	$18,000
Seed, fertilize and mulch	3,400	SQ YD	$1.00	$3,000

BARRETTO POINT SITE

ALTERNATIVE 4
EXCAVATION AND REMOVAL OF ALL FILL MATERIAL IN THE PLANNED PARK AREA, THE FORMER PAINT AND VARNISH MANUFACTURING AREA AND REMAINING SITE AREA AND EXTACTION AND TREATMENT OF GROUNDWATER AS PART OF SOIL REMOVAL IN THE FORMER PAINT AND VARNISH MANUFACTURING AREA

COST ESTIMATE(continued)

Item	Quantity	Units	Unit Cost	Total
Capital Costs				
Emission Controls (sprung structure and carbon filters)	-	Lump Sum	$500,000	$500,000
Pilot and Bench Study (includes pump test)	-	Lump Sum	$25,000	$25,000
Groundwater Extraction and Treatment System				
Installation of 4 extraction wells and pump s (includes soil borings, well construction, well development, well development water disposal, pumps and vaults)	-	Lump Sum	$50,000	$50,000
Aeration tank and blowers	-	Lump Sum	$75,000	$75,000
Thermal oxidizer	-	Lump Sum	$30,000	$30,000
Rapid mix/coagulation/plate settler	-	Lump Sum	$50,000	$50,000
Aeration towers and blowers	-	Lump Sum	$50,000	$50,000
Granular activated carbon filter	-	Lump Sum	$25,000	$25,000
Electric	-	Lump Sum	$5,000	$5,000
Building	-	Lump Sum	$50,000	$50,000
		Estimated Capital Cost		**$21,862,000**
Contingency and Engineering Fees				
Contingency allowance (15%)				$3,279,000
Engineering fees (10%)***				$2,186,000
Estimated Contingency and Engineering Fees				$5,465,000
TOTAL ESTIMATED CAPITAL COST				**$27,327,000**

BARRETTO POINT SITE

ALTERNATIVE 4
EXCAVATION AND REMOVAL OF ALL FILL MATERIAL IN THE PLANNED PARK AREA, THE FORMER PAINT AND VARNISH MANUFACTURING AREA AND REMAINING SITE AREA AND EXTACTION AND TREATMENT OF GROUNDWATER AS PART OF SOIL REMOVAL IN THE FORMER PAINT AND VARNISH MANUFACTURING AREA

COST ESTIMATE(continued)

Item	Quantity	Units	Unit Cost	Total
Annual Operating and Maintenance Costs				
Groundwater Extraction and Treatment System				
Extraction well pumps (includes service and power costs)	-	Lump Sum	$10,000	$10,000
Treatment system (including service and power)	-	Lump Sum	$10,000	$10,000
Residuals disposal	-	Lump Sum	$5,000	$5,000
System O&M labor	365	Hours	$50.00	$18,000
	Annual cost			**$43,000**
Discharge Monitoring Costs Per Event				
Discharge sampling	1	Mandays	$500	$500
Equipment, materials and supplies	-	Lump Sum	$100	$100
Sample analysis****	1	Samples	$500	$500
	Estimated per event monitoring costs			$1,100
	Costs for one year*****			**$13,000**

REMEDIAL ALTERNATIVE 4
TOTAL ESTIMATED COSTS **$27,383,000**

*Includes bonds, insurance, temporary facilities, pre-construction submittals and as built drawings
**Volume accounts for compaction
*** Includes design and construction inspection.
****Sample analysis includes full TCL+30 parameters, TAL metals and cyanide
*****Sampling frequency includes 12 times per year

PLANNED PARK AREA ALTERNATIVES

BARRETTO POINT SITE

ALTERNATIVE PPA1
NO ACTION AND INSTITUTIONAL CONTROLS

COST ESTIMATE

Item	Quantity	Units	Unit Cost	Total
Capital Costs				
				$0
Estimated Capital Cost				**$0**
Contingency and Engineering Fees				
Contingency allowance				$0
Engineering fees				$0
Estimated Contingency and Engineering Fees				**$0**
TOTAL ESTIMATED CAPITAL COST				**$0**
Annual Maintenance Costs				
Fence				
Site inspection*	12	Mandays	$500.00	$6,000
Miscellaneous repairs	-	Lump Sum	$2,000.00	$2,000
Annual cost				$8,000
Present worth of annual operation & maintenance cost for 30 yrs (i=5%)				$123,000
REMEDIAL ALTERNATIVE PPA1 TOTAL ESTIMATED COSTS				**$123,000**

*Assumes monthly inspections

BARRETTO POINT SITE

ALTERNATIVE PPA2
PLACEMENT OF 2 FEET OF CLEAN SOIL COVER
AND INSTITUTIONAL CONTROLS

COST ESTIMATE

Item	Quantity	Units	Unit Cost	Total
Capital Costs				
Mobilization/demobilization*	-	Lump Sum	$150,000	$150,000
Site Preparation				
Clearing and grubbing	5	Acres	$6,000	$30,000
Grading	3,000	CY	$6.00	$18,000
Soil Cover				
Warning barrier	25,000	SQ YD	$0.50	$13,000
Buy/haul/place 18" general fill**	15,000	CY	$15.00	$225,000
Buy/haul/place 6" top soil**	5,000	CY	$25.00	$125,000
Seed, fertilize and mulch	25,000	SQ YD	$1.00	$25,000
Additional Bank Stabilization				
Buy/haul/place rip-rap	400	CY	$55.00	$22,000
		Estimated Capital Cost		**$608,000**
Contingency and Engineering Fees				
Contingency allowance (20%)				$122,000
Engineering fees (20%)***				$122,000
		Estimated Contingency and Engineering Fees		$244,000
		TOTAL ESTIMATED CAPITAL COST		**$852,000**
Annual Operating and Maintenance Costs				
Cover				
Site inspection	4	Mandays	$500	$2,000
Vegetation maintenance and site materials	-	Lump Sum	$10,000	$10,000
Miscellaneous site work	10	Mandays	$500	$5,000
	Annual cost			$17,000
	Present worth of annual operation & maintenance cost for 30 yrs (i=5%)			**$261,000**
	REMEDIAL ALTERNATIVE PPA2			
	TOTAL ESTIMATED COSTS			**$1,113,000**

*Includes bonds, insurance, temporary facilities, pre-construction submittals and as built drawings

**Volumes account for compaction.

***Includes design and construction inspection.

BARRETTO POINT SITE

ALTERNATIVE PPA3
EXCAVATION AND REMOVAL OF TWO FEET OF SOIL,
REPLACEMENT WITH CLEAN SOIL
AND INSTITUTIONAL CONTROLS

COST ESTIMATE

Item	Quantity	Units	Unit Cost	Total
Capital Costs				
Mobilization/demobilization*	-	Lump Sum	$150,000	$150,000
Site Preparation				
Clearing and grubbing	5	Acres	$6,000	$30,000
Excavation of Contaminated Soil				
Excavation of soil	16,000	CY	$8.00	$128,000
Transportation and disposal of non hazardous waste/soil	20,000	Ton	$45.00	$900,000
Soil Cover				
Warning barrier	25,000	SQ YD	$0.50	$13,000
Buy/haul/place 18" general fill**	15,000	CY	$15.00	$225,000
Buy/haul/place 6" top soil**	5,000	CY	$25.00	$125,000
Seed, fertilize and mulch	25,000	SQ YD	$1.00	$25,000
		Estimated Capital Cost		**$1,596,000**
Contingency and Engineering Fees				
Contingency allowance (20%)				$319,000
Engineering fees (15%)***				$239,000
		Estimated Contingency and Engineering Fees		$558,000
		TOTAL ESTIMATED CAPITAL COST		**$2,154,000**

BARRETTO POINT SITE

ALTERNATIVE PPA3
EXCAVATION AND REMOVAL OF TWO FEET OF SOIL,
REPLACEMENT WITH CLEAN SOIL
AND INSTITUTIONAL CONTROLS

COST ESTIMATE (continued)

Item	Quantity	Units	Unit Cost	Total
Annual Operating and Maintenance Costs				
Cover				
Site inspection	4	Mandays	$500	$2,000
Vegetation maintenance and site materials	-	Lump Sum	$10,000	$10,000
Miscellaneous site work	10	Mandays	$500	$5,000
	Annual cost			$17,000
	Present worth of annual operation & maintenance cost for 30 yrs (i=5%)			**$261,000**
	REMEDIAL ALTERNATIVE PPA3 TOTAL ESTIMATED COSTS			**$2,415,000**

*Includes bonds, insurance, temporary facilities, pre-construction submittals and as built drawings
**Volumes account for compaction.
***Includes design and construction inspection.

BARRETTO POINT SITE

ALTERNATIVE PPA4
EXCAVATION AND REMOVAL OF ALL FILL MATERIAL AND REPLACEMENT WITH CLEAN SOIL

COST ESTIMATE

Item	Quantity	Units	Unit Cost	Total
Capital Costs				
Mobilization/demobilization*	-	Lump Sum	$150,000	$150,000
Site Preparation				
Clearing and grubbing	5	Acres	$6,000	$30,000
Excavation of Contaminated Soil				
Excavation of soil	100,000	CY	$8.00	$800,000
Transportation and disposal of non hazardous waste/soil	120,000	Ton	$45.00	$5,400,000
Soil Backfill and Soil/vegetative Cover				
Buy/haul/place 18" general fill**	115,000	CY	$15.00	$1,725,000
Buy/haul/place 6" top soil**	5,000	CY	$25.00	$125,000
Seed, fertilize and mulch	25,000	SQ YD	$1.00	$25,000
		Estimated Capital Cost		**$8,255,000**
Contingency and Engineering Fees				
Contingency allowance (20%)				$1,651,000
Engineering fees (5%)***				$413,000
		Estimated Contingency and Engineering Fees		$2,064,000
		TOTAL ESTIMATED CAPITAL COST		**$10,319,000**

REMEDIAL ALTERNATIVE PPA4
TOTAL ESTIMATED COSTS **$10,319,000**

*Includes bonds, insurance, temporary facilities, pre-construction submittals and as built drawings
**Volumes account for compaction.
***Includes design and construction inspection.

FORMER PAINT AND VARNISH MANUFACTURING AREA
ALTERNATIVES

BARRETTO POINT SITE

ALTERNATIVE FPVM1
NO ACTION AND INSTITUTIONAL CONTROLS

COST ESTIMATE

Capital Costs

Item	Quantity	Units	Unit Cost	Total
				$0
Estimated Capital Cost				$0
Contingency and Engineering Fees				
Contingency allowance (15%)				$0
Engineering fees (20%)*				$0
Estimated Contingency and Engineering Fees				$0
TOTAL ESTIMATED CAPITAL COST				$0

Annual Maintenance Costs

Fence				
Site inspection*	12	Mandays	$500.00	$6,000
Miscellaneous repairs	-	Lump Sum	$2,000.00	$2,000
Annual cost				$8,000
Present worth of annual operation & maintenance cost for 30 yrs (i=5%)				$123,000

REMEDIAL ALTERNATIVE FPVM1
TOTAL ESTIMATED COSTS **$123,000**

*Assumes monthly inspections

BARRETTO POINT SITE

ALTERNATIVE FPVM2
EXCAVATION AND REMOVAL OF SHALLOW SOIL,
PLACEMENT OF A GEOMEMBRANE CAP
AND INSTITUTIONAL CONTROLS

COST ESTIMATE

Item	Quantity	Units	Unit Cost	Total
Capital Costs				
Mobilization/demobilization*	-	Lump Sum	$150,000	$150,000
Site Preparation				
Clearing and grubbing	0.7	Acres	$6,000.00	$4,000
Excavation of Contaminated Soil				
Excavation of soil	3,500	CY	$8.00	$28,000
Increase for level C work (assume 25% increase)				$7,000
Transportation and disposal of non hazardous waste	4,000	Ton	$45.00	$180,000
Transportation and disposal of hazardous waste	300	Ton	$150.00	$45,000
Geomembrane Cover				
Buy/haul/place 6 " general fill	700	CY	$15.00	$11,000
Buy/haul/place 60 mil HDPE geomembrane	3,400	SQ YD	$7.00	$24,000
Buy/haul/place geocomposite	3,400	SQ YD	$7.00	$24,000
Buy/haul/place 24" barrier protection layer	2,700	CY	$20.00	$54,000
Buy/haul/place 6" top soil	700	CY	$25.00	$18,000
Seed, fertilize and mulch	3,400	SQ YD	$1.00	$3,000
Emission Controls	-	Lump Sum	$15,000.00	$15,000
		Estimated Capital Cost		**$563,000**
Contingency and Engineering Fees				
Contingency allowance (20%)				$113,000
Engineering fees (30%)**				$169,000
		Estimated Contingency and Engineering Fees		$282,000
		TOTAL ESTIMATED CAPITAL COST		**$845,000**

BARRETTO POINT SITE

ALTERNATIVE FPVM2
EXCAVATION AND REMOVAL OF SHALLOW SOIL,
PLACEMENT OF A GEOMEMBRANE CAP
AND INSTITUTIONAL CONTROLS

COST ESTIMATE (CONTINUED)

Item	Quantity	Units	Unit Cost	Total
Annual Operating and Maintenance Costs				
Cover				
Site inspection	4	Mandays	$500.00	$2,000
Vegetation maintenance and site materials	-	Lump Sum	$2,000.00	$2,000
Miscellaneous site work	4	Mandays	$500.00	$2,000
	Annual cost			$6,000
	Present worth of annual operation & maintenance cost for 30 yrs (i=5%			**$92,000**

REMEDIAL ALTERNATIVE FPVM2
TOTAL ESTIMATED COSTS **$937,000**

*Includes bonds, insurance, temporary facilitie
as built drawings
** Includes design and construction inspection.

BARRETTO POINT SITE

ALTERNATIVE FPVM3
EXCAVATION AND REMOVAL OF SHALLOW SOIL,
PLACEMENT OF AN ASPHALT CAP
AND INSTITUTIONAL CONTROLS

COST ESTIMATE

Item	Quantity	Units	Unit Cost	Total
Capital Costs				
Mobilization/demobilization*	-	Lump Sum	$100,000	$100,000
Site Preparation				
Clearing and grubbing	0.7	Acres	$6,000.00	$4,000
Excavation of Contaminated Soil				
Excavation of soil	1,700	CY	$8.00	$14,000
Increase for level C work (assume 25% increase)				$4,000
Transportation and disposal of non hazardous waste	2,000	Ton	$45.00	$90,000
Transportation and disposal of hazardous waste	200	Ton	$150.00	$30,000
Pavement Cap	3,400	SY	$30.00	$102,000
Emission Controls	-	Lump Sum	$15,000.00	$15,000
		Estimated Capital Cost		**$359,000**
Contingency and Engineering Fees				
Contingency allowance (20%)				$72,000
Engineering fees (30%)**				$108,000
Estimated Contingency and Engineering Fees				$180,000
TOTAL ESTIMATED CAPITAL COST				**$539,000**

BARRETTO POINT SITE

ALTERNATIVE FPVM3
EXCAVATION AND REMOVAL OF SHALLOW SOIL,
PLACEMENT OF AN ASPHALT CAP
AND INSTITUTIONAL CONTROLS

COST ESTIMATE (continued)

Item	Quantity	Units	Unit Cost	Total
Annual Operating and Maintenance Costs				
Pavement Cover				
Site inspection	4	Mandays	$500.00	$2,000
Miscellaneous site work	4	Mandays	$500.00	$2,000
Patching and repair	50	SY	$30.00	$1,500
	Annual cost			$4,000
	Present worth of annual operation & maintenance cost for 30 yrs (i=5%)			**$61,000**
REMEDIAL ALTERNATIVE FPVM3 TOTAL ESTIMATED COSTS				**$600,000**

*Includes bonds, insurance, temporary facilities, pre-construction submittals and as built drawings

** Includes design and construction inspection.

BARRETTO POINT SITE

ALTERNATIVE FPVM4
SOIL VAPOR EXTRACTION, EXCAVATION AND REMOVAL OF SHALLOW SOIL,
PLACEMENT OF AN ASPHALT CAP,
AND INSTITUTIONAL CONTROLS

COST ESTIMATE

Item	Quantity	Units	Unit Cost	Total
Capital Costs				
Mobilization/demobilization*	-	Lump Sum	$200,000.00	$200,000
Site Preparation				
Clearing and grubbing	0.7	Acres	$6,000.00	$4,000
Excavation of Contaminated Soil				
Excavation of soil	2,000	CY	$8.00	$16,000
Increase for level C work (assume 25% increase)				$4,000
Transportation and disposal of non hazardous waste	2,000	Ton	$45.00	$90,000
Transportation and disposal of hazardous waste	500	Ton	$90.00	$45,000
Pavement Cap	3,400	SY	$150.00	$510,000
Soil Vapor Extraction System				
Installation of soil vapor extraction wells	-	Lump Sum	$40,000.00	$40,000
Installation of soil vapor extraction system (including compressor, blower and carbon treatment system)	-	Lump Sum	$170,000.00	$170,000
Construction of system building	-	Lump Sum	$20,000.00	$20,000
Initial startup and testing	-	Lump Sum	$30,000.00	$30,000
Confirmatory sampling	-	Lump Sum	$5,000.00	$5,000
Pilot test	-	Lump Sum	$55,000.00	$55,000
Emission Controls	-	Lump Sum	$15,000.00	$15,000
		Estimated Capital Cost		**$1,204,000**
Contingency and Engineering Fees				
Contingency allowance (20%)				$241,000
Engineering fees (20%)**				$241,000
		Estimated Contingency and Engineering Fees		$482,000
		TOTAL ESTIMATED CAPITAL COST		**$1,686,000**

BARRETTO POINT SITE

ALTERNATIVE FPVM4
SOIL VAPOR EXTRACTION, EXCAVATION AND REMOVAL OF SHALLOW SOIL,
PLACEMENT OF AN ASPHALT CAP,
AND INSTITUTIONAL CONTROLS

COST ESTIMATE (CONTINUED)

Item	Quantity	Units	Unit Cost	Total
Annual Operating and Maintenance Costs				
Pavement Cover				
Site inspection	4	Mandays	$500.00	$2,000
Miscellaneous site work	4	Mandays	$500.00	$2,000
Patching and repair	50	SY	$30.00	$1,500
	Annual cost			$4,000
	Present worth of annual operation & maintenance cost for 30 yrs (i=5%)			**$61,000**
Soil Vapor Extraction System				
SVE System O&M (includes service and power costs, sampling and monitoring, and carbon replacement)	-	Lump Sum	$300,000.00	$300,000
	Annual cost			$300,000
	Present worth of annual operation & maintenance cost for 3 yrs (i=5%)			**$817,000**

REMEDIAL ALTERNATIVE FPVM4
TOTAL ESTIMATED COSTS **$2,564,000**

*Includes bonds, insurance, temporary facilities, pre-construction submittals and as built drawings
** Includes design and construction inspection.

BARRETTO POINT SITE

ALTERNATIVE FPVM5
EXCAVATION AND REMOVAL OF CONTAMINATED SOIL
AND REPLACEMENT WITH CLEAN SOIL

COST ESTIMATE

Item	Quantity	Units	Unit Cost	Total
Capital Costs				
Mobilization/demobilization*	-	Lump Sum	$200,000.00	$200,000
Site Preparation				
Clearing and grubbing	0.7	Acres	$6,000.00	$4,000
Excavation of Contaminated Soil				
Drive,remove and salvage sheeting	15,000	SQFT	$45.00	$675,000
Excavation of soil	11,800	CY	$20.00	$236,000
Increase for level B work (assume 75% increase)				$177,000
Transportation and disposal of non hazardous waste/soil	12,700	Ton	$75.00	$953,000
Transportation and disposal of hazardous waste	1,400	Ton	$150.00	$210,000
Replacement with Clean Fill				
Buy/haul/place general fill	13,400	CY	$15.00	$201,000
Buy/haul/place 6" top soil	700	CY	$25.00	$18,000
Seed, fertilize and mulch	3,400	SQ YD	$1.00	$3,000
Emission Controls (Installation of sprung structure, and carbon filtration system)	-	Lump Sum	$500,000.00	$500,000
Estimated Capital Cost				**$3,177,000**
Contingency and Engineering Fees				
Contingency allowance (20%)				$635,000
Engineering fees (10%)**				$318,000
Estimated Contingency and Engineering Fees				$953,000
TOTAL ESTIMATED CAPITAL COST				**$4,130,000**

REMEDIAL ALTERNATIVE FPVM5
TOTAL ESTIMATED COSTS **$4,130,000**

*Includes bonds, insurance, temporary facilities, pre-construction submittals and as build drawings

** Includes design and construction inspection.

BARRETTO POINT SITE

ALTERNATIVE FPVM6
EXCAVATION AND REMOVAL OF CONTAMINATED SOIL
AND REPLACEMENT WITH TREATMENT PLANT DIGESTERS

COST ESTIMATE

Item	Quantity	Units	Unit Cost	Total
Capital Costs				
Mobilization/demobilization*	-	Lump Sum	$200,000.00	$200,000
Site Preparation				
Clearing and grubbing	0.7	Acres	$6,000.00	$4,000
Excavation of Contaminated Soil				
Drive,remove and salvage sheeting	15,000	SQFT	$45.00	$675,000
Excavation of soil	11,800	CY	$20.00	$236,000
Increase for level B work (assume 75% increase)				$177,000
Transportation and disposal of non hazardous waste/soil	12,700	Ton	$75.00	$953,000
Transportation and disposal of hazardous waste	1,400	Ton	$150.00	$210,000
Emission Controls	-	Lump Sum	$500,000.00	$500,000
		Estimated Capital Cost		**$2,955,000**
Contingency and Engineering Fees				
Contingency allowance (20%)				$443,000
Engineering fees (10%)**				$296,000
Estimated Contingency and Engineering Fees				$739,000
TOTAL ESTIMATED CAPITAL COST				**$3,694,000**

REMEDIAL ALTERNATIVE FPVM6
TOTAL ESTIMATED COSTS **$3,694,000**

*Includes bonds, insurance, temporary facilities, pre-construction submittals and as build drawings

** Includes design and construction inspection.

REMAINING SITE AREA ALTERNATIVES

BARRETTO POINT SITE

ALTERNATIVE RSA1
NO ACTION AND INSTITUTIONAL CONTROLS

COST ESTIMATE

Item	Quantity	Units	Unit Cost	Total
Capital Costs				
				$0
Estimated Capital Cost				**$0**
Contingency and Engineering Fees				
Contingency allowance				$0
Engineering fees				$0
Estimated Contingency and Engineering Fees				**$0**
TOTAL ESTIMATED CAPITAL COST				**$0**
Annual Maintenance Costs				
Fence				
Site inspection*	12	Mandays	$500.00	$6,000
Miscellaneous repairs	-	Lump Sum	$2,000.00	$2,000
Annual cost				$8,000
Present worth of annual operation & maintenance cost for 30 yrs (i=5%)				$123,000
REMEDIAL ALTERNATIVE RSA1 TOTAL ESTIMATED COSTS				**$123,000**

*Assumes monthly inspections

BARRETTO POINT SITE

ALTERNATIVE RSA2
PLACEMENT OF 2 FEET OF CLEAN SOIL COVER
AND INSTITUTIONAL CONTROLS

COST ESTIMATE

Item	Quantity	Units	Unit Cost	Total
Capital Costs				
Mobilization/demobilization*	-	Lump Sum	$150,000	$150,000
Site Preparation				
Clearing and grubbing	7.3	Acres	$6,000	$44,000
Soil Cover				
Warning barrier	36,000	SQ YD	$0.50	$18,000
Buy/haul/place 18" general fill**	22,000	CY	$15.00	$330,000
Buy/haul/place 6" top soil**	8,000	CY	$25.00	$200,000
Seed, fertilize and mulch	36,000	SQ YD	$1.00	$36,000
Additional Bank Stabilization				
Buy/haul/place rip-rap	600	CY	$55.00	$33,000
		Estimated Capital Cost		**$811,000**
Contingency and Engineering Fees				
Contingency allowance (20%)				$162,000
Engineering fees (20%)***				$162,000
		Estimated Contingency and Engineering Fees		$324,000
		TOTAL ESTIMATED CAPITAL COST		**$1,135,000**
Annual Operating and Maintenance Costs				
Cover				
Site inspection	4	Mandays	$500	$2,000
Vegetation maintenance and site materials	-	Lump Sum	$5,000	$5,000
Miscellaneous site work	10	Mandays	$500	$5,000
	Annual cost			$12,000
	Present worth of annual operation & maintenance cost for 30 yrs (i=5%)			**$184,000**
	REMEDIAL ALTERNATIVE RSA2			
	TOTAL ESTIMATED COSTS			**$1,319,000**

*Includes bonds, insurance, temporary facilities, pre-construction submittals and as built drawings

**Volumes account for compaction.

*** Includes design and construction inspection.

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BARRETTO POINT SITE

ALTERNATIVE RSA3
EXCAVATION AND REMOVAL OF 2 FEET OF SOIL,
REPLACEMENT WITH CLEAN SOIL
AND INSTITUTIONAL CONTROLS

COST ESTIMATE

Item	Quantity	Units	Unit Cost	Total
Capital Costs				
Mobilization/demobilization*	-	Lump Sum	$150,000	$150,000
Site Preparation				
Clearing and grubbing	7.3	Acres	$6,000	$44,000
Excavation of Contaminated Soil				
Excavation of soil	24,000	CY	$8.00	$192,000
Transportation and disposal of non hazardous waste/soil	30,000	Ton	$45.00	$1,350,000
Soil Cover				
Buy/haul/place 18" general fill**	22,000	CY	$15.00	$330,000
Buy/haul/place 6" top soil**	8,000	CY	$25.00	$200,000
Seed, fertilize and mulch	36,000	SQ YD	$1.00	$36,000
		Estimated Capital Cost		**$2,152,000**
Contingency and Engineering Fees				
Contingency allowance (20%)				$430,000
Engineering fees (15%)***				$323,000
		Estimated Contingency and Engineering Fees		$753,000
		TOTAL ESTIMATED CAPITAL COST		**$2,905,000**

BARRETTO POINT SITE

ALTERNATIVE RSA3
EXCAVATION AND REMOVAL OF 2 FEET OF SOIL AND
REPLACEMENT WITH CLEAN SOIL
AND INSTITUTIONAL CONTROLS

COST ESTIMATE (continued)

Item	Quantity	Units	Unit Cost	Total
Annual Operating and Maintenance Costs				
Cover				
Site inspection	4	Mandays	$500	$2,000
Vegetation maintenance and site materials	-	Lump Sum	$5,000	$5,000
Miscellaneous site work	6	Mandays	$500	$3,000
	Annual cost			$10,000
	Present worth of annual operation & maintenance cost for 30 yrs (i=5%)			**$184,000**

REMEDIAL ALTERNATIVE RSA3
TOTAL ESTIMATED COSTS **$3,089,000**

*Includes bonds, insurance, temporary facilities, pre-construction submittals and as built drawings
**Volumes account for compaction.
*** Includes design and construction inspection.

BARRETTO POINT SITE

ALTERNATIVE RSA4
EXCAVATION AND REMOVAL OF ALL FILL MATERIAL AND REPLACEMENT WITH CLEAN SOIL

COST ESTIMATE

Item	Quantity	Units	Unit Cost	Total
Capital Costs				
Mobilization/demobilization*	-	Lump Sum	$150,000	$150,000
Site Preparation				
Clearing and grubbing	7.3	Acres	$6,000	$44,000
Excavation of Contaminated Soil				
Excavation of soil	120,000	CY	$8.00	$960,000
Transportation and disposal of non hazardous waste/soil	150,000	Ton	$45.00	$6,750,000
Soil Cover				
Buy/haul/place general fill**	142,000	CY	$15.00	$2,130,000
Buy/haul/place 6" top soil**	8,000	CY	$25.00	$200,000
Seed, fertilize and mulch	36,000	SQ YD	$1.00	$36,000
		Estimated Capital Cost		**$10,270,000**
Contingency and Engineering Fees				
Contingency allowance (20%)				$2,054,000
Engineering fees (5%)***				$514,000
		Estimated Contingency and Engineering Fees		$2,568,000
		TOTAL ESTIMATED CAPITAL COST		**$12,838,000**

REMEDIAL ALTERNATIVE RSA4
TOTAL ESTIMATED COSTS **$12,838,000**

*Includes bonds, insurance, temporary facilities, pre-construction submittals and as built drawings
**Volumes account for compaction.
*** Includes design and construction inspection.

GROUNDWATER IN THE VICINITY OF THE FORMER PAINT AND VARNISH MANUFACTURING AREA ALTERNATIVES

ALTERNATIVE G1
BARRETTO POINT SITE
NO ACTION AND INSTITUTIONAL CONTROLS
COST ESTIMATE

Item	Quantity	Units	Unit Cost	Total
Capital Costs				
			Estimated Capital Cost	**$0**
Contingency and Engineering Fees				
Contingency allowance (15%)				$0
Engineering fees (10%)				$0
			Estimated Contingency and Engineering Fees	$0
			TOTAL ESTIMATED CAPITAL COST	**$0**

BARRETTO POINT SITE

ALTERNATIVE G2
IN-SITU TREATMENT (OXYGEN RELEASE COMPOUNDS)

COST ESTIMATE

Item	Quantity	Units	Unit Cost	Total
Capital Costs				
Mobilization/demobilization*	-	Lump Sum	$50,000	$50,000
Injection well installation	130	wells	$2,000	$260,000
Monitoring well installation	4	wells	$3,000	$12,000
ORC Slurry Injection Cost	3	applications	$50,000	$150,000
		Estimated Capital Cost		**$472,000**
Contingency and Engineering Fees				
Contingency allowance (20%)				$94,000
Engineering fees (25%)**				$118,000
		Estimated Contingency and Engineering Fees		$212,000
		TOTAL ESTIMATED CAPITAL COST		**$684,000**
Annual Operating and Maintenance Costs				
Groundwater Monitoring Costs Per Event				
Groundwater sampling	1	Mandays	$500	$500
Purge water disposal	4	Drums	$200	$800
Equipment, materials and supplies	-	Lump Sum	$1,000	$1,000
Sample analysis	4	Samples	$200	$800
	Estimated per event monitoring costs			$3,100
	Present worth of annual groundwater monitoring (5 yrs, i=5%)***			**$38,000**
		REMEDIAL ALTERNATIVE G2 TOTAL ESTIMATED COSTS		**$722,000**

*Includes bonds, insurance, temporary facilities, pre-construction submittals and as built drawings

** Includes design and construction inspection.

***Sample analysis includes volatle organic compounds, ORP,pH,DO,iron,BOD and COD Sample frequency is quarterly for the first 3 years and biannually for the next 2 years.

BARRETTO POINT SITE

ALTERNATIVE G3
EXTRACTION AND TREATMENT AS PART OF SOIL EXCAVATION

COST ESTIMATE

Item	Quantity	Units	Unit Cost	Total
Capital Costs				
Mobilization/demobilization*	-	Lump Sum	$50,000	$50,000
Pilot and Bench Study (includes pump test)	-	Lump Sum	$25,000	$25,000
Groundwater Extraction and Treatment System				
Installation of 4 extraction wells and pump system (includes soil borings, well construction, well development, well development water disposal, pumps and vaults)	-	Lump Sum	$50,000	$50,000
Aeration tank and blowers	-	Lump Sum	$75,000	$75,000
Thermal Oxidizer	-	Lump Sum	$30,000	$30,000
Rapid mix/coagulation/plate settler	-	Lump Sum	$50,000	$50,000
Aeration towers and blowers	-	Lump Sum	$50,000	$50,000
Granular activated carbon filter	-	Lump Sum	$25,000	$25,000
Electric	-	Lump Sum	$5,000	$5,000
Building	-	Lump Sum	$50,000	$50,000
		Estimated Capital Cost		**$410,000**
Contingency and Engineering Fees				
Contingency allowance (15%)				$62,000
Engineering fees (20%)**				$82,000
		Estimated Contingency and Engineering Fees		$144,000
		TOTAL ESTIMATED CAPITAL COST		**$554,000**

BARRETTO POINT SITE

ALTERNATIVE G3
EXTRACTION AND TREATMENT AS PART OF SOIL EXCAVATION

COST ESTIMATE (continued)

Item	Quantity	Units	Unit Cost	Total
Annual Operating and Maintenance Costs				
Groundwater Extraction and Treatment System				
Extraction well pumps (includes service and power costs)	-	Lump Sum	$10,000	$10,000
Treatment system (including service and power)	-	Lump Sum	$10,000	$10,000
Residuals disposal	-	Lump Sum	$5,000	$5,000
System O&M labor	365	Hours	$50.00	$18,000
	Annual cost			**$43,000**
Discharge Monitoring Costs Per Event				
Discharge sampling	1	Mandays	$500	$500
Equipment, materials and supplies	-	Lump Sum	$100	$100
Sample analysis***	1	Samples	$500	$500
	Estimated per event monitoring costs			$1,100
	Costs for one year****			**$13,000**
	REMEDIAL ALTERNATIVE G2 TOTAL ESTIMATED COSTS			**$610,000**

*Includes bonds, insurance, temporary facilities, pre-construction submittals and as built drawings
** Includes design and construction inspection.
***Sample analysis includes full TCL+30 parameters, TAL metals and cyanide
****Sampling frequency includes 12 times per year