FEASIBILITY STUDY REPORT

DRAFT

OPERABLE UNIT I

LOCKHEED MARTIN TACTICAL DEFENSE SYSTEMS DIVISION
(Former Unisys Corp. Site)

Great Neck, New York
NYSDEC Site No.130045

Prepared for:
New York State
Department of Environmental Conservation

On behalf of:
Lockheed Martin Tactical Defense Systems Division of
Lockheed Martin Tactical Systems, Inc.

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Prepared by:
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1.0 Introduction

On December 13, 1991, Unisys Corporation (Unisys) entered into an Administrative Order on Consent (AOC) with the New York State Department of Environmental Conservation (NYSDEC). Prior to that time the site was placed on the NYSDEC Inactive Hazardous Waste Disposal Site List and was classified as a Class 2 site. The site was given NYSDEC ID Number 130045. The AOC required completion of Interim Remedial Measures (IRM) and a Remedial Investigation/Feasibility Study (RI/FS). In May 1995, Loral Corporation (Loral) purchased certain assets and liabilities of Unisys including the Unisys Great Neck, NY facility. In 1996, the electronics and systems integration businesses of Loral were acquired by Lockheed Martin Corporation (Lockheed Martin) and subsequently renamed Lockheed Martin Tactical Systems, Inc. With this purchase, Lockheed Martin has assumed immediate responsibility for the AOC. Two Interim Remedial Measures (IRMs) have been implemented at this site for groundwater and soil. Both IRMs are currently still in operation.

In 1995, NYSDEC divided the site into two, separate operable units. Operable Unit I includes the portion of the project area owned by Lockheed Martin (i.e. 94 acres of land as described in Section 2.0). Operable Unit II includes land immediately surrounding the site. This document represents the Feasibility Study (FS) for Operable Unit I.

The purpose of this FS is to evaluate methods to prevent, minimize, or eliminate the release of hazardous substances from the site and to minimize the risk to human health and the environment. This FS is consistent with NYSDEC's Technical and Administrative Guidance Memorandum (TAGM) HWR 90-4030, entitled "*Selection of Remedial Actions at Inactive Hazardous Waste Sites*". Other NYSDEC TAGMs have also been used to guide the technology and remedial action screening processes. The specific objectives for the Operational Unit I FS are as follows:

- Contain the existing groundwater conditions on-site;
- Reduce the mass of volatile organic compounds (VOCs) in the on-site groundwater and;
- Reduce the mass and level of VOCs found in on-site soils. Soil VOC levels are to be reduced to levels which are protective of groundwater.

The FS uses current and site-specific information, such that previously implemented remedial actions are considered and alternative technologies are identified and ranked based on the following criteria:

- Compliance with Federal Applicable, or Relevant and Appropriate Requirements (ARARs) and NY State Standards, Criteria, and Guidelines (SCGs)
- Overall protection of human health and environment
- Short-term effectiveness
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, and volume
- Implementability
- Cost

2.0 Background Information

2.1 Site Description

The site consists of 94 acres of land located at the intersection of Marcus Avenue and Lakeville Road between the Village of Lake Success and the Town of North Hempstead in Nassau County, New York (see Figure 1). The property has a main manufacturing building, and six smaller buildings located immediately south of the main building, which total approximately, 1.5 million ft. sq. Three small recharge basins are located in the southwest corner of the property adjacent to Lakeville Road. The recharge basins collect snow melt and rain runoff from the roof and parking lots. The majority of the remaining property is used for parking.

2.2 Site History

The facility was originally designed and built in 1941 by the United States Government and was operated under contract by the Sperry Gyroscope Company, a division of Sperry Rand Company, until 1951. In 1951, the government sold the property to Sperry. Sperry merged with Burroughs Corporation in 1986 to form Unisys Corporation. On May 5, 1995 Loral Corporation acquired the assets of Unisys Defense Systems, a division of Unisys Corp. In 1996, the electronics and systems integration businesses of Loral were acquired by Lockheed Martin. Originally, the property included an additional 55 acres with a large manufacturing building immediately to the east of the present property. However, this building was demolished, the property was sold to a developer in the 1970s, and the present day Triad Business Park was constructed.

At present, the site houses administration offices and engineering departments. In the past, the facility has been used to manufacture a wide range of defense-related products. Past manufacturing processes included a casting foundry, etching, degreasing, plating, painting, machining and assembly. Chemicals used during manufacturing at the plant included halogenated and non-halogenated hydrocarbon solvents, cutting oil, paints and fuel oils as well as inorganic plating compounds.

In the past, unused solvents were reportedly delivered to the site, used on-site, and removed in 55-gallon drums. Currently, all process chemicals are located in the chemical storage area and are handled per Resource Conservation and Recovery Act (RCRA) requirements. A search of corporate archives was conducted and little or no written record of either wastes generated in the past, or historical waste handling practices, was available. The above summary of historical waste handling practices is primarily based upon interviews of former employees.

2.3 Remedial Investigation Summary

The following sections briefly summarize the data and results presented in the Remedial Investigation (RI) report and the Supplemental RI report. The reader is encouraged to review these reports since the following sections are only a summary.

2.3.1 Summary of Soil Investigation

The purpose of the soils investigation performed during the RI was to identify areas on-site that might have been affected by past site activities and which may in turn be affecting groundwater. The soils investigation included the collection of soil samples from the former dry wells, from monitor well borings, and from the Long Island Lighting Company (LILCO) substations located on the southwest corner of the property. In addition, five soil-gas surveys were performed as part of the soil investigation. Methods and results are described in more detail in the RI report and the results are summarized as follows.

- The soil-gas surveys detected VOCs at three of the six survey locations (grids 3, 4 and 6). The detections at grids 3 and 4 were relatively low and not indicative of significant impact. The results for grid 6 (the dry well area) were elevated as expected and were consistent with previous analytical results from this area which showed elevated levels of TCE, PCE and 1,2-DCE. During the supplemental RI soil samples were collected at grids 3 and 4 and analyzed for the full Target Compound List (TCL). Results of the analysis indicate that VOCs were not detected.
- As shown on Table 2A, analysis of soil samples from the dry well soil borings confirmed the presence of elevated levels of VOCs and indicated that elevated levels of some metals may also be present. The highest concentrations of VOCs and metals detected during the RI were associated with sludge material encountered while boring through the location of the former

dry wells. In addition, low levels of semi-VOCs and trace concentrations of pesticides and PCBs were detected.

- VOCs were not detected in the LILCO substation samples; however, low levels of semi-VOCs were detected in all four samples and PCBs were detected in one sample at 0.39 mg/kg.

Results of the RI soil investigation indicate that the only area of VOC-affected soil is in the vicinity of the former dry wells (Southeast corner of the main building), where soil-vapor extraction and groundwater recovery and treatment systems are already in place as part of the IRM. The primary VOCs of concern, PCE, TCE and 1,2 DCE, were not detected in any of the LILCO substation samples and the semi-VOCs that were detected were not consistent with those found on-site. As a result, it does not appear that the compounds detected on the LILCO property are related to site activities.

2.3.2 Summary of Groundwater Investigation

The main objectives of the groundwater investigation were to define the hydraulic characteristics of the site and to define the vertical and horizontal extent of groundwater impacts. The investigation included the testing and repair of Lloyd Well No. N1802, the installation and sampling of on-site and off-site monitoring wells, a review of existing off-site well records and water quality, water-level monitoring, aquifer testing and groundwater flow modeling. Methods and results are described in more detail in the RI report and the results are summarized as follows.

- The groundwater sampling results show that VOCs, primarily PCE, TCE and 1,2-DCE, were detectable in most of the wells sampled as part of the RI (see Table 2). Four semi-VOCs were randomly detected in nine wells at relatively low concentrations (0.6 to 1 ug/L) with the exception of phenol which was detected in 1ML and 15GL at 45 and 2,100 ug/L, respectively. One pesticide, heptachlor, was detected in the samples. PCBs were not detected in any of the groundwater samples.
- The highest concentration of VOCs in groundwater beneath the site is present within the Upper and Intermediate Magothy. Concentrations of VOCs in the deeper portions of the Magothy aquifer are significantly lower.
- The analytical data indicates that metals concentrations in all wells, with the exception of 15ML, were below NYS Maximum Contaminant Levels (MCLs) for drinking water. Well 15ML is located upgradient of the site in the Sears parking lot and only one metal, cadmium, was detected above MCLs.

2.3.3 Summary of Surface Water and Sediment Investigation

As part of the RI, surface-water and sediment samples were collected from the three on-site recharge basins to determine if they have been affected by site activities. The basins receive surface-water runoff from the entire site through a network of on-site storm and roof drains and are located in the southwestern corner of the site.

Results of the recharge basin sampling showed the presence of low levels of VOCs, semi-VOCs, pesticides and PCBs in the sediment samples. In contrast, the only organic parameter detected in the surface-water samples was 1,2-DCE, at a maximum concentration of 2 ug/L. Many of the inorganic parameters analyzed were detected in both the sediment and surface-water samples with the concentrations and number of detections being greatest in the sediment samples. Another noticeable pattern is the fairly even distribution of detections and concentrations between the three basins, which is not surprising considering that they are interconnected and receive runoff from the same sources.

The results of the recharge basin sampling are not inconsistent with the nature and purpose of the recharge basins, which is to collect storm-water runoff from surrounding parking lots, walkways, rooftops and unpaved areas and allow it to drain to the underlying sediments. Many of the compounds detected in the recharge basin samples are leached from the surrounding pervious and impervious surfaces or transported on sediments and deposited in the basins. As runoff collects in the basins, sediments picked up enroute settle to the bottom and become part of a natural filter which removes impurities from the water as it drains through the bottom of the basin. Over time, these impurities concentrate in the bottom sediments as is evident by the results presented above. Studies of recharge basins on Long Island show that the compounds and concentrations detected in these samples are not uncommon (Ku, 1986).

2.3.4 Summary of Air Quality Investigation

Results of a flux chamber test performed during the RI indicate that VOCs are not being emitted from the subsurface of the site in the southeast corner of the main building. Methods and results of the air quality investigation are described in more detail in the RI report.

2.4 Interim Remedial Measures

The purpose of the interim remedial measures (IRM) is to minimize the risk to the environment and public health during the performance of RI/FS activities and prior to NYSDEC's Record of Decision (ROD). IRM activities at this site consist of both groundwater and soil gas remediation technologies. Performance of the groundwater remediation IRM is discussed in the IRM Work Plan dated January 27, 1993. Performance of the soil remediation IRM is discussed in the IRM Work Plan dated December 10, 1993.

Both remediation systems have been in operation since shortly after the Work Plans were approved by the NYSDEC. Results of the remedial activities are reported to the NYSDEC on a monthly basis. In short, the groundwater treatment system has treated approximately 840 million gallons of water and removed approximately 8,000 lbs. of volatile organic compounds (VOCs) to date. The soil-vapor extraction and treatment system has treated and removed approximately 35,000 lbs. of VOCs to date.

3.0 Identification and Screening of Remedial Action Technologies

3.1 Introduction

Remedial actions at the site should strive to attain New York State Standards, Criteria, and Guidelines (SCGs) and Federal Applicable, or Relevant and Appropriate Requirements (ARARs) or other applicable Federal and state environmental standards. Potentially applicable federal ARARs fall within three categories: Chemical-Specific, Action-Specific, and Location-Specific. NYSDEC has elected to categorize its ARARs as SCGs and has also divided SCGs into the aforementioned three categories. Each category is briefly described below.

- Chemical-Specific ARARs - Usually technology or risk-based numerical limitations or methodologies that, when applied to site-specific conditions, result in the establishment of acceptable concentrations of a chemical that may be found in, or discharged to, the ambient environment.
- Action-Specific ARARs - Usually technology or activity-based requirements or limitations on actions taken with respect to hazardous substances. These requirements typically define acceptable treatment, storage, and disposal procedures for hazardous substances during the implementation of the response action.
- Location-Specific ARARs - Restrictions placed on the concentration of hazardous substances or the conduct of activities solely because the activities occur at a special location. These requirements relate to the geographical or physical position of the site rather than the nature of the materials or the proposed remedial action. These requirements limit the type of remedial action that can be implemented and may impose additional constraints on a cleanup action.

Appendix B contains a list of chemical-specific ARARs/SCGs for groundwater cleanup criteria, groundwater discharge criteria, air emissions, soil cleanup criteria, and transport and disposal criteria.

3.2 Remedial Action Objectives

The purpose of identifying remedial action objectives (RAOs) is to establish cleanup goals for protecting human health and the environment through reduction of the volume and mobility of constituents of concern. Action has already been taken to achieve the RAOs through the IRMs implemented to date. The RAOs identified for the site are media-specific and include the following:

- Exposure Route(s) and Receptor(s)
- Constituent(s) of Concern
- Acceptable Contaminant Level(s)

3.2.1 Determination of Groundwater Remedial Objectives

Groundwater cleanup levels are based on New York State (NYS) drinking water standards as indicated in Chapter I State Sanitary Code, Subpart 5-1, Public Water Systems (March 11, 1992). NYS drinking water standards are found in Appendix B, Table 1-1 "Chemical-Specific ARARs for Groundwater Cleanup Criteria." Organic compounds detected during the RI well sampling were tabulated and compared to groundwater cleanup levels on Table 1. As shown on Table 1, only four VOCs (i.e., 1,2-dichloroethene, trichloroethylene, tetrachloroethylene, and Freon 113) were considered constituents of concern.

Phenol was detected in one well (15ML) above drinking water standards; however, 15ML is located upgradient of the site in the Sears parking lot. In addition, the analytical data indicates that metals concentrations in all wells, with the exception of 15ML, meet drinking water standards. Only one metal, cadmium, was detected in 15ML. The detection of cadmium and phenol in 15ML appears to be unrelated to the site and the compounds will not be considered as constituents of concern in the FS.

3.2.2 Determination of Soil Remedial Objectives

Soil cleanup levels were determined using procedures outlined in the NYSDEC TAGM # HWR-94-4046 entitled "Determination of Soil Cleanup Objectives and Cleanup Levels." Results of the RI indicate that the only area of VOC affected soil is in the area of the former dry wells (southeast corner of the main building). During the RI five borings were advanced through the probable source of the VOCs and two soil samples were collected per boring for TCL analysis. As shown on Tables 2A and 2B, results of the analysis indicate that organic and inorganic compounds were detected in the vicinity of the former dry wells. Although VOCs are present in groundwater from this source area, inorganics have not been detected in downgradient groundwater above drinking water standards.

As shown on Table 2A, inorganic concentrations for the 10 dry well soil samples collected as part of the Remedial Investigation were compared with site background levels, Eastern US background levels from TAGM 94-4046, and NYSDEC recommended soil cleanup objectives from TAGM 94-4046 (Determination of Soil Cleanup Objectives and Cleanup Levels). Results of the inorganic soil quality evaluation indicate that five samples do not meet NYSDEC soil cleanup objectives for inorganics. As shown on Table 2A, the greatest number of compounds with elevated concentrations, and the highest concentrations, were detected in the 6 to 8 foot sample from B-18 followed by the same sample interval from B-19. The sample descriptions contained on the geologic logs show that these samples consisted of a very moist, black, silty material (sludge) with a strong odor. Borings and samples other than B-18 and B-19 with elevated inorganic levels included: 1) B-16 (19-21') with chromium, mercury and zinc, and 2) B-16 (13-15') with mercury and zinc.

Site soil cleanup objectives for organics which are protective of groundwater are based upon the water/soil partitioning theory which is conservative in nature and assumes that the soil and groundwater are in direct contact. The theory predicts the maximum amount of organic chemicals that may remain in soil and not violate drinking water standards. The water-soil equilibrium theory is based on the ability of organic carbon in soil to adsorb organic compounds. The model used to determine site specific allowable soil concentrations and site specific soil cleanup objectives was found in NYSDEC TAGM 94-4046.

Cs = f x Koc x Cw

Where: Cs = allowable soil concentration

f = the fraction organic carbon of the soil ; use site specific f = 0.03 (3%)
(reference Supplemental RI Report, December 1995)

Koc = 3.64 - 0.55log S; S = water solubility in ppm

Cw = the appropriate water quality value from TOGs 1.1.1

Results of the model as calculated using a site specific organic carbon fraction of 0.03 (3%) are contained in Appendix C and are summarized as the "Site Specific Soil Cleanup Objectives " on Table 2B. As shown on Table 2B, the model identified eight (8) VOCs and three (3) semi-VOCs as constituents of concern in soil.

The identification of the inorganic and organic compounds associated with the dry well area as constituents of concern is inherently conservative since the samples used in the evaluation were collected from the probable source and are not representative of the average concentrations for the area targeted for remediation. Specifically, concentrations of VOCs and inorganics quantified in the dry well sludge (samples B-18 and B-19, 6 to 8 feet) are several orders of magnitude higher than those concentrations detected in the other soil boring samples collected from the same general area. In later sections of this report, specific processes and technologies applicable to mitigating these compounds will be considered. The FS evaluation will focus on mitigating the VOC constituents of concern in the dry well sludge because this material could serve as an on-going source of VOC contamination to groundwater. Removal of the sludge would also serve to further minimize the potential for a release of inorganics to groundwater, even though downgradient groundwater has not been affected by inorganics. The RAOs for the dry well area are identified on Table 3.

One other soil sample, Sample #14 collected from Soil Gas Grid 3, contained arsenic above the NYSDEC recommended cleanup objective of 7.5 mg/kg and above the NYS background concentration range of 3 to 12 mg/kg cited in TAGM 94-4046. Arsenic was detected in this soil sample at 24.9 mg/kg. However, a study conducted by the United States Geological Survey (USGS) to estimate natural background concentration ranges of inorganics in soil identified an observed range of <0.1 mg/kg to 73 mg/kg for arsenic in the Eastern United States (ref. Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States, Professional Paper 1270, Shacklette and Boerngen). The concentration in natural background soils as noted in the USGS study support the conclusion that the arsenic level detected in Sample #14 is not significant. Concentrations of volatile and semi-volatile organic compounds, pesticides and PCBs detected in this sample were all below their respective NYSDEC recommended soil cleanup objective. No action is proposed for Soil Gas Grid 3.

3.2.3 Determination of Sediment Remedial Objectives

Sediment remedial objectives were also evaluated using site specific cleanup levels developed in accordance with NYSDEC TAGM # HWR-94-4046 entitled "Determination of Soil Cleanup Objectives and Cleanup Levels" as described in detail in the previous section. Results of the water/soil partitioning model evaluation for recharge basin sediments are found on Table 2C. As shown on Table 2C, five (5) organic compounds were found above the site specific cleanup objectives. Inorganic concentrations for the recharge basin samples were compared with site background levels, and with Eastern US background levels and NYSDEC-recommended soil cleanup objectives from TAGM 94-4046. Results of the inorganic sediment quality evaluation indicate that nine (9) metals were above NYSDEC soil cleanup objectives.

3.3 General Response Actions

In the previous section, RAOs were identified which would be used to ensure that any remedial action taken at the site would reduce the potential direct contact exposure and reduce toxicity volume and mobility. In order to achieve these objectives, it is necessary to determine specific technologies and processes that may be applicable for implementation. To identify the technologies and processes, it is first necessary to identify General Response Actions (GRAs) that may achieve the RAOs. The GRAs are broad categories for which specific technologies and processes are then selected that, when implemented, will achieve the RAOs. The GRAs identified, based on the site conditions, are:

- No Action/Institutional Actions
- Containment Actions
- Collection/Excavation/Treatment Actions

Typically, a "No Action" alternative is evaluated to provide a baseline on which potential technologies could be measured. The "No Action" alternative is not evaluated further in this FS because remedial actions have already been initiated and accomplishment of some level of the RAOs has already been achieved. Remedial actions already implemented at the site include institutional controls, environmental monitoring, and removal. The context in which these technologies and processes are evaluated further is in terms of additional or enhanced implementation relative to what has already been done at this site. Table 4 presents the media-specific GRAs identified for the site. As can be seen, the GRAs may be applicable to more than one RAO.

3.4 Identification and Initial Screening of Remedial Technologies and Process Options

An initial screening process was carried out by first expanding each GRA into a series of technologies and processes available for addressing remediation of the site. Many available technologies and processes were furthered subdivided into specific process options. Each of the technologies identified as a part of a GRA was screened against the RAOs, taking into account the expected effectiveness and implementability. Proven technologies received prime consideration, but innovative technologies were also considered. Table 5 presents the initial identification of remedial technologies and process options.

3.4.1 Technologies and Processes Eliminated from Evaluation

Following the initial screening process, options were eliminated from further consideration that were not viable or because an RAO could not be obtained. Additionally, technologies that were infeasible due to physical limitations or technological limitations were also eliminated from further consideration. The following technologies and processes were eliminated from evaluation:

- No Action - certain GRAs have been implemented
- Containment Technologies - do not reduce volume or toxicity
- Biotreatment - technical limitations
- Discharge to POTW - excessive discharge volumes make this option infeasible for groundwater
- Discharge to Surface Waters - physical and technical limitations for groundwater

3.4.2 Technologies and Processes Selected for Evaluation

The following technologies and processes will be evaluated further:

- Groundwater Monitoring (currently conducted)
- Groundwater Collection (currently conducted)
- Physical Treatments (carbon adsorption, air stripping)
- Chemical Treatments (UV oxidation)
- In-Situ Soil Treatments (vapor extraction)

- (Potential) Off-Gas Treatments (carbon adsorption, catalytic oxidation)
- Groundwater Reinjection (currently conducted)
- In-Situ Catalytic Degradation and Air Sparging
- Soil Removal
- Administrative Controls (deed restrictions)

4.0 Evaluation of Remedial Technologies and Process Options

Several technologies and process options were identified in the previous section that may achieve the RAOs appropriate to the site. The initial screening also identified technologies and processes that were not technically implementable at the site. The remaining potentially feasible technologies and process options were evaluated and scored in this section for effectiveness and implementability as required by NYSDEC. The following sections provide a brief description of each technology and process screened using TAGM-HWR-90-4030, including a generalized evaluation of compliance with the RAOs.

4.1 Groundwater Process Options and Remedial Technologies

4.1.1 Pump and Treat

4.1.1.1 Groundwater Collection

Groundwater collection is an effective means of preventing plume migration and reducing concentrations of constituents. Groundwater collection is typically conducted through the use of groundwater extraction wells or subsurface collection systems such as trenches or drains. Extracted groundwater typically requires treatment prior to discharge. Groundwater collection using extraction wells has already been implemented as an IRM at the site.

4.1.1.2 Carbon Adsorption

Carbon adsorption is the oldest and one of the most commonly used water purifying processes. Carbon adsorption is a physical process in which organic compounds are removed from groundwater by adsorbing onto the highly porous surface structure of the carbon. This technology has proven to be very effective for the removal of VOCs and can be easily implemented. Removal efficiencies greater than 95% are usually achieved.

4.1.1.3 Air Stripping

Air stripping is also one of the oldest and most commonly used technologies for the removal of VOCs in groundwater. Air stripping is a physical operation in which dissolved molecules are transferred from a liquid into a flowing gas or vapor stream. The driving force for the mass transfer is provided by the concentration gradient between the liquid and the gas phases and is governed by Henry's Law. This technology has proven to be very effective for the removal of VOCs and can be easily implemented. Removal efficiencies greater than 95% are usually achieved. Air stripping may require vapor stream treatment prior to discharge to the atmosphere.

4.1.1.4 UV Oxidation

UV oxidation involves the addition of an oxidant such as hydrogen peroxide and using ultra-violet light as a catalyst. The oxidant and catalyst generate hydroxyl radicals which react with organic compounds to produce by-products of carbon dioxide and water. UV oxidation is a proven technology for the complete destruction of VOCs in groundwater and can be easily implemented.

4.1.1.5 Groundwater Discharge

Groundwater recovery and treatment requires discharge of treated water. Reinjection is the one discharge option identified for this site. Reinjection involves the reintroduction of treated groundwater into the aquifer through a series of deep wells. Reinjection not only recharges the aquifer with potable water but expedites the remediation process by increasing the rate of VOC recovery through "flushing" an aquifer. Reinjection is currently used at the site as part of an IRM.

4.1.1.6 Off-Gas Treatment Technologies

Some technologies and process options for the treatment or removal of VOCs in groundwater generate a vapor stream that may require treatment or removal of VOCs. The feasible off-gas treatments identified for this site consist of regenerative carbon adsorption and catalytic incineration. Each off-gas treatment technology is discussed in the following sections.

4.1.1.6.1 Regenerative Carbon Adsorption

The same principal of liquid phase carbon is utilized; however, adsorbing VOCs in an air phase is more efficient then adsorbing VOCs in a liquid phase. Basically the air is heated to reduce relative humidity, then the air is passed through the carbon to adsorb the VOCs. Carbon adsorption is a physical process in which VOCs are removed by adsorbing onto the highly porous surface structure of the carbon. Once the carbon is saturated it is regenerated with low pressure steam. The steam is condensed and the liquid phases are separated. The water phase can be recirculated into the stripper and the organic phase is drummed and removed. Two carbon beds are typically required so that while one bed is being utilized, the other can be regenerated.

4.1.1.6.2 Catalytic Incineration

Catalytic incineration is similar to thermal incineration except that the gas stream is passed through a catalyst to oxidize the combustible emissions. The catalyst is used to initiate and promote combustion at much lower temperatures than those required for thermal incineration. Particularly for VOCs, catalytic incinerators are capable of complete destruction of the compounds while cost-effective incinerators are capable of 90-95% destruction efficiencies. Catalytic incinerators have economical advantages over thermal incinerators due to the lower temperature of combustion and resulting natural gas savings.

4.1.2 In-Situ Groundwater Treatment

4.1.2.1 In-Situ Catalytic Degradation

Catalytic degradation involves the addition of an oxidizer and a catalyst to groundwater. The oxidant and catalyst generate hydroxyl radicals which react with organic compounds to produce by-products of carbon dioxide and water. This process is typically conducted in-situ using an extensive network of injection wells located throughout the plume area.

4.1.2.2 In-Situ Air Sparging

Air sparging is a process where air is introduced under pressure through soils below the water table to increase the rate of volatilization of constituents in the saturated zone. Air sparging is generally used at sites with unconsolidated materials such as sand and gravel, or relatively permeable formations and is generally used in conjunction with vapor extraction to effectively reduce VOCs levels in soil and groundwater. Air sparging can also be used as a delivery mechanism for nutrients to promote biodegradation

4.1.3 Groundwater Monitoring

Groundwater monitoring provides a means of determining if groundwater has been affected by constituents of concern. Should monitoring indicate the need, other actions may be taken to assure human health and environmental protection. A groundwater monitoring program has already been implemented at the site and serves as an indicator of groundwater quality and is used to evaluate current interim remedial measures.

4.2 Soil Remedial Technologies

4.2.1 Soil Vapor Extraction

Soil vapor extraction is the process of inducing a vacuum in the subsurface to volatilize and extract VOCs through extraction wells and is generally used at sites with unconsolidated materials such as sand and gravel, or relatively permeable formations. Soil vapor extraction is very effective at reducing VOC concentrations adsorbed to the soil in the vadose or unsaturated zone. This remedial technology will not be effective on inorganic contaminants; therefore, an alternate remedial technology may be needed along with soil vapor extraction.

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Table 4
General Response Actions
Lockheed Martin
Great Neck, NY

Environmental Media	Remedial Action Objectives (RAOs)	General Response Actions (GRAs)
Groundwater	<u>Human Health</u> Prevent ingestion of groundwater having concentrations in excess of the following: <u>Constituent</u> <u>Concentration</u> 1,2-DCE 5 ug/L TCE 5 ug/L PCE 5 ug/L Freon 113 5 ug/L	<u>No Action/Institutional Actions</u> 1. No Action 2. Alternate Water Supply 3. Monitoring <u>Containment Actions</u> 1. Containment <u>Collection/Treatment Actions</u> 1. Collection/Treatment/Discharge 2. In-Situ Groundwater Treatment 3. Water Supply Treatment
	<u>Groundwater Protection</u> Restore aquifer at downgradient property line to the following: <u>Constituent</u> <u>Concentration</u> 1,2-DCE 5 ug/L TCE 5 ug/L PCE 5 ug/L Freon 113 50 ug/L	<u>No Action/Institutional Actions</u> 1. No Action 2. Alternate Water Supply 3. Monitoring <u>Containment Actions</u> 1. Containment <u>Collection/Treatment Actions</u> 1. Collection/Treatment/Discharge 2. In-Situ Groundwater Treatment
Soil	<u>Groundwater Protection</u> Prevent migration of constituents that would impact groundwater: <u>Constituent</u> <u>Concentration</u> 1,2-DCE 0.885 mg/Kg TCE 1.89 mg/Kg PCE 4.15 mg/Kg Xylene 3.6 mg/Kg Ethylbenzene 16.5 mg/Kg Beryllium 1.75 mg/Kg Cadmium 10 mg/Kg Chromium 50 mg/Kg Cobalt 60 mg/Kg Lead 500 mg/Kg Magnesium 5,000 mg/Kg Mercury .20 mg/Kg Nickel 25 mg/Kg Selenium 3.9 mg/Kg Zinc 50 mg/Kg	<u>No Action/Institutional Actions</u> 1. No Action 2. Monitoring <u>Containment Actions</u> 1. Containment <u>Excavation/Treatment Actions</u> 1. Excavation/Treatment/Disposal 2. In-Situ Soil Treatment

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Table 4 (Continued)
General Response Actions
Lockheed Martin
Great Neck, NY

Environmental Media	Remedial Action Objectives (RAOs)	General Response Actions (GRAs)
Recharge Basin Sediments	<u>Groundwater Protection</u> Prevent migration of constituents that would impact groundwater. The constituents and corresponding cleanup goals are as follows: <u>Constituent</u> — <u>Concentration</u> Chrysene — 1.2 mg/Kg Benzo(b)fluoroanthene — 3.3 mg/Kg Benzo(k)fluoroanthene — 3.3 mg/Kg	<u>No Action/Institutional Actions</u> 1. No Action 2. Monitoring <u>Containment Actions</u> 1. Containment <u>Excavation/Treatment Actions</u> 1. Excavation/Treatment/Disposal 2. In-Situ Soil Treatment
	<u>Human Health</u> Prevent ingestion and dermal contact of soil particles having concentrations in excess of the following: <u>Constituent</u> — <u>Concentration</u> Arsenic — 12 mg/Kg Chromium — 50 mg/Kg Lead — 500 mg/Kg Magnesium — 5,000 mg/Kg Mercury — .20 mg/Kg Nickel — 25 mg/Kg Selenium — 3.9 mg/Kg Silver — 5 mg/Kg Zinc — 50 mg/Kg	<u>No Action/Institutional Actions</u> 1. No Action 2. Monitoring <u>Containment Actions</u> 1. Containment <u>Excavation/Treatment Actions</u> 1. Excavation/Treatment/ Disposal 2. In-Situ Soil Treatment

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Table 5
Remedial Technology Types and Process Options
Lockheed Martin
Great Neck, NY

Environmental Media	Remedial Action Objectives (RAOs)	General Response Actions (GRAs)	Remedial Technology Types	Process Options
Groundwater	<u>Human Health</u> Prevent ingestion of groundwater having concentrations in excess of the following: <u>Constituent</u> <u>Concentration</u> 1,2-DCE 5 ug/L TCE 5 ug/L PCE 5 ug/L Freon 113 5 ug/L	<u>No Action/ Institutional Actions</u> 1. No Action 2. Alternate Water Supply 3. Monitoring	<u>No Action/Institutional Options</u> 1. Deed Restrictions 2. Groundwater Monitoring	
		<u>Containment Actions</u> 1. Containment	<u>Containment Technologies</u> 1. Vertical Barriers 2. Horizontal Barriers	 Slurry Walls, Sheet Piling Liners, Grout Injection
	<u>Groundwater Protection</u> Restore aquifer at downgradient property line to the following: <u>Constituent</u> <u>Concentration</u> 1,2-DCE 5 ug/L TCE 5 ug/L PCE 5 ug/L Freon 113 5 ug/L	<u>Collection/Treatment Actions</u> 1. Collection/Treatment/Discharge 2. In-Situ Groundwater Treatment 3. Water Supply Treatment	<u>Extraction Technologies</u> 1. Groundwater Collection	 Pumping Wells, Subsurface Collection
			<u>Treatment Technologies</u> 1. Physical Treatment 2. Chemical Treatment 3. In-situ Treatment 4. Off-Gas Treatment	 Air Stripping, Adsorption UV Oxidation Catalytic Degradation, Air Sparging/ Vapor Extraction, Bioremediation Adsorption, Incineration
			<u>Disposal Technologies</u> 1. Discharge to POTW 2. Discharge to Surface Waters 3. Reinjection	 After Treatment After Treatment After Treatment

Table 5 (Continued)
Remedial Technology Types and Process Options
Lockheed Martin
Great Neck, NY

Environmental Media	Remedial Action Objectives (RAOs)	General Response Actions (GRAs)	Remedial Technology Types	Process Options
Soil	Environmental Protection Prevent migration of constituents that would impact groundwater. The constituents and corresponding cleanup goals are as follows: Constituent — Concentration 1,2-DCE — 0.885 mg/Kg TCE — 1.89 mg/Kg PCE — 4.15 mg/Kg Xylene — 3.6 mg/Kg Ethylbenzene — 16.5 mg/Kg Beryllium — 1.75 mg/Kg Cadmium — 10 mg/Kg Chromium — 50 mg/Kg Cobalt — 60 mg/Kg Lead — 500 mg/Kg Magnesium — 5,000 mg/Kg Mercury — .20 mg/Kg Nickel — 25 mg/Kg Selenium — 3.9 mg/Kg Zinc — 50 mg/Kg	No Action/ Institutional Actions 1. No Action 2. Monitoring Containment Actions 1. Containment Excavation/Treatment Actions 1. Excavation/Treatment/Disposal 2. In-Situ Soil Treatment	No Action/Institutional Options 1. Deed Restrictions Containment Technologies 1. Vertical Barriers 2. Horizontal Barriers 3. Surface Controls Removal Technologies 1. Excavation Treatment Technologies 1. Physical Treatment 2. Chemical Treatment 3. In-Situ Treatment	 Slurry Walls, Sheet Piling Liners, Grout Injection Stabilization, Revegetation Solids Excavation Incineration, Desorption, Washing Solvent Extraction, Solidification/Stabilization Vapor Extraction, Surfactant Flushing/Catalytic Degradation, Bioremediation, Vitrification

Table 5 (Continued)
Remedial Technology Types and Process Options
Lockheed Martin
Great Neck, NY

Environmental Media	Remedial Action Objectives (RAOs)	General Response Actions (GRAs)	Remedial Technology Types	Process Options
Recharge Basin Sediments	<u>Environmental Protection</u> Prevent migration of constituents that would impact groundwater. The constituents and corresponding cleanup goals are as follows: <u>Constituent</u> — <u>Concentration</u> Chrysene — 1.2 mg/Kg Benzo(b)fluoroanthene — 3.3 mg/Kg Benzo(k)fluoroanthene — 3.3 mg/Kg	<u>No Action/ Institutional Actions</u> 1. No Action 2. Monitoring <u>Containment Actions</u> 1. Containment	<u>No Action/Institutional Options</u> 1. Deed Restrictions 2. Fencing <u>Containment Technologies</u> 1. Vertical Barriers 2. Horizontal Barriers 3. Surface Controls	Slurry Walls, Sheet Piling Liners, Grout Injection Stabilization, Revegetation
	<u>Human Health</u> Prevent ingestion and dermal contact of soil particles having concentrations in excess of the following: <u>Constituent</u> — <u>Concentration</u> Arsenic — 12 mg/Kg Chromium — 50 mg/Kg Lead — 500 mg/Kg Magnesium — 5,000 mg/Kg Mercury — .20 mg/Kg Nickel — 25 mg/Kg Selenium — 3.9 mg/Kg Silver — 5 mg/Kg Zinc — 50 mg/Kg	<u>Excavation/Treatment Actions</u> 1. Excavation/Treatment/Disposal 2. In-Situ Soil Treatment	<u>Removal Technologies</u> 1. Excavation <u>Treatment Technologies</u> 1. Physical Treatment 2. Chemical Treatment 3. In-Situ Treatment	Solids Excavation Incineration, Desorption, Washing Solvent Extraction, Solidification/Stabilization Vapor Extraction, Surfactant Flushing/Catalytic Degradation, Bioremediation, Vitrification

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Table 6
Media Specific Remedial Alternatives
Lockheed Martin
Great Neck, NY

Media	Alternative	Remedial Technology	Process Options	Off-Gas Treatment	Discharge	Monitoring
Groundwater	1	Groundwater Collection	Carbon Adsorption	None	Reinjection	2/year groundwater monthly discharge
Groundwater	2	Groundwater Collection	Air Stripping	None	Reinjection	2/year groundwater monthly discharge
Groundwater	2A	Groundwater Collection	Air Stripping	Vapor Phase Carbon Adsorption	Reinjection	2/year groundwater monthly discharge
Groundwater	2B	Groundwater Collection	Air Stripping	Catalytic Incineration	Reinjection	2/year groundwater monthly discharge
Groundwater	3	Groundwater Collection	UV Oxidation	None	Reinjection	2/year groundwater monthly discharge
Soil	1A	Vapor Extraction Soil Removal	Catalytic Incineration	Catalytic Incineration	Atmosphere	1/4ly stack test
Soil	1B	Vapor Extraction Soil Removal	Regenerative Carbon Adsorption	Regenerative Carbon Adsorption	Atmosphere	1/4ly stack test
Recharge Basin Sediment	2	Sediment Removal	Dredging	None	None	Confirmatory Sampling
Recharge Basin Sediment	3	Sediment Removal	Excavation	None	Sewers	Confirmatory Sampling
Recharge Basin Sediment	4	Deed Restrictions	None	None	None	2/year groundwater

4.2.1.1 Off-Gas Treatment Technologies

The soil vapor extraction process generates a vapor waste stream that requires treatment or removal of VOCs from air. The feasible off-gas treatments identified for this site consist of regenerative carbon adsorption and catalytic incineration. Each off-gas treatment technology is briefly discussed in the following sections.

4.2.1.1.1 Regenerative Carbon Adsorption

Granular activated carbon would be utilized to remove VOCs from the soil gas of the SVE system prior to discharge of the air stream to the atmosphere. Two carbon beds are typically required (one bed stays on-line while the second bed is regenerated). This treatment technology is the same as that described in Section 4.1.1.6.1 for treating off-gases from the air stripping tower of the groundwater remedial alternative.

4.2.1.1.2 Catalytic Incineration

This treatment technology is the same as that described in Section 4.1.1.6.2 for the groundwater remedial alterñative. Catalytic incineration would be used to oxidize the combustible emissions from the soil gas from the SVE system prior to discharge to the atmosphere. This technology is effective for controlling emissions. Supplemental fuel (i.e., natural gas) may need to be provided in order for effective operation of this system.

4.2.2 Removal of Soil

Soil removal would encompass the excavation of soil and sludge contained within inactive dry wells that are in excess of the Site Specific Cleanup Objectives. Five (5) former dry wells are located to the southeast of the main building. The locations of these underground structures are depicted in Figure 2 of Appendix G, Soil Borings and Dry well Area Map.

The three (3) dry wells located on the east of the building (where soil borings SB-1, SB-5 and SB-6 were advanced), are interconnected and has been utilized for the disposal of process wastewater. Samples from soil borings SB-1, SB-5 and SB-6 identified the presence of elevated concentrations of VOCs and metals, and also the presence of black silty soils (sludge). Soils from these three dry wells will be excavated as a source area remedial action.

Another dry well, located south of the southeast corner of the building, in the areas where boring SB-7 was drilled and sampled, formerly received drainage from a truck loading bay. Reportedly, the drainage flowed through an oil/water separator located immediately adjacent to the dry well prior to entering the dry well. To the west of this dry well is the fifth below grade structure in the area where boring SB-9 was drilled and sampled. According to facility personnel, underground tanks containing hydrocarbons had been located in this area; however, it is not certain as to whether a dry well was also present at this location. The tanks were removed in 1989, and it is possible that the dry well, if it existed, was removed when the tanks were excavated. Soil samples collected from borings SB-7 and SB-9 were below the Site Specific Soil Cleanup Objectives; therefore, soil removal at these two locations is not warranted, based on soil sampling data.

Removal of the contaminated sludge and soils from the three inactive dry wells near borings SB-1, SB-5 and SB-6 would eliminate a potential source that may be impacting ground water. This response action will also be effective in reducing the levels of inorganic constituents present in the dry well soils, which would not be addressed by the soil vapor extraction system. Excavated soil would be transported to a permitted off-site treatment/disposal facility.

4.3 Recharge Basin Sediment Remedial Technologies

Three remedial alternatives are being considered in this section to address the sediments in the stormwater recharge basins. These alternatives include: 1) removing sediments by hydraulic dredging, 2) removing sediments by excavation, or 3) leaving the sediments in place but imposing land use and site access restrictions to further minimize the potential for exposure.

4.3.1 Dredging of Sediments

Dredging of the sediments would take place with a hydraulic dredge. Dredged soil would be dewatered on-site and transported to a permitted treatment/disposal facility, while water produced during the dredging and dewatering operations would be recharged on-site, discharged to the local sewers, or transported off-site to a permitted treatment/disposal facility, depending on the chemical and physical characteristics of the water. The volume of metallic constituents would be reduced by removing sediments containing these constituents. However, dredging could also release contaminants that are bound in the sediment to groundwater.

4.3.2 Sediment Removal from Drainage Basins by Excavation

Sediment removal would take place with bulldozers and excavators. Prior to excavating, the basins would be drained. Standing water contained in the basins would be pumped to the local sanitary or stormwater sewer system depending on local approvals. However, runoff of any rainwater during excavation would have to be diverted so as not to flush contaminants into the groundwater while the sediments are disturbed by excavation equipment. The excavated soil would be transported to a permitted treatment/disposal facility. The volume of metallic constituents would be reduced by removing contaminated sediments from the basins. However, excavating could also release contaminants to groundwater that are otherwise immobile and are bound in the sediment.

4.3.3 Deed Restrictions

Administrative controls can be implemented to minimize potential threats to public health and the environment. For the recharge basins, the primary concern associated with elevated metals in the sediment is posed by potential contact exposure to human receptors, if or when the basins are no longer active and the sediments become exposed. A deed restriction can be imposed on the portion of the site where the recharge basins are located to alleviate this concern. Deed restrictions are covenants incorporated into a property deed which limits the use of the property. The deed will be executed by the property owner and recorded in the office of the County Clerk of Nassau. The deed restriction will be written to prohibit modifications to the site without NYSDEC approval to prevent potential future development on the basin property. In addition, engineering controls such as a security fence can be constructed around the recharge basins to prevent trespassing of unauthorized persons.

5.0 Development of Remedial Alternatives

To develop potential remedial alternatives for the site, individual technologies and groups of technologies/processes must be evaluated in general terms of effectiveness and implementability. This evaluation must determine the applicability of specific technologies and process options in terms of their ability to attain the RAOs for the site. From the set of remaining technologies and processes, remedial alternatives can be developed. The final alternatives incorporate different combinations of technologies. Table 6 provides a summary of media-specific remedial alternatives for the site.

Based on this evaluation of technologies and process options, five (5) groundwater remedial alternatives, two (2) soil remedial alternatives, and three (3) sediment remedial alternatives were developed for this site and are discussed below.

5.1 Groundwater Remedial Alternatives

Groundwater monitoring, groundwater collection, and groundwater reinjection are included in all alternatives under Section 5.1. Groundwater collection will be achieved through the pumpage of high capacity recovery wells. The approximate pumping rates, locations, and quantity of recovery wells were determined with a groundwater flow model. Based on the model, an estimated five extraction wells would be used to extract approximately 1,800 gallons per minute (gpm) of groundwater, and five diffusion wells would be used to reinject the treated groundwater to the aquifer.

The primary VOC contaminants in the groundwater plume include 1,2-dichloroethene, trichloroethylene, tetrachloroethylene, 1,1-dichloroethene and Freon. Based on contaminant distribution within the plume, the highest concentrations were observed on-site, within the lower portion of the Glacial Aquifer and the Upper/Intermediate Magothy aquifer. Based on the proposed pumping scenario, the estimated average concentration of VOCs in groundwater is expected to be approximately:

Contaminant	Estimated Concentration
1,2-Dichloroethene	2.30 mg/L
Tetrachloroethylene	0.150 mg/L
Trichloroethylene	0.130 mg/L
1,1-Dichloroethene	0.005 mg/L
Freon	0.010 mg/L

The locations, anticipated capacities and screened zones of the extraction wells are presented in Section 7.0 and Appendix F of this report which summarizes the groundwater model.

5.1.1 Groundwater Alternative 1 - Carbon Adsorption

Under Alternative 1, groundwater would be collected by a series of extraction wells and conveyed to a carbon adsorption vessel or a series of carbon adsorption vessels for the removal of VOCs in groundwater. Treated groundwater would be reinjected through a series of deep injection wells upgradient of the extraction wells. A groundwater monitoring program would be implemented to evaluate the effectiveness of the remedial alternative.

5.1.2 Groundwater Alternative 2 - Air Stripping

Alternative 2 consists of groundwater collection with air stripping for the removal of VOCs. Treated groundwater would be discharged by reinjection. Groundwater would be collected by a series of extraction wells and conveyed to an air stripper or a series of air strippers for the removal of VOCs in groundwater. Treated groundwater would be reinjected through a series of deep injection wells upgradient of the extraction wells. A groundwater monitoring program would be implemented to evaluate the effectiveness of the remedial alternative.

5.1.3 Groundwater Alternative 2A - Air Stripping/Vapor Carbon Adsorption

Alternative 2A consists of groundwater collection with air stripping for the removal of VOCs. Air emissions from the air stripper(s) would be treated by vapor carbon adsorption prior to discharge to the atmosphere.

5.1.4 Groundwater Alternative 2B - Air Stripping/Catalytic Incineration Off-Gas Treatment

Alternative 2B consists of groundwater collection with air stripping for the removal of VOCs. Air emissions from the air stripper(s) would be treated by catalytic oxidation prior to discharge to the atmosphere. Groundwater would be collected by a series of extraction wells and conveyed to an air stripper or a series of air strippers for the removal of VOCs in the groundwater.

5.1.5 Groundwater Alternative 3 - UV Oxidation

Alternative 3 consists of groundwater collection with UV Oxidation for the removal of VOCs. Treated groundwater would be discharged by reinjection. Groundwater would be collected by a series of extraction wells and conveyed to a UV oxidation and carbon adsorption systems for the removal of VOCs in groundwater. Treated groundwater would be reinjected through a series of deep injection wells upgradient of the extraction wells. Because UV oxidation destruction generates by-products of carbon dioxide and water, VOC emission control is not needed. However, UV lamps do require routine maintenance in order to maintain VOC destruction efficiency and prevent the release of toxic intermediate products into the atmosphere resulting from incomplete oxidation. A groundwater monitoring program would be implemented to evaluate the effectiveness of the remedial alternative.

5.2 Soil Remedial Alternatives

5.2.1 Soil/Sediment Alternative 1A-Vapor Extraction/Catalytic Incineration Off-Gas Treatment/Source Area Excavation

Alternative 1A encompasses the continued operation of the existing in-situ soil vapor extraction (SVE) system. Under this remedial alternative, off-gas treatment from the SVE system will utilize catalytic incineration. The SVE system will be supplemented with excavation and removal of contaminated soils and sludges within and below three inactive dry wells. Because this remedial alternative employs use of the existing SVE system that was installed and currently operating as an IRM, the SVE system will be reevaluated as part of this remedial alternative to confirm that the existing system is operating effectively. Adjustments and modifications will be made to the SVE system as may be warranted based on this evaluation.

Soil samples SB-1, 5, 6, and B-16 through B-19, previously conducted in the vicinity of and within the three dry wells located to the east of the southeast corner of the main plant (see Figure 2 of Appendix G), indicated elevated concentrations of VOCs and inorganic compounds, as well as the presence of a sludge. Removal of these soils and sludge will help to reduce the duration of the operating time for the SVE system as well as remove inorganics that are present in the dry well soils. During the soil boring program, a clay layer was encountered at approximately 30 to 32 feet below grade. The analytical data from the borings indicate that concentrations of VOCs in samples collected from the surface of the clay contained elevated levels of VOCs. Volatile organic compounds have an affinity to accumulate in clay because of the lower porosity and higher organic content of the unit. The surface of this contaminated clay layer may now contain elevated concentrations of VOCs that are acting as an ongoing source leaching VOCs to groundwater. Therefore, to help expedite the time frame for soil remediation, dry well excavation will extend down to a depth of approximately 30 feet below grade to the surface of this clay unit.

In order to excavate down to 30 feet below grade, sheeting, shoring or some other means of maintaining the stability of the excavation walls will be required. The aerial extent of the excavation will be approximately 10 feet by 10 feet encompassing each of the three dry wells. Based on analytical results of soil borings constructed in the area of these three dry wells, it is estimated that with the excavation of these dry wells, approximately 1,000 pounds of solvent will be removed.

Soil borings SB-7, SB-9 and B-15 were constructed in the vicinity of the dry well(s) and former USTs located on the south side of the main plant. However, the exact location of these underground structures could not be confirmed. It is possible that the dry well, if one existed near the former tanks, was removed when the tanks were excavated. Although analytical results for samples collected at SB-7 and SB-9 were not in exceedance of the Recommended Site Specific Soil Cleanup Objectives, a limited subsurface investigation consisting of shallow trenching and test pits will be conducted in the vicinity of these underground structures to confirm that no addition underground sources of contamination are present at these locations. Any structures, sludges or contaminated soils if encountered during the subsurface investigation will be excavated and removed. If no underground sources or contaminated material is found, confirmatory soil samples will be collected from the test pits and/or trenches to help document these findings.

To the extent that the soil removal program is being performed to supplement the SVE treatment system, confirmatory sampling will not be conducted following dry well excavation. However, a groundwater monitoring well will be installed immediately downgradient of the dry well area to help monitor and evaluate the effectiveness of the soil remediation program on groundwater quality. This well will be installed to screen the Upper Glacial Aquifer at a depth of approximately 125 to 135 feet below grade.

5.2.2 Soil/Sediment Alternative 1B-Soil Vapor Extraction/Regenerative Carbon Adsorption Off-Gas Treatment/Source Area Excavation

Alternative 1B also encompasses use of the existing in-situ soil vapor extraction system; however, off-gas treatment would consist of regenerative carbon adsorption. Elements of the dry well excavation, additional subsurface investigation and evaluation and/or modifications to the SVE system as summarized in Section 5.2.1 above are identical for this alternative.

5.3 Recharge Basin Sediment Remedial Alternatives

5.3.1 Soil/Sediment Alternative 2 - Dredging of Sediments

Alternative 2 encompasses the removal of the recharge basin sediments by means of a hydraulic dredge. The depth to which sediment removal is to be performed would need to be established if this alternative is implemented. For the purpose of this alternative evaluation, an assumed three (3) feet of sediments will be removed. Dredged soil would be dewatered and transported to a permitted treatment/disposal facility. Water produced during the dredging operation would either be recharged on-site, discharged to the local sewers, or transported to a permitted treatment/disposal facility, depending on the chemical and physical characteristics of the water. Following dredging, confirmatory samples would be collected to document that sediment removal is complete. This remedial alternative would require use of specialty hydraulic dredging equipment which may not be available locally. The size of these recharge basins is considered to be relatively small when compared to typical project applications where sediment removal by hydraulic dredging is more commonly employed, such as in lakes, rivers and coastal waters. Therefore, dredging equipment that is commercially available may need to be modified for use at this site, if possible.

5.3.2 Soil/Sediment Alternative 3 - Basin Draining and Sediment Excavation

Alternative 3 consists of draining each of the three basins via high capacity pumps and excavating the top three feet of sediment. The water would be discharged to the municipal sanitary or stormwater sewer system while the sediments would be transported off-site to a permitted treatment/disposal facility.

In order to remove sediments from the basins, the basins must first be drained. However, since the basins are active and continue to receive stormwater runoff, it would not be possible to take all three basins out of service at the same time unless drainage from rain was diverted elsewhere. If sediment removal from the basins was done sequentially, one or two basins would be taken out of service while the other basin(s) would continue to receive runoff. To accommodate this, modifications to the existing stormwater collection piping would be needed to redirect stormwater flow to one of the alternate basins. However, because the three basins are interconnected, total isolation of a particular basin to allow for excavation is not possible even if stormwater is diverted away to another basin. Seepage will occur between the basins since the three basins are underlain and bermed by sand and are at different elevations, making it difficult to keep one basin from draining to the other.

Prior to the discharge of any standing water from the basins to the local sanitary or stormwater sewer system, approvals from Nassau County Department of Public Works (NCDPW) would be required. In addition, guidance is required from NCDPW as to the maximum allowable discharge rate to the sewers based on existing sewer capacity. In the development of this remedial alternative, it was assumed that the standing water from the basins will be acceptable for disposal to the municipal sewers (based on chemical and physical characteristics, and volume), that a discharge rate of 300 gallons per minute (gpm) can be accommodated by the sewer lines, and that there will be no time restrictions as to when the discharge to the sewers may occur. It was estimated based on the size of the basins, assuming that the basins were full, that there are a total of approximately 11 million gallons of standing water requiring discharge to the sewers.

Removal of approximately three (3) feet of sediments from each basin would take place with bulldozers and excavators. The excavated soil would be transported to a permitted treatment/disposal facility. The sediment would be prepared for transport (for moisture control) by either the addition of kiln dust or fly ash. It is estimated that a total of approximately 27,000 cubic yards of soil would be removed from the three basins (based on an approximate 240,000 square feet of surface area and assuming a 3 feet excavation), and approximately 50,000 tons of soil will be disposed of off-site. This estimate of 50,000 tons includes the addition of fly ash or kiln dust for moisture control, which is needed for transport. The TCLP data for sediment samples that were collected on August 8, 1996, one from each basin, indicate that the sediment in the recharge basins do not exhibit hazardous characteristics and therefore, can be managed as a non-hazardous waste for disposal. Analytical data for the sediment samples are included in Table 4 of Appendix G. After excavation, confirmatory soil samples will be collected to evaluate the effectiveness of the remedial action. Because this work could not be performed on all basins at the same time, it is estimated that sediment removal from all three recharge basins will take approximately 6 to 9 months to complete.

The volume of inorganic constituents would be reduced by removing contaminated sediments. However, excavating could also release contaminants that are bound in the sediment to groundwater that are otherwise immobile.

5.3.3 Soil/Sediment Alternative 4 - Deed Restrictions

Alternative 4 consists of a deed restriction or covenant incorporated into a property deed which limits the use and future development of the property. Under this remedial alternative, the water and sediments would remain in the recharge basins. A deed restriction will be used to limit access to the basins and restrict future use of the site. In addition, a fence will be constructed around the entire recharge basin property to prevent unauthorized access to this area. The fence will be inspected routinely and repaired as needed to ensure the integrity of the fence. The site will also be posted to indicate that contaminated materials are present and that trespassing, swimming and fishing are prohibited. In addition, groundwater monitoring would be performed to evaluate the effectiveness of this remedy. One new monitoring well (to be completed in the Upper Glacial aquifer) will be installed downgradient (to the northwest) of the basins. This new well, and one of the existing downgradient monitoring wells completed in the Lower Glacial aquifer (i.e., 4GL), will be sampled on a semi-annual basis for two years for metals. Groundwater monitoring will be terminated after establishing four consecutive rounds (two years) of groundwater data which demonstrates that concentrations are within the NYS Class GA Groundwater Quality Standards for metals.

6.0 Detailed Evaluation of Remedial Alternatives

In this section of the FS, the five (5) groundwater remedial alternatives and the two (2) soil remedial alternatives are analyzed individually in comparison with specific evaluation criteria required by NYSDEC. A comparative analysis of the remedial alternatives relative to one another using the same evaluation criteria is also presented. The criteria evaluated include:

1. Compliance with SCGs
2. Overall protection of human health and environment
3. Short-term effectiveness
4. Long-term effectiveness
5. Reduction of toxicity, mobility and volume through treatment
6. Implementability
7. Cost

Subsections 6.1 and 6.2 presents the individual analysis for each of the five groundwater remedial alternatives and the two soil remedial alternatives, and Subsections 6.3 and 6.4 presents the comparative analysis using the scoring system presented in TAGM-HWR-90-4030. Appendix D contains TAGM-HWR-90-4030 scoring results for each alternative.

6.1 Groundwater Remedial Alternative Analysis

The following groundwater remedial alternatives are evaluated individually using the specific evaluation criteria required by NYSDEC. Alternatives 1 through 3 all consist of groundwater collection, groundwater monitoring and reinjection, but with different treatment technology process options. Groundwater collection will be achieved through the pumpage of high capacity recovery wells. The pumping rates, locations, and quantity of recovery wells will be determined with a groundwater flow model. A discussion of the groundwater flow model is described in section 7.0 of the report.

6.1.1 Groundwater Alternative 1 - Carbon Adsorption

Alternative 1 would comply with applicable ARARs and SCGs including groundwater cleanup and discharge criteria listed in Appendix B. Compliance with these ARARs and SCGs will result in protection of human health and environment. Achievement of groundwater RAOs would be met through the short-term effectiveness of plume migration control and a permanent, long-term reduction in toxicity, mobility and volume of the constituents of concern at the site. Remedial effectiveness would be evaluated through a groundwater monitoring program.

Groundwater treatment would be provided by a series of granular activated carbon adsorption units. This technology has proven to be very effective in the removal of VOCs from groundwater and is capable of meeting groundwater discharge criteria. Removal efficiencies greater than 95% can be expected. Disadvantages of this alternative include off-site regeneration of carbon and relatively high costs for carbon regeneration.

Specific Alternative 1 groundwater remedial technologies and process options have already been implemented as an IRM. A final remedial measure consisting of Alternative 1 would easily be implemented and would be an effective solution..

6.1.2 Groundwater Alternative 2 - Air Stripping

Alternative 2 would comply with applicable ARARs and SCGs for groundwater, but may not comply with ARARs and SCGs for the air emissions. Achievement of groundwater RAOs would be met through the short-term effectiveness of plume migration control and a permanent, long-term reduction in toxicity, mobility and volume of the constituents of concern at the site. Remedial effectiveness would be evaluated through a groundwater monitoring program.

Groundwater treatment would be provided by air strippers. This technology has proven to be very effective in the removal of VOCs from groundwater and is capable of meeting groundwater discharge criteria. Removal efficiencies greater than 95% can be expected. Disadvantages of this alternative are relatively high energy consumption, potential fouling of the air strippers and air emissions that may require control. During the initial operation of the treatment system operation, mass loading rates associated with the emission may warrant control. As the mass loading decreases over time, air emission control may not be required.

6.1.3 Groundwater Alternative 2A - Air Stripping/Vapor Carbon Adsorption

Alternative 2A is the same as Alternative 2 with the addition of vapor phase carbon for emissions control. It consists of groundwater collection with air stripping for the removal of VOCs. Air emissions from the air stripper(s) would be treated by vapor carbon adsorption prior to discharge to the atmosphere. Compared to Alternative 2, this would be further protective of human health and environment. Treated groundwater would be discharged by reinjection. Groundwater monitoring would be implemented to evaluate the effectiveness of the alternative.

Carbon adsorption has proven to be very effective in the removal of VOCs in off-gas emissions. Off-gas removal efficiencies greater than 95% can be expected. Advantages include the ease of operation, VOC emissions will be minimized, and the probability of a noncompliance event is minimized. Disadvantages include the need for off-site disposal/treatment of the spent carbon and the increased energy consumption necessary to dehumidify the air.

6.1.4 Groundwater Alternative 2B - Air Stripping/Catalytic Incineration Off-Gas Treatment

Alternative 2B is also the same as Alternative 2 with the addition of off-gas treatment consisting of catalytic incineration. This alternative would be further protective of human health and environment by treating off-gas emissions prior to discharge to the atmosphere.

Catalytic incineration has proven to be effective in the removal of VOCs in off-gas emissions. Off-gas removal efficiencies greater than 95% can be expected. Advantages include complete destruction of VOCs. Disadvantages include the potential need for acid gas scrubbers, and higher energy costs.

6.1.5 Groundwater Alternative 3 - UV Oxidation

Alternative 3 consists of groundwater collection with UV Oxidation for the removal of VOCs. Treated groundwater would be discharged by reinjection. This alternative would be protective of human health and environment by destroying VOCs and generating by-products of carbon dioxide and water.

UV oxidation has proven to be very effective in the removal of VOCs in groundwater. Removal efficiencies greater than 95% can be expected. Advantages include complete destruction of VOCs with no air emissions and ease of implementation. Common limiting steps included the presence of other dissolved materials which are preferentially oxidized. Non-hydrocarbon dissolved contaminants, including naturally occurring metals (e.g., iron) and minerals, will also be subject to the oxidation reaction. Other disadvantages include the need for hydrogen peroxide and high energy requirements.

6.2 Soil Remedial Alternatives Analysis

The following soil remedial alternatives are evaluated individually using the specific evaluation criteria required by NYSDEC. Alternatives 1A and 1B consist of limited source area excavations and in-situ soil vapor extraction but with different treatment technology process options.

6.2.1 Soil/Sediment Alternative 1A - Soil Vapor Extraction/Catalytic Incineration Off-Gas Treatment/Source Area Excavation

The SVE portion of this remedial alternative has already been implemented as an IRM. Catalytic incineration technology, which is presently being used, has proven to be very effective in the removal of VOCs from air and is capable of meeting air emission discharge criteria. Under this remedial alternative, the SVE treatment system will be supplemented with soil and sludge removal by excavation.

The removal of sludges and soils within and beneath the dry wells will reduce the overall volume of inorganic and organic constituents. This will supplement the soil vapor extraction treatment by reducing the mass of organics requiring treatment and thereby reducing the duration of SVE treatment operation. Further, removal of these areas will reduce the volume of soils impacted with inorganics and eliminate the potential for future migration. Excavated soil would be disposed of off-site at a permitted facility.

Based on the removal rate of the SVE experienced over the past two years and assuming a non-linear relationship toward the end of the treatment period, we expect that the system will operate for an additional 2 to 5 years. A request will be made to the NYSDEC to terminate operation of the SVE when either the soil concentrations meet the Site Specific Soil Cleanup Objectives, or when the SVE system is no longer effective in removing soil gas, whichever occurs first. This latter point occurs when no further reduction of soil vapor concentrations are observed over time (i.e., the asymptote of the soil gas removal vs. time curve). The system will be shut down, allowed to equilibrate, and restarted to determine if additional soil gas is available for removal. At such time, soil sampling will be conducted and compared to the site specific soil cleanup objectives to assess the adequacy of the remediation.

Alternative 1A would comply with applicable ARARs and SCGs including proposed soil cleanup criteria listed in Appendix B. Compliance with these SCGs will result in protection of human health and environment. Achievement of soil RAOs would be met through the permanent and long-term reduction in toxicity and volume of the constituents of concern in soil at the site. Alternative 1A would be effective, easily implemented and a cost-effective remedial measure.

6.2.2 Soil/Sediment Alternative 1B - Soil Vapor Extraction/Carbon Adsorption Off-Gas Treatment/Source Area Excavation

Alternative 1B is similar to Alternative 1A except that off-gas emissions would be treated using regenerative vapor phase carbon. Vapor phase carbon has proven to be very effective in the removal of VOCs from air and is capable of meeting air emission discharge criteria. Removal efficiencies greater than 95% can be expected. However, because of the relatively high mass load of VOCs from the SVE system requiring treatment, the operation and maintenance cost associated with use of vapor phase carbon for VOC control was determined to be more costly than use of a catalytic incinerator. The soil and sludge removal program described for Alternative 1A above would be identical under this remedial alternative.

6.3 Recharge Basin Sediment Remedial Alternatives

6.3.1 Soil/Sediment Alternative 2 - Dredging of Sediments

Alternative 2, which consists of dredging of the recharge basin sediments by means of a hydraulic dredge, would comply with applicable ARARs and SCGs including the proposed Site Specific Soil Cleanup Objectives listed in Appendix B. Achievement of soil RAOs would be met through the permanent and long-term reduction in toxicity and volume of the constituents of concern in soil at the site. Although dredging would meet applicable ARARs and SCGs, it has several disadvantages:

- Dredging could exacerbate the contamination problem by mobilizing the currently immobile inorganic and organic constituents. At present, only VOCs are observed in downgradient groundwater at concentrations above drinking water standards. Dredging may alter the stability of complexed inorganics that are adsorbed to the sediment, and help to release the contaminants to groundwater.
- This alternative would be very difficult to implement primarily because of the relatively small size of the individual basins. Hydraulic dredging is typically and more easily performed in open waterways or large sized lagoons. Specialized equipment to accommodate these basins, which may not be available locally, would be needed for this work.
- This alternative would not be cost-effective.

6.3.2 Soil/Sediment Alternative 3 - Basin Draining and Sediment Excavation

Alternative 3 consists of draining each of the three basins via high capacity pumps and excavating the top three feet of sediment. The water would be discharged to the municipal sewer system while the sediments would be transported to the proper permitted treatment/disposal facility.

Although discussions have been initiated with officials at the Nassau County Department of Public Works regarding requirements for acceptance of the basin water to the local sewers, according to the NCDPW, they can not comment on the acceptability of a waste stream until a formal request is made to the Commissioner requesting an approval for a specific discharge. Since such a request is premature at this time, the viability of this water management option remains uncertain. If the standing water from the basins cannot be discharged to the local sewers and an alternate means of water disposal is required, the overall cost of this alternative may increase significantly.

Similar to Alternative 2 above for hydraulic dredging, Alternative 3 would comply with applicable ARARs and SCGs including the proposed Site Specific Soil Cleanup Objectives listed in Appendix B. Achievement of soil RAOs would be met through the permanent and long term reduction in toxicity and volume of the constituents of concern in soil at the site. Although excavating the sediments would meet applicable ARARs and SCGs, removal of the sediments could potentially mobilize the currently immobile inorganic and organic constituents that are bound to the sediments into groundwater. At present only VOCs are observed in downgradient groundwater at concentrations above drinking water standards. Excavation may alter the stability of complexed inorganics that are adsorbed to the sediment and help to release the contaminants to groundwater. This remedial alternative is not cost-effective.

6.3.3 Soil/Sediment Alternative 4 - Deed Restrictions

Under this remedial alternative, the soils and sediments would be left in place in the recharge basins. The primary constituents of concern are metals in the sediment, attributed to site runoff. Concentrations in the standing water in the basins are not elevated.

Administrative and engineering controls would be used to limit access to the site. A deed restriction(s) prohibiting modification to the site without NYSDEC approval will be placed on future development of the parcel(s) where the recharge basins are located. In addition, a security fence around the basins will be maintained to prevent trespassing. The fence will be inspected to determine if it is effective at keeping out trespassers. If the fence is not effective, an appropriate replacement will be installed or appropriate repairs will be made. The site will also be posted in a highly visible manner indicating that contaminated materials are present and that trespassing, swimming and fishing are prohibited. Groundwater monitoring will be performed at two downgradient wells to monitor the effectiveness of this remedy.

This alternative would comply with ARARs and SCGs for groundwater since contaminants in the basins have not impacted groundwater. The primary constituents of concern in the basins are metals, and groundwater downgradient of this area has not shown any indication of metals impact. This alternative provides short term and long term protectiveness of human health and the environment. Since the sediments are located under several feet of standing water, the sediments are not accessible to site workers or to the public, particularly since the basins will be fenced to prevent trespassing. Further, because this alternative does not involve any sediment removal, this alleviates the concern that inorganics bound to the sediments may be released to groundwater during or following sediment removal activities. This alternative can be readily implemented and is the most cost-effective remedy of the alternatives evaluated for the basins.

6.4 Comparative Analysis

6.4.1 Groundwater Remedial Alternatives

The five groundwater remedial alternatives were scored using the criteria established in TAGM-HWR-90-4030. Table 7 summarizes the results of the evaluation. The individual scoring worksheet for each alternative is contained in Appendix D.

The information on capital and operation & maintenance (O & M) costs for the five groundwater remedial alternatives is presented in Appendix E. Some remedial actions have already been implemented at the site and the costs for these actions have been used in the estimates. TAGM-HWR-90-4030 suggests that the cost score be developed based on a proportionality approach. The cost score for each alternative is determined by summing all the alternatives and dividing the sum by the cost of the alternative. The groundwater remedial alternatives are ranked in descending order:

Alternative 2A - Air Stripping/Carbon Adsorption Off-Gas	82.7 points
Alternative 2B - Air Stripping/Catalytic Incineration Off-Gas Treatment	82.7 points
Alternative 1 - Carbon Adsorption	80.7 points
Alternative 3 - UV Oxidation	80.0 points
Alternative 2 - Air Stripping	77.0 points

The basis for all groundwater remedial alternatives consists of groundwater collection, treatment, and reinjection. Groundwater collection will achieve the groundwater RAOs through the short-term effectiveness of plume migration control and a permanent, long-term reduction in toxicity and volume of the constituents of concern at the site. Remedial effectiveness would be evaluated through a groundwater monitoring program.

The significant difference between groundwater remedial alternatives is the selected process option for the treatment of groundwater prior to reinjection. The primary treatment technologies, including air stripping, carbon adsorption and UV oxidation, are all capable of reducing constituent of concern concentrations to acceptable groundwater discharge limitations for reinjection. Removal efficiencies greater than 95% can be expected. Off-gas treatment technologies including catalytic incineration, carbon adsorption, and regenerated carbon adsorption are all capable of reducing constituent of concern concentrations to acceptable air discharge limitations. Off -gas removal efficiencies greater than 95% can be expected.

As the remedial alternative scoring summary in Table 7 indicates, the scoring for the TAGM-HWR-90-4030 criteria are very similar for each alternative with the exception of cost. There are, however, a few notable scoring differences with the implementability criteria of each alternative. The fact that the selection of a groundwater remedial alternative is based mostly on cost is not surprising since the basis for each alternative is similar and each alternative is capable of meeting applicable ARARs and SCGs.

6.4.2 Soil Remedial Alternatives

The two soil remedial alternatives were scored using the criteria established in TAGM-HWR-90-4030. Table 7 summarizes the results of the evaluation. The individual scoring worksheet for each alternative is contained in Appendix D.

The information on capital and operation & maintenance (O & M) costs for the two soil remedial alternatives is presented in Appendix E. Some remedial actions have already been implemented at the site and the costs for these actions have been used in the estimates. TAGM-HWR-90-4030 suggests that the cost score be developed based on a proportionality approach. The cost score for each alternative is determined by summing all the alternatives and dividing the sum by the cost of the alternative.

The soil remedial alternatives are ranked in descending order:

Alternative 1A - Vapor Extraction/Catalytic Incineration/Source Area Excavation	79.2 points
Alternative 1B - Vapor Extraction/Regenerative Carbon Adsorption/Source Area Excavation	77.9 points

The basis for the soil remedial alternatives consists of vapor extraction supplemented by limited source area excavation. This combination of technologies will achieve the RAO for soil and is capable of reducing constituent of concern concentrations in soil to below levels proposed in Table 4. The proposed allowable levels of VOCs in soil represent VOC concentrations which will not contribute to elevated levels of VOCs in groundwater according to the NYSDEC TAGM 94-4046 soil leaching model.

The significant difference between soil remedial alternatives is the selected process option for off-gas treatment of constituents of concern prior to discharge to the atmosphere. Off-gas treatment technologies, catalytic incineration and regenerated carbon adsorption, are both capable of reducing constituent of concern concentrations to acceptable air discharge limitations. Removal efficiencies greater than 95% can be expected.

As the remedial alternative scoring summary in Table 7 indicates, the scoring for the TAGM-HWR-90-4030 criteria are very similar for each alternative with the exception of cost. There is, however, a minor scoring difference with implementability of the alternatives. The basis for each alternative is identical and each alternative is capable of meeting applicable ARARs and SCGs. Therefore, deciding criteria for the soil remedial alternative is the cost.

6.4.3 Recharge Basin Sediment Remedial Alternatives

The three recharge basin sediment alternatives were scored using the criteria established in TAGM-HWR-90-4030. Table 7 summarizes the results of the evaluation. The individual scoring worksheet for each alternative is contained in Appendix D.

The information on capital and operation & maintenance (O & M) costs for the three sediment remedial alternatives is presented in Appendix E. TAGM-HWR-90-4030 suggests that the cost score be developed based on a proportionality approach. The cost score for each alternative is determined by summing all the alternatives and dividing the sum by the cost of the alternative.

The recharge basin sediment alternatives are ranked in descending order:

Alternative 4 - Deed Restrictions	76.5 points
Alternative 3 - Basin Draining and Sediment Excavation	65.3 points
Alternative 2 - Dredging of Sediments	64.0 points

As the remedial alternative scoring summary in Table 7 indicates, the scoring for the TAGM-HWR-90-4030 criteria are similar for each alternative with the exceptions of cost and implementability. There is, however, a minor scoring difference based upon the reduction of toxicity, mobility and volume of hazardous constituents. Each alternative is protective of human health and groundwater. Therefore, the deciding criteria for a recharge basin sediment remedial alternative is implementability and cost. The high cost of dredging (present worth of $9.6M) and excavating (present worth of $8.5M), engineering and institutional difficulties that would be encountered, and potential adverse effects resulting from release of contaminants to groundwater make the sediment dredging and excavation alternatives less favorable than the deed restriction, fencing and continued monitoring alternative. This is particularly the case since removal of the sediments would not necessarily result in a greater degree of human health or groundwater protection than instituting a deed restriction and constructing a fence to limit access to the sediments. Therefore, potential risks posed by basin sediments to human receptors can be effectively mitigated by maintaining present land usage and restricting access.

7.0 Remedial Alternative Selection

As stated previously, the purpose of this feasibility study was to select media-specific remedial alternatives for the protection of human health and the environment through the reduction of material volume, mobility or volume of groundwater and soil constituents. Action has already been taken to attain this objective through the IRMs implemented to date.

The information analyzed and presented in this remedial alternative feasibility study has resulted in identification of a suitable groundwater, soil, and recharge basin sediment remedial alternative for the site. The highest scoring alternatives identified under the NYSDEC TAGM quantitative protocol are Alternative 1A for soil, Alternative 2A for groundwater, and Alternative 4 for the recharge basin sediments.

7.1 Selected Soil Remedial Alternative (1A)

The selected soil remedial alternative consists of soil vapor extraction with catalytic incineration off-gas treatment (see Figure 3) and excavation of three dry wells as a means of source area removal. The dry well system, consisting of three (3) leaching pools located on the east side of the southeast corner of the building (where borings SB-1, SB-5, SB-6, and B-16 through B-19 were advanced), will be excavated. Excavated soil would be transported to a permitted off-site treatment/disposal facility. The volume of inorganic and organic constituents of concern would be reduced by removing soil containing these constituents.

Soil vapor will be collected from a series of vapor extraction wells located within the areas of highest concentrations of constituents of concern. Soil vapor will be destroyed using catalytic incineration prior to discharge to the atmosphere. The system will be operated and maintained as indicated in the IRM Work Plan and all addenda. The selected remedial alternative has been successfully implemented as an interim remedial measure and has been operating since January 1994. The existing SVE system will be examined, evaluated and modified or adjusted as needed to maintain effective operation of the system.

The selected remedial alternative is capable of meeting the applicable ARARs and SCGs. The mass of VOCs in the soil in the area of the dry wells is estimated to have been on the order of 70,000 lbs. This estimate is based on the average concentrations of total volatile organic compounds detected in samples collected in the area of the former dry wells that were identified during the RI. Results of the VOC mass estimation are contained in Appendix A.

To date, based on actual field data, the soil-vapor extraction and treatment system has recovered and treated approximately 35,000 lbs. of VOCs. In addition, it is estimated that approximately 1,000 pounds of VOCs will be removed by the excavation of the three dry wells. Therefore, assuming that the estimate of 70,000 pounds at one time in the soil is reasonably accurate, it is estimated that approximately 35,000 pounds of VOC still remain in the soil at this time. This estimate of 35,000 lbs. may be conservative (higher than what is actually present), since other factors (i.e., biodegradation and flushing of soils by precipitation) that contribute to a lowering of concentrations may have occurred since the RI. Nevertheless, assuming a 35,000 pound estimate, and using the removal rate experienced over the past two years, and assuming a non-linear relationship toward the end of the treatment period, we expect that the system will be operated for an additional 2 to 5 years.

The objective of the remedial alternative is to achieve the RAOs presented in Table 3, and specifically, to reduce concentrations of organic compounds in soil to levels protective of groundwater quality standards.

7.2 Selected Groundwater Remedial Alternative (2A)

The selected groundwater remedial alternative consists of groundwater collection from a series of extraction and recovery wells. As shown on Figure 4, extracted groundwater will be treated using air strippers for the removal of VOCs. Air emissions from the air stripper(s) would be treated by vapor carbon adsorption prior to discharge to the atmosphere. Treated groundwater would be discharged by reinjection. Groundwater monitoring would be implemented to evaluate the effectiveness of the alternative. The proposed treatment system will be evaluated after it becomes operational to determine if additional treatment of the effluent from the air stripper is needed.

The selected remedial alternative is capable of meeting the applicable ARARs and SCGs. To date, the groundwater treatment system has recovered and treated over 840 million gallons of water. The objective of the remedial alternative is to achieve the RAOs presented in Table 3 and specifically, to prevent constituent plume migration and reduce organic compound concentrations in groundwater.

Over time, the remedial alternative will be evaluated by sampling both on-site and off-site monitoring wells to determine its ability to provide hydraulic control, to meet discharge standards, and to reduce on-site groundwater concentrations to the remedial action objectives.

7.2.1 Groundwater Flow Model

A groundwater flow model was used to evaluate and design an effective extraction system. A numerical mathematical model was used to simulate the groundwater flow conditions at the site and predict the best location and pumping rates for groundwater extraction wells. Simulation of groundwater flow in the vicinity of the site was accomplished using the U.S. Geological Survey's MODFLOW code (McDonald and Harbaugh, 1988). This is a U.S. EPA-endorsed finite difference groundwater model for simulating hydraulic heads over a specified model domain. Following calibration of MODFLOW, a pathline analysis was undertaken using PATH3D to delineate capture zones around the pumping centers. This was accomplished by placing particles in cells upgradient of the pumping centers of interest and running forward simulations under pumping conditions. Detailed descriptions of the numerical implementation, code verification, and model results are included in Appendix F.

The model-predicted potentiometric surface compared favorably with the actual potentiometric surface. This means that the model effectively simulates the current groundwater flow conditions at the site. After calibration of the potentiometric surface, the model was then used to predict the effect of pumping groundwater from various extraction well configurations. Pumping rates in existing and proposed wells were progressively modified until the extraction network most effectively captured the on-site VOC plume in model layers 1,2, and 3. Appendix F Figures 3.1, 3.2, and 3.3 show the predicted containment model and capture zone for layers 1, 2, and 3 respectively. These figures show that five pumping wells will be needed to effectively collect the VOC plume in model layers 1, 2, and 3.

7.2.2 Groundwater Collection System

Based on existing hydraulic data, and utilizing the predictions from the groundwater model described above, it is estimated that a total of five (5) extraction wells will be operated across the site extracting 1,800 gpm. The pumping wells to be used for groundwater collection include EW3 and RW3 pumping at 300 gpm each and EW1, RW1, and RW1A pumping at 400 gpm each. Wells EW1, RW1, and EW3 have been installed and are being operated as part of the IRM. These wells are connected via an existing 12-inch forced main. The extraction system will be expanded by the installation of well RW3 near the western boundary of the site and RW1A as a deeper well adjacent to RW1. The groundwater collection system will be evaluated after it becomes operational to determine if additional extraction wells are needed and if so, the extraction system will be modified. A process flow schematic showing the conceptual layout of the groundwater extraction and treatment system is shown in Figure 4.

Model layers 1, 2, and 3 will be targeted for control for the following reasons:

- Based upon the RI data the majority of the contaminated groundwater is present on-site in the Upper and Intermediate Magothy Aquifer.
- Typically, the concentration of contaminants in the Lower Magothy are significantly lower then in the Upper and Intermediate Magothy.
- The injection and extraction wells of the non-contact cooling system are screened in model layers 2 and 3. The historic extraction and injection of water into model layers 2 and 3 encouraged contaminant transport/migration into these layers.

7.3 Selected Recharge Basin Remedial Alternative (4)

The selected alternative for the recharge basin sediments consists of a deed restriction which limits the use of the basins. A covenant precluding the removal or filling of the recharge basins would prevent unacceptable contact with the recharge basin sediments. Further controls such as a fence will be maintained around the basins to further restrict access to the basins. In addition, the site will be posted to indicate that contaminated materials are present and that trespassing, swimming and fishing are prohibited. Groundwater monitoring would be implemented to evaluate the effectiveness of this remedy.

This remedy provides for short-term and long-term protection of human health and the environment. The quantitative risk assessment for ingestion, dermal contact, and soil inhalation of the recharge basin sediments identified potential sub-chronic, chronic, and carcinogenic risks associated with ingestion and dermal contact. Potential risks would be present only if sediments from the recharge basins become accessible for contact. Given current usage of the basins, the sediments contained in them are on the bottom under as much as twenty feet of water. Thus the sediments are not exposed or accessible to human contact. Provided that the basins continue to be used as recharge basins and the basins remain restricted by means of fencing, the sediments contained in the basins will not become accessible for human receptor contact. Therefore, potential risks posed by ingestion and/or dermal contact with contaminated sediments can effectively be avoided.

In evaluating cost benefits between the deed restriction alternative (present worth of $1.3M), the sediment dredging (present worth of $9.6M), and sediment excavation (present worth $8.5M), there is an added cost of approximately $8.3M associated with the hydraulic dredging alternative and an added cost of $7.2M associated with the sediment excavation alternative. However, based on the cost for sediment dredging or excavation, and considering that a deed restriction would also be sufficiently protective of human health and the groundwater, with a lower likelihood for groundwater impact to occur, a deed restriction, together with fencing, posting of signs and continued groundwater monitoring is the recommended remedy for the recharge basins.

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9. *TAGM # HWR-94-4046, Determination of Soil Cleanup Objectives and Cleanup Level,*. NYSDEC, 1994.

10. *Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States*, H.T. Shacklette and J.G. Boerngen, United States Geological Survey, Professional Paper 1270.

TABLES

H2M GROUP

Table 1
RI Groundwater Quality Evaluation
Lockheed Martin
Great Neck, NY

Compound	Minumum to Maximum Concentration	Number of Samples Above Background (54 total)	NYS MCLs
	Micrograms/Liter		
1,1 Dichloroethene	ND to 2J	0	5
1,2 - Dichloroethene (total)	2 to 11,000	54	5
1,1,1 - Trichloroethane	ND to 120	1 (25GL)	5
Trichloroethene	ND to 320	51	5
Tetrachloroethene	ND to 350	52	5
Freon 113	ND to 77	5	5
Phenol	ND to 2,100	1 (15ML)	50
Diethylphthalate	ND to 1J	0	50
Di-n-butylphthalate	ND to 0.6J	0	50
Butylbenzylphthalate	ND to 0.7J	0	50
Heptachlor	ND to 0.034J	0	0.4

ND Not detected
J Value is estimated - compound detected below the practical quantitation limit.
B Compound detected in either the field blank, trip blank and/or laboratory blank

H2M GROUP

Table 2A
RI Soil Quality Evaluation - Inorganics
Loral Defense Systems East Great Neck, NY

Compound	RI	Dry Well Soil Sample Results			TAGM 94-4046	
	Background Sample	Minumum to Maximum Concentration	Average Concentration	Samples Above Background, NYSDEC Soil Cleanup Objectives, and Eastern US Background	Eastern US Background	NYS Recomended Soil Clean-Up Objectives
	Miligrams per Kilogram					
Aluminum	21,100	1,270 to 20,600	5247	- - -	33,000	SB
Arsenic	8.8	0.23 to 6.4	1.9	- - -	3-12	7.5 or SB
Barium	63.9	6.9 to 491	80	- - -	15-600	300 or SB
Beryllium	0.77B	ND to 2.6	0.62	G(2.6)	0-1.75	0.16 or SB
Cadmium	ND	ND to 23.9	4.2	G(23.9)	0.1-1	10
Chromium	23.9	ND to 670J	81	D(55), G(670)	1.5-40	50
Cobalt	7B	1.8 to 98.8	13	G(98.8)	2.5-60	30 or SB
Lead	82.3	2.2J to 9,780J	1041	G(9,780)	200-500	400*
Magnesium	2290	400 to 15,300	2295	G(15,300)	100-5000	SB
Manganese	379	39.1 to 254	117	- - -	50-5000	SB
Mercury	0.06B	ND to 23.1	2.8	G(23.1), C(0.52), D(1.6), I(2.2)	0.001-0.2	0.1
Nickel	28.5	12.6 to 679	80	G(679)	0.5-25	13 or SB
Selenium	0.83B	ND to 9.4	1.4	G(9.4)	0.1-3.9	2 or SB
Silver	ND	ND to 6.7J	1.2	- - -	0.01 - 5.0	SB
Vanadium	50.9	ND to 36.8	11	- - -	1-300	150 or SB
Zinc	55.7	ND to 4,350	52	G(4,350), C(95), D(140), H(95), I(416)	9-50	20 or SB
Cyanide	ND	ND to 11.3	3.6	- - -	NA	Site-Specific

ND Not detected
J Value is estimated - compound detected below the practical quantitation limit.
B Compound detected in either the field blank, trip blank and/or laboratory blank
SB Site Background
A= B15(10-12'), B= B15(18-20'), C= B16(13-15'), D=B16(19-21'), E= B17(16-18'), F= B17(18-20'), G= B18(6-8')
H= B18(22-24'), I= B19(6-8'), J= B19(18-20')
* TheEPA's Interim Lead Hazard Guidance establishes a residential screening level of 400 ppm.

H2M GROUP

Table 2B
RI Soil Quality Evaluation - Organics
Lockheed Martin
Great Neck, NY

Compound	RI Background Sample	Dry Well Soil Sample Results: Minumum to Maximum Concentration	Dry Well Soil Sample Results: Number of Samples Above Cleanup Objective	Dry Well Soil Sample Results: Average Concentration	Site-Specific Soil Clean-Up Objectives[(a)]
	Miligrams per Kilogram				
1,2 - Dichloroethene (total)	ND	ND to 160J	G	16.842	0.885
1,1,1 - Trichloroethane	ND	ND to 65J	G	7.342	2.28
Trichloroethene	ND	ND to 7,800	C, E, G, H, I	834.7	1.89
Benzene	ND	ND to 0.096J	0	0.018	0.174
Tetrachloroethene	ND	0.002J to 18,000	C, D, E, F. G. H. I. J	2436.7	4.155
Toluene	ND	ND to 280B	I	28.84	4.5
Chlorobenzene	ND	ND to 61J	G	6.942	4.95
Ethylbenzene	ND	ND to 440J	G, I	50.422	16.5
Xylene (total)	ND	ND to 3,200	C, E, G, H, I	366.5	3.6
Phenol	ND	ND to 27	I, J	2.98	0.33
1,3 - Dichlorobenzene	ND	ND to 7.3J	I	0.737	4.65
1,4 - Dichlorobenzene	ND	ND to 14J	---	1.814	25.5
1,2 - Dichlorobenzene	ND	ND to 89	I	11.43	23.97
4 - Methylphenol	ND	ND to 87	I	8.99	2.55
2,4 - Dimethylphenol	ND	ND to 54	---	5.697	unknown
1,2,4 - Trichlorobenzene	ND	ND TO 2.1J	---	0.21	10.05
Napthalene	ND	ND to 28J	---	5.318	39
2 - Methylnaphthalene	ND	ND to 9.7J	---	2.116	109.05
Fluorene	ND	ND to 0.34J	---	0.034	1095
Phenanthrene	0.34J	ND to 4.6J	---	1.646	654.75
Anthracene	0.023J	ND to 0.18J	---	0.029	2100
Di-n-butylphthalate	0.018J	ND to 210B	G	21.0	24.3
Fluoranthene	0.42	ND to 1.1J	---	0.189	5700
Pyrene	0.52	ND to 1.5J	---	0.377	1994.25
Benzo(a)anthracene	0.190J	ND to 0.49J	---	0.057	8.28
Chrysene	0.340J	ND to 0.5J	---	0.069	1.2
bis(2-ethylhexy)phthalate	0.053J	ND to 6.0	---	2.245	1305.9
Benzo(b)fluoranthene	0.260J	ND to 0.50J	---	0.059	3.3
Benzo(k)fluoranthene	0.200J	ND to 0.60J	---	0.068	3.3
Indeno(1,2,3-cd)pyrene	0.110J	ND to 0.059J	---	0.006	9.6
Benzo(g,h,i)perylene	0.020J	ND to 0.049J	---	0.005	24000
Heptachlor	ND	ND to 0.031J	---	0.006	0.36
Aldrin	ND	ND to 0.22J	---	0.027	2.88
Endosulfan II	ND	ND to 0.084	---	0.014	2.4093
4,4' - DDD	ND	ND to 0.091J	---	0.036	23.1
Endosulfan Sulfate	ND	ND to 0.025J	---	0.005	3.0114
4,4' - DDT	140	ND to 0.068J	---	0.009	7.29
alpha - Chlordane	ND	ND to 0.14J	---	0.015	unknown
gamma - Chlordane	ND	ND to 0.022J	---	0.004	unknown
Arochlor - 1242	ND	ND to 3.8J	---	0.443	5.253
Arochlor - 1248	ND	ND to 0.41	---	0.071	5.253
Arochlor - 1254	ND	ND to 3.9	---	0.698	5.253
Arochlor - 1260	ND	ND to 1.8J	---	0.31	5.253

ND Not detected
J Value is estimated - compound detected below the practical quantitation limit.
B Compound detected in either the field blank, trip blank and/or laboratory blank
A= B15(10-12'), B= B15(18-20'), C= B16(13-15'), D=B16(19-21'), E= B17(16-18'), F= B17(18-20'), G= B18(6-8')
H= B18(22-24'), I= B19(6-8'), J= B19(18-20')
(a)= Developed in accordance with NYSDEC TAGM HWR 94-4046

H2MGROUP

Table 2C
RI Recharge Basin Sediment Evaluation - Organics
Lockheed Martin
Great Neck, NY

Compound	RI Background Sample	Recharge Basin Sediment Samples: Minumum to Maximum Concentration	Recharge Basin Sediment Samples: Samples Above Cleanup Objective	Recharge Basin Sediment Samples: Average Concentration	Site-Specific Soil Clean-Up Objectives[a]
	Miligrams per Kilogram				
Carbon disulfide	ND	ND to 0.002	---	---	8.1
1,2 - Dichloroethene (total)	ND	ND to 0.003	---	---	0.885
Trichloroethene	ND	ND to 0.010	---	---	1.89
Tetrachloroethene	ND	ND to 0.016	---	---	4.155
Toluene	ND	ND to 0.004	---	---	4.5
Xylene (total)	ND	ND to 0.0015	---	---	3.6
Napthalene	ND	ND to 0.47	---	---	39
2 - Methylnaphthalene	ND	ND to 0.26	---	---	109.05
Acenaphthylene	ND	ND to 0.48	---	---	123
Acenaphthene	ND	ND to 4.9	---	---	276
Dibenzofuran	ND	ND to0.73	---	---	18.45
Fluorene	ND	ND to 4.6	---	---	1095
Phenanthrene	0.34J	0.48 to 12	---	---	654.75
Anthracene	0.023J	0.0.1 to 9.3	---	---	2100
Carbazole	ND	ND to 0.12	---	---	unknown
Di-n-butylphthalate	0.018J	ND to 1.2	---	---	24.3
Fluoranthene	0.42	1 to 60	---	---	5700
Pyrene	0.52	0.13 to 48	---	---	1994.25
Benzo(a)anthracene	0.190J	ND to 31	S	5.28	8.28
Chrysene	0.340J	0.85 to 31	K, L, O, P, Q, R, S, T	7.67	1.2
bis(2-ethylhexy)phthalate	0.053J	ND to 7.3B	---	---	1305.9
Benzo(b)fluoranthene	0.260J	0.074J to 23	K, O, P, Q, S, T	6.14	3.3
Benzo(k)fluoranthene	0.200J	ND to 33	K, O, Q, S, T	7.21	3.3
Benzo(a)pyrene	ND	0.047J to 28	---	---	33
Dibenzo(a,h)anthracene	ND	ND to 0.36J	---	---	4950000
Indeno(1,2,3-cd)pyrene	0.110J	ND to 16J	Q	2.88	9.6
Benzo(g,h,i)perylene	0.020J	ND to 1.2J	---	---	24000
4,4' - DDE	ND	ND to 0.22J	---	---	13.2
4,4' - DDD	ND	ND to 0.92J	---	---	23.1
4,4' - DDT	140	ND to 0.068J	---	---	7.29
alpha - Chlordane	ND	ND to 0.058J	---	---	unknown
gamma - Chlordane	ND	ND to 0.055	---	---	unknown
Arochlor - 1242	ND	ND to 0.12J	---	---	5.253
Arochlor - 1248	ND	ND to 2.4J	---	---	5.253
Arochlor - 1254	ND	ND to 1.5	---	---	5.253
Arochlor - 1260	ND	ND to 0.25J	---	---	5.253

ND Not detected
J Value is estimated - compound detected below the practical quantitation limit.
B Compound detected in either the field blank, trip blank and/or laboratory blank
K= EB1, L= EB2, M= EB3, N= EB4, O= CB1, P= CB2, Q= CB3, R= CB4, S= WB1, T= WB2 (see Figure 6-1 in the RI report)
(a)= Developed in accordance with NYSDEC TAGM HWR 94-4046.

Table 2D
RI Recharge Basin Sediment Evaluation - Inorganics
Lockheed Martin
Great Neck, NY

Compound	RI	Recharge Basin Sediment Samples			TAGM 94-4046	
	Background Sample	Minumum to Maximum Concentration	Samples Above Background, NYSDEC Soil Cleanup Objectives, and Eastern US Background	Average Concentration	Eastern US Background	NYS Recomended Soil Clean-Up Objectives
	Miligrams per Kilogram					
Aluminum	21,100	5,140 to 18,500	- - -	7817.0	33,000	SB
Arsenic	8.8	.76-18.6	L, O	7.7	3-12	7.5 or SB
Barium	63.9	15.5-35.1	- - -	56.6	15-600	300 or SB
Beryllium	0.77B	ND	- - -	0.4	0-1.75	0.16 or SB
Cadmium	ND	ND to .65	- - -	4.3	0.1-1	10
Chromium	23.9	14.1-171	K, L, M, O, P, Q, T	79.6	1.5-40	50
Cobalt	7B	2-15.3	- - -	7.5	2.5-60	400*
Lead	82.3	12.8-1,470	L, O, Q, T, P, K	677.6	200-500	SB
Magnesium	2290	804-6,510	O	2852.4	100-5000	SB
Manganese	379	38.9-160	- - -	89.7	50-5000	SB
Mercury	0.06B	ND-3.4	K, L, M, O, P, Q, R, S, T	1.4	0.001-0.2	0.1
Nickel	28.5	ND-119	K, L, M, O, P, Q, S, T	50.2	0.5-25	13 or SB
Selenium	0.83B	ND-6	L	1.4	0.1-3.9	2 or SB
Silver	ND	2.4-626	K, L, M, O, P, Q, R, S, T	246.3	0.01 - 5.0	SB
Vanadium	50.9	17.5-256	- - -	103.4	1-300	150 or SB
Zinc	55.7	107-1,770	K, L, M, N, O, P, Q, R, S, T	656.6	9-50	20 or SB
Cyanide	ND	ND-29.2	- - -	8.5	NA	Site-Specific

ND Not detected
J Value is estimated - compound detected below the practical quantitation limit.
B Compound detected in either the field blank, trip blank and/or laboratory blank
SB Site Background
K= EB1, L= EB2, M= EB3, N= EB4, O= CB1, P= CB2, Q= CB3, R= CB4, S= WB1, T= WB2 (see Figure 6-1 in the RI report)
* TheEPA's Interim Lead Hazard Guidance establishes a residential screening level of 400 ppm.

Table 3
Remedial Action Objectives
Lockheed Martin
Great Neck, NY

Environmental Media	Remedial Action Objectives (RAOs)
Groundwater	<u>Human Health</u> Prevent ingestion of water having concentrations in excess of the following: <u>Constituent</u> <u>Concentration</u> 1,2-DCE 5 ug/L TCE 5 ug/L PCE 5 ug/L Freon 113 5 ug/L
Soil	<u>Groundwater Protection</u> Prevent migration of constituents that would impact groundwater. The constituents and corresponding cleanup goals are as follows: <u>Constituent</u> <u>Concentration</u> 1,2-DCE 0.885 mg/Kg TCE 1.89 mg/Kg PCE 4.15 mg/Kg Xylene 3.6 mg/Kg Ethylbenzene 16.5 mg/Kg Beryllium 1.75 mg/Kg Cadmium 10 mg/Kg Chromium 50 mg/Kg Cobalt 60 mg/Kg Lead 500 mg/Kg Magnesium 5,000 mg/Kg Mercury .20 mg/Kg Nickel 25 mg/Kg Selenium 3.9 mg/Kg Zinc 50 mg/Kg
Recharge Basin Sediments	<u>Human Health</u> Prevent ingestion and dermal contact of soil particles having concentrations in excess of the following: <u>Constituent</u> <u>Concentration</u> Arsenic 12 mg/Kg Chromium 50 mg/Kg Lead 500 mg/Kg Magnesium 5,000 mg/Kg Mercury .20 mg/Kg Nickel 25 mg/Kg Selenium 3.9 mg/Kg Silver 5 mg/Kg Zinc 50 mg/Kg

TABLES

Table 1
RI Groundwater Quality Evaluation
Lockheed Martin
Great Neck, NY

Compound	Minumum to Maximum Concentration	Number of Samples Above Background (54 total)	NYS MCLs
	Micrograms/Liter		
1,1 Dichloroethene	ND to 2J	0	5
1,2 - Dichloroethene (total)	2 to 11,000	54	5
1,1,1 - Trichloroethane	ND to 120	1 (25GL)	5
Trichloroethene	ND to 320	51	5
Tetrachloroethene	ND to 350	52	5
Freon 113	ND to 77	5	5
Phenol	ND to 2,100	1 (15ML)	50
Diethylphthalate	ND to 1J	0	50
Di-n-butylphthalate	ND to 0.6J	0	50
Butylbenzylphthalate	ND to 0.7J	0	50
Heptachlor	ND to 0.034J	0	0.4

ND Not detected
J Value is estimated - compound detected below the practical quantitation limit.
B Compound detected in either the field blank, trip blank and/or laboratory blank

H2M GROUP

Table 2A
RI Soil Quality Evaluation - Inorganics
Loral Defense Systems East Great Neck, NY

Compound	RI Background Sample	Dry Well Soil Sample Results: Minumum to Maximum Concentration	Average Concentration	Samples Above Background, NYSDEC Soil Cleanup Objectives, and Eastern US Background	TAGM 94-4046: Eastern US Background	NYS Recomended Soil Clean-Up Objectives
	Miligrams per Kilogram					
Aluminum	21,100	1,270 to 20,600	5247	- - -	33,000	SB
Arsenic	8.8	0.23 to 6.4	1.9	- - -	3-12	7.5 or SB
Barium	63.9	6.9 to 491	80	- - -	15-600	300 or SB
Beryllium	0.77B	ND to 2.6	0.62	G(2.6)	0-1.75	0.16 or SB
Cadmium	ND	ND to 23.9	4.2	G(23.9)	0.1-1	10
Chromium	23.9	ND to 670J	81	D(55), G(670)	1.5-40	50
Cobalt	7B	1.8 to 98.8	13	G(98.8)	2.5-60	30 or SB
Lead	82.3	2.2J to 9,780J	1041	G(9,780)	200-500	400*
Magnesium	2290	400 to 15,300	2295	G(15,300)	100-5000	SB
Manganese	379	39.1 to 254	117	- - -	50-5000	SB
Mercury	0.06B	ND to 23.1	2.8	G(23.1), C(0.52), D(1.6), I(2.2)	0.001-0.2	0.1
Nickel	28.5	12.6 to 679	80	G(679)	0.5-25	13 or SB
Selenium	0.83B	ND to 9.4	1.4	G(9.4)	0.1-3.9	2 or SB
Silver	ND	ND to 6.7J	1.2	- - -	0.01 - 5.0	SB
Vanadium	50.9	ND to 36.8	11	- - -	1-300	150 or SB
Zinc	55.7	ND to 4,350	52	G(4,350), C(95), D(140), H(95), I(416)	9-50	20 or SB
Cyanide	ND	ND to 11.3	3.6	- - -	NA	Site-Specific

ND Not detected
J Value is estimated - compound detected below the practical quantitation limit.
B Compound detected in either the field blank, trip blank and/or laboratory blank
SB Site Background
A= B15(10-12'), B= B15(18-20'), C= B16(13-15'), D=B16(19-21'), E= B17(16-18'), F= B17(18-20'), G= B18(6-8')
H= B18(22-24'), I= B19(6-8'), J= B19(18-20')
* TheEPA's Interim Lead Hazard Guidance establishes a residential screening level of 400 ppm.

H2M GROUP

Table 2B
RI Soil Quality Evaluation - Organics
Lockheed Martin
Great Neck, NY

Compound	RI Background Sample	Dry Well Soil Sample Results: Minumum to Maximum Concentration	Dry Well Soil Sample Results: Number of Samples Above Cleanup Objective	Dry Well Soil Sample Results: Average Concentration	Site-Specific Soil Clean-Up Objectives[a]
	Miligrams per Kilogram				
1,2 - Dichloroethene (total)	ND	ND to 160J	G	16.842	0.885
1,1,1 - Trichloroethane	ND	ND to 65J	G	7.342	2.28
Trichloroethene	ND	ND to 7,800	C, E, G, H, I	834.7	1.89
Benzene	ND	ND to 0.096J	0	0.018	0.174
Tetrachloroethene	ND	0.002J to 18,000	C, D, E, F. G. H. I. J	2436.7	4.155
Toluene	ND	ND to 280B	I	28.84	4.5
Chlorobenzene	ND	ND to 61J	G	6.942	4.95
Ethylbenzene	ND	ND to 440J	G, I	50.422	16.5
Xylene (total)	ND	ND to 3,200	C, E, G, H, I	366.5	3.6
Phenol	ND	ND to 27	I, J	2.98	0.33
1,3 - Dichlorobenzene	ND	ND to 7.3J	I	0.737	4.65
1,4 - Dichlorobenzene	ND	ND to 14J	---	1.814	25.5
1,2 - Dichlorobenzene	ND	ND to 89	I	11.43	23.97
4 - Methylphenol	ND	ND to 87	I	8.99	2.55
2,4 - Dimethylphenol	ND	ND to 54	---	5.697	unknown
1,2,4 - Trichlorobenzene	ND	ND TO 2.1J	---	0.21	10.05
Napthalene	ND	ND to 28J	---	5.318	39
2 - Methylnaphthalene	ND	ND to 9.7J	---	2.116	109.05
Fluorene	ND	ND to 0.34J	---	0.034	1095
Phenanthrene	0.34J	ND to 4.6J	---	1.646	654.75
Anthracene	0.023J	ND to 0.18J	---	0.029	2100
Di-n-butylphthalate	0.018J	ND to 210B	G	21.0	24.3
Fluoranthene	0.42	ND to 1.1J	---	0.189	5700
Pyrene	0.52	ND to 1.5J	---	0.377	1994.25
Benzo(a)anthracene	0.190J	ND to 0.49J	---	0.057	8.28
Chrysene	0.340J	ND to 0.5J	---	0.069	1.2
bis(2-ethylhexy)phthalate	0.053J	ND to 6.0	---	2.245	1305.9
Benzo(b)fluoranthene	0.260J	ND to 0.50J	---	0.059	3.3
Benzo(k)fluoranthene	0.200J	ND to 0.60J	---	0.068	3.3
Indeno(1,2,3-cd)pyrene	0.110J	ND to 0.059J	---	0.006	9.6
Benzo(g,h,i)perylene	0.020J	ND to 0.049J	---	0.005	24000
Heptachlor	ND	ND to 0.031J	---	0.006	0.36
Aldrin	ND	ND to 0.22J	---	0.027	2.88
Endosulfan II	ND	ND to 0.084	---	0.014	2.4093
4,4' - DDD	ND	ND to 0.091J	---	0.036	23.1
Endosulfan Sulfate	ND	ND to 0.025J	---	0.005	3.0114
4,4' - DDT	140	ND to 0.068J	---	0.009	7.29
alpha - Chlordane	ND	ND to 0.14J	---	0.015	unknown
gamma - Chlordane	ND	ND to 0.022J	---	0.004	unknown
Arochlor - 1242	ND	ND to 3.8J	---	0.443	5.253
Arochlor - 1248	ND	ND to 0.41	---	0.071	5.253
Arochlor - 1254	ND	ND to 3.9	---	0.698	5.253
Arochlor - 1260	ND	ND to 1.8J	---	0.31	5.253

ND Not detected
J Value is estimated - compound detected below the practical quantitation limit.
B Compound detected in either the field blank, trip blank and/or laboratory blank
A= B15(10-12'), B= B15(18-20'), C= B16(13-15'), D=B16(19-21'), E= B17(16-18'), F= B17(18-20'), G= B18(6-8')
H= B18(22-24'), I= B19(6-8'), J= B19(18-20')
(a)= Developed in accordance with NYSDEC TAGM HWR 94-4046

Table 2C
RI Recharge Basin Sediment Evaluation - Organics
Lockheed Martin
Great Neck, NY

Compound	RI Background Sample	Recharge Basin Sediment Samples: Minumum to Maximum Concentration	Samples Above Cleanup Objective	Average Concentration	Site-Specific Soil Clean-Up Objectives[(a)]
	Miligrams per Kilogram				
Carbon disulfide	ND	ND to 0.002	---	---	8.1
1,2 - Dichloroethene (total)	ND	ND to 0.003	---	---	0.885
Trichloroethene	ND	ND to 0.010	---	---	1.89
Tetrachloroethene	ND	ND to 0.016	---	---	4.155
Toluene	ND	ND to 0.004	---	---	4.5
Xylene (total)	ND	ND to 0.0015	---	---	3.6
Napthalene	ND	ND to 0.47	---	---	39
2 - Methylnaphthalene	ND	ND to 0.26	---	---	109.05
Acenaphthylene	ND	ND to 0.48	---	---	123
Acenaphthene	ND	ND to 4.9	---	---	276
Dibenzofuran	ND	ND to0.73	---	---	18.45
Fluorene	ND	ND to 4.6	---	---	1095
Phenanthrene	0.34J	0.48 to 12	---	---	654.75
Anthracene	0.023J	0.0.1 to 9.3	---	---	2100
Carbazole	ND	ND to 0.12	---	---	unknown
Di-n-butylphthalate	0.018J	ND to 1.2	---	---	24.3
Fluoranthene	0.42	1 to 60	---	---	5700
Pyrene	0.52	0:13 to 48	---	---	1994.25
Benzo(a)anthracene	0.190J	ND to 31	S	5.28	8.28
Chrysene	0.340J	0.85 to 31	K, L, O, P, Q, R, S, T	7.67	1.2
bis(2-ethylhexy)phthalate	0.053J	ND to 7.3B	---	---	1305.9
Benzo(b)fluoranthene	0.260J	0.074J to 23	K, O, P, Q, S, T	6.14	3.3
Benzo(k)fluoranthene	0.200J	ND to 33	K, O, Q, S, T	7.21	3.3
Benzo(a)pyrene	ND	0.047J to 28	---	---	33
Dibenzo(a,h)anthracene	ND	ND to 0.36J	---	---	4950000
Indeno(1,2,3-cd)pyrene	0.110J	ND to 16J	Q	2.88	9.6
Benzo(g,h,i)perylene	0.020J	ND to 1.2J	---	---	24000
4,4' - DDE	ND	ND to 0.22J	---	---	13.2
4,4' - DDD	ND	ND to 0.92J	---	---	23.1
4,4' - DDT	140	ND to 0.068J	---	---	7.29
alpha - Chlordane	ND	ND to 0.058J	---	---	unknown
gamma - Chlordane	ND	ND to 0.055	---	---	unknown
Arochlor - 1242	ND	ND to 0.12J	---	---	5.253
Arochlor - 1248	ND	ND to 2.4J	---	---	5.253
Arochlor - 1254	ND	ND to 1.5	---	---	5.253
Arochlor - 1260	ND	ND to 0.25J	---	---	5.253

ND Not detected
J Value is estimated - compound detected below the practical quantitation limit.
B Compound detected in either the field blank, trip blank and/or laboratory blank
K= EB1, L= EB2, M= EB3, N= EB4, O= CB1, P= CB2, Q= CB3, R= CB4, S= WB1, T= WB2 (see Figure 6-1 in the RI report)
(a)= Developed in accordance with NYSDEC TAGM HWR 94-4046.

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Table 2D
RI Recharge Basin Sediment Evaluation - Inorganics
Lockheed Martin
Great Neck, NY

Compound	RI Background Sample	Recharge Basin Sediment Samples: Minumum to Maximum Concentration	Recharge Basin Sediment Samples: Samples Above Background, NYSDEC Soil Cleanup Objectives, and Eastern US Background	Recharge Basin Sediment Samples: Average Concentration	TAGM 94-4046: Eastern US Background	TAGM 94-4046: NYS Recomended Soil Clean-Up Objectives
	Miligrams per Kilogram					
Aluminum	21,100	5,140 to 18,500	- - -	7817.0	33,000	SB
Arsenic	8.8	.76-18.6	L, O	7.7	3-12	7.5 or SB
Barium	63.9	15.5-35.1	- - -	56.6	15-600	300 or SB
Beryllium	0.77B	ND	- - -	0.4	0-1.75	0.16 or SB
Cadmium	ND	ND to .65	- - -	4.3	0.1-1	10
Chromium	23.9	14.1-171	K, L, M, O, P, Q, T	79.6	1.5-40	50
Cobalt	7B	2-15.3	- - -	7.5	2.5-60	400*
Lead	82.3	12.8-1,470	L, O, Q, T, P, K	677.6	200-500	SB
Magnesium	2290	804-6,510	O	2852.4	100-5000	SB
Manganese	379	38.9-160	- - -	89.7	50-5000	SB
Mercury	0.06B	ND-3.4	K, L, M, O, P, Q, R, S, T	1.4	0.001-0.2	0.1
Nickel	28.5	ND-119	K, L, M, O, P, Q, S, T	50.2	0.5-25	13 or SB
Selenium	0.83B	ND-6	L	1.4	0.1-3.9	2 or SB
Silver	ND	2.4-626	K, L, M, O, P, Q, R, S, T	246.3	0.01 - 5.0	SB
Vanadium	50.9	17.5-256	- - -	103.4	1-300	150 or SB
Zinc	55.7	107-1,770	K, L, M, N, O, P, Q, R, S, T	656.6	9-50	20 or SB
Cyanide	ND	ND-29.2	- - -	8.5	NA	Site-Specific

ND Not detected
J Value is estimated - compound detected below the practical quantitation limit.
B Compound detected in either the field blank, trip blank and/or laboratory blank
SB Site Background
K= EB1, L= EB2, M= EB3, N= EB4, O= CB1, P= CB2, Q= CB3, R= CB4, S= WB1, T= WB2 (see Figure 6-1 in the RI report)
* TheEPA's Interim Lead Hazard Guidance establishes a residential screening level of 400 ppm.

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Table 3
Remedial Action Objectives
Lockheed Martin
Great Neck, NY

Environmental Media	Remedial Action Objectives (RAOs)
Groundwater	Human Health Prevent ingestion of water having concentrations in excess of the following: Constituent / Concentration 1,2-DCE 5 ug/L TCE 5 ug/L PCE 5 ug/L Freon 113 5 ug/L
Soil	Groundwater Protection Prevent migration of constituents that would impact groundwater. The constituents and corresponding cleanup goals are as follows: Constituent / Concentration 1,2-DCE 0.885 mg/Kg TCE 1.89 mg/Kg PCE 4.15 mg/Kg Xylene 3.6 mg/Kg Ethylbenzene 16.5 mg/Kg Beryllium 1.75 mg/Kg Cadmium 10 mg/Kg Chromium 50 mg/Kg Cobalt 60 mg/Kg Lead 500 mg/Kg Magnesium 5,000 mg/Kg Mercury .20 mg/Kg Nickel 25 mg/Kg Selenium 3.9 mg/Kg Zinc 50 mg/Kg
Recharge Basin Sediments	Human Health Prevent ingestion and dermal contact of soil particles having concentrations in excess of the following: Constituent / Concentration Arsenic 12 mg/Kg Chromium 50 mg/Kg Lead 500 mg/Kg Magnesium 5,000 mg/Kg Mercury .20 mg/Kg Nickel 25 mg/Kg Selenium 3.9 mg/Kg Silver 5 mg/Kg Zinc 50 mg/Kg

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Table 4
General Response Actions
Lockheed Martin
Great Neck, NY

Environmental Media	Remedial Action Objectives (RAOs)	General Response Actions (GRAs)
Groundwater	Human Health Prevent ingestion of groundwater having concentrations in excess of the following: Constituent — Concentration 1,2-DCE — 5 ug/L TCE — 5 ug/L PCE — 5 ug/L Freon 113 — 5 ug/L	No Action/Institutional Actions 1. No Action 2. Alternate Water Supply 3. Monitoring Containment Actions 1. Containment Collection/Treatment Actions 1. Collection/Treatment/Discharge 2. In-Situ Groundwater Treatment 3. Water Supply Treatment
	Groundwater Protection Restore aquifer at downgradient property line to the following: Constituent — Concentration 1,2-DCE — 5 ug/L TCE — 5 ug/L PCE — 5 ug/L Freon 113 — 50 ug/L	No Action/Institutional Actions 1. No Action 2. Alternate Water Supply 3. Monitoring Containment Actions 1. Containment Collection/Treatment Actions 1. Collection/Treatment/Discharge 2. In-Situ Groundwater Treatment
Soil	Groundwater Protection Prevent migration of constituents that would impact groundwater: Constituent — Concentration 1,2-DCE — 0.885 mg/Kg TCE — 1.89 mg/Kg PCE — 4.15 mg/Kg Xylene — 3.6 mg/Kg Ethylbenzene — 16.5 mg/Kg Beryllium — 1.75 mg/Kg Cadmium — 10 mg/Kg Chromium — 50 mg/Kg Cobalt — 60 mg/Kg Lead — 500 mg/Kg Magnesium — 5,000 mg/Kg Mercury — .20 mg/Kg Nickel — 25 mg/Kg Selenium — 3.9 mg/Kg Zinc — 50 mg/Kg	No Action/Institutional Actions 1. No Action 2. Monitoring Containment Actions 1. Containment Excavation/Treatment Actions 1. Excavation/Treatment/Disposal 2. In-Situ Soil Treatment

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Table 4 (Continued)
General Response Actions
Lockheed Martin
Great Neck, NY

Environmental Media	Remedial Action Objectives (RAOs)	General Response Actions (GRAs)
Recharge Basin Sediments	Groundwater Protection Prevent migration of constituents that would impact groundwater. The constituents and corresponding cleanup goals are as follows: Constituent — Concentration Chrysene — 1.2 mg/Kg Benzo(b)fluoroanthene — 3.3 mg/Kg Benzo(k)fluoroanthene — 3.3 mg/Kg	No Action/Institutional Actions 1. No Action 2. Monitoring Containment Actions 1. Containment Excavation/Treatment Actions 1. Excavation/Treatment/Disposal 2. In-Situ Soil Treatment
	Human Health Prevent ingestion and dermal contact of soil particles having concentrations in excess of the following: Constituent — Concentration Arsenic — 12 mg/Kg Chromium — 50 mg/Kg Lead — 500 mg/Kg Magnesium — 5,000 mg/Kg Mercury — .20 mg/Kg Nickel — 25 mg/Kg Selenium — 3.9 mg/Kg Silver — 5 mg/Kg Zinc — 50 mg/Kg	No Action/Institutional Actions 1. No Action 2. Monitoring Containment Actions 1. Containment Excavation/Treatment Actions 1. Excavation/Treatment/ Disposal 2. In-Situ Soil Treatment

Table 5
Remedial Technology Types and Process Options
Lockheed Martin
Great Neck, NY

Environmental Media	Remedial Action Objectives (RAOs)	General Response Actions (GRAs)	Remedial Technology Types	Process Options
Groundwater	<u>Human Health</u> Prevent ingestion of groundwater having concentrations in excess of the following: <u>Constituent</u> <u>Concentration</u> 1,2-DCE 5 ug/L TCE 5 ug/L PCE 5 ug/L Freon 113 5 ug/L	<u>No Action/ Institutional Actions</u> 1. No Action 2. Alternate Water Supply 3. Monitoring	<u>No Action/Institutional Options</u> 1. Deed Restrictions 2. Groundwater Monitoring	
		<u>Containment Actions</u> 1. Containment	<u>Containment Technologies</u> 1. Vertical Barriers 2. Horizontal Barriers	 Slurry Walls, Sheet Piling Liners, Grout Injection
	<u>Groundwater Protection</u> Restore aquifer at downgradient property line to the following: <u>Constituent</u> <u>Concentration</u> 1,2-DCE 5 ug/L TCE 5 ug/L PCE 5 ug/L Freon 113 5 ug/L	<u>Collection/Treatment Actions</u> 1. Collection/Treatment/Discharge 2. In-Situ Groundwater Treatment 3. Water Supply Treatment	<u>Extraction Technologies</u> 1. Groundwater Collection	 Pumping Wells, Subsurface Collection
			<u>Treatment Technologies</u> 1. Physical Treatment 2. Chemical Treatment 3. In-situ Treatment 4. Off-Gas Treatment	 Air Stripping, Adsorption UV Oxidation Catalytic Degradation, Air Sparging/ Vapor Extraction, Bioremediation Adsorption, Incineration
			<u>Disposal Technologies</u> 1. Discharge to POTW 2. Discharge to Surface Waters 3. Reinjection	 After Treatment After Treatment After Treatment

Table 5 (Continued)
Remedial Technology Types and Process Options
Lockheed Martin
Great Neck, NY

Environmental Media	Remedial Action Objectives (RAOs)	General Response Actions (GRAs)	Remedial Technology Types	Process Options
Soil	<u>Environmental Protection</u> Prevent migration of constituents that would impact groundwater. The constituents and corresponding cleanup goals are as follows: <u>Constituent</u> — <u>Concentration</u> 1,2-DCE 0.885 mg/Kg TCE 1.89 mg/Kg PCE 4.15 mg/Kg Xylene 3.6 mg/Kg Ethylbenzene 16.5 mg/Kg Beryllium 1.75 mg/Kg Cadmium 10 mg/Kg Chromium 50 mg/Kg Cobalt 60 mg/Kg Lead 500 mg/Kg Magnesium 5,000 mg/Kg Mercury .20 mg/Kg Nickel 25 mg/Kg Selenium 3.9 mg/Kg Zinc 50 mg/Kg	<u>No Action/ Institutional Actions</u> 1. No Action 2. Monitoring <u>Containment Actions</u> 1. Containment <u>Excavation/Treatment Actions</u> 1. Excavation/Treatment/Disposal 2. In-Situ Soil Treatment	<u>No Action/Institutional Options</u> 1. Deed Restrictions <u>Containment Technologies</u> 1. Vertical Barriers 2. Horizontal Barriers 3. Surface Controls <u>Removal Technologies</u> 1. Excavation <u>Treatment Technologies</u> 1. Physical Treatment 2. Chemical Treatment 3. In-Situ Treatment	Slurry Walls, Sheet Piling Liners, Grout Injection Stabilization, Revegetation Solids Excavation Incineration, Desorption, Washing Solvent Extraction, Solidification/Stabilization Vapor Extraction, Surfactant Flushing/Catalytic Degradation, Bioremediation, Vitrification

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Table 5 (Continued)
Remedial Technology Types and Process Options
Lockheed Martin
Great Neck, NY

Environmental Media	Remedial Action Objectives (RAOs)	General Response Actions (GRAs)	Remedial Technology Types	Process Options
Recharge Basin Sediments	Environmental Protection Prevent migration of constituents that would impact groundwater. The constituents and corresponding cleanup goals are as follows: Constituent — Concentration Chrysene — 1.2 mg/Kg Benzo(b)fluoroanthene — 3.3 mg/Kg Benzo(k)fluoroanthene — 3.3 mg/Kg	No Action/ Institutional Actions 1. No Action 2. Monitoring	No Action/Institutional Options 1. Deed Restrictions 2. Fencing	
		Containment Actions 1. Containment	Containment Technologies 1. Vertical Barriers 2. Horizontal Barriers 3. Surface Controls	Slurry Walls, Sheet Piling Liners, Grout Injection Stabilization, Revegetation
	Human Health Prevent ingestion and dermal contact of soil particles having concentrations in excess of the following: Constituent — Concentration Arsenic — 12 mg/Kg Chromium — 50 mg/Kg Lead — 500 mg/Kg Magnesium — 5,000 mg/Kg Mercury — .20 mg/Kg Nickel — 25 mg/Kg Selenium — 3.9 mg/Kg Silver — 5 mg/Kg Zinc — 50 mg/Kg	Excavation/Treatment Actions 1. Excavation/Treatment/Disposal	Removal Technologies 1. Excavation	Solids Excavation
		2. In-Situ Soil Treatment	Treatment Technologies 1. Physical Treatment 2. Chemical Treatment 3. In-Situ Treatment	Incineration, Desorption, Washing Solvent Extraction, Solidification/Stabilization Vapor Extraction, Surfactant Flushing/Catalytic Degradation, Bioremediation, Vitrification

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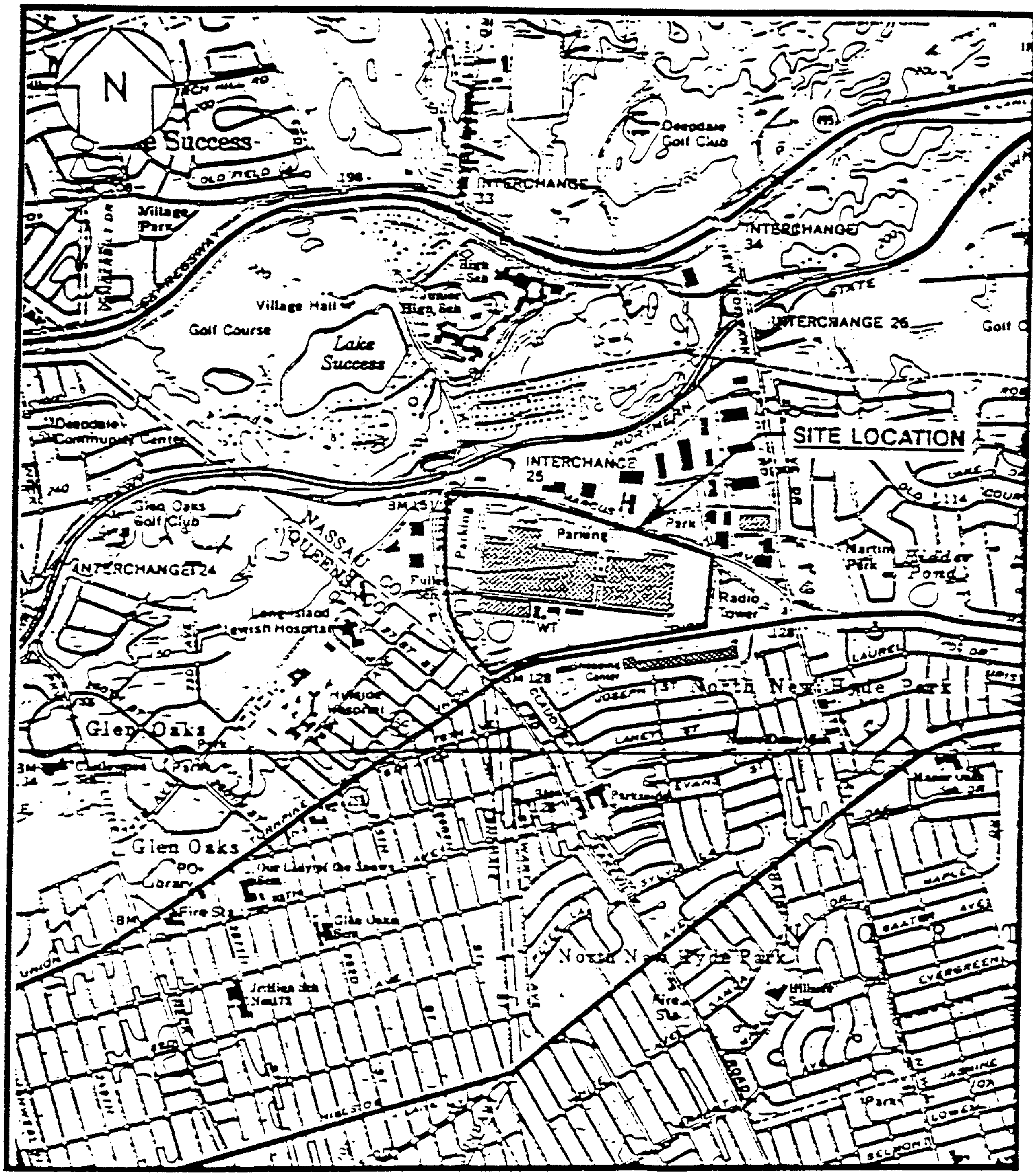
Table 6
Media Specific Remedial Alternatives
Lockheed Martin
Great Neck, NY

Media	Alternative	Remedial Technology	Process Options	Off-Gas Treatment	Discharge	Monitoring
Groundwater	1	Groundwater Collection	Carbon Adsorption	None	Reinjection	2/year groundwater monthly discharge
Groundwater	2	Groundwater Collection	Air Stripping	None	Reinjection	2/year groundwater monthly discharge
Groundwater	2A	Groundwater Collection	Air Stripping	Vapor Phase Carbon Adsorption	Reinjection	2/year groundwater monthly discharge
Groundwater	2B	Groundwater Collection	Air Stripping	Catalytic Incineration	Reinjection	2/year groundwater monthly discharge
Groundwater	3	Groundwater Collection	UV Oxidation	None	Reinjection	2/year groundwater monthly discharge
Soil	1A	Vapor Extraction Soil Removal	Catalytic Incineration	Catalytic Incineration	Atmosphere	1/4ly stack test
Soil	1B	Vapor Extraction Soil Removal	Regenerative Carbon Adsorption	Regenerative Carbon Adsorption	Atmosphere	1/4ly stack test
Recharge Basin Sediment	2	Sediment Removal	Dredging	None	None	Confirmatory Sampling
Recharge Basin Sediment	3	Sediment Removal	Excavation	None	Sewers	Confirmatory Sampling
Recharge Basin Sediment	4	Deed Restrictions	None	None	None	2/year groundwater

FIGURES



SOURCE: USGS QUADRANGLES
SEA CLIFF & LYNBROOK, NY

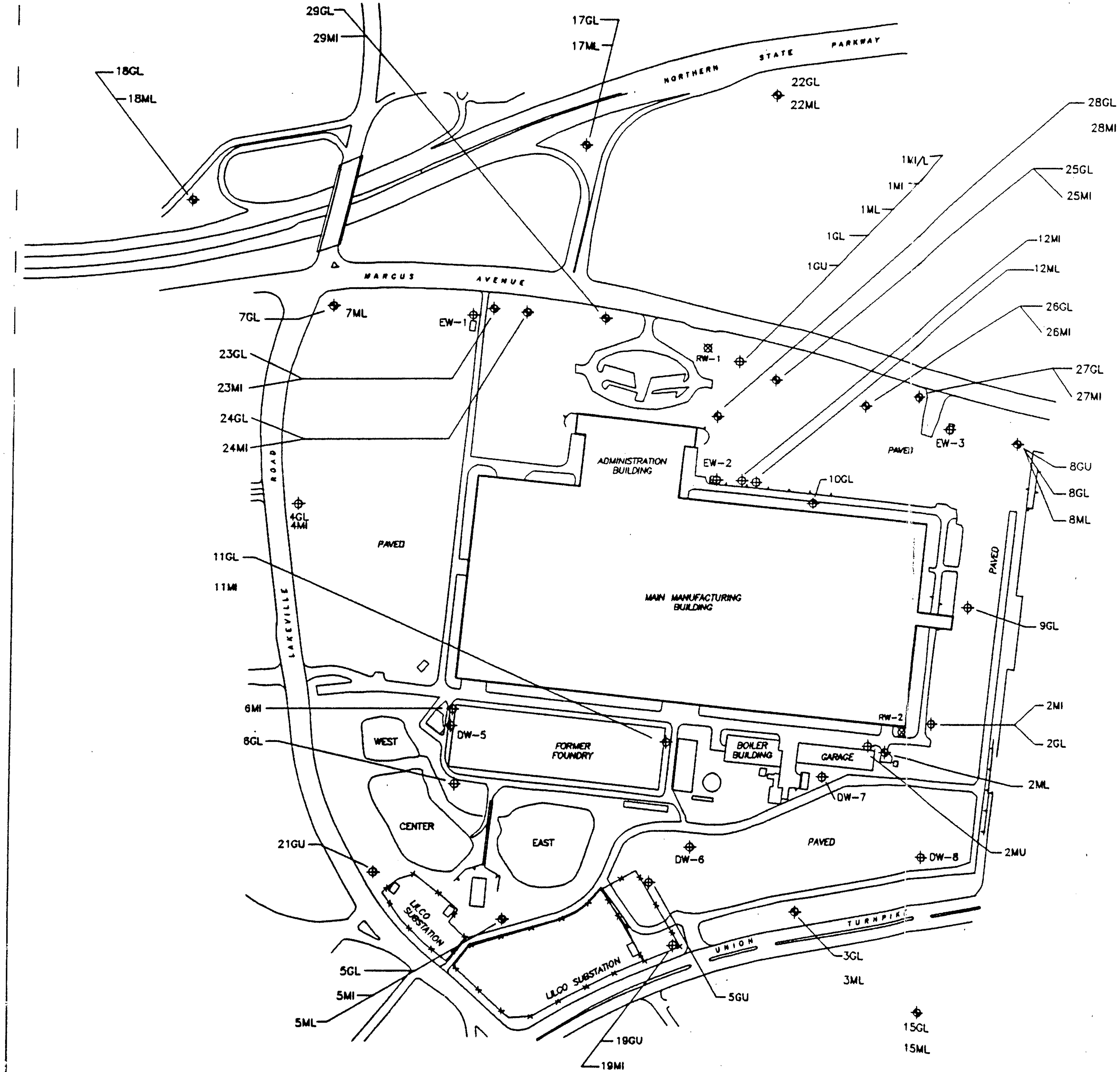
0 2,000

SCALE IN FEET

FIGURE 1
SITE LOCATION MAP

LOCKHEED MARTIN
GREAT NECK, NEW YORK

H2MGROUP ENGINEERS ARCHITECTS PLANNERS SCIENTISTS SURVEYORS
MELVILLE, N.Y. TOTOWA, N.J.



LEGEND

8ML	GROUNDWATER MONITOR WELL
EW-3	GROUNDWATER WELL
GU	GLACIAL UPPER (90–115 ft bg)
GL	GLACIAL LOWER (125–185 ft bg)
MI	MAGOTHY INTERMEDIATE (210–250 ft bg)
ML	MAGOTHY LOWER (300–400 ft bg)
RW	RECOVERY WELL
EW	EXTRACTION WELL
DW	DIFFUSION WELL

FIGURE 2
LOCKHEED MARTIN
GREAT NECK, NEW YORK
MONITORING WELL LOCATION MAP

GRAPHIC SCALE
350 0 175 350
(IN FEET)
1 inch = 350 ft.

H2MGROUP ENGINEERS · ARCHITECTS · PLANNERS · SCIENTISTS · SURVEYORS
MELVILLE, N.Y. TOTOWA, N.J.

APPENDIX A
VOC Mass Calculation for Soil and Groundwater

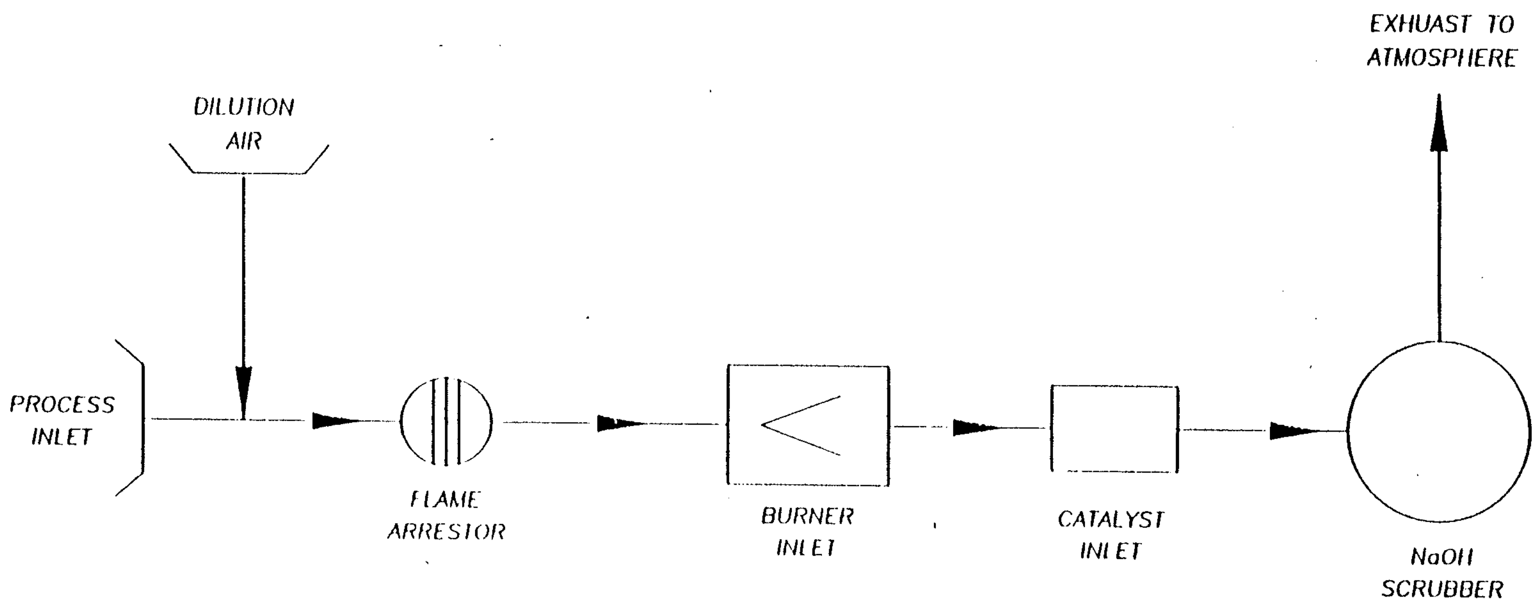
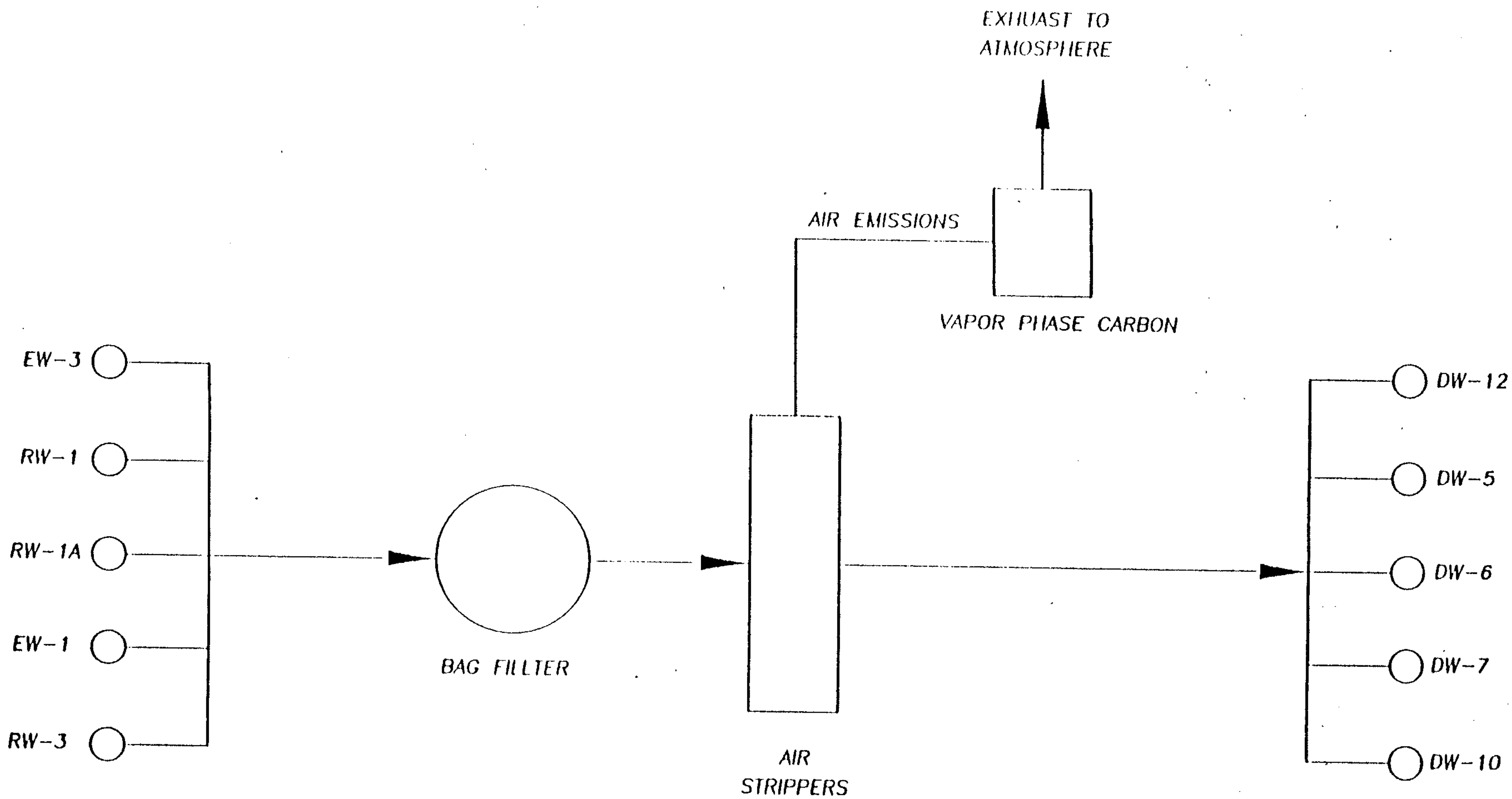


FIGURE 3
LOCKHEED MARTIN
GREAT NECK, NEW YORK
ALTERNATIVE 1A
PROCESS FLOW DIAGRAM



LEGEND

RW-1 RECOVERY WELL

EW-1 EXTRACTION WELL

DW DIFFUSION WELL

FIGURE 4
LOCKHEED MARTIN
GREAT NECK, NEW YORK
ALTERNATIVE 2A
PROCESS FLOW DIAGRAM

APPENDIX A

VOC MASS CALCULATION FOR GROUNDWATER

The mass of VOCs in groundwater under the site was estimated based on RI groundwater sampling results.. The aquifer was subdivided in two layers and the average total volatile organic compound concentration was calculated for each layer. Layer A extends from the top of the water table (elevation 42 feet msl) to the bottom of the lowest extraction well (elevation -140 feet msl) and is 180 feet thick. Layer B extends from the bottom of the lowest extraction well to the top of the Raritan Clay (elevation -350 feet msl) and is 210 feet thick. Results of the VOC mass estimation are contained in Appendix A and are summarized below.

Layer	Average VOC Concentration (ug/kg)	Groundwater Volume (gal)	TVOC Mass (lb)
A	1,000	1.4×10^9	11,700
B	260	1.7×10^9	3,700
Total		**3.1×10^9**	**15,400**

The quantities given above are only estimates and several assumptions were made in order to calculate the mass of TVOCs. These assumptions include the porosity is 0.25 and the RI analytical data is representative of average current groundwater conditions. These quantities will be reevaluated as more data becomes available.

Layer A

Top elevation = 40 msl Average conc. = 1,000 ug/L
Bottom elevation = -140 msl
Thickness = 180 ft
Area = 98 acres = 4.27×10^6 ft^2
Volume of Water = (180 ft.)(4.27×10^6 ft^2)(.25 porosity)(7.48 gal/ft^3)
= 1.4×10^9 gal
Mass VOCs = (1,000 ug/L)(1.4×10^9 gal)(3.785 L/gal)(10^{-9} kg/ug)
= 5,300 kg = 11,700 lb

Layer B

Top elevation = -140 msl Average conc. = 260 ug/L
Bottom elevation = -350 msl
Thickness = 210 ft
Area = 98 acres = 4.27×10^6 ft^2
Volume of Water = (210 ft)(4.27×10^6 ft^2)(.25 porosity)(7.48 gal/ft^3)
= 1.7×10^9 gal
Mass VOCs = (260 ug/L)(1.7×10^9 gal)(3.785L/gal)(10^{-9} ug/kg)
= 1,700 kg = 3,700 lb

Estimated Total VOCs in Groundwater = 15,400 lb

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AVERAGE CONCENTRATION OF TVOC IN LAYER A WELLS
NOVEMBER 1994

WELL #	TOTAL DEPTH	TOP OF CASING ELEVATION	BOTTOM ELEVATION	TOTAL	1,1-DCE	1,2-DCE	TCE	PCE	1,1,1-TC	OTHER
2MI	250	128.57	-121.43	1040	--	760	140	140	--	--
11MI	250	129.39	-120.61	22	--	22	2J	2J	--	--
5MI	250	130.31	-119.69	800	--	560	140	100	--	--
12MI	253	133.61	-119.39	161	--	83	34	44	2J	--
28MI	250	136.57	-113.43	3168	--	3100	--	68	--	77
6MI	240	128.8	-111.2	15	--	15	3J	2J	--	--
19MI	248	137.22	-110.78	675	--	490	110	75	--	--
1MI	255	144.39	-110.61	1560	--	1200	160	200	--	--
26MI	240	130.79	-109.21	174	--	134	16	24	--	8.7
27MI	230	122.24	-107.76	92	--	54	16	22	--	4.1
29MI	250	143.48	-106.52	327	--	260	42	25	--	17
4MI	250	145.1	-104.9	729	--	530	100	99	--	--
25MI	220	135.75	-84.25	3620	--	3300	--	320	--	--
24MI	220	139.97	-80.03	192	--	140	34	18	--	--
23MI	215	138.88	-76.12	17	--	15	1.1	0.8	--	--
2MU	185	125.9	-59.1	1270	--	920	170	180	--	--
27GL	180	121.75	-58.25	80	--	39	23	17	0.8	7.5
26GL	184	130.46	-53.54	95	--	55	25	15	--	--
25GL	170	134.66	-35.34	459	--	39	300	--	120	23
8GL	150	120.32	-29.68	130	2J	62	40	28	--	--
9GL	155	126.94	-28.06	90	2J	41	28	21	1J	--
29GL	170	143.37	-26.63	4940	--	4700	--	240	--	--
18GL	170	150.24	-19.76	330	--	230	64	36	--	6J
2GL	147	128.35	-18.65	281	--	210	33	38	--	--
28GL	150	136.21	-13.79	11000	--	11000	--	--	--	--
11GL	140	129.02	-10.98	930	--	670	100	160	--	--
23GL	150	139.82	-10.18	205	--	140	46	19	--	--
24GL	150	139.89	-10.11	3070	--	2400	320	350	--	--
3GL	149	139.5	-9.5	1090	--	770	160	160	--	--
10GL	132	126.03	-5.97	87	2J	37	27	23	2J	--
4GL	150	144.81	-5.19	618	--	450	100	68	--	--
1GL	147	144.41	-2.59	2430	--	2100	130J	330	--	--

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AVERAGE CONCENTRATION OF TVOC IN LAYER A WELLS
NOVEMBER 1994

WELL #	TOTAL DEPTH	TOP OF CASING ELEVATION	BOTTOM ELEVATION	TOTAL	1,1-DCE	1,2-DCE	TCE	PCE	1,1,1-TC	OTHER
7GL	150	149.76	-0.24	207	--	140	41	26	--	--
5GL	130	130.32	0.32	116	--	81	18	17	--	--
6GL	125	128.3	3.3	90	--	63	15	12	--	7J
1GU	115	143.77	28.77	127	2J	69	35	23	2J	--
8GU	90	120.42	30.42	65	2J	30	19	16	2J	--
21GU	98	132.85	34.85	6	1	3	2	--	--	--
5GU	95	131.32	36.32	265	--	180	43	42	--	--
19GU	99	137.2	38.2	0	--	4J	3J	2J	--	--
Average Concentration				**1,014**						

Notes:

All concentrations in ppb, Other = 1,2-Dichloroethane, 1,1-Dichloroethane, Dichlorodifluoromethane, Chloroform, Chlorobenzene, benzene, Xylene, Ethylbenzene
J = Parameter was determined to be present below the method detection limit. The concentration is an estimated value.
-- = Not detected. DCE = Dichloroethene, TCE = Trichloroethene, PCE = Tetrachloroethene, TCA = Trichloroethane.

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AVERAGE CONCENTRATION OF TVOC IN LAYER B WELLS
NOVEMBER 1994

WELL #	TOTAL DEPTH	TOP OF CASING ELEVATION	BOTTOM ELEVATION	TOTAL	1,1-DCE	1,2-DCE	TCE	PCE	1,1,1-TC	OTHER
2ML	447	125.69	-321.31	19	--	19	4J	4J	--	--
12ML	393	133.85	-259.15	256	--	230	14J	26	--	--
1ML	395	144.89	-250.11	52	--	29	13	10	--	--
8ML	355	126.94	-228.06	78	2J	32	27	19	4J	--
5ML	350	129.17	-220.83	260	--	210	27	23	--	--
3ML	350	137.02	-212.98	35	--	19	16	3J	--	71
7ML	355	148.98	-206.02	460	--	320	94	46	3J	--
1MI/L	342	144.55	-197.45	733	--	450	190	93	--	--
18ML	345	149.55	-195.45	428	--	260	120	48	--	--
Average Concentration				**258**						

Notes:

All concentrations in ppb, Other = 1,2-Dichloroethane, 1,1-Dichloroethane, Dichlorodifluoromethane, Chloroform, Chlorobenzene, benzene, Xylene, Ethylbenzene
J = Parameter was determined to be present below the method detection limit. The concentration is an estimated value.
-- = Not detected. DCE = Dichloroethene, TCE = Trichloroethene, PCE = Tetrachloroethene, TCA = Trichloroethane.

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VOC MASS CALCULATION FOR SOIL

Available data was used to estimate the mass of VOCs adsorbed to impacted soils located in the vicinity of the former dry wells. Data utilized included soil samples collected prior to the RI in 1988, 1990, and 1991 and soil samples collected during the RI. Total VOC (TVOC) analytical results were plotted on a cross section in order to estimate the volume of soil impacted by VOCs. Review of the plotted data indicated an area of relatively high VOCs in the immediate vicinity of the dry wells (area 1) and a much larger area (area 2) with lower VOC concentrations surrounding area 1. Results of the VOC mass estimation are summarized below.

Area	Soil Volume (yd^3)	Soil Mass (lb)	TVOC Mass (lb)
1	13,900	41×10^6	52,000
2	120,000	3.56×10^8	18,000
Total	**133,900**	$\mathbf{3.97 \times 10^8}$	**70,000**

The quantities given above are only estimates and several assumptions were made in order to calculate the mass of TVOCs. These assumptions include the area of impacted soil is cylindrical in shape with a diameter of 125 feet in Area 1 and 225 feet in Area 2; the analytical data is representative of average current soil conditions, and the zone of impacted soil does not extend more than 10 feet below the groundwater table. These quantities will be reevaluated as more data becomes available.

Area 1

Soil volume $= \pi(63\text{ ft})^2(30\text{ ft})$
$= 374{,}069\text{ ft}^3$
$= 13{,}900\text{ yd}^3$

Soil mass $= 374{,}069\text{ ft}^3 \times 110\text{ lb/ft}^3 \times 1\text{ lb./}2.2\text{ kg}$
$= 18.7 \times 10^6\text{ kg}$
$= 41 \times 10^6\text{ lb}$

TVOC mass $= 18.7 \times 10^6\text{ kg} \times 10^{-6}\text{ kg/mg} \times 1{,}250\text{ mg/kg}$
$= 23{,}400\text{ kg}$
$= 52{,}000\text{ lb}$

Area 2

Soil volume = $[\pi(113\ \text{ft})^2\ (90\ \text{ft})] - 374{,}100\ \text{ft}^3$
$= 3.24 \times 10^6\ \text{ft}^3$
$= 120{,}000\ \text{yd}^3$

Soil mass = $3.24 \times 10^6\ \text{ft}^3 \times 110\ \text{lb/ft}^3 \times 1\ \text{lb}/2.2\ \text{kg}$
$= 1.62 \times 10^8\ \text{kg}$
$= 3.56 \times 10^8\ \text{lb}$

TVOC mass = $1.62 \times 10^8\ \text{kg} \times 10^{-6}\ \text{kg/mg} \times 45\ \text{mg/kg}$
$= 7{,}200\ \text{kg}$
$= 18{,}000\ \text{lb}$

Estimated Total VOCs in Soil = Approximately 70,000 lb

H2M GROUP

Pre RI Soil Sampling Data

Great Neck, NY

Boring	Vapor Well	Boring Depth (ft.)	Date Drilled	Sample Number	Sample Depth (ft)	PHC (ppm)	Total VOCs	Total SVOCs	Total Pest./PCBs	Parameters
B-1	no	4	1/13/88	B-1	10..12	ND	ND	--	--	vocs, phc, metals
B-2	no	20	3/31/88	B-2	10..12	+	+	--	--	vocs, phc, metals
B-3	no	29	3/31/88	B-3	25..27	+	+	--	--	vocs, phc, metals
B-4	no	35	4/5/88	B-4	20..22	+	+	--	--	vocs, phc, metals
B-4	no	35	4/5/88	B-4	30..32	+	+	--	--	vocs, phc, metals
B-4	no	35	4/5/88	B-4	35..37	+	+	--	--	vocs, phc, metals
B-5	no	18	4/5/88	B-5	15..17	+	+	--	--	vocs, phc, metals
B-6	no	30	4/11/88	B-6	25..27	ND	ND	--	--	vocs, phc, metals
B-7	no	30	4/11/88	B-7	30-32	16	ND	--	--	vocs, phc, metals
B-8	no	30	4/11/88	B-8	30..32	ND	ND	--	--	vocs, phc, metals
B-9	no	32	4/12/88	B-9	30..32	ND	ND	--	--	vocs, phc, metals
B-10	no	12	4/12/88	B-10	5..7	41	ND	--	--	vocs, phc, metals
B-11	no	30	3/31/88	B-11	30-32	ND	ND	--	--	vocs, phc, metals
B-12	no	30	3/31/88	B-12	30-32	ND	ND	--	--	vocs, phc, metals
B-13	no	30	3/31/88	B-13	25..27	ND	ND	--	--	vocs, phc, metals
B-14	no	30	4/12/88	B-14	25..27	ND	ND	--	--	vocs, phc, metals
SVB1	no	50	6/12/90	--	--	--	--	--	--	not sampled
SVB2	VW1	91	6/14/90	SVB2-50-51.5	50-51.5	--	18	--	--	vocs
SVB2	"	91	6/14/90	SBVB2-85-86.5	85-86.5	--	94,000	--	--	vocs
SVB3	VW2	45	6/18/90	--	--	--	--	--	--	not sampled
SVB4	VW3	93	6/18/90	SVB4-80-81.5	80-81.5	--	ND	--	--	vocs
SVB5	VW4	80	6/21/90	SVB5-60-61.5	60..61.5	--	*	--	--	vocs
SVB5	"	80	6/21/90	SBV5-50-51.5	50..51.5	--	6300	--	--	vocs
SVB5	"	80	6/21/90	SVB5-12	12	--	*	--	--	vocs
SVB5	"	80	6/21/90	SVB5-70-71.5	70-71.5	--	*	--	--	vocs
SVB5	"	80	6/21/90	SVB5-80-81.5	80-81.5	--	8400	--	--	vocs
SVB6	no	37	6/21/90	SVB6-12	12	--	--	--	--	#2 fuel oil (ND)
SVB7	VW5	93	--	--	--	--	--	--	--	NA
SVB8	no	25	6/25/90	--	--	--	--	--	--	NA

note: all results in ppb unless otherwise noted, -- not analyzed, * detected in blank or below mdl, ND not detested, + data not available.

H2M GROUP

Pre RI Soil Sampling Data

Great Neck, NY

Boring	Vapor Well	Boring Depth (ft.)	Date Drilled	Sample Number	Sample Depth (ft)	PHC (ppm)	Total VOCs	Total SVOCs	Total Pest./PCBs	Parameters
SVB9	VW6	90	--	--	--	--	--	--	--	NA
SVB10	VW7	48	7/30/91	SVB102022	20..22	--	*	--	--	tcl vocs
SVB10	"	48	33449	SVB104042	40..42	--	5	--	--	tcl vocs
SVB11	VW8	90	7/24/91	SVB112022	20..22	--	ND	--	--	tcl vocs
SVB11	"	90	7/24/91	SVB114042	40..42	--	59	--	--	tcl vocs
SVB11	"	90	7/24/91	SVB116062	60..62	--	ND	--	--	tcl vocs
SVB11	"	90	7/24/91	SVB118082	80..82	--	27	--	--	tcl vocs
SVB12	no	3	7/25/90	--	--	--	--	--	--	not sampled
SVB13	VW9	90	7/26/91	SVB132022	20..22	--	*	--	--	tcl vocs
SVB13	"	90	7/26/91	SVB134042	40..42	--	*	--	--	tcl vocs
SVB13	"	90	7/26/91	SVB136062	60..62	--	*	--	--	tcl vocs
SVB13	"	90	7/26/91	SVB138082	80..82	--	65	--	--	tcl vocs
SVB14	VW10	90	8/16/91	SVB142022	20..22	--	*	--	--	tcl vocs
SVB14	"	90	8/16/91	SVB144042	40..42	--	*	--	--	tcl vocs
SVB14	"	90	8/16/91	SVB146062	60..62	--	*	--	--	tcl vocs
SVB14	"	90	8/16/91	SVB148082	80..82	--	15	--	--	tcl vocs
SVB15	VW11	90	8/6/91	SVB152022	20..22	--	*	--	--	tcl vocs
SVB15	"	90	8/6/91	SVB154042	40..42	--	*	--	--	tcl vocs
SVB15	"	90	8/6/91	SVB156062	60..62	--	*	--	--	tcl vocs
SVB15	"	90	8/6/91	SVB158082	80..82	--	ND	--	--	tcl vocs
SVB16	VW12	90	8/14/91	SVB162022	20..22	--	7	--	--	tcl vocs
SVB16	"	90	8/14/91	SVB164042	40..42	--	6	--	--	tcl vocs
SVB16	"	90	8/14/91	SVB166062	60..62	--	6	--	--	tcl vocs
SVB16	"	90	8/14/91	SVB168082	80..82	--	30	--	--	tcl vocs
SVB17	VW13	90	8/22/91	SVB17	20..22	--	1,330,000	--	--	tcl vocs
SVB17	"	90	8/22/91	SVB-17	60-62	--	308,000	--	--	tcl vocs
SVB17	"	90	8/22/91	SVB-17	40-42	--	*	--	--	tcl vocs
SVB17	"	90	8/22/91	SVB-17	80-82	--	130,000	--	--	tcl vocs
SVB17	"	90	8/22/91	SVB-17B	20-22	--	1,899,000	--	--	tcl vocs

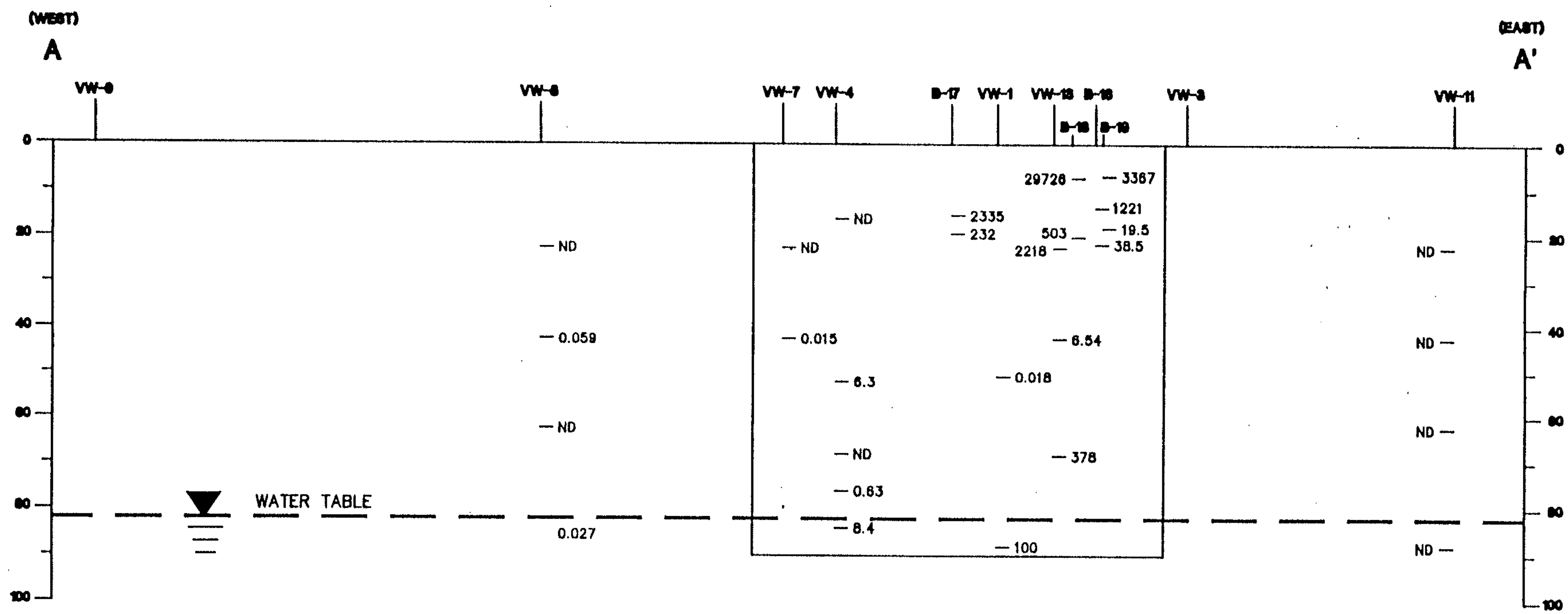
note: all results in ppb unless otherwise noted, -- not analyzed, * detected in blank or below mdl, ND not detested, + data not available.

Pre RI Soil Sampling Data

Great Neck, NY

Boring	Vapor Well	Boring Depth (ft.)	Date Drilled	Sample Number	Sample Depth (ft)	PHC (ppm)	Total VOCs	Total SVOCs	Total Pest./PCBs	Parameters
SVB17	"	90	8/22/91	SVB-17 011	40-42	--	--	--	--	tcl vocs
SVB17	"	90	8/22/91	SVB-17 RE	60-62	--	348,000	--	--	tcl vocs
SVB17	"	90	8/22/91	SVB-17 RE	80-82	--	130,000	--	--	tcl vocs
SVB17	"	90	8/22/91	SVB-17B RE	20-22	--	2,200,000	--	--	tcl vocs
SVB17	"	90	8/22/91	SVB-17 002 RE	40-42	--	15.5	--	--	tcl vocs
SVB17	"	90	8/22/91	SVB-17 011 RE	40-42	--	*	--	--	tcl vocs
SVB17	"	90	8/22/91	SVB-17	20-Dec	--	--	1140	48/890	tcl sem-voc,pest/PCB
SVB17	"	90	8/22/91	SVB-17 RE	20-Dec	--	--	1640	--	tcl semi-vols
SVB17	"	90	8/22/91	SVB-17	30-40	--	--	ND	ND/ND	tcl sem-voc,pest/PCB
SVB17	"	90	8/22/91	SVB-17	50-60	--	--	6270	--	tcl sem-voc
SVB17	"	90	8/22/91	SVB-17	70-80	--	--	5370	ND/2730	tcl sem-voc,pest/PCB
SVB17	"	90	8/22/91	SVB-17	20-Dec	--	--	--	--	tcl pest/PCB
SVB17	"	90	8/22/91	SVB-17	30-40	--	--	--	--	tcl pest/PCB
SVB-17	"		SVB-18	50-60	--	--	--	--	tcl pest/PCB	LBG
SVB17	"	90	8/22/91	SVB-17	70-80	--	--	--	--	tcl pest/PCB
SVB17	"	90	8/22/91	SVB-17	20-Dec	--	--	--	--	tal metals plus cyanide
SVB17	"	90	8/22/91	SVB-17	30-40	--	--	--	--	tal metals plus cyanide
SVB17	"	90	8/22/91	SVB-17	50-60	--	--	--	--	tal metals plus cyanide
SVB17	"	90	8/22/91	SVB-17	70-80	--	--	--	--	tal metals plus cyanide
SVB18	VW14	42	8/23/91	--	--	--	--	--	88/3060--	tcl pest/PCB

note: all results in ppb unless otherwise noted, -- not analyzed, * detected in blank or below mdl, ND not detested, + data not available.



ALL CONCENTRATIONS TOTAL VOLATILE ORGANIC COMPOUNDS IN Mg / Kg

DATE	11/17/95
SCALE	AS NOTED
DRAWN BY:	D.A.P.
CHK. BY:	F.J.F.
PROJ. MGR.:	F.J.F.
PROJ. NO.:	87041
ISSUED:	X

LORAL DEFENSE SYSTEMS – EAST
GEOLOGIC CROSS-SECTION A-A'
SOIL QUALITY

LORAL

FIGURE 1

FILE NAME: G:\CEA\DWGS\87041\87041-34

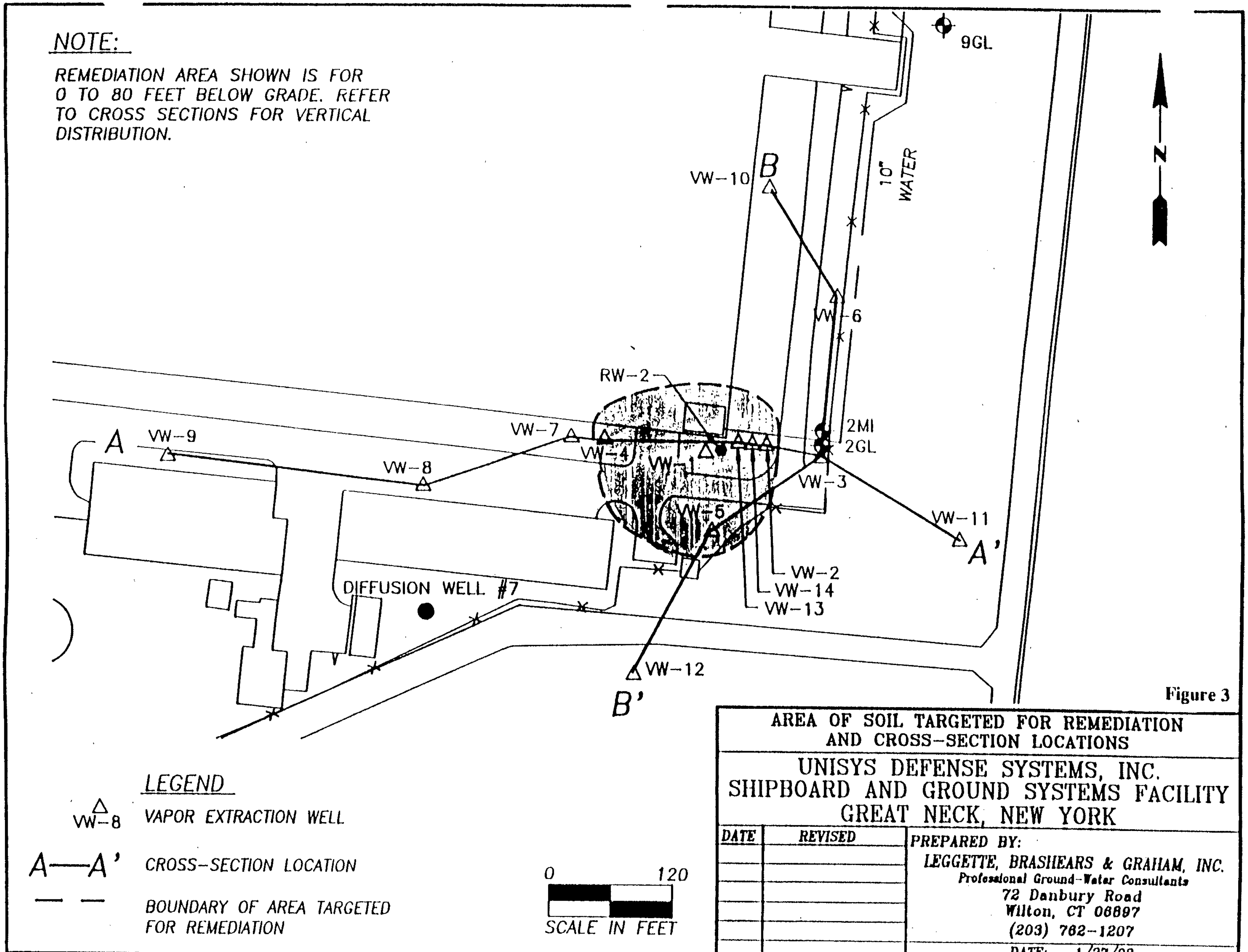


Figure 3

AREA OF SOIL TARGETED FOR REMEDIATION AND CROSS-SECTION LOCATIONS

UNISYS DEFENSE SYSTEMS, INC.
SHIPBOARD AND GROUND SYSTEMS FACILITY
GREAT NECK, NEW YORK

DATE	REVISED	PREPARED BY: LEGGETTE, BRASHEARS & GRAHAM, INC. Professional Ground-Water Consultants 72 Danbury Road Wilton, CT 06897 (203) 762-1207
		DATE: 1/27/92

APPENDIX B
ARARs and TBCs

1.0 Applicable or Relevant and Appropriate Requirements
1.1 ARARs for Groundwater Cleanup Criteria
1.1.1 Federal Regulations

The following sources of ARARs have been identified for site groundwater:

40 CFR	Part 141	National Primary Drinking Water Regulations
	Subpart B	Maximum Contaminant Levels
	Section 141.11	Maximum Contaminant Levels for Inorganic Chemicals
	Section 141.12	Maximum Contaminant Levels for Organic Chemicals
	Subpart F	Maximum Contaminant Level Goals
	Section 141.50	Maximum Contaminant Level Goals for Inorganic Chemicals
	Section 141.51	Maximum Contaminant Level Goals for Inorganic Chemicals
	Subpart G	National Revised Drinking Water Regulations: Maximum Contaminant Levels
	Section 141.61	Maximum contaminant Levels for Organic Contaminants
40 CFR	Part 143	National Secondary Drinking Water Regulations
	Section 143.3	Secondary Maximum Contaminant Levels

1.1.2 New York Regulations

The following sources of ARARs have been identified for site groundwater:

6 NYCRR	Part 701	Classification - Surface Waters and Ground Waters
	Section 701.15	Class GA Fresh Ground Waters
	Part 702	Derivation and Use of Standards and Guidance Values
	Section 702.1	Basis for Derivation of Water Quality Standards and Guidance Values
	Section 702.2	Standards and Guidance Values for Protection of Human Health and Sources of Potable Water Supplies
	Part 703	Surface Water and Ground Water Quality Standards and Ground Water Effluent Standards
	Section 703.5	Water Quality Standards for Taste, Color and Odor-Producing, Toxic and Other Deleterious Substances
10 NYCRR	Part 5	Drinking Water Supplies
	Subpart 5-1	Public Water Systems
	Section 5-1.51	Maximum Contaminant Levels

Section 5-1.52	Tables; Table 1 - Inorganic Chemicals and Physical Characteristics Maximum Contaminant Level Determination, Table 3 - Organic Chemicals Maximum Contaminant Level Determination

1.1.3 Specific ARARs for Groundwater Cleanup Criteria

The specific ARARs for groundwater cleanup criteria are listed in table 1.1.

1.2 ARARs for Groundwater Discharge Criteria

1.2.1 Federal Regulations

The following sources of ARARs have been identified for site groundwater discharge:

40 CFR	Part 141	National Primary Drinking Water Regulations
	Subpart B	Maximum Contaminant Levels
	Section 141.11	Maximum Contaminant Levels for Inorganic Chemicals
	Section 141.12	Maximum Contaminant Levels for Organic Chemicals
	Subpart F	Maximum Contaminant Level Goals
	Section 141.50	Maximum Contaminant Level Goals for Inorganic Chemicals
	Section 141.51	Maximum Contaminant Level Goals for Inorganic Chemicals
	Subpart G	National Revised Drinking Water Regulations: Maximum Contaminant Levels
	Section 141.61	Maximum Contaminant Levels for Organic Contaminants
40 CFR	Part 143	National Secondary Drinking Water Regulations
	Section 143.3	Secondary Maximum Contaminant Levels

1.2.2 New York Regulations

The following sources of ARARs have been identified for site groundwater discharge:

6 NYCRR	Part 701	Classifications - Surface Waters and Ground Waters
	Section 701.15	Class GA Fresh Ground Waters
	Part 702	Derivation and Use of Standards and Guidance Values
	Section 702.1	Basis for Derivation of Water Quality Standards and Guidance Values

	Section 702.2	Standards and Guidance Values for Protection of Human Health and Sources of Potable Water Supplies
	Section 702.16	Derivation and Implementation of Effluent Limitations
	Part 703	Surface Water and Ground Water Quality Standards and Ground Water Effluent Standards
	Section 703.5	Water Quality Standards for Taste, Color and Odor-Producing, Toxic and Other Deleterious Substances
	Section 703.6	Ground Water Effluent Standards and Limitations for Discharges to Class GA Waters
10 NYCRR	Part 5	Drinking Water Supplies
	Subpart 5-1	Public Water Systems
	Section 5-1.51	Maximum Contaminant Levels
	Section 5-1.52	Tables; Table 1 - Inorganic Chemicals and Physical Characteristics Maximum Contaminant Level Determination, Table 3 - Organic Chemicals Maximum Contaminant Level Determination

1.2.3 Specific ARARs for Groundwater Discharge Criteria

The specific ARARs for groundwater discharge criteria are listed in table 1.2.

1.3 ARARs for Air Emission Discharge Criteria

1.3.1 Federal Regulations

The EPA has established guidance values on the control of air emissions through the Clean Air Act at CERCLA sites for groundwater treatment (EPA, 1989). This guidance indicates that the sources most in need of controls are those with an actual emissions rate in excess of 3 lbs/hr or 15 lbs/day, or a calculated annual rate of 10 tons/year of total VOCs. The calculated annual rate assumes 24-hour operation, 365 days per year.

1.3.2 New York Guidelines

The New York State DEC Division of Air Resources has issued draft guidelines for the control of toxic ambient air contaminants in New York State. These guidelines are presented in the New York State Air Guide-1. State guidance values pertaining to potential air emissions from treatment equipment to be used at the site are listed in table 1.3.

1.4 ARARs for Transport and Disposal Criteria

1.4.1 Federal Regulations

The following sources of ARARs have been identified for treatment, transportation and disposal of hazardous byproducts:

40 CFR	Part 261	Identification and Listing of Hazardous Waste
	Part 262	Standards Applicable to Generators of Hazardous Waste
	Part 263	Standards Applicable to Transporters of Hazardous Waste
	Part 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities
	Subpart B	General Facility Standards
	Subpart E	Manifest System, Record keeping and Reporting
	Subpart N	Landfills
	Subpart O	Incinerators
	Part 265	Interim Status Standards of Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities
	Subpart B	General Facility Standards
	Subpart E	Manifest System, Record keeping and Reporting
	Subpart N	Landfills
	Subpart O	Incinerators
	Subpart P	Thermal Treatment
	Subpart Q	Chemical, Physical and Biological Treatment
	Part 268	Land Disposal Restrictions
49 CFR	Part 172	Hazardous Material Regulations of the Department of Transportation, Hazardous Materials Tables and Hazardous Communications Requirements and Emergency Response Information Requirements
	Part 173	Hazardous Material Regulations of the Department of Transportation, Shippers, General Requirements for Shipping and Packaging
	Part 178	Hazardous Material Regulations of the Department of Transportation's, Shipping Container Specifications
	Part 179	Hazardous Material Regulations of the Department of Transportation, Specifications for Tank Cars

1.4.2 New York Regulations

The following sources of ARARs have been identified for treatment, transportation and disposal of hazardous byproducts:

6 NYCRR	Part 360	Solid Waste Management Facilities
	Part 370	Hazardous Waste Management System - General
	Part 371	Identification and Listing of Hazardous Waste
	Part 372	Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities
	Part 373	Hazardous Waste management Facilities
	Subpart 373.1	Hazardous Waste treatment, Storage and Disposal Facility Permitting Requirements
	Subpart 373.2	Final Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities
	Subpart 373.3	Interim Status Standards Regulation for Owners and Operators of Hazardous Waste Facilities
	Part 376	Land Disposal Restrictions

1.5 ARARs for Soil Cleanup Criteria

State guidance values pertaining to soil cleanup objectives are continued in the NYSDEC Technical and Administrative Guidance Memorandum (TAGM) (HWR-924046), date November 16, 1992. The TAGM is a TBC and provides numerical soil cleanup standards for volatile, semivolatile, pesticide, herbicide, PCBS and heavy metal constituents.

Note:
TBC - To Be Considered

List of ARARs and TBCs

Water	
40 CFR 141.11-16	Maximum Contaminant Levels
40 CFR 141.50-52	Maximum Contaminant Level Goals
40 CFR 144-147	Underground Injection Control Regulations
40 CFR 122-125	National Pollutant Discharge Elimination System
40 CFR 403	Pretreatment Standards
40 CFR 131	Water Quality Criteria
6 NYCRR 701.115	Derivation of Effluent Limitations
6 NYCRR 702	Special Classifications and Standards
6 NYCRR 703	Groundwater Classifications, Quality Standards and Effluent Standards and/or Limitations
6 NYCRR 750-757	Implementation of NPDES Program in NYS
10 NYCRR 5	Public Water Supply MCLs
10 NYCRR 170	Water Supply Sources
Air	
40 CFR 50	National Primary and Secondary Ambient Air Quality Standards
40 CFR 61	National Emissions Standards for Hazardous Air Pollutants
40 CFR 60	New Source Performance Standards
6 NYCRR 257	Air Quality Standards
6 NYCRR 212	General Process Emission Sources
Hazardous Waste	
40 CFR 264	Identification and Listing of Hazardous Wastes
40 CFR 264.90-109	Groundwater Protection and Monitoring
6 NYCRR 371	Identification and Listing of Hazardous Waste
6 NYCRR 372	Hazardous Waste Manifest System and Related Standards
Miscellaneous	
6 NYCRR 182	Endangered Species of Fish and Wildlife
29 CFR 1910	Occupational Safety and Health Act

"Integrated Risk Information System (IRIS)", USEPA 1990
"Guidance for conducting Remedial Investigations and Feasibility Studies Under CERCLA", USEPA
NYSDEC TAGMs
"Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites", NYDEC

Note:
TBC - To Be Considered

H2M GROUP

TABLE 1.1

Chemical-Specific ARARs for Groundwater Cleanup Criteria (1)

Compound	Federal Standards			State Standards		Minimum ARAR-Based Groundwater Cleanup Criteria
	MCL (2)	MCLGs (3)	SMCLs (4)	Groundwater Quality Standards (5)	Drinking Water Standards (6)	
Carbon disulfide	NR	NR	NR	NR	50 u	50
Chlorobenzene	NR	NR	NR	5	5 p	5
Chloroform	100	NR	NR	7	100	7
Chloromethane	NR	NR	NR	NR	5 p	5
Dieidrin	NR	NR	NR	ND 2.5	5	ND 2.5
1,2-Dichloroethylene Total (2)	70	70	NR	5	5 p	5
Di-n-butyl-phthalate	NR	NR	NR	NR	50 u	50
Di-n-octyl-phthalate	NR	NR	NR	NR	50 u	50
Ethylbenzene	700	700	NR	5	5 p	5
Heptachlor epoxide	NR	0*	NR	ND 2.2	0.2	ND 0.2
4-Methly-2-pentanone	NR	NR	NR	NR	50 u	50
Naphthalene	NR	NR	NR	NR	50 u	50
Tetrachloroethylene	5	0*	NR	5	5 p	5
Trichloroethylene	5	0*	NR	5	5 p	5
Vinyl chloride	2	0*	NR	2	2	2
Xylenes	10,000	10,000	NR	5	5 p	5
Freon 113	NR	NR	NR	NR	5	5
TICs	NR	NR	NR	NR	50 u	50
Aluminum	NR	NR	50	NR	NR	NR
Antimony	6	3	NR	NR	NR	6
Arsenic	50	NR	NR	25	50	25
Barium	1,000	2,000	NR	1,000	2,000	1,000
Beryilium	1	0*	NR	NR	NR	1
Cadmium	10	5	NR	10	5	5
Calcium	NR	NR	NR	NR	NR	NR
Chromium	50	100	NR	50	100	50
Cobalt	NR	NR	NR	NR	NR	NR
Copper	NR	1,300	1,000	200	1,300 (action lev.)	200
Iron	NR	NR	300	300 +	300 +	300
Lead	50	0*	NR	25	15 (at tap)	25
Magnesium	NR	NR	NR	NR	NR	NR
Manganese	NR	NR	50	300 +	300 +	300
Nickel	NR	NR	NR	NR	NR	NR
Potassium	NR	NR	NR	NR	NR	NR
Silver	50	NR	NR	50	60	50
Sodium	NR	NR	NR	20,000	NR	20,000
Vanadium	NR	NR	NR	NR	NR	NR
Zinc	NR	NR	5,000	300	5,000	300

(1) Micrograms per liter
(2) 40 CFR 141.11, 141.12, 141.61.
(3) 40 CFR 143.51.
(4) 40 CFR 143.3
(5) 6 NYCRR 703.5
(6) 10 NYCRR 5-1.52.

NR Not Regulated.
P Principle Organic Compound; each cannot exceed 5 ug/l.
NDx Not detected at or above x.
* The EPA believes that an MCLG of zero is not an appropriate setting for cleanup levels, and the corresponding MCL will be the potentially relevant and appropriate requirement (EPA, 1990).
\+ The total of iron and manganese cannot exceed 500 ug/l.

H2MGROUP

TABLE 1.2

Chemical-Specific ARARs for Groundwater Discharge Criteria [1]

Compound	Federal Standards			State Standards		
	MCL [2]	MCLGs [3]	SMCLs [4]	Groundwater Quality Standards [5]	Drinking Water Standards [6]	Groundwater Effluent Standards Class GA [7]
Carbon disulfide	NR	NR	NR	NR	50 u	NR
Chlorobenzene	NR	NR	NR	5	5 p	NR
Chloroform	100	NR	NR	7	100	7
Chloromethane	NR	NR	NR	NR	5 p	NR
Dieidrin	NR	NR	NR	ND 2.5	5	ND
1,2-Dichloroethylene, Total [2]	70	70	NR	5	5 p	5
Di-n-butyl-phthalate	NR	NR	NR	NR	50 u	770
Di-n-octyl-phthalate	NR	NR	NR	NR	50 u	NR
Ethylbenzene	700	700	NR	5	5 p	NR
Heptachlor epoxide	NR	0*	NR	ND 2.2	0.2	ND
4-Methly-2-pentanone	NR	NR	NR	NR	50 u	NR
Naphthalene	NR	NR	NR	NR	50 u	NR
Tetrachloroethylene	5	0*	NR	5	5 p	NR
Trichloroethylene	5	0*	NR	5	5 p	10
Vinyl chloride	2	0*	NR	2	2	5
Xylenes	10,000	10,000	NR	5	5 p	NR
Freon 113	NR	NR	NR	5	5	5
TICs	NR	NR	NR	NR	50 u	NR
Aluminum	NR	NR	50	NR	NR	2,000
Antimony	6	3	NR	NR	NR	NR
Arsenic	50	NR	NR	25	50	50
Barium	1,000	2,000	NR	1,000	2,000	2,000
Beryilium	1	0*	NR	NR	NR	NR
Cadmium	10	5	NR	10	5	20
Calcium	NR	NR	NR	NR	NR	NR
Chromium	50	100	NR	50	100	100
Cobalt	NR	NR	NR	NR	NR	NR
Copper	NR	1,300	1,000	200	1,300 (action lev.)	1,000
Iron	NR	NR	300	300 +	300 +	600 #
Lead	50	0*	NR	25	15 (at tap)	50
Magnesium	NR	NR	NR	NR	NR	NR
Manganese	NR	NR	50	300 +	300 +	600 #
Nickel	NR	NR	NR	NR	NR	2,000
Potassium	NR	NR	NR	NR	NR	NR
Silver	50	NR	NR	50	60	100
Sodium	NR	NR	NR	20,000	NR	NR
Vanadium	NR	NR	NR	NR	NR	NR
Zinc	NR	NR	5,000	300	5,000	5,000

(1) Micrograms per liter
(2) 40 CFR 141.11, 141.12, 141.61.
(3) 40 CFR 143.51.
(4) 40 CFR 143.3.
(5) 6 NYCRR 703.5
(6) 10 NYCRR 5-1.52.
(7) 6 NYCRR 703.6.
(8) 6 NYCRR 702.16.
NR Not Regulated.

P Principle Organic Compound; each cannot exceed 5 ug/l.
U Unspecified Organic Compound; each cannot exceed 50 ug/l.
NDx Not detected at or above x.
* The EPA believes that an MCLG of zero is not an appropriate setting for cleanup levels, and the corresponding MCL will be the potentially relevant and appropriate requirement (EPA, 1990)
++ Applies to each individual compound.
+ The total of iron and manganese cannot exceed 500 ug/l.
# Combined concentration of iron and manganese shall not exceed 1.000 ug/l.

H2M GROUP

TABLE 1.3

New York State Draft Guidelines for Air Emissions (1)

Compound	Short-Term Guideline Concentration	Annual Guideline Concentration
Chlorobenzene	11,000	20
Chloroform	980	23
Chloromethane	22,000	770
Dieidrin	NR	NR
1,2-Dichloroethylene Total (2)	190,000	1,900
Di-n-butyl-phthalate	NR	NR
Di-n-octyl-phthalate	NR	NR
Ethylbenzene	100,000	1,000
Heptachlor epoxide	NR	NR
4-Methly-2-pentanone	NR	NR
Naphthalene	12,000	120
Tetrachloroethylene	40,000	1.2
Trichloroethylene	33,000	4.50E-01
Vinyl chloride	1,300	2.00E-02
Xylenes	100,000	300
Freon 113 (Trichlorotrifluorethane)	1,800,000	30,000
TICs	NR	NR
Aluminum	NR	NR
Antimony	120	1.2
Arsenic	2.0E-01	2.3E-04
Barium	120	5.0E-01
Beryilium	5.0E-02	4.0E-04
Cadmium	2.0E-01	5.0E-04
Calcium	NR	NR
Chromium	1.0E-01	2.0E-05
Cobalt	12	1.2E-01
Copper	240	2.4
Iron	NR	NR
Lead	NR	NR
Magnesium	NR	NR
Manganese	240	3.0E-01
Nickel	1.5	2.0E-02
Potassium	NR	NR
Silver	NR	NR
Sodium	NR	NR
Vanadium	100	2.0E-01
Zinc	NR	NR

(1) Micrograms per cubic meter.

NYSDEC Air Guide-1, April 4, 1994.

NR Not Regulated.

APPENDIX D
TAGM Scoring of Remedial Alternatives

Groundwater Alternative 1 - Carbon Adsorption

CRITERIA

Compliance with SCGs

1. Compliance with chemical-specific SCGs
   i) Meets chemical-specific SCGs such as groundwater standards — Yes _X_ 4 points; No ____ 0 points

2. Compliance with action-specific SCGs
   i) Meets SCGs such as technology standards for incineration or landfill — Yes _X_ 3 points; No ____ 0 points

3. Compliance with location-specific SCGs
   i) Meets location-specific SCGs such as Freshwater Wetlands Act — Yes _X_ 3 points; No ____ 0 points

Total Points (Maximum = 10) _10_ points

Protection of Human Health and Environment

1. Use of the site after remediation
   i) Unrestricted use of the land and water **(if Yes, go to end of table)** — Yes _X_ 20 points; No ____ 0 points

2. Human health and the environment exposure after remediation
   i) Is the exposure to contaminants via air route acceptable? — Yes ____ 3 points; No ____ 0 points

   ii) Is the exposure to contaminants via groundwater/surface water acceptable? — Yes ____ 4 points; No ____ 0 points

   iii) Is the exposure to contaminants via sediments/soil acceptable? — Yes ____ 3 points; No ____ 0 points

3. Magnitude of residual public health risks after remediation
   i) Health risk — < 1 in 1,000,000 ____ 5 points; < 1 in 100,000 ____ 2 points

4. Magnitude of residual environmental risks after remediation
   i) Less than acceptable — ____ 5 points
   ii) Slightly greater than acceptable — ____ 3 points
   iii) Significant risk still exists — ____ 0 points

Total Points (Maximum = 20) _20_ points

Short-Term Effectiveness

1. Protection of community during remedial actions
   i) Are there significant short-term risks to the community that must be addressed? — Yes ____ 0 points; No _X_ 4 points

   ii) Can the risk be easily controlled? — Yes ____ 1 point; No ____ 0 points

   iii) Does the mitigative effort to control risk impact the community life-style? — Yes ____ 0 points; No ____ 2 points

2. Environmental impacts
   i) Are there significant short-term risks to the environment that must be addressed **(if No, go to Factor 3)** — Yes ____ 0 points; No _X_ 4 points

   ii) Are the available mitigative measures reliable to minimize potential impacts? — Yes ____ 3 points; No ____ 0 points

3. Time to implement the remedy
   i) What is the time required to implement the remedy? — < 2 yrs _X_ 1 point; > 2 yrs ____ 0 points

   ii) Required duration of the mitigative effort to control short-term risk — < 2yrs ____ 1 point; > 2yrs _X_ 0 points

Total Points (Maximum = 10) _9_ points

Groundwater Alternative 1 - Carbon Adsorption

Long-Term Effectiveness and Permanence

1. On-site or off-site treatment or land disposal
   - i) On-site treatment — _X_ 3 points
   - ii) Off-site treatment — _____ 1 point
   - iii) On-site or off-site land disposal — _____ 0 points

2. Permanence of the remedial alternative
   - i) Will the remedy be classified as permanent in accordance with Sec 2.1(a), (b), or (c)? **(if Yes, go to Factor 4)**
     Yes _X_ 3 points
     No _____ 0 points

3. Lifetime of remedial actions
   - i) Expected lifetime or duration of effectiveness of the remedy
     25-30 yrs _X_ 3 points
     20-25 yrs _____ 2 points
     15-20 yrs _____ 1 point
     < 15 yrs _____ 0 points

4. Quantity and nature of waste or residual left at the site after remediation
   - i) Quantity of untreated hazardous waste left at the site
     None _____ 3 points
     < 25% _X_ 2 points
     25-50% _____ 1 point
     > 50% _____ 0 points
   - ii) Is there treated residual left at the site **(if No, go to Factor 5)**
     Yes _____ 0 points
     No _X_ 2 points
   - iii) Is the treated residual toxic?
     Yes _____ 0 points
     No _____ 1 point
   - iv) Is the treated residual mobile?
     Yes _____ 0 points
     No _____ 1 point

5. Adequacy and reliability of controls
   - i) Operation and maintenance required for a period of:
     < 5 yrs ____ 1 point
     > 5 yrs _X_ 0 points
   - ii) Are environmental controls required as part of the remedy to handle potential problems? **(if No, go to "iv")**
     Yes _____ 0 points
     No _X_ 1 point
   - iii) Degree of confidence that controls can adequately handle potential problems
     Moderate to very confident _____ 1 point
     Somewhat to not confident _____ 0 points
   - iv) Relative degree of long-term monitoring required (compared with other alternatives)
     Minimum _____ 2 points
     Moderate _____ 1 point
     Extensive _X_ 0 points

Total Points (Maximum = 15) _14_ points

Groundwater Alternative 1 - Carbon Adsorption

Reduction of Toxicity, Mobility or Volume

1. Volume of hazardous waste reduced
   i) Quantity of hazardous waste destroyed or treated
      - 99-100% _____ 8 points
      - 90-99% _____ 7 points
      - 80-90% _____ 6 points
      - 60-80% _X_ 4 points
      - 40-60% _____ 2 points
      - 20-40% _____ 1 point
      - < 20% _____ 0 points

   ii) Are there untreated or concentrated hazardous waste produced as a result of (I)
      - Yes _X_ 0 points
      - No _____ 2 points

   iii) After remediation, how is the untreated, residual hazardous waste material disposed?
      - Off-site land disposal _____ 0 points
      - On-site land disposal _____ 1 point
      - Off-site destruction/treatment _X_ 2 points

2. Reduction in mobility of hazardous waste
   i) Quality of available wastes immobilized after destruction or treatment
   (if Factor 2 is not applicable go to Factor 3)
      - 90-100% _____ 2 points
      - 60-90% _____ 1 point
      - < 60% _____ 0 points

   ii) Method of immobilization
      - Reduced mobility by containment _____ 0 points
      - Reduced mobility by alternative treatment technologies _____ 3 points

3. Irreversibility of the destruction or treatment or immobilization of hazardous waste
   i) Completely irreversible _X_ 5 points
   ii) Irreversible for most of the hazardous waste constituents _____ 3 points
   iii) Irreversible for only some of the hazardous waste constituents _____ 2 points
   iv) Reversible for most of the hazardous waste constituents _____ 0 points

Total Points (Maximum = 15) _11_ points

Implementability

1. Technical Feasibility
   a) Ability to construct technology
      i) Not difficult to construct, No uncertainties _X_ 3 points
      ii) Somewhat difficult to construct, No uncertainties _____ 2 points
      iii) Very difficult to construct, Significant uncertainties _____ 1 point
   b) Reliability of technology
      i) very reliable in meeting the specified process efficiencies or performance goals _X_ 3 points
      ii) Somewhat reliable in meeting the specified process efficiencies or performance goals _____ 2 points
   c) Schedule of delays due to technical problems
      i) Unlikely _X_ 2 points
      ii) Somewhat likely _____ 1 point
   d) Need of undertaking additional remedial action if necessary
      i) No future remedial actions may be anticipated _____ 2 points
      ii) Some future remedial actions may be necessary _X_ 1 point

2. Administrative Feasibility
   a) Coordination with other agencies
      i) Minimal coordination is required _____ 2 points
      ii) required coordination is normal _X_ 1 point
      iii) extensive coordination is required _____ 0 points

3. Availability of Services and Materials
   a) Availability of prospective technologies
      i) Are technologies under consideration generally commercially available?
         - Yes _X_ 1 point
         - No _____ 0 points
      ii) Will more than one vendor be available to provide a competitive bid?
         - Yes _X_ 1 point
         - No _____ 0 points
   b) Availability of necessary equipment and specialists
      i) Additional equipment and specialists may be available without significant delay.
         - Yes _X_ 1 point
         - No _____ 0 points

Total Points (Maximum = 15) _13_ points

Groundwater Alternative 2 - Air Stripping

CRITERIA

Compliance with SCGs

1. Compliance with chemical-specific SCGs	
i) Meets chemical-specific SCGs such as groundwater standards (Does not meet air standards)	Yes _____ 4 points No __X__ 0 points
2. Compliance with action-specific SCGs	
i) Meets SCGs such as technology standards for incineration or landfill	Yes __X__ 3 points No _____ 0 points
3. Compliance with location-specific SCGs	
i) Meets location-specific SCGs such as Freshwater Wetlands Act	Yes __X__ 3 points No _____ 0 points
	Total Points (Maximum = 10) _6_ points

Protection of Human Health and Environment

1. Use of the site after remediation	
i) Unrestricted use of the land and water **(if Yes, go to end of table)**	Yes __X__ 20 points No _____ 0 points
2. Human health and the environment exposure after remediation	
i) Is the exposure to contaminants via air route acceptable?	Yes _____ 3 points No _____ 0 points
ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes _____ 4 points No _____ 0 points
iii) Is the exposure to contaminants via sediments/soil acceptable?	Yes _____ 3 points No _____ 0 points
3. Magnitude of residual public health risks after remediation	
i) Health risk	< 1 in 1,000,000 _____ 5 points < 1 in 100,000 _____ 2 points
4. Magnitude of residual environmental risks after remediation	
i) Less than acceptable	_____ 5 points
ii) Slightly greater than acceptable	_____ 3 points
iii) Significant risk still exists	_____ 0 points
	Total Points (Maximum = 20) _20_ points

Short-Term Effectiveness

1. Protection of community during remedial actions	
i) Are there significant short-term risks to the community that must be addressed?	Yes __X__ 0 points No _____ 4 points
ii) Can the risk be easily controlled?	Yes _____ 1 point No __X__ 0 points
iii) Does the mitigative effort to control risk impact the community life-style?	Yes __X__ 0 points No _____ 2 points
2. Environmental impacts	
i) Are there significant short-term risks to the environment that must be addressed **(if No, go to Factor 3)**	Yes __X__ 0 points No _____ 4 points
ii) Are the available mitigative measures reliable to minimize potential impacts?	Yes _____ 3 points No __X__ 0 points
3. Time to implement the remedy	
i) What is the time required to implement the remedy?	< 2 yrs __X__ 1 point > 2 yrs _____ 0 points
ii) Required duration of the mitigative effort to control short-term risk	< 2yrs _____ 1 point > 2yrs __X__ 0 points
	Total Points (Maximum = 10) _1_ points

Groundwater Alternative 2 - Air Stripping

Long-Term Effectiveness and Permanence

1. On-site or off-site treatment or land disposal
   - i) On-site treatment — _X_ 3 points
   - ii) Off-site treatment — _____ 1 point
   - iii) On-site or off-site land disposal — _____ 0 points
2. Permanence of the remedial alternative
   - i) Will the remedy be classified as permanent in accordance with Sec 2.1(a), (b), or (c)? **(if Yes, go to Factor 4)** — Yes _X_ 3 points; No _____ 0 points
3. Lifetime of remedial actions
   - i) Expected lifetime or duration of effectiveness of the remedy — 25-30 yrs _X_ 3 points; 20-25 yrs _____ 2 points; 15-20 yrs _____ 1 point; < 15 yrs _____ 0 points
4. Quantity and nature of waste or residual left at the site after remediation
   - i) Quantity of untreated hazardous waste left at the site — None _____ 3 points; < 25% _X_ 2 points; 25-50% _____ 1 point; > 50% _____ 0 points
   - ii) Is there treated residual left at the site **(if No, go to Factor 5)** — Yes _____ 0 points; No _X_ 2 points
   - iii) Is the treated residual toxic? — Yes _____ 0 points; No _____ 1 point
   - iv) Is the treated residual mobile? — Yes _____ 0 points; No _____ 1 point
5. Adequacy and reliability of controls
   - i) Operation and maintenance required for a period of: — < 5 yrs ____ 1 point; > 5 yrs _X_ 0 points
   - ii) Are environmental controls required as part of the remedy to handle potential problems? **(if No, go to "iv")** — Yes _____ 0 points; No _X_ 1 point
   - iii) Degree of confidence that controls can adequately handle potential problems — Moderate to very confident _____ 1 point; Somewhat to not confident _____ 0 points
   - iv) Relative degree of long-term monitoring required (compared with other alternatives) — Minimum _____ 2 points; Moderate _____ 1 point; Extensive _X_ 0 points

Total Points (Maximum = 15) _14_ points

Groundwater Alternative 2 - Air Stripping

Reduction of Toxicity, Mobility or Volume

1. Volume of hazardous waste reduced
   i) Quantity of hazardous waste destroyed or treated

   99-100% _____ 8 points
   90-99% _____ 7 points
   80-90% _____ 6 points
   60-80% __X_ 4 points
   40-60% _____ 2 points
   20-40% _____ 1 point
   < 20% _____ 0 points

   ii) Are there untreated or concentrated hazardous waste produced as a result of (I)

   Yes _____ 0 points
   No __X_ 2 points

   iii) After remediation, how is the untreated, residual hazardous waste material disposed?

   Off-site land disposal _____ 0 points
   On-site land disposal _____ 1 point
   Off-site destruction/treatment _____ 2 points

2. Reduction in mobility of hazardous waste
   i) Quality of available wastes immobilized after destruction or treatment
   (if Factor 2 is not applicable go to Factor 3)

   90-100% _____ 2 points
   60-90% _____ 1 point
   < 60% _____ 0 points

   ii) Method of immobilization

   Reduced mobility by containment _____ 0 points
   Reduced mobility by alternative treatment technologies _____ 3 points

3. Irreversibility of the destruction or treatment or immobilization of hazardous waste
   i) Completely irreversible __X_ 5 points
   ii) Irreversible for most of the hazardous waste constituents _____ 3 points
   iii) Irreversible for only some of the hazardous waste constituents _____ 2 points
   iv) Reversible for most of the hazardous waste constituents _____ 0 points

Total Points (Maximum = 15) _11_ points

Implementability

1. Technical Feasibility
   a) Ability to construct technology
      i) Not difficult to construct, No uncertainties __X__ 3 points
      ii) Somewhat difficult to construct, No uncertainties _____ 2 points
      iii) Very difficult to construct, Significant uncertainties _____ 1 point
   b) Reliability of technology
      i) very reliable in meeting the specified process efficiencies or performance goals _____ 3 points
      ii) Somewhat reliable in meeting the specified process efficiencies or performance goals __X_ 2 points
   c) Schedule of delays due to technical problems
      i) Unlikely _____ 2 points
      ii) Somewhat likely __X_ 1 point
   d) Need of undertaking additional remedial action if necessary
      i) No future remedial actions may be anticipated _____ 2 points
      ii) Some future remedial actions may be necessary __X__ 1 point

2. Administrative Feasibility
   a) Coordination with other agencies
      i) Minimal coordination is required _____ 2 points
      ii) required coordination is normal __X_ 1 point
      iii) extensive coordination is required _____ 0 points

3. Availability of Services and Materials
   a) Availability of prospective technologies
      i) Are technologies under consideration generally commercially available?

      Yes __X__ 1 point
      No _____ 0 points

      ii) Will more than one vendor be available to provide a competitive bid?

      Yes _X___ 1 point
      No _____ 0 points

   b) Availability of necessary equipment and specialists
      i) Additional equipment and specialists may be available without significant delay.

      Yes __X__ 1 point
      No _____ 0 points

Total Points (Maximum = 15) _11_ points

Groundwater Alternative 2A - Air Stripping/Vapor Phase Carbon Adsorption Off-GasTreatment

CRITERIA

Compliance with SCGs

1. Compliance with chemical-specific SCGs
   i) Meets chemical-specific SCGs such as groundwater standards — Yes _X_ 4 points; No ____ 0 points

2. Compliance with action-specific SCGs
   i) Meets SCGs such as technology standards for incineration or landfill — Yes _X_ 3 points; No ____ 0 points

3. Compliance with location-specific SCGs
   i) Meets location-specific SCGs such as Freshwater Wetlands Act — Yes _X_ 3 points; No ____ 0 points

Total Points (Maximum = 10) _10_ points

Protection of Human Health and Environment

1. Use of the site after remediation
   i) Unrestricted use of the land and water **(if Yes, go to end of table)**. — Yes _X_ 20 points; No ____ 0 points

2. Human health and the environment exposure after remediation
   i) Is the exposure to contaminants via air route acceptable? — Yes ____ 3 points; No ____ 0 points

   ii) Is the exposure to contaminants via groundwater/surface water acceptable? — Yes ____ 4 points; No ____ 0 points

   iii) Is the exposure to contaminants via sediments/soil acceptable? — Yes ____ 3 points; No ____ 0 points

3. Magnitude of residual public health risks after remediation
   i) Health risk — < 1 in 1,000,000 ____ 5 points; < 1 in 100,000 ____ 2 points

4. Magnitude of residual environmental risks after remediation
   i) Less than acceptable — ____ 5 points
   ii) Slightly greater than acceptable — ____ 3 points
   iii) Significant risk still exists — ____ 0 points

Total Points (Maximum = 20) _20_ points

Short-Term Effectiveness

1. Protection of community during remedial actions
   i) Are there significant short-term risks to the community that must be addressed? — Yes ____ 0 points; No _X_ 4 points

   ii) Can the risk be easily controlled? — Yes ____ 1 point; No ____ 0 points

   iii) Does the mitigative effort to control risk impact the community life-style? — Yes ____ 0 points; No ____ 2 points

2. Environmental impacts
   i) Are there significant short-term risks to the environment that must be addressed **(if No, go to Factor 3)** — Yes ____ 0 points; No _X_ 4 points

   ii) Are the available mitigative measures reliable to minimize potential impacts? — Yes ____ 3 points; No ____ 0 points

3. Time to implement the remedy
   i) What is the time required to implement the remedy? — < 2 yrs _X_ 1 point; > 2 yrs ____ 0 points

   ii) Required duration of the mitigative effort to control short-term risk — < 2yrs ____ 1 point; > 2yrs _X_ 0 points

Total Points (Maximum = 10) _9_ points

Groundwater Alternative 2A - Air Stripping/Vapor Phase Carbon Adsorption Off-GasTreatment

Long-Term Effectiveness and Permanence

1. On-site or off-site treatment or land disposal
   - i) On-site treatment — _X_ 3 points
   - ii) Off-site treatment — _____ 1 point
   - iii) On-site or off-site land disposal — _____ 0 points

2. Permanence of the remedial alternative
   - i) Will the remedy be classified as permanent in accordance with Sec 2.1(a), (b), or (c)? **(if Yes, go to Factor 4)** — Yes _X_ 3 points; No _____ 0 points

3. Lifetime of remedial actions
   - i) Expected lifetime or duration of effectiveness of the remedy — 25-30 yrs _X_ 3 points; 20-25 yrs _____ 2 points; 15-20 yrs _____ 1 point; < 15 yrs _____ 0 points

4. Quantity and nature of waste or residual left at the site after remediation
   - i) Quantity of untreated hazardous waste left at the site — None _____ 3 points; < 25% _X_ 2 points; 25-50% _____ 1 point; > 50% _____ 0 points
   - ii) Is there treated residual left at the site **(if No, go to Factor 5)** — Yes _____ 0 points; No _X_ 2 points
   - iii) Is the treated residual toxic? — Yes _____ 0 points; No _____ 1 point
   - iv) Is the treated residual mobile? — Yes _____ 0 points; No _____ 1 point

5. Adequacy and reliability of controls
   - i) Operation and maintenance required for a period of: — < 5 yrs ____ 1 point; > 5 yrs _X_ 0 points
   - ii) Are environmental controls required as part of the remedy to handle potential problems? **(if No, go to "iv")** — Yes _____ 0 points; No _X_ 1 point
   - iii) Degree of confidence that controls can adequately handle potential problems — Moderate to very confident _____ 1 point; Somewhat to not confident _____ 0 points
   - iv) Relative degree of long-term monitoring required (compared with other alternatives) — Minimum _____ 2 points; Moderate _____ 1 point; Extensive _X_ 0 points

Total Points (Maximum = 15) _14_ points

Groundwater Alternative 2A - Air Stripping/Vapor Phase Carbon Adsorption Off-GasTreatment

Reduction of Toxicity, Mobility or Volume

1. Volume of hazardous waste reduced
   i) Quantity of hazardous waste destroyed or treated
      - 99-100% _____ 8 points
      - 90-99% _____ 7 points
      - 80-90% _____ 6 points
      - 60-80% __X_ 4 points
      - 40-60% _____ 2 points
      - 20-40% _____ 1 point
      - < 20% _____ 0 points

   ii) Are there untreated or concentrated hazardous waste produced as a result of (I)
      - Yes __X__ 0 points
      - No _____ 2 points

   iii) After remediation, how is the untreated, residual hazardous waste material disposed?
      - Off-site land disposal _____ 0 points
      - On-site land disposal _____ 1 point
      - Off-site destruction/treatment __X__ 2 points

2. Reduction in mobility of hazardous waste
   i) Quality of available wastes immobilized after destruction or treatment **(if Factor 2 is not applicable go to Factor 3)**
      - 90-100% _____ 2 points
      - 60-90% _____ 1 point
      - < 60% _____ 0 points

   ii) Method of immobilization
      - Reduced mobility by containment _____ 0 points
      - Reduced mobility by alternative treatment technologies _____ 3 points

3. Irreversibility of the destruction or treatment or immobilization of hazardous waste
   i) Completely irreversible __X_ 5 points
   ii) Irreversible for most of the hazardous waste constituents _____ 3 points
   iii) Irreversible for only some of the hazardous waste constituents _____ 2 points
   iv) Reversible for most of the hazardous waste constituents _____ 0 points

Total Points (Maximum = 15) _11_ points

Implementability

1. Technical Feasibility
   a) Ability to construct technology
      i) Not difficult to construct, No uncertainties __X__ 3 points
      ii) Somewhat difficult to construct, No uncertainties _____ 2 points
      iii) Very difficult to construct, Significant uncertainties _____ 1 point
   b) Reliability of technology
      i) very reliable in meeting the specified process efficiencies or performance goals __X__ 3 points
      ii) Somewhat reliable in meeting the specified process efficiencies or performance goals _____ 2 points
   c) Schedule of delays due to technical problems
      i) Unlikely __X__ 2 points
      ii) Somewhat likely _____ 1 point
   d) Need of undertaking additional remedial action if necessary
      i) No future remedial actions may be anticipated _____ 2 points
      ii) Some future remedial actions may be necessary __X__ 1 point

2. Administrative Feasibility
   a) Coordination with other agencies
      i) Minimal coordination is required _____ 2 points
      ii) required coordination is normal __X__ 1 point
      iii) extensive coordination is required _____ 0 points

3. Availability of Services and Materials
   a) Availability of prospective technologies
      i) Are technologies under consideration generally commercially available?
         - Yes __X__ 1 point
         - No _____ 0 points

      ii) Will more than one vendor be available to provide a competitive bid?
         - Yes __X__ 1 point
         - No _____ 0 points
   b) Availability of necessary equipment and specialists
      i) Additional equipment and specialists may be available without significant delay.
         - Yes __X__ 1 point
         - No _____ 0 points

Total Points (Maximum = 15) _13_ points

Groundwater Alternative 2B - Air Stripping/Catalytic Incineration Off-Gas Treatment

CRITERIA

Compliance with SCGs

1. Compliance with chemical-specific SCGs	
i) Meets chemical-specific SCGs such as groundwater standards	Yes __X__ 4 points No _____ 0 points
2. Compliance with action-specific SCGs	
i) Meets SCGs such as technology standards for incineration or landfill	Yes __X_ 3 points No _____ 0 points
3. Compliance with location-specific SCGs	
i) Meets location-specific SCGs such as Freshwater Wetlands Act	Yes __X_ 3 points No _____ 0 points
	Total Points (Maximum = 10) _10_ points

Protection of Human Health and Environment

1. Use of the site after remediation	
i) Unrestricted use of the land and water **(if Yes, go to end of table)**	Yes __X_ 20 points No _____ 0 points
2. Human health and the environment exposure after remediation	
i) Is the exposure to contaminants via air route acceptable?	Yes _____ 3 points No _____ 0 points
ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes _____ 4 points No _____ 0 points
iii) Is the exposure to contaminants via sediments/soil acceptable?	Yes _____ 3 points No _____ 0 points
3. Magnitude of residual public health risks after remediation	
i) Health risk	< 1 in 1,000,000 _____ 5 points < 1 in 100,000 _____ 2 points
4. Magnitude of residual environmental risks after remediation	
i) Less than acceptable	_____ 5 points
ii) Slightly greater than acceptable	_____ 3 points
iii) Significant risk still exists	_____ 0 points
	Total Points (Maximum = 20) _20_ points

Short-term Effectiveness

1. Protection of community during remedial actions	
i) Are there significant short-term risks to the community that must be addressed?	Yes ____ 0 points No __X__ 4 points
ii) Can the risk be easily controlled?	Yes _____ 1 point No _____ 0 points
iii) Does the mitigative effort to control risk impact the community life-style?	Yes ____ 0 points No ____ 2 points
2. Environmental impacts	
i) Are there significant short-term risks to the environment that must be addressed **(if No, go to Factor 3)**	Yes _____ 0 points No __X__ 4 points
ii) Are the available mitigative measures reliable to minimize potential impacts?	Yes _____ 3 points No _____ 0 points
3. Time to implement the remedy	
i) What is the time required to implement the remedy?	< 2 yrs __X_ 1 point > 2 yrs ____ 0 points
ii) Required duration of the mitigative effort to control short-term risk	< 2yrs _____ 1 point > 2yrs __X_ 0 points
	Total Points (Maximum = 10) _9_ points

Groundwater Alternative 2B - Air Stripping/Catalytic Incineration Off-Gas Treatment

Long-Term Effectiveness and Permanence

1. On-site or off-site treatment or land disposal	
i) On-site treatment	_X_ 3 points
ii) Off-site treatment	_____ 1 point
iii) On-site or off-site land disposal	_____ 0 points
2. Permanence of the remedial alternative	
i) Will the remedy be classified as permanent in accordance with Sec 2.1(a), (b), or (c)? **(if Yes, go to Factor 4)**	Yes _X_ 3 points No _____ 0 points
3. Lifetime of remedial actions	
i) Expected lifetime or duration of effectiveness of the remedy	25-30 yrs _X_ 3 points 20-25 yrs _____ 2 points 15-20 yrs _____ 1 point < 15 yrs _____ 0 points
4. Quantity and nature of waste or residual left at the site after remediation	
i) Quantity of untreated hazardous waste left at the site	None _____ 3 points < 25% _X_ 2 points 25-50% _____ 1 point > 50% _____ 0 points
ii) Is there treated residual left at the site **(if No, go to Factor 5)**	Yes _____ 0 points No _X_ 2 points
iii) Is the treated residual toxic?	Yes _____ 0 points No _____ 1 point
iv) Is the treated residual mobile?	Yes _____ 0 points No _____ 1 point
5. Adequacy and reliability of controls	
i) Operation and maintenance required for a period of:	< 5 yrs ____ 1 point > 5 yrs _X_ 0 points
ii) Are environmental controls required as part of the remedy to handle potential problems? **(if No, go to "iv")**	Yes _____ 0 points No _X_ 1 point
iii) Degree of confidence that controls can adequately handle potential problems	Moderate to very confident _____ 1 point Somewhat to not confident _____ 0 points
iv) Relative degree of long-term monitoring required (compared with other alternatives)	Minimum _____ 2 points Moderate _____ 1 point Extensive _X_ 0 points

Total Points (Maximum = 15) _14_ points

Groundwater Alternative 2B - Air Stripping/Catalytic Incineration Off-Gas Treatment

Reduction of Toxicity, Mobility or Volume

1. Volume of hazardous waste reduced
   i) Quantity of hazardous waste destroyed or treated

      99-100% _____ 8 points
      90-99% _____ 7 points
      80-90% _____ 6 points
      60-80% __X__ 4 points
      40-60% _____ 2 points
      20-40% _____ 1 point
      < 20% _____ 0 points

   ii) Are there untreated or concentrated hazardous waste produced as a result of (I)

      Yes _____ 0 points
      No __X__ 2 points

   iii) After remediation, how is the untreated, residual hazardous waste material disposed?

      Off-site land disposal _____ 0 points
      On-site land disposal _____ 1 point
      Off-site destruction/treatment _____ 2 points

2. Reduction in mobility of hazardous waste
   i) Quality of available wastes immobilized after destruction or treatment
      (if Factor 2 is not applicable go to Factor 3)

      90-100% _____ 2 points
      60-90% _____ 1 point
      < 60% _____ 0 points

   ii) Method of immobilization

      Reduced mobility by containment _____ 0 points
      Reduced mobility by alternative treatment technologies _____ 3 points

3. Irreversibility of the destruction or treatment or immobilization of hazardous waste
   i) Completely irreversible __X__ 5 points
   ii) Irreversible for most of the hazardous waste constituents _____ 3 points
   iii) Irreversible for only some of the hazardous waste constituents _____ 2 points
   iv) Reversible for most of the hazardous waste constituents _____ 0 points

Total Points (Maximum = 15) __11__ points

Implementability

1. Technical Feasibility
   a) Ability to construct technology
      i) Not difficult to construct, No uncertainties __X__ 3 points
      ii) Somewhat difficult to construct, No uncertainties _____ 2 points
      iii) Very difficult to construct, Significant uncertainties _____ 1 point
   b) Reliability of technology
      i) very reliable in meeting the specified process efficiencies or performance goals __X__ 3 points
      ii) Somewhat reliable in meeting the specified process efficiencies or performance goals _____ 2 points
   c) Schedule of delays due to technical problems
      i) Unlikely __X__ 2 points
      ii) Somewhat likely _____ 1 point
   d) Need of undertaking additional remedial action if necessary
      i) No future remedial actions may be anticipated _____ 2 points
      ii) Some future remedial actions may be necessary __X__ 1 point

2. Administrative Feasibility
   a) Coordination with other agencies
      i) Minimal coordination is required _____ 2 points
      ii) required coordination is normal __X__ 1 point
      iii) extensive coordination is required _____ 0 points

3. Availability of Services and Materials
   a) Availability of prospective technologies
      i) Are technologies under consideration generally commercially available?
         Yes __X__ 1 point
         No _____ 0 points
      ii) Will more than one vendor be available to provide a competitive bid?
         Yes __X__ 1 point
         No _____ 0 points
   b) Availability of necessary equipment and specialists
      i) Additional equipment and specialists may be available without significant delay.
         Yes __X__ 1 point
         No _____ 0 points

Total Points (Maximum = 15) __13__ points

Groundwater Alternative 3 - UV Oxidation

CRITERIA

Compliance with SCGs

1. Compliance with chemical-specific SCGs
   i) Meets chemical-specific SCGs such as groundwater standards — Yes __X__ 4 points; No ______ 0 points

2. Compliance with action-specific SCGs
   i) Meets SCGs such as technology standards for incineration or landfill — Yes __X__ 3 points; No _____ 0 points

3. Compliance with location-specific SCGs
   i) Meets location-specific SCGs such as Freshwater Wetlands Act — Yes __X__ 3 points; No _____ 0 points

Total Points (Maximum = 10) __10__ points

Protection of Human Health and Environment

1. Use of the site after remediation
   i) Unrestricted use of the land and water **(if Yes, go to end of table)** — Yes __X__ 20 points; No _____ 0 points

2. Human health and the environment exposure after remediation
   i) Is the exposure to contaminants via air route acceptable? — Yes _____ 3 points; No _____ 0 points

   ii) Is the exposure to contaminants via groundwater/surface water acceptable? — Yes _____ 4 points; No _____ 0 points

   iii) Is the exposure to contaminants via sediments/soil acceptable? — Yes _____ 3 points; No _____ 0 points

3. Magnitude of residual public health risks after remediation
   i) Health risk — < 1 in 1,000,000 _____ 5 points; < 1 in 100,000 _____ 2 points

4. Magnitude of residual environmental risks after remediation
   i) Less than acceptable — _____ 5 points
   ii) Slightly greater than acceptable — _____ 3 points
   iii) Significant risk still exists — _____ 0 points

Total Points (Maximum = 20) __20__ points

Short-Term Effectiveness

1. Protection of community during remedial actions
   i) Are there significant short-term risks to the community that must be addressed? — Yes ____ 0 points; No __X__ 4 points

   ii) Can the risk be easily controlled? — Yes ____ 1 point; No _____ 0 points

   iii) Does the mitigative effort to control risk impact the community life-style? — Yes ____ 0 points; No ____ 2 points

2. Environmental impacts
   i) Are there significant short-term risks to the environment that must be addressed **(if No, go to Factor 3)** — Yes ____ 0 points; No __X__ 4 points

   ii) Are the available mitigative measures reliable to minimize potential impacts? — Yes __X__ 3 points; No _____ 0 points

3. Time to implement the remedy
   i) What is the time required to implement the remedy? — < 2 yrs __X__ 1 point; > 2 yrs _____ 0 points

   ii) Required duration of the mitigative effort to control short-term risk — < 2yrs _____ 1 point; > 2yrs __X__ 0 points

Total Points (Maximum = 10) __12__ points

Groundwater Alternative 3 - UV Oxidation

Long-Term Effectiveness and Permanence

1. On-site or off-site treatment or land disposal	
i) On-site treatment	_X_ 3 points
ii) Off-site treatment	_____ 1 point
iii) On-site or off-site land disposal	_____ 0 points
2. Permanence of the remedial alternative	
i) Will the remedy be classified as permanent in accordance with Sec 2.1(a), (b), or (c)? **(if Yes, go to Factor 4)**	Yes _X_ 3 points No _____ 0 points
3. Lifetime of remedial actions	
i) Expected lifetime or duration of effectiveness of the remedy	25-30 yrs _X_ 3 points 20-25 yrs _____ 2 points 15-20 yrs _____ 1 point < 15 yrs _____ 0 points
4. Quantity and nature of waste or residual left at the site after remediation	
i) Quantity of untreated hazardous waste left at the site	None _____ 3 points < 25% _X_ 2 points 25-50% _____ 1 point > 50% _____ 0 points
ii) Is there treated residual left at the site **(if No, go to Factor 5)**	Yes _____ 0 points No _X_ 2 points
iii) Is the treated residual toxic?	Yes _____ 0 points No _____ 1 point
iv) Is the treated residual mobile?	Yes _____ 0 points No _____ 1 point
5. Adequacy and reliability of controls	
i) Operation and maintenance required for a period of:	< 5 yrs ____ 1 point > 5 yrs _X_ 0 points
ii) Are environmental controls required as part of the remedy to handle potential problems? **(if No, go to "iv")**	Yes _____ 0 points No _X_ 1 point
iii) Degree of confidence that controls can adequately handle potential problems	Moderate to very confident _____ 1 point Somewhat to not confident _____ 0 points
iv) Relative degree of long-term monitoring required (compared with other alternatives)	Minimum _____ 2 points Moderate _____ 1 point Extensive _X_ 0 points

Total Points (Maximum = 15) __14__ points

Groundwater Alternative 3 - UV Oxidation

Reduction of Toxicity, Mobility or Volume

1. Volume of hazardous waste reduced
   i) Quantity of hazardous waste destroyed or treated
      - 99-100% _____ 8 points
      - 90-99% _____ 7 points
      - 80-90% _____ 6 points
      - 60-80% __X__ 4 points
      - 40-60% _____ 2 points
      - 20-40% _____ 1 point
      - < 20% _____ 0 points

   ii) Are there untreated or concentrated hazardous waste produced as a result of (I)
      - Yes _____ 0 points
      - No __X__ 2 points

   iii) After remediation, how is the untreated, residual hazardous waste material disposed?
      - Off-site land disposal _____ 0 points
      - On-site land disposal _____ 1 point
      - Off-site destruction/treatment _____ 2 points

2. Reduction in mobility of hazardous waste
   i) Quality of available wastes immobilized after destruction or treatment
   (if Factor 2 is not applicable go to Factor 3)
      - 90-100% _____ 2 points
      - 60-90% _____ 1 point
      - < 60% _____ 0 points

   ii) Method of immobilization
      - Reduced mobility by containment _____ 0 points
      - Reduced mobility by alternative treatment technologies _____ 3 points

3. Irreversibility of the destruction or treatment or immobilization of hazardous waste
   i) Completely irreversible __X__ 5 points
   ii) Irreversible for most of the hazardous waste constituents _____ 3 points
   iii) Irreversible for only some of the hazardous waste constituents _____ 2 points
   iv) Reversible for most of the hazardous waste constituents _____ 0 points

Total Points (Maximum = 15) __11__ points

Implementability

1. Technical Feasibility
   a) Ability to construct technology
      i) Not difficult to construct, No uncertainties __X__ 3 points
      ii) Somewhat difficult to construct, No uncertainties _____ 2 points
      iii) Very difficult to construct, Significant uncertainties _____ 1 point
   b) Reliability of technology
      i) very reliable in meeting the specified process efficiencies or performance goals __X__ 3 points
      ii) Somewhat reliable in meeting the specified process efficiencies or performance goals _____ 2 points
   c) Schedule of delays due to technical problems
      i) Unlikely _____ 2 points
      ii) Somewhat likely __X__ 1 point
   d) Need of undertaking additional remedial action if necessary
      i) No future remedial actions may be anticipated _____ 2 points
      ii) Some future remedial actions may be necessary __X__ 1 point

2. Administrative Feasibility
   a) Coordination with other agencies
      i) Minimal coordination is required _____ 2 points
      ii) required coordination is normal __X__ 1 point
      iii) extensive coordination is required _____ 0 points

3. Availability of Services and Materials
   a) Availability of prospective technologies
      i) Are technologies under consideration generally commercially available?
         - Yes _____ 1 point
         - No __X__ 0 points

      ii) Will more than one vendor be available to provide a competitive bid?
         - Yes _____ 1 point
         - No __X__ 0 points
   b) Availability of necessary equipment and specialists
      i) Additional equipment and specialists may be available without significant delay.
         - Yes _____ 1 point
         - No __X__ 0 points

Total Points (Maximum = 15) __9__ points

Soil/Sediment Alternative 1A - Vapor Extraction With Catalytic Oxidation

CRITERIA

Compliance with SCGs

1. Compliance with chemical-specific SCGs
   i) Meets chemical-specific SCGS such as groundwater standards

   Yes __X__ 4 points
   No _____ 0 points

2. Compliance with action-specific SCGs
   i) Meets SCGs such as technology standards for incineration or landfill

   Yes __X__ 3 points
   No _____ 0 points

3. Compliance with location-specific SCGs
   i) Meets location-specific SCGs such as Freshwater Wetlands Act

   Yes __X__ 3 points
   No _____ 0 points

Total Points (Maximum = 10) __10__ points

Protection of Human Health and Environment

1. Use of the site after remediation
   i) Unrestricted use of the land and water **(if Yes, go to end of table)**

   Yes __X__ 20 points
   No _____ 0 points

2. Human health and the environment exposure after remediation
   i) Is the exposure to contaminants via air route acceptable?

   Yes _____ 3 points
   No _____ 0 points

   ii) Is the exposure to contaminants via groundwater/surface water acceptable?

   Yes _____ 4 points
   No _____ 0 points

   iii) Is the exposure to contaminants via sediments/soil acceptable?

   Yes _____ 3 points
   No _____ 0 points

3. Magnitude of residual public health risks after remediation
   i) Health risk

   < 1 in 1,000,000 _____ 5 points
   < 1 in 100,000 _____ 2 points

4. Magnitude of residual environmental risks after remediation
   i) Less than acceptable _____ 5 points
   ii) Slightly greater than acceptable _____ 3 points
   iii) Significant risk still exists _____ 0 points

Total Points (Maximum = 20) __20__ points

Short-Term Effectiveness

1. Protection of community during remedial actions
   i) Are there significant short-term risks to the community that must be addressed?

   Yes _____ 0 points
   No __X__ 4 points

   ii) Can the risk be easily controlled?

   Yes _____ 1 point
   No _____ 0 points

   iii) Does the mitigative effort to control risk impact the community life-style?

   Yes _____ 0 points
   No _____ 2 points

2. Environmental impacts
   i) Are there significant short-term risks to the environment that must be addressed **(if No, go to Factor 3)**

   Yes _____ 0 points
   No __X__ 4 points

   ii) Are the available mitigative measures reliable to minimize potential impacts?

   Yes _____ 3 points
   No _____ 0 points

3. Time to implement the remedy
   i) What is the time required to implement the remedy?

   < 2 yrs __X__ 1 point
   > 2 yrs _____ 0 points

   ii) Required duration of the mitigative effort to control short-term risk

   < 2yrs _____ 1 point
   > 2yrs __X__ 0 points

Total Points (Maximum = 10) __9__ points

Soil/Sediment Alternative 1A - Vapor Extraction With Catalytic Oxidation

Long-Term Effectiveness and Permanence

1. On-site or off-site treatment or land disposal
   i) On-site treatment — _X_ 3 points
   ii) Off-site treatment — _____ 1 point
   iii) On-site or off-site land disposal — _____ 0 points

2. Permanence of the remedial alternative
   i) Will the remedy be classified as permanent in accordance with Sec 2.1(a), (b), or (c)? **(if Yes, go to Factor 4)** — Yes _X_ 3 points; No _____ 0 points

3. Lifetime of remedial actions
   i) Expected lifetime or duration of effectiveness of the remedy — 25-30 yrs _____ 3 points; 20-25 yrs _____ 2 points; 15-20 yrs _____ 1 point; < 15 yrs _____ 0 points

4. Quantity and nature of waste or residual left at the site after remediation
   i) Quantity of untreated hazardous waste left at the site — None _____ 3 points; < 25% _X_ 2 points; 25-50% _____ 1 point; > 50% _____ 0 points

   ii) Is there treated residual left at the site **(if No, go to Factor 5)** — Yes _____ 0 points; No _X_ 2 points

   iii) Is the treated residual toxic? — Yes _____ 0 points; No _____ 1 point

   iv) Is the treated residual mobile? — Yes _____ 0 points; No _____ 1 point

5. Adequacy and reliability of controls
   i) Operation and maintenance required for a period of: — < 5 yrs _X_ 1 point; > 5 yrs _____ 0 points

   ii) Are environmental controls required as part of the remedy to handle potential problems? **(if No, go to "iv")** — Yes _____ 0 points; No _X_ 1 point

   iii) Degree of confidence that controls can adequately handle potential problems — Moderate to very confident _____ 1 point; Somewhat to not confident _____ 0 points

   iv) Relative degree of long-term monitoring required (compared with other alternatives) — Minimum _X_ 2 points; Moderate _____ 1 point; Extensive _____ 0 points

Total Points (Maximum = 15) ___14 **points**

Soil/Sediment Alternative 1A - Vapor Extraction With Catalytic Oxidation

Reduction of Toxicity, Mobility or Volume

1. Volume of hazardous waste reduced
   i) Quantity of hazardous waste destroyed or treated

   99-100% _____ 8 points
   90-99% _____ 7 points
   80-90% __X__ 6 points
   60-80% _____ 4 points
   40-60% _____ 2 points
   20-40% _____ 1 point
   < 20% _____ 0 points

   ii) Are there untreated or concentrated hazardous waste produced as a result of (I)

   Yes _____ 0 points
   No __X_ 2 points

   iii) After remediation, how is the untreated, residual hazardous waste material disposed?

   Off-site land disposal _____ 0 points
   On-site land disposal _____ 1 point
   Off-site destruction/treatment _____ 2 points

2. Reduction in mobility of hazardous waste
   i) Quality of available wastes immobilized after destruction or treatment
   (if Factor 2 is not applicable go to Factor 3)

   90-100% _____ 2 points
   60-90% _____ 1 point
   < 60% _____ 0 points

   ii) Method of immobilization

   Reduced mobility by containment _____ 0 points
   Reduced mobility by alternative treatment technologies _____ 3 points

3. Irreversibility of the destruction or treatment or immobilization of hazardous waste
   i) Completely irreversible __X_ 5 points
   ii) Irreversible for most of the hazardous waste constituents _____ 3 points
   iii) Irreversible for only some of the hazardous waste constituents _____ 2 points
   iv) Reversible for most of the hazardous waste constituents _____ 0 points

Total Points (Maximum = 15) __13_ points

Implementability

1. Technical Feasibility
   a) Ability to construct technology
      i) Not difficult to construct, No uncertainties _____ 3 points
      ii) Somewhat difficult to construct, No uncertainties _X__ 2 points
      iii) Very difficult to construct, Significant uncertainties _____ 1 point
   b) Reliability of technology
      i) very reliable in meeting the specified process efficiencies or performance goals __X__ 3 points
      ii) Somewhat reliable in meeting the specified process efficiencies or performance goals _____ 2 points
   c) Schedule of delays due to technical problems
      i) Unlikely _____ 2 points
      ii) Somewhat likely __X__ 1 point
   d) Need of undertaking additional remedial action if necessary
      i) No future remedial actions may be anticipated __X__ 2 points
      ii) Some future remedial actions may be necessary _____ 1 point

2. Administrative Feasibility
   a) Coordination with other agencies
      i) Minimal coordination is required _____ 2 points
      ii) required coordination is normal _____ 1 point
      iii) extensive coordination is required __X__ 0 points

3. Availability of Services and Materials
   a) Availability of prospective technologies
      i) Are technologies under consideration generally commercially available?

      Yes __X__ 1 point
      No _____ 0 points

      ii) Will more than one vendor be available to provide a competitive bid?

      Yes _X___ 1 point
      No _____ 0 points

   b) Availability of necessary equipment and specialists
      i) Additional equipment and specialists may be available without significant delay.

      Yes __X__ 1 point
      No _____ 0 points

Total Points (Maximum = 15) _11__ points

Soil/Sediment Alternative 1B - Vapor Extraction With Regenerative Carbon Adsorption

CRITERIA

Compliance with SCGs

1. Compliance with chemical-specific SCGs
   i) Meets chemical-specific SCGS such as groundwater standards — Yes _X_ 4 points; No ____ 0 points

2. Compliance with action-specific SCGs
   i) Meets SCGs such as technology standards for incineration or landfill — Yes _X_ 3 points; No ____ 0 points

3. Compliance with location-specific SCGs
   i) Meets location-specific SCGs such as Freshwater Wetlands Act — Yes _X_ 3 points; No ____ 0 points

Total Points (Maximum = 10) _10_ points

Protection of Human Health and Environment

1. Use of the site after remediation
   i) Unrestricted use of the land and water **(if Yes, go to end of table)** — Yes _X_ 20 points; No ____ 0 points

2. Human health and the environment exposure after remediation
   i) Is the exposure to contaminants via air route acceptable? — Yes ____ 3 points; No ____ 0 points

   ii) Is the exposure to contaminants via groundwater/surface water acceptable? — Yes ____ 4 points; No ____ 0 points

   iii) Is the exposure to contaminants via sediments/soil acceptable? — Yes ____ 3 points; No ____ 0 points

3. Magnitude of residual public health risks after remediation
   i) Health risk — < 1 in 1,000,000 ____ 5 points; < 1 in 100,000 ____ 2 points

4. Magnitude of residual environmental risks after remediation
   i) Less than acceptable — ____ 5 points
   ii) Slightly greater than acceptable — ____ 3 points
   iii) Significant risk still exists — ____ 0 points

Total Points (Maximum = 20) _20_ points

Short-Term Effectiveness

1. Protection of community during remedial actions
   i) Are there significant short-term risks to the community that must be addressed? — Yes ____ 0 points; No _X_ 4 points

   ii) Can the risk be easily controlled? — Yes ____ 1 point; No ____ 0 points

   iii) Does the mitigative effort to control risk impact the community life-style? — Yes ____ 0 points; No ____ 2 points

2. Environmental impacts
   i) Are there significant short-term risks to the environment that must be addressed **(if No, go to Factor 3)** — Yes ____ 0 points; No _X_ 4 points

   ii) Are the available mitigative measures reliable to minimize potential impacts? — Yes ____ 3 points; No ____ 0 points

3. Time to implement the remedy
   i) What is the time required to implement the remedy? — < 2 yrs _X_ 1 point; > 2 yrs ____ 0 points

   ii) Required duration of the mitigative effort to control short-term risk — < 2yrs ____ 1 point; > 2yrs _X_ 0 points

Total Points (Maximum = 10) _9_ points

Soil/Sediment Alternative 1B - Vapor Extraction With Regenerative Carbon Adsorption

Long-Term Effectiveness and Permanence

1. On-site or off-site treatment or land disposal
   - i) On-site treatment — _X_ 3 points
   - ii) Off-site treatment — _____ 1 point
   - iii) On-site or off-site land disposal — _____ 0 points

2. Permanence of the remedial alternative
   - i) Will the remedy be classified as permanent in accordance with Sec 2.1(a), (b), or (c)? **(if Yes, go to Factor 4)**
     - Yes _X_ 3 points
     - No _____ 0 points

3. Lifetime of remedial actions
   - i) Expected lifetime or duration of effectiveness of the remedy
     - 25-30 yrs _____ 3 points
     - 20-25 yrs _____ 2 points
     - 15-20 yrs _____ 1 point
     - < 15 yrs _____ 0 points

4. Quantity and nature of waste or residual left at the site after remediation
   - i) Quantity of untreated hazardous waste left at the site
     - None _____ 3 points
     - < 25% _X_ 2 points
     - 25-50% _____ 1 point
     - > 50% _____ 0 points
   - ii) Is there treated residual left at the site **(if No, go to Factor 5)**
     - Yes _____ 0 points
     - No _X_ 2 points
   - iii) Is the treated residual toxic?
     - Yes _____ 0 points
     - No _____ 1 point
   - iv) Is the treated residual mobile?
     - Yes _____ 0 points
     - No _____ 1 point

5. Adequacy and reliability of controls
   - i) Operation and maintenance required for a period of:
     - < 5 yrs _X_ 1 point
     - > 5 yrs _____ 0 points
   - ii) Are environmental controls required as part of the remedy to handle potential problems? **(if No, go to "iv")**
     - Yes _____ 0 points
     - No _X_ 1 point
   - iii) Degree of confidence that controls can adequately handle potential problems
     - Moderate to very confident _____ 1 point
     - Somewhat to not confident _____ 0 points
   - iv) Relative degree of long-term monitoring required (compared with other alternatives)
     - Minimum _X_ 2 points
     - Moderate _____ 1 point
     - Extensive _____ 0 points

Total Points (Maximum = 15) _14_ points

Soil/Sediment Alternative 1B - Vapor Extraction With Regenerative Carbon Adsorption

Reduction of Toxicity, Mobility or Volume

1. Volume of hazardous waste reduced
   i) Quantity of hazardous waste destroyed or treated

   99-100% _____ 8 points
   90-99% _____ 7 points
   80-90% __X__ 6 points
   60-80% _____ 4 points
   40-60% _____ 2 points
   20-40% _____ 1 point
   < 20% _____ 0 points

   ii) Are there untreated or concentrated hazardous waste produced as a result of (I)

   Yes _____ 0 points
   No __X__ 2 points

   iii) After remediation, how is the untreated, residual hazardous waste material disposed?

   Off-site land disposal _____ 0 points
   On-site land disposal _____ 1 point
   Off-site destruction/treatment _____ 2 points

2. Reduction in mobility of hazardous waste
   i) Quality of available wastes immobilized after destruction or treatment
   (if Factor 2 is not applicable go to Factor 3)

   90-100% _____ 2 points
   60-90% _____ 1 point
   < 60% _____ 0 points

   ii) Method of immobilization

   Reduced mobility by containment _____ 0 points
   Reduced mobility by alternative treatment technologies _____ 3 points

3. Irreversibility of the destruction or treatment or immobilization of hazardous waste
   i) Completely irreversible __X__ 5 points
   ii) Irreversible for most of the hazardous waste constituents _____ 3 points
   iii) Irreversible for only some of the hazardous waste constituents _____ 2 points
   iv) Reversible for most of the hazardous waste constituents _____ 0 points

Total Points (Maximum = 15) __13__ points

Implementability

1. Technical Feasibility
   a) Ability to construct technology
      i) Not difficult to construct, No uncertainties _____ 3 points
      ii) Somewhat difficult to construct, No uncertainties __X__ 2 points
      iii) Very difficult to construct, Significant uncertainties _____ 1 point
   b) Reliability of technology
      i) very reliable in meeting the specified process efficiencies or performance goals _____ 3 points
      ii) Somewhat reliable in meeting the specified process efficiencies or performance goals __X__ 2 points
   c) Schedule of delays due to technical problems
      i) Unlikely _____ 2 points
      ii) Somewhat likely __X__ 1 point
   d) Need of undertaking additional remedial action if necessary
      i) No future remedial actions may be anticipated __X__ 2 points
      ii) Some future remedial actions may be necessary _____ 1 point

2. Administrative Feasibility
   a) Coordination with other agencies
      i) Minimal coordination is required _____ 2 points
      ii) required coordination is normal _____ 1 point
      iii) extensive coordination is required __X__ 0 points

3. Availability of Services and Materials
   a) Availability of prospective technologies
      i) Are technologies under consideration generally commercially available?
      Yes __X__ 1 point
      No _____ 0 points

      ii) Will more than one vendor be available to provide a competitive bid?
      Yes __X__ 1 point
      No _____ 0 points
   b) Availability of necessary equipment and specialists
      i) Additional equipment and specialists may be available without significant delay.
      Yes __X__ 1 point
      No _____ 0 points

Total Points (Maximum = 15) __10__ points

Soil/Sediment Alternative 2 - Dredging of Drainage Basin Sediments

CRITERIA

Compliance with SCGs

1. Compliance with chemical-specific SCGs
   i) Meets chemical-specific SCGS such as groundwater standards — Yes __X__ 4 points; No ____ 0 points

2. Compliance with action-specific SCGs
   i) Meets SCGs such as technology standards for incineration or landfill — Yes _____ 3 points; No __X__ 0 points

3. Compliance with location-specific SCGs
   i) Meets location-specific SCGs such as Freshwater Wetlands Act — Yes ______ 3 points; No __X__ 0 points

Total Points (Maximum = 10) __4__ points

Protection of Human Health and Environment

1. Use of the site after remediation
   i) Unrestricted use of the land and water **(if Yes, go to end of table)** — Yes __X__ 20 points; No _____ 0 points

2. Human health and the environment exposure after remediation
   i) Is the exposure to contaminants via air route acceptable? — Yes _____ 3 points; No _____ 0 points

   ii) Is the exposure to contaminants via groundwater/surface water acceptable? — Yes _____ 4 points; No _____ 0 points

   iii) Is the exposure to contaminants via sediments/soil acceptable? — Yes _____ 3 points; No _____ 0 points

3. Magnitude of residual public health risks after remediation
   i) Health risk — < 1 in 1,000,000 _____ 5 points; < 1 in 100,000 _____ 2 points

4. Magnitude of residual environmental risks after remediation
   i) Less than acceptable — _____ 5 points
   ii) Slightly greater than acceptable — _____ 3 points
   iii) Significant risk still exists — _____ 0 points

Total Points (Maximum = 20) __20__ points

Short-Term Effectiveness

1. Protection of community during remedial actions
   i) Are there significant short-term risks to the community that must be addressed? — Yes ______ 0 points; No __X__ 4 points

   ii) Can the risk be easily controlled? — Yes ___ 1 point; No _____ 0 points

   iii) Does the mitigative effort to control risk impact the community life-style? — Yes ____ 0 points; No ___ 2 points

2. Environmental impacts
   i) Are there significant short-term risks to the environment that must be addressed **(if No, go to Factor 3)** — Yes ____ 0 points; No __X__ 4 points

   ii) Are the available mitigative measures reliable to minimize potential impacts? — Yes ____ 3 points; No _____ 0 points

3. Time to implement the remedy
   i) What is the time required to implement the remedy? — < 2 yrs __X__ 1 point; > 2 yrs ____ 0 points

   ii) Required duration of the mitigative effort to control short-term risk — < 2yrs __X__ 1 point; > 2yrs _____ 0 points

Total Points (Maximum = 10) __10__ points

Soil/Sediment Alternative 2 - Dredging of Drainage Basin Sediments

Reduction of Toxicity, Mobility or Volume

1. Volume of hazardous waste reduced
   i) Quantity of hazardous waste destroyed or treated
      - 99-100% _____ 8 points
      - 90-99% __X_ 7 points
      - 80-90% _____ 6 points
      - 60-80% _____ 4 points
      - 40-60% _____ 2 points
      - 20-40% _____ 1 point
      - < 20% _____ 0 points

   ii) Are there untreated or concentrated hazardous waste produced as a result of (I)
      - Yes _____ 0 points
      - No __X_ 2 points

   iii) After remediation, how is the untreated, residual hazardous waste material disposed?
      - Off-site land disposal __X_ 0 points
      - On-site land disposal _____ 1 point
      - Off-site destruction/treatment _____ 2 points

2. Reduction in mobility of hazardous waste
   i) Quality of available wastes immobilized after destruction or treatment **(if Factor 2 is not applicable go to Factor 3)**
      - 90-100% __X__ 2 points
      - 60-90% _____ 1 point
      - < 60% _____ 0 points

   ii) Method of immobilization
      - Reduced mobility by containment _____ 0 points
      - Reduced mobility by alternative treatment technologies _____ 3 points

3. Irreversibility of the destruction or treatment or immobilization of hazardous waste
   i) Completely irreversible _____ 5 points
   ii) Irreversible for most of the hazardous waste constituents _____ 3 points
   iii) Irreversible for only some of the hazardous waste constituents _____ 2 points
   iv) Reversible for most of the hazardous waste constituents __X__ 0 points

Total Points (Maximum = 15) __11_ points

Implementability

1. Technical Feasibility
   a) Ability to construct technology
      i) Not difficult to construct, No uncertainties _____ 3 points
      ii) Somewhat difficult to construct, No uncertainties _____ 2 points
      iii) Very difficult to construct, Significant uncertainties __X__ 1 point
   b) Reliability of technology
      i) very reliable in meeting the specified process efficiencies or performance goals _____ 3 points
      ii) Somewhat reliable in meeting the specified process efficiencies or performance goals __X_ 2 points
   c) Schedule of delays due to technical problems
      i) Unlikely _____ 2 points
      ii) Somewhat likely __X__ 1 point
   d) Need of undertaking additional remedial action if necessary
      i) No future remedial actions may be anticipated _____ 2 points
      ii) Some future remedial actions may be necessary __X__ 1 point

2. Administrative Feasibility
   a) Coordination with other agencies
      i) Minimal coordination is required _____ 2 points
      ii) required coordination is normal _____ 1 point
      iii) extensive coordination is required __X__ 0 points

3. Availability of Services and Materials
   a) Availability of prospective technologies
      i) Are technologies under consideration generally commercially available?
         - Yes _____ 1 point
         - No __X_ 0 points
      ii) Will more than one vendor be available to provide a competitive bid?
         - Yes _X___ 1 point
         - No _____ 0 points
   b) Availability of necessary equipment and specialists
      i) Additional equipment and specialists may be available without significant delay.
         - Yes _X__ 1 point
         - No _____ 0 points

Total Points (Maximum = 15) _7__ points

Soil/Sediment Alternative 3 - Sediment Removal From Drainage Basin By Excavation

CRITERIA

Compliance with SCGs

1. Compliance with chemical-specific SCGs
   i) Meets chemical-specific SCGS such as groundwater standards — Yes __X__ 4 points; No ____ 0 points

2. Compliance with action-specific SCGs
   i) Meets SCGs such as technology standards for incineration or landfill — Yes ____ 3 points; No __X__ 0 points

3. Compliance with location-specific SCGs
   i) Meets location-specific SCGs such as Freshwater Wetlands Act — Yes ____ 3 points; No __X__ 0 points

Total Points (Maximum = 10) __4__ points

Protection of Human Health and Environment

1. Use of the site after remediation
   i) Unrestricted use of the land and water **(if Yes, go to end of table)** — Yes __X__ 20 points; No ____ 0 points

2. Human health and the environment exposure after remediation
   i) Is the exposure to contaminants via air route acceptable? — Yes ____ 3 points; No ____ 0 points
   ii) Is the exposure to contaminants via groundwater/surface water acceptable? — Yes ____ 4 points; No ____ 0 points
   iii) Is the exposure to contaminants via sediments/soil acceptable? — Yes ____ 3 points; No ____ 0 points

3. Magnitude of residual public health risks after remediation
   i) Health risk — < 1 in 1,000,000 ____ 5 points; < 1 in 100,000 ____ 2 points

4. Magnitude of residual environmental risks after remediation
   i) Less than acceptable — ____ 5 points
   ii) Slightly greater than acceptable — ____ 3 points
   iii) Significant risk still exists — ____ 0 points

Total Points (Maximum = 20) __20__ points

Short-Term Effectiveness

1. Protection of community during remedial actions
   i) Are there significant short-term risks to the community that must be addressed? — Yes ____ 0 points; No __X__ 4 points
   ii) Can the risk be easily controlled? — Yes ____ 1 point; No ____ 0 points
   iii) Does the mitigative effort to control risk impact the community life-style? — Yes ____ 0 points; No ____ 2 points

2. Environmental impacts
   i) Are there significant short-term risks to the environment that must be addressed **(if No, go to Factor 3)** — Yes ____ 0 points; No __X__ 4 points
   ii) Are the available mitigative measures reliable to minimize potential impacts? — Yes ____ 3 points; No ____ 0 points

3. Time to implement the remedy
   i) What is the time required to implement the remedy? — < 2 yrs __X__ 1 point; > 2 yrs ____ 0 points
   ii) Required duration of the mitigative effort to control short-term risk — < 2yrs __X__ 1 point; > 2yrs ____ 0 points

Total Points (Maximum = 10) __10__ points

Soil/Sediment Alternative 3 - Sediment Removal From Drainage Basin By Excavation

Long-Term Effectiveness and Permanence

1. On-site or off-site treatment or land disposal
   - i) On-site treatment ____ 3 points
   - ii) Off-site treatment _____ 1 point
   - iii) On-site or off-site land disposal __X__ 0 points

2. Permanence of the remedial alternative
   - i) Will the remedy be classified as permanent in accordance with Sec 2.1(a), (b), or (c)? **(if Yes, go to Factor 4)**

     Yes __X__ 3 points
     No _____ 0 points

3. Lifetime of remedial actions
   - i) Expected lifetime or duration of effectiveness of the remedy

     25-30 yrs _____ 3 points
     20-25 yrs _____ 2 points
     15-20 yrs _____ 1 point
     < 15 yrs _____ 0 points

4. Quantity and nature of waste or residual left at the site after remediation
   - i) Quantity of untreated hazardous waste left at the site

     None _____ 3 points
     < 25% __X_ 2 points
     25-50% _____ 1 point
     > 50% _____ 0 points

   - ii) Is there treated residual left at the site **(if No, go to Factor 5)**

     Yes _____ 0 points
     No __X_ 2 points

   - iii) Is the treated residual toxic?

     Yes _____ 0 points
     No _____ 1 point

   - iv) Is the treated residual mobile?

     Yes _____ 0 points
     No _____ 1 point

5. Adequacy and reliability of controls
   - i) Operation and maintenance required for a period of:

     < 5 yrs _X__ 1 point
     > 5 yrs ____ 0 points

   - ii) Are environmental controls required as part of the remedy to handle potential problems? **(if No, go to "iv")**

     Yes _____ 0 points
     No __X_ 1 point

   - iii) Degree of confidence that controls can adequately handle potential problems

     Moderate to very confident _____ 1 point
     Somewhat to not confident _____ 0 points

   - iv) Relative degree of long-term monitoring required (compared with other alternatives)

     Minimum __X__ 2 points
     Moderate _____ 1 point
     Extensive _____ 0 points

Total Points (Maximum = 15) ___11 points

Soil/Sediment Alternative 3 - Sediment Removal From Drainage Basin By Excavation

Reduction of Toxicity, Mobility or Volume

1. Volume of hazardous waste reduced
   i) Quantity of hazardous waste destroyed or treated
      - 99-100% _____ 8 points
      - 90-99% __X__ 7 points
      - 80-90% _____ 6 points
      - 60-80% _____ 4 points
      - 40-60% _____ 2 points
      - 20-40% _____ 1 point
      - < 20% _____ 0 points

   ii) Are there untreated or concentrated hazardous waste produced as a result of (I)
      - Yes _____ 0 points
      - No __X__ 2 points

   iii) After remediation, how is the untreated, residual hazardous waste material disposed?
      - Off-site land disposal __X__ 0 points
      - On-site land disposal _____ 1 point
      - Off-site destruction/treatment _____ 2 points

2. Reduction in mobility of hazardous waste
   i) Quality of available wastes immobilized after destruction or treatment.
   (if Factor 2 is not applicable go to Factor 3)
      - 90-100% __X__ 2 points
      - 60-90% _____ 1 point
      - < 60% _____ 0 points

   ii) Method of immobilization
      - Reduced mobility by containment _____ 0 points
      - Reduced mobility by alternative treatment technologies _____ 3 points

3. Irreversibility of the destruction or treatment or immobilization of hazardous waste
   i) Completely irreversible _____ 5 points
   ii) Irreversible for most of the hazardous waste constituents _____ 3 points
   iii) Irreversible for only some of the hazardous waste constituents _____ 2 points
   iv) Reversible for most of the hazardous waste constituents __X__ 0 points

Total Points (Maximum = 15) __11__ points

Implementability

1. Technical Feasibility
   a) Ability to construct technology
      i) Not difficult to construct, No uncertainties _____ 3 points
      ii) Somewhat difficult to construct, No uncertainties _____ 2 points
      iii) Very difficult to construct, Significant uncertainties __X__ 1 point
   b) Reliability of technology
      i) very reliable in meeting the specified process efficiencies or performance goals _____ 3 points
      ii) Somewhat reliable in meeting the specified process efficiencies or performance goals __X__ 2 points
   c) Schedule of delays due to technical problems
      i) Unlikely _____ 2 points
      ii) Somewhat likely __X__ 1 point
   d) Need of undertaking additional remedial action if necessary
      i) No future remedial actions may be anticipated _____ 2 points
      ii) Some future remedial actions may be necessary __X__ 1 point

2. Administrative Feasibility
   a) Coordination with other agencies
      i) Minimal coordination is required _____ 2 points
      ii) required coordination is normal _____ 1 point
      iii) extensive coordination is required __X__ 0 points

3. Availability of Services and Materials
   a) Availability of prospective technologies
      i) Are technologies under consideration generally commercially available?
         - Yes _____ 1 point
         - No __X__ 0 points
      ii) Will more than one vendor be available to provide a competitive bid?
         - Yes __X__ 1 point
         - No _____ 0 points
   b) Availability of necessary equipment and specialists
      i) Additional equipment and specialists may be available without significant delay.
         - Yes __X__ 1 point
         - No _____ 0 points

Total Points (Maximum = 15) __7__ points

Soil/Sediment Alternative 4 - Drainage Basin Deed Restriction

CRITERIA

Compliance with SCGs

1. Compliance with chemical-specific SCGs
   i) Meets chemical-specific SCGS such as groundwater standards — Yes _____ 4 points; No __X__ 0 points

2. Compliance with action-specific SCGs
   i) Meets SCGs such as technology standards for incineration or landfill — Yes _____ 3 points; No __X__ 0 points

3. Compliance with location-specific SCGs
   i) Meets location-specific SCGs such as Freshwater Wetlands Act — Yes __X__ 3 points; No _____ 0 points

Total Points (Maximum = 10) __3__ points

Protection of Human Health and Environment

1. Use of the site after remediation
   i) Unrestricted use of the land and water **(if Yes, go to end of table)** — Yes _____ 20 points; No __X__ 0 points

2. Human health and the environment exposure after remediation
   i) Is the exposure to contaminants via air route acceptable? — Yes __X__ 3 points; No _____ 0 points

   ii) Is the exposure to contaminants via groundwater/surface water acceptable? — Yes __X__ 4 points; No _____ 0 points

   iii) Is the exposure to contaminants via sediments/soil acceptable? — Yes _____ 3 points; No __X__ 0 points

3. Magnitude of residual public health risks after remediation
   i) Health risk — < 1 in 1,000,000 __X__ 5 points; < 1 in 100,000 _____ 2 points

4. Magnitude of residual environmental risks after remediation
   i) Less than acceptable — __X__ 5 points
   ii) Slightly greater than acceptable — _____ 3 points
   iii) Significant risk still exists — _____ 0 points

Total Points (Maximum = 20) __17__ points

Short-Term Effectiveness

1. Protection of community during remedial actions
   i) Are there significant short-term risks to the community that must be addressed? — Yes _____ 0 points; No __X__ 4 points

   ii) Can the risk be easily controlled? — Yes __X__ 1 point; No _____ 0 points

   iii) Does the mitigative effort to control risk impact the community life-style? — Yes _____ 0 points; No __X__ 2 points

2. Environmental impacts
   i) Are there significant short-term risks to the environment that must be addressed **(if No, go to Factor 3)** — Yes _____ 0 points; No __X__ 4 points

   ii) Are the available mitigative measures reliable to minimize potential impacts? — Yes _____ 3 points; No _____ 0 points

3. Time to implement the remedy
   i) What is the time required to implement the remedy? — < 2 yrs __X__ 1 point; > 2 yrs _____ 0 points

   ii) Required duration of the mitigative effort to control short-term risk — < 2yrs _____ 1 point; > 2yrs __X__ 0 points

Total Points (Maximum = 10) __10__ points

Soil/Sediment Alternative 4 - Drainage Basin Deed Restriction

Long-Term Effectiveness and Permanence

1. On-site or off-site treatment or land disposal
   - i) On-site treatment — _X_ 3 points
   - ii) Off-site treatment — ____ 1 point
   - iii) On-site or off-site land disposal — ____ 0 points
2. Permanence of the remedial alternative
   - i) Will the remedy be classified as permanent in accordance with Sec 2.1(a), (b), or (c)? **(if Yes, go to Factor 4)** — Yes ____ 3 points; No __X__ 0 points
3. Lifetime of remedial actions
   - i) Expected lifetime or duration of effectiveness of the remedy — 25-30 yrs _X_ 3 points; 20-25 yrs ____ 2 points; 15-20 yrs ____ 1 point; < 15 yrs ____ 0 points
4. Quantity and nature of waste or residual left at the site after remediation
   - i) Quantity of untreated hazardous waste left at the site — None ____ 3 points; < 25% ____ 2 points; 25-50% ____ 1 point; > 50% __X_ 0 points
   - ii) Is there treated residual left at the site **(if No, go to Factor 5)** — Yes ____ 0 points; No __X_ 2 points
   - iii) Is the treated residual toxic? — Yes ____ 0 points; No ____ 1 point
   - iv) Is the treated residual mobile? — Yes ____ 0 points; No ____ 1 point
5. Adequacy and reliability of controls
   - i) Operation and maintenance required for a period of: — < 5 yrs ____ 1 point; > 5 yrs _X_ 0 points
   - ii) Are environmental controls required as part of the remedy to handle potential problems? **(if No, go to "iv")** — Yes ____ 0 points; No _X_ 1 point
   - iii) Degree of confidence that controls can adequately handle potential problems — Moderate to very confident ____ 1 point; Somewhat to not confident ____ 0 points
   - iv) Relative degree of long-term monitoring required (compared with other alternatives) — Minimum _X_ 2 points; Moderate ____ 1 point; Extensive ____ 0 points

Total Points (Maximum = 15) __11_ points

Soil/Sediment Alternative 4 - Drainage Basin Deed Restriction

Reduction of Toxicity, Mobility or Volume

1. Volume of hazardous waste reduced
   i) Quantity of hazardous waste destroyed or treated
      - 99-100% _____ 8 points
      - 90-99% _____ 7 points
      - 80-90% _____ 6 points
      - 60-80% _____ 4 points
      - 40-60% _____ 2 points
      - 20-40% _____ 1 point
      - < 20% __X__ 0 points

   ii) Are there untreated or concentrated hazardous waste produced as a result of (I)
      - Yes _____ 0 points
      - No __X__ 2 points

   iii) After remediation, how is the untreated, residual hazardous waste material disposed?
      - Off-site land disposal _____ 0 points
      - On-site land disposal __X__ 1 point
      - Off-site destruction/treatment _____ 2 points

2. Reduction in mobility of hazardous waste
   i) Quality of available wastes immobilized after destruction or treatment
   (if Factor 2 is not applicable go to Factor 3)
      - 90-100% __X__ 2 points
      - 60-90% _____ 1 point
      - < 60% _____ 0 points

   ii) Method of immobilization
      - Reduced mobility by containment _____ 0 points
      - Reduced mobility by alternative treatment technologies _____ 3 points

3. Irreversibility of the destruction or treatment or immobilization of hazardous waste
   i) Completely irreversible _____ 5 points
   ii) Irreversible for most of the hazardous waste constituents __X__ 3 points
   iii) Irreversible for only some of the hazardous waste constituents _____ 2 points
   iv) Reversible for most of the hazardous waste constituents _____ 0 points

Total Points (Maximum = 15) __8__ points

Implementability

1. Technical Feasibility
   a) Ability to construct technology
      i) Not difficult to construct, No uncertainties __X__ 3 points
      ii) Somewhat difficult to construct, No uncertainties _____ 2 points
      iii) Very difficult to construct, Significant uncertainties _____ 1 point
   b) Reliability of technology
      i) very reliable in meeting the specified process efficiencies or performance goals _____ 3 points
      ii) Somewhat reliable in meeting the specified process efficiencies or performance goals __X__ 2 points
   c) Schedule of delays due to technical problems
      i) Unlikely __X__ 2 points
      ii) Somewhat likely _____ 1 point
   d) Need of undertaking additional remedial action if necessary
      i) No future remedial actions may be anticipated _____ 2 points
      ii) Some future remedial actions may be necessary __X__ 1 point

2. Administrative Feasibility
   a) Coordination with other agencies
      i) Minimal coordination is required __X__ 2 points
      ii) required coordination is normal _____ 1 point
      iii) extensive coordination is required _____ 0 points

3. Availability of Services and Materials
   a) Availability of prospective technologies
      i) Are technologies under consideration generally commercially available?
         - Yes __X__ 1 point
         - No _____ 0 points

      ii) Will more than one vendor be available to provide a competitive bid?
         - Yes __X__ 1 point
         - No _____ 0 points
   b) Availability of necessary equipment and specialists
      i) Additional equipment and specialists may be available without significant delay.
         - Yes __X__ 1 point
         - No _____ 0 points

Total Points (Maximum = 15) __13__ points

Soil/Sediment Alternative 2 - Dredging of Drainage Basin Sediments

Long-Term Effectiveness and Permanence

1. On-site or off-site treatment or land disposal
   i) On-site treatment ____ 3 points
   ii) Off-site treatment _____ 1 point
   iii) On-site or off-site land disposal __X__ 0 points

2. Permanence of the remedial alternative
   i) Will the remedy be classified as permanent in accordance with Sec 2.1(a), (b), or (c)? **(if Yes, go to Factor 4)**
   Yes __X__ 3 points
   No _____ 0 points

3. Lifetime of remedial actions
   i) Expected lifetime or duration of effectiveness of the remedy
   25-30 yrs _____ 3 points
   20-25 yrs _____ 2 points
   15-20 yrs _____ 1 point
   < 15 yrs _____ 0 points

4. Quantity and nature of waste or residual left at the site after remediation
   i) Quantity of untreated hazardous waste left at the site
   None _____ 3 points
   < 25% __X__ 2 points
   25-50% _____ 1 point
   > 50% _____ 0 points

   ii) Is there treated residual left at the site **(if No, go to Factor 5)**
   Yes _____ 0 points
   No __X__ 2 points

   iii) Is the treated residual toxic?
   Yes _____ 0 points
   No _____ 1 point

   iv) Is the treated residual mobile?
   Yes _____ 0 points
   No _____ 1 point

5. Adequacy and reliability of controls
   i) Operation and maintenance required for a period of:
   < 5 yrs __X__ 1 point
   > 5 yrs ___ 0 points

   ii) Are environmental controls required as part of the remedy to handle potential problems? **(if No, go to "iv")**
   Yes _____ 0 points
   No __X__ 1 point

   iii) Degree of confidence that controls can adequately handle potential problems
   Moderate to very confident _____ 1 point
   Somewhat to not confident _____ 0 points

   iv) Relative degree of long-term monitoring required (compared with other alternatives)
   Minimum __X__ 2 points
   Moderate _____ 1 point
   Extensive _____ 0 points

Total Points (Maximum = 15) ___11 points

APPENDIX E
Capital and Operational/Maintenance Cost Analysis

Present Worth Evaluation

	Groundwater Remediation					Soil Remediation	
	GW Alternative 1 Carbon	GW Alternative 2 Stripper	GW Alternative 2A Stripper Carbon Off-Gas	GW Alternative 2B Stripper Catalytic Off-Gas	GW Alternative 3 UV Oxidation	Soil/Sediment Alternative 1A Catalytic Oxidation	Soil/Sediment Alternative 1B Regenerative Carbon
Total Capital Cost	$2,289,640	$2,297,640	$2,518,440	$3,094,440	$2,969,640	$1,036,120	$1,252,000
Annual O & M Cost	$1,079,300	$515,300	$615,300	$639,300	$985,300	$138,808	$152,408
Present Worth O & M Cost	$28,279,915	$13,502,000	$16,122,000	$16,751,000	$25,817,000	$680,938	$747,654
Total Present Worth	**$30,570,000**	**$15,800,000**	**$18,641,000**	**$19,845,000**	**$28,787,000**	**$1,717,000**	**$2,000,000**

Notes:

(1) Groundwater Alternatives 1, 2, 2A, 2B, & 3are based on 30 years, 5% interest and 4% inflation compounded annually.

(2) Soil/Sediment Alternatives 1A & 1B are based on 5 years, 5% interest and 4% inflation compounded annually.

(3) These cost estimates represent our opinion as design professionals of probable construction and operation costs and are provided for general guidance in the establishment of budgets. Actual contractor bids to the client are a function of final design, competitive bidding and market conditions.

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Present Worth Evaluation (Cont'd)

	Sediment Remediation		
	Soil/Sediment Alternative 2 Dredging	Soil/Sediment Alternative 3 Excavation	Soil/Sediment Alternative 4 Deed Restriction
Total Capital Cost	$9,620,120	$8,549,750	$1,258,500
Annual O & M Cost	$0	$0	$3,300
Present Worth O & M Cost	$0	$0	$86,500
Total Present Worth	**$9,620,120**	**$8,549,750**	**$1,345,000**

Notes:

(1) Soil/Sediment Alternative 4 is based on 30 years, 5% interest and 4% inflation compounded annually.

(2) These cost estimates represent our opinion as design professionals of probable construction and operation costs and are provided for general guidance in the establishment of budgets. Actual contractor bids to the client are a function of final design, competitive bidding and market conditions.

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Groundwater Alternative 1 - Carbon Adsorption
Cost Analysis

Capital & Installation Costs:

	Unit Cost	Quantity	Total Cost
Extraction			
Extraction Wells	$32,000	5	$160,000
Pump system	$19,000	5	$95,000
Transmission pipe/conduit (LF)	$45	2,085	$93,825
			$348,825
Treatment			
Building, heat, ventilation	$110,000	1	$110,000
Power source	$15,000	1	$15,000
Landscaping and security	$10,000	1	$10,000
Pressure filitration	$80,000	1	$80,000
Process piping/valves	$55,000	1	$55,000
Process control	$60,000	1	$60,000
Process electrical	$30,000	1	$30,000
Liquid phase GAC	$320,000	1	$320,000
			$680,000
Recharge			
Wet well	$20,000	1	$20,000
Diffusion wells	$32,000	5	$160,000
Pumping system	$7,000	5	$35,000
Distribution piping (LF)	$45	4,160	$187,200
			$402,200
Subtotal			$1,431,025
Contingency (20%)			$286,205
Engineering (15%)			$214,654
Construction Mgmt. (15%)			$214,654
Administration (10%)			$143,103
			$2,289,640

Annual Operating Cost:

	Unit Cost	Quantity	Total Cost
Electricity - Well Pump	$0.12 per kwhr	350 Hp	$275,000
Carbon Replacement	$12,480/event	50	$624,000
Maintenance - Materials	$50,000	1	$50,000
Solids Disposal	$500 per drum	20	$10,000
Analytical Monitoring	$525/week	52	$30,000
System Engineer	$35/hour	500	$17,500
Operator - 1 man	$35/hour	2080	$72,800
		Subtotal	**$1,079,300**

30 Year Present Worth @ 5% Interest & 4% Inflation

Compounded Annually for 30 Yrs. **$28,279,915**

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Groundwater Alternative 2 - Air Stripping
Cost Analysis

Capital & Installation Costs:

	Unit Cost	Quantity	Total Cost
Extraction			
Extraction Wells	$32,000	5	$160,000
Pump system	$19,000	5	$95,000
Transmission pipe/conduit (LF)	$45	2,085	$93,825
			$348,825
Treatment			
Building, heat, ventilation	$110,000	1	$110,000
Power source	$15,000	1	$15,000
Landscaping and security	$10,000	1	$10,000
Pressure filitration	$80,000	1	$80,000
Process piping/valves	$55,000	1	$55,000
Process control	$60,000	1	$60,000
Process electrical	$30,000	1	$30,000
Intermediate wet well	$20,000	1	$20,000
Process pump	$25,000	1	$25,000
Air stripper (2 units)	$280,000	1	$280,000
			$685,000
Recharge			
Wet well	$20,000	1	$20,000
Diffusion wells	$32,000	5	$160,000
Pumping system	$7,000	5	$35,000
Distribution piping (LF)	$45	4,160	$187,200
			$402,200
Subtotal			$1,436,025
Contingency (20%)			$287,205
Engineering (15%)			$215,404
Construction Mng. (15%)			$215,404
Administration (10%)			$143,603
		Subtotal	**$2,297,640**

Annual Operating Cost:

	Unit Cost	Quantity	Total Cost
Electricity - Well Pump	$0.12 per kwhr	425 Hp	$335,000
Maintenance - Materials	$50,000	1	$50,000
Solids Disposal	$500 per drum	20	$10,000
Analytical Monitoring	$525/week	52	$30,000
System Engineer	$35/hour	500	$17,500
Operator - 1 man	$35/hour	2080	$72,800
		Subtotal	**$515,300**

30 Year Present Worth @ 5% Interest & 4% Inflation
Compounded Annually for 30 Yrs. **$13,501,937**

H2M GROUP

Groundwater Alternative 2A - Air Stripping/Vapor Phase Carbon Off-Gas Treatment Cost Analysis

Capital & Installation Costs:

	Unit Cost	Quantity	Total Cost
Extraction			
Extraction Wells	$32,000	5	$160,000
Pump system	$19,000	5	$95,000
Transmission pipe/conduit (LF)	$45	2,085	$93,825
			$348,825
Treatment			
Building, heat, ventilation	$110,000	1	$110,000
Power source	$15,000	1	$15,000
Landscaping and security	$10,000	1	$10,000
Pressure filitration	$80,000	1	$80,000
Process piping/valves	$55,000	1	$75,000
Process control	$60,000	1	$70,000
Process electrical	$30,000	1	$40,000
Intermediate wet well	$20,000	1	$20,000
Process pump	$25,000	1	$25,000
Air stripper (2 units)	$280,000	1	$280,000
Booster blower (30 Hp)	$8,000	1	$8,000
Vapor phase GAC	$90,000	1	$90,000
			$823,000
Recharge			
Wet well	$20,000	1	$20,000
Diffusion wells	$32,000	5	$160,000
Pumping system	$7,000	5	$35,000
Distribution piping (LF)	$45	4,160	$187,200
			$402,200
Subtotal			$1,574,025
Contingency (20%)			$314,805
Engineering (15%)			$236,104
Construction Mng. (15%)			$236,104
Administration (10%)			$157,403
		Subtotal	**$2,518,440**

Annual Operating Cost:

	Unit Cost	Quantity	Total Cost
Electricity - Well Pump	$0.12 per kwhr	450 Hp	$355,000
Vapor Carbon Replacement		30 ton	$80,000
Maintenance - Materials	$50,000	1	$50,000
Solids Disposal	$500 per drum	20	$10,000
Analytical Monitoring	$525/week	52	$30,000
System Engineer	$35/hour	500	$17,500
Operator - 1 man	$35/hour	2,080	$72,800
		Subtotal	**$615,300**

30 Year Present Worth @ 5% Interest & 4% Inflation Compounded Annually for 30 Yrs.	**$16,122,146**

H2MGROUP

Groundwater Alternative 2B - Air Stripping/Catalytic Incineration Off-Gas Treatment Cost Analysis

Capital & Installation Costs:

	Unit Cost	Quantity	Total Cost
Extraction			
Extraction Wells	$32,000	5	$160,000
Pump system	$19,000	5	$95,000
Transmission pipe/conduit (LF)	$45	2,085	$93,825
			$348,825
Treatment			
Building, heat, ventilation	$110,000	1	$110,000
Power source	$15,000	1	$15,000
Landscaping and security	$10,000	1	$10,000
Pressure filitration	$80,000	1	$80,000
Process piping/valves	$55,000	1	$75,000
Process control	$60,000	1	$70,000
Process electrical	$30,000	1	$40,000
Intermediate wet well	$20,000	1	$20,000
Process pump	$25,000	1	$25,000
Air stripper (2 units)	$280,000	1	$280,000
Booster blower (30 Hp)	$8,000	1	$8,000
Catylytic oxidizer	$450,000	1	$450,000
			$1,183,000
Recharge			
Wet well	$20,000	1	$20,000
Diffusion wells	$32,000	5	$160,000
Pumping system	$7,000	5	$35,000
Distribution piping (LF)	$45	4,160	$187,200
			$402,200
Subtotal			$1,934,025
Contingency (20%)			$386,805
Engineering (15%)			$290,104
Construction Mng. (15%)			$290,104
Administration (10%)			$193,403
		Subtotal	**$3,094,440**

Annual Operating Cost:

	Unit Cost	Quantity	Total Cost
Electricity - Well Pump	$0.12 per kwhr	425 Hp	$335,000
Catalytic oxidizer oper. cost		1	$94,000
Catlyst replacement	150k/5yr	1/5	$30,000
Maintenance - Materials	$50,000	1	$50,000
Solids Disposal	$500 per drum	20	$10,000
Analytical Monitoring	$525/week	52	$30,000
System Engineer	$35/hour	500	$17,500
Operator - 1 man	$35/hour	2,080	$72,800
		Subtotal	**$639,300**

30 Year Present Worth @ 5% Interest & 4% Inflation Compounded Annually for 30 Yrs. **$16,750,996**

H2MGROUP

Groundwater Alternative 3 - UV Oxidation
Cost Analysis

Capital & Installation Costs:

	Unit Cost	Quantity	Total Cost
Extraction			
Extraction Wells	$32,000	5	$160,000
Pump system	$19,000	5	$95,000
Transmission pipe/conduit (LF)	$45	2,085	$93,825
			$348,825
Treatment			
Building, heat, ventilation	$110,000	1	$110,000
Power source	$15,000	1	$20,000
Landscaping and security	$10,000	1	$10,000
Pressure filitration	$80,000	1	$80,000
Process piping/valves	$55,000	1	$55,000
Process control	$60,000	1	$60,000
Process electrical	$30,000	1	$30,000
UV/oxidation system	$740,000	1	$740,000
			$1,105,000
Recharge			
Wet well	$20,000	1	$20,000
Diffusion wells	$32,000	5	$160,000
Pumping system	$7,000	5	$35,000
Distribution piping (LF)	$45	4,160	$187,200
			$402,200
Subtotal			$1,856,025
Contingency (20%)			$371,205
Engineering (15%)			$278,404
Construction Mng. (15%)			$278,404
Administration (10%)			$185,603
			$2,969,640

Annual Operating Cost:

	Unit Cost	Quantity	Total Cost
Electricity - Well Pump	$0.12 per kwhr	425 Hp	$335,000
UV/OX operating cost	$460,000/yr.	1	$460,000
UV/OX - maintenance/materials		1	$10,000
Maintenance - Materials	$50,000	1	$50,000
Solids Disposal	$500 per drum	20	$10,000
Analytical Monitoring	$525/week	52	$30,000
System Engineer	$35/hour	500	$17,500
Operator - 1 man	$35/hour	2,080	$72,800
		Subtotal	**$985,300**

30 Year Present Worth @ 5% Interest & 4% Inflation Compounded Annually for 30 Yrs. **$25,816,919**

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Soil/Sediment Alternative 1A -
Vapor Extraction/Catalytic Incineration Off-Gas Treatment
/Limited Soil Removal
Cost Analysis

Capital & Installation Costs:

	Unit Cost	Quantity	Total Cost
Source Area Remediation (3 Drywells)			
Mobilization/Demobilization	$5,000	1	$5,000
Sheeting (sf)	$20	4,800	$96,000
Soil Excavation (cy)	$25	336	$8,400
Backfill (cy)	$12	120	$1,440
Transp. & Disp./Landfill (tons)	$160	320	$51,200
Transp. & Disp./Incin. (tons)	$870	160	$139,200
Additional Investigation (2 Drywells)			
Trenching (cy)	$25	150	$3,750
Sampling & Analysis	$450	20	$9,000
Restoration & Monitoring			
Restoration	$10,000	1	$10,000
Monitoring Well Installation	$3,500	1	$3,500
SVE System			
Catalytic Unit	$186,000	1	$186,000
Vapor Wells	$45,000	1	$45,000
System Installation	$35,000	1	$35,000
System Eval. & Modification	$75,000	1	$75,000
Subtotal			**$668,490**
Contingency (20%)			$133,670
Engineering (15%)			$100,270
Construction Mgmt. (15%)			$100,270
Administration (10%)			$33,420
			$1,036,120

Annual Operating Cost:

	Unit Cost	Quantity	Total Cost
Electricity	$0.12 per KWH	12 Hp	$9,408
Gas	estimated		$18,000
Caustic	$500/tote	4	$2,000
Maintenance - Materials	5% of capital	190 K	$9,500
Analytical Monitoring	$800/month	12	$9,600
System Engineer	$35/hour	500	$17,500
Operator - 1 man	$35/hour	2080	$72,800
		Subtotal	**$138,808**

30 Year Present Worth @ 5% Interest & 4% Inflation
Compounded Annually for 30 Yrs. **$680,938**

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Soil/Sediment Alternative 1B - Vapor Extraction/Regenerated Carbon Adsorption Off-Gas Treatment /Limited Soil Removal Cost Analysis

Capital & Installation Costs:

	Unit Cost	Quantity	Total Cost
Source Area Remediation (3 Drywells)			
Mobilization/Demobilization	$5,000	1	$5,000
Sheeting (sf)	$20	4,800	$96,000
Soil Excavation (cy)	$25	336	$8,400
Backfill (cy)	$12	120	$1,440
Transp. & Disp./Landfill (tons)	$160	320	$51,200
Transp. & Disp./Incin. (tons)	$870	160	$139,200
Additional Investigation (2 Drywells)			
Trenching (cy)	$25	150	$3,750
Sampling & Analysis	$450	20	$9,000
Restoration & Monitoring			
Restoration	$10,000	1	$10,000
Monitoring Well Installation	$3,500	1	$3,500
SVE System			
Regen. Carbon Unit - 3 beds	$300,000	1	$300,000
Vapor Wells	$45,000	1	$45,000
System Installation	$35,000	1	$35,000
System Eval. & Modification	$75,000	1	$75,000
Subtotal			**$782,490**
Contingency (20%)			$156,500
Engineering (15%)			$117,380
Construction Mgmt. (15%)			$117,380
Administration (10%)			$78,250
			$1,252,000

Annual Operating Cost:

	Unit Cost	Quantity	Total Cost
Electricity	$0.12 per KWH	12 Hp	$9,408
Steam	$50 per month	12	$600
Recovered Solvent Disposal	$550 per drum	60	$33,000
Maintenance - Materials	5% of capital	190 K	$9,500
Analytical Monitoring	$800/month	12	$9,600
System Engineer	$35/hour	500	$17,500
Operator - 1 man	$35/hour	2080	$72,800
		Subtotal	**$152,408**

30 Year Present Worth @ 5% Interest & 4% Inflation Compounded Annually for 30 Yrs. **$747,654**

Soil/Sediment Alternative 2 -
Hydraulic Dredging of Recharge Basins
Cost Analysis

	Unit Cost	Quantity	Total Cost
Mobilization/Demobilization	$50,000	1	$50,000
Dredging	$360,000	1	$360,000
Dewatering Sediment (cy)	$13	27,550	$358,150
Water T & D (per gal)	$1	1,851,973	$1,851,973
Sediment T & D (per ton)	$140	50,000	$7,000,000
		Subtotal	$9,620,123

Soil/Sediment Alternative 3 -
Sediment Removal from Recharge Basins by Excavation
Cost Analysis

	Unit Cost	Quantity	Total Cost
Mobilization/Demobilization	$50,000	1	$50,000
Vehicular Access (road)	$20,000	1	$20,000
Fabricate Temp. Staging Area	$25,000	1	$25,000
Water Removal & Disposal			
Labor (/day)	$1,500	65	$97,500
Equipment (/day)	$150	65	$9,750
POTW Discharge fees (/gallon)	$0.01	11,700,000	$117,000
Influent Piping Modification	$37,500	1	$37,500
Soil Excavation & Disposal			
Excavation (/day)	$10,000	90	$900,000
Kiln Dust (/cy)	$20	6,750	$135,000
Loading (/day)	$1,200	90	$108,000
Trans. & Disp./Landfill (/ton)	$140	50,000	$7,000,000
Confirmatory Sampl. & Analysis	$50,000	1	$50,000
			$8,549,750

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Soil/Sediment Alternative 4 - Deed Restrictions for Recharge Basins
Adminstrative and Engineering Controls
Cost Analysis

Capital Costs:

	Unit Cost	Quantity	Total Cost
Loss of Land Use (/acre)	$300,000	4	$1,200,000
Legal Work	$25,000	1	$25,000
Fencing (/lf)	$7.40	3,000	$22,200
Monitoring Well	$3,500	1	$3,500
			$1,250,700

Annual Operating Costs:

	Unit Cost	Quantity	Total Cost
Groundwater Monitoring (/yr)	$750	1	$750
Fence Ins. & Maint. (/yr)	$750	1	$750
			$1,500

30 Year Present Worth @ 5% Interest & 4% Inflation
Compounded Annually for 30 Yrs. **$39,300**

TOTAL COST: **$1,290,300**

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APPENDIX F
Groundwater Model Expanded Description

1.0 INTRODUCTION

As part of the Remedial Investigation/Feasibility Study (RI/FS), a three-dimensional groundwater model was constructed for the vicinity of Lockheed Martin's Great Neck site. The purpose of the model was to evaluate various groundwater pumping scenarios to determine the nominal groundwater extraction and injection flow rates to provide hydraulic control of contaminated groundwater on the site. Additionally, the locations and screened intervals for existing and proposed wells for the groundwater pump and treat system were evaluated.

2.0 MODEL DESCRIPTION

A series of groundwater modeling programs were used in order to evaluate the subsurface hydrogeology and potential transport of the dissolved solvent plume at the Great Neck site. A three-dimensional computer model of the site was constructed using the PC-based Visual MODFLOW™, Version 1.5 (Waterloo Hydrogeologic, 1996) pre-processor program. The pre-processor framework of the site was imported into the PC-based model MODFLOW™, Version EM (United States Geological Survey (USGS), 1990) to perform a mathematical finite-difference model to evaluate the resultant potentiometric surfaces and inferred groundwater flow directions. The MODPATH™ Version 1.2 (USGS, 1990) particle tracking post-processing package was used to compute pathlines which indicate the most probable contaminant migration pathway based upon the modeled conditions and time frame. All model results were exported through the Visual MODFLOW post-processor for output.

The movement of groundwater in an aquifer can be described by the following partial differential equation:

$$\frac{\partial}{\partial x}\left(Kxx\frac{\partial h}{\partial x}\right)+\frac{\partial}{\partial y}\left(Kyy\frac{\partial h}{\partial y}\right)+\frac{\partial}{\partial z}\left(Kzz\frac{\partial h}{\partial z}\right)-\bar{V}=S_s\frac{\partial h}{\partial t}$$

Where: Kxx, Kyy, and Kzz are hydraulic conductivities along the x, y, and z coordinate axes (Length, L/Time, T);

h is the potentiometric head (L);

$\bar{V}$ is a volumetric flux per unit volume of groundwater or surface waters into or out of the aquifer (1/T);

S_s is the specific storage of the aquifer (1/L);

and t is time (T)

Analytical solutions of this generalized partial differential equation are typically not possible except in extremely simple cases. For this reason, finite difference approximations or other numerical methods are employed. The MODFLOW model used by H2M uses a block-centered finite-difference approximation to estimate the solution to the general groundwater flow equation.

2.1 Hydrogeologic Framework

The physical characteristics (including regional and site-specific hydrogeology) are thoroughly described in the RI and only a summary is provided herein. The topography of the site is low-lying with shallow slopes. The surface elevation of the site is approximately 130 feet above mean sea level (msl) and is covered by relatively impermeable surfaces such as asphalt parking lots, buildings, etc. Much of the surface water occurring as the result of precipitation is discharged to the storm-water infiltration basins discussed in the RI. However, because the site is a relatively small part of the horizontal model domain, the estimated recharge of 22 inches per year was evenly distributed over the entire model grid.

Based upon data collected during the RI, the site is underlain by approximately 120 feet of unconsolidated sand, gravel, silt , and clay of the Upper Glacial aquifer Only the 10 to 20 feet of the Upper Glacial aquifer is under saturated conditions.. There is no significant lithologic changes across the Upper Glacial and Magothy aquifers contact. The Magothy aquifer occurs beneath the Upper Glacial aquifer to a depth of approximately 350 feet below msl. The lithologies encountered within the Magothy aquifer include layers of sand and silt with interbedded lenses of gravel and clay. The clay member of the Raritan formation is found beneath the Magother aquifer and is estimated to be 200-feet thick.

Based upon data in the RI, the groundwater flow direction in the Upper Glacial, Intermediate and Deep Magothy aquifers was to the north with a deflection to the northeast, north of the site. It was thought that this deflection in groundwater flow direction was due to the presence of two public supply wells located north of the site.

An evaluation of the vertical extent of the on-site groundwater contamination indicates that the majority of the contamination is present in the Upper and Intermediate Magothy aquifer; therefore, the model concentrated upon the saturated Magothy aquifer to a depth of approximately 145 feet below msl (approximately 275 feet below ground surface).

2.2 Model Construction

This section of Appendix F describes the parameters input into the model. Where possible, actual field data collected from the site as part of the RI were utilized. More general data from published sources were utilized where site-specific data were not available.

2.2.1 Model Grid

The area modeled was a 2.5 mile (north-south direction) by 2.3 mile (east-west) rectangle approximately centered on the Lockheed Martin facility. Initially, the model was constructed with 60 rows and 70 columns. During the steady-state flow calibration phase of modeling (as discussed later), this model grid was used. Additional rows and grids were added where higher model resolution was required (such as in the area of pumping and injection wells). The final model consisted of 158 rows and 163 columns. In general, the model had a tighter grid spacing in the vicinity of the Lockheed Martin site.

2.2.2 Model Layers

The model consists of six layers (see Table 2.2.2.1). Layer 1 was defined to represent the unconfined Upper Glacial aquifer which has a minimal saturated thickness at the site (i.e., 10 to 20 feet thick). The bottom elevation of Layer 1 was selected from the geologic cross section presented in the RI. Layers 2 through 5 were constructed to represent the Magothy aquifer. Layer 2's top and bottom elevations of +20 and -60 feet msl, respectively were selected to represent the approximate screened intervals of wells RW-1 and DW-8. The upper half of the screened interval for RW-2 is also in Layer 2. The top and bottom elevations of -60 and -138 feet msl, respectively of Layer 3 were selected to represent the approximate screened intervals of EW-1, EW-3, EW-3, DW-5, DW-6, and DW-7. Additionally, the bottom half of the screened interval for RW-2 was in this layer. The top and bottom elevations of Layers 4 and 5 (see Table 2.2.2.1) were selected to represent the approximate screened interval of various public supply pumping wells present within the model grid. Layer 6 was defined to represent the Raritan Clay member of the Lloyd formation.

2.2.3 Model Hydraulic Boundary Conditions

In order to initiate and calibrate the model, a steady-state flow model with no active pumping wells was first constructed. For each layer, constant head boundary conditions were defined at the peripheries of the model domain to produce potentiometric surfaces which reflected field-measured conditions. The November 22, 1994 potentiometric surface maps for the Upper Glacial, Intermediate Magothy, and Deep Magothy aquifers presented in the RI were used as calibration targets for the steady-state flow model. The resultant model runs for the upper five model layers indicated that the steady-state flow model was well calibrated. Sensitivity analyses indicated that the steady-state flow model was sensitive to changes in the constant head boundary conditions but relatively insensitive to changes in the hydraulic parameters (i.e., hydraulic conductivity, storativity, etc.) input into the model.

2.2.4 Model Hydraulic Parameters and Calibration

The hydraulic parameters including horizontal hydraulic conductivity (K_{xy}), vertical hydraulic conductivity (K_z), storativity (S_s), specific yield (S_y), and porosity used for the different model

TABLE 2.2.2.1
LOCKHEED MARTIN
GREAT NECK, NEW YORK
GROUNDWATER MODEL PARAMETERS

Layer Number	Layer Top (ft msl)	Layer Bottom (ft msl)	Layer Thickness (ft)	Kxy (ft/day)	Kz (ft/day)	Ss	Sy	Porosity
1	130	20	110	268	26.8	0.2	0.2	0.30
2	20	-60	80	90	2.25	0.0132	0.0132	0.30
3	-60	-138	78	300	7.5	0.193	0.193	0.30
4	-138	-258	120	300	7.5	0.193	0.193	0.30
5	-258	-350	92	300	7.5	0.193	0.193	0.30
6	-350	-400	50	0.0001	0.00001	0.000001	0.000001	0.50

layers are presented in Table 2.2.2.1. The hydraulic parameters for Layer 1 (the Upper Glacial aquifer) were taken from McClymonds and Franke, 1972.

The initial hydraulic parameters for Layer 2 were determined by analyzing the aquifer pumping test data for RW-1 which was pumped at 450 gallons per minute (gpm), as reported in the RI. A horizontal to vertical conductivity ratio of 40:1 for the Magothy was assumed. The hydraulic conductivity parameter was adjusted within reasonable values to calibrate the parameters of Layer 2 while RW-1 was pumped within the model at 450 gpm. The 40:1 horizontal to vertical conductivity ratio was maintained. The layer's hydraulic parameters were considered calibrated when the head differences observed during the pumping test in monitoring wells 25GL and 25MI matched the head differences calculated by the model.

The initial hydraulic parameters for Layer 3 were determined by analyzing the results of the aquifer pumping tests conducted for EW-1, EW-2, and EW-3. A horizontal to vertical conductivity ratio of 40:1 for the Magothy was assumed. The hydraulic conductivity parameter was adjusted within reasonable values to calibrate the parameters of Layer 3 while EW-1 was pumped within the model at 985 gpm. The 40:1 horizontal to vertical conductivity ratio was maintained. The layer's hydraulic parameters were considered calibrated when the head differences observed during the pumping test in monitoring wells 28MI, 25MI, 26MI, and 27MI matched the head differences calculated by the model.

The aquifer pumping test data used to calibrate the model for the Upper and Intermediate Magothy was for Layers 2 and 3; therefore, hydraulic parameters from the available literature were used for the Upper Glacial aquifer. Inspection of the geophysical and lithologic logs for the deep Magothy aquifer (Layers 4 and 5) indicate that there were no significant lithogic differences within the Magothy aquifer; therefore, the hydraulic parameters from Layer 3 were used for Layers 4 and 5. Typical hydraulic parameters for low permeable clay were used for Layer 6 (the Raritan clay) of the model.

3.0 GROUNDWATER RECOVERY SCENARIO

Once the model had been calibrated both under steady-state and pumping conditions, several extraction and injection scenarios were run. Prior to running the model, a series of 10 particles were inserted within each model layer. The final model was constructed to evaluate the optimal extraction/injection well network for establishing hydraulic control in Layers 2 and 3 (the Upper and Intermediate Magothy aquifer). Layers 2 and 3 were targeted for hydraulic control for the following reasons:

1. Based upon the RI data, the majority of the contaminated groundwater is present in the Upper and Intermediate Magothy aquifer.

2. Typically, the concentrations of contaminants are an order of magnitude lower in the deeper portions of the Magothy aquifer. The contaminants currently present in the

deeper layers will degrade by natural attenuation processes assuming that additional source loading of halogenated solvents from higher in the aquifer (i.e., Layers 2 and 3) are interdicted by the treatment system.

3. The injection and extraction wells of the historic non-contact cooling water system were generally screened in Layers 2 and 3 This encouraged the migration/transport of contaminants into these layers.

A total of five extraction wells and five injection wells proved to be the most efficient remediation system. The wells, their screened intervals, and pumping rates are included in Table 3.1. The total pumping rate was 1,800 gpm. The resultant model outputs presenting the simulated potentiometric surface maps and particle tracks for Layers 1, 2, and 3 are included as Figures 3.1, 3.2, and 3.3, respectively. In this scenario, all on-site particles are captured from the highly impacted Layers 2 and 3. The majority of the on-site particles (and by inference, the contamination) in Layer 1 (the Upper Glacial aquifer) are also captured.

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TABLE 3.1
LOCKHEED MARTIN
GREAT NECK, NEW YORK
GROUNDWATER MODEL PUMPING SCENARIOS

Well ID	Screened Interval (ft msl)	Model Layer	Pumping Rate[1] (gpm)
EW-1	-60 to -95	3	-400
RW-1	0 to -50	2	-400
RW-1A	-75 to -115	3	-400
EW-3	-100 to -145	3	-300
RW-3	-60 to -95	3	-300
DW-5	-90 to -140	3	+400
DW-6	-80 to -120	3	+400
DW-7	-60 to -105	3	+400
DW-10	-70 to -120	3	+300
DW-12	-70 to -120	3	+300
Total Groundwater Removal:			**-1800**
Total Groundwater Injection:			**+1800**

Notes:

[1] A (-) denotes groundwater withdrawal.
A (+) denotes groundwater injection.

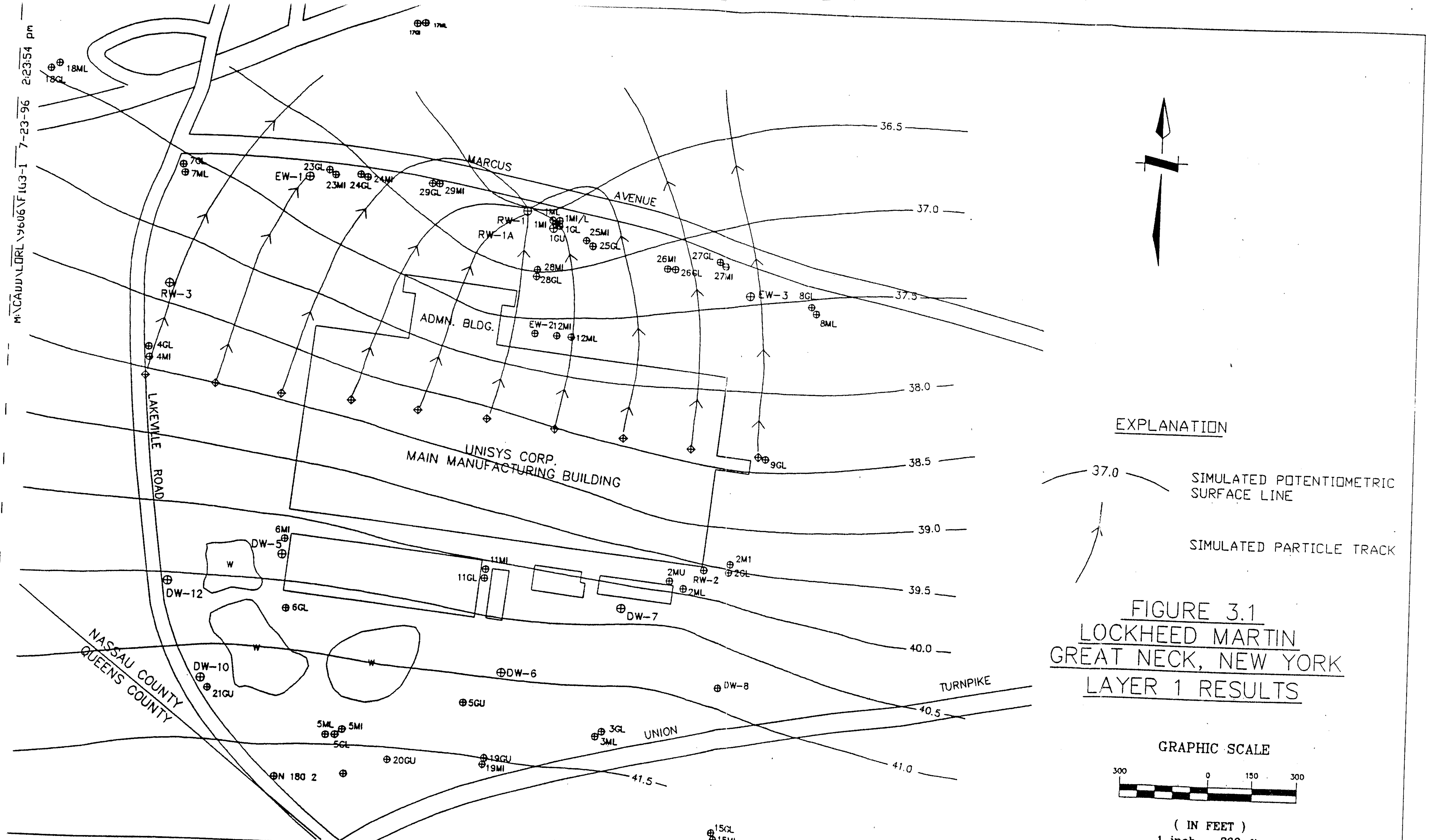

FIGURE 3.1
LOCKHEED MARTIN
GREAT NECK, NEW YORK
LAYER 1 RESULTS

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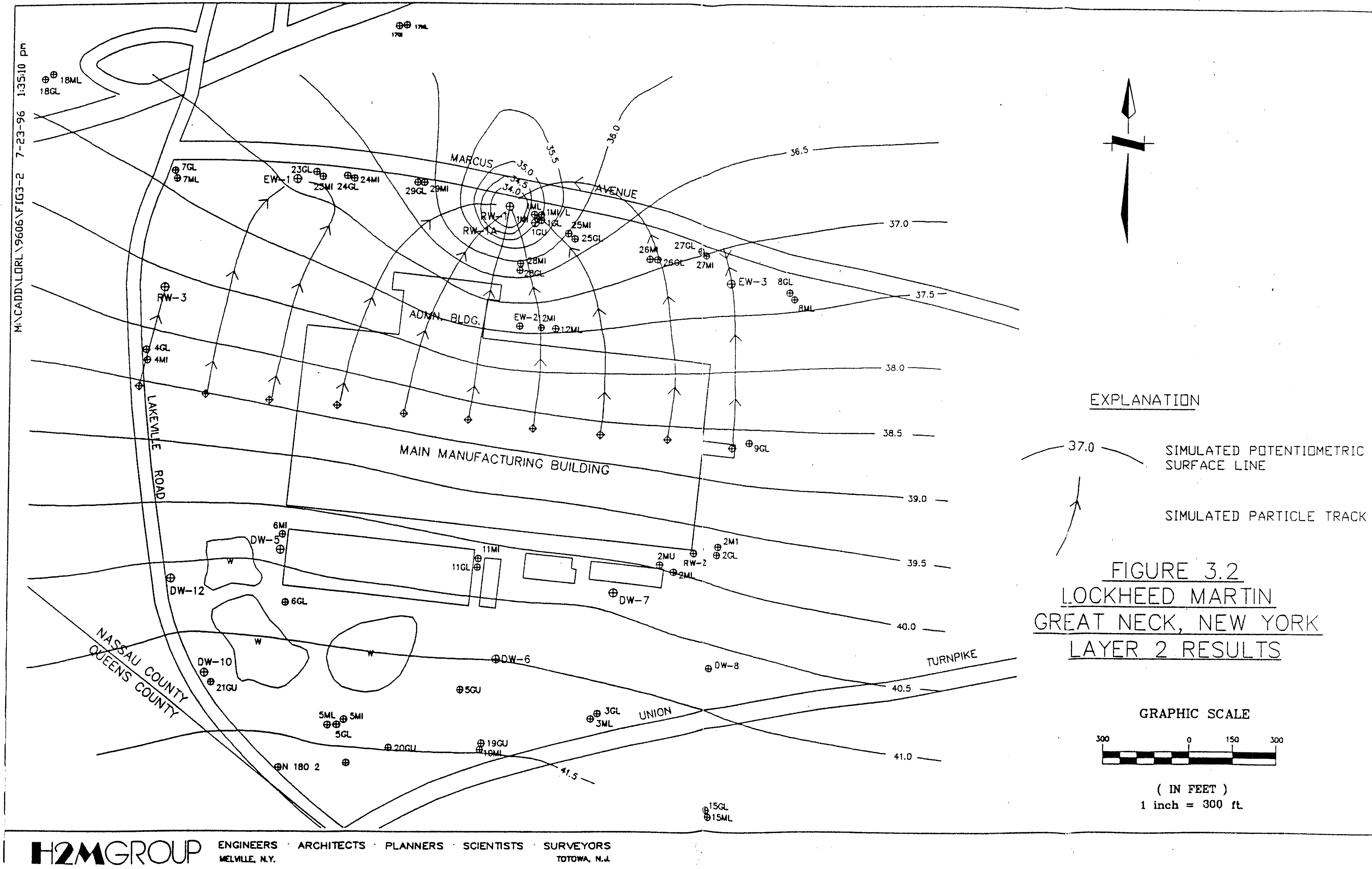


FIGURE 3.2
LOCKHEED MARTIN
GREAT NECK, NEW YORK
LAYER 2 RESULTS

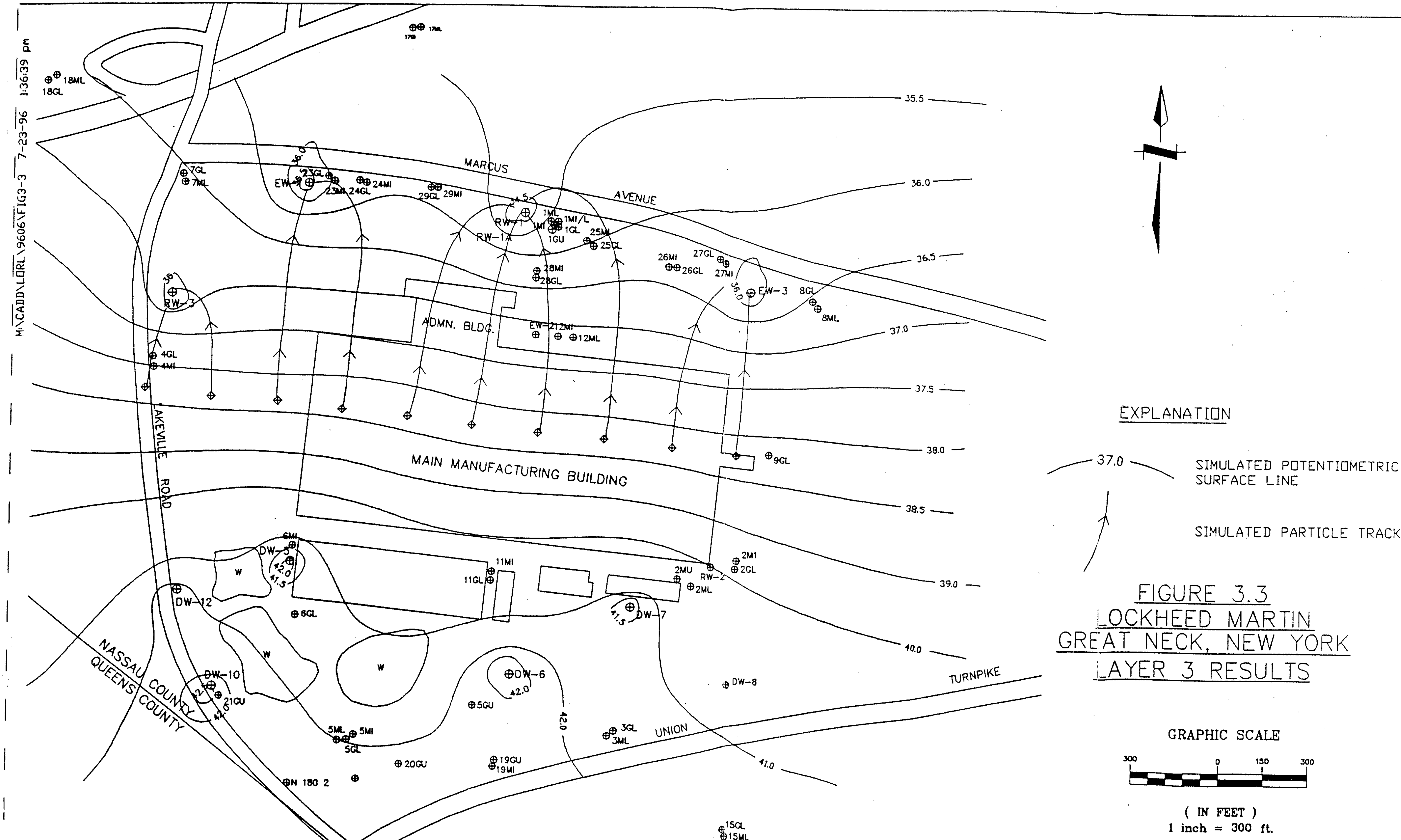
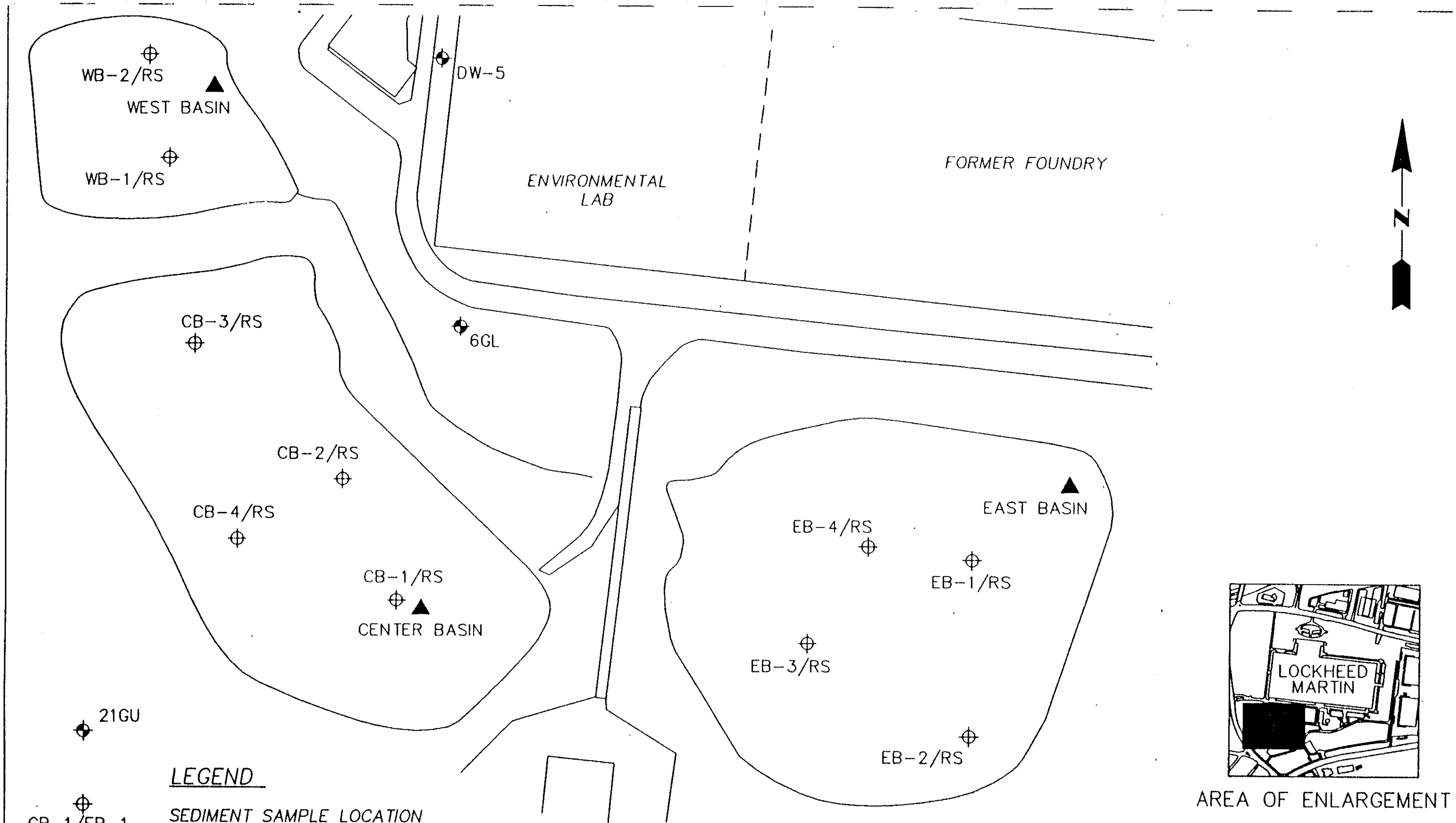


FIGURE 3.3
LOCKHEED MARTIN
GREAT NECK, NEW YORK
LAYER 3 RESULTS

APPENDIX G
Recharge Basin Sediment and Dry Well Soil Sample Results



LEGEND

CB-1/EB-1		SEDIMENT SAMPLE LOCATION
CENTER BASIN		WATER SAMPLE LOCATION
6GL		GROUND-WATER MONITOR WELL

LOCKHEED MARTIN
GREAT NECK, NEW YORK FACILITY

SURFACE-WATER AND SEDIMENT SAMPLING LOCATIONS (DRAINAGE BASINS) AUG. 8, 1996

DATE: 9/10/96 FIGURE: 1

M:\CADD\LORL\9606\FIG6_1 9-10-96 1:03:09 pm

H2M GROUP ENGINEERS ARCHITECTS PLANNERS SCIENTISTS SURVEYORS
MELVILLE, N.Y. TOTOWA, N.J.

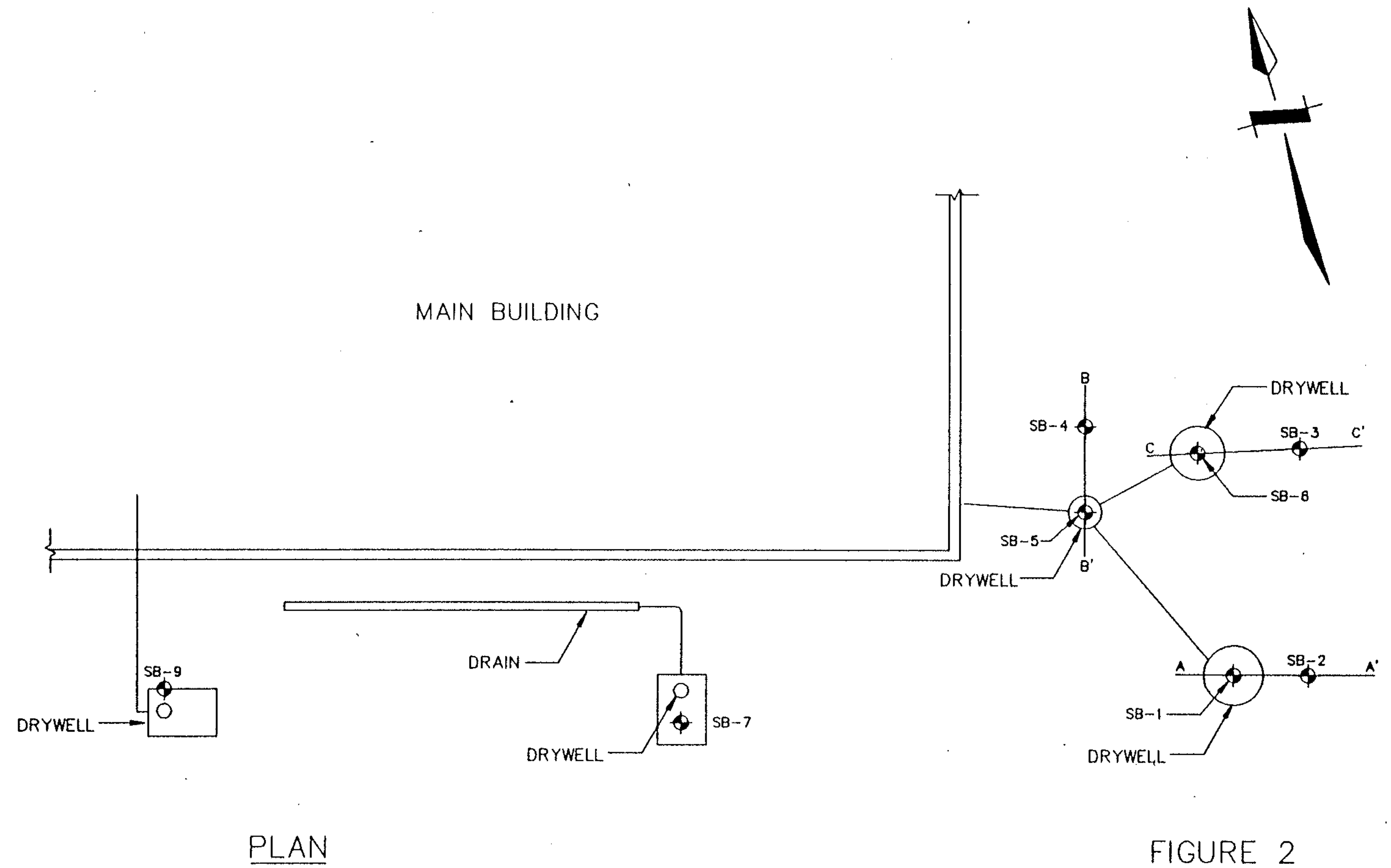


FIGURE 2
LOCKHEED MARTIN
SOIL BORING LOCATIONS
DRYWELL AREA

GRAPHIC SCALE

16 0 8 16

(IN FEET)
1 inch = 16 ft.

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H2M GROUP ENGINEERS ARCHITECTS PLANNERS SCIENTISTS SURVEYORS
MELVILLE, N.Y. TOTOWA, N.J.

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Table 1
Lockheed Martin
Drainage Basin Sediment Sampling
Metals Analytical Results
August 8, 1996

SAMPLE	WEST BASIN		EAST BASIN			CENTER BASIN				CONCENTRATIONS OF CONCERN[2]			
LOCATION	WB-1/RS	WB-2/RS	EB-1/RS	EB-2/RS	EB-3/RS	CB-1/RS	CB-2/RS	CB-3/RS	CB-4/RS	RSCO[A]	EUS BG[B]	NCDOH[C]	USGS[D]
Metals - mg/kg													
Silver	138	127	3.1	173	180	140	84.4	128	33.6	SB[3]	NA[4]	<0.5	NA
Aluminum	19,000	1,990	2,600	18,200	20,200	19,400	15,000	14,500	7,280	SB	33,000	NA	NA
Arsenic	22.1	20.7	2.3	14.5	16.0	16.0	21.0	19.0	10.8	7.5 or SB	3-12	1.8-14.0	0.0
Barium	106	109	ND	99.5	ND	ND	ND	ND	ND	300 or SB	15-600	20.0-112.0	NA
Beryllium	ND[1]	ND	ND	ND	ND	ND	ND	ND	ND	0.16 or SB	0-1.75	NA	NA
Calcium	6,900	9,380	294	5,200	5,680	5,590	5,220	5,200	3,090	SB	130-35,000	NA	NA
Cadmium	6.4	6.5	ND	8.2	7.5	7.8	30.9	7.1	2.7	10	0.1-1	0.4-12.7	0-2
Cobalt	ND	ND	ND	ND	ND	ND	ND	ND	ND	30 or SB	2.5-60	NA	NA
Chromium	244	232	8.7	160	170	184	133	170	74.3	50	1.5-40	9.9-299.0	10-20
Copper	2,280	2,400	67.4	2,190	2,430	2,570	2,550	3,200	1,210	25 or SB	1-50	NA	8-28
Iron	26,700	26,900	8,030	21,100	22,600	20,300	19,000	22,200	11,200	2000 or SB	2,000-550,000	NA	4,000-8,300
Mercury	1.8	1.2	ND	2.5	2.7	2.7	1.3	2.3	0.56	0.1	0.001-0.2	0.04-0.23	0.0
Potassium	1,860	1,970	334	1,360	1,410	1,320	1,310	1,070	576	SB	8,500-43,000	NA	NA
Magnesium	6,330	7,860	817	4,970	5,440	5,180	5,450	4,500	3,050	SB	100-5,000	NA	NA
Manganese	172	170	47.4	147	160	139	143	128	83.2	SB	5-5,000	NA	41-97
Sodium	402	517	44.1	543	600	3,170	4,070	1,080	876	SB	6,000-8,000	NA	NA
Nickel	89.3	90.0	10.9	86.0	83.8	57.5	66.1	76.9	35.8	13 or SB	0.5-25	NA	NA
Lead	1,390	141	27.4	1,170	1,190	1,840	ND	624	226	200-500	200-500	102.0-269.0	70-1,200
Antimony	ND	ND	ND	ND	ND	ND	ND	ND	ND	SB	NA	NA	NA
Selenium	ND	ND	ND	ND	3.2	4.0	4.8	ND	2.4	2 or SB	0.1-3.9	<0.5	NA
Thallium	ND	ND	ND	ND	ND	ND	ND	ND	ND	SB	NA	NA	NA
Vanadium	141	156	6.2	149	154	137	94.8	107	44.8	150 or SB	1-300	NA	NA
Zinc	1,190	1,320	69.6	1,190	1,200	1,050	1,070	1,500	580	20 or SB	9-50	NA	18-132

Notes:

[1] ND - Analyte not detected.

[2] Levels of Concern - Values based on NYSDEC TAGM - Recommended Soil Cleanup Objectives, HWR-94-4046, Revised 4/95 and other indicated documents.

[A] RSCO - Recommended Soil Cleanup Objective

[B] EUS BG - Eastern USA Background

[C] NCDOH - Nassau County Background Soil Metal Levels

[D] USGS - Effects of Urban Stormwater Runoff on Ground Water Beneath Recharge Basins and Long Island, New York, 1986. Data collected in recharge basins located in Huntington, Laurel Hollow, Plainview, and Syosset.

[3] SB - Site Background.

[4] NA - Not available.

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Table 2
Lockheed Martin
Drainage Basin Sediment Sampling
Semi-Volatile Organic Compound Analytical Results
August 8, 1996

SAMPLE	WEST BASIN		EAST BASIN			CENTER BASIN				NYSDEC
LOCATION	WB-1/RS	WB-2/RS	EB-1/RS	EB-2/RS	EB-3/RS	CB-1/RS	CB-2/RS	CB-3/RS	CB-4/RS	RSCO[1]
Semi-VOC's (mg/kg)										
Carbazole	1.9	1.7	0.93	2.5	3.2	ND	ND	2.4	2.5	NA[3]
Phenanthrene	3.9	4.7	2.1	5.7	8.1	ND	4.0	5.0	5.1	50
Anthracene	ND[2]	ND	0.65	1.7	2.1	ND	ND	ND	1.7	50
Fluoroanthene	7.4	7.2	2.5	8.4	12	2.7	6.7	7.4	5.4	50
Pyrene	ND[1]	9.7	3.8	19	29	3.4	7.4	8.7	6.6	50
Chrysene	5.3	5.0	1.9	5.5	12	ND	4.1	4.7	3.1	0.4
Benzo (a) anthracene	3.3	3.4	1.5	7.8	8.1	ND	ND	3.6	2.8	0.224 or MDL[4]
Benzo (b) fluoroanthene	5.2	5.1	1.8	7.8	14	ND	3.9	4.3	2.4	0.224 or MDL
Benzo (k) fluoroanthene	6.3	3.5	1.6	8.1	11	ND	3.6	4.9	2.6	0.224 or MDL
Benzo (a) pyrene	3.9	3.5	1.4	5.5	4.9	ND	3.1	3.7	2.3	0.061 or MDL
Indeno (1,2,3-c,d) pyrene	1.9	ND	0.5	2.8	4.9	ND	ND	ND	ND	3.2
Dibenzo (a,h) anthracene	ND	ND	ND	1.7	3.1	ND	ND	ND	ND	0.014 or MDL
Benzo (g,h,i) perylene	1.8	ND	0.42	2.6	4.6	ND	ND	ND	ND	50

Notes:
1 NYSDEC RSCO - Values based on NYSDEC TAGM - Recommended Soil Cleanup Objectives, HWR-94-4046, Revised 4/95.
2 ND - Analyte not detected.
3 NA - Not available.
4 MDL - Method detection limit.

Table 3
Lockheed Martin
Drainage Basin Sediment Sampling
PCB's Analytical Results
August 8, 1996

SAMPLE	WEST BASIN		EAST BASIN			CENTER BASIN				NYSDEC	
LOCATION	WB-1/RS	WB-2/RS	EB-1/RS	EB-2/RS	EB-3/RS	CB-1/RS	CB-2/RS	CB-3/RS	CB-4/RS	RSCO[1]	USGS[2]
PCB's - mg/kg											
Aroclor 1242	ND[3]	ND	0.53	ND	0.26	ND	ND	ND	ND	NA	NA
Aroclor 1248	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Aroclor 1254	0.33	0.81	0.28	0.37	0.99	0.33	0.72	1.4	0.15	NA	NA
Aroclor 1260	ND	0.68	0.07	0.49	0.89	ND	0.38	0.5	ND	NA	NA
Gross PCB	NA[4]	NA	NA	NA	NA	NA	NA	NA	NA	1-10	<0.1-100

Notes:
1 NYSDEC RSCO - Values based on NYSDEC TAGM - Recommended Soil Cleanup Objectives, HWR-94-4046, Revised 4/95.
 1.0 - Surface
 10 - Subsurface
2 USGS - Effects of Urban Stormwater Runoff on Ground Water Beneath Recharge Basins and Long Island, New York, 1986. Data collected in recharge basins located in Huntington, Laurel Hollow, Plainview, and Syosset.
3 ND - Analyte not detected.
4 NA - Not Available/Not Applicable.

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Table 4
Lockheed Martin
Drainage Basin Sediment Sampling
TCLP Metals Analytical Results
August 8, 1996

SAMPLE LOCATION	WB-1/RS		CB-1/RS		CB-2/RS		CONCENTRATIONS OF CONCERN[2]		
	Total (mg/kg)	TCLP (mg/l)	Total (mg/kg)	TCLP (mg/l)	Total (mg/kg)	TCLP (mg/l)	RSCO (mg/kg)[A]	EUS BG (mg/kg)[B]	TCLP (mg/l)[C]
Metals									
Silver	138	<0.01	140	<0.01	84.4	<0.01	SB[3]	NA[4]	5.0
Aluminum	19,000	NA[4]	19,400	NA	15,000	NA	SB	33,000	NA
Arsenic	22.1	0.02	16.0	0.03	21.0	0.02	7.5 or SB	3-12	5.0
Barium	106	0.45	ND	0.38	ND	0.50	300 or SB	15-600	100.0
Beryllium	ND[1]	NA	ND	NA	ND	NA	0.16 or SB	0-1.75	NA
Calcium	6,900	NA	5,590	NA	5,220	NA	SB	130-35,000	NA
Cadmium	6.4	<0.005	7.8	0.02	30.9	0.02	10	0.1-1	1.0
Cobalt	ND	NA	ND	NA	ND	NA	30 or SB	2.5-60	NA
Chromium	244	<0.01	184	<0.01	133	<0.01	50	1.5-40	5.0
Copper	2,280	NA	2,570	NA	2,550	NA	25 or SB	1-50	NA
Iron	26,700	NA	20,300	NA	19,000	NA	2000 or SB	2,000-550,000	NA
Mercury	1.8	<0.0002	2.7	<0.0002	1.3	<0.0002	0.1	0.001-0.2	0.2
Potassium	1,860	NA	1,320	NA	1,310	NA	SB	8,500-43,000	NA
Magnesium	6,330	NA	5,180	NA	5,450	NA	SB	100-5,000	NA
Manganese	172	NA	139	NA	143	NA	SB	5-5,000	NA
Sodium	402	NA	3,170	NA	4,070	NA	SB	6,000-8,000	NA
Nickel	89.3	NA	57.5	NA	66.1	NA	13 or SB	0.5-25	NA
Lead	1,390	0.06	1,840	2.0	ND	0.38	200-500	200-500	5.0
Antimony	ND	NA	ND	NA	ND	NA	SB	NA	NA
Selenium	ND	<0.03	4.0	<0.03	4.8	<0.03	2 or SB	0.1-3.9	1.0
Thallium	ND	NA	ND	NA	ND	NA	SB	NA	NA
Vanadium	141	NA	137	NA	94.8	NA	150 or SB	1-300	NA
Zinc	1,190	NA	1,050	NA	1,070	NA	20 or SB	9-50	NA

Notes:
[1] ND - Analyte not detected.
[2] Levels of Concern - Values based on NYSDEC TAGM - Recommended Soil Cleanup Objectives, HWR-94-4046, Revised 4/95 and other indicated documents.
[A] RSCO - Recommended Soil Cleanup Objective.
[B] EUS BG - Eastern USA Background.
[C] TCLP - Maximum concentration of contaminants for the TCLP.
[3] SB - Site Background.
[4] NA - Not available.

H2MGROUP

TABLE 5
LOCKHEED MARTIN
VOC ANALYTICAL RESULTS
SOIL SAMPLES

SAMPLE ID SAMPLE DEPTH	SB-1 (10-11)	SB-1 (11-12)	SB-1 (12-14)	SB-1 (14-16)	SB-1 (24-26)	SB-1 (30-32)	SB-2 (12-14 ft)	SB-2 (18-20 ft)	SB-2 (20-22 ft)	SB-2 (24-26 ft)	SB-2 (30-32 ft)	NYSDEC RSCO[2]
VOCs - ug/kg												
Dichlorodifluoromethane	<200[1]	<200	<200	<200	<50	<2	<2	<2	<2	<2	<2	NA[3]
Chloromethane	<200	<200	<200	<200	<50	<2	<2	<2	<2	<2	<2	NA
Vinyl Chloride	<200	<200	<200	<200	<50	<2	<2	<2	<2	<2	<2	200
Bromomethane	<200	<200	<200	<200	<50	<2	<2	<2	<2	<2	<2	NA
Chloroethane	<200	<200	<200	<200	<50	<2	<2	<2	<2	<2	<2	1,900
Fluorotrichloromethane	<200	<200	<200	<200	<50	<2	<2	<2	<2	<2	<2	NA
1,1-Dichloroethene	<200	<200	<200	<200	<50	<2	<2	<2	<2	<2	<2	400
Methylene Chloride	<200	<200	<200	<200	<50	<2	<2	<2	<2	<2	<2	100
Trans-1,2-Dichloroethene	<200	<200	<200	<200	<50	<2	<2	<2	<2	<2	<2	300
1,1-Dichloroethane	<200	<200	<200	<200	<50	<2	<2	<2	<2	<2	<2	200
Cis-1,2-Dichloroethene	1,300	400	3,300	2,100	<50	<2	<2	<2	<2	<2	<2	250
Chloroform	300	<200	<200	<200	<50	<2	<2	<2	<2	<2	<2	300
1,1,1-Trichloroethane	<200	<200	800	<200	<50	<2	<2	<2	<2	<2	<2	800
Carbon Tetrachloride	<200	<200	<200	<200	<50	<2	<2	<2	<2	<2	<2	600
1,2-Dichloroethane	<200	<200	<200	<200	<50	<2	<2	<2	<2	<2	<2	100
Trichloroethene	82,000	35,000	570,000	100,000	7,700	51	<2	<2	<2	<2	<2	700
1,2-Dichloropropane	<200	<200	<200	<200	<50	<2	<2	<2	<2	<2	<2	NA
Bromodichloromethane	<200	<200	<200	<200	<50	<2	<2	<2	<2	<2	<2	NA
Trans-1,3-Dichloropropene	<200	<200	<200	<200	<50	<2	<2	<2	<2	<2	<2	NA
Cis-1,3-Dichloropropene	<200	<200	<200	<200	<50	<2	<2	<2	<2	<2	<2	NA
1,1,2-Trichloroethane	<200	<200	<200	<200	<50	<2	<2	<2	<2	<2	<2	NA
Tetrachloroethene	1,700,000	260,000	4,400,000	650,000	120,000	2,900	99	37	<2	<2	270	1,400
Cholorodibromomethane	<200	<200	<200	<200	<50	<2	<2	<2	<2	<2	<2	NA
Chlorobenzene	<200	<200	<200	<200	<50	<2	<2	<2	<2	<2	<2	1,700
Bromoform	<200	<200	<200	<200	<50	<2	<2	<2	<2	<2	<2	NA
1,1,2,2-Tetrachloroethane	<200	<200	<200	<200	<50	<2	<2	<2	<2	<2	<2	600
M-Dichlorobenzene	400	<200	900	200	<50	7	<2	<2	<2	<2	<2	1,600
P-Dichlorobenzene	2,600	200	7,100	900	330	13	<2	<2	<2	<2	<2	8,500
O-Dichlorobenzene	16,000	1,100	49,000	6,000	2,600	100	3	3	<2	<2	8	7,900
Trichlorotrifluoroethane (Freon 113)	17,000	3,000	180,000	19,000	85	<2	<2	<2	<2	<2	<2	6,000
Photoionization Detector (ppm)	43.2	144	210	245	196	68.1	7.0	5.8	9.4	2.3	8.6	NA

NOTES:

1 < - Indicates analyte was not detected above instrument detection limits.

2 NYSDEC Recommended Soil Cleanup Objectives and Cleanup Levels Division of Hazardous Waste Remediation - Technical and Administrative Guidance Memorandum (NYSDEC TAGM No. 92-4046, revised 4/95).

3 NA - Indicates Recommended Soil Cleanup Objective was not available.

TABLE 5 (CONT.)
LOCKHEED MARTIN
VOC ANALYTICAL RESULTS
SOIL SAMPLES

SAMPLE ID SAMPLE DEPTH	SB-3 (18-20 ft)	SB-3 (22-24 ft)	SB-3 (24-26 ft)	SB-3 (26-28 ft)	SB-3 (28-30 ft)	SB-4 (6-8 ft)	SB-4 (10-12 ft)	SB-5 (12-14 ft)	SB-5 (14-16 ft)	SB-5 (24-26 ft)	SB-5 (26-28 ft)	SB-5 (28-31 ft)	NYSDEC RSCO[2]
VOCs - ug/kg													
Dichlorodifluoromethane	<2[1]	<2	<2	<2	<2	<2	<2	<200	<50	<2	<100	<200	NA[3]
Chloromethane	<2	<2	<2	<2	<2	<2	<2	<200	<50	<2	<100	<200	NA
Vinyl Chloride	<2	<2	<2	<2	<2	<2	<2	<200	<50	<2	<100	<200	200
Bromomethane	<2	<2	<2	<2	<2	<2	<2	<200	<50	<2	<100	<200	NA
Chloroethane	<2	<2	<2	<2	<2	<2	<2	<200	<50	<2	<100	<200	1,900
Fluorotrichloromethane	<2	<2	<2	<2	<2	<2	<2	<200	<50	<2	<100	<200	NA
1,1-Dichloroethene	<2	<2	<2	<2	<2	<2	<2	<200	<50	<2	<100	<200	400
Methylene Chloride	<2	<2	<2	<2	<2	<2	<2	<200	<50	<2	<100	<200	100
Trans-1,2-Dichloroethene	<2	<2	<2	<2	<2	<2	<2	<200	<50	<2	<100	<200	300
1,1-Dichloroethane	<2	<2	<2	<2	<2	<2	<2	<200	<50	<2	<100	<200	200
Cis-1,2-Dichloroethene	<2	<2	<2	<2	<2	<2	<2	3,200	90	<2	1,100	<200	250
Chloroform	<2	<2	<2	<2	<2	<2	<2	<200	<50	<2	<100	<200	300
1,1,1-Trichloroethane	<2	<2	<2	<2	<2	<2	<2	<200	<50	<2	900	<200	800
Carbon Tetrachloride	<2	<2	<2	<2	<2	<2	<2	<200	<50	<2	<100	<200	600
1,2-Dichloroethane	<2	<2	<2	<2	<2	<2	<2	<200	<50	<2	<100	<200	100
Trichloroethene	<2	<2	<2	<2	170	19	<2	15,000	2,000	5	120,000	1,600,000	700
1,2-Dichloropropane	<2	<2	<2	<2	<2	<2	<2	<200	<50	<2	<100	<200	NA
Bromodichloromethane	<2	<2	<2	<2	<2	<2	<2	<200	<50	<2	<100	<200	NA
Trans-1,3-Dichloropropene	<2	<2	<2	<2	<2	<2	<2	<200	<50	<2	<100	<200	NA
Cis-1,3-Dichloropropene	<2	<2	<2	<2	<2	<2	<2	<200	<50	<2	<100	<200	NA
1,1,2-Trichloroethane	<2	<2	<2	<2	<2	<2	<2	<200	<50	<2	<100	<200	NA
Tetrachloroethene	<2	<2	<2	20	1,900	840	21	170,000	100,000	1,800	120,000	3,800,000	1,400
Cholorodibromomethane	<2	<2	<2	<2	<2	<2	<2	<200	<50	<2	<100	<200	NA
Chlorobenzene	<2	<2	<2	<2	<2	<2	<2	<200	<50	<2	<100	<200	1,700
Bromoform	<2	<2	<2	<2	<2	<2	<2	<200	<50	<2	<100	<200	NA
1,1,2,2-Tetrachloroethane	<2	<2	<2	<2	<2	<2	<2	<200	<50	<2	270	<200	600
M-Dichlorobenzene	<2	<2	<2	<2	<2	<2	<2	<200	<50	7	150	1,400	1,600
P-Dichlorobenzene	<2	<2	<2	<2	6	<2	<2	200	<50	24	600	5,100	8,500
O-Dichlorobenzene	3	<2	<2	<2	72	<2	<2	500	<50	400	5,100	55,000	7,900
Trichlorotrifluoroethane (Freon 113)	<2	<2	<2	<2	<2	<2	<2	<200	<50	<2	1,600	<200	6,000
Photoionization Detector (ppm)	6.6	5.8	5.4	6.2	7.4	1.9	2.3	201	145	10.5	137	365	NA

NOTES:

[1] < - Indicates analyte was not detected above instrument detection limits.

[2] NYSDEC Recommended Soil Cleanup Objectives and Cleanup Levels Division of Hazardous Waste Remediation - Technical and Administrative Guidance Memorandum (NYSDEC TAGM No. 92-4046, revised 4/95).

[3] NA - Indicates Recommended Soil Cleanup Objective was not available.

H2M GROUP

TABLE 5 (CONT.)
LOCKHEED MARTIN
VOC ANALYTICAL RESULTS
SOIL SAMPLES

SAMPLE ID	SB-6	SB-6	SB-6	SB-6	SB-6	SB-7	SB-7	SB-7	SB-9	QA/QC SAMPLES			NYSDEC
SAMPLE DEPTH	(10-12 ft)	(14-16 ft)	(24-26 ft)	(26-28 ft)	(28-30 ft)	(13-15 ft)	(15-17 ft)	(17-19 ft)	(15 ft)	SB-5 DUP.[4] (12-14 ft)	SB-6 DUP.[5] (28-30 ft)	Field Blank[6]	RSCO[2]
VOCs - ug/kg													
Dichlorodifluoromethane	<25[1]	<5	<2	<20	<50	<2	<2	<20	<2	<100	<100	<1	NA[3]
Chloromethane	<25	<5	<2	<20	<50	<2	<2	<20	<2	<100	<100	<1	NA
Vinyl Chloride	<25	<5	<2	<20	<50	<2	<2	<20	<2	<100	<100	<1	200
Bromomethane	<25	<5	<2	<20	<50	<2	<2	<20	<2	<100	<100	<1	NA
Chloroethane	<25	<5	<2	<20	<50	<2	<2	<20	<2	<100	<100	<1	NA
Fluorotrichloromethane	27	<5	<2	<20	<50	<2	<2	<20	<2	<100	<100	<1	1,900
1,1-Dichloroethene	<25	<5	<2	<20	<50	<2	<2	<20	<2	<100	<100	<1	NA
Methylene Chloride	<25	<5	<2	<20	<50	<2	<2	<20	<2	<100	<100	<1	400
Trans-1,2-Dichloroethene	<25	<5	<2	<20	<50	<2	<2	<20	<2	<100	<100	<1	100
1,1-Dichloroethane	<25	<5	<2	<20	<50	<2	<2	<20	<2	<100	<100	<1	300
1,1-Dichloroethane	<25	<5	<2	<20	<50	<2	<2	<20	<2	<100	<100	<1	200
Cis-1,2-Dichloroethene	1,900	22	<2	<20	36 J	<2	<2	<20	<2	8,200	<100	<1	250
Chloroform	<25	<5	<2	<20	64	<2	<2	<20	<2	<100	150	<1	300
1,1,1-Trichloroethane	<25	<5	<2	<20	480	<2	<2	<20	<2	230	340	<1	800
Carbon Tetrachloride	<25	<5	<2	<20	<50	<2	<2	<20	<2	<100	<100	<1	600
1,2-Dichloroethane	<25	<5	<2	<20	<50	<2	<2	<20	<2	<100	<100	<1	100
Trichloroethene	5,400	580	7	310	160,000	65	8	150	<2	110,000	200,000	<1	700
1,2-Dichloropropane	<25	<5	<2	<20	<50	<2	<2	<20	<2	<100	<100	<1	NA
Bromodichloromethane	<25	<5	<2	<20	<50	<2	<2	<20	<2	<100	<100	<1	NA
Trans-1,3-Dichloropropene	<25	<5	<2	<20	<50	<2	<2	<20	<2	<100	<100	<1	NA
Cis-1,3-Dichloropropene	<25	<5	<2	<20	<50	<2	<2	<20	<2	<100	<100	<1	NA
1,1,2-Trichloroethane	<25	<5	<2	<20	50	<2	<2	<20	<2	<100	<100	<1	NA
Tetrachloroethene	71,000	3,800	260	12,000	790,000	250	26	1,300	30	250,000	350,000	<1	1,400
Cholorodibromomethane	<25	<5	<2	<20	<50	<2	<2	<20	<2	<100	<100	<1	NA
Chlorobenzene	<25	<5	<2	<20	<50	<2	<2	<20	<2	<100	<100	<1	1,700
Bromoform	<25	<5	<2	<20	<50	<2	<2	<20	<2	<100	<100	<1	NA
1,1,2,2-Tetrachloroethane	<25	5	<2	<20	110	<2	<2	<20	<2	<100	<100	<1	600
M-Dichlorobenzene	1,000	370	26	22	260	<2	<2	<20	<2	<100	360	<1	1,600
P-Dichlorobenzene	230	20	22	40	1,500	<2	<2	<20	<2	200	1,900	<1	8,500
O-Dichlorobenzene	770	80	130	150	8,700	5	<2	120	6	1,700	14,000	<1	7,900
Trichlorotrifluoroethane (Freon 113)	1,200	<5	<2	<20	<50	<2	<2	<20	<2	210	<100	<1	6,000
Photoionization Detector (ppm)	16.7	18.7	35.4	225	281	10.1	9.7	14.6	35.7	NA	NA	NA	NA

NOTES:

1 < - Indicates analyte was not detected above instrument detection limits.

2 NYSDEC Recommended Soil Cleanup Objectives and Cleanup Levels Division of Hazardous Waste Remediation - Technical and Administrative Guidance Memorandum (NYSDEC TAGM No. 92-4046, revised 4/95).

3 NA - Indicates Recommended Soil Cleanup Objective was not available.

4 Sample was a blind duplicate and was assigned the fictitious ID SB-15 (12-14 ft) in the field.

5 Sample was a blind duplicate and was assigned the fictitious ID SB-16 (28-30 ft) in the field.

6 Units are ug/l.

TABLE 6
LOCKHEED MARTIN
METALS AND TPH ANALYTICAL RESULTS
SEDIMENT SAMPLES

SAMPLE ID	SB-1	SB-5	SB-5	SB-6	SB-6	SB-7	SB-9	CONCENTRATIONS OF CONCERN[2]		
SAMPLE DEPTH	(10-11)	(12-14 ft)	(28-31 ft)	(10-12 ft)	(28-30 ft)	(17-19 ft)	(15 ft)	RSCO[A]	EUS BG[B]	NCDOH[C]
Metals - mg/kg										
Silver	<1.1	<1.1	<1.2	2.8	<1.1	<1.1	<1.1	SB[5]	NA	NA
Arsenic	6.5	<1.1	<1.2	1.9	<1.1	<1.1	2.3	7.5 or SB	3-12	1.8-14
Beryllium	<0.56	<0.56	<0.58	<0.57	<0.54	<0.54	<0.54	SB	0-1.75	NA
Cadmium	2.6	1.4	1.0	6.0	<0.54	<0.54	<0.54	10	0.1-1	0.4-12.7
Chromium	126	25.9	12.8	64.7	13.0	8.5	18.5	50	1.5-40	9.9-299
Copper	534	57.4	24.5	227	11.9	5.4	56.5	25 or SB	1-50	NA
Mercury	2.6	1.4	0.34	243	<0.09	<0.09	<0.10	0.1	0.001-0.2	0.04-0.23
Nickel	37.5	19.1	15.2	25.0	10.9	8.6	16.3	13 or SB	0.5-25	NA
Lead	261	124	72.4	148	6.2	3.7	25.0	400	200-500	102-269
Antimony	<6.7	<6.8	<7.0	<6.8	<6.5	<6.4	<6.5	SB	NA	NA
Selenium	1.1	<0.56	<0.58	<0.57	<0.54	<0.54	<1.1	2 or SB	0.1-3.9	<0.5
Thallium	<1.1	<1.1	<1.2	<1.1	<1.1	<1.1	<1.1	SB	NA	NA
Zinc	322	214	59.6	284	20.6	11.8	39.1	20 or SB	9-50	NA
TPH (mg/kg)	NA	NA	1,090	NA	NA	NA	NA	NA	NA	NA

NOTES:

1 < - Indicates analyte was not detected above instrument detection limits.

2 Concentrations of Concern - Values based on NYSDEC TAGM - Recommended Soil Cleanup Objectives, HWR-94-4046, Revised 4/95 and other indicated documents.

A RSCO - Recommended Soil Cleanup Objective

B EUS BG - Eastern USA Background

C NCDOH - Nassau County Background Soil Metal Levels

3 NA - Indicates Recommended Soil Cleanup Objective was not available.

4 B - Indicates that analyte was detected in associated blank sample.

5 SB - Site Background.