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ON-SITE FOCUSED FEASIBILITY STUDY
OPERABLE UNIT NO. 1
AMERICAN DRIVE-IN CLEANERS SITE
Site No. 1-30-049

Work Assignment Number
D003060-17.1

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AMERICAN DRIVE-IN CLEANERS
ON-SITE FOCUSED FEASIBILITY STUDY
TABLE OF CONTENTS

AMERICAN DRIVE-IN CLEANERS
ON-SITE FOCUSED FEASIBILITY STUDY
TABLE OF CONTENTS (CONT'D)

TABLE OF CONTENTS (CONT'D)

TABLES

AMERICAN DRIVE-IN CLEANERS
ON-SITE FOCUSED FEASIBILITY STUDY
TABLE OF CONTENTS (CONT'D)

FIGURES

AMERICAN DRIVE-IN CLEANERS
ON-SITE FOCUSED FEASIBILITY STUDY
TABLE OF CONTENTS (CONT'D)

APPENDICES

1.0 INTRODUCTION

This report presents the results of an On-Site Focused Feasibility Study of alternatives for the environmental remediation of Operable Unit No. 1 for the American Drive-In Cleaners Site (Site) located in Levittown, Nassau County, and New York. The Site is listed as a Class 2 site on the New York State Department of Environmental Conservation (NYSDEC) Registry of Inactive Hazardous Waste Sites, Site No. 1-30-049.

1.1 BACKGROUND

In response to apparent soil and groundwater contamination at the Site, the NYSDEC commissioned a Remedial Investigation/Feasibility Study (RI/FS) of the Site. The RI and FS were completed on behalf of NYSDEC under Superfund Standby Contract Work Assignment # D003060-17 to TAMS Consultants, Inc. (TAMS). The RI/FS was completed by GZA GeoEnvironmental of New York (GZA) as a subconsultant to TAMS.

The objective of the RI was to characterize the nature and extent of on-Site and off-Site contamination, to provide data for completing the FS. The scope of work for the RI is described in work plan documents approved by the NYSDEC (see Section 1.3). The RI included a qualitative risk assessment to identify potential risks to human health and the environment due to contaminants present on Site and off Site. The results of the RI were summarized in a separate report prepared by GZA entitled "Remedial Investigation Report, American Drive-In Cleaners, Levittown, New York," dated November 2000.

This On-Site FS report addresses contamination and remediation issues for the American Drive-In Cleaners (ADC) property and areas located near the Site (i.e., north of Hempstead Turnpike), potentially impacted by Site contamination (i.e., Operable Unit No. 1). Off-Site contamination and remediation issues for the ADC property will be evaluated in an Off-Site FS.

As described in the work plan documents, the FS is focused in nature, in that the feasibility of a select group of remedial alternatives is to be assessed. A number of such alternatives were originally presented in Section 1.5 of the "Project Management Plan, American Drive-In Cleaners, Levittown, New York". During a meeting between GZA and NYSDEC on November 4, 1999, a revised group of remedial alternatives was tentatively agreed upon. A summary of this meeting is included in Appendix A.

Finally, a technical review (Preliminary Screening) of applicable technologies was completed by TAMS/GZA, and the results were discussed during a conference call between TAMS, GZA and NYSDEC on March 15, 2000. The On-Site, Focused FS (FFS) study includes four remedial alternative categories and their associated remedial technologies, which are presented below.

- Alternative No. 1: No action (natural attenuation with groundwater monitoring).

- Alternative No. 2: Hydraulic containment and ex-situ treatment of groundwater, and traditional in-situ treatment of soils via soil vapor extraction.

- Alternative No. 3: Traditional in-situ treatment of groundwater via air sparging/vapor extraction, and in-situ treatment of soils via soil vapor extraction.

- Alternative No. 4: Innovative in-situ treatment of soil and groundwater via chemical oxidation, treatment of soils via soil vapor extraction, and hydraulic containment and ex-situ treatment of groundwater.

For the purposes of this On-Site FFS, remedial systems located on-Site or near the Site (north of Hempstead Turnpike) are described and evaluated. Additional details regarding the criteria used during preliminary screening and the components of these remedial alternatives are presented in Section 3.0.

1.2 PURPOSE AND ORGANIZATION OF REPORT

The purpose of the On-Site FFS is to identify and evaluate technologies that are available to remediate the on-Site areas identified in the RI as requiring remedial action. The technologies most appropriate for the on-Site conditions are then developed into Remedial Action Alternatives that are evaluated based on their environmental benefits and cost. The information presented in the On-Site FFS will be used by NYSDEC to select on-Site remedial action(s). The on-Site remedial action(s) selected for the Site will be summarized by the NYSDEC in a Proposed Remedial Action Plan (PRAP), which will be released for public comment. After receipt of public comments, the NYSDEC will issue a Record of Decision (ROD).

1.3 SCOPE OF WORK

GZA completed the following scope of work for the On-Site FFS.

- Identified Standards, Criteria and Guidelines (SCGs) that may apply to the specific conditions at the Site. These generally include State requirements that are used as a basis for establishing cleanup goals for the Site and other regulatory requirements that may apply to proposed remedial actions.

- Identified proposed cleanup goals (SCG goals) and remedial objectives for contaminants of concern at the Site.

- Completed preliminary screening of remedial technologies to develop a focussed list of technologies/alternatives that appear implementable and effective based on the Site conditions and list of contaminants identified during the RI.

- Developed and coupled on-Site remedial alternatives for detailed analysis that were evaluated on the basis of:

    1. Compliance with applicable or relevant and appropriate SCGs and remediation goals;
    2. Overall protection of human health and the environment;
    3. Short-term impacts and effectiveness;
    4. Long-term effectiveness and permanence;
    5. Reduction of toxicity, mobility and volume;
    6. Implementability; and
    7. Cost.

- Compared the alternatives based on the seven criteria identified above.

- Provided conclusions regarding the On-Site FFS.

- Prepared this report summarizing the findings of the On-Site FFS.

This On-Site FFS study and report was completed in general accordance with:

- The scope of work described in the "Project Management Plan, American Drive-In Cleaners RI/FS, Site No. 1-30-049", dated September 1997;

- Procedures recommended in the NYSDEC Division of Hazardous Waste Remediation, TAGM 4025 Guidance, "Guidelines for Remedial Investigation/Feasibility Studies" dated March 1989;

- NYSDEC Division of Hazardous Waste Remediation TAGM 4030 Guidance, "Selection of Remedial Actions at Inactive Hazardous Waste Sites", as revised May 1990; and

- USEPA Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, dated October 1988.

The scope of work for the ADC Site was prepared by TAMS and GZA and submitted to NYSDEC for review and approval. The scope of work was subsequently finalized and issued as part of the Project Management Plan dated September 1997. The Project Management Plan incorporates the following additional work plan documents.

- "Field Activity Plan, American Drive-In Cleaners Site RI/FS, Site No. 1-30-049", dated September 1997.

- "Quality Assurance Project Plan, American Drive-In Cleaners Site RI/FS, Site No. 1-30-049", dated September 1997.

- "Health and Safety Plan, American Drive-In Cleaners Site RI/FS, Site No. 1-30-049", dated September 1997.

- "Citizen Participation Plan, American Drive-In Cleaners Site RI/FS, Site No. 1-30-049", dated September 1997.

The following documents/correspondence also describe subsequent or additional information concerning the project scope of work.

- Letter approving the September 1997 Work Plans, dated December 1, 1997, from NYSDEC to TAMS.

- Letter regarding Summary of Phase 1 Field Results and Recommendations for Phase 2 and Interim Remedial Measure (IRM), from TAMS to NYSDEC, dated July 28, 1998.

- Letter regarding Agreement on Modifications of Recommendations (presented in the July 28, 1998 correspondence), and NYSDEC Request to Pursue IRM Options; from NYSDEC to TAMS, dated September 4, 1998.

- "Addendum No. 1, American Drive-In Cleaners Site RI/FS, Site No. 1-30-049", dated November 3, 1998.

- Letter approving Addendum No. 1, dated November 1, 1998, from NYSDEC to TAMS/GZA; authorizing Phase 2 Field Work and Investigation of IRM Options.

- Telephone conversation between NYSDEC and TAMS/GZA, dated March 5, 1999, regarding the IRM Scope of Work.

- Letter regarding Summary of Phase 2 Groundwater Sampling Results, dated April 9, 1999, from TAMS/GZA to NYSDEC.

- "Amendment No. 1, American Drive-In Cleaners Site RI/FS, Site No. 1-30-049", dated April 22, 1999; included Cesspool Cleanout IRM.

- Letter approving Amendment No. 1, dated June 29, 1999, from NYSDEC to TAMS; authorizing Cesspool Cleanout IRM.

- Letter regarding Meeting Summary from GZA to NYSDEC, dated November 23, 1999.

1.4 SITE INFORMATION

This Section summarizes the findings of the Site RI study conducted between 1998 and 2000 at the ADC Site.

1.4.1 Site Description

The ADC Site property consists of approximately 16,000 square feet (sf) or 0.37 acres of land, located at 3801 Hempstead Turnpike, Levittown, Nassau County, New York (see Figures 1-1 & 1-2). The Site includes a single masonry block structure, approximately 4,800 sf. The Town of Hempstead Tax Assessors offices 1997 property records indicate Kasper Irrevokable Trust owns the property. Currently, the Site building is occupied by tenants including: ADC (west side of the building), Willy Mae Bicycles, Robert's Barber Shop, and Blimpie Restaurant (east side of the building). According to Mr. Parvis Nezami (operator of the ADC part of the building), he leases the entire building and manages the property.

A chain link fence is located at the property limits to the west and north. A building (discount beverage store) is located near the east limit of the property. The right-of-way of Hempstead Turnpike is the southern limit of the property. The property areas immediately adjacent to the on-Site building include unpaved areas (with little vegetation) to the east, west and north. A parking area, approximately 8,000 sf, is located south of the on-Site building along the Hempstead Turnpike.

The surrounding area is mixed commercial and residential. The Site is bordered to the west and north by Frank's Nursery and Crafts, to the east by a discount beverage store and to the south by Hempstead Turnpike beyond which is a retail department store (Target). Until approximately January 1999 the property south of the Turnpike was a vacant lot, beyond which are the Island Trees Middle and High Schools. Since June 1999, the vacant property south of the Site was developed as a Target store with associated parking. The Target store opened for business in March 2000. A second retail establishment is planned for construction west of the Target store.

1.4.2 Site History

The Site was developed in the mid-1950s with the existing building. ADC, a dry cleaning facility, has occupied the building since it was constructed. The majority of the building is no longer used by ADC and is occupied by several small commercial facilities. Businesses that have historically or are currently located at the Site include a bicycle shop, barber shop, bagel shop, sandwich shop, etc. The Site was originally connected to a sanitary septic system that was reportedly located north of the Site. In April 1981, the building was connected to the public sewer system. Prior to the 1950s, the Site and surrounding area were generally vacant and agricultural lands.

The dry cleaning facility typically used the cleaning solvent tetrachloroethene (PCE) on a daily basis for clothing dry cleaning. Additionally, an underground storage tank was reportedly located on the Site and abandoned (backfilled) in place. The tank was believed to contain fuel oil. No significant petroleum contamination was found in the area of the UST.

Three cesspool systems associated with the ADC building were reportedly located on the northern portion of the Site (currently occupied by Frank's Nursery and Crafts). These systems reportedly consist of three cesspools for former laundromat wastewater; two cesspools for former sanitary waste; and five cesspools for roof drain and cooling water. Two additional cesspool structures were identified in the alley east of the ADC building with a drain leading from the building to the southern-most cesspool. The origin of this drain (i.e., roof drain, sanitary drain, floor drain, etc.) remains unknown. Significant concentrations of PCE were identified in these two on-Site cesspools (with the highest concentrations noted in the southern-most cesspool).

The northern three cesspool systems and the reported UST could have been sources of contamination in the past; however, the concentration levels detected from samples collected adjacent to these Site features do not suggest significant residual contamination. The primary focus of the RI study was regarding the use and possible spillage of PCE associated with the two cesspools located in the alley east of the ADC building, and an area adjacent to the northwest exterior corner of the Site building.

Site activities conducted during the RI study were done in two Phases. Phase 1 was completed in January through April, 1998. Phase 2 was conducted in January through February, 1999. The Phase 1 activities generally included Geoprobe soil borings, test pits, soil gas survey, test boring and monitoring well installations, groundwater level survey and environmental sampling. The Phase 2 work generally consisted of test boring and monitoring well installations, a groundwater level survey, and environmental sampling.

1.4.3 Subsurface Conditions

The overburden deposits encountered at the Site generally consist of the following in descending order: fill materials, glacial outwash, and fine sands. The composition of the fill material varies, depending on the location at the Site; and, was encountered at depths ranging from 1 to 7 feet, and at greater depths adjacent to underground structures (i.e., cesspools and former USTs). The material is generally comprised of brown sandy silt, brown silty sands and tan gravely sands with trace amounts of brick and organics. In addition to the silty sandy deposits, a thin layer of black fine to coarse sand (approximately 2 to 3 inches thick) was encountered between 5 and 6 ft bgs at most Geoprobe locations.

Glacial outwash deposits, consisting primarily of gravelly sand, were encountered under the fill material at the Site. This glacial sediment was observed at depths up to approximately 85 feet below ground surface and appears to be the upper of two water-bearing units explored during the study. The saturated portion of the glacial outwash was typically found to be about 50 feet thick. Below the glacial outwash are fine sands of the Magothy Formation, which comprise the lower of the water bearing units explored during the RI study. This material is generally a brown fine to medium sand and was penetrated to a depth of approximately 120 feet bgs (elevation -30 feet). This formation reportedly extends to depths greater than 700 feet below sea level.

1.4.4 Site Hydrology

The ground surface elevation at the study area ranges from approximately 75 to 85 feet above mean sea level. The overall ADC Site ground surface is generally flat with the parking areas sloping down to the south. The asphalt paved area south of the Site building is the only feature directing surface water runoff at the Site. The stormwater from the parking areas generally drains to catch basins along Hempstead Turnpike, which eventually drain to a recharge basin located northwest of the Site on Wantagh Avenue. Rainfall on the non-paved areas west, north and east of the Site building generally infiltrates into the subsurface soils. No surface water bodies were observed within the study area.

The groundwater flow direction in the study area is to the south (see the groundwater contour maps, Figures 1-3 and 1-4). An irrigation well belonging to the Island Trees High School (ITHS) is located about 1,000 feet south of the Site. This well pumps water from the upper glacial aquifer during the growing seasons (April through October) and is used to irrigate both the middle and high schools' athletic fields and landscaped areas south of the Site. During the times of the year when the ITHS irrigation well is in operation, the localized groundwater flow direction may be affected such that the flow of groundwater could be skewed towards the southeast in the direction of the pumping well.

The groundwater velocity at the Site study area was calculated to range from 0.2 to 1.7 feet per day (fpd) with an average of 0.9 fpd or 330 feet per year (fpy). The average groundwater flow velocity from the source area (two cesspools in the alley east of the ADC building) to well MW-8S was calculated to be approximately 1.5 fpd or 550 fpy; and the average velocity from wells MW-8S to MW-9S was calculated to be approximately 1.1 fpd or 400 fpy.

1.4.5 Nature and Extent of Contamination

The RI environmental sampling program included collection of samples from the Site media including: subsurface soils and overburden groundwater (from both on-Site and off-Site, downgradient locations (i.e., south of the ADC property boundary at Hempstead Turnpike)). Table 1-1 shows a summary of media, locations and analysis conducted for samples collected during the RI. Additionally, a soil gas survey was completed at the Site. The soil gas results are summarized on Figure 1-5.

Based on the analytical laboratory tests results from the environmental sampling, the primary chemical compound class detected at the Site are the volatile organic compounds (VOCs). The most significant and frequently detected VOC at the Site was PCE, which was known to be used at the Site. However, other chemical classes including semi-volatile compounds (SVOCs) and inorganic (metals) compounds were analyzed for and detected at the Site (See Tables 1-2 through 1-7 for the sample analytical results for collected Site samples, including those collected both on-Site and off-Site downgradient of the southern Site property boundary. Several compounds of these chemical classes were identified at concentrations exceeding associated New York State standards or guidance values. However, these exceedances are not considered significant as discussed in the RI report.

PCE was detected in soil gas, subsurface soils, and groundwater. Two source areas were identified (see Figure 1-6) based on the presence of PCE in unsaturated soils. The most significant source was identified in the location of the two cesspools identified in the eastern portion of the Site property. Dense nonaqueous phase liquid (DNAPL)[1] was also apparent in this area based on the analytical testing and field screening at this location. The DNAPL appears to extend downward to the saturated zone. An area of unsaturated soils in the northwestern portion of the Site is also contaminated with PCE.

Daughter compounds of PCE (including trichloroethene (TCE) and 1,2-dichloroethene (1,2-DCE)) were generally detected in groundwater at well locations downgradient of the cesspool source area of the Site. The presence of these compounds would suggest the possibility of degradation at the Site.

An interim remedial measure (IRM) was conducted at the Site in August 1999 to address the PCE-contaminated soils in the southern-most cesspool located in the eastern portion of the Site. TAMS contracted Environmental Products and Services Inc. (EPS) of Linden, New Jersey to remove approximately two feet (approximately two cubic yards) of impacted soils from the bottom of the cesspool. EPS disposed of the impacted soils as hazardous waste. PCE-impacted soils (subsurface soils) still remain in and below the cesspool structure.

1.4.6 Contamination Fate and Transport

Two primary observed migration pathways were identified at the Site during the RI study, including overburden groundwater migration and soil vapor migration.

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[1] DNAPL as used in this report refers to PCE product that could be bound within soil pores and/or free liquid. DNAPL is anticipated to be present in the east alley southern cesspool based on visual observation of samples and is supported by organic vapor meter soil sample headspace results and analytical data.

Both direct discharge of PCE or PCE-impacted wastewater into the cesspools and direct surface water infiltration through surface soils with subsequent leaching of PCE from unsaturated soils, result in a contaminant migration pathway from the Site soils into the overburden groundwater. This pathway provides a vertical (through soils) as well as a horizontal (through groundwater flow) migration pathway. Groundwater migration is expected to spread the contamination generally to the south in the direction of groundwater flow. The ITHS irrigation well southeast of the Site may have altered the natural groundwater flow pattern, thus spreading PCE contamination in areas to the southeast of the Site during periods of operation. Vertical spreading is also expected. The retarded PCE seepage velocity was estimated to range from 0.07 to 0.6 fpd with an average of 0.3 fpd or 110 fpy. Thus, PCE is expected to flow at about one-third of the groundwater transport rate.

Volatilization is expected and documented at the Site based on the soil gas survey results. The migration of soil gas contaminated with PCE is expected; however, it is much less predictable than groundwater migration. This contamination may migrate laterally within this zone or vertically with potential discharge to ground surface or to buildings or other structures. Utilities may provide preferential pathways for vapor migration.

1.4.7 Qualitative Risk Assessment

A qualitative risk assessment was completed based on the information and data obtained during the RI study. Human health and ecological assessments were completed.

The qualitative risk assessment identified contamination in each medium assessed at levels exceeding Federal and New York State risk-based criteria. The media and primary issues include the following.

- Groundwater: Exhibited high levels of organics (e.g., PCE), which can migrate off Site to impact downgradient receptors, in addition to continuing to harm the aquifer.
- Subsurface Soils: Continues to impact groundwater via leaching of contamination (e.g., PCE); and uncontrolled excavations could lead to high exposure levels.
- Vapor Migration: Due to both groundwater and subsurface soils, vapor migration is expected to potentially impact underground structures, surface structures and excavations above or into the plume.

2.0 IDENTIFICATION OF STANDARDS, CRITERIA AND GUIDELINES AND REMEDIAL ACTION OBJECTIVES

2.1 INTRODUCTION

Standards, Criteria and Guidelines (SCGs) are used at inactive hazardous waste sites to establish the locations where remedial actions are warranted and to establish cleanup goals. SCGs include State requirements. This section presents potentially applicable SCGs and other standards criteria and establishes cleanup goals and remedial action objectives for contaminated on-Site media. Also presented are estimates of areas and volumes of contaminated on-Site groundwater and subsurface soils to assist in evaluating remedial alternatives later in this report.

2.2 POTENTIALLY APPLICABLE STANDARDS, CRITERIA AND GUIDELINES (SCGs) AND OTHER CRITERIA

- *Applicable Requirements* are legally enforceable standards or regulations, which have been promulgated under State law such as groundwater standards for drinking water.

- *Relevant and Appropriate Requirements* include those requirements, which have been promulgated under State law which may not be "applicable" to the specific contaminant released or the remedial action contemplated, but are sufficiently similar to Site conditions to be considered relevant and appropriate. If a relevant and appropriate requirement is well suited to a site, it carries the same weight as an applicable requirement during the evaluation of remedial alternatives.

- *To Be Considered Criteria* are non-promulgated advisories or guidance issued by State agencies that may be used to evaluate whether a remedial alternative is protective of human health and the environment in cases where there are no standards or regulations for a particular contaminant or site condition. These criteria may be considered with SCGs in establishing cleanup goals for protection of human health and the environment.

The following subsections present the three categories of SCGs: chemical-specific, location-specific, and action-specific.

2.2.1 Chemical-Specific SCGs

Chemical-specific SCGs are typically technology or health-risk based numerical limitations on the contaminant concentrations in the ambient environment. They are used to assess the extent of remedial action required and to establish cleanup goals for a site. Chemical-specific SCGs may be directly used as actual cleanup goals, or as a basis for establishing appropriate cleanup goals for the contaminants of concern at a site. Chemical-specific SCGs for on-Site soil and groundwater at the ADC Site are identified in Tables 2-1 through 2-3. The list of chemical-specific SCGs was developed using the risk-based criteria presented as part of the qualitative risk assessment for the RI.

2.2.2 Location-Specific SCGs

Location-specific SCGs apply to sites that contain features such as wetlands, floodplains, sensitive ecosystems or historic buildings that are located on, or in close proximity to the Site. Based on the RI, wetlands, floodplains, sensitive ecosystems or historic buildings are not located on, or in close proximity to the Site. Thus, location-specific SCGs were not identified for this Site.

2.2.3 Action-Specific SCGs

Action-specific SCGs are usually administrative or activity-based limitations that guide how remedial actions are conducted. These may include record-keeping and reporting requirements; permitting requirements; design and performance standards for remedial actions; and treatment, storage and disposal practices. Action-specific SCGs identified for the Site are provided in Table 2-3.

2.3 REMEDIAL ACTION OBJECTIVES

This section presents the objectives for on-Site remedial actions that may be taken to protect human health and the environment. To develop the remedial action objectives, TAMS/GZA completed the following as part of the RI and On-Site FFS.

- Identified contaminants present in the environmental media in the study area.
- Evaluated existing or potential exposure pathways in which the contaminants may effect human health and the environment.
- Identified pathways having a moderate to high likelihood for exposure.
- Identified chemical-specific SCGs that apply to the likely exposure routes to establish the contaminants of concern and proposed cleanup goals for purposes of remediation.
- Established remedial action objectives for the contaminants of concern to reduce the potential for future exposure.

Remedial action objectives are presented for the environmental media in the study area, based on the contaminants of concern and SCG Goals. Remedial action objectives are summarized at the end of this section.

2.3.1 Contaminants of Concern and SCG Goals

Tables 2-1 and 2-2 list the contaminants detected in samples collected on Site and the chemical-specific SCGs (risk-based exposure limits) that apply to the likely exposure routes for the environmental media of interest. Potential exposure pathways are discussed in Subsection 2.3.2. Proposed on-Site cleanup goals for each contaminant were developed in accordance with the procedures described below.

Proposed on-Site cleanup SCGs for organic compounds were selected by comparing the chemical-specific SCGs appropriate to the likely exposure pathways. The cleanup SCG was then selected based on the potential exposure scenarios and contaminated media encountered within the study area.

Contaminants of concern were identified for on-Site environmental media by identifying the contaminants that exceeded the proposed cleanup SCGs and then evaluating the frequency that cleanup goals were exceeded and the relative toxicity of the contaminant. In general, contaminants of concern were established based on the following criteria.

- Contaminants that exceeded the proposed State SCGs in greater than 5 percent of the samples tested within the medium; but
- Excluding select inorganic compounds considered being essential human nutrients (i.e., iron, magnesium, calcium, potassium and sodium) that are present at slightly elevated levels above natural background.

It should be noted that due to the limited number of samples tested for SVOCs, more than 5 percent of the samples tested exceeded the proposed cleanup SCGs for two compounds (benzo (a) anthracene and benzo (a) pyrene). Additionally, metals were detected at the Site but are not considered significant as described in the RI report. The primary contaminants of concern are VOCs, specifically PCE.

Tables 2-4 and 2-5 identify the contaminants of concern for the purposes of remediation in on-Site environmental media (i.e., groundwater and subsurface soils), the range of concentrations detected, the proposed cleanup SCG, the number of samples that exceed the cleanup SCG, and the number of samples analyzed.

2.3.2 Contaminated Media and Exposure Pathways

This subsection addresses the environmental media in the study area and describes the types of contaminants present and the potential exposure pathways. As described in the Qualitative Risk Assessment in the RI Report, it is assumed that PCE-impacted soils that existed prior to the IRM work still remain in and below the cesspool structure. Therefore, for the purposes of this On-Site FFS, subsurface soils identified herein include the PCE-impacted soils removed as part of the IRM work.

2.3.2.1 Subsurface Soils

The RI data indicate that contamination is present in the subsurface soils at the Site. Table 2-4 lists the contaminants of concern detected in samples of the subsurface soils. Although some SVOC and metal contaminants were identified at elevated levels at the Site, the primary contaminants of concern include VOCs, specifically PCE.

Potential exposure pathways for the contaminated subsurface soils include ingestion, inhalation and dermal contact by maintenance personnel or earthwork construction workers. The likelihood of exposure via these pathways is expected to be low, due to the fact that on-Site intrusive work is expected to be performed in accordance with requirements for NYSDEC inactive hazardous waste sites (e.g., health and safety monitoring). In addition, the contaminated subsurface soils have the potential to leach contaminants into the overburden groundwater. Therefore, remedial action is warranted.

2.3.2.2 Overburden Groundwater

Overburden groundwater sampling and laboratory analyses were completed as part of the RI. Table 2-5 identifies the contaminants of concern detected in on-Site overburden groundwater samples. Based on qualitative risk assessment presented in the RI study, the contaminant of concern for groundwater is VOCs, specifically PCE.

The potential exposure pathway for overburden groundwater appears to be via contact with contaminated groundwater at points of possible groundwater discharge/extraction. The likelihood of exposure to groundwater due to construction activity is considered low since the groundwater is situated approximately 35 feet below ground surface. A public water system deriving water from deeper aquifers in Nassau County services the area currently, and public or private drinking water wells were not identified within a ½-mile radius of the Site during the RI. Exposure to contaminated overburden groundwater associated with the Site (from drinking water supply wells) is unlikely. The potential for exposure via these pathways is slight. However, exposure may result from groundwater wells used for other purposes including cooling, dewatering, and irrigation (e.g., ITHS irrigation well). Potential exposure may include ingestion, inhalation of vapors, or dermal contact to irrigation waters. Therefore, remediation of on-Site groundwater is warranted. Off-Site groundwater contamination and remediation issues for the ADC property will be evaluated in Off-Site FS studies.

2.3.3 Remedial Action Objectives

This subsection presents the proposed remedial action objectives to reduce the potential for future exposure.

2.3.3.1 Subsurface Soils

The remedial action objectives for on-Site subsurface soils are:

(1) Reduce the potential for direct human or animal contact with the contaminated subsurface soils;

(2) Reduce the risk of further contaminating groundwater by reducing the potential for leaching of contaminants into the groundwater; and

(3) Reduce the potential for future introduction of contaminants into the structures.

2.3.3.2 Overburden Groundwater

The remedial action objectives for on-Site overburden groundwater are:

(1) Reduce further off-Site migration of contaminated overburden groundwater to the extent practical;

(2) Reduce the levels of contamination in the overburden groundwater at the Site to the extent practical;

(3) Attain the proposed cleanup goals for overburden groundwater quality at the Site boundary (the northern edge of Hempstead Turnpike) to the extent practical; and

(4) Reduce the risk of exposure to overburden groundwater by reducing the potential for inhalation of organic vapors, ingestion of contaminated groundwater and dermal contact with contaminated groundwater.

2.4 REMEDIAL ACTION AREAS AND VOLUMES

This subsection presents the estimates of areas and volumes of contaminated groundwater and soils to assist in evaluating remedial alternatives later in this report. The estimates are based on the information presented in the RI Report, as summarized in Section 1.0 herein, and as depicted on Figures 1-6 and 1-7. Calculations of the estimated areas and volumes of PCE contamination are presented in Appendix B.

The estimated volume of on-Site contaminated groundwater is approximately 1.3 million gallons. This estimate is based on the average saturated thickness of the PCE plume; and the estimated area of contaminated groundwater at the Site (associated with PCE concentrations greater than 5 ppb (SCG), based on RI analytical results for samples from on-Site monitoring wells), depicted on Figure 1-7. The plume (greater than 5 ug/l of PCE) appears to be concentrated in the upper 45 feet of the aquifer, based on water level measurements in Site monitoring wells and groundwater analytical results. The porosity value (assumed to be 0.35 (Bear, 1979)) is based on published values for this type of soil (gravelly sand).

The estimated volume of on-Site contaminated subsurface soils above the water table is approximately 1,600 cubic yards. This estimate includes the soils (with PCE concentrations greater than 1,400 ppb[2] (SCG)), associated with two areas: (1) the two cesspools identified in the eastern portion of the ADC property; and, (2) the northwestern portion of the ADC property which may be associated with storage and/or spillage of PCE. The soil volume estimate is based on the following.

1. Two cesspools (eastern portion of property): PCE is present from the bottom of the cesspools (approximately 12 feet below ground surface) to the groundwater table (approximately 35 feet below ground surface), as well as adjacent to the cesspools (including under buildings) due to assumed lateral spreading from discharge through the sidewalls. The impacted area is assumed to be 2,700 square feet in extent. The estimated volume of contaminated soil is approximately 1,400 cubic yards. (Approximately 2 cubic yards of source (highly contaminated) material was previously removed for off-Site disposal during the IRM.)

2. The northwestern portion of the ADC property: PCE is present from approximately 4 feet below ground surface to approximately 8 feet below ground surface, in an area assumed to be 1,100 square feet in extent. The estimated volume of contaminated soil is approximately 170 cubic yards.

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[2] Note: The SCG for PCE is based on a TAGM # 4046 RSCO of 1,400 ppb (based on an assumed organic carbon content of 1%). However, it should be noted that the typical organic carbon content measured at the site (for non-waste samples) was about 0.2 %. Based on the measured carbon content at the Site (0.2 %), the RSCO (as calculated utilizing TAGM 4046) would be 300 ppb.

These areas are based on the results of analytical testing from the RI.

3.0 IDENTIFICATION OF REMEDIAL ACTION ALTERNATIVES

3.1 INTRODUCTION

This section presents the results of the preliminary screening (see Section 1.1) of remedial actions that may be used to control the contaminants of concern and to achieve the on-Site remedial action objectives. Potential remedial actions, including general response actions (e.g., containment, in-situ treatment) that may be accomplished using various remedial technologies, have been evaluated during the preliminary screening on the basis of effectiveness, implementability, and relative cost. The purpose of the preliminary screening is to eliminate remedial actions that may not be effective based on anticipated on-site conditions, or that cannot be implemented technically at the site; and, to narrow the list of alternatives that will be evaluated in greater detail.

As described in Section 1.1, the list of general response actions considered herein is intended to include those actions that are most appropriate for the Site and, therefore, is not exhaustive. A select, focused group of general response actions and remedial technologies for groundwater and soil was considered.

This section also presents a description of the on-Site remedial action alternatives that have been developed for the ADC Site. The alternatives were developed using the general response actions and remedial technologies that passed the preliminary screening. These alternatives are evaluated in greater detail on the basis of environmental benefits and cost in Sections 4.0 (Detailed Analysis of Alternatives) and 5.0 (Comparative Analysis of Alternatives).

3.2 GENERAL RESPONSE ACTIONS

To satisfy the on-Site remedial action objectives for the ADC Site, remediation will be required for the groundwater and subsurface soils. General response actions that are available to meet the remedial action objectives under consideration (as described in Section 1.1) are identified below.

General response actions for the contaminated groundwater include:

- No Action;
- Containment;
- In-Situ Treatment; and
- Ex-Situ Treatment.

General response actions for the contaminated subsurface soils include:

- No Action;
- Containment; and
- In-Situ Treatment.

It should be noted that excavation (for off-site disposal or ex-situ treatment) is not considered an applicable remedial action at the ADC Site due to limited access (including structures/buildings and utilities) to the source areas.

3.2.1 Criteria for Preliminary Screening

In accordance with guidance documents issued by the NYSDEC (TAGM #4030) and the USEPA (Guidance for Conducting RI/FS Studies under CERCLA), the criteria used for preliminary screening of general response actions and remedial technologies include the following.

- Effectiveness - The effectiveness evaluation focuses on the degree to which a remedial action is protective of human health and the environment. An assessment is made of the extent to which an action: (1) reduces the mobility, toxicity and volume of contamination at the site; (2) meets the remediation goals identified in the remedial action objectives; (3) effectively handles the estimated areas and volumes of contaminated media; (4) reduces impacts to human health and the environment in the short-term during the construction and implementation phase; and (5) how proven or reliable the proposed action may be in the long-term with respect to the contaminants and conditions at the site. Alternatives that do not provide adequate protection of human health and the environment are eliminated from further consideration.

- Implementability - The implementability evaluation focuses on the technical and administrative feasibility of a remedial action. Technical feasibility refers to the ability to construct and operate a remedial action for the specific conditions at the site and the availability of necessary equipment and technical specialists. Technical feasibility also includes the future maintenance, replacement and monitoring that may be required for a remedial action. Administrative feasibility refers to compliance with applicable rules, regulations, statutes and the ability to obtain permits or approvals from other government agencies or offices; and the availability of adequate capacity at permitted treatment, storage and disposal facilities and related services. Remedial actions that do not appear to be technically or administratively feasible, or that would require equipment, specialists or facilities that are not available within a reasonable period of time, are eliminated from further consideration.

- Relative Cost - In the preliminary screening of remedial actions, relative costs are considered rather than detailed cost estimates. The capital costs and operation and maintenance costs of the remedial actions are compared on the basis of engineering judgement, where each action is evaluated as to whether the costs are high, moderate or low relative to other remedial actions based on knowledge of site conditions. A remedial action is eliminated during preliminary screening on the basis of cost if other remedial actions are comparably effective and implementable at a much lower cost.

The results of the preliminary screening are summarized below. Those general response actions and remedial technologies, which appear to meet the remedial action objectives for one or more of the environmental media (i.e., groundwater and/or soil), are described.

3.2.2 Groundwater

An evaluation of the analytical and field data for on-Site groundwater indicates that PCE contamination above the SCGs is present in groundwater throughout the ADC Site. In addition, contamination in the form of DNAPL is also apparently in the unsaturated soils and likely extends to the groundwater table in the eastern cesspool area. Groundwater restoration in the presence of DNAPL is often considered impractical, because no remedial technologies other than excavation are available for completely removing subsurface DNAPL. Several factors, including the limited access to the cesspool source area hot spot and lack of a confining layer (to tie in remedial containment systems), limit the potential use of remedial actions such as containment (e.g., cutoff wall) and excavation. Other innovative technologies (e.g., Fenton's Reagent) may be effective at remediating a portion of the DNAPL contamination; however, these technologies are unlikely to provide for complete DNAPL mass reduction without extensive effort and expense.

The following subsections discuss the preliminary screening of various general response actions and remedial technologies that were considered for remediation of groundwater.

3.2.2.1 No Action

The No Action alternative involves taking no further action to remedy groundwater conditions at the Site. NYSDEC and USEPA guidance requires that the No Action alternative automatically pass through the preliminary screening and be compared to other alternatives in the detailed analysis of alternatives (Section 4.0).

3.2.2.2 Containment

The purpose of groundwater containment is to isolate, or restrict the flow of contaminated groundwater. This is generally accomplished by removing water from the ground, such as by pumping from extraction wells. Containment technologies that rely on groundwater extraction are occasionally supplemented with a low permeability subsurface barrier wall to improve the effectiveness of the extraction system. Another groundwater containment technology includes groundwater collection trenches, which are constructed for the purpose of collecting groundwater. However, these technologies are not readily implementable because a low permeability formation does not exist within a reasonable depth (i.e., within 100 feet of the ground surface) at the ADC Site. Therefore, these technologies did not pass preliminary screening and are not described herein.

3.2.2.2.1 Groundwater Extraction

Groundwater extraction is a commonly used method to control the migration of contaminated groundwater and to collect contaminated groundwater for subsequent treatment. Groundwater extraction wells are generally installed with a drill rig. Well screens and filter packs are generally installed to intercept the saturated thickness of the contaminated water-bearing zone. Extraction wells can be installed to provide a hydraulic barrier for control of migration of contaminated groundwater, or at specific locations for source area remediation.

Effectiveness - Groundwater extraction wells appear to be an effective remedy that could be used in conjunction with other technologies to meet the remedial action objectives for the groundwater. Extraction wells, in conjunction with a groundwater treatment system (described in Subsection 3.2.2.4 below), would reduce the mobility, toxicity and volume of contaminated groundwater. Extraction wells can be installed with limited Site disturbance and relatively low potential for impacts to human health and the environment during installation, as compared to other technologies that are more intrusive. Extraction wells are a proven and reliable technology for removal of groundwater for remediation. Extraction is not effective for remediation of DNAPL.

Implementability - For the subsurface conditions at the ADC Site, groundwater extraction wells are an implementable technology for removal of groundwater for subsequent treatment. The materials, equipment and labor necessary to install extraction wells are readily available. Extraction wells can be reliably installed to the required depth and the screened interval can be installed to meet the subsurface conditions.

Cost - The relative costs for extraction wells are expected to be moderate as compared to other remedial technologies used to remove groundwater for treatment. Capital costs would include materials, equipment and labor to install the extraction wells, submersible pumps, and piping and associated appurtenances. Operation and maintenance costs would include long-term pumping costs to remove groundwater for treatment, routine maintenance on wells and piping, and costs for groundwater monitoring.

In summary, groundwater extraction wells appear to be an effective and implementable technology for removal of contaminated groundwater from the ground for subsequent treatment using other remedial technologies (described in Subsection 3.2.2.4).

3.2.2.3 In-Situ Treatment

The following subsections present the results of the preliminary screening of in-situ treatment technologies for remediation of contaminated groundwater. Both a traditional method (air sparging) and an innovative method (chemical oxidation) of in-situ treatment, as classified by USEPA, are presented.

3.2.2.3.1 Air Sparging

The technology of air sparging involves contaminant reduction primarily by volatilization and biodegradation. Sparging is conducted by injecting air into the subsurface below the water table under controlled pressure and volume. Contaminants, such as chlorinated compounds, that are dissolved in the groundwater and adsorbed onto soil are volatilized (or stripped) when in contact with the injected air. Air containing stripped contaminants migrates upward through the groundwater into and through the unsaturated zone, where it is ultimately collected in vacuum/vapor extraction wells, in order to capture volatilized chemicals prior to discharge into the atmosphere. The air is then treated and discharged to the atmosphere.

In addition to the stripping process that occurs on contaminants in the groundwater, it has been shown that air sparging provides for enhanced biodegradation under certain conditions. However, the majority of the contaminants detected at the Site (including PCE) are degraded anaerobically in the subsurface environment. Therefore, sparging is not expected to significantly enhance biodegradation of Site contaminants.

Effectiveness - This technology is generally effective in removal of VOCs from groundwater, especially highly volatile compounds such as chlorinated solvents. The effectiveness of this technology is based in part on the Site geology. Higher removal efficiencies are generally accomplished in coarse-grained soils, as airflow channels are more evenly distributed both laterally and vertically. However, existing subsurface heterogeneities may inhibit the sparged air from contacting dissolved phase PCE in groundwater. Air sparging is anticipated to reduce VOC concentrations (by about one order of magnitude), but is not believed to be able to meet the groundwater remediation objective for PCE (5 ppb).

In addition, air sparging is not effective for remediation of DNAPL, as the potential exists to mobilize and spread DNAPL, which could increase the size of the plume. Therefore, air sparging would be appropriately implemented downgradient of the east Site alley (proximate to the cesspools). Long-term effectiveness may be limited due to potential aquifer plugging caused by the precipitation of metals in groundwater in the sparged area.

Implementability - For the subsurface conditions at the ADC Site, air sparging wells are an implementable technology for in-situ treatment of groundwater. The materials, equipment and labor for installation of a sparging system are available and can be readily implemented. Sparge wells can be reliably installed to the required depth and the screened interval can be installed to meet the subsurface conditions. The system requirements include a blower/air compressor system, and a vapor extraction/treatment system (described below in Subsection 3.2.3.3.1). Pilot testing would be required on Site to evaluate the required design parameters (e.g., sparge well spacing, injection flow rate, etc.), relative to the desired remediation of PCE in groundwater.

Cost - Relative costs are expected to be moderate. Capital costs may include the materials and installation of sparge wells and a blower/air compressor system. (Also, installation of a vapor extraction system would be necessary for collection and treatment of volatilized contaminants. This system is described below in Subsection 3.2.3.3.1). Operation and maintenance costs may include use of electrical power for the compressor system, and routine maintenance of system piping, well screen, etc.

In summary, air sparging appears to be a moderately effective and implementable technology for treatment of contaminated groundwater at the ADC Site.

3.2.2.3.2 In-Situ Chemical Oxidation

In-situ chemical oxidation is a technology whereby an oxidant (e.g., Fenton's Reagent, Potassium Permanganate ($KMnO_4$)) is applied/injected into an aquifer or subsurface soils. (Fenton's Reagent consists of hydrogen peroxide with an iron catalyst creating a hydroxyl free radical.). Both oxidants are capable of oxidizing complex organic compounds such as PCE (GWRTAC, TE-99-01); and are, therefore, amenable to remediating the primary compound detected at the Site. Following the injection of Fenton's Reagent, a reaction with organic compounds occurs, and residual hydrogen peroxide decomposes into water and oxygen, and iron precipitates. Such a reaction is exothermic meaning heat is generated. The reaction of potassium permanganate with organic compounds produces various compounds including manganese dioxide, carbon dioxide and oxidized intermediate organic compound.

This technology has a limited application to unsaturated soils. Utilization of this process requires source areas, including areas of DNAPL, be treated along with soluble phase PCE in groundwater for the technology to be effective. Otherwise, this technology will not be effective in treating the dissolved fraction of the PCE in groundwater, as rebound (i.e., a return of groundwater contamination) would likely occur due to continued leaching of PCE from the DNAPL.

The process includes placing injection points throughout the area to be treated, and injection of Fenton's Reagent/dissolved $KMnO_4$ into the aquifer/subsurface. The technology is complemented by venting or soil vapor extraction to collect off-gases that escape to the vadose zone. Also, in-situ chemical oxidation is often coupled with groundwater extraction and ex-situ treatment, to capture oxidant material and potentially mobilized DNAPL. As requested by NYSDEC, it is assumed herein that groundwater extraction would be required to complement in-situ oxidation.

> *Effectiveness* - In-situ oxidation using Fenton's Reagent or potassium permanganate would be effective for treatment of the contamination at the Site. However, the ability of this technology to treat the source area to meet the remedial goals is uncertain, as complete reduction of the DNAPL mass without excavation is not usually considered effective with any technology. However, oxidation could be used to reduce the mass of DNAPL.

Subsurface heterogeneities may inhibit the oxidant from contacting the PCE gases, dissolved phase in water, and PCE DNAPL, thus preventing full treatment of the subsurface soils, groundwater contamination, or DNAPL. However, the three Fenton's vendors (GeoCleanse, Isotec, and Mantech) and primary potassium permanganate chemical supplier (Carus) are confident in the ability of chemical oxidants to effectively treat PCE and DNAPL.

As further described below, successful application of this process requires that the reagent be injected through a series of injections (i.e., a phased approach). This approach would attempt to optimize the amount of physical contact between the oxidant and the DNAPL mass, as well as generate a manageable amount of heat/off-gases. The successful application of an in-situ oxidant is dependent on the amount of DNAPL mass that is treated in this manner. A sufficient quantity of reagent/catalyst is required to come in contact with the DNAPL in order to treat the DNAPL mass, such that the DNAPL would no longer serve as a source of PCE contamination in groundwater.

Implementability - Each of the three Fenton's vendors uses a different concentration of reagent. GeoCleanse injects a relatively high concentration of reagent. The other two vendors use more dilute solutions (less heat and gas generation), thus making Fenton's a potentially implementable treatment technology, since normal operations at the Site would only require limited space allocation around the injection points for the in-situ treatment. These two vendors (Isotec and Mantech) inject the reagent in a phased approach, with confirmatory sampling performed in between injection events to monitor the effectiveness of the treatment. Of the two, Isotec uses the more dilute solution, which generates less heat and results in fewer implementation issues.

Potassium permanganate injection is also a potentially implementable treatment technology, as placement of injection wells, and often used recirculation wells, around the Site would require limited space. A $KMnO_4$ mixing/feed system would be located within the associated groundwater treatment system building.

The materials, equipment and labor necessary to implement this technology are available from at least one vendor. A pilot-scale treatability study would be necessary to assess system design. To implement this technology, portions of the Site would have to be shut down for a minimum of five weeks.

Cost - The cost for implementing this technology is documented to be generally less than groundwater extraction and treatment technologies, when used on a limited basis. The required concentrations and duration/frequency of oxidant injection would be specific to the vendor selected. Therefore, this technology may have limited application at the Site, as it may be cost effective for source areas only.

Using the lower concentration rate of Fenton's Reagent (as provided by Isotec) or potassium permanganate will result in limited disruption to the Site operations. The high concentration Fenton's Reagent will not be considered further due to anticipated Site disruptions. However, unless the process is used to attempt to treat the DNAPL, in-situ oxidation should not be attempted on dissolved portions of the plume, as rebound will occur due to continued leaching of PCE from DNAPL in the saturated and unsaturated soils.

In summary, the injection of a chemical oxidation agent (e.g., Fenton's Reagent or potassium permanganate) could be effective if used to treat a substantial amount of the DNAPL mass. Limited application of in-situ oxidation appears to be a reasonable approach for use of this technology. Consequently, use of this technology to treat the DNAPL area will be considered further in the detailed analysis.

3.2.2.4 Ex-Situ Treatment

This general response action involves aboveground treatment of removed groundwater from the subsurface using other technologies for subsequent discharge/disposal. This could involve: (1) treating the groundwater to the cleanup goals and discharging the treated water back into the Site groundwater; (2) treating the groundwater and discharging the treated water to a nearby water body or stormwater sewer in conformance with State Pollutant Discharge Elimination System (SPDES) permit requirements; or (3) pretreating the water sufficient to meet the pretreatment standards for the Nassau County Publicly Owned Treatment Works (POTW) prior to discharge to the existing sanitary sewer system.

According to the Nassau County Department of Public Works (NCDPW), pretreated groundwater from remediation systems is generally not accepted for discharge into the sanitary sewer system for subsequent treatment at its water treatment facility (POTW). Also, county stormwater sewers are located on the southern edge of the ADC property (i.e., the northern edge of Hempstead Turnpike), that discharge into a local county stormwater detention basin. On-Site subsurface reinjection of treated groundwater could potentially mobilize DNAPL and associated contaminated groundwater beyond Site areas, causing the contamination to spread. Therefore, as discussed with NYSDEC, it is conservatively assumed that treated groundwater would be discharged into the stormwater sewer system rather than the sanitary sewer system. The required limit for discharge to the stormwater sewer system is 5 ppb, in accordance with SPDES permit requirements.

The following subsections describe the results of preliminary screening of technologies that were considered for ex-situ treatment of groundwater.

3.2.2.4.1 Air Stripping

Air stripping involves passing air through the contaminated groundwater to induce volatilization and removal of VOCs. Air that contains organic vapors stripped from the groundwater can be treated by either filtration with activated carbon, or catalytic oxidation, prior to discharge to the atmosphere. Air stripping is most appropriate for situations where the contaminants to be treated are volatile and where there are not significant concentrations of dissolved ions that may precipitate (e.g., iron).

Effectiveness - Air stripping is expected to be an effective technology for treating the groundwater to achieve the stormwater discharge (SPDES) permit standards. This is a proven and reliable technology for treatment of water containing VOCs. A shallow tray air stripper could be used to treat the groundwater prior to discharge to the sanitary sewer system. Air emissions may need to be treated prior to discharge, based on the anticipated levels, for protection of human health and the environment. Metals such as iron and manganese can precipitate onto the trays in the air stripper requiring more frequent maintenance. Therefore, pretreatment of the groundwater for metals may be required.

Implementability - The labor, equipment and materials for installation of an air stripper at the Site are readily available. It may be necessary to treat the air emissions from the stripper by catalytic oxidation, carbon, or appropriate method to meet NYSDEC requirements for allowable concentrations of PCE in air. The use of activated carbon or catalytic oxidation equipment for the air stripper could be used in conjunction with the soil vapor extraction system, if utilized.

The process equipment that would be required to implement an air stripping treatment system would include construction of a shelter building, an electrical power source, instrumentation and controls system equipment, an equalization tank to receive influent water from the groundwater extraction well(s), potential metals treatment process (e.g., greensands filter), an air stripper unit with an air blower, an off-gas treatment system to remove organic vapors from air prior to discharge to the atmosphere, activated carbon for polishing of the groundwater, and discharge piping for effluent water leading to the existing stormwater sewer system. In addition, effluent discharge and SPDES permits will be required from Nassau County and NYSDEC, which should be attainable. If an air stripper is used at this Site for treatment, treatability studies may be required in order to complete the design based on the required discharge limit. In addition, the system will need to substantially comply with appropriate State and Federal air permit requirements.

Cost - The relative costs for air stripping are expected to be moderate to high as compared to other remedial technologies used to treat contaminated groundwater. Capital costs would include the process equipment noted above and their installation. Operation and maintenance costs would include changing of filters on a regular basis, cleaning and replacing trays or packing media in the air stripper, maintaining the off-gas system, and electrical power consumption.

In summary, air stripping appears to be an effective and implementable technology for ex-situ treatment of contaminated groundwater prior to discharge to the existing stormwater sewer system, when used in conjunction with other technologies (e.g., catalytic oxidation, carbon polishing).

3.2.2.4.2 Carbon Adsorption

Liquid phase carbon adsorption is used to remove organic compounds from groundwater by adsorbing the organic compounds onto the surface of granular activated carbon. Water is treated as it flows through the granular activated carbon. Granular activated carbon can be packed into a treatment column or placed in properly sized drums or pressure vessels connected in series. On a regular basis, the granular activated carbon must be changed since its adsorption capacity is depleted with use.

Effectiveness - Use of carbon may be an ineffective method of primary groundwater treatment of groundwater, due to the elevated concentrations of chlorinated VOCs detected in the groundwater. The carbon usage rate for groundwater treatment is expected to be high, particularly during initial start up when higher flow rates are anticipated. Thus, it is anticipated that significant quantities of activated carbon would be consumed, that would result in the need for frequent carbon change-out, at least initially in the extraction process. Carbon may also be utilized in a treatment process for the purposes of final polishing following the use of one of the other treatment technologies.

Implementability - Granular activated carbon treatment columns or containers are readily available and relatively simple to install and replace.

Cost - The cost of this technology when used as a method of treatment is expected to be high for groundwater, due to labor and materials needed for frequent carbon change-out.

In summary, the use of liquid phase carbon adsorption for treatment of the groundwater would not be cost effective for groundwater treatment, as compared to other available treatment technologies for the PCE concentrations detected in the groundwater.

3.2.3 Subsurface Soil

An evaluation of the analytical and field data for subsurface soils from the RI indicates that PCE contamination above the SCGs is present in areas throughout the Site. As shown on Figure 1-6 and as further described in Section 1.0, the most highly-contaminated soils are located in two general areas (i.e., (1) the two cesspools identified in the eastern portion of the ADC property; and, (2) the northwestern portion of the ADC property which may be associated with storage and/or spillage of PCE). Soil contamination is present in the unsaturated soils in these two areas, and to the groundwater table in the cesspool area.

The following subsections discuss the preliminary screening of various general response actions and remedial technologies that were considered for remediation of Site subsurface soils.

3.2.3.1 No Action

The No Action alternative involves taking no further action to remedy the condition of contaminated soils. NYSDEC and USEPA guidance requires that the No Action alternative automatically pass through the preliminary screening and be compared to other alternatives in the detailed analysis of alternatives (Section 4.0).

3.2.3.2 Containment

The containment action for the ADC Site soils could generally be used to reduce the potential for direct contact with contaminated materials; limit erosion and transport of contaminated surface soils; provide a surface seal for the soil vapor extraction system; and reduce infiltration of precipitation through contaminated soils and into the groundwater. A significant portion of the Site is currently contained by an asphalt pavement cover, which is one remedial technology option for containment. The following subsection presents the preliminary screening of this capping alternative for possible limited additional Site use.

3.2.3.2.1 Asphalt Pavement Cover

An asphalt pavement cover includes a layer of base course stone or gravel, overlain by an asphalt binder course and a final asphalt wearing course. The layers of the pavement section are graded into place and compacted. This type of cover system is appropriate in situations where moderate reductions in infiltration of precipitation and a surface seal (for use with soil vapor extraction and/or in-situ air sparging systems) are desired. Asphalt pavement covers also serve to preserve the use of the property for vehicle parking and light traffic, and to limit contact with contaminated soils.

> *Effectiveness* - It appears that an asphalt pavement cover will be effective in helping to achieve the remedial action objectives for the groundwater and soil, since it would reduce the potential for direct contact with the contaminated soils; reduce infiltration; serve as a surface seal (for use with soil vapor extraction and/or in-situ air sparging systems); and, limit erosion and transport of contaminated materials. To maintain the long-term effectiveness of an asphalt cover, periodic maintenance (i.e., crack sealing, seal coating or pavement overlay) may be required. Although an asphalt pavement cover allows greater infiltration of precipitation than other cap technologies, it is likely that an adequately maintained asphalt pavement cover will be protective of human health and the environment, in conjunction with other soil and groundwater treatment/containment technologies.
>
> *Implementability* - The materials, equipment and labor for construction of an asphalt pavement cover are available and can be readily implemented during the period when the asphalt batching plants in the area are open (generally March to November). A significant portion of the Site is currently contained by an asphalt pavement cover.
>
> *Cost* - Costs for an asphalt pavement cover are expected to be low to moderate as compared to other cap designs (not considered herein). Capital costs may include materials, labor and equipment to construct the asphalt pavement section. Operation and maintenance costs may include periodic crack sealing, seal coating, and/or repaving with an asphalt overlay.

In summary, an asphalt pavement cover appears to be have limited application at the Site, since a significant portion of the Site is currently contained by an asphalt pavement cover. An asphalt pavement cover is an effective and implementable technology for helping to meet the remedial action objectives for on-Site groundwater and soil.

3.2.3.3 In-Situ Treatment

The following subsections present the results of the preliminary screening of in-situ treatment technologies for remediation of contaminated, unsaturated subsurface soils (above the groundwater table). Both a traditional method (soil vapor extraction) and an innovative method (chemical oxidation) of in-situ treatment, as classified by USEPA, are presented.

3.2.3.3.1 Soil Vapor Extraction

Soil vapor extraction (SVE) is a method of in-situ soil treatment that involves drawing air through the pore spaces of unsaturated soils to induce "stripping" of VOCs from the soil and into the air stream. A typical soil vapor extraction system could consist of air injection and/or extraction wells (horizontal or vertical) or trenches that draw air through the unsaturated zone soils plus an air treatment system to remove VOCs from the extracted soil vapor.

Effectiveness - Soil vapor extraction is an effective technology for reducing concentrations of VOCs in soils, especially chlorinated organics such as PCE; and to extract soil gas vapors associated with contaminated groundwater and groundwater remediation systems. SVE may be effective in reducing the time required for remediation when used in conjunction with a groundwater extraction system. This technology is effective in coarse-grained sandy soils that are present at the Site, especially when an asphalt pavement surface seal is used to increase the vacuum from the system. SVE is a proven and reliable technology for remediation of soils contaminated with VOCs.

Implementability - The materials, equipment and labor for installation of a soil vapor extraction system are available and can be readily implemented. The system requirements include installation of wells or subsurface trenches to extract air, a blower, and an air treatment system such as vapor phase activated carbon or catalytic oxidation. Pilot testing would be performed on Site to evaluate the required design parameters (e.g., SVE well spacing, vacuum, etc.), relative to the desired remediation of PCE in fill and aquifer soils. A surface seal is generally placed over the area to enhance performance; asphalt pavement may be adequate for this purpose. Substantial compliance with air permit regulations will likely be required for this system.

Cost - Relative costs are expected to be moderate. Capital costs may include well or trench materials and installation, the blower system and an air treatment system. Operation and maintenance costs may include use of electrical power for the blower system, periodic replacement of vapor phase activated carbon (if used), or periodic replacement of the oxidizing material and power for a catalytic oxidation system (if used). Catalytic oxidation is likely to be the selected treatment technology, due to its expected lower O&M costs than carbon. Also, the system could be shared with an air stripper to provide off-gas treatment, as described in Subsection 3.2.2.4.1 above.

In summary, a soil vapor extraction system appears to be an effective and implementable technology for source area remediation, especially when used in conjunction with a groundwater extraction and treatment system or in-situ air sparging system.

3.2.3.3.2 Chemical Oxidation

For a discussion of this technology alternative and its applicability for treating Site soils, refer to Subsection 3.2.2.3.2 above.

3.3 REMEDIAL ACTION ALTERNATIVES

Four on-Site remedial action alternatives have been assembled using the general response actions and remedial technologies that passed the preliminary screening. Table 3-1 provides a summary of the alternatives. An expanded description of each of the alternatives is provided below.

For the purposes of this On-Site FFS, components of remedial systems located on-Site or near the Site (north of Hempstead Turnpike) are described as "on-Site" systems.

3.3.1 Alternative No. 1 – No Action with Annual Groundwater Monitoring

The No Action alternative involves taking no further action to remedy Site conditions, other than to perform groundwater monitoring. This alternative allows for natural attenuation of impacted groundwater and soil. NYSDEC and USEPA guidance requires that the No Action alternative be considered in the detailed analysis of alternatives. However, the No Action alternative is considered an unacceptable alternative, as the Site would remain in its present condition and human health and the environment would not be adequately protected.

This alternative assumes that annual groundwater monitoring would be conducted in Site wells for 30 years. These wells are identified on Figure 3-1. During each monitoring event, eight of the sixteen wells would be purged and sampled, and water levels in the sixteen Site wells would be measured. Groundwater samples would be analyzed for VOCs.

3.3.2 Alternative No. 2 – Groundwater Extraction and Treatment and Soil Vapor Extraction

Figure 3-2 present conceptual sketches of the remedial actions for Alternative No. 2. Groundwater extraction and ex-situ treatment are components of this alternative. Extraction wells are located downgradient of the two cesspools located in the alley east of the ADC building. The extraction wells would be operated for the purposes of containment of impacted on-Site groundwater and to prevent further migration of the highly contaminated groundwater associated with the cesspool source area.

In addition, this alternative provides for treatment of impacted unsaturated soil, associated with the cesspool source area (northeast Site corner) and the northwestern Site area, via SVE. SVE would also provide for the reduction of groundwater contamination. Additionally, this alternative consists of construction of an asphalt cover at unpaved areas and closure of the two cesspools in the northeast Site corner. This alternative is considered a traditional approach to Site remediation.

The following is a description of the remedial actions included in Alternative No. 2, specific to both groundwater and soil.

Groundwater Remedial Actions:

- A pilot study should be performed on Site (downgradient of the east alley) in order to provide information to efficiently design the groundwater extraction system. The pilot study should consist of 24- or 48-hour pump tests. Results of the pump tests will be used to assess optimum pump rates and well layouts for the pumping wells.

- A treatability study should be performed on representative groundwater samples collected during the pump tests. The treatment technologies should be assessed for applicability (e.g., metals removal, air stripping design, activated carbon design, etc.).

- Two groundwater extraction wells (including the well installed for the pilot study) would be installed to provide containment of contaminated groundwater based on the current understanding of the Site (see Figure 3-2). The wells would be located proximate to/downgradient of the cesspools and outside of the suspected DNAPL area to prevent downgradient migration of DNAPL through the wells. The extraction system would be operated for long-term groundwater control (i.e., 30 years) by extracting water at approximately 10 to 20 gallons per minute (gpm), or 5 to 10 gallons per minute at each well. Extraction wells would be constructed of 6-inch stainless steel casing. The wells would be screened from the top of the groundwater table (approximately 35 feet bgs) to approximately 80 feet bgs, to intercept the more pervious portion of the Upper Glacial aquifer and the PCE plume. Groundwater would be pumped from the extraction wells via 2-inch diameter underground piping to a treatment system.

- A groundwater treatment system would be installed in a treatment building. The NYSDEC would attempt to reach an agreement with Frank's Nursery and Crafts to locate the building north of the cesspools on Frank's Nursery and Crafts property (see Figure 3-2). The building would consist of a pre-engineered metal building and slab-on-grade concrete foundation, and would be approximately 30 feet by 30 feet in size in order to house the treatment system and SVE system treatment equipment. The building would include a concrete floor and curbing to provide secondary containment. An internal sump would also be installed for liquid removal (if needed).

- The groundwater treatment system is expected to consist of an equalization tank, a metals removal system (for metals including iron and manganese), an air stripper, a granular activated carbon system (for polishing), and an effluent holding tank. It is assumed that the influent groundwater has relatively low turbidity, and thus filtration is not assumed. A catalytic oxidation system would be used for destruction of organic air emissions from the air stripper (and the SVE system as described below). In addition, an instrumentation and controls system for the extraction wells and treatment system would be housed within the building. Treated water would be discharged to the stormwater sewer system located along Hempstead Turnpike.

- Groundwater monitoring would be performed to evaluate the extent to which the remedial action objectives are being met at the southern ADC property boundary. It is assumed that quarterly groundwater monitoring would be conducted in years 1 and 2; and annually in years 3 through 30. During each monitoring event, eight existing Site wells (plus potentially one additional downgradient well, as applicable) would be purged and sampled, and water levels in the sixteen/seventeen wells would be measured. Groundwater samples would be analyzed for VOCs only.

- Operation and maintenance activities are necessary for the extraction and treatment systems (e.g., cleaning catalytic oxidizer and air stripper, monitoring effluent air and water, etc). This work is necessary to maintain treatment performance and life span. This work should be performed monthly. It is assumed that a smaller capacity catalytic oxidizer would be exchanged for the original system following shut-down of the SVE system (assumed at year 5), which would decrease utility costs.

Soil Remedial Actions:

- In accordance with the Nassau County requirements, abandonment/closure of the cesspools would be performed. Conduits, drains and other piping connected to the cesspools would first be sealed or plugged with grout. Accumulated water would be pumped from the cesspools and disposed of properly. The cesspools would then be backfilled with clean soil and a one-foot thick cap of clay or concrete would be installed to the ground surface. The cesspool area alley would be paved as described below.

- A pilot study for the SVE system would be performed to confirm the effectiveness of the technology and to evaluate full-scale system design parameters, including: (1) SVE well spacing, (2) air extraction rates and pressures, and (3) anticipated VOC vapor concentrations and mass removal rates. It is expected that one extraction well, along with monitoring well/probes installed in the unsaturated zone, and a mobile extraction and treatment unit (which would include pump, valves and a drop-out tank), would be used for the pilot study.

- An SVE system would be installed around the perimeter of the ADC Site building, as depicted on Figure 3-2. Ten vertical SVE wells (including the well installed for the pilot study) would be installed, utilizing conventional well installation techniques, to depths ranging from approximately 10 feet bgs on the northern and western sides of the building, to approximately 30 feet bgs (i.e., just above the water table) along the eastern and southern sides of the building. Based on the subsurface soil conditions, the radius of influence of the wells is expected to be greater than about 20 feet, which would include areas beneath the Site building and the discount beverage store building. The wells would be connected to vapor treatment equipment, to be housed in the groundwater treatment building, via underground piping, which would be equipped with valves in order to isolate portions of the SVE system. Treatment equipment would include the following:

    - Extraction blower/vacuum pump, with silencers at the inlet and outlet as necessary;
    - Air/water separator to remove excess moisture from the air stream;
    - Centrifugal pump to transfer removed water to the treatment system equalization tank;
    - Temperature and pressure gauges and flow meters; and
    - Catalytic oxidizer (to be shared with the groundwater treatment system air stripper, described above).

3.3.3 Alternative No. 3 –In-Situ Air Sparging and Soil Vapor Extraction

Figure 3-3 presents conceptual sketches of the remedial actions for Alternative No. 3. In-situ groundwater treatment via air sparging is a component of this alternative. Sparging wells are located downgradient of the two cesspools located in the alley east of the ADC building, perpendicular to the groundwater flow direction. The air sparge wells would be operated for the purposes of treating PCE-impacted, on-Site groundwater associated with the cesspool source area. Vapor extraction wells would collect air within the unsaturated zone containing stripped volatile compounds, for treatment prior to discharge into the atmosphere. Also, this alternative provides for treatment of impacted Site unsaturated soil via SVE, construction of an asphalt cover at unpaved areas, and closure of the two cesspools in the northeast Site corner. SVE would also provide for the reduction of groundwater contamination. This alternative is also considered a traditional approach to Site remediation.

The following is a description of the remedial actions included in Alternative No. 3, specific to both groundwater and soil.

Groundwater Remedial Actions:

- A pilot study for the air sparging system would be performed to confirm the effectiveness of the technology and to evaluate full-scale system design parameters, including: (1) sparge well spacing, (2) air injection rates and pressures, and (3) anticipated VOC vapor concentrations and mass removal rates. It is expected that one sparge well, along with monitoring wells/probes installed in the saturated zone, and a mobile extraction and treatment unit (which would include pump, valves and a drop-out tank), would be used for the pilot study. The air sparging pilot study would be performed concurrently with the SVE system pilot study, described under Alternative No. 2.

- An in-situ air sparging system would be installed downgradient of the cesspool source area, as depicted on Figure 3-3. Sixteen sparge wells (including the well installed for the pilot study) would be installed to depths of 45 to 65 feet, utilizing conventional well installation techniques. The sparge wells would consist of ¾-inch carbon (riser) and stainless steel (bottom 10 to 30 feet below groundwater table) riser, with a 5-foot screen. Based on the subsurface soil conditions, the radius of influence of the wells is expected to be between 10 to 20 feet.

  The air injection blower and associated silencer, along with the SVE system treatment equipment, would be housed in a treatment building, approximately 20 feet by 30 feet in size. The NYSDEC would attempt to reach an agreement with Frank's Nursery and Crafts to locate the building north of the cesspools on Frank's Nursery and Crafts property (see Figure 3-3). The building would consist of a pre-engineered metal building with a slab-on-grade concrete foundation. Air injection piping network would be installed underground. The sparge system would be equipped with temperature and pressure gauges and flow meters, as well as valves for the purposes of isolating portions of the sparging system. The sparging system may be operated in a pulsed (i.e., ON/OFF) manner, in order to limit the effects of aquifer plugging and therefore, maintain the efficiency of the system.

It is assumed, based on the nature and extent of PCE soils contamination, that the air sparging system would be operated on a long-term basis (i.e., 30 years) for reducing PCE concentrations in the groundwater.

- Groundwater monitoring would be performed as described for Alternative No. 2.

- Operation and maintenance activities for the in-situ air sparging system would be performed on a regular basis and as otherwise necessary, to keep the system in good working order. The system pressures and flow rates would be monitored; and, the valves, piping and fittings, and treatment equipment and controls system would be inspected on a routine basis.

Soil Remedial Actions:

- Closure of the cesspools would be performed as described under Alternative No. 2.

- A pilot study for the SVE system would be performed as described under Alternative No. 2, in conjunction with the pilot study for the in-situ air sparging system as described above.

- An SVE system would be installed and operated as described under Alternative No. 2. In addition, as depicted on Figure 3-3, the SVE system would also be installed in the treatment area of the in-situ air sparging system to capture volatilized PCE. This requires six additional wells be installed to depths of approximately 30 feet. Eight SVE system wells would operate in conjunction with the sparge wells. Treatment equipment would be housed in the treatment building and would include the following:

    - Extraction blower/vacuum pump, with silencers at the inlet and outlet as necessary;
    - Air/water separator to remove excess moisture from the air stream;
    - Centrifugal pump to transfer removed water to a storage tank;
    - Temperature and pressure gauges and flow meters; and
    - Catalytic oxidizer.

It is assumed, based on the nature and extent of soil and groundwater PCE contamination, that that the SVE system would be operated on a long-term basis. Specifically, as described for Alternative No. 2, it is estimated that treatment for 1 to 10 years would be required to reduce contaminant levels in unsaturated soils to less than 1,400 ug/kg (SCG); five years is assumed for the cost estimate. Also, the SVE wells to be operated in association with the air sparging system are assumed to be operated for 30 years.

- Operation and maintenance activities for the SVE system would be similar to Alternative No. 2, and would be performed in conjunction with the O&M activities for the air sparging system. It is assumed that activated carbon would be exchanged for the catalytic oxidizer to treat stripped volatile organics from the air sparge system, following shut-down of the SVE wells located adjacent to the ADC building (assumed at year 5).
- For the purposes of monitoring the effectiveness of the SVE system, soil samples would be collected and tested as described in Alternative No. 2.
- An asphalt pavement cover would be constructed as described for Alternative No. 2.

3.3.4 Alternative No. 4 –In-Situ Chemical Oxidation, Soil Vapor Extraction and Groundwater Extraction and Treatment

Conceptual sketches of the remedial actions for Alternative No. 4 are included as Figure 3-4. A component of this alternative is in-situ chemical oxidation to address the highly contaminated groundwater and saturated and unsaturated soils, and DNAPL associated with the cesspool source area. Injection of a chemical oxidant (either Fenton's Reagent or Potassium Permanganate) is an innovative technology, which provides an aggressive approach to treatment of the highly contaminated saturated and unsaturated areas where DNAPL is present. Groundwater monitoring and extraction/treatment systems would also be installed to monitor the progress of treatment; to capture oxidant material; and to provide for long-term groundwater containment and treatment. Vapor extraction wells would collect off-gases within the unsaturated zone, for treatment prior to discharge into the atmosphere.

Also, this alternative provides for traditional treatment of impacted Site unsaturated soil via SVE, construction of an asphalt cover at unpaved areas, and closure of the two cesspools in the northeast Site corner. SVE would also provide for the reduction of groundwater contamination.

For the purposes of this On-Site FFS, it is assumed for this alternative that in-situ chemical oxidation via Fenton's is effective at treating the highly contaminated saturated and unsaturated soil, DNAPL, and highly contaminated groundwater associated with the cesspool source area, such that on-Site groundwater extraction/treatment is required for ten (10) years. Residual contamination may be able to be addressed as part of the Off-Site FS studies.

The following is a description of the remedial actions included in Alternative No. 4, specific to both groundwater and soil.

Groundwater Remedial Actions:

- As discussed with NYSDEC, for the purposes of this On-Site FFS, one chemical oxidation technology is selected for detailed analysis. Although both chemical oxidants are considered to be effective at reducing PCE concentrations at the cesspool source area, Fenton's Reagent (by Isotec) is considered and evaluated herein for in-situ groundwater/soil treatment for a number of reasons, including the following.
    - A phased approach towards in-situ chemical oxidation would be implemented, starting with a pilot study, in order to assess the feasibility of the process. A Fenton's pilot study is a less difficult and costly approach to implement than potassium permanganate. This is primarily due to the additional cost/equipment associated with the need to mix potassium permanganate with extracted groundwater (or in some cases potable water), prior to injecting the oxidant mixture into source areas.
    - The use of potassium permanganate for wastewater treatment is well documented in available literature. However, the use of potassium permanganate for in-situ oxidation is an emerging technology, and relatively few full-scale studies and applications for soil and groundwater remediation have been performed (GWRTAC, TE-99-01). Therefore, greater technical uncertainty associated with the implementation of this technology currently exists than for Fenton's. The effectiveness and costs of these remedial technologies may be more appropriately compared during remedial design, following additional full- and pilot-scale applications of $KMnO_4$ at other remediation sites.
    - The overall costs of a full-scale application of Fenton's Reagent and potassium permanganate would be comparable, relative to the costs of other available innovative in-situ treatment technologies (e.g., in-situ thermal treatment via steam stripping).

- Fenton's Reagent would be injected to reduce the volume of highly contaminated saturated and unsaturated soil, DNAPL and highly contaminated groundwater associated with the cesspool source area. The Reagent would be applied through shallow (15 to 35 feet deep) injection wells (or injected via Geoprobe borings) to unsaturated soils, where DNAPL is located in the eastern Site alley. Reagent would also be applied through deep (35 to 65 feet deep) injection wells to treat saturated soils and groundwater, both in the alley and parking lot (south of the alley) to target groundwater with PCE concentrations greater than 1 ppm. This technology would be applied using the phased approach described below:

    - First, a pilot study would be performed to assess the feasibility of the process at the Site and to design the injection volumes of the Fenton's Reagent. The pilot study would include first a laboratory treatability study to further evaluate the efficiency of the Fenton's Reagent with Site groundwater and soil samples. Next, four shallow injection wells, two deep injection wells, and two groundwater monitoring wells would be installed and three injection events would be performed, to treat an approximate 30 by 40 foot area. The wells are assumed to be 4-inch diameter PVC wells.

    - If the results of the pilot study are favorable, there are no Site safety problems associated with the process, and the groundwater is not adversely affected by the process; a full-scale/phased application of the technology would be implemented. An additional four shallow and ten deep injection wells would be installed, and it is assumed that six injection events would be completed.

  A full-scale application of Fenton's is assumed for the purposes of this On-Site FFS. Also, for the purposes of this On-Site FFS, it is assumed that in-situ chemical oxidation via Fenton's would reduce the mass of subsurface PCE in saturated and unsaturated soils and groundwater, and PCE DNAPL, such that on-Site groundwater extraction and treatment is required for ten (10) years.

  It is anticipated that injections would be phased approximately 30 to 45 days apart, with sampling between successive injection events. Use of the Isotec patented solution will not require shutdown of the Site or the set-up of extensive exclusion zones. The Isotec solution is expected to result in an approximate 10°C increase in temperature in the saturated zone.

For safety concerns, it would be necessary to have the vapor extraction system (described below) in operation above the injection points to limit the potential for vapor migration from reaction of gasses and vapors from entering the ADC building or surrounding buildings.

Soil/groundwater sampling and testing would be necessary to evaluate the extent to which the remedial action objectives are being met in the injected zone. It is assumed that nine sampling events for soil and groundwater would be conducted during the pilot study and full-scale implementation of this work. Each sampling event would consist of collection of an estimated four soil samples and four groundwater samples, for VOC analysis.

- Groundwater extraction and treatment systems would be installed on Site, as described for Alternative No. 2, following associated pilot and treatability studies. Groundwater extraction/treatment systems would be operated to capture Fenton's Reagent material; and to provide for groundwater containment and treatment. It is estimated that long-term (i.e., ten years) groundwater extraction and treatment at 10 to 20 gpm would be required.
- Groundwater monitoring would be performed as described for Alternative No. 2.
- Operation and maintenance activities for the extraction and treatment system would be performed as described for Alternative No. 2, except that following shut-down of the SVE system (assumed at year 5), activated carbon would be used to treat off-gases from the air-stripper.

Soil Remedial Actions:

- Closure of the cesspools would be performed as described for Alternative No. 2.
- A pilot study should be performed for the SVE system as described under Alternative No. 2.
- The SVE system would be installed and operated as described for Alternative No. 2. If the Fenton's Reagent treatment area were to be expanded beyond the area depicted on Figure 3-4, additional SVE wells would also be installed to collect off-gases that escape to the vadose zone. It is assumed that three additional wells would be installed to a depth of 30 feet for operation in conjunction with a full-scale Fenton's application. Treatment equipment would be housed in the treatment building and would include the following:
    - Extraction blower/vacuum pump, with silencers at the inlet and outlet as necessary;
    - Air/water separator to remove excess moisture from the air stream;

  - Centrifugal pump to transfer removed water to the treatment system equalization tank;
  - Temperature and pressure gauges and flow meters; and
  - Catalytic oxidizer (to be shared with the groundwater extraction and treatment system described above).

- Operation and maintenance activities for the SVE system would be similar to Alternative No. 2. Five years of SVE system operation is assumed.

- For the purposes of monitoring the effectiveness of the SVE system, soil samples would be collected and tested as described in Alternative No. 2.

- An asphalt pavement cover would be installed as described for Alternative No. 2.

4.0 DETAILED ANALYSIS OF ALTERNATIVES

4.1 INTRODUCTION

The purpose of the detailed analysis of remedial action alternatives is to present the relevant information to select an on-Site remedy. During the detailed analysis, the alternatives established in Section 3.0 are compared on the basis of environmental benefits and costs using criteria established by NYSDEC in TAGM HWR-4030. This approach is intended to provide needed information to compare the merits of each alternative and select an appropriate remedy that satisfies the remedial action objectives for the Site.

This section first presents a summary of the seven evaluation criteria (six environmental criteria and cost) in TAGM HWR-4030 to be used to compare the alternatives. Two additional criteria, State and Community Acceptance, will be evaluated as part of the On-Site FFS review.

4.2 DESCRIPTION OF EVALUATION CRITERIA

1. Short-Term Impacts and Effectiveness: This criterion addresses the impacts of the alternative during the construction and implementation phase until the remedial action objectives are met. Factors to be evaluated include protection of the community during the remedial actions; protection of workers during the remedial actions; and the time required to achieve the remedial action objectives. Several alternatives described within the following sections may not be effective in meeting remedial action objectives in less than 30 years. Therefore, references to short-term impacts and effectiveness may include discussions of impacts/effectiveness over a period of 30 years.

2. Long-Term Effectiveness and Permanence: This criterion addresses the long-term protection of human health and the environment after completion of the remedial action. An assessment is made of the effectiveness of the remedial action in managing the risk posed by untreated wastes and/or the residual contamination remaining after treatment, and the long-term reliability of the remedial action.

3. Reduction of Toxicity, Mobility, and Volume: This criterion addresses NYSDEC's preference for selecting "remedial technologies that permanently and significantly reduce the toxicity, mobility and volume" of the contaminants of concern at the Site. This evaluation consists of assessing the extent that the treatment technology destroys toxic contaminants, reduces mobility of the contaminants using irreversible treatment processes, and/or reduces the total volume of contaminated media.

4. Implementability: This criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of services and materials required during implementation. Technical feasibility refers to the ability to construct and operate a remedial action for the specific conditions at the Site and the availability of necessary equipment and technical specialists. Technical feasibility also considers construction and operation and maintenance difficulties, reliability, ease of undertaking additional remedial action (if required), and the ability to monitor effectiveness. Administrative feasibility refers to compliance with applicable rules, regulations, statutes and the ability to obtain permits or approvals from other government agencies or offices.

5. Compliance with Applicable or Relevant and Appropriate SCGs and Remediation Goals: This criterion is used to evaluate the extent to which each alternative may achieve the proposed cleanup goals. The cleanup goals were developed based on SCGs developed in Section 2.0.

6. Overall Protection of Human Health and the Environment: This criterion provides an overall assessment of protection of human health and the environment, based on a composite of factors assessed under the evaluation criteria, especially short-term effectiveness, long-term effectiveness and performance, and compliance with cleanup goals.

7. Cost: The estimated capital costs, long-term operation and maintenance costs, and environmental monitoring costs are evaluated. The estimates included herein assume Engineering costs would equal 15% of the capital costs; and, Contingency/Administrative costs would equal 10% of the capital costs. A present worth analysis is made to compare the remedial alternatives on the basis of a single dollar amount for the base year. For the present worth analysis, assumptions are made regarding the interest rate applicable to borrowed funds and the average inflation rate. It is also assumed that a 30-year operational period would be necessary for groundwater control systems and Site monitoring. The comparative

cost estimates are intended to reflect actual costs with an accuracy of +50 percent to -30 percent.

8. State Acceptance: This criterion evaluates the technical and administrative issues and concerns of the State regarding the alternatives, and is addressed in the Proposed Remedial Action Plan (PRAP) based on comments regarding the RI/FS and proposed remedial action plan.

9. Community Acceptance: This criterion evaluates the comments of the public regarding the alternatives, and is also addressed in the PRAP similar to criteria No. 8 above.

4.3 DETAILED ANALYSIS OF ALTERNATIVES

Alternatives No. 1 through 4 are evaluated individually in terms of the seven environmental and cost criteria described above. Descriptions of the alternatives are provided in Section 3.3. Table 4-1 presents a summary of the Detailed Analysis.

4.3.1 Alternative No. 1 – No Action with Annual Groundwater Monitoring

1. Short-Term Impacts and Effectiveness: No short-term impacts (other than those existing) are anticipated during the implementation of this alternative since there are no construction activities involved, only sampling. Field personnel would wear appropriate personal protective equipment during groundwater sampling in order to limit health risks due to exposure to contaminants and physical hazards. In addition, equipment used for sampling purposes would be decontaminated prior to leaving the Site, as necessary, in order to avoid the transport of contaminants.

   This alternative does not include source removal or treatment, and will not meet the on-Site remedial action objectives in a reasonable or predictable timeframe. Human health and the environment would not be protected under this alternative. The duration of natural cleanup would depend on the natural attenuation rate, and volatilization of VOCs in groundwater and soil. There are uncertainties in the rate and interaction of the various natural attenuation processes. Therefore, it is recognized that the length of time required for natural cleanup or attenuation of groundwater or soil contamination is unknown, but expected to be greater than 30 years to reach the remedial action objectives. Consequently, in accordance with USEPA guidance, a duration of 30 years (the maximum time period specified for evaluation) is assumed for this alternative.

2. Long-Term Effectiveness and Permanence: Because this alternative does not involve removal or treatment of the contaminated groundwater or soil, the risks involved with the migration of contaminants and direct contact with contaminants would remain essentially the same. Annual collection of groundwater samples would be performed to assess the natural attenuation of the contamination. Given

the mass of on-Site contaminants, reduction in risk associated with natural attenuation is not expected in a reasonable or predictable timeframe. Therefore, this alternative is not expected to provide long-term protection to human health and the environment.

3. Reduction of Toxicity, Mobility, and Volume: This alternative does not involve the removal or treatment of the source of on-Site contamination. Therefore, neither the toxicity, nor mobility, nor volume of contamination is expected to be reduced significantly. Natural attenuation of contaminants may reduce the concentrations in groundwater and soil over time. However, this reduction is not expected to be significant within a reasonable amount of time (i.e., 30 years), given the high concentrations of PCE (i.e., DNAPL) detected at the Site.

4. Implementability: This alternative is readily implementable on a technical basis, in that it involves no actions other than annual groundwater monitoring. Groundwater sampling can be performed without sophisticated equipment, and the necessary services and equipment are readily available. There may, however, be administrative difficulties associated with implementing this alternative as a result of community acceptance to No Action based on the nature and extent of groundwater and soil contamination. Also, institutional controls (e.g., deed or access restrictions) would be required for the on-Site property to preclude contact with remaining contaminated media.

5. Compliance with Applicable or Relevant and Appropriate SCGs and Remediation Goals: This alternative will not comply with the chemical-specific SCGs for the Site. The contaminant levels in the groundwater and soil are not expected to decrease appreciably over time, as neither natural attenuation nor volatilization is expected to significantly reduce the levels of contamination.

   No location-specific SCGs were identified. Action-specific SCGs (e.g., OSHA regulations) will be met during sampling activities.

6. Overall Protection of Human Health and the Environment: This alternative is not protective of human health and the environment, since the Site would remain in its present condition. As identified as part of the qualitative risk assessment, groundwater can migrate off Site, to impact downgradient receptors and continue to harm the aquifer. Also, subsurface soils will serve as a continuing impact to groundwater. Uncontrolled excavations could lead to high exposure levels; and vapor migration is expected to potentially impact underground structures, surface structures and future excavations within the plume limits.

7. Cost: The costs associated with this Alternative are presented in Table C-1 (Appendix C). Costs are provided for comparative purposes. No capital costs are anticipated for this alternative. The estimate assumes that groundwater will be sampled on an annual basis, estimated to total approximately $ 6,000 per year over a

period of 30 years. The total present worth of this analysis is $ 92,000, based on a 30-year period and a discount rate of five percent.

4.3.2 Alternative No. 2 – Groundwater Extraction and Treatment and Soil Vapor Extraction

1. Short-Term Impacts and Effectiveness: There are several potential short-term impacts associated with this alternative.

- During installation of the soil vapor extraction piping and groundwater extraction and discharge forcemain trenches, it is expected that releases of PCE to the air will occur. Releases of PCE to the air are also expected to occur during closure of the on-Site cesspools. There is potential for impacts to human health (for the public, on-Site patrons/employees, and construction personnel) due to vapor and particulate releases. Thus, vapor suppression may be required, in addition to dust monitoring, in order to mitigate potential adverse conditions. Field construction personnel would wear appropriate personal protective equipment during installation in order to limit health risks due to exposure to contaminants and physical hazards. The installation of SVE and groundwater extraction wells is not expected to generate significant vapor or particulate releases.

- Contamination of equipment used for installation purposes could carry contamination off Site. Therefore, equipment will be decontaminated prior to leaving the Site, as necessary, in order to avoid the transport of contaminants.

- Disruptions to current operations at the Site property (e.g., patronage of businesses) and adjacent properties (Frank's Nursery and Crafts, and Discount Beverage Center) are expected to occur during the implementation of this alternative, due to the installation of groundwater extraction/SVE wells and piping, and other remedial actions.

- Field personnel would wear appropriate personal protective equipment during groundwater sampling in order to limit health risks due to exposure to contaminants and physical hazards. In addition, equipment used for sampling purposes would be decontaminated prior to leaving the Site, as necessary, in order to avoid the transport of contaminants.

Regarding effectiveness, human health and the environment (in terms of affecting habitat or vegetation) would be protected under this alternative.

For unsaturated Site soil, this alternative is expected to meet the remedial action objectives within ten years, because the PCE product will be extracted and treated. However, these objectives may not be met throughout the Site, because even though the PCE levels will be reduced throughout the Site, heterogeneities (e.g., zones of lower permeability) may preclude achieving the SCG of 1,400 ug/kg (PCE) in portions of the cesspool area via SVE; therefore, some residual DNAPL may remain. The efficiency of the SVE system will reduce with time, and it is expected that the system may become ineffective such that continuous operation is no longer practical (anticipated to be about 5 years). Soil sampling will be performed to monitor system effectiveness.

Extraction of on-Site groundwater will serve to contain the off-Site migration of contaminated groundwater. It is not expected that this alternative will meet the remedial action objective of 5 ug/L (PCE) between the cesspool source area and the downgradient property line within a 30-year timeframe, unless the ongoing groundwater contamination source in saturated soil (DNAPL) is significantly reduced..Thus, groundwater extraction beyond a 30-year timeframe (the maximum time period specified for evaluation) may be required. Similar to unsaturated soil remediation, heterogeneities may limit the effectiveness of achieving the PCE SCG in some Site areas.

Groundwater sampling would be performed to monitor the effectiveness of the groundwater extraction system.

In the event that either the soil vapor extraction or groundwater extraction and treatment systems fail to operate, the migration of contaminated groundwater or soil vapor to receptors may be possible. In order to limit this potential, monthly maintenance and inspections of the systems will be performed. Also, it is assumed that control systems would be automated with remote access capabilities.

2. Long-Term Effectiveness and Permanence: For unsaturated Site soil, this alternative is considered an adequate, reliable and permanent remedy and, as such, the risks involved with the migration of contaminants and direct contact with soil contaminants would be reduced.

   However, long-term groundwater extraction would be required due to the presence of DNAPL in saturated soil at the cesspool source area. Therefore, this alternative is considered an adequate and reliable remedy for mitigating human health and environmental impacts (in terms of affecting habitat or vegetation) due to groundwater. The aquifer proximate to the cesspool source area will remain impacted for an indefinite period of time (i.e., this alternative is not a permanent groundwater remedy).

3. Reduction of Toxicity, Mobility, and Volume: This alternative involves the removal and treatment of the unsaturated zone sources of Site contamination. Therefore, for unsaturated Site soil, the toxicity, mobility and volume of contamination are expected to be reduced significantly through the use of soil vapor extraction and subsequent vapor treatment. The contaminant reduction via SVE, coupled with the asphalt pavement cover for containment and cesspool closure, will effectively decrease the continuing sources of groundwater contamination.

   The toxicity, mobility and volume of on-Site groundwater contamination are also expected to be reduced significantly through the use of extraction wells and subsequent treatment. The mass of PCE product (i.e., DNAPL) in saturated soil would also be reduced. However, despite the extraction of groundwater at the cesspool source area, DNAPL reduction is not considered predictable and is a slow process controlled by several factors (e.g., diffusion). Consequently, significant residual DNAPL contamination in the saturated zone is anticipated beyond the 30-year timeframe under consideration.

   Residual wastes will be generated through groundwater treatment and will be disposed of off Site. The nature of this waste (i.e., hazardous vs. non-hazardous) is not known, and should be determined as part of a treatability study.

4. Implementability: This alternative is readily implementable on a technical basis. Construction and installation of the groundwater extraction/treatment and soil vapor extraction systems would involve standard construction methods and equipment; and materials and services necessary for construction are readily available. With regard to operation and maintenance, the materials and services required for the systems are also readily available. Also, the instrumentation and control systems will be automated with remote access capabilities, such that the effect of possible system shut-downs would be minimized. Confirmatory soil and groundwater sampling would be performed to monitor the effectiveness of remedial systems.

   In terms of administrative concerns, this alternative is also considered to be implementable. Implementation of this alternative would require coordination with and approval by Nassau County, Hempstead and Levittown agencies (e.g., Department of Public Works, Building Department, etc.), as well as coordination with the owners/occupants of the Site building and adjacent properties (e.g., Frank's Nursery and Crafts, Discount Beverage). However, there are no anticipated, specific problems associated with obtaining permits or approvals from the various agencies and other concerns. Disruption of current Site operations is expected to be a concern.

   Institutional controls (e.g., deed or access restrictions) would be required for the Site property to preclude contact with remaining contaminated media.

5. Compliance with Applicable or Relevant and Appropriate SCGs and Remediation Goals: This alternative is expected to meet the chemical-specific SCGs for the unsaturated on-Site soils within ten years through the use of SVE. However, as indicated above, these objectives may not be met throughout the Site as residual DNAPL may remain due to such factors as subsurface heterogeneities.

   It is expected that this alternative will meet the chemical-specific SCGs for on-Site groundwater between the cesspool source area and the downgradient property line within a 30-year timeframe for the majority of the Site areas. However, heterogeneities may limit the effectiveness of achieving the PCE SCG in some areas due to the presence of PCE product (DNAPL) in saturated soil (associated with the cesspool source area). As such, SCGs are not expected to be met at the source area in a reasonable and predictable timeframe. As discussed previously, it is not considered practical to remediate DNAPL in the unsaturated zone at the ADC Site.

   No location-specific SCGs were identified. Action-specific SCGs (e.g., OSHA regulations) will be met during construction activities.

6. Overall Protection of Human Health and the Environment: This on-Site alternative is considered to be protective of human health and the environment (in terms of affecting habitat or vegetation). Implementation of this alternative would result in remediation of unsaturated soils and groundwater, except for possible highly contaminated areas of soil and groundwater associated with the cesspool source area DNAPL. Although the alternative will not meet the SCGs throughout the Site, this alternative for groundwater remediation is considered to be protective of human health since groundwater will be contained on Site.

7. Cost: The quantities, unit costs, and subtotal costs and associated assumptions for this Alternative, estimated for comparative purposes, are presented in Table C-2 (Appendix C). The capital cost for this alternative is estimated to total approximately $ 887,000.

   The total present worth of operation and maintenance (O&M) costs is estimated to be approximately $ 2,334,000.

   The total present worth of this alternative is based on a 30-year period and a discount rate of five percent. The total estimated present worth cost of this alternative is $ 3,221,000.

4.3.3 Alternative No. 3 – In-Situ Air Sparging and Soil Vapor Extraction

1. Short-Term Impacts and Effectiveness: There are several potential short-term impacts associated with this alternative.

- During installation of the in-situ air sparging and soil vapor extraction systems piping trenches, it is expected that releases of PCE to the air will occur. Releases of PCE to the air are also expected to occur during closure of the on-Site cesspools. There is potential for impacts to human health (for the public, on-Site patrons/employees, and construction personnel) due to vapor and particulate releases. Thus, vapor suppression may be required, in addition to dust monitoring, in order to mitigate potential adverse conditions. Field construction personnel would wear appropriate personal protective equipment during installation in order to limit health risks due to exposure to contaminants and physical hazards. The installation of sparging and SVE is not expected to generate significant vapor or particulate releases.

- Contamination of equipment used for installation purposes could carry contamination off Site. Therefore, equipment will be decontaminated prior to leaving the Site, as necessary, in order to avoid the transport of contaminants.

- Disruptions to current operations at the Site property (e.g., patronage of businesses) and adjacent properties (Frank's Nursery and Crafts, and Discount Beverage Center) are expected to occur during the implementation of this alternative.

- Field personnel would wear appropriate personal protective equipment during groundwater sampling in order to limit health risks due to exposure to contaminants and physical hazards. In addition, equipment used for sampling purposes would be decontaminated prior to leaving the Site, as necessary, in order to avoid the transport of contaminants.

Regarding effectiveness, human health and the environment (in terms of affecting habitat or vegetation) would be protected under this alternative for unsaturated soil. This alternative is expected to meet the remedial action objectives for the unsaturated, on-Site soils within ten years, because the PCE product will be extracted and treated. However, these objectives may not be met throughout the Site, because even though the PCE levels will be reduced throughout the Site, heterogeneities (e.g., zones of lower permeability) may preclude achieving the SCG of 1400 ug/kg (PCE) in portions of the cesspool area via SVE; therefore, some residual DNAPL may remain. The efficiency of the SVE system will reduce with time, and it is expected that the system may become ineffective such that continuous operation is no longer practical. Soil sampling will be performed to monitor system effectiveness.

Human health and the environment (in terms of affecting habitat or vegetation) would not be protected for on-Site groundwater contamination under this alternative. This alternative does not include containment of impacted groundwater, and is not expected to reduce PCE concentrations to the remedial action objective of 5 ug/L (PCE) between the cesspool source area and the downgradient property line within a 30-year timeframe. The PCE source present in saturated soils (DNAPL) is not anticipated to be remediated, as similar to soil remediation, heterogeneities may limit the effectiveness of sparging. Thus, in-situ air sparging beyond a 30-year timeframe (the maximum time period specified for evaluation) would likely be required on Site.

Groundwater and soil sampling will be performed to monitor the effectiveness of the air sparging and SVE systems.

In the event that the air sparging or soil vapor extraction systems fail to operate, the migration of contaminated groundwater or soil vapor to receptors may be possible. In order to limit this potential eventuality, monthly maintenance and inspections of the system will be performed. Also, it is assumed that control systems would be automated with remote access capabilities.

2. <u>Long-Term Effectiveness and Permanence</u>: For unsaturated on-Site soil, this alternative is considered an adequate, reliable and permanent remedy and, as such, the risks involved with the migration of contaminants and direct contact with soil contaminants would be reduced.

   However, this alternative is not considered an adequate, reliable, or permanent remedy for mitigating human health and environmental impacts (in terms of affecting habitat or vegetation) due to groundwater. Long-term, in-situ air sparging beyond a 30-year timeframe (the maximum time period specified for evaluation) would likely be required on Site due to the presence of source DNAPL in saturated soil at the cesspool source area. The on-Site aquifer, proximate to the cesspool source area and downgradient, will remain impacted for an indefinite period of time (i.e., this alternative is not a permanent groundwater remedy).

3. <u>Reduction of Toxicity, Mobility, and Volume</u>: This alternative involves the removal and treatment of the unsaturated zone sources of on-Site contamination. Therefore, for unsaturated Site soil, the toxicity, mobility and volume of contamination are expected to be reduced significantly through the use of soil vapor extraction and subsequent vapor treatment. Also, the contaminant reduction via SVE, coupled with the asphalt pavement cover for containment and cesspool closure, will effectively decrease the impact of leaching from the continuing sources of groundwater contamination.

   The toxicity, mobility and volume of groundwater contamination will not be significantly affected by this alternative. Sparging will reduce the PCE concentrations in groundwater at the downgradient property line, but the groundwater standards are not expected to be met. Significant residual DNAPL contamination is anticipated beyond the 30-year timeframe under consideration. Contaminated groundwater (PCE concentrations greater than 5 ug/L) will continue to migrate off Site.

4. Implementability: This alternative is readily implementable on a technical basis. Construction and installation of the air sparging and soil vapor extraction systems would involve standard construction methods and equipment; and materials and services necessary for construction are readily available. With regard to operation and maintenance, the materials and services required for the systems are also readily available. Also, the instrumentation and control systems will be automated with remote access capabilities, such that the affect of possible system shut-downs would be minimized. Confirmatory soil and groundwater sampling would be performed to monitor the effectiveness of remedial systems.

   In terms of administrative concerns, this alternative is also considered to be implementable. Implementation of this alternative would require coordination with and approval by Nassau County, Hempstead and Levittown agencies (e.g., Department of Public Works, Building Department, etc.), as well as coordination with the owners/occupants of the Site building and adjacent properties (e.g., Frank's Nursery and Crafts, Discount Beverage). However, there are no anticipated, specific problems associated with obtaining permits or approvals from the various agencies and other concerns. Disruption of current Site operations is expected to be a concern.

   Institutional controls (e.g., deed or access restrictions) would be required for the Site property to preclude contact with remaining contaminated media.

5. Compliance with Applicable or Relevant and Appropriate SCGs and Remediation Goals: This alternative is expected to meet the chemical-specific SCGs for the unsaturated, on-Site soils within ten years through the use of SVE. However, as indicated above, these objectives may not be met throughout the Site, as residual DNAPL may remain due to such factors as subsurface heterogeneities.

   It is not expected that this alternative will meet the chemical-specific SCGs for groundwater on Site within a 30-year timeframe. Similar to soil remediation, heterogeneities may limit the effectiveness of sparging toward achieving the PCE SCG in at the cesspool source area, due to the presence of DNAPL in saturated soil. As such, SCGs may not be met at the source area or on Site in a reasonable and predictable timeframe. Contaminated groundwater (PCE concentrations greater than 5 ug/L) will continue to migrate off Site.

   No location-specific SCGs were identified. Action-specific SCGs (e.g., OSHA regulations) will be met during construction activities.

6. Overall Protection of Human Health and the Environment: This alternative is considered to be protective of human health and the environment (in terms of affecting habitat or vegetation) for remediation of the unsaturated soils. However, the highly-contaminated groundwater associated with the cesspool source area would be largely unaffected by implementation of this alternative. The alternative is not expected to meet the SCGs on Site and does not provide for on-Site containment. Therefore, this alternative is not considered to be protective of human health and the environment with respect to groundwater contamination.

7. Cost: The quantities, unit costs, and subtotal costs and associated assumptions for this Alternative, estimated for comparative purposes, are presented in Table C-3 (Appendix C). The capital cost for this alternative is estimated to total approximately $ 791,000.

   The total present worth of operation and maintenance (O&M) costs is estimated to be approximately $ 1,745,000.

   The total present worth of this alternative is based on a 30-year period and a discount rate of five percent. The total estimated present worth cost of this alternative is $ 2,536,000.

4.3.4 Alternative No. 4 – In-Situ Chemical Oxidation, Soil Vapor Extraction and Groundwater Extraction and Treatment

1. Short-Term Impacts and Effectiveness: There are several potential short-term impacts associated with this alternative.

   - During installation of the soil vapor extraction piping and groundwater extraction and discharge forcemain trenches, it is expected that releases of PCE to the air will occur. Releases of PCE to the air are also expected to occur during closure of the cesspools. There is potential for impacts to human health (for the public, on-Site patrons/employees, and construction personnel) due to vapor and particulate releases. Thus, vapor suppression may be required, in addition to dust monitoring, in order to mitigate potential adverse conditions. Field construction personnel would wear appropriate personal protective equipment during installation in order to limit health risks due to exposure to contaminants and physical hazards. The installation of SVE and groundwater extraction wells is not expected to generate significant vapor or particulate releases.

   - Contamination of equipment used for installation purposes could carry contamination off Site. Therefore, equipment will be decontaminated prior to leaving the Site, as necessary, in order to avoid the transport of contaminants.

- Disruptions to current operations at the Site property (e.g., patronage of businesses) and adjacent properties (Frank's Nursery and Crafts, and Discount Beverage Center) are expected to occur during the implementation of this alternative, due to the installation of groundwater extraction/SVE/Fenton's injection wells and piping, and other remedial actions.

- Application of Fenton's Reagent will require the storage of hydrogen peroxide (a strong oxidizer) and other chemicals at the Site. Experienced personnel will use special handling procedures. Appropriate labels and MSDS sheets will be required.

- Field personnel would wear appropriate personal protective equipment during groundwater sampling in order to limit health risks due to exposure to contaminants and physical hazards. In addition, equipment used for sampling purposes would be decontaminated prior to leaving the Site, as necessary, in order to avoid the transport of contaminants.

Regarding effectiveness, human health and the environment (in terms of affecting habitat or vegetation) would be protected under this alternative.

For unsaturated soil, this alternative is expected to meet the on-Site remedial action objectives within ten years, because the PCE product will be extracted and treated. However, these objectives may not be met throughout the Site, because even though the PCE levels will be reduced throughout the Site, heterogeneities (e.g., zones of lower permeability) may preclude achieving the SCG of 1,400 ug/kg (PCE) in portions of the cesspool area via SVE; therefore, residual DNAPL may remain. The effectiveness of the SVE system will reduce with time, and it is expected that the system may become ineffective such that continuous operation is no longer practical. Soil sampling will be performed to monitor system effectiveness.

The cesspool source DNAPL area is proposed to be aggressively treated with Fenton's Reagent. As this is an innovative technology, its effectiveness to meet the SCGs is currently unknown, although it will be successful in reducing a portion of the DNAPL in saturated and unsaturated soil. The results of the pilot study will provide better information regarding remediation of the DNAPL area.

Extraction wells will serve to contain the off-Site migration of contaminated groundwater. Depending upon the results of the Fenton's Reagent pilot study and full-scale application, it may be possible to meet the groundwater remedial action objective of 5 ug/L (PCE). However, as discussed previously, DNAPL remediation below the water table is complicated by various factors including subsurface heterogeneities and aquifer parameters. Isotec indicated that the DNAPL and areas of highly contaminated groundwater and soil could be treated; the question is the degree of cleanup. Thus, groundwater extraction beyond a 30-year timeframe (the maximum time period specified for evaluation) may be required at the cesspool source area.

However, for the purposes of this On-Site FFS, it is assumed that in-situ chemical oxidation (Fenton's) will reduce the mass of subsurface PCE in saturated and unsaturated soils and groundwater, and PCE DNAPL, such that on-Site groundwater extraction and treatment is required for ten years. Residual contamination may be able to be addressed as part of the Off-Site FS studies.

Groundwater and soil sampling will be performed to monitor groundwater extraction and SVE system effectiveness and the degree of success of Fenton's Reagent.

In the event that either the soil vapor extraction or groundwater extraction and treatment systems fail to operate, the migration of contaminated groundwater or soil vapor to receptors may be possible. In order to limit this potential, monthly maintenance and inspections of the systems will be performed. Also, it is assumed that control systems would be automated with remote access capabilities.

2. Long-Term Effectiveness and Permanence: For unsaturated Site soil, this alternative is considered an adequate, reliable and permanent remedy and, as such, the risks involved with the migration of contaminants and direct contact with soil contaminants would be reduced.

   This alternative is considered an adequate and reliable remedy for mitigating human health and environmental impacts (in terms of affecting habitat or vegetation) due to groundwater. Long-term groundwater extraction may be required due to the possible presence of residual DNAPL and adsorbed PCE on saturated and unsaturated soil at the cesspool source area after Fenton's Reagent application. The aquifer proximate to the cesspool source area may remain impacted for an indefinite period of time due to the presence of DNAPL (i.e., this alternative may not be a permanent groundwater remedy). However, this alternative assumes that the application of Fenton's Reagent is successful, such that on-Site groundwater extraction and treatment is not required on a long-term basis, rather for ten years. Remaining contamination may be able to be addressed as part of the Off-Site FS studies.

3. Reduction of Toxicity, Mobility, and Volume: This alternative involves the removal and treatment of unsaturated zone sources of on-Site contamination. Therefore, for unsaturated Site soil, the toxicity, mobility and volume of contamination are expected to be reduced significantly through the application of Fenton's Reagent and the use of soil vapor extraction and subsequent vapor treatment. Also, the contaminant reduction via SVE, coupled with the asphalt pavement cover for containment and cesspool closure, will effectively eliminate the unsaturated soils as continuing sources of groundwater contamination.

   The toxicity, mobility and volume of on-Site groundwater contamination will also be reduced significantly through the use of extraction wells and subsequent treatment. The mass of PCE product (i.e., DNAPL) in saturated soil will also be reduced by Fenton's Reagent. However, the amount of reduction is not known, but is expected to be more effective than the groundwater extraction alone. (The effectiveness of Fenton's to reduce the mass of PCE product will be evaluated during the pilot study and throughout the phased approach to the full-scale application.) Significant residual DNAPL contamination is possible beyond the 30-year timeframe under consideration. However, for the purposes of this On-Site FFS, it is assumed that the effectiveness of Fenton's Reagent at reducing the mass of PCE product is such that groundwater extraction and treatment are required for a ten-year timeframe.

   Residual wastes will be generated through groundwater treatment, and will be disposed of off Site. The nature of this waste (i.e., hazardous vs. non-hazardous) is not known, and should be determined as part of a treatability study.

4. Implementability: This alternative is readily implementable on a technical basis. Construction and installation of the groundwater extraction/treatment and soil vapor extraction systems would involve standard construction methods and equipment; and materials and services necessary for construction are readily available. The Fenton's Reagent selected for this Site is a proprietary process. Obtaining competitive bids will not be possible. With regard to operation and maintenance, the materials and services required for the systems are also readily available. Also, the instrumentation and control systems will be automated with remote access capabilities, such that the effect of possible system shutdowns would be minimized. Confirmatory soil and groundwater sampling would be performed to monitor the effectiveness of remedial systems.

   In terms of administrative concerns, this alternative is also considered to be implementable. Implementation of this alternative would require coordination with and approval by Nassau County, Hempstead and Levittown agencies (e.g., Department of Public Works, Building Department, etc.), as well as coordination with the owners/occupants of the Site building and adjacent properties (e.g., Frank's Nursery and Crafts, Discount Beverage). However, there are no anticipated, specific problems associated with obtaining permits or approvals from the various agencies and other concerns. Disruption of current Site operations is expected to be a concern.

Institutional controls (e.g., deed or access restrictions) would be required for the Site property to preclude contact with remaining contaminated media.

5. Compliance with Applicable or Relevant and Appropriate SCGs and Remediation Goals: This alternative is expected to meet the chemical-specific SCGs for the unsaturated Site soils within ten years through the use of SVE and Fenton's Reagent. However, as indicated above, these objectives may not be met throughout the Site, as residual DNAPL may remain due to such factors as subsurface heterogeneities.

   It is expected that this alternative will meet the chemical-specific SCGs for groundwater within a 30-year timeframe for the majority of on-Site areas. However, heterogeneities may limit the effectiveness of achieving the PCE SCG in some Site areas due to the PCE product (DNAPL) in soil at the cesspool source area, which is unlikely to be completely remediated. As such, SCGs may not be met at the source area in a reasonable and predictable timeframe.

   However, for the purposes of this On-Site FFS, it is assumed that that the application of Fenton's Reagent is successful, such that on-Site groundwater extraction and treatment is not required on a long-term basis, rather for ten years. Remaining contamination may be able to be addressed as part of the Off-Site FS studies.

   No location-specific SCGs were identified. Action-specific SCGs (e.g., OSHA regulations) will be met during construction activities.

6. Overall Protection of Human Health and the Environment: This on-Site alternative is considered to be protective of human health and the environment (in terms of affecting habitat or vegetation). Implementation of this alternative would result in remediation of unsaturated soils and groundwater, except for possible highly contaminated groundwater and soil associated with the cesspool source area. Although the alternative may not meet the SCGs, this alternative for groundwater remediation is considered to be protective of human health, since Fenton's is assumed to be effective at reducing the DNAPL mass such that on-Site groundwater containment is required for ten years.

7. Cost: The quantities, unit costs, and subtotal costs and associated assumptions for this alternative, estimated for comparative purposes, are presented in Table C-4 (Appendix C). The capital cost for this alternative is estimated to total approximately $ 1,484,000.

   The total present worth of operation and maintenance (O&M) costs is estimated to be approximately $ 1,237,000.

The total present worth of this alternative is based on a 30-year period and a discount rate of five percent. The total estimated present worth cost of this alternative is $ 2,721,000.

5.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section presents the comparative analysis of remedial alternatives. The alternatives are compared below on the basis of the six environmental and one cost criteria. The comparative analysis is based on the evaluations provided in Section 4.0.

5.1 SHORT-TERM IMPACTS AND EFFECTIVENESS

Alternatives No. 2, 3 and 4 involve intrusive work, which could cause releases of contamination during installation of the remedial systems. These alternatives may also pose disruptions to current Site operations. Alternative No. 1 is not expected to cause releases of contamination or disruption to Site operations.

Alternatives No. 2, 3 and 4 are expected to achieve the remedial action objectives for unsaturated soil within a ten-year timeframe; although, as noted previously, there could be areas on Site where these objectives may not be met (primarily due to the presence of residual DNAPL in unsaturated soil).

Assuming Fenton's Reagent is able to significantly reduce the DNAPL mass in saturated and unsaturated soil, then Alternative No. 4 would be able to more effectively meet the remedial goals for groundwater than Alternative No. 2. Therefore, it is expected that Alternative No. 4 would effectively remediate on-Site groundwater.

Alternative No. 2 is not expected to meet the remedial action objective of 5 ug/L (PCE) between the cesspool source area and the downgradient property line within a 30-year timeframe, unless the ongoing groundwater contamination source in saturated soil (DNAPL) is significantly reduced via groundwater extraction. Alternative No. 3 is not expected to effectively achieve the groundwater remedial objectives within a 30-year timeframe (primarily due to the presence of DNAPL).

Alternative No. 1 is not expected to be effective in meeting the remedial action objectives.

5.2 LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternatives No. 2, 3, and 4 are considered to be adequate, reliable and permanent remedies for the remediation of unsaturated soils; and, as such, the risks involved with the migration of contaminants and direct contact with soil contaminants would be reduced.

Alternatives No. 2 and 4 are considered to be adequate and reliable remedies for the remediation of groundwater; although, due to the presence of residual DNAPL, the aquifer may remain impacted for an indefinite period of time (i.e., these alternatives may not be permanent groundwater remedies). For Alternative No. 4, this On-Site FFS assumes that the Fenton's approach is effective such that long-term (i.e., greater than ten years) groundwater extraction and treatment are unnecessary. Therefore, Alternative No. 4 is assumed to be an effective long-term remedy.

Alternative No. 3 is not considered an adequate, reliable, or permanent remedy for the remediation of groundwater. The aquifer will remain impacted for an indefinite period of time (i.e., this alternative would not be a permanent groundwater remedy).

Alternative No. 1 is not considered an adequate, reliable, or permanent long-term Site remedy for both groundwater and soil.

5.3 REDUCTION OF TOXICITY, MOBILITY AND VOLUME

Alternatives No. 2 and 4 provide for the greatest reduction of toxicity, mobility and volume of Site contaminants, as the alternatives will reduce contaminant concentrations in saturated and unsaturated soil and groundwater, and will provide for hydraulic containment of groundwater on Site.

Based on the effectiveness of the Fenton's approach, Alternative No. 4 could provide a significant reduction in contaminant levels in the highly contaminated soil (saturated and unsaturated) and groundwater. This On-Site FFS assumes that Alternative No. 4 provides for a significant reduction of the subsurface PCE mass, such that a greater reduction of toxicity, mobility and volume is achieved in a shorter time frame (approximately ten years) than in Alternative No. 2.

Alternative No. 3 would not provide for significant reduction of toxicity, mobility and volume of contaminants in groundwater, as the alternative is not anticipated to reduce contaminant concentrations in groundwater by greater than an order of magnitude. Also, Alternative No. 3 would provide for a reduction in toxicity, mobility and volume of unsaturated soil contamination.

Alternative No. 1 will not reduce the toxicity, mobility and volume of Site contaminants, except as occurs through natural attenuation.

5.4 IMPLEMENTABILITY

Alternatives No. 1, 2, 3 and 4 are technically implementable with readily available methods, equipment, materials and services. The use of Fenton's Reagent may be problematic as only one vendor exists for the selected application (Isotec); obtaining competitive bids is not possible; scheduling the application may be difficult; and it is an innovative technology.

Alternatives No. 1, 2, 3, and 4 are also administratively implementable.

5.5 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE SCGS AND REMEDIATION GOALS

Alternatives No. 2, 3 and 4 are expected to achieve compliance with the chemical-specific SCGs/remediation action objectives for unsaturated Site soils; but, Alternative No. 1 is not expected to achieve such compliance.

Of the four alternatives, Alternatives No. 2 and 4 are expected to achieve compliance with the chemical-specific SCGs/remediation action objectives for groundwater for the majority of the Site areas. For the purposes of this On-Site FFS, it is assumed that that the application of Fenton's Reagent is successful; and that residual contamination (concentrations above the SCGs) may be addressed as part of the Off-Site FS studies.

Alternatives No. 1 and 3 are not expected to achieve compliance with the chemical-specific SCGs/remedial action objectives for groundwater.

Each of the alternatives evaluated is considered to be in compliance with action-specific SCGs; permits (e.g., building permits) and approvals necessary for implementing these alternatives will be obtained prior to initiating the remedial action. No location-specific SCGs were identified.

5.6 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternative Nos. 2 and 4 will be protective of human health and the environment. The primary difference between the two alternatives lies in the approach to remediating DNAPL at the cesspool source area. Alternative No. 2 utilizes the traditional soil vapor extraction for unsaturated soil and groundwater extraction and treatment scenario at the source area. Alternative No. 4 utilizes an innovative technology (Fenton's Reagent) to remediate DNAPL in both saturated and unsaturated soil, and is likewise coupled with source area soil vapor extraction and on-Site groundwater extraction and treatment. It is expected that Fenton's Reagent would be able to treat more of the DNAPL mass in a shorter period of time than traditional soil vapor and groundwater extraction. In either approach it is likely that some residual DNAPL will remain, thus serving as a continual source of groundwater contamination. However, for the purposes of this On-Site FFS, Fenton's is expected to be effective at reducing the DNAPL mass, such that groundwater containment and extraction/treatment is required for ten years.

Alternatives No. 1 and 3 do not provide for adequate protection of human health and the environment with regard to contaminated environmental media.

5.7 COST

The estimated costs associated with the implementation of each alternative are summarized on Table 4-1. Appendix C provides more detailed information.

Alternative No. 1 does not include remedial actions for soil or groundwater; rather, this alternative only includes long-term groundwater monitoring. The present worth of this alternative is approximately $ 92,000 assuming a 30-year period and a discount rate of five percent.

The costs for Alternatives 2, 3 and 4 are in the range of $2,500,000 to $ 3,500,000.

Alternative No. 2, which includes groundwater extraction and ex-situ treatment and soil vapor extraction (for unsaturated soil remediation) is estimated to cost approximately $ 3,221,000. These total present worth estimates assume a 30-year period and a discount rate of five percent.

Alternative No. 3, which includes in-situ air sparging (for groundwater remediation) and soil vapor extraction (for unsaturated soil remediation) is estimated to cost approximately $ 2,536,000. These total present worth estimates assume a 30-year period and a discount rate of five percent.

Alternative No. 4, which includes injection of Fenton's Reagent, groundwater extraction and ex-situ treatment, and soil vapor extraction (for unsaturated soil remediation) is estimated to cost approximately $ 2,721,000. These total present worth estimates assume a 30-year period and a discount rate of five percent.

6.0 SUMMARY AND CONCLUSIONS

This report presents the results of the On-Site Focused Feasibility Study (FFS) for Operable Unit No. 1 for the American Drive-In Cleaners Site. This report is a companion document to the Remedial Investigation (RI), dated November 2000. The nature of this Site complicates the On-Site FFS in that the property is currently occupied and bordered by several commercial establishments, including American Drive-In Cleaners. The On-Site FFS was undertaken with an understanding that disruptions to the commercial operations were to be limited (i.e., extended periods of Site shutdown would not be acceptable).

The RI identified PCE as the compound of concern for the Site. PCE was found most frequently and in the highest concentrations for the compounds measured. Two unsaturated zone source areas were identified, including the two cesspools in the alley east of the ADC building and the northwestern portion of the ADC property. PCE was detected at a concentration of about 13% in unsaturated soils (prior to the Interim Remedial Measure (IRM)) beneath the southern-most cesspool, which is the highest concentration detected on Site. The presence of DNAPL is suspected in the eastern alley both in the vadose zone and saturated soils below the groundwater table. Approximately two cubic yards of source material were removed during the IRM.

Groundwater contamination was also identified, and the concentrations were reported to be the highest in MW-7S, directly downgradient of the cesspools. The peak concentration was 16,000 ug/L. Based on information collected during the RI, the PCE plume is anticipated to be over 1,000 feet long, 400 feet wide and 20 to 45 feet thick; and its spread is expected to be affected by the seasonal pumping of the Island Trees High School irrigation well, located about 1,000 feet south of the Site.

Complete decontamination of the Site is not considered feasible at this Site due to the presence of DNAPL. Complete DNAPL remediation is generally not considered practical in a reasonable or predictable timeframe. Excavation to depths of about 35 feet (i.e., the top of the groundwater table) or greater, adjacent to existing structures, is not considered cost effective or implementable.

Several innovative technologies were screened to address the DNAPL including: Fenton's Reagent, potassium permanganate, steam stripping, ozone injection, and others. Most of these technologies would require disruption to the site operations. However, the injection of a chemical oxidant (i.e., low concentration Fenton's Reagent (Isotec) or potassium permanganate) appears to be the least disruptive technology that could serve to aggressively treat the DNAPL. Thus, it was the innovative technology included for the detailed analysis. As discussed with the NYSDEC, one available chemical oxidation technology was evaluated in the On-Site FFS. Fenton's Reagent was selected for evaluation based on several reasons including its higher frequency of use, number of available case histories and expected costs.

Four remedial action alternatives were assembled for remediating the Site. These are discussed below.

Alternative No. 1 – No Action with Annual Groundwater Monitoring

The No Action alternative involves taking no further action to remedy the condition of the Site, other than to perform groundwater monitoring. This alternative allows for natural attenuation of impacted groundwater and soil.

Alternative No. 2 – Groundwater Extraction and Treatment and Soil Vapor Extraction

This alternative includes the extraction of soil gas vapor to remediate unsaturated on-Site soils, and groundwater extraction and ex-situ treatment to remediate groundwater. To contain and remediate contaminated groundwater, groundwater would be extracted via wells directly downgradient of the cesspool source area and treated with an air stripper. Extracted soil gas vapor and air stripper off-gas would be treated by catalytic oxidation.

Alternative No. 3 – In-Situ Air Sparging and Soil Vapor Extraction

As in Alternative No. 2, this alternative provides for treatment of impacted unsaturated soil associated with source areas using soil vapor extraction and treatment. Also, in-situ groundwater treatment via air sparging is a component of this alternative. Sparging wells would be located directly downgradient of the cesspool source area. Vapor extraction wells would collect air within the unsaturated zone containing stripped volatile compounds, for treatment via catalytic oxidation/activated carbon.

Alternative No. 4 – In-Situ Chemical Oxidation, Soil Vapor Extraction and Groundwater Extraction and Treatment

As in Alternatives No. 2 and 3, this alternative provides for treatment of impacted unsaturated soil associated with on-Site source areas via SVE. Also included with this alternative is the application of in-situ chemical oxidation (i.e., Fenton's Reagent) to treat the highly contaminated saturated and unsaturated soil, highly contaminated on-Site groundwater and DNAPL associated with the cesspool source area. Similar to Alternative No. 2, extraction of groundwater is included with this alternative, to contain potentially mobilized contamination; and to provide for groundwater containment and treatment.

The use of Fenton's Reagent, an innovative technology, is provided as an aggressive approach to treating the highly contaminated cesspool source area. This alternative assumes that the application of Fenton's Reagent is effective at reducing the mass of subsurface PCE in saturated and unsaturated soils and groundwater, and PCE DNAPL, such that on-Site groundwater extraction and treatment is required for ten years. Remaining contamination above the SCGs, following ten years of operations of on-Site remedial systems, may be addressed as part of the Off-Site FS studies.

Alternatives No. 2 and 4 would be protective of human health and the environment. The primary difference between the two alternatives lies in the approach to remediating DNAPL in the cesspool source area saturated and unsaturated soil. Both Alternatives No. 2 and 4 utilize SVE to traditionally treat unsaturated source area soils, which is expected to be effective throughout most areas of the Site, although it is possible that residual DNAPL will remain.

With regard to groundwater, Alternative No. 2 utilizes the traditional groundwater extraction and treatment scenario at the source area via extraction wells, which would also provide for on-Site hydraulic containment. However, Alternative No. 4 utilizes an innovative technology (chemical oxidation via Fenton's Reagent) to remediate DNAPL. Fenton's Reagent is expected to reduce the PCE mass along with groundwater remediation via extraction wells (dissolved PCE removal). It is expected and assumed, for the purposes of this On-Site FFS, that Fenton's Reagent would be able to treat more of the DNAPL mass than the traditional groundwater extraction well system. Thus, for Alternative No. 4, operation of the on-Site groundwater extraction and treatment systems is assumed to be required for a period of ten years. However, in either approach it is likely that some residual DNAPL will remain, thus serving as a continual source of groundwater contamination.

Alternative No. 3 provides for protection of human health and the environment with regard to contaminated unsaturated soil, but does not provide for protection with regard to groundwater. Air sparging is not expected to reduce PCE concentrations to the groundwater standard, nor does sparging provide for on-Site hydraulic containment.

Alternative No. 1 does not provide for adequate protection of human health and the environment with regard to contaminated environmental media.

The costs for Alternatives 2, 3 and 4 are in the range of approximately $ 2,500,000 to $ 3,500,000. Treatability and pilot studies would be necessary to refine the estimated costs and design for these systems. These studies would provide additional information regarding the effectiveness of the various technologies included in the proposed remedial alternatives.

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TABLES

TABLES

Table 1-1
Analytical Testing Summary
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

Sample Location	Sample Number	Depth (ft)	Date Sampled	Matrix	TCL VOC	SVOCs	TOC	RCRA 8 Metal	RCRA 8 Metals (Filt.)	Cyanide	TCLP C/R/I
Geoprobe Borings											
GP-1C	S-3	4-6	1/20/98	Soil	X	X		X		X	
GP-1D	S-10*	18-20	1/20/98	Soil	X	X		X		X	
GP-2	S-2	2-4	1/22/98	Soil	X			X		X	
	S-10	18-20	1/22/98	Soil	X			X		X	
GP-3A	Surface	0-2	1/20/98	Soil	X		X	X		X	
GP-3	S-3	4-6	1/20/98	Soil	X			X		X	
GP-4	S-7	12-14	1/20/98	Soil	X			X		X	
	S-11	20-22	1/20/98	Soil	X						
	S-12	22-24	1/20/98	Soil				X		X	
GP-5	S-8	14-16	1/15/98	Soil	X			X		X	
	S-15	28-30	1/15/98	Soil	X			X		X	
GP-6	S-11	20-22	1/21/98	Soil	X			X		X	
	S-17	32-34	1/21/98	Soil	X						
	S-18	34-38	1/21/98	Soil				X		X	
GP-7	S-2	2-4	1/21/98	Soil	X		X	X		X	
	S-6(Hold)	10-12	1/21/98	Soil							
	S-8	14-18	1/21/98	Soil	X		X	X		X	
	S-9(Hold)	16-18	1/22/98	Soil							
	S-16	32-34	1/22/98	Soil			X				
GP-8	S-5	6-10	1/22/98	Soil	X		X	X		X	
	S-12	32-34	1/22/98	Soil	X		X				
	S-13	34-36	1/22/98	Soil				X		X	
GP-9	S-3	4-6	1/21/98	Soil	X			X		X	
	S-11*	20-22	1/21/98	Soil	X			X		X	
	S-18(Hold)	34-36	1/21/98	Soil							
GP-10	S-3	4-6	1/22/98	Soil	X		X	X		X	
	S-7	12-14	1/22/98	Soil	X			X		X	
GP-11	S-4	6-8	1/20/98	Soil	X		X	X		X	
	S-17	32-34	1/20/98	Soil	X						
	S-16	34-36	1/20/98	Soil				X		X	
GP-12 Dup of GP-10, S-7	S-1	12-14	1/22/98	Soil	X			X		X	
Rinsate Sample	EB	-	1/20/98	Equipment Blank	X	X		X		X	
Test Pits											
TP-1	S-1	10.6-12.3	1/21/98	Soil	X			X		X	
TP-1	S-2	10.9-12.3	1/21/98	Soil	X		X	X		X	X
TP-2	S-1	4-8	1/22/98	Soil	X			X		X	
TP-3	S-1	4-8	1/22/98	Soil	X			X		X	
TP-3	S-2	8-12	1/22/98	Soil	X		X			-	
TP-5	S-1	11	1/22/98	Soil	X			X		X	
Monitoring Wells											
MW-1S ^{4}	-	-	1990	Groundwater	X						
MW-1S ^{4}	-	-	1990	Groundwater	X						
MW-1S	-	-	1/20/98	Groundwater	X						
MW-1S	-	-	3/18/98	Groundwater	X			X		X	
MW-1S	-	-	2/3/99	Groundwater	X						
MW-1S*	-	-	4/22/98	Groundwater	X			X	X	X	
MW-1I*	-	-	3/18/98	Groundwater	X			X		X	
MW-1I	-	-	4/22/98	Groundwater	X			X		X	
MW-1I	-	-	2/3/99	Groundwater	X						
MW-2S	-	-	3/18/98	Groundwater	X			X		X	
MW-2	-	-	4/21/98	Groundwater	X			X	X	X	
MW-2S	-	-	2/2/99	Groundwater	X						
MW-3S	-	-	3/18/98	Groundwater	X			X	X	X	
MW-3S	-	-	4/21/98	Groundwater	X			X	X	X	
MW-3S	-	-	2/2/99	Groundwater	X						
MW-4S ^{4}	-	-	1990	Groundwater	X						
MW-4S ^{4}	-	-	1990	Groundwater	X						
MW-4S	-	-	2/25/98	Groundwater	X						
MW-4S	-	-	3/18/98	Groundwater	X			X	X	X	
MW-4S	-	-	4/21/98	Groundwater	X			X	X	X	

Table 1-1
Analytical Testing Summary
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

Sample Location	Sample Number	Depth (ft)	Date Sampled	Matrix	TCL VOC	SVOCs	TOC	RCRA 8 Metal	RCRA 8 Metals (Filt.)	Cyanide	TCLP C/R/I
MW-4S	-	-	2/3/99	Groundwater	X						
MW-4S	-	-	7/30/99	Groundwater	X						
MW-4S	-	-	1/20/00	Groundwater	X						
MW-10S Dup of MW-4S	-	-	1/20/00	Groundwater	X						
MW-5S	-	-	3/18/98	Groundwater	X			X	X	X	
MW-5S	-	-	4/21/98	Groundwater	X			X	X	X	
MW-5S	-	-	2/2/99	Groundwater	X						
MW-6S	-	-	3/19/98	Groundwater	X			X	X	X	
MW-6S	-	-	4/21/98	Groundwater	X			X	X	X	
MW-6S	-	-	2/2/99	Groundwater	X						
MW-6I	-	-	3/18/98	Groundwater	X			X		X	
MW-6I	-	-	4/21/98	Groundwater	X			X		X	
MW-6I	-	-	2/3/99	Groundwater	X						
MW-7S	-	-	3/20/98	Groundwater	X			X	X	X	
MW-7S	-	-	4/22/98	Groundwater	X			X	X	X	
MW-8S Dup of MW-7S	-	-	4/22/98	Groundwater	X			X	X	X	
MW-7S	-	-	2/4/99	Groundwater	X						
MW-7S	-	-	1/20/00	Groundwater	X						
MW-7I	-	-	3/20/98	Groundwater	X			X		X	
MW-8I Dup of MW-7I	-	-	3/20/98	Groundwater	X			X		X	
MW-7I	-	-	4/22/98	Groundwater	X			X		X	
MW-7I	-	-	2/4/99	Groundwater	X						
MW-7I	-	-	1/20/00	Groundwater	X						
MW-7D	-	-	2/4/99	Groundwater	X						
MW-6S*	-	-	2/4/99	Groundwater	X						
MW-8S*	-	-	1/20/00	Groundwater	X						
MW-8I	-	-	2/4/99	Groundwater	X						
MW-10S Dup of MW-8I	-	-	2/4/99	Groundwater	X						
MW-8I	-	-	1/20/00	Groundwater	X						
MW-9S	-	-	2/4/99	Groundwater	X						
MW-9S	-	-	1/20/00	Groundwater	X						
MW-9I*	-	-	2/4/99	Groundwater	X						
MW-9D	-	-	2/4/99	Groundwater	X						
ITHS-Well	-	-	7/30/99	Groundwater	X						
ITHS-Well	-	-	1/19/00	Groundwater	X						
Trip Blank	-	-	3/20/98	Trip Blank	X						
Trip Blank	-	-	4/21/98	Trip Blank	X						
Trip Blank	-	-	4/22/98	Trip Blank	X						
Trip Blank-1	-	-	2/2/99	Trip Blank	X						
Trip Blank-2	-	-	2/3/99	Trip Blank	X						
Trip Blank-3	-	-	2/4/99	Trip Blank	X						
Trip Blank	-	-	1/20/00	Trip Blank	X						
Rinsate	-	-	3/18/98	Equipment Rinsate Blank	X			X	X	X	
Rinsate	-	-	4/22/98	Equipment Rinsate Blank	X			X	X	X	
Rinsate-1	-	-	2/2/99	Equipment Rinsate Blank	X						
Rinsate-2	-	-	2/3/99	Equipment Rinsate Blank	X						
Rinsate-3	-	-	2/4/99	Equipment Rinsate Blank	X						

Notes:

1) TCLP = Toxicity Characteristic Leachate Procedure, C/R/I = Corrosivity/Reactivity/Ignitability.
2) * Matrix Spike/Matrix Spike Duplicate Sample.
3) Filt. = Filtered metal sample analyzed for Lead only.
4) Samples collected by the Nassau County Department of Health.
5) Dup = Duplicate sample, ITHS = Island Trees High School Irrigation Well.
6) TCL VOCs = Target Compound List Volatile Organic Compounds.
7) TCL SVOCs = Target Compound List Semi-Volatile Organic Compounds.
8) TOC = Total Organic Carbon.

Table 1-3
Summary of Detected SVOC Compounds in Soil Samples
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

Sample ID	RSCO	GP-1C	GP-1D
	TAGM	S-3	S-10
Sample Depth (ft. bgs)	4046	4-6	18-20
Sample Date		1/20/98	1/20/98
Detected Compound (ug/kg)			
Phenanthrene	50,000	430	
Anthracene	50,000	62 J	
Carbazole	50,000	45 J	
Fluoranthene	50,000	570	
Pyrene	50,000	630	
Butylbenzylphthalate	50,000	40 J	
Benzo(a)anthracene	224	**270 J**	
Chrysene	400	320 J	
bis(2-Ethylhexyl)phthalate	50,000	320 J	
Benzo(b)fluoranthene	1,100	480 XJ	
Benzo(k)fluoranthene	1,100	450 XJ	
Benzo(a)pyrene	61	**300 J**	
Indeno(1,2,3-cd)pyrene	3,200	140 J	
Benzo(g,h,i)perylene	50,000	130 J	

Notes:

1) Qualifiers defined in Appendix D.
2) RSCO = "Recommended Soil Cleanup Objective" in NYSDEC Division Technical and Administrative Guidance Memorandum on the Determination of Soil Cleanup Objectives and Cleanup Levels dated January 24, 1994 (TAGM 4046).
3) Blank column for GP-1C indicates compounds not detected above detection limits.
4) Table is for detected SVOC compounds only.
5) ug/kg = parts per billion.
6) Bold values indicate compounds exceeding RSCOs.
7) ft. bgs = feet below ground surface.

Table 1-2
Summary Of Detected VOC Compounds In Soil Samples
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

Sample ID:	TAGM	GP-1C	GP-1D	GP-2	GP-2	GP-3A	GP-3	GP-4	GP-4	GP-5	GP-5	GP-6	GP-6	GP-7	GP-7
	# 4046	S-3	S-10	S-2	S-10	Surface	S-3	S-7	S-11	S-8	S-15	S-11	S-17	S-2	S-8
Sample Depth (ft. bgs)	RSCO	4-6	18-20	2-4	18-20	0-2	4-6	12-14	20-22	14-16	28-30	20-22	32-34	2-4	14-16
Sample Date		01/20/1998	01/20/1998	01/22/1998	01/22/1998	01/20/1998	01/20/1998	01/20/1998	01/20/1998	01/15/1998	01/15/1998	01/21/1998	01/21/1998	01/21/1998	01/21/1998
Detected Compound (ug/kg)															
Methylene chloride	100									1 J					
Acetone	200														
2-Butanone (MEK)	300														
Trichloroethene (TCE)	700	220 J				1 J									
Tetrachloroethene (PCE)	1400	**11,000** [5]	2 J		2 J	120 D	**36,000** [5]				1 J	3 J		82	**25,000,000** [5] **(2.5%)**
Toluene	1500					2 J									
Total Dichloroethene (DCE)	300	190 J													

Sample ID:	RSCO	GP-8	GP-8	GP-9	GP-9	GP-10	GP-10	GP-11	GP-11	TP-1	TP-1	TP-2	TP-3	TP-3	TP-5
	#4046	S-5	S-12	S-3	S-11	S-3	S-7	S-4	S-17	S-1	S-2	S-1	S-1	S-2	S-1
Sample Depth (ft. bgs)	RSCO	8-10	32-34	4-6	20-22	4-6	12-14	6-8	32-34	10.8-12.3	10.9-12.3	10-12	8-10	10-12	11
Sample Date		01/22/1998	01/22/1998	01/21/1998	01/21/1998	01/22/1998	01/22/1998	01/20/1998	01/20/1998	01/21/1998	01/21/1998	01/22/1998	01/22/1998	01/22/1998	01/22/1998
Detected Compound (ug/kg)										(Bottom of cesspool)	(Bottom of cesspool) (White fiber material)				(Bottom of cesspool)
Methylene chloride	100						2 J					1 J		1 J	
Acetone	200						7 J					8 J			
2-Butanone (MEK)	300											4 J			12 J
Trichloroethene (TCE)	700												1 J		3 J
Tetrachloroethene (PCE)	1400		2 J	12	91	1 J	85			**6,400**	**130,000,000** [5] **(13%)**		120 D	140	130
Toluene	1500												2 J		
Total Dichloroethene (DCE)	300														

Notes:

1) Qualifiers defined in Appendix D.
2) ug/kg = Parts per billion
3) RSCO = "Recommended Soil Cleanup Objective" in NYSDEC Division Technical and Administrative Guidance Memorandum on the Determination of Soil Cleanup Objectives and Cleanup Levels dated January 24, 1994 (TAGM 4046).
4) Only VOC compounds detected are presented.
5) TCLP Regulatory Level for PCE is 0.7 mg/l. 20x TCLP concentration is an indication that the sample may exceed the TCLP Regulatory level if tested. 20 x 0.7 mg/l = 14 ppm or 14,000 ppb.
6) Bold values indicate compounds exceeding RSCOs.
7) ft. bgs = feet below ground surface.
8) Results presented for GP-10, S-7 are the higher of the sample and its duplicate.

Table 1-4
Summary of Metal Compounds in Soil Samples
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

Sample ID	Guidance Value		GP-1C	GP-1D	GP-2	GP-2	GP-3A	GP-3	GP-4	GP-4	GP-5	GP-5	GP-6	GP-6	GP-7	GP-7
	TAGM 4046	Eastern US Soil Background	S-3	S-10	S-2	S-10	Surface	S-3	S-7	S-12	S-8	S-15	S-11	S-18	S-2	S-8
Sample Depth (ft. bgs)			4-6	18-20	2-4	18-20	0-2	4-6	12-14	22-24	14-16	28-30	20-22	34-36	2-4	14-16
Collection date			1/20/98	1/20/98	1/22/98	1/22/98	1/20/98	1/20/98	1/20/98	1/20/98	1/15/98	1/15/98	1/21/98	1/21/98	1/21/98	1/21/98
Detected Compound (mg/kg)																
Aluminum	SB	33,000	2,900	615	1,170	1,020	16,200	2,440	1,510	565	630	882	2,190	685	822	77
Antimony	SB	NA														
Arsenic	7.5	3 - 12**	4.7	1.5 B		0.75 B	12.5	2.7	1.2 B				1.8 B			
Barium	300	15 - 600	15 B	4.4 B	7.4 B	5.7 B	38.5 B	9.7 B	7.6 B	4.1 B	2.8 B	5.2 B	8.7 B	3.8 B	4.1 B	12.9 B
Beryllium	0.16	0 - 1.75	0.14 B		0.15 B	0.14 B	0.56 B	0.13 B	0.12 B				0.18 B	0.12 B	0.13 B	
Cadmium	1	0.1 - 1	0.21 B													
Calcium	SB	130 - 35,000**	5,380	97.4 B	103 B	290 BJ	1,240	4,060	914 B	29 B	33.7 B	128 B	153 B		60.6 B	52.7 B
Chromium	10	1.5 - 40**	9.5	5.6	3.3 J	8.2 J	18.7	9.8	16	1.3 B	2.4	14.6	13.1 J	2.5 J	2.5 J	2 B
Cobalt	30	2.5 - 60**	2.3 B	0.7 B	2.7 B	0.92 B	8.5 B	2.2 B	15 B	0.2 B	0.48 B	0.63 B	1.6 B	0.31 B	0.89 B	
Copper	25	1 - 50	15.1	2.2 B	3.2 BJ	3 BJ	14.8	12.3	3.6 B	1.5 B	1.6 B	3.1 B	5.1 BJ	1.7 B	4.2 BJ	4.8 BJ
Iron	2,000	2,000 - 550,000	5,930	2,860	3,620	5,250	19,800	6,360	4,380	1,680	2,630	3,240	6,220	1,880	4,370	1,900
Lead	SB	200 - 500[5]	44	1.5	1.1	1.7	18.1	11.6	2.6	1.1	1.2	1.7	5.1'	0.91 B	2.5	7.7
Magnesium	SB	100 - 5,000	3,000	129 B	238 B	309 B	2,160	1,610	515 B	46.6 B	126 B	156 B	395 B	60.2 B	185 B	14.8 B
Manganese	SB	50 - 5,000	111 J	33.2 J	102 J	59.6 J	282 J	85.1 J	108 J	26.9 J	38.6 J	41.9 J	82.3 J	17.2 J	52.6 J	3.6 J
Mercury	0.1	0.001 - 0.2	0.08 B				0.09 B	0.07 B								0.05 B
Nickel	13	0.5 - 25	6.2 B	1.7 B	3 BJ	2.1 B	11.8	4 B	2.5 B	0.59 B	0.93 B	1.4 B	2.8 B	0.82 B	3.1 BJ	0.62 B
Potassium	SB	8,500 - 43,000**	151 B	71.4 B	102 B	103 B	538 B	127 B	115 B	27.5 B	60.2 B	80.7 B	136 B	43.2 B	81.9 B	22 B
Selenium	2	0.1 - 3.9	0.82 B				1.8									
Silver	SB	NA														0.33 B
Sodium	SB	6,000 - 8,000		133 B		123 B			178 B	126 B	143 B	121 B	112 B	131 B	133 B	137 B
Thallium	SB	NA														
Vanadium	130	1 - 300	11.1 J	2.9 BJ	3.4 B	4.1 B	28.5 J	15.3 J	3.7 BJ	2.3 BJ	2.3 BJ	3.2 BJ	5.5 B	2.8 B	2.7 B	1.3 B
Zinc	20	9 - 50	70.3	3.1 BJ	R	R	30	29.1	4.8 J	10.4 J	1.6 BJ	3.2 BJ	R	R	R	R
Cyanide	SB	NA														

Notes:

1) Qualifiers defined in Appendix D.
2) TAGM 4046 = Recommended Soil Cleanup Objective in NYSDEC Division Technical and Administrative Guidance Memorandum on the Determination of Soil Cleanup Objectives and Cleanup Levels dated January 24, 1994.
3) "Eastern USA Background" in TAGM 4046.
4) Blank = not detected above detection limits.
5) Background levels for lead vary widely. Average levels in undeveloped, rural areas may range from 4 - 61 mg/kg. Average background levels in metropolitan or suburban areas or near highways are much higher and typically range from 200 - 500 mg/kg.
6) SB = Site Background; ** = New York State background.
7) mg/kg = parts per million, N/A = Not Available, ft bgs = feet below ground surface.
8) The results presented for GP-10,S-7 are the higher of the sample and its duplicate.

Table 1-4
Summary of Metal Compounds in Soil Samples
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

Sample ID	Guidance Value		GP-8	GP-8	GP-9	GP-9	GP-10	GP-10	GP-11	GP-11	TP-1	TP-1	TP-2	TP-3	TP-5
	TAGM 4046	Eastern US Soil Background	S-5	S-13	S-3	S-11	S-3	S-7	S-4	S-18	S-1	S-2	S-1	S-1	S-1
Sample Depth (ft. bgs)			8-10	34-36	4-6	20-22	4-6	12-14	6-8	34-36	10.8-12.3	10.9-12.3	4-8	4-8	11
Collection date			1/22/98	1/22/98	1/21/98	1/21/98	1/22/98	1/22/98	1/20/98	1/20/98	1/21/98	1/21/98	1/22/98	1/22/98	1/22/98
Detected Compound (mg/kg)															
Aluminum	SB	33,000	1,420	831	881	1,190	781	961	1,000	613	2,400	903 J	974	4,420	4,050
Antimony	SB	NA													
Arsenic	7.5	3 - 12**		0.73 B		1.1 B		1.6 B			3.1			4.8	3.6
Barium	300	15 - 600	5.2 B	2.3 B	5.1 B	13 B	3.6 B	5 B	4.7 B	3.3 B	12 B	164 J	4.3 B	17.7 B	17.4 B
Beryllium	0.16	0 - 1.75	0.12 B	0.11 B	0.14 B	0.2 B		0.17 B			0.17 B		0.15 B	0.25 B	0.26 B
Cadmium	1	0.1 - 1										2.2 BJ		0.09 B	0.13 B
Calcium	SB	130 - 35,000**	292 BJ		38.9 B	206 BJ	165 B	191 BJ	29.4 B		1,560 J	4,490 J		3,720 J	1,370 J
Chromium	10	1.5 - 40**	6.7 J	4.2 J	2.5 J	7.6 J	1.9 B	5.8 J	3.4	3.1	5.9 J	32.3 J	4.1 J	9.5 J	9.6 J
Cobalt	30	2.5 - 60**	1.3 B	0.34 B	1.2 B	1.7 B	0.86 B	1.1 B	1.2 B	0.27 B	2.2 B	1 BJ	1.3 B	2.7 B	3 B
Copper	25	1 - 50	5 J	1.9 B	2.3 B	3.8 BJ	1.9 B	2.9 BJ	2.2 B	1.6 B	14.1 J	268 J	4.1 BJ	15.4 J	48.7 J
Iron	2,000	2,000 - 550,000	3,210	2,270	3,080	8,170	2,100	4,640	2,730	1,780	8,760	2,880 J	3,440	6,680	8,100
Lead	SB	200 - 500^5	1.9	1.3	1.1	2.2	1.2	1.6	1.5	1.2	34.1	94.6 J	1.5	23.6	15.7
Magnesium	SB	100 - 5,000	345 B	64.5 B	165 B	313 B	242 B	300 B	145 B	42.2 B	861 B	871 BJ	188 B	970 B	1040 B
Manganese	SB	50 - 5,000	56.8 J	23.1 J	68.7 J	174	55.5 J	63.1 J	92.3 J	55.1 J	112 J	21.7 J	80.7 J	108 J	77.2 J
Mercury	0.1	0.001 - 0.2										4 J		0.11	
Nickel	13	0.5 - 25	2 B	1.5 B	1.5 B	2.6 B	1.3 BJ	1.7 B	1.4 B	0.62 B	3.8 BJ	20.9 J	1.4 B	4.8 BJ	7 BJ
Potassium	SB	8,500 - 43,000**	86.8 B	45.6 B	68.6 B	92 B	56 B	112 B	84.7 B	25.5 B	161 B	95 BJ	110 B	211 B	200 B
Selenium	2	0.1 - 3.9											0.72 B	0.73 B	
Silver	SB	NA										22.9 J		0.26 B	
Sodium	SB	6,000 - 8,000			137 B	135 B	114 B	126 B	126 B	128 B		711 BJ	109 B	142 B	
Thallium	SB	NA													
Vanadium	130	1 - 300	3.1 B	2.9 B	3.1 B	5.4 B	2.1 B	3.1 B	1.9 BJ	2.3 BJ	8.9 B	5.3 BJ	2.9 B	10.6 B	10.3 B
Zinc	20	9 - 50	R	R	R	R	22.5	R	3.6 BJ	2.3 BJ	19.1	197 J	R	70.1	54.8
Cyanide	SB	NA													

Notes:

1) Qualifiers defined in Appendix D.
2) TAGM 4046 = Recommended Soil Cleanup Objective in NYSDEC Division Technical and Administrative Guidance Memorandum on the Determination of Soil Cleanup Objectives and Cleanup Levels dated January 24, 1994.
3) "Eastern USA Background" in TAGM 4046.
4) Blank = not detected above detection limits.
5) Background levels for lead vary widely. Average levels in undeveloped, rural areas may range from 4 - 61 mg/kg. Average background levels in metropolitan or suburban areas or near highways are much higher and typically range from 200 - 500 mg/kg.
6) SB = Site Background; ** = New York State background.
7) MG/KG = parts per million, N/A = Not Available, ft. bgs = feet below ground surface.
8) The results presented for GP-10, S-7 are the higher of the sample and its duplicate.

Table 1-5
Summary of Total Organic Carbon in Soil Samples
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

Sample ID:	GP-3A Surface	GP-7 S-2	GP-7 S-8	GP-7 S-16	GP-8 S-5	GP-8 S-12	GP-10 S-3	GP-11 S-4	TP-1 S-2	TP-3 S-2
Sample Depth (ft. bgs):	0-2	2-4	14-16	32-34	8-10	32-34	4-6	6-8	10.9-12.3	8-12
Sample Date:	01/20/1998	01/21/1998	01/21/1998	01/22/1998	01/22/1998	01/22/1998	01/22/1998	01/20/1998	01/21/1998	01/22/1998
Organic Carbon (mg/kg)	8,530	814	4,770	384	640	1,070	331	1,160	50,430 E	15,700

Notes:

1) E = If a soil sample concentration exceeds 16,000 mg/kg with a 10 mg weight, then the sample may be non-linear; considered an estimated value.
2) ft. bgs = feet below ground surface.
3) mg/kg = parts per million.

Table 1-6
Summary of Detected VOC Compounds in Groundwater Samples
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

Sample ID:	Class GA	MW-1S[3]	MW-1S[3]	MW-1S	MW-1S	MW-1S	MW-1S	MW-1I	MW-1I	MW-1I	MW-2S	MW-2S	MW-2S	MW-3S	MW-3S	MW-3S	MW-4S[3]	MW-4S[3]	MW-4S	MW-4S	MW-4S	MW-4S	MW-4S	MW-4S[6]	MW-5S	MW-5S	MW-5S
Collection Date:	Standard	1990	1990	01/20/98	03/18/98	04/22/98	02/03/99	03/18/98	04/22/98	02/03/99	03/18/98	04/21/98	02/02/99	03/18/98	04/21/98	02/02/99	1990	1990	02/25/98	03/18/98	04/21/98	02/03/99	07/30/99	01/20/00	03/18/98	04/21/98	02/02/98
Units of Measure:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Compound																											
Methylene chloride	5				3 J			1 J			3 J			2 J						3 J					2 J		
Acetone	50 (GV)																										
1,2-Dichloropropane	5																										
Trichloroethene	5				4 J	6 J	9 J																2 J	1 J			
Dibromochloromethane	50 (GV)																										
1,1,2-Trichloroethane	1																										
Bromoform	50 (GV)																										
Tetrachloroethene	5	237	274	260	180	250	360			2 J							22	64	76	40	130	580	380 D	180			
1,1,2,2 Tetrachloroethane	5																										
Toluene	5							2 J		34														5 J			
Xylene (Total)	5																										
Total DCE	5				2 J	3 J	8J																				

Sample ID:	Class GA	MW-6S	MW-6S	MW-6S	MW-6I	MW-6I	MW-6I	MW-7S	MW-7S[6]	MW-7S	MW-7S	MW-7I[6]	MW-7I	MW-7I	MW-7I	MW-7D	MW-8S	MW-8S	MW-8I[6]	MW-8I	MW-9S	MW-9S	MW-9I	MW-9D	ITHS-Well[5]	ITHS-Well[5]
Collection Date:	Standard	03/19/98	04/21/98	02/02/99	03/18/98	04/21/98	02/03/99	03/20/98	04/22/98	02/04/99	01/20/00	03/20/99	04/22/98	02/04/99	01/20/00	02/04/99	02/04/99	01/20/00	02/04/99	01/20/00	02/03/99	01/20/00	02/03/99	02/03/99	07/30/99	01/19/00
Units of Measure:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Compound																										
Methylene chloride	5				1 J																				7 J	
Acetone	50 (GV)											6 J														
1,2-Dichloropropane	5					1 J																				
Trichloroethene	5					1 J					230						26 J	14			4 J	3 J				
Dibromochloromethane	50 (GV)					2 J																				
1,1,2-Trichloroethane	1					3 J																				
Bromoform	50 (GV)					6 J																				
Tetrachloroethene	5	34	8 J	2 J				6,800	5,200	16,000	3,400 D[8]	120	130	1,400	1,600 D	2	1,500	570 D	180	100	150	74			21	4 J
1,1,2,2 Tetrachloroethane	5					11																				
Toluene	5				2 J							2 J		18 J				2 J	43	6 J		1 J		16		3 J
Xylene (Total)	5				1 J																					1 J
Total DCE	5										140						27 J	10			4 J	1 J				

Notes:

1) Results compared to 6NYCRR Part 703 (Groundwater Quality Class GA Standards).
2) GV = Guidance Value: Division of Water Technical and Operational Guidance Series (TOGS 1.1.1) Ambient Water Quality Standards and Guidance Values.
3) Sampling done by Nassau County Department of Health.
4) Blank indicates compound not detected above detection limit. NSG = No Standard or Guidance Value. VOCs not listed were not detected.
5) ITHS Well - Island Trees High School Irrigation Well.
6) Results presented for MW-4S (1/20/00), MW-7S (4/22/98), MW-7I (3/20/98), and MW-8I (2/4/99) are the higher of these samples and their respective duplicates.
7) Results presented for samples collected on 1/20/00 are not validated data.
8) Tetrachloroethene result presented for MW-7S (1/20/00) is probably biased low; refer to Section 4.4.1 of the Remedial Investigation, dated November 2000, for details.

Table 1-7
Summary of Detected RCRA 8 Metals and Cyanide in Groundwater Samples
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site 1-30-049
Levittown, New York

Sample ID: Date Sampled: **Detected Compound (ug/L)**	Class GA Standard	MW-1S 03/18/1998	MW-1S 04/22/1998	MW-1I 03/18/1998	MW-1I 04/22/1998	MW-2S 03/18/1998	MW-2S 04/21/1998	MW-3S 03/18/1998	MW-3S 04/21/1998	MW-4S 03/18/1998	MW-4S 04/21/1998
Arsenic	25										
Barium	1,000	44.3 B	49.7 B	60.3 B	70.3 B	23.4 B	38.6 B	100 B	140 B	57.5 B	75.1 B
Cadmium	5									7	3.9 B
Chromium	50	1.9 B	2.8 B	5.4 B	2.6 B	2.1 B	2.8 B	18.6	12.7	10.7	14
Lead (Total)	25	1.9 B	3.2	1.6 B	2.3 B	4.2	8.4	39.8	26.2	26	36.7
Lead (Filtered) [6]	25	NT	NT	NT	NT	NT	NT	1.9 BJ	NT		NT
Mercury	0.7										
Selenium	10		R		5.7 NJ		R		3.7 BJ		
Silver	50	1.8 B									

Sample ID: Date Sampled: **Detected Compound (ug/L)**	Class GA Standard	MW-5S 03/18/1998	MW-5S 04/21/1998	MW-6S 03/19/1998	MW-6S 04/21/1998	MW-6I 03/18/1998	MW-6I 04/21/1998	MW-7S 03/20/1998	MW-7S [5] 04/22/1998	MW-7I [5] 03/20/1998	MW-7I 04/22/1998
Arsenic	25	10.3	6.4 B	3.9 B	7 B			12	15.5		
Barium	1,000	115 B	119	115 B	152 B	85.8 B	103 B	132 B	143 B	72.7 B	71.1 B
Cadmium	5	19.9	8.7								
Chromium	50	28.5	29	9.9 B	14.6	4.1 B	1.4 B	31.5	23.1	3.3 B	3.2
Lead (Total)	25	81.2	82	6.8	14.1	2.4 B	2.1 B	23.5	32.6	1.8 B	3.4
Lead (Filtered) [6]	25		NT		NT	NT	NT		NT	NT	NT
Mercury	0.7	0.41	0.12 B						0.15 B		0.3
Selenium	10								7 J		
Silver	50										

Notes:

1) Qualifiers defined in Appendix D.
2) Results compared to 6NYCRR Part 703 (Groundwater Quality Class GA Standards).
3) Blank indicates compound not detected above detection limit.
4) NT = Not Tested.
5) Results presented for MW-7S (4/22/98) and MW-7I (3/20/98) are the higher of these samples and their respective duplicates.
6) Filtered samples collected based on sample turbidity values greater than 50 nephelometric units. Filtered samples were analyzed for lead only.
7) ug/L = parts per billion.

Table 2-1
Chemical Specific Standards, Criteria, and Guidelines (SCGs) - Subsurface Soil
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

	USEPA and State Criteria				Selected SCG Goal	
Parameter	NYSDEC TAGM 3028	NYSDEC TAGM 4046	USEPA Region 3 Risk-Based Concentrations (RBCs)	USEPA Region 9 Preliminary Remediation Goals (PRGs)	SCG Goal	Basis of Selected SCG Goal
Volatile Organics (ug/kg)						
Methylene Chloride	85,000	100	760,000	9,800,000	100	NYSDEC TAGM 4046
Acetone	7,800,000	200	200,000,000	6,200,000	200	NYSDEC TAGM 4046
Total Dichloroethene	780,000	300	18,000,000	150,000	300	NYSDEC TAGM 4046
2-Butanone	47,000,000	300	1,200,000,000	28,000,000	300	NYSDEC TAGM 4046
Trichloroethene	58,000	700	520,000	79,000	700	NYSDEC TAGM 4046
Tetrachloroethene	12,000	1,400	110,000	1,700,000	1,400	NYSDEC TAGM 4046
Toluene	16,000,000	1,500	410,000,000	2,000,000	1,500	NYSDEC TAGM 4046
Semi-volatile Organics (ug/kg)						
Phenanthrene	NV	50,000	NV	NV	50,000	NYSDEC TAGM 4046
Anthracene	23,000,000	50,000	610,000,000	390,000,000	50,000	NYSDEC TAGM 4046
Carbazole	32,000	50,000	290,000	NV	32,000	NYSDEC TAGM 3028
Fluoranthene	3,100,000	50,000	82,000,000	30,000,000	50,000	NYSDEC TAGM 4046
Pyrene	2,300,000	50,000	61,000,000	54,000,000	50,000	NYSDEC TAGM 4046
Butylbenzylphthalate	16,000,000	50,000	410,000,000	180,000,000	50,000	NYSDEC TAGM 4046
Benzo (a) Anthracene	900	224 or MDL	7800	NV	224 or MDL	NYSDEC TAGM 4046
Chrysene	88,000	400	780,000	NV	400	NYSDEC TAGM 4046
Bis (2-Ethylhexyl) Phthalate	46,000	50,000	410,000	18,000,000	46,000	NYSDEC TAGM 3028
Benzo (b) Fluoranthene	900	1,100	7,800	NV	900	NYSDEC TAGM 3028
Benzo (k) Fluoranthene	9,000	1,100	78,000	NV	1,100	NYSDEC TAGM 4046
Benzo (a) Pyrene	90	61 or MDL	780	NV	61 or MDL	NYSDEC TAGM 4046
Indeno (1,2,3-cd) Pyrene	900	3,200	7,800	NV	900	NYSDEC TAGM 3028
Benzo(g,h,i) Perylene	NV	50,000	NV	NV	50,000	NYSDEC TAGM 4046
Metals (mg/kg)						
Aluminum	NV	SB	2,000,000	1,700,000	SB	NYSDEC TAGM 4046
Arsenic	0.4	7.5 or SB	3.8	440	0.4	NYSDEC TAGM 3028
Barium	5,500	300 or SB	140,000	120,000	300 or SB	NYSDEC TAGM 4046
Beryllium	0.15	0.16 or SB	4,100	3,700	0.15	NYSDEC TAGM 3028
Cadmium	78	1 or SB	1,000	810	1 or SB	NYSDEC TAGM 4046
Calcium	NV	SB	NV	NV	SB	NYSDEC TAGM 4046
Chromium	NV	10 or SB	6,100	6100	10 or SB	NYSDEC TAGM 4046
Cobalt	NV	30 or SB	120,000	120,000	30 or SB	NYSDEC TAGM 4046
Copper	NV	25 or SB	82,000	76,000	25 or SB	NYSDEC TAGM 4046
Iron	NV	2000 or SB	610,000	610,000	2000 or SB	NYSDEC TAGM 4046
Lead	400	SB	NV	NV	400	NYSDEC TAGM 3028
Magnesium	NV	SB	NV	NV	SB	NYSDEC TAGM 4046
Manganese	11,000	SB	41,000	32,000	11,000	NYSDEC TAGM 3028
Mercury	23	0.1	NV	610	0.1	NYSDEC TAGM 4046
Nickel	1,600	13 or SB	41,000	41,000	13 or SB	NYSDEC TAGM 4046
Potassium	NV	SB	NV	NV	SB	NYSDEC TAGM 4046
Selenium	390	2 or SB	10,000	10,000	2 or SB	NYSDEC TAGM 4046
Silver	390	SB	10,000	10,000	390	NYSDEC TAGM 3028
Sodium	NV	SB	NV	NV	SB	NYSDEC TAGM 4046
Vanadium	550	150 or SB	14,000	14,000	150 or SB	NYSDEC TAGM 4046
Zinc	23,000	20 or SB	610,000	610,000	20 or SB	NYSDEC TAGM 4046

Notes:

1) This table lists those analytical parameters that were detected in subsurface soil samples.
2) This table lists selected SCG Goals that were derived by comparing chemical-specific SCGs. See text for additional details.
3) TAGM 3028 = Contained-In Action Levels, dated August 4, 1997.
4) TAGM 4046 = "Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives Levels", prepared by NYSDEC, January 24, 1994.
5) USEPA Region 3 Risk-Based Concentrations (RBCs), dated October 7, 1999, for soil industrial.
6) USEPA Region 9 Preliminary Remediation Goals (PRGs), dated October 1, 1999, for industrial soil chronic HQ=1, integrated (inhalation, dermal contact, and ingestion).
7) NV = No Value; SB = Site Background; and MDL = Method Detection Limit.

Table 2-2
Chemical Specific Standards, Criteria, and Guidelines (SCGs) - Overburden Groundwater
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

	USEPA and State Criteria								Selected SCG Goals	
	NYSDEC Class GA	NYSDEC TAGM 3028	USEPA MCLs	USEPA MCLGs	USEPA Health Advisories			USEPA Region 9 Preliminary Remediation Goals (PRGs)		
Parameter					Child/ One Day	Child/ Long Term	Adult Lifetime		SCG Goal	Basis of Selected SCG Goal
Volatile Organics (ug/l)										
Methylene chloride	5 (std.)	5	NV	NV	NV	NV	NV	2,200	5	NYSDEC Class GA
Acetone	50 (guid.)	50	NV	NV	NV	NV	NV	3,700	50	NYSDEC Class GA
1, 2 -Dichloropropane	5 (std.)	5	5	0	NV	NV	NV	40	5	NYSDEC Class GA
Trichloroethene (TCE)	5 (std.)	5	5	0	NV	NV	NV	220	5	NYSDEC Class GA
Dibromochloromethane	50 (guid.)	50	NV	NV	NV	NV	NV	730	50	NYSDEC Class GA
1,1,2-Trichloroethane	1 (std.)	5	5	3	600	400	3	150	1	NYSDEC Class GA
Bromoform	50 (guid.)	50	NV	NV	5,000	2,000	NV	730	50	NYSDEC Class GA
Tetrachloroethene	5 (std.)	5	5	0	2,000	1,000	NV	370	5	NYSDEC Class GA
1,1,2,2-Tetrachloroethane	5 (std.)	5	NV	NV	NV	NV	NV	2,200	5	NYSDEC Class GA
Toluene	5 (std.)	5	1,000	1,000	20,000	2,000	1,000	7,300	5	NYSDEC Class GA
Xylene (total)	5 (std.)	5	10,000	10,000	40,000	40,000	10,000	73,000	5	NYSDEC Class GA
Total DCE	5 (std.)	5	70	70	4,000	2,000	70	370	5	NYSDEC Class GA
Metals (ug/l)										
Arsenic	25 (std.)	25	50	NV	NV	NV	NV	11	25	NYSDEC Class GA
Barium	1,000 (std.)	1,000	2,000	2,000	NV	NV	2,000	2,600	1,000	NYSDEC Class GA
Cadmium	5 (std.)	5	5	5	40	5	5	18	5	NYSDEC Class GA
Chromium	50 (std.)	50	100	100	1,000	200	100	110	50	NYSDEC Class GA
Lead (Total)	25 (std.)	15	15	0	NV	NV	NV	NV	15	NYSDEC TAGM 3028
Mercury	0.7 (std.)	2	2	2	NV	NV	2	11	0.7	NYSDEC Class GA
Selenium	10 (std.)	10	50	50	NV	NV	NV	180	10	NYSDEC Class GA

Notes:
1) This table lists those analytical parameters that were detected in collected on-Site groundwater samples.
2) This table lists selected SCG Goals that were derived by comparing chemical specific SCGs. See text for additional details.
3) NYSDEC Class GA Groundwater Standards as promulgated in 6 NYCRR 703, dated June 1998 (std. = standard; guid. = guidance value).
4) NYSDEC TAGM 3028 = Contained-In Action Levels, dated August 4, 1997.
5) USEPA Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs), dated November 24, 1999, for public water supplies.
6) USEPA Health Advisories, dated October 1996, developed to be protective of adverse non-carcinogenic health effects associated with exposure of child for one day and longer term (approximately 7 years or 10% of lifetime) and lifetime exposure for adults.
7) USEPA Region 9 Preliminary Remediation Goals (PRGs), for tap water by ingestion, dated October 1, 1999.
8) NV = No Value.

Table 2-3
Potentially Applicable SCGs
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

ACT/AUTHORITY	CRITERIA/ISSUES	CITATION	BRIEF DESCRIPTION	STATUS	COMMENTS
LOCAL CHEMICAL-SPECIFIC SCGs					
None Identified.					
STATE CHEMICAL-SPECIFIC SCGs					
	Determination of Soil Cleanup Objectives and Cleanup Levels	NYSDEC TAGM HWR-94-4046 (January 1994)	Establishes Recommended Soil Cleanup Objectives (RSCOs) for soil.	Applicable	RSCOs are based on residential exposure assumptions and may be conservative since the American Drive-In Cleaners Site is located in a commercial zoned area.
	Contained-In Action Levels	NYSDEC TAGM 3028 (August 4, 1997)	It is the purpose of this policy to set minimum criteria (i.e., action levels, cover requirements, and restricted access) for an environmental medium contaminated by listed hazardous waste which must be met in order to preclude its management as hazardous waste.	Applicable	The "contained in" criteria does not imply that these levels are cleanup levels.
	Determination of Groundwater Cleanup Objectives and Guidance Values	NYSDEC TOGS 1.1.1 (Reissue Date June 1998); 6 NYCRR 706	Establishes Groundwater Effluent Limitations for Class GA Groundwater.	Applicable	
FEDERAL CHEMICAL-SPECIFIC SCGs					
Comprehensive Environmental Responsibility Cleanup and Liability Act (CERCLA)	Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities	USEPA OSWER Directive #9355.4-12, Response, July 1994	USEPA-recommended residential screening level for lead (400 ppm, based on permissible exposure to children).	Applicable	USEPA (1996) also suggests somewhat higher levels (750 to 1500 ppm) are acceptable for adults.
National Primary and Secondary Regulations	USEPA Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs)	USEPA OSWER Directive #9355.4-12, Response, July 1994; 40 CFR 141, November 24, 1999.	National primary drinking water regulations are legally enforceable standards that apply to public water systems. National secondary drinking water regulations are non-enforceable guidelines regulating contaminants that may cause cosmetic or aesthetic effects	Applicable	
USEPA Office of Water	Drinking Water Regulations and Health Advisories	USEPA, EPA/822/B/96/002, October 1996	USEPA health advisories are nonregulatory concentrations of drinking water contaminants considered protective of adverse noncarcinogenic health effects.	Applicable	
USEPA Region 9	Preliminary Remediation Goals	USEPA, dated October 1, 1999.	USEPA Region 9 PRGs are used for evaluating contaminated sites in terms of exposure pathways (for ingestion of tap water and inhalation/dermal contact/ingestion of soil).	Applicable	
USEPA Region 3 Risk Assessment Guidance	Risk-Based Concentrations (RBCs) Table	USEPA, dated October 7, 1999.	USEPA Region 3 RBCs are based on adult occupational exposure (ingestion of) commercial/industrial soil; for use with "Selecting Exposure Routes and Contaminants of Concern by Risk-Based Screening" (EPA/903/R-93/001)	Applicable	
LOCAL ACTION-SPECIFIC SCGs					
Nassau County Health Department/Department of Public Works	Closure of cesspools	Plumber's Handbook, 1995; Section 2.04	Establishes procedures for properly abandoning a former cesspool.	Applicable	
Nassau County Department of Public Works	Effluent discharge to a county stormwater system/detention basin		A permit must be filed with the County or Town for discharge into county- or town-owned stormwater system/detention basin.	Potentially Applicable	
Nassau County Department of Public Works	Effluent Discharge/Connection to Sanitary Sewer System	Nassau County Sewer Ordinance, No. 266-1985.	A permit must be filed with the County for any new connection to the Nassau County Sewer System.	Potentially Applicable	
Nassau County Department of Public Works	Road Opening Permit	Plumber's Handbook, 1995; Section 1.02	A permit must be filed with the Village, County or Town before excavation with a local right-of-way.	Potentially Applicable	

Table 2-3
Potentially Applicable SCGs
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

ACT/AUTHORITY	CRITERIA/ISSUES	CITATION	BRIEF DESCRIPTION	STATUS	COMMENTS
Town of Hempstead Department of Buildings	Building and Plumbing Permits	Building Zone Ordinance	A permit must be filed with the town for construction of any new buildings; interior plumbing also must be approved.	Potentially Applicable	
Town of Hempstead	Permissible Sound Levels	Building Zone Ordinance	Establishes allowable noise emissions from construction equipment and property line noise limits.	Potentially Applicable	
Nassau County Fire Commission			Establishes requirement for fire alarms and sprinkler Systems.	Potentially Applicable	For systems required in treatment buildings.
STATE ACTION-SPECIFIC SCGs					
	Transportation of Hazardous Materials	6 NYCRR 364	Regulates transportation of hazardous materials.	Potentially Applicable	Relevant to off-site transport of remediation derived wastes
New York State Vehicle and Traffic Law, Article 386; Environmental Conservation Law Articles 3 and 19.	Noise from Heavy Motor Vehicles	6 NYCRR 450	Defines maximum acceptable noise levels.	Potentially Applicable	Marginally applicable; appears to apply to over-the-road vehicles, not construction equipment.
Environmental Conservation law, Articles 3, 15, 17, 19 and 70; Administrative Procedures Act, Article 301	Uniform Procedures	6 NYCRR 621	Establishes the procedures used in the processing of applications for permits.	Applicable	
Environmental Conservation Law, Articles 3, 15, and 17	New York State Pollution Discharge Elimination System	6 NYCRR 750 - 758	Establishes permit requirements for point source discharges into state waters.	Potentially Applicable	Supercedes need to obtain NPDES permits since New York has an approved SPDES program. New York SPDES program does not require a permit for discharge o uncontrolled stormwater runoff as per 6 NYCRR 751.3(a)(7). Discharge to municipal sewers appears to be under local jurisdiction.
Environmental Conservation Law, Articles 3 and 19.	Prevention and Control of Air Contaminants and Air Pollution	6 NYCRR 200 - 202	Establishes general provisions and requires construction and operation permits for emission of air pollutants.	Potentially Applicable	Identifies NYC Metropolitan Area as non-attainment area for ozone; Nassau County as non-attainment area for CO.
Environmental Conservation Law, Article 15; also Public Health Law Articles 1271 and 1276 (Part 288 only)	Air Quality Classifications and Standards	6 NYCRR 256, 257, and 288	Establishes air quality classification system and air quality standards for various pollutants including particulates and non-methane hydrocarbons.	Potentially Applicable	
Environmental Conservation Law, Articles 3, 19, 23, 27, and 70	Hazardous Waste Management System General	6 NYCRR 370	Provides definition of terms and general standards applicable to 6 NYCRR 370 - 374, 376.	Potentially Applicable	
	Identification and Listing of Hazardous Waste	6 NYCRR 371	Identifies characteristic hazardous waste and lists specific wastes.	Potentially Applicable	
	Hazardous Waste Manifest System and Related Standards	6 NYCRR 372	Establishes manifest system and recordkeeping standards for generators and transporters of hazardous waste and for treatment, storage, and disposal facilities.	Potentially Applicable	Relevant to transportation and off-site treatment of hazardous waste
	Hazardous Waste Treatment, Storage, and Disposal Facility Permitting Requirements	6 NYCRR 373	Regulates treatment, storage, and disposal of hazardous waste.	Potentially Applicable	Relevant to off-site treatment/disposal of hazardous waste
	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities	6 NYCRR 374	Subpart 374-1 establishes standards for the management of specific hazardous wastes. (Subpart 374-2 establishes standards for the management of used oil.)	Potentially Applicable	
Environmental Conservation Law, Articles 1, 3, 27, and 52; Administrative Procedures Act Articles 301 and 305.	Inactive Hazardous Waste Disposal Site	6 NYCRR 375	Identifies process for investigation and remedial action at state funded Registry site; provides exception from NYSDEC permits.	Potentially Applicable	

Table 2-3
Potentially Applicable SCGs
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

ACT/AUTHORITY	CRITERIA/ISSUES	CITATION	BRIEF DESCRIPTION	STATUS	COMMENTS
Environmental Conservation Law, Articles 3 and 27.	Land Disposal Restrictions	6 NYCRR 376	Identifies hazardous wastes which are restricted from land disposal. Defines treatment standards for hazardous waste.	Potentially Applicable	
Environmental Conservation Law, Articles 1, 3, 8, 19, 23, 27, 52, 54, and 70.	Solid Waste Management Facilities	6 NYCRR 360	360-1: General provisions; includes identification of "beneficial use" potentially applicable to non-hazardous oily waste/soil (360-1.15). 360-2: Regulates construction and operation of landfills, including construction & demolition (C&D) debris landfills	Potentially Applicable	May be applicable for establishing off-site treatment and disposal options for excavated contaminated non-hazardous soil and debris.
New York State Department of Transportation	Permit to Work Within DOT Right-of-Ways		Outlines procedures for construction-related street closure or work within state highways or rights-of-way.	Potentially Applicable	Hempstead Turnpike is a state road.
FEDERAL ACTION-SPECIFIC SCGs					
Comprehensive Environmental Response, Compensation, and Liability Act of 1980 and Superfund Amendments and Reauthorization Act of 1986 (SARA)	National Contingency Plan	40 CFR 300, Subpart E	Outlines procedures for remedial actions and for planning and implementing off-site removal actions.	Potentially Applicable	
Occupational Safety and Health Act	Worker Protection	29 CFR 1904, 1910, and 1926	Specifies minimum requirements to maintain worker health and safety during hazardous waste operations. Includes training requirements and construction safety requirements.	Potentially Applicable	Under 40 CFR 300.38, requirements of OSHA apply to all activities which fall under jurisdiction of the National Contingency Plan.
Executive Order	Delegation of Authority	Executive Order 12316 and Coordination with Other Agencies	Delegates authority over remedial actions to Federal Agencies		
Clean Water Act	National Pollution Discharge Elimination System (NPDES)	40 CFR 122 and 125	Issues permits for discharge into navigable waters. Establishes criteria and standards for imposing treatment requirements on permits.	Potentially Applicable	New York SPDES program incorporates the NPDES program by reference.
Safe Drinking Water Act	Underground Injection Control Program	40 CFR 144	Establishes performance standards, well requirements, and permitting requirements for groundwater re-injection wells.	Potentially Applicable	Potentially applicable for remedial alternatives utilizing Fenton's reagent chemistry in which non-hazardous reagents are introduced to the subsurface via injection wells.
	Underground Injection Control Program: Technical Criteria and Standards	40 CFR 146	Establishes technical criteria and standards that must be met in groundwater re-injection permits for Class V wells. Class V wells include wells used in experimental technologies.	Potentially Applicable	
Clean Air Act	National Primary and Secondary Ambient Air Quality Standards	40 CFR 50	Establishes emission limits for six pollutants (SO_2, PM_{10}, CO, O_3, NO_2, and Pb).	Potentially Applicable	
	National Emission Standards for Hazardous Air Pollutants	40 CFR 61	Provides emission standards for 8 contaminants. Identifies 25 additional contaminants, including PCE and TCE, as having serious health effects but does not provide emission standards for these contaminants.	Potentially Applicable	
Resource Conservation and Recovery Act	Criteria for Municipal Solid Waste Landfills	40 CFR 258	Establishes minimum national criteria for management of non-hazardous waste.	Potentially Applicable	Applicable for remedial alternatives which involve generation of non-hazardous waste. Non-hazardous waste must be hauled and disposed of in accordance with RCRA.

Table 2-3
Potentially Applicable SCGs
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

ACT/AUTHORITY	CRITERIA/ISSUES	CITATION	BRIEF DESCRIPTION	STATUS	COMMENTS
	Hazardous Waste Management System General	40 CFR 260	Provides definition of terms and general standards applicable to 40 CFR 260 - 265, 268.	Potentially Applicable	Applicable for remedial alternatives which involve generation of a hazardous waste (*e.g.*, contaminated soil). Hazardous waste must be handled and disposed of in accordance with RCRA.
	Identification and Listing of Hazardous Waste	40 CFR 261	Identifies solid wastes which are subject to regulation as hazardous wastes.	Potentially Applicable	
	Standards Applicable to Generators of Hazardous Waste	40 CFR 262	Establishes requirements (e.g., EPA ID numbers and manifests) for generators of hazardous waste.	Potentially Applicable	
	Standards Applicable to Transporters of Hazardous Waste	40 CFR 263	Establishes standards which apply to persons transporting manifested hazardous waste within the United States.	Potentially Applicable	
	Standards Applicable to Owners and Operators of Treatment, Storage, and Disposal Facilities	40 CFR 264	Establishes the minimum national standards which define acceptable management of hazardous waste.	Potentially Applicable	
	Standards for owners of hazardous waste facilities	40 CFR 265	Establishes interim status standards for owners and operators of hazardous waste treatment, storage and disposal facilities.	Potentially Applicable	
	Land Disposal Restrictions	40 CFR 268	Identifies hazardous wastes which are restricted from land disposal.	Potentially Applicable	
	Hazardous Waste Permit Program	40 CFR 270, 124	USEPA administers hazardous waste permit program for CERCLA/Superfund Sites. Covers basic permitting, application, monitoring, and reporting requirements for off-site hazardous waste management facilities.	Potentially Applicable	

Note: No location specific SCGs identified.

Table 2-4
Contaminants of Concern and SCG Goals - Subsurface Soil
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

Parameter	Minimum	Maximum	Selected SCG Goal	Number of Samples Exceeding	Number of Samples Tested
Volatile Organics (ug/kg)					
Methylene Chloride	1	2	100	0	28
Acetone	7	8	200	0	28
Total Dichloroethene	one value detected	190	300	0	28
2-Butanone	4	12	300	0	28
Trichloroethene	1	220	700	0	28
Tetrachloroethene	1	130,000,000	1,400	5	28
Toluene	two values detected	2	1,500	0	28
Semi-volatile Organics (ug/kg)					
Phenanthrene	one value detected	430	50,000	0	2
Anthracene	one value detected	62	50,000	0	2
Carbazole	one value detected	45	32,000	0	2
Fluoranthene	one value detected	570	50,000	0	2
Pyrene	one value detected	630	50,000	0	2
Butylbenzylphthalate	one value detected	40	50,000	0	2
Benzo (a) Anthracene	one value detected	270	224 or MDL	1	2
Chrysene	one value detected	320	400	0	2
Bis (2-Ethylhexyl) Phthalate	one value detected	320	46,000	0	2
Benzo (b) Fluoranthene	one value detected	480	900	0	2
Benzo (k) Fluoranthene	one value detected	450	1,100	0	2
Benzo (a) Pyrene	one value detected	300	61 or MDL	1	2
Indeno (1,2,3-cd) Pyrene	one value detected	140	900	0	2
Benzo(g,h,i) Perylene	one value detected	130	50,000	0	2
Metals (mg/kg)					
Aluminum	76.7	16,200	SB	0	27
Arsenic	0.73	12.5	0.4	13	27
Barium	2.3	164	300 or SB	0	27
Beryllium	0.11	0.56	0.15	7	27
Cadmium	0.09	2.2	1 or SB	1	27
Calcium	29	5,380	SB	0	27
Chromium	1.3	32.3	10 or SB	5	27
Cobalt	0.2	15	30 or SB	0	27
Copper	1.5	268	25 or SB	2	27
Iron	1,680	19,800	2,000 or SB	24	27
Lead	0.91	94.6	400	0	27
Magnesium	14.8	3,000	SB	0	27
Manganese	3.6	282	11,000	0	27
Mercury	0.05	4	0.1	2	27
Nickel	0.59	20.9	13 or SB	1	27
Potassium	22	538	SB	0	27
Selenium	0.72	1.8	2 or SB	0	27
Silver	0.26	22.9	390	0	27
Sodium	109	711	SB	0	27
Vanadium	1.3	28.5	150 or SB	0	27
Zinc	1.6	197	20 or SB	7	27

Notes:

1) See Table 2-1 for derivation of proposed SCG goals.
2) The range of concentrations shown represents the maximum and minimum for those samples in which the contaminant was detected and the concentration quantified after validation. Samples with "non-detect" results were not considered in the range.
3) "Number of Samples Exceeding" denotes the number of samples tested that exceed the select SCG goal.
4) NV = No Value.
5) Eastern USA background concentrations for metals are included in Table 1-4.

Table 2-5
Contaminants of Concern and SCG Goals - Overburden Groundwater
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

Parameter	Minimum	Maximum	Selected SCG SCG Goal	Number of Samples Exceeding	Number of Samples Tested
Volatile Organics (ug/l)					
Methylene chloride	one value detected	1	5	0	15
Acetone	one value detected	6	50	0	15
1, 2 -Dichloropropane	one value detected	1	5	0	15
Trichloroethene (TCE)	1	230	5	1	15
Dibromochloromethane	one value detected	2	50	0	15
1,1,2-Trichloroethane	one value detected	3	1	1	15
Bromoform	one value detected	6	50	0	15
Tetrachloroethene	2	16,000	5	10	15
1,1,2,2-Tetrachloroethane	one value detected	11	5	1	15
Toluene	2	18	5	1	15
Xylene (total)	one value detected	1	5	0	15
Total DCE	one value detected	140	5	4	15
Metals (ug/l)					
Arsenic	3.9	15.5	25	0	8
Barium	71.1	152	1,000	0	8
Chromium	1.4	31.5	50	0	8
Lead (Total) (see note 4)	1.8	32.6	15	2	8
Mercury	0.15	0.3	0.7	0	8
Selenium	one value detected	7	10	0	8

Notes:

1) See Table 2-2 for derivation of proposed SCG goals. This table lists those analytical parameters that were detected in collected on-Site groundwater samples.
2) The range of concentrations shown represents the maximum and minimum for those samples in which the contaminant was detected and the concentration quantified after validation. Samples with "non-detect" results were not considered in the range.
3) "Number of Samples Exceeding" denotes the number of samples tested that exceed the select SCG goal.
4) Based on result of filtered lead analysis (vs. total lead), the lead detections may be a result of the high turbidity of the groundwater samples.

Table 3-1
Summary of Remedial Action Alternatives
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

Proposed Remedial Actions (1)	Alternative No. 1: No Action with Annual Groundwater Monitoring	Alternative No. 2: Groundwater Extraction and Treatment and Soil Vapor Extraction	Alternative No. 3: In-Situ Air Sparging and Soil Vapor Extraction	Alternative No. 4: In-Situ Chemical Oxidation, Soil Vapor Extraction and Groundwater Extraction and Treatment
GROUNDWATER:				
Annual Groundwater Monitoring	X	X	X	X
Groundwater Extraction Well(s)		X		X
Ex-Situ Groundwater Treatment		X		X
In-Situ Air Sparging			X	
In-Situ Chemical Oxidation (e.g., Fenton's Reagent, Potassium Permanganate)				X
SOIL:				
Soil Vapor Extraction and Treatment		X	X	X
Cesspools Abandonment/Closure		X	X	X
Asphalt Pavement Cover		X	X	X
In-Situ Chemical Oxidation (e.g., Fenton's Reagent, Potassium Permanganate)				X

Notes:
(1) Refer to Section 3.0 for detailed descriptions of remedial action alternatives.

Table 4-1A
Detailed Analysis of Remedial Action Alternatives
Alternative No. 1: No Action with Annual Groundwater Monitoring

American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

Evaluation Criteria	Detailed Analysis
Short-Term Impacts and Effectiveness	**Short-Term Impacts:** - No short-term impacts (other than those existing) are anticipated since there are no construction activities involved, only sampling. **Effectiveness:** - Alternative does not involve source removal or treatment; will not meet the remedial action objectives in a reasonable or predictable timeframe.
Long-Term Effectiveness and Permanence	**Groundwater and Soil:** - Risks involved with the migration of contaminants and direct contact with contaminants would remain essentially the same. - Not expected to provide long-term protection to human health and the environment.
Reduction of Toxicity, Mobility and Volume	- Does not involve the removal or treatment of the source of Site contamination. - Neither the toxicity, mobility, nor volume of contamination is expected to be reduced significantly, nor within a reasonable amount of time.
Implementability	- Readily implementable on a technical basis. - Potential administrative difficulties.
Compliance with Applicable or Relevant and Appropriate SCGs and Remediation Goals	- Will not comply with the chemical-specific SCGs for the Site. - No location-specific SCGs were identified. - Action-specific SCGs would be met.
Overall Protection of Human Health and the Environment	- Not protective of human health and the environment.

Table 4-1A
Detailed Analysis of Remedial Action Alternatives
Alternative No. 1: No Action with Annual Groundwater Monitoring
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

Evaluation Criteria	Detailed Analysis
Cost	- Capital Costs: $ 0 - Total Present Worth of O&M Costs: $ 92,000 - Total Net Present Worth: $ 92,000

NOTE: This table summarizes the detailed analysis as presented in Section 4.0.
See Section 4.0 for additional details and definitions of criteria. See Section 3.0 for the development of remedial action alternatives.

Table 4-1B
Detailed Analysis of Remedial Action Alternatives
Alternative No. 2: Groundwater Extraction and Treatment and Soil Vapor Extraction
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

Evaluation Criteria	Detailed Analysis
Short-Term Impacts and Effectiveness	**Short-Term Impacts:** - There is potential for on-Site impacts to human health. - Disruptions to current operations at the Site property and adjacent properties (Franks Nursery and Crafts and Discount Beverage Center) are expected to occur. **Effectiveness:** - Human health and the environment (in terms of affecting habitat or vegetation) would be protected under this alternative. - Expected to meet the remedial action objectives for the unsaturated on-Site soil within ten years. These objectives may not be met throughout the Site due to potential residual DNAPL. - Not expected to meet the groundwater remedial action objective on Site, between the cesspool source area and downgradient property boundary, unless the DNAPL mass is significantly reduced. Groundwater extraction may be required beyond a 30-year timeframe. Does provide on-Site containment of contaminated groundwater.
Long-Term Effectiveness and Permanence	- Considered an adequate, reliable and permanent remedy for unsaturated soil; would reduce risks involved with the migration of contaminants and direct contact with soil contaminants. - Long-term groundwater extraction would be required due to the presence of DNAPL in saturated soil at the cesspool source area. Considered an adequate and reliable remedy for mitigating human health and environmental impacts due to groundwater. - The aquifer in the cesspool source area will remain impacted for an indefinite period of time (as long as DNAPL in saturated soil is present). This alternative is not likely a permanent groundwater remedy.
Reduction of Toxicity, Mobility and Volume	- Involves the removal and treatment of unsaturated zone sources of Site contaminants through the use of a soil vapor extraction system, which will significantly reduce the toxicity, mobility, and volume of contaminants. - The toxicity, mobility, and volume of on-Site groundwater contamination is also expected to be significantly reduced through the use of groundwater extraction wells and subsequent groundwater treatment.

Table 4-1B
Detailed Analysis of Remedial Action Alternatives
Alternative No. 2: Groundwater Extraction and Treatment and Soil Vapor Extraction
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

Evaluation Criteria	Detailed Analysis
Implementability	- Readily implementable on a technical basis because construction and installation of the groundwater extraction/treatment and soil vapor extraction systems involve standard construction methods and equipment. Materials and services necessary for construction are readily available. - Readily implementable on an administrative basis because there are no anticipated specific problems associated with obtaining permits and approvals. - Disruption of current Site operations is expected to be a concern. - Institutional controls would be required.
Compliance with Applicable or Relevant and Appropriate SCGs and Remediation Goals	- Expected to meet the chemical-specific SCGs for the majority of Site unsaturated soils within ten years. - May meet the chemical-specific SCGs for on-Site groundwater within a 30-year timeframe for the majority of Site areas, but may be limited by effectiveness at remediating DNAPL in the saturated soils. - The DNAPL source area may not be completely remediated and may not meet the SCGs in a reasonable and predictable timeframe. - No location-specific SCGs were identified. - Action-specific SCGs would be met during construction activities.
Overall Protection of Human Health and the Environment	- This alternative is considered to be protective of human health and the environment (in terms of affecting habitat or vegetation). Would result in remediation of unsaturated soils and groundwater.
Cost	Alternative No. 2 - Capital Costs: $ 887,000 - Total Present Worth of O&M Costs: $ 2,334,000 - Total Net Present Worth: $ 3,221,000

NOTE: This table summarizes the detailed analysis as presented in Section 4.0.
See Section 4.0 for additional details and definitions of criteria. See Section 3.0 for the development of remedial action alternatives.

Table 4-1C
Detailed Analysis of Remedial Action Alternatives
Alternative No. 3: In-Situ Air Sparging and Soil Vapor Extraction
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

Evaluation Criteria	Detailed Analysis
Short-Term Impacts and Effectiveness	**Short-Term Impacts:** - There is potential for on-Site impacts to human health. - Disruptions to current operations at the Site property and adjacent properties (Franks Nursery and Crafts and Discount Beverage Center) are expected to occur. **Effectiveness:** - Human health and the environment (in terms of affecting habitat or vegetation) would be protected for on-Site unsaturated soil. - Expected to meet the remedial action objectives for the unsaturated on-Site soil within ten years. These objectives may not be met throughout the Site due to potential residual DNAPL. - Human health and the environment (in terms of affecting habitat or vegetation) would not be protected for groundwater contamination under this alternative. Not expected to reduce concentrations to the remedial action objectives between the cesspool source area and the downgradient property line within a 30-year timeframe. Does not provide on-Site containment of contaminated groundwater.
Long-Term Effectiveness and Permanence	- Considered an adequate, reliable and permanent remedy for unsaturated soil; would reduce risks involved with the migration of contaminants and direct contact with soil contaminants. - This alternative is not considered an adequate, reliable, or permanent remedy for mitigating human health and environmental impacts (in terms of affecting habitat or vegetation) due to groundwater. - The aquifer will remain impacted for an indefinite period of time.
Reduction of Toxicity, Mobility and Volume	- Involves the removal and treatment of unsaturated zone sources of Site contaminants through the use of a soil vapor extraction system, which will significantly reduce the toxicity, mobility, and volume of contaminants. - The toxicity, mobility, and volume of on-Site groundwater contamination will not be significantly reduced by this alternative; sparging will reduce the PCE concentrations in groundwater at the downgradient property line, but not to the groundwater standard.

Table 4-1C
Detailed Analysis of Remedial Action Alternatives
Alternative No. 3: In-Situ Air Sparging and Soil Vapor Extraction
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

Evaluation Criteria	Detailed Analysis
Implementability	- Readily implementable on a technical basis because construction and installation of the air sparging and soil vapor extraction systems involve standard construction methods and equipment. Materials and services necessary for construction are readily available. - Readily implementable on an administrative basis because there are no anticipated specific problems associated with obtaining permits and approvals. - Disruption of current Site operations is expected to be a concern. - Institutional controls would be required.
Compliance with Applicable or Relevant and Appropriate SCGs and Remediation Goals	- Expected to meet the chemical-specific SCGs for the majority of Site unsaturated soils within ten years. - Not expected to meet the chemical-specific SCGs for groundwater within a 30-year timeframe, as heterogeneities may limit the effectiveness of sparging. Sparging will reduce the PCE concentrations in groundwater at the downgradient property line but the groundwater standard is not expected to be met. - No location-specific SCGs were identified. - Action-specific SCGs would be met during construction activities.
Overall Protection of Human Health and the Environment	- This alternative is considered to be protective of human health and the environment (in terms of affecting habitat or vegetation) for remediation of the unsaturated soils, but not for groundwater. - Therefore, this alternative is not considered to be protective of human health and the environment.
Cost	Alternative No. 3 - Capital Costs: $ 791,000 - Total Present Worth of O&M Costs: $ 1,745,000 - Total Net Present Worth: $ 2,536,000

NOTE: This table summarizes the detailed analysis as presented in Section 4.0.
See Section 4.0 for additional details and definitions of criteria. See Section 3.0 for the development of remedial action alternatives.

Table 4-1D
Detailed Analysis of Remedial Action Alternatives
Alternative No. 4: In-Situ Chemical Oxidation, Soil Vapor Extraction and Groundwater Extraction and Treatment
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

Evaluation Criteria	Detailed Analysis
Short-Term Impacts and Effectiveness	**Short-Term Impacts:** - There is potential for on-Site impacts to human health. - Disruptions to current operations at the Site property and adjacent properties (Franks Nursery and Crafts and Discount Beverage Center) are expected to occur. **Effectiveness:** - Human health and the environment (in terms of affecting habitat or vegetation) would be protected under this alternative. - Expected to meet the remedial action objectives for the unsaturated on-Site soil within ten years. These objectives may not be met throughout the Site due to potential residual DNAPL. - The DNAPL area will be aggressively treated using Fenton's Reagent (in a phased approach). Depending upon the results of the Fenton's Reagent pilot study and full scale application, it may be possible to meet the remedial action objective for groundwater. - Does provide on-Site containment of contaminated groundwater. - For the purposes of this FFS, it is assumed that Fenton's will reduce the mass of subsurface PCE in saturated and unsaturated soils and groundwater, and PCE DNAPL, such that on-Site groundwater extraction and treatment is required for 10 years.
Long-Term Effectiveness and Permanence	- Considered an adequate, reliable and permanent remedy for unsaturated soil; would reduce risks involved with the migration of contaminants and direct contact with soil contaminants. - Considered an adequate and reliable remedy for mitigating human health and environmental impacts in terms of affecting habitat or vegetation) due to groundwater. - The aquifer proximate to the cesspool area may remain impacted for an indefinite period of time (due to the presence of DNAPL). However, for the purposes of this FFS, Fenton's is assumed to be effective at reducing the subsurface PCE DNAPL mass, such that groundwater extraction and treatment are not required on a long-term basis, rather for ten years.

Table 4-1D
Detailed Analysis of Remedial Action Alternatives
Alternative No. 4: In-Situ Chemical Oxidation, Soil Vapor Extraction and Groundwater Extraction and Treatment
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

Evaluation Criteria	Detailed Analysis
Reduction of Toxicity, Mobility and Volume	- Involves the removal and treatment of the unsaturated zone sources of Site contaminants through the use of a soil vapor extraction system and Fenton's Reagent, which are expected to significantly reduce the toxicity, mobility, and volume of the contaminants. - Fenton's Reagent will reduce the mass of the DNAPL source in saturated soils. The amount of reduction is unknown, but is expected to be more effective than extraction wells alone. Significant residual DNAPL is possible beyond the 30-year timeframe under consideration. However, for the purposes of this FFS, Fenton's is assumed to be effective such that groundwater extraction and treatment is required for ten years.
Implementability	- Readily implementable on a technical basis because construction and installation of the groundwater extraction/treatment and soil vapor extraction systems involve standard construction methods and equipment. Materials and services necessary for construction are readily available. - Materials and services for operation and maintenance of the system are also readily available. - Fenton's Reagent (Isotec) is a proprietary process and obtaining competitive bids will be limited. - This alternative is readily implementable on an administrative basis because there are no anticipated specific problems associated with obtaining permits and approvals. - Disruption of current Site operations is expected to be a concern. - Institutional controls would be required.

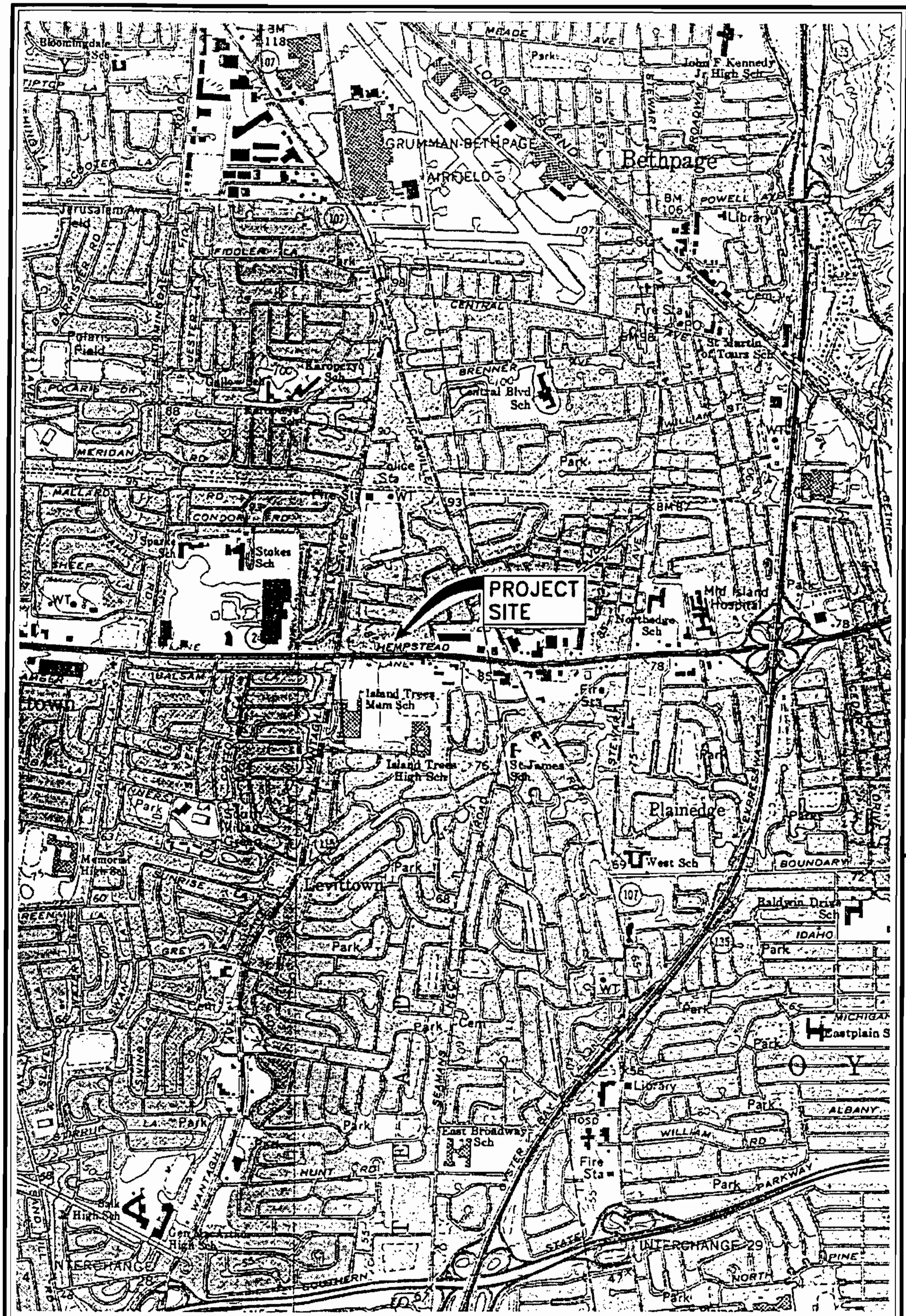
Table 4-1D
Detailed Analysis of Remedial Action Alternatives
Alternative No. 4: In-Situ Chemical Oxidation, Soil Vapor Extraction and Groundwater Extraction and Treatment
American Drive-In Cleaners
On-Site Focused Feasibility Study
Site No. 1-30-049
Levittown, New York

Evaluation Criteria	Detailed Analysis
Compliance with Applicable or Relevant and Appropriate SCGs and Remediation Goals	- Expected to meet the chemical-specific SCGs for the majority of Site unsaturated soils within ten years. - Expected to meet the chemical-specific SCGs for groundwater within a 30-year timeframe. Similar to soil remediation, may be limited by effectiveness at remediating DNAPL in the saturated soils to meet PCE SCGs in some Site areas. - PCE product (DNAPL) and PCE absorbed to soil (in the cesspool source area) are not likely to be completely remediated; however, for the purposes of this FFS, it is assumed that Fenton's is assumed to be effective such that groundwater extraction and treatment is required for ten years. Remaining contamination may be able to be addressed as part of the Off-Site FS studies. - No location-specific SCGs were identified. - Action-specific SCGs would be met during construction activities.
Overall Protection of Human Health and the Environment	- This alternative is considered to be protective of human health and the environment (in terms of affecting habitat or vegetation). Would result in remediation of unsaturated soils and groundwater. - This alternative for groundwater remediation is considered to be protective of human health, since groundwater will be contained on Site.
Cost	Alternative No. 4 - Capital Costs: $ 1,484,000 - Total Present Worth of O&M Costs: $ 1,237,000 - Total Net Present Worth: $ 2,721,000

NOTE: This table summarizes the detailed analysis as presented in Section 4.0.
See Section 4.0 for additional details and definitions of criteria. See Section 3.0 for the development of remedial action alternatives.

FIGURES

FIGURES



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SCALE IN FEET

0 1000 2000 4000

AMERICAN DRIVE-IN CLEANERS

LEVITTOWN, NEW YORK

ON-SITE FOCUSED FEASIBILITY STUDY

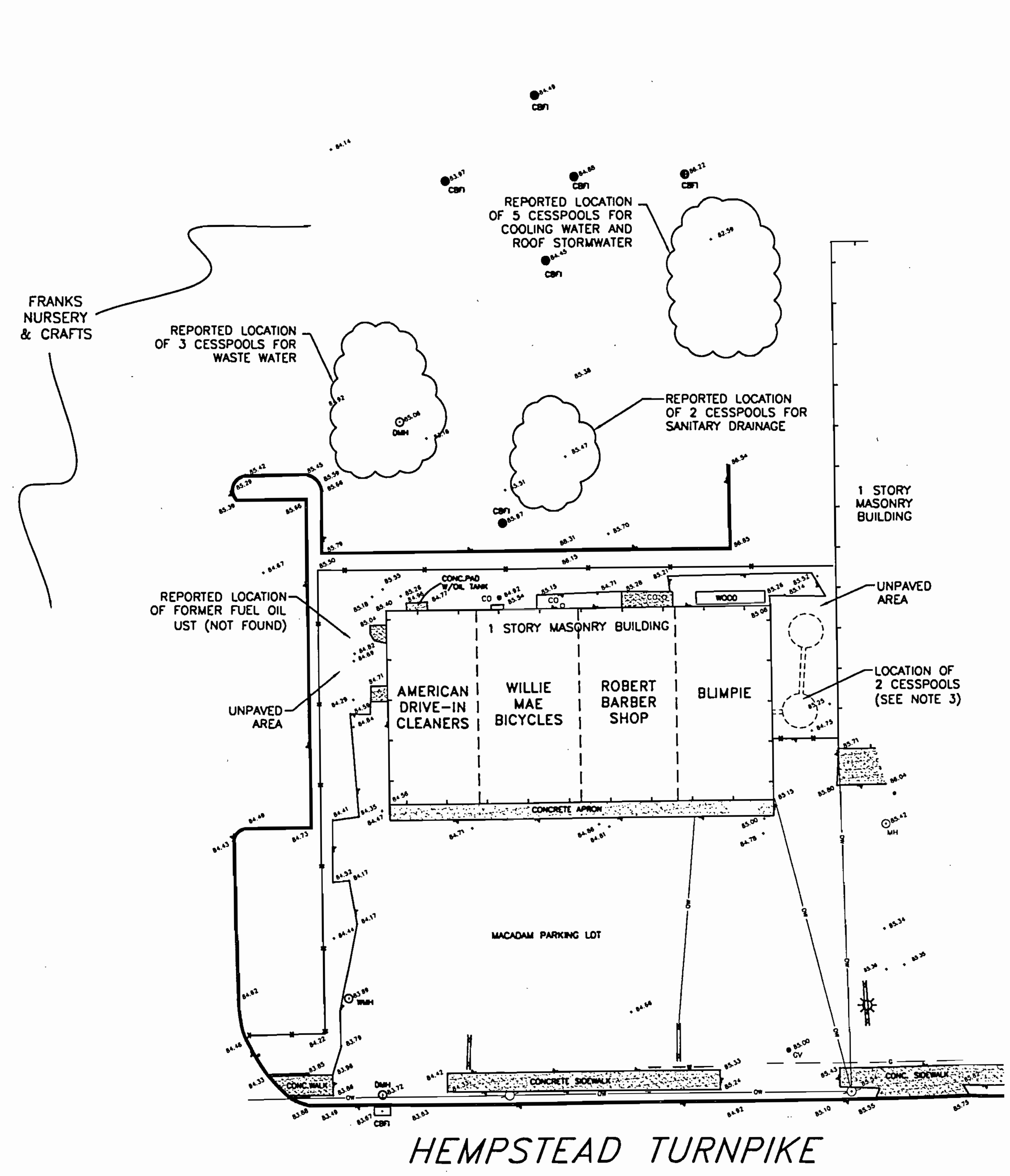
LOCUS PLAN

PROJECT No.
55172

FIGURE No.
1-1

NOTE:

BASE MAP ADAPTED FROM
U.S.G.S. QUADRANGLE MAPS
FREEPORT, N.Y. – 1969 &
AMITYVILLE, N.Y. – 1969.



N

LEGEND:

—▸—	MACADAM
━━	CURB
━━	DROP CURB
▨	CONCRETE
—x—	FENCE
•	BOLLARD
═	SIGN
☼	LIGHT POLE
⌀	UTILITY POLE
—OW—	OVERHEAD WIRES
MH ○	MANHOLE
CO ○	CLEANOUT
CBFI ●	CATCH BASIN FIELD INLET
DMH ○	DRAINAGE MANHOLE
—G—	GAS PAINT MARK
CV ○	GAS VALVE
WMH ○	WATER MANHOLE
—W—	WATER PAINT MARK
84.36	SPOT ELEVATION

NOTES:

1. BASE MAP ADAPTED FROM A PLAN ENTITLED, "AMERICAN DRIVE-IN CLEANERS; LEVITTOWN, LONG ISLAND, NASSAU COUNTY, NEW YORK", PREPARED BY YEC, INC, DATED MAY 1998.
2. THE SIZE AND LOCATION OF EXISTING SITE FEATURES SHOULD BE CONSIDERED APPROXIMATE.
3. THE TWO CESSPOOLS IDENTIFIED IN THE EASTERN PORTION OF THE SITE WERE OBSERVED WITH A DRAIN PIPE LEADING FROM THE SITE BUILDING AS SHOWN. THE ORIGIN OF THE PIPE IS UNKNOWN (i.e., FLOOR DRAIN, ROOF DRAIN, SANITARY, etc.).

REV No.	DESCRIPTION	BY	DATE

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DATE: FEBRUARY 2001

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SCALE IN FEET
0 15 30 60

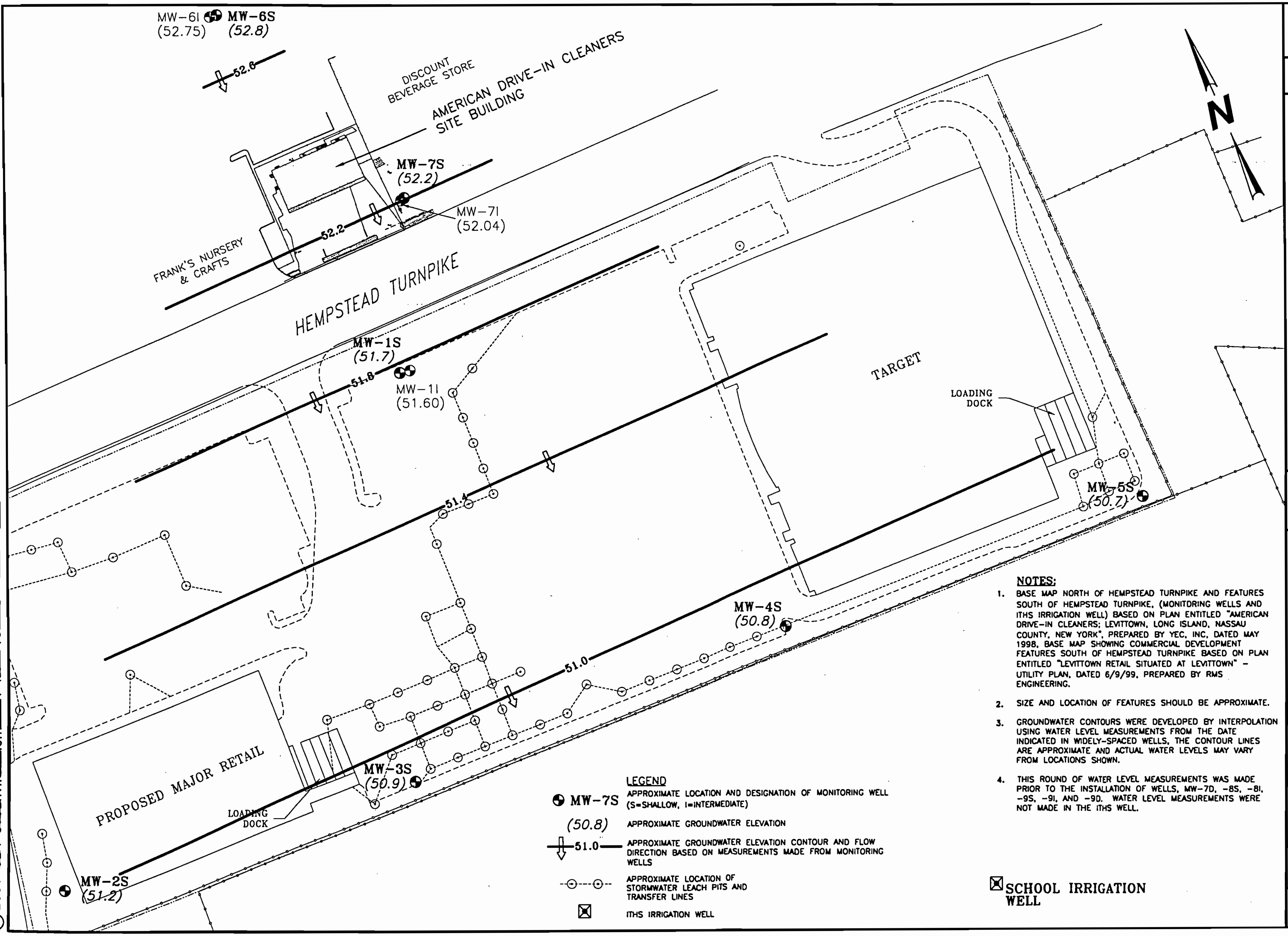
AMERICAN DRIVE-IN CLEANERS
LEVITTOWN, NEW YORK

ON-SITE FOCUSED FEASIBILITY STUDY

SITE PLAN

PROJECT No.
55172

FIGURE No.
1-2



LEGEND

● MW-7S	APPROXIMATE LOCATION AND DESIGNATION OF MONITORING WELL (S=SHALLOW, I=INTERMEDIATE)
(50.8)	APPROXIMATE GROUNDWATER ELEVATION
⇩ 51.0	APPROXIMATE GROUNDWATER ELEVATION CONTOUR AND FLOW DIRECTION BASED ON MEASUREMENTS MADE FROM MONITORING WELLS
--⊙--⊙--	APPROXIMATE LOCATION OF STORMWATER LEACH PITS AND TRANSFER LINES
☒	ITHS IRRIGATION WELL

☒ SCHOOL IRRIGATION WELL

NOTES:

1. BASE MAP NORTH OF HEMPSTEAD TURNPIKE AND FEATURES SOUTH OF HEMPSTEAD TURNPIKE, (MONITORING WELLS AND ITHS IRRIGATION WELL) BASED ON PLAN ENTITLED "AMERICAN DRIVE-IN CLEANERS; LEVITTOWN, LONG ISLAND, NASSAU COUNTY, NEW YORK", PREPARED BY YEC, INC, DATED MAY 1998, BASE MAP SHOWING COMMERCIAL DEVELOPMENT FEATURES SOUTH OF HEMPSTEAD TURNPIKE BASED ON PLAN ENTITLED "LEVITTOWN RETAIL SITUATED AT LEVITTOWN" – UTILITY PLAN, DATED 6/9/99, PREPARED BY RMS ENGINEERING.
2. SIZE AND LOCATION OF FEATURES SHOULD BE APPROXIMATE.
3. GROUNDWATER CONTOURS WERE DEVELOPED BY INTERPOLATION USING WATER LEVEL MEASUREMENTS FROM THE DATE INDICATED IN WIDELY-SPACED WELLS, THE CONTOUR LINES ARE APPROXIMATE AND ACTUAL WATER LEVELS MAY VARY FROM LOCATIONS SHOWN.
4. THIS ROUND OF WATER LEVEL MEASUREMENTS WAS MADE PRIOR TO THE INSTALLATION OF WELLS, MW-7D, -8S, -8I, -9S, -9I, AND -9D. WATER LEVEL MEASUREMENTS WERE NOT MADE IN THE ITHS WELL.

REV No.	DESCRIPTION	BY	DATE

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SCALE IN FEET
0 50 100 200

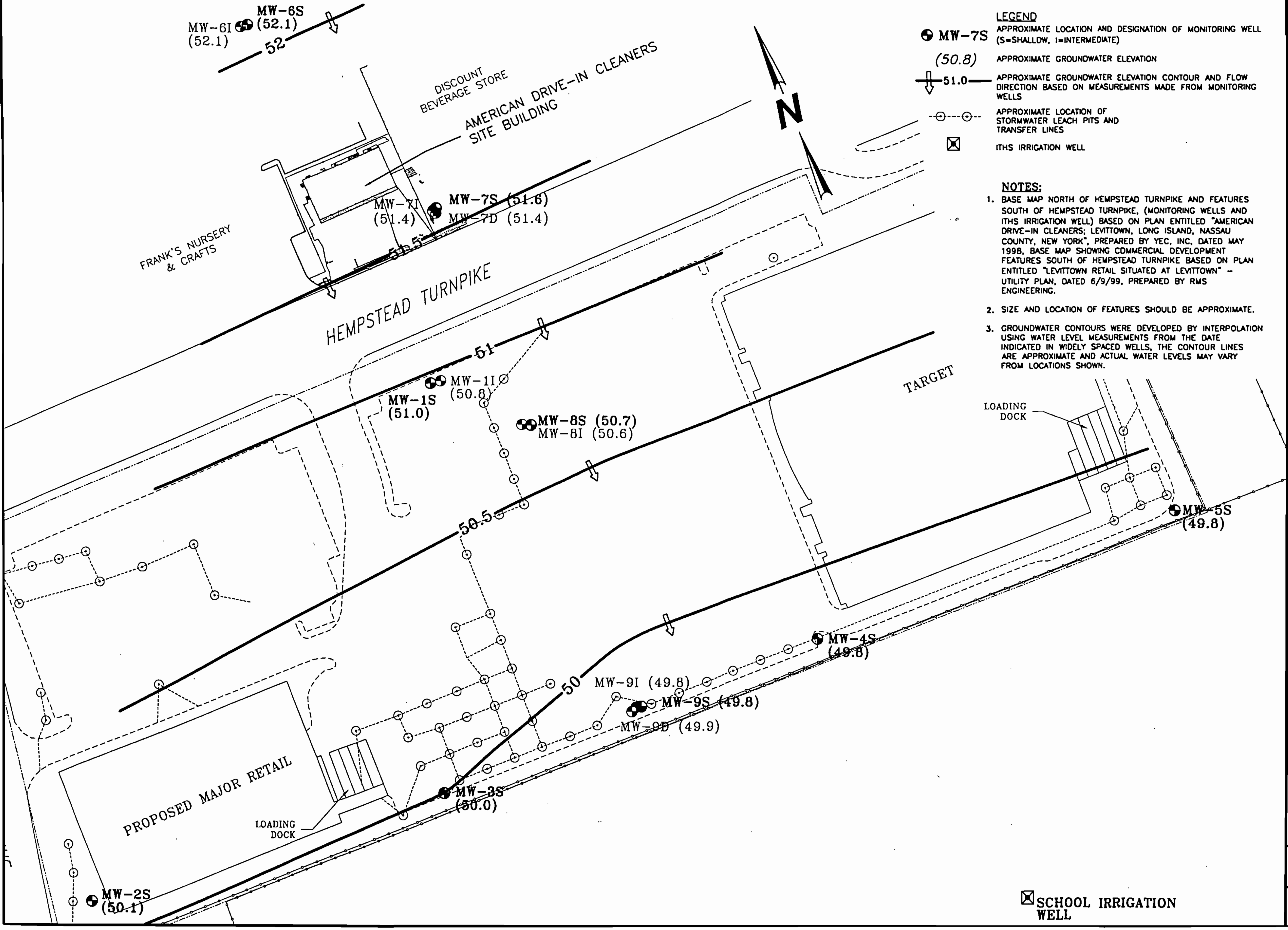
AMERICAN DRIVE-IN CLEANERS
LEVITTOWN, NEW YORK

ON-SITE FOCUSED FEASIBILITY STUDY

GROUNDWATER CONTOUR PLAN
SHALLOW MONITORING WELLS
(3/20/98)

PROJECT No.
55172

FIGURE No.
1-3



LEGEND

● MW-7S	APPROXIMATE LOCATION AND DESIGNATION OF MONITORING WELL (S=SHALLOW, I=INTERMEDIATE)
(50.8)	APPROXIMATE GROUNDWATER ELEVATION
⇩ 51.0	APPROXIMATE GROUNDWATER ELEVATION CONTOUR AND FLOW DIRECTION BASED ON MEASUREMENTS MADE FROM MONITORING WELLS
-⊙---⊙-	APPROXIMATE LOCATION OF STORMWATER LEACH PITS AND TRANSFER LINES
☒	ITHS IRRIGATION WELL

NOTES:

1. BASE MAP NORTH OF HEMPSTEAD TURNPIKE AND FEATURES SOUTH OF HEMPSTEAD TURNPIKE, (MONITORING WELLS AND ITHS IRRIGATION WELL) BASED ON PLAN ENTITLED "AMERICAN DRIVE-IN CLEANERS; LEVITTOWN, LONG ISLAND, NASSAU COUNTY, NEW YORK", PREPARED BY YEC, INC. DATED MAY 1998. BASE MAP SHOWING COMMERCIAL DEVELOPMENT FEATURES SOUTH OF HEMPSTEAD TURNPIKE BASED ON PLAN ENTITLED "LEVITTOWN RETAIL SITUATED AT LEVITTOWN" – UTILITY PLAN, DATED 6/9/99, PREPARED BY RMS ENGINEERING.
2. SIZE AND LOCATION OF FEATURES SHOULD BE APPROXIMATE.
3. GROUNDWATER CONTOURS WERE DEVELOPED BY INTERPOLATION USING WATER LEVEL MEASUREMENTS FROM THE DATE INDICATED IN WIDELY SPACED WELLS. THE CONTOUR LINES ARE APPROXIMATE AND ACTUAL WATER LEVELS MAY VARY FROM LOCATIONS SHOWN.

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DATE: FEBRUARY 2001

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SCALE IN FEET

0 50 100 200

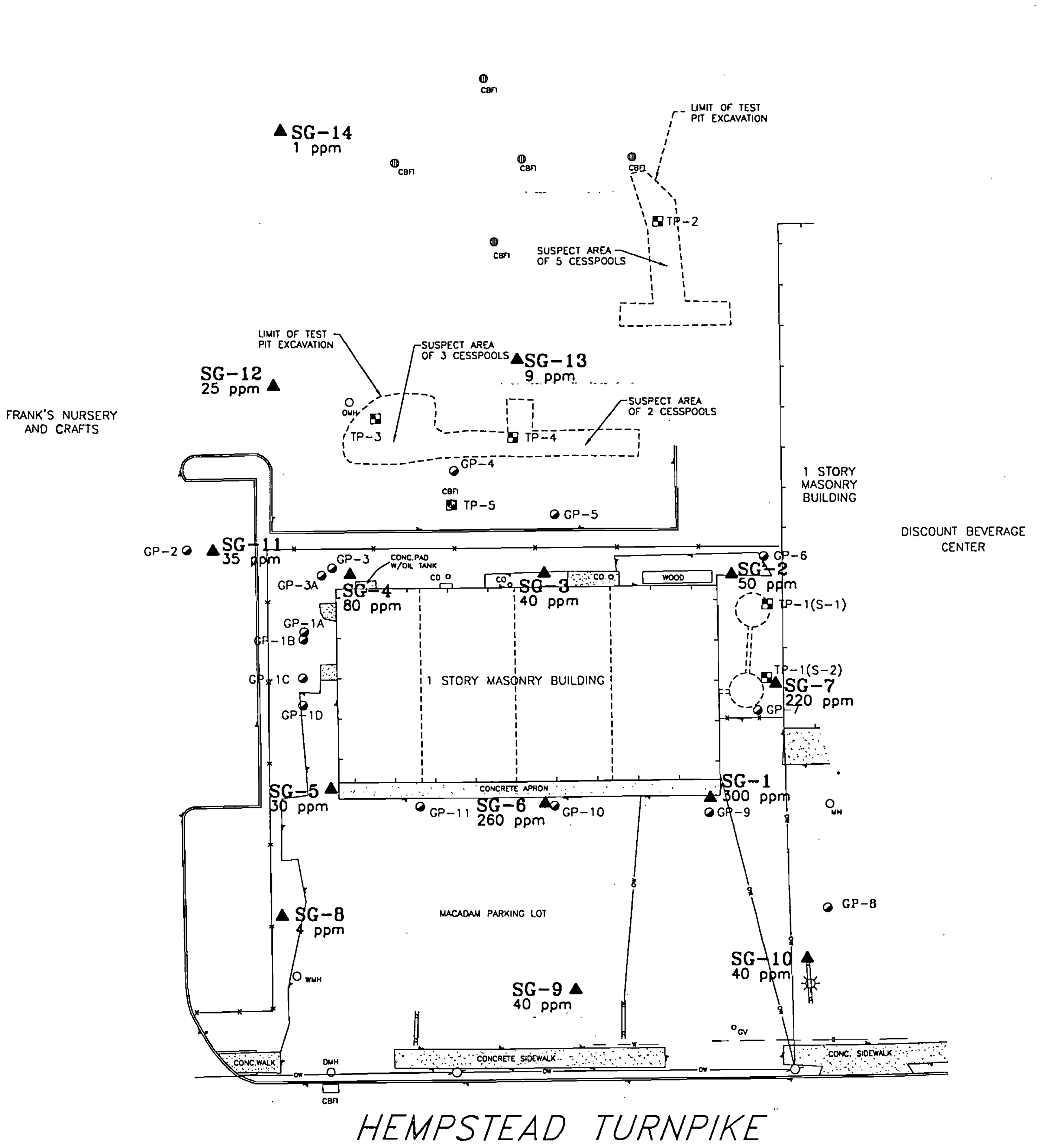
AMERICAN DRIVE-IN CLEANERS
LEVITTOWN, NEW YORK

ON-SITE FOCUSED FEASIBILITY STUDY

GROUNDWATER CONTOUR PLAN
SHALLOW MONITORING WELLS
(2/2/99)

PROJECT No.
55172

FIGURE No.
1-4



N

LEGEND:

——▸——	MACADAM
═══	CURB
━━━	DROP CURB
▨	CONCRETE
——×——	FENCE
•	BOLLARD
═══	SIGN
☼	LIGHT POLE
ø	UTILITY POLE
——OW——	OVERHEAD WIRES
MH ○	MANHOLE
CO ○	CLEANOUT
CBFI ⦶	CATCH BASIN FIELD INLET
DMH ○	DRAINAGE MANHOLE
——G——	GAS PAINT MARK
GV ○	GAS VALVE
WMH ○	WATER MANHOLE
——W——	WATER PAINT MARK
SG-10 ▲ 40 ppm	SOIL GAS PROBE LOCATION 40 ppm = TOTAL VOLATILE ORGANIC VAPOR IN PARTS PER MILLION
◐ GP-2	GEOPROBE SOIL BORING LOCATION
▨ TP-2	TEST PIT SAMPLE LOCATION
┌╌╌┐	LIMIT OF TEST PIT EXCAVATION

NOTES:

1. BASE MAP ADAPTED FROM A PLAN ENTITLED, "AMERICAN DRIVE-IN CLEANERS; LEVITTOWN, LONG ISLAND, NASSAU COUNTY, NEW YORK", PREPARED BY YEC, INC. DATED MAY 1998.
2. THE SIZE AND LOCATION OF EXISTING SITE FEATURES SHOULD BE CONSIDERED APPROXIMATE.
3. THE TWO CESSPOOLS IDENTIFIED IN THE EASTERN PORTION OF THE SITE WERE OBSERVED WITH A DRAIN PIPE LEADING FROM THE SITE BUILDING AS SHOWN. THE ORIGIN OF THE PIPE IS UNKNOWN (i.e., FLOOR DRAIN, ROOF DRAIN, SANITARY, etc.).

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SCALE IN FEET
0 15 30 60

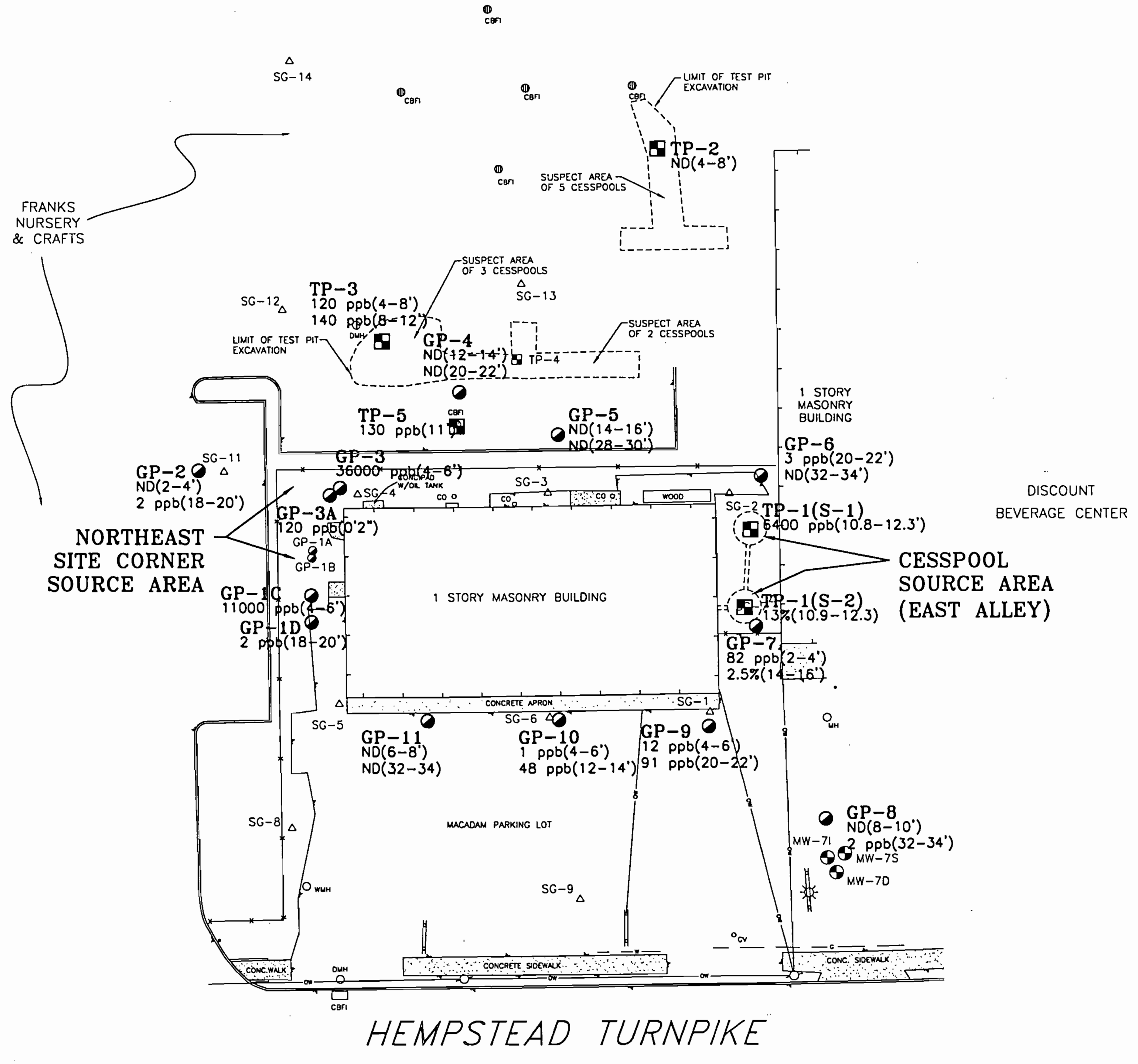
AMERICAN DRIVE-IN CLEANERS
LEVITTOWN, NEW YORK

ON-SITE FOCUSED FEASIBILITY STUDY

SOIL GAS RESULTS
(TOTAL ORGANIC VAPORS)

PROJECT No.
55172

FIGURE No.
1-5



LEGEND:

——▸——	MACADAM
═══	CURB
———	DROP CURB
▨	CONCRETE
——×——	FENCE
•	BOLLARD
═	SIGN
☼	LIGHT POLE
ø	UTILITY POLE
——OW——	OVERHEAD WIRES
MH ○	MANHOLE
CO ○	CLEANOUT
CBFI ◍	CATCH BASIN FIELD INLET
DMH ○	DRAINAGE MANHOLE
——G——	GAS PAINT MARK
GV ○	GAS VALVE
WMH ○	WATER MANHOLE
——W——	WATER PAINT MARK
SG-10 △	SOIL GAS PROBE LOCATION
◒ GP-10 1 ppm(4-6')	GEOPROBE SOIL BORING LOCATION 1 ppm = TOTAL VOLATILE ORGANIC VAPOR IN PARTS PER MILLION AND DEPTH
▚ TP-3 120 ppm(4-8')	TEST PIT SAMPLE LOCATION 40 ppm = TOTAL VOLATILE ORGANIC VAPOR IN PARTS PER MILLION AND DEPTH
◐ MW-7D	MONITORING WELL LOCATION S=SHALLOW I=INTERMEDIATE D=DEEP
⬚	LIMIT OF TEST PIT EXCAVATION

N

NOTES:

1. BASE MAP ADAPTED FROM A PLAN ENTITLED, "AMERICAN DRIVE-IN CLEANERS; LEVITTOWN, LONG ISLAND, NASSAU COUNTY, NEW YORK", PREPARED BY YEC, INC. DATED MAY 1998.
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SCALE IN FEET
0 15 30 60

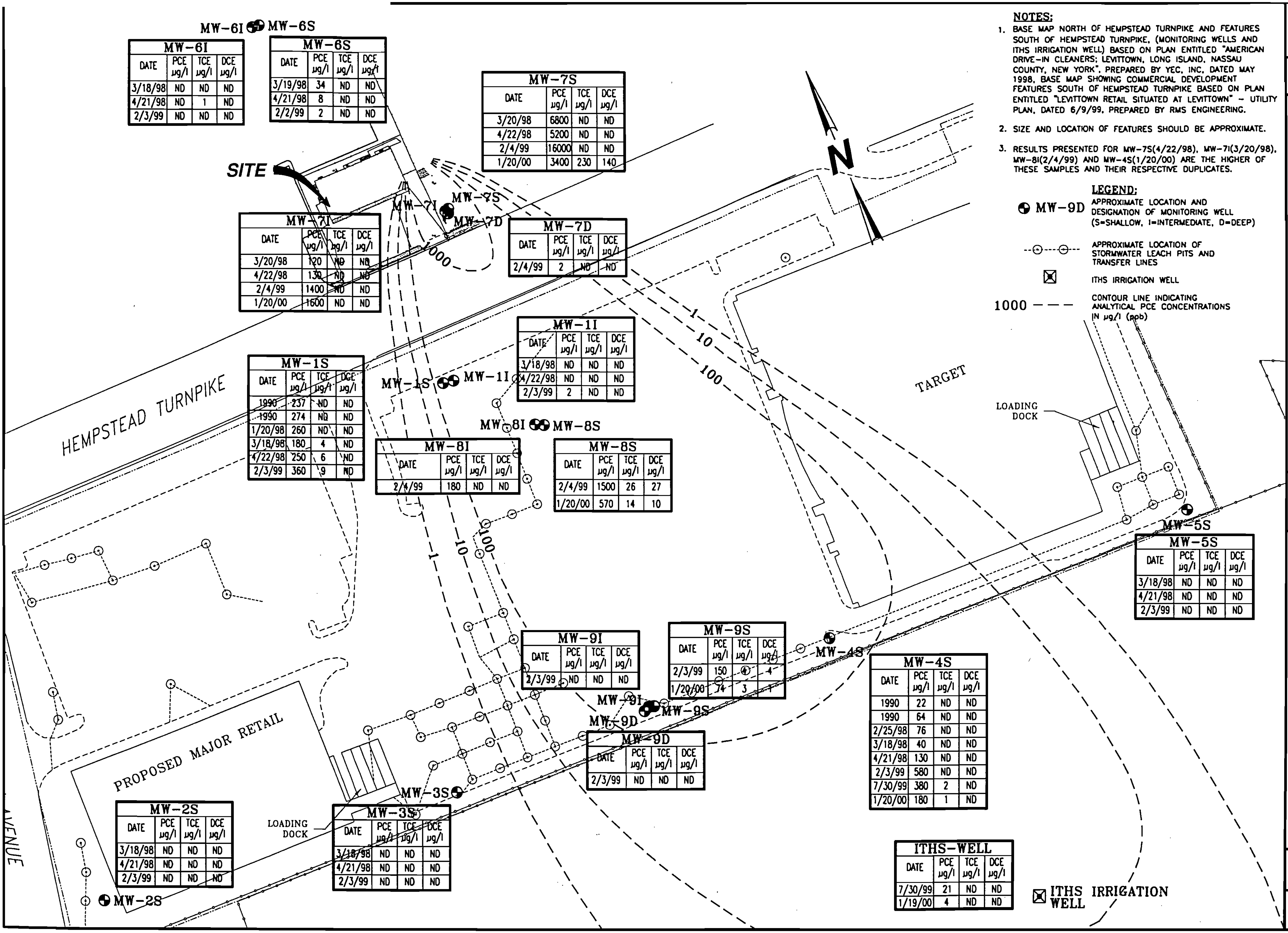
AMERICAN DRIVE-IN CLEANERS
LEVITTOWN, NEW YORK

ON-SITE FOCUSED FEASIBILITY STUDY

SUMMARY OF DETECTED VOC COMPOUNDS IN SOIL SAMPLES (PCE DETECTED LOCATIONS ONLY)

PROJECT No.
55172

FIGURE No.
1-6



MW-6I

DATE	PCE µg/l	TCE µg/l	DCE µg/l
3/18/98	ND	ND	ND
4/21/98	ND	1	ND
2/3/99	ND	ND	ND

MW-6S

DATE	PCE µg/l	TCE µg/l	DCE µg/l
3/19/98	34	ND	ND
4/21/98	8	ND	ND
2/2/99	2	ND	ND

MW-7S

DATE	PCE µg/l	TCE µg/l	DCE µg/l
3/20/98	6800	ND	ND
4/22/98	5200	ND	ND
2/4/99	16000	ND	ND
1/20/00	3400	230	140

MW-7I

DATE	PCE µg/l	TCE µg/l	DCE µg/l
3/20/98	120	ND	ND
4/22/98	130	ND	ND
2/4/99	1400	ND	ND
1/20/00	1600	ND	ND

MW-7D

DATE	PCE µg/l	TCE µg/l	DCE µg/l
2/4/99	2	ND	ND

MW-1I

DATE	PCE µg/l	TCE µg/l	DCE µg/l
3/18/98	ND	ND	ND
4/22/98	ND	ND	ND
2/3/99	2	ND	ND

MW-1S

DATE	PCE µg/l	TCE µg/l	DCE µg/l
1990	237	ND	ND
1990	274	ND	ND
1/20/98	260	ND	ND
3/18/98	180	4	ND
4/22/98	250	6	ND
2/3/99	360	9	ND

MW-8I

DATE	PCE µg/l	TCE µg/l	DCE µg/l
2/4/99	180	ND	ND

MW-8S

DATE	PCE µg/l	TCE µg/l	DCE µg/l
2/4/99	1500	26	27
1/20/00	570	14	10

MW-5S

DATE	PCE µg/l	TCE µg/l	DCE µg/l
3/18/98	ND	ND	ND
4/21/98	ND	ND	ND
2/3/99	ND	ND	ND

MW-9I

DATE	PCE µg/l	TCE µg/l	DCE µg/l
2/3/99	ND	ND	ND

MW-9S

DATE	PCE µg/l	TCE µg/l	DCE µg/l
2/3/99	150	4	4
1/20/00	74	3	1

MW-9D

DATE	PCE µg/l	TCE µg/l	DCE µg/l
2/3/99	ND	ND	ND

MW-4S

DATE	PCE µg/l	TCE µg/l	DCE µg/l
1990	22	ND	ND
1990	64	ND	ND
2/25/98	76	ND	ND
3/18/98	40	ND	ND
4/21/98	130	ND	ND
2/3/99	580	ND	ND
7/30/99	380	2	ND
1/20/00	180	1	ND

MW-2S

DATE	PCE µg/l	TCE µg/l	DCE µg/l
3/18/98	ND	ND	ND
4/21/98	ND	ND	ND
2/3/99	ND	ND	ND

MW-3S

DATE	PCE µg/l	TCE µg/l	DCE µg/l
3/18/98	ND	ND	ND
4/21/98	ND	ND	ND
2/3/99	ND	ND	ND

ITHS-WELL

DATE	PCE µg/l	TCE µg/l	DCE µg/l
7/30/99	21	ND	ND
1/19/00	4	ND	ND

NOTES:

1. BASE MAP NORTH OF HEMPSTEAD TURNPIKE AND FEATURES SOUTH OF HEMPSTEAD TURNPIKE, (MONITORING WELLS AND ITHS IRRIGATION WELL) BASED ON PLAN ENTITLED "AMERICAN DRIVE-IN CLEANERS; LEVITTOWN, LONG ISLAND, NASSAU COUNTY, NEW YORK", PREPARED BY YEC, INC, DATED MAY 1998, BASE MAP SHOWING COMMERCIAL DEVELOPMENT FEATURES SOUTH OF HEMPSTEAD TURNPIKE BASED ON PLAN ENTITLED "LEVITTOWN RETAIL SITUATED AT LEVITTOWN" – UTILITY PLAN, DATED 6/9/99, PREPARED BY RMS ENGINEERING.
2. SIZE AND LOCATION OF FEATURES SHOULD BE APPROXIMATE.
3. RESULTS PRESENTED FOR MW-7S(4/22/98), MW-7I(3/20/98), MW-8I(2/4/99) AND MW-4S(1/20/00) ARE THE HIGHER OF THESE SAMPLES AND THEIR RESPECTIVE DUPLICATES.

LEGEND:

● MW-9D	APPROXIMATE LOCATION AND DESIGNATION OF MONITORING WELL (S=SHALLOW, I=INTERMEDIATE, D=DEEP)
--⊙---⊙---	APPROXIMATE LOCATION OF STORMWATER LEACH PITS AND TRANSFER LINES
☒	ITHS IRRIGATION WELL
1000 – – –	CONTOUR LINE INDICATING ANALYTICAL PCE CONCENTRATIONS IN µg/l (ppb)

REV No.	DESCRIPTION	BY	DATE

DRAWN BY: DEW
DATE: FEBRUARY 2001

SCALE IN FEET
0 50 100 200

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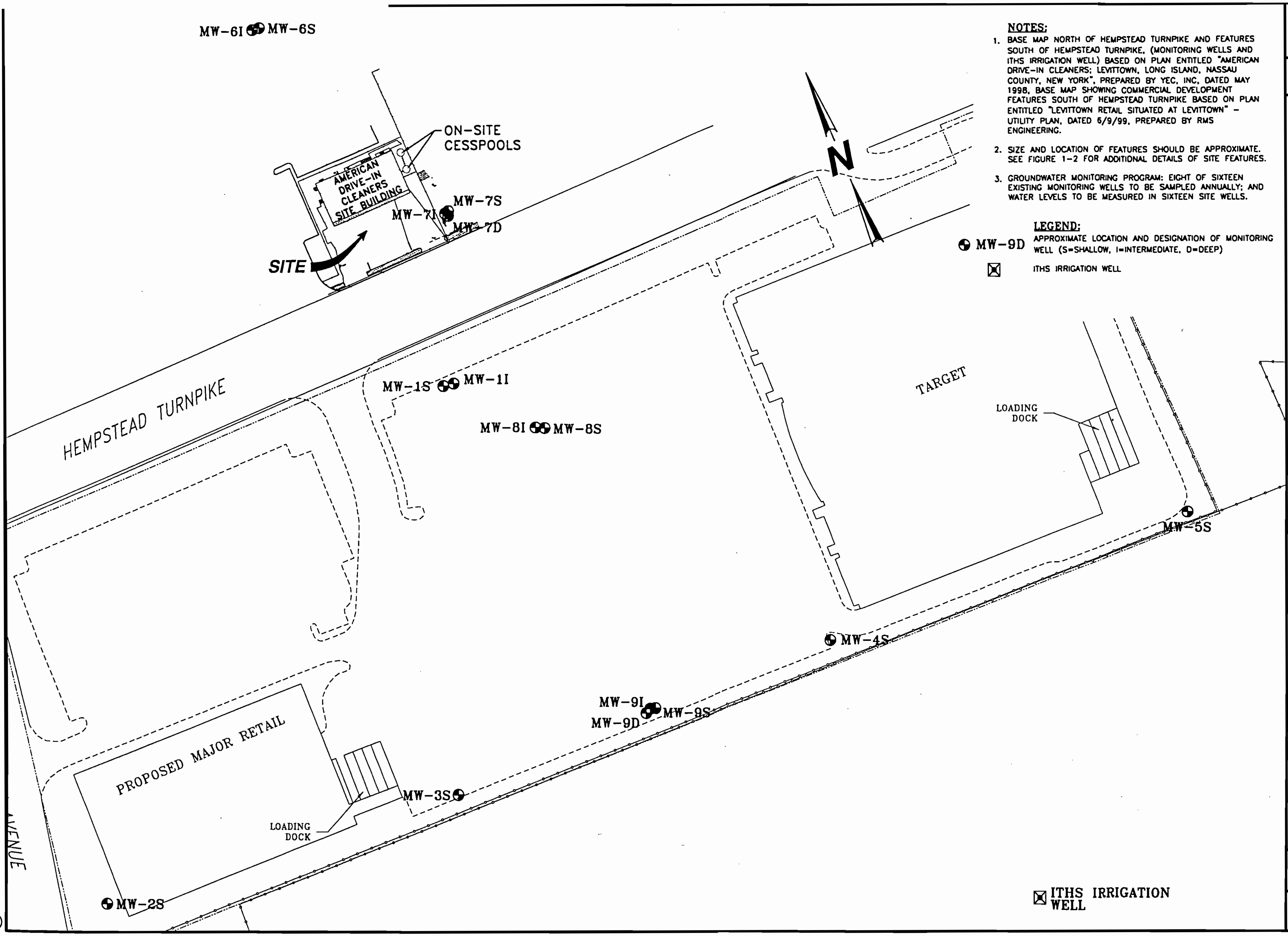
AMERICAN DRIVE-IN CLEANERS
LEVITTOWN, NEW YORK

ON-SITE FOCUSED FEASIBILITY STUDY

GROUNDWATER TARGET COMPOUND
VOC DETECTIONS &
SHALLOW GROUNDWATER
PCE CONCENTRATIONS CONTOUR MAP

PROJECT No.
55172

FIGURE No.
1-7



NOTES:

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2. SIZE AND LOCATION OF FEATURES SHOULD BE APPROXIMATE. SEE FIGURE 1-2 FOR ADDITIONAL DETAILS OF SITE FEATURES.
3. GROUNDWATER MONITORING PROGRAM: EIGHT OF SIXTEEN EXISTING MONITORING WELLS TO BE SAMPLED ANNUALLY; AND WATER LEVELS TO BE MEASURED IN SIXTEEN SITE WELLS.

LEGEND:

● MW-9D	APPROXIMATE LOCATION AND DESIGNATION OF MONITORING WELL (S=SHALLOW, I=INTERMEDIATE, D=DEEP)
☒	ITHS IRRIGATION WELL

REV No.	DESCRIPTION	BY	DATE

DRAWN BY: DEW

DATE: FEBRUARY 2001

SCALE IN FEET

0 50 100 200

GZA GeoEnvironmental of New York

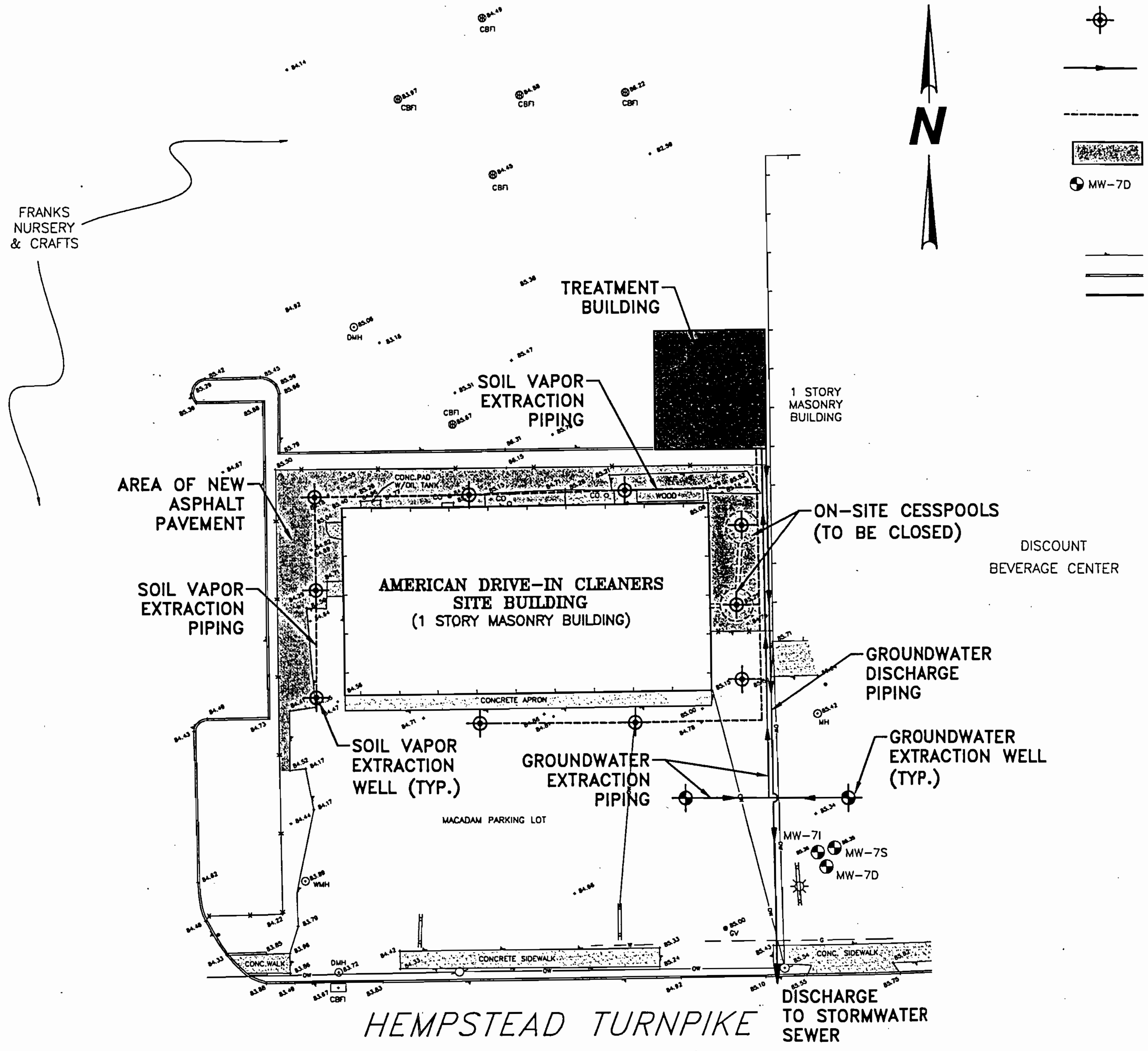
AMERICAN DRIVE-IN CLEANERS
LEVITTOWN, NEW YORK

ON-SITE FOCUSED FEASIBILITY STUDY

ALTERNATIVE 1
GROUNDWATER SAMPLING LOCATIONS

PROJECT No.
55172

FIGURE No.
3-1



LEGEND:

⊕	CONCEPTUAL GROUNDWATER EXTRACTION WELL
⊕	CONCEPTUAL SOIL VAPOR EXTRACTION WELL
——→	APPROXIMATE LOCATION AND FLOW DIRECTION OF GROUNDWATER EXTRACTION/DISCHARGE PIPING
- - - - -	APPROXIMATE LOCATION OF SOIL VAPOR EXTRACTION PIPING
▨	INDICATES APPROXIMATE AREA OF NEW ASPHALT PAVEMENT COVER
◐ MW-7D	EXISTING MONITORING WELL LOCATION (S=SHALLOW) (I=INTERMEDIATE) (D=DEEP)
——	MACADAM (EXISTING)
═══	CURB
——	DROP CURB

▨	CONCRETE
—x—	FENCE
•	BOLLARD
═	SIGN
☼	LIGHT POLE
⌀	UTILITY POLE
—OW—	OVERHEAD WIRES
MH ○	MANHOLE
CO ○	CLEANOUT
CBN ⊕	CATCH BASIN FIELD INLET
DMH ○	DRAINAGE MANHOLE
—G—	GAS PAINT MARK
GV ○	GAS VALVE
WMH ○	WATER MANHOLE
—W—	WATER PAINT MARK
• 84.86	SPOT ELEVATION

NOTES:

1. BASE MAP ADAPTED FROM A PLAN ENTITLED, "AMERICAN DRIVE-IN CLEANERS; LEVITTOWN, LONG ISLAND, NASSAU COUNTY, NEW YORK", PREPARED BY YEC, INC, DATED MAY 1998.

2. THE SIZE AND LOCATION OF EXISTING SITE FEATURES SHOULD BE CONSIDERED APPROXIMATE. SEE FIGURE 1-2 FOR ADDITIONAL DETAILS OF SITE FEATURES.

3. GROUNDWATER MONITORING PROGRAM (SEE FIGURE 3-1): EIGHT MONITORING WELLS TO BE SAMPLED QUARTERLY (i.e., FOUR TIMES PER YEAR) IN YEARS 1-2, AND ANNUALLY THEREAFTER; AND WATER LEVELS TO BE MEASURED IN EXISTING MONITORING WELLS.

4. GROUNDWATER EXTRACTION SYSTEM (GWES) AND DISCHARGE PIPING TO BE INSTALLLED AT A DEPTH OF APPROXIMATELY 4 FEET BELOW GROUND SURFACE, AND WITHIN A COMMON TRENCH WITH SOIL VAPOR EXTRACTION SYSTEM (SVES) PIPING, WHERE APPROPRIATE.

5. APPROXIMATE LOCATIONS AND DIMENSIONS OF GWES, SVES AND TREATMENT BUILDING ARE INDICATED. ACTUAL LOCATIONS AND DIMENSIONS MAY VARY FOR REMEDIAL DESIGN, AS NECESSARY.

REV No.	DESCRIPTION	BY	DATE

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DATE: FEBRUARY 2001

SCALE IN FEET
0 15 30 60

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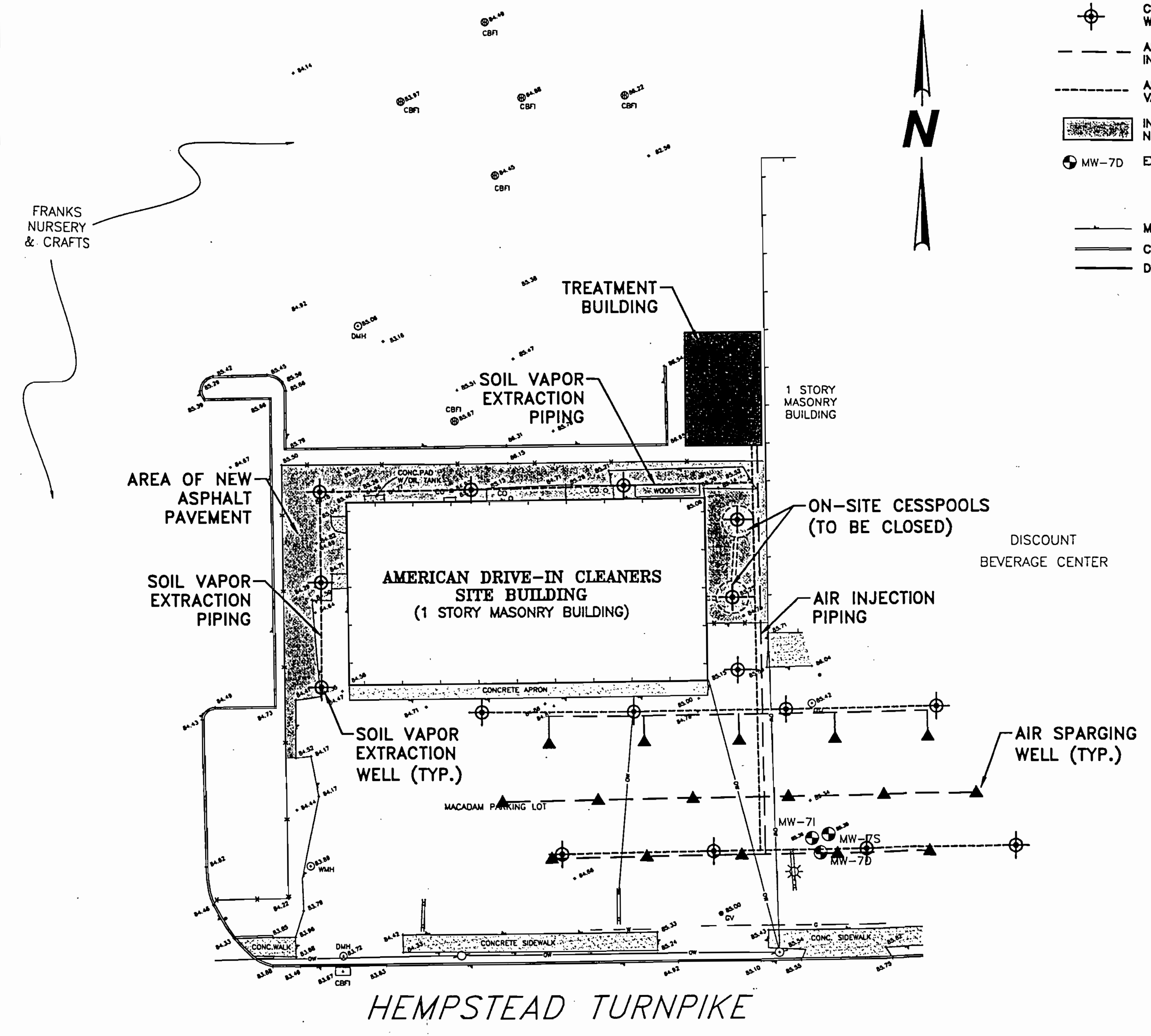
AMERICAN DRIVE-IN CLEANERS
LEVITTOWN, NEW YORK
ON-SITE FOCUSED FEASIBILITY STUDY

ALTERNATIVE 2
GROUNDWATER EXTRACTION
& TREATMENT AND SOIL VAPOR
EXTRACTION SYSTEMS LAYOUT

PROJECT No.
55172

FIGURE No.
3-2



LEGEND:

▲ CONCEPTUAL AIR SPARGING WELL
⊕ CONCEPTUAL SOIL VAPOR EXTRACTION WELL
— — — APPROXIMATE LOCATION OF AIR INJECTION PIPING
- - - - - APPROXIMATE LOCATION OF SOIL VAPOR EXTRACTION PIPING
▨ INDICATES APPROXIMATE AREA OF NEW ASPHALT PAVEMENT COVER
● MW-7D EXISTING MONITORING WELL LOCATION
(S=SHALLOW)
(I=INTERMEDIATE)
(D=DEEP)
MACADAM (EXISTING)
CURB
DROP CURB
▨ CONCRETE
—×— FENCE
• BOLLARD
SIGN
☼ LIGHT POLE
Ø UTILITY POLE
—OW— OVERHEAD WIRES
MH ○ MANHOLE
CO ○ CLEANOUT
CBFI ◎ CATCH BASIN FIELD INLET
DMH ○ DRAINAGE MANHOLE
—G— GAS PAINT MARK
GV ○ GAS VALVE
WMH ○ WATER MANHOLE
—W— WATER PAINT MARK
• 84.66 SPOT ELEVATION

NOTES:

1. BASE MAP ADAPTED FROM A PLAN ENTITLED, "AMERICAN DRIVE-IN CLEANERS; LEVITTOWN, LONG ISLAND, NASSAU COUNTY, NEW YORK", PREPARED BY YEC, INC, DATED MAY 1998.

2. THE SIZE AND LOCATION OF EXISTING SITE FEATURES SHOULD BE CONSIDERED APPROXIMATE. SEE FIGURE 1-2 FOR ADDITIONAL DETAILS OF SITE FEATURES.

3. GROUNDWATER MONITORING PROGRAM (SEE FIGURE 3-1): EIGHT MONITORING WELLS TO BE SAMPLED QUARTERLY (I.e., FOUR TIMES PER YEAR) IN YEARS 1-2, AND ANNUALLY THEREAFTER; AND WATER LEVELS TO BE MEASURED IN EXISTING MONITORING WELLS.

4. IN-SITU AIR SPARGING SYSTEM (IASS) PIPING TO BE INSTALLLED WITHIN A COMMON TRENCH WITH SOIL VAPOR EXTRACTION SYSTEM (SVES) PIPING, WHERE APPROPRIATE.

5. APPROXIMATE LOCATIONS AND DIMENSIONS OF IASS, SVES AND TREATMENT BUILDING ARE INDICATED. ACTUAL LOCATIONS AND DIMENSIONS MAY VARY FOR REMEDIAL DESIGN, AS NECESSARY.

REV No.	DESCRIPTION	BY	DATE

DRAWN BY: DEW
DATE: FEBRUARY 2001

GZA GeoEnvironmental of New York

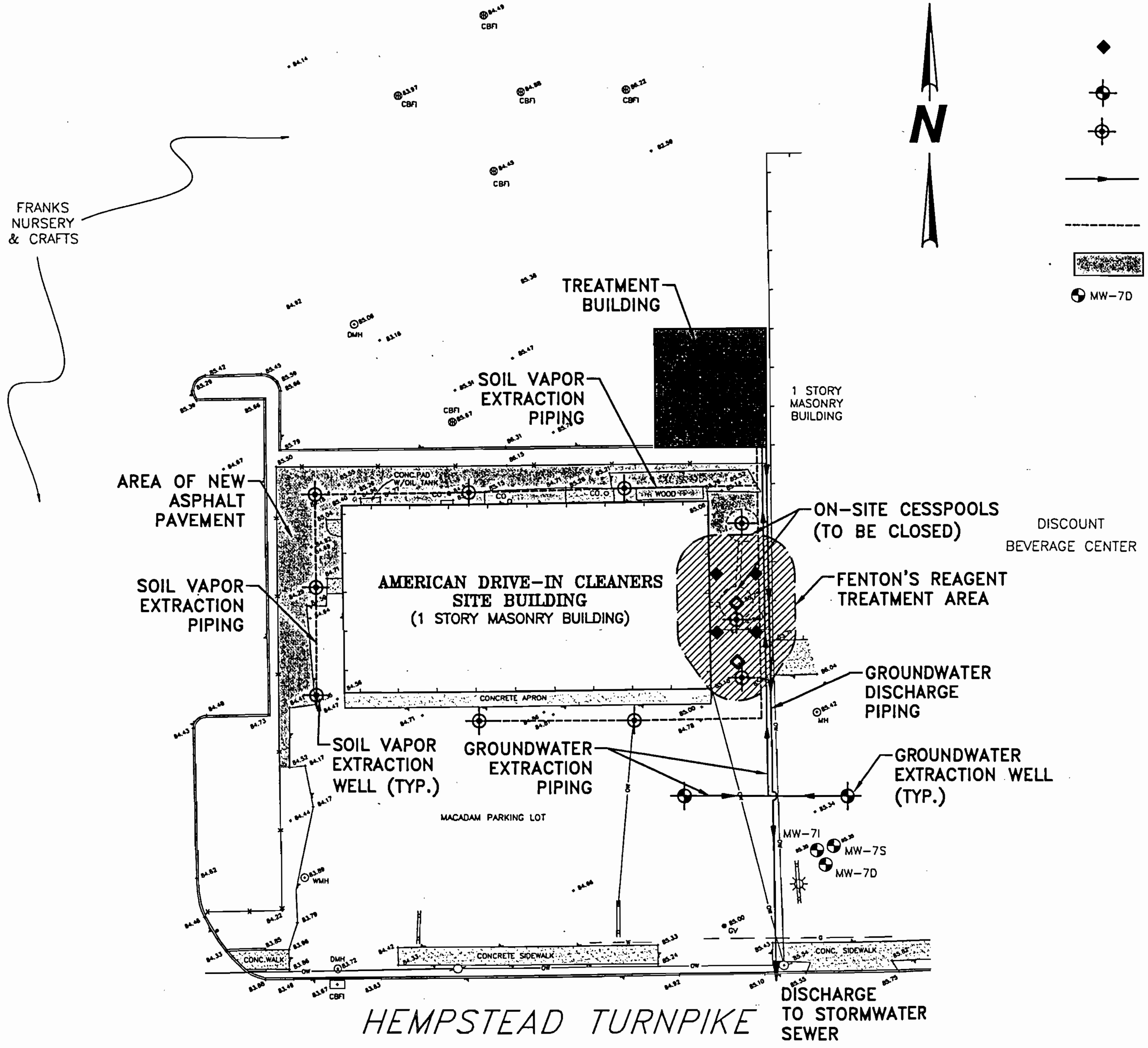
SCALE IN FEET
0 15 30 60

AMERICAN DRIVE-IN CLEANERS
LEVITTOWN, NEW YORK
ON-SITE FOCUSED FEASIBILITY STUDY

ALTERNATIVE 3 IN-SITU AIR SPARGING AND SOIL VAPOR EXTRACTION SYSTEMS LAYOUT

PROJECT No.
55172

FIGURE No.
3-3



LEGEND:

◇	CONCEPTUAL DEEP FENTON'S REAGENT INJECTION POINT (35 TO 65 FEET DEEP)
◆	CONCEPTUAL SHALLOW FENTON'S REAGENT INJECTION POINT (15 TO 35 FEET DEEP)
⊕	CONCEPTUAL GROUNDWATER EXTRACTION WELL
⊕	CONCEPTUAL SOIL VAPOR EXTRACTION WELL
—►—	APPROXIMATE LOCATION AND FLOW DIRECTION OF GROUNDWATER EXTRACTION/DISCHARGE PIPING
----------	APPROXIMATE LOCATION OF SOIL VAPOR EXTRACTION PIPING
▨	INDICATES APPROXIMATE AREA OF NEW ASPHALT PAVEMENT COVER
◐ MW-7D	EXISTING MONITORING WELL LOCATION (S=SHALLOW) (I=INTERMEDIATE) (D=DEEP)
——	MACADAM (EXISTING)
——	CURB
——	DROP CURB
▨	CONCRETE
—x—	FENCE
•	BOLLARD
——	SIGN
☼	LIGHT POLE
ø	UTILITY POLE
—OW—	OVERHEAD WIRES
MH ○	MANHOLE
CO ○	CLEANOUT
CBFI ◍	CATCH BASIN FIELD INLET
DMH ○	DRAINAGE MANHOLE
—G—	GAS PAINT MARK
GV ○	GAS VALVE
WMH ○	WATER MANHOLE
—W—	WATER PAINT MARK
•	SPOT ELEVATION

NOTES:

1. BASE MAP ADAPTED FROM A PLAN ENTITLED, "AMERICAN DRIVE-IN CLEANERS; LEVITTOWN, LONG ISLAND, NASSAU COUNTY, NEW YORK", PREPARED BY YEC, INC, DATED MAY 1998.

2. THE SIZE AND LOCATION OF EXISTING SITE FEATURES SHOULD BE CONSIDERED APPROXIMATE. SEE FIGURE 1-2 FOR ADDITIONAL DETAILS OF SITE FEATURES.

3. GROUNDWATER MONITORING PROGRAM (SEE FIGURE 3-1): EIGHT MONITORING WELLS TO BE SAMPLED QUARTERLY (i.e., FOUR TIMES PER YEAR) IN YEARS 1-2, AND ANNUALLY THEREAFTER; AND WATER LEVELS TO BE MEASURED IN EXISTING MONITORING WELLS.

4. GROUNDWATER EXTRACTION SYSTEM (GWES) AND DISCHARGE PIPING TO BE INSTALLLED AT A DEPTH OF APPROXIMATELY 4 FEET BELOW GROUND SURFACE, AND WITHIN A COMMON TRENCH WITH SOIL VAPOR EXTRACTION SYSTEM (SVES) PIPING, WHERE APPROPRIATE.

5. APPROXIMATE LOCATIONS AND DIMENSIONS OF GWES, SVES, FENTON'S REAGENT INJECTION SYSTEM AND TREATMENT BUILDING ARE INDICATED. ACTUAL LOCATIONS AND DIMENSIONS MAY VARY FOR REMEDIAL DESIGN, AS NECESSARY.

REV No.	DESCRIPTION	BY	DATE

DRAWN BY: DEW

DATE: FEBRUARY 2001

GZA GeoEnvironmental of New York

SCALE IN FEET

0 15 30 60

AMERICAN DRIVE-IN CLEANERS
LEVITTOWN, NEW YORK
ON-SITE FOCUSED FEASIBILITY STUDY

ALTERNATIVE 4
FENTON'S REAGENT INJECTION, SOIL VAPOR EXTRACTION, AND GROUNDWATER EXTRACTION & TREATMENT SYSTEMS LAYOUT

PROJECT No.
55172

FIGURE No.
3-4

APPENDIX A

LETTER TO NYSDEC REGARDING MEETING SUMMARY, DATED NOVEMBER 23, 1999

APPENDIX A

GZA
GeoEnvironmental
of New York

Engineers and
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bsidiary of GZA
Environmental
nologies, Inc.

November 23, 1999
File: 55291

Mr. Robert Filkins
New York State Department of Environmental Conservation
Division of Environmental Remediation
50 Wolf Road
Albany, New York 12233-7010

Re: Meeting Summary
American Drive-In Cleaners RI/FS
NYSDEC Site # 1-30-049

Dear Mr. Filkins:

This letter presents a summary of our meeting on Thursday November 4, 1999. The purpose of our meeting was to review the results of the RI Phase 1, Phase 2 and IRM work completed, review/discuss the FS remedial options, discuss possible need for additional investigative work and discuss project schedule and milestones. The meeting was attended by Gary Klawinski (GZA), Robert Filkins (NYSDEC) and Robert Cozzy (NYSDEC). The following is a summary of information from the meeting:

Phase 1 and 2 Work

The following is a brief summary of the Phase 1 and 2 work.

- Groundwater concentrations in the plume area increased significantly in several monitoring wells (MW-7S, MW-7I and MW-4S) between the April 1998 and the February 1999 sample rounds. MW-7S increased from 3,400 ppb to 16,000 ppb. MW-7I increased from 130 ppb to 1,400 ppb. MW-4S increased from 130 ppb to 580 ppb. Several other wells located in the area of the plume (MW-8S, MW-8I and MW-9S) were sampled in February 1999 only.

- Soil and groundwater sample results collected in the area north of the site (Franks Nursery) did not indicate the presence of significant contamination.

- Soil "hotspot" areas at the site include shallow (to 6 feet) PCE impacted soil in the northeast corner of the site. The source of this contamination is likely associated with storage and possible spills of PCE.

- Soil in the alleyway area on the east side of the site is impacted with PCE contamination. The contamination is suspected to be associated with discharges to the cesspool located in the alleyway. DNAPL was present in the sediments in the base of the cesspool and highly contaminated soil extends down to the water table which is located about 30 feet below ground surface.

- The school irrigation well and monitoring well MW-4S were sampled in July 1999. The concentration of PCE in the school well was 21 ppb. The school irrigation well was operating and being used for irrigation purposes at the time of the sampling.

Interim Remedial Measure (Removal of impacted material from the cesspool in the alleyway)

PCE impacted material were removed from the alleyway cesspool in August 1999. Approximately one to two feet of material (approximately 2 cubic yards of material) were removed from the base of the cesspool. The cesspool material was disposed of as hazardous waste. Impacted soil below the cesspool remained in-place.

Possible Phase 3 Work

Due to the increase in concentration between sample rounds (as noted above), it was agreed that another sample round from the wells at the source area to the school irrigation well would be completed. This will include wells MW-7S, MW-7I, MW-8S, MW-8I, MW-9S, MW-4S and the school irrigation well. The additional sample round data will provide information related to the anticipated concentrations that are representative of those anticipated for remediation of impacted groundwater.

TAMS/GZA will complete one full round of water level measurement as part of the sample round. This will include all available wells and the school irrigation well (if possible).

Feasability Study Remedial Options

The following tentative remedial alternatives were agreed upon at the meeting:

Area 1 (Impacted Soil in the Northeast Corner of the Site)

- Excavation and Disposal (not practical immediately adjacent to the building)
- Soil Vapor Extraction System (SVES) with catalytic oxidation treatment

Area 2 (Impacted Soil in the Cesspool/Alleyway Extending South to Hempstead Turnpike)

- Soil Vapor Extraction System (SVES) with catalytic oxidation treatment
- Fenton's Reaction

Area 3 (Impacted Groundwater Under Hempstead Turnpike)

- No action

Area 4 (Impacted Groundwater North of Hempstead Turnpike)

- Fenton's Reaction
- Sparging with SVE
- Pump and treat

Area 5 (Impacted Groundwater South of Hempstead Turnpike above 1 ppm)

- Pump and treat
- Reactive wall

Area 6 (Impacted Groundwater South of Hempstead Turnpike below 1 ppm to the School Irrigation Well)

- Pump and treat with possible use of the school irrigation well

Area 7 (Impacted Groundwater South of the School Irrigation Well)

- No action (capture by pumping likely below 5 ppb)

* The detailed analysis of technologies/alternatives will be combined as appropriate between areas. For example, if SVE is selected for Area 1 and Area 2 it may be combined with sparging. As discussed, Fenton's reaction is an innovative technology and may require a pilot test to assess its effectiveness.

Other Items

- TAMS/GZA will contact the representatives of the downgradient site to get access to the site for groundwater sampling and to obtain a site plan for consideration of remediation equipment location.
- As requested by NYSDEC, TAMS/GZA will consult with Eric Olbrick (NYSDEC) regarding the use of Fenton's reaction as a remedy for other NYSDEC projects.

Schedule/Milestones

- TAMS/GZA will continue work on the remedial investigation and feasibility study report as appropriate. TAMS/GZA will coordinate our work to complete another sample round as soon as possible. TAMS/GZA will submit the draft RI/FS report four weeks after receipt of the validated data. Additionally, TAMS/GZA will contact NYSDEC following receipt of the non-validated analytical data to discuss the data and refine the remedial alternatives.

Please call us if you have any questions

Very truly yours,

GZA GEOENVIRONMENTAL OF NEW YORK

Gary J. Klawinski
Project Manager

cc: Paul Kareth (TAMS Consultants, Inc.)

APPENDIX B

APPENDIX B

CALCULATIONS OF ESTIMATED AREAS AND VOLUMES OF CONTAMINATED GROUNDWATER AND SOILS

Page No. 1 OF 5

Project AMERICAN DRIVE-IN CLEANERS | File No. 55172

Location LEVITTOWN, NEW YORK | Date 4/17/2000 | By LLV

Subject ESTIMATED AREAS AND VOLUMES - | Checked 5/12/00 | By JTG

~~Based on~~ PCE CONTAMINATED GROUNDWATER | Revised 5/25/00 | By LLV

AND SOIL | 1/31/01 By DJT

GROUNDWATER: (ref. Figure 1-7 in FS Report)

Estimate area and volume of contaminated groundwater plume, using analytical results from RI.

- Area of contaminated groundwater:

- PCE detected in groundwater samples collected from former cesspool area (source area) @ MW-7S, I, D ~~to downgradient off site wells (MW-1S, I; MW-8S, I; MW-4S, MW-9S, I, D; and ITHS irrigation well)~~ DJT 1/31/01

→ Areas within 10 ppb contour line (by planimeter):

- ON-SITE (North of Hempstead Tnpk): $(1.1\text{ in}^2)\left(\frac{100'}{1''}\right)^2 = \boxed{11,000\text{ sf}}$
(5 ppb contour line ≈ same order of magnitude)

- ~~OFF SITE: $(39\text{ in}^2)\left(\frac{100\text{ ft}}{1\text{ in}}\right)^2 = 390,000\text{ sf} \times 1.25 = 487,500\text{ sf}$ (add ≈ 25% to account for 5ppb)~~ DJT 1/31/01

- Average saturated aquifer thickness - with PCE:

- PCE detected at concentrations > 5 ppb (PCE) in shallow wells (intercept GW table @ ≈ 35' b.g.s.), and intermediate wells (installed to ≈ 35 - 45' below GW table).

Therefore:

- plume thickness appears to be concentrated in upper 20-45' of aquifer (on average).

Therefore: assume 45 ft (ON-SITE) ~~and 25 ft (OFF SITE)~~ average DJT 1/31/01
(based on > 1 ppm PCE concentration in MW-7I) ~~(based on MW-1I, MW-9I < 5 ppb concentration; MW-8I, ITHS well > 5ppb concentration)~~

- Porosity:

Assume = 0.35 (Bear, 1979, p.88)
(based on published values for this type of soil, gravelly sand)

- Volume of contaminated (PCE) groundwater:

ON-SITE: $(11,000\text{ sf})(45\text{ ft})(0.35) \cong 173,000\text{ cf} \times 7.48\text{ gallons/cf}$
$\cong \boxed{1,290,000\text{ gallons}}$

Project AMERICAN DRIVE-IN CLEANERS File No. 55172

Location LEVITTOWN, NEW YORK Date 4/18/2000 By LLV

Subject ESTIMATED AREAS AND VOLUMES Checked 5/1/2/00 By JTB

Based on PCE CONTAMINATED GROUNDWATER AND SOIL Revised 1/31/01 By DJJ

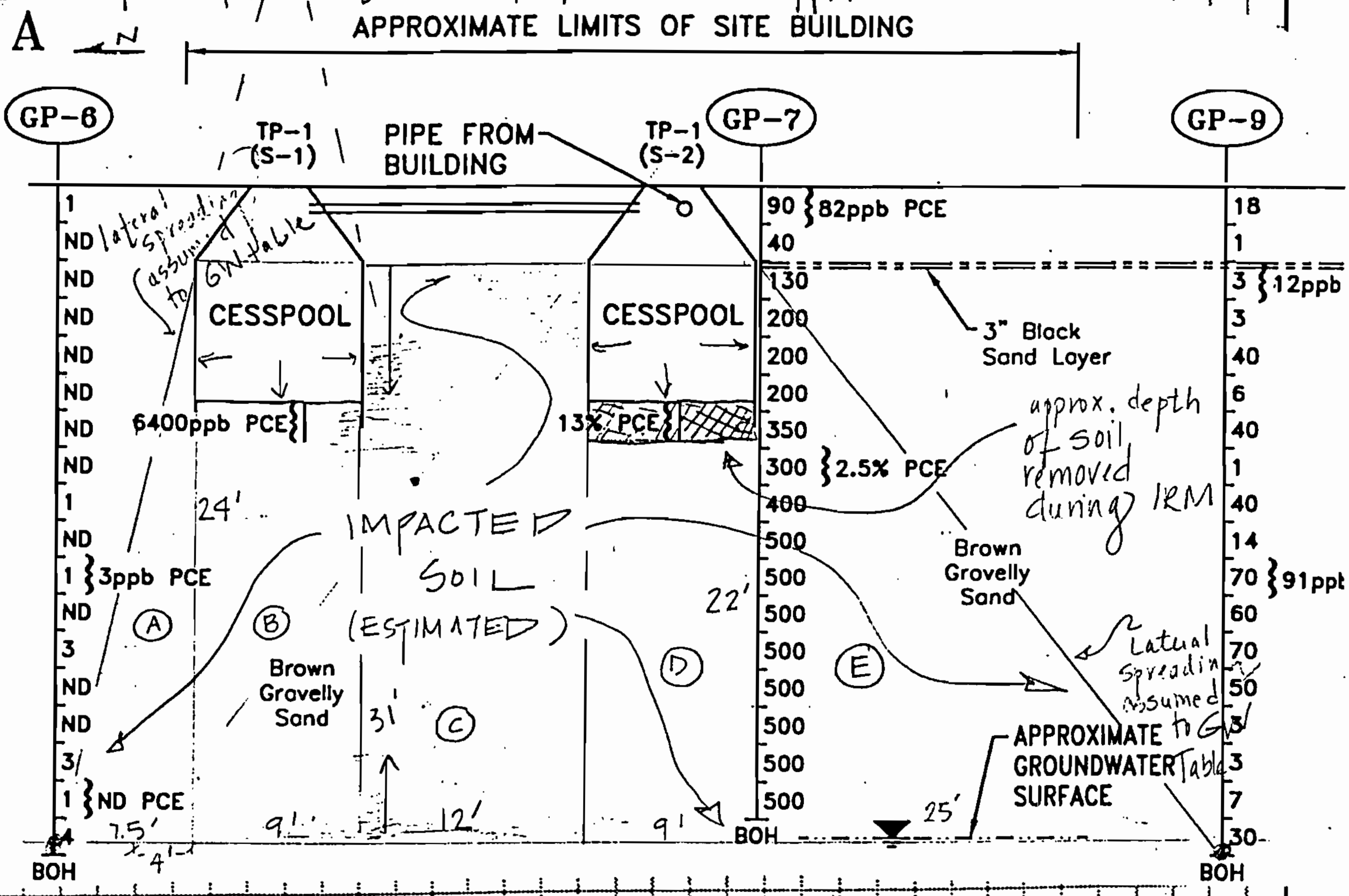
~~OFF-SITE: (487,500 sf)(25 ft)(0.35) ≅ 4,260,000 cf × 7.48 gal/cf ≅ 32,000,000 gallons~~

DJT 1/31/01

Soil: (ref: Figure 1-6 in FS Report; and Geoprobe Logs in FS Appendix B)

1) · TWO FORMER CESSPOOLS (EASTERN PORTION OF PROPERTY):

Estimate area and associated volumes of contaminated (PCE) soil, using analytical results from RI. Assume lateral spreading from cesspools of PCE at concentrations > 1400 ppb.



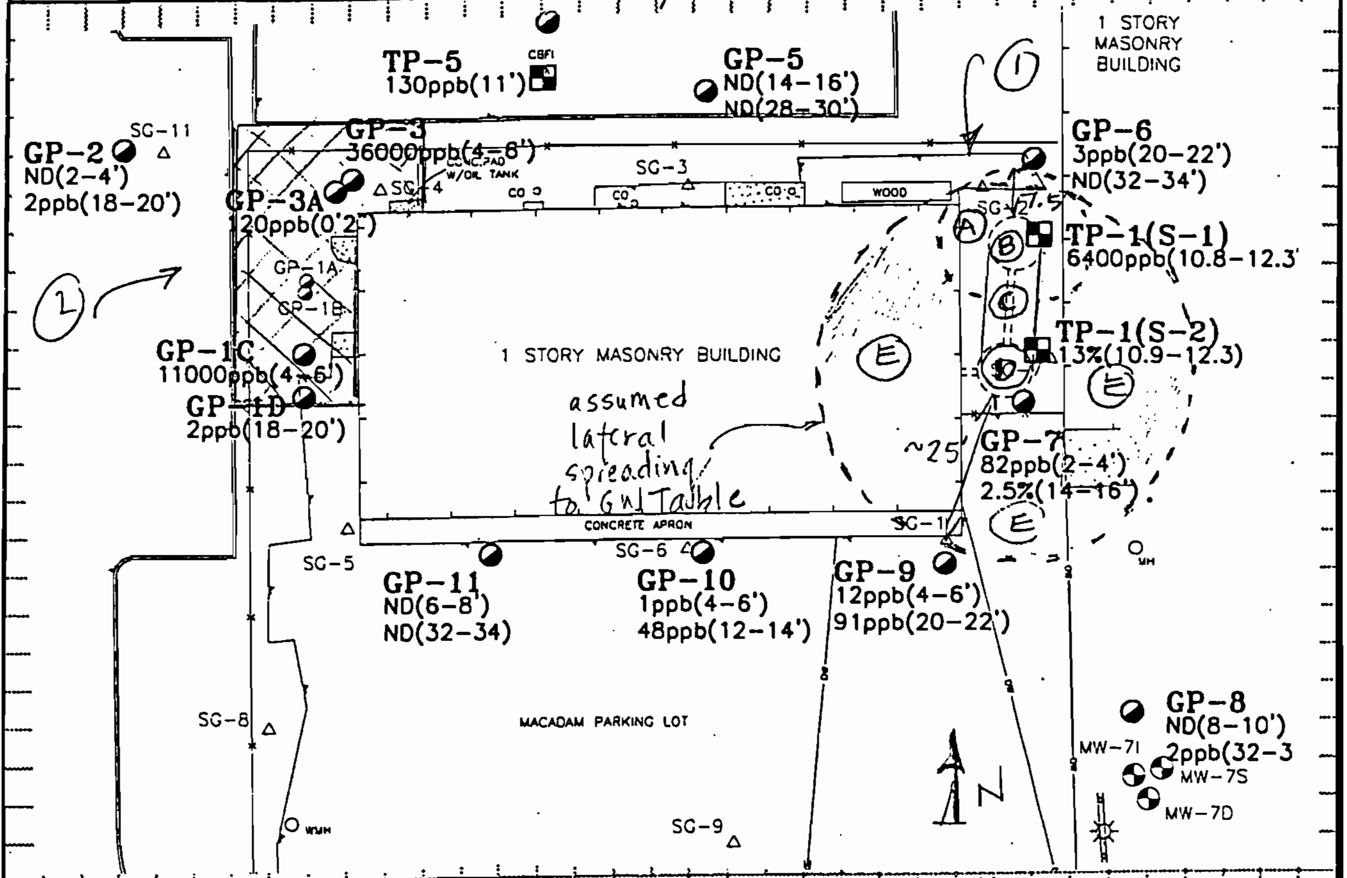
Ref: Figure 6 in RI Report - Cross Section A-A
(scale: (Horizontal & Vertical) - 1" = 10')

Project AMERICAN DRIVE-IN CLEANERS File No. 55172

Location LEVITTOWN, NEW YORK Date 4/18/2000 By LLV

Subject ESTIMATED AREAS AND VOLUMES Checked 5/12/00 By JTB

~~Based on~~ PCE CONTAMINATED GW/SOIL Revised 1/31/01 By DJT



cf: Figure 1-6 in FS Report - Summary of Detected VOC Compounds in Soil Samples (scaled: 1" = 30')

- Area ≈ $\pi\left(25' + \left(\frac{9}{2}\right)\right)^2 \approx$ 2700 sf (See Fig 6 pg 2, for assumptions re: area)
- VOLUME: (See Figure 6, page 2, for assumptions regarding depths)

AREA Ⓑ: $\approx \pi\left(\frac{9}{2}\right)^2 (24') =$ 56 cy

AREA Ⓒ: $\approx (31')(9')(12') =$ 124 cy

AREA Ⓓ: $\approx \pi\left(\frac{9}{2}\right)^2 (22') =$ 52 cy (accounts for ≈ 2' material removed during IRM)

AREA Ⓐ: (out 7.5 feet @ GW table due to lateral spreading — see figure 6 @ bottom of page 2; not including above volumes)

$$\approx \frac{1}{3}\pi\left(7.5 + \frac{9}{2}\right)^2 (50) - (56\,cy)\left(27\,\frac{cf}{cy}\right) - \underset{(cesspool)}{\pi\left(\frac{9}{2}\right)^2 (8')} - \frac{1}{3}\pi\left(\frac{9}{2}\right)^2 (19)$$

Ⓑ

cesspool [illegible]

= 190 cy

Project AMERICAN DRIVE-IN CLEANERS — File No. 55172
Location LEVITTOWN, NEW YORK — Date 4/18/2000 — By LLV
Subject ESTIMATED AREAS AND VOLUMES- — Checked 5/12/00 — By JMB
~~Based on~~ PCE CONTAMINATED GW/SOIL — Revised 1/31/01 — By DJT

AREA Ⓔ: (not including volumes accounted for in Ⓐ – Ⓓ above)
(but 25 feet @ GW table due to lateral spreading –
see Figure 3 at bottom of page 2)

$$\approx \tfrac{1}{3}\pi\left(25+\left(\tfrac{9}{2}\right)\right)^2(37') - \underbrace{(52\,cy)\left(27\,cf/cy\right)}_{Ⓓ} - \underbrace{\pi\left(\tfrac{9}{2}\right)^2(10')}_{\text{(cesspool)}}$$

$$- \underbrace{\tfrac{1}{3}\pi\left(\tfrac{9}{2}\right)^2(6)}_{\text{(cesspool and above)}} - \underbrace{(0.75)\left(124\,cy\left(27\,cf/cy\right)\right)}_{(75\%\,Ⓒ)}$$

$$- \underbrace{(0.33)\left(56\,cy\left(27\,cf/cy\right)\right)}_{(33\%\,Ⓑ)} - \underbrace{(0.25)(190\,cy)\left(27\,cf/cy\right)}_{(25\%\,Ⓐ)}$$

$$= \underline{1010\,cy}$$

$$\sum_{Ⓐ-Ⓔ} = 190 + 56 + 124 + 52 + 1010 = \boxed{1400\,cy}$$

2) NORTHWESTERN PORTION OF THE ADC PROPERTY:

Estimate area and associated volume of contaminated (PCE) soil, using analytical results from RI.

(see portion of Figure 6 (RI Report) on page 5)

→

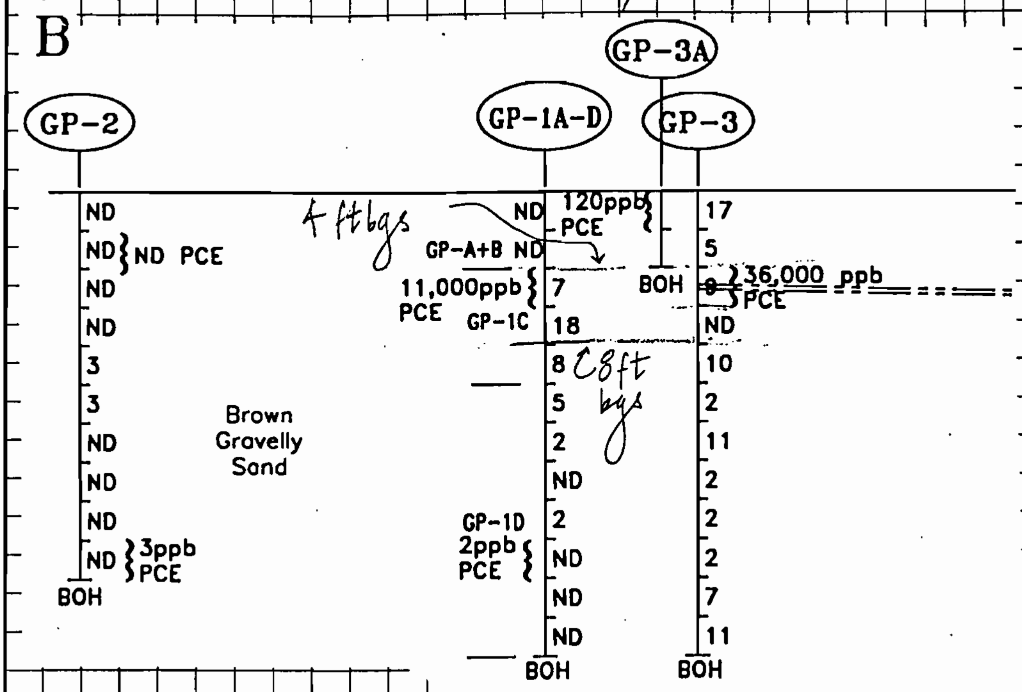
Page No. 5 of 5

Project AMERICAN DRIVE-IN CLEANERS
File No. 55172

Location LEVITTOWN NEW YORK
Date 4/21/2000 By LLV

Subject ESTIMATED AREAS AND VOLUMES -
Checked 5/1/2000 By JMJ

~~Based on~~ PCE CONTAMINATED GW/SOIL
Revised 1/31/01 By DJT



ref: Figure 6 in RI Report - cross section B-B
(scale: Horizontal & Vertical - 1" = 10')

- Area ≈ (20' × 45') + (10' × 15') = 1,100 sf (see Fig. 1-6, pg 3)
(- assumed based on results for GP-1, GP-2, GP-3, SG-4, SG-5, SG-11)

- Volume:
  - assume depth of PCE at concentrations > 1400 ppb is between 4 and 8 feet below ground surface.
  - volume ≈ (1,100 sf)(4 ft) = 170 cy

APPENDIX C

APPENDIX C

COST ESTIMATE AND BACKUP

Table C-1
Cost Estimate Summary
Alternative No.1:
No Action with Annual Groundwater Monitoring
On-Site Focused Feasibility Study
American Drive-In Cleaners
Site No. 1-30-049
Levittown, New York

Item No.	Description	Capital Costs	Present Worth of O&M Costs
1	Groundwater Monitoring	$ -	$ 92,000
Subtotal		$ -	$ -
Engineering (15%)		$ -	
Contingency/Administration (10%)		$ -	
TOTAL		$ -	$ 92,000

Net Present Worth

Capital Costs	$ -
Present Worth of Annual O&M Costs	$ 92,000
TOTAL NET PRESENT WORTH =	$ 92,000

Notes:

1.) Refer to the attached pages for descriptions of the cost estimate assumptions.

2.) Present Worth of O&M costs were calculated for a 30-year duration, using a 5% discount rate (i.e., interest rate = 9%, inflation rate = 4%).

3.) Total costs are rounded to the nearest $1,000.

Table C-2
Cost Estimate Summary
Alternative No. 2:
Groundwater Extraction and Treatment and Soil Vapor Extraction
On-Site Focused Feasibility Study
American Drive-In Cleaners
Site No. 1-30-049
Levittown, New York

Item No.	Description	Capital Costs	Present Worth of O&M Costs
1	Groundwater Extraction	$ 77,000	$ 96,000
2	Ex-Situ Groundwater Treatment and Discharge	$ 484,000	$ 1,986,000
3	Groundwater Monitoring	$ 24,000	$ 126,000
4	Soil Vapor Extraction and Treatment (see Note 4)	$ 120,000	$ 108,000
5	Soil Sampling/Soil Vapor Extraction System Monitoring	$ -	$ 14,000
6	Cesspool Abandonment/Closure	$ 3,000	$ -
7	Asphalt Pavement Cover	$ 2,000	$ 4,000
Subtotal		$ 710,000	$ 2,334,000
Engineering (15%)		$ 106,000	
Contingency/Administration (10%)		$ 71,000	
TOTAL		$ 887,000	$ 2,334,000

Net Present Worth

Capital Costs	$ 887,000
Present Worth of Annual O&M Costs	$ 2,334,000
TOTAL NET PRESENT WORTH =	$ 3,221,000

Notes:

1.) Refer to the attached pages for descriptions of the cost estimate assumptions.

2.) Present Worth of O&M costs were calculated for a 30-year duration, using a 5% discount rate (i.e., interest rate = 9%, inflation rate = 4%).

3.) Total costs are rounded to the nearest $1,000.

4.) Capital and O&M costs for the treatment building/catalytic oxidation system/electrical/controls/etc. are included with the costs for ex-situ groundwater treatment and discharge (Item 2 above). See attached assumption pages for details.

Table C-3
Cost Estimate Summary
Alternative No.3:
In-Situ Air Sparging and Soil Vapor Extraction
On-Site Focused Feasibility Study
American Drive-In Cleaners
Site No. 1-30-049
Levittown, New York

Item No.	Description	Capital Costs	Present Worth of O&M Costs
1	In-Situ Air Sparging	$ 354,000	$ 1,107,000
2	Groundwater Monitoring	$ 24,000	$ 126,000
3	Soil Vapor Extraction and Treatment (see Note 4)	$ 250,000	$ 494,000
4	Soil Sampling/Soil Vapor Extraction System Monitoring	$ -	$ 14,000
5	Cesspool Abandonment/Closure	$ 3,000	$ -
6	Asphalt Pavement Cover	$ 2,000	$ 4,000
Subtotal		$ 633,000	$ 1,745,000
Engineering (15%)		$ 95,000	
Contingency/Administration (10%)		$ 63,000	
TOTAL		$ 791,000	$ 1,745,000

Net Present Worth

Capital Costs	$ 791,000
Present Worth of Annual O&M Costs	$ 1,745,000
TOTAL NET PRESENT WORTH =	$ 2,536,000 (see note 5)

Notes:

1.) Refer to the attached pages for descriptions of the cost estimate assumptions.

2.) Present Worth of O&M costs were calculated for a 30-year duration, using a 5% discount rate (i.e., interest rate = 9%, inflation rate = 4%).

3.) Total costs are rounded to the nearest $1,000.

4.) Capital and O&M costs for the treatment building/electrical/controls/etc. are included with the costs for in-situ air sparging (Item 1 above). See attached assumption pages for details.

5.) Groundwater with PCE concentrations above the groundwater standard (SCG) is anticipated to migrate beyond the ADC Site southern property boundary. Additional information regarding the efficiency of in-situ air sparging would be determined during the pilot study.

Cost Estimate Assumptions
Alternative 1:
No Action with Annual Groundwater Monitoring

On-Site Focused Feasibility Study
American Drive-In Cleaners
Site No.1-30-049
Levittown, New York

Item No. 1: Groundwater Monitoring

Assume monitoring conducted on an annual basis for 30 years.

Assume includes well redevelopment (purge 3 - 5 well volumes) and sampling of 8 existing Site monitoring wells (see Figure 3-1). Also, assume water level measurements performed in sixteen Site wells.

Estimated cost of each sampling effort includes field labor, equipment, and expenses: $3,700

Estimated cost of analytical testing includes:

- Laboratory Analysis of 8 groundwater samples plus QA/QC samples (1 duplicate, 2 MS/MSDs, 1 rinsate blank, 1 trip blank) for TCL VOCs.
- Validation of the laboratory data.
- Estimated cost: $1,800

Assume preparation of a brief data summary report. Estimated cost for report preparation and time for project coordination: $450.

Above costs are based on 1999 rates as presented in the PMP Amendment No. 1.

Total Annual Groundwater Monitoring Cost = $6,000 (years 1 - 30)

NOTE:
See backup calculations following this description page.

GZA GeoEnvironmental of New York

Cost Estimate Assumptions
Alternative No. 2:
Groundwater Extraction and Treatment and Soil Vapor Extraction

On-Site Focused Feasibility Study
American Drive-In Cleaners
Site No. 1-30-049
Levittown, New York

Item No. 1: Groundwater Extraction

Assumes flow rate from extraction wells to be approximately 10 gpm each.

Assume Groundwater Extraction System Pilot Study is conducted which includes: ($43,000)

- installation and materials for one, 6-inch stainless steel extraction well to approximately 80 feet BGS with 45 feet of screen section using traditional well design.
- installation and materials for three, 2-inch PVC piezometers installed to approximately 70 feet BGS.
- performing 48-hour pump test (cost includes labor and equipment rental).
- assumes direct discharge of pump water to sanitary sewer.

Assumes one additional extraction well installed to complete the Groundwater Extraction System: ($29,000)

Assumes extraction and discharge forcemain; wells to treatment building and treatment building to sw sewer: ($5000).

Assumes annual cost for Operation and Maintenance of Groundwater Extraction System: $5,000/year

- costs include monitoring of system, labor, parts and repair, etc.; costs for contracted ops firm included with costs for treatment system.

Assumes groundwater extraction pumps and accessories to be replaced, and wells to be refurbished, every 5 years: $7,500 (every 5 years)

Refer to Figure 3-2 for locations of extraction wells and piping.

Cost Estimate Assumptions
Alternative No. 2:
Groundwater Extraction and Treatment and Soil Vapor Extraction

On-Site Focused Feasibility Study
American Drive-In Cleaners
Site No. 1-30-049
Levittown, New York

Item No. 2: Ex-Situ Groundwater Treatment and Discharge

Assumes flow rate from extraction wells to be approximately 20 gpm.

Assumes average initial influent concentration of PCE to be approximately 1 - 10 ppm; TDS is low such that filtration not required.

Assumes Treatability Study is conducted for system design: $10,000

Assumes Treatment Building (30 ft x 30 ft) is fabricated and constructed which includes: ($250,000)
- prefabricated metal structure with epoxy-coated paint, a concrete foundation with secondary containment, and insulation.
- instrumentation and controls, electrical and plumbing systems.

Assumes the following equipment is used for the Treatment System: ($224,000)
- 4000-gallon equalization tank with air compressor for aeration.
- metals filtration (for removal of iron and manganese).
- four pumps and one spare pump, needed to transfer groundwater throughout the system.
- air stripper for PCE removal from the groundwater.
- granular activated carbon vessel to polish the groundwater from the air stripper.
- catalytic oxidizer to treat air emitted from air stripper.
  (catalytic oxidizer also assumed to also be used for SVE system vapor treatment)
- 4000-gallon discharge holding tank.
- Startup/Shakedown for the Groundwater Pretreatment System.
- Electrical utilities will have to be connected to the Pretreatment Building.

Assumes effluent discharge limit (PCE) is to be 5 ppb to be discharged to storm sewer.

Assumes annual Operation and Maintenance cost for Groundwater Treatment System: $141,000/year (years 1 through 5)
Assumes annual Operation and Maintenance cost for Groundwater Treatment System: $139,000/year (year 6)
Assumes annual Operation and Maintenance cost for Groundwater Treatment System: $121,000/year (years 7 - 30)
- costs include monitoring and clean out of system, gas and electric utilities, labor, repairs, analytical testing of system, etc. Sale of 1000 scfm catox system (year 6) for $27,500, purchase 300 scfm catox - $45,000 (yrs 6 to 30), for years 6 to 30, because assume SVE system not operated after year 5. Air stripper off-gas treated by smaller capacity catox system, at approx. $30,000

Assumes Treatment System pumps, air compressor, and select accessories to be replaced every 5 years: $10,000 (every 5 years)

Refer to Figure 3-2 for location treatment building and effluent discharge piping to the sanitary sewer.

Cost Estimate Assumptions
Alternative No. 2:
Groundwater Extraction and Treatment and Soil Vapor Extraction

On-Site Focused Feasibility Study
American Drive-In Cleaners
Site No. 1-30-049
Levittown, New York

Item No. 3: Groundwater Monitoring

Assume monitoring conducted quarterly in years 0 - 2; annually in years 3 - 30.

Assume includes well redevelopment (purge 3 - 5 well volumes) and sampling of 8 existing Site monitoring wells (see Figure 3-2). Also, assume water level measurements performed in sixteen Site wells.

Estimated cost of each sampling effort includes field labor, equipment, and expenses: $3,700

Estimated cost of analytical testing includes:

- Laboratory Analysis of 8 groundwater samples plus QA/QC samples (1 duplicate, 2 MS/MSDs, 1 rinsate blank, 1 trip blank) for TCL VOCs.
- Validation of the laboratory data.
- Estimated cost: $1,800

Assume preparation of a brief data summary report. Estimated cost for report preparation and time for project coordination: $450.

Above costs are based on 1999 rates as presented in the PMP Amendment No. 1.

Total Annual Groundwater Monitoring Cost = $24,000 (years 0 - 2)
Total Annual Groundwater Monitoring Cost = $6,000 (years 3 - 30)

Item No. 4: Soil Vapor Extraction

Assumes flow rate from system is approximately 600 scfm; required vacuum is 40 inches water column; and average initial influent concentration is 500 ppmv. Assume operate system for approx. 5 years.

Assume SVE System Pilot Study is conducted which includes:
- installation and materials for 1 well to 30 feet (costs included with system wells below).
- installation and materials for three couplets of 2- 3/4-inch PVC monitoring points installed to 30 feet BGS.
- mobile treatment unit used to treat extracted soil vapors.
- perform 3-day study (cost includes labor, materials and equipment rental): $20,000

Assumes 10 vertical wells (5 to 10 feet bgs, 5 to 30 feet bgs) and header piping installed;
(total estimated cost: $100,000)
- mobilization/demobilization for pipe installation labor, equipment and materials.
- installation of 10 wells (Sch. 40 PVC); traditional SVE well design.
- installation (via trenching) and materials for approximately 350 lf piping, 4-inch diameter solid HDPE pipe
- piping installed at depth of 4 feet BGS.
- piping installation: backfill soils amended with bentonite to limit short-circuiting of air flow.
- piping is butt-fusion welded; sloped to vapor treatment equipment.
- saw-cutting and patching of existing asphalt is included, where necessary.
- Equipment is used for the vapor treatment system:
  - Air/Water Separator (240 gallons)
  - Extraction Blower (up to 1,000 scfm, 40 in WC) and motor (20 hp)
  - Pressure relief valve for blower
  - Vacuum and pressure gauges
  - Thermometer
  - Catalytic Oxidizer to treat air (cost included in groundwater treatment system above)
  - Centrifugal pump to transfer condensate to EQ tank
  - Flowmeter
  - Process piping/valves
- Installation and startup for the SVE System.

Assumes replaceable pressure gauge valve boxes installed and connected to collection lines via piping; placed flush-mounted at the intersection of each collection line with header piping and other appropriate fittings.

Assumes costs for building to house treatment system, instrumentation and controls system, and electrical hookup are included above for groundwater treatment building.

Assumes annual O&M cost for SVE System (for 5 years): $25,000/year (for 5 years)
- cost includes electric costs for system (not catalytic oxidizer), misc. labor for repairs, emergency repairs, parts and supplies.
- cost does not include O&M for catalytic oxidizer, contracted O&M firm to monitor automated system and perform routine operations, housekeeping, or effluent air sampling costs -- included with groundwater pretreatment system costs above.

Refer to Figure 3-2 for locations of vapor extraction piping and treatment building.

Cost Estimate Assumptions
Alternative No. 2:
Groundwater Extraction and Treatment and Soil Vapor Extraction

On-Site Focused Feasibility Study
American Drive-In Cleaners
Site No. 1-30-049
Levittown, New York

Item No. 5: Soil Sampling/Soil Vapor Extraction System Monitoring

Assume collect two soil samples in order to monitor the effectiveness of the SVE system, via geoprobe sampling.
Collect samples from two locations: northwest Site corner (4 - 10 feet bgs), and south of cesspool area (20 - 30 feet bgs).
Assume perform in years 1, 2, 3, 4 and 5.

Estimated cost of each sampling effort includes field labor, equipment, and expenses: $2,000.

Estimated cost of analytical testing includes: (estimated cost is $800)
- Laboratory Analysis of 2 soil samples plus QA/QC samples (1 duplicate, 2 MS/MSDs, 1 rinsate blank) for TCL VOCs.
- Validation of the laboratory data.

Assume preparation of a brief data summary report. Estimated cost for report preparation and time for project coordination is $450.

Above costs are based on 1999 rates as presented in the PMP Amendment No. 1.

Total Estimated Sampling Cost = $3,300/event (years 1, 2, 3, 4 and 5)

Item No. 6: Cesspool Abandonment/Closure

Assume close two cesspools per Nassau County requirements (see Figure 3-2 for locations).

Assume prepare cesspools for closure:
- plug/seal conduits, drains or other piping connected to cesspools.
- pump out accumulated water (assume 1 foot standing water in each).

Assume backfill cesspools with clean soil backfill (approx. 60 cy total), and top with a 1-foot concrete/clay cap.

Total Estimated Closure Cost = $3,000

Item No. 7: Asphalt Pavement Cover

Assume construct new asphalt pavement cover over areas not currently paved to enhance SVE system efficiency and for protection of the groundwater extraction/SVE systems piping. Does not include repairs to existing asphalt following trenching activities associated with installation of the groundwater and soil vapor extraction system piping.

Assume asphalt cover consists of 6-inch base course (3/4-inch crushed stone), 2-inch binder course, and 2-inch wearing course.
- Approximate area to receive new pavement: 90 square yards
- Cost of new pavement: $2,000

Assume entire paved portion of the Site and Discount Beverages property to be maintained over a 30-year time period, for purposes of maintaining a consistent surface treatment. O&M would include:
- annual patching (over localized areas, as necessary; assume 10 sy per year): $200/year
- sealcoat entire paved area (approx. 490 sy) every 5 years: $500 (every 5 years)

Refer to Figure 3-2 for location of new asphalt pavement cover.

NOTE:
See backup calculations following this description page.

ALT. 2

Page No. 1 of 9

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/10/2000 By LLV
Subject ON-SITE GROUNDWATER EXTRACTION & TREATMENT SYSTEMS
Checked 5/26/00 By DJT
Based on
Revised
By

GROUNDWATER EXTRACTION SYSTEM:

- Install 2 wells to provide for source removal and hydraulic containment of on-site groundwater. Install to 80' bgs, with 45' of screen.
- Based on preliminary modelling by MODFLOW (Waterloo Hydrogeologic), it is expected that the wells should be pumped @ 20gpm total (or 10 gpm each).
- PILOT STUDY:

→ install 1 well to approx. 80 ft bgs with traditional well design to provide design information for extraction wells.

- assume pump test performed – $150/hr for 48 hrs; includes pump/accessories, generator, field time for 2 geologist

  ($150/hr)(48 hr) ≅ $7200

- assume discharge to sanitary sewer is acceptable to Nassau County (requires prior approval; is generally allowed)
- well installation: assume install well with 6" casing ϕ.
  - driller mob./demob = $1600 (PUP)
  - drill – 8 1/4" ID HSA to 80' bgs: (ECHOS 33-23 items)

    (80')($35/ft) ≅ $2800
  - collect approx. 20 split spoons:

    (20)($30/ea) ≅ $600
  - soil cuttings in approx. 15 drums for offsite disposal:

    (15)($75/drum) ≅ $1100 (experience on similar projects)
  - assume 45' well screen (6" ϕ SS):

    (45')($164/ft) ≅ $7400 (ECHOS 33-23)

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Engineers and Scientists

ALT 2

Page No. 2 of 9

Project: AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location: LEVITTOWN, NY
Date: 5/10/2000 By: LLV
Subject: ON-SITE GROUNDWATER EXTRACTION AND TREATMENT SYSTEMS
Checked: 5/26/00 By: DJT
~~Based on~~
Revised By

- 35' riser (6"φ ss): (ECHOS 33-23 items)
  (35')($136/ft) ≅ $4800
- ss wellplug:
  (1)($200) = $200
- Sand pack:
  (46')($27/ft) = $1300
- 3' bentonite seal:
  (3')($125/ft) ≅ $400
- Grout:
  (28')($65/ft) ≅ $1800
- 3' concrete:
  (3')($10/ft) ≅ $30
- 4'x4' vault to house well head piping/valves:
  ≅ $3500
- Piping (4"φ PVC) + Valves: (ECHOS 19-01-0207)
  (90')($7/lf) + $1000 ≅ $1600
- Flow Meter: $500 (estimate by Badger Meter)
- Submersible Pump (for 10 GPM, 1 Hp) (ECHOS 33-23-0501)
  ≅ $1200
- Three 2" PVC Piezometers: (3)($2000/ea) ≅ $6000
- Decon: (4 borings)(1 hr/boring)($120/hr) ≅ $500 (PMP)

ALT. 2

Page No. 3 of 9

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS

File No. 55172

Location LEVITTOWN, NY

Date 5/10/2000 By LLV

Subject ON-SITE GROUNDWATER EXTRACTION AND TREATMENT SYSTEM

Checked 5/26/00 By DJT

~~Based on~~

Revised By

TOTAL ≅ $43,000

Additional Extraction Well Installation:

- Assume pilot study well used as one well; install 2nd well:

≅ $29,000 (based on costs above)

Forcemain Piping Installation:

- Assume piping installed to connect extraction wells to treatment system. Piping would be installed in similar trench as SVE system, where applicable. Also include discharge piping to SW sewer.
- Trenching (shared with SVE system piping):
  - assume 4"φ HDPE: (~$7/lf)(160 lf) ≅ $1100 (Means A12.3-110-1420)
- Trenching (not shared with SVE system piping)

(TRENCHING/ BACKFILL/ RESTORATION OF PAVEMENT): (~$35)($110/lf) ≅ $3900

SEE SVE CALCS

$5000

GW Extraction System O&M:

- Assume contract operations firm for on-site treatment system would perform O&M and monitor extraction system. No costs included here.

Assume replace GW pumps every 5 years:

= (2)($1200) = $2400 (every 5 years)

see page 2

ALT. 2

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/10/2000 By LLV
Subject ON-SITE GROUNDWATER EXTRACTION AND TREATMENT SYSTEM
Checked 5/26/00 By DJT
~~Based on~~
Revised
By

- Assume refurbish wells every 5 years : ≈ $5000 (every 5 years) (based on experience w/ similar projects)

$\xrightarrow{\sim}$ $7500 (every 5 years)

- Assume annual O&M cost for repairs, etc.: $5000/yr (annual) (labor/materials and electricity)

(based on experience with similar projects)

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ALT. 2

Page No. 5 of 9

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/10/2000
By LLV
Subject ON-SITE GROUNDWATER EXTRACTION AND TREATMENT SYSTEMS
Checked 5/26/00
By DJT
Based on
Revised
By

CAPITAL COSTS: Assume Treatability Study ≃ $10,000

- Assume influent Groundwater Concentration (avg.) = 1-10 ppm (PCE)
- Permit for discharge to SW sewer would require treatment to 5 ppb (PCE)
- Anticipated flow rate from extraction system = 20 gpm
- Use air stripping w/ carbon polishing, to treat VOCs.
Use metals filtration system to treat for removal of iron & manganese.
Use catalytic oxidation to treat air stripper off-gas, because would share with SVE system.
  → but assume follow shutdown of SVE with:
    - smaller capacity CATOX system
- Treatment building - assume consists of prefabricated metal building w/ insulation, epoxy-coated paint; foundation = slab on grade with secondary containment.
(To be shared with SVE system equipment.)
- Assumes TDS is low, such that filtration is not required.
- TREATMENT BUILDING: (30' x 30') assumed

$200,000 (based on similar projects)

- Instrumentation/controls system, control room, electrical & interior plumbing system → assume ≈ 25% building cost

≈ $50,000 (based on experience with similar projects)

- Assumes 4000 gallon EQ Tank; aeration may be required.

↓ $5,000 (Estimates from Peyce Plus & Commercial Plastics)

↓ compressor = $2000

ALT. 2

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/10/2000
By LLV
Subject ON-SITE GROUNDWATER EXTRACTION AND TREATMENT SYSTEMS
Checked 5/26/00
By DJT
Based on
Revised
By

- Need 4 pumps (+ 1 backup) to transfer flow in system:
  (centrifugal — (1 Hp))

  $\sim(\$3000)(5) = \$15{,}000$ (ECHOS 33-29-0102
  " " " -0103)

- Metals filtration system - used to remove iron/manganese prior to entering air stripper:

  $15,000 (Process Equipt. Sales)

- Air stripper to remove PCE:

  ≃ $12,000 (Product Recovery Mgt, Carbonaire Environmental)
  (for 1-10 ppm)

- GAC: (polishing step)

  ≈ $10,000 (Carbonair, Calgon, TIGG)

- Catalytic Oxidizer: (including heat exchanger, cat cell to reduce energy costs)

  assume ≤ 1000 scfm flow volume
  initial vapor concentration ≈ 500 ppmV

  $110,000 (Falmouth, Stealth Industries, Baker)

- Effluent Holding Tank: (4000 gal) $5000 (same as EQ Tank)

- Start-up/Shakedown: $30,000 (based on experience on similar projects)

- Connection of Utilities: $20,000 (")

ALT 2

Page No. 7 of 9

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS

File No. 55172

Location LEVITTOWN, NY

Date 5/10/2000 By LLV

Subject ON-SITE GROUNDWATER EXTRACTION AND TREATMENT SYSTEM

Checked 5/21/00 By DJT

Revised By

Based on

→ TREATMENT SYSTEM ≈ $474,000

O&M:

- Use contracted operations firm to monitor & maintain GWE&T Systems.
  - on-site supervision 1 wk/mo @: ($45/hr)(40 hr/mo) ≅ 1800 × 12 mo/yr ≅ $22,000
- Remote monitoring: $5000/yr (Based on experience on similar projects)
- Electrical/Natural Gas Utilities: (yrs 1-5)

Natural Gas:

CATOX → (1.2 MIL BTU/hr)($0.60/100,000 BTU)(24 hr/day)(365 d/yr)

≈ ($63,000/yr)(0.60) → ≅ $40,000/yr

40% reduction due to heat exchanger/catcell

∴ $50,000/yr (1-5 yrs) - to heat plant

Electricity:

CATOX BLOWER → 15 hp
PUMPS ~ → 5 hp
(20 hp)(746 W/HP)($0.12/KWH) ≅NYC
* (24 hr/day)(365 d/yr) = $16,000/yr

+ misc. electrical → $25,000/yr (1-5 yrs)

TOTAL UTILITIES → $75,000/yr (1-5)

ALT2

Page No. 8 of 9

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/10/2000 By LLV
Subject ON-SITE GW EXTRACTION & TREATMENT SYSTEM
Checked 5/26/00 By DJT
Revised By
~~Based on~~

- Waste (housekeeping, air stripper, catox, EQ Tank, etc) Disposal:
  ≈ $10,000/yr (based on experience with similar projects)
- GAC: replace carbon yearly: $3000/yr (Calgon, Carbonair)
- Metals Filter: $3,000/yr (Process Equip.)
- Labor (for misc.):
  electrician – $3000/yr (85 hrs @ $35/hr)
  mechanic – $3000/yr (125 hrs @ $24/hr)
  laborer – $1500/yr (100 hrs @ $15/hr)
  } ECHOS p. 2-57, 2-68
- Emergency Repairs: $2000/yr
- Parts/Supplies (misc.): $4000/yr
  } Based on experience with similar systems
  $6000/yr
- Analytical Testing (effluent):
  ∴ (12 mo/yr)(4 GW samples)($120/sample) = $9400
  ∴ (12 mo/yr)(2 air samples)($150/sample)
- Assume no GW discharge costs ($/gal) b/c to SW sewer – other than misc. fees
- Every 5 years – replace 1 pump, air compressor – and other misc. piping/valve accessories.
  → $10,000/yr (every 5 yrs)

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ALT. 2

Project: AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location: LEVITTOWN, NY
Date: 5/10/2000 By: LLV
Subject: GWE&TS (ON-SITE)
Checked: 5/26/00 By: DJT
~~Based on~~
Revised By

Assume: year 5, turn off SVE system.

Therefore, Catox system can be changed to a "smaller" unit, to treat stripper off-gas. Assume groundwater influent is still 1-10 ppm PCE.

According to Carbonair, off-gas from stripper ≈ 300 scfm

∴ assume sell 1000 scfm Catox unit → resale yields 25% of original cost (Falmouth, Stealth Industries)

$(\$110{,}000)(0.25) \longrightarrow \approx \$\underline{27{,}500}$ (yr 6)

∴ assume purchase new Catox unit - 300 scfm

$\approx \$\underline{45{,}000}$ (10 hp blower) (yr. 6)

<u>O&M</u>: would run from yrs 6-30; yearly cost for electrical/gas ≈ $30,000 (per Falmouth)

<u>NOTE</u>: Catox would be more cost effective than carbon over 25-year period. Carbon changeout would be required about every 1-2 months (approx. 50-60 days) per Carbonair. → - Especially if groundwater remains at high concentrations (DNAPL)
Cost of changeout would run ≈ ($40,000 - $50,000/yr)

∴ O&M:

annual cost: $66,000

+ every 5 years: $10,000

Plus: yrs 1-5 : $75,000

resale new

Yr 6 : -$27,500 + $45,000 + $30,000 ≅ $73,000
+ 25,000 (plant utilities)

Yr. 7-30 : $55,000

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ALT 2

Page No. 1 of 6

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS File No. 55172

Location LEVITTOWN, NY Date 5/3/2000 By LLV

Subject SOIL VAPOR EXTRACTION SYSTEM Checked 5/26/00 By DJT

Based on Revised By

Assume:

⊙ Well radius of influence ≥ 20 ft

⊙ Install wells:

soil remediation
- 5 vertical wells to 10 ft bgs (north & west sides of building)
- 5 vertical wells to 30 ft bgs (east & south sides of building)

⊙ Assume vacuum required = 40 in H_2O (rec. for gravelly/sandy soils)

⊙ Approx. flow rate from each well ≈ 60 scfm (avg.)

⟶ Total flow rate = (10)(60 scfm) = 600

⊙ Pilot Study would be performed to confirm system design (e.g., well spacing, flow rates, etc.):

assume includes:
① install one extraction well with monitoring probes (2 clusters, 3 e
② use mobile extraction / treatment unit

(use 1999 PMP Amendment No 1 costs)

LABOR: assume test requires 3 days
well/pt. installation requires 2 days. } 5 days
(PM/design costs not included → include w/ eng'g costs)

Staff Engineer: (5 days)(10 hours/day)($64/hr) ≑ $3000

Geologist: (2 days)(10 hours/day)($53/hr) ≑ $1000

EXPENSES: equipment (hnu, water level meter, etc) ≈ $400

per diem, rental truck, etc ≈ $6000

MOBILE TREATMENT UNIT: 100-250 scfm system, 6 cylinder
(quote - ProAct services)
≈ $5000 (includes technician for 3 days)

INSTALLATION OF MONITORING PTS:

· Geoprobe services = ($1000)(2 days) = $2000

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ALT. 2

Page No. 2 of 6

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/3/2000
By LLV
Subject SOIL VAPOR EXTRACTION SYSTEM
Checked 5/26/00
By DJT
Based on
Revised
By

• Decon : (1 hr)($120/hr) ≈ $100

• Materials : (3/4"ϕ Sch. 40 pvc casing)

($6/lf)(30 ft/ea)(2 clusters × 3 ea) ≅ $1100

(lockable cover)($125/ea)(6) ≅ $750

} $1800

• Install one 30' well → included in SVE well cost below.

→ TOTAL PILOT STUDY ≅ $20,000

① SVE System Installation:

- Contractor mob / demob = $20,000 (ECHOS, A 33-23-1107)

- SVE collection piping:
  assume us 4"ϕ HDPE piping, installed 4' bgs)
  Length ≈ 350 ft
  unit cost (trenching in asphalt pavement & repair):

some cost sharing w/ GWES piping

- trenching / backfill ≈ $15/lf (Means A 12.3-110-1440)
- backfill material ≈ $5/lf (" " " 310-1600)
  add ≈ $2/lf for washed gravel, not sand and to account for smaller pipe ϕ
- pipe ≈ $7/lf (Means A 12.3-110-1420)
- saw cutting ≈ $1.50/lf
- asphalt patching : $4.70/lf

} (see costs for GWE system)

≈ $35/lf

∴ Cost ≈ (350 lf)($35/lf) = $12,000

- Pressure gauge valve piping / valve boxes: install to isolate sections @ each well: (cost based on experience w/ similar projects)

($15/ea)(10) = $150

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ALT. 2

Page No. 3 of 6

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/3/2010
By LLV
Subject SOIL VAPOR EXTRACTION SYSTEM
Checked 5/25/10
By DJT
Based on
Revised
By

- Vertical Wells:
  - assume drill 5 wells to 10 ft
  - assume drill 5 wells to 30 ft
  - install 4" φ pvc riser pipe and screen
- mob/demob = $1600 (drilling-PMP)
- drilling - 8 1/4" HSA:
  (200 ft)($35/ft) ≅ $7,000 (ECHOS 33-23-1103)
- 4" φ pvc casing:
  (50 ft)($9/ft) ≅ $500 (ECHOS 33-23-0102)
- 4" φ pvc screen:
  (10 * 15 ft/ea)($20/ft) ≅ $3000 (ECHOS 33-23-0202)
- Well plug:
  (10 ea)($38/ea) ≅ $400 (ECHOS 33-23-0302)
- Sand pack:
  (10 * 6 ft/ea)($27/lf) ≅ $1600 (ECHOS 33-23-1403)
- Bentonite Seal:
  (10 * 1 ft/ea)($125/ft) ≅ $1200 (ECHOS 33-23-2103)
- Grout:
  (10 * 2 ft/ea)($65/ft) ≅ $1300 (ECHOS 33-23-1803)
- Road box:
  (10)($125/ea) ≅ $1200 (PMP)

⟶ wells ≈ $18,000

ALT. 2

Page No. 4 of 6

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/3/2000
By LLV
Subject SOIL VAPOR EXTRACTION SYSTEM
Checked 5/25/00
By DJT
Based on
Revised
By

- Process Equipment: (quotes from Electrolab)
  - Catalytic Oxidizer: included with GWTS costs
  - Treatment building / Instrumentation / Controls: included in costs for GWTS system
  - Electricity Hook-up: included in costs for GWTS system
  - Extraction blower ≈ $10,000 (with 20 HP motor)
    (≤ 1000 scfm, 40" H_2O vacuum)
  - Pressure Relief Valve ≈ $300
  - Vacuum Gauge ≈ $40
  - Thermometer ≈ $120
  - Air/Water Separator ≈ $2700
    (240-gallon)
  - Pressure Gauge: $140 (EZHOS 33-31-0209)
  - Flow Meter: $500
  - Centrifugal Pump: $5000
  - Tank for condensate water: not needed — would pump condensate to EQ Tank

→ Equipment ≈ $19,000 ✓

- System Start-up / Shakedown ≈ $30,000 (based on experience on similar projects)

→ TOTAL SVE CAPITAL COST ≈ $100,000
(excluding pilot study)

with pilot study = $120,000

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: ALT. 2

Page No. 5 of 6

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS   File No. 55172
Location LEVITTOWN, NY   Date 5/3/2000   By LLV
Subject SOIL VAPOR EXTRACTION SYSTEM   Checked 5/25/00   By DJT
~~Based on~~   Revised   By

O & M Costs:

- Assume operated for 5 years.
- Cost for contract operations firm / remote monitoring — included with costs for GWTS system.
- Electrical —
  - Catalytic Oxidizer: included in GWTS costs
  - Extraction Blower: ≈ 746 watts per HP; ≈ $0.12 per KWhr

    ∴ (20 HP)(746 W)($0.12/1000 W)(24 hr/day)(365 d/y

    ≅ $15,700/yr
  - Centrifugal Pump: (746 W)($0.12/1000 W)(24 hr/day)(365 day/y

    ≅ $800/yr

    → $17,000/yr
- Misc. wastes disposal — costs included with GWTS system for general housekeeping.
- Catox catalyst: included in GWTS costs
- Labor: (for repairs per year)
  - electrician: $1500/yr (40 hrs @ $35/hr, ECHOS p.2-37)
  - mechanic: $1200/yr (50 hrs @ $24/hr, p.2-37)
  - laborer: $1500/yr (100 hrs @ $15/hr, p.2-37)

  $4200/yr

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ALT. 2

Page No. 6 OF 6

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS

File No. 55172

Location LEVITTOWN, NY

Date 5/3/2000 By LLV

Subject SOIL VAPOR EXTRACTION SYSTEM

Checked 5/25/00 By DJT

Based on

Revised By

- Emergency repairs → assume $2000/yr.
- Parts/supplies → assume $2000/yr.

} based on experience with similar projects

→ Total O&M: $25,000

(years 1, 2, 3, 4 & 5)

: ALT. 2

Page No. 1 of 2

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/2/2000
By LLV
Subject SOIL SAMPLING (SVE MONITORING)
Checked 5/25/00
By DJT
Based on
Revised
By

Assume

- soil sampling via geoprobe rig performed on unsaturated soils five (5) times throughout SVE system lifetime:
  → years 1, 2, 3, 4, 5
- assume collect within zone of influence of SVE system.
- collect samples from 2 locations (also headspace during sampling):
  - northwest site corner → depth ≈ 4-10 feet bgs
  - south of on-site cesspools → depth ≈ 20-30 feet bgs.
- analyze samples for VOCs
- duration = 1 day by field geologist + geoprobe rig/personnel.
- use prices in prop. Amendment No. 1

LABOR: (1)(8 hrs/day)(\$53.22/hr) ≈ \$450

EQUIPMENT: Hnu PID → ≈ \$50/day rental

EXPENSES: Per diem, rental truck, gasoline, tolls, Level D, office ≈ \$350

(1 day)

CONSUMABLES: Gloves, paper towels, DI water, ice ≈ \$50

OFFICE LABOR: (to coordinate work and produce brief data report)

PM: (1 hr)(\$98.67/hr) ≈ \$100
Staff Engineer: (4 hrs)(\$64.06/hr) ≈ \$250
Geologist: (2 hrs)(\$53.22/hr) ≈ \$100
} \$450

ANALYTICAL TESTING:

- 2 (samples) + 1 (duplicate) + 2 (MS/MSD) + 1 (rinsate blank)
  = 6 samples
  - Lab Tests = (6)(\$110) = \$660
  - Validation = (6)(\$26) = \$150
  } ≈ \$810

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ALT. 2

Page No. 2 of 2

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS

File No. 55172

Location LEVITTOWN, NY

Date 5/2/2000 By LLV

Subject SOIL SAMPLING (SVE MONITORING)

Checked 5/24/00 By DJT

Based on

Revised By

GEOPROBE SERVICES:

- Rig & Equipment: (1 day)($1000) = $1000
- Geoprobe Soil Samples: ($3/ea)(3+8 samples) ≈ $30
- Decon: ($120/hr)(1 hr) = $100

} $1130

Total: $3,300/event

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ALT. 2

Page No. 1 of 1
Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/3/2000
By LLV
Subject CESSPOOL CLOSURE
Checked 5/25/00
By DJT
Based on
Revised
By

Assume:

- Plug conduits, drains, other piping are sealed or plugged with grout first.
- Accumulated water is pumped out of cesspools.
- Backfill cesspools with clean soil, and top with one-foot thick layer of clay or concrete.
- Paving included with asphalt pavement cover cost.

Costs:

- Plug/seal any conduits : assume \$1000
- Pump out/dispose of water : \$500 (assume 1' water in each cesspool)

(remove and containerize water)

$$\left(1' * \pi\left(\frac{9'}{2}\right)^2 \times 7.48\frac{cf}{gal.}\right)\left(\$0.85/\text{gallon}\right)$$

$\approx \$500$

(characterization and disposal of drummed water - assume hazardous)

(costs based on experience on similar projects)

- Soil backfill:

-volume of clean soil = $\left(\pi\left(\frac{9'}{2}\right)^2(12'-1')\right) + \left(\pi\left(\frac{9'}{2}\right)^2(15'-1')\right)$

(northern cesspool)

$\approx 60cy$

-backfill with clean soil using ≈1cy bucket backhoe:

("certified clean")

$\left(\approx\$15/cy\right)\left(60cy\right) \approx \$900$ (1999 Means 022-216)

- one foot concrete cap:

-volume = $(1')\left(\pi(3'/2)^2\right) * 2$ cesspools $\approx (0.5cy)$

-for field mix concrete: $\left(\$70/cy\right)\left(0.5cy\right) \approx \$50$ (Means 033-122)

→ TOTAL ≈ \$3000

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ALT. 1

Page No. 1 of 2

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 4/28/2000 By LLV
Subject GROUNDWATER MONITORING
Checked 5/24/2000 By DJT
~~Based on~~
Revised
By

Assume:

○ sample 8 existing monitoring wells
○ purge each 3-5 well volumes and sample by 2 field geologists.
○ Water levels measured in 16 wells.
○ assume duration = 2-10 hour days.
○ collect unfiltered samples; analysis by VOCs only.
○ use unit prices in PMP Amendment No. 1

Labor:

(2)(20 hours)($53.22/hr) = $2100 × 1.08 (h.fee) ≈ $2250

Equipment:

- Hnu (2 days)
- Water Level Indicator (2 days) ←
- pH/conductivity/temperature meters
- HDPE Tubing (≈400 lf)
- Pump Rental (1 wk)

} ≈ $600

Expenses:

- Per diem, rental truck, gasoline, tolls, Level D, office ≈ $700

2 days

Consumables:

- gloves/paper towels, DI water, ice ≈ $150

Office Labor:

(to coordinate work & produce data letter report)

PM: (1 hr)($98.67/hr) ≈ $100
Staff Engineer: (4 hrs)($64.06/hr) ≈ $250
Geologist: (2 hrs)($53.22/hr) ≈ $100

} $450

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ALT. 1

Page No. 2 of 2

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS

File No. 55172

Location LEVITTOWN, NY

Date 4/28/2000 By LLV

Subject GROUNDWATER MONITORING

Checked 5/24/2000 By DJT

Based on

Revised By

Analytical Testing:

8 samples + 1 duplicate + 2 MS/MSD + 1 rinsate blank + 1 trip blank
= 13 samples

- Laboratory: (\$110)(13) = \$1400
- Validation: (\$26)(13) = \$350

\$1750 * 1.14 ≃ \$1800
(sub mgt fee)

Total: ≈ \$6000/event

Perform Annually ⟶ $\boxed{\$6000/\text{year}}$

ALT. 2

Page No. 1 of 1

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172

Location LEVITTOWN, NY
Date 5/2/2000
By LLV

Subject ASPHALT PAVEMENT COVER
Checked 5/24/00
By DJT

~~Based on~~
Revised
By

Assume:

- ⊙ New asphalt pavement cover constructed over areas currently not paved (i.e., west, north, and east of ADC building).
- ⊙ Shall consist of 6 inches compacted 3/4" crushed stone (base course) 2" binder course, and 2" wearing course.
- ⊙ Not included: repairs to existing asphalt pavement due to trenching associated with remediation system piping.
- ⊙ O&M costs to include patching & sealcoating of site within and around remediation systems area, to retain consistent surface treatment.

CAPITAL COSTS:

- Area requiring new pavement ≈ (15'×45') + (110'×10') + (15'×45') ≅ 2500 sf ≅ 90 sy
- unit price per sy: (1999 Means Cost Estimating Guide, No. 022-308-0100, 025-104-0120, 025-109-0380)
  - 6" Base Course : $8/sy
  - 2" Binder Course : $4/sy
  - 2" Wearing Course : $4.50/sy

  } ≈ $16.50/sy * 1.24 (LOCATION FACTOR) ≈ $20/sy

∴ (90 sy)($20/sy) ≅ **$2000**

O&M COSTS: (1919 Means)

- Area requiring O&M:
  - 90 sy (new pavement)
  - \+ 400 sy (existing pavement – ADC Site property and Discount Beverages property ≈ 60' × 180')
  - 490 sy
- Sealcoat every 5 years: (490 sy)($1/sy) ≅ **$500** (every 5 years)
- Assume patch approximately 10 sy per year: (10 sy)($20/sy) ≅ **$200** (every year)

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ALT. 2

Page No. 1 of 2

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 4/28/2000 By LLV
Subject GROUNDWATER MONITORING
Checked 5/24/2000 By DJT
~~Based on~~
Revised
By

Assume: maybe one additional (downgradient well) included

- ⊙ sample (8) existing monitoring wells
- ⊙ purge each 3-5 well volumes and sample by 2 field geologists.
- ⊙ water levels measured in (16) wells maybe 17
- ⊙ assume duration = 2-10 hour days.
- ⊙ collect unfiltered samples; analysis by VOCs only.
- ⊙ use unit prices in PMP Amendment No. 1

Labor:

(2)(20 hours)($53.22/hr) = $2100 * 1.08 (fix fee) ≅ $2250

Equipment:

- Hnu (2 days)
- Water level indicator (2 days)
- pH/conductivity/temperature meters
- HDPE Tubing (≈400 lf.)
- Pump Rental (1 wk)

} ≈ $600

Expenses:

- Per diem, rental truck, gasoline, tolls, Level D, office ≈ $700

2 days

Consumables:

- gloves/paper towels, DI water, ice ≈ $150

Office Labor:

(to coordinate work & produce data letter report)

PM: (1 hr)($98.67/hr) ≅ $100
Staff Engineer: (4 hrs)($64.06/hr) ≅ $250
Geologist: (2 hrs)($53.22/hr) ≅ $100

} $450

ALT. 2

Page No. 2 of 2

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 4/28/2000
By LLV
Subject GROUNDWATER MINITORING
Checked 5/24/2000
By DJT
~~Based on~~
Revised
By

Analytical Testing:

8 samples + 1 duplicate + 2 MS/MSD + 1 rinsate blank + 1 trip blank
= 13 samples

- Laboratory: ($110)(13) = $1400
- Validation: ($26)(13) = $350

$1750 * 1.14 ≃ $1800
(sub mgt fee)

Total: ≈ $6000/event

Years 1 - 2: perform quarterly → $24,000/yr (0-2)

Years 3-30: perform annually → $6000/yr (3-30)

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ALT. 3

Page No. 1 of 5

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS, File No. 55172
Location LEVITTOWN, NY Date 5/4/2000 By LLV
Subject IN-SITU AIR SPARGING SYSTEM Checked 5/25/00 By DJT
Based on Revised By

Assume:

⊙ Well radius of influence ≈ 10 - 20 ft.
⊙ Install wells (~16 total) to depths between 45-65 ft (50 ft average).
⊙ Assume: required injection pressures between 10 - 20 psig, or max 25 psig to account for pipe headloss.
⊙ Injection flow rates: assume 5-10 scfm per well ∴ (16)(5-10) ≈ 100 - 200 scfm

⊙ Pilot Study: to confirm system design (e.g., well spacing, required pressures, etc.)

assume includes:
① install one sparge well w/ monitoring probes (2 clusters, 3 ea)
② use mobile treatment / injection unit.
(use 1999 PMP Amendment No. 1 costs, as applicable).

LABOR: assume test requires 3 days } 5 days
well / monitoring pt. installation requires 2 days }
(PM / design costs included w/ Upfront Eng'g costs – not included here).

Staff Engineer: (5 days)(10 hrs/day)($64/hr) ≅ $3000

Geologist: (2 days)(10 hrs/day)($53/hr) ≅ $1000

EXPENSES: equipment (PID, water level meter) ≅ $400
per diem, truck rental, etc. ≅ $6000

MOBILE UNIT: 100 - 250 scfm system
(quote - ProAct services) ≈ $5000 (includes 3 days of technician time)

Air Sparge Well: included in costs for full system below.

Monitoring pt Installation:

- Geoprobe: ($1000/day)(2 days) ≅ $2000
- Decon: (1 hr)($120/hr) ≅ $100

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ALT. 3

Page No. 2 of 5
Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/4/2000
By LLV
Subject IN-SITU AIR SPARGING SYSTEM
Checked 5/25/00
By DJT
Based on
Revised
By

- Materials: (3/4" ϕ Sch. 40 PVC casing)

($6/lf)(50 lf ea avg.)(2 clusters × 3 ea) +

lockable cover @ ($125/ea)(6) ≈ $2600

→ TOTAL PILOT STUDY ≅ $20,000

- Air Sparging System:
- Contractor Mob/Demob (included with SVE system)
- IASS piping:

assume use 2" ϕ HDPE pipe, installed 4' bgs:

length (outside SVE trench) ≅ 155 lf – include trenching cost

length (sharing SVE trench) ≅ 330 lf – piping only

→ cost to trench & install pipe ≅ $35 – $4.50 ≅ $30/lf

diff. between 4"ϕ & 2"ϕ PVC

(see SVE costs)

∴ (155 lf)($30) ≅ $4700

→ cost to install pipe w/ SVE pipe: ($10/lf)(330 lf) ≅ $3300

→ PIPING COST ≈ $8000

- Pressure gauge boxes: install to isolate sections @ each line & well

($15/ea)(16 + 6) ≅ $300

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ALT. 3

Page No. 3 of 5

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172

Location LEVITTOWN, NY
Date 5/4/2000
By LLV

Subject IN-SITU AIR SPARGING SYSTEM
Checked 5/25/00
By DJT

Based on
Revised
By

• Vertical Wells:

- assume drill to avg. 50' depth
- install 3/4"φ carbon steel (for 35' per well); stainless steel casing (for 10' per well); stainless steel screen (for 5' per well).

• mob/demob = $1600 (drilling - pmp)

• drilling - 4 1/4" HSA:

(16×50')($23/lf) ≅ $18,400 (ECHOS 33-23-1101)

• Carbon Steel Casing:

(16 * 35')($25/lf) ≅ $14,000 (ECHOS 33-23-0221)

• Stainless Steel Casing and Screen:

(16 × 15')($30/lf) ≅ $7200 (ECHOS 33-23-0221)

• Well Plug (S.S.):

(16)($43/ea) ≅ $700 (ECHOS 33-23-0221)

• Sand pack:

(16 × 6'/well)($11/ft) ≅ $1100 (ECHOS 33-23-1401)

• Bentonite Seal:

(16 × 1'/well)($31/ft) ≅ $500 (ECHOS 33-23-2101)

• Grout:

(16 × 2'/well)($25/ft) ≅ $800 (ECHOS 33-23-1803)

• Road Box:

(16 × $125/ea) ≅ $2000 (PMP)

WELLS ≈ $46,000

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ALT. 3

Page No. 4 of 5

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date
By LLV
Subject IN-SITU AIR SPARGING SYSTEM
Checked 5/25/00
By DJT
~~Based on~~
Revised
By

- Equipment:
  - Treatment Building (20' × 30'), slab on grade construction, pre-engineered metal-type ≈ $175,000 (based on experience w/ similar projects)
  - Electrical/instrumentation & controls systems and interior piping ≈ 25% of bldg cost

total → $220,000

- Electrical Hook-up: $20,000 (based on experience with similar projects)
- Injection Blower: (≈ 200 scfm, 15 Hp, 15 ÷ 25 psi) ≈ $6000 (ElectroLab quotations)
- Pressure Relief Valve ≈ $300
- Pressure Gauges ≈ ($140 ea)(16) = $2400
- Thermometer ≈ $120
- Flow Meter: $500
- System Startup/Shakedown ≈ $30,000

→ Equipment and Treatment Building = $280,000

TOTAL IASS COST: (excluding pilot study) $334,000 → or $354,000 w/ pilot study

ALT 3

Page No. 5 of 5

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/4/2000 By LLV
Subject IN-SITU AIR SPARGING SYSTEM
Checked 5/25/00 By PJT
Based on
Revised
By

O & M Costs: Assume:

- Assume operated for 30 years
- Cost – contract operational firm: ≈ $29000/yr (based on experience with similar project.)
  ≈(48 hrs/mo * $45/hr)
- remote monitoring of system: $5000/yr
- electrical & natural gas utilities:
  - Blower: (15 hp)(746 W)($0.12/1000 W)(24 hr/day)(365 d/yr)
    = $12,000/yr

    + $15,000/yr for general electric and gas

    ⟶ $27,000/yr
- misc. waste disposal: $10,000/yr
- Labor: (for misc. & repairs per year) – ECHOS p. 2-37
  - electrician : (50 hrs * $35/hr) ≈ $1800
  - mechanic : (100 hrs * $24/hr) ≈ $2400
  - Laborer : (100 hrs * $15/hr) ≈ $1500

  } $5700/yr
- Emergency repairs ⟶ assume $2000/yr
- Parts/supplies replacement ⟶ assume $2000/yr

} based on experience with similar projects

⟶ TOTAL O & M: $72,000/yr

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ALT. 3

Page No. 1 of 2
Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 4/28/2000
By LLV
Subject GROUNDWATER MONITORING
Checked 5/24/2000
By DTT
~~Based on~~
Revised
By

Assume: maybe one additional well included (downgradient)

- ⊙ sample (8) existing monitoring wells
- ⊙ purge each 3-5 well volumes and sample by 2 field geologists.
- ⊙ water levels measured in (16) wells maybe 17
- ⊙ assume duration = 2 - 10 hour days.
- ⊙ collect unfiltered samples; analysis by VOCs only.
- ⊙ use unit prices in PMP Amendment No. 1

Labor:

$(2)(20\text{ hours})\left(\frac{\$53.22}{hr}\right) = \$2100 * 1.08 \cong \$\underline{2250}$ (fix fee)

Equipment:

- · Hnu (2 days)
- · Water level Indicator (2 days)
- · pH/conductivity/temperature meters
- · HDPE Tubing (≈ 400 lf.)
- · Pump Rental (1 wk)

} ≈ $600

Expenses:

· Per diem, rental truck, gasoline, tolls, Level D, office ≈ $700

2 days

Consumables:

· gloves/paper towels, DI water, ice ≈ $150

Office Labor:

(to coordinate work & produce data letter report)

PM: (1 hr)($98.67/hr) ≅ $100
Staff Engineer: (4 hrs)($64.06/hr) ≅ $250
Geologist: (2 hrs)($53.22/hr) ≅ $100
} $450

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ALT. 3

Page No. 2 of 2

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 4/28/2000 By LLV
Subject GROUNDWATER MONITORING
Checked 5/24/2000 By DTT
~~Based on~~
Revised By

Analytical Testing:

8 samples + 1 duplicate + 2 MS/MSD + 1 rinsate blank + 1 trip blank
= 13 samples

- Laboratory: ($110)(13) = $1400
- Validation: ($26)(13) = $350

$1750 * 1.14 ≈ $1800
(sub mgt fee)

Total: ≈ $6000/event

Years 1-2: perform quarterly → $24,000/year (0-2)

Years 3-30: perform annually → $6000/year (3-30)

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ALT 3

Page No. 1 of 6

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/3/2000 By LLV
Subject SOIL VAPOR EXTRACTION SYSTEM
Checked 5/25/00 By DJT
Based on
Revised By

Assume:

⊙ Well radius of influence ≥ 29 ft
⊙ Install wells:
soil remediation { · 5 vertical wells to 10 ft bgs (north & west sides of building)
· 5 vertical wells to 30 ft bgs (east & south sides of building)
· 6 " " to 30 ft " (air sparging system)

⊙ Assume vacuum required = 40 in H_2O (rec. for gravelly/sandy soils)

⊙ Approx. flow rate from each well ≈ 60 scfm (avg.)

⟶ Total flow rate = (16)(60 scfm) = 960

⊙ Pilot Study would be performed to confirm system design (e.g., well spacing, flow rates, etc.):

assume includes:
① install one extraction well with monitoring probes (2 clusters, 3 ea
② use mobile extraction/treatment unit

(use 1999 PMP Amendment No 1 costs)

LABOR: assume test requires 3 days } 5 days
well/pt. installation requires 2 days }
(PM/design costs not included ⟶ include w/ eng'g costs)

Staff Engineer: (5 days)(10 hours/day)(\$64/hr) ≑ \$3000

Geologist: (2 days)(10 hours/day)(\$53/hr) ≑ \$1000

EXPENSES: equipment (hnu, water level meter, etc) ≈ \$400

per diem, rental truck, etc ≈ \$6000

MOBILE TREATMENT UNIT: 100-250 scfm system, 6 cylinder
(quote - ProAct Services)
≈ \$5000 (includes technician for 3 days)
- share costs w/ ISAS

INSTALLATION OF MONITORING PTS:

· Geoprobe services = (\$1000)(3 days) = \$3000

ALT. 3

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/3/2000 By LLV
Subject SOIL VAPOR EXTRACTION SYSTEM
Checked 5/25/00 By DJT
Based on
Revised By

- Decon : (1 hr)($120/hr) ≈ $100
- Materials : (3/4" φ Sch. 40 pvc casing)
  ($6/lf)(30 ft/ea)(2 clusters × 3 ea) ≅ $ ~~360~~ 1100 lf
  (lockable cover)($125/ea)(6) ≅ $750
  } $ 1800
- Install one 30' well - included with SVE well costs below

→ TOTAL PILOT STUDY ≅ $20,000

① SVE System Installation:

- Contractor mob / demob = $20,000 (Echos, A 33-23-1187)
- SVE collection piping: HDPE pipe
  assume use 4" φ [illegible], installed 4' bgs)
  length ≈ 560 ft
  unit cost (trenching in asphalt pavement & repair):
  - trenching / backfill ≈ $15/lf (Means A 12.3-110-1440)
  - backfill material ≈ $5/lf (" " " 310-1600)
    add ≈ $2/lf for washed gravel, not sand and to account for smaller pipe φ
  - pipe ≈ $7/lf (Means A 12.3-110-1420)
  - saw cutting ≈ $1.50/lf
  - asphalt patching : $4.70/lf

  } (see costs for system)

  Some cost shared w/ air sparge system

  ≈ $35/lf

  ∴ COST ≈ (560 lf)($35/lf) = $20,000

- Pressure gauge valve piping / valve boxes: install to isolate sections @ each well: (cost based on experience w/ similar projects)
  ($15/ea)(16) = $240

ALT. 3

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS.
File No. 55172
Location LEVITTOWN, NY
Date 5/3/2010 By LLV
Subject SOIL VAPOR EXTRACTION SYSTEM
Checked 5/25/10 By DJT
Based on
Revised
By

- Vertical Wells:
  - assume drill 5 wells to 10 ft
  - assume drill 11 wells to 30 ft
  - install 4"φ pvc riser pipe and screen

- mob/demob = $1600 (drilling-PMP)

- drilling - 8¼" HSA:

  (380 ft)($35/ft) ≅ $13,000 (ECHOS 33-23-1103)

- 4"φ pvc casing:

  (140 ft)($9/ft) ≅ $1300 (ECHOS 33-23-0102)

- 4"φ pvc screen:

  (16*15 ft/ea)($20/ft) ≅ $5000 (ECHOS 33-23-0202)

- Well plug:

  (16 ea)($38/ea) ≅ $600 (ECHOS 33-23-0302)

- Sand pack:

  (16*6 ft/ea)($27/lf) ≅ $2600 (ECHOS 33-23-1403)

- Bentonite Seal:

  (16*1 ft/ea)($125/ft) ≅ $2000 (ECHOS 33-23-2103)

- Grout:

  (16*2 ft/ea)($65/ft) ≅ $2100 (ECHOS 33-23-1803)

- Road box:

  (16)($125/ea) ≅ $2000 (PMP)

→ Wells ≈ $30,000

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Engineers and Scientists

ALT. 3

Page No. 4 of 6

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date
By LLV
Subject SOIL VAPOR EXTRACTION SYSTEM
Checked 5/25/00
By DJT
Based on
Revised
By

- Process Equipment: (quotes from Electrolab)
  - Catalytic Oxidizer: $110,000 (assumes avg. initial influent = 500 ppmv @ ≤1000 scfm)
  - Treatment building / Instrumentation / Controls: included in costs for ISAS system
  - Electricity Hook-up: included in costs for ISAS system
  - Extraction Blower ≈ $10,000 (with 20 HP motor) (≤1000 scfm, 40" H2O vacuum)
  - Pressure Relief Valve ≈ $300
  - Vacuum Gauge ≈ $40
  - Thermometer ≈ $120
  - Air/Water Separator (240-gallon) ≈ $2700
  - Pressure Gauge: $140 (EZHOS 33-31-0201)
  - Flow Meter: $500
  - Centrifugal Pump: $5000
  - Tank for condensate water: $1500

→ Equipment ≈ $130,000

- System Start-up / Shakedown ≈ $30,000 (based on experience on similar projects)

→ TOTAL SVE CAPITAL COST ≈ $230,000 (excluding pilot study)

$260,000 [illegible]

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ALT. 3

Page No. 5 of 6

Project: AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location: LEVITTOWN, NY
Date: 5/3/2000
By: LLV
Subject: SOIL VAPOR EXTRACTION SYSTEM
Checked: 5/25/00
By: DJT
Based on
Revised
By

O & M Costs:

- Assume operated for 5 years.
- Cost for contract operations firm / remote monitoring – included with costs for ISAS system.
- Electrical –
  - Catalytic Oxidizer: $75,000/yr (see GWTS cost Est., Alt. 2)
  - Extraction Blower: ≈ 746 watts per HP; ≈ $0.12 per KWhr
    ∴ (20 HP)(746 W)($0.12/1000 W)(24 hr/day)(365 d/
    ≅ $15,700/yr
  - Centrifugal Pump: $800/yr (see ALT. 2 SVE system)

⟶ $92,000

- Misc. waste disposal – costs included with ISAS system for general housekeeping.
- Disposal of condensate / catox wastes and cost to purchase / replenish Catox catalyst. ≈ $10,000/yr
- Analytical Testing – CATOX air emissions – $4000/yr (see GWTS cost est., Alt 2.)
- Labor: (for repairs per year)
  - electrician: $1500/yr (40 hrs @ $35/hr, ECHOS p. 2-37)
  - mechanic: $1200/yr (50 hrs @ $24/hr, p. 2-37)
  - laborer: $1500/yr (100 hrs @ $15/hr, p. 2-37)

$4200/yr

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ALT. 3

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/3/2000 By LLV
Subject SOIL VAPOR EXTRACTION SYSTEM
Checked 5/25/00 By DJT
Based on
Revised
By

- Emergency repairs → assume $2000/yr.
- Parts/supplies → assume $2000/yr.

} based on experience with similar projects

→ Total O&M: $114,000

(years 1, 2, 3, 4 & 5)

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ALT. 3

Page No. 1 of 2
Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/2/2000 By LLV
Subject SOIL SAMPLING (SVE MONITORING)
Checked 5/24/00 By DJT
Based on
Revised By

Assume

- soil sampling via geoprobe rig performed on unsaturated soils five (5) times throughout SVE system lifetime:
  $\rightarrow$ years 1, 2, 3, 4, 5.
- assume collect within zone of influence of SVE system.
- collect samples from 2 locations (also headspace during sampling):
  - northwest site corner → depth ≈ 4-10 feet bgs
  - south of on-site cesspools → depth ≈ 20-30 feet bgs.
- analyze samples for VOCs
- duration = 1 day by field geologist + geoprobe rig/personnel.
- use prices in prop Amendment No. 1

LABOR: $(1)\left(8\ \frac{\text{hrs}}{\text{day}}\right)\left(\frac{\$53.22}{\text{hr}}\right) \cong \$450$

EQUIPMENT: Hnu PID → ≈ $50/day rental

EXPENSES: $\underbrace{\text{Per diem, rental truck}}_{\text{1 day}}$, gasoline, tolls, Level D, office ≈ $350

CONSUMABLES: Gloves, paper towels, DI water, ice ≈ $50

OFFICE LABOR: (to coordinate work and produce brief data report)

$$\left.\begin{array}{l}\text{PM: (1 hr)(\$98.67/hr)} \approx \$100 \\ \text{Staff Engineer: (4 hrs)(\$64.06/hr)} \cong \$250 \\ \text{Geologist: (2 hrs)(\$53.22/hr)} \cong \$100\end{array}\right\} \$450$$

ANALYTICAL TESTING:

- 2 (samples) + 1 (duplicate) + 2 (MS/MSD) + 1 (rinsate blank) = 6 samples
- Lab Tests = (6)($110) = $660 } ≈ $810

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ALT. 3

Page No. 2 of 2

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/2/2000 By LLV
Subject SOIL SAMPLING (SVE MONITORING)
Checked 5/24/00 By DJT
Revised By
Based on

GEOPROBE SERVICES:

- Rig & Equipment: (1 day)($1000) = $1000
- Geoprobe Soil Samples: ($3/ea)(3+8 samples) ≈ $30
- Decon: ($120/hr)(1 hr) = $100

} $1130

Total: $3,300/event

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ALT. 3

Page No. 1 of 1

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/3/2000
By LLV
Subject CESSPOOL CLOSURE
Checked 5/24/00
By DJT
Based on
Revised
By

Assume:

- ⊙ Plug conduits, drains, other piping are sealed or plugged with grout first.
- ⊙ Accumulated water is pumped out of cesspools.
- ⊙ Backfill cesspools with clean soil, and top with one-foot thick layer of clay or concrete
- ⊙ Paving included with asphalt pavement cover cost

COSTS:

- Plug/seal any conduits: assume $1000
- Pump out/dispose of water: $500 (assume 1' water in each cesspool) (remove and containerize water)

$$\left(1' * \pi\left(\frac{9'}{2}\right)^2 \times 7.48\frac{cf}{gal.}\right)\left(\$0.85/\text{gallon}\right)$$

(characterization and disposal of drummed water - assume hazardous)

$\approx \$500$

(costs based on experience on similar projects)

- Soil backfill:
  - volume of clean soil $= \left(\pi\left(\frac{9'}{2}\right)^2(12'-1')\right) + \left(\pi\left(\frac{9'}{2}\right)^2(15'-1')\right)$ (northern cesspool) $\approx 60\,cy$
  - backfill with clean soil ("certified clean") using ≈1 cy bucket backhoe: $\left(\approx \$15/cy\right)\left(60\,cy\right) \cong \$900$ (1999 Means 022-216)
- one foot concrete cap:
  - volume $= (1')\left(\pi(3'/2)^2\right) * 2$ cesspools $\cong (0.5\,cy)$
  - for field mix concrete: $\left(\$70/cy\right)\left(0.5\,cy\right) \approx \$50$ (Means 033-122)

⟶ TOTAL ≈ $3000

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ALT. 3

Page No. 1 of 1

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/2/2000 By LLV
Checked 5/25/00 By DTT
Subject ASPHALT PAVEMENT COVER
~~Based on~~
Revised
By

Assume:

- ⊙ New asphalt pavement cover constructed over areas currently not paved (i.e., west, north, and east of ADC building).
- ⊙ Shall consist of 6 inches compacted 3/4" crushed stone (base course), 2" binder course, and 2" wearing course.
- ⊙ Not included: repairs to existing asphalt pavement due to trenching associated with remediation system piping.
- ⊙ O&M costs to include patching & sealcoating of site within and around remediation systems area, to retain consistent surface treatment.

CAPITAL COSTS:

- Area requiring new pavement ≈ (15' × 45') + (110' × 10') + (15' × 45')
  ≅ 2500 sf ≅ 90 sy
- unit price per sy: (1999 Means Cost Estimating Guide, No. 022-308-0100, 025-104-0120, 025-104-0380)
  - 6" Base Course: $8/sy
  - 2" Binder Course: $4/sy
  - 2" Wearing Course: $4.50/sy

  } ≈ $16.50/sy * 1.241 ← LOCATION FACTOR

  ≈ $20/sy

∴ (90 sy)($20/sy) ≅ $2000

O&M COSTS: (1919 Means)

- Area requiring O&M:
  - 90 sy (new pavement)
  - \+ 400 sy (existing pavement - ADC Site property and Discount Beverages property ≈ 60' × 180')
  - 490 sy
- Sealcoat every 5 years: (490 sy)($1/sy) ≅ $500 (every 5 years)
- Assume patch approximately 10 sy per year:
  (10 sy)($20/sy) ≅ $200 (every year)

Table C-4
Cost Estimate Summary
Alternative No. 4:
In-Situ Chemical Oxidation, Soil Vapor Extraction and Groundwater Extraction and Treatment
On-Site Focused Feasibility Study
American Drive-In Cleaners
Site No. 1-30-049
Levittown, New York

Item No.	Description	Capital Costs	Present Worth of O&M Costs
1	In-Situ Chemical Oxidation (Fenton's Reagent)	$ 477,000	$ -
2	Groundwater Extraction	$ 77,000	$ 44,000
3	Ex-Situ Groundwater Treatment and Discharge	$ 484,000	$ 941,000
4	Groundwater Monitoring	$ 24,000	$ 126,000
5	Soil Vapor Extraction and Treatment (see Note 4)	$ 120,000	$ 108,000
6	Soil Sampling/Soil Vapor Extraction System Monitoring	$ -	$ 14,000
7	Cesspool Abandonment/Closure	$ 3,000	$ -
8	Asphalt Pavement Cover	$ 2,000	$ 4,000
Subtotal		$ 1,187,000	$ 1,237,000
Engineering (15%)		$ 178,000	
Contingency/Administration (10%)		$ 119,000	
TOTAL		$ 1,484,000	$ 1,237,000

Net Present Worth

Capital Costs	$ 1,484,000
Present Worth of Annual O&M Costs	$ 1,237,000
TOTAL NET PRESENT WORTH =	$ 2,721,000

Notes:

1.) Refer to the attached pages for descriptions of the cost estimate assumptions.

2.) Present Worth of O&M costs were calculated for a 30-year duration using a 5% discount rate (i.e., interest rate = 9%, inflation rate = 4%). It should be noted that the assumed duration of some items is less than 30 years.

3.) Total costs are rounded to the nearest $1,000.

4.) Capital and O&M costs for the treatment building/catalytic oxidation system/electrical/controls/etc. are included with the costs for ex-situ groundwater treatment and discharge (Item 3 above). See attached assumption pages for details.

5.) The above estimate assumes in-situ chemical oxidation is effective at treating highly contaminated saturated and unsaturated soil, DNAPL and highly contaminated groundwater associated with the cesspool source area, such that groundwater extraction/treatment is required for 10 years.

Cost Estimate Assumptions
Alternative No. 3:
In-Situ Air Sparging and Soil Vapor Extraction

On-Site Focused Feasibility Study
American Drive-In Cleaners
Site No. 1-30-049
Levittown, New York

Item No. 1: In-Situ Air Sparging

Assumes flow rate from system is approximately 200 scfm; required injection pressure is max. 25 psig.

Assume IASS Pilot Study is conducted which includes:

- Installation and materials for 1 well to 50 feet (costs included with system wells below).
- Installation and materials for three couplets of 2- 3/4-inch PVC monitoring points installed to 50 feet BGS.
- mobile treatment unit used to inject air and treat extracted vapors (using SVE system below).
- perform 3-day study (cost includes labor, materials and equipment rental): $20,000

Assumes 16 vertical wells (5 to 10 feet bgs, 11 to 30 feet bgs) and header piping installed
(total estimated cost: $334,000)

- ~~mobilization/demobilization for pipe installation labor, equipment and materials.~~
- installation of 16 wells (3/4inch carbon steel (riser) above water table, stainless steel riser and screen below); traditional sparge design.
- installation (via trenching) and materials for approximately 485 ft. of piping, 2-inch diameter solid HDPE pipe
- piping installed at depth of 4 feet BGS.
- saw-cutting and patching of existing asphalt is included, where necessary.
- Equipment is used for the sparge system:
  - Injection Blower (up to 200 scfm) and motor (15 hp)
  - Pressure gauges
  - Thermometer
  - Flowmeter
  - Process piping/valves
- Installation and startup for the sparge system.
- Replaceable pressure gauge valve boxes installed and connected to collection lines via piping; placed
- Assumes Treatment Building (20 ft X 30 ft) is fabricated and constructed which includes:
  - prefabricated metal structure with epoxy-coated paint, a concrete foundation with secondary containment, and insulation.
  - instrumentation and controls, electrical and plumbing systems.
- Startup for the Sparging System.

Assumes annual Operation and Maintenance cost for In-Situ Air Sparging System: $72,000/year (years 1 through 30)

- costs include monitoring and clean out of system, gas and electric utilities, labor, repairs, new parts/supplies for system, etc.

Refer to Figure 3-3 for location air sparging wells and treatment building.

Cost Estimate Assumptions
Alternative No. 3:
In-Situ Air Sparging and Soil Vapor Extraction

On-Site Focused Feasibility Study
American Drive-In Cleaners
Site No. 1-30-049
Levittown, New York

Item No. 2: Groundwater Monitoring

Assume monitoring conducted quarterly in years 0 - 2; annually in years 3 - 30.

Assume includes well redevelopment (purge 3 - 5 well volumes) and sampling of 8 existing Site monitoring wells (see Figure 3-3). Also, assume water level measurements performed in sixteen Site wells.

Estimated cost of each sampling effort includes field labor, equipment, and expenses: $3,700

Estimated cost of analytical testing includes:

- Laboratory Analysis of 8 groundwater samples plus QA/QC samples (1 duplicate, 2 MS/MSDs, 1 rinsate blank, 1 trip blank) for TCL VOCs.
- Validation of the laboratory data.
- Estimated cost: $1,800

Assume preparation of a brief data summary report. Estimated cost for report preparation and time for project coordination: $450.

Above costs are based on 1999 rates as presented in the PMP Amendment No. 1.

Total Annual Groundwater Monitoring Cost = $24,000 (years 0 - 2)
Total Annual Groundwater Monitoring Cost = $6,000 (years 3 - 30)

Cost Estimate Assumptions
Alternative No. 3:
In-Situ Air Sparging and Soil Vapor Extraction

On-Site Focused Feasibility Study
American Drive-In Cleaners
Site No. 1-30-049
Levittown, New York

Item No. 3: Soil Vapor Extraction

Assumes flow rate from system is approximately 960 scfm; required vacuum is 40 inches water column; and average initial influent concentration is 500 ppmv. Assume operate system for approx. 5 years.

Assume SVE System Pilot Study is conducted which includes:
- Installation and materials for 1 well to 30 feet (costs included with system wells below).
- Installation and materials for three couplets of 2- 3/4-inch PVC monitoring points installed to 30 feet BGS.
- mobile treatment unit used to treat extracted soil vapors.
- perform 3-day study (cost includes labor, materials and equipment rental): $20,000

Assumes 16 vertical wells (5 to 10 feet bgs, 11 to 30 feet bgs) and header piping installed;
(total estimated cost: $230,000)
- mobilization/demobilization for pipe installation labor, equipment and materials.
- installation of 16 wells (Sch. 40 PVC); traditional SVE well design.
- installation (via trenching) and materials for approximately 560 lf piping, 4-inch diameter solid HDPE pipe
- piping installed at depth of 4 feet BGS.
- piping installation: backfill soils amended with bentonite to limit short-circuiting of air flow.
- piping is butt-fusion welded; sloped to vapor treatment equipment.
- saw-cutting and patching of existing asphalt is included, where necessary.
- Equipment is used for the vapor treatment system:
  - Air/Water Separator (240 gallons)
  - Extraction Blower (up to 1,000 scfm, 40 in WC) and motor (20 hp)
  - Pressure relief valve for blower
  - Vacuum and pressure gauges
  - Thermometer
  - Catalytic Oxidizer to treat air
  - Centrifugal pump to transfer condensate to holding tank
  - Flowmeter
  - Process piping/valves
- Installation and startup for the SVE System.

Assumes replaceable pressure gauge valve boxes installed and connected to collection lines via piping; placed flush-mounted at the intersection of each collection line with header piping and other appropriate fittings.

Assumes costs for building to house treatment system, instrumentation and controls system, and electrical hookup are included above for IASS treatment building.

Assumes annual O&M cost for SVE System (for 5 years): $114,000/year (for 5 years)
- cost includes electric costs for system, misc. labor for repairs, emergency repairs, parts and supplies, effluent air sampling, condensate disposal, purchase of catalyst.
- cost does not include contracted O&M firm to monitor automated system and perform routine operations, housekeeping -- included with air sparging system costs above.

Refer to Figure 3-3 for locations of vapor extraction piping and treatment building.

Cost Estimate Assumptions
Alternative No. 3:
In-Situ Air Sparging and Soil Vapor Extraction

On-Site Focused Feasibility Study
American Drive-In Cleaners
Site No. 1-30-049
Levittown, New York

Item No. 4: Soil Sampling/Soil Vapor Extraction System Monitoring

Assume collect two soil samples in order to monitor the effectiveness of the SVE system, via geoprobe sampling.
Collect samples from two locations: northwest Site corner (4 - 10 feet bgs), and south of cesspool area (20 - 30 feet bgs).
Assume perform in years 1, 2, 3, 4 and 5.

Estimated cost of each sampling effort includes field labor, equipment, and expenses: $2,000.

Estimated cost of analytical testing includes: (estimated cost is $800)
- Laboratory Analysis of 2 soil samples plus QA/QC samples (1 duplicate, 2 MS/MSDs, 1 rinsate blank) for TCL VOCs.
- Validation of the laboratory data.

Assume preparation of a brief data summary report. Estimated cost for report preparation and time for project coordination is $450.

Above costs are based on 1999 rates as presented in the PMP Amendment No. 1.

Total Estimated Sampling Cost = $3,300/event (years 1, 2, 3, 4 and 5)

Item No. 5: Cesspool Abandonment/Closure

Assume close two cesspools per Nassau County requirements (see Figure 3-3 for locations).

Assume prepare cesspools for closure:
- plug/seal conduits, drains or other piping connected to cesspools.
- pump out accumulated water (assume 1 foot standing water in each).

Assume backfill cesspools with clean soil backfill (approx. 60 cy total), and top with a 1-foot concrete/clay cap.

Total Estimated Closure Cost = $3,000

Item No. 6: Asphalt Pavement Cover

Assume construct new asphalt pavement cover over areas not currently paved to enhance SVE system efficiency and for protection of the in-situ air sparging/SVE systems piping. Does not include repairs to existing asphalt following trenching activities associated with installation of the air sparging and soil vapor extraction system piping.

Assume asphalt cover consists of 6-inch base course (3/4-inch crushed stone), 2-inch binder course, and 2-inch wearing course.
- Approximate area to receive new pavement: 90 square yards
- Cost of new pavement: $2,000

Assume entire paved portion of the Site and Discount Beverages property to be maintained over a 30-year time period, for purposes of maintaining a consistent surface treatment. O&M would include:
- annual patching (over localized areas, as necessary; assume 10 sy per year): $200/year
- sealcoat entire paved area (approx. 490 sy) every 5 years: $500 (every 5 years)

Refer to Figure 3-3 for location of new asphalt pavement cover.

NOTE:
See backup calculations following this description page.

Cost Estimate Assumptions
Alternative No. 4:
In-Situ Chemical Oxidation, Soil Vapor Extraction and Groundwater Extraction and Treatment

On-Site Focused Feasibility Study
American Drive-In Cleaners
Site No. 1-30-049
Levittown, New York

Item No. 1: In-Situ Chemical Oxidation (Fenton's Reagent)

Fenton's Reagent technology would be applied via a step-wise approach: first, perform pilot study; then, if pilot study yields favorable results, perform full-scale application. Assume full-scale application for purposes of cost estimate.

Assumes a Pilot Study (lab study plus 3 injection events in 6 injection wells (4 shallow, 2 deep)) will be conducted to asses the feasibility of Fenton's Reagent process. Injection well installation (4-inch diameter PVC) included. Assumes 2 groundwater monitoring wells (2-inch diameter PVC) will be installed in close proximity to the DNAPL source area: $101,000

Assumes a total of 16 additional, 4-inch diameter PVC injection wells will be installed: $63,000

Assumes a total of 6 additional injection events will be conducted: $268,000

Assumes 9 sampling events for soil and groundwater will be conducted following the 9 injection events (completed in year 0). Assume 4 soil samples collected; 4 groundwater samples from monitoring wells. $45,000

Refer to Figure 3-4 for location of Fenton's Reagent injection points.

Item No. 2: Groundwater Extraction

Assumes flow rate from extraction wells to be approximately 10 gpm each.

Assume Groundwater Extraction System Pilot Study is conducted which includes: ($43,000)
- installation and materials for one, 6-inch stainless steel extraction well to approximately 80 feet BGS with 45 feet of screen section using traditional well design.
- installation and materials for three, 2-inch PVC piezometers installed to approximately 70 feet BGS.
- performing 48-hour pump test (cost includes labor and equipment rental).
- assumes direct discharge of pump water to sanitary sewer.

Assumes one additional extraction well installed to complete the Groundwater Extraction System: ($29,000)

Assumes extraction and discharge forcemain; wells to treatment building and treatment building to storm sewer: ($5000).

Assumes in-Situ chemical oxidation is effective at treating source DNAPL such that groundwater extraction/treatment is required for ten years.

Assumes annual cost for Operation and Maintenance of Groundwater Extraction System: $5,000/year (10 years)
- costs include monitoring of system, labor, parts and repair, etc.; costs for contracted O & M firm included with costs for treatment system.

Assumes groundwater extraction pumps and accessories to be replaced, and wells to be refurbished, every 5 years: $7,500 (year 5)

Refer to Figure 3-4 for locations of extraction wells and piping.

Cost Estimate Assumptions
Alternative No. 4:
In-Situ Chemical Oxidation, Soil Vapor Extraction and Groundwater Extraction and Treatment

On-Site Focused Feasibility Study
American Drive-In Cleaners
Site No. 1-30-049
Levittown, New York

Item No. 3: Ex-Situ, Groundwater Treatment and Discharge

Assumes flow rate from extraction wells to be approximately 20 gpm.

Assumes average initial influent concentration of PCE to be approximately 1 - 10 ppm; TDS is low such that filtration not required.

Assumes Treatability Study is conducted for system design: $10,000

Assumes Treatment Building (30 ft x 30 ft) is fabricated and constructed which includes: ($250,000)
- prefabricated metal structure with epoxy-coated paint, a concrete foundation with secondary containment, and insulation.
- instrumentation and controls, electrical and plumbing systems.

Assumes the following equipment is used for the Treatment System: ($224,000)
- 4000-gallon equalization tank with air compressor for aeration.
- metals filtration (for removal of iron and manganese).
- four pumps and one spare pump, needed to transfer groundwater throughout the system.
- air stripper for PCE removal from the groundwater.
- granular activated carbon vessel to polish the groundwater from the air stripper.
- catalytic oxidizer to treat air emitted from air stripper.
  (catalytic oxidizer also assumed to also be used for SVE system vapor treatment)
- 4000-gallon discharge holding tank.
- Startup/Shakedown for the Groundwater Pretreatment System.
- Electrical utilities will have to be connected to the Pretreatment Building.

Assumes effluent discharge limit (PCE) is to be 5 ppb to be discharged to storm water sewer.

Assumes in-situ chemical oxidation is effective at treating source DNAPL such that groundwater extraction/treatment is required for ten years.

Assumes annual Operation and Maintenance cost for Groundwater Treatment System: $141,000/year (years 1 through 5)
Assumes annual Operation and Maintenance cost for Groundwater Treatment System: $74,000/year (year 6)
Assumes annual Operation and Maintenance cost for Groundwater Treatment System: $101,000/year (years 7 - 10)
- costs include monitoring and clean out of system, gas and electric utilities, labor, repairs, analytical testing of system, etc. Sale of 1000 scfm catox system (year 6) for $27,500, purchase GAC adsorbers at $10,000 for years 6 to 10, because assume SVE system not operated after year 5, and carbon required to treat air stripper off-gas. Carbon changeout required on a yearly basis; assumed at $10,000/year.

Assumes Pretreatment System pumps, air compressor, and select accessories to be replaced every 5 years: $10,000 (year 5)

Refer to Figure 3-4 for location treatment building and effluent discharge piping to the sanitary sewer.

Cost Estimate Assumptions
Alternative No. 4:
In-Situ Chemical Oxidation, Soil Vapor Extraction and Groundwater Extraction and Treatment

On-Site Focused Feasibility Study
American Drive-In Cleaners
Site No. 1-30-049
Levittown, New York

Item No. 4: Groundwater Monitoring

Assume monitoring conducted quarterly in years 0- 2; annually in years 3 - 30.

Assume includes well redevelopment (purge 3 - 5 well volumes) and sampling of 8 existing Site monitoring wells (see Figure 3-4). Also, assume water level measurements performed in sixteen Site wells.

Estimated cost of each sampling effort includes field labor, equipment, and expenses: $3,700

Estimated cost of analytical testing includes:
- Laboratory Analysis of 8 groundwater samples plus QA/QC samples (1 duplicate, 2 MS/MSDs, 1 rinsate blank, 1 trip blank) for TCL VOCs.
- Validation of the laboratory data.
- Estimated cost: $1,800

Assume preparation of a brief data summary report. Estimated cost for report preparation and time for project coordination: $450.

Above costs are based on 1999 rates as presented in the PMP Amendment No. 1.

Total Annual Groundwater Monitoring Cost = $24,000 (years 0 - 2)
Total Annual Groundwater Monitoring Cost = $6,000 (years 3 - 30)

Item No. 4: Soil Vapor Extraction

Assumes flow rate from system is approximately 600 scfm; required vacuum is 40 inches water column; and average initial influent concentration is 500 ppmv. Assume operate system for approx. 5 years.

Assume SVE System Pilot Study is conducted which includes:
- installation and materials for 1 well to 30 feet (costs included with system wells below).
- installation and materials for three couplets of 2- 3/4-inch PVC monitoring points installed to 30 feet BGS.
- mobile treatment unit used to treat extracted soil vapors.
- perform 3-day study (cost includes labor, materials and equipment rental): $20,000

Assumes 10 vertical wells (5 to 10 feet bgs, 5 to 30 feet bgs) and header piping installed;
(total estimated cost: $100,000)
- mobilization/demobilization for pipe installation labor, equipment and materials.
- installation of 10 wells (Sch. 40 PVC); traditional SVE well design.
- installation (via trenching) and materials for approximately 350 lf piping, 4-inch diameter solid HDPE pipe
- piping installed at depth of 4 feet BGS.
- piping installation: backfill soils amended with bentonite to limit short-circuiting of air flow.
- piping is butt-fusion welded; sloped to vapor treatment equipment.
- saw-cutting and patching of existing asphalt is included, where necessary.
- Equipment is used for the vapor treatment system:
  - Air/Water Separator (240 gallons)
  - Extraction Blower (up to 1,000 scfm, 40 in WC) and motor (20 hp)
  - Pressure relief valve for blower
  - Vacuum and pressure gauges
  - Thermometer
  - Catalytic Oxidizer to treat air (cost included in groundwater treatment system above)
  - Centrifugal pump to transfer condensate to EQ tank
  - Flowmeter
  - Process piping/valves
- installation and startup for the SVE System.

Assumes replaceable pressure gauge valve boxes installed and connected to collection lines via piping; placed flush-mounted at the intersection of each collection line with header piping and other appropriate fittings.

Assumes costs for building to house treatment system, instrumentation and controls system, and electrical hookup are included above for groundwater treatment building.

Assumes annual O&M cost for SVE System (for 5 years): $25,000/year (for 5 years)
- cost includes electric costs for system (not catalytic oxidizer), misc. labor for repairs, emergency repairs, parts and supplies.
- cost does not include O&M for catalytic oxidizer, contracted O&M firm to monitor automated system and perform routine operations, housekeeping, or effluent air sampling costs – included with groundwater pretreatment system costs above.

Refer to Figure 3-4 for locations of vapor extraction piping and treatment building.

Item No. 6: Soil Sampling/Soil Vapor Extraction System Monitoring

Assume collect two soil samples in order to monitor the effectiveness of the SVE system, via geoprobe sampling.
Collect samples from two locations: northwest Site corner (4 - 10 feet bgs) and south of cesspool area (20 - 30 feet bgs).
Assume perform in years 1, 2, 3, 4 and 5.

Estimated cost of each sampling effort includes field labor, equipment, and expenses: $2,000.

Estimated cost of analytical testing includes: (estimated cost is $800)

- Laboratory Analysis of 2 soil samples plus QA/QC samples (1 duplicate, 2 MS/MSDs, 1 rinsate blank) for TCL VOCs.
- Validation of the laboratory data.

Assume preparation of a brief data summary report. Estimated cost for report preparation and time for project coordination is $450.

Above costs are based on 1999 rates as presented in the PMP Amendment No. 1.

Total Estimated Sampling Cost = $3,300/event (years 1, 2, 3, 4 and 5)

Item No. 7: Cesspool Abandonment/Closure

Assume close two cesspools per Nassau County requirements (see Figure 3-4 for locations).

Assume prepare cesspools for closure:

- plug/seal conduits, drains or other piping connected to cesspools.
- pump out accumulated water (assume 1 foot standing water in each).

Assume backfill cesspools with clean soil backfill (approx. 60 cy total), and top with a 1-foot concrete/clay cap.

Total Estimated Closure Cost = $3,000

Item No. 8: Asphalt Pavement Cover

Assume construct new asphalt pavement cover over areas not currently paved to enhance SVE system efficiency and for protection of the groundwater extraction/SVE systems piping. Does not include repairs to existing asphalt following trenching activities associated with installation of the groundwater and soil vapor extraction system piping.

Assume asphalt cover consists of 6-inch base course (3/4-inch crushed stone), 2-inch binder course, and 2-inch wearing course.

- Approximate area to receive new pavement: 90 square yards
- Cost of new pavement: $2,000

Assume entire paved portion of the Site and Discount Beverages property to be maintained over a 30-year time period, for purposes of maintaining a consistent surface treatment. O&M would include:

- annual patching (over localized areas, as necessary; assume 10 sy per year): $200/year
- sealcoat entire paved area (approx. 490 sy) every 5 years: $500 (every 5 years)

Refer to Figure 3-4 for location of new asphalt pavement cover.

NOTE:
See backup calculations following this description page.

ALT. 4

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/17/2000 By LLV
Subject FENTON'S REAGENT
Checked 5/24/00 By DJT
Based on
Revised
By

Assume:

o Full scale application by ISOTEC using step-wise/phased approach following favorable results of pilot study. SVE system costs included with on-site system.

① Lab Study – to evaluate efficiency of ISOTEC; perform studies on site groundwater and soil samples.

$7,000

② Pilot Study – to gather information on effectiveness and perform initial reduction of organic loading in treatment area

- install 4 shallow injection wells (15-35' bgs)
- install 2 deep injection wells (35-65' bgs)
- install 2 monitoring wells (40' & 70')

} 4" ϕ PVC wells with native backfill

- perform 3 injection events; phase approximately 35-40 days apart.

ISOTEC QUOTE ≈ $67,000

plus cost for wells:

- mob/demob = $1,600 (PMP) – drill rig

→ MONITORING WELLS (2"ϕ):

- drilling via 4¼" HSA, total of 40' + 70' = 110'

(110 ft)($23/ft) ≈ $2500 (ECHOS 33-23-1101)

- 10' PVC screen per well → 10' × 2 wells = 20' (2"ϕ)

(20')($11/ft) ≈ $200 (ECHOS 33-23-0201)

- well riser → (110' – 20') = 90' (2"ϕ)

(90 ft)($6/ft) ≈ $550

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ALT. 4

Page No. 2 of 4

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/17/2000 By LLV
Subject FENTON'S REAGENT
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- well plug : (2ea)($15) = $30 (ECHOS 33-23-0301)
- road boxes : (2ea)($125) = $250 (PMP)
- sandpack (11' per well) : (22')($11/ft) = $250 (ECHOS 33-23-1401)
- bentonite seal (3' per well) : (6')($31/ft) = $190 (ECHOS 33-23-2101)
- grout (110' − 22' − 6' − 6' = 76') : (76')($25/ft) = $1900 (ECHOS 33-23-1801)
  finish concrete
- Concrete (3' per well) : (6')($2/ft) ≈ $10 (ECHOS 33-23-1811)
- decon ≈ $500 (PMP)
- drums for cuttings and disposal : $1000 (PMP ; ≈ 0.6 tons material)
- 1 hr well development per well : (2 hrs)($150/hr) = $300
  - based on experience on similar projects
- total monitoring well cost ≈ $7,700

→ INJECTION WELLS (4"ϕ) :

- drilling via 6 5/8" HSA, total of 15' + 20' + 30' + 35' + 40' + 65' = 205'
  (205')($25/ft) ≈ $5100 (ECHOS 33-23-1102)
- PVC screen : 10' + 10' + 15' + 20' + 15' + 30' = 100'
  (100')($21/ft) = $2100 (ECHOS 33-23-0202)
- PVC riser : 5' + 10' + 15' + 15' + 25' + 35' = 105'
  (105')($10/ft) = $1100 (ECHOS 33-23-0102)
- well plug : (6)($38/ea) = $230 (ECHOS 33-23-0302)
- protective road boxes : (6ea)($125) = $750 (PMP)

ALT. 4

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/17/2000 By LLV
Subject FENTONS' REAGENT
Checked 5/24/00 By DJT
~~Based on~~
Revised
By

- sandpack (1' above top of screen): (106')($13/ft) = $1400
(ECHOS 33-23-1pe

- bentonite seal (3' per well): (6 × 3')($31/ft) = $550
(ECHOS 33-23-2101)

- grout (185' − 18' − 101' − 18' = 48'): (48')($25/ft) = $1200
finish concrete
(ECHOS 33-23-1801)

- concrete (3' per well): (18')($2/ft) = $40 (ECHOS 33-23-1811)

- decon ≈ $500
- drums for cuttings/disposal: $4,000 (PMP; ≈2.5 tons metri
- 1 hr well development per well: (6 hrs)($150/hr) = $900
→ based on experience on similar projects

→ total cost for injection wells (initial 6) = $18,000

③ Full-scale:

If pilot study results are favorable, perform 6 injection events; install 4 additional shallow and 10 addition deep wells.

→ ISOTEC QUOTE ≈ $268,000

→ additional wells:

(10)(≈60') + (4)(≈30') = 720'

$$\frac{\$18{,}000}{205' \text{ wells}} = \frac{x}{720' \text{ wells}}$$

≈ $63,000

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ALT. 4

Page No. 4 of 4

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/17/2000 By LLV
Subject FENTON'S REAGENT
Checked 5/24/00 By DJT
~~Based on~~
Revised By

Soil & Groundwatu Sampling:

⊙ Assume collect 4 soil samples from 4 borings and sample 4 monitoring wells per event; analyze for VOCs.

⊙ Perform 9 sampling events (ie year one)

- mob/demob geoprobe rig: $1,000/day (PMP) → $1000
- 4 samples collected: (4)($3/ea) ≈ $10 (PMP)
(assume put cuttings back down borehole)
- Decon ≈ $500 (based on experience on similar projects)
- Analytical Testing: (4)($110/ea) ≈ $440
- Groundwatu sampling (1 day assumed + lab analysis): ≈ $3000 (approx. half effort of groundwater monitoring task)

∴ Per event: ≈ $5000
× 9 events → $45,000

TOTAL FENTON'S COST:

$ 7000
+ $67,000
+ $1,600
+ $7700
+ $18000
+ $63000
+ $268 000
+ $45000

$477,000

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ALT. 4

Page No. 1 of 9

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS

File No. 55172

Location LEVITTOWN, NY

Date 5/10/2100 By LLV

Subject ON-SITE GROUNDWATER EXTRACTION & TREATMENT SYSTEMS

Checked 5/26/00 By DJT

~~Based on~~

Revised 2/5/01 By DJT

GROUNDWATER EXTRACTION SYSTEM:

- Install 2 wells to provide for source removal and hydraulic containment of on-site groundwater. Install to 80' bgs, with 45' of screen.

- Based on preliminary modelling by MODFLOW (Waterloo Hydrogeologic), it is expected that the wells should be pumped @ 20gpm total Q (or 10 gpm each).

- PILOT STUDY:

→ install 1 well to approx. 80 ft bgs with traditional well design to provide design information for extraction wells.

- assume pump test performed – $150/hr for 48 hrs; includes pump/accessories, generator, field time for 2 geologist

  $(\$150/hr)(48\ hr) \cong \$7200$

- assume discharge to sanitary sewer is acceptable to Nassau County (requires prior approval; is generally allowed)

- well installation: assume install well with 6" casing ϕ.

  - driller mob./demob. = $1600 (PUP)

  - drill – 8 1/4" ID HSA to 80' bgs: (ECHOS 33-23 items)

    $(80')(\$35/ft) \cong \$2800$

  - collect approx. 20 split spoons:

    $(20)(\$30/ea) \cong \$600$

  - soil cuttings in approx 15 drums for offsite disposal:

    $(15)(\$75/drum) \cong \$1100$ (experience on similar projects)

  - assume 45' well screen (6" ϕ SS):

    $(45')(\$164/ft) \cong \$7400$ (ECHOS 33-23)

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ALT 4

Page No. 2 of 9

Project	AMERICAN DRIVE-IN CLEANERS SITE RI/FS	File No.	55172
Location	LEVITTOWN, NY	Date 5/10/2000	By LLV
Subject	ON-SITE GROUNDWATER EXTRACTION	Checked 5/26/00	By DJT
~~Based on~~	AND TREATMENT SYSTEMS	Revised 2/5/01	By DJT

- 35' riser (6"ϕ SS): (ECHOS 33-23 items)
  (35')($136/ft) ≅ $4800

- SS well plug:
  (1)($200) = $200

- Sand pack:
  (46')($27/ft) = $1300

- 3' bentonite seal:
  (3')($125/ft) ≅ $400

- Grout:
  (28')($65/ft) ≅ $1800

- 3' concrete:
  (3')($10/ft) = $30

- 4'x4' vault to house well head piping/valves:
  ≅ $3500

- Piping (4"ϕ PVC) + Valves: (ECHOS 19-01-0207)
  (90')($7/lf) + $1000 ≅ $1600

- Flow Meter: $500 (estimate by Badger Meter)

- Submersible Pump (for 10 GPM, 1 Hp) (ECHOS 33-23-0501)
  ≅ $1200

- Three 2" PVC Piezometers: (3)($2000/ea) ≅ $6000

- Decon: (4 borings)(1 hr/boring)($120/hr) ≅ 500 (PMP)

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ALT. 4

Page No. 3 of 9

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS File No. 55172
Location LEVITTOWN, NY Date 5/10/2000 By LLV
Subject ON-SITE GROUNDWATER EXTRACTION AND TREATMENT SYSTEM Checked 5/26/00 By DJT
~~Based on~~ Revised 2/5/01 By DJT

TOTAL ≅ $43,000

Additional Extraction Well Installation:

- Assume pilot study well used as one well; install 2nd well:

≅ $29,000 (based on costs above)

Forcemain Piping Installation:

- Assume piping installed to connect extraction wells to treatment system. Piping would be installed in similar trench as SVE system, where applicable. Also include discharge piping to SW sewer.
- Trenching (shared with SVE system piping):
  - assume 4"Φ HDPE: (~$7/lf)(160 lf) ≅ $1100 (Means A12.3-110-1420)
- Trenching (not shared with SVE system piping)

(TRENCHING/ BACKFILL/ RESTORATION OF PAVEMENT): (~$35)($110/lf) ≅ $3900

SEE SVE CALCS

$5000

GW Extraction System O&M: (10 years) Yr

- Assume contract operations firm for on-site treatment system would perform O&M and monitor extraction system. No costs included here.
- Assume replace GW pumps every 5 years:

= (2)($1200) = $2400 (every 5 years) ∴ year 5, yr 10

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ALT. 4

Page No. 4 of 9

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS File No. 55172
Location LEVITTOWN, NY Date 5/10/2000 By LLV
Subject ON-SITE GROUNDWATER EXTRACTION Checked 5/26/00 By DJT
~~Based on~~ AND TREATMENT SYSTEM Revised 2/5/01 By DJT

- Assume refurbish wells every 5 years : ≈ $5000 (based on experience w/ similar projects)

(every 5 years)

$\xrightarrow{\sim}$ $7500 (every 5 years) @ Year 5 yr

- Assume annual O&M cost for repairs, etc. : $5000/yr (annual) (labor/materials and electricity)

(based on experience with similar projects)

ALT. 4

Page No. 5 of 9

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS

File No. 55172

Location LEVITTOWN, NY

Date 5/10/2000 By LLV

Subject ON-SITE GROUNDWATER EXTRACTION AND TREATMENT SYSTEMS

Checked 5/26/00 By DJT

~~Based on~~

Revised 2/5/01 By DJT

CAPITAL COSTS: Assume Treatability Study ≈ $ 10,000

- Assume influent Groundwater Concentration (avg) = 1-10 ppm (PCE)
- Permit for discharge to SW sewer would require treatment to 5 ppb (PCE).
- Anticipated flow rate from extraction system = 20 gpm
- Use air stripping, w/ carbon polishing, to treat VOCs.
  Use metals filtration system to treat for removal of iron & manganese.
  Use catalytic oxidation to treat air stripper off-gas, because would share with SVE system.

↳ but assume follow shutdown of SVE with:

\- Granular Activated Carbon System

- Treatment building - assume consists of prefabricated metal building w/ insulation, epoxy-coated paint; foundation = slab on grade with secondary containment.
  (To be shared with SVE system equipment.)
- Assumes TDS is low, such that filtration is not required.
- TREATMENT BUILDING: (30'x 30') assumed

$200,000 (based on similar projects)

- Instrumentation/controls system, control room, electrical & interior plumbing system → assume ≈ 25% building cost

≈ $50,000 (based on experience with similar projects)

- Assumes 4000 gallon EQ Tank; aeration may be required.

↓

$5,000

(Estimates from Pipe Plus & Commercial Plastics)

↓ compressor = $2000

ALT. 4

Page No. 6 of 9

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/10/2000 By LLV
Subject ON-SITE GROUNDWATER EXTRACTION
Checked 5/26/00 By DJT
~~Based on~~ AND TREATMENT SYSTEMS
Revised 2/5/01 By DJT

- Need 4 pumps (+1 backup) to transfer flow in system: (centrifugal – (1 Hp))

  $\sim(\$3000)(5) = \$15,000$ (Echos 33-29-0102
  " " " -0103)

- Metals filtration system - used to remove iron/manganese prior to entering air stripper:

  $15,000 (Process Equipt. Sales)

- Air stripper to remove PCE:

  ≈ $12,000 (Product Recovery Mgt, Carbonaire Environmental)
  (for 1-10 ppm)

- GAC: (polishing step)

  ≈ $10,000 (Carbonair, Calgon, TIGG)

- Catalytic Oxidizer: (including heat exchanger, cat cell to reduce energy costs)

  assume ≤ 1000 scfm flow volume
  initial vapor concentration ≈ 500ppmV

  $110,000 (Falmouth, Stealth Industries, Baker)

- Effluent Holding Tank: (4000 gal) $5000 (same as EQ Tank)

- Start-up/Shakedown: $30,000 (based on experience on similar projects)

- Connection of Utilities: $20,000 (")

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ALT 4

Page No. 7 of 9

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/10/2000 By LLV
Subject ON-SITE GROUNDWATER EXTRACTION AND TREATMENT SYSTEM
Checked 5/26/00 By DJT
Based on
Revised 2/5/01 By DJT

→ TREATMENT SYSTEM ≈ $474,000   473,000

O & M: (10 years)

- Use contracted operations firm to monitor & maintain GWE&T Systems.
  - on-site supervision 1 wk/mo @: ($45/hr)(40 hr/mo) ≅ 1800 × 12 mo/yr ≅ $22,000/yr
- Remote monitoring: $5000/yr (Based on experience on similar projects)
- Electrical / Natural Gas Utilities: (yrs 1-5)

Natural Gas:

CATOX → (1.2 MIL BTU/hr)($0.60/100,000 BTU)(24 hr/day)(365 d/yr)

≈ ($63,000/yr)(0.60) → ≅ $40,000/yr

40% reduction due to heat exchanger/catcell

∴ $50,000/yr (1-5 yrs) to heat plant

Electricity:

CATOX BLOWER → 15 hp
PUMPS ~ → 5 hp

(20 hp)(746 W/HP)($0.12/KWH) ← ≅NYC
× (24 hr/day)(365 d/yr) = $16,000/yr

+ misc. electrical → $25,000/yr (1-5 yrs)

TOTAL UTILITIES → $75,000/yr (1-5)

ALT 4

Page No. 8 of 9

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172

Location LEVITTOWN, NY
Date 5/10/2000 By LLV

Subject ON-SITE GW EXTRACTION & TREATMENT SYSTEM
Checked 5/26/00 By DJT

~~Based on~~
Revised 2/5/01 By DJT

- Waste (housekeeping, air stripper, catox, EQ Tank, etc) Disposal:
  ≈ $10,000/yr (based on experience with similar projects)
- GAC: replace carbon yearly: $3000/yr (Calgon, Carbonair)
- Metals Filter: $3,000/yr (Process Equip.)
- Labor (for misc.):
  - electrician – $3000/yr (85 hrs @ $35/hr)
  - mechanic – $3000/yr (125 hrs @ $24/hr)
  - laborer – $1500/yr (100 hrs @ $15/hr)

  } ECHOS p. 2-57, 2-68
- Emergency Repairs: $2000/yr
- Parts/Supplies (Misc): $4000/yr

  } Based on experience with similar systems

  $6000/yr
- Analytical Testing (effluent):
  - (12 mo/yr)(4 GW samples)($120/sample) = $9400
  - (12 mo/yr)(2 air samples)($150/sample)
- Assume no GW discharge costs ($/gal) b/c to SW sewer – other than misc. fees.
- Every 5 years – replace 1 pump air compressor – and other misc. piping/valve accessories.

  → $10,000/yr (every 5 yrs)

  ∴ year 5

  JT✓

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ALT. 4

Page No. 9 of 9

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/10/2000 By LLV
Subject GWETS (ON-SITE)
Checked 5/26/00 By DJT
Based on
Revised 2/5/01 By DJT

Assume:

In year 5, turn off SVE system.

Also assume Fenton's Reagent treats saturated soil contamination @ cesspool source area, such that influent GW concentrations < 1 ppm @ 20 gpm flow rate.

Per Carbonair, off-gas from air stripper could be then treated with carbon; carbon changeout required about 1-2 times per year.

∴ Carbon Adsorbers = $10,000

∴ annual changeout & disposal = $10,000 > note - utility costs for CATOX >> $10,000/yr

→ Sale of CATOX system ≈ $27,500

∴ O&M Summary:

annual costs ≈ $66,000/yr

✓ + every 5 yrs ≈ $10,000/yr (year 5 only)

✓ + plus - yrs 1-5 $75,000/yr — see Alt. 2

\+ - yr 6 − $27,500 (catox sale)
\+ $10,000
\+ $25,000 (utilities) > $35000/yr } $7500

\+ - yrs 7-~~30~~ 10 + $35,000

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ALT. 4

Page No. 1 of 2

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 4/28/2000 By LLV
Subject GROUNDWATER MONITORING
Checked 5/24/2000 By PJT
~~Based on~~
Revised
By

Assume: maybe one additional (downgradient) well included

- sample 8 existing monitoring wells
- purge each 3-5 well volumes and sample by 2 field geologists.
- water levels measured in 16 wells — maybe 17
- assume duration = 2-10 hour days.
- collect unfiltered samples; analysis by VOCs only.
- use unit prices in PMP Amendment No. 1

Labor:

(2)(20 hours)($53.22/hr) = $2100 * 1.08 (fix fee) ≈ $2250

Equipment:

- Hnu (2 days)
- Water level indicator (2 days)
- pH/conductivity/temperature meters
- HDPE Tubing (≈400 lf)
- Pump Rental (1 wk)

≈ $600

Expenses:

- Per diem, rental truck, gasoline, tolls, Level D, office ≈ $700

2 days

Consumables:

- gloves/paper towels, DI water, ice ≈ $150

Office Labor:

(to coordinate work & produce data letter report)

PM: (1 hr)($98.67/hr) ≈ $100
Staff Engineer: (4 hrs)($64.06/hr) ≈ $250
Geologist: (2 hrs)($53.22/hr) ≈ $100

$450

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ALT. 4

Page No. 2 of 2

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 4/28/2000 By LLV
Subject GROUNDWATER MONITORING
Checked 5/24/2000 By DJT
~~Based on~~
Revised By

Analytical Testing:

8 samples + 1 duplicate + 2 MS/MSD + 1 rinsate blank + 1 trip blank
= 13 samples

- Laboratory: ($110)(13) = $1400
- Validation: ($26)(13) = $350

$1750 * 1.14 ≈ $1800
(sub mgt fee)

Total: ≈ $6000/event

Years 1-2: Perform quarterly → $24,000/year (0-2)

Years 3-30: Perform annually → $6000/year (3-30)

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ALT 4

Page No. 1 of 6

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/3/2000
By LLV
Subject SOIL VAPOR EXTRACTION SYSTEM
Checked 5/25/00
By DJT
Based on
Revised
By

Assume:

⊙ Well radius of influence ≥ 20 ft

⊙ Install wells:

soil remediation
- 5 vertical wells to 10 ft bgs (north & west sides of building)
- 5 vertical wells to 30 ft bgs (east & south sides of building)

⊙ Assume vacuum required = 40 in H_2O (rec. for gravelly/sandy soils)

⊙ Approx. flow rate from each well ≈ 60 scfm (avg.)

→ Total flow rate = (10)(60 scfm) = 600

⊙ Pilot Study would be performed to confirm system design (e.g., well spacing, flow rates, etc.):

assume includes:
① install one extraction well with monitoring probes (2 clusters, 3 ea.)
② use mobile extraction/treatment unit

(use 1999 PMP Amendment No 1 costs)

LABOR: assume test requires 3 days
well/pt. installation requires 2 days } 5 days
(PM/design costs not included → include w/ eng'g costs)

Staff Engineer: (5 days)(10 hours/day)($64/hr) ≈ $3000

Geologist: (2 days)(10 hours/day)($53/hr) ≈ $1000

EXPENSES: equipment (hnu, water level meter, etc) ≈ $400

perdiem, rental truck, etc ≈ $6000

MOBILE TREATMENT UNIT: (quote - ProAct services)
100-250 scfm system, 6 cylinder
≈ $5000 (includes technician for 3 days)

INSTALLATION OF MONITORING PTS:

- Geoprobe services = ($1000)(2 days) = $2000

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/3/2000 By LLV
Subject SOIL VAPOR EXTRACTION SYSTEM
Checked 5/25/00 By DJT
Based on
Revised
By

- Decon: (1 hr)($120/hr) ≈ $100
- Materials: (3/4" ϕ Sch. 40 pvc casing)

  ($6/lf)(30 ft/ea)(2 clusters × 3 ea) ≅ $~~360~~ 1100

  (lockable cover)($125/ea)(6) ≅ $750

  } $1800 for
- Install one 30' well — included in costs below

⟶ TOTAL PILOT STUDY ≅ $20,000

① SVE System Installation:

- Contractor mob / demob = $20,000 (Echos, A 33-23-1107)
- SVE collection piping: HDPE piping

  assume as 4" ϕ ~~[illegible]~~, installed 4' bgs)

  length ≈ 350 ft

  unit cost (trenching in asphalt pavement & repair):

  Assume cost sharing with GWES

  - trenching/backfill ≈ $15/lf (Means A 12.3-110-1440)
  - backfill material ≈ $5/lf (" " " 310-1600)

    add ≈ $2/lf for washed gravel, not sand and to account for smaller pipe ϕ
  - pipe ≈ $7/lf (Means A 12.3-110-1420)
  - saw cutting ≈ $1.50/lf
  - asphalt patching: $4.70/lf

  } (see costs for GWE system)

  ≈ $35/lf

  ∴ Cost ≈ (350 lf)($35/lf) = $12,000
- Pressure gauge valve piping / valve boxes: install to isolate sections @ each well: (cost based on experience w/ similar projects)

  ($15/ea)(10) = $150

ALT. 4

Page No. 3 of 6

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS

File No. 55172

Location LEVITTOWN, NY

Date 5/3/2010 By LLV

Subject SOIL VAPOR EXTRACTION SYSTEM

Checked 5/25/10 By DJT

~~Based on~~

Revised By

- Vertical Wells:
  - assume drill 5 wells to 10 ft
  - assume drill 5 wells to 30 ft
  - install 4"φ pvc riser pipe and screen

- mob/demob = $1600 (drilling-PMP)

- drilling - 8 1/4" HSA:

  (200 ft)($35/ft) ≅ $7,000 (ECHOS 33-23-1103)

- 4"φ pvc casing:

  (50 ft)($9/ft) ≅ $500 (ECHOS 33-23-0102)

- 4"φ pvc screen:

  (10 * 15 ft/ea)($20/ft) ≅ $3000 (ECHOS 33-23-0202)

- Well plug:

  (10 ea)($38/ea) ≅ $400 (ECHOS 33-23-0302)

- Sand pack:

  (10 * 6 ft/ea)($27/ft) ≅ $1600 (ECHOS 33-23-1403)

- Bentonite Seal:

  (10 * 1 ft/ea)($125/ft) ≅ $1200 (ECHOS 33-23-2103)

- Grout:

  (10 * 2 ft/ea)($65/ft) ≅ $1300 (ECHOS 33-23-1803)

- Road box:

  (10)($125/ea) ≅ $1200 (PMP)

→ Wells ≈ $18,000

ALT. 4

Page No. 4 of 6

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS

File No. 55172

Location LEVITTOWN, NY

Date

By LLV

Subject SOIL VAPOR EXTRACTION SYSTEM

Checked 5/25/00

By DJT

Based on

Revised

By

- Process Equipment: (quotes from Electrolab)
  - Catalytic Oxidizer: included with GWTS costs
  - Treatment building / Instrumentation / Controls: included in costs for GWTS system
  - Electricity Hook-up: included in costs for GWTS system
  - Extraction Blower ≈ $10,000 (with 20 HP motor)
    (≤ 1000 scfm, 40" H2O vacuum)
  - Pressure Relief Valve ≈ $300
  - Vacuum Gauge ≈ $40
  - Thermometer ≈ $120
  - Air/Water Separator ≈ $2700 (240-gallon)
  - Pressure Gauge: $140 (EZHOS 33-31-0209)
  - Flow Meter: $500
  - Centrifugal Pump: $5000
  - Tank for condensate water: not needed - pump condensate to EQ Tank

⟶ Equipment ≈ $19,000

- System Start-up / Shakedown ≈ $30,000 (based on experience on similar projects)

⟶ TOTAL SVE CAPITAL COST ≅ $100,000 ↘ $120,000
(excluding pilot study) with pilot study

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ALT. 4

Page No. 5 of 6

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/3/2000 By LLV
Subject SOIL VAPOR EXTRACTION SYSTEM
Checked 5/25/00 By DJT
Based on
Revised By

O&M Costs:

- Assume operated for 5 years.
- Cost for contract operations firm / remote monitoring — included with costs for GWTS system.
- Electrical —
  - Catalytic Oxidizer: included in GWTS costs
  - Extraction Blower: ≈ 746 watts per HP; ≈ $0.12 per KWhr

$$\therefore (20\ HP)(746\ W)\left(\frac{\$0.12}{1000\ W}\right)\left(\frac{24\ hr}{day}\right)\left(\frac{365\ d}{y}\right)$$

$$\cong \$15{,}700/yr$$

  - Centrifugal Pump: $(746\ W)\left(\frac{\$0.12}{1000\ W}\right)\left(\frac{24\ hr}{day}\right)\left(\frac{365\ days}{yr}\right)$

$800/yr

→ $17,000/yr

- Misc. waste disposal — costs included with GWTS system for general housekeeping.
- Catox catalyst: included in GWTS costs
- Labor: (for repairs per year)
  - electrician: $1580/yr (40 hrs @ $35/hr, ECHOS p. 2-37)
  - mechanic: $1200/yr (50 hrs @ $24/hr, p. 2-37)
  - laborer: $1500/yr (100 hrs @ $15/hr, p. 2-37)

$4200/yr

ALT. 4

Page No. 6 OF 6

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS

File No. 55172

Location LEVITTOWN, NY

Date 5/3/2000 By LLV

Subject SOIL VAPOR EXTRACTION SYSTEM

Checked 5/25/00 By DJT

Revised By

Based on

- Emergency repairs → assume $2000/yr.
- Parts/supplies → assume $2000/yr.

} based on experience with similar projects.

→ Total O&M: $ 25,000

(years 1, 2, 3, 4 & 5)

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ALT. 4

Page No. 1 of 2

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/2/2000 By LLV
Subject SOIL SAMPLING (SVE MONITORING)
Checked 5/24/00 By DJT
Based on
Revised By

Assume

- soil sampling via geoprobe rig performed on unsaturated soils five (5) times throughout SVE system lifetime:
  - → years 1, 2, 3, 4, 5.
- assume collect within zone of influence of SVE system.
- collect samples from 2 locations (also headspace during sampling):
  - northwest site corner → depth ≈ 4-10 feet bgs
  - south of on-site cesspools → depth ≈ 20-30 feet bgs.
- analyze samples for VOCs
- duration = 1 day by field geologist + geoprobe rig/personnel.
- use prices in pup Amendment No. 1

LABOR: $(1)(8 \text{ hrs}/\text{day})(\$53.22/\text{hr}) \approx \$450$

EQUIPMENT: Hnu PID → ≈ $50/day rental

EXPENSES: $\underbrace{\text{Per diem, rental truck}}_{\text{1 day}}$, gasoline, tolls, Level D, office ≈ $350

CONSUMABLES: Gloves, paper towels, DI water, ice ≈ $50

OFFICE LABOR: (to coordinate work and produce brief data report)

$$\left.\begin{array}{l}\text{PM: } (1 \text{ hr})(\$98.67/\text{hr}) \approx \$100\\ \text{Staff Engineer: } (4 \text{ hrs})(\$64.06/\text{hr}) \cong \$250\\ \text{Geologist: } (2 \text{ hrs})(\$53.22/\text{hr}) \cong \$100\end{array}\right\} \$450$$

ANALYTICAL TESTING:

- 2 (samples) + 1 (duplicate) + 2 (MS/MSD) + 1 (rinsate blank) = 6 samples
- Lab Tests = (6)($110) = $660 } ≈ $810

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ALT. 4

Page No. 2 OF 2

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS

File No. 55172

Location LEVITTOWN, NY

Date 5/2/2000

By LLV

Subject SOIL SAMPLING (SVE MONITORING)

Checked 5/24/00

By OJT

Based on

Revised

By

GEOPROBE SERVICES:

- Rig & Equipment: (1 day)($1000) = $1000
- Geoprobe Soil Samples: ($3/ea)(3 + 8 samples) ≈ $30
- Decon: ($120/hr)(1 hr) = $100

$1130

Total: $3,300/event

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ALT. 4

Page No. 1 of 1

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS
File No. 55172
Location LEVITTOWN, NY
Date 5/2/2000
By LLV
Subject ASPHALT PAVEMENT COVER
Checked 5/24/00
By DJT
~~Based on~~
Revised
By

Assume:

- ⊙ New asphalt pavement cover constructed over areas currently not paved (i.e., west, north, and east of ADC building).
- ⊙ Shall consist of 6 inches compacted 3/4" crushed stone (base course), 2" binder course, and 2" wearing course.
- ⊙ Not included: repairs to existing asphalt pavement due to trenching associated with remediation system piping.
- ⊙ O&M costs to include patching & sealcoating of site within and around remediation systems area, to retain consistent surface treatment.

CAPITAL COSTS:

- Area requiring new pavement $\approx (15' \times 45') + (110' \times 10') + (15' \times 45')$
  $\cong 2500 sf \cong \underline{90 sy}$
- unit price per sy: (1999 Means Cost Estimating Guide, No. 022-308-0100, 025-104-0120, 025-104-0380)
  - 6" Base Course: \$8/sy
  - 2" Binder Course: \$4/sy
  - 2" Wearing Course: \$4.50/sy

  $\left.\right\} \approx \$16.50/sy * 1.241$ ← LOCATION FACTOR

  $\approx \underline{\$20/sy}$

$\therefore (90 sy)(\$20/sy) \overset{\sim}{=} \underline{\underline{\$2000}}$

O&M COSTS: (1919 Means)

- Area requiring O&M:
  90 sy (new pavement)
  \+ 400 sy (existing pavement - ADC Site property and Discount Beverages property ≈ 60' × 180')
  490 sy
- Sealcoat every 5 years: $(490 sy)(\$1/sy) \overset{\sim}{=} \underline{\underline{\$500}}$ (every 5 years)
- Assume patch approximately 10 sy per year:
  $(10 sy)(\$20/sy) \cong \underline{\underline{\$200}}$ (every year)

ALT. 4

Page No. 1 of 1

Project AMERICAN DRIVE-IN CLEANERS SITE RI/FS

File No. 55172

Location LEVITTOWN, NY

Date 5/3/2000 By LLV

Subject CESSPOOL CLOSURE

Checked 5/24/00 By DJT

Based on

Revised By

Assume:

- Plug conduits, drains, other piping are sealed or plugged with grout first.
- Accumulated water is pumped out of cesspools.
- Backfill cesspools with clean soil, and top with one-foot thick layer of clay or concrete.
- Paving included with asphalt pavement area cost.

COSTS:

- Plug/seal any conduits: assume $1000
- Pump out / dispose of water: $500 (remove and containerize water)

(assume 1' water in each cesspool)

$\left(1' * \pi\left(\frac{9'}{2}\right)^2 \times 7.48\frac{cf}{gal.}\right)\left(\$0.85/gallon\right)$ (characterization and disposal of drummed water - assume hazardous)

$\approx \$500$

(costs based on experience on similar projects)

- Soil backfill:

$-\text{volume of clean soil} = \left(\pi\left(\frac{9'}{2}\right)^2(12'-1')\right) + \left(\pi\left(\frac{9'}{2}\right)^2(15'-1')\right)$

(northern cesspool)

$\approx 60cy$

→ backfill with clean soil using ≈1cy bucket backhoe:

("certified clean")

$\left(\approx \$15/cy\right)\left(60cy\right) = \$900$ (1999 Means 022-216)

- one foot concrete cap:

$-\text{volume} = (1')(\pi(3'/2)^2) * 2 \text{ cesspools} \simeq (0.5cy)$

$-\text{for field mix concrete: } (\$70/cy)(0.5cy) \approx \$50$ (Means 033-122)

→ TOTAL ≈ $3000