REMEDIATION SYSTEM EVALUATION

MORGAN TERMINAL
BROOKLYN, NEW YORK

Report of the Remediation System Evaluation,
Site Visit Conducted at the Morgan Terminal Site
June 4, 2003

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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NOTICE AND DISCLAIMER

Work described herein was performed by GeoTrans, Inc. (GeoTrans) for the U.S. Environmental Protection Agency (U.S. EPA). Work conducted by GeoTrans, including preparation of this report, was performed under S&K Technologies Prime Contract No. GS06T02BND0723 and under Dynamac Prime Contract No. 68-C-02-092, Work Assignment ST-1-08. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

This report has undergone review by the state site manager and EPA headquarters staff. For more infomation about this project, contact: Joe Vescio (703-603-0003 or vescio.joseph@epa.gov) or Kathy Yager (617-918-8362 or yager.kathleen@epa.gov).

EXECUTIVE SUMMARY

A Remediation System Evaluation (RSE) involves a team of expert hydrogeologists and engineers, independent of the site, conducting a third-party evaluation of site operations. It is a broad evaluation that considers the goals of the remedy, site conceptual model, above-ground and subsurface performance, and site exit strategy. The evaluation includes reviewing site documents, visiting the site for up to 1.5 days, and compiling a report that includes recommendations to improve the system. Recommendations with cost and cost savings estimates are provided in the following four categories:

- improvements in remedy effectiveness
- reductions in operation and maintenance costs
- technical improvements
- gaining site closeout

The recommendations are intended to help the site team identify opportunities for improvements. In many cases, further analysis of a recommendation, beyond that provided in this report, may be needed prior to implementation of the recommendation. Note that the recommendations are based on an independent evaluation by the RSE team, and represent the opinions of the RSE team. These recommendations do not constitute requirements for future action, but rather are provided for the consideration of all site stakeholders. This RSE report pertains to conditions that existed at the time of the RSE site visit, and any site activities that have occurred subsequent to the RSE site visit are not reflected in this RSE report.

The Morgan Terminal site is an abandoned oil terminal located at 200 Morgan Avenue in Brooklyn, New York. The site has historically been contaminated with diesel fuel, No.6 fuel oil, and BTEX/MTBE. Current contamination largely consists of No. 6 fuel oil and relatively low concentrations of BTEX/MTBE. The surrounding area is comprised of industrial facilities and warehouses. Morgan Avenue borders the site to the west and the English Kills borders the site to the north and east. Figure 1 depicts the primary features of the site and the site's location with respect to the English Kills.

Site-related contamination was first reported in 1992 by the Coast Guard when oil was found seeping into the English Kills. Between December 1992 and January 1993 a remedial investigation was conducted including the installation of 20 ground water monitoring wells and tank testing. The tanks were cleaned in 1994, and a remediation system became operational in June 1995. The State does not own the property. The current owner reportedly lives in Florida and, at the time of the interim consent order in 1994, over $800,000 in back taxes were owed. The State has a lien on the property to recover costs if the property is ever sold.

The observations and recommendations contained in this report are not intended to imply a deficiency in the work of either the system designers or operators but are offered as constructive suggestions in the best interest of the EPA, the public, and the facility. These recommendations have the obvious benefit of being formulated based upon operational data unavailable to the original designers.

Recommendations to improve effectiveness in protecting human health and the environment are as follows:

- Analysis of chlorinated solvents and polynuclear aromatic hydrocarbons (PAHs) should be added to the ground water monitoring program for at least two quarters to determine if ground water is contaminated with these constituents. It does not appear that ground water has been sampled for these constituents. Site records indicate that chlorinated solvents were present at the mg/L level in some of the tanks that may have leaked. PAHs are often associated with No. 6 fuel oil.

- The site structures, including the storage tanks and loading docks, should be removed. The contaminated soil found beneath these structures and located above the water table could be investigated and/or excavated. Although the property is in a favorable business location given its proximity to the water, the presence of these structures and the underlying contamination are substantial business risks. Removing these structures and either delineating or removing the underlying contamination will help the future development of the property and assist in remedial activities.

- The site conceptual model should be updated after the demolition and excavation. Changes in infiltration and ground water flow may be expected. In addition, much of the source material may be removed. The site conceptual model should also be updated with respect to chlorinated solvent or PAH contamination if any is detected in the above-recommended sampling and analysis.

- The site team could not locate a discharge permit for its remediation system and no sampling of the effluent is conducted. The discharge permit/agreement should either be located or a new one should be obtained and sampling should be conducted accordingly.

The RSE team does not provide any specific recommendations for cost reduction but does agree with recent cost reduction measures undertaken by the site team, including the elimination of vacuum enhanced fluid recovery events and a reduction in the well-gauging frequency. Recommendations are provided for technical improvement, including improving the site reports and simplifying the treatment system. One recommendation is provided for gaining site closeout, or rather, system closeout. It is to consider an alternative remedial approach based on institutional controls and passive skimming of free product. The rationale for this approach is the immobility and relatively low toxicity of the No. 6 fuel, the absence of free product discharges to surface water, and the high cost of removing the remaining free product and impacts that reach below the water table. The success of implementing this type of approach, however, is contingent on finding no significant chlorinated solvent and PAH ground water contamination.

A table summarizing the recommendations, including estimated costs and/or savings associated with those recommendations, is presented in Section 7.0 of this report.

PREFACE

This report was prepared as part of a pilot project conducted by the United States Environmental Protection Agency (USEPA) Office of Underground Storage Tanks (OUST) and Office of Superfund Remediation and Technology Innovation(OSRTI). The objective of this project is to conduct Remediation System Evaluations (RSEs) of pump and treat systems managed by State UST programs. The following organizations are implementing this project.

Organization	Key Contact	Contact Information
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1.0 INTRODUCTION

1.1 PURPOSE

During fiscal years 2000, 2001, and 2002, Remediation System Evaluations (RSEs) were conducted at 24 Fund-lead pump and treat (P&T) sites (i.e., those sites with pump and treat systems funded and managed by Superfund and the States). Due to the opportunities for system optimization that arose from those RSEs, EPA OSRTI and OUST are performing a pilot study of conducting RSEs at UST sites. During fiscal year 2003, RSEs at up to 3 State-managed UST sites are planned in an effort to evaluate the effectiveness of this optimization tool for this class of sites. GeoTrans, Inc., an EPA contractor, is conducting these evaluations, and representatives from EPA OUST are attending the RSEs as observers.

The Remediation System Evaluation (RSE) process was developed by the US Army Corps of Engineers (USACE) and is documented on the following website:

http://www.environmental.usace.army.mil/library/guide/rsechk/rsechk.html

A RSE involves a team of expert hydrogeologists and engineers, independent of the site, conducting a third-party evaluation of site operations. It is a broad evaluation that considers the goals of the remedy, site conceptual model, above-ground and subsurface performance, and site exit strategy. The evaluation includes reviewing site documents, visiting the site for 1 to 1.5 days, and compiling a report that includes recommendations to improve the system. Recommendations with cost and cost savings estimates are provided in the following four categories:

- improvements in remedy effectiveness
- reductions in operation and maintenance costs
- technical improvements
- gaining site closeout

The recommendations are intended to help the site team (the responsible party, if one exists, and the regulators) identify opportunities for improvements. In many cases, further analysis of a recommendation, beyond that provided in this report, might be needed prior to implementation of the recommendation. Note that the recommendations are based on an independent evaluation by the RSE team, and represent the opinions of the RSE team. These recommendations do not constitute requirements for future action, but rather are provided for the consideration of all site stakeholders. This RSE report pertains to conditions that existed at the time of the RSE site visit, and any site activities that have occurred subsequent to the RSE site visit are not reflected in this RSE report.

The Morgan Terminal facility was selected by EPA OUST, in coordination with State agencies. This report provides a brief background on the site and current operations, a summary of the observations made during a site visit, and recommendations for changes and additional studies. The cost impacts of the recommendations are also discussed.

1.2 TEAM COMPOSITION

The team conducting the RSE consisted of the following individuals:

Rob Greenwald, Hydrogeologist, GeoTrans, Inc.
Peter Rich, Civil and Environmental Engineer, GeoTrans, Inc.
Doug Sutton, Water Resources Engineer, GeoTrans, Inc.

The RSE team was also accompanied by the following observers:

- Joe Vescio, EPA OUST
- Judy Barrows, EPA OUST

EPA-OUST is jointly conducting this RSE Pilot Study for UST sites with EPA-OSRTI.

1.3 DOCUMENTS REVIEWED

Author	Date	Title
NYSDEC	12/3/1992	Interim Order on Consent
Fenley & Nicol Environmental	3/6/1993	Subsurface Investigation at Morgan Terminal
Fenley & Nicol Environmental	2/14/1995	Remediation Proposal, Morgan Terminal
Fenley & Nicol Environmental	6/20/1996	Status Report - November 1995 - April 1996
Fenley & Nicol Environmental	2/26/1997	Semi-Annual Status Report Morgan Terminal
Fenley & Nicol Environmental	4/9/1998	Status Report, Morgan Oil Terminal
Fenley & Nicol Environmental	3/2/1999	Status Report, Morgan Oil Terminal
Fenley & Nicol Environmental	8/14/1999	Status Report, Morgan Oil Terminal, July 1998 - March 1999
Miller Environmental Group	6/2001	Site Status Report, January 2001 - June 2001
EcoTest Laboratories, Inc.	7/26/2001	Laboratory Data
EcoTest Laboratories, Inc.	8/8/2002	Laboratory Data
Miller Environmental Group	11/2002	Site Status Monitoring Report, July 2002 - November 2002

1.4 PERSONS CONTACTED

The following individuals associated with the site were present for the visit:

- Skip Taylor, Miller Environmental Group
- Louis Nardolillo, Miller Environmental Group
- Karen Sheridan, Miller Environmental Group
- Jennifer Rommel, NYSDEC
- Kerry Foley, NYSDEC
- Jeff Vought, NYSDEC
- Ben Singh, EPA Region II

1.5 SITE LOCATION, HISTORY, AND CHARACTERISTICS

1.5.1 LOCATION

The Morgan Terminal site is an abandoned oil terminal located at 200 Morgan Avenue in Brooklyn, New York. The site consists of a two story terminal operations building and maintenance building, seven bulk fuel oil storage tanks, and several underground storage tanks. The site has historically been impacted by diesel fuel and No. 6 fuel oil and dissolved hydrocarbons. Current contamination largely consists of No. 6 fuel oil. The surrounding area is comprised of industrial facilities and warehouses. Morgan Avenue borders the site to the west, the English Kills borders the site to the north and east, and an alley and other industrial properties border the site to the south. Figure 1-1 depicts the primary features of the site and the site's location with respect to the English Kills.

Site-related contamination was first reported in 1992 by the Coast Guard when oil was found seeping into the English Kills. Between December 1992 and January 1993 a remedial investigation (RI) was conducted including the installation of 20 ground water monitoring wells and tank testing. Primary recommendations included additional subsurface investigation, removal of floating product from monitoring wells, emptying and cleaning of tanks, and design of a remediation system. Additional investigations have occurred and the site now has over 40 monitoring wells. The tanks were cleaned in 1994, and a remediation system became operational in June 1995.

The State does not own the property. The current owner reportedly lives in Florida and, at the time of the interim consent order in 1994, over $800,000 in back taxes were owed. The State has a lien on the property to recover costs if the property is ever sold.

1.5.2 POTENTIAL SOURCES

The fuel oil storage tanks and other operations were the likely sources of contamination. The following table outlines for each storage tank the construction material, capacity, and former contents. Other smaller underground storage tanks are also present on the site and are indicated on Figure 1-1.

Tank Number	Type	Capacity	Product Formerly Stored
1	Steel/Carbon Steel	645,000	Nos. 5 or 6 Fuel Oil
2	Steel/Carbon Steel	7,000	Nos. 1, 2, or 4 Fuel Oil
3	Steel/Carbon Steel	55,000	Nos. 1, 2, or 4 Fuel Oil
4	Steel/Carbon Steel	67,000	Nos. 1, 2, or 4 Fuel Oil
5	Steel/Carbon Steel	507,000	Nos. 5 or 6 Fuel Oil
6	Steel/Carbon Steel	400,000	Nos. 1, 2, or 4 Fuel Oil
7	Steel/Carbon Steel	244,000	Nos. 1, 2, or 4 Fuel Oil

Though some tanks have been removed and other tanks have been cleaned, the conditions beneath the large storage tanks (including ST-1 through ST-5 on Figure 1-1) have not been investigated and this area may have significant free product in the soil. The wells with the highest dissolved hydrocarbon concentrations (in the vicinity of FN-26) are not near the wells with free product as shown in Figures 1-1 and 1-2, but the remaining free product at the site may serve as a continuing source for other dissolved phase contamination. Analysis of the contents from some of the tanks in 1994 revealed chlorinated hydrocarbons (tetrachloroethene, 1,1,1-tetrachloroethane, and trichloroethene) at the mg/L level. As of the RSE site visit, ground water samples had not been analyzed for these constituents.

It is generally understood that the free product remaining at the site is No. 6 fuel oil and that the majority of the lighter oils have either discharged to the English Kills or have been removed with the remediation system.

1.5.3 HYDROGEOLOGIC SETTING

According to the 1993 subsurface investigation conducted by Fenley & Nicol, the site is underlain by dark, very loose to medium compacted, fine to medium-grained sand with traces of pebbles, silt, brick, and concrete (fill). The predominant native formation consists of fine to medium sand with traces of pebbles. A peat layer is present at 12 feet below ground surface. The ground water table is generally 2 to 6 feet below ground surface.

Ground water flow is generally to the northwest toward the English Kills at an approximate hydraulic gradient of 0.01 feet/foot. Ground water flow, however, is substantially influenced by mounding near the storage tanks. As a result, ground water near the southern boundary of the property flows off site to the south. MTBE contamination has been found over 50 feet to the south of the site (FN-22 as depicted in Figure 1-2).

The wells yield very little water (i.e., approximately 1 gpm) but this may be predominantly due to fouling of the wells over time rather than the hydraulic properties of the aquifer. No record of pump tests were found, and the extraction rate of the remediation system is not provided. For reference, however, approximately 625 gallons of total fluids were removed by 5 vacuum enhanced fluid recovery events conducted in two wells (FN-11A and FN-15A), or approximately 6 gallons of total fluids per well per event.

1.5.4 RECEPTORS

The primary receptor is the English Kills. Discharges to the English Kills are no longer visible and may not be occurring. No investigation of the Kills or its sediments has taken place since the original reporting of the contamination.

Workers would also be potential receptors if trenching or other subsurface activity is required. Though not specifically identified from a well search, supply wells are present in the area, including one that is advertised at a car wash along on Morgan Avenue. This well or other wells are not likely receptors unless substantial dissolved contamination is present. Ground water sampling and analysis to date suggest that dissolved hydrocarbon contamination is not a threat to these receptors; however, samples have not been analyzed for chlorinated hydrocarbons.

1.5.5 DESCRIPTION OF GROUND WATER PLUME

Contaminants of concern include both free product and dissolved phase contamination. Figure 1-1 depicts the site monitoring wells and indicates those where free product has recently been observed. Figure 1-2 depicts the extent of MTBE and BTEX (benzene, toluene, ethylbenzene, and xylene) dissolved phase contamination. Although the extent of free product is smaller than it historically has been, the remaining free product is generally No. 6 fuel oil, which has been difficult to remove through either extraction or in-situ degradation.

Ground water samples have only been analyzed for hydrocarbons, including BTEX and MTBE. Although concentrations are above State standards in some locations, they are generally within an order of magnitude of the standards, with the exception of benzene in a limited area around FN-26. Although chlorinate hydrocarbons where detected within some of the storage tanks in 1994 at the mg/L range, ground water samples have not been analyzed for these constituents.

2.0 SYSTEM DESCRIPTION

2.1 SYSTEM OVERVIEW

The remediation system became operational in June 1995, extracts ground water from select monitoring wells, and treats the water prior to discharge to the sewer. Historically, extraction has been achieved from 10 monitoring wells outfitted with ejector pumps that are powered by a 5 HP compressor. At the time of the RSE site visit, only three of the pumps (FN-17, FN-28, and FN-30) were working, and the total extraction flow rate was estimated to be about 1 gpm. FN-37 was also online but was not functional.

The total fluids (both free product and water) are pumped to the head of the treatment system and flow by gravity through phase separation components before being pumped through GAC and then pumped to the discharge point. The treatment system as a whole consists of the following components:

- 1,000 gallon oil/water separator tank
- 550 gallon oil collection tank with secondary containment
- secondary 300 gallon separator
- 275-gallon influent tank with Teel 0.5 HP sump pump
- 55 gallon Carbtrol GAC vessel
- 275-gallon effluent tank with Teel 0.5 HP sump pump

The pumps are operated by level switches. Hi-hi switches are provided at the pumped tanks and the oil collection tank to prevent spills by stopping the compressor if a hi-hi level is reached. System piping is 2-inch diameter Schedule 40 PVC. The GAC unit is located in a shed with the compressor. All other components are outside and are insulated and heat traced.

Ground water extraction and treatment was augmented by vacuum enhanced fluid recovery (VEFR) that was conducted by a mobile unit. VEFR was discontinued in 2002, due to low recovery.

2.2 MONITORING PROGRAM

The monitoring program has historically consisted of gauging wells on a bi-weekly basis, but has recently been modified to gauging wells on a monthly basis and conducting quarterly sampling and analysis for BTEX and MTBE at approximately 9 perimeter well (FN-7, FN-13, FN-19, FN-20, FN-21, FN-23, FN-25, FN-29, and FN-46). For sampling, the wells are purged by low-flow pumps and the samples are taken with bailers. Wells are not sampled if free product is observed. EPA Method 602 is used for analysis. Although product thickness is measured, the measurements are not accurate because the No. 6 fuel oil coats the interface probe and prevents an accurate reading of the oil/water interface. Site status reports are provided to NYSDEC on a semi-annual basis.

The treatment plant influent and effluent are not sampled and the extraction rate is not measured.

3.0 SYSTEM OBJECTIVES, PERFORMANCE AND CLOSURE CRITERIA

3.1 CURRENT SYSTEM OBJECTIVES AND CLOSURE CRITERIA

The remediation goals are not clearly stated in the reports, but NYSDEC stated during the site visit that the goal is to eliminate measurable product. The presence of dissolved BTEX and MTBE contamination also suggests that site goals include decreasing the ground water concentrations to below applicable standards. The following table outlines the most stringent NYSDEC ground water standards for BTEX and MTBE as well as the chlorinated hydrocarbons that were detected in the storage tanks in 1994. The applicable standards for this site might be less stringent depending on the classification of ground water and surface water in the area.

Contaminant	NYSDEC Standard
Benzene	1 ug/L
Ethylbenzene	5 ug/L
Toluene	5 ug/L
Xylene (each isomer)	5 ug/L
MTBE	10 ug/L
Trichloroethene	5 ug/L
Tetrachloroethene	5 ug/L
1,1,1-Trichloroethane	5 ug/L

3.2 TREATMENT PLANT OPERATION STANDARDS

NYSDEC representatives at the RSE site visit did not know if there is a permit to discharge treated water to the sewer or where water in the sewer is discharged. Sampling of the effluent is not conducted.
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4.0 FINDINGS AND OBSERVATIONS FROM THE RSE SITE VISIT

4.1 FINDINGS

The observations provided below are not intended to imply a deficiency in the work of the system designers, system operators, or site managers but are offered as constructive suggestions in the best interest of the EPA, NYSDEC, and the public. These observations obviously have the benefit of being formulated based upon operational data unavailable to the original designers. Furthermore, it is likely that site conditions and general knowledge of ground water remediation have changed over time.

4.2 SUBSURFACE PERFORMANCE AND RESPONSE

4.2.1 PLUME CAPTURE

Although the original extraction system, comprised of 10 extraction wells, might have provided sufficient extraction to provide a hydraulic barrier between the contamination and the English Kills, the current system, comprised of 3 to 4 wells pumping approximately 1 gpm, likely does not. As stated by NYSDEC and their contractors during the site visit, the system is operating to maximize product removal.

4.2.2 AQUIFER RESTORATION

Discharges to the English Kills are no longer observable. Although free product is present, it is relatively immobile. This immobility prevents further discharge to surface water, but it also complicates extracting it from the subsurface. The site team estimates that approximately 10 to 20 gallons of product were removed during the past year of system operation. In addition, VEFR events conducted in 2002 generally recovered little product, and additions of Biosolve did not prove effective. As a result, the VEFR events have been discontinued. The following monitoring wells had observable free product between July and October 2002: FN-11a, FN-15a, FN-17a, FN-28a, FN-31a, FN-32, FN-33a, FN-34. These wells are indicated on Figure 1. The product thickness is not provided. Accurate measurements could not be obtained because the oil coated the interface probe and prevented it from identifying the product/water interface.

Dissolved BTEX and MTBE contamination exceed standards in few of the site wells. The following table presents those monitoring wells where dissolved contamination exceeded standards in July 2002. This dissolved contamination is also presented in Figure 1-2. The operating recovery wells are not in the vicinity of the monitoring wells with elevated dissolved contaminant concentrations. Wells with free product were not sampled but might have included dissolved contamination.

Monitoring Well	MTBE (ug/L)	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Xylene* (ug/L)
State Standard	**10**	**1**	**5**	**5**	**5**
FN-2	12	85	3	<1	<2
FN-4	27	15	13	10	50
FN-20	<1	<1	5	15	69
FN-22	4	<1	<1	2	15
FN-23	20	<1	<1	<1	<2
FN-24	19	<1	<1	<1	<2
FN-26	94	130	5	1	7
FN-40	51	<1	<1	<1	<2

** There are multiple isomers for xylenes. The concentration for the isomer with the highest concentration is presented.*

4.3 COMPONENT PERFORMANCE

4.3.1 EXTRACTION SYSTEM WELLS, PUMPS, AND HEADER

The majority of the ejector pumps are not operating because they are in need of repair. The pumps are now obsolete and, as a result, the parts are hard to obtain. According to the site contractor, the timing mechanisms are the most troublesome aspects. Parts have been used from some pumps to keep others running.

The low well yield may partially be due to fouling of the well screens. Cleaning of the wells is planned for the Summer of 2003.

4.3.2 SEPARATORS

The separators appear to be functioning as intended. Separated product from the primary separator is discharged to a storage tank. The product in the secondary separator, however, must be removed manually. During the RSE site visit there was thin layer of product in the bottom of the secondary containment structure for the primary separator. The separators and the other tanks outside of the maintenance shed are insulated and heat traced. Freezing has not been a problem.

4.3.3 GAC

The GAC is replaced approximately 3 times per year based on an increase in pressure to 10 psi or greater. No sampling of the influent and effluent is conducted, so the performance of the GAC cannot be determined.

4.4 COMPONENTS OR PROCESSES THAT ACCOUNT FOR MAJORITY OF ANNUAL COSTS

The approximate annual O&M costs were discussed during the RSE site visit. Based on the input from the contractors, the RSE team estimates that O&M will cost approximately $22,000 in the upcoming years. This is a decrease in O&M cost from previous years primarily due to reductions in scope, such as the elimination of the VEFR events and reduction of well gauging frequency from biweekly to monthly.

Item Description	Estimated Cost per Year
System operation and maintenance	$6,000
Semi-annual reporting	$2,400
Sampling and well gauging	$3,500
Electricity	$3,300
GAC replacement	$1,200
Laboratory analysis	$5,200
Total Estimated Cost	**$21,600**

4.4.1 UTILITIES

The site utilities are primarily due to the compressor and process pumps. Electricity bills suggest that the site uses, on average, 55 kWh per day at a cost of $0.16 per kWh. This translates to approximately $3,200 per year. Service and miscellaneous charges of approximately $100 brings the total annual electricity cost to approximately $3,300 per year.

4.4.2 NON-UTILITY CONSUMABLES AND DISPOSAL COSTS

GAC is the only consumable used at the site. Replacements occur approximately 3 times per year at a cost of approximately $400, including GAC, labor, and disposal. There is apparently no cost for discharging treated water to the sewer.

4.4.3 LABOR

Labor primarily consists of servicing the treatment system and ejector pumps, sampling, gauging, and reporting. Project management is included in the costs, and a discount is provided to the State.

4.4.4 CHEMICAL ANALYSIS

Chemical analysis costs are estimated by the RSE team assuming approximately $100 per sample and 13 samples per quarterly event, including QA/QC samples.

4.5 RECURRING PROBLEMS OR ISSUES

The ejector pumps require frequent servicing and parts are difficult to obtain. Another recurring problem is the inability to obtain an accurate product thickness measurement. When submerged into the free product, the interface probe is coated with the No. 6 fuel oil and cannot detect the interface between the product and the underlying water.

During the RSE site visit, one of the well vaults was flooded, allowing free product to rise to within an inch of ground surface.

The site also faces a security issue. The New York Police Department, in cooperation with NYSDEC, conducts frequent raids to address vagrants, trespassers, and associated criminal acts.

4.6 REGULATORY COMPLIANCE

The site team is unaware of a discharge permit, and no effluent sampling is conducted. It is therefore difficult to determine if the treatment system is in compliance.

4.7 TREATMENT PROCESS EXCURSIONS AND UPSETS, ACCIDENTAL CONTAMINANT/REAGENT RELEASES

The site team did not indicate any treatment process excursions or releases.

4.8 SAFETY RECORD

The site team did not indicate any reportable incidents.

5.0 EFFECTIVENESS OF THE SYSTEM TO PROTECT HUMAN HEALTH AND THE ENVIRONMENT

5.1 GROUND WATER

Under the current conceptual model, surface water is the only receptor of contaminated ground water. However, there may be private water supply wells in the area. Because the No. 6 fuel oil is relatively immobile, it does not pose an immediate threat to supply wells, if they are present. Dissolved BTEX/MTBE contamination is present in relatively low concentrations and should not adversely affect nearby potential receptors. Dissolved chlorinated compounds might be present in the subsurface but have not been sampled in ground water as part of the site activities. If chlorinated compounds are present in the ground water, they might be the most likely contaminants to impact nearby supply wells.

5.2 SURFACE WATER

Surface water was historically affected by discharges of fuel oil from ground water. Such discharges, however, have not been visually observed since the site characterization and remedial activities began in 1994. Dissolved contamination might be discharging to surface water. Dissolved BTEX/MTBE is present at low concentrations but above State standards. The remediation system likely does not provide a hydraulic barrier between contamination sources and surface water. Dissolved contamination is not expected to adversely impact surface water unless substantial chlorinated solvent contamination is detected. The surface water quality has not been determined as part of the site activities, but if contamination is detected in surface water it could result from other facilities.

5.3 AIR

Indoor air has not been considered a potential receptor at this site. Dissolved site-related hydrocarbons are relatively limited in extent and sufficiently low in concentration that they are likely not adversely affecting indoor air at any of the neighboring buildings. Chlorinated hydrocarbons, if present in sufficient quantities, could adversely affect indoor air quality of surrounding buildings or of future buildings on this site. Benzene in the vicinity of FN-26 could potentially adversely affect indoor air quality if the concentrations do not decline and the property is developed without appropriate engineering controls.

5.4 SOILS

The site is covered in either concrete or asphalt, and contaminated soils are not present at the surface. Subsurface activities, such as trenching and construction, however, could expose workers to contaminated soils.

5.5 Wetlands and Sediments

There are no wetlands in the vicinity of the site. Sediments in the English Kills have not been sampled as part of the site activities. If they are contaminated, the contamination is not necessarily due to the Morgan Oil site given the presence of other industrial facilities in the area.

6.0 RECOMMENDATIONS

Cost estimates provided herein have levels of certainty comparable to those done for CERCLA Feasibility Studies (-30/+50%), and these cost estimates have been prepared in a manner consistent with EPA 540-R-00-002, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, July 2000.

6.1 RECOMMENDATIONS TO IMPROVE EFFECTIVENESS

6.1.1 DETERMINE IF CHLORINATED SOLVENTS AND PAHS ARE PRESENT IN GROUND WATER

Analysis of liquid in Tank #5 and a vacuum truck on June 21, 1994 indicate elevated concentrations (e.g, over 1 mg/L) of tetrachloroethene, trichloroethene, 1,1,1-trichloroethane, and trichlorofluoromethane. Given the history of discharges from tanks at this facility, there is potential for these contaminants to be present in ground water. In addition, some potentially hazardous polynuclear aromatic hydrocarbons (PAHs) are typically associated with No. 6 fuel oil and may be present in the dissolved phase. There is no indication in site records that chlorinated solvent or PAH contamination of ground water has been investigated as part of site activities. These compounds should be added to the ground water monitoring program for two quarters and should be included in the ground water monitoring program for longer if they are detected in ground water above State standards. This recommendation could be implemented by analyzing the samples from the next two events with method 8260b and 8270c instead of method 602. The added cost should be less than $4,000 for the two events. If the current monitoring network does not adequately delineate the plume of these newly analyzed constituents, then additional investigation may be required.

6.1.2 IMPROVE THE SITE CONDITION BY DEMOLISHING STRUCTURES AND INVESTIGATING AND/OR EXCAVATING UNDERLYING CONTAMINATED SOILS

The property is not maintained, is a safety hazard, and an attraction for vagrants and vandals. Furthermore, although the property is in a promising location for potential businesses and could provide the city with additional tax revenue, the site contamination and presence of the tanks and decrepit infrastructure makes acquiring the property a substantial business risk.

In addition to improving the site aesthetically and improving the probability of development, removal of the derelict equipment and structures will allow investigation and remediation of the site to proceed unimpeded. The site tanks (including retaining/containment walls and mounded soil), structures, pipes, and loading racks should be removed. The concrete and steel could be disposed in a C&D landfill or recycled. Some cleaning would be necessary to remove oil staining. Based on a review of the site map, the footprint of all structures on the property is as follows:

Structure	Dimensions*	Estimated Footprint
3 loading docks	20 ft x 75 ft (each)	1,500 ft^2
Terminal operations building	75 ft x 40 ft	3,000 ft^2
Maintenance building	35 ft x 35 ft	1,225 ft^2
Maintenance garage	40 ft x 75 ft	3,000 ft^2
Fuel storage tanks and containment (southern site boundary)	270 ft x 70 ft	18,900 ft^2
Fuel storage tanks and containment (eastern site boundary)	140 ft x 100 ft	14,000 ft^2
Miscellaneous (~10%)		4,000 ft^2
Estimated total		45,625 ft^2

* *Building dimensions are estimated based on site map provided in Figure 1.*

After demolition, the site team could evaluate the need for further investigation and remediation in areas where structures have been removed. Potential options for addressing contamination in those areas might include the following:

- Option 1 - The site team could investigate, delineate, and document contamination. Even if contamination is not removed, delineating it reduces risk to potential buyers because they can better quantify the cost of remediation and compare that cost with the value of the property.

- Option 2 - The site team could remove visible contamination (e.g., within one foot of the surface) and replace removed material with clean material to prevent direct exposure. This level of remediation could serve as a temporary solution that prevents direct exposure to contamination. Further remediation could occur, if necessary, during future site development.

- Option 3 - The site team could excavate contaminated soils with extensive free product to the water table (a depth of approximately 5 feet) and replace excavated material with clean material. No further excavation would likely be necessary. Although contamination would likely remain below the water table, it would be best addressed through long-term remedial activities.

Excavated soils could be recycled for asphalt, brick, or other construction material, or at worst, placed in a Subtitle D landfill. For the most part, the material on this site is likely non-hazardous. Petroleum products are not listed hazardous waste, this site is not a Superfund or RCRA site, benzene levels are not high enough to even consider the waste to be characteristically hazardous, and even if they were, the petroleum exemption to RCRA (40CFR 280) would keep the material non-hazardous. The only constituents that may be an issue are the chlorinated hydrocarbons that were detected in some of the tank samples. Prior to excavation, and certainly prior to disposal, soil samples should be collected to determine the extent chlorinated solvent contamination of soils. This sampling is especially merited if chlorinated solvents are found during ground water sampling events.

The estimated cost for removing the structures and the above presented options are provided in the following table. The NYSDEC would need to evaluate the cost of each item against available resources and the improved likelihood of selling the property. Without further information regarding the site and potential buyers, the RSE team would likely recommend pursuing the demolition followed by Option 1 and/or Option 2, depending on what is found at the surface when the structures are removed.

Item	Quantity	Unit Cost	Estimated Cost**
Demolition of site structures (i.e., tanks, buildings, pipes, loading docks, etc.)	50,000 ft^2 of structures at an average height of 15 ft	$0.42/cf *	$430,000
Option 1 - Investigate, delineate, and document contamination beneath removed structures • work plan, etc. • 3 days of direct push sampling • installation of up to 4 monitoring wells • 2 rounds of sampling and analysis at new wells • documentation in a comprehensive report			$85,000
Option 2 - Excavation of contaminated soil beneath tanks, including transportation and non-hazardous disposal (270 ft x 70 ft and 140 ft x 100 ft containment areas to a depth of 1 foot)	1,200 cubic yards (~1,800 tons)	$75/ton	$185,000
Option 3 - Excavation of soil with extensive contamination to water table (270 ft x 70 ft and 140 ft x 100 ft containment areas to a depth of 5 feet plus an additional 500 cubic yards of miscellaneous soils)	6,600 cubic yards (~9,900 tons)	$75/ton	$1,000,000

** Architects, Contractors, Engineers 2003 Guide to Construction Costs*
*** Cost includes a 10% markup for oversight plus an additional 25% for contingency*

6.1.3 DEVELOP A REVISED SITE CONCEPTUAL MODEL AND SET MEASURABLE OBJECTIVES

Site conditions will be substantially altered during tank removal and soil excavation. Site changes will likely include the destruction of some monitoring wells, removal of source material, and changes in infiltration and ground water flow patterns. A site conceptual model should be developed after the tanks are removed. Visual observations made during the excavation should add to the understanding of the site. Also, up to 4 to 5 additional monitoring wells in former tank locations may be needed to improve the current understanding of the site after demolition. Ground water monitoring should continue for at least four quarters after the excavation to determine water level and contaminant trends after the excavation. These trends could be the basis for determining the need for future active remediation or the potential for a more passive approach.

Potential receptors in the area and exposure pathways for those receptors should also be reevaluated given the understanding of new site conditions and data on chlorinated solvents and PAHs in ground water. Potential receptors include the English Kills, water supply wells in the area (if any), and indoor air in nearby buildings. Ground water sampling results to date do not suggest a substantial threat to supply wells or indoor air, but if chlorinated compounds are found in ground water, the pathway to all receptors should likely be evaluated.

To date, the objective has been to prevent discharge of free product to the English Kills. The discharge of free product to surface water has not been observed for a number of years. Although removal of the product is preferable, it may be technically impracticable without excavation well below the water table. Given the relatively low toxicity of No. 6 fuel oil, a containment-only objective for free product may be more appropriate, and that containment is already provided by its immobility.

The addition of the wells, the development of the site conceptual model, and the determination of applicable remediation objectives will likely require approximately $30,000. This cost estimate does not include a full evaluation of indoor air because not enough information is available at this time to determine the scope of an appropriate evaluation or even if one is needed.

6.1.4 OBTAIN A DISCHARGE AGREEMENT AND COLLECT EFFLUENT SAMPLES

The site should have an appropriate discharge permit or agreement and discharge samples should be collected and analyzed for the applicable constituents. Currently treated water is discharged to the local sewer that is likely a combined sewer that routes water to a POTW under most circumstances. An agreement should be in place and in the DEC and contractor's possession so that appropriate sampling (i.e. quarterly TPH, BTEX, MTBE, and potentially chlorinated solvents) can be conducted and reported. It is estimated that the increase in costs due to sampling and reporting might be $3,000 per year.

6.2 RECOMMENDATIONS TO REDUCE COSTS

The RSE team does not provide any specific cost reduction recommendations but does agree with the recent elimination of the VEFR events and the reduction in well gauging from biweekly to monthly. After another four quarters of ground water sampling, the RSE team advocates evaluating the potential for reducing the sampling frequency from quarterly to semi-annually. After these four additional quarters sufficient information should be available to determine concentration trends for both hydrocarbons and chlorinated hydrocarbons, if they are present.

6.3 MODIFICATIONS INTENDED FOR TECHNICAL IMPROVEMENT

6.3.1 IMPROVE REPORTS

The semi-annual reports are the primary mechanism for documenting site activities and performance and should be improved. Suggested improvements include eliminating or reducing errors and including information about ground water extracted and treated (i.e., flow rates and process sampling data discussed in Section 6.1.4). Errors identified by the RSE team in the July 2002 - November 2002 Site Status Monitoring Report include the following:

- Tables 1 and 2 have the incorrect site name, dates, and data.
- The figures are not numbered.
- The MTBE and BTEX plume maps do not accurately represent the concentrations.
- The ground water flow map shows depth to water data rather than water level elevations.

The RSE team recommends the use of bubble maps to indicate constituent concentrations. Because no interpolation is used, bubble maps provide the data rather than interpretations of the data. They are therefore easier to review and compare to data tables and are less prone to potential errors, inconsistencies, or potentially faulty interpretations. The bubble map might include a different symbol for those wells with free product or dissolved contamination, and may use a symbol that is increased or decreased in size depending on the product thickness or dissolved concentration. In order to convert water depths to water elevations, survey information is required. These are likely available in the old Fenley & Nicol reports where water elevations were calculated and plotted.

The RSE team estimates that about $2,000 per year, in addition to the current expenditures, should be sufficient to improve the semiannual reports.

6.3.2 CONSIDER REMOVING THE GAC EFFLUENT TANK

The GAC effluent tank could be eliminated, allowing discharge directly from the GAC unit. This would eliminate a 0.5 hp pump and the heat trace requirements for the tank. Removing this tank and pump will save about $500 per year in utility costs and simplify future system maintenance.

6.3.3 REPAIR INSULATION OR RELOCATE TREATMENT COMPONENTS

If the current treatment system is still used after implementing the recommendations in Section 6.1, the insulation on the treatment components should be repaired or the components should be located within a shelter. A flow meter should be added so that discharge flow can be recorded. About $2,000 is necessary for the flow meter plus insulation repair. If another shed is purchased to house additional components the cost will likely increase by another $3,000.

6.4 CONSIDERATIONS FOR GAINING SITE CLOSE OUT

6.4.1 CONSIDER AN ALTERNATIVE REMEDIAL APPROACH

Given its current function and the current objectives, the remediation system does not appear to be effective with respect to ground water remediation. The system most likely does not extract enough water to provide capture of free product or dissolved contamination and yet, due to the relative immobility of No. 6 fuel oil, no discharges of free product to surface water have occurred. In addition, little product is recovered (e.g., less than 20 gallons per year) even with the introduction of Biosolve and VEFR events. Therefore, the system is not effective for containment or restoration and does not appear necessary for containment of the free product.

Steam injection was mentioned during the site visit as a possible method for removing additional product. Although it may be successful in removal of localized product, implementation of a full scale system would be extremely expensive and has a relatively high probability of being unsuccessful site wide. The peat layer at 12 feet below ground surface impedes any chemical oxidation and aerobic bioremediation possibilities.

The only active remediation that would have a good chance of removing a substantial percentage of the petroleum mass at the site is excavation to below the water table. Boring logs indicate impacts to at least 20 feet below ground surface and impacts are likely present over most of the site (approximately 2 acres). The volume of soil requiring removal would be approximately 50,000 cubic yards or more, and a significant dewatering effort would be required during excavation. The cost of this effort would be above $3,000,000 beyond the cost of the recommendations in Section 6.1. Excavation does not appear to be warranted at the site due to the apparent lack of exposure pathways and the relatively low toxicity of the fuel oil.

Assuming chlorinated solvent contamination is not found in ground water, the site team should consider passive skimming and periodic bailing of product from wells and institutional controls for long-term remediation. The ground water monitoring frequency could be reduced to annual in order to monitor the remaining dissolved MTBE/BTEX contamination. If benzene concentrations persist at FN-26, quarterly VEFR events at FN-26, FN-2, and FN-4 could be conducted for one year to decrease the concentrations.

The cost of implementing this approach is minimal compared to the costs of removing the tanks and excavating soil. The reduced scope for annual activities would eliminate the costs for system operation, electricity, and GAC replacement ($10,500 per year). In addition, it would reduce the sampling and analysis costs by approximately $5,000 per year. Total annual expenses might be under $10,000 per year.

If dissolved ground water concentrations (e.g., chlorinated solvents) are sufficiently high to merit containment, the extraction system should be reworked to provide ample extraction. New extraction wells would likely be required, and the pumps should be replaced with currently available pneumatic submersible total fluids pumps. The monitoring program should also be adapted to evaluate the performance of plume capture. The specific modifications would require more information regarding the extent and magnitude of the dissolved constituents of concern, especially for the chlorinated solvents.

6.5 SUGGESTED APPROACH TO IMPLEMENTATION

The first priority should be to sample ground water for chlorinated solvents because many of the other decisions at the site require knowledge as to whether or not these constituents are present and the magnitude and extent of any contamination. Off-site investigation may be necessary if significant chlorinated solvent contamination is found.

The site structures and tanks should be removed as soon as possible. In addition, as described in Section 6.1.2, varying degrees of investigation and/or remediation could also be considered to facilitate sale of the property. A variety of site development options would be possible. Vapor toxicity is low and potential vapor intrusion could be addressed by design/construction methods. Businesses would likely be interested in the property due to its location, which would provide tax revenue to the city and potentially provide jobs in the neighborhood. With the greater potential for site development, the State and City would be more inclined to resolve the ownership/liens and outstanding tax issues. Eventually some of the costs spent in remediation would be recouped by the State and/or City. Moreover, the safety hazards and attractions to vagrants would be eliminated.

Other recommendations including the discharge agreement, removal of the GAC effluent tank, insulation repair, flow meter installation, report improvements and consideration of passive skimming/periodic bailing instead of total fluids pumping can be initiated concurrently with the site demolition or can be delayed until the post-demolition site conceptual model is developed.

7.0 SUMMARY

The observations and recommendations contained in this report are not intended to imply a deficiency in the work of either the system designers or operators but are offered as constructive suggestions in the best interest of the EPA and the public. These recommendations have the obvious benefit of being formulated based upon operational data unavailable to the original designers.

Recommendations for improving effectiveness in protecting human health and the environment include analyzing ground water samples for chlorinated solvents and PAHs, demolishing the site structures, investigating and/or excavating contaminated soils beneath those structures, revising the site conceptual model to account for the site conditions after the demolition and excavation, and obtaining a permit or agreement to discharge the treated water. No specific recommendations were offered for cost reduction; however, the RSE team does agree with the recent elimination of the VEFR events and reduction in well gauging frequency. Recommendations for technical improvement include improving the semi-annual reports and removing the GAC effluent tank from the treatment system. One recommendation for gaining site closeout, or more specially system closeout, is provided. It is to consider an alternative remedial approach based on institutional controls and passive skimming of free product. The rationale for this approach is the immobility and relatively low toxicity of the No. 6 fuel, the absence of free product discharges to surface water, and the high cost of removing the remaining free product and impacts that reach below the water table. The success of implementing this type of approach, however, is contingent on finding chlorinated solvent and PAH concentrations below standards.

Table 7-1 summarizes the costs and cost savings associated with each recommendation in Sections 6.1 through 6.3. Both capital and annual costs are presented. Also presented is the expected change in life-cycle costs over a 30-year period for each recommendation both with discounting (i.e., net present value) and without it.

Table 7-1. Cost Summary Table

Recommendation	Reason	Additional Capital Costs ($)	Estimated Change in Annual Costs ($/yr)	Estimated Change In Life-cycle Costs ($) [1]	Estimated Change In Life-cycle Costs ($) [2]
6.1.1 Determine If Chlorinated Solvents and PAHs Are Present in Ground Water	Effectiveness	$4,000	$0	$4,000	$4,000
6.1.2 Improve The Site Condition By Demolishing Structures and Investigating and/or Excavating Underlying Contaminated Soils	Effectiveness	$515,000 to $1,430,000[3]	$0	$515,000 to $1,430,000[3]	$515,000 to $1,430,000[3]
6.1.3 Develop A Revised Site Conceptual Model and Set Measurable Objectives	Effectiveness	$30,000	$0	$30,000	$30,000
6.1.4 Obtain A Discharge Agreement and Collect Effluent Samples	Effectiveness	$0	$3,000	$90,000	$48,500
6.3.1 Improve Reports	Technical Improvement	$0	$2,000	$60,000	$32,000
6.3.2 Consider Removing The GAC Effluent Tank	Technical Improvement	$0	($500)	($15,000)	($8,000)
6.3.3 Repair Insulation or Relocate Treatment Components	Technical Improvement	$2,000	$0	$2,000	$2,000
6.4.1 Consider an Alternative Remedial Approach	Gain Site/System Closeout	$0	($15,500)	($465,000)	($250,000)

Costs in parentheses imply cost reductions.

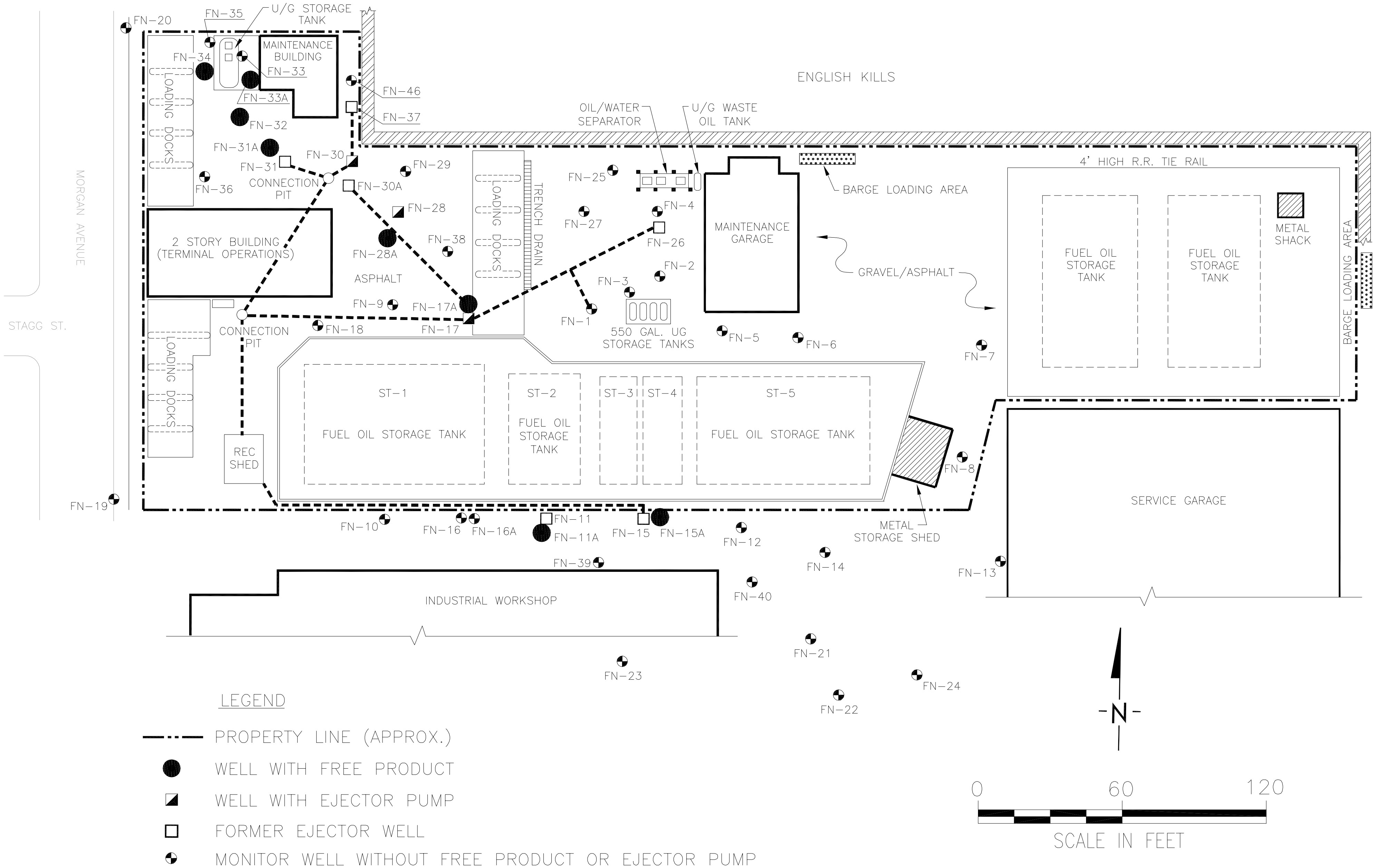
[1] assumes 30 years of operation with a discount rate of 0% (i.e., no discounting)

[2] assumes 30 years of operation with a discount rate of 5% and no discounting in the first year

[3] Implementing any of the options in this recommendation could improve the potential for redevelopment that would provide increased tax revenues and other benefits.

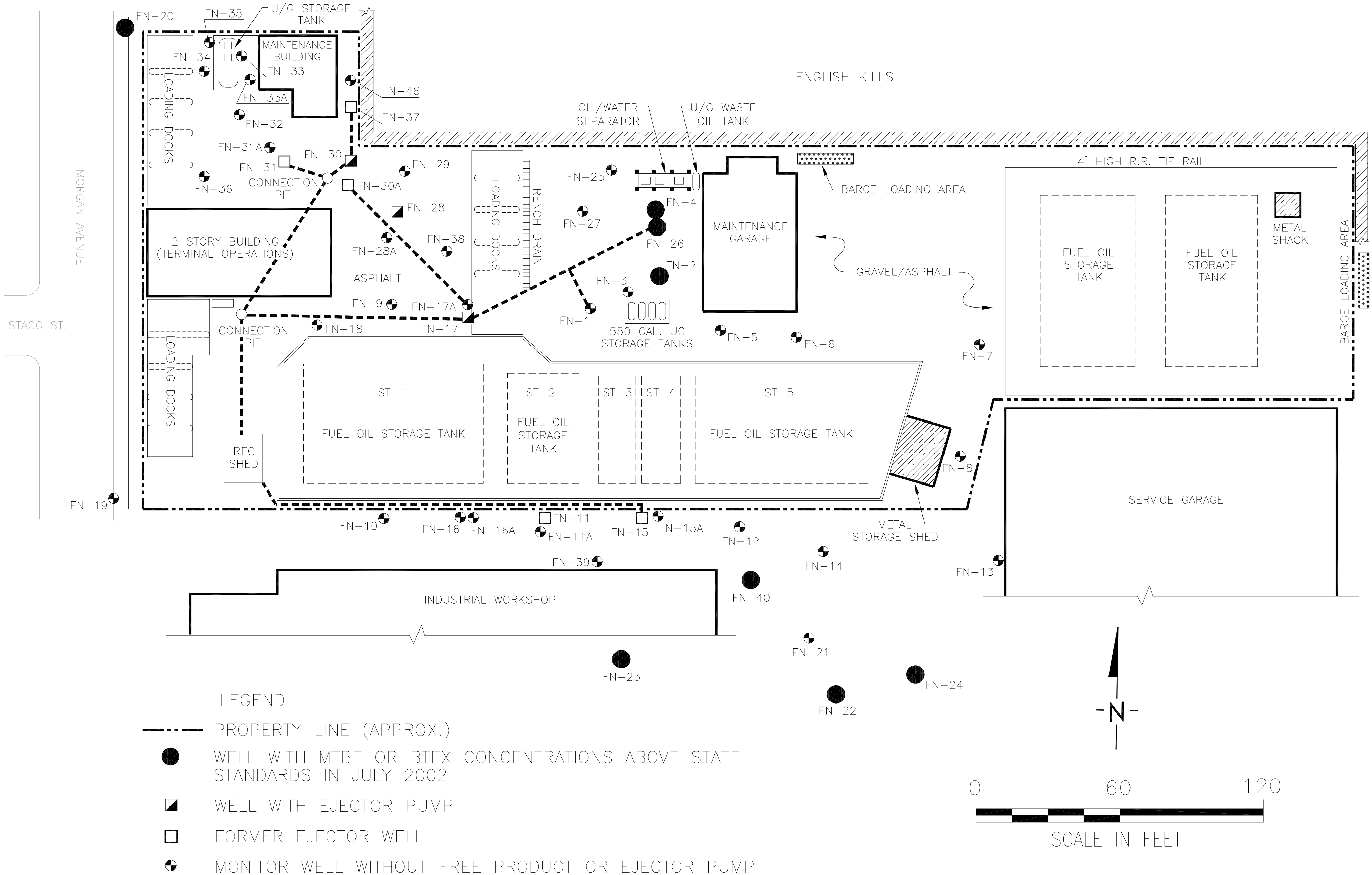
FIGURES

FIGURE 1-1. SITE MAP AND OBSERVED EXTENT OF FREE PRODUCT IN 2002.



(Note: This figure was generated based on site figures developed by Miller Environmental Group, Inc. and discussions during the RSE site visit.)

FIGURE 1-2. EXTENT OF DISSOLVED CONTAMINATION ABOVE THE MOST STRINGENT STATE STANDARDS AS OBSERVED IN JULY 2002.



(Note: This figure was generated based on site figures developed by Miller Environmental Group, Inc. and discussions during the RSE site visit.)