DRAFT REMEDIAL ACTION PLAN
UNREGULATED USTS NEAR BUILDING 3A

FEDERAL CENTER
607 HARDESTY AVENUE, KANSAS CITY, MO

Missouri DNR ST# 10970
Spill # 000309-0815-NRB Jackson County
Contract No.: GS06P98GYC0012
GSA Project No.: RMO20490

Prepared for:

Property Management Division, Technical Support Branch (6PMT-E)
1500 East Bannister Road, Room 2135
Kansas City, Missouri 64131-3088

Prepared by:

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MARCH 2002

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DEPARTMENT OF NATURAL RESOURCES
www.dnr.state.mo.us

February 24, 2003

Mr. David Hartshorn
General Services Administration
1500 Bannister Road, Room 2135
Kansas City, MO 64131-3088

RE: Federal Center Facility, 607 Hardesty Avenue, Kansas City, Missouri

Dear Mr. Hartshorn:

I received your email on February 20, 2003, regarding the approval of the Lead Abatement Plan, Building 4 Underground Storage Tanks (UST) and Building 3A USTs. These remedial action plans will be utilized to show potential buyers the Missouri Department of Natural Resources (department) has reviewed and approved these plans.

The lead abatement plan does not list the dimensions or size of the firing range. These dimensions are listed in the Site Inspection report. Please provide a diagram of the firing range with the dimensions drawn on the diagram. Were the walls tested to see if lead contamination is in the paint? The site inspection report states the walls are painted cinder blocks. If the paint is lead based the sampling results may be erroneous. Otherwise the work plan is approved for implementation.

The Building 4 Underground Storage Tanks are regulated tanks. This plan was submitted to the Tanks Section of the department. Mr. Eric Tse, Project manager in the Tanks Section, asked me to oversee this plan as well as the unregulated tanks at this site. He has no objections to the draft remedial action plan as written. This remedial action plan is also approved for implementation.

The Building 3A Underground Storage Tanks are unregulated tanks. The Voluntary Cleanup Program (VCP) has been providing oversight of these tanks. The required plans as outlined in Section 7.4 of the remedial action plan will need to be submitted and approved by the VCP prior to any field activities. An underground injection permit will also need to be submitted to the Water Pollution Control Program (WPCP) prior to remediation. It takes time to acquire an injection permit from WPCP so please allow adequate time before remediation. This draft remedial action plan for the three USTs near Building 3A is approved for implementation.

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The department is aware a prospective purchaser may conduct the remediation as outlined in the Early Transfer Authority and Covenant Deferral Request. The VCP would like to be notified as soon as possible if a potential buyer for the site proposes doing the remediation. The final remedial action plan would need to be submitted by the person doing the remediation. This plan may be different than the one outlined by the draft remedial action plan.

If you have any questions please contact me at 573-761-7538 or P.O. Box 176, Jefferson City, Missouri 65102-0176.

Sincerely,

HAZARDOUS WASTE PROGRAM

Christine O'Keefe

Christine O'Keefe
Environmental Specialist
Voluntary Cleanup Section

CO:ph

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List of Acronyms

bgs	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CALM	Cleanup Levels for Missouri
CAPE	Cape Environmental Management Inc.
CDR	Covenant Deferral Request
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFR	Code of Federal Regulations
CMA	Corrective Measures Alternative
CMS	Corrective Measures Study
COC	Contaminant of Concern
°C	Degrees Celsius
DGLS	Missouri Division of Geology and Land Survey
ETA	Early Transfer Authority
gpm	Gallons per Minute
GRH	Gasoline Range Hydrocarbons
GSA	General Services Administration
GTARC	Groundwater Target Concentration
HSA	Hollow Stem Auger
LPCA	Liquid Phase Carbon Adsorption
µg/kg	Micrograms per kilogram
MCL	US EPA Maximum Contaminant Level
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
MO DNR	Missouri Department of Natural Resources
MTBE	Methyl t-Butyl Ether

MW	Monitoring Well
ND	Not Detected
NPL	National Priorities List
O&M	Operation and Maintenance
OMB	Office of Management and Budget
ORC	Oxygen Release Compound
PID	Photoionization Detector
ppm	Parts per Million
PTA	Property Transfer Agreement
RA	Response Action
RAP	Remedial Action Plan
RFH	Radio Frequency Heating
SB	Soil Boring
SCR	Site Characterization Report
STARC	Soil Target Concentration
SVE	Soil Vapor Extraction
SVOC	Semivolatile Organic Compound
TEH	Total Extractable Hydrocarbons
UIC	Underground Injection Control
USDW	Underground Sources of Drinking Water
US EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
VCP	Voluntary Cleanup Program
VOC	Volatile Organic Compound
WPCP	Water Pollution Control Program

1.0 INTRODUCTION

1.1 Purpose

The General Services Administration (GSA) has completed a site characterization at the Federal Center (site) located at 607 Hardesty Avenue, Kansas City, in Jackson County, Missouri. Petroleum hydrocarbon contamination in soil and groundwater is present at the site in concentrations that exceed the Cleanup Levels for Missouri (CALM), which are promulgated by the Division of Environmental Quality, Hazardous Waste Program, Missouri Department of Natural Resources (MO DNR). As a result this Remedial Action Plan (RAP) is prepared to present corrective measure objectives for soil and groundwater impacted by release(s) from three unregulated, previously closed underground storage tanks (UST) near Building 3A. This RAP includes current site information, provides a Corrective Measures Study (CMS), recommends remedial actions in response to contamination at the site, and provides a conceptual design for remedial actions. This RAP is being submitted through the Voluntary Cleanup Program (VCP), which is administered by the Hazardous Waste Program's Voluntary Cleanup Section. The MO DNR VCP section provides oversight for voluntary cleanups of properties contaminated with hazardous substances. Additionally, this RAP and the recommended remedial actions for soil and groundwater contamination, once approved by the MO DNR, will be included as part of an Early Transfer Authority (ETA) package that will be presented to the Governor of Missouri. The GSA intends to present the ETA package to the Governor in order to transfer ownership of the property as soon as possible. The process of early property transfer is a means where federal properties can be sold provided that an approved RAP for the property is in place and the government is pursuing funding for the implementation of the RAP. Specifics with respect to the ETA process are presented below.

1.2 Early Transfer Authority

The Comprehensive Environmental Response Compensation and Liability Act (CERCLA) contains a covenant that requires the federal government to perform all remedial action necessary to protect human health and the environment prior to transfer. However, Section 120(h)(3)(C) allows landholding agencies to request deferral of the CERCLA covenant through the ETA program. Congress authorized ETA in the Fiscal Year 1997 Department of Defense

Authorization Bill, amending CERCLA. As long as safeguards are in place to protect human health and the environment, ETA allows the federal government to transfer property to non-federal entities before the completion of environmental cleanup. The governor of the state in which the property is located must concur that the property is suitable for early transfer. Since ETA's enactment, federal properties have been successfully conveyed to local communities prior to the completion of environmental cleanup. These early transfers met local communities' needs for expedited property transfer, reduced customer agencies' protection and maintenance costs, and ensured for the protection of human health and the environment.

Before Congress enacted ETA, CERCLA required the federal government to complete all necessary cleanup actions on a property before transferring title out of government ownership. Federal funding for the property's environmental cleanup often proved difficult to obtain and insufficient to meet cleanup costs. While waiting for the government to finish remediation, potential new owners faced difficulties trying to obtain financing and structure deals. As a result some property transfers took years to execute, delaying restoration and redevelopment.

Early transfer provides the opportunity for simultaneous cleanup and redevelopment. Marrying remediation with redevelopment often proves to be extremely cost-effectiveness as it enables the cleanup remedy to be designed with the final site reuse in mind.

Early transfer also allows for privatization of cleanup. For example, the transferee or a developer may perform the remediation in exchange for a reduced purchase price. This may be extremely beneficial in certain cases. Private developers often have greater incentive, experience, and funding to complete environmental cleanup. A non-federal entity may also purchase insurance to address environmental risks and assure the availability of funds for unexpected cleanup costs.

ETA is presented in this RAP as part of the overall recommended corrective measure for the site. ETA is discussed more specifically in Subsection 4.2.2.

1.3 Site Background

The site is a federal property located at 607 Hardesty Avenue, Kansas City, in Jackson County, Missouri. The Federal Center consists of seven buildings with associated parking areas located on approximately 18 acres of land. The site was reportedly acquired by the Department of Army in 1940 and was developed as a supply depot to support military operations. Currently, GSA owns the site. During the period of supply depot operations several USTs were present on the site to support the military operations. After World War II, depot functions declined and several of the buildings and associated USTs have been demolished, abandoned, and/or removed.

1.4 Site Location and History

The site occupies an area of approximately one city block within a business district northeast of downtown Kansas City. Independence Avenue borders the site to the north, the Kansas City Terminal Railroad to the East and South, and Hardesty Avenue to the West. The 7.5-minute United States Geological Survey (USGS) Kansas City quadrangle map for the site and the surroundings is provided in Figure 1. A Site Map is included as Figure 2.

The site was developed incrementally throughout the period of 1940 through 1960. The site was reportedly acquired by the Department of Army in 1940 and was developed as a supply depot to support military operations. Development included the addition of numerous buildings, approximately nine USTs, and a service station. After World War II, depot functions declined and several of the buildings and associated USTs have been demolished or removed.

This RAP addresses contamination associated with three unregulated USTs near Building 3A:

- Two 23,000-gallon USTs were formerly located in the grassy area east of Building 3A. These USTs were removed circa 1988
- One 178,000-gallon UST was located southeast of Building 3A. This UST was abandoned in-place circa 1988.

In December 2000, Cape Environmental Management Inc. (CAPE) performed a site characterization at the subject property to attempt to identify the horizontal and vertical extent of contamination around the UST locations near Building 3A. Soil and groundwater samples were

collected from soil borings (SB) and monitoring wells (MW) installed during these field activities. Soil boring and monitoring well locations for the site characterization activities are shown on Figures 3 and 5. During the installation of MW7, free product was encountered in the soils and groundwater. From the results of the site characterization, CAPE recommended that an additional investigation be performed in this area.

An additional investigation was conducted in May 2001 to attempt to horizontally delineate free product and soil contamination in and around the unregulated tank locations near Building 3A. Twelve soil borings (SB50 through SB61) were installed to depths ranging from 12 to 24 feet below ground surface (bgs) north, east, and south of the three tank locations in the subject area addressed by this RAP. The soil boring locations are shown on Figure 3. Free product was present in four soil borings (SB50, SB52, SB55, and SB57) in the vicinity of the closed 178,000-gallon UST. As a result of the additional investigation, soil contamination was horizontally delineated. The extent of soil contamination is shown on Figure 4.

As a result of the investigation groundwater contamination was also horizontally delineated. The horizontal extent of groundwater contamination is presented on Figure 6.

In November 2001, CAPE returned to the site to confirm the presence or absence of additional USTs in the vicinity of Buildings 3 and 3A. A ground penetrating radar (GPR) survey was performed on the west, north, east, and southeast sides of the buildings and no other USTs were identified.

Based on the findings of the site characterization, CAPE is submitting this RAP for the closed unregulated USTs located near Building 3A.

1.5 Scope of the Remedial Action

This RAP addresses contamination in soil and groundwater associated with three closed unregulated USTs near Building 3A. The scope of the RAP is to utilize site-specific information from relevant site investigations to formulate site remedial action objectives and to evaluate various response actions appropriate for achieving the objectives. Based on this evaluation, the

RAP provides a recommended remedial action alternative and outlines a conceptual design and implementation plan for the selected alternative.

1.6 Environmental Setting

1.6.1 Regional Geology

The Federal Center is located in Jackson County, Kansas City, Missouri. Jackson County is located near the middle of an approximately 150-mile wide, north-south trending band of Pennsylvanian Age rocks which stretched from western Missouri to eastern Kansas. The beds exhibit a subtle prevailing dip to the west-northwest. The region is underlain by rock units of the Pennsylvanian System and the Missourian Series (Kansas City Group and Pleasanton Group) in the Time Stratigraphic Unit age classification. Alternating layers of shales and limestone with an associated sandstone layer are common in the Kansas City Group.

Jackson County is located in the Saline Groundwater Province. In the upland area above the alluvial valleys of the Missouri River, the Blue River, and the Little River, the unconsolidated sediment is typically deficient of groundwater. Jackson County is underlain by bedrock aquifers at depths of 250 to 400 feet that contain saline water, which coincides with the presence of Pennsylvanian rocks. Due to the fact that the Jackson County is located in the Saline Groundwater Province, the main supply of water for domestic usage is from the alluvium of the Missouri River or from the surface impoundments within the localized watershed. Figure 7 presents the potentiometric surface map for the site. Figure 8 presents the geologic cross section of the site.

1.6.2 Demography and Land Use

The site occupies an area of approximately one city block within a business district northeast of downtown Kansas City. Land use surrounding the site is a mix of light commercial and residential properties.

The Federal Center currently encompasses seven buildings with associated parking areas located on approximately 18 acres of land. Most of the buildings are unoccupied, empty, and/or used for storage. The Federal Aviation Administration currently occupies Building 6, but their lease expired at the end of November 2001.

1.6.3 Site Geology

Soil types on site vary from coarse-grained backfill soils to fine-grained native soils. Backfill materials are present from surface to 4 feet bgs, silty clay from 4 feet to 12 feet bgs, fine clay from 12 feet to 24 feet bgs, and inorganic clays from 24 feet to 40 feet bgs. At the ground surface, soils were silty gravel (unified soil classification group symbol "GM") that are black in color with no moisture to inorganic clays (unified soil classification group symbol "CH") that are light brown in color, highly moist, and highly plastic at 40 feet bgs.

1.6.4 Site Hydrogeology

Jackson County is underlain by bedrock aquifers at depths of 250 to 400 feet that contain saline water that coincides with the presence of Pennsylvanian rocks. Total thickness of the aquifer ranges from 1,200 to more than 4,000 feet. Due to the fact that Jackson County is located in the Saline Groundwater Province, the main supply of water for domestic usage is from the alluvium of the Missouri River. Some of the localities obtain groundwater from other lesser rivers that flow into the Missouri River or from surface impoundments within the local watershed.

Upon completing the groundwater sampling activities and surveying activities, aquifer testing was performed on December 7, 2000. Limited aquifer testing was performed in monitoring well MW-3 as part of the site characterization activities. Detailed information regarding the site characterization is presented in Section 2.0.

The calculated average hydraulic gradient at the site was 0.0075 feet per feet. Two slug tests were performed in monitoring well MW-3. The data collected from these two tests were used to estimate the hydraulic conductivity using the Hvorslev Method. The estimated hydraulic conductivity for the site is 2.4×10^{-3} feet per day. Using Darcy's Law, the calculated hydraulic gradient, and the hydraulic conductivity, the seepage velocity is estimated to be approximately 3×10^{-2} feet/year. The hydraulic conductivity data and calculations are presented in Appendix C.

2.0 BACKGROUND

2.1 Site Characterization Summary

Site characterization field activities were conducted in December 2000 and in May 2001. The site characterization field activities were performed to characterize the nature and extent of soil and groundwater contamination associated with the unregulated tanks near Building 3A. A summary of the findings is presented below. The site characterization activities are reported in the Site Characterization Report (SCR) and the SCR Addendum, both of which are being submitted to MO DNR concurrently with this RAP.

2.1.1 Soil Borings

A total of thirty soil borings were installed in the vicinity of the USTs to evaluate the nature and extent of contamination. Soil samples from SB28 to SB44 were collected to evaluate the extent of contamination in the UST locations (Figure 2). Soil borings SB50 through SB61 were advanced to determine the horizontal and vertical extent of soil contamination and free product. The depths of the soil borings ranged from 12 to 24 feet bgs. Soil samples were analyzed by Iowa Method OA1 and OA2 for petroleum hydrocarbons. During the investigation two soil borings, SB27 and SB29, were terminated due to drilling refusal at five feet bgs. Based on field screening results that indicated the absence of volatile organics, soil samples were not collected from soil borings SB53, SB54, SB59, and SB60. Field screening results are included in the SCR and SCR Addendum. Free product was encountered in SB50, SB51, SB52, SB55, and SB57, therefore no soil samples were collected from these borings. (S.E. Corner of Bldg. 3)

Soil borings were installed at the following locations:

- Six soil borings (SB27, SB28, SB29, SB30, SB31, and SB32) were installed along the north-northeast of Building 3A. SB27 and SB29 were terminated due to drilling refusal at 5 feet bgs
- Seven soil borings (SB33, SB34, SB36, SB37, SB38, SB53, SB56) were installed along the east side of Building 3A near the two former 23,000-gallon USTs
- Seven soil borings (SB35, SB40, SB41, SB42, SB54, SB55, and SB57) were installed along the southeast side of Building 3A near the two former 23,000-gallon USTs and the 178,000-gallon UST

- Two soil borings (SB43 and SB58) were installed northeast of Building 3A topographically downgradient from the two former 23,000-gallon USTs
- Seven soil borings (SB39, SB50, SB51, SB52, SB59, SB60, and SB61) were installed south of Building 3A and west of the former 178,000-gallon UST to attempt to horizontally delineate the subsurface contamination in that direction
- One soil boring (SB22) was installed east of Building 7 upgradient of the tank cluster
- Soil borings SB16, SB44, and SB49 were installed south, west, and southeast of the former USTs to attempt to horizontally delineate subsurface contamination topographically upgradient.

Soil boring locations are presented in Figure 3. A total of eighteen soil samples were submitted for analysis by Iowa OA1 and OA2 methods.

2.1.2 Monitoring Well Installation

A total of six groundwater monitoring wells (MW4 through MW8, and MW10) were installed in the vicinity of soil contamination associated with the USTs near Building 3A. Groundwater monitoring well locations are presented on Figure 5. Due to the proximity of these USTs, the tank areas were considered one tank cluster for the purpose of the groundwater delineation. Field screening data from the soil borings and site background information were used to identify monitoring well locations.

Monitoring wells were installed at the following locations near Building 3A:

- SB22 was converted into monitoring well MW4 and was installed upgradient of the tank cluster area
- SB28 was converted into monitoring well MW5 and was installed in the vicinity of the two former 23,000-gallon USTs on northeast side of Building 3A
- SB35 was converted into monitoring well MW6 was installed along the south-southeast side of the two former 23,000-gallon UST limits of excavation
- SB37 and SB39 were converted into monitoring wells MW7 and MW8 and were installed along the eastside of Building 3A within the former location of the two former 23,000-gallon USTs
- SB49 was converted to monitoring well MW9 and was installed at the southwestern border of the property. This well is upgradient from all suspected contamination sources on site and was used to establish background levels.
- Monitoring well MW10 was installed downgradient of the tank cluster area.

2.1.3 Ground Penetrating Radar Survey

The Hardesty site has been in the Federal Registry of Properties for many years. As a result, various versions of building plans were available for review during the course of the project. As a result of reviewing the plans, suspect tank locations were identified based on these plans northwest of Building 3 and west of Building 3A. In order to confirm or deny the presence of USTs at these locations a GPR survey was conducted on November 14, 2001 and November 20, 2001 along the perimeter of Buildings 3 and 3A. No USTs were identified. Results of the GPR Survey indicated no significant subsurface anomalies. These results suggest that no USTs remain in the suspected areas.

2.2 Site Characterization Findings

2.2.1 Soil Samples

A total of eighteen soil samples were analyzed for volatile organic compounds (VOCs) and total extractable hydrocarbons (TEH) using Iowa Method OA1 and OA2. Method OA1 includes laboratory analysis for mineral spirits, jet fuel, kerosene, diesel fuel, fuel oil, and motor oil. Method OA2 includes laboratory analysis for gasoline-range hydrocarbons (GRH); benzene, toluene, ethylbenzene, and xylene (BTEX); and methyl tert-butyl ether (MTBE). Laboratory analytical results for the soil samples are summarized in Table 1. Soil sample locations with corresponding laboratory analytical results are presented on Figure 4.

The acceptable soil concentrations (cleanup levels) for this RAP are the CALMs for soil (MO DNR, 1992). The CALM values are intended to protect human health and the environment. CALMs for site contaminants are discussed in Subsection 3.2. A summary of soil contamination with respect to CALMs is presented below.

Laboratory analytical results for soil samples collected in the vicinity of the Building 3A indicated concentrations of diesel fuel, GRH, and BTEX constituents at or above the laboratory reporting limits. No other constituents analyzed under OA1 and OA2 methods were reported.

An evaluation of the sample analytical results is provided below:

- No soil sample analytical results exceeded CALMs for GRH, toluene, ethylbenzene, or xylenes
- One soil sample at SB40 (20-24 feet bgs) had a detection of benzene (0.095 mg/kg) slightly above the CALM of 0.05 mg/kg
- Concentrations of diesel fuel were reported above the CALM for total petroleum hydrocarbons (TPH) of 200 mg/kg in nine soil samples. The concentrations ranged from 230 mg/kg at SB32 (12-16 feet bgs) to 5,100 mg/kg at SB28 (12-16 feet bgs). Soil contaminated above cleanup levels for TPH was encountered from 4 feet bgs (SB33) to 24 feet bgs (SB40).

2.2.2 Groundwater Samples

A total of nine groundwater samples were collected for OA1 and OA2 analysis. Duplicate samples for quality control were collected at MW7 and MW9. Analysis of MW9 (background) samples were non-detect (ND) for all analytes. Laboratory analytical results for the groundwater samples are summarized in Table 2. Corresponding groundwater sample analytical results are presented on Figure 6.

The acceptable groundwater concentrations (cleanup levels) for this RAP are the CALMs for groundwater (MO DNR, 1992). A summary of groundwater contamination with respect to the CALMs is presented below.

Laboratory analytical results of the groundwater samples collected from the monitoring wells at Building 3A indicated concentrations of GRH, benzene, and diesel fuel at or above the laboratory reporting limits.

An evaluation of the sample analytical results for detected analytes is provided below:

- No groundwater samples exceeded the CALMs for GRH and benzene
- Concentrations of diesel fuel were indicated in MW5, MW7, MW7 duplicate, and MW8 ranging from 9,000 micrograms per liter (µg/L) (MW5) to 39,000 µg/L (MW7). Concentrations of diesel fuel at MW7 and MW8 are above the CALM of 10,000 µg/L of TPH, which includes diesel fuel.

2.2.3 Estimated Local Groundwater Flow Direction

After completing the monitoring well installation activities, the relative elevation of the casing top of each well was determined. Groundwater elevation measurements were measured from the casing top. Using this groundwater elevation data, a potentiometric surface map was developed.

The estimated potentiometric surface at the time that water level measurements were collected is presented as Figure 7. Groundwater elevations were measured in nine monitoring wells using a water level indicator. At the time groundwater elevation measurements were collected, groundwater was encountered at elevations of 774.19 in MW1 to 770.99 in MW5. Groundwater is estimated to be flowing north-northeast. Due to the previous work performed at the site (i.e., extensive excavation in clay materials to a depth of up to 35 feet) the estimated groundwater flow direction is likely to be representative of the sandy unit below the clayey soils at approximately 20 feet bgs.

2.2.4 Extent of Contamination

Contamination associated with the three closed USTs has adversely impacted soils in an approximate area of 5,500 square feet of the 18-acre site. Soil contamination in this area extends from approximately four feet bgs to a maximum of twenty-four feet bgs where free product and groundwater were encountered. An estimated volume of approximately 3,600 cubic yards (5,470 tons) of impacted soil is present. The estimated extent of soil contamination is shown on Figure 9.

Groundwater contamination has been horizontally delineated in the central portion of the site. Groundwater contamination does not extend offsite. The approximate areal extent of groundwater contamination is 6,000 square feet. The estimated extent of groundwater contamination is shown on Figure 6.

2.3 Potential Receptors

Underground utilities run east to west on the eastside of Building 3A, providing a potential pathway for contaminants. However, during the site characterization, soil was sampled near the location of the underground utilities and no significant source of contamination was located in the potential pathway.

The closest environmental receptor is an unnamed creek approximately 1,000 feet north of the property. A second unnamed creek is located approximately 2,200 feet northeast of the site.

Considering the depth of soil contamination, it is unlikely that human receptors are currently exposed to subsurface soil contamination in the current time frame. The site has controlled access and digging in the area is not permitted without approval from GSA.

A private and public well survey of the area did not identify any drinking water wells within ½ mile of the site. According to the Kansas City Water Services Department, drinking water is supplied by the public water system to all residences in the vicinity of the site. Additionally, it is unlikely that human receptors would be exposed to contaminated groundwater considering that the plume is relatively immobile, has not migrated off site, and the installation of on-site shallow aquifer drinking water wells would not be permitted under current site controls. The contaminated groundwater is confined to a geologic unit that is not currently used for drinking water in the areas downgradient of the site.

A change in land ownership could result in potential exposures to human receptors through on site digging/excavating and the installation of drinking water wells in the contaminated aquifer.

3.0 CORRECTIVE MEASURE OBJECTIVES

3.1 Purpose

Corrective measure objectives for this site are developed to protect human health and the environment through media-specific actions. The corrective measure objectives specify the media-specific contaminants of concern (COC), exposure pathways and receptors, and an acceptable concentration (i.e., cleanup level) to address COCs. Corrective measure objectives presented in this RAP provide a general description of what the corrective measure will accomplish for a specific media.

Based on the information provided in the site characterization report, the media of concern at the site are groundwater and subsurface soils. The COCs for subsurface soil are benzene and diesel fuel. Potential exposure pathways for subsurface soil include direct exposure to humans through dermal contact and inhalation (dust and volatilized contaminants) as a result of digging and excavating activities. Soil contamination is also present at levels that could impact groundwater quality through soil-to-groundwater contaminant leaching. The COC for groundwater is diesel fuel. Potential exposure pathways for groundwater include direct exposure to humans through dermal contact, ingestion, and inhalation (volatilized contaminants) as a result of excavation, the installation of wells, or contact with contaminated well water. Due to the localized area, the relative immobility of groundwater contamination (seepage velocity approximately 0.03 feet/year), and the presence of soil contamination below the surface, there are currently no potential exposure pathways to environmental receptors. The acceptable concentrations (cleanup levels) are the CALMs for soil and groundwater (MO DNR, 1992). Although benzene and diesel fuel were the only contaminants detected above cleanup levels, confirmatory and monitoring samples will be analyzed for all contaminants analyzed for by the Iowa OA1 and OA2 methods.

3.2 Establishment of Remediation Levels

Based on the Overview of CALM flowchart (Appendix A), appropriate soil cleanup levels and groundwater cleanup levels are listed in the following subsections. The CALM values are intended to protect human health and the environment.

3.2.1 Soil Cleanup Levels

The CALMs for soil are the Soil Target Concentrations (STARC) for direct exposure (ingestion/dermal absorption/inhalation) and for leaching to groundwater. The direct exposure STARC is based on an unrestricted land use (Scenario A), as determined by the Land Use Scenario Flowchart (Appendix B). This scenario is selected due to the future potential for residential use of the property by subsequent landowners. The lowest of the direct ingestion or leaching to groundwater STARCs will be used as the cleanup goal. The STARCs for contaminants detected above laboratory reporting limits at the site are:

- benzene – 0.05 mg/kg (leaching to groundwater)
- toluene – 3.7 mg/kg (leaching to groundwater)
- ethylbenzene - 32 mg/kg (leaching to groundwater)
- xylenes - 16 mg/kg (leaching to groundwater)
- TPH (including GRH and diesel fuel) - 200 mg/kg (direct exposure).

Soil contamination in the form of benzene and diesel fuel exceeds the soil cleanup guidelines established by MO DNR. Diesel fuel contamination in soil ranges from just above the CALM of 200 mg/kg (230 mg/kg) to concentrations greater than 5,000 mg/kg. These concentrations in soil represent potential for human exposure in the event of construction or excavation at the site. Benzene was detected in only one location at the site and slightly exceeded the CALM. The CALM for benzene is based on the potential for benzene to leach from soil and contaminate groundwater above US EPA Maximum Contaminant Levels (MCL). The corrective measure objective for soil will address these potential exposure pathways.

3.2.2 Groundwater Cleanup Levels

The CALMs for groundwater are the Groundwater Target Concentrations (GTARC). The GTARCs for contaminants detected above laboratory reporting limits at the site are:

- benzene - 5 μg/L
- TPH (including GRH and diesel fuel) - 10,000 μg/L.

Groundwater contamination in the form of diesel fuel exceeds the groundwater cleanup level established by MO DNR of 10,000 μg/L. Diesel fuel contamination in groundwater ranges from

9,000 µg/L to 39,000 µg/L. Although groundwater contamination is isolated to a small portion of the site and does not extend offsite, the contamination does represent a potential for human exposure via exposure to contaminated groundwater during excavation or construction and exposure in the event that impacted groundwater is extracted. The corrective measure objective for groundwater will address these potential exposures.

3.3 Corrective Measure Objectives

Based on the purpose of the corrective measures and the cleanup levels that were identified for the site, the following corrective measure objectives are defined for the site:

3.3.1 Remediation of Soil

Corrective measure alternatives will be developed that focus on remediating soil contamination to levels below the CALMs for benzene and diesel fuel.

3.3.2 Remediation of Groundwater

Corrective measure alternatives will be developed that focus on remediating groundwater contamination to levels below the CALM for diesel fuel.

4.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

This section consists of the first part of the CMS that is the identification and screening of technologies applicable to each general response action. Response actions (RA) are actions used to achieve the corrective measure objectives. This section identifies remedial technologies that are potentially relevant for achieving the corrective measure objectives at the site. The remedial technologies are evaluated with respect to their general ability to protect human health and the environment, applicability to site conditions, and potential limitations. Remedial technology options that pass the initial screening phase will be retained for possible inclusion during the development of corrective measure alternatives in Section 5.0. In Section 6.0, the corrective measure alternatives will be evaluated with respect to effectiveness, implementability, and cost. Based on this evaluation, an alternative or combination of alternatives will be selected for implementation for each media of concern.

4.1 Response Actions

To achieve the corrective measure objectives presented in Section 3.0, general RAs for groundwater and soil have been developed. These RAs will be used in the assessment of technologies and in the development of corrective measure alternatives. Each RA and its subsequent remedial technologies are discussed in this section. The RAs for groundwater and soil are presented below.

Groundwater Response Actions and Associated Remedial Technologies

Response Action	Remedial Technologies
No Action	None
Institutional Controls	Deed Assurances, ETA
Groundwater Monitoring	Groundwater Monitoring
Hydraulic Containment	Extraction
Groundwater Treatment	Physical Biological

Soil Response Actions and Associated Remedial Technologies

Response Action	Remedial Technologies
No Action	None
Institutional Controls	Deed Assurance, ETA
Excavation	Excavation and Off-Site Disposal
In-situ Treatment	Physical Biological

4.2 Groundwater Response Actions and Associated Technologies

4.2.1 No Action

The no action option is based on the lack of implementation of any corrective measure alternatives at the site. This option does not take steps to reduce contamination and does not provide protection of human health and the environment.

Applicability

No active steps would be taken to implement or document contaminant reduction or protection of human health and the environment. However, this RA is considered in this RAP so that a comparison can be made between taking no action at the site and implementing various alternatives.

Limitations

No action does not reduce contamination and does not provide long-term protection of human health and the environment.

Feasibility

Because no steps or processes are required for no action it is feasible to implement.

No action will be retained for further consideration as a basis for comparison with other technologies/alternatives.

4.2.2 Institutional Controls

Institutional controls are those actions that will control groundwater use and site access through public agencies or records. Institutional controls do not have a direct bearing on site restoration (i.e., not an active form of remediation) but reduce the potential for human exposure. Institutional controls for the purpose of this RAP will implemented through requirements of ETA, CERCLA Section 120(h)(3) (transfer of federal property by deed before all necessary remedial action has been taken).

ETA allows for the deferral of the required CERCLA deed covenant that states that "all remedial action necessary to protect human health and the environment has been completed prior to property transfer." The federal landholding agency assembles a Covenant Deferral Request (CDR) package to formally request deferral of the CERCLA covenant until completion of cleanup. The governor of the state and, when the property is a National Priorities List (NPL) site, the Environmental Protection Agency (US EPA) Administrator, must determine that the property is suitable for early transfer. In this case, the site is not an NPL site and only the Governor of Missouri would be involved. Suitability for early transfer is evaluated on the following criteria:

- The intended reuse is consistent with the protection of human health and the environment
- The deed or other agreement proposed to govern the transfer contains assurances that provide:
    - any necessary use restrictions will ensure the protection of human health and the environment by restricting groundwater use at the site
    - any necessary use restrictions will ensure that required cleanup actions will not be disrupted
    - that all necessary response action will be taken and identify the schedule for investigation and completion of all necessary response action as approved by the appropriate regulatory agency

  - that the federal agency responsible for the property will submit a budget request to the Office of Management and Budget (OMB) that adequately addresses schedules for investigation and completion of all necessary response action subject to Congressional authorizations and appropriations.
- The deferral of the covenant will not substantially delay any necessary response action on the property
- The public was given notice and allowed at least 30 days to review and comment on the suitability of the property for early transfer.

4.2.2.1 Groundwater Use Restrictions

Placing groundwater restrictions on the property would involve the documentation of the restrictions with the Jackson County Records Department. The Jackson County Records Department would restrict the installation of shallow groundwater extraction wells in or near the existing groundwater contamination. This would be important for protection of human health for reasons such as preventing the installation of a drinking water well on the property.

Deed recordation other than the transfer agreement specified within ETA would also be used to establish groundwater use restrictions. The deed recordation or transfer agreement would, in perpetuity, notify any potential purchaser of the property that groundwater contamination exists or existed in a portion of the site. The deed recordation will reference this RAP and other environmental documents that contain the rationale for the restrictions.

In the event that the ownership of the property was transferred, the government's disposal agency would ensure that the transfer documents for real property reflect the groundwater use controls. The legal office of the government and its telephone number would be included as a point of contact in the purchase agreement and deed in case a problem arises with a use control, additional contamination is found, or the transferee wishes to revise or terminate a groundwater use control. All applicable and appropriate state land use control management systems in effect at the time of transfer would also be implemented. Additional land use control mechanisms related to property transfer (notices, media use restrictions, self-certification) would be evaluated and implemented as necessary and appropriate.

4.2.2.2 Evaluation of Institutional Controls

Institutional controls applied through ETA accelerates the return of idled or underused property to productive use. Re-utilization of existing infrastructure also prevents development of outlying Greenfields. In addition to creating jobs and increasing tax revenues, there are several benefits to state regulatory agencies and local communities. This is especially true when the buyer completes the cleanup. For example, state oversight of the cleanup is simpler and less costly when a non-federal owner is conducting the cleanup. Sovereign immunity and state authority issues may be eliminated. Also, state enforcement and the application of institutional controls are generally less problematic with a single private entity. Combining the above factors with the purchaser's added incentive for results accelerates the environmental cleanup process. Environmental insurance can help assure lenders, regulators, owners, and local communities that adequate funds will be available.

Institutional controls provide an effective means of protecting human health. This approach takes no active steps to reduce contamination at the site but, when properly implemented, provides an effective means of protecting human health.

Applicability

Institutional controls can be applied to the site in order to provide long term protection of human health.

Limitations

Institutional controls do not provide documentation of long-term contaminant reduction.

Feasibility

Institutional controls are easily implemented at the site. Institutional controls can be applied to the site by registering the restrictions with the Jackson County Records Department. ETA has been proven feasible and successful at many other sites. As ETA benefits both the landowner and the local community, the process is easily initiated and completed.

Because institutional controls provide long term protection for human health through deed recordation and groundwater use restrictions, institutional controls will be retained for further consideration.

4.2.3 Groundwater Monitoring

A groundwater monitoring program would document both the effectiveness of any chosen remediation process in reducing contaminant concentrations and the level of exposure to potential receptors from those contaminants.

Applicability

Groundwater monitoring is applicable to most remediation sites where contamination exists. Long term monitoring would document contaminant reduction and demonstrate that receptors will not be exposed to increasing groundwater contamination. Groundwater monitoring is considered applicable to groundwater contamination at the site.

Limitations

There are no limitations for groundwater monitoring at the site.

Feasibility

Groundwater monitoring is considered feasible to implement and involves only periodic groundwater sampling and project oversight with respect to reporting of groundwater trends, maintaining institutional controls until remedial standards area achieved, and public education. Groundwater monitoring would be relatively easy to implement given that groundwater monitoring wells exist downgradient of the source area. Additional monitoring wells may be required to adequately monitor the contaminant concentrations and potential exposure concentrations.

Groundwater monitoring will be retained for further consideration.

4.2.4 Hydraulic Containment

Containment measures are often performed to prevent, or significantly reduce, the migration and concentration of contaminants in groundwater. In general, containment is performed when the migration of contaminants represents a threat to human health and the environment, and the entire contaminant plume will need to be contained. Containment can be accomplished by utilizing extraction wells to create a hydraulic barrier, or by the installation of interception trenches or slurry walls to stop migration of contaminants. Extraction is generally performed by installing extraction wells within a plume to remove contaminated groundwater. After groundwater is extracted from the subsurface, treatment is usually required.

4.2.4.1 Groundwater Extraction

Groundwater extraction involves the installation of a pump within a well to remove contaminated groundwater. The extracted groundwater would then require treatment prior to discharge and/or disposal. Groundwater extraction is a principle component of pump-and-treat processes, which are commonly used at contaminated sites.

The purpose of groundwater extraction is to remove contaminants from the groundwater, thereby reducing contaminant concentrations and preventing migration of contaminants beyond the well. Well design is dependent on the physical site characteristics of the groundwater and type(s) of contaminants.

The effectiveness of a groundwater extraction system is determined by performing groundwater monitoring. Groundwater monitoring helps to assess the overall reduction of contaminant levels and ultimately assist in determining the duration of groundwater extraction activities. Piezometers may be installed to allow the operator to make iterative adjustments to the pumping rates in response to changes in subsurface conditions or the treatment processes.

<u>Applicability</u>

Groundwater extraction is considered an applicable technology for corrective measures at the site.

<u>Limitations</u>

The following factors may limit the applicability and effectiveness of groundwater extraction as part of the remedial process:

- Site geologic conditions present a significant limitation to effectively implementing groundwater extraction. Previous remediation activities performed on site involved source removal by excavation (up to 30 feet below ground surface). Soils were primary moist to dry silty clays. In the event that groundwater at depth were in contact with residual source materials in these clays, groundwater extraction would be limited due to low hydraulic conductivity
- System designs may fail to contain the contaminant as predicted, allowing the plume to migrate, or pumping equipment failure occurs rendering the technological approach unsatisfactory
- Residual saturation of the contaminant in the soil pores cannot be removed by groundwater extraction. Contaminants tend to be sorbed in the soil matrix
- Biofouling of the extraction wells and associated treatment train is a common problem that can severely affect system performance.

Feasibility

Groundwater extraction is a component of many pump and treat processes, and is one of the most commonly used groundwater remediation technologies at contaminated sites. Whereas groundwater extraction does not remediate the contaminants in the groundwater, it does provide the means for pumping the groundwater to the surface for treatment. However, groundwater extraction is not considered feasible due to subsurface geologic conditions (low hydraulic conductivity due to clay layers) at the site.

Groundwater extraction will not be retained for further consideration.

4.2.5 Groundwater Treatment

Groundwater treatment can be performed following extraction (ex-situ) or by directly remediating the groundwater in place (in-situ). Groundwater that is extracted usually requires treatment prior to disposal. Ex-situ treatment generally requires shorter time periods but requires pumping of groundwater, leading to increased costs. In-situ treatment allows groundwater to be treated without being brought to the surface, resulting in significant cost savings. In-situ treatment requires longer time periods and there is less certainty about the uniformity of treatment because of variability in subsurface geology.

4.2.5.1 Physical Groundwater Treatment

The physical groundwater treatment technologies evaluated in this section include:

- Air Sparging
- Hot Water or Steam Flush/Strip
- Liquid Phase Carbon Adsorption

4.2.5.1.1 Air Sparging

Air sparging is an in-situ technology in which air is injected through a contaminated aquifer. Injected air traverses horizontally and vertically in channels through the soil column within the groundwater, creating an underground stripping mechanism that removes VOCs in the groundwater by volatilization. This injected air helps to flush (bubble) the contaminants up into the unsaturated zone where a soil vapor extraction (SVE) system is usually implemented in conjunction with air sparging to remove the vapor phase contamination. This technology is designed to operate at high flow rates to maintain increased contact between groundwater and soil, and to strip more groundwater by sparging. Oxygen added to contaminated groundwater and vadose zone soils can also enhance biodegradation of contaminants below and above the water table. Air sparging has a medium to long duration, and is more effective in areas with high concentrations of VOCs.

Applicability

The target contaminant groups for air sparging are VOCs. Target contaminants at the site for groundwater are diesel fuels which are semi-volatile organic compounds (SVOC). Air sparging is not considered applicable to site.

Limitations

Factors that may limit the applicability and effectiveness of the process include:

- Diesel fuels are not considered a target contaminant for air sparging
- Airflow through the saturated zone may not be uniform, which implies that there can be uncontrolled movement of potentially dangerous vapors
- Depth of contaminants and specific site geology may interfere with the effectiveness of the technology

- Soil heterogeneity may cause some zones to be relatively unaffected
- If air sparging is performed in areas where no contaminated soils are evident, then the stripping of the groundwater could result in contaminating the soil unless intensive SVE is performed.

Feasibility

Air sparging is not considered feasible at the site primarily because of its ineffectiveness with heavier petroleum contaminants such as diesel fuel. Additionally, air sparge may require additional treatment technologies and would be adversity impacted by low permeability soils.

Air sparging will not be retained for further consideration.

4.2.5.1.2 Hot Water or Steam Flush/Strip

Hot water or steam flush/strip remediation techniques involve the forcing of hot water or steam into an aquifer through injection wells to vaporize volatile and semi-volatile contaminants. Vaporized components rise to the unsaturated zone where they are removed by SVE and then treated. Hot water or steam flushing/stripping is a pilot-scale technology. Biological treatment follows the displacement of vaporized volatiles and semi-volatiles. Treatment continues until groundwater contaminant concentrations satisfy regulatory requirements. The process has been successful in removing large portions of oily waste accumulations and retarding downward and lateral migration of organic contaminants. The process is applicable to shallow and deep contaminated areas, and readily available mobile equipment can be used.

Applicability

The target contaminant groups for hot water or steam flushing/stripping are SVOCs and fuels. This technology is applicable to diesel fuels that are present at this site.

Limitations

Factors that may limit the applicability and effectiveness of the process are similar to those for air sparging. Site specific soil heterogeneity and depth of contaminants may interfere with uniform delivery of the hot water/steam to the subsurface, which could significantly impact process effectiveness.

Feasibility

This technology is not considered feasible at this site due to site geology. Contaminants are present in clay soils that are not conducive to vertical flow of steam or water.

Hot water or steam flush/strip technologies will not be retained for further consideration.

4.2.5.1.3 Liquid Phase Carbon Adsorption

Liquid phase carbon adsorption (LPCA) is a full-scale ex-situ technology in which groundwater is extracted and pumped through one or more vessels containing activated carbon to which dissolved organic contaminants adsorb. When the concentration of contaminants in the effluent from the bed exceeds a certain level, the carbon can be regenerated in place, removed and regenerated at an off-site facility, or removed and disposed.

Pretreatment for removal of suspended solids from influent streams is an important design consideration. Suspended solids in a liquid stream may accumulate in the column, causing an increase in pressure drop. When the pressure drop becomes too high, the accumulated solids must be removed. The solids removal process necessitates adsorber downtime and may result in carbon loss and disruption of the mass transfer zone.

Applicability

The target contaminant groups for carbon adsorption are hydrocarbons and SVOCs. LPCA is effective for removing contaminants at low concentrations from water at nearly any flow rate and for removing higher concentrations of contaminants from water at low flow rates [typically 2 to 4 liters per minute or 0.5 to 1 gallons per minute (gpm)]. Although LPCA is effective as a primary treatment process, it is particularly effective as a secondary treatment (polishing) process in conjunction with other remedial technologies to attain regulatory compliance. Because LPCA requires groundwater extraction, and groundwater extraction is not feasible at the site, LPCA is not applicable to the site.

Limitations

The following factors may limit the applicability and effectiveness of the process:

- LPCA requires groundwater extraction which is not considered applicable to this site
- Streams with high suspended solids [> 50 milligrams per liter (mg/L)] and oil and grease (> 10 mg/L) may cause fouling of the carbon and may require frequent treatment. In such cases, pretreatment is generally required
- Costs are high if used as the primary treatment on waste streams with high contaminant concentration levels
- Type, pore size, and quality of the carbon, as well as the operating temperature, will impact process performance
- Water-soluble compounds and small molecules are not adsorbed well
- All spent carbon eventually needs to be properly disposed
- Low production of system wells.

Feasibility

Although this process is effective as a primary treatment process, it would be more effective for use as a secondary treatment process to polish treated effluent prior to discharge.

LPCA will not be retained for further consideration due to limitations in its ability to remediate groundwater contamination as a stand-alone technology.

4.2.5.2 Biological Groundwater Treatment

4.2.5.2.1 Enhanced In-situ Bioremediation

In-situ bioremediation relies on indigenous microorganisms to break down dissolved phase contaminants in the groundwater. Enhanced in-situ bioremediation involves using injection wells or trenches to introduce oxygen and/or nutrients into the subsurface environment to promote the growth of naturally occurring microorganisms and accelerate the breakdown of contaminants.

Applicability

In-situ bioremediation is applicable for the remediation of groundwater contaminated with fuels including diesel. In-situ bioremediation is a proven technology where properly implemented. Because the groundwater contamination plume at the site is small, groundwater extraction or circulation would not be required to effectively implement in-situ bioremediation. As a result enhanced in-situ bioremediation is considered applicable to the site.

Limitations

Factors that may limit the applicability of enhanced in-situ bioremediation are presented below:

- Where the subsurface is heterogeneous, it is difficult to enhance bioremediation by delivering oxygen and the nutrient solution throughout every portion of the contaminated zone. Higher permeability zones will be cleaned up much faster because groundwater flow rates are greater
- Biological treatment is usually implemented above a low permeability layer and with groundwater monitoring wells downgradient.

Feasibility

Enhanced in-situ bioremediation is considered applicable to the site and the type of contamination present. Due to the small plume size, few injection points would be required. The MO DNR allows the injection of compounds into the subsurface for remediation of groundwater through an injection control program. Further information about the injection control permit process is included in Subsection 7.2. Enhanced in-situ bioremediation is considered feasible for this site. Additionally, existing groundwater monitoring wells can be used to monitor contaminant degradation.

Enhanced in-situ bioremediation will be retained for further evaluation.

4.3 Soil Response Actions and Associated Remedial Technologies

4.3.1 No Action

The no action option is based on the lack of implementation of any corrective measures alternatives at the site. This option does not take steps to reduce contamination and does not provide protection of human health and the environment.

Applicability

No active steps would be taken to implement or document contaminant reduction or protection to human health and the environment. However, this technology would be applicable to this RAP so that a comparison can be made between taking no action at the site and implementing various alternatives.

Limitations

No action does not document the reduction of contamination and does not provide long-term protection of human health and the environment.

Feasibility

Because no steps or processes are required for no action it is feasible to implement at this site.

No action will be retained for further consideration a basis for comparison with other technologies/alternatives.

4.3.2 Institutional Controls

Institutional controls are those actions that will control land use and site access through public agencies or records. Institutional controls do not have a direct bearing on site restoration (i.e., not an active form of remediation) but reduce the potential for human exposure. Institutional controls for the purpose of this RAP will implemented through requirements of ETA, CERCLA Section 120(h)(3) (transfer of federal property by deed before all necessary remedial action has been taken).

ETA allows for the deferral of the required CERCLA deed covenant that states that "all remedial action necessary to protect human health and the environment has been completed prior to property transfer." The federal landholding agency assembles a CDR package to formally request deferral of the CERCLA covenant until completion of cleanup. The governor of the state and, when the property is a NPL site, the US EPA Administrator, must determine that the property is suitable for early transfer. In this case, the site is not an NPL site and only the Governor of Missouri would be involved. Suitability for early transfer is evaluated on the following criteria:

- The intended reuse is consistent with the protection of human health and the environment
- The deed or other agreement proposed to govern the transfer contains assurances that provide:
    - any necessary use restrictions will ensure the protection of human health and the environment by restricting groundwater use at the site

  - any necessary use restrictions will ensure that required cleanup actions will not be disrupted
  - that all necessary response action will be taken and identify the schedule for investigation and completion of all necessary response action as approved by the appropriate regulatory agency
  - that the federal agency responsible for the property will submit a budget request to the Office of Management and Budget (OMB) that adequately addresses schedules for investigation and completion of all necessary response action subject to Congressional authorizations and appropriations.
- The deferral of the covenant will not substantially delay any necessary response action on the property
- The public was given notice and allowed at least 30 days to review and comment on the suitability of the property for early transfer.

4.3.2.1 Land Use Restrictions

Placing land use restrictions on the property would involve the documentation of the restrictions with the Jackson County Records Department. The Jackson County Records Department would restrict digging or excavation below specified depths in or near the existing soil contamination. This would be important for protection of human health for reasons such as preventing the direct exposure to contaminated soil on the property through digging or excavation activities.

Deed recordation other than the transfer agreement specified within ETA would also be used to establish land use restrictions. The deed recordation or transfer agreement would, in perpetuity, notify any potential purchaser of the property that soil contamination exists or existed in a portion of the site. The deed recordation will reference this RAP and other environmental documents that contain the rationale for the restrictions.

In the event that the ownership of the property was transferred, the government's disposal agency would ensure that the transfer documents for real property reflect the land use controls. The legal office of the government and its telephone number would be included as a point of contact in the purchase agreement and deed in case a problem arises with a use control, additional contamination is found, or the transferee wishes to revise or terminate a land use control. All applicable and appropriate state land use control management systems in effect at

the time of transfer would also be implemented. Additional land use control mechanisms related to property transfer (notices, media use restrictions, self-certification) would be evaluated and implemented as necessary and appropriate.

4.3.2.2 Evaluation of Institutional Controls

Institutional controls provide an effective means of protecting human health. This approach takes no active steps to reduce contamination at the site but, when properly implemented, provides an effective means of protecting human health.

Applicability

Institutional controls can be applied to the site in order to provide long term protection of human health.

Limitations

Institutional controls do not provide documentation of long-term contaminant reduction.

Feasibility

Institutional controls are easily implemented at the site. Institutional controls can be applied to the site by registering the restrictions with the Jackson County Records Department. ETA has been proven feasible and successful at many other sites. As ETA benefits both the landowner and the local community, the process is easily initiated and completed.

Because institutional controls provide long term protection for human health through deed recordation and land use restrictions, institutional controls will be retained for further consideration.

4.3.3 Excavation

This technology includes excavation and removal of contaminated soils. Soils would be excavated, stockpiled, sampled, loaded into trucks and transported off-site for treatment and/or disposal. Some pretreatment of the contaminated media may be required.

Applicability

Excavation and off-site disposal is applicable to the complete range of contaminant groups with no particular target group. Excavation is considered applicable to the type of soil contamination present at this site.

Limitations

Limitations associated with excavation and off-site disposal are presented below.

- Generation of fugitive emissions may be a problem during excavation
- The distance from the contaminated site to the disposal facility influences cost
- Depth of the contaminated media and the localization of the contamination must be considered.

Feasibility

The excavation and disposal of contaminated soils near Building 3A is feasible due to the clay soils and the presence of heavy heating oils. At the site, soil contamination is located at depths of 4 to 24 feet bgs and the surface area to be excavated is not extensive. Additionally, the site geology is conducive to this type of remediation. Large scale excavations in unsaturated soils up to 35 feet bgs have been performed on the site near Building 3A.

Excavation and off-site disposal will be retained for further consideration.

4.3.4 In-situ Treatment

In-situ treatment allows soil to be treated without being excavated and transported, resulting in significant cost savings. In-situ treatment technologies generally require that long time periods and variability in soil characteristics can make uniform degradation of contaminants difficult. Physical and biological in-situ treatment technologies are discussed in the following sections.

4.3.4.1 Physical

In-situ physical treatment of soil uses the physical properties of the contaminants or the contaminated medium to destroy, separate, or contain the contamination. Physical treatment is typically cost effective and can be completed in short time periods (in comparison with biological treatment). Equipment is readily available and is not engineering or energy-intensive.

Treatment residuals from separation techniques will require treatment or disposal, which will add to the total project costs and may require permits.

4.3.4.1.1 Thermally-Enhanced Soil Vapor Extraction

Thermally-enhanced SVE is a technology that uses electrical resistance heating, electromagnetic/radio frequency heating, or hot air/steam injection to increase the volatilization rate of VOCs to facilitate extraction. The heating apparatus would be placed in various locations along with extraction and injection points. The extraction and injection points are similar to groundwater extraction wells, except that they are typically screened above the groundwater surface. The extracted vapor may be treated and discharged to the atmosphere or re-injected into the soil to provide oxygen for further biodegradation of contaminants. If injection points were used, an underground injection control permit would be required.

Thermally-enhanced SVE is normally a short-to-medium term technology. The process is similar to standard SVE, but requires heat resistant extraction wells and one or more of the following enhancements:

- *Electrical Resistance Heating* uses an electrical current to heat less permeable soils such as clays and fine-grained sediments so that water and contaminants trapped in these relatively conductive regions are vaporized and ready for vacuum extraction. Electrodes are placed directly into the less permeable soil matrix and activated so that electrical current passes through the soil, creating a resistance, which then heats the soil. The heat dries out the soil causing fractures
- *Radio Frequency Heating (RFH)* is an in-situ process that uses electromagnetic energy to heat soils and enhances soil vapor extraction. The RFH technique heats a discrete volume of soil using rows of vertical electrodes embedded in soil. The technique can heat soils to over 300 degrees Celsius (°C)
- *Hot Air or Steam Injection* is implemented below the contaminated zone to heat up contaminated soil. The heating enhances the release of contaminants from the soil matrix.

Applicability

Thermally-enhanced SVE is effective in remediating heavy fuel oils but not as effective in remediating VOC contamination. High moisture content, clays, and fine-grained sediments are limitations of standard SVE that thermal enhancement may help overcome. Heating, especially radio frequency heating and electrical resistance heating, can improve airflow in high moisture

content but is limited in clays and fine-grained sediments. After application of this process, subsurface conditions are excellent for biodegradation of residual contaminants.

As with SVE, remediation using thermally-enhanced SVE systems are highly dependent upon specific soil and chemical properties of the contaminated media. A typical site consisting of 20,000 tons of contaminated media would require approximately 12 months to remediate using this technology.

Limitations

Limitations associated with thermally-enhanced SVE are presented below.

- Soil contamination at the site is present in clay soils. Although thermally-enhanced SVE may help overcome limitations presented by clay soils and effects on SVE, the degree to which thermal application would improve performance is not known.
- Off-gas treatment may be required
- Residual liquids may require treatment
- Thermally-enhanced SVE is not effective in the saturated zone
- Site specific soil heterogeneity may interfere with the uniform delivery of heat to the subsurface that could significantly impact process effectiveness.

Feasibility

The thermally-enhanced SVE process has been successful in removing large portions of oily waste accumulations and retarding downward and lateral migration of organic contaminants. The process is applicable to shallow and deep contaminated areas, and readily available mobile equipment can be used. However, the performance of this technology would be limited due to clays present at this site and, for the purpose of this RAP, is considered not feasible.

Thermally-enhanced SVE will not be retained for further consideration.

4.3.4.2 Biological

In-situ bioremediation techniques are destruction techniques directed toward stimulating the microorganisms to grow and use the contaminants as a food and energy source by creating a

favorable environment for the microorganisms. Biological processes are typically implemented at low cost. Contaminants can be destroyed and often little to no residual treatment is required.

4.3.4.2.1 Bioventing

Bioventing is an in-situ process of moving air through contaminated soils to increase soil oxygen concentrations and stimulate the biodegradation of contaminants (US EPA, 1993a). Bioventing is similar in implementation and equipment to air sparge/SVE. The difference is in the flow rates of air. In soil venting, the vacuum is set at a low enough pressure so that air is circulated within the soil column to keep the system aerobic, the flow rate is kept as low as possible to conserve moisture. With SVE, as much air as is physically possible is withdrawn from the soil column.

Applicability

Bioventing is effective in remediating soils contaminated with VOCs and fuels. Bioventing is applicable to soils with high permeability. The on-site soils are clay which have a low permeability. The circulation of air would not be very efficient and hard to control.

Limitations

MO DNR considers bioventing a "Passive Corrective Action." According to MO DNR the site must meet all of the following for conditions for "Passive Corrective Action". The four conditions are:

- There is no potential for contaminant migration
- There is no physical access to contaminated areas for cleanup equipment or personnel
- There is no significant risk of harm to public health, safety, and the environment as indicated by technically based risk and exposure assessment
- There is convincing evidence that there are no active remediation technologies that will work at the site.

These limitations can not be met at this site. Additionally, bioventing would require an underground injection control permit.

Feasibility

Due to the presence of soil contamination in clay soils at the site, the distribution of air would be limited. Additionally, due to restrictions with respect to MO DNR guidance, bioventing is not considered feasible.

Bioventing will not be retained for further consideration.

5.0 DEVELOPMENT OF CORRECTIVE MEASURE ALTERNATIVES

5.1 Evaluation of Retained Technologies

Section 4.0 presented remediation technologies for specific groundwater and soil response actions. Based on the site contaminants, site conditions, and inferred limitations associated with various technologies presented in Section 4.0, several of the remedial technologies were eliminated as viable alternatives.

The technologies retained for further evaluation for groundwater and soil response actions are provided in the following tables:

Retained Groundwater Technologies

Response Action	Retained Action
No Action	None (retained for comparative purposes)
Institutional Controls	Deed Assurances, ETA
Groundwater Treatment	Enhanced In-situ Bioremediation
Groundwater Monitoring	Groundwater Monitoring

Retained Soil Technologies

Response Action	Retained Action
No Action	None (retained for comparative purposes)
Institutional Controls	Deed Assurances, ETA
Excavation	Excavation and Off-Site Disposal

5.2 Formulation of Corrective Measures Alternatives

Corrective Measure Alternatives (CMAs) are formulated to address the environmental issues and contaminant pathways associated with the site. The alternatives were developed based on the following considerations:

- The CMAs were developed to address the corrective measure objectives established for the site in Section 3.0
- The CMAs were formulated using the technologies retained from the screening process discussed in Section 4.0
- Response actions and technologies that are complementary and/or interrelated were combined to form CMAs
- A no action alternative is retained for comparative purposes
- The CMAs are formulated to facilitate the transfer of property through ETA.

5.3 Corrective Measure Alternatives

The technologies retained from Section 4.0 have been combined into CMAs based on the considerations presented in Subsection 5.2. The CMAs are presented for groundwater and soil at the site.

5.3.1 Groundwater CMAs

The following Groundwater CMAs have been developed:

- Alternative No. 1 – No Action
- Alternative No. 2 – Enhanced In-situ Bioremediation, Groundwater Monitoring, and Institutional Controls

5.3.2 Soil CMAs

The following Soil CMAs have been developed:

- Alternative No. 3 – No Action
- Alternative No. 4 – Excavation, Off-Site Disposal, and Institutional Controls

5.3.3 CMA Evaluation

Section 6.0 will evaluate each alternative with respect to effectiveness, implementability, and cost.

6.0 DETAILED EVALUATION OF CORRECTIVE MEASURES

This section presents a detailed analysis of CMAs related to groundwater and soils at the Building 3A site. Each CMA will be evaluated with respect to its effectiveness, implementability, and cost. Effectiveness evaluates the ability of the alternative to meet the corrective measure objectives and evaluate if the alternative has a proven history and reliability. Implementability evaluates the ability of the alternative to meet technical aspects of construction and operation and maintenance (O&M) for the project. Cost provides capital and O&M cost estimates for each alternative.

The CMAs for groundwater are presented below:

- Alternative No. 1 – No Action
- Alternative No. 2 – Enhanced In-situ Bioremediation, Groundwater Monitoring, and Institutional Controls.

The CMAs for soil are:

- Alternative No. 3 – No Action
- Alternative No. 4 – Excavation, Off-Site Disposal, and Institutional Controls.

6.1 Evaluation Criteria

The evaluation criteria presented in this section are effectiveness, implementability, and cost. Each CMA will be evaluated according to these criteria. The CMA that is evaluated as the most beneficial alternative with respect to effectiveness, implementability, and cost will be selected as the recommended corrective measure for the site. Each evaluation criterion is described below.

6.1.1 Effectiveness

This criterion evaluates the extent to which a remedial action meets the corrective measure objectives described in Section 3.0 with an emphasis on reducing the overall risk to human health and the environment. It also considers the degree to which the action provides sufficient long-term controls and reliability to prevent exposures that exceed levels protective of human and environmental receptors. Factors considered include performance and reliability characteristics, the ability to reduce contaminant concentration, and a proven track record.

6.1.2 Implementability

This criterion evaluates the technical and administrative factors affecting implementation of a remedial action and considers the availability of services and materials required during implementation. Technical factors assessed include ease and reliability of initiating construction and O&M, prospects for implementing any additional future actions, and adequacy of monitoring systems to detect failures. Uncertainties associated with construction, operation, and performance monitoring are also considered.

Service and material considerations include equipment and operator availability and applicability or development requirements for prospective technologies. The availability of services and materials is addressed by considering the material components of the proposed technologies and the locations and quantities of those materials. Administrative factors include ease of obtaining permits, enforcing deed restrictions, or maintaining long-term control of the site.

6.1.3 Cost

Relative costs are included for each remedial action technology to facilitate evaluation and comparison among alternatives. Costs presented in this section included a breakdown of estimated implementation (capital) costs as well as a comparison of O&M costs for the applicable technologies.

6.2 Evaluation of Alternatives for Groundwater

6.2.1 Alternative No.1 – No Action

6.2.1.1 Description of Alternative No. 1

The No Action alternative provides a basis for comparing existing site conditions with those resulting from implementation of the other proposed alternatives.

Under Alternative No. 1, reduction in contaminant concentrations will be achieved via unmonitored natural attenuation. Existing groundwater migration pathways remain as-is since no additional remedial activities are implemented at the site. Concentrations of contaminants above cleanup levels will remain in the groundwater near Building 3A for decades.

6.2.1.2 Evaluation of Alternative No. 1 - No Action

Effectiveness

Alternative No. 1 results in no additional risk reduction at the site. The no action alternative would provide risk reduction through ongoing natural attenuation processes in soil and groundwater. However, the risk reduction would not be monitored or documented. This alternative does not meet the remedial action objective and is not protective of human health or the environment.

Implementability

This alternative is technically and administratively implementable, as no engineering or administrative procedures are required.

Cost

No costs are associated with the Alternative No. 1 since no actions are being implemented at the site.

6.2.2 Alternative No. 2 - Enhanced In-situ Bioremediation, Groundwater Monitoring, and Institutional Controls

6.2.2.1 Description of Alternative No. 2

In-situ bioremediation relies on indigenous microorganisms to break down dissolved phase contaminants in the groundwater. Enhanced in-situ bioremediation would involve actively introducing oxygen and/or nutrients into the subsurface environment to promote the growth of naturally occurring microorganisms and accelerate the breakdown of contaminants.

A groundwater monitoring program would be implemented that would document both the effectiveness of the remediation process in reducing contaminant concentrations and confirm that the contamination is not moving downgradient.

Institutional controls are those actions that will control groundwater use and site access through public agencies or records. In order to expedite the remediation of the site, institutional controls will be designed to facilitate the transfer of property through ETA. Institutional controls are

those actions that will control groundwater use and site access through public agencies or records. Institutional controls do not have a direct bearing on site restoration (i.e., not an active form of remediation) but reduce the potential for human exposure. Institutional controls for the purpose of this RAP will implemented through requirements of ETA, CERCLA Section 120(h)(3) (transfer of federal property by deed before all necessary remedial action has been taken). All remedial actions necessary to protect human health and the environment presented in this RAP will be implemented through the ETA and/or transfer agreements.

A major facet involved in implementing institutional controls to achieve ETA is the designation of property use. The deed restrictions will disallow the use of the property for activities that would allow contact with groundwater. The property will be transferred solely for permitted uses.

Effectiveness

Enhanced in-situ bioremediation is effective in the treatment of constituents of both VOCs and heavy fuels. Therefore, this technology would be effective in reducing and/or capturing the contaminants for treatment, and would meet the remedial action objective for this area. Groundwater monitoring would be effective in documenting the reduction of groundwater contamination. Institutional controls are not an effective means of reducing or controlling existing contamination. However, institutional controls would be effective in protecting human health by limiting access to groundwater and facilitating groundwater remediation through the ETA process.

Institutional controls implemented through ETA such as groundwater use restrictions and deed recordation will be effective in protecting human health and the environment. Additionally, ETA provides a method for effective and timely remediation. ETA presents the following advantages with respect to timely remediation of the site:

- Allows transfer of contaminated property to the purchaser before all necessary cleanup actions have taken place. If ETA could not be obtained for this site, the corrective measure objective for groundwater would not be met for many years
- Accelerates cleanup via privatization. The purchaser would have the incentive to initiate remediation of the site as soon as possible and to use contractors who would perform the

remediation in a timely and efficient manner. Additionally, cleanup can be integrated with redevelopment resulting in improved cost effectiveness

- Generates tax revenues and employment opportunities early from quicker development and reuse
- Ensures that required investigations, response actions, and oversight activities are not disrupted.

Implementability

Enhanced in-situ bioremediation is implementable. The system components are readily available and the design, construction, and start-up phases are well established and easily implemented. Groundwater monitoring is easily implemented by utilizing the existing monitoring wells on site. Additional monitoring wells can be installed for monitoring purposes. Institutional controls are easily implemented through the ETA process, which has been completed successfully at a number of federal properties throughout the United States.

Cost

Alternative No. 2 implementation costs are moderate as compared to typical site cleanups. Capital costs for this alternative, including installation of the bioremediation and groundwater monitoring system would be approximately $301,700. The O&M costs would be approximately $31,600 yearly and $136,950 over five years. Treatment costs are dependent on the length of time needed for contaminant reduction to cleanup levels and the number of applications of oxygen/nutrients needed to achieve the cleanup levels. The approximate costs for implementation of Alternative No. 2 are presented in Table 3. The detailed cost breakdown for this alternative is presented in Appendix D.

6.3 Evaluation of Alternatives for Soil

6.3.1 Alternative No. 3 - No Action

6.3.1.1 Description of Alternative No. 3

The no action alternative provides a basis for comparing existing site conditions with those resulting from implementation of the other proposed alternatives. Alternative No. 3 does not involve corrective measures in reference to the soils at the Building 3A site. The soils will

remain in-place and contaminant reduction will only occur through unmonitored natural attenuation.

6.3.1.2 Evaluation of Alternative No. 3

Effectiveness

Alternative No. 3 can be considered effective in reducing contaminant levels due to biodegradation over time. Short and long-term exposures to contaminated soils are not addressed as part of the no action alternative.

Implementability

This alternative is technically and administratively implementable since no engineering or administrative procedures are required.

Cost

No costs are associated with Alternative No. 3, since no actions are being implemented at the site.

6.3.2 Alternative No. 4 – Excavation, Off-Site Disposal, and Institutional Controls

6.3.2.1 Description of Alternative No. 4

This technology includes excavation and removal of contaminated soils. Soils would be excavated, stockpiled, sampled, loaded into trucks, and transported off-site for disposal. After excavation, the excavated materials would be replaced with clean backfill. Institutional controls would be put in place to restrict land use and site access during and following excavation and to facilitate ETA. In order to expedite the remediation of the site, institutional controls will be designed to facilitate the transfer of property through ETA. Institutional controls are those actions that will control land use and site access through public agencies or records. Institutional controls do not have a direct bearing on site restoration (i.e., not an active form of remediation) but reduce the potential for human exposure. Institutional controls for the purpose of this RAP will implemented through requirements of ETA, CERCLA Section 120(h)(3) (transfer of federal property by deed before all necessary remedial action has been taken). All remedial actions

necessary to protect human health and the environment presented in this RAP will be implemented through the ETA and/or transfer agreements.

A major facet involved in implementing institutional controls to achieve ETA is the designation of property use. The deed restrictions will disallow the use of the property for the purpose of residences, schools, parks, recreation, care of minors, food warehousing, agriculture, nurseries, or any other use involving contact with or use of soil. The property will be transferred solely for permitted uses.

6.3.2.2 Evaluation of Alternative 4

Effectiveness

Excavation is applicable to the complete range of contaminant groups. Excavation is considered an effective means of removing soil contamination by providing long-term contaminant concentration reduction at the source. Institutional controls are not an effective means of reducing or controlling existing contamination. However, institutional controls would be effective in protecting human health by limiting access to subsurface soil and facilitating soil remediation through the ETA process. Remedial action objectives would be met through excavation of contaminated soils and implementation of institutional controls.

Implementability

Equipment for this alternative is readily available and implementation could be relatively quick and easy. Excavation activities to depths of approximately 35 feet have been successfully completed at the Hardesty Federal Center.

Cost

The cost of excavating the soils will be moderate to high depending on the volume of soils to be removed. Capital costs for this alternative would be approximately $371,000. ts would not be incurred as excavation of soils does not require further maintenance. The approximate costs for implementation of Alternative No. 4 are presented in Table 4. The detailed cost breakdown for this alternative is presented in Appendix D.

6.4 Comparison of Corrective Measures Alternatives

The following subsections provide a brief comparison of the CMAs.

6.4.1 Groundwater

The CMAs for groundwater are:

- Alternative No. 1 – No Action
- Alternative No. 2 – Enhanced In-situ Bioremediation, Groundwater Monitoring, and Institutional Controls.

Effectiveness

Alternative No. 1 is a no action alternative, which does not involve any remedial actions. It is not effective in meeting remedial action objective.

Alternative No. 2 is enhanced in-situ bioremediation, groundwater monitoring, and institutional controls. This is a proven technology for treating VOCs and SVOCs and is effective in meeting the remedial action objective.

Implementability

Alternative No.1 is easily implementable since no action will be taken.

Alternative No. 2 would involve the installation of several injection wells or trenches. Groundwater monitoring is easily implemented with the use of existing wells at the site. Institutional controls encompassed in the ETA process have proven to be implementable.

Cost

No costs are associated with Alternative No. 1.

The estimated total cost for implementation of Alternative No. 2 including capital investment and O&M is $438,600.

6.4.2 Soil

The CMAs for soil are:

- Alternative No. 3 – No Action
- Alternative No. 4 – Excavation, Off-Site Disposal, and Institutional Controls.

Effectiveness

Alternative No. 3 would not be effective since it does not address the corrective measure objective.

Alternative No. 4 would be effective by removing the contaminated soil and replacing it with clean soil. The excavation of the contaminated soils could be implemented in a short period of time and completed within 10 days. Institutional controls would not be effective in remediation of contaminated soils, but used as a supplement to control exposure during and following excavation activities and to facilitate the remediation process through ETA.

Costs

No costs are associated with Alternative No. 3.

The approximate capital costs for Alternative No. 4 would be $371,000. No O&M costs are projected for Alternative No. 4.

6.5 Recommended Remedial Action

6.5.1 Groundwater

Alternative No. 2 – Enhanced In-situ Bioremediation, Groundwater Monitoring, and Institutional Controls via ETA is the recommended CMA for groundwater treatment.

The primary advantages of this alternative are summarized below:

- Alternative No. 2 is a proven treatment process for diesel fuel constituents. The corrective measure objective for groundwater would be met using this alternative.
- Reduction of groundwater contamination would be documented by groundwater monitoring and implementation of institutional controls would facilitate site remediation through ETA.
- ETA will ensure timely remediation activities are performed at the site.

- The technologies have proven to be administratively feasible and technically implementable.

6.5.2 Soil

Alternative No. 4 – Excavation, Off-Site Disposal, and Institutional Controls via ETA is the recommended remedial action for the contaminated soil. The primary advantages of this alternative are summarized below:

- Excavation of the contaminated soils is the most effective option with respect to contaminant reduction and can be implemented over a short period of time. Excavation of soils would meet the corrective measure objective.
- Excavation has been used successfully to remove soil contaminants in other areas of the Hardesty Federal Center.
- This alternative would provide the maximum level of protection for human health because the source will be removed from the site.
- Institutional controls would prevent access to any remaining subsurface soil contamination and would facilitate the remediation process through ETA.

7.0 CONCEPTUAL DESIGN

The objective of this section is to provide a conceptual design of the proposed remedial actions presented in Section 6.0. The recommended remedial action for groundwater is Alternative No. 2 – Enhanced In-situ Bioremediation, Groundwater Monitoring, and Institutional Controls. The recommended remedial action for soil is Alternative No. 4 – Excavation, Off-site Disposal, and Institutional Controls.

7.1 Conceptual Design

The conceptual design of a recommended remedial action is a preliminary design of the cleanup alternative (15% design point). The purpose of the conceptual design is to describe the form and content of a corrective measure, provide key components or elements that would be required, and provide the procedures for implementing the corrective measures.

The conceptual design completes the process of the RAP for the unregulated USTs near Building 3A by detailing the recommended remedial actions for the site and providing the specific steps that would be required to meet the corrective measure objectives for the project. Steps for implementation of institutional controls and remediation of groundwater and soil are presented below.

7.1.1 Implementation of Institutional Controls

Upon approval of the RAP, institutional controls will be initiated at the site. The institutional controls will be implemented via ETA in accordance with CERCLA Section 120(h)(3). The GSA will prepare a CDR package for submittal to the Governor of Missouri. The CDR package will contain the following background information:

- Property description
- Nature and extent of contamination
- Analysis of the intended land use during the deferral period
- Summary of MO DNR-approved corrective actions for remediation of soil and groundwater at the site.

The CDR will contain a copy of the deed for the property and/or a copy of the property transfer agreement (PTA). The deed or PTA will contain the following:

- Notice: A copy of the notice to be included in the deed as required by CERCLA Section 120(h)(1) and (3) and in accordance with regulations set forth at 40 Code of Federal Regulations (CFR) Part 373
- Covenant: A copy of the covenant warranting that any additional remedial action found to be necessary after the date of transfer shall be conducted by the United States as required by CERCLA Section 120 (h)(3)(A)(ii)(II)
- Access: A copy of the clause which reserves to the government access to the property in any case in which an investigation, response, or corrective action is found to be necessary after the date of transfer as required by CERCLA Section 120(h)(3)(A)(iii)
- Response Action Assurances: A copy of the response action assurances that will be included in the deed or other agreement proposed to govern the transfer as required under CERCLA Section (h)(3)(C)(ii). As required by the statute, these assurances shall:
    - provide for any necessary restrictions on the use of the property to ensure the protection of human health and the environment
    - provide that there will be restrictions on the use necessary to ensure that required remedial investigations, response actions, and oversight activities will not be disrupted
    - provide that all necessary response actions will be taken and identify the schedule(s) for investigation(s) and completion of all necessary response action(s) as approved by the appropriate regulatory agency
    - provide that the GSA has or will obtain sufficient funding through either: (a) submission of a budget request (or budget requests in the event multi-year funding is needed) to the Director of the OMB that adequately addresses schedule for investigation and completion of all necessary response action, subject to congressional authorizations and appropriations; or (b) sufficient current appropriations to accomplish investigation(s) and completion(s) of all necessary response action(s). In addition to (a) or (b), the GSA may also have an agreement with the transferee to fund and/or accomplish all or part of the remediation.

The final CDR will include a response to comments document which contains the GSA's responses to the written comments received during the public comment period under Section 120 (h)(3)(C)(I)(III) and to the written comments received from the regulatory agencies on the draft CDR.

In the event that ownership of the property is transferred, a transferee may agree to conduct response actions on the property. However, the GSA remains responsible for ensuring that all necessary response actions including, as appropriate, investigations and requirements under an Interagency Agreement are done. When property is transferred prior to completion of the cleanup, the GSA should include in each deed provisions notifying the transferee of the requirement for, and status of, an Interagency Agreement or other enforceable environmental cleanup agreement or order, as appropriate.

The GSA will also notify the transferee that the State of Missouri and their agents, employees, and contractors, will have rights of access as necessary to implement response actions and oversight responsibilities at the facility.

In the event that the transferee has agreed to fund and conduct the cleanup or portions of the cleanup as a condition of the transfer, the GSA will provide to the State of Missouri documentation demonstrating that the transferee has or will become legally obligated to conduct the required response actions in accordance with the RAP. Should the transferee become unable or unwilling to complete the cleanup or order under its agreement with the GSA, the GSA will complete the cleanup.

If the transferee is expected to perform any response action (e.g., excavation of contaminated soil in an area where facilities are to be constructed), then the State of Missouri should receive assurance from the GSA that the transferee has:

- the technical capacity (in-house or through appropriate contract management) to perform anticipated investigations and response or corrective actions
- the financial capacity to execute environmental cleanup activity requirements that are known or can reasonably be anticipated, based on current information available.

The transferee should agree to conduct all necessary environmental response actions in accordance with CERCLA. In the case where the transferee does not perform cleanup in accordance with CERCLA or the terms of a cleanup agreement, then the United States may enter the property and perform any necessary response action.

7.1.1.1 Requesting Covenant Deferral

Before preparing a CDR, GSA will notify the Governor of Missouri of the intent to request a CERCLA Covenant Deferral and invite participation in the development and review of the draft CDR. This notice should allow sufficient time for EPA and State agencies to participate in the development and review and comment on a draft CDR.

As required by Section 120(h)(3)(C)(I)(III), the GSA will provide notice, by publication in a newspaper of general circulation in the vicinity of the property, of the proposed transfer. The notice should include:

- The identity of the property proposed for transfer, the proposed transferee and the intended use of the property
- A statement that the proposed transfer is pursuant to CERCLA 120(h)(3)(C) which allows the transfer of federal property before remedial action is completed when certain conditions are satisfied
- An assessment of whether the transfer is consistent with protection of human health and the environment will be made only after a comprehensive evaluation of the environmental condition of the property in consultation with the appropriate State agencies
- A summary of the decision-making process, e.g., that the property will not be transferred until the Governor of Missouri concurs that the transfer of the property for use as intended is consistent with protection of human health and the environment and that the federal agency has provided assurance that response actions will be taken
- The address and telephone number of the agency office which may be contacted for obtaining a copy of the draft CDR, site- specific information and the address of the location of the administrative record for the response program
- A statement that interested members of the public may comment on the suitability of the property (the draft CDR) for transfer and must submit such comments to the agency before a date not less than 30 days from the date of the publication of the notice.

After the public comment period has expired, the GSA may then submit the final CDR to the appropriate state representative. Property cannot be transferred by deed until the CERCLA Covenant is explicitly deferred by the State of Missouri.

7.1.1.2 Completion of Response Actions after Transfer

When all response actions necessary to protect human health and the environment have been taken [e.g., when there has been a demonstration to the State of Missouri that the approved

remedy is "operating properly and successfully" pursuant to CERCLA Section 120(h)(3)(B) (regardless of whether the GSA or the transferee has taken the action)], the GSA shall execute and deliver to the transferee an appropriate document containing a warranty that all such response action has been taken. This warranty will satisfy the requirement of CERCLA Section 120(h)(3)(A)(ii)(I).

7.1.2 Remedial Action for Groundwater

The following subsections describe the purpose, description, and design criteria and basis for each element of the selected remedial action for groundwater.

7.1.2.1 Enhanced In-situ Bioremediation

7.1.2.1.1 Description

Bioremediation of groundwater at the site will be enhanced using Oxygen Releasing Compound (ORC®), a proprietary formulation of magnesium peroxide that releases oxygen slowly when hydrated. The ORC® is available in both a powder form that can be made into a slurry and exchangeable filter socks to be used in injection wells.

Prior to implementation of the corrective measures, additional data will be collected at the site. Based on MO DNR guidance, the parameters listed below will be collected and will be presented to MO DNR for final approval of the in-situ bioremediation corrective measure for groundwater. Prior to initiation of data collection, a sampling and analysis plan will be prepared and submitted to MO DNR. The following parameters have been collected during previous site investigations:

- Total extent of soil contamination to be treated
- Baseline soils contamination analytical data
- Soil type, texture, or grain size analysis
- Baseline soil properties
- Hydrogeologic constraints.

The following parameters will be collected upon approval of the sampling and analysis plan:

- Bioassay of types and populations of microbes
- Biofeasibility of bench scale studies
- Vertical infiltration rates

- Soil moisture and pH.

The parameters presented above will be compiled and submitted to MO DNR for final approval.

7.1.2.1.2 Design Criteria and Basis

For this application, the powder and slurry forms of ORC® will be used. Following excavation of contaminated soils, the ORC® slurry will be placed in the bottom of the excavation cavity prior to backfill with clean soils. This application will contact the groundwater at the bottom of the excavation in some areas and will permit enhanced bioremediation in the remaining soils. ORC® slurry will also be injected into the subsurface using direct push injection techniques.

Excavation Area Treatment

The first stage of enhanced bioremediation will be performed during soil excavation activities. A slurry containing 0.3% ORC® would be spread across the bottom of the excavation area where the water table is encountered. Where the water table is not encountered, the ORC® powder will be physically mixed with the soil in the upper 2 feet of the excavation floor.

Downgradient Plume Treatment

The second stage of enhanced bioremediation will entail application of ORC® to the subsurface by the use of direct push or augured holes into which a grout-like slurry of ORC® is applied. ORC® is typically applied in a grid pattern or a barrier pattern over the intended area of treatment. The grid pattern approach attempts to amend the plume by injecting ORC® directly into the contaminated unit over the entire horizontal and vertical extent of the plume. The barrier approach is installed perpendicular to the groundwater flow direction at regular intervals (10 to 25 feet injection point spacing) throughout the length of the plume. The barrier approach is typically utilized for larger more widespread plumes.

Due to the relative immobility of the contaminant plume and the corrective measure objective of restoring groundwater to cleanup levels (rather than containment), the grid pattern will be used at this site. The proposed bioremediation system layout including projected locations of injection points is presented on Figure 10. The ORC® injection area would consist of fifty injection points configured in a grid pattern across the areal extent of the plume. The injection points will be

spaced at 10 foot centers. The vertical injection points will be installed via geoprobe (direct push) techniques. A 40% ORC® slurry mixture will be injected into the groundwater at each injection point. Due to the elevated concentrations of diesel fuel at some sampling locations, another application may be required after six months to remediate groundwater in certain hot spots. An additional application of ORC® would help to counteract recharge of contamination from areas of clayey soil where diesel fuel is sorbed in significant quantities.

7.1.2.2 Groundwater Monitoring

A groundwater monitoring program will be implemented to evaluate the groundwater contaminant plume and the effectiveness of the bioremediation system.

7.1.2.2.1 Description

Groundwater monitoring will be conducted on a semi-annual basis. The monitoring data will be utilized to optimize system performance and to ensure that remedial action objectives are being met. Concentration data for site contaminants will provide the critical basis for evaluating system performance.

7.1.2.2.2 Design Criteria and Basis

The existing monitoring wells that comprise the groundwater monitoring network are depicted on Figure 10. The five existing monitoring wells will be utilized to assess the effectiveness of the source area remediation. Three additional monitoring wells will be installed beyond the leading edge of the groundwater plume at the border of the property.

Groundwater samples will be analyzed using Iowa OA1 and OA2 Methods during monitoring efforts. The monitoring program will include water level measurements, concentration trend charts for key indicator constituents and plan view delineation of impacted groundwater. Groundwater monitoring will be conducted semi-annually for five years or until groundwater contaminant levels have been reduced below cleanup levels. The monitoring results and the performance of the remediation system will be evaluated on an annual basis within progress reports submitted to the MO DNR VCP.

7.1.3 Remedial Action for Soil

The following subsections describe the purpose, description, and design criteria and basis for each element of the selected remedial action for soil.

7.1.3.1 Excavation and Off-Site Disposal

The purpose of the excavation and off-site disposal of contaminated soils is to remove soils contaminated above cleanup levels.

7.1.3.1.1 Description

The removal of soils contaminated with diesel fuel and benzene is the first phase of the proposed RAP. Approximately 5,500 tons of contaminated soil will be removed. For purposes of estimating the volume of contaminated soil, the top 6 feet of soil is considered clean. Figure 9 shows the projected area of excavation. The specific calculations used to calculate the volume of excavated soil and tonnage of contaminated soil for disposal are presented in Table 5.

7.1.3.1.2 Design Criteria and Basis

The soil contamination is predominately located at 8 to 12 feet bgs with contamination extending to a depth of 16 to 24 feet bgs in a few locations. Excavation will continue horizontally until confirmation sampling indicates the soil contaminated above cleanup levels has been removed. Excavation will continue vertically until confirmation sampling indicates that soil contaminated above cleanup levels has been removed or groundwater is encountered. The projected area of excavation (indicated on Figure 9) is based on soil borings that indicated the presence of free product or detections of diesel fuel above cleanup levels.

Soil excavation will be performed using a bulldozer, backhoe, two trackhoes, two operators, one laborer, one support person, and a Site Safety and Health Officer. As previously mentioned, CAPE has performed excavation activities at the Federal Center at the past. Although the soil has exhibited consistent tight clay composition that allows excavation without shoring or sloping requirements, some sloping of the excavation sidewalls will be performed for safety reasons. Due to the potential depth of excavation, operators will be required to operate equipment within the excavation cavity. Design of the work plan and the health and safety plan will anticipate the hazards involved in this activity and measures will be taken to sufficiently plan activities and protect workers during the project.

Soil samples will be collected from sidewalls of the excavation using the excavator bucket. The soil samples will be analyzed using a Photoionization Detector (PID). Soil samples will be placed in a ziplock bag and allowed to off-gas for 15 minutes. The tip of the PID probe will be inserted into the bag and the instrument reading will be noted in the field notebook along with location of the sample. The depth of the sample will also be noted in the field book. If field screening indicates a headspace reading of <10 parts per million (ppm) then the sample will be considered clean. A portion of the clean sample from each of the excavated area will be placed into a sample container and sent to the laboratory for analysis to confirm soils above cleanup levels have been removed.

Composite samples will be collected from soils that are stockpiled for disposal. These samples will be shipped off-site for analysis to characterize the soil for the off-site disposal facility. Once approval has been received from the off-site facility, the contaminated soil will be loaded in trucks and transported off-site. Soil that was determined to be clean by field analysis will be backfilled. Clean backfill will be used to fill the remaining open excavated area.

7.2 Permitting

Underground Injection Control

The Safe Drinking Water Act of 1974 and later amendments established the Federal Underground Injection Control (UIC) Program. The State of Missouri has obtained primacy from the US EPA for the UIC program. EPA has divided injection wells into five classes, based upon where the wells inject fluids in relation to Underground Sources of Drinking Water (USDW) and whether the injected fluids are hazardous or non-hazardous. The type of injection wells proposed for this project are considered Class V wells. Class V includes a variety of different well types and are also referred to as shallow injection wells. Some of these wells are regulated by the Division of Geology and Land Survey (DGLS) and certain types by the Water Pollution Control Program (WPCP). These wells are generally used to inject non-hazardous fluids into, or above, a USDW.

Groundwater remediation wells are a specific type of Class V wells. These injection wells are used in the cleanup of contaminated sites, and are permitted by the WPCP under the Missouri

Clean Water Law, RSMo 644. For fuel spill cleanups, general permits are issued for projects that do not directly affect the groundwater. UIC site-specific permits are issued for projects determined by the state to directly affect the groundwater. UIC permit applications are reviewed in greater detail to assure maximum protection of groundwater resources. Other types of cleanup operations also require a site-specific UIC permit.

The permit application will be submitted to MO DNR VCP following approval of this RAP.

7.3 Estimated Costs

The estimated capital and O&M costs for the bioremediation system and groundwater monitoring is presented in Table 3. The estimated capital costs for the soil excavation and off-site disposal are presented in Table 4. Supporting documentation for the cost estimates are included in Appendix D.

7.4 Required Plans

7.4.1 Work Plan

A Work Plan will be submitted to MO DNR VCP prior to field activities. The Work Plan will present detailed procedures for excavation activities, remediation system construction, and monitoring well installation. The Work Plan will include a Sampling and Analysis Plan, Waste Management/Disposal Plan, Quality Assurance/Quality Control Plan, and Health and Safety Plan. Field work activities will not begin until the Work Plan has been reviewed and approved by MO DNR VCP.

7.4.2 Operation and Maintenance Plan

A detailed O&M Plan will be submitted for the groundwater monitoring system upon completion of the system start-up. General descriptions of expected operation and maintenance activities are provided in the following subsections for the purpose of this conceptual design.

7.4.2.1 Training

Operation of the corrective measures will require training of key personnel involved in the installation and operation of the bioremediation and groundwater monitoring system. Training

will be conducted prior to and during the initial start-up period. Training will also be incorporated into the O&M Plan documentation.

7.4.2.2 Maintenance Activities

Observation of system components will be conducted on a monthly basis. For the groundwater monitoring system, activities may include:

- Inspection of monitoring wells
- General housekeeping
- Scheduled maintenance and repairs as needed

7.4.2.3 O&M Plan Contents

An O&M plan will be prepared and submitted to MO DNR VCP concurrently with the work plan. The following elements, at a minimum, will be addressed within the O&M Plan:

- Training of key personnel
- Description of the bioremediation application to the site
- Preventive maintenance program and schedules for groundwater monitoring wells
- Description of material applied to the site
- Description of groundwater monitoring equipment
- Records and reporting mechanisms required
- Contacts and phone numbers of manufacturers
- Safety Plan

7.4.3 Environmental Monitoring Plan

A detailed Environmental Monitoring Plan will be submitted to direct activities of the bioremediation and groundwater monitoring programs. Monitoring of the bioremediation system will include measuring and documenting dissolved oxygen and other biological parameters as part of the groundwater monitoring program. System monitoring will be performed at more frequent intervals at startup and during transient stages of operation. Groundwater contaminant monitoring as well as water quality monitoring will be performed on a semi-annual basis.

7.5 Schedule of Implementation

Implementation of remedial action will commence once approval of this RAP is received from the MO DNR VCP. The first phase of the RAP will be application for necessary permits and completion of institutional controls for groundwater and soil and measures to complete all requirements for ETA. The second phase of RAP implementation will be the excavation of the contaminated soil. The third phase of the RAP will be preparation of system design plans and specifications and the construction of the bioremediation system. Concurrent with the operation of the bioremediation system, the groundwater monitoring program will be implemented. Initial start-up activities will include thorough system checks and performance evaluations. These activities will be documented and included in the O&M Plan for the system. The schedule of implementation is included as Appendix E.

7.6 Reporting

Progress Reports will be submitted to the MO DNR VCP during remedial action system construction and start-up phases in accordance with the schedule presented as Appendix E. Progress Reports will also be prepared and submitted to the MO DNR VCP throughout the operation of the remediation system. During the first year of operation, Progress Reports will be submitted semi-annually. After the first year of operation, Progress Reports will be submitted to the MO DNR VCP on an annual basis. Groundwater monitoring information will be incorporated into these semi-annual and annual Progress Reports.

A Final CALM Report will be prepared and submitted to the MO DNR VCP once the remedial action objective for groundwater has been achieved at the site. The remedial action objective for soil will be met following excavation of contaminated soil and verification by off-site analysis. Attainment of groundwater cleanup standards will be demonstrated by three consecutive confirmation sampling events. Following MO DNR VCP review and approval of the Final CALM Report for the site, the remediation system will be decommissioned. Decommissioning will include removal of equipment and proper abandonment of any below-grade wells and/or piping.

8.0 REFERENCES

Missouri Department of Natural Resources, September 1998. *Cleanup Levels for Missouri (CALM)*. Division of Environmental Quality, Hazardous Waste Program.

Missouri Department of Natural Resources, September 2001.Soil and Groundwater Target Concentrations (STARC and GTARC). *Cleanup Levels for Missouri, Appendix B*. Division of Environmental Quality, Hazardous Waste Program.

US EPA, 1993a. In-Situ Bioremediation of Ground Water and Geological Material: A Review of Technologies. Office of Research and Development. EPA/5R-93/124.

Tables

TABLE 1
Summary of Soil
Analytical Results
GSA Hardesty
607 Hardesty Avenue, Kansas City, Missouri

Sample ID **Date**	CALMs (STARC)	HAR-SB16 (16-20) 30-Nov-00	SB16(16-20) Dup 30-Nov-00	HAR-SB22 (16-20) 01-Dec-00	HAR-SB28 (12-16) 05-Dec-00	HAR-SB30 (16-20) 05-Dec-00
Analytical Method						
EPA Method 8021A / OA1	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Gasoline Range Hydrocarbons	200	ND	ND	ND	120	17
Benzene	0.05	ND	ND	ND	ND	ND
Toluene	3.7	ND	ND	ND	ND	ND
Ethylbenzene	32	ND	ND	ND	0.180	ND
Xylene (total)	16	ND	ND	ND	ND	ND
Methyl-tert-butyl Ether	none	ND	ND	ND	ND	ND
Method OA2	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Mineral Spirits	none	ND	ND	ND	ND	ND
Jet Fuel	200	ND	ND	ND	ND	ND
Kerosene	200	ND	ND	ND	ND	ND
Diesel Fuel	200	ND	ND	ND	**5,100**	40
Fuel Oil	none	ND	ND	ND	ND	ND
Motor Oil	none	ND	ND	ND	ND	ND
EPA Method 1311/6010	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
TCLP Lead	none	N/A	N/A	N/A	N/A	N/A

ND - Not Detected
N/A - This sample was not analyzed for this parameter.
mg/kg - milligrams per kilogram
CALM - Cleanup Levels for Missouri (lowest value of direct exposure and soil to groundwater leachate scenarios)
Bold numbers indicate that they exceed the MO DNR cleanup level

TAB_ I

Summary of Soil
Analytical Results
GSA Hardesty
607 Hardesty Avenue, Kansas City, Missouri

Sample ID	HAR-SB31 (8-12)	HAR-SB32 (12-16)	HAR-SB33 (4-8)	HAR-SB34 (16-20)	HAR-SB35 (12-16)
Date	05-Dec-00	05-Dec-00	05-Dec-00	05-Dec-00	05-Dec-00
Analytical Method					
EPA Method 8021A / OA1	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Gasoline Range Hydrocarbons	ND	29	5.10	7.30	49
Benzene	ND	ND	ND	ND	ND
Toluene	ND	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	ND	ND
Xylene (total)	ND	0.19	ND	ND	ND
Methyl-tert-butyl Ether	ND	ND	ND	ND	ND
Method OA2	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Mineral Spirits	ND	ND	ND	ND	ND
Jet Fuel	ND	ND	ND	ND	ND
Kerosene	ND	ND	ND	ND	ND
Diesel Fuel	ND	**230**	**270**	**1,000**	**440**
Fuel Oil	ND	ND	ND	ND	ND
Motor Oil	ND	ND	ND	ND	ND
EPA Method 1311/6010	mg/L	mg/L	mg/L	mg/L	mg/L
TCLP Lead	N/A	N/A	N/A	N/A	N/A

ND - Not Detected
N/A - This sample was not analyzed for this parameter.
mg/kg - milligrams per kilogram
Bold numbers indicate that they exceed the MO DNR cleanup level

TAB[illegible] 1
Summary of Soil
Analytical Results
GSA Hardesty
607 Hardesty Avenue, Kansas City, Missouri

Sample ID	HAR-SB36 (16-20)	HAR-SB37 (16-20)	HAR-SB38 (12-16)	HAR-SB39 (16-20)	SB39 (16-20)Dup
Date	05-Dec-00	06-Dec-00	06-Dec-00	06-Dec-00	06-Dec-00
Analytical Method					
EPA Method 8021A / OA1	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Gasoline Range Hydrocarbons	17	50	5.80	6.20	5.90
Benzene	ND	ND	ND	ND	ND
Toluene	ND	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	ND	ND
Xylene (total)	ND	0.47	ND	ND	ND
Methyl-tert-butyl Ether	ND	ND	ND	ND	ND
Method OA2	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Mineral Spirits	ND	ND	ND	ND	ND
Jet Fuel	ND	ND	ND	ND	ND
Kerosene	ND	ND	ND	ND	ND
Diesel Fuel	**3,400**	**1,500**	ND	150	**250**
Fuel Oil	ND	ND	ND	ND	ND
Motor Oil	ND	ND	ND	ND	ND
0					
EPA Method 1311/6010	mg/L	mg/L	mg/L	mg/L	mg/L
TCLP Lead	N/A	N/A	N/A	N/A	N/A

ND - Not Detected
N/A - This sample was not analyzed for this parameter.
mg/kg - milligrams per kilogram
Bold numbers indicate that they exceed the MO DNR cleanup level

TABLE 1
Summary of Soil
Analytical Results
GSA Hardesty
607 Hardesty Avenue, Kansas City, Missouri

Sample ID	HAR-SB40 (20-24)	HAR-SB41 (12-16)	HAR-SB42 (20-24)	HAR-SB43 (12-16)	HAR-SB56
Date	06-Dec-00	06-Dec-00	06-Dec-00	06-Dec-00	30-May-01
					Soil
Analytical Method					
EPA Method 8021A / OA1	mg/kg	mg/kg	mg/kg	mg/kg	ug/kg
Gasoline Range Hydrocarbons	24	ND	ND	ND	ND
Benzene	0.095	ND	ND	ND	ND
Toluene	0.09	ND	ND	ND	ND
Ethylbenzene	0.11	ND	ND	ND	ND
Xylene (total)	0.21	ND	ND	ND	ND
Methyl-tert-butyl Ether	ND	ND	ND	ND	ND
Method OA2	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Mineral Spirits	ND	ND	ND	ND	ND
Jet Fuel	ND	ND	ND	ND	ND
Kerosene	ND	ND	ND	ND	ND
Diesel Fuel	**1,400**	ND	ND	ND	ND
Fuel Oil	ND	ND	ND	ND	ND
Motor Oil	ND	ND	ND	ND	ND
EPA Method 1311/6010	mg/L	mg/L	mg/L	mg/L	mg/L
TCLP Lead	N/A	N/A	N/A	N/A	N/A

ND - Not Detected
N/A - This sample was not analyzed for this parameter.
mg/kg - milligrams per kilogram
CALM - Corrective Action Cleanup Levels (lowest value of direct exposure and soil to groundwater leachate scenarios)
Bold numbers indicate that they exceed the MO DNR cleanup level

TABLE 1
Summary of Soil
Analytical Results
GSA Hardesty
607 Hardesty Avenue, Kansas City, Missouri

Sample ID	HAR-SB58	HAR-SB61
Date	31-May-01	31-May-01
	Soil	Soil
Analytical Method		
EPA Method 8021A / OA1	ug/kg	ug/kg
Gasoline Range Hydrocarbons	ND	ND
Benzene	ND	ND
Toluene	ND	ND
Ethylbenzene	ND	ND
Xylene (total)	ND	ND
Methyl-tert-butyl Ether	ND	ND
Method OA2	mg/kg	mg/kg
Mineral Spirits	ND	ND
Jet Fuel	ND	ND
Kerosene	ND	ND
Diesel Fuel	ND	ND
Fuel Oil	ND	ND
Motor Oil	ND	ND
EPA Method 1311/6010	mg/L	mg/L
TCLP Lead	N/A	N/A

ND - Not Detected
N/A - This sample was not analyzed for this parameter.
mg/kg - milligrams per kilogram
Bold numbers indicate that they exceed the MO DNR cleanup level

TABLE 2
Summary of Groundwater
Analytical Results
GSA Hardesty
607 Hardest Avenue, Kansas City, Missouri

Sample ID Date	CALMs (GTARC)	HAR-MW4 07-Dec-00	HAR-MW5 07-Dec-00	HAR-MW6 07-Dec-00	HAR-MW7 08-Dec-00	MW7(Dup) 07-Dec-00	HAR-MW8 07-Dec-00	HAR-MW9 08-Dec-00	MW9(Dup) 08-Dec-00	MW-10 31-May-01
Analytical Method										
EPA Method 8021A / OA1	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	ug/L
Gasoline Range Hydrocarbons	10,000	ND	1,040	ND	ND	1,030	2,540	ND	ND	ND
Benzene	5	ND	2.63	ND	ND	ND	ND	ND	ND	ND
Toluene	150	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	700	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylene (total)	320	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl-tert-butyl Ether	20	ND	ND	ND	ND	ND	ND	ND	ND	ND
Method OA2	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/L
Mineral Spirits	none	ND	ND	ND	ND	ND	ND	ND	ND	ND
Jet Fuel	10000	ND	ND	ND	ND	ND	ND	ND	ND	ND
Kerosene	10000	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diesel Fuel	10000	ND	9,000	ND	**14,000**	**39,000**	**31,000**	ND	ND	ND
Fuel Oil	none	ND	ND	ND	ND	ND	ND	ND	ND	ND
Motor Oil	none	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND - Not Detected
µg/l - micrograms per liter
mg/l - milligrams per liter
CALM - Cleanup Levels for Missouri
Bold ı bold number indicates that they exceed the MO DNR groundwater cleanup levels

TABLE 3
Summary of Costs for Alternative 2
GSA Hardesty
607 Hardesty Avenue, Kansas City, Missouri

Category/Task			Estimated Cost
Engineering Services			$159,802.50
Site Restoration			$2,396.30
Mobilization/Demobilization			$45,850.00
		Subtotal Project Costs	$208,048.80
Design and Engineering	Estimated as 10 percent of subtotal project costs		$20,804.88
Site Safety and Health	Estimated as 5 percent of subtotal project costs		$10,402.44
Construction Oversight	Estimated as 10 percent of subtotal project costs		$20,804.88
Permitting	Estimated as 5 percent of subtotal project costs		$10,402.44
Unlisted Items	15 percent of subtotal project costs		$31,207.32
		Estimated Capital Cost	**$301,670.76**
		Estimated O&M Cost (yearly)	**$31,632.00**
Estimated 5 Year Present Worth Costs			**$438,621.50**

TABLE 4
Summary of Costs for Alternative 4
GSA Hardesty
607 Hardesty Avenue Kansas City, Missouri

Category/Task			Estimated Cost
Engineering Services			$156,915.20
Site Restoration			$77,971.30
Mobilization/Demobilization			$23,250.00
		Subtotal Project Costs	$256,136.50
Design and Engineering	Estimated as 10 percent of subtotal project costs		$25,613.65
Site Safety and Health	Estimated as 5 percent of subtotal project costs		$12,806.83
Construction Oversight	Estimated as 10 percent of subtotal project costs		$25,613.65
Permitting	Estimated as 5 percent of subtotal project costs		$12,806.83
Unlisted Items	15 percent of subtotal project costs		$38,420.48
		Estimated Capital Cost	**$371,397.94**

TABLE 5
Summary of Excavation Parameters and Calculations
GSA Hardesty
607 Hardest Avenue Kansas City, Missouri

Zone	Area (ft2)	Depth (ft)	Volume (ft3)	Volume (yd3)	Tonnage[1]
Clean Soil	5,470.00	6.00	32,820.00	1,215.56	1,823.33
Contaminated Soil[2]	5,470	18	98,460	3,647	5,470
Slope[3]			22,050	817	1,225
Total Soil Excavated			153,330	5,679	8,518

Notes:
1) Tons are determined by multiplying the cubic yards by 1.5.
2) Contaminated Soil Estimate is based on a clean top layer of soil from 0-6 feet bls.
This portion will be transported off-site for disposal.
3) Slope is calculated at a 1:5 ratio (70 degree slope).

Figures

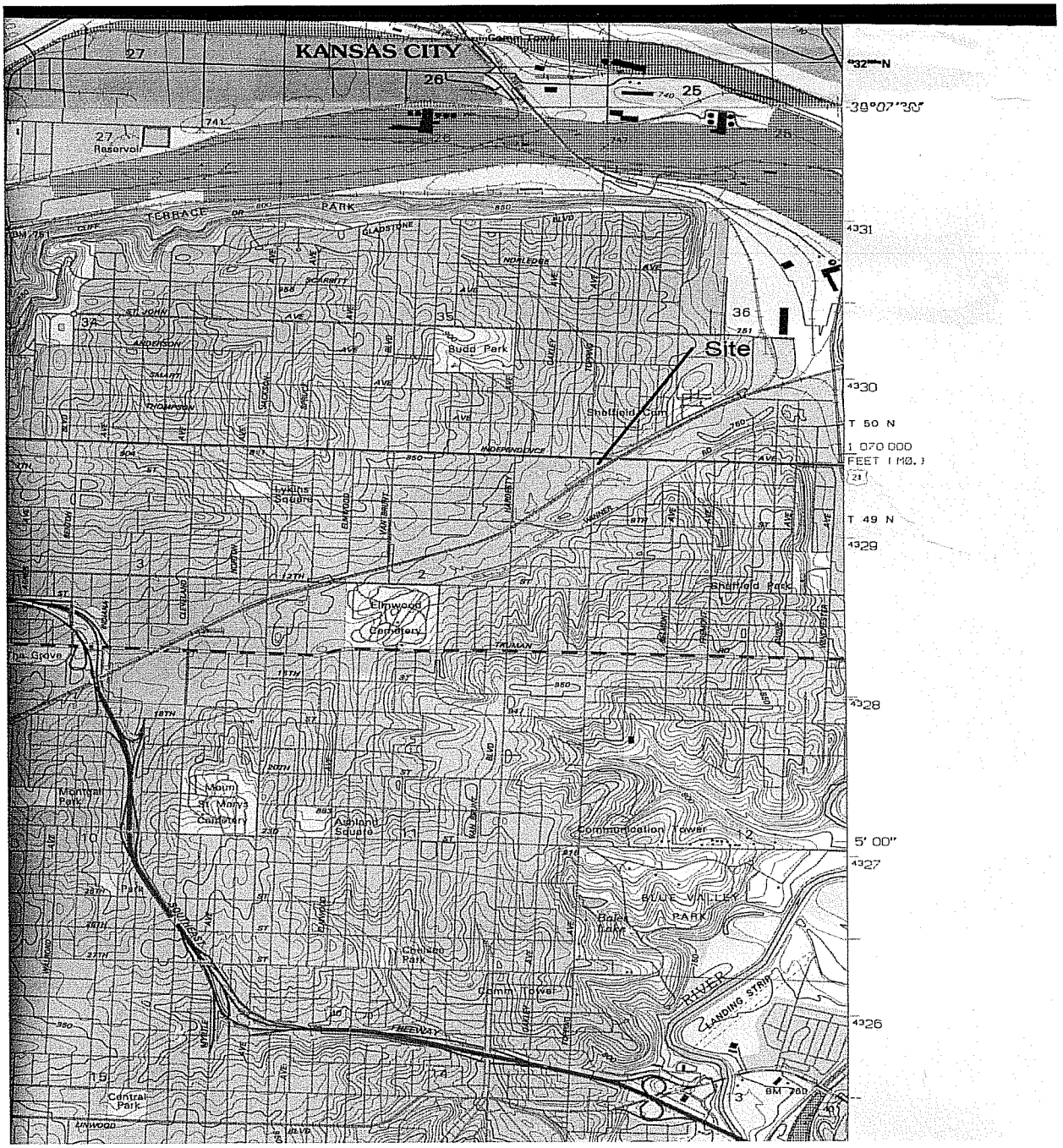
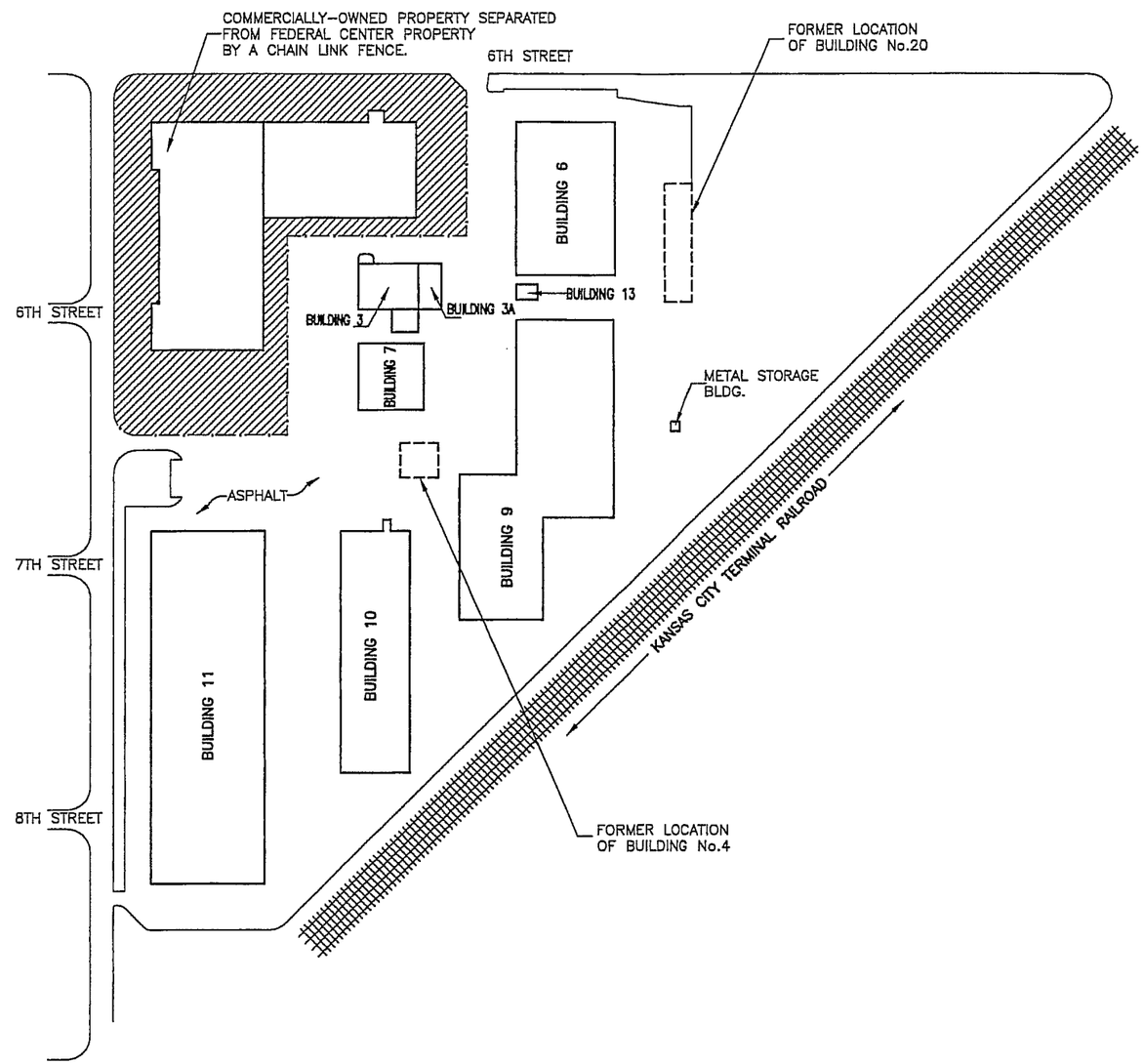


Figure 1 USGS 7.5 Minute Topographic Map
Kansas City, MO-KS
1991



N

GRAPHIC SCALE

0 40' 200' 400'

SCALE: 1" = 200'-0"

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Atlanta, GA 30345
(770) 908-7200

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No.	Date	Remarks

APPROVED BY:

DATE:

PROJECT NAME:

GSA HEARTLAND
CORRECTIVE ACTION PLAN
FEDERAL CENTER

607 HARDESTY AVENUE
KANSAS CITY, MO

GSA PROJECT No. RMO 20490

SHEET TITLE:

FIGURE 2
SITE MAP

JOB NO: 8801C.012.000

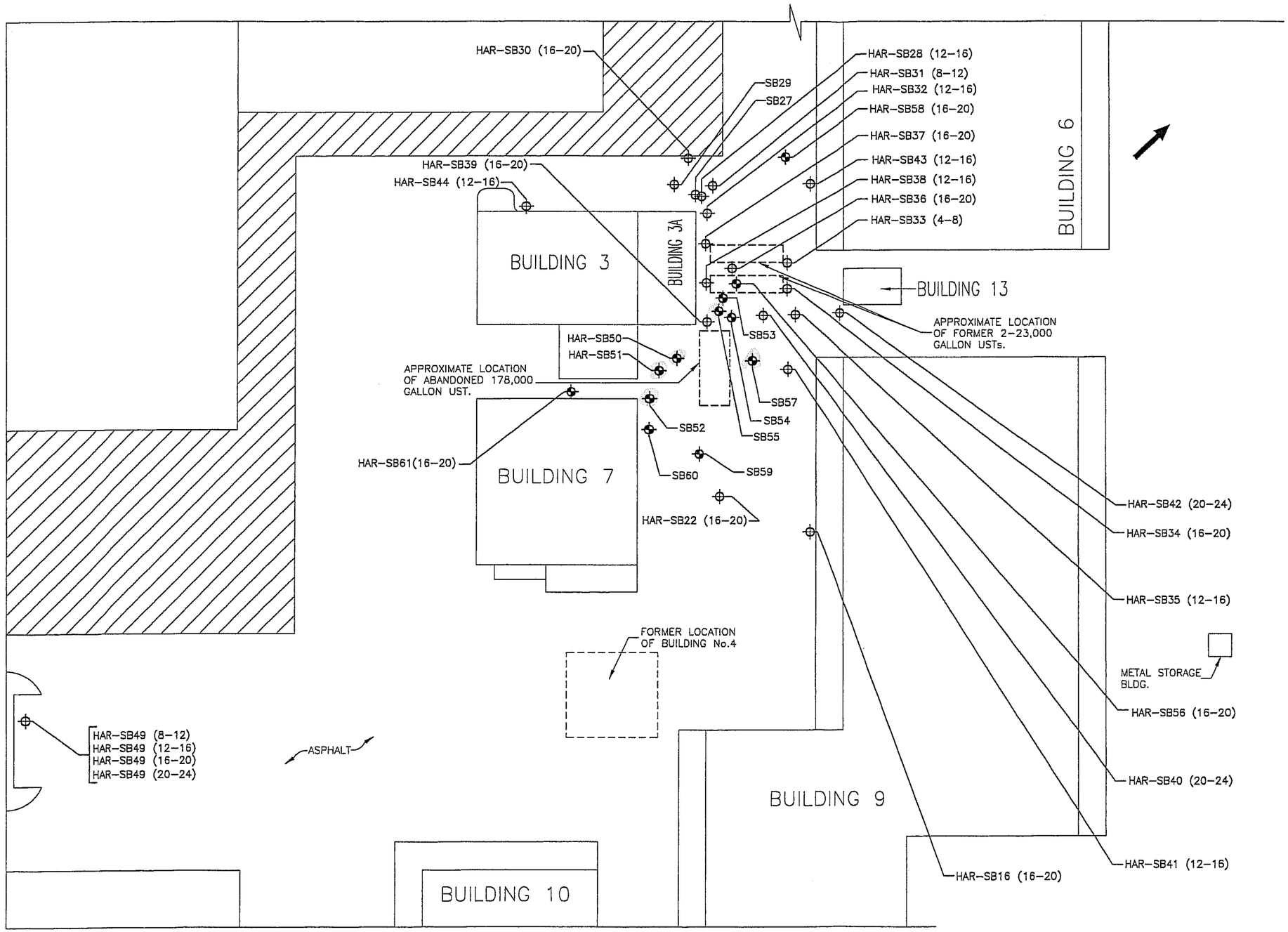
SHEET NUMBER: FIGURE 2
SHEET: 2 OF 10

DRAWN BY: C.RIOS

CHECKED BY: K.NALAVALA

FILE NAME: HAVFIG2.DWG

DATE: FEB. 02



LEGEND

NEW BORINGS (INSTALLED 5/30/01-6/1/01) FOR HORIZONTAL AND VERTICAL DELINEATION

HAR-SB57(16-20)

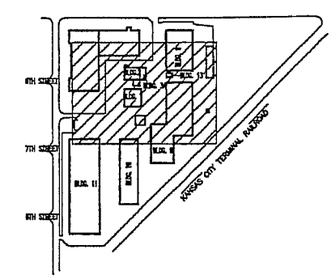
- DEPTH, RANGING 16-20 FEET
- LOCATION NUMBER
- SOIL BORING
- HARDESTY

BORINGS INSTALLED DURING A SITE CHARACTERIZATION EFFORT (11/27/00-12/8/00)

HAR-SB22(16-20)

- DEPTH, RANGING 16-20 FEET
- LOCATION NUMBER
- SOIL BORING
- HARDESTY

ESTIMATED DIRECTION OF GROUNDWATER FLOW



KEY PLAN

NOT TO SCALE

GRAPHIC SCALE

0 10' 60' 120'

SCALE: 1" = 60'-0"

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FEDERAL CENTER
607 HARDESTY AVENUE
KANSAS CITY, MO

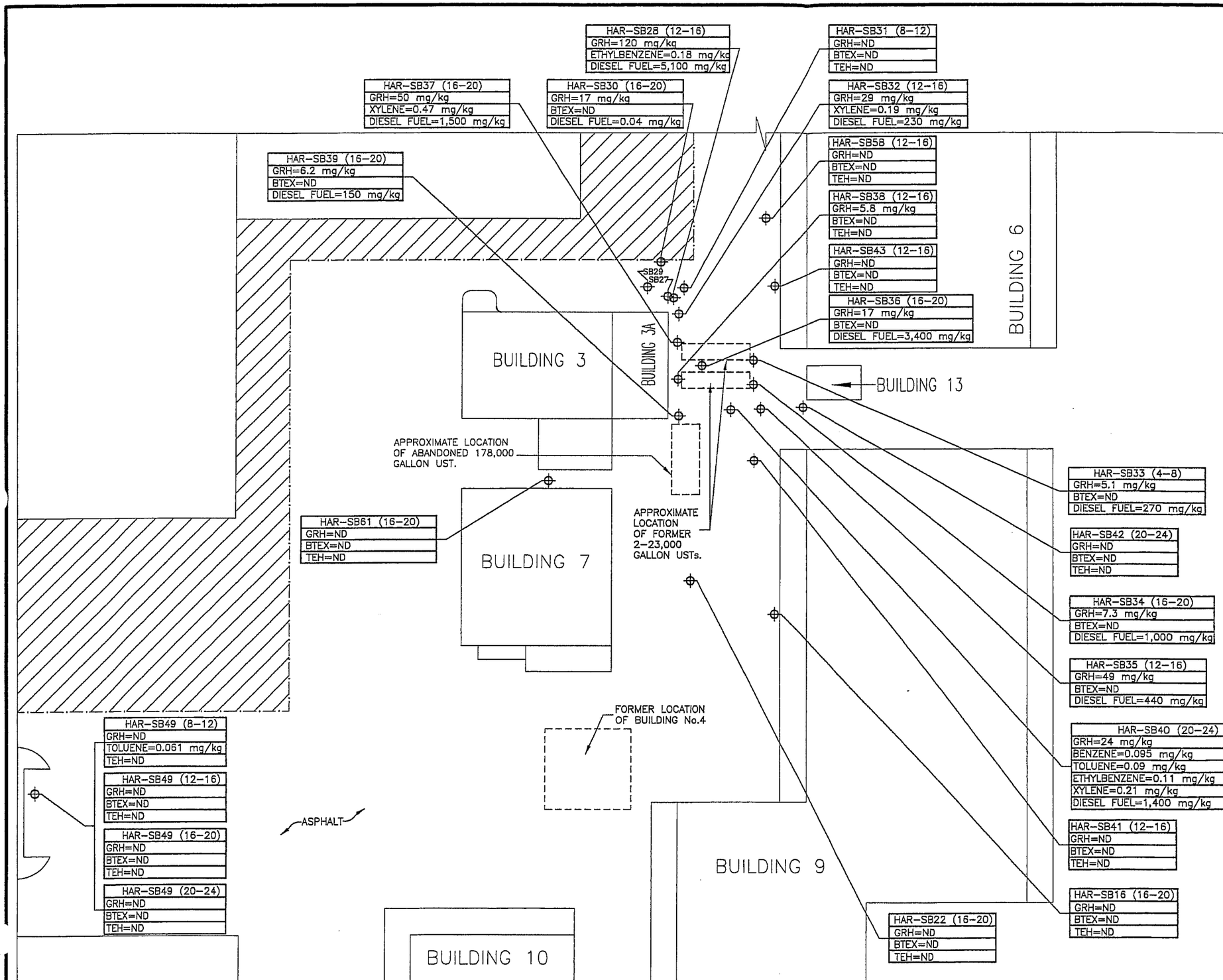
GSA PROJECT No. RMO 20490

SHEET TITLE:

FIGURE 3
BUILDING 3A
SOIL BORING
LOCATION MAP

JOB NO.: 8801C.012.000

SHEET NUMBER: FIGURE 3	DRAWN BY: C.RIOS
SHEET: 3 OF: 10	CHECKED BY: K.NALAVALA
FILE NAME: HAVFIG3.DWG	DATE: FEB. 02



LEGEND

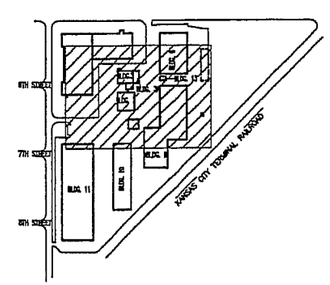
GRH	GASOLINE RANGE HYDROCARBONS
ND	NOT DETECTED
BTEX	BENZENE, TOLUENE, ETHYLBENZENE, XYLENES
TEH	TOTAL EXTRACTABLE HYDROCARBONS
mg/kg	MILLIGRAMS PER KILOGRAM

HAR-SB16(16-20)

- DEPTH, RANGING 16-20 FEET
- LOCATION NUMBER
- SOIL BORING
- HARDESTY

NOTES:

1. DUE TO THE REFUSAL IN SB27 AND SB29 LOCATIONS, THESE SOIL BORINGS WERE STOPPED WITHIN 5 FEET BELOW GROUND SURFACE. NO SOIL SAMPLES WERE COLLECTED FROM SB27 AND SB29 LOCATIONS.
2. DUE TO VISIBLE CONTAMINATION OR HIGH FIELD SCREENING RESULTS, SOIL SAMPLES WERE NOT COLLECTED FROM SB50, SB55, SB57, AND SB60.



KEY PLAN

NOT TO SCALE

GRAPHIC SCALE

0 10' 60' 120'

SCALE: 1" = 60'-0"

CAPE ENVIRONMENTAL MANAGEMENT INC

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607 HARDESTY AVENUE
KANSAS CITY, MO

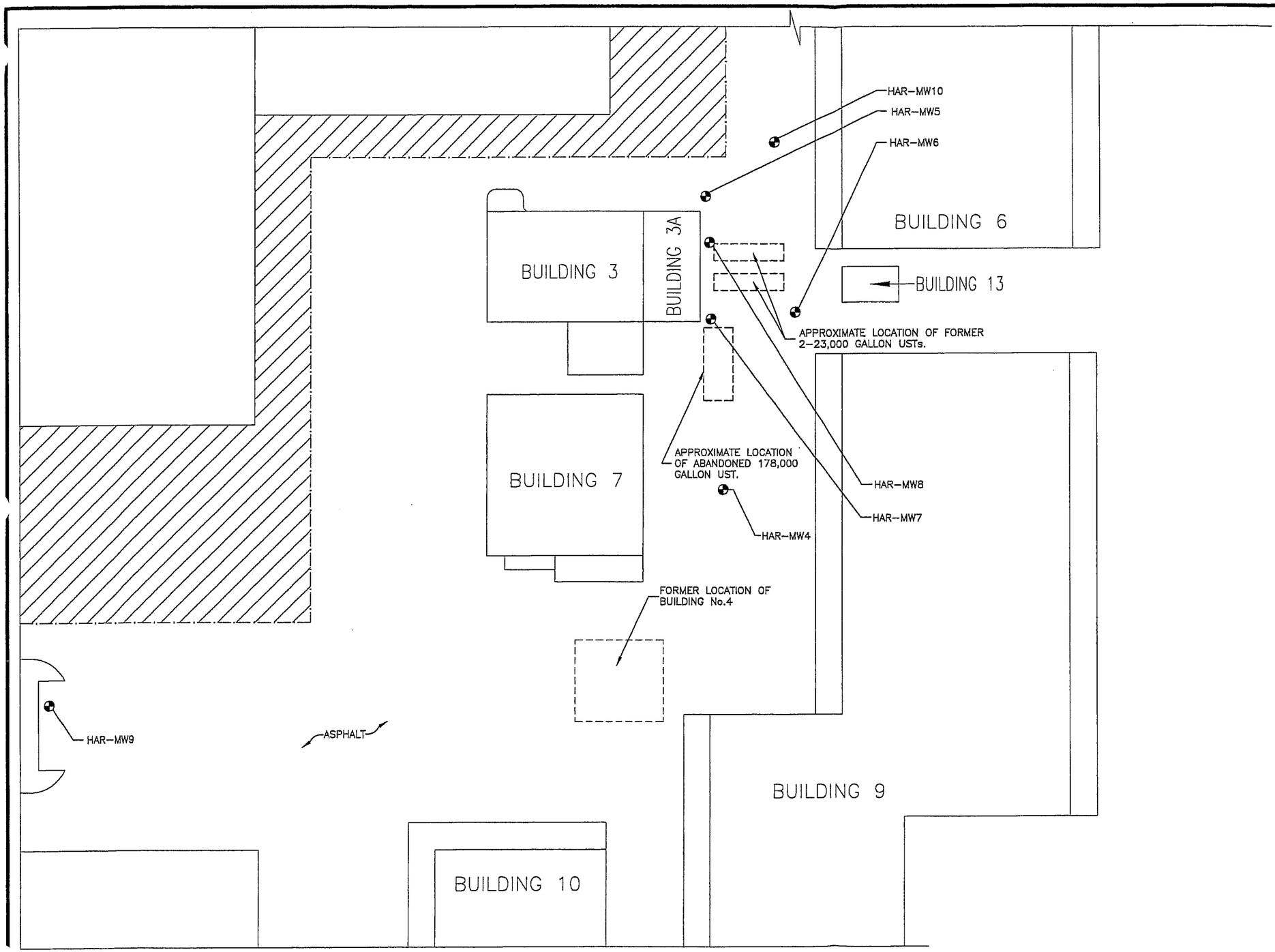
GSA PROJECT No. RMO 20490

SHEET TITLE:

FIGURE 4
BUILDING 3A
SOIL CONTAMINANT CONCENTRATION MAP

JOB NO: 8801C.012.000

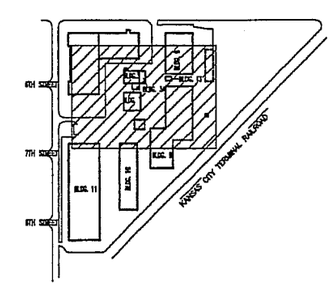
SHEET NUMBER	DRAWN BY
FIGURE 4	C.RIOS
SHEET: 4 OF: 10	CHECKED BY: K.NALAVALA
FILE NAME: HAVFIG4.DWG	DATE: FEB. 02



LEGEND

HAR-MW7

- LOCATION NUMBER
- MONITORING WELL DESIGNATION
- HARDESTY



KEY PLAN
NOT TO SCALE

N

GRAPHIC SCALE

0 10' 60' 120'

SCALE: 1" = 60'-0"

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FEDERAL CENTER

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KANSAS CITY, MO

GSA PROJECT No. RMO 20490

SHEET TITLE:

FIGURE 5
BUILDING 3A MONITORING
WELL LOCATION MAP

JOB NO: 8801C.012.000

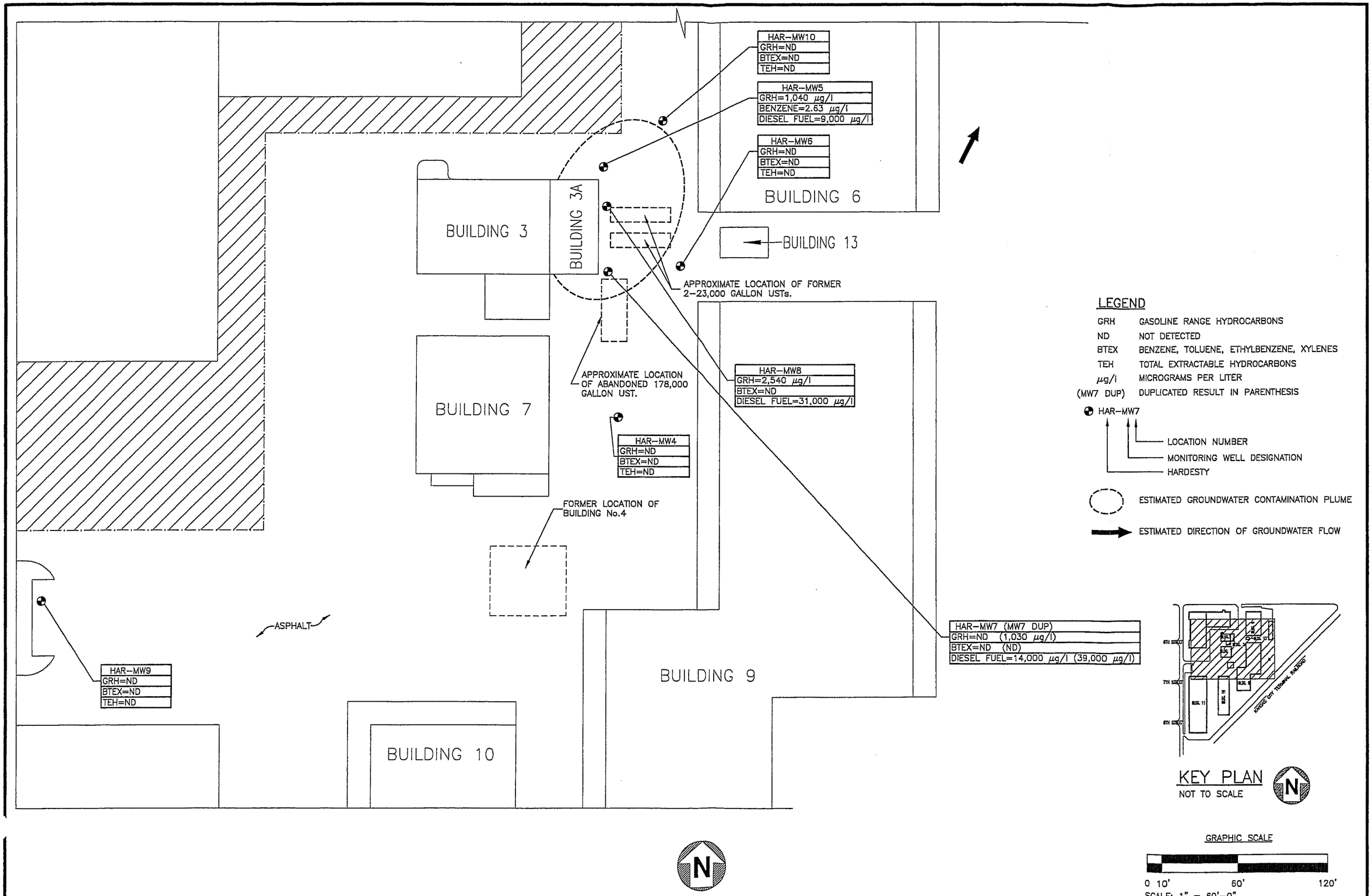
SHEET NUMBER: FIGURE 5
SHEET: 5 OF: 10

DRAWN BY: C.RIOS

CHECKED BY: K.NALAVALA

FILE NAME: HAVFIG5.DWG

DATE: FEB. 02



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GSA HEARTLAND
CORRECTIVE ACTION PLAN
FEDERAL CENTER

607 HARDESTY AVENUE
KANSAS CITY, MO

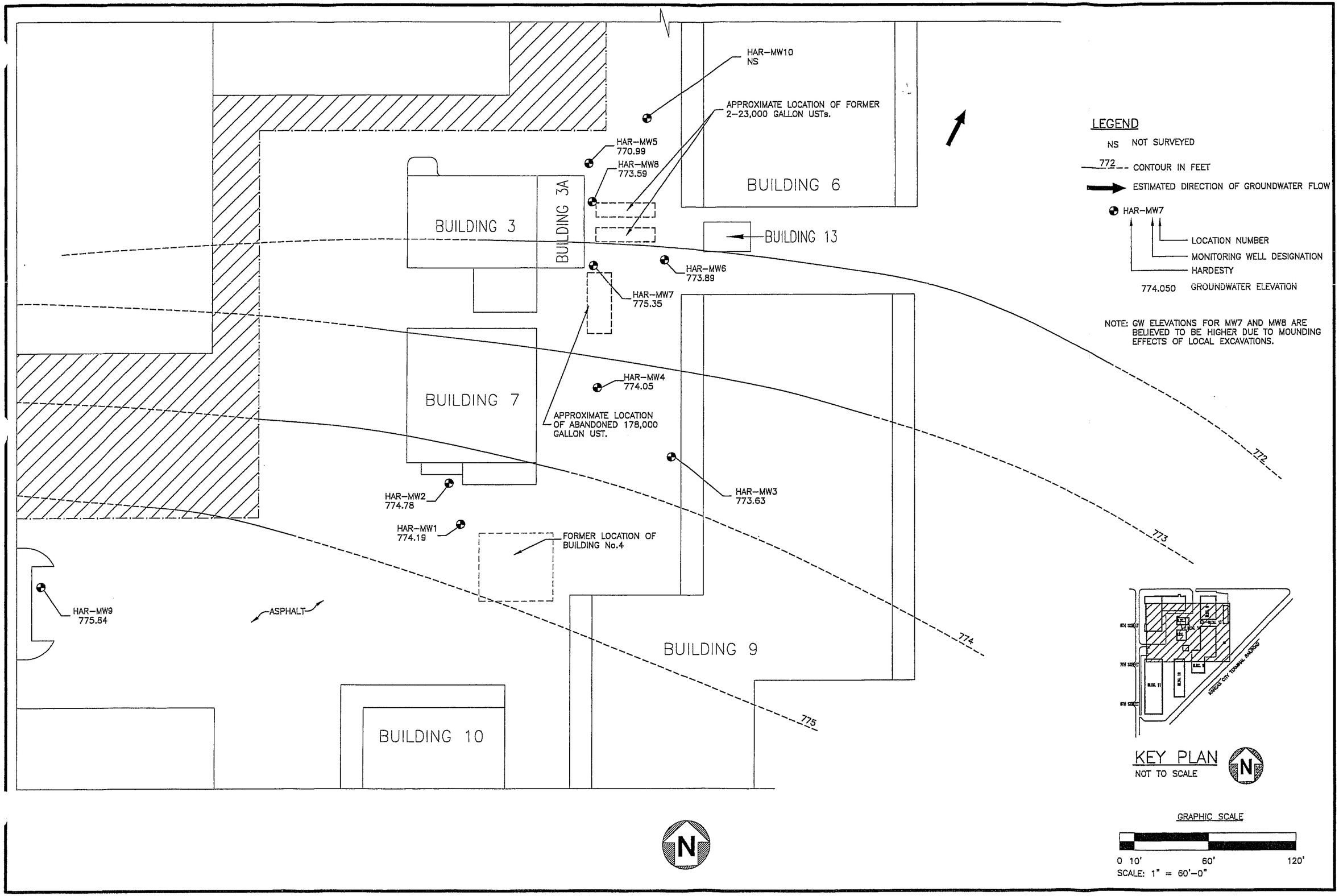
GSA PROJECT No. RMO 20490

SHEET TITLE:

FIGURE 6
BUILDING 3A
GROUNDWATER CONTAMINANT
CONCENTRATION MAP
AND CONTAMINATION PLUME

JOB NO: 8801C.012.000

SHEET NUMBER: FIGURE 6	DRAWN BY: C.RIOS
SHEET: 6 OF: 10	CHECKED BY: K.NALAVALA
FILE NAME: HAVFIG6.DWG	DATE: FEB. 02



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REVISIONS:

No.	Date	Remarks

APPROVED BY:

DATE:

PROJECT NAME:

GSA HEARTLAND
CORRECTIVE ACTION PLAN
FEDERAL CENTER

607 HARDESTY AVENUE
KANSAS CITY, MO

GSA PROJECT No. RMO 20490

SHEET TITLE:

FIGURE 7
POTENTIOMETRIC
SURFACE MAP
DEC. 8, 2000

JOB NO: 8801C.012.000

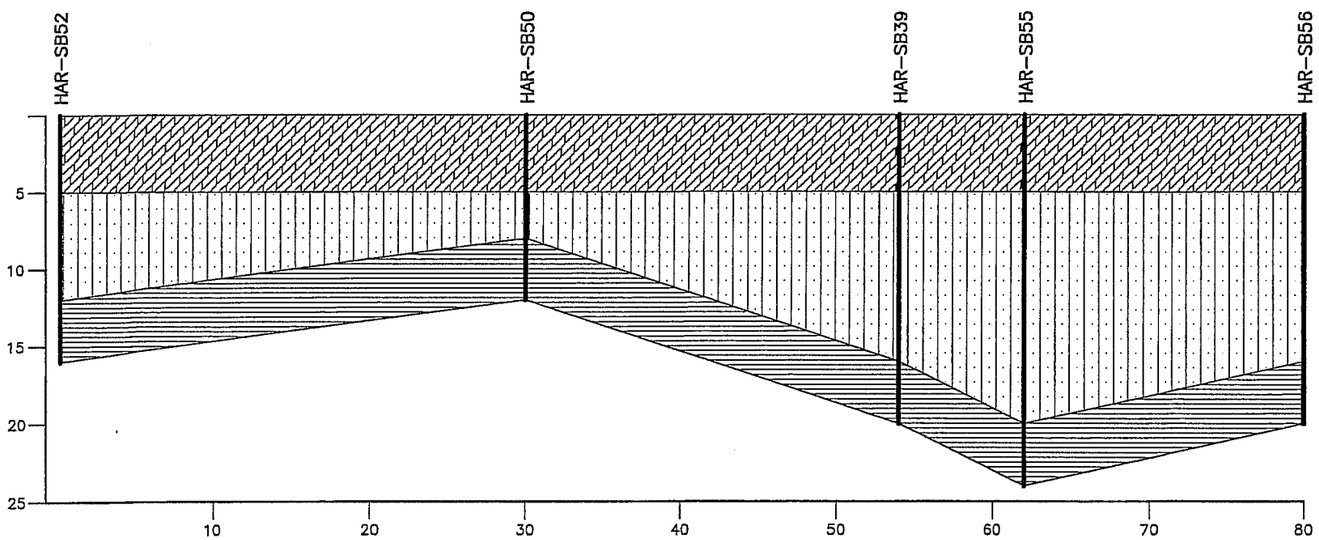
SHEET NUMBER: FIGURE 7
SHEET: 7 OF: 10

DRAWN BY: C.RIOS

CHECKED BY: K.NALAVALA

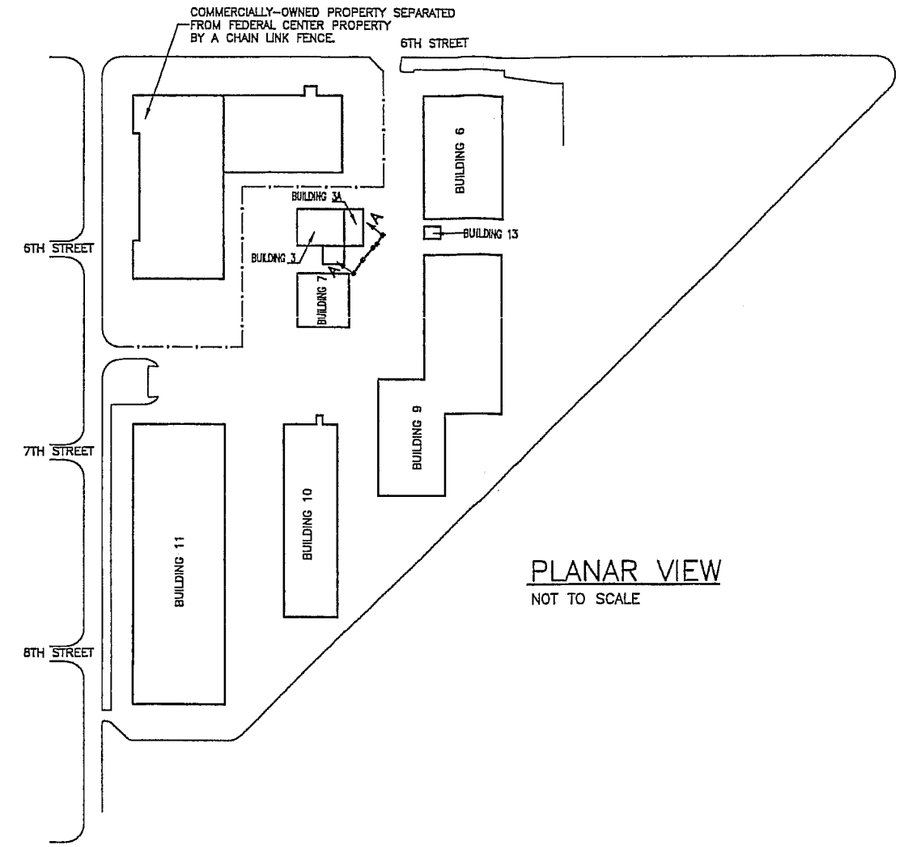
FILE NAME: HAVFIG7.DWG

DATE: FEB. 02



CROSS SECTION A–A'

SCALE AS SHOWN



PLANAR VIEW

NOT TO SCALE

LEGEND

- SAND SILTY CLAY
- SILTY CLAY
- FREE PHASE HYDROCARBONS
- WATER TABLE

GRAPHIC SCALE

VERTICAL 1' 5' 10'

SCALE: 1"= 5'–0"

GRAPHIC SCALE

HORIZONTAL 0 2' 10' 20'

SCALE: 1"= 10'–0"

C A P E
ENVIRONMENTAL MANAGEMENT I N C

2302 Parklake Drive, NE
Suite 200
Atlanta, GA 30345
(770) 908-7200

REVISIONS:

No.	Date	Remarks

APPROVED BY:

DATE:

PROJECT NAME:

GSA HEARTLAND
CORRECTIVE ACTION PLAN
FEDERAL CENTER

607 HARDESTY AVENUE
KANSAS CITY, MO

GSA PROJECT No. RMO 20490

SHEET TITLE:

FIGURE 8
CROSS SECTION

JOB NO: 8801C.012.000

SHEET NUMBER: FIGURE 8

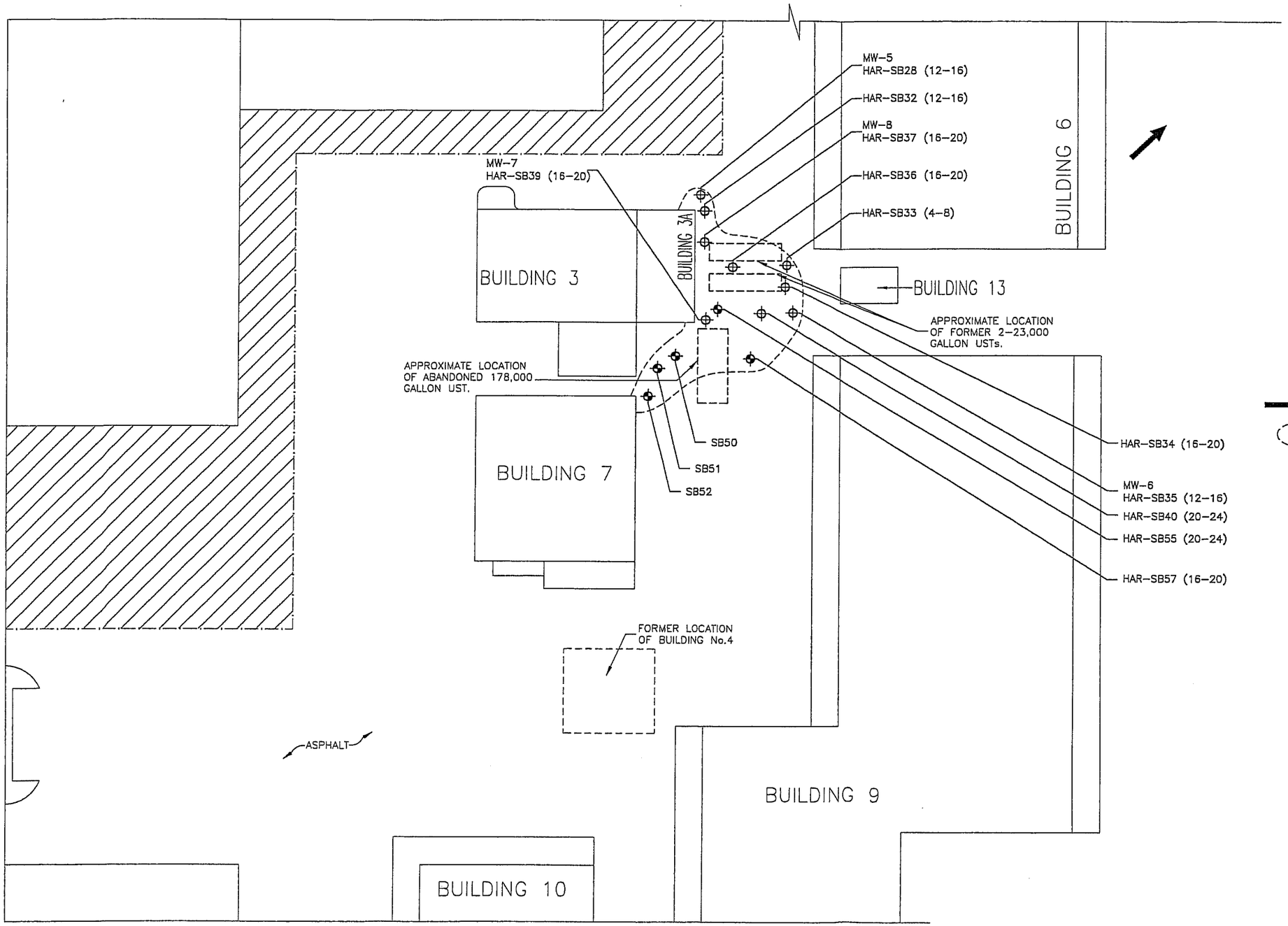
SHEET: 8 OF: 10

DRAWN BY: C.RIOS

CHECKED BY: K.NALAVALA

FILE NAME: HAVFIG8.DWG

DATE: FEB. 02



LEGEND

MW-5
HAR-SB28 (12-16) — SOIL BORING CONVERTED TO A PERMANENT GROUNDWATER MONITORING WELL

NEW BORING (INSTALLED 5/30/01-6/1/01) FOR HORIZONTAL AND VERTICAL DELINEATION

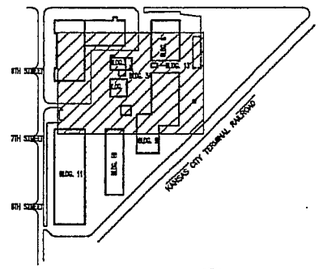
HAR-SB57(16-20)
- DEPTH OF PRODUCT (FEET)
- LOCATION NUMBER
- SOIL BORING
- HARDESTY

BORINGS INSTALLED DURING A SITE CHARACTERIZATION EFFORT (11/27/00-12/8/00)

HAR-SB22(16-20)
- DEPTH OF PRODUCT (FEET)
- LOCATION NUMBER
- SOIL BORING
- HARDESTY

ESTIMATED DIRECTION OF GROUNDWATER FLOW

PROPOSED AREA OF EXCAVATION



KEY PLAN
NOT TO SCALE

GRAPHIC SCALE

0 10' 60' 120'
SCALE: 1" = 60'-0"

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I N C
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Atlanta, GA 30345
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REVISIONS:

No.	Date	Remarks

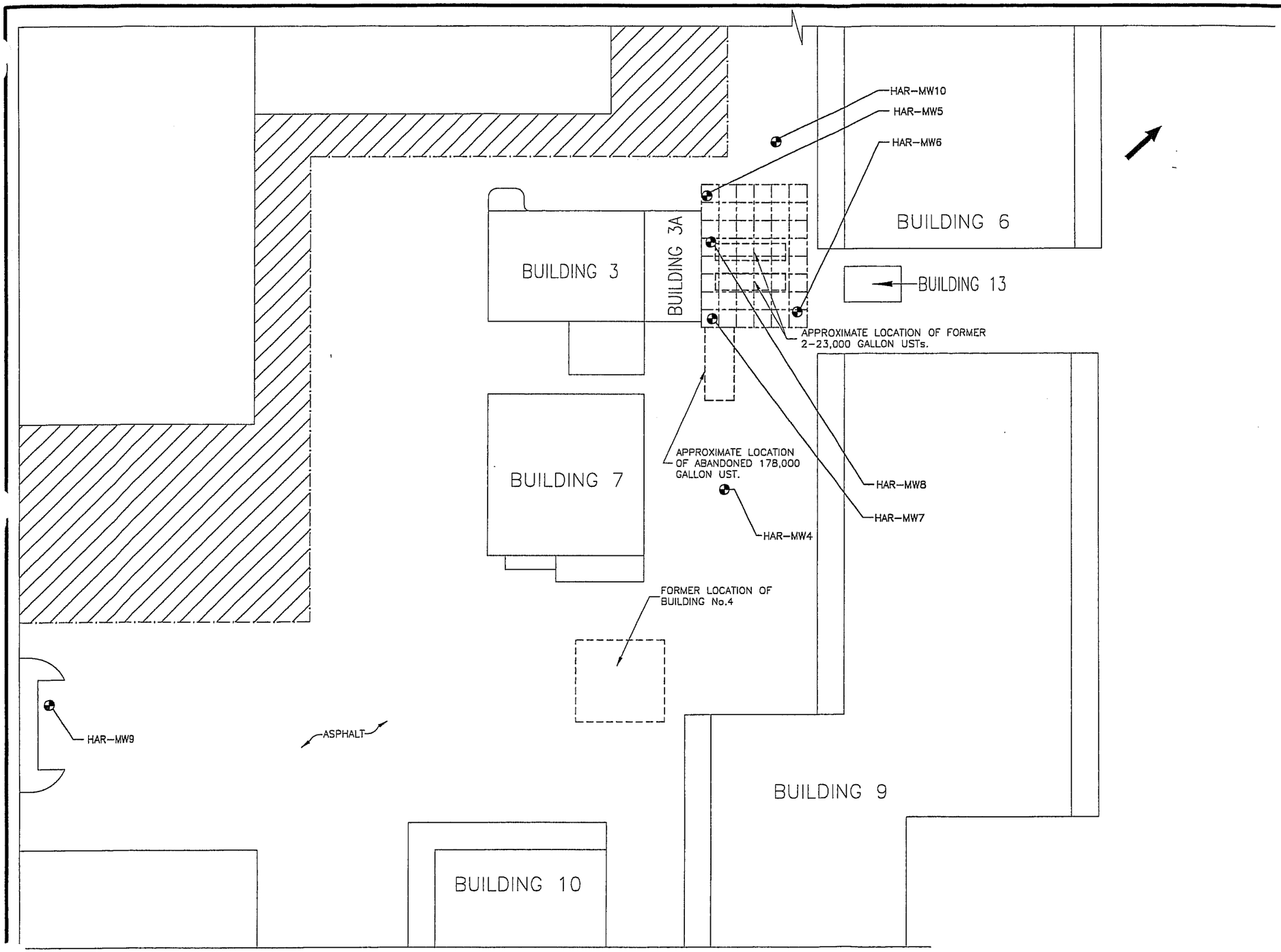
APPROVED BY:
DATE:

PROJECT NAME:
GSA HEARTLAND CORRECTIVE ACTION PLAN
FEDERAL CENTER
607 HARDESTY AVENUE
KANSAS CITY, MO
GSA PROJECT No. RMO 20490

SHEET TITLE:
FIGURE 9
PROPOSED AREA OF EXCAVATION

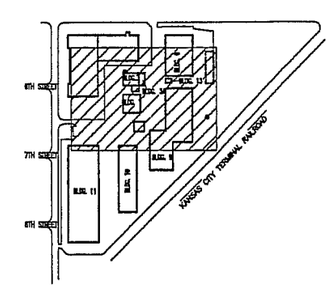
JOB NO: 8801C.012.000

SHEET NUMBER:	DRAWN BY:
FIGURE 9	C.RIOS
SHEET: 8 OF: 9	CHECKED BY: K.NALAVALA
FILE NAME: HAVFIG9.DWG	DATE: FEB. 02



LEGEND

- MONITORING WELLS USED FOR GROUNDWATER MONITORING
- HAR-MW7
  - LOCATION NUMBER
  - MONITORING WELL DESIGNATION
  - HARDESTY
- ESTIMATED DIRECTION OF GROUNDWATER FLOW
- DIRECT PUSH INJECTION GRID



KEY PLAN
NOT TO SCALE

N

GRAPHIC SCALE

0 10' 60' 120'

SCALE: 1" = 60'-0"

C A P E
ENVIRONMENTAL MANAGEMENT I N C
2302 Parklake Drive, NE
Suite 200
Atlanta, GA 30345
(770) 908-7200

REVISIONS:

No.	Date	Remarks

APPROVED BY:

DATE:

PROJECT NAME:

GSA HEARTLAND CORRECTIVE ACTION PLAN FEDERAL CENTER

607 HARDSEY AVENUE
KANSAS CITY, MO

GSA PROJECT No. RMO 20490

SHEET TITLE:

FIGURE 10
PROPOSED BIOREMEDIATION AND GROUNDWATER MONITORING SYSTEM LAYOUT

JOB NO: 8801C.012.000

SHEET NUMBER: FIGURE 10
SHEET: 10 OF: 10

DRAWN BY: C.RIOS

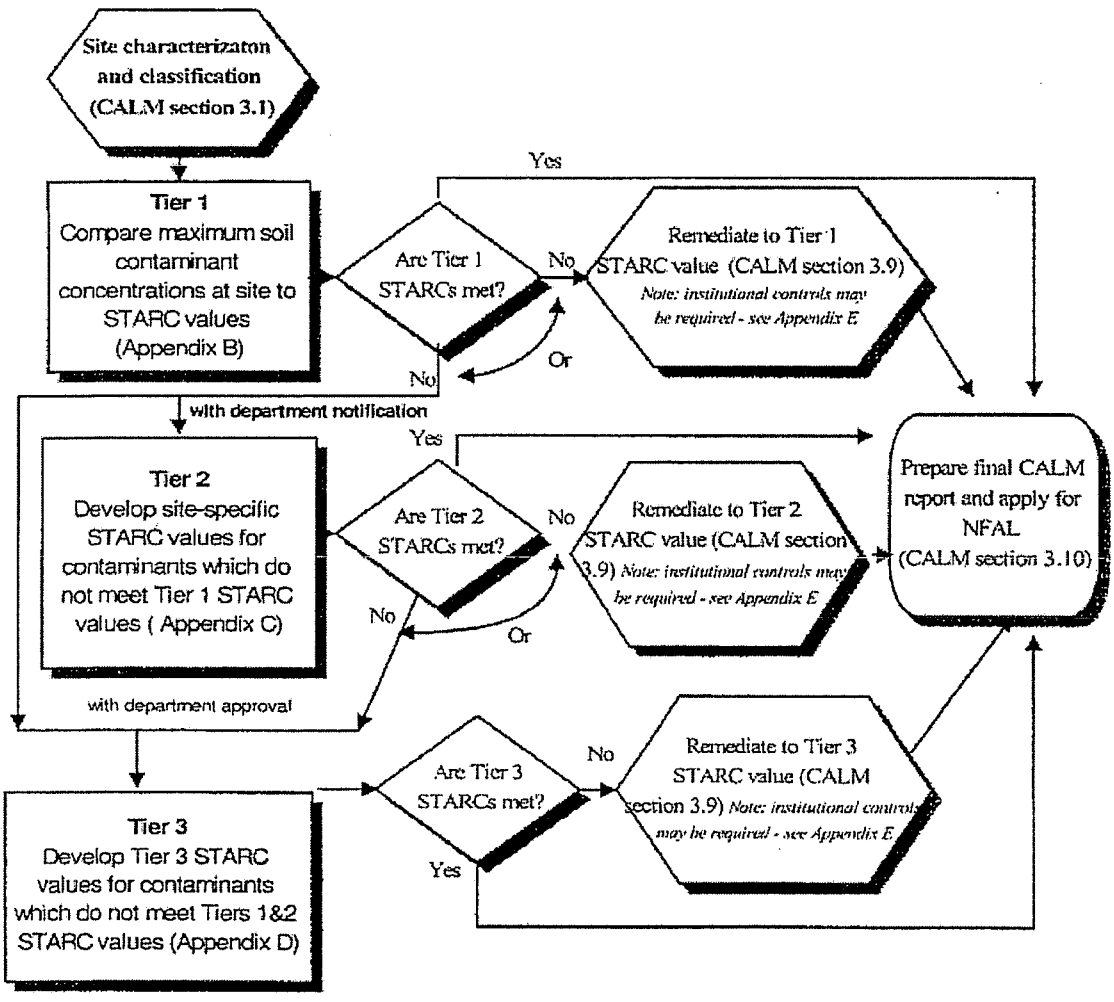
CHECKED BY: K.NALAVALA

FILE NAME: HAVFIG10.DWG

DATE: FEB. 02

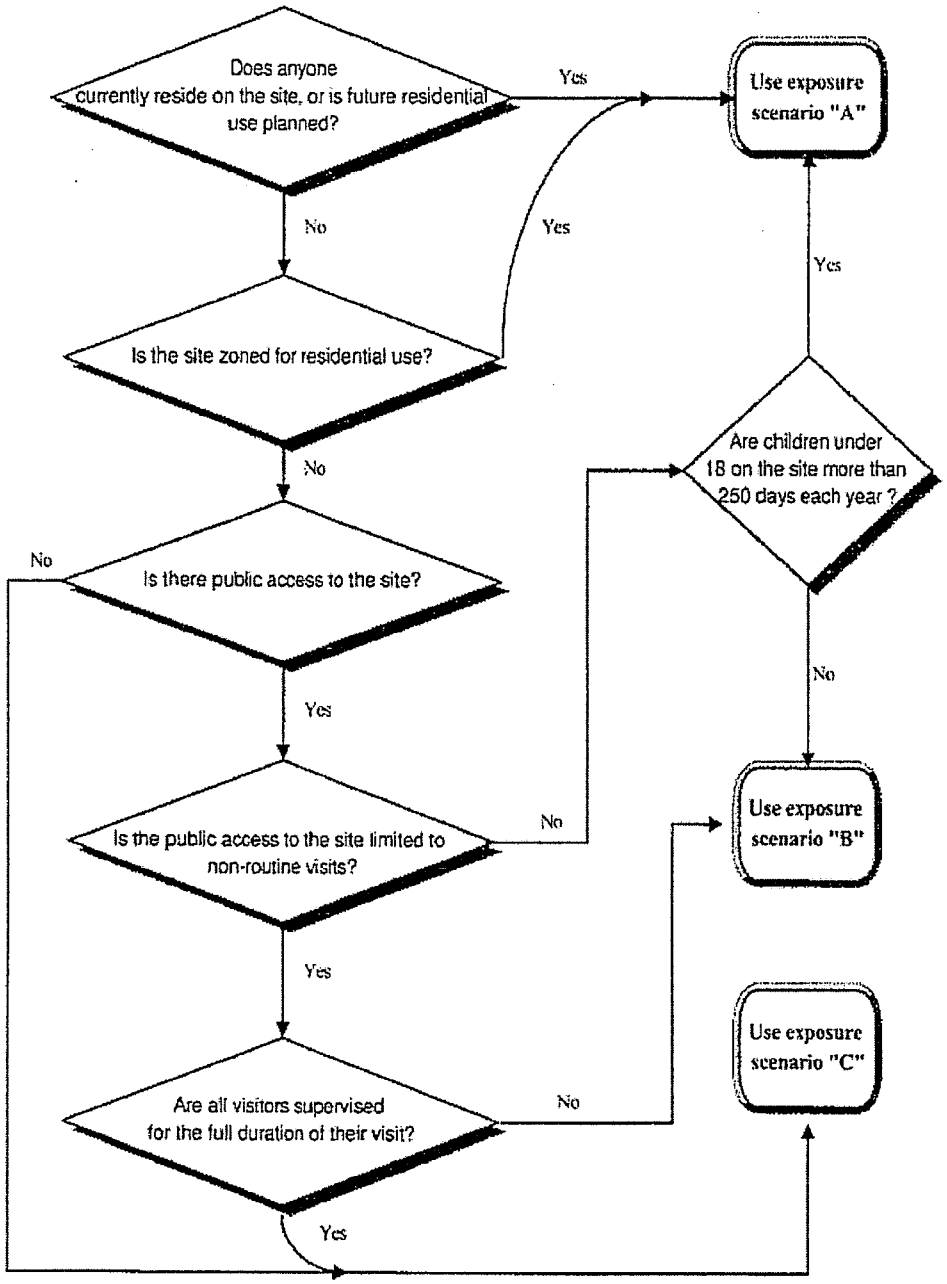
Appendix A

Overview of the CALM Selection Process From the *Cleanup Levels for Missouri* (MO DNR, 1998)


Site characterizaton and classification (CALM section 3.1)
Tier 1
Compare maximum soil contaminant concentrations at site to STARC values (Appendix B)
Are Tier 1 STARCs met?
Yes
No
Remediate to Tier 1 STARC value (CALM section 3.9)
Note: institutional controls may be required - see Appendix E
Or
No
with department notification
Tier 2
Develop site-specific STARC values for contaminants which do not meet Tier 1 STARC values (Appendix C)
Are Tier 2 STARCs met?
Yes
No
Remediate to Tier 2 STARC value (CALM section 3.9) Note: institutional controls may be required - see Appendix E
Or
No
with department approval
Prepare final CALM report and apply for NFAL (CALM section 3.10)
Tier 3
Develop Tier 3 STARC values for contaminants which do not meet Tiers 1&2 STARC values (Appendix D)
Are Tier 3 STARCs met?
No
Remediate to Tier 3 STARC value (CALM section 3.9) Note: institutional controls may be required - see Appendix E
Yes

Appendix B

Land Use Scenario Flow Chart
From the *Cleanup Levels for Missouri* (MO DNR, 1998)


Does anyone currently reside on the site, or is future residential use planned?
Yes
Use exposure scenario "A"
No
Yes
Yes
Is the site zoned for residential use?
No
Are children under 18 on the site more than 250 days each year ?
No
Is there public access to the site?
No
Yes
No
Use exposure scenario "B"
Is the public access to the site limited to non-routine visits?
Yes
Use exposure scenario "C"
Are all visitors supervised for the full duration of their visit?
No
Yes

Appendix C

Engineering Calculations and Slug Test Data

Engineering Calculations

Assumptions:
Flow velocity calculated using geometric K average from slug test data and Porosity assumed to be 0.30 (Fetter C.W. 1998, Applied Hydrogeology, Merill Publishing Company, New Jersey)

Calculations:

Note: Using Hvorslev Method to determine hydraulic conductivity

K is hydraulic Conductivity (ft/day)
r is the radius of the well casing (ft)
R is the radius of well screen (ft)
Le is the length of the well screen (ft)
To is the time it takes for the water level to rise or fall to 37 percent of the initial change (seconds)

Test-1

$$K = \frac{r^2 \ln(Le/R)}{2LeTo}$$

$$= \frac{0.006944 \times \ln(34/0.1667)}{2 \times 34 \times 1980}$$

$$= \mathbf{2.74 \times 10^{-7}\ ft/sec}$$

Test-2

$$K = \frac{r^2 \ln(Le/R)}{2LeTo}$$

$$= \frac{0.006944 \times \ln(34/0.1667)}{2 \times 34 \times 3540}$$

$$= \mathbf{1.53 \times 10^{-7}\ ft/sec}$$

Calculating Geometric Mean of K:

Hydraulic conductivity (K)	ln (K)
2.74×10^{-7}	-15.110
1.53×10^{-7}	-15.692
Sum: 1.71×10^{-5}	-30.802
mean ln(K):	-30.802/2 = -15.401
Geometric Mean = Exp[mean ln(K)]	$e^{-15.401}$ = **2.04×10^{-7} ft/sec**

Hydraulic Conductivity (K) = 2.04×10^{-7} ft/sec or 0.01762 ft/day

Seepage velocity (Vs)

$$= \frac{\text{Hydraulic conductivity (K) X Hydraulic gradient (I)}}{\text{Effective porosity } (n_e)}$$

$$= \frac{0.01762 \text{ X } 0.00411}{0.3}$$

$$= \mathbf{2.4 \text{ X } 10^{-3} \text{ feet/day}}$$

Appendix D

Detailed Cost Estimate Information

Table D-1
Cost Estimate for Enhanced In-Situ Bioremediation and Groundwater Monitoring

Category/Task	Quantity	Unit Measure	Unit Rate	Estimated Cost
Site Work				
Mobilization of construction equipment and facilities	1	ls	$20,000.00	$20,000.00
Mobilization of personnel	1	ls	$2,600.00	$2,600.00
Utility clearance	5	dy	$1,200.00	$6,000.00
Monitoring well installation	3	ls	$4,000.00	$12,000.00
Monitoring well development	3	ea.	$1,200.00	$3,600.00
Geoprobe soil boring (application of ORC)	4	dy	$1,500.00	$6,000.00
ORC purchase	13000	lb	$8.50	$110,500.00
ORC shipping	13000	lb	$0.25	$3,250.00
Water quality monitoring system (oxygen meter)	1	ea	$6,000.00	$6,000.00
Organic vapor analyzer	1	ea	$3,700.00	$3,700.00
Soil cuttings disposal (3 drums per well)	3	ea	$500.00	$1,500.00
System start-up (5% of component installation)	1	ls	-	$7,252.50
Site Restoration				
Restore vegetation and planting	0.1	ac	$23,963.00	$2,396.30
Demobilization				
Demobilization of construction equipment and facilities	1	ls	$5,300.00	$5,300.00
Demobilization of personnel	1	ls	$2,600.00	$2,600.00
Removal of temporary facilities	1	ls	$350.00	$350.00
Installation report	1	ls	$15,000.00	$15,000.00
			Subtotal Project Costs	**$208,048.80**
Design and Engineering				
Estimated as 10 percent of subtotal project costs				$20,804.88
Site Safety and Health				
Estimated as 5 percent of subtotal project costs				$10,402.44
Construction Oversight				
Estimated as 10 percent of subtotal project costs				$20,804.88
Permitting				
Estimated as 5 percent of subtotal project costs				$10,402.44
Unlisted Items				
15 percent of subtotal project costs				$31,207.32
			Estimated Capital Cost	**$301,670.76**
Semiannual Operation and Maintenance (Groundwater Monitoring)				
Labor for monitoring (8 monitoring wells, 2 events)	16	hr	$52.00	$832.00
Laboratory analysis (2 events)	16	sample	$675.00	$10,800.00
Monitoring reporting	1	ls	$20,000.00	$20,000.00
			Estimated O&M Cost (annual)	**$31,632.00**
			Present Worth Value of O&M Cost at 5 Years	**$136,950.74**
			Total Present Worth Cost	**$438,621.50**

Table D-2
Cost Estimate for Excavation and Off-Site Disposal

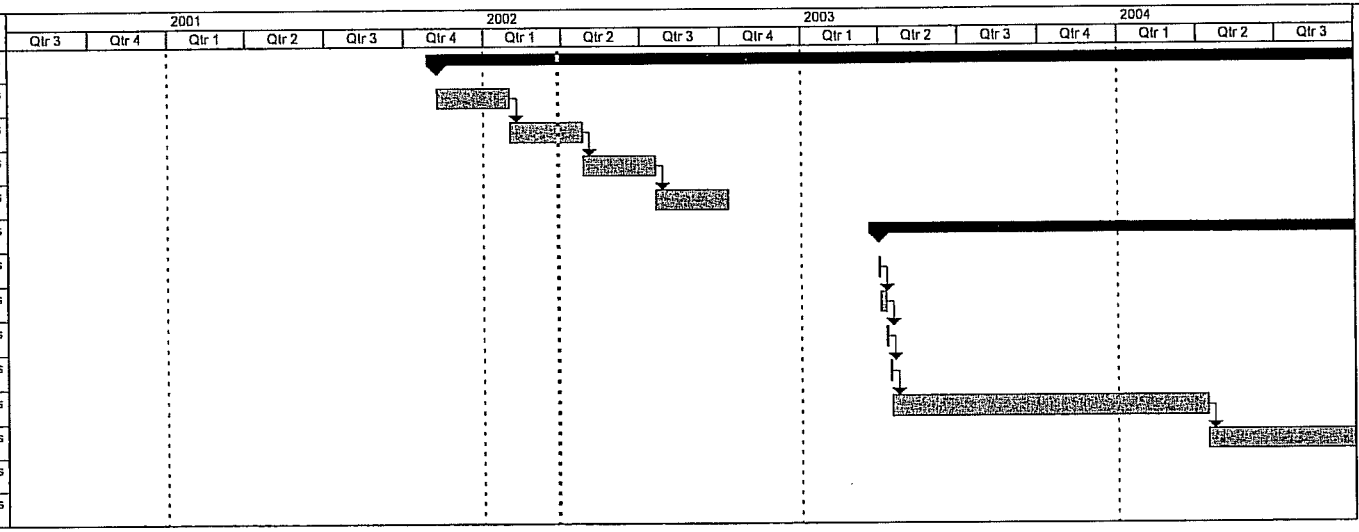
Category/Task	Quantity	Unit Measure	Unit Rate	Estimated Cost
Site Work				
Mobilization of Construction Equipment and Facilities	1	ls	-	$20,000.00
Mobilizaton of Personnel	1	ls	-	$2,600.00
Earthwork - soil excavation	5680	cy	$9.39	$53,335.20
Off-Site Contaminated Soil Disposal	5470	ton	$14.00	$76,580.00
Security, First Aid, Fire protection	1	ls	-	$4,400.00
Site Restoration				
Earthwork - backfilling	5680	cy	$12.75	$72,420.00
Restoration of Paved Areas	330	sy	$3.50	$1,155.00
Restore vegetation and planting (sod)	0.1	ac	$23,963.00	$2,396.30
Demobiliztion				
Demobilization of Construction Equipment and Facilities	1	ls	-	$5,300.00
Demobilizaton of Personnel	1	ls	-	$2,600.00
Removal of temporary facilities	1	ls	-	$350.00
Reporting	1	ls	-	$15,000.00
		Subtotal Project Costs		**$256,136.50**
Design and Engineering				
Estimated as 10 percent of subtotal project costs				$25,613.65
Site Safety and Health				
Estimated as 5 percent of subtotal project costs				$12,806.83
Construction Oversight				
Estimated as 10 percent of subtotal project costs				$25,613.65
Permitting				
Estimated as 5 percent of subtotal project costs				$12,806.83
Unlisted Items				
15 percent of subtotal project costs				$38,420.48
		Estimated Capital Cost		**$371,397.93**

Appendix E

Schedule of Implementation

Schedule for
GSA Hardesty Building 3A RAP
March 2002

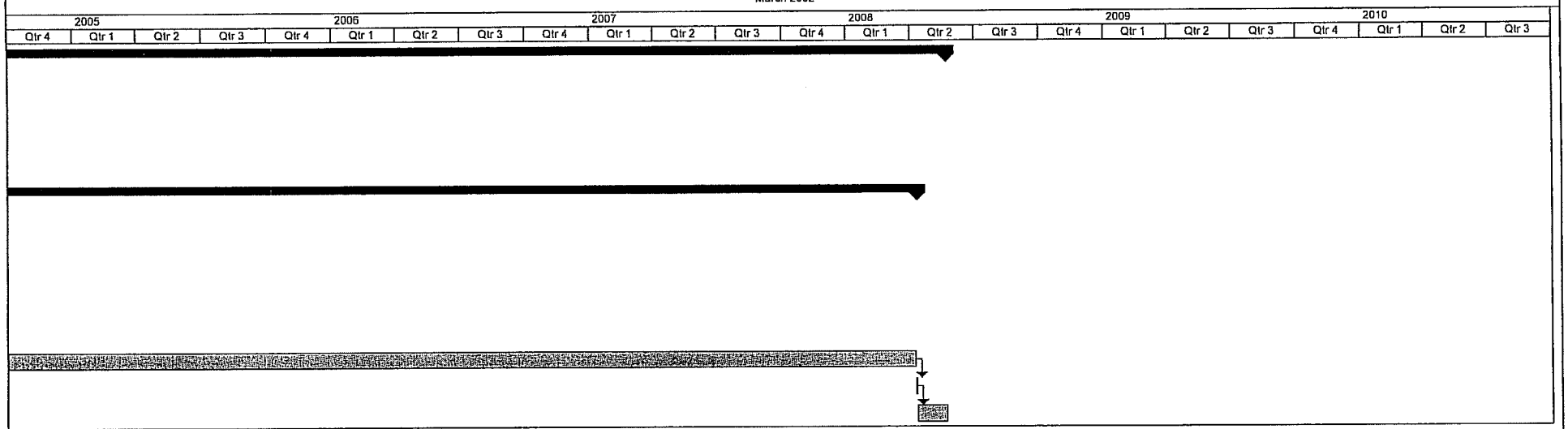
ID	Task Name	Duration
1	**Building 3A Unregulated Tanks RAP**	**1705 days**
2	Internal Draft RAP	60 days
3	Draft Final RAP	60 days
4	Final RAP	60 days
5	Preparation of Work Plans	60 days
6	**Field Work**	**1313 days**
7	Bioremediation Parameter Collection	2 days
8	Excavation	5 days
9	Remedial System Construction	2 days
10	Groundwater Monitoring Well Installation	2 days
11	Semiannual Monitoring and Reporting	260 days
12	Annual System Monitoring and Reporting	1040 days
13	Confirmation Sampling	2 days
14	Final CALM Report	30 days



Date: Wed 3/27/02

Task | Milestone | Rolled Up Task | Rolled Up Progress | External Tasks
Progress | Summary | Rolled Up Milestone | Split | Project Summary

Schedule for
GSA Hardesty Building 3A RAP
March 2002



Date: Wed 3/27/02

Task		Milestone		Rolled Up Task		Rolled Up Progress		External Tasks	
Progress		Summary		Rolled Up Milestone		Split		Project Summary	