PATRIOT ENGINEERING and ENVIRONMENTAL, Inc.

Engineering Value for Project Success

REMEDIATION WORK PLAN
FORMER JEFF'S SUPERLUBE SITE
402 N. HARRISON STREET
ALEXANDRIA, INDIANA
BFD #4160910; RLF CA# BF-00E48101-B
PATRIOT PROJECT NO. 18-1903-01E

Submitted to: **INDIANA BROWNFIELDS PROGRAM**
Ms. Katie Erny
Office of Land Quality
100 N. Senate Ave., Room 1276
Indianapolis, IN 46204

Submitted for: **CITY OF ALEXANDRIA**
Mr. Warren Brown
Department of Redevelopment
125 North Wayne Street
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Submitted by: **PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.**
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April 19, 2019

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1.0 INTRODUCTION

Patriot Engineering and Environmental, Inc. (Patriot) was retained for the City of Alexandria (City) by the Indiana Brownfields Program (IBP or Program) to prepare a Remediation Work Plan (RWP) for the Former Jeff's Superlube property, located at 402 N. Harrison Street, Alexandria, Madison County, Indiana (Site). The project is being funded through the United States Environmental Protection Agency (U.S. EPA) via a Revolving Loan Fund (RLF) Subgrant (RLF CA# BF-00E48101-B). The Site location is depicted on Figure 1. Regulatory closure of the Site is being pursued through IBP using the Indiana Department of Environmental Management's (IDEM's) Remediation Closure Guide (RCG). The Site was entered into the IBP and assigned BFD #4160910. Patriot, in preparing this RWP, relied on soil and groundwater data generated by another consultant and reported in the following document:

- *Phase II Environmental Site Assessment Report* (*IWM Consulting Group*, July 6, 2018)

A copy of this document is included in Attachment 1.

1.1 PROJECT IDENTIFICATION

The Site is located at 402 N. Harrison Street, Alexandria, Madison County, Indiana (Figure 1). The Site consists of four individual parcels totaling approximately 0.32 acre and is located in a mixed residential and commercial area on the north side of the Alexandria business district. The Site includes one single-story automotive service garage building that is currently vacant.

The City acquired the Site in August 2017 when Madison County assigned the Site to the Department of Redevelopment due to property tax delinquency. The Site was reportedly utilized as a service station from approximately1945 to 1993, and as an oil change operation from 1993 to 2012. According to the 2018 Phase II Environmental Site Assessment report, there are at least three underground storage tanks (USTs) at the Site in two separate locations (southeast and southwest tank pits), a possible fourth UST in one of the tank pits, as well as a hydraulic lift. In addition, a historic UST area located between the two known tank pits was identified from a 1949 Sanborn map, and a former dispenser island was located to the east of all of the UST basins. A hydraulic lift is located in the former building area in the west-central portion of the Site. The current Site layout is illustrated in Figure 2.

The Site is bordered to the north by a funeral home, to the west by a residential property, to the east by N. Harrison Street, followed by a residential property, and to the south by W. Broadway Street, followed by a commercial property (grocery store). According to the Alexandria, Indiana, quadrangle topographic map (United States Geological Survey [USGS] 2013), the Site is located in the Section 13, Township 21 North, Range 7 East in Monroe Township, Madison County, Indiana. The topography of the Site is relatively flat. The average ground surface elevation is approximately 860 feet above mean sea level.

The Site is currently owned by the City of Alexandria. The Site and project contacts are:

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Department of Redevelopment
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1.2 OVERVIEW OF CURRENT CONTAMINANT CONDITIONS

1.2.1 Discovery and Sources of Contamination

The 2018 Phase II Environmental Site Assessment report (Attachment 1) documented relatively low petroleum impacts to soil and groundwater; however, several individual constituent concentrations exceeded one or more IDEM RCG screening levels.

1.2.2 Remedial Measures Taken

No soil or groundwater remedial measures have been undertaken to date at the Site.

1.2.3 Existing Deed Restrictions, Land Use Restrictions, or Environmental Notices

There are currently no known deed or land use restrictions or environmental notices associated with the Site.

2.0 SITE BACKGROUND AND BASELINE PROJECT ASSESSMENT

The following sections present information on the Site history, summarize previous environmental investigations, and provide information on the physical location and setting, constituents of concern (COCs), and potentially complete contaminant exposure pathways.

2.1 SITE DESCRIPTION

The Site includes one single-story automotive service garage building that is currently vacant. The Site layout, including the UST and dispenser areas, the former UST area, and the building location is illustrated in Figure 2. The area around the building is paved with asphalt, with concrete over the former UST and dispenser areas. The area immediately north of the building is gravel-covered.

2.1.1 Hazardous Materials

There are no records of hazardous materials being historically used at the Site. The specific petroleum products historically used and/or stored at the Site during service station operations are unknown; however, potential products include gasoline, diesel fuel, kerosene, and/or waste motor oil.

2.1.2 Previous Investigation Activities

A Phase II ESA was performed at the Site in May 2018 and details of the work were reported in the *Phase II Environmental Site Assessment Report* (*IWM Consulting Group*, July 6, 2018), a copy of which is included in Attachment 1. A summary of the Phase II ESA is provided in the following paragraphs.

The scope of work of the Phase II ESA included a limited geophysical survey, along with advancement of eight soil borings and collection of soil and groundwater samples at each boring location. The boring locations are illustrated on Figure 2. The results are summarized in Tables 2 (soil) and 3 (groundwater) in the *Phase II Environmental Site Assessment Report* in Attachment 1. The data are also summarized graphically in Figures 4 and 5 in Attachment 1, respectively. The soil results indicated that 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and naphthalene concentrations exceeded the IDEM RCG soil migration to groundwater (MTG) screening levels in boring JS-GP1 (2-4'). In addition, naphthalene was also present above the MTG screening level in boring JS-GP4 (6-8'), JS-GP6 (6-6.75'), and JS-GP8 (4-6'), while the 1-methylnaphthalene concentration in boring JS-GP4 (6-8') also exceeded its MTG screening level.

The groundwater analytical results indicate benzene and naphthalene concentrations above the Tap Water screening level in borings JS-GP4 and JS-GP8. The naphthalene concentration in the groundwater sample from boring JS-GP5 also exceeded the Tap Water screening level, while the 1-methylnaphthalene concentrations in borings JS-GP4 and JS-GP5 exceeded the Tap Water screening level. Dissolved lead concentrations exceeded the Tap Water screening levels in boring JS-GP3 only.

2.2 Geographic Information

The political location information for the Site is:

County:	Madison
Township:	21N
Range:	7E
Section:	Southeast ¼ of Section 13
Latitude:	40º 16' 56.34"
Longitude:	-85 º 40' 28.84"

The ground surface elevation at the Site is approximately 860 feet above mean sea level (MSL) and the surface topography of the Site is relatively flat as shown on Figure 1. Storm water runoff at the Site is directed off-Site through sheet water flow to drains located on N. Harrison Street and W. Broadway Street. The nearest major drainage feature is Pipe Creek, which flows toward the west approximately 0.6 miles south of the Site. Based on topography, local groundwater flow in the general vicinity of the Site is likely to the south-southwest.

2.3 GEOLOGIC INFORMATION

2.3.1 Regional Geology

The Site is located in the Tipton Till Plan physiographic province of Indiana, and within the White River Basin. The Tipton Till Plain is a nearly flat glacial plain covering central Indiana, underlain by thick glacial till and slightly eroded by postglacial streams. The unconsolidated materials are approximately 100 feet thick in the Alexandria area and overlie Silurian-age limestone and dolomite of the Wabash and Pleasant Mill Formations and the Salamonie Dolomite, Cataract Formation, and Brassfield Limestone. A bedrock fault, the Fortville Fault, is present just east of Alexandria.

2.3.2 Regional Hydrogeology

There are two aquifers in the Alexandria area including a buried sand-and-gravel aquifer, and a carbonate bedrock aquifer. The buried sand-and-gravel aquifer, where continuous, can provide large amounts of water and is usually confined by layers of low-permeability till. Recharge is primarily through the overlying till, and aquifer thicknesses range from approximately 5 to 50 feet. Well yields typically range from approximately 10 to 250 gallons per minute (gpm). The carbonate bedrock aquifer in the Alexandria area is generally of relatively low permeability except in weathered areas. Thicknesses range from 40 to 300 feet but only the upper 150 feet is commonly tapped. Well yields of more than 100 gpm are possible in the carbonate bedrock aquifer.

Surface water runoff at the Site is primarily sheet flow. The edges and perimeter of the Site drain toward the property boundaries and into storm drains that are part of the City of Alexandria storm water sewer system.

A water well search was performed using the on-line database provided by the Indiana Department of Natural Resources (IDNR). A total of 259 wells were identified within an approximately two-mile radius of the Site, with the closest well located approximately 750 feet south of the Site, according to the IDNR Water Wells Enhanced Viewer. This well is identified as a 38-foot deep private well, screened in a gravel layer from 34-38 feet below grade and owned by Dyer Realty. The wells is listed as being used for a private water supply. A Water Well Record for this well is included in Attachment 2, along with a figure showing the locations of nearby wells, which was obtained using the IDNR Water Wells Enhanced Viewer.

According to the on-line IDEM Wellhead Proximity Determinator (Attachment 2), the Site is not located within a wellhead protection area.

2.3.3 Site Geology and Hydrogeology

Copies of the geologic logs for the borings advanced at the Site by IWM are included in the IWM Phase II ESA Report in Attachment 1. These logs were used to develop a geologic cross-section which is included as Figure 3. Based on this information, the Site geology consists of interbedded layers of silt, clay, and sand from the ground surface to a depth of approximately 20 feet below grade, the deepest penetration of any boring. In general, a clay layer is present from the ground surface to approximately 8 feet below grade, underlain by a silty sand layer approximately two feet thick. Below the silty sand layer is another clay unit which extends to approximately 12 feet below grade. Beneath this second clay unit are interbedded sands and silts extending to at least 20 feet below grade.

Groundwater was encountered during drilling in the both the shallow silty sand layer (8-10 feet below grade) and in the interbedded silt/sand unit at approximately 12 feet below grade. It is possible that these two units may be interconnected, although depth to water information obtained during the 2018 Phase II ESA suggested there may be two separate water-bearing units. The groundwater elevation contour map included in the Phase II ESA report (Attachment 1) shows radial flow from an apparent mound centered on the former tank pit area in the south-central portion of the Site. However, due to the wide range of depth-to-water data (difference of more than 12 feet between the shallowest and deepest values) and the possibility that the temporary wells were completed in different water-bearing units, the actual groundwater flow direction cannot be determined at this time.

2.4 ECOLOGIC INFORMATION

The nearest potential ecological feature is Pipe Creek, located approximately 0.6 miles south-southwest of the Site. Pipe Creek is also the closest major drainage feature and flows toward the west-southwest on the south edge of Alexandria.

The U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) Interactive Mapper (USFWS, 2009) shows various mapped wetlands along Pipe Creek to the south and east of the Site (Attachment 3), including freshwater forested/shrub wetlands and riverine areas. All of these areas are more than 3,000 feet from the Site.

The IDNR lists nine mollusks, three insects, one amphibian, five birds, two mammals, and nine plants on their Madison County threatened, endangered or rare species list (Attachment 5). Based on the location of the Site in an urban area that has been developed for more than 100 years, it is highly unlikely that any of these species would be present on or near the Site.

2.5 POTENTIALLY SUSCEPTIBLE AREAS AND RECEPTORS

2.5.1 Potentially Susceptible Water Supply Sources

Water from the municipal supply (City of Alexandria, which obtains its water from a municipal well field) is available in the Site area. Per the IDEM Wellhead Proximity Determinator on-line database (Attachment 2), the Site is not located in a wellhead protection area.

The IDNR water well mapper was used to identify water supply wells at or near the Site (Attachment 2). There are no water supply wells at the Site or at any of the nearby properties, all of which is provided with potable water by the City of Alexandria. A total of 259 wells were identified within an approximately two-mile radius of the Site, with the closest well located approximately 750 feet south of the Site, according to the IDNR Water Wells Enhanced Viewer. This well is identified as a 38-foot deep private well, screened in a gravel layer from 34-38 feet below grade and owned by Dyer Realty. The well is listed as being used for a private water supply. A Water Well Record for this well is included in Attachment 2, along with a figure showing the locations of nearby wells, which was obtained using the IDNR Water Wells Enhanced Viewer.

2.5.2 Potentially Susceptible Geological Areas

According to the Indiana Geological Survey (IGS), the Site is not located in or near a Karst area (IGS, 2009). No other potentially susceptible geologic features, such as mined areas or fractured rock areas, are located near the Site.

2.5.3 Potentially Susceptible Human Receptors

The building at the Site is currently vacant. Vapor intrusion to the building is theoretically possible, based on the results of the investigation which identified naphthalene concentrations in groundwater in two on-Site wells at concentrations exceeding the residential groundwater migration to indoor air screening levels. However, there are no known utilities crossing the impacted area and connecting to the Site building. Also, as indicated in Section 5.4.3 of the IDEM Remediation Closure Guide (RCG), petroleum vapor intrusion generally does not occur when at least five feet of clean, unsaturated soil is present between the petroleum impacts and the building in question.

The presence of naphthalene in soil and groundwater in close proximity to the southern edge of the building means that the potential for vapor intrusion to the building cannot be completely ruled out. However, since the depth to water at this Site is greater than five feet, vapor intrusion is unlikely for the on-Site building.

The nearest residential area is located adjacent to the western edge of the Site. Vapor intrusion in these areas related to the Site is unlikely but cannot currently be ruled out as long as groundwater impacts are above residential vapor intrusion from groundwater screening levels (VIGWSLs). The nearest school is St. Mary Elementary School, located approximately 3,500 feet west of the Site. This area has no potential for vapor intrusion impacts from the Site, based on the distance and location respective to the Site.

2.5.4 Potentially Susceptible Ecological Areas

There are no natural areas located on-Site. Off-site ecological areas are not anticipated to be impacted due to the distance to the areas as described previously.

2.6 CHEMICALS OF POTENTIAL CONCERN

COCs detected above IDEM RCG screening levels present potential threats to human health and are considered as chemicals of potential concern (COPCs) that need to be addressed in remediation plans for the Site. Based on investigation results, COPCs in the indicated media are summarized below:

Shallow and Subsurface Soil	On-Site Groundwater	Off-Site Soil	Off-Site Groundwater
1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, Naphthalene, 1-Methylnaphthalene, 2-Methylnaphthalene	Benzene, Naphthalene, 1-Methylnaphthalene, Lead	None	Benzene, Naphthalene,1-Methylnaphthalene, Lead

Other common petroleum COPCs, such as toluene, ethylbenzene, xylenes, and various PAHs may also be present in soil and/or groundwater in the former UST system areas. Attachment 4 includes information on the chemical, physical, and toxicological properties of these COPCs.

Soil and groundwater data are summarized in Tables 2, and 3, respectively, in the *Phase II Environmental Site Assessment Report* (IWM, July 6, 2018) included in Attachment 1 and soil and groundwater impacts exceeding IDEM residential and/or commercial/industrial screening levels depicted on Figures 4 and 5 of that report, respectively.

2.7 POTENTIAL CONTAMINANT TRANSPORT MECHANISMS

Surface soils in unpaved areas are not known to be impacted; therefore, surface runoff of soil contaminants will not occur. Subsurface soil contaminants could be leached to groundwater by storm water infiltration. Groundwater contaminants could be transported to down-gradient locations through groundwater flow.

COPCs such as benzene, toluene, ethylbenzene, xylenes, and naphthalene are volatile compounds that could volatilize upward through the subsurface. The potential for volatilization to the indoor air of the Site building at unacceptable concentrations is unlikely based on Section 5.4.3 of the IDEM Remediation Closure Guide (RCG), which states that petroleum vapor intrusion generally does not occur when at least five feet of clean, unsaturated soil is present between the petroleum impacts and the building in question. However, although the depth to water at this Site is greater than five feet, soil impacts (naphthalene) are present in close proximity to the south side of the existing building. Consequently, the potential for vapor intrusion to the building cannot be ruled out. Volatile COPCs could also potentially move laterally along preferential pathways, such as subsurface utility lines, and be transported to surrounding properties; however, there are no known utilities crossing the impacted area as detailed in Section 2.5.3 and shown on Figure 2.

2.8 POTENTIAL HUMAN EXPOSURE PATHWAYS

The potentially susceptible areas discussed in Section 2.5 were evaluated in conjunction with the contaminated media, their locations and depths, potential transport mechanisms, and proposed land use to determine potentially complete human exposure pathways at the Site and surrounding properties. Potential receptors and potentially complete exposure pathways are summarized in the following table:

Potential Receptor	Potential Complete Exposure Pathways
On-Site or Off-Site excavation workers	Inhalation of vapors containing elevated levels of COPCs; accidental ingestion of impacted groundwater
On-Site commercial workers	Inhalation of vapors containing elevated levels of

	COPCs

The potentially complete human exposure pathways are depicted graphically on the Conceptual Site Model (CSM) presented in Figure 4.

3.0 ADDITIONAL FIELD INVESTIGATION REQUIREMENTS

The investigations performed to date have not delineated the extent of the released compounds to RCG screening levels in soil and groundwater. The extent of soil impacts should be able to be delineated as part of the proposed remedial activities (UST closure/soil excavation, detailed in the following section), while post-remediation groundwater monitoring from a monitoring well network to be installed following completion of remedial activities will complete delineation of groundwater impacts.

4.0 REMEDIATION PLAN

The objective of remedial efforts is to reduce the COPC concentrations in on-Site soils and groundwater, resulting in subsequent reductions in off-Site impacts via natural attenuation to the point where groundwater monitoring can demonstrate plume stability. This would result in a restricted Site closure using Environmental Restrictive Covenants (ERCs) to prohibit groundwater use and restrict the impacted property use(s) to commercial/industrial purposes. Because commercial Site users will not be exposed to subsurface soil, and groundwater will not be used at the Site or in the surrounding area because they are connected to a municipal water supply, there are no currently complete exposure pathways for the soil and groundwater. Therefore, remediation goals will focus on eliminating the potential for future vapor intrusion by reducing the VOC concentrations in the on-Site soils and the on-Site/off-Site groundwater to below the applicable IDEM RCG screening levels. The remediation goals for the Site are as follows:

- Soils – IDEM RCG Commercial/Industrial Direct Contact Screening Levels
- On-Site Groundwater – Commercial/Industrial VIGWSLs
- Off-Site Groundwater – Residential VIGWSLs and Tap Water Screening Levels

These remediation goals are reasonable for the land use scenarios at the Site. The remediation goals for on-Site soil and groundwater and for off-Site groundwater are listed below.

COPC	On-Site Subsurface Soil (mg/kg)	On-Site/Off-Site Commercial/Industrial Vapor Intrusion Groundwater Screening Levels	On-Site/Off-Site Tap Water Screening Levels (ug/L)
Benzene	1,800	120	5
Ethylbenzene	480	NL	700
Toluene	820	NL	1,000
Xylenes	260	NL	10,000
n-Propylbenzene	260	NL	660
n-Hexane	140	NL	1,500
1,2,4-Trimethylbenzene	220	NL	15
1,3,5-Trimethylbenzene	180	NL	120
Naphthalene	3,100	460	1.7
1-Methylnaphthalene	390	NL	11
2-Methylnaphthalene	6,800	NL	36
Benzo(a)anthracene	29	NL	0.12
Lead	800	NL	15
		NL	

4.1 EVALUATION OF REMEDIATION ALTERNATIVES

There is usually more than one technology available to achieve remediation objectives at any given site. These alternatives are considered and compared as part of the evaluation process leading to the selection of a remedial approach. Site geologic and hydrogeologic characteristics, cleanup objectives and the contaminants targeted for remediation play a primary role in selecting the appropriate remediation strategy. The estimated time to achieve regulatory closure and potential interruptions to ongoing site activities can also play a role in the selection of an applicable remedy. Overall costs are also a factor. The following remediation technologies were evaluated with respect to these criteria.

- Soil Excavation
- Groundwater Pump and Treat
- Air Sparging/Soil Vapor Extraction (AS/SVE)
- Chemical Oxidation/Enhanced Bioremediation

4.1.1 Soil Excavation

Soil impacts exceeding IDEM RCG Migration to Groundwater Screening Levels were identified in several locations in the former UST system area. In addition, the UST system (including tanks and piping), as well as a former hydraulic lift, are still present at the Site. Removal of the UST system and hydraulic lift to prevent possible future release(s) from fluids still present in the system is an essential component of the remedial approach for this Site. In addition, excavation of impacted soils identified during UST system and hydraulic lift closure activities is also a potentially cost-effective and viable remedial option for this Site.

4.1.2 Groundwater Pump and Treat

Groundwater Pump and Treat (P&T) is an ex-situ remedial technology designed to reduce concentrations of contaminants dissolved in groundwater and adsorbed to saturated soil by removing contaminated groundwater from the subsurface by pumping, and then treating the water before it is discharged. P&T is not typically an effective means of removing dissolved-phase constituents from groundwater, compared to other mechanical removal technologies such as AS/SVE, and is primarily used only when plume control or capture is required. Most P&T systems quickly become diffusion-limited and are not cost-effective except when plume capture is necessary.

The relatively thin upper saturated unit and the probable low permeability of the silt/sand lower saturated zone renders conventional P&T unlikely at this Site. Vacuum-enhanced P&T (also known as dual-phase extraction, or DPE) is a technically-feasible remedial technology at this Site; however, the capital costs to design, install, and operate/maintain a P&T system are impractical with respect to the anticipated benefits, particularly given the relatively low groundwater impacts. Consequently, since plume capture does not appear to be critical, P&T and DPE, although viable options, are not the most appropriate approach for this Site.

4.1.3 Air Sparging/Soil Vapor Extraction

Air sparging (AS) is an in-situ remedial technology that reduces concentrations of volatile organic constituents that are adsorbed to soil and dissolved in groundwater. This technology involves the injection of contaminant-free air into saturated soil, enabling a phase transfer of contaminants from a dissolved state to a vapor phase that travels into the unsaturated zone. The air is then vented to the surface through soil vapor extraction (SVE) mechanisms and treated as necessary. The same SVE system not only removes the sparged vapors, it also remediates unsaturated soil by using a vacuum to create airflow through the subsurface soil.

The continual flow of air results in volatilization of contaminants either from adsorbed phase or free phase and ultimate removal by the system.

The geology at this Site is not suitable for AS/SVE, due to the lack of an adequate vadose zone to capture sparged vapors, and the probable low permeability of the saturated units. In addition, as with P&T, the capital costs to design, install, and operate/maintain a AS/SVE system would be high.

4.1.4 In-Situ Chemical Oxidation (ISCO)/Enhanced Bioremediation

In-situ chemical oxidation (ISCO) involves injection of chemicals into the subsurface to rapidly oxidize adsorbed- and dissolved-phase hydrocarbons. Various chemicals have been employed in ISCO approaches, including persulfates, percarbonates, permanganates, hydrogen peroxide, and Fenton's reagent. The relatively small impacted on-Site area makes it a viable candidate for chemical oxidation; however, the COPC concentrations are not high enough to warrant such an aggressive approach.

Enhanced bioremediation for petroleum hydrocarbons involves injection of slow-release oxygen compounds into the impacted area to enhance long-term aerobic biodegradation of VOCs and PAHs via native microorganisms. It is seldom necessary to add aerobic bacteria to such injections, as they are almost always present in high concentrations at most sites and simply need oxygen to increase their degradation rate. Based on the size of the impacted area, enhanced aerobic biodegradation via addition of oxygen-releasing compounds to the base of the excavated area (and/or via injection) appears to be a viable, cost-effective option for this Site in conjunction with soil excavation.

The use of either of these options without removing the USTs and associated impacted soils is not a viable approach, since the USTs and residual soil impacts could continue to act as a source to impact groundwater. However, enhanced bioremediation in combination with UST closure/soil excavation may be an effective option to enhance aerobic biodegradation of residual soil/groundwater impacts.

4.1.5 Monitored Natural Attenuation/Plume Stability Monitoring

Monitored natural attenuation (MNA) and plume stability monitoring relies on natural attenuation mechanisms to degrade petroleum hydrocarbons in soil and groundwater without other remedial efforts. If it can be demonstrated via statistical analysis that the plume is stable or receding, and is not or will not impact downgradient receptors, site closure can be achieved with institutional controls, specifically environmental restrictive covenants (ERCs) on properties where impacts exceed residential screening levels. Monitoring must be performed for a minimum of eight consecutive quarters in order to obtain sufficient data to perform a valid statistical analysis.

Without removal of the USTs and hydraulic lift, and excavation of associated impacted soils, MNA/plume stability is not a viable option for this Site, since it would inhibit redevelopment. However, following removal of the USTs and excavation of impacted soils, MNA/plume stability is a viable component of the remedial strategy for this Site.

4.1.6 Remedial Cost Evaluation of Viable Options

Focused soil excavation, in combination with UST system/hydraulic lift removal, and enhanced bioremediation via oxygen releasing compound application/injection is a practical, potentially cost-effective remedial option. Groundwater P&T would require the design, construction, and operation/maintenance of mechanical systems to remediate impacted groundwater, with attendant capital costs. ISCO has no capital costs, but is overly aggressive for this Site. MNA/plume stability, while not a viable option by itself, appears to be a good complement to remedial activities. The estimated total project costs for each option, including groundwater monitoring and closure reporting/well abandonment, are summarized below:

Soil Excavation/Enhanced Bio*	**Annual Cost**	**Total Cost**
UST Closure/Soil Excavation	$115,000	$115,000
Monitoring Well Installation	$8,500	$8,500
Groundwater Monitoring/Reporting	$8,000/yr.	$16,000
Closure/Well Abandonment	$3,500	$3,500
	Estimated Total Cost	*$140,700*

*Includes UST system/hydraulic lift removal/closure

Groundwater P&T*	Annual Cost	Total Cost
Capital Cost (System Installation)	$175,000	$175,000
Operation & Maintenance (O&M)	$40,000/yr.	$40,000 - $120,000
Monitoring Well Installation	$8,500	$8,500
Groundwater Monitoring/Reporting	$8,000/yr.	$24,000 - $40,000
Closure/Well Abandonment**	$3,500	$3,500
	Estimated Total Cost	*$251,000 - $347,000*

*Assumes 1-3 years of system operation, plus two years of post-operation groundwater monitoring

** Includes decommissioning of remedial system/electrical power drop

As this analysis indicates, Soil Excavation/Enhanced Bio is clearly the best option for this Site.

4.2 RECOMMENDED REMEDIATION STRATEGY

As detailed in the preceding paragraphs, UST system closure with focused soil excavation/enhanced Bio appears to be the most efficient, cost-effective option to address the residual impacts at this Site. The UST closure/soil excavation/enhanced bioremediation approach will be combined with installation of a permanent monitoring well network and completion of plume stability monitoring, as well as the use of ERCs, as necessary, to prohibit groundwater use and prevent future exposure. Details of the proposed implementation of this approach are provided in the following sections.

4.3 REMEDIATION STRATEGY IMPLEMENTATION

Excavation and Removal of USTs

The UST system closure activities will include excavation, cleaning, and removal of up to four USTs, which for the purposes of this RWP are assumed to include three 3,000-gallon capacity gasoline USTs and one, 1,000-gallon capacity waste oil UST. UST removal activities will be performed by an Indiana-licensed UST removal contractor.

Removal of Liquid/Sludge from USTs

During the excavation and removal process, up to 1,500 gallons of petroleum-contaminated liquid and/or sludge will be removed from the Site, if necessary.

Confirmatory Soil Sampling

Upon the completion of UST excavation, cleaning and removal, the excavation area will be evaluated for stained soils, free product, petroleum-type odors, and VOCs using a photoionization detector (PID).

Confirmatory sampling will be performed in accordance with the IDEM RCG, the IDEM RPG, and the UST Closure Assessment Guidelines, as well as the project-specific Quality Assurance Project Plan (QAPP). In addition, it is assumed that two soil samples will be collected from below the hydraulic lift area. All of the samples will be contained in laboratory-supplied sample jars, labeled, and stored in a cooler on ice for submittal to Pace Analytical Services, Inc (Pace) using chain-of-custody controls. Samples will be analyzed in accordance with the IDEM RCG analytical requirements for gasoline, diesel, and used oil USTs. The samples for soil VOC analysis will be collected using Terra Core samplers in accordance with U.S. EPA Method 5035. If a water sample is collected from the UST pit, analysis for lead scavengers would be performed using U.S. EPA Method 8011.

Over-Excavation of Petroleum Impacted Soil

Concurrently with UST system removal, up to 1,500 tons of petroleum-impacted soil will be excavated and removed from the Site, including in the hydraulic lift area. The contaminated soils that exhibit the highest adsorbed/dissolved concentrations of petroleum hydrocarbons will be excavated and transported to the Waste Management Jay County landfill in Portland, Indiana, located approximately 35 miles east of the Site.

The soils will be monitored during excavation for evidence of contamination, including staining, odors, and VOC measurements on the PID. Contaminated soil will be loaded directly into dump trucks for transportation to the selected disposal facility. Excavation and disposal of contaminated soil will continue vertically and horizontally until field screening indicates that all contaminated soil has been excavated or until 1,500 tons of soil has been removed from the Site.

Over-Excavation Confirmatory Soil Sampling

Additional confirmatory soil samples will be collected, as necessary, at the conclusion of the over-excavation activities. Samples will be collected in accordance with the IDEM RCG, the IDEM RPG, and the UST Closure Assessment Guidelines, as well as the project-specific Quality Assurance Project Plan (QAPP), using the methodology described above.

Application of Oxygen-Releasing Compound (ORC)

Following completion of the soil excavation and confirmatory sampling, approximately 1,000 pounds of ORC will be applied to the base of the excavation area and mixed into the upper portion of the water-bearing zone. ORC is a proprietary formulation of food-grade calcium oxy-hydroxide manufactured by Regenesis that increases the dissolved oxygen content in the subsurface, enhancing aerobic biodegradation of petroleum hydrocarbon compounds.

4.4 HEALTH AND SAFETY PLAN

A Site-specific Health and Safety Plan (HASP) was prepared for the remediation and monitoring activities. The plan includes elements contained in 29 CFR 1910.120. The HASP can be found as Attachment 5. The HASP was and will be reviewed with all field personnel prior to beginning each day's activities. Visitors to the Site during monitoring activities will also be required to review and comply with the HASP.

5.0 MONITORING/CONFIRMATION SAMPLING PLAN

This section describes the long-term monitoring plan for the Site, including soil sampling, groundwater monitoring, sample collection methods, and post remedial action confirmation sampling.

5.1 SOIL CONFIRMATION SAMPLING

The purpose of soil confirmation sampling (if necessary) is typically used to verify the effectiveness of the remediation strategy and attainment of the proposed cleanup objectives. At this Site, soil confirmation sampling will be performed following UST system removal and focused soil excavation. Sampling will be performed in accordance with the project-specific QAPP.

5.2 GROUNDWATER MONITORING

The purpose of groundwater monitoring is to verify the effectiveness of the remediation strategy and evaluate the progress of attaining the proposed cleanup objectives.

Groundwater Monitoring Well Installation

Following the completion of the UST closure and subsurface investigation, a monitoring well network consisting of five 2-inch diameter groundwater monitoring wells (MW-1 through MW-5) will be installed at the Site. The groundwater monitoring wells will be installed utilizing a Geoprobe® with hollow-stem augers or a hollow stem auger (HAS) drill rig. The wells will be screened in the appropriate saturated zone and constructed of Schedule 40 flush-threaded PVC with 10-foot 0.010-inch factory slotted screens. The screens will be positioned to account for season fluctuations within the groundwater level. The annular space around the well screens will be surrounded by washed quartz sand then capped with a minimum of 2-feet of hydrated bentonite. The remaining annular space will be filled with grout to the ground surface. The well tops will be completed with a locking manhole and flush-mounted protective cover set in a concrete pad.

Groundwater Monitoring Well Survey and Development

The groundwater monitoring wells will be surveyed relative to an arbitrary datum, set to 100 feet, with an accuracy of 0.01 foot vertical. The surveying rod will be placed on a marked point on the northern edge of the casing of each well to obtain the well’s top of casing (TOC) measurement. In addition, GPS readings will be taken to obtain the latitude and longitude of each well.

The groundwater monitoring wells will be developed to provide adequate hydraulic communication between the wells and the surrounding water-bearing formation, and to ensure that the well yields representative water samples. Well development will involve removing a minimum of five volumes of water from the monitoring well using a purge pump.

Quarterly Groundwater Sampling

Following well installation, a quarterly monitoring program will be initiated and will continue for eight consecutive quarters. Sampling will be performed in accordance with the project-specific QAPP. Prior to sampling the monitoring wells, the depth to groundwater will be measured from a marked position on the north side of each well casing with an electronic water level meter to the nearest 0.01-foot. The water level meter will be properly decontaminated with an Alconox/distilled water rinse to prevent cross contamination. The groundwater levels will be used to determine groundwater flow.

The monitoring wells will be sampled using low-flow purging/sampling techniques in general accordance with the micro-purge sampling method outlined in the IDEM Micro-Purge Sampling Option Technical Guidance Document (TGD) (June 3, 1998, revised November 3, 2009) and applicable Patriot SOP(s).

A submersible pump will be used to purge and sample the monitoring wells at low flow rates of less than or equal to 400-500 milliliters per minute (ml/min). During low-flow purging, a multi parameter water quality probe with a flow through cell will be used to measure temperature, conductivity, turbidity, DO, pH, and ORP. Parameters will be measured every three (3) to five (5) minutes and will be recorded on field logs. Groundwater samples will be collected once the parameter values stabilize in accordance with the criteria stated in the IDEM Micro-Purge TGD. The pump will be decontaminated after use at each well and new disposable polyethylene tubing will be used at each well location. Note that the first groundwater sampling event will not occur until a minimum of 48 hours after the development of the groundwater wells.

The groundwater samples collected each quarter will be analyzed for:

- VOCs by U.S. EPA Method 8260;
- PAHs by U.S. EPA Method 8270SIM;
- Total lead by U.S. EPA Method 6010, and,
- Lead scavengers by U.S. EPA Method 8011.

One duplicate and one trip blank sample will be submitted for laboratory analysis for QA/QC.

Quarterly Groundwater Sampling Reports

A report will be prepared following the completion of each quarterly sampling event and receipt of the laboratory analytical data. The report will include a narrative of the activities performed, presentation of the field and laboratory data, and an interpretation of the results. A scaled Site Plan showing the sampling locations, potentiometric map, analytical data, and a copy of the laboratory analytical report will also be included in the report.

6.0 COMPLETION OF REMEDIAL ACTIVITIES

Upon the completion of the final groundwater monitoring event, a statistical data analysis of the contaminant concentrations in the groundwater at the Site will be completed using the Pro-

UCL software. The statistical analysis will be submitted along with supporting documentation to request No Further Action (NFA) status under the IDEM RCG. An Environmental Restrictive Covenant (ERC) may be required as part of the NFA request to prevent future exposure to residual impacts. If contaminant concentrations or the statistical analysis do not support closure, then further monitoring and/or remediation may be required.

Well Abandonment

Upon receipt of NFA status at the Site, the groundwater monitoring wells will be abandoned by a licensed Indiana Water Well Driller in accordance with 312 Indiana Administrative Code (IAC) 13-10-2. The licensed Water Well Driller will complete the Well Abandonment Reports for submittal to the Program and the Indiana Department of Natural Resources.

7.0 SCHEDULE

Initiation of the remedial strategy proposed in this RWP will be implemented within 45 days of approval of the RWP and other required documents by the IDEM. UST closure/soil excavation activities can be completed within two weeks, and monitoring will continue for a minimum of two years (eight consecutive quarters) following completion of the UST closure/soil excavation activities.

8.0 REFERENCES

Fenelon, J.M., and Bobay, K.E. 1994. "Hydrogeologic Atlas of Aquifers in Indiana." USGS Water Resources Investigation Report 92-4142.

Indiana Department of Environmental Management (IDEM). "Remediation Closure Guide." March 22, 2012 with updates through 2018.

Indiana Geological Survey. 2009. "Karst in Indiana." Internet address: http://igs.indiana.edu/geology/karst/karstInIndiana/index.cfm.

United States Department of Agriculture (USDA) – Natural Resources Conservation Service Web Soil Survey. 2009. Internet address: http://websoilsurvey.nrcs.usda.gov.

U.S. Fish and Wildlife Service (USFWS). 2009. National Wetland Inventory Online Mapper. On-line address: http://wetlandsfws.er.usgs.gov/wtlnds/launch.html.

USGS. 2013, 7.5-Minute Topographic Map, Alexandria, Indiana

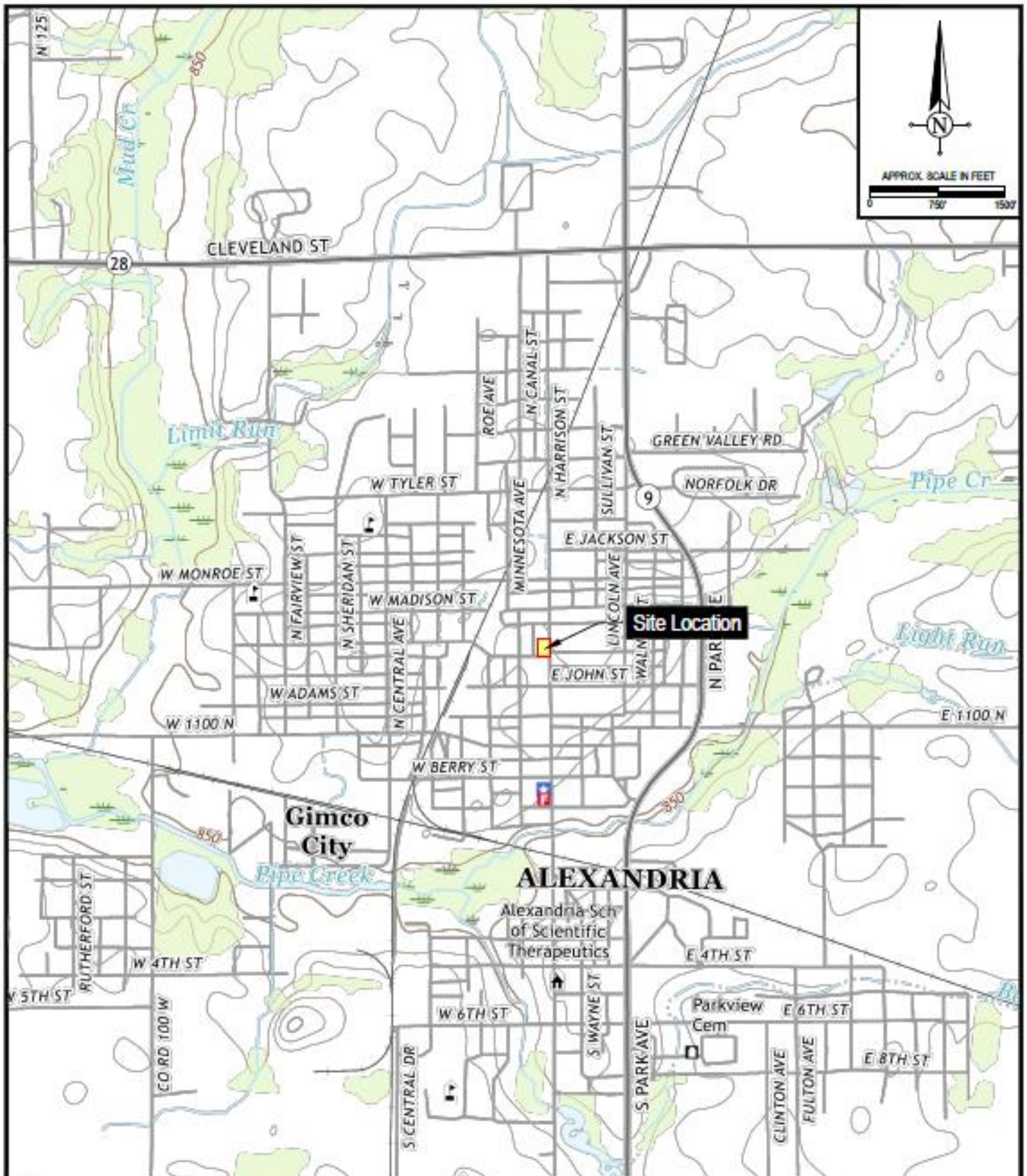
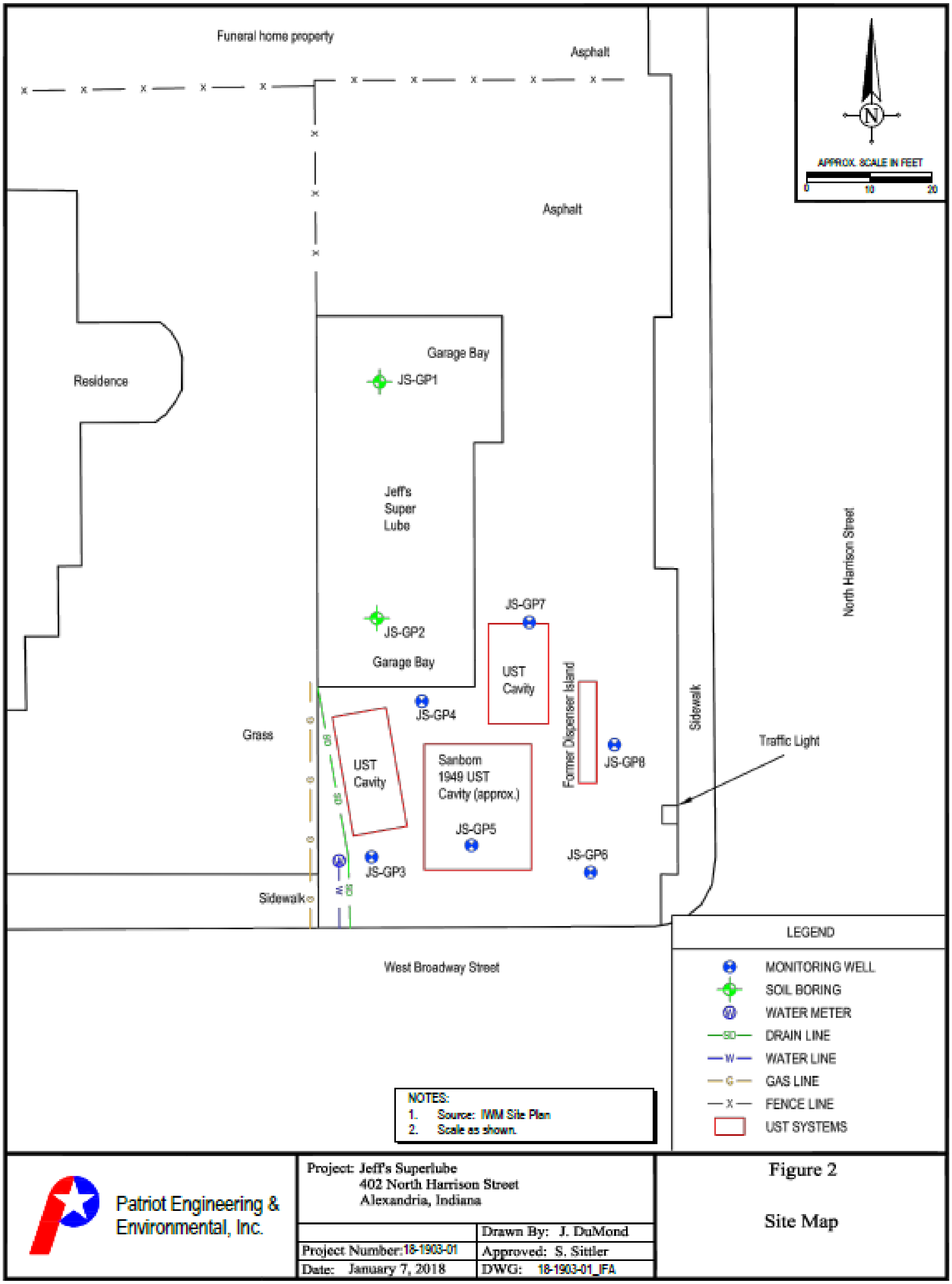
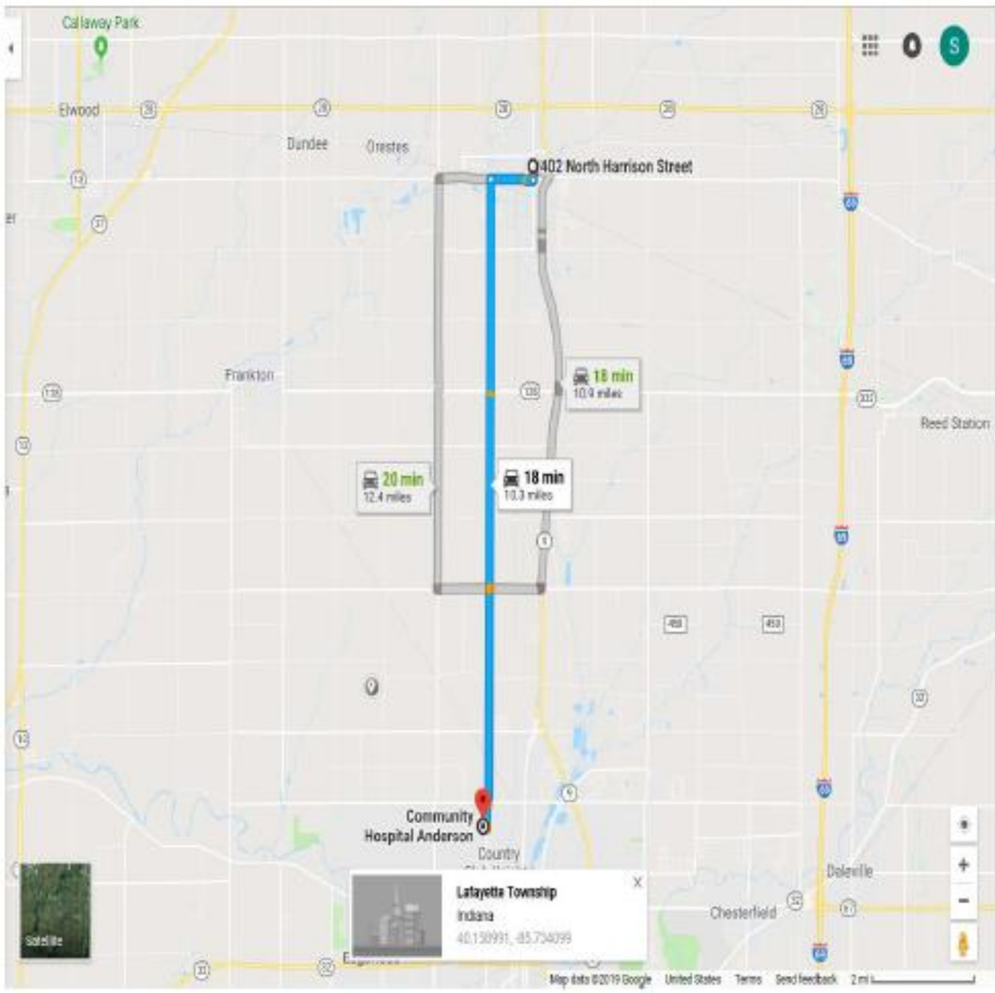


Image Source:
USGS Alexandria Topo 2016

Patriot Engineering & Environmental, Inc.

Project: Jeff's Superlube 402 North Harrison Street Alexandria, Indiana		Figure 1
	Drawn By: J. DuMond	Site Vicinity Map
Project Number: 18-1903-01	Approved: S. Sittler	
Date: January 7, 2018	DWG: 18-1903-01_IFA	


Funeral home property
Asphalt
APPROX. SCALE IN FEET
0
10
20
N
Asphalt
Garage Bay
JS-GP1
Residence
Jeff's
Super
Lube
North Harrison Street
JS-GP7
JS-GP2
Garage Bay
UST
Cavity
Former Dispenser Island
Sidewalk
JS-GP4
Grass
Traffic Light
Sanborn
1949 UST
Cavity (approx.)
JS-GP8
UST
Cavity
JS-GP5
JS-GP6
JS-GP3
Sidewalk
LEGEND
West Broadway Street
MONITORING WELL
SOIL BORING
WATER METER
DRAIN LINE
WATER LINE
GAS LINE
FENCE LINE
UST SYSTEMS
NOTES:
1. Source: IWM Site Plan
2. Scale as shown.
Patriot Engineering &
Environmental, Inc.
Project: Jeff's Superlube
402 North Harrison Street
Alexandria, Indiana
Drawn By: J. DuMond
Project Number: 18-1903-01
Approved: S. Sittler
Date: January 7, 2018
DWG: 18-1903-01_IFA
Figure 2
Site Map



From site, proceed south on N. Harrison Street 0.2 miles toward E. Broadway Street. Turn right (west) on W. Washington Street and proceed 0.8 miles to N 100 W/Indiana Avenue. Turn left (south) on N 100 West/Indiana Avenue and proceed 8.8 miles – road becomes N. Madison Street. Continue on N. Madison Street 0.4 miles to Medical Arts Blvd. Turn right (west) onto Medical Arts Blvd. into Community Hospital Anderson (1515 N. Madison Street, Anderson, IN).