Analysis of Brownfield Cleanup Alternatives
Former McClung Warehouses Property
Knoxville, Tennessee
S&ME Project No. 4143-17-017
EPA Brownfields Cooperative
Agreement No. BF-00D47816-0

PREPARED FOR:

City of Knoxville Office of Redevelopment
400 Main Street, Suite 655
Knoxville, Tennessee 37902

PREPARED BY:

S&ME, Inc.
6515 Nightingale Lane
Knoxville, TN 37909

September 14, 2018

September 14, 2018

City of Knoxville Office of Redevelopment
400 Main Street, Suite 655
Knoxville, Tennessee 37902

Attention: Ms. Anne Wallace

Reference: **Analysis of Brownfield Cleanup Alternatives**
Former McClung Warehouses Property
Knoxville, Tennessee
EPA Brownfields Cooperative Agreement No. BF-00D47816-0
S&ME Project No. 4143-17-017

Dear Anne:

S&ME, Inc. (S&ME) has updated the Analysis of Brownfield Cleanup Alternatives (ABCA) to supplement the document previously prepared by Tetra Tech (*Revised Final Analysis of Brownfields Cleanup Alternatives* dated November 16, 2015) for the Former McClung Warehouses Property located in Knoxville, Tennessee. This ABCA was prepared under a Brownfields Cleanup Grant provided by the United States Environmental Protection Agency (EPA), Region 4, under EPA Brownfields Cooperative Agreement No. BF-00D47816-0. S&ME appreciates this opportunity to be of service to you. Please call if you have questions concerning this report or any of our services.

Sincerely,

S&ME, Inc.

Elizabeth Porter, PG, PMP
Project Manager

James R. Bruce, PG, CHMM
Quality Assurance Officer

CC: Olga Perry, USEPA
Lee Barron, TDEC Knoxville
Paula Middlebrooks, TDEC

Table of Contents

1.0 General Site Information

The former McClung Warehouses property consists of nine parcels containing approximately five acres, owned by the City of Knoxville (City), and formerly located at 401, 420, 501, 505, 512, 517, 519, 523 and 525 W. Jackson Avenue in Knoxville, Tennessee (Figure 1, Appendix I). In addition, the property includes a 30-foot-wide public alley right-of-way (ROW) located behind the former parcels at 501, 505, 517, 519, and 523 W. Jackson. The property center is approximately located at 35.9677° N latitude and -83.9229° W longitude. The properties are identified on the Knox County Tax Assessor's Tax Map as Tax Map 94E, Group J, Parcels 1, 1.01, 2, 4, 5.02, 5.03 and 11.01, as well as the public alley ROW. The City would like to develop the property into a mixed-use complex consisting of commercial and residential properties.

Businesses that formerly operated at the McClung Warehouses site included an automobile garage, woodworking shop, freight shipping businesses, and railroad freight storage, shipment, and administrative operations. Based on the results of a review of historical documents, the portion of the site located at 401 W. Jackson Avenue was previously occupied by railroad freight sheds and an administrative office building from approximately 1884 to 1997. In 1903, the C.M. McClung and Company operated on this portion of the site, but vacated the property by 1917. A blacksmith shed also operated on this portion of the site for approximately 70 years. Freight businesses, including Universal Southern Cartage Company and Cargo Manufactured Products, Inc., also operated on this portion of the site from the 1970s through the 1980s. By 2006, the property was a paved, self-service pay-to-park parking lot. The portion of the site located at 501 and 505 W. Jackson Avenue was previously occupied by drug and oil warehouses from approximately 1884 to 1890. By 1903, this portion of the site was vacant. In 1893, the McClung Warehouses were constructed on the portion of the site located at 505 and 509 W. Jackson Avenue, which sold items such as lanterns, glassware, clocks, automobiles tires, lawn mowers, and bicycles. By 1917, the McClung Warehouses had expanded to the portion of the site located at 501, 517, and 523 W. Jackson Avenue. By 1950, the portion of the site located at 525 W. Jackson Avenue was occupied by Crane Co. In addition, an automobile garage occupied the portion of the site located at 512 W. Jackson Avenue. By 1973, the 512 W. Jackson Avenue property was a paved, free parking lot.

Businesses operated in the McClung Warehouses until 2007 (including a woodworking shop located at 509 W. Jackson Avenue). In 2007, a fire destroyed the warehouses located at 501, 505, and 509 W. Jackson Avenue. In 2014, a second fire destroyed the warehouses located at 517, 519, 523, and 525 W. Jackson Avenue.

2.0 Site Assessment Activities

In 2009, S&ME Inc. (S&ME) conducted a Phase I Environmental Site Assessment (ESA) and identified several potential recognized environmental conditions (RECs). Based on these findings, in 2009, S&ME conducted a soil sampling and passive soil vapor survey at the portion of the site located at 401 W. Jackson Avenue. S&ME collected soil and passive soil gas samples at the site. Arsenic (31 milligrams per kilogram (mg/kg)) and lead (880 mg/kg) were detected in the soil at concentrations that exceeded the corresponding 2008 Environmental Protection Agency (EPA) Regional Screening Levels (RSLs) of 1.6 mg/kg and 800 mg/kg for industrial soil,

respectively. Six of the seven passive soil vapor samples contained detectable concentrations of petroleum-related compounds such as total petroleum hydrocarbons (TPH); benzene, toluene, ethylbenzene and xylene (BTEX); undecane, tridecane, and pentadecane (diesel-range hydrocarbons); and naphthalene and 2-methylnaphthalene. However, the passive soil vapor survey did not quantify the volume of contaminated media or identify the source of the contamination. Based on the results of the samples collected (soil and soil gas), S&ME recommended confirmation sampling and analysis before construction.

In 2015, Tetra Tech, on behalf of the EPA, conducted a Targeted Brownfield Assessment (TBA) at the property, consisting of Phase I and II Environmental Site Assessments (ESAs). In January 2015, Tetra Tech personnel conducted an initial site visit at the property and identified recognized environmental conditions (RECs), visually inspected the on-site structures for possible asbestos-containing materials (ACMs), and identified other environmental hazards on the property. The *Phase I Environmental Site Assessment Report: McClung Warehouses*, prepared for EPA by Tetra Tech in August 2015, identified the following RECs:

- The portion of the site located at 401 W. Jackson Avenue was used by the railroad from approximately 1884 to 1997. Additionally, a blacksmith shed operated on this portion of the site for approximately 70 years.
- The McClung Warehouses, Crane Co., and oil and drug warehouses operated on the portion of the site located at 401, 501, 505, 509, 517, 519, 523, and 525 W. Jackson Avenue.
- An automobile garage operated on the portion of the site located at 512 W. Jackson Avenue for approximately 19 years.
- Suspected ACM was observed in the remnants of the warehouses at the site.

Based on the results of the initial site visit, EPA concluded that a Phase II ESA was appropriate to assess the RECs identified during the Phase I ESA and to identify the presence and nature of contamination, if any, on the site. During the week of March 23, 2015, Tetra Tech conducted a Phase II ESA which included soil, groundwater, soil gas, and suspected ACM sampling. Tetra Tech collected 18 surface and subsurface soil samples, three composite soil samples (including one duplicate), six soil gas samples (including one split), three groundwater samples (including one duplicate), and 53 suspected ACM samples. The analytical results for these samples are summarized below. For full details of the sampling event, see the Final Phase II Environmental Site Assessment Report: McClung Warehouses, prepared for EPA by Tetra Tech in August 2015, and currently available on the City's website: (http://www.knoxvilletn.gov/government/city_departments_offices/redevelopment/epa_cleanup_grant_applications/).

All Tetra Tech surface and subsurface soil samples contained one or more target analyte list (TAL) metals, such as arsenic, cobalt, manganese, and thallium at levels that exceed EPA RSLs for residential or industrial soil.

- No volatile organic compounds (VOCs) or semivolatile organic compounds (SVOCs) were detected in the surface and subsurface soil samples above EPA RSLs for residential or industrial soils.
- Two soil gas samples contained benzene at concentrations that exceeded the calculated Vapor Intrusion Screening Level (VISL) for carcinogenic risk under a residential scenario.

- Groundwater samples collected by Tetra Tech contained metals, but none of the concentrations exceeded EPA Maximum Contaminant Levels (MCLs).
- Six suspected ACM samples contained asbestos at greater than 1 percent.

In order to evaluate the need for vapor intrusion mitigation during site redevelopment, additional information was needed, and thus the assessment activities documented below were proposed. In 2018, S&ME updated the soil gas evaluation to provide current supplemental data for design purposes. S&ME also addressed data gaps identified in planning for the site cleanup, including the potential for impacts associated with the garage operated at 512 W. Jackson Avenue. These Phase II ESA activities were performed subsequent to the Tetra Tech *Revised Final Analysis of Brownfield Cleanup Alternatives* (ABCA), dated November 16, 2015.

The 2018 S&ME Phase II ESA, conducted on behalf of the City, was performed under a Brownfields Cleanup Grant provided by the EPA, Region 4, under EPA Brownfields Cooperative Agreement No. BF-00D47816-0.

The extensive background information summarized above can be found in the Tetra Tech ABCA and supporting documents. To supplement that information, the S&ME Phase II ESA consisted of a ground-penetrating radar (GPR) survey, followed by the collection and laboratory analysis of passive and active soil gas samples, soil samples, groundwater samples, as well as asbestos and lead-based paint (LBP) samples from the site.

Initially, S&ME used a subcontractor specializing in GPR to survey the parcels located at 420 and 512 W. Jackson Avenue to further evaluate the property for potential buried structures and areas of previous subsurface disturbance based on the past use as an automotive garage. Evidence of underground storage tanks was not observed during the GPR survey. Passive soil vapor sampling was then performed using Amplified Geochemical Imaging, LLC (AGI) modules manufactured and analyzed by AGI (Figure 2, Appendix I). Four of the seven collected soil gas samples detected low levels of TPH, and two of the samples detected very low levels of petroleum hydrocarbon constituents such as benzene and toluene. One of the samples also detected very low levels of polynuclear aromatic hydrocarbons (PAHs). Based on the findings of the GPR survey and the passive soil gas survey, soil borings were installed and active soil gas samples were collected to fill in data gaps from the previous site assessment activities.

Eight soil samples (Figure 3, Appendix I) were analyzed for target analyte list (TAL) metals, TPH-gasoline range organics (TPH-GRO), PAHs, extractable petroleum hydrocarbons (EPH), and VOCs. Each of these samples reported arsenic concentrations which exceeded the EPA May 2018 Industrial and Residential Regional Screening Levels (RSL_{ind} and RSL_{res}, respectively), which is not uncommon in East Tennessee, and the detected concentrations may generally fall within the statistical range of background concentrations. The highest arsenic concentrations occurred at depths of four feet or more below ground surface (bgs), which has been considered during the evaluation of the analytical results and remedial alternatives proposed herein.

The reported concentrations for aluminum, cobalt, and iron exceeded the RSL_{res} at all eight sample locations. Manganese exceeded the RSL_{res} at seven locations and vanadium exceeded the RSL_{res} in four locations. The RSL_{ind} was exceeded in two locations by cobalt and in one location by manganese, at depths of 2.5 feet or greater bgs. Multiple VOCs and PAHs were detected in at least one submitted soil sample, but the concentrations were below the RSL_{res} and RSL_{ind} for each analyte, except for benzo(a)pyrene, which exceeds the RSL_{res} in one sample.

Four of the initial soil samples submitted for EPH analysis reported concentrations above laboratory detection levels. Only one location (SB-7) reported an EPH concentration which exceeded the Tennessee Department of Environment and Conservation (TDEC) Division of Solid Waste Management (DSWM) threshold for disposal as a special waste (100 milligrams/kilogram (mg/kg)). The EPH concentration in sample SB-7 was 855 mg/kg. In an effort to further delineate the extent of petroleum hydrocarbon impacts in the vicinity of soil sample SB-7, a second round of assessment was performed in this location, with five additional samples submitted for EPH laboratory analysis. The area of petroleum hydrocarbon impacts was further defined, and will be addressed herein as part of the recommended remedial activities. The maximum EPH concentration detected in the second round of sampling was 334 mg/kg (GP-1).

As a follow-up to previous assessment activities performed by others, five surficial soil samples were submitted for laboratory analysis for pesticides (Figure 3, Appendix I). Dieldrin was observed in sample HA-4 at a concentration of 2.06 mg/kg, which exceeds both the RSL_{res} (0.034) and the RSL_{ind} (0.14). There were no reported detections of pesticides above the RSL_{res} or RSL_{ind} for any of the other submitted samples.

Two rounds of active soil gas sampling were performed (Figure 4, Appendix I). Based on the benzene concentrations in the ten original active soil gas samples collected at a depth of three feet, S&ME recommended additional soil gas and groundwater sampling to gain a better understanding of the current source and risk associated with the detected benzene concentrations in soil gas. In the second round of sampling, three locations were selected for vertical profiling of the benzene concentrations, and soil gas samples at these three locations were collected at depths of 1.5 feet, three feet and five feet bgs. In addition, temporary groundwater monitoring wells were installed at three locations near the areas where elevated benzene was detected in the soil gas, to determine if benzene in groundwater was a possible source. The findings of the additional assessment activities did not detect benzene in groundwater (nor were any other VOCs detected in groundwater), but elevated benzene in soil gas was confirmed in the second round of soil gas sampling performed by S&ME.

Each of the soil gas samples (including the initial round SG-1 through SG-10, and the vertical profiles SG-1 ABC, SG-3 ABC, and SG-5 ABC) was analyzed for VOCs by Method TO-15. Multiple compounds analyzed under EPA Method TO-15 were detected above the corresponding laboratory detection limit. Several of the detected compounds exceed the RSL_{res}, and 14 compounds exceed both the RSL_{res} and RSL_{ind} in at least one of the samples. Benzene exceeded the RSL_{ind} (1.6 micrograms per cubic meter ($\mu g/m^3$)) in each of the ten initial samples, with a maximum concentration of 64.6 $\mu g/m^3$. This prompted the second round of active air sampling, consisting of vertical profiles, where benzene concentrations exceeded the RSL_{ind} in each of the nine additional samples, with a maximum concentration of 41.7 $\mu g/m^3$. Naphthalene exceeded the RSL_{ind} in four samples in the first round, and six samples in the second round.

The Vapor Intrusion Screening Level (VISL) calculator was used to evaluate vapor intrusion (VI) carcinogenic risk using the Target Carcinogenic Risk (TCR) of 1×10^{-6}. The results of VISL screening under a residential scenario using the highest detected concentration of each analyte identified a VI carcinogenic risk in excess of the TCR for benzene, 1,3-butadine, benzyl chloride, carbon tetrachloride, chloroform, 1,2 dichloroethane and naphthalene. A VI hazard was identified in excess of the Target Hazard Quotient (THQ) of 0.1 for 1,3-butadine, benzyl chloride and naphthalene. The results of VISL screening under a commercial scenario using the highest detected concentration

for each analyte identified a VI carcinogenic risk in excess of the TCR for benzene, 1,3-butadine and naphthalene. A VI Hazard was not identified in the commercial scenario.

Of the contaminants with a VI carcinogenic risk, benzene was detected at elevated concentrations most frequently (all 19 locations exceeded the benzene RSL_{ind}), followed by naphthalene (10 locations exceeded the naphthalene RSL_{ind}). To further evaluate the benzene risk, S&ME used the VISL calculator to evaluate benzene results with concentrations below the maximum detected (64.6 µg/m^3 in SG-5). The VISL calculator identified a VI carcinogenic risk in the residential scenario when benzene concentrations exceeded 12 µg/m^3. The VISL calculator under a residential use scenario identified a VI issue in multiple locations across the site, from the northeast corner to the southwest corner, and on the City parcels both north and south of Jackson Avenue. The VISL VI carcinogenic risk levels range from no risk to 1.1E-05 for the residential scenario, and from no risk to 2.5E-06 for the commercial scenario. Within this range, current TDEC protocol indicates that mitigation is recommended for new construction sites.

S&ME also collected two sample of suspect ACM and two paint chips for LBP analysis from the surficial layer of the demolition debris to assist in characterizing this material for future disposal purposes. Both ACM and LBP were detected in the demolition debris (Figure 5, Appendix I).

The cleanup alternatives discussed in Section 3.0 are based on the findings compiled to date from both the S&ME and Tetra Tech assessment activities.

3.0 Cleanup Alternatives

In an effort to support the City's redevelopment efforts, and to insure that site redevelopment is performed in accordance with applicable regulations, a Brownfield Voluntary Agreement (BVA) is recommended. The BVA to be established for the site would address the potential for construction worker and site occupant contact with impacted soils during and after redevelopment, and it would address the vapor intrusion potential, including design of an engineered vapor mitigation system, if warranted based on redevelopment plans. The goal of the vapor mitigation system would be to break the exposure pathway for vapor migration, if such a pathway is confirmed for the proposed use.

In addition to the recommended BVA, this section presents additional recommendations for addressing environmental concerns identified at the site.

3.1 Surface and Subsurface Soil

Option 1: No Action: No action is a zero cost option; however, it does not prevent residents from coming into contact with contamination at the site.

Option 2: Source Removal: Surface and subsurface soil contained TAL metals such as arsenic, aluminum, iron, cobalt, lead, manganese, vanadium, and thallium at concentrations above their respective EPA RSL_{res} and RSL_{ind}. Dieldrin was observed in sample HA-4 at a concentration of 2.06 mg/kg, which exceeds both the RSL_{res} and the

RSL_{ind}. In addition, an area of petroleum hydrocarbon impacts was observed in the vicinity of soil boring SB-7, to a depth of approximately five feet.

Tetra Tech previously identified that the concentrations detected in the surface and subsurface soils were below their respective EPA Removal Management Levels (RMLs) for residential and industrial soils, except for two samples, including MC-SB05-09, collected at nine feet bgs at 501 W. Jackson Avenue, and MC-COM-01-DUP collected at four inches bgs in the unpaved area of the Option Tract behind the former warehouses at 501, 505, and 509 W. Jackson Avenue. Arsenic was detected at 150 mg/kg in subsurface soil sample MC-SB05-09, which is above the EPA May 2018 RML of 68 mg/kg for residential soil. Lead was detected at 420 mg/kg in surface soil sample MC-COM-01-DUP, which is above the EPA 2018 RML of 400 mg/kg for residential soil. In the 2018 S&ME sampling event, the only additional metal or pesticide that exceeded the 2018 RML was arsenic in sample SB-2, detected at a concentration of 118 mg/kg at a depth of nine to 10.5 feet.

RMLs are used to help identify areas, contaminants, and conditions where a removal action may be appropriate. Sites where contaminant concentrations fall below RMLs, are not necessarily "clean." In some cases, further action or study may be warranted. Also, sites with contaminant concentrations above the RMLs may not necessarily warrant a removal action; factors including location and depths of construction, the use of site-specific exposure scenarios or other program considerations may need to be evaluated.

Based on the findings, a limited, localized soil removal is recommended. Specifically, the area with petroleum hydrocarbon impacts in the vicinity of SB-7 would be excavated, and the material would be transported to Domermuth Environmental Services for treatment and subsequent landfill disposal. Removal of petroleum hydrocarbon-impacted material would help to reduce the potential for future VI risk associated with these contaminants. Although some areas of elevated metals were also detected in the soil, they are generally isolated and range from surficial to deeper (greater than eight feet bgs) occurrences. The future use and layout of the site is unknown, but would likely have a large building/parking area footprint. This type of redevelopment would limit residential exposure to subsurface soils. Rather than spending cleanup funds to remove metals that may not pose a risk in the final redevelopment scenario, addressing this issue through the Brownfield Voluntary Agreement (BVA) is recommended. The BVA should include a provision for placement of buildings, parking areas, at least two feet of clean soil, or another type of TDEC-approved contact barrier over the existing ground surface as warranted to limit exposure to metals, if the redevelopment includes residential use.

The proposed petroleum hydrocarbon cleanup is estimated to cost between $40,000-$45,000, based on the size of the area identified during the additional site characterization. This would include backfilling the excavation with crusher run in anticipation of future redevelopment, but would not include repaving the excavated area.

3.2 Asbestos-containing Materials

Option 1: No Action: No action is a zero cost option; however, it is not a viable option because the remnants of the building are in disrepair and the buildings have been partially demolished. Therefore, the asbestos identified in the buildings needs to be removed. Lead-based paint has also been identified in the demolition debris.

Option 2: Landfill Disposal: As documented previously in the Tetra Tech ABCA, the black wall adhesive and roof flashing identified as ACM in the remaining structures are non-friable and; therefore, is not regulated asbestos-containing material (RACM) provided it is not subjected to grinding, cutting, sanding, or abrading. These homogenous areas may be disposed of within a landfill permitted to receive the waste along with the demolition debris as long as they remain in good condition. Tetra Tech stated that doing so can greatly increase disposal costs, and further stated that often, the most economical means of addressing waste classified as non-friable RACM is to remove and dispose of it separately, prior to demolition, thus preventing all demolition debris from being contaminated. Tetra Tech proposed that removal and disposal of RACM typically costs around $1.50 to $2.00 per square foot, translating to about $4,500 to $6,000 to dispose of the RACM they identified in the remnant structures on site.

The previous ABCA did not address the piles of demolition debris on the property, resulting from the demolition of the structures after the fires. Due to the nature of the building demolition following the fires, asbestos abatement of the warehouses was not feasible at that time. Consequently, ACM was confirmed in the debris piles during the S&ME 2018 assessment activities. Some of the debris is currently ramped along Jackson Avenue, and removal of this material is not recommended until site redevelopment is planned. Three debris piles are located beyond the Jackson Avenue area, and they collectively contain approximately 750 cubic yards of debris (Figure 6, Appendix I). Since the ACM cannot feasibly be segregated from these piles, they would be considered asbestos waste, and should be handled accordingly. S&ME obtained quotes from two area contractors for proper transport and disposal at Chestnut Ridge Class I Landfill, and the estimates ranged from $120,000 and $145,000, excluding oversight, air monitoring and final clearance.

3.3 Vapor Intrusion

Option 1: No Action: No action is a zero cost option; however, it is not effective in controlling or preventing residents from exposure to contamination at the site.

Option 2: Vapor Mitigation: As documented in the S&ME Phase II ESA and summarized above, the VISL screening under a residential scenario identified a VI carcinogenic risk in excess of the TCR for benzene, 1,3-butadine, benzyl chloride, carbon tetrachloride, chloroform, 1,2 dichloroethane and naphthalene. A VI hazard was identified in excess of the THQ of 0.1 for 1,3-butadine, benzyl chloride and naphthalene. The results of VISL screening under a commercial scenario identified a VI carcinogenic risk in excess of the TCR for benzene, 1,3-butadine and naphthalene. A VI Hazard was not identified in the commercial scenario.

Of the contaminants with a VI carcinogenic risk, benzene was detected at elevated concentrations most frequently, followed by naphthalene. To further evaluate the benzene risk, S&ME used the VISL calculator to evaluate benzene results with concentrations below the maximum detected. The VISL calculator identified a VI carcinogenic risk in the residential scenario when benzene concentrations exceeded 12 µg/m^3. The VISL calculator under a residential use scenario identified a VI issue in multiple locations across the site, from the northeast corner to the southwest corner, and on the City parcels both north and south of Jackson Avenue.

The VISL VI carcinogenic risk levels range from no risk to 1.1E-05 for the residential scenario, and from no risk to 2.5E-06 for the commercial scenario. Within this range, current TDEC protocol indicates that mitigation is recommended for new construction sites. If residential structures are planned vapor intrusion mitigation may be

warranted. However, in the absence of a site development plan, or information on building vs. parking areas, it is not feasible to address the vapor mitigation at this time, beyond some general recommendations for the type of mitigation that may be appropriate.

Depending on the extent, design and location of residential development on the site, a mitigation vapor barrier may be considered. TDEC would require a minimum 20-mil VOC-resistant vapor barrier, installed and sealed per manufacturer's specifications. As an alternative, an unvented VOC-resistant asphaltic-based vapor barrier with certified design and installation could be considered. Passive or active sub-slab venting may also be considered. It is not possible to provide a cost for this cleanup alternative in the absence of site-specific design considerations.

4.0 Potential Climate Change Conditions

As presented in the Tetra Tech ABCA, in light of reasonably foreseeable changing climate conditions, including rising sea levels, increased frequency and intensity of flooding, and extreme weather events, an evaluation of the remedial alternatives discussed above was conducted. Sources of information used to conduct this evaluation include:

- Scenarios for Climate Assessment and Adaptation, accessed on-line at: http://scenarios.globalchange.gov/content/scenarios
- Climate Explorer, accessed on-line at: https://toolkit.climate.gov/tools/climate-explorer

The site is located in Knoxville, Tennessee, a highly urbanized area in eastern Tennessee. Rising sea levels along the coastal areas of the southeastern United States and salt water intrusion are not expected to adversely impact the remedial alternatives discussed in the sections above. Also, the site is located outside the 100-year floodplain of the Tennessee River. Other factors associated with climate change, including increases and decreases in temperature, potential for wildfires, and extreme weather events like hurricanes, also are not expected to adversely impact the recommended remedial alternatives.

Changes in ground thaw and freeze cycles and depths to groundwater in the surficial aquifer could potentially impact soil vapor concentrations, but not to an extent that can be measured or addressed at this time. It is anticipated that the remedial alternative recommended above to address vapor intrusion will be a conservative approach that is protective of human health based on the planned future redevelopment of the Site.

5.0 Conclusion

Prior to redevelopment activities, the petroleum contaminated soil identified in the S&ME 2018 Phase II ESA report should be removed and disposed of at an approved waste disposal facility. Depending on the priorities for the remaining funds, a qualified asbestos abatement company could also be retained to begin to appropriately address the asbestos issues. The VI potential should be addressed during site redevelopment, but there is insufficient information regarding future use to design and install a system at this time. A Brownfield Agreement should be prepared to address these issues and provide liability protection for the future site owners.

Based on the assessment activities to date, the remedial alternatives presented, and climate change scenarios evaluated, S&ME does not anticipate the need to modify the proposed cleanup alternatives to address changing climate conditions.

Disclaimer: This ABCA has been prepared in accordance with EPA and TDEC standards. The cleanup alternatives are based on our understanding of existing site conditions at the time field sampling was conducted. While efforts have been made to adequately characterize site conditions, the full extent of contamination may prove to be greater or less than what is represented herein. As a result, the actual cost of implementing cleanup options may vary. Cleanup costs are based on anticipated future use of the property; however, specific details on future use were not available at the completion of this ABCA.

Appendices

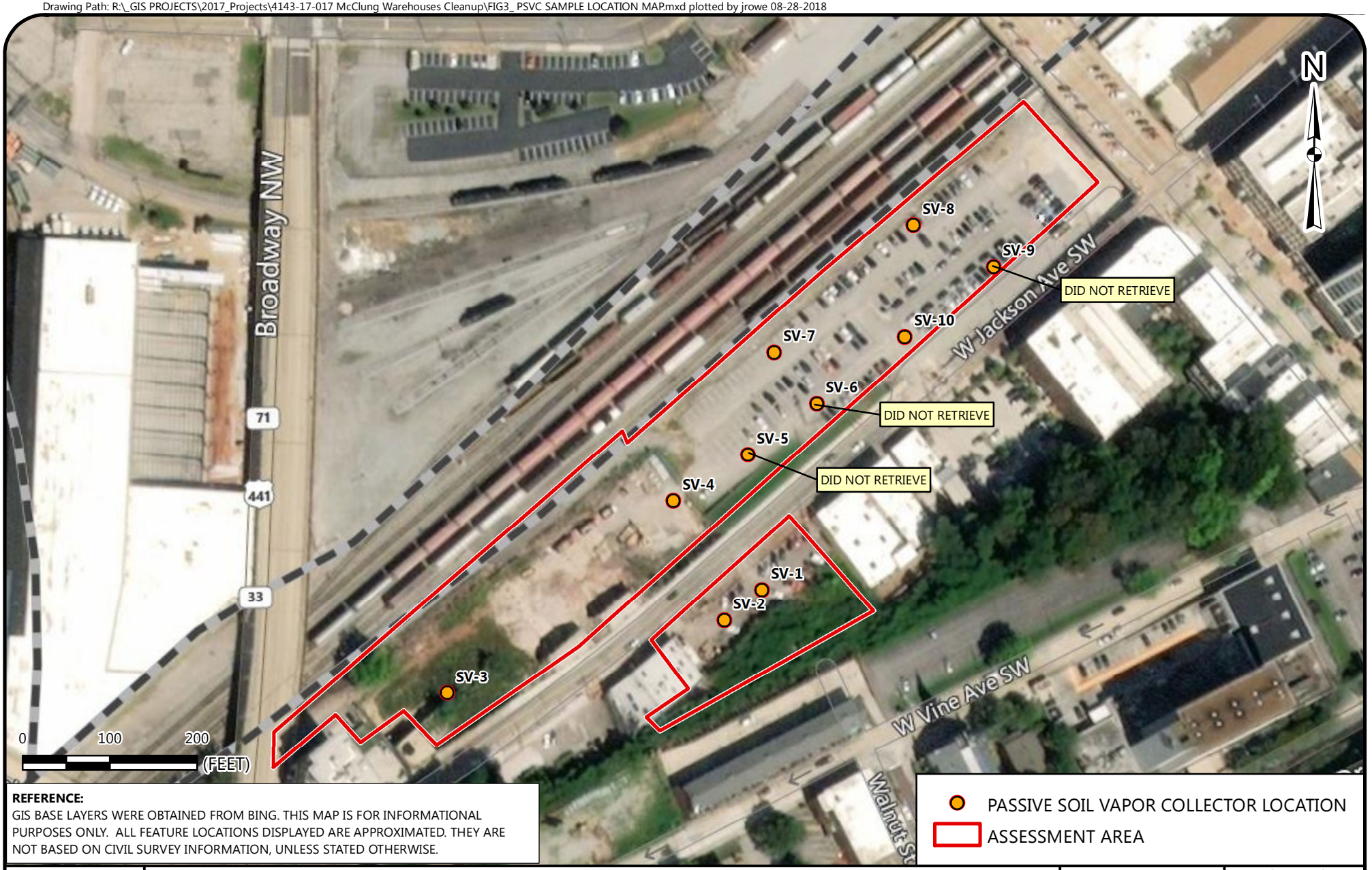
Appendix I – Figures

USGS TOPOGRAPHIC SITE VICINITY MAP
KNOXVILLE, TN QUAD

FORMER MCCLUNG WAREHOUSES
KNOXVILLE, TENNESSEE

SCALE:	FIGURE NO.
AS SHOWN	1
DATE: 9-27-17	
PROJECT NUMBER 4143-17-017	

Drawing Path: R:_GIS PROJECTS\2017_Projects\4143-17-017 McClung Warehouses Cleanup\FIG3_ PSVC SAMPLE LOCATION MAP.mxd plotted by jrowe 08-28-2018



REFERENCE:
GIS BASE LAYERS WERE OBTAINED FROM BING. THIS MAP IS FOR INFORMATIONAL PURPOSES ONLY. ALL FEATURE LOCATIONS DISPLAYED ARE APPROXIMATED. THEY ARE NOT BASED ON CIVIL SURVEY INFORMATION, UNLESS STATED OTHERWISE.

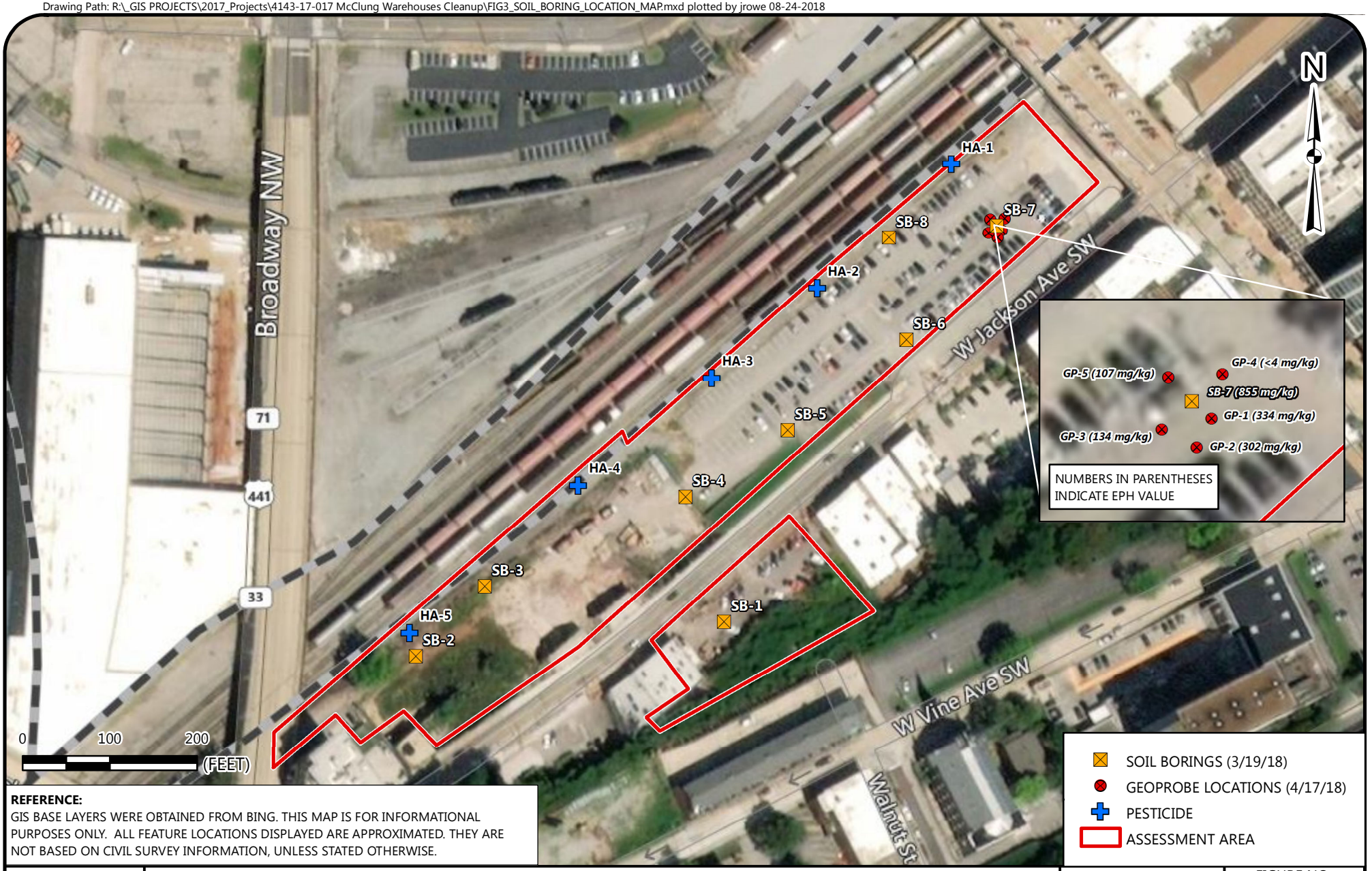
PASSIVE SOIL VAPOR COLLECTOR MAP

FORMER MCCLUNG WAREHOUSES
KNOXVILLE, TENNESSEE

SCALE: 1 " = 150 '
DATE: 8-28-18
PROJECT NUMBER: 4143-17-017

FIGURE NO. 2

Drawing Path: R:_GIS PROJECTS\2017_Projects\4143-17-017 McClung Warehouses Cleanup\FIG3_SOIL_BORING_LOCATION_MAP.mxd plotted by jrowe 08-24-2018



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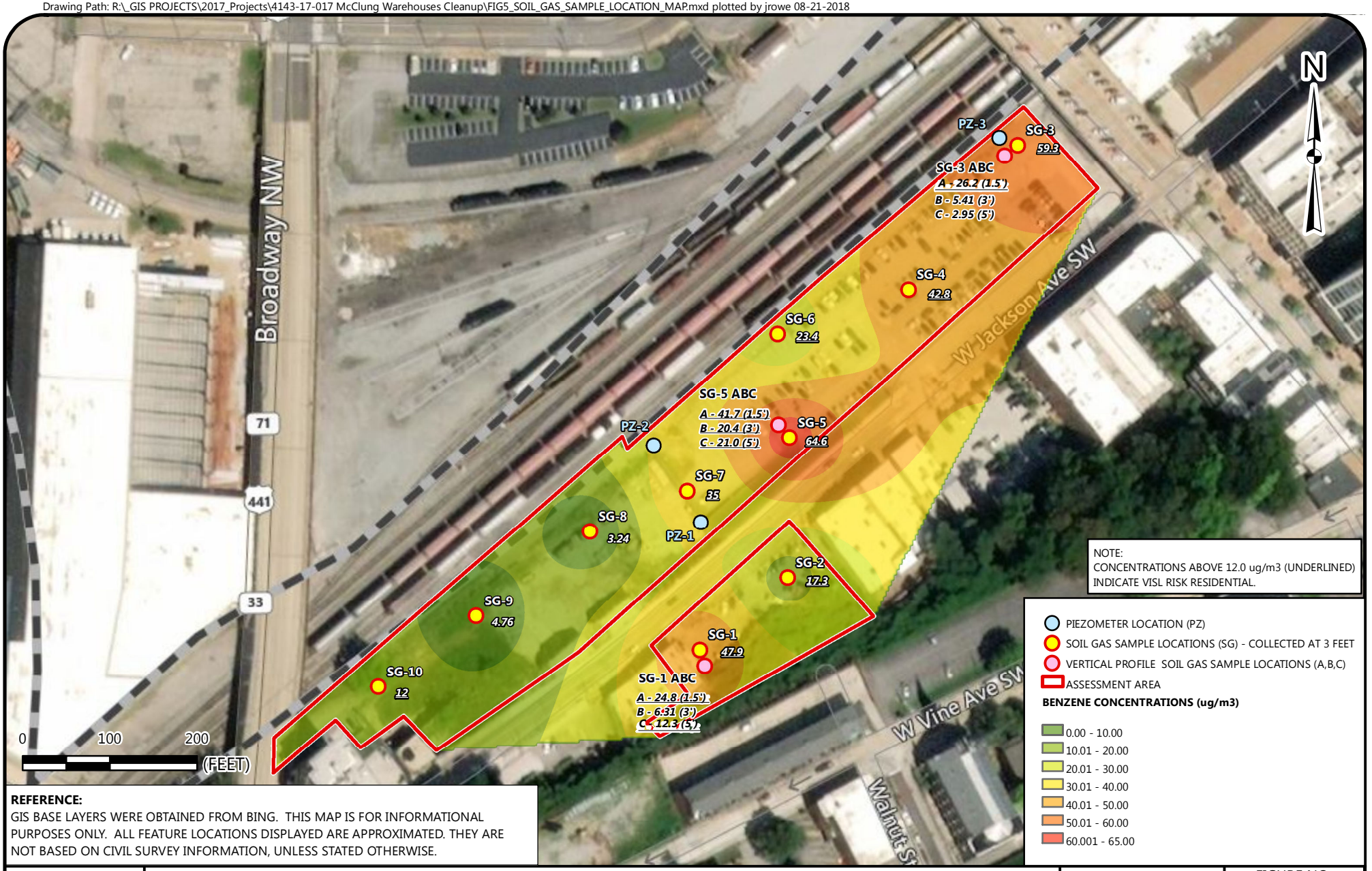
SOIL BORING LOCATION MAP

FORMER MCCLUNG WAREHOUSES
KNOXVILLE, TENNESSEE

SCALE:	1 " = 150 '
DATE:	8-24-18
PROJECT NUMBER:	4143-17-017
FIGURE NO.	3

Drawing Path: R:_GIS PROJECTS\2017_Projects\4143-17-017 McClung Warehouses Cleanup\FIG5_SOIL_GAS_SAMPLE_LOCATION_MAP.mxd plotted by jrowe 08-21-2018



REFERENCE:
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SOIL GAS AND GROUNDWATER SAMPLE LOCATION MAP WITH BENZENE SOIL GAS CONCENTRATION ISOCONTOURS

FORMER MCCLUNG WAREHOUSES
KNOXVILLE, TENNESSEE

SCALE: 1 " = 150 '
DATE: 8-21-18
PROJECT NUMBER: 4143-17-017

FIGURE NO. 4

Drawing Path: R:_GIS PROJECTS\2017_Projects\4143-17-017 McClung Warehouses Cleanup\ASB LBP SAMPLE LOCATION MAP.mxd plotted by EBuckingham 07-12-2018

REFERENCE:
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LEAD PAINT SAMPLE
ASBESTOS SAMPLE

ASBESTOS AND LEAD BASED PAINT SAMPLE LOCATION MAP

FORMER MCCLUNG WAREHOUSES
KNOXVILLE, TENNESSEE

SCALE: 1 " = 84 '
DATE: 4-12-18
PROJECT NUMBER: 4143-17-017

FIGURE NO. 5

Drawing Path: R:_GIS PROJECTS\2017_Projects\4143-17-017 McClung Warehouses Cleanup\SOIL VOLUME CALCULATION MAP.mxd plotted by ebuckingham 04-12-2018

REFERENCE:
ALL DEBRIS VOLUMES GIVEN IN CUBIC YARDS.
GIS BASE LAYERS WERE OBTAINED FROM GOOGLE. THIS MAP IS FOR INFORMATIONAL PURPOSES ONLY. ALL FEATURE LOCATIONS DISPLAYED ARE APPROXIMATED. THEY ARE NOT BASED ON CIVIL SURVEY INFORMATION, UNLESS STATED OTHERWISE.

DEBRIS VOLUME CALCULATIONS

FORMER MCCLUNG WAREHOUSES
KNOXVILLE, TENNESSEE

SCALE: NTS
DATE: 4-12-18
PROJECT NUMBER: 4143-17-017

FIGURE NO. 6