Superfund Program
Proposed Plan – August 2020
Pike and Mulberry Streets PCE Plume Site
Martinsville, Indiana

A. INTRODUCTION

The United States Environmental Protection Agency (EPA) is issuing this Proposed Plan to present EPA's Preferred Alternative for actively remediating groundwater and soil vapor contamination, continuing to prevent potential exposures to tetrachloroethylene (PCE) from drinking contaminated groundwater, and reducing exposures from vapor intrusion (VI) at the Pike and Mulberry Streets PCE Plume (Site) in Martinsville, Morgan County, Indiana.

This Proposed Plan is being issued by EPA, the lead agency for Site activities. EPA, in consultation with the Indiana Department of Environmental Management (IDEM), will select a final remedy for the Site after reviewing and considering all information submitted during the 30-day public comment period. EPA, in consultation with IDEM, may modify the Preferred Alternative or select another response action presented in this Plan based on new information or public comments. Therefore, the public is encouraged to review and comment on all the alternatives presented in this Proposed Plan.

EPA is issuing this Proposed Plan to fulfill its public participation responsibilities under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This Proposed Plan highlights key information that can be found in greater detail in the Final Remedial Investigation (RI) and Feasibility Study (FS) reports and other documents contained in the Administrative Record file for the Site. EPA and IDEM encourage the public to review these documents to gain a more comprehensive understanding of the Site and Superfund activities that have been conducted at the Site. Site documents can be found on EPA's website for the Site (www.epa.gov/superfund/pike-mulberry-pce) or at the following locations:

Morgan County Public Library
110 South Jefferson Street
Martinsville, Indiana
765-342-3451
Mon-Thur: 9 a.m. to 8:30 p.m.
Fri-Sat: 9 a.m. to 5:30 p.m.
Sun: 1 p.m. to 5 p.m.

EPA Region 5 Records Center
77 W. Jackson Boulevard (SRC-7J)
Chicago, Illinois 60604
312-886-0900
Mon-Fri: 8 a.m. to 4 p.m. – Call for appointment

The remedial alternatives EPA evaluated for the groundwater contamination at the Site are detailed in the FS Report. The alternatives include the no action alternative, monitored natural attenuation (MNA), in situ chemical reduction (ISCR), and in situ chemical oxidation (ISCO). Each of the active groundwater remedies evaluated also includes long-term monitoring (LTM) and the use of institutional controls (ICs) to prevent future exposures to contaminated groundwater. EPA also evaluated options for continuing to treat the City of Martinsville public drinking water supply, concurrent with implementation of one of the groundwater treatment options, to continue to protect residents from exposures via the drinking water pathway. These

options included the use of activated carbon (which is currently used), air stripping, or an air oxidative process.

The remedial alternatives EPA evaluated for soil vapor contamination at the Site are detailed in the FS Report. The alternatives include the no action alternative, pathway sealing in buildings with installation of VI mitigation systems (VIMS), soil vapor source removal, and soil vapor source removal with pathway sealing and VIMS installation. Each of the active soil vapor remedies evaluated also includes LTM and the use of ICs to prevent future exposures to soil vapor contamination.

EPA's Preferred Alternative for remediation of contaminated groundwater at the Site is ISCO with LTM and ICs. EPA is also proposing the continued use of activated carbon to treat the city's municipal drinking water supply and is further proposing to connect private residences to the municipal drinking water supply if needed. More details about the Preferred Groundwater Alternative are provided later in this Proposed Plan. The estimated cost to implement the Preferred Groundwater Alternative is $4.27 million, which includes both the estimated cost of continued carbon treatment of the City of Martinsville's municipal drinking water until groundwater associated with the Site is cleaned up to below safe drinking water standards as well as the cost to connect private residences to the municipal drinking water supply.

EPA's Preferred Alternative for remediation of contaminated soil vapor at the Site is soil vapor source removal. EPA is also proposing pathway sealing, the installation of VIMS, LTM, and ICs to reduce exposures from VI. More details about the Preferred Soil Vapor Alternative are provided later in this Proposed Plan. The estimated cost to implement the Preferred Soil Vapor Alternative is $7.54 million, including the soil vapor source removal; and pathway sealing, VIMS, LTM, and ICs. Though this cost estimate includes the cost of LTM, it does not include the costs of conducting a pre-design source investigation and additional VI sampling, which will largely be expended and determined during the remedial design (RD) and remedial action (RA) phases.

EPA's final decision on the remedy for the groundwater and soil vapor contamination at the Site will be announced in local newspaper notices and presented in an EPA document called a Record of Decision (ROD). The ROD will include a Responsiveness Summary that summarizes EPA's responses to public comments on this Proposed Plan. Based on new information and/or comments received during the public comment period, the selected remedy may differ in some respects from the details of the Preferred Alternative presented in this Proposed Plan.

B. SITE BACKGROUND

Site Description

The Site is located in Martinsville, Indiana, which is approximately 30 miles southwest of Indianapolis, Indiana (see Figure 1 for Site location) and is primarily a PCE groundwater plume that is centered near the intersection of Pike and Mulberry Streets in Martinsville. The groundwater plume extends downgradient to the northwest to a municipal wellfield and upgradient to the southeast just beyond the intersection of Jackson and Sycamore Streets, with a lobe extending to the west past the intersection of Morgan Street and Shirley Drive. The municipal wellfield is used as the public drinking water supply for the City of Martinsville (the

City). Figure 2 depicts Site features, land use, monitoring wells, and municipal wells, and Figure 3 depicts the shallow groundwater contaminant plume.

The Site also includes soil vapor contamination resulting from contaminants volatilizing from soil and groundwater. Figures 4 and 5 depict the area of soil vapor contamination, which is similar in aerial extent to the shallow groundwater contaminant plume with a few exceptions. One notable exception is an area of soil vapor contamination that extends to the east on Washington Street outside of the groundwater plume area. This area of soil vapor contamination may be intersecting with another area of contamination being investigated by IDEM (O'Neal's Cleaning Depot).

The contaminants of concern (COC) at the Site, which are CERCLA hazardous substances, consist of PCE in groundwater and PCE and trichloroethene (TCE) in soil vapor.

History of Contamination and Response Actions

The former Master Wear facility (the Facility) is located on the west side of the courthouse square in downtown Martinsville. The Facility was constructed in 1956 and operated as a furniture store until 1985. Master Wear, Inc. (Master Wear), also known as American Glove, operated in the Facility from January 1986 to November 1991. Master Wear was an industrial dry cleaner that used PCE to perform laundering and dry cleaning for commercial and institutional organizations. Between 1987 and 1991, multiple complaints of illegal dumping and mishandling of waste drums at the Facility were reported to IDEM. Several spills and releases were also reported. The warehouse portion of the Facility was vacated in 1991, but since then, miscellaneous household items have been stored there. The western portion of the Facility periodically housed miscellaneous shops, such as a hair-styling business, an antiques shop, a curios shop, a manicure service, and an insurance office.

In August of 1992, IDEM removed drums from the Facility and oversaw investigations at or near the Facility between 1996 and 1999.

In November 2002, the PCE concentration in City well PW-1, downgradient from the Facility, exceeded the federal Safe Drinking Water Act maximum contaminant level (MCL) of 5 micrograms per liter (µg/L). The IDEM Office of Water Quality ordered the well temporarily closed, and the City diverted its drinking water supply to the other two wells in the municipal wellfield until it implemented granular activated carbon (GAC) treatment of the drinking water supply in 2005.

The IDEM Site Investigation Program began investigating the presence of PCE in the municipal wellfield in late 2002. The Facility was entered into the Comprehensive Environmental Response, Compensation, and Liability Information System database in January 2003. IDEM staff conducted a preliminary assessment (PA)/site inspection (SI) in 2003 and 2004 in four phases. In the first phase, IDEM confirmed the presence of PCE in Municipal Well #3 (at a concentration of 4.2 µg/L) and identified Master Wear, Inc. as a possible PCE source. However, contamination also was found in samples that were crossgradient to the former Master Wear facility. The second phase of the PA/SI involved the use of a direct-push technology (DPT) rig to collect soil and groundwater samples at and near the former Master Wear facility. IDEM detected PCE in subsurface soil at levels as high as 270 milligrams per kilogram (mg/kg) and in

groundwater as high as 20,000 µg/L at the former Master Wear facility. In the third phase, IDEM collected indoor air samples and confirmed the presence of indoor air contamination at various businesses and residences in the immediate vicinity of the groundwater plume. In the fourth phase IDEM advanced an additional 14 borings using a DPT rig to collect groundwater samples. At this time, IDEM referred the matter to EPA's Superfund Removal Program.

Removal Action

A Time-Critical Removal Action (TCRA), overseen by EPA, was conducted from 2005 through 2008 at the Facility. The TCRA was implemented by Master Wear under an Administrative Order issued by EPA. The action was conducted to address PCE contamination in soil, groundwater, and indoor air on or near the Facility property. The treatment of the identified source area included installing a combination air sparging (AS) and soil vapor extraction (SVE) system over a limited area of the source zone, including the parking lot just north of the Facility and along portions of Mulberry Street up to Morgan Street. The SVE/AS system, along with individual subslab depressurization (SSD) VIMS and passive venting in nearby structures, began operation on January 7, 2005, to address VI. The TCRA did not include removal of impacted soils except from piping trenches and SVE/AS well locations when the remedial system was installed.

The SVE/AS operated until November 9, 2006, when the closure criteria were met, and the system was shut down. Two pre-closure assessments (PCAs) were conducted in 2006 (one in April and one in November) to evaluate the efficiency of the system at addressing soil and soil vapor contamination near the Facility. Ten direct-push borings were advanced during the first PCA adjacent to soil borings demonstrating the highest PCE concentrations in soil during previous investigations, and an additional five borings were advanced during the November PCA.

Figure 6 provides the soil sampling results from the PCAs for the Master Wear removal action. It shows a comparison of PCE concentrations in subsurface soil from the original investigations to the PCE concentrations from the PCAs. The borings advanced during the April PCA are denoted with an "A" suffix after the original boring name, and the borings advanced during the November PCA are denoted with a "B" suffix. The PCE concentrations that exceeded IDEM's targeted clean-up level (640 µg/kg) are shown in red, and PCE concentrations less than IDEM's targeted clean-up level are shown in blue. PCE concentrations in soil samples collected from the April PCA range from 16 to 1,600 µg/kg, and PCE concentrations in soil samples collected from the November PCA range from below the quantitation limit to 750 µg/kg at soil boring location SB-4B, which was the only remaining soil boring location after the November PCA with a PCE concentration in soil exceeding the IDEM's targeted clean-up level. This sample was collected from the 18- to 20-foot depth interval and the boring was located within the Facility parking lot towards the northwest corner of the building, approximately 30 feet to the northwest of the MW-1 well cluster and 15 feet southeast of the SVE-1 extraction well. Although the system included one SVE well and two air sparge wells beneath the Facility, the PCAs did not include results for soil samples from beneath the Facility nor did it assess the effectiveness of the SVE/AS under the Facility.

The SVE/AS system was restarted in August 2007 after indoor air samples from two of three spaces sampled within the Facility exceeded the sub-chronic action levels. The system was turned off again on March 31, 2008, at which time indoor air, soil, and groundwater sample

results indicated that the closure criteria had been met. The SVE/AS system and individual SSD systems were later removed. Analyses of soil and groundwater samples collected after the TCRA, to evaluate the performance of the SVE/AS system, detected residual levels of PCE concentrations but these were below IDEM's targeted clean-up level.

Post-removal Investigation

After completion of removal activities, groundwater in and around the facility was monitored. Also, the City continued to monitor PCE in groundwater from its municipal wellfield and has continued to operate its GAC unit to comply with MCLs for PCE.

After it had obtained sufficient data to determine that a groundwater plume remained that would continue to threaten the municipal wellfield for some time and that the Facility was not likely the only source of groundwater contamination in the area, IDEM requested that EPA assess the Site to determine its eligibility for the Superfund National Priorities List.

EPA added the Pike and Mulberry Streets PCE Plume Site to the NPL in May 2013. The Site is so named as preliminary investigation data indicated that this intersection was in the approximate center of the plume and is not named "Master Wear" because preliminary data included elevated concentrations of groundwater contamination upgradient of the Master Wear facility, indicating other contributing sources to the groundwater contamination. The preliminary site investigation activities identified the following industries and business as possible sources of PCE and/or other chlorinated solvent contamination:

- Former Black Lumber Company
- Semi-truck repair facility (southeast of Black Lumber Company)
- Twigg Corporation
- Former Harman-Motive
- Junkyard (located south and adjacent to Black Lumber Company)
- Numerous dry cleaners in operation or operated in the past in the vicinity of the Site, including:
    - Central Dry Cleaners (operated from 1954 to 1976)
    - Manitorium Cleaners (operated from 1954 to 1962)
    - Kent Cleaners/Richard Deering (operated from 1962 to 1978)
    - Master Wear facility
    - Artesian City Cleaners (operated from 1954 to 1999)
    - Martinsville Cleaners (operated until 1989)
    - O'Neal's Clothes Depot (1983–present)

Remedial Investigation Activities

After the Site was listed on the NPL, EPA initiated an investigation to identify responsible parties (potentially responsible parties or PRPs) capable of leading the RI. EPA was unable to identify any liable and viable PRPs to conduct the RI so it initiated a federally funded RI in 2014. The RI included seven sampling phases conducted from April 2015 through January 2017. The RI activities, data collection methodologies, resulting data, physical characteristics of the Site, nature and extent of contamination, contaminant fate and transport, and conceptual site model (CSM) are documented in detail in the RI Report. Results from Phases 6 and 7 are also

documented in the *Vapor Intrusion Data Evaluation Technical Memorandum*, which is included in the RI report.

A human health risk assessment (HHRA) and a screening-level ecological risk assessment (SLERA) were also completed as part of the RI. The HHRA is presented as Appendix M in the RI and the SLERA is presented as Appendix O in the RI report.

Concurrent Investigations

A third-party VI investigation was performed in August 2015, for three noncontiguous buildings located within the footprint of the PCE groundwater plume. The findings of this investigation indicated the presence of volatile organic compounds (VOCs) within and underneath these three buildings. Additional VI sampling was conducted by EPA's Superfund Technical Assessment and Response Team in January 2016, after the preliminary findings of the first four phases of the RI were evaluated. The Agency for Toxic Substances and Disease Registry (ATSDR) recommended that additional testing be conducted at two properties to determine if VI presents a potential health hazard to current and future occupants (ATSDR 2016). Nine residential properties were sampled based on the ATSDR recommendation and proximity to the PCE groundwater plume.[1]

IDEM is also conducting investigative and cleanup activities, including VI, related to O'Neal's Clothes Depot (currently Vista Cleaners), which is located approximately 0.5 mile to the east of the Facility.

Community Involvement

EPA conducted community interviews in 2015 and in 2019 to better understand the community and its needs regarding the Site. These interviews were conducted with residents and business owners in the community as well as local and county officials. EPA completed a community involvement plan for the Site in August 2019 (https://semspub.epa.gov/work/05/949417.pdf).

C. SITE CHARACTERISTICS

Physical Characteristics and Land Use

The Site is in Martinsville, Indiana, which is located in south central Indiana and is approximately 30 miles southwest of Indianapolis, Indiana (Figure 1). Martinsville is surrounded by unincorporated areas of Morgan County, and the nearby towns include Paragon (6.5 miles to the west) and Morgantown (9.4 miles to the southeast).

Martinsville is the county seat of Morgan County, and the town's residential population is approximately 11,800 people (2010 Census), with 5,100 housing units. In the RI, EPA estimated that up to 4,748 people live within ¼ mile of the Site.

[1] EPA conducted its more extensive VI investigation as part of Phases 6 and 7 of the RI after this ATSDR recommendation.

The buildings that overlay the Site are a mix of residential, commercial, and industrial uses. The economy of the area consists of agricultural and industrial concerns. The latter includes brick manufacturing, aircraft and missile components, and several large-scale goldfish hatcheries. Martinsville is surrounded by rural farmland, and the City is a suburban setting with a town square. The major routes through Martinsville are State Routes 37, 44, and 252. The north-to-south-flowing White River is located 1.5 miles to the west/northwest of Martinsville.

During the RI, EPA did not identify any subsurface features in the area (natural or manmade), other than City of Martinsville water, storm, and sanitary sewer lines and private company utilities. However, after RI activities were completed, EPA was made aware of possible subsurface structures such as a tunnel underneath or in the vicinity of the Facility. If found during pre-design investigations, subsurface structures in this area may have some relevancy in the design of the remedial action for soil vapor.

Climate

The climate of Morgan County is humid and temperate, with warm, humid summers and moderately cold winters. According to the National Oceanic and Atmospheric Administration, average daily temperatures for Morgan County ranges from 72.1 degrees Fahrenheit (°F) in the summer to 29.5 °F in the winter. For the period of record (1971–2000), annual average precipitation is approximately 43.1 inches, ranges from 40 inches in the northern part of the basin to 48 inches in the south-central part of the basin, and usually is distributed evenly throughout the year. Rainfall in the winter and early spring is generally of long duration, steady, and of mild intensity, whereas late spring and summer rainfall tends to be of short duration and high intensity.

Topography

Martinsville is approximately 607 feet above mean sea level. The Site is located in the Norman Upland physiographic unit of the White River Basin in south-central Indiana. The Norman Upland is characterized by narrow, flat-topped divides and deep V-shaped valleys. Local relief is typically 125 to 250 feet. The Norman Upland is well-drained by a strongly dendritic stream pattern.

Regional Soils

The predominant surficial soil types mapped for the Site and surrounding area are dominated by Martinsville loam, Princeton fine sandy loam, Rensselaer clay loam, and Whitaker loam. These account for approximately 92 percent of the surficial soil types within the City of Martinsville.

The Martinsville loam occurs in outwash plains and terraces and is well-drained and moderately permeable. Surface soil to a depth of about 8 inches is usually a brown to grayish brown, very friable, dry fine sandy loam. The subsurface to 43 inches is typically a firm, brown to dark yellowish-brown clay to sandy clay loam.

The Princeton fine sandy loam consists of well-drained soils that are typically formed on dunes and less commonly, on stream terraces. Slope variation can range from 2 to 25 percent. Surface characteristics are brown to grayish brown, very friable, dry fine sandy loam to a depth of 8

inches. Subsurface layering consists of brown to yellowish red sandy or sandy clay loam or loamy sand that is friable and approximately 52 inches thick.

Rensselaer clay loam occurs within the depressions on outwash plains and is poorly drained. Slope variation can range from 0 to 2 percent. Surficial material, to a depth of 11 inches, is typically a gray to very dark gray, friable, dry clay loam. Material underlying the above layer, to a depth of 60 inches, is gray to dark gray, friable to firm, clay or silt loam.

Whitaker loam consists of very deep, somewhat poorly drained soils formed in stratified silty and loamy outwash on outwash, lake, or till plains. Slope variation can range from 0 to 6 percent. The soil is generally dark grayish brown to light brownish gray, dry, friable loam to a depth of 9 inches. Subsurface soil is typically brown to grayish brown, friable to firm, clay or sandy clay loam down to 39 inches.

Regional Geology

The City of Martinsville is located in a glacial outwash (sands and gravel) area, ranging from less than 50 to over 150 feet thick, of Wisconsinan, Illinoian, and pre-Illinoian glaciation events and overlies bedrock composed of mainly siltstones and shales (with minor sandstone and limestone) of the Mississippian-age Borden Group. A topsoil layer less than 10 feet thick overlies the glacial deposits in the study area. The Borden Group ranges from 485 to 800 feet thick.

Regional Surface Water Hydrology

Surface water hydrology is dominated by the West Fork of the White River, located approximately 1.17 miles from the Master Wear facility. The White River Basin is part of the Mississippi River system and drains 11,350 square miles of central and southern Indiana. Long-term average streamflow is about 12,300 cubic feet per second near the White River's confluence with the Wabash River in southwestern Indiana. Variations in streamflow are generally moderate and seasonal. Streamflow is typically highest in April and May and lowest in late summer and fall. There is a levee northwest of the city to control the flow of the West Fork of the White River.

Regional Hydrogeology and Groundwater Use

The regional aquifer is in the fluvial and glaciofluvial (glacial outwash) sand and gravel unit found near the surface to the bedrock along the floodplain of the White River. Although not necessarily a continuous, single geologic deposit, these unconsolidated sands and gravels are a single stratigraphic unit with hydraulic connectivity throughout. Hydraulic conductivities for sand and gravel aquifers within the White River Basin, similar to the one in this study area, range from 24 to 1,500 feet per day and produce well yields from 10 to 2,000 gallons per minute (gpm). The City of Martinsville's municipal wells use groundwater from the unconsolidated sand and gravel aquifer located within this unit.

Bedrock aquifers are developed in an upper weathered zone of the Mississippian Borden group. The upper weathered zone is a zone of enhanced permeability produced by weathering before, during, and after glaciation. The availability of water in this weathered zone is highly variable

and is dependent on the degree of enhanced permeability, the type and thickness of overlying deposits, and the bedrock topography. The shale siltstone upper weathered bedrock aquifer is used primarily for domestic and stock water supplies in areas where no other aquifers are available.

Site Geology

Generally, the geology at the Site consists of approximately 5 to 8 inches of topsoil (when present) composed of silt or clay with variable amounts of sand. Topsoil thicknesses of 9 to 12 inches are present in a few locations. Locations without topsoil are usually paved with fine sand below asphalt/concrete and gravel. Below topsoil and pavement with fine sand is predominately fine to medium, coarse to rounded gravel and fine to coarse sand with no to some silt and clay. The underlying bedrock is encountered at between approximately 53 to 98.5 feet below ground surface (bgs), with the bedrock's high elevation being located toward the middle of the Site (near monitoring wells MW-01, MW-02, MW-16, and MW-07). No local or regional fine-grained layers appear to be present beneath the Site based on review of previously installed boring logs and geologic material observed during the RI.

Site Surface Water Hydrogeology

Since the Site is located in urban commercial and residential areas, the surface drainage pattern has been altered by roadway, driveway, and building construction. Surface water runoff from buildings, developments, and streets is directed into the City of Martinsville stormwater sewer system. A local topographic high is located to the northeast of the Site, designated on topographic maps as Lincoln Hill, with a maximum elevation of approximately 830 feet above mean sea level.

Site Hydrogeology

The groundwater contamination at the Site is in the surficial aquifer. During the RI, EPA found the depth to groundwater to range from 5 to 17 ft bgs. For purposes of investigation, EPA divided this aquifer into shallow (17-27 ft bgs), intermediate (43-60 ft bgs), and top of bedrock (67-99 ft bgs) water-bearing zones. Based on data gathered during the RI and historical data, EPA found that groundwater elevation in each zone of the aquifer was highest in the southeast corner of the Site and lowest in the northwest corner and groundwater migrates to the northwest, towards the municipal supply wells. The northwest migration pattern is likely influenced by the municipal supply wells. A more western or southwestern groundwater migration pattern toward the White River to the west would be expected without the hydraulic influence of the municipal supply wells. EPA observed seasonal variations in water levels between the spring, summer, and fall. Water levels were on average approximately 4 feet higher in the summer than the fall and approximately 2 to 3 feet higher in the summer than the spring; however, EPA observed that the gradients are consistently in a southeast to northwest direction with groundwater flow.

During the RI, EPA also determined that the hydraulic conductivity of the aquifer ranged from 1.2×10^{-3} to 4.1×10^{-2} centimeters per second (cm/s) in the shallow zone of the aquifer, 9.0×10^{-4} to 3.6×10^{-2} cm/s in the intermediate zone of the aquifer, and 3.7×10^{-2} to 4.2×10^{-2} cm/s in the top of bedrock zone of the aquifer. EPA calculated the average groundwater velocities ranging from 34.4 feet per year (ft/year) to 89.3 ft/year in the shallow zone, 137 ft/year to 233 ft/year in

the intermediate zone, and 605 ft/year to 982 ft/year in the top of bedrock zone. Although the vertical gradients showed some variability between each phase of the groundwater investigation, the average gradients were typically downward (from shallow to intermediate or to deep portions of the aquifer) and relatively low (less than 0.001 foot per foot). The low vertical gradients indicate that the groundwater flow is predominantly in the horizontal direction. However, EPA observed anomalously high and upward vertical gradients in the MW-4 well nest, likely due to the bedrock high that is directly downgradient of the nest.

Remedial Investigation Results

EPA conducted the RI between April 2015 and February 2017 using a phased approach. The significant findings and conclusions from the site characterization activities completed during the RI are summarized below. The April 2018 Final RI Report provides additional detail about site investigations and can be found at: (https://semspub.epa.gov/src/document/05/941790).

Groundwater

The only groundwater contaminant that EPA identified above its screening level (SL) is PCE. The SL for PCE is the Safe Drinking Water Act MCL of 5 µg/l. The highest PCE detection that EPA found during the RI (240 µg/l) is in a monitoring well located near the Facility. EPA identified PCE degradation products, including TCE and cis-1,2-dichloroethylene (cis-1,2-DCE), in groundwater but not above their respective SLs (MCLs of 5 µg/l and 70 µg/l, respectively). The groundwater plume is well-defined horizontally and vertically and is limited to the upper, surficial aquifer. The groundwater plume consists of two "lobes" radiating from the Facility. A third "lobe" extends towards the Facility from a potential upgradient source. The plume is most extensive in the shallow zone of this aquifer with some contamination extending to the intermediate depth. At the municipal wellfield, the plume is drawn into the lower portion of the aquifer by the pumping action of the production wells. The concentrations are highest in the center of the plume near the Facility with lower concentrations on the periphery, including the portion of the plume that is being drawn into the municipal wells.

Soil

EPA performed soil sampling at 66 locations and found a single exceedance of the residential, risk-based SLs. Specifically, EPA detected TCE at 3,600 micrograms per kilogram (µg/kg) in a single, shallow soil sample from just north of the Facility, compared to the residential SL for TCE of 410 µg/kg. Although EPA identified PCE in 27 of the 66 soil samples, all detections were below the residential SL of 8,100 µg/kg.

The extent of impacted soils appears to be limited to this area immediately adjacent to the Facility and the uppermost soil interval. This is likely due to the efforts of the previous removal action EPA oversaw at that Facility that treated the soils using SVE/AS. EPA notes that there may be impacted soils under the former Master Wear facility that have not been sampled or treated and pre-design investigation of this area may be required.

Soil Vapor

Figures 4 and 5 are maps presenting the PCE and TCE, respectively, in soil vapor data collected during the RI.

EPA conducted soil vapor sampling over four phases. In the first two phases, EPA sampled soil vapor in 18 and 17[2] soil vapor points (SVPs) located above the center (highest concentration area) of the groundwater plume. In the third and fourth phases, EPA conducted an expanded soil vapor investigation using 77 (third phase) and 52 (fourth phase) temporary soil vapor probes and an instrument that analyzes samples and provides results in real time. EPA arranged the temporary soil vapor points around the circumference of the initial (first and second phase) soil vapor exceedances and installed additional soil vapor points in expanding concentric circles to delineate the extent of the soil vapor plume. EPA then compared these results of the analyses of these soil vapor samples to its most protective risk-based residential SL for soil vapors below the slab (sub-slab) of a home or other dwelling.

During each of the first and second phases of its soil vapor investigation, EPA identified 15 PCE exceedances and 3 TCE exceedances of EPA's risk-based, residential sub-slab VI screening levels (VISLs), 360 micrograms per cubic meter ($\mu g/m^3$) for PCE and 16 $\mu g/m^3$ for TCE. In both phases, EPA found the highest concentrations of PCE and TCE in soil vapor (180,000 $\mu g/m^3$ and 16,000 $\mu g/m^3$ respectively) in a soil vapor well (SG-1) located just north of the Facility[3]. EPA also found particularly elevated soil vapor concentrations at several other soil vapor points in the vicinity of SG-1.

In the third and fourth phases, EPA identified 40 additional PCE exceedances and 11 additional TCE exceedances of EPA's risk-based, residential sub-slab VISLs, as well as two additional areas with notably elevated soil vapor concentrations, though none were similar in magnitude to the concentrations detected in the vicinity SG-1. One is located to the southeast of the Facility, in the vicinity of the intersection of Jackson and Sycamore Streets. The other is located to the northwest of the Facility, in the vicinity of the intersection of Harrison and Cherry Streets.

EPA was able to use the data from the four phases of soil vapor sampling to nearly fully delineate the extent of the soil vapor plume above the most conservative risk-based residential SLs for sub-slab vapors, with one notable exception. EPA was not able to delineate the eastern extent of the soil vapor plume on Washington Street. EPA believes that soil vapor from the Site plume in this area may comingle with soil vapors from a concurrent groundwater plume that IDEM is investigating, O'Neal's Dry Cleaners.

Conceptual Site Model

EPA developed the conceptual site model (CSM) by integrating technical information from a variety of sources, including the physical characteristics, the nature and extent of contamination, and contaminant fate and transport pathways. Figure 7 presents the CSM of PCE in groundwater and soil vapor, Figure 8 presents the CSM of TCE in soil vapor, and Figure 9 presents the CSM of COCs in soil.

[2] During the second phase of soil vapor sampling, one of the soil vapor points did not pass a leak test and was not re-sampled.
[3] EPA notes that this soil vapor well is in close proximity to the single soil sample exceedance.

The sources of potential contamination at the Site are likely historical discharges of waste material and solvents from the former Master Wear facility and possibly other sources, such as those identified in the "Site Background" section of this proposed plan. Although clean-up activities have been implemented to address the potential source area at the former Master Wear facility in the past, recent sampling indicates that PCE concentrations in groundwater downgradient (and upgradient) of the Facility exceed the MCL. In addition, soil exceeds its SL in one surface sample collected near the former Master Wear facility. Soil vapor exceeds the PCE and TCE SLs at multiple locations upgradient and downgradient of the Facility.

COCs could have been released to the environment as dissolved-phase constituents in water or as free-phase product (nonaqueous phase liquid or NAPL)[4]. Dissolved-phase COCs would migrate downward and be subject to soil sorption and volatilization. Likewise, free-phase NAPL would migrate downward and be subject to soil sorption and volatilization, as well as dissolution into soil moisture and retention of discontinuous droplets in soil pores. Precipitation and infiltration will continue to leach sorbed-phase COCs (and trapped NAPL, if any) downward to the saturated zone over time, constituting a continuing source of contaminants to groundwater.

Based on previous investigations conducted at the Site and the data gathered during the RI, EPA has determined that the vadose zone is not currently a continuing source of groundwater contamination sitewide, though it could be in the future. However, EPA has determined that vadose zone contamination may be an ongoing source of soil vapor contamination, particularly at soil sample point SG-01 (near the former Master Wear facility). EPA identified an exceedance of TCE in surface soil (1 to 2 feet bgs) at this location and detected PCE and TCE in shallow soils in the multiple other locations within this vicinity (though below SLs). An AS/SVE system was operated in this area as part of the Master Wear removal action, and it achieved the treatment objectives and substantially reduced VOC concentrations in soil. EPA believes that residual PCE and TCE may still be present in vadose zone soil in this area.

PCE, the primary groundwater COC, is not expected to adsorb to the sandy matrix present beneath the Site. For this reason, the plume is expected to continue to migrate with the groundwater flow, primarily by advection and dispersion. Groundwater flow in the shallow, intermediate, and top of bedrock water-bearing zones of the aquifer is to the northwest, towards the municipal supply wells, and is likely influenced by the pumping rates of the municipal supply wells. A more western or southwestern groundwater flow direction toward the White River to the west would be expected without the hydraulic influence of the municipal supply wells.

PCE and TCE are the principal contaminants within soil vapor at the Site. These and other VOCs located in subsurface soils or in groundwater can volatilize, migrate through soil as vapor, and transport into and accumulate in indoor spaces, where inhalation exposures can occur. Generally, EPA observed PCE and TCE vapors in soil to follow exceedances in groundwater and along preferential pathways (e.g., utility corridors).

Based on soil vapor concentrations detected during Phases 2 through 5, three areas were identified where PCE soil vapor concentrations are greater than 15,000 $\mu g/m^3$ as shown in Figure 4. The first high PCE soil vapor concentration area is located around the former Master Wear facility and the former Manitorium Cleaners. Contamination released from these facilities may be acting as potential soil vapor sources. The second high PCE soil vapor concentration area is

[4] Note that EPA has not identified any remaining NAPL at the Site.

located within the northwest portion of the study area approximately 1,200 feet downgradient of the former Master Wear facility. However, this area is not located near an identified potential past PCE user nor are there high concentrations of PCE in groundwater in this area. There may be an unidentified source of PCE in soil vapor in this area, or PCE may be migrating to this area through preferential pathways from another source area. Preferential pathways, such as the sanitary line, storm line, or other utility conduits, may transport VOC vapors between a potential source and building over greater distances than what is typically observed due to vadose zone diffusion and advection. The third high PCE soil vapor concentration area is located to the southeast (and upgradient) of the former Master Wear facility and just to the west of the former Central Dry Cleaners. Contamination released from this facility may be acting as a source of the soil vapor in this area.

EPA also observed elevated PCE concentrations in soil vapor samples to the east of the Site along Washington Street. EPA did not identify any past potential PCE users in this area and believes that these contaminants could have potentially migrated along a utility corridor. In particular, the pipe bedding for the water main that runs along Washington Street could potentially serve as a preferential pathway for vapor migration. Sanitary and/or storm lines may also be present along portions of Washington Street and serve as soil vapor conduits. In addition, PCE in soil vapor from the potential source at the O'Neal's Clothing Depot site may also be migrating from the east along the utility corridor.

EPA only identified three locations with TCE concentrations in soil vapor exceeding the SL (16 $\mu g/m^3$), and each is generally located near identified potential past PCE users (Master Wear, Artesian City Cleaners, and Central Dry Cleaners), as shown in Figure 5. TCE was detected well above the VISL (160,000 $\mu g/m^3$) in one location near the former Master Wear facility and the former Manitorium Cleaners.

Soil vapor can migrate across a building slab and/or basement or foundation walls through two mechanisms: (1) advection through cracks, seams, or other openings, and (2) diffusion directly through the concrete, brick, or concrete blocks. Advection across the slab has been the predominant mechanism discussed in the literature and guidance. Building characteristics such as age, condition, construction type, HVAC type, and the presence of preferential pathways can also influence the VI pathway. Advection can be affected by barometric pressure changes, wind load, thermal currents, depressurization caused by HVAC systems, exhaust fans, or the stack effect, which is caused by the difference in pressure between the less-dense interior heated air and denser cold outdoor air. This pressure differential can result in infiltration of air and soil vapor into the lower part of the building. The gas permeability of the slab affects the rate at which vapor enters a structure.

Building slabs at the properties where VI assessments were conducted were in varying degrees of condition ranging from good with no observed cracks, to significant cracking or even missing sections with exposed dirt. These observed openings can generally be presumed to be routes for potential VI.

Once VOCs have entered the indoor air of a building, concentrations can be attenuated through a number of dilution processes, including both natural and mechanical building ventilation and adsorption to building materials. The building envelope leakage (walls and roof) and the mechanical ventilation rate affect the dilution of VOCs that have entered the building.

VOCs do not persist in indoor air without an ongoing source, as typical residential air exchange rates are on the order of 0.25 air exchanges per hour. If the source is discontinued, concentrations rapidly decrease within a few days. In addition, VOCs are subject to sorption and desorption processes from building materials. Therefore, observed persistence in indoor air is evidence for the presence of an ongoing source, which can be either ongoing VI or a product containing VOCs in use or stored within the structure.

At this site, the presence and operation of a heating system within a building appears to be a major consideration for VI due to the stack effect. There does not seem to be a strong geographic pattern between VI category and property location; however, there are multiple properties where access was not granted for VI sampling, so EPA is basing this observation on limited data.

D. SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

The Site has not been divided into operable units.

This Proposed Plan presents information about the potential exposures from the Site and presents EPA's Preferred Alternative to address the groundwater plume and VI in occupied structures that overlie the groundwater contamination plume (see Figure 3) and/or are within the soil vapor plume (see Figures 4 and 5).

E. SUMMARY OF SITE RISKS

EPA used data from the RI to conduct a baseline human health risk assessment (BHHRA) and a screening level ecological risk assessment (SLERA). To conduct these risk assessments, EPA assumed that the current land use at the Site will remain the same in the future, which consists of mostly residential and small commercial operations but also includes some government buildings and light industry. EPA also assumed that properties at the Site will continue to have access to municipal water, while recognizing some properties in the vicinity of the Site have private wells. EPA issued both of these risk assessments in April 2018 as appendices to the RI report.

Human Health Risk

EPA performed a BHHRA to assess risks posed by the Site in the absence of any remedial or other clean-up actions. Because this Proposed Plan addresses only groundwater and soil vapor contamination, this section is limited to the risks posed by VI and exposure to contaminated groundwater.

To evaluate the potentially complete exposure pathways further, EPA estimated and quantified the magnitude, frequency, and duration of exposures as well as the concentrations of the contaminants at the point of exposure. In the BHHRA, EPA followed its guidance in using upper-bound parameter values (as opposed to average values) for exposure frequency and exposure duration. EPA also followed its guidance in selecting intake variable values for a given pathway such that the combination of values from all variables results in a reasonable estimate of the maximum exposure for each exposure pathway.

WHAT IS HUMAN HEALTH RISK AND HOW IS IT CALCULATED?

A Superfund human health risk assessment estimates the "baseline risk." This is an estimate of the likelihood of developing cancer or non-cancer health effects if no cleanup action were taken at a site. To estimate baseline risk at a Superfund site, EPA undertakes a four-step process:

Step 1: Analyze Contamination
Step 2: Estimate Exposure
Step 3: Assess Potential Health Dangers
Step 4: Characterize Site Risk

In Step 1, EPA looks at the concentrations of contaminants found at a site as well as past scientific studies on the effects these contaminants have had on people (or animals, when human studies are unavailable). A comparison between site-specific concentrations and concentrations reported in past studies helps EPA to determine which concentrations are most likely to pose the greatest threat to human health.

In Step 2, EPA considers the different ways that people might be exposed to the contaminants identified in Step 1, the concentrations that people might be exposed to, and the potential frequency and duration of exposure. Using this information, EPA calculates a "reasonable maximum exposure" scenario, which portrays the highest level of exposure that could reasonably be expected to occur.

In Step 3, EPA uses the information from Step 2 combined with information on the toxicity of each chemical to assess potential health risks. EPA considers two types of risk: cancer and non-cancer risk. The likelihood of any kind of cancer resulting from exposure to carcinogens at a Superfund site is generally expressed as an upper bound incremental probability, such as a "1 in 10,000 chance" (expressed in scientific notation as 1E-04). In other words, for every 10,000 people exposed, one extra cancer may occur as a result of exposure to site contaminants. An extra cancer case means that one more person could get cancer than would normally be expected to from all other causes. The risk of cancer from other causes has been estimated to be as high as one in three. For non-cancer health effects, EPA calculates a "hazard index" (HI). The ratio of exposure to toxicity is called a hazard quotient (HQ). The HI is generated by adding the HQs for all chemicals of concern that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An HQ of less than 1 indicates that the dose from an individual contaminant is less than the reference dose, so non-cancer health effects are unlikely. The key concept here is that a "threshold level" (measured usually as an HI of less than 1) exists below which non-cancer health effects are no longer predicted. EPA's acceptable cancer risk range is 1E-06 to 1E-04. EPA considers HI < 1 as acceptable. Generally, remedial action at a Site is warranted if cancer risks exceed 1E-04 and/or if non-cancer hazards exceed an HI of 1.

In Step 4, the results of the three previous steps are combined, evaluated and summarized. EPA adds up the potential risks from the individual contaminants and exposure pathways and calculates a total site risk.

Contaminants of Potential Concern

In the BHHRA, EPA evaluated the potential COCs in both groundwater and soil vapor. In groundwater, EPA determined PCE and TCE in groundwater as posing potential risks but only detected PCE above its MCL. In soil vapor, EPA determined that both PCE and TCE posed potential risks via the vapor intrusion pathway and identified both of these contaminants above their respective soil vapor SLs. Therefore, EPA identified PCE as a COC for groundwater and both PCE and TCE as COCs for soil vapor.

Groundwater

The BHHRA presents the potential current and future risks to human health posed by exposure to contaminated groundwater via ingestion, inhalation, or dermal contact (described as "potable use" in the BHHRA report) for both residents and commercial or industrial workers. EPA evaluated the potential potable use of untreated, contaminated groundwater for the purposes of the BHHRA. These exposure scenarios are only theoretical as the groundwater from the city's municipal wells is being effectively treated using activated carbon, and EPA did not identify any private, residential wells with contamination above SLs. However, it is possible that residential wells exist (or could be installed) within the Site groundwater contaminant plume.

In the BHHRA, EPA also evaluated the potential exposure of construction workers to contaminated groundwater via dermal contact or inhalation of contaminant vapors. For this exposure scenario, EPA considered potential exposure to groundwater contamination present in shallow monitoring wells screened at 10 ft bgs or less from construction activities involving digging.

Based on groundwater data it gathered during the RI from monitoring wells and the municipal wellfield (pre-treatment), EPA found that the range of concentrations of Site contaminants in groundwater do not present an unacceptable cancer risk to adult or child residents but may pose an unacceptable non-cancer risk to residents. Specifically, EPA determined that the highest concentrations of Site contaminants in groundwater increase a resident's ELCR by 2 in 100,000 (2×10^{-5}), which is less risk that EPA's maximum acceptable ELCR of 1×10^{-4}. However, EPA did determine that the Site contaminants in groundwater pose an unacceptable potential non-cancer health risk to adult and child residents, with a measured HI as high as 3.

In the BHHRA, EPA determined that groundwater contaminants at the Site do not pose an unacceptable cancer or non-cancer health risk to industrial, commercial, or construction workers (non-potable uses).

Soil Vapor

In the BHHRA, EPA considered current and future potential soil vapor exposure scenarios to residents, industrial/commercial workers, and construction workers. For each of these receptor groups, EPA considered exposure scenarios involving inhalation of indoor air after soil vapor

contaminants from the Site had accumulated within a structure. For the construction worker scenario, EPA evaluated exposure to soil vapor from the Site released to the ambient air during digging activities.

Based on sampling data gathered during the RI, EPA found that the range of indoor air concentrations of Site contaminants do not present an unacceptable cancer risk to adult or child residents but may pose an unacceptable non-cancer risk to these residents. Specifically, EPA determined that highest indoor air concentration of Site contaminants measured in residential properties at the Site have the potential to increase a resident's ELCR by 2 in 100,000 (2×10^{-5}), which is less risk than EPA's acceptable maximum ELCR of 1 in 10,000 (1×10^{-4}). However, EPA also determined that the indoor air concentrations of Site contaminants pose unacceptable risks at two of the 50 properties sampled, with a measured HI as high as 6.

Based on sampling data gathered during the RI, EPA found that the range of indoor air concentrations of Site contaminants do not present an unacceptable cancer risk to industrial/commercial workers but may pose an unacceptable non-cancer risk to these workers. Specifically, EPA determined that highest indoor air concentration of Site contaminants measured in commercial properties at the Site have the potential to increase a worker's excess lifetime cancer risk (ELCR) by 8 in one million (8×10^{-6}), which is less risk than EPA's acceptable maximum ELCR of 1 in 10,000 (1×10^{-4}). However, EPA also determined that the indoor air concentration of one Site contaminant (TCE) at one of the 50 sampled properties poses an unacceptable potential non-cancer risk to workers (i.e. an HI of greater than 1).

EPA notes that it was only able to sample 50 of the more than 200 occupied structures within the soil vapor plume and that it is unclear how many additional properties may have unacceptable risks from Site-related exposures to COCs via the VI pathway.

Ecological Risk

EPA conducted a SLERA and determined that Site contaminants do not pose actual or potential unacceptable risks to ecological receptors. Specifically, EPA used the surface soil and groundwater data generated during the RI to assess risk for both aquatic and terrestrial invertebrates, fish, and wildlife (i.e., ecological receptors) by comparing measured concentrations of Site contaminants in soil and groundwater with ecological screening levels established for soil and surface water, respectively. Because the Site is located in a heavily developed urban area, potential ecological receptors are limited, and EPA did not identify any special habitats or endangered species threatened by Site contaminants. However, the maximum concentration of two Site contaminants exceeded their respective screening values in at least one sample of soil or groundwater.

In soil, cis-1,2-Dichloroethene (cis-1,2-DCE), exceeded its screening value in the 1- to 2-foot depth interval of a single sample taken in the vicinity of the former Masterwear facility. Due to the low frequency of detection of cis-1,2-DCE in soil, the absence of suitable wildlife habitat in the vicinity of the sample location where it identified the exceedance, and the fact that this was the only Site contaminant to exceed its respective screening level, EPA concluded that Site contaminants in soil do not require further evaluation relative to ecological risk.

In groundwater, PCE exceeded the surface water screening value in shallow groundwater in 3 of 45, 5 of 63, and 5 of 62 samples in the three phases of sampling. However, contaminants confined to groundwater do not present ecological risk because there is no exposure pathway through which ecological receptors could be exposed to contaminants in groundwater. EPA conservatively compared concentrations of contaminants in groundwater to their respective surface water screening levels to evaluate risk in the unlikely event that groundwater was to daylight into a stream or spring, in which case ecological receptors could be exposed. Groundwater daylighting into surface water is not currently occurring at the Site, and the potential for this to occur is considered very low based on the depth of the groundwater, locations of the plume, and Site hydrology.

Therefore, EPA concluded in the SLERA that COC concentrations in soil and groundwater do not present significant risk to ecological receptors and that no further evaluation relative to ecological risk at the Site is necessary.

Conclusion of Risk Assessments

EPA concludes that the Preferred Alternative identified in this Proposed Plan, or one of the active measures considered in this Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

F. REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) are goals specific to media for protecting human health and the environment. They are based on unacceptable risks, anticipated current and future land use, objectives and expectations of the action, and statutory requirements.

EPA developed the following RAOs specific to this proposed action:

- Protect human health by reducing or eliminating exposure (via ingestion, inhalation, or direct contact) to groundwater COCs at concentrations that could pose an unacceptable risk to human health for current and future groundwater use.

- Reduce COC concentrations in groundwater to restore the aquifer to its beneficial use as a drinking water aquifer within a reasonable timeframe[5].

- Protect human health by reducing or eliminating the potential for COCs in soil vapor or groundwater to volatilize and migrate into buildings through the VI pathway.

- Protect human health by reducing or eliminating exposure (via inhalation) to COCs in indoor air, resulting from the intrusion of soil vapors, at concentrations that could pose an unacceptable risk to human health for current and future use of affected properties.

[5]Currently the City of Martinsville is effectively using this aquifer as a drinking water source because it treats the groundwater before providing it to customers. This RAO is more specifically intended to restore the groundwater in the aquifer to drinking water standards before treatment.

To meet these RAOs, EPA is proposing the following preliminary remedial goals (PRGs):

- Groundwater: Drinking Water MCL for PCE = 5 µg/L
- Soil Vapor[6]:
    - Residential:
        - 70 µg/m^3 for TCE
        - 1,390 µg/m^3 for PCE
    - Commercial/industrial:
        - 292 µg/m^3 for TCE
        - 5,840 µg/m^3 for PCE

G. SUMMARY OF REMEDIAL ALTERNATIVES

EPA is proposing: (1) continued carbon treatment of groundwater from the municipal wellfield operated by the City of Martinsville (provided that the wellfield remains in or near its current location); (2) in situ chemical oxidation (ISCO) to address the concentrated portion of the Site groundwater plume; (3) long term monitoring (LTM) of the groundwater plume to confirm that Site contaminants in groundwater throughout the plume are reducing in concentration at a reasonable rate; (4) institutional controls (ICs) to insure that drinking water wells screened in the groundwater plume are not used and new ones are not installed; (5) connection of private residences to the municipal drinking water supply if needed; (6) removal of soil vapor source(s) using soil vapor extraction and other means as necessary; (7) monitoring of occupied structures without VIMS located above the soil vapor plume at the Site to identify unacceptable VI exposures, (8) pathway sealing and installation of VIMS as needed; and (9) ICs to restrict building and land use within or nearby the soil vapor plume at the Site and to ensure the integrity of the VIMS.

The remainder of this section of the proposed plan describes the clean-up alternatives EPA considered before deciding on the set of proposed clean-up options described above.

In the FS, EPA initially considered the following remedial alternatives:

- Groundwater:
    - Monitored natural attenuation (MNA)
    - Enhanced in situ bioremediation
    - In situ chemical reduction (ISCR)
    - In situ chemical oxidation (ISCO)

[6] A discussion of how these values were determined can be found in Section 2.3 of the FS Report. The need for VIMS will be determined first by sub-slab soil vapor concentrations. EPA, in consultation with IDEM, will determine the need to include an additional evaluation for indoor air concentrations and, if it is deemed necessary, will establish target indoor air concentrations based on the most recent health protective data available at that time.

- In situ sorptive-reactive media
- In well air stripping
- Three treatment alternatives at the city's municipal water treatment plant (WTP), to be implemented in conjunction with one of the above remedies, including:

    - Granular activated carbon
    - Air stripping
    - Advance oxidation process

- Soil Vapor:

    - Pathway sealing
    - Pathway sealing and VIM
    - Soil vapor source removal
    - Pathway sealing, soil vapor source removal, and VIM

In its initial evaluation in the FS report, EPA determined that in situ enhanced bioremediation, in situ reactive media, and in well air stripping did not meet its initial screening criteria for groundwater and pathway sealing (alone) did not meet its initial screening criteria for soil vapor. Then, EPA conducted a detailed analysis of the remaining alternatives, in comparison to an alternative involving no action.

A summary of the cleanup alternatives for which EPA conducted a detailed analysis to consider for this response action is provided below.

Description of Remedial Alternatives

Common Elements

All of the remedial alternatives, except the no action alternative, include the following common elements:

- Access to private properties and public rights-of-way;

- Treatment of the groundwater from the City of Martinsville's municipal wellfield before it is provided to the city's customers (provided the wellfield remains at or near the same location);

- Connection of private residences to the city's public drinking water supply if needed[7]; and

- Groundwater and VI sampling.

[7] EPA is proposing to provide for private residences to connect to the city's municipal water supply if said residence is dependent on a private well for drinking water and the private well is within the plume. EPA estimates the cost for a single installation to be $4,000 and that the number of residences needing this connection are very low since previous efforts revealed none. Therefore, EPA estimates that the potential cost from these connections are insignificant in comparison to the cost of the active groundwater remedies.

All of the remedial alternatives will benefit from governmental Institutional Controls (ICs), as follows:

- Prohibiting the installation of potable wells in groundwater above SDWA MCLs;

- Closing potable wells and/or reducing the use of potable wells in groundwater above SDWA MCLs; and

- Requiring construction of new, occupiable structures overlying groundwater or soil vapor concentrations greater than VISLs to include protective measures, such as vapor barriers or sub-slab depressurization systems.

Groundwater Alternatives

For the two active groundwater alternatives presented below, GW5 and GW6, EPA evaluated active treatment in only the core of the groundwater plume. For these evaluations, EPA defined the "core of the groundwater plume" as that portion of the groundwater plume with PCE concentrations greater than 46 µg/l.

Alternative GW1—*No Action*

EPA is required to evaluate a "no action" alternative when considering potential remedial actions for a site to provide a baseline for comparison to the other potential response actions. The no-action alternative means that no remedial action would be undertaken and that no institutional controls, containment, removal, treatment, or other mitigating actions would be implemented to control exposure to COCs. The no-action alternative also assumes that the City would no longer pump and operate its current municipal wellfield. Therefore, the potential human health and environmental risks associated with exposure to the COCs which EPA identified in its risk assessments would not be mitigated. In addition, contamination from the Site would not be contained and could spread and expand the Site boundaries.

Estimated Costs for Alternative GW1

Direct Capital Costs:	$0
O&M Costs:	$0
Total Periodic Costs:	$0
WTP Costs:	$0
Total Present Value:	$0

Alternative GW2—*Water Treatment Plant (WTP) Alternatives*

Alternative GW2 is a group of alternatives that EPA assumes will be implemented concurrently with the other, active groundwater alternatives, GW3 to GW8 presented below. EPA is proposing to implement one of the Alternative GW2 treatment options to continue to protect City residents from groundwater contamination via the drinking water pathway, while it also implements one or more of the other groundwater alternatives to reduce concentrations of PCE in the groundwater plume to below EPA's targeted levels or PRGs[8]. For the Alternative GW2

[8] In this case, the PRG is the MCL for PCE (5 µg/l).

options, EPA assumed that current pumping from the three existing municipal extraction wells will continue and only evaluated different treatment processes at the WTP for the extracted groundwater. EPA did not evaluate extraction from additional wells as part of its assessment of the Alternative GW2 treatment options.

For Alternative GW2, EPA evaluated three different treatment technologies to reduce PCE concentrations to meet drinking water standards in groundwater that is already being pumped for municipal use. The three GW2 treatment technologies are:

- *Alternative GW2A.* Alternative GW2A would continue operations of the City WTP using GAC treatment to reduce PCE concentrations to below the MCL.

- *Alternative GW2B.* Alternative GW2B would replace the existing GAC treatment system with an air stripper. Air strippers remove COCs from liquid (water) by providing contact between the liquid and air. The air is then released to the atmosphere or potentially treated to remove the COCs and subsequently released to the atmosphere.

- *Alternative GW2C.* Alternative GW2C would replace the existing GAC treatment system with an advanced oxidation process (AOP) treatment system. AOP treatment combines ultraviolet light or ozone with hydrogen peroxide to form hydroxyl radicals, which are powerful oxidants that effectively oxidize recalcitrant organic compounds (like PCE).

The estimated O&M and total periodic[9] costs presented below for each of the three WTP alternatives are annual costs, though these costs for Alternative GW2A would be incurred every 2 years. Though the number of years that these WTP alternatives would need to be operated varies depending on the overall groundwater remedy selected, the total present value presented below for each of the three WTP alternatives is based on 15 years of operation, so they are directly comparable.

Estimated Costs for WTP Alternatives

	Estimated Costs for Alternative GW2A	***Estimated Costs for Alternative GW2B***	***Estimated Costs for Alternative GW2C***
Direct Capital Cost	$0	$627,484	$2,384,051
O&M Costs	$61,500	$62,143	$272,345
Total Periodic Costs	$87,514	$0	$0
Total Present Value	$1,003,034	$1,391,266	$5,731,390

Alternative GW3—*Monitored Natural Attenuation (MNA) and Institutional Controls*

Alternative GW3 addresses the risk to current and potential future receptors by relying on natural attenuation to decrease COC concentrations in groundwater and using institutional controls to prevent COC exposure while natural attenuation is ongoing. The following are the main components of Alternative GW3:

[9] Periodic costs are costs that are expected to be encountered while the treatment alternative is being implemented that do not fit in the O&M or direct capital costs categories.

- MNA, including the following:

    - Sampling and analyzing groundwater samples to assess natural attenuation of COCs in groundwater;
    - Modeling groundwater and natural attenuation processes; and
    - Completing five-year reviews.

- Implementing institutional controls to prevent domestic use of untreated groundwater within or nearby the plume.

Each of the main components of this alternative is discussed in the following paragraphs.

EPA defines MNA as "the reliance on natural attenuation processes (within the context of a carefully controlled and monitored clean-up approach) to achieve site-specific remedial objectives within a timeframe that is reasonable compared to other methods." Natural attenuation processes include a variety of physical, chemical, or biological processes that act without human intervention to reduce the contaminant mass, toxicity, mobility, volume, or concentrations in soil and groundwater. Biodegradation is the most important destructive attenuation mechanism, although abiotic destruction of some compounds does occur. Nondestructive attenuation mechanisms include sorption, dispersion, dilution from recharge, and volatilization.

MNA is appropriate as a remedial approach only when it can be demonstrated to be capable of achieving the RAOs within a timeframe that is reasonable compared to that offered by other methods. MNA is typically applied in conjunction with active remediation measures (e.g., source control[10]), or as a follow-up to active remediation measures that have already occurred.

Evaluating natural attenuation usually involves both determining what natural attenuation processes are occurring and estimating future results of these processes. Therefore, if EPA selects this remedy, it would include continued monitoring and data evaluation over time to document and verify the effectiveness of these processes. The evaluation may consist of groundwater or fate-and-transport modeling to predict the effects of natural attenuation. The evaluation method may also be updated periodically to verify progress and compare groundwater analysis results to the predictions.

In addition to modeling, the use of natural attenuation as part of the remedial plan will require that an LTM program be instituted. The monitoring data would provide information to allow EPA to decide if natural attenuation is meeting Site objectives and to verify that changes in Site conditions do not reduce the effectiveness of natural attenuation. Groundwater would be monitored to determine if COC concentrations within the plume decrease as the result of existing natural attenuation processes or if additional remedial action would be required. The existing monitoring well network would be used to monitor groundwater COC concentrations, breakdown products, geochemical conditions, and natural attenuation parameters, including dissolved oxygen, oxidative-reductive potential (ORP), turbidity, pH, and conductivity. A detection plan for early warning of impacts on sensitive receptors, such as residential wells, would be provided. Plans could also be developed for contingent remedial efforts that could be executed if natural attenuation processes do not fulfill expectations.

[10] EPA previously oversaw the operation of an SVE/AS system that was designed to remediate the primary contaminated soil and groundwater source at the Site and does not expect source control to be necessary at the Site.

The NCP requires five-year reviews as long as hazardous substances with the potential to cause risk to human health and the environment remain at the Site. As part of the five-year review process, EPA would evaluate risk and determine if MNA is continuing to be protective of human health and the environment.

Institutional controls implemented as part of this remedy would protect human health and the environment until natural attenuation processes (or a contingent remedy) reduce COC concentrations in groundwater to below PRGs. Institutional controls would restrict access, land use, and domestic use of groundwater at the Site. The following are some examples of potential institutional controls that could be employed to address COCs in groundwater upgradient of the municipal wells:

- Working with the local jurisdiction to develop changes in the law to restrict well drilling and groundwater access;

- Recording the groundwater contamination in the land record to provide notice of the issue to prospective land owners and the public; and

- Recording contaminated aquifers on the state registry to maintain institutional tracking.

For the estimated total present value for Alternative GW3 presented below, EPA assumed 35 years of groundwater monitoring and operation of the carbon treatment on the WTP (Alternative GW2A). This is amount of time EPA estimates will be required to achieve groundwater PRGs using MNA. The periodic costs presented below would be incurred every 5 years.

Estimated Costs for Alternative GW3:

Direct Capital Costs:	$158,933
Annual O&M Costs:	$84,050
Total Periodic Costs:	$42,081
WTP Costs:	$1,934,435
Total Present Value:	$3,285,377

Alternative GW5—*In Situ Chemical Reduction (ISCR), LTM, and ICs*

Alternative GW5 addresses the risk to current and potential future receptors using ISCR and institutional controls to prevent COC exposure until ISCR and natural attenuation reduce groundwater COCs to below PRGs. ISCR involves injecting an insoluble chemical amendment, such as zero-valent iron (ZVI), carbon sources, or some combination of these, in solid or slurry form into the groundwater plume to create a zone of strongly reducing conditions, triggering and accelerating reductive dechlorination of the COC contaminants.

The following are the main components of Alternative GW5:

- In situ chemical reduction, including the following:

    - Injecting ISCR amendments into the subsurface within the core of the shallow groundwater plume including ZVI and a carbon substrate, to stimulate abiotic and biotic processes; and
    - Relying on natural attenuation to achieve the PRGs for the areas of the plume with lower COC concentrations.

- LTM, including the following:

    - Sampling and analyzing groundwater samples for COCs and daughter products; and
    - Completing five-year reviews.

- Institutional controls to prevent domestic use of untreated groundwater within or nearby the plume.

Both ICs and LTM would be implemented for Alternative GW5 in the same manner as for Alternative GW3.

Alternative GW5 would primarily consist of injecting ISCR amendments into the shallow aquifer to promote ISCR. Injecting an ISCR reagent has proven to be highly effective in treating chlorinated compounds based on an oxidation-reduction process where the contaminant serves as an electron acceptor and the ISCR reagent as the electron donor. Chlorinated compounds can accept electrons from ZVI and be reduced to nontoxic end products, such as ethene and ethane. In addition to the chemical component of ISCR, the reduced conditions in groundwater created by the ZVI are also favorable for stimulating the growth of microorganisms capable of degrading compounds. In addition, if ZVI is combined with nutrients and an electron acceptor or energy source, several physical, chemical, and microbiological processes combine to create strong reducing conditions that stimulate rapid and complete dechlorination of organic solvents. These biogeochemical reductions minimize the generation of daughter products, such as vinyl chloride, and result in end products of ethene and ethane.

Injections would be accomplished using a permanent network of wells or by temporary injection wells through direct push technology (DPT) and screening tools. Injection points could be spaced on a grid pattern at the Facility or in off-set rows to create a reactive zone to intercept contaminated groundwater.

The geochemical conditions induced by ISCR, would also induce biotic processes in downgradient portions of the groundwater plume and could help to reduce COC concentrations to below the PRGs within the remainder of the groundwater plume.

Predesign investigations may be conducted to refine estimates of contaminant mass and depth intervals or to collect remedy-specific parameters. During and after treatment, performance monitoring would be conducted to establish baseline conditions at the Site prior to remediation, determine the degree of contaminant reduction, and monitor contaminant migration. The potential for methane generation and need for methane control during remediation would also be evaluated before and during treatment. Parameters specific to the performance of ISCR would also be monitored during treatment, such as ISCR amendments, microorganisms, pH, ORP,

dissolved oxygen, methane, ethane, ethene, and general chemistry. EPA would use this performance monitoring to evaluate if additional injections are necessary and, if so, whether it is more technically and economically effective to continue with the same ISCR amendment or to focus on promoting the biotic processes leading to reductive dehalogenation.

For the estimated total present value for Alternative GW5 presented below, EPA assumed two injection events would be conducted and that LTM and WTP operation (Alternative GW2A) would continue for 17 years. This is the amount of time EPA estimates will be required for natural processes to reduce COC concentrations in groundwater to below PRGs after the initial injection of ISCR amendments decrease concentrations in the core of the plume. The annual O&M costs are presented as a range because EPA estimates this cost to vary by year, as detailed in the FS report. The periodic costs presented below would be incurred every 5 years.

Estimated Costs for Alternative GW5:

Direct Capital Costs:	$1,337,696
Annual O&M Costs:	$82,027 - $404,907
Total Periodic Costs:	$42,081
WTP Costs:	$1,119,113
Total Present Value:	$4,382,898

Alternative GW6—*In Situ Chemical Oxidation (ISCO), LTM, and ICs*

Alternative GW6 consists of injecting a liquid chemical oxidant (persulfate, permanganate, or peroxide) into the shallow groundwater. The following are the main components of Alternative GW6:

- ISCO, including the following:
    - Injecting an oxidant into the subsurface to oxidize COCs within the core of the shallow groundwater plume; and
    - Relying on natural attenuation to achieve the PRGs for the areas of the plume with lower COC concentrations.
- LTM, including the following:
    - Sampling and analyzing groundwater samples for COCs and daughter products; and
    - Completing five-year reviews.
- ICs to prevent domestic use of untreated groundwater within or nearby the plume.

ICs and LTM would be implemented for Alternative GW6 as discussed for Alternatives GW3 and GW5.

ISCO involves oxidation, a chemical process that can convert hazardous contaminants, such as PCE, to nonhazardous or less toxic compounds that are inert, more stable, or less mobile. Alternative GW6 would primarily consist of injecting a chemical oxidant into the core of the

groundwater plume within the shallow aquifer to treat the COCs present in the core of the groundwater plume. The COCs would be converted into innocuous compounds commonly found in nature, such as carbon dioxide, water, and inorganic chloride.

The oxidants that may be applicable to the Site include permanganate and persulfate, which have been used for the remediation of chlorinated solvents like PCE. Permanganate is commonly available in two forms: potassium permanganate, a crystalline solid that is typically mixed with water onsite to form a solution; and a liquid sodium permanganate. Compared to other oxidants, permanganate is relatively stable and persistent in the subsurface; as a result, it can migrate by diffusive processes, allowing it to treat more of the groundwater plume. Persulfate typically must be activated in the field by applying iron ethylenediaminetetraacetate or a base, such as sodium hydroxide, to increase pH. For persulfate to be effective in field applications, the activator must be distributed and transported with the persulfate. Natural mineral activated persulfate using ambient groundwater minerals would also be considered.

As discussed for Alternative GW5, injections would be accomplished using a permanent network of injection wells or temporary injection wells using DPT and screen tools. The oxidant would be injected into the subsurface, exit the well screens (if applicable), and spread laterally into the aquifer formation. The oxidant would mix and react with the COCs in the surrounding groundwater. Recirculation wells or injection and extraction well combinations may be employed to improve mixing and oxidant distribution in the subsurface. Fewer wells would be required using these delivery approaches. This could be an advantage as the groundwater plume is located below a highly developed area.

The injection points could be arranged in rows to create a reactive zone to intercept contaminated groundwater. If necessary, injection points could also be spaced on a grid pattern within the parking lot of the Facility. As with Alternative GW5, the injections would be focused on treating the core of the groundwater plume with the highest PCE concentrations. After the initial injection period, an evaluation would be conducted to determine if additional injections are necessary.

Potassium permanganate encapsulated in wax cylinders is another method of delivering oxidant into the subsurface. If used, the cylinders could be placed in the aquifer using DPT applications or could be lowered into wells. The presence of the protective wax barrier slows down and controls oxidant release, resulting in sustained oxidant release creating reactive zones in the subsurface for long-term passive treatment of groundwater. However, the limited permanganate concentration released from these wax cylinders may not be sufficient to treat PCE in the sandy aquifer.

Predesign investigations would be performed to refine the COC mass estimate and vertical intervals for injections. During and after treatment, performance monitoring would be conducted to establish baseline conditions at the Site prior to remediation, determine the degree of contaminant reduction, and monitor contaminant migration. Parameters specific to the performance of ISCO would also be monitored, such as oxidant concentrations, metals that may be solubilized due to highly oxidative conditions (e.g., arsenic, barium, cadmium, chromium, lead, or selenium), pH, ORP, dissolved oxygen, and general chemistry.

For the estimated total present value for Alternative GW6 presented below, EPA assumed two injection events would be conducted and that LTM and WTP operation (Alternative GW2A) would continue for 15 years. This is the amount of time EPA estimates will be required for natural processes to reduce COC concentrations in groundwater to below PRGs after the initial injection of ISCO amendments decrease concentrations in the core of the plume. The annual O&M costs are presented as a range because EPA estimates this cost to vary by year, as detailed in the FS report. The periodic costs presented below would be incurred every 5 years.

Estimated Costs for Alternative GW6:

Direct Capital Costs:	$1,913,970
Annual O&M Costs:	$82,027 - 346,058
Total Periodic Costs:	$42,081
WTP Costs:	$1,003,034
Total Present Value:	$4,266,387

Soil Vapor Alternatives

In the FS, EPA conducted an initial analysis of 5 soil vapor alternatives but conducted a detailed evaluation of 4 of these soil vapor alternatives. In this proposed plan, EPA is only presenting the 4 soil vapor alternatives for which it conducted a detailed analysis. EPA presents its rationale for screening out 1 of the initial 5 soil vapor alternatives in the FS report.

Alternative SV1—*No Action*

EPA is required to evaluate a "no action" alternative when considering potential remedial actions for a site to provide a baseline for comparison to the other potential response actions. The no-action alternative means that no remedial action would be undertaken, and affected soil vapor would remain at the Site without implementing any institutional controls, containment, removal, treatment, or other mitigating actions to control exposure to COCs. Therefore, the potential human health and environmental risks associated with exposure to the COCs would not be mitigated.

Direct Capital Costs:	$0
O&M Costs:	$0
Total Periodic Costs:	$0
Total Present Value:	$0

Alternative SV3—Pathway Sealing, VI Mitigation, LTM, and ICs

Alternative SV3 consists of installing active or passive VIMS for existing buildings to reduce COCs in indoor air. The following are the main components of Alternative SV3:

- Pathway sealing to close the preferential routes of VI into buildings.
- VIMS, including the following:
    - Performing predesign diagnostic testing for design of a VIMS;

    - Installing a VIMS for each building where COCs in indoor or crawlspace air pose an unacceptable risk to human health due to the VI pathway;

    - Operating active VIMS in buildings where selected as the appropriate mitigation measure; and

    - Performing O&M activities and monitoring the performance of the VIMS.

- LTM, including the following:

    - Sampling and analyzing indoor, outdoor, and crawlspace air samples for COCs and daughter products;

    - Sampling and analyzing subslab soil vapor samples for COCs and daughter products, if warranted; and

    - Completing five-year reviews.

- ICs as needed to require enhanced engineering barriers in new construction within or near the soil vapor plume and to ensure the integrity of the VIMS.

Pathway Sealing: Cracks and openings in the building foundation are the preferential routes of vapor entry, rather than diffusion through the concrete slab itself. Thus, an important first step in preventing VI is to seal preferential vapor entry points, which can include the following:

- Cracks or holes in the building walls, floors, slabs, and foundation;
- Gaps in and around fieldstone walls, utilities, floor drains, dry utilities, and pipes;
- Construction joints between walls and slabs;
- Floor and utility penetrations, such as those for plumbing, sewer drainage, heating ducts, and electrical conduit; and
- Floor drains and open sumps.

As part of Alternative SV3, each building to be sealed would be thoroughly inspected to identify preferential vapor entry points prior to initiating further remedial action. The base of the building envelope would be visually inspected to identify cracks, building joints, and other building features that could be potential soil vapor entry points. In addition, potential entry points could be surveyed with a portable photoionization detector or a portable HAPSITE GC/MS. It is often possible to find elevated concentrations of COCs at particular points (that is, preferential pathways) where VI is occurring. The sealing technique would be selected to be appropriate for each type of vapor entry point. Periodic maintenance and visual inspections of the seal could be performed, and appropriate repairs would be made as needed.

Long-term Monitoring: LTM would be conducted to identify areas where VI from the Site remains a threat and, where appropriate, to assess potential VI in occupied structures. LTM could include sampling for COC concentrations in soil vapor in exterior soil vapor probes or wells in addition to sampling for COC concentrations in indoor air, crawlspace air, and/or sub-slab soil vapor. Samples (particularly those in and under occupied structures) would be collected during multiple seasons, including during both heating and cooling seasons. Outdoor ambient air would

be concurrently sampled for COCs to determine if contaminants are likely to be attributable to VI rather than ambient sources. Though the frequency of LTM may vary, it would continue as long as the VI pathway continues to present an unacceptable risk to human health.

VI Mitigation: An appropriate mitigation measure would be selected for each occupied structure where COCs in indoor or crawlspace air from VI pose an unacceptable risk to human health. EPA may also select a mitigation measure at occupied structures where there is the potential for COCs from VI to pose a future risk to human health. Future risk may be assessed by COC concentrations in soil vapor or subslab soil vapor. Mitigation measures can generally be classified as active or passive technologies. Active VIM technologies would be implemented in occupied structures where there is current unacceptable risk to human health. EPA could elect to implement passive VIM technologies for occupied structures with no current but a potential future unacceptable risk from VI.

A common active mitigation measure is active depressurization technology (ADT), which has been used successfully to mitigate the VI pathway into residential, commercial, and school buildings. ADT systems are widely considered the most practical VIM strategy for most existing buildings, including those with basement slabs or slab-on-grade foundations. ADT systems are generally recommended for consideration for VIM because of their moderate cost and their demonstrated capability to achieve significant concentration reductions in a wide variety of buildings. Sub-slab depressurization (SSD) systems, a common type of ADT system, function by creating a pressure difference across the building slab to prevent soil vapor from entering the building, thus overcoming the building's natural under-pressurization, which is the driving force for VI. Alternative SV3 would include installing SSD systems in occupied structures with a basement slab or slab-on-grade and where ADT is warranted. The SSD system would be constructed by coring one or more holes through the existing slab, removing soil from beneath the slab to create a suction pit, placing vertical suction pipes into the holes, and sealing the openings around the pipes. These pipes would be manifolded and connected to powered mitigation fans or blowers. The fans would extract soil vapor collected from the targeted subslab area, creating a negative pressure field between the subslab and indoor spaces. The extracted air would be discharged to the atmosphere outside the structure at a height above the outdoor breathing zone and away from windows and air supply intakes. As part of the design process, pre-mitigation diagnostic testing may be required to optimize the VIMS design.

In buildings with a crawlspace or basement with an earthen floor, a vapor-resistant membrane would be placed over the ground to retard the flow of vapor into the building. The membrane would be sealed to the walls of the building, and one or more suction points would be fitted through the membrane using a gasket. This type of system is referred to as submembrane depressurization (SMD) and is like an SSD, except that the membrane is used as a surrogate for a slab to depressurize the soil.

Before or shortly after VIMs are installed, an operation, maintenance, and monitoring (OM&M) plan would be prepared to identify activities that should be performed following start-up of the system and a schedule for conducting these activities, including an exit strategy for discontinuing SSD/SMD system operation. The SSD/SMD systems would be inspected periodically which could include measuring field parameters and conducting visual inspections. Routine inspections would also include evaluating significant changes made to the building that would impact the

design of the mitigation system or the environment in which it is operated. Routine maintenance of the systems may include periodic fan replacement.

Passive venting relies on natural diffusion, natural pressure gradients, the stack effect, or wind-driven ventilation fans to cause soil vapor to migrate to collection pipes and exhaust to the atmosphere. Passive systems generally have the same components as active systems, except that they do not include electric-powered fans. As a contingency measure, the passive system could be converted to an active system if needed.

For future construction, VIM technology may include barriers, such as geomembranes or spray-applied membranes. Other technologies for new buildings that could be considered include passive venting layers and aerated floor systems.

Institutional Controls: Institutional controls would be a necessary part of this remedy to protect human health. Specifically, land-use controls (LUCs) could be implemented at the Site in areas where VI sampling indicates that the vapor intrusion pathway potentially presents an unacceptable risk. Other institutional controls may also be necessary to allow access for the installation, startup, and long-term OM&M of VIM and to ensure the integrity of the systems. ICs may also inform the need for VIM for future construction prior to the remediation of the groundwater plume. These ICs would require onsite VI evaluations at building construction sites. If the results of the evaluation indicate potential VI issues or if VI is not evaluated, these potential ICs would require VIM technology be applied to address soil vapor that could enter the building. These ICs would be necessary to ensure that the VI pathway is effectively addressed in the future. EPA expects that ICs would be in effect on an interim basis until the cleanup goals are met and unacceptable risk to human health is no longer present.

For the estimated total present value for Alternative SV3 presented below, EPA assumed that the indoor air action level triggering the need for a VIMs based on an HI of 1 (or an ELCR 10^{-5}) and that 34 residential and 21 commercial buildings would need VIMS. EPA estimated that the VIMS would need to be operated for 30 years, which is based on the assumption that contaminant levels will no longer pose a VI risk at that time. EPA estimated two sets of periodic costs as detailed below, one cost to be incurred every 5 years and another cost to be incurred every 10 years.

Direct Capital Costs:	$4,961,904
Annual O&M Costs:	$91,632
Total Periodic Costs (every 5 years):	$36,101
Total Periodic Costs (every 10 years):	$275,573
Total Present Value:	$7,430,653

Alternative SV4—Soil Vapor Source Removal, LTM, and ICs

Alternative SV4 primarily relies on removing sources of soil vapor contamination to decrease COC concentrations in soil vapor that act as the driving force for VI. The following are the main components of Alternative SV4:

- Soil vapor source removal, including the following:

    - Excavating shallow soil within the Facility parking lot that may be acting as a source of COCs in soil vapor; and

    - Installing and operating an SVE system or multiple SVE systems to address high-concentration soil vapor areas.

- LTM, including the following:

    - Sampling and analyzing indoor, outdoor, and crawlspace air samples for COCs and daughter products;

    - Sampling and analyzing subslab soil vapor samples for COCs and daughter products, if warranted; and

    - Completing five-year reviews.

- ICs as needed to require enhanced engineering barriers in new construction within or near the soil vapor plume and to ensure the integrity of the VIMS.

This alternative would include LTM and ICs as described for Alternative SV3. The remaining component of this alternative is discussed in the following paragraphs.

Soil Vapor Source Removal: Alternative SV4 would reduce a significant source of soil vapor contamination. Residual soil contamination may be contributing to COCs in soil vapor. The highest PCE and TCE concentrations were detected within the 1- to 2-feet depth interval of SG-1, which is in the Facility parking lot. The soil within the immediate vicinity of this sample location could be excavated and transported offsite for disposal. The goal of soil excavation would be to remove contaminated soil acting as a continuing source of soil vapor contamination near the Facility that is readily accessible. Waste characterization sampling would determine whether the soil would be disposed of as hazardous or nonhazardous waste. Following excavation, the excavated area would be backfilled with clean fill material from an offsite source, and site restoration would be performed.

EPA identified 3 main areas with particularly elevated PCE concentrations in soil vapor (greater than 15,000 $\mu g/m^3$). In addition to soil excavation, Alternative SV4 would also include installing SVE systems within one or more of the high-concentration PCE soil vapor areas. At a minimum, an SVE system would be installed in the area surrounding the Facility. The goal of an SVE system would be to treat the source of soil vapor contamination that cannot be readily addressed by excavation. The most elevated TCE concentrations in soil vapor (greater than 1,000 $\mu g/m^3$) are near the Facility and would be among the areas addressed by this system. SVE wells could be installed beneath the Facility using directional drilling to address residual soil contamination. Secondary systems could also be installed to address the two additional areas with elevated PCE concentrations in soil vapor, one to the northwest of the Facility (near HAP-023 and HAP-084) and one to the southeast of the Facility (near the former location of Central Dry Cleaners). The need for these secondary systems would be determined as part of predesign investigations. The extracted soil vapor would be treated to remove COCs prior to discharge to the atmosphere if required by state and federal air discharge regulations.

Predesign activities would be required for the design of the SVE system(s). Soil samples may also be collected in targeted areas as part of a predesign investigation to optimize the SVE design and to determine the need for secondary systems. If possible, soil samples would be collected to assess if soil contamination is present beneath the Facility. A field pilot study would also be conducted, if necessary, to establish the radius-of-influence and other design parameters for the SVE system. Based on the results of the predesign activities, the SVE system could also be thermally enhanced, if warranted.

OM&M would also be required for the SVE system(s), including periodic inspections, field measurements, and performance verification. Maintenance of the SVE system(s) would include periodic carbon replacement, if off-gas treatment is implemented, and system component replacement, as needed.

For the estimated total present value for Alternative SV4 presented below, EPA assumed that the SVE systems would be operated for 5 years. EPA estimates that the periodic costs presented below would be incurred every 5 years.

Direct Capital Costs:	$2,273,931
Annual O&M Costs:	$224,372
Total Periodic Costs:	$36,101
Total Present Value:	$3,338,829

Alternative SV5—*Pathway Sealing, Soil Vapor Source Removal, VIMs, LTM, and ICs*

Alternative SV5 is a combination of Alternative SV3 and SV4 in that it includes VIM for individual buildings, as well as soil vapor source removal to address residual soil contamination and high concentration soil vapor areas. The following are the main components of Alternative SV5:

- Pathway sealing to close the preferential routes of VI into buildings.
- Soil vapor source removal, including the following:
    - Excavating shallow soil within the Facility parking lot that may be acting as a source of COCs in soil vapor; and
    - Installing and operating an SVE system or multiple SVE systems to address high-concentration soil vapor areas.
- VIM, including the following:
    - Performing predesign diagnostic testing for design of the VIMS;
    - Installing a VIMS for each building where COCs in indoor or crawlspace air pose an unacceptable risk to human health due to the VI pathway;

- Operating active systems in buildings, where selected as the appropriate VIM measure; and

- Performing OM&M activities and monitoring the performance of the VIMS.

- LTM, including the following:

  - Sampling and analyzing indoor, outdoor, and crawlspace air samples for COCs and daughter products;

  - Sampling and analyzing subslab soil vapor samples for COCs and daughter products, if warranted; and

  - Completing five-year reviews.

- ICs as needed to require enhanced engineering barriers in new construction within or near the soil vapor plume and to ensure the integrity of the VIMS.

The components for Alternative SV5 have been previously discussed as part of Alternatives SV3 and SV4.

For the estimated total present value for Alternative SV5 presented below, EPA assumed the indoor air action level triggering the need for a VIMs based on an HI of 1 (or an ELCR of 10^{-5}) and that 34 residential and 21 commercial buildings would need VIMs. EPA also assumed that the VIMS would be operated for 30 years. EPA estimates that the periodic costs presented below would be incurred every 5 years.

Direct Capital Costs:	$6,075,915
Annual O&M Costs:	$304,150
Total Periodic Costs:	$72,202
Total Present Value:	$7,539,713

H. EVALUATION OF REMEDIAL ALTERNATIVES

Section 121(b)(1) of CERCLA articulates nine evaluation criteria for assessing remedial alternatives for sites that require remediation or mitigation. This evaluation promotes consistent identification of the relative advantages and disadvantages of each alternative, thereby guiding selection of remedies that offer the most effective and efficient means of achieving site cleanup goals. While all nine criteria are important, they are weighed differently in the decision-making process depending on whether they evaluate protection of human health and the environment or compliance with federal and state requirements (threshold criteria), consider technical or economic merits (primary balancing criteria), or involve the evaluation of non-EPA reviewers that may influence an EPA decision (modifying criteria). To be selected, an alternative must meet the threshold criteria. The nine criteria are described below, followed by a discussion of how each alternative meets or does not meet each criterion.

Explanation of the Nine Evaluation Criteria

Threshold Criteria

1. ***Overall Protection of Human Health and the Environment*** addresses whether a remedy provides adequate protection of human health and the environment and describes how risks posed by the site are eliminated, reduced, or controlled through treatment, engineering, or institutional controls.

2. ***Compliance with Applicable or Relevant and Appropriate Requirements*** addresses whether a remedy will meet all applicable or relevant and appropriate requirements (ARARs) of federal and state environmental statutes and/or justifies a waiver.

Primary Balancing Criteria

3. ***Long-Term Effectiveness and Permanence*** refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup levels have been met.

4. ***Reduction of Toxicity, Mobility, or Volume through Treatment*** addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of the hazardous substances as a principal element.

5. ***Short-Term Effectiveness*** addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction of the remedy until cleanup levels are achieved.

6. ***Implementability*** addresses the technical and administrative feasibility of a remedy from design through construction, including the availability of services and materials needed to implement a particular option, and coordination with other governmental entities.

7. ***Cost*** includes estimated capital and annual O&M costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in today's dollar value. Cost estimates are expected to be accurate within a range of +50% to -30%.

Modifying Criteria

8. ***State Agency Acceptance*** considers whether the state support agency concurs with, opposes, or has no comment on the Preferred Alternative presented in the Proposed Plan.

9. ***Community Acceptance*** considers whether the public agrees with EPA's analyses of the Preferred Alternative described in the Proposed Plan.

Comparison of Alternatives

In this section, the remedial alternatives are compared to each other in terms of how well they meet the specified evaluation criteria. Threshold and primary balancing criteria are presented separately for groundwater and soil vapor. The two modifying criteria, state and community acceptance, are briefly addressed below for both media combined and will be further evaluated

after this proposed plan undergoes public comment, then addressed in the Record of Decision. For more details on the comparative analysis of the alternatives, see Section 4.4 and Tables 4-9 and 4-10 of the FS report for the Site.

Groundwater:

All groundwater alternatives except the no action alternative (Alternative GW1) include continued operation of treatment operations at the WTP. For purposes of conducting the evaluations of these groundwater alternatives in the FS, EPA assumed that WTP Alternative GW2A (GAC treatment) would be used. GAC treatment has proven to be effective, requires no upfront capital costs, and is the most cost-efficient option in present value, even after an assumed 35-year operating period.

1. *Overall Protection of Human Health and the Environment*

Alternative GW1 (No Action) is not protective because it allows for groundwater COC concentrations exceeding PRGs to remain in place and potentially expose current and future receptors to COCs above acceptable levels, and it does not prevent or minimize plume migration.

Alternative GW3 is protective of human health and the environment, even though no active treatment process is used, because it prevents access to contaminated groundwater through the use of ICs and continued GAC treatment at the WTP. Modeling provided in the FS estimates that PCE concentrations would decrease below the PRG in about 34 years.

Alternatives GW5 and GW6 include active in situ groundwater treatment in addition to ICs and continued GAC treatment at the WTP. As such, these alternatives offer greater protection than the other alternatives considered.

2. *Compliance with ARARs*

Alternative GW1 (No Action) does not comply with ARARs. Alternative GW3 would meet chemical specific ARARs once natural attenuation processes have reduced PCE concentrations within the plume to below the PRG. Alternatives GW5 and GW6 would comply with ARARs. The primary ARARs to be met relate to reducing PCE concentrations in groundwater to below their PRGs, treating off-gas if required, and proper management and disposal of waste generated during the remedial action. Specific ARARs are listed in Table 2-1 of the FS report.

3. *Long-term Effectiveness and Permanence*

The long-term effectiveness and permanence of the alternatives are evaluated in terms of the magnitude of residual risk, adequacy and reliability of controls, and potential environmental impacts of the remedial actions.

The residual risk of Alternative GW1 (No Action) would remain unchanged until natural attenuation processes reduced groundwater concentrations to levels no longer posing a risk. EPA estimates this would take 34 year; however, this alternative proposes no monitoring to track or confirm that. No active treatment processes would be used to reduce COC concentrations in groundwater in Alternative GW3; however, after 34 years, the groundwater would achieve

performance standards through natural attenuation in conjunction with treatment at the municipal well field (Alternative GW2), eliminating residual risk. No residual risks would be anticipated with Alternatives GW5 and GW6 because both active treatment methods would be expected to reduce COC concentrations to below the performance standard, and then, natural attenuation processes would eventually reduce COC concentrations to below their respective PRGs. However, if any COC adsorbed on the aquifer matrix was to back-diffuse into the groundwater over time, it is anticipated that the more persistent carbon substrate would make Alternative GW5 better able to address this newly released PCE. Treatment chemicals used for Alternative GW5 and GW6 are not expected to result in residual risks because of their short lifespan, ranging from 2 to 5 years, and exposures not addressed by institutional controls are not expected to occur over this period.

Implementation of Alternative GW5 includes residual risks associated with methane generation and/or formation and accumulation of more harmful daughter products, such as vinyl chloride. Both of these residual risks can be carefully managed with monitoring and the addition of methane-inhibiting supplements.

Alternatives GW3, GW5, and GW6 include institutional controls that would be adequate and reliable in preventing direct contact with and ingestion of untreated contaminated groundwater. Additionally, Alternatives GW3, GW5, and GW6 would require LTM of COC concentrations and natural attenuation parameters to monitor the progress of natural attenuation processes. Alternatives GW5 and GW6 would also include monitoring to evaluate performance of the remedy.

4. *Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment*

No treatment processes are used for Alternative GW1 and GW3; therefore, no reduction of toxicity, mobility, or volume through treatment is anticipated. However, natural attenuation processes would be expected to reduce concentrations of PCE to below its PRG in approximately 34 years. Alternatives GW5 and GW6 include in situ treatment via injection of a chemical reductant and chemical oxidant, respectively; therefore, both alternatives would meet the NCP preference for treatment. Alternative GW6 would be expected to treat more contaminant mass than Alternative GW5 over the shorter timeframe, accelerating a decrease in toxicity, mobility, and volume of PCE during the initial phase of implementation. EPA expects the overall reduction in toxicity, mobility, and volume for GW5 and GW6 to be the same.

5. *Short-term Effectiveness*

No additional risks are associated with Alternative GW1 because no remedial action would be taken, and no construction would be performed. The remedial option, other than No Action, that would pose the least amount of risk in the short-term is Alternative GW3 because this option contains the least amount of construction and work required as it is ongoing. Alternatives GW5 and GW6 would pose the most risk in the short-term because of the number of surface penetrations required, the timeframe for injections, and the use of chemicals and potential exposure to the community during implementation of the remedy. The overall difference in risk between Alternatives GW5 and GW6 would be nominal, except for the type and quantity of chemical used and the timeframe required for injection. The potential exposures would be

controlled through standard best management practices, such as appropriate decontamination protocols, careful dosing, air monitoring, and appropriate traffic control measures.

6. *Implementability*

Alternative GW1 requires no construction or treatment and would be the easiest to implement. For costing purposes, Alternative GW3 assumes installation of three monitoring wells with materials that are readily available. Alternatives GW5 and GW6 would have the greatest implementability challenges because both alternatives are active treatment options requiring the use of chemicals and DPT injections. Alternative GW5 would be more difficult to implement than Alternative GW6 because Alternative GW5 would involve injection of a viscous slurry into the aquifer.

7. *Cost*

An overview of the cost analysis performed for this evaluation and the detailed breakdowns for each of the alternatives are presented in Appendix D of the FS report. Total costs are summarized below and include costs for the City WTP to continue to operate in its current configuration (Alternative GW2A):

Alternative GW1	Alternatives GW3	Alternative GW6	Alternative GW5
$0	$3.29 million	$4.27 million	$4.38 million

Soil Vapor:

1. Overall Protection of Human Health and the Environment

Alternative SV1 (No Action) would not be protective because there would be no remediation of soil vapor, and exposures to current and future receptors would continue. Alternatives SV3 and SV5 would be protective of human health because subslab soil vapors would be mitigated through active SSD or SMD. Alternative SV4 would not be protective of human health in the short-term because no VIMS are installed to address risk to current receptors. However, Alternative SV4 would become protective of human health once soil vapor source removal occurs and concentrations in soil vapor and indoor air are confirmed to be below remedial goals.

2. *Compliance with ARARs*

Alternative SV1 (No Action) would not comply with ARARs because no remedial actions would be taken to address unacceptable risk. Alternatives SV3 and SV5 would comply with ARARs because VIMSs would remove unacceptable risk to current and future receptors. Alternative SV4 would not comply with chemical-specific ARARs despite remedial actions being taken because no VIMS would be installed to address risk to current receptors. Specific ARARs are listed in Table 2-1 of the FS report.

3. *Long-term Effectiveness and Permanence*

The residual risk of Alternative SV1 (No Action) would remain unchanged. Alternative SV3 would address exposures leading to residual risks by implementation of VIMS, pathway sealing,

and ICs. However, because no soil vapor source removal would occur, residual risk would remain until natural attenuation processes reduce concentrations in soil vapor to below PRGs. Though EPA does not have enough data to estimate the rate of natural attenuation in soil vapor, it expects this to be similar to the 34 years estimated for groundwater to achieve PRGs. VIMS monitoring would be required to verify that COC concentrations in indoor air do not exceed target levels.

Alternative SV4 would address soil vapor source material but would not provide protection from residual risks until all source material is removed or has attenuated, which could continue to provide a source for soil vapor migrating into indoor air at concentrations greater than PRGs. Off-gas treatment would be included, if required to reduce the rate of COCs venting to the atmosphere.

Alternative SV5 would address residual risk by implementing VIMS after soil vapor source removal occurs. Residual COC concentrations remaining in the subsurface would be addressed by natural attenuation. VIMS monitoring would be required to verify that COC concentrations do not exceed target levels. Off-gas treatment from SVE would be included, if required to reduce environmental impacts of COCs venting to the atmosphere.

4. *Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment*

No active treatment processes would be used for Alternative SV1 and SV3; therefore, no reduction of toxicity, mobility, or volume through treatment is anticipated. However, natural attenuation processes and extraction from VIMS are expected to reduce COC concentrations.

Alternatives SV4 and SV5 would include physical treatment using an SVE system to remove contaminated soil vapors from the subsurface (potentially with off-gas treatment) and soil excavation to remove contaminated soil. Therefore, both alternatives would meet the NCP preference for treatment.

Alternatives SV4 and SV5 would both increase mobility of soil vapors during SVE. There would be the potential for residual contamination to remain in the subsurface in areas where the radius of influence of vapor extraction wells is insufficient to remove all contaminated soil vapors.

5. *Short-term Effectiveness*

There are no additional risks associated with Alternative SV1 because no remedial action would be taken, and no construction would be performed. The remedial option with the greatest short-term effectiveness is Alternative SV3. This option would have the least amount of construction and work required. Alternatives SV4 and SV5 would provide the least degree of short-term effectiveness because of the installation of the SVE system (vertical or horizontal extraction points and potentially off-gas treatment) and soil excavation and offsite disposal activities. The overall difference between Alternatives SV4 and SV5 would be that only Alternative SV5 would require the installation of individual VIMS in multiple buildings so Alternative SV5 would be effective in controlling exposures in the short term; whereas, SV4 would not. Exposure to contaminated soil and soil vapor during construction would be controlled through standard best management practices such as appropriate decontamination protocols, air monitoring, and appropriate traffic control measures.

6. *Implementability*

Alternative SV1 would require no construction or treatment and would be the easiest to implement. Alternative SV3 would only require the installation of VIMS with materials that are readily available. Alternative SV4 would require the installation of an SVE system, soil excavation, and offsite disposal of contaminated soil. Alternative SV5 would have the greatest implementability challenges as it requires the most activities, including VIM and SVE system installation, soil excavation, and offsite disposal of contaminated soils.

7. *Cost*

An overview of the cost analysis performed for this evaluation and the detailed breakdowns for each of the alternatives are presented in Appendix D of the FS report. Although the initial capital cost for Alternative SV5 is significantly greater than Alternative SV3, Alternatives SV3 and SV5 have a similar overall present-values due to the longer timeframe required for O&M for Alternative SV3 (30 years versus 5 years for Alternative SV5). Total costs are summarized as follows:

Alternative SV1	Alternative SV4	Alternative SV3	Alternative SV5
$0	$3.34 million	$7.43 million	$7.54 million

Groundwater and Soil Vapor:

8. *State Agency Acceptance*

EPA will further evaluate State acceptance of the Preferred Alternative after the public comment period ends. Based on discussions to date, EPA expects IDEM to concur with the selection of the combination of Groundwater Alternative GW6, WTP Alternative GW2A, and Soil Vapor Alternative SV5.

9. *Community Acceptance*

EPA will further evaluate community acceptance of the Preferred Alternative after the public comment period ends. EPA will include a Responsiveness Summary in the ROD that responds to comments received during the public comment period. To date, community concerns expressed to EPA have included VI and the safety of municipal drinking water.

I. EPA'S PREFERRED ALTERNATIVES

EPA's preferred alternative for groundwater is Alternative GW6 (with WTP Alternative GW2A), and EPA's preferred alternative for soil vapor is Alternative SV5. At this time, EPA finds that these alternatives best satisfy the evaluation criteria, but EPA's selected remedy could change based on information it receives during the public comment period.

Alternative GW6 (with WTP Alternative GW2A):

EPA finds that Alternatives GW6 (ISCO) and GW5 (ISCR) are the only groundwater alternatives evaluated that would achieve substantial risk reduction by reducing through treatment the toxicity, mobility, and volume of COCs, and EPA estimates that Alternatives GW6 and GW5 would be similar in short-term and long-term effectiveness and implementability. However, EPA estimates that Alternative GW6 would achieve PRGs in a shorter timeframe than Alternative GW5. Furthermore, ISCO amendments do not change the fundamental chemistry of the aquifer as would be required for ISCR to be effective. Additionally, EPA estimates Alternative GW6 will be slightly less expensive to implement than Alternative GW5.

EPA believes that continued operation of the GAC system (WTP Alternative GW2A) on the city's municipal WTP is preferable to replacing the GAC with an air stripper or air oxidation process because it has been demonstrated to be effective at reducing groundwater COCs to below Safe Drinking Water Act standards and is the most cost-effective option. WTP Alternative GW2A is the only WTP alternative that would require no upfront capital costs, and EPA estimates its overall cost to be less than the other WTP alternatives even after 30 years of operation.

Alternative SV5:

EPA finds that Alternatives SV5 (VIMS with source removal) and SV3 (VIMS) are the only soil vapor alternatives evaluated that would be protective of human health and the environment and comply with ARARs. However, Alternative SV5 is more protective in the long-term compared to the other soil vapor alternatives evaluated because it involves removal of source materials that could be contributing to elevated soil vapor concentrations. Alternative SV5 would also achieve significant risk reduction by reducing through treatment the toxicity, mobility, and volume of COCs. Though EPA estimates that Alternative SV5 would be more difficult to implement than the other soil vapor alternatives evaluated, EPA believes these challenges are outweighed by the expected long-term effectiveness. In addition, EPA estimates that Alternative SV5 would be very similar in cost to Alternative SV3, despite the added efforts involved in implementing source removal activities.

The Preferred Alternatives includes ISCO with continued operation of GAC at the WTP and installation of VIMS with soil vapor source removal (including SVE and possible soil excavation). More details describing these alternatives can be found in the FS report for the Site.

Based on the information available at this time, EPA believes the Preferred Alternatives meet the threshold criteria and provide the best balance of tradeoffs among the alternatives evaluated with respect to balancing and modifying criteria. EPA expects the Preferred Alternatives to satisfy the following statutory requirements of CERCLA §121(b): (1) be protective of human health and the environment; (2) comply with ARARs; (3) be cost-effective, (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) satisfy the preference for treatment as a principal element.

J. COMMUNITY PARTICIPATION

EPA relies on public input to endeavor to address questions and concerns of the local community regarding the remedy selected for each Superfund site.

To assure that the community's concerns are being addressed, a public comment period lasting thirty (30) calendar days will open on August 3, 2020, and close on September 2, 2020. During this time the public is encouraged to submit comments to EPA on the Proposed Plan. Comments can be submitted using any of the following options:

- By confidential voicemail at 312-886-6015
- By fax to 312-697-2568
- By website, directly at: www.epa.gov/superfund/pike-mulberry-pce
- By email to safakas.kirstin@epa.gov
- By mail to: Kirstin Safakas
  U.S. EPA Region 5
  External Communications Office
  77 W. Jackson Blvd.
  Chicago, IL 60604-3590
- During the live question and answer on August 12, 2020 described further below

Due to the ongoing COVID-19 pandemic, EPA has altered its public outreach methods to ensure safety of all residents. EPA has posted to its website for the Site (www.epa.gov/superfund/pike-mulberry-pce) a pre-recorded video presentation summarizing the investigative findings for the Site as well as this proposed plan. In addition, EPA will be hosting a live question and answer session on Wednesday, August 12, 2020, from 6 pm to 8 pm EDT. To access this session, dial into our conference line at 312-667-5632 and use conference code 1344648. EPA plans to have a court reporter formally document your questions and comments during this question and answer session.

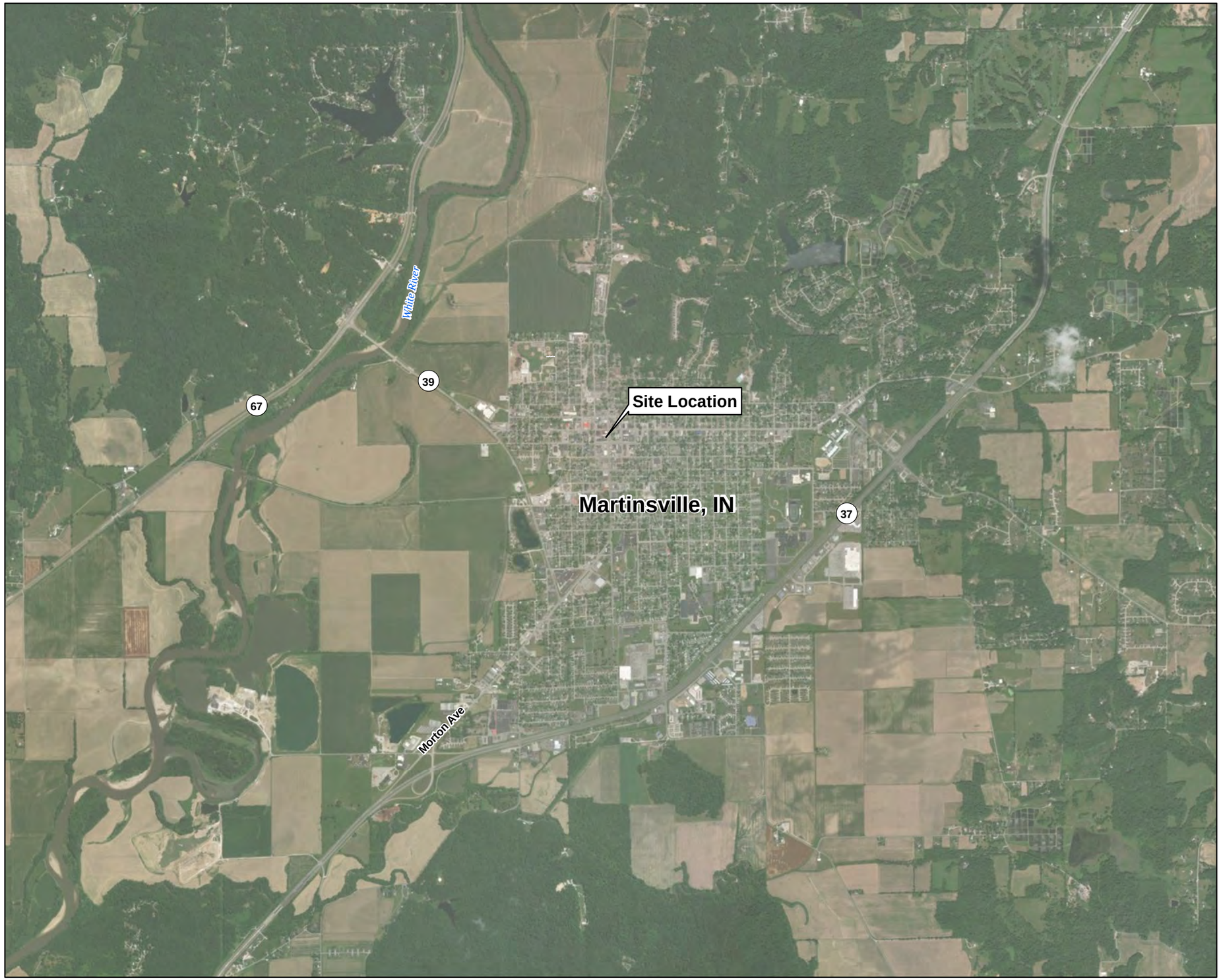
An Administrative Record has been created for the Site and will be completed upon issuance of the Record of Decision. Site documents, including Administrative Record documents, can be found on EPA's website for the Site (www.epa.gov/superfund/pike-mulberry-pce) or at the following locations:

Morgan County Public Library
110 South Jefferson Street
Martinsville, Indiana
765-342-3451
Mon-Thur: 9 a.m. to 8:30 p.m.
Fri-Sat: 9 a.m. to 5:30 p.m.
Sun: 1 p.m. to 5 p.m.

EPA Region 5 Records Center
77 W. Jackson Boulevard (SRC-7J)
Chicago, Illinois 60604
312-886-0900
Mon-Fri: 8 a.m. to 4 p.m. – Call for appointment

EPA will respond in writing to all significant comments in a Responsiveness Summary, which will be part of the ROD. EPA will announce the selected cleanup alternative in local newspaper advertisements and will place a copy of the ROD on EPA's website at www.epa.gov/superfund/pike-mulberry-pce and in the local information repositories.

In addition, questions about the Proposed Plan, and requests for information can be sent via email to Erik Hardin (hardin.erik@epa.gov) or Kirstin Safakas (Safakas.kirstin@epa.gov).

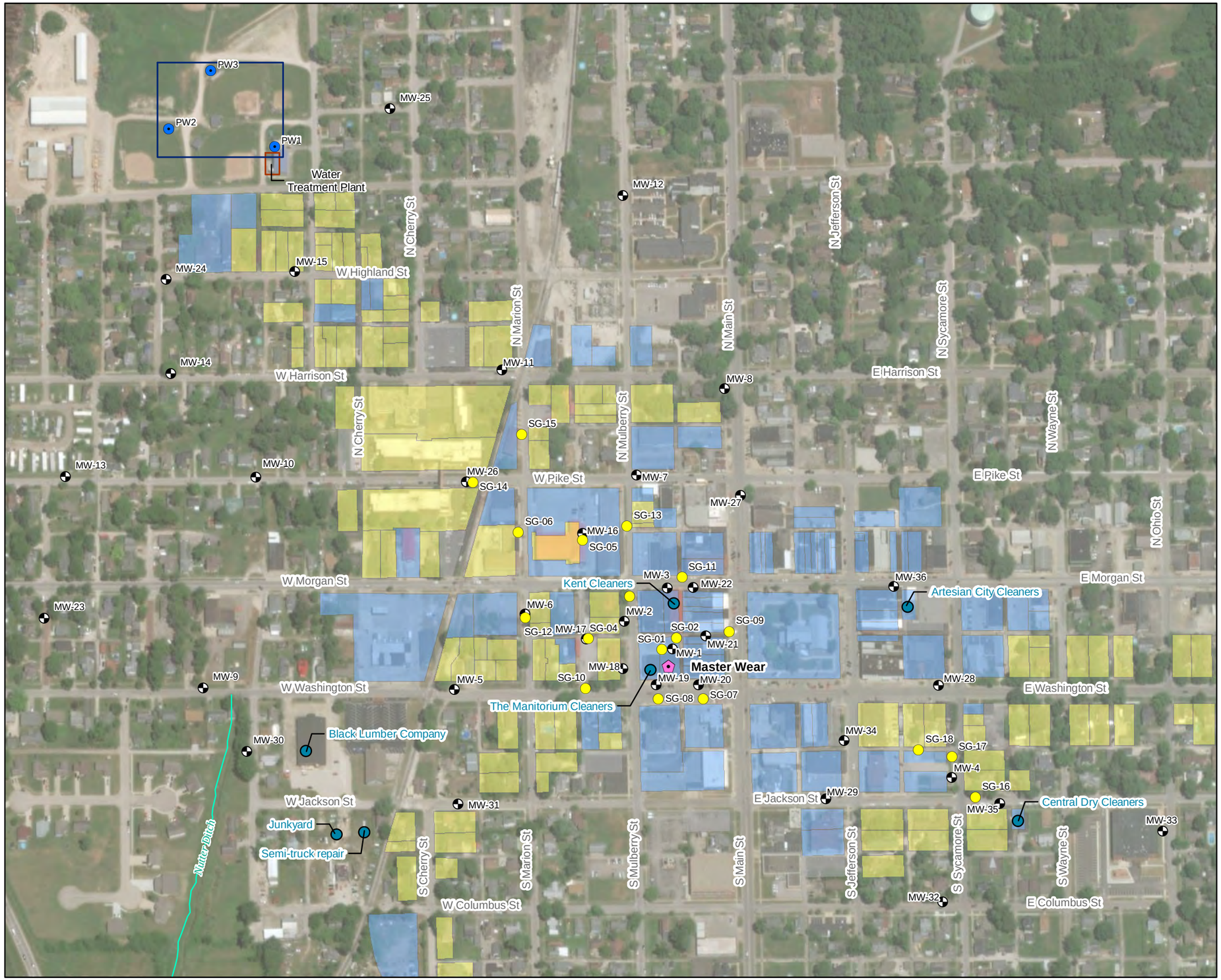


N

0 0.25 0.5
Miles

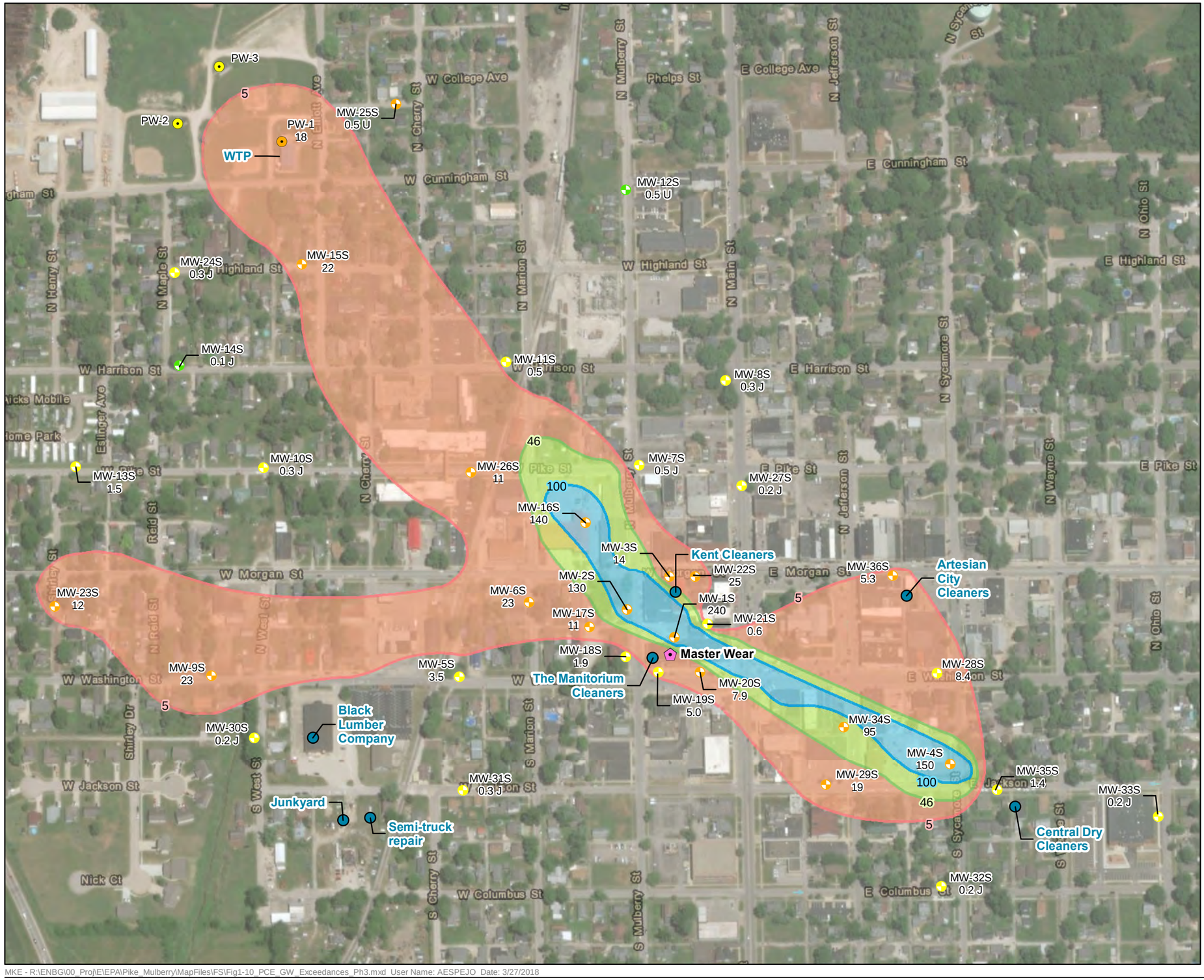
Figure 1
Site Location Map
Pike and Mulberry Streets PCE Plume Site
Martinsville, Indiana

ch2m



Note:
Location of Nutter Ditch is approximate.

Figure 2
Site Features and Land Use
Pike and Mulberry Streets PCE Plume Site
Martinsville, Indiana



LEGEND

- Potential Past PCE User
- Former Master Wear Facility

Monitoring Well

- Detected Above MCL
- Detected Below MCL
- Not Detected

Municipal Wells (PW)

- Detected Above MCL
- Detected Below MCL
- Not Detected

Groundwater Contour Concentrations (µg/L)

- 100
- 46
- 5

Notes:

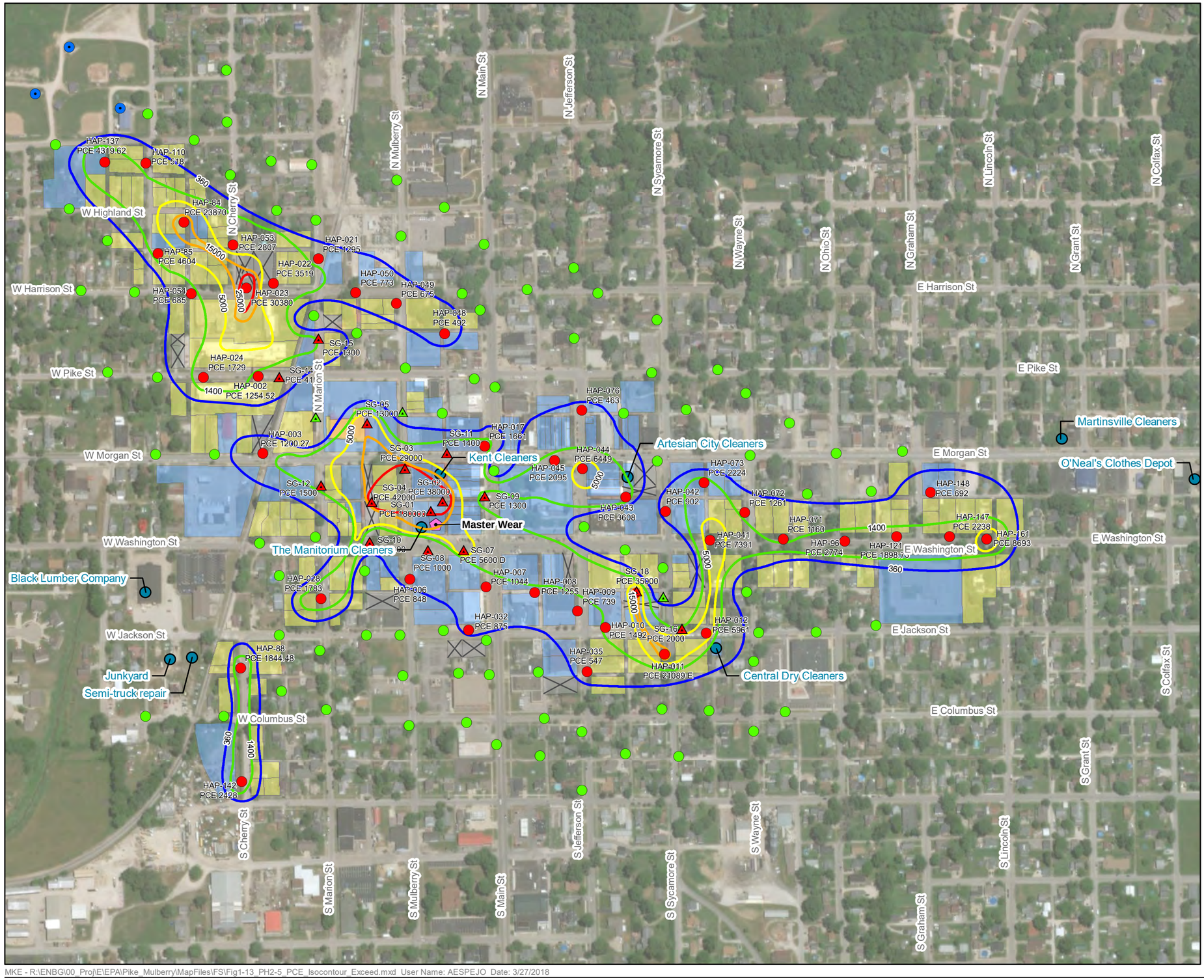
1. EPA = U.S. Environmental Protection Agency
2. G = indicates groundwater grab sample collected from soil boring at approximately 10 ft. below ground surface
3. J = Estimated detection
4. MCL = Maximum Contaminant Level
5. PCE = tetrachloroethene
6. U = Result not detected
7. UJ = Estimated result not detected
8. µg/L = micrograms per liter
9. Dashed lines indicate where plume is inferred or estimated
10. PCE screening level (SL) = 5 µg/L
11. PCE in intermediate well MW-7M was 24 µg/L

N

0 162.5 325

Feet

Figure 3
PCE Exceedances in Shallow Groundwater - Phase 3
Pike and Mulberry Streets PCE Plume Site
Martinsville, Indiana



LEGEND

- Potential Past PCE User
- Former Master Wear Facility
- Municipal Well
- Residential (129.5)
- Commercial/Industrial (90.5)
- No Sampling (park or parking lot) (18)

PCE Isocontours

Value

- 360
- 1400
- 5000
- 15000
- 25000

PCE Concentrations

- Permanent Soil Vapor Probe with results of PCE greater than the VISL
- Permanent Soil Vapor Probe with results of PCE below the VISL
- Temporary Soil Vapor Point with HAPSITE results of PCE greater than the VISL
- Temporary Soil Vapor Point with HAPSITE results of PCE below the VISL

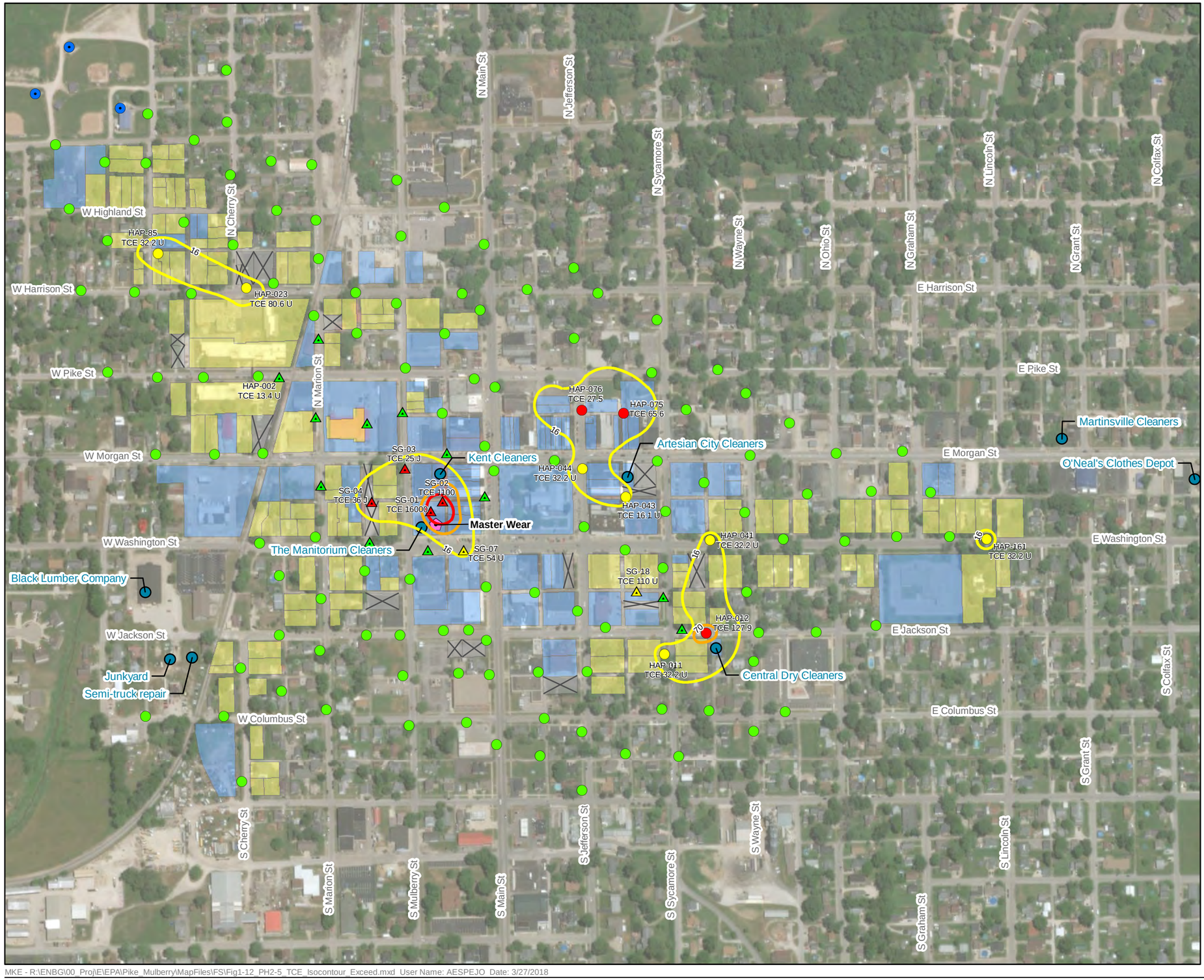
Notes:

1. All units are in µg/m³
2. PCE VISL is 360 µg/m³
3. VISLs are based on EPA VISL Calculator Version 3.5.1 (EPA 2016) with May 2016 RSLs, a residential exposure scenario, target Excess Lifetime Cancer Risk (ELCR) of 1x10-6, and a Hazard Index of 1
4. The 1400 contour line represents the ELCR of 1x10-5
5. U = HAPSITE result is non-detect
6. E = HAPSITE result exceeds calibration range and result is Estimated
7. PCE = tetrachloroethene
8. VISL = Vapor Intrusion Screening Level

All permanent soil vapor probe locations had soil vapor results that exceeded the PCE VISLs in August and October 2015 except for SG-6, SG-13, and SG-17.

Figure 4
PCE Soil Vapor Results (Phases 2 through 5) and Property Type Designations
Pike and Mulberry Streets PCE Plume Site
Martinsville, Indiana

ch2m



LEGEND

- Potential Past PCE User
- Former Master Wear Facility
- Municipal Well
- Residential (129.5)
- Commercial/Industrial (90.5)
- No Sampling (park or parking lot) (18)

TCE Isocontours

- 16
- 70
- 1000

TCE Concentrations

- Permanent Soil Vapor Probe with results of TCE greater than the VISL
- Permanent Soil Vapor Probe with Detection Limit greater than the VISL
- Permanent Soil Vapor Probe with results of TCE below the VISL
- Temporary Soil Vapor Point with HAPSITE results of TCE greater than the VISL
- Temporary Soil Vapor Probe with Detection Limit greater than the VISL
- Temporary Soil Vapor Point with HAPSITE results of TCE below the VISL

Notes:
1. All units are in µg/m³
2. TCE VISL is 16 µg/m³
3. VISLs are based on EPA VISL Calculator Version 3.5.1 (EPA 2016) with May 2016 RSLs, a residential exposure scenario, target Excess Lifetime Cancer Risk (ELCR) of 1x10-6, and a Hazard Index of 1
4. The 70 contour line represents the ELCR of 1x10-5
5. U = HAPSITE result is non-detect
6. E = HAPSITE result exceeds calibration range and result is Estimated
7. TCE = trichloroethene
8. VISL = Vapor Intrusion Screening Level

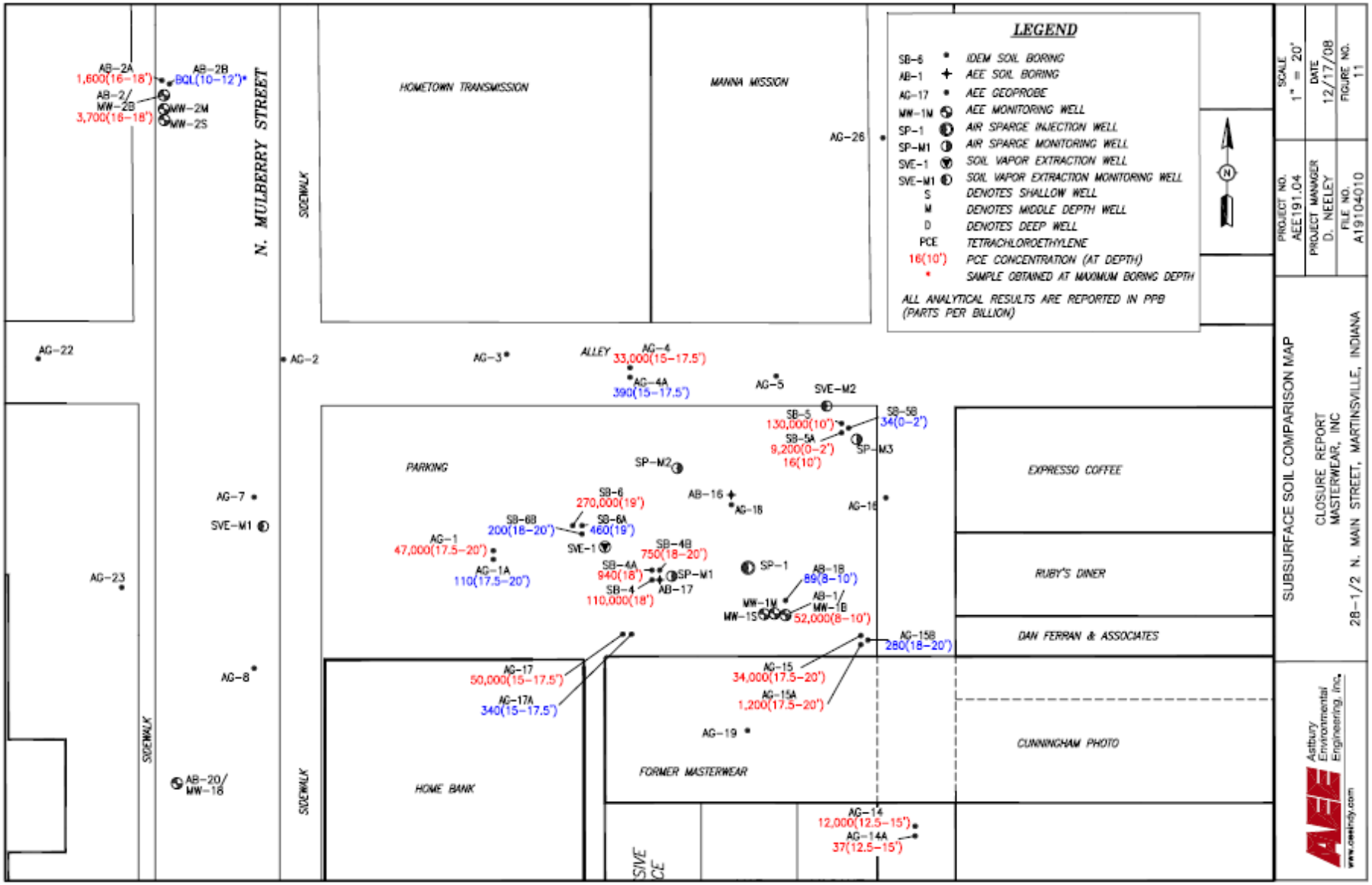
All permanent soil vapor probe locations had soil vapor results that exceeded the TCE VISLs in August and October 2015 except for SG-6, SG-13, and SG-17.

N

0 200 400
Feet

Figure 5
TCE Soil Vapor Results (Phases 2 through 5) and Property Type Designations
Pike and Mulberry Streets PCE Plume Site
Martinsville, Indiana

Figure 6 – Soil Sample Results from PCA for Master Wear Removal Action



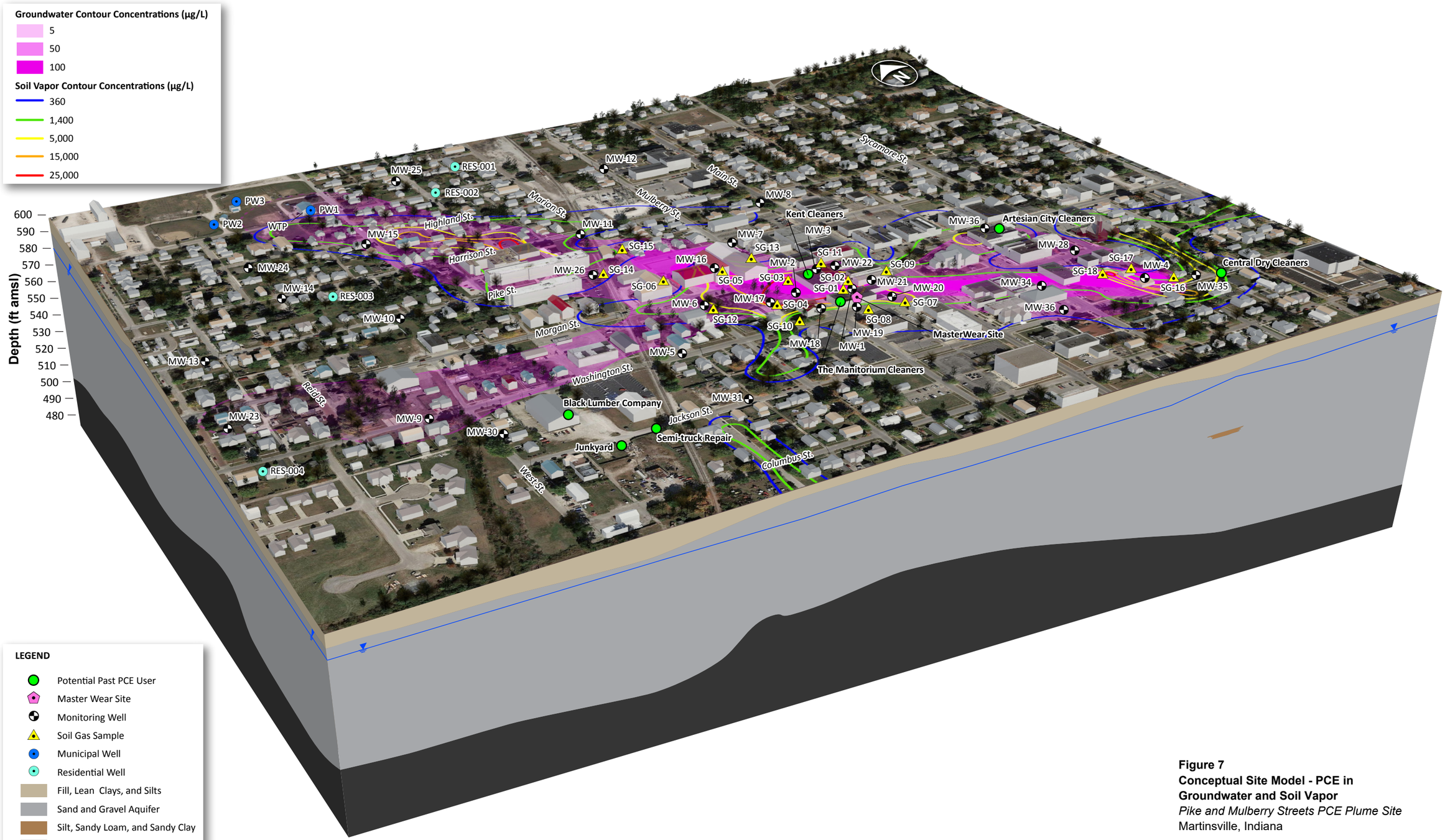


Figure 7
Conceptual Site Model - PCE in Groundwater and Soil Vapor
Pike and Mulberry Streets PCE Plume Site
Martinsville, Indiana

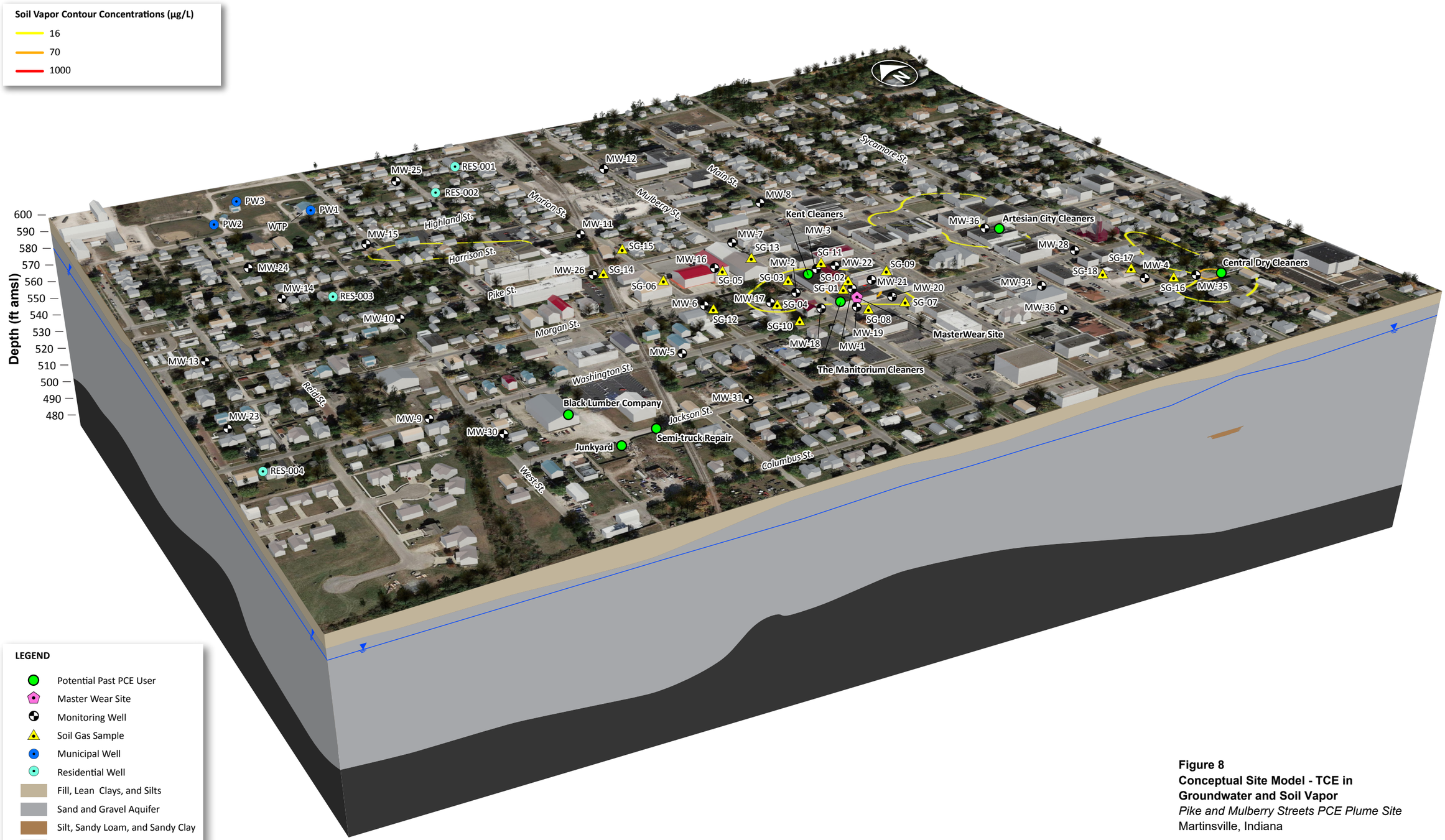


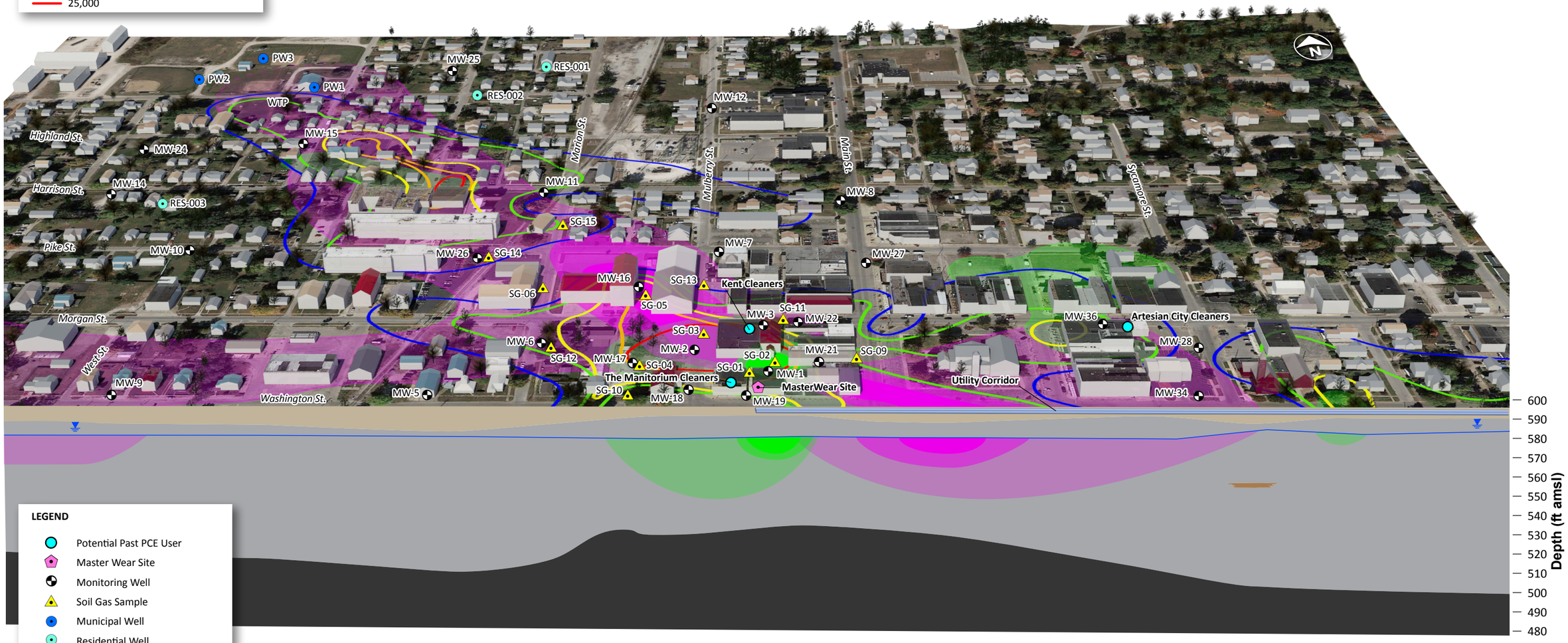
Figure 8
Conceptual Site Model - TCE in Groundwater and Soil Vapor
Pike and Mulberry Streets PCE Plume Site
Martinsville, Indiana

PCE Groundwater Contour Concentrations (µg/L)
- 5
- 50
- 100

PCE Soil Vapor Contour Concentrations (µg/L)
- 360
- 1,400
- 5,000
- 15,000
- 25,000

TCE Groundwater Contour Concentrations (µg/L)
- 16
- 70
- 1000

Screening Levels
- PCE – 8,100 µg/kg
- TCE – 410 µg/kg



LEGEND
- Potential Past PCE User
- Master Wear Site
- Monitoring Well
- Soil Gas Sample
- Municipal Well
- Residential Well
- Fill, Lean Clays, and Silts
- Sand and Gravel Aquifer
- Silt, Sandy Loam, and Sandy Clay
- Bedrock
- Groundwater Level

Figure 9
Conceptual Site Model - PCE and TCE in Soil
Pike and Mulberry Streets PCE Plume Site
Martinsville, Indiana