Superfund Program

Proposed Plan – September 2018
Behr Dayton Thermal VOC Plume Site
Dayton, Ohio

A. INTRODUCTION

The United States Environmental Protection Agency (EPA) is issuing this Proposed Plan to present EPA's Preferred Interim Alternative for actively remediating groundwater contamination and reducing exposures from vapor intrusion (VI) at the Behr Dayton Thermal VOC Plume Superfund Site (Site) in Dayton, Montgomery County, Ohio. This interim cleanup plan is being proposed to remediate the center of the groundwater plume and to supersede and enhance the VI monitoring and mitigation efforts currently being conducted as a separate action. The center portion of the plume that EPA is proposing to remediate under this interim action includes those portions of the plume with trichloroethylene (TCE) concentrations greater than 500 parts per billion (ppb) and constitutes most of the groundwater contamination at the Site. These interim measures are to occur concurrent with EPA developing the long-term cleanup option for the remaining portions of the groundwater plume as well as Site-related soil contamination.

This Proposed Plan is being issued by EPA, the lead agency for site activities. EPA, in consultation with the Ohio EPA, will select an interim remedy for the Site after reviewing and considering all information submitted during the 30-day public comment period. EPA, in consultation with the Ohio EPA, may modify the Preferred Interim 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 Focused Feasibility Study (FFS) reports and other documents contained in the Administrative Record file for the Site. EPA and the Ohio EPA 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/behr-dayton-thermal) or at the following locations:

E.C. Doren Branch Library
359 Maryland Avenue
Dayton, Ohio 45404

EPA Region 5 Records Center
77 W. Jackson Boulevard (SRC-7J)
Chicago, IL 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 in the center of the groundwater plume are detailed in the FFS Report. The alternatives include the no action alternative, pump and treat (P&T) with air stripping and discharge to surface water, air sparging (AS) with soil vapor extraction (SVE) using horizontal directionally drilled wells, and in situ chemical oxidation via direct injection.

A separate action being conducted under a 2009 Unilateral Administrative Order issued by EPA (the 2009 UAO), currently monitors Site-related exposures via the VI pathway and mitigates them using sub-slab depressurization systems (also known as VI mitigation systems or VIMS) at occupied structures and an SVE system near one of the source areas. The 2009 UAO preceded a detailed analysis of alternatives for mitigating the VI exposure pathway in the source media that EPA completed in the 2017 RI. Though EPA believes these current mitigation efforts adequately protect human health from the site-related VI pathway in the short term, the 2009 UAO was intended as a temporary measure until characterization could be completed, and it is insufficient for addressing site-related VI in the long term. Specifically, the monitoring requirements do not continue until the Site (i.e., source media) reaches clean-up goals, and the screening levels triggering the need for a VIMS need to be verified or updated based on current health protective data. Therefore, this proposed plan identifies EPA's plan to include in its selected remedy expanded VI monitoring and mitigation activities (i.e., VIMS) using information from the 2017 RI.

EPA's Preferred Interim Alternative for remediation of contaminated groundwater in the center of the groundwater plume is AS with SVE using horizontal directionally-drilled wells. More details about the Preferred Interim Alternative are provided later in this Proposed Plan. The estimated cost to implement the Preferred Interim Alternative is $18,113,000, which includes an estimate of the cost of continued and additional VI monitoring and mitigation activities.

EPA's final decision on the interim remedy for the center of the groundwater plume and reducing exposures to vapor intrusion 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 public comments received during the public comment period, the selected interim 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 within the City of Dayton, Ohio, approximately 1.5 to 2 miles north of downtown Dayton in an area of mixed industrial, commercial, and residential land uses (See Figure 1). The Site includes the MAHLE Behr Dayton Thermal LLC (MAHLE) facility located at 1600 Webster Street (the MAHLE facility), Gem City Chemicals, Inc. (Gem City) located at 1287 Air City Avenue (the GEM City facility), Aramark Uniform Services (Aramark) located at 1200 Webster Street (the Aramark facility), and other areas where hazardous substances, pollutants, or contaminants from those properties or from former operations at those properties have or may come to be located.

More specifically, the Site is defined by the extent of the groundwater plume with contaminants that present unacceptable risks to human health and is currently identified west of Ohio State Route 202 (Troy Street) extending to the boundaries of the Great Miami River to the north and west, the confluence of the Great Miami and Mad Rivers to the southwest, and Mad River to the south. EPA continues to look into other potential sources of contamination that could have contributed to the plume at the Site. However, the portion of the groundwater plume EPA is proposing to remediate under this action is a smaller area extending to the south by southwest from the MAHLE facility.

History of Contamination and Response Actions

The MAHLE Facility[1]

MAHLE is the current owner and operator of the MAHLE facility and has been identified as a potentially responsible party (PRP). The MAHLE facility manufactures sub-assemblies of vehicle heating, ventilation, and air conditioning equipment. Chrysler[2] owned and operated this facility from 1936 until 2002, when it sold the facility to Behr Dayton Thermal LLC (now MAHLE Behr Dayton Thermal LLC). Historical manufacturing operations at the MAHLE facility involved the use of industrial solvent cleaners, including tetrachloroethylene (PCE), TCE, 1,1,1-trichloroethane (1,1,1-TCA), and sulfuric acid. Hazardous substances, including PCE and TCE, were released into the subsurface from the MAHLE facility. Soil investigations have identified PCE and TCE in the subsurface, and groundwater investigations have identified chlorinated solvents, including TCE, PCE, and 1,1,1-TCA in the groundwater below the facility.

Since the early 1990s, Chrysler documented groundwater contamination beneath the facility. In the early 2000s, Chrysler began to design, install, and later operate onsite and offsite groundwater remediation systems. This included an onsite SVE system for the removal of volatile organic compound (VOC) contaminants from vadose zone soil in the southern portion of the facility. The SVE system began operation in October 2003 and continued operating through December 2005. Additionally, Chrysler installed groundwater extraction wells to capture contaminated groundwater and injected a sodium lactate solution into the extracted groundwater before reinjecting it into the upper aquifer. The solution was added to promote the growth of anaerobic bacteria that break down chlorinated solvents. Chrysler operated this pump, treat, and reinject remedial groundwater system from June 2004 through December 2005.

In 2006, Chrysler signed an administrative order on consent (AOC) to conduct a time-critical removal action to abate vapor migration of hazardous substances from groundwater into buildings by installing and monitoring VIMS at affected residences and buildings. As part of this work, Chrysler also installed and operated an SVE system to the south of the Chrysler facility to enhance the mitigation of Site-related soil vapors[3] from entering homes and businesses to the south of the facility (the 2008 SVE system). Chrysler began installing the 2008 SVE system in

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[1] Because the MAHLE facility was owned by Behr Dayton Thermal LLC when the RI began, many Site documents refer to it as "the Behr facility."

[2] Throughout this proposed plan, "Chrysler" is used to describe the entity that previously owned the MAHLE facility. The detailed ownership history of the company commonly referred to as Chrysler is beyond the scope of this document; however, it is important to note that the current company operating under the name Chrysler is a different entity than the company known as Chrysler that previously owned and operated the MAHLE facility. More details of the ownership history of Chrysler can be found in the RI report.

[3] These soil vapors have volatilized from the contaminated groundwater.

May 2008. The 2008 SVE system applies a vacuum to an area of the subsurface between 5 and 20 feet below ground surface (bgs) to remove vapor-phase contaminants. Chrysler subsequently filed for bankruptcy and stopped work under the 2006 AOC, and EPA issued the 2009 UAO to Behr Dayton Thermal Products LLC to continue the removal action, including operation and maintenance (O&M) of the 2008 SVE system.

Behr Dayton Thermal Products LLC (now MAHLE) had participated in negotiations for, but did not sign, the 2006 AOC. It has since entered into an Administrative Settlement Agreement and Order on Consent (ASAOC) for an Engineering Evaluation / Cost Analysis (EE/CA) in 2013, and an ASAOC for a non-time critical removal action in 2015. The EE/CA described a separate, non-time critical removal action to address an area of impacted groundwater located at or near the southern boundary the MAHLE facility. In January 2018, MAHLE began operating an AS and SVE[4] system to remove this groundwater contamination at the southern edge of its facility under the 2015 ASAOC.

The Aramark Facility

Aramark, which operates an industrial laundry providing uniform cleaning services at the Aramark facility, also has been identified as a PRP for this Site. Aramark used PCE at this facility until 1987 when dry cleaning solvents and equipment, including a PCE storage tank located outside of the northeast corner of the building, were permanently removed. In December 1991, Aramark removed two underground storage tanks (USTs) containing gasoline and fuel oil stored at its facility.

During UST excavation activities, Aramark looked for potential soil contamination using visual inspection and a photoionization detector (PID). Although there were no visible signs of leakage from the tank or any associated piping, PID measurements indicated the presence of VOCs in soil surrounding the USTs. After soil samples from the bottom of the tank excavation areas revealed soil contamination, Aramark conducted a soil investigation and found soil impacted primarily from PCE to depths of 15 feet bgs at concentrations as high as 72 μg/kg (at 5 feet bgs). In 1992, Aramark installed four groundwater monitoring wells at the Site, each to an approximate depth of 28 feet bgs, and observed concentrations of PCE and TCE in the monitoring wells downgradient of the Aramark facility as high as 373 and 1,050 ppb, respectively.

To reduce the potential for additional soil contamination leaching to the underlying groundwater, Aramark operated an AS/SVE system at its facility from September 25, 1996, until 2003.

The Gem City Facility

Gem City, which has operated at the GEM City facility since 1969, manufactures custom molded urethane products and does bulk chemical distribution and prepackaging. This facility includes truck loading and unloading areas, a railroad spur, and chemical handling and storage areas. EPA enviromnental investigations at the Gem City facility have identified compounds in soil that include methylene chloride, PCE, TCE, 1,1,1-TCA, isopropyl alcohol, acetone, toluene, xylene, and methyl ethyl ketone.

[4] This SVE system is in addition to the SVE system located south of the MAHLE facility in 2008. MAHLE continues to operate the 2008 SVE system as well.

In May 1986, Gem City removed 10 USTs that were grouped into the three areas at its facility. The USTs included two to three tanks used for fuel oil storage. The remaining tanks were used to store Stoddard (not chlorinated) solvents. Ohio EPA and EPA did not know the conditions of these tanks during operation and removal, the specific products stored, or the removal procedures Gem City used. In 1987, Gem City collected 12 shallow soil samples from its facility with a backhoe. Some samples were found to contain concentrations of PCE as high as 554 milligrams per kilogram (mg/kg), TCE as high as 141 mg/kg, and 1,1,1-TCA as high as 14 mg/kg. Groundwater samples collected by Gem City from monitoring wells within the Gem City boundary between 1988 and 1993 showed concentrations of TCE as high as 597 ppb, PCE as high as 848 ppb, and 1,1,1-TCA as high as 1,830 ppb. The general areas showing contamination included a chemical pouring shed, storage shed, former aboveground storage tank area, and the general location of the USTs Gem City removed in 1986.

Ohio EPA became aware of the contamination in groundwater at the Gem City facility in 1989 during a regional investigation of the sources of VOC contamination in the Dayton Mad River Well Field. A numerical groundwater modeling study suggested that the leading edge of the groundwater plume from the Gem City facility would reach the Dayton Miami South Well Field within 3 years. Gem City installed an SVE system consisting of five SVE wells and a groundwater P&T system consisting of an extraction well and an air stripper at its facility without Ohio EPA oversight or formal approval. On July 6, 1992, Ohio EPA and Gem City entered into an Administrative Order on Consent in which Gem City agreed to "prevent the further off-property migration of contaminants from the Facility."

EPA estimates the capture zone of the groundwater extraction well at the Gem City facility to be 300 feet. It reportedly underlies the entire actively operated area at the facility and extends to or beyond the Gem City facility boundaries to the north and east. As of March 31, 2016, Gem City reported it had pumped approximately 4 billion gallons of water from the recovery well. Gem City reported that the SVE system, which operated for two years, removed an estimated 1,100 pounds of VOCs.

Vapor Intrusion

In 2002, Chrysler notified Ohio EPA that the VOC plume from the MAHLE facility (Behr at the time) was migrating offsite in the groundwater. The concentrations of chlorinated VOCs, specifically TCE, vinyl chloride (VC), and cis-1,2-dichloroethene (cis-1,2-DCE), in the groundwater, exceeded EPA Office of Solid Waste and Emergency Response (OSWER) VI screening levels for these chemicals. This indicated additional investigation was needed to assess the potential risk to area residents due to VI.

By 2006, the reported concentrations of chlorinated VOCs detected in groundwater migrating offsite from the MAHLE facility led to Ohio EPA concerns that vapor-phase chlorinated solvents could migrate from the groundwater and travel through the vadose zone as soil vapor and into homes and businesses in the neighborhood south of the MAHLE facility. In October 2006, Ohio EPA sampled the soil vapor in the residential area south of the MAHLE facility at seven locations at approximately 1 foot above the water table, which varies across the Site between approximately 17 and 25 feet bgs. Contaminant concentrations in these soil vapor samples significantly exceeded the EPA OSWER VI screening levels for chlorinated VOCs in soil vapor.

The Ohio EPA soil vapor sampling indicated TCE at concentrations up to 160,000 parts per billion by volume (ppbV), cis-1,2-DCE at concentrations up to 11,000 ppbV, and 1,1-DCE at concentrations up to 1,200 ppbV.

Based on the results of the soil vapor investigation south of the MAHLE facility, Ohio EPA formally requested assistance from the EPA Emergency Response Branch on November 6, 2006, to conduct a time-critical VI investigation at the Site. EPA initiated an additional VI investigation by sampling sub-slab soil vapor and indoor air in the neighborhood south of the MAHLE facility in November 2006.

After reviewing the results of the sampling, EPA met with Chrysler and Behr Dayton Thermal LLC in November 2006, to discuss an Administrative Order on Consent and establish the scope of work for a proposed removal action that focused on installing sub-slab VIMS in residences with indoor air TCE concentrations greater than 0.4 ppbV. On December 19, 2006, EPA executed the Administrative Order on Consent with Chrysler.

As indoor air and sub-slab sampling continued in 2007 and 2008, the VI investigation area increased to include most of the neighborhood south of the MAHLE facility extending to the Great Miami River.

Two schools in the area, Kiser Elementary School and McGuffey School, were sampled in 2007. Due to elevated VOC concentrations at the McGuffey School, a sub-slab soil VIMS was installed; however, indoor air levels remained above the screening level. The Dayton City School Board decided to relocate students to another building outside the affected area. The school was closed in August 2007 and eventually demolished in 2011.

From 2007 through 2009, Chrysler installed and maintained VIMS at many residential buildings (homes), along with commercial and industrial buildings, in proximity to and downgradient from the MAHLE facility under the 2006 AOC. In 2009, after Chrysler filed for bankruptcy and stopped work, EPA issued a unilateral order to Behr Dayton Thermal Products LLC to take over the removal action work, which continues under the oversight of EPA. These activities, among other things, involve obtaining access agreements for sampling, conducting additional baseline indoor air and sub-slab vapor sampling, installing VIMS, and inspecting, monitoring, and maintaining VIMS.

Available information to date indicates samples have been collected from more than 395 locations, and over 280 VIMS have been installed in over 240 homes and other buildings since 2007 as part of this removal action. Due to ongoing sampling of new properties as part of the removal action and O&M of existing VIMS, these numbers will vary over time.

The 2009 UAO also required Behr Dayton Thermal LLC to continue to operate the SVE system Chrysler installed in May 2008 in the neighborhood just downgradient (south) of the MAHLE facility to mitigate soil vapors that lead to unacceptable VI exposures. Ohio DOH reported that TCE levels were significantly reduced in samples from both indoor air and in the soil vapor in the nearby residential area after this SVE system became operational in July 2008.

C. SITE CHARACTERISTICS

Physical Characteristics and Land Use

The Site is located within Dayton, Ohio, approximately 1.5 to 2 miles north of downtown Dayton. The City of Dayton is the sixth largest city in the State of Ohio and the county seat for Montgomery County. The 2010 census reported the population was 141,527. According to the U.S. Census Bureau, the city has a total area of 56.50 square miles, of which 55.65 square miles are land and 0.85 square miles are water.

The topography of the area is generally flat with slight grades and little relief. Because the downtown area of Dayton lies on the flood plain of the Great Miami River, it is characterized by gently sloping terrain. Surface elevations range from around 760 feet above mean sea level (amsl) in the northeast to 730 feet amsl in the southwest.

Dayton's climate features hot, muggy summers and cold, dry winters, and is either classified as a humid subtropical climate or a humid continental climate. Unless otherwise noted, the data presented come from the official climatology station, Dayton International Airport, which is located about 10 miles north of downtown Dayton. The airport lies within the valley of the Great Miami River, and temperatures there are typically cooler than downtown. At the airport, monthly mean temperatures range from 27.5 degrees Fahrenheit (°F) in January to 74.1°F in July. Precipitation averages 41.1 inches annually, with total rainfall peaking in May.

The land use at the Site includes a mix of residential, commercial, and industrial properties. There are also portions of several city parks within the Site: Deeds Park, Claridge Park, and Kettering Field. The industrial properties include active facilities operated by three named PRPs, the MAHLE facility, the Aramark facility, and the Gem City facility.

Site Geology, Hydrogeology, and Hydrology

Regional Geology

The regional geology consists of portions of the Great Miami Buried Valley Aquifer System (GMBVAS). The GMBVAS stems from valleys cut into the bedrock (shale and limestone) by river and glacial erosion followed by filling with glacial deposits (clay/silt, sand, and gravel). In general, the bedrock valleys were eroded by stream flow and later filled with sand and gravel glacial outwash deposits, resulting in highly permeable buried valley aquifers. These buried valley aquifers have a predominant groundwater flow direction from north to south. The valley train deposits, in most places, are separated by clay-rich till zones into an upper sand and gravel unit and a lower sand and gravel unit. Bedrock in the area is a sequence of shale and limestone named the Richmond Group that is locally capped by the Brassfield Limestone.

As the glaciers melted and retreated, the water from the melting ice deposited vast quantities of sand and gravel (outwash). The outwash deposits in the Dayton area range in thickness from approximately 120 to 250 feet. The deposits are highly permeable. Therefore, they are used as municipal and industrial water sources.

Regional Hydrogeology

Groundwater in the Dayton area occurs within the upper and the lower sand and gravel (outwash) aquifers of the GMBVAS. The aquifers are contained horizontally and vertically within the low permeability bedrock valleys eroded into the Richmond Group. Regional groundwater in both aquifers flows toward the south, following the downgrade direction of the Deep Stage valley drainage system. The aquifers are separated vertically by a clay-rich till zone that occurs as an aerially extensive layer of till or as closely associated till lenses and masses.

The glacial deposits range in thickness from 150 to 250 feet. Each upper and lower sand and gravel aquifer ranges from approximately 30 to 100 feet thick. Water from the aquifers is pumped at the Dayton Mad River Well Field and Miami South Well Field[5], where high water levels are maintained by artificial recharge. The approximate yield for the sand and gravel aquifers is reported to be greater than 500 gallons per minute (gpm), and up to 2,000 gpm based on actual city production well pumping rates.

The non-continuous low-permeability clay-rich till that forms the base of the upper aquifer is reported to range in thickness from approximately 10 to 50 feet thick and occurs at depths ranging from 30 to 75 feet bgs. Where it is present, it confines water in the lower aquifer. Recharge to the lower aquifer, in which most high-capacity production wells are screened, occurs largely by vertical leakage through the clay-rich basal till and from underflow. Where the clay-rich basal till is absent, the two aquifers are directly connected.

Groundwater recharge in the Dayton area occurs primarily as infiltration of stream flow through the streambed into the upper aquifer and secondarily as infiltration of precipitation and underflow within the lower aquifer. Thus, the availability of groundwater depends not only on the physical properties of the aquifers but also on the character of the surface water flow and the rate at which water can percolate through streambeds under various conditions. These conditions are impacted by anthropogenic activities such as river damming and groundwater pumping for municipal and industrial use.

Site-Specific Geology

The upper aquifer extends from the ground surface to the top of a clay-rich till that serves as a base for this aquifer, and ranges in thickness from approximately 60 to 100 feet. The upper aquifer is characterized using the Unified Soil Classification System as a well-graded gravel and medium to coarse sand (GW-SW) with occasional isolated silt and clay till layers. Gravel and cobble zones are also present in the upper aquifer.

In addition to the clay-rich basal till, shallow silt and clay till is generally present as thin lenses or thicker block remnants that were deposited during different stages of glacial melt. The thickness of the shallower silt and clay till ranges from several feet to more than 30 feet. It is present at depths ranging from near surface to approximately 80 feet bgs. The shallower silt and clay till deposits are thinner and considerably less extensive than the clay-rich basal till that

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[5] Only the Miami South Well Field is near the Site. It draws from the lower aquifer as opposed to the surficial aquifer where the groundwater plume associated with the Site is located. Site contamination has not been found in the lower aquifer, and only a small portion of the groundwater plume associated with the Site flows in the direction of the Miami South Well Field.

forms the base of the upper aquifer. The frequency of the shallow silt and clay till lenses and blocks increases toward the south and west of the investigation area.

The top of clay-rich basal till that forms the bottom of the upper aquifer ranges in depth from approximately 60 to 100 feet bgs. Although this basal till is relatively extensive across the investigation area, it is absent in several boring logs (particularly, in the western portion of the investigation area). This unit generally consists of soft to firm gray silt and clay with medium to fine sand and trace gravel. It ranges in thickness from 1 to 45 feet, and the top of this basal till ranges in elevation from 685 to 660 feet amsl in the RI area.

Site-Specific Hydrogeology

The site-specific hydrogeology is focused primarily on the upper aquifer where Site-related contamination is found. As Figure 6 shows, the upper aquifer is generally separated from the lower aquifer by the clay-rich basal till; however, this confining layer is semi-continuous in the study area since it was not identified in several of the borings located in the western portion of the RI area.

Groundwater flows primarily to the southwest towards Deeds Park but is impacted by groundwater extraction from the lower aquifer at the Dayton Miami South Well Field to the northeast and from dewatering at two wells in the upper aquifer identified as the Eastern and Western Keowee Street dewatering wells. In addition, there are localized influences across the study area that can be associated with groundwater remediation system pumping centers.

Hydraulic gradients in the upper aquifer vary considerably across the Site, with measured gradients ranging from 0.0002 ft/ft to 0.003 ft/ft, and are generally lowest in the northeast portions of the RI area and highest in the southwest. Data indicates that there is not a significant vertical gradient. In 2014, groundwater elevations in the study area ranged from approximately 742 feet amsl to the east near the Mad River to approximately 721 feet amsl near the confluence of the rivers at Deeds Park.

Due to the aquifer thickness, EPA screened groundwater monitoring wells across three portions of the upper, shallow, intermediate, and deep aquifer and reported the results of the RI separately for each of these layers.

Site Hydrology

Two major rivers, the Great Miami and the Mad Rivers, bound three sides of the Site and groundwater generally flows towards their confluence (see Figure 1).

The Great Miami River discharge at river mile 80, located approximately one mile downstream of the Site, is reported to have an annual discharge ranging from 954 to 5,375 cubic feet per second (cfs), with an average of 2,674 cfs from 1974 through 2013. Based on river discharge, the Great Miami River carries the predominant flow of the river system, and this river is considered a losing stream under normal conditions.

The nearest active USGS streamflow gauge on the Mad River is located approximately 4 miles upstream of Stanley Avenue. The annual average stream flow at this location, reported from

1974 to 2013, is 736 cfs. The Mad River average annual discharge ranged from 369 to 1,333 cfs. Although the Mad River is generally considered a losing stream, it can become a gaining stream, at times, due to pumping from extraction wells located at the Keowee Street underpass at U.S. Route 4.

Remedial Investigation Results

EPA conducted an RI at the Site from August 2010 through March 2016. The significant findings and conclusions from the site characterization activities completed during the RI are summarized below. The November 2017 Final RI Report provides additional detail about site investigations.

Groundwater

The screening-level human health risk assessment performed during Phase I activities identified three chlorinated VOCs as the primary risk drivers in groundwater at the Site (PCE, TCE, and vinyl chloride). These chlorinated VOCs and another associated degradation product, cis-1,2-DCE, in addition to 1,1,1-TCA, were the chemicals of potential concern (COPCs) assessed in each portion of the upper aquifer. Although other COPCs were identified in groundwater, EPA chose these five chlorinated VOCs for delineation because they extend furthest across the Site.

In the shallow portion of the upper aquifer, the plumes have migrated the furthest laterally (compared to the other portions), extending over the largest area. The highest concentrations of the PCE and TCE plumes are generally located beneath the MAHLE facility, along the southern boundary of the MAHLE facility extending downgradient, and downgradient of the Aramark facility. Degradation product plumes, cis-1,2-DCE and VC, and the 1,1,1-TCA plume are generally enclosed within the higher PCE and TCE concentration areas. All of the chlorinated VOCs, except TCE, are fully delineated in the shallow portion of the upper aquifer. TCE is not fully delineated downgradient adjacent to the rivers but is present over the largest extent in the shallow portion as shown in Figure 2.

In the intermediate portion of the upper aquifer, the plumes are less extensive than in the shallow portion and delineated within the study boundary. PCE and cis-1,2-DCE are each present beneath the MAHLE and Gem City facilities, downgradient of the MAHLE facility, and downgradient of Aramark. VC and 1,1,1-TCA are each present generally beneath the MAHLE facility. Similar to its distribution in the shallow portion of the upper aquifer, TCE is present over the largest extent in the intermediate portion as shown in Figure 3. EPA generally identified the highest concentrations of the chlorinated VOCs in the intermediate portion of the upper aquifer.

In the deep portion of the upper aquifer, the plumes' extents are delineated. PCE, cis-1,2-DCE, and VC are present in the deep portion, generally beneath the MAHLE facility and downgradient of the Aramark facility. EPA did not identify any exceedances of 1,1,1-TCA in this portion of the upper aquifer. TCE is present over the largest extent of the deep zone and is shown in Figure 4. Overall, the chlorinated VOC plumes decrease in size with depth and show limited lateral migration in this portion of the upper aquifer.

Releases from the facilities impacted the upper aquifer, but EPA did not find concentrations greater than screening levels in the lower aquifer where the municipal wells are screened.

Soil Vapor

EPA has been addressing the VI pathway, a complete exposure pathway at the Site, under removal action orders since before the RI began. As such, EPA did not completely evaluate the VI pathway in the RI; instead, it only demonstrated in the RI that the VI pathway is complete for the Site overall and that there is a quantitative risk to human health. In the RI, EPA compiled available indoor air and sub-slab soil vapor samples collected before VIMS were installed (i.e., samples indicative of normal conditions unaffected by mitigation efforts) in residential and commercial buildings to document the potential risks associated with the VI exposure pathway. Additionally, EPA compared concentrations of chlorinated VOCs in groundwater to vapor-intrusion screening levels (VISLs). EPA finds that the previous removal actions (i.e., the time critical removal action for VI that includes installation of VIMS and operating the 2008 SVE system, and the non-time critical removal action that includes an AS/SVE system) are not adequately addressing VI in the long term. This proposed plan indicates EPA's plan to select a remedy that includes VI mitigation activities.

The RI delineated the current lateral extent of the area potentially impacted by VI (the VI area of potential concern [AOPC]) by comparing concentrations of the chlorinated VOCs in the shallow groundwater interval to groundwater-to-indoor air VISLs. Because TCE results were generally the highest concentrations and largest plume extent, EPA used the shallow TCE groundwater concentrations to represent the AOPC (Figure 5). The AOPC adds a 100-foot buffer, referred to as the "initial lateral inclusion zone," outside the extent of TCE groundwater VISL concentrations to account for potential vapor migration from a vapor source.

This 100-foot buffer is also typically used to identify areas that generally warrant future assessment. EPA used the AOPC with 100-foot buffer data to support ongoing or additional activities that address the VI pathway in areas that have not previously been assessed for installation of VI mitigation. EPA has used these results to expand the number of properties to be sampled (and mitigated if necessary) for VI under the 2009 UAO.

Soil

EPA compared soil samples collected from 2011 (facility-focused sampling) through 2016 (confirmation facility and background sampling) to support the baseline human health risk assessment (BHHRA) to industrial regional screening levels (RSLs), the most likely future-use scenario of the three facilities. EPA also compared metals and polycyclic aromatic hydrocarbon (PAH) results to background concentrations, as metals can be naturally occurring and PAHs are frequently released from various man-made sources such as street run-off. The following summarizes the soil results:

- Of the VOCs, TCE exceeded the industrial soil RSL only at the Gem City facility. In particular, TCE exceeded the industrial RSL at five locations across that property and is delineated laterally. One location reported TCE at concentrations greater than the RSL at depth; but four adjacent borings indicate that vertical migration is limited in the area.

- Of the metals, only arsenic exceeded both its industrial soil RSL and background concentration at one location. Overall concentrations are similar to background and likely naturally occurring, however.
- Of the PAHs, soil from only two locations exceeded the industrial RSL and background concentration. However, the overall concentrations are similar to background and are likely present due to their ubiquity in the environment.

EPA compared soil concentrations of metals and PAHs to screening levels protective of groundwater (i.e., soil leaching). Results of the evaluation indicated little to no potential for these chemicals to impact groundwater. For this reason, and because these contaminants are not considered Site-related, they are not being addressed as part of this proposed Superfund action. This proposed plan indicates EPA's plan to select an interim remedy to address the core of a chlorinated VOC groundwater plume and address the resultant groundwater-driven VI issues across the entire groundwater plume. EPA plans to evaluate the Site-related soil impacts in a sitewide feasibility study that will be completed in the future.

Conceptual Site Model

Figure 6 is a three-dimensional image of the conceptual site model for the Site.

The groundwater contamination associated with the Site lies in the upper aquifer, which is separated from a deeper, lower aquifer, by a semi-continuous clay-rich basal till. Depth to groundwater in the upper aquifer is generally 15 to 20 feet bgs, which is lower than the bottom elevation of adjacent rivers, indicating that these rivers are losing streams in the study area. Impacts to the upper aquifer occurred due to releases of chlorinated solvent as dense non-aqueous phase liquid (DNAPL) from the facilities associated with the Site. The DNAPL then migrated vertically to groundwater and through the portions of the upper aquifer (shallow, intermediate, and deep).

EPA did not observe migration of contaminated groundwater associated with the Site to the lower aquifer, where pumping for the Dayton Miami South Well Field occurs. Additionally, EPA did not identify any residual DNAPL in soil or well borings that could act as an ongoing source to groundwater. The evaluation of the maximum concentrations of aqueous PCE and TCE indicate that only PCE is potentially present as residual DNAPL, and if so, near the location of wells BE-MW101D (deep portion) and PZ-8I (intermediate portion) beneath the MAHLE facility.

Once dissolved in groundwater, the plumes (impacted groundwater) migrated laterally downgradient in the shallow and intermediate portions of the upper aquifer, primarily through advection. Lateral migration has resulted from both natural hydraulic gradients and anthropogenic pumping at municipal wellfields, dewatering systems, and localized remedial systems. However, elevated concentrations are still noted beneath the MAHLE facility where some residual source material is thought to remain. EPA also noted limited lateral migration in the deep portion of the upper aquifer. COPCs greater than risk-based screening levels were not identified in the lower aquifer, where pumping for the Dayton Miami South Wellfield occurs.

Though the RI found that groundwater contamination associated with the Site is not impacting municipal well fields and no other drinking water wells have been found at or near the Site, the contamination deters use of this portion of the aquifer as a potential source of drinking water. Also, if left untreated, some of the contaminated groundwater associated with the Site could eventually migrate to the lower aquifer to the northeast where the Dayton Miami South Wellfield is located.

Contaminant vapors have migrated through the vadose zone to the indoor air of buildings at the Site. This interim remedial action will address VI threats in areas not previously addressed as part of the current removal action to address VI.

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 core of the groundwater plume and to address VI for buildings which overlie the groundwater contamination plume not currently being addressed by EPA Removal actions. The proposed response action is intended to clean up the portions of the groundwater plume with TCE concentrations greater than 500 ppb, and to address VI in all occupied buildings within the VI AOPC that currently does or may present an unacceptable risk to human health.

Two removal actions continue at the Site. One is a non-time critical removal action under the 2015 ASAOC, that requires operating AS and SVE in the portion of the groundwater plume located at the southern edge of the MAHLE facility where Site contaminant concentrations are the highest. This removal action would continue to operate in parallel with EPA's proposed remedy. The other ongoing removal action at the Site is the time critical removal action conducted under the 2009 UAO that requires VI sampling, mitigation, and maintenance, as well as operation of the 2008 SVE system located south of the MAHLE facility. EPA's proposed remedy would continue and expand these activities as part of the selected remedial action. The proposed remedy would apply updated and enhanced VI sampling and action levels.

This Proposed Plan presents an interim early action. It is being proposed before completion of the final FS and addresses the portion of the groundwater plume with TCE concentrations greater than 500 ppb, and VI for the entire groundwater plume associated with the Site. This proposed response action does not address source materials because no such materials have been identified; however, it does target the portion of the groundwater contamination at the Site with the highest concentrations.

EPA anticipates selecting a final remedy for the Site to address soil contamination and the remaining portion of the groundwater plume in the future.

E. SUMMARY OF SITE RISKS

EPA performed a baseline human health risk assessment (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 contamination and VI, this section is limited to the risks posed by groundwater and soil vapor.

Human Health Risk

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.

Groundwater

The BHHRA presents the potential current and future risks to human health posed by residential use of contaminated groundwater (see Figure 7). The upper contaminated aquifer is not currently used as the municipal drinking water source or for private well drinking water. Although groundwater in the lower aquifer north of the MAHLE facility flows to the Dayton Miami South Well Field, the Site-related contamination has not been found in the lower aquifer. Residential use of groundwater is assessed for hypothetical future use to support risk management decision making. The BHHRA also assessed a scenario involving construction workers contacting shallow groundwater.

EPA identified multiple groundwater contaminants of potential concern (COPCs). Approximately 98 percent of the cumulative risk for a residential exposure scenario are accountable to TCE and PCE. The BHHRA evaluated data collected between September 2011 and March 2016 from 449 samples from 282 locations. EPA evaluated data from two exposure areas, the core of the VOC plume and the plume fringe, separately. The core of the VOC plume includes areas where TCE or PCE concentrations are greater than 100 times the maximum contaminant level (MCL)[6] or 500 ppb. The core of the VOC plume is estimated to contain about 75 percent of the plume mass despite only composing 20 percent of the plume area. All other groundwater, with contaminant concentrations above the MCL, is designated as the plume fringe.

The lifetime excess cancer risk for future residents exposed to contaminated groundwater via ingestion from the core of the VOC plume is 3 in 100; and the noncancer risk is an HI of 2,560. The cancer risk exceeds EPA's target risk range of between 1E-4 and 1E-6 and Ohio EPA's target risk level of IE-5. The non-cancer risk is also unacceptable.

Future construction workers exposed to shallow groundwater from the core of the VOC plume through incidental ingestion and dermal contact have an increased lifetime risk of cancer of 3E-6 and a non-cancer risk with an HI of 18. The cancer risk is within EPA's target risk range and Ohio EPA's target risk level. The non-cancer risk is unacceptable.

Soil Vapor

Table A-7 from the BHHRA (included at the end of this proposed plan) provides a summary of the VI comparison data used to establish risk from soil vapor.

These comparison data provide a baseline assessment of potential risks and confirm that some residents and workers in homes and businesses located above the contaminated groundwater plume associated with the Site are exposed to indoor air above risk-based screening levels. This risk assessment uses updated values for assessing VI risk compared to values used to identify VI risk and trigger action for the removal work being conducted under the 2009 UAO.

Ecological Risk

EPA conducted a screening-level ecological risk assessment (SLERA) to evaluate if the groundwater contaminant plume is posing potentially unacceptable risk to ecological receptors. Because the Site is located in a heavily developed urban area, potential ecological receptors are limited. EPA did not identify any special habitats or endangered species threatened by Site contaminants.

In the SLERA, EPA only identified potential ecological receptors at the Site in the two rivers that border the Site. Further, EPA identified the groundwater surface water interface (GSI) pathway (contaminated groundwater migrating into the rivers) as the only potential ecological exposure pathway at the Site that needs to be evaluated. EPA evaluated the GSI pathway in the Great Miami and Mad Rivers based on the ratio of exposure concentrations to screening values,

[6] The MCL for TCE is 5 ppb so the plume core was defined for the HHRA and now for this proposed plan as 500 ppb. EPA selected 500 ppb to define the plume's core as it contains approximately 75 percent of the total contaminant mass in only 20 percent of the plume area.

resulting in ecological hazard quotients. The SLERA concludes that VOCs in groundwater do not present unacceptable ecological risk to aquatic receptors and that no further ecological risk evaluation is warranted.

Conclusion of Risk Assessments

EPA concluded 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 RAO specific to this proposed interim action:

- Significantly reduce concentrations of groundwater COCs in the core of the VOC plume, as measured by asymptotic performance levels.
- Protect residents from ingestion exposure to COCs in groundwater at concentrations greater than their Safe Drinking Water Act maximum contaminant levels (MCLs).
- Protect construction workers from incidental ingestion and dermal contact that present an unacceptable risk.
- Protect residents and industrial workers from unacceptable inhalation exposure to COCs caused by VI.

G. SUMMARY OF REMEDIAL ALTERNATIVES

EPA is proposing: (1) AS with SVE to address the core of the VOC plume; (2) sampling buildings located above the entire Site groundwater plume to identify unacceptable VI exposures, installation of VIMSs as needed, and monitoring/maintaining all new and existing VIMS.

Because EPA is currently addressing the VI pathway in a separate cleanup action, the FS did not conduct an analysis of remedial options for addressing this pathway. The most common VI cleanup option is a VIMS which draws vapors from below a building to the outside, above the roofline, so the vapors do not enter the indoor air. EPA is proposing that each alternative below, except for the no action alternative, include evaluation of VI risk for all buildings above the full Site groundwater plume and installing of VIMSs as needed.

Provided below is a summary of the cleanup alternatives that EPA considered for this interim response action. For each cost estimate, EPA assumed 30 years of O&M.

Description of Interim Remedial Alternatives

Common Elements

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

- Access to private properties and public rights-of-way
- Sampling occupied buildings above the groundwater plume for potential VI
- Installing additional VIMS where VI sampling results exceed current screening levels
- O&M of existing and newly-installed VIMS until VI risk is mitigated
- Routine surveying of home ownership to insure existing VIMS are effective and potentially affected properties are sampled
- Continued operation of the non-time critical removal action AS and SVE systems, and integration of these systems with the interim remedial action if possible
- Groundwater and VI sampling

All of the interim remedial alternatives will also require Institutional Controls (ICs), as follows:

- Prohibiting the installation of potable wells in groundwater above SDWA MCLs.
- Requiring construction of new, occupied structures overlying groundwater concentrations greater than VISLs to include protective measures, such as a vapor barriers or sub-slab depressurization systems.
- Restrictions to protect construction workers against exposures to contaminated groundwater from unacceptable ingestion or dermal exposures.

Alternative 1 – *No Action*

EPA is required to evaluate a "no action" alternative when considering potential remedial actions for a site. Based on the BHHRA, it is expected that this alternative would allow residents and workers at the Site to be potentially exposed to Site-related contamination at concentrations that represent a potential threat to human health. Specifically, if the no action alternative were selected, residents and workers could potentially be exposed to contaminated groundwater or soil vapors associated with the Site through consumption of groundwater from future drinking water wells, construction activities, or the VI pathway.

Estimated C•sts for Alternative 1

Capital Cost:	$0
Annual O&M Cost:	$0
Total O&M Cost:	$0
Total Present Worth Cost:	$0

Alternative 2 – *Pump and Treat*

P&T involves pumping contaminated groundwater to a treatment system to remove the contaminants and would likely produce relatively rapid initial reductions in groundwater concentrations.

Approximately six groundwater extraction wells would be needed to capture groundwater with VOC concentrations exceeding 500 ppb. The six wells would pump approximately 1.75 million gallons of water per day (mgd), an average of about 200 gallons per minute per extraction well. Subsurface piping would be used to convey the water to a centralized treatment system. Up to 9,500 feet of trenching would be required, and construction would be performed by a combination of jack-and-bore directional drilling and conventional right-of-way utility work. Approximately 18,000 feet of dedicated subsurface high-density polyethylene (HDPE) conveyance piping would be required to convey the influent from each extraction well to the treatment system. Pipe sizing would range from 4 to 6 inches in diameter, depending on the length of conveyance to the treatment system and the estimated head loss. Due to the relatively flat relief at the Site, and the availability of submersible well pumps to provide at least 150 feet of hydraulic head, no lift stations would be required.

The centralized treatment system would treat the influent with air stripping, which is a conventional treatment method for these relatively volatile COCs. The combined influent from the six extraction wells would be treated in a single process stream. The off gas from the air strippers would be treated with vapor-phase granular activated carbon (VGAC). The VGAC would be replaced routinely as the media becomes saturated with COCs. Based on estimated contaminant mass levels and VGAC adsorption efficiencies, the VGAC would be replaced approximately twice yearly. Spent carbon would be characterized and then transported to a licensed facility for appropriate disposal or regeneration.

The treated groundwater would be conveyed continuously via a transfer pump to the Mad River for discharge. Initial information indicates that discharging 5 mgd of clean water to the Mad River could improve the river's aesthetic quality, particularly during low-flow seasons. Discharge to a POTW was not considered due to potential capacity issues and cost limitations since the POTW would levy a fee based on the discharge rate. EPA assumes a five mgd discharge rate to a POTW to be cost-prohibitive - anticipated to be over $5 million in annual discharge fees alone.

The air stripping system would operate and comply with air chemical-specific ARARs. Ohio Admin. Code § 3745-15-05 provides a *de minimis* air contaminant source exemption from air permit requirements if hazardous air pollutant emissions do not have the potential to exceed 10 pounds per day or 1 ton per year. Though no permit would be required on-site under CERCLA regardless of the potential air emission rate, it is expected that the off-gas treatment system would discharge less than 10 pounds per day and 1 ton per year after the first five years of operation. Discharge to the Mad River would comply with the substantive National Pollutant Discharge Elimination System (NPDES) requirements. Construction of an outfall near the River would need to comply with the substantive requirements established under CWA Section 404 for the Mad River. Furthermore, based on Ohio Rev. Code § 6101.19, the Miami Conservancy District would also be contacted. Chemical additions may be necessary to prevent fouling of the air stripping treatment system, and would have to comply with the substantive NPDES requirements.

Several things complicate the use of P&T at the Site. The system would likely have to be temporarily stopped during large precipitation events or flooding that could complicate discharge to the Mad River. There may be complications from inorganics such as iron, hardness (calcium and magnesium), and other constituents. Iron fouling, calcium scaling, and other effects can significantly hinder treatment efficiency and system uptime. Sequestering agents, anti-scaling reagents, chlorination, and other remedies could be incorporated into the treatment train to maintain system efficiency.

The P&T system would require approximately 10 years of operation to achieve the remedial goals in the core of the VOC plume, including semi-annual groundwater monitoring. Operation of the non-time critical removal action AS and SVE system currently in place at the MAHLE facility would be redundant to the P&T system and would no longer be needed as part of this alternative. In contrast, the groundwater plume by Gem City would not be treated by Alternative 2 P&T, therefore current treatment of that plume would continue to operate as part of this remedy. Additionally, the VIMS would need to be operated and maintained throughout the operation of this remedy, since the Alternative 2 P&T would not resolve the indoor air exposures. EPA assumes a need to conduct VI for 30 years before the VIMS are no longer needed, which would likely depend on a subsequent groundwater remedy beyond this interim remedial measure. O&M costs for the VIMS are based on continued operation of approximately 120 existing and 40 new systems.

Estimated Costs for Alternative 2

Capital Cost: $6,000,000
Annual O&M Cost: $800,000 for the first 5 years, $790,000 for years 6 through 10, $330,000 for years 11 through 30
Total O&M Cost (10 years for groundwater P&T; 30 years for VIMSs): $13,300,000
Total Present Worth Cost: $19,300,000

Alternative 3 - *Air Sparging/Soil Vapor Extraction via Horizontal Directionally Drilled Wells*

During AS, air is injected underground into the contaminated groundwater to strip the VOCs from the groundwater, and convert them to a gas that then migrates above the water table, where the SVE system draws the VOC gases from underground and releases them to the atmosphere. AS/SVE treatment for the core of the VOC plume would likely yield relatively rapid initial reductions in groundwater concentrations of VOCs within the zone of influence of the system. The extracted gas would be treated with a VGAC system before release to the atmosphere. It is estimated that active treatment with AS/SVE would continue for 5 years in the core of the VOC plume to meet the remedial action object of significant reductions as measured by asymptotic performance levels.

Horizontal AS wells (drilling through the subsurface horizontally) would be installed to distribute air through the treatment area. Eight AS wells would be installed in seven transects using horizontal drilling techniques. The longer transects would contain multiple AS wells installed end to end to provide treatment to the entire length of the transect. The horizontal AS wells would measure 3 to 4 inches in diameter, contain 200 to 1,200 feet of screen, and be placed perpendicular to the direction of groundwater flow. A single-ended installation method could be used for each horizontally drilled AS well, which would be installed to a depth of approximately 80 feet bgs to effectively treat the shallow and intermediate portion of the contaminated aquifer. Double ended installation could also be an option. The angle of installation for horizontal wells would be 4 feet horizontal for every vertical foot drilled. Therefore, an additional 320 feet of drilling would be required for each AS well to reach the required installation depth.

In addition, eight 4- to 6-inch-diameter horizontally drilled SVE wells would be installed near the AS wells to approximately 20 feet bgs using directional drilling techniques. To avoid low permeability zones when drilling/placing the horizontal wells, additional exploratory borings may be drilled during the remedial design to identify locations of clay lenses along the proposed alignments of the horizontally drilled AS wells.

An estimated 4,800 feet of conveyance pipe would be installed in approximately 2,100 feet of trench to connect the AS and SVE wells to three independent remediation compounds. Conveyance pipe would be sized according to expected flow rates: 3 to 4 inches for the AS lines and 6 to 8 inches for the SVE lines. Dedicated piping would convey air to or from the remediation compounds to the AS and SVE wells.

Each remediation compound would house compressors, blowers, and other equipment to service a portion of the AS and SVE wells and provide enough AS injection capacity to deliver up to 1,050 standard cubic feet per minute (scfm) of air flow (0.5 scfm per foot of screen) and an SVE capacity to extract up to 1,300 scfm. One 10,000-pound VGAC treatment unit would be needed at each remediation compound to treat the extracted soil vapors before discharging them to the atmosphere. Security fencing would need to be installed around each equipment compound.

The VIMS would be operated and maintained for an estimated 30 years. Eventual groundwater cleanup goals may be reached more quickly, and fewer VIMSs may be needed, with the AS/SVE remedy than the P&T remedy.

Discharge from the VGAC units must comply with the substantive air permitting requirements of Ohio Admin. Code § 3745-15-05. In addition, this alternative would be required to comply with the substantive requirements of Ohio Admin. Code § 3745-34-11, which pertains to underground injection.

AS/SVE would not prevent further lateral or vertical migration of COCs outside the target treatment zone. The SVE system must be properly designed and operated to be effective and reliable, and address and mitigate any performance issues immediately when encountered.

Operation of the AS/SVE systems is estimated to continue for up to 5 years to meet remedial goals in the core of the VOC plume. The AS/SVE system that MAHLE installed in 2017 as part of a non-time critical removal action, under the 2015 ASAOC, would continue to operate long-term along with the newly installed AS/SVE wells. The area influenced by the Gem City P&T system falls outside the active target treatment zone of the Alternative 3 AS/SVE system and also would continue to operate as part of this remedy.

Estimated Costs for Alternative 3

Capital Cost:	$6,800,000
Annual O&M Cost:	$830,000 for the first 3 years, $810,000 for years 4 and 5, $330,000 for years 6 through 30
Total O&M Cost (30 years):	$11,300,000
Total Present Worth Cost:	$18,100,000

Alternative 4 – *In Situ Chemical Oxidation via Direct Injection*

In Situ Chemical Oxidation (ISCO) would be utilized to oxidize VOCs within the core of the VOC plume. Contaminants would be oxidized into compounds that do not pose a threat to human health (like carbon dioxide and water). Key factors that influence the effectiveness of ISCO include total oxidant demand (the amount of treatment chemical needed to oxidize the groundwater contaminants) and contact between the groundwater contaminants and the oxidant. Based on site conditions, permanganate would serve as the oxidant because it persists longer than other oxidants. Although the oxidizing potential of the permanganate anion is less than that of other oxidants such as hydrogen peroxide, persulfate, and ozone, it is still efficient and is kinetically favorable for TCE. The chemistry of permanganate is straightforward (no catalyst involved) and selective, and its tendency for higher persistence in the subsurface enables longer contact times and transport distances in the subsurface.

Permanent injection wells would be installed to target the core of the VOC plume in the contaminated aquifer shallow and intermediate zones. Injection wells would be installed using a modified grid pattern, with transects installed along existing road rights-of-way. EPA estimates that 1,290 injection wells on 30-foot centers along each transect to varying depths in the aquifer would be needed to target different depth intervals during injection events. Based on the target interval, injection wells would be installed in pairs or triplets as follows:

- Shallow zone only—a pair of injection wells screened from 20 to 35 feet bgs and 35 to 50 feet bgs
- Intermediate zone only—a pair of injection wells screened from 35 to 50 feet bgs and 50 to 65 feet bgs
- Shallow and intermediate zones—three injection wells screened from 20 to 35 feet bgs, 35 to 50 feet bgs, and 50 to 65 feet bgs

Annual injection events are estimated to be performed for 5 years. Assuming a porosity of 0.3 and a permanganate natural oxidant demand of 2 grams per kilogram of soil, approximately 3.7 million gallons per event of 3 percent permanganate solution (915,000 pounds) would be injected into the injection wells per event. EPA assumes tanker trucks would deliver the premixed 3 percent permanganate solution to the Site and directly into the injection wells. This would prevent the need for a large staging area for mixing chemicals onsite. Each injection event would take approximately 170 working days.

To monitor performance, groundwater samples would be collected semiannually for VOC analysis from monitoring wells that surround the active treatment area. Groundwater samples would be analyzed for metals due to the potential temporary mobilization of metals after injecting oxidant into the subsurface.

Prior to injecting chemicals into the subsurface, the remedy must meet the substantive requirements of Ohio Admin. Code § 3745-34-11, for an exemption for class V injection wells used for remediation.

There are several challenges implementing this remedy. Even distribution of oxidant through injections in the target treatment zone could be difficult, though proper pre-design investigations, design, and monitoring can alleviate this challenge. Permanganate is a strong oxidant and poses risks to site workers and potential nearby pedestrians during injection. However, if workers wear appropriate personal protective equipment at all times and work areas are barricaded appropriately, permanganate solution can be safely handled and injected by workers in the field. Engineering controls would be required to protect the environment from spills. There is a risk of potential temporary mobilization of metals resulting from injecting oxidant into the subsurface. Additionally, there is a risk as to how the public will perceive the purple permanganate solution being injected into the ground. Delivering a pre-mixed solution from tanker trucks will help lessen the visibility of the permanganate solution to the public. Getting an even distribution of oxidant through injections in the target treatment zone will also present a challenge.

The AS/SVE system, installed in 2017 as part of the non-time critical removal action, under the 2015 ASAOC, would be integrated into the treatment plan and continue to operate long-term. ISCO injections would not be performed in the area that is influenced by the AS/SVE system. The area influenced by the Gem City P&T system falls outside the active target treatment zone of the ISCO treatment and would continue to operate. Additionally, the VIMS would be operated and maintained throughout the execution of this remedy, since ISCO would have no immediate effect on VI issues. EPA based O&M costs for the VIMS on continued operation of approximately 120 existing and 40 new systems.

During active treatment, annual expenses would include the oxidant, labor to inject the oxidant into the subsurface, performance monitoring, and preparation of monthly reports.

Estimated Costs for Alternative 4

Capital Cost:	$8,300,000
Annual O&M Cost:	$8,700,000 for the first 5 year, $330,000 for years 6 through 30.
Total O&M Cost (30 years):	$52,700,000
Total Present Worth Cost:	$61,000,000

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 has to 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. The two modifying criteria, state and community acceptance, will be further evaluated after this proposed plan undergoes public comment and will be addressed in the Record of Decision. For more details on the comparative analysis of the alternatives, see Section 5 and Table 5-1 of the FFS report for the Site.

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

Alternative 1 (No Action) would provide no improvement over current conditions and no risk reduction, and therefore would not be protective of human health or the environment. Because Alternative 1 does not meet this threshold criterion and is therefore not eligible to be selected, it is not discussed further in this Proposed Plan.

Alternatives 2 through 4 are all anticipated to protect human health and the environment. All Alternatives are estimated to need 30 years of operation for the VIMSs. Alternative 2 is estimated to require 10 years to achieve the groundwater RAOs; Alternatives 3 and 4 are estimated to take 5 years to achieve the groundwater RAOs.

Alternative 2 (P&T) is a proven method for groundwater remediation, especially in aquifers with high hydraulic conductivity and the relatively soluble contaminants present at the Site. P&T would reduce contaminant mass (rapidly at first) and exert hydraulic control in target treatment zone but would not prevent further lateral or vertical migration of the core VOC plume. P&T is not expected to reduce the need for VIMS.

Alternative 3 (AS/SVE with horizontally drilled wells) would reduce contaminant mass (rapidly at first) by stripping the COCs from groundwater and capturing them with an SVE system. The captured air would be treated aboveground before it is discharged to the atmosphere. Like P&T, AS/SVE would not prevent further lateral or vertical migration of the plume. SVE could help mitigate VI issues and potentially reach VI RAOs more quickly, reducing the time the VIMS must continue to operate.

Alternative 4 (ISCO via direct injection) would oxidize contaminants within the 500 ppb areas to innocuous compounds like carbon dioxide and water. Like P&T and AS/SVE, ISCO would not prevent further lateral or vertical migration of the plume; however, because of oxidant drift from the target treatment zone, some contaminant destruction would occur downgradient of the core VOC plume. ISCO is not expected to reduce the need for VIMS.

2. ***Compliance with ARARs***

In accordance with the NCP (40 CFR 300.430(f)(l)(ii)(C)(l)), interim actions such as this are not required to comply with all ARARs as long as the final remedial action at the Site will attain them. However, some ARARs still apply to this interim action, and EPA believes that all ARARs can be adhered to in implementing Alternatives 2, 3, or 4.

The P&T remedy would comply with location-specific ARARs and action-specific ARARs, including, but not limited to, well installation, prohibitions on polluting waters, treated water discharge, potential air emissions, and waste handling ARARs.

The AS/SVE remedy would comply with location-specific ARARs and action-specific ARARs, including but not limited to well installation, class V injection wells, subsurface injections, potential air emissions, and waste handling ARARs.

Alternative 4 would comply with location-specific ARARs and action-specific ARARs, including well installation, Class V well, subsurface injection, and waste handling ARARs.

3. ***Long-term Effectiveness and Permanence***

Each of the remedial Alternatives evaluated are interim remedies, and additional remedial measures will likely be needed for the groundwater contamination after they achieve interim groundwater remedial action objectives. Alternative 3 would better satisfy this criterion than Alternative 2, as the technology is more reliable. Alternative 4 is the least reliable technology – it would be difficult to achieve sufficient contact of the oxidizer with the Site contaminant within the heterogeneous formation.

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

Alternative 4 best satisfies this criterion as ISCO permanently reduces toxicity, mobility and volume *in situ* by converting the contaminants to innocuous compounds. Alternatives 2 and 3 rely on extraction or volatilization of contaminants and treatment above ground.

5. ***Short-term Effectiveness***

Alternative 3 would best satisfy this criterion as it would involve the least amount of impacts to the community from construction and operation activities. Alternative 4 would satisfy this criterion the least, as risks and public perception of injecting strong oxidants within or near businesses and residences might pose unacceptable short-term impacts to the community. Alternative 3 is also the only alternative that has the potential to reduce impacts from VI in the short term.

6. ***Implementability***

Alternative 3 best satisfies this criterion as it entails the fewest implementation challenges. The total amount of initial construction is similar to Alternative 2, but it requires much less drilling than Alternative 4. Once constructed, O&M for Alternative 3 is simpler than that required for Alternatives 2 and 4. Alternative 3 does not involve the handling of chemicals.

Alternative 2 must manage a very large volume of water. Both this large volume of water and the vapors air stripping would generate would need to be treated. Treatment would also be required to prevent fouling of the wells. Such treatment could be complicated, depending on the chemical additives required.

Alternative 4 requires many annual visits handling dangerous chemicals (though these dangers can be managed effectively with proper precautions). That alternative would also require the drilling of nearly 1,300 injection wells.

7. ***Cost***

The estimated costs for Alternatives 2 and 3 are considerably less than the estimated cost of Alternative 4. The net present values of Alternatives 2 and 3 are approximately one-third of Alternative 4.

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 Ohio EPA to concur with the selection of Preferred Remedial Alternative 3.

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 continued operation of VIMS.

I. EPA'S PREFERRED ALTERNATIVE

Alternative 3 (AS/SVE via horizontally directionally drilled wells) is the Preferred Alternative as it best satisfies the evaluation criteria. Though no source materials constituting principal threats have been identified at the Site, the Preferred Alternative would achieve substantial risk reduction by reducing through treatment the toxicity, mobility, and volume of contamination in the most concentrated portion of the groundwater contaminant plume associated with the Site. EPA recommends this alternative over the other alternatives evaluated because it is the most reliable and effective in the shorter-term at achieving Site-wide RAOs. It is also the most cost-effective of the active treatment alternatives evaluated. AS/SVE would meet remedial objectives more quickly than P&T. The Preferred Alternative complements the existing AS/SVE system at the MAHLE facility, reducing implementation costs since that AS/SVE infrastructure is already in place to treat that portion of the Site groundwater plume. AS/SVE also has the best potential to reduce VI impacts and operation of VIMS in the short term.

The Preferred Alternative includes AS/SVE with horizontal directionally drilled wells and additional VI sampling, monitoring, and mitigation. More details describing the proposed AS/SVE system can be found in the FFS report for the Site and in Figures 8 and 9 of this proposed plan. The VI portion of the Preferred Alternative would eventually replace the existing

Workplan under the 2009 UAO, would address the entire area potentially impacted by VI identified in Figure 5 of this proposed plan, and will include:

1) Sampling additional occupied commercial, residential, and industrial buildings for potential VI impacts as well as resampling of occupied buildings above the Site groundwater plume not previously identified as impacted by VI;
2) Installing new VIMS for occupied commercial, residential, and industrial buildings impacted by VI above current health-based screening levels; and
3) Maintenance and monitoring of new and existing VIMS and the 2008 SVE;

Based on the information available at this time, EPA believes the Preferred Alternative meets the threshold criteria and provides the best balance of tradeoffs among the alternatives evaluated with respect to balancing and modifying criteria. EPA expects the Preferred Alternative 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 ensure that the remedy selected for each Superfund site meets the needs and concerns of the local community.

To assure that the community's concerns are being addressed, a public comment period lasting thirty (30) calendar days will open on September 5, 2018, and close on October 5, 2018. During this time the public is encouraged to submit comments to EPA on the Proposed Plan.

A public meeting will be held to discuss the Proposed Plan on September 20, 2018, at 6:00 p.m., at Kiser Elementary School located at 1401 Leo Street in Dayton. An Administrative Record has been created for the Site and will be completed upon issuances 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/behr-dayton-thermal) or at the following locations:

E.C. Doren Branch Library
359 Maryland Avenue
Dayton, Ohio 45404

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

It is important to note that although EPA has proposed a Preferred Alternative, it is an interim remedy for the Site. The final remedy for the Site has not yet been proposed or selected. All comments received during the public comment period will be considered and addressed by EPA before it selects an interim remedy for the Site.

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

Written comments, questions about the Proposed Plan, and requests for information can be sent to either EPA representative below:

Erik Hardin (SR-6J) Remedial Project Manager Region 5 EPA 77 West Jackson Boulevard Chicago, IL 60604 hardin.erik@epa.gov	Heriberto León (SI-6J) Community Involvement Coordinator Region 5 EPA 77 West Jackson Boulevard Chicago, IL 60604 leon.heriberto@epa.gov

Table A-7. Pre-Mitigation Indoor Air and Subslab Soil Gas Data Summary - Detects

Baseline Human Health Risk Assessment, Remedial Investigation Report

Behr Dayton Thermal System VOC Plume Site, Dayton, Ohio

Structure Type	Number of Structures Sampled	Sample Matrix	Analyte	Unit	Number of Samples	Number of Non-detects	Number of Detects	Minimum Nondetect Concentration	Maximum Nondetect Concentration	Minimum Detect Concentration	Maximum Detect Concentration	Average Detect	Historical SL[a]	VISL[b]	VISL (1×10^{-5})[c]	Number of Detects > Historical SL[a]	Number of Detects > VISL[b]	Number of Detects > VISL[c]
Commercial	28	Indoor Air	PCE	ppbv	2	0	2	--	--	0.66	4.5	2.6	50	6.9	27	0	1	0
			TCE	ppbv	16	1	15	0.5	0.5	0.3	430	46	1.7	0.56	1.6	14	14	14
		Subslab Soil Vapor	PCE	ppbv	1	0	1	--	--	840	840	840	500	236	1,300	1	1	0
			TCE	ppbv	24	3	21	0.16	0.16	0.2	14,400	2,015	17	19	53	12	10	10
Residential	395	Indoor Air	PCE	ppbv	271	168	103	0.08	2.4	0.15	30	2.2	12	1.6	6.2	6	24	8
			TCE	ppbv	362	132	230	0.038	2.4	0.04	1,440	13	0.4	0.089	0.39	170	227	174
		Subslab Soil Vapor	PCE	ppbv	208	54	154	0.65	6.4	0.19	7000	218	120	53	210	32	60	19
			TCE	ppbv	346	66	280	0.04	2	0.1	67,000	1,629	17	3	13	225	231	202
Industrial	19	Indoor Air	TCE	ppbv	21	11	10	0.2	62	0.1	22	9.2	100,000	0.56	1.6	0	8	8

Notes:

ppbv = parts per billion (by volume)

PCE = tetrachloroethene

TCE = trichloroethene

SL = screening-level

VISL = vapor intrusion screening level

[a] Historical RBSLs for residential and commercial structures were based on EPA's OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air

[b] VISLs for indoor air are USEPA residential indoor air RSLs (November 2016) based on a target cancer risk of 1×10^{-6} and a noncancer HQ of 1. VISLs for

[c] VISLs for indoor air are USEPA residential indoor air RSLs (November 2016) based on a target cancer risk of 1×10^{-5} and a noncancer HQ of 1. VISLs for

Figures

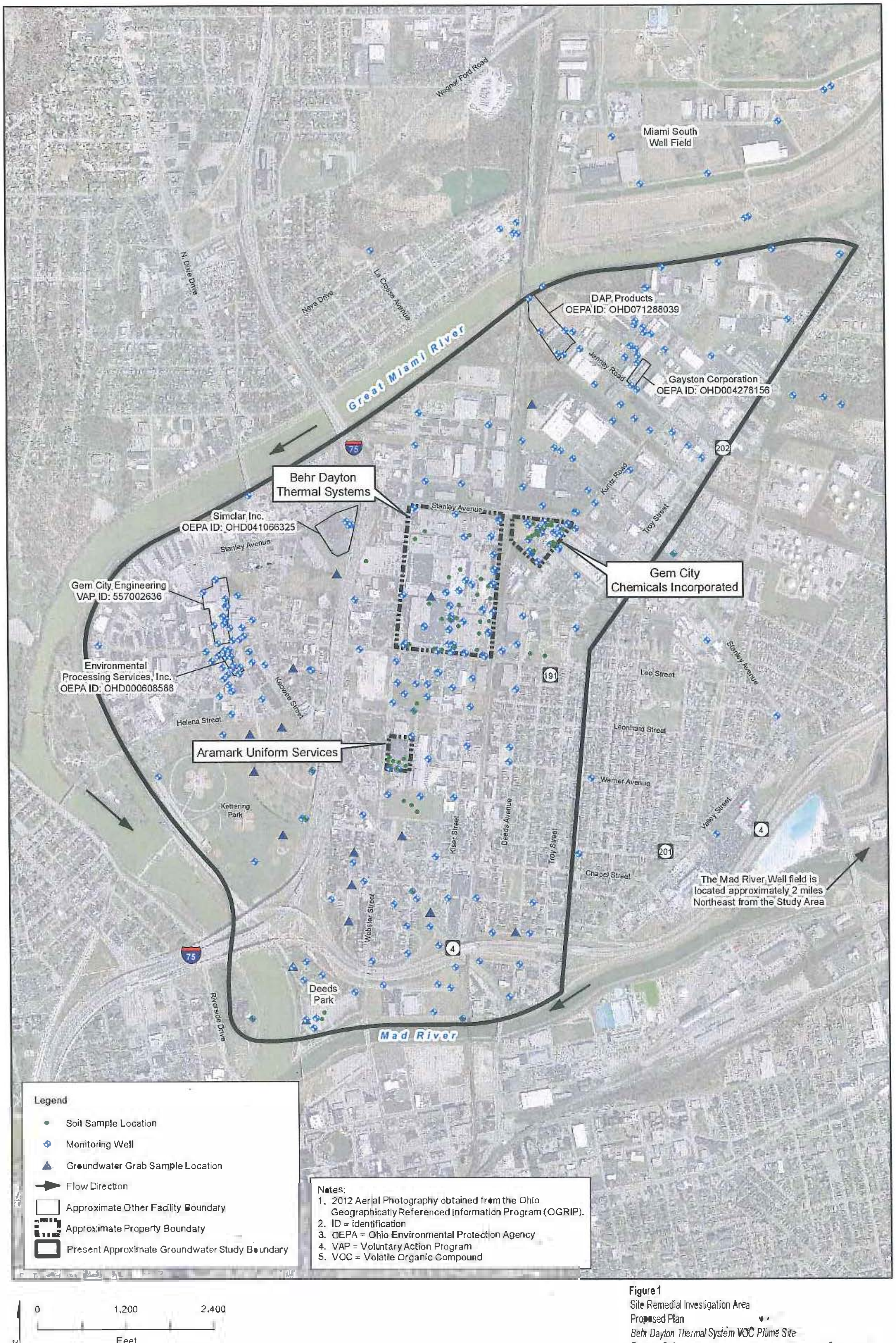

Figure 1
Site Remedial Investigation Area
Proposed Plan
Behr Dayton Thermal System VOC Plume Site
Dayton, Ohio

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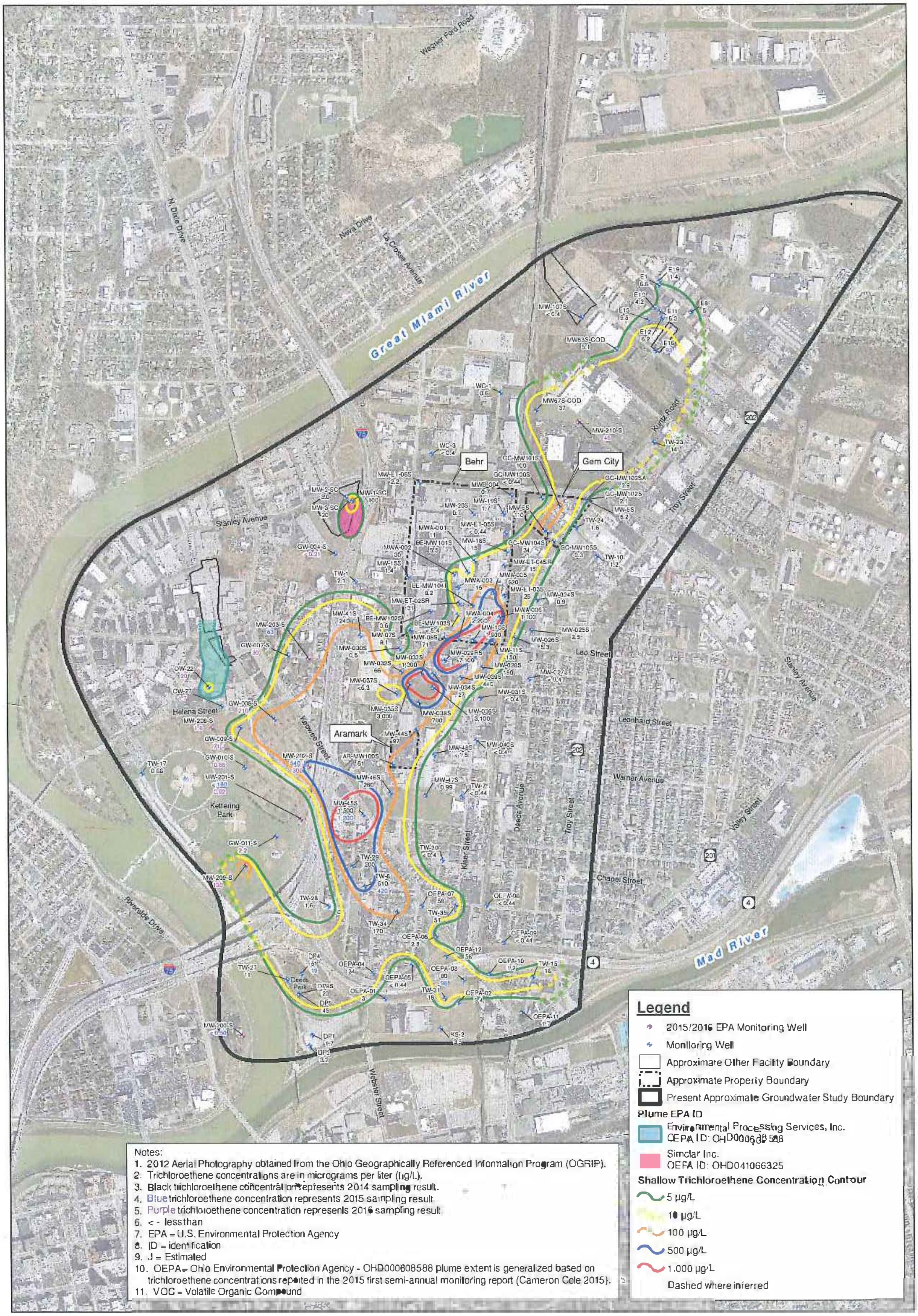
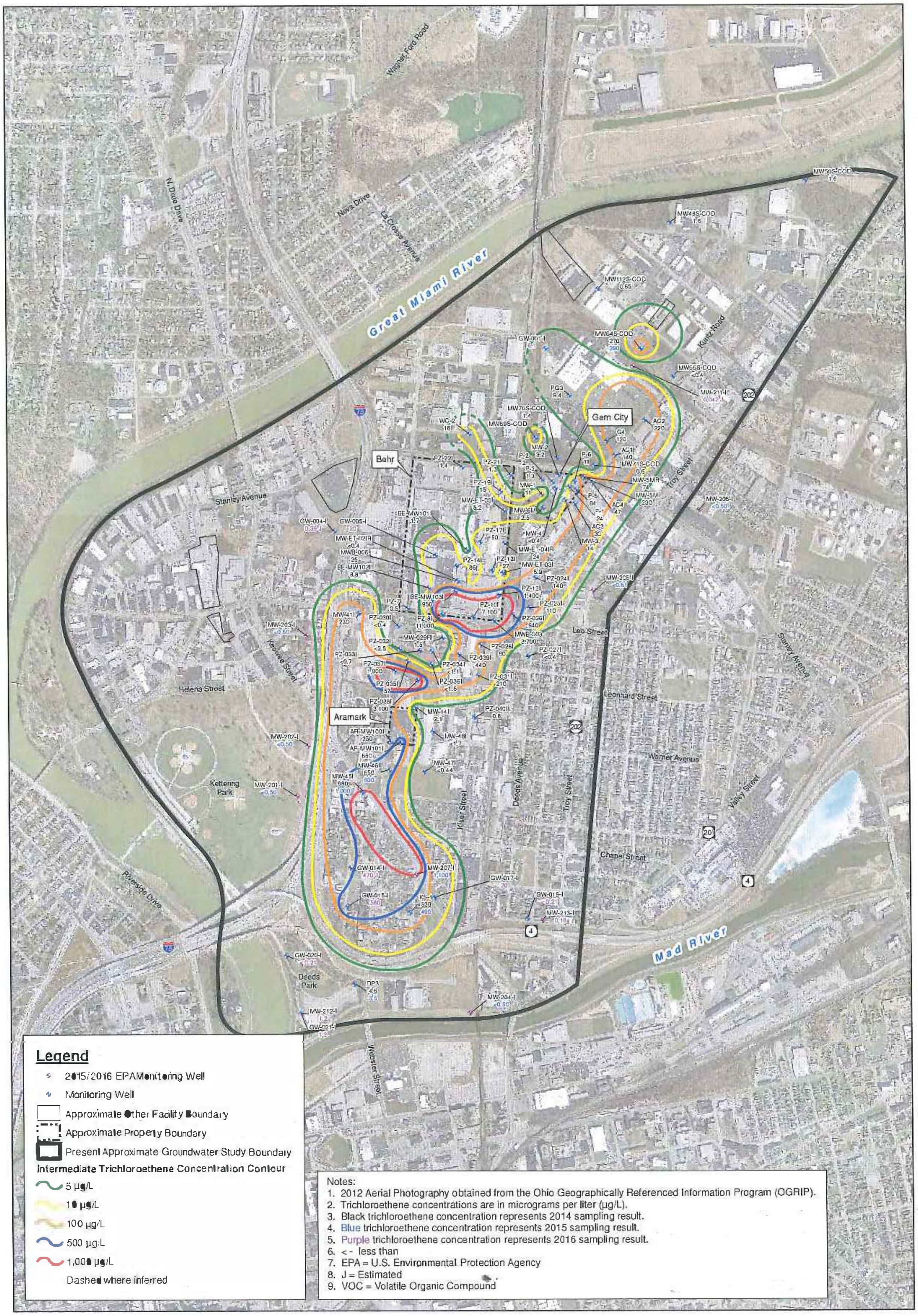
\\MKEFPP01.PROJ\USENVIRONMENT\ALPROTE\420125_BEHRDAYTONTHERMAL\MAPFILES\2018\FFS\FIGURE 1-2 - SITE PLAN.MXD JHANSEN1 1/23/2018 1:48:00 PM



0 1,200 2,400
Feet

Figure 2
Shallow Zone of Surficial Aquifer Groundwater TCE Contour Map
Proposed Plan
Behr Dayton Thermal System VOC Plume Site
Dayton, Ohio

ch2m



0 1,200 2,400
Feet

Figure 3
Intermediate Zone of Surficial Aquifer Groundwater TCE Contour Map
Proposed Plan
Behr Dayton Thermal System VOC Plume Site
Dayton, Ohio

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\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\420125_BEHRDAYTONTHERMAL\MAPFILES\2016\FFS\FIGURE 1-8 - INTERMEDIATE TCE CONTOURS(2016).MXD JHANSEN1 1/22/2018 3:35:03 PM

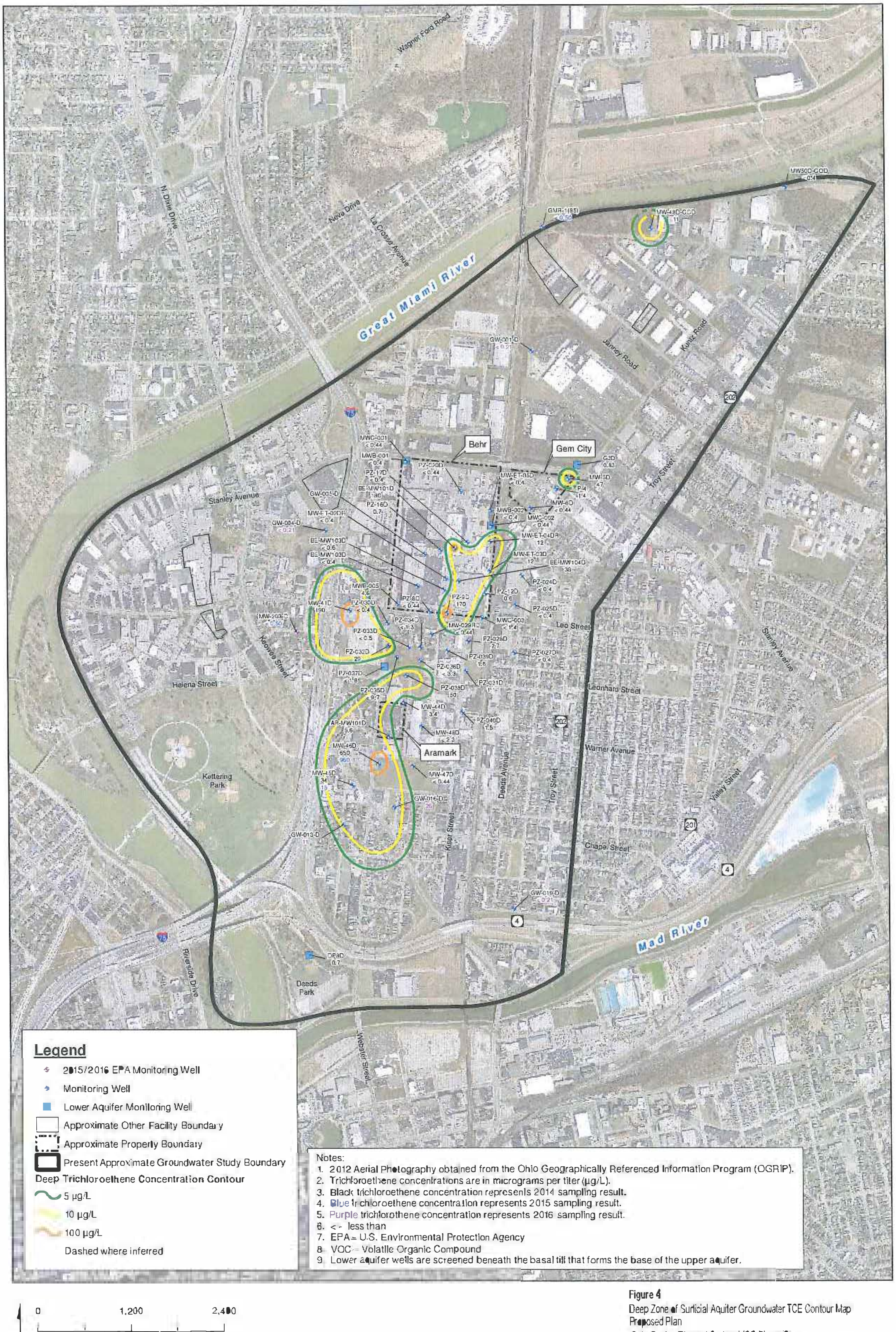

Figure 4
Deep Zone of Surficial Aquifer Groundwater TCE Contour Map
Proposed Plan
Behr Dayton Thermal System VOC Plume Site
Dayton, Ohio

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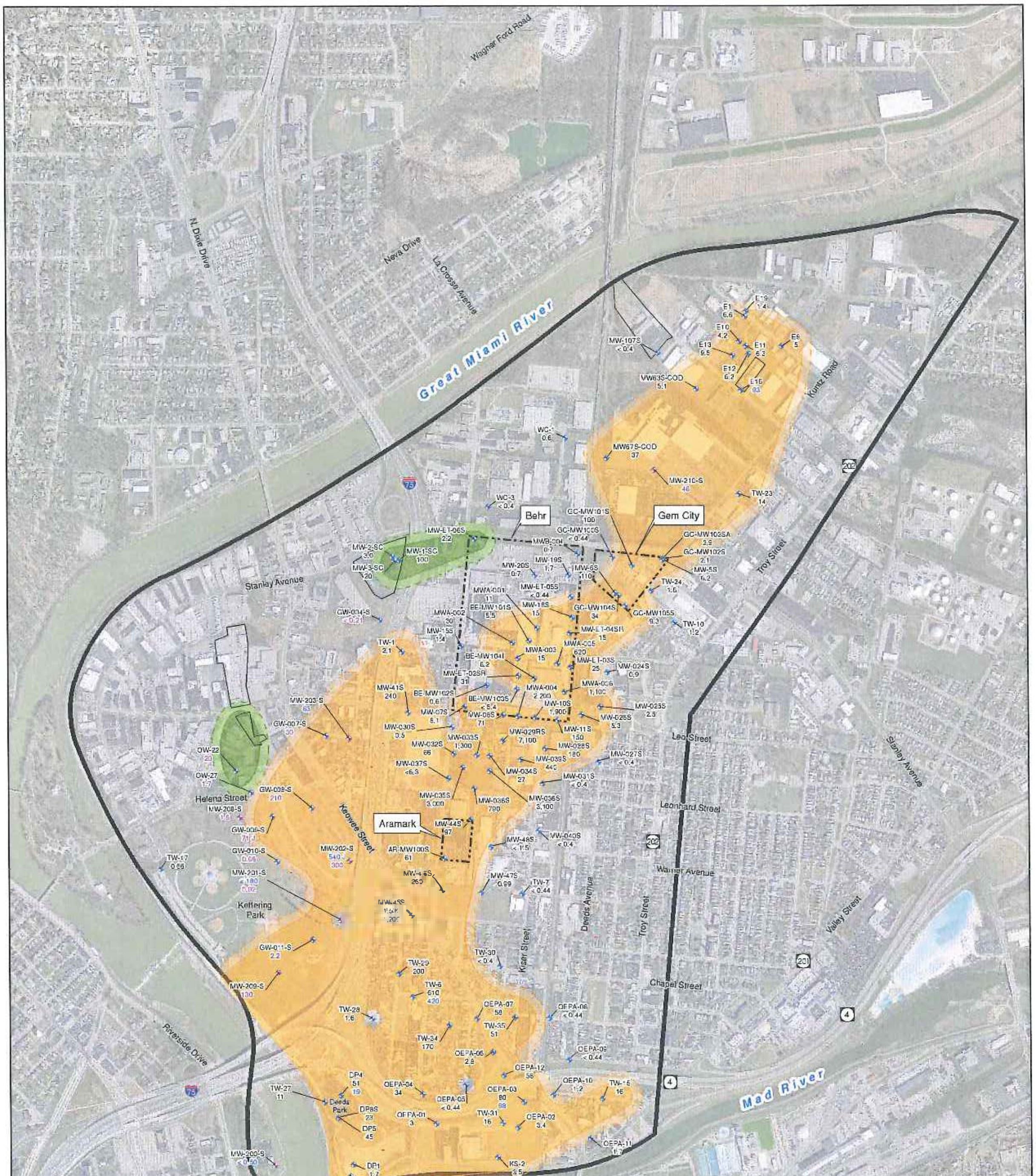
\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\420125_BEHRDAYTONTHERMAL\MAPFILES\2018\FFS\FIGURE 1-5 - DEEP TCE CONTOURS(2016).MXD JHANSEN1 1/23/2018 3:23:17 PM



Legend

- 2015/2016 EPA Monitoring Well
- Monitoring Well
- Estimated Extent of TCE VI AOPC
- 100-foot buffer from TCE VI AOPC
- Approximate Other Facility Boundary
- Approximate Property Boundary
- Present Approximate Groundwater Study Boundary

VISL Exceedences Potentially Attributed to Non-Site Related Groundwater Plume

- Estimated Extent of TCE VI AOPC
- 100 foot buffer from TCE VI AOPC

Notes:
1. 2012 Aerial Photography obtained from the Ohio Geographically Referenced Information Program (OGRIP).
2. Trichloroethene (TCE) concentrations are in micrograms per liter (µg/L).
3. Black trichloroethene concentration represents 2014 sampling result.
4. Blue TCE concentration represents 2015 sampling result.
5. Purple TCE concentration represents 2016 sampling result.
6. < - less than
7. EPA = U.S. Environmental Protection Agency
8. J = Estimated
9. The TCE VISL is 2 µg/L based on a residential exposure scenario, a target cancer risk of 1 x 10-6, a noncancer HQ of 1, attenuation factor of 0.001, and a site-specific average groundwater temperature equal to 14 degrees Celsius.
10. VISL = vapor intrusion screening level
11. VOC = Volatile Organic Compound
12. Estimated VI AOPC is based on the spatial distribution of groundwater concentrations in exceedance of the U.S. EPA (2016) groundwater-to-indoor air vapor intrusion screening level (VISL).
13. VI AOPC = vapor intrusion (groundwater-to-indoor air) area of potential concern
14. HQ = Hazard Quotient
15. The 100-foot buffer from the VI AOPC is horizontal and/or vertical distance used in VI investigations when comparing groundwater concentrations to VISLs to support the decision whether additional investigation may be need (EPA, 2016).

0 1,200 2,400
Feet

Figure 5
VI AOPC - TCE in Groundwater above VISL with 100-foot Buffer
Proposed Plan
Behr Dayton Thermal System VOC Plume Site
Dayton, Ohio

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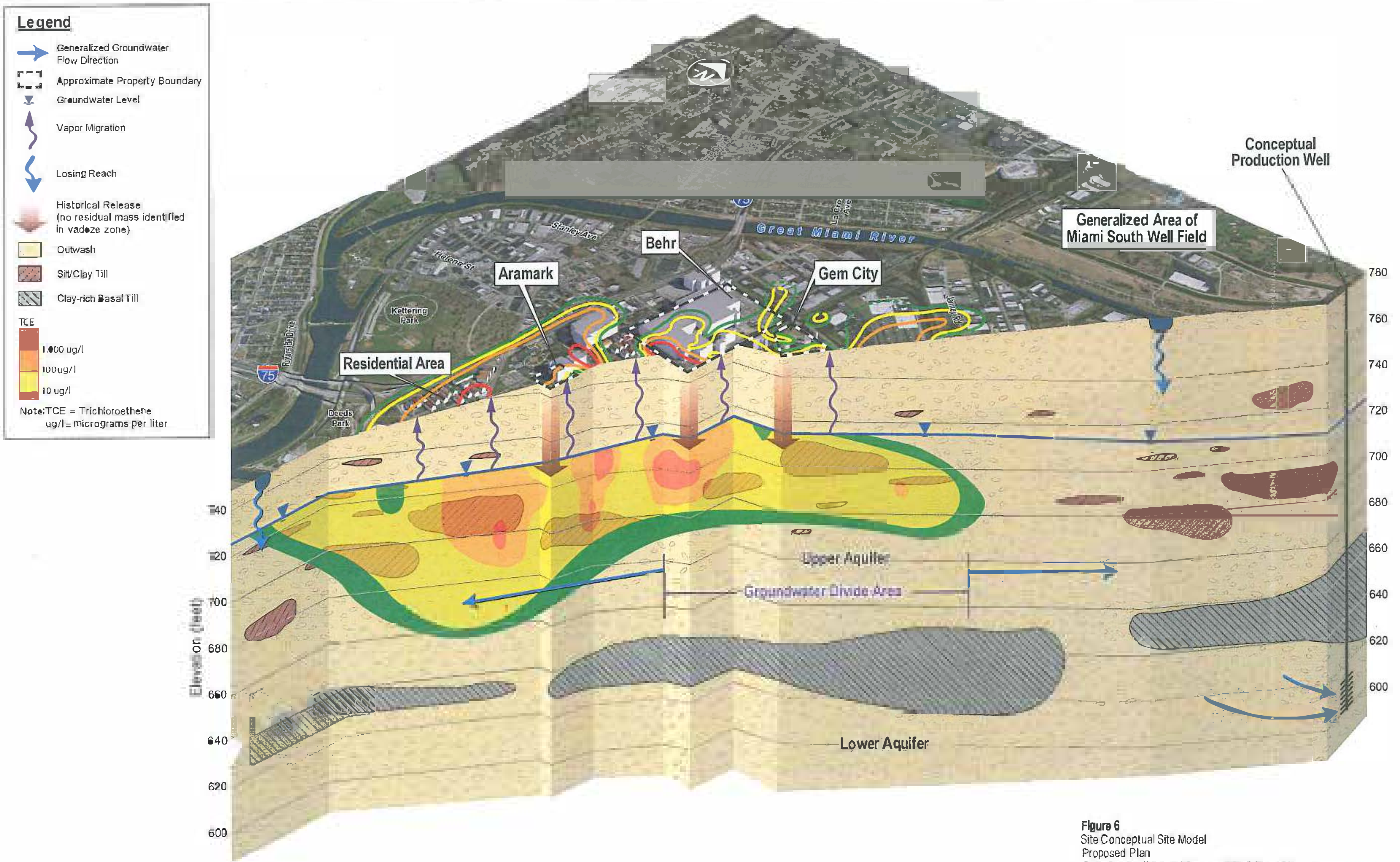

Figure 6
Site Conceptual Site Model
Proposed Plan
Behr Dayton Thermal System VOC Plume Site
Dayton, Ohio

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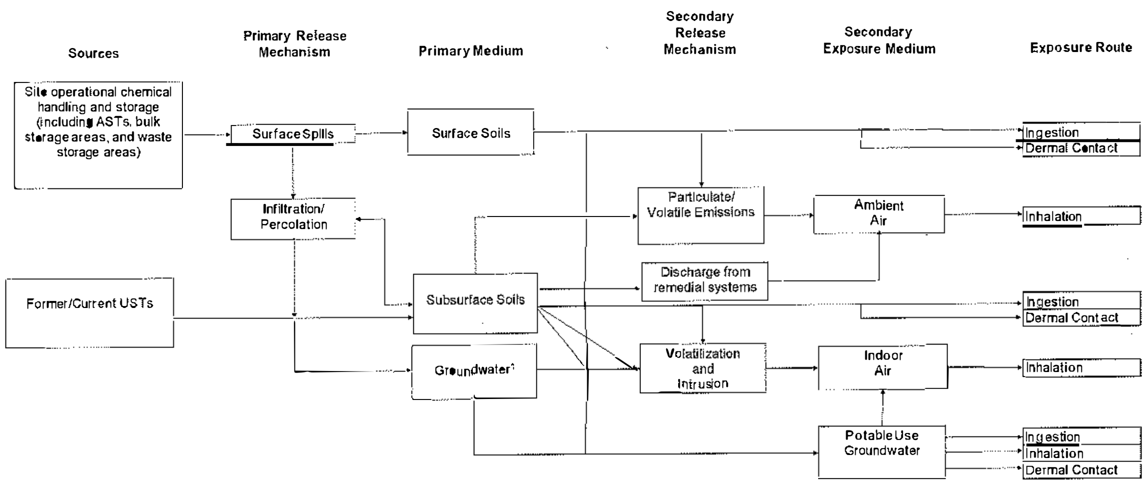
EN0724151033GNV ES2_Behr_CSM_v1.ai 12-20-2016 DCD



Exposure Route	Current and Future Potential Human Receptors: On-facility: Industrial Worker	On-facility: Construction Worker	On-facility: Resident	Sitewide / Off-facility: Industrial Worker	Sitewide / Off-facility: Construction Worker	Sitewide / Off-facility: Resident
Ingestion	+	+	-	-	-	-
Dermal Contact	+	+	-	-	-	-
Inhalation	+	+	+	+	+	+
Ingestion	+	+	-	-	-	-
Dermal Contact	+	+	-	-	-	-
Inhalation	+	-	+	+	-	+
Ingestion	++	-	+	++	-	+
Inhalation	++	-	+	++	-	+
Dermal Contact	++	-	+	++	-	+

+ Potentially complete exposure pathways

++ Potentially complete exposure pathways for a hypothetical future scenario

- Incomplete pathway

FIGURE 7
Baseline Human Health Risk Assessment Conceptual Model
Proposed Plan
Behr Dayton Thermal Systems VOC Plume Site
Dayton, Ohio

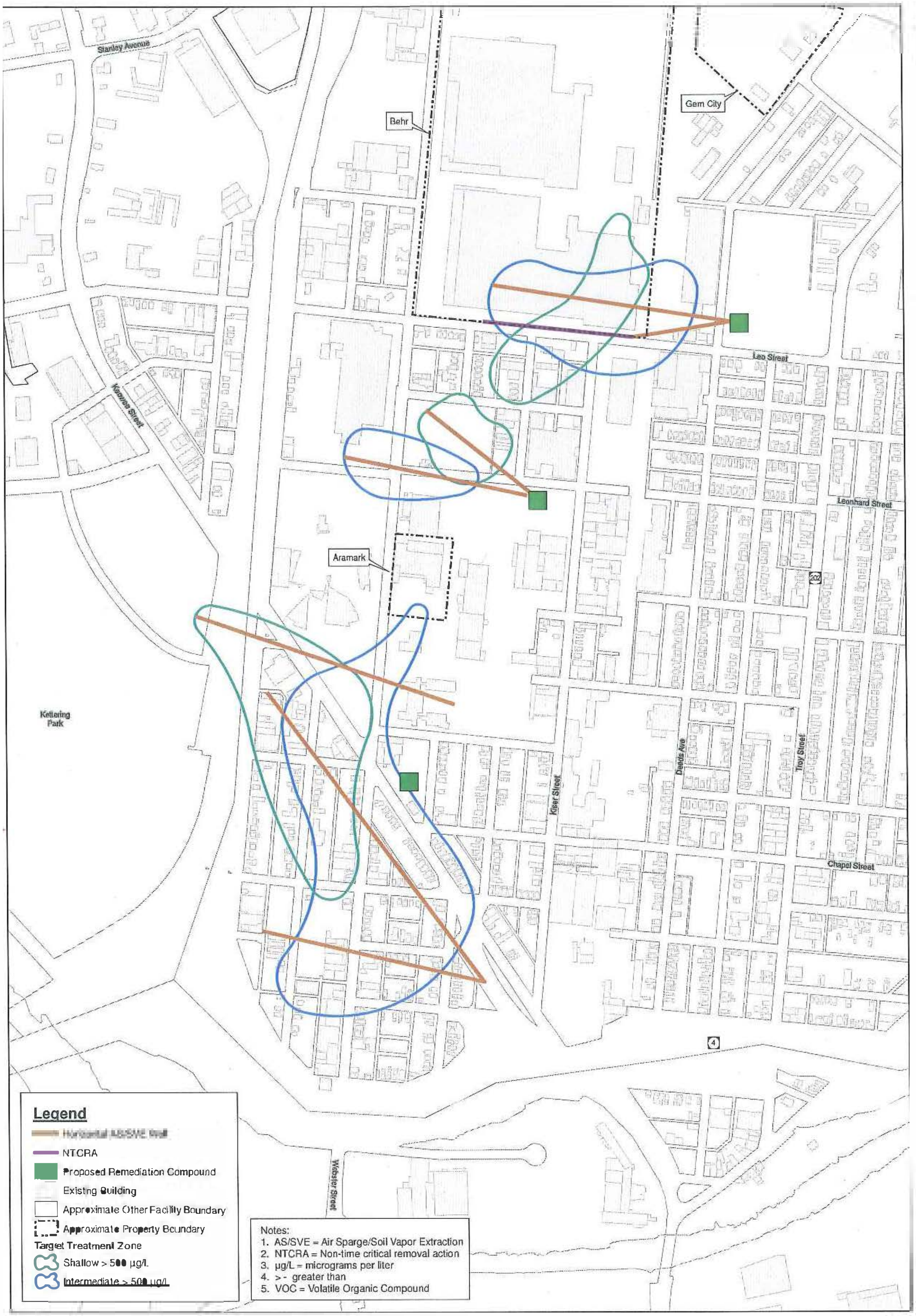
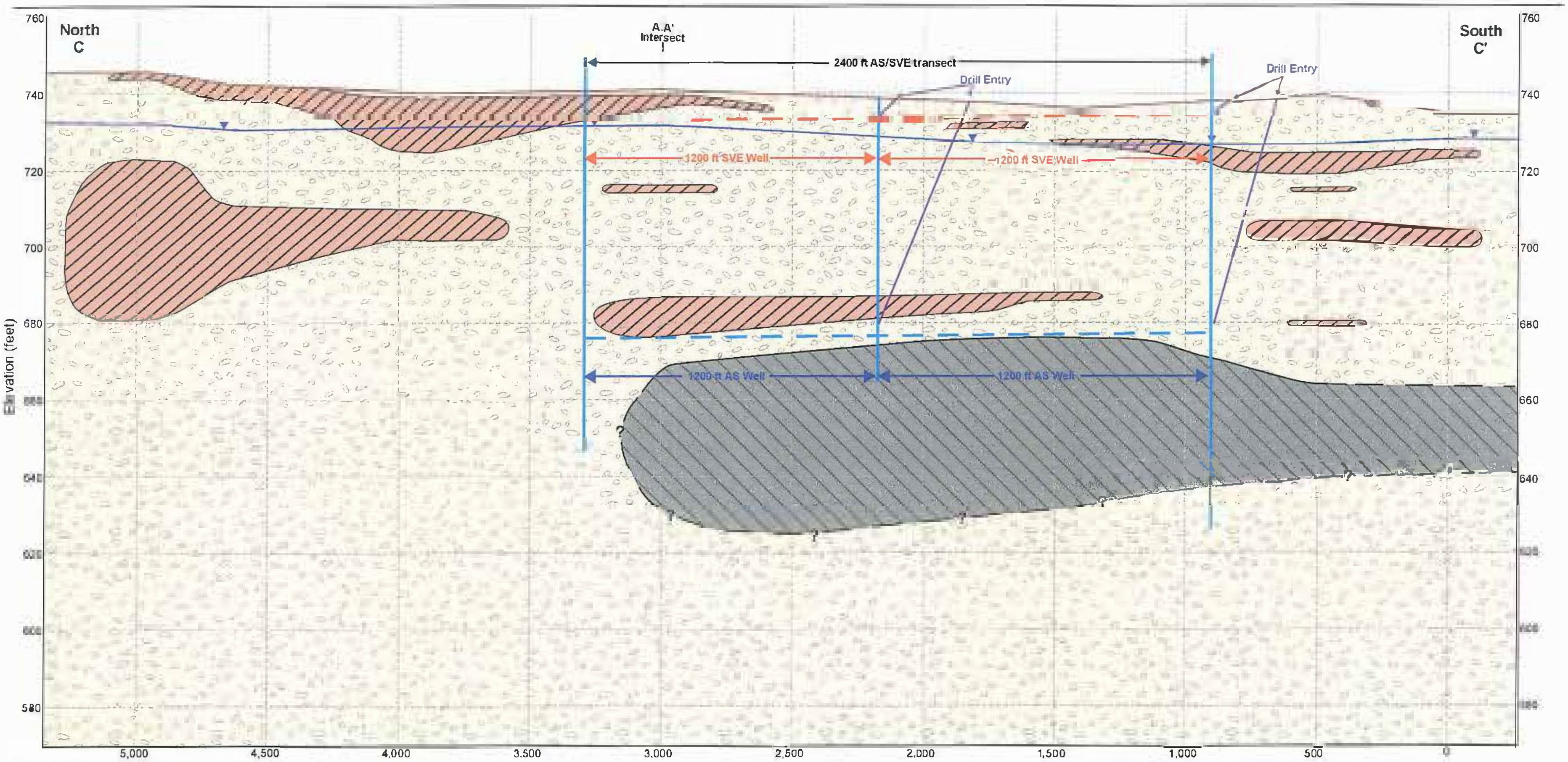
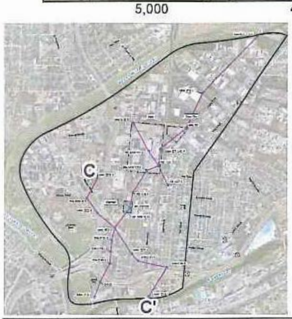


Figure 8
Conceptual Layout of AS/SVE with Horizontal Directionally Drilled Wells
Behr Dayton Thermal System VOC Plume Site
Dayton, Ohio

ch2m



VERTICAL SCALE: 1" = 26.3'
HORIZONTAL SCALE: 1" = 387.6'



LEGEND

- Potentiometric Surface
- Drilling Length to AS or SVE Well Depth
- AS Well
- SVEWell
- Outwash
- Silt/Clay Till
- Clay-rich Basal Till (dashed where inferred)

Notes:
1. Potentiometric surface delineated using measurements in shallow wells from March 2014 Synoptic Water Level event
2. AS = air sparging
3. SVE = soil vapor extraction
4. ft = feet

Figure 9
Conceptual Cross Section of AS/SVE with Horizontal Directionally Drilled Wells
Behr Dayton Thermal System VOC Plume Site
Dayton, Ohio

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