Proposed Plan for Amendment to Selected Remedy **May 30, 2023**

Lammers Barrel Superfund Site

Beavercreek, Greene County, Ohio

INTRODUCTION

The United States Environmental Protection Agency (EPA) is issuing this Proposed Plan as part of 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).

The purpose of this Proposed Plan is to provide background information about the Lammers Barrel Site ("the Site") and describe the following proposed changes to the Selected Remedy for soil, Operable Unit 1 (OU1), at the Site:

- a fundamental change to the soil remedy for the Site, comprised of changing from In-situ Biological Treatment (ISBT) to In-situ Thermal Treatment (ISTT) of on-site contaminated soil.

The proposed change to the soil remedy for the Site will be protective of human health and the environment, will meet applicable and/or relevant and appropriate requirements (ARARs), will be cost-effective, and will be effective in the long term.

This document is issued by EPA, the lead agency for the activities at the Site. EPA, in consultation with the Ohio Environmental Protection Agency (OEPA), the support agency, will select a revised soil remedy for the Site after reviewing and considering all information submitted during a 30-day public comment period. EPA, in consultation with OEPA, may modify the proposed revision to the soil remedy for the Site as presented in this Proposed Plan based on new information or public comments. Therefore, EPA encourages the public to review and comment on the proposed change presented in this Proposed Plan.

This Proposed Plan summarizes information that can be found in greater detail in the Remedial Investigation (RI), Feasibility Study (FS), and Focused Feasibility Study (FFS) Reports, the prior Record of Decision (ROD) for the Site, and other documents contained in the Administrative Record (RA) for the Site. EPA and OEPA encourage the public to review these documents to gain a more comprehensive understanding of the Site and the Superfund activities that have been conducted at the Site to date.

The public is encouraged to comment on this Proposed Plan. EPA will publish a notice of the availability of the ROD amendment and a brief description of the proposed amendment in a major local newspaper of general circulation. EPA will hold a public comment period for 30 days and accept comments 30 days from the issuance of this Proposed Plan. EPA will hold a public meeting on June 22, 2023**,** to explain the Proposed Plan and all of the alternatives presented in the Focused Feasibility Study. Oral and written comments will also be accepted at the meeting. The meeting will be held at the Beavercreek City Council Chambers (1368

Research Park Drive, Beavercreek, OH) at 6:00 pm. In addition, members of the public may submit comments by (1) using the comment form on EPA's webpage at either www.epa.gov/superfund/lammers-barrel-factory; (2) submitting a written comment via email at palomeque.adrian@epa.gov; or (3) submitting a written comment by mail to U.S. EPA Region 5, Attention: Adrian Palomeque, 77 West Jackson Boulevard (Mail Code: RE-19J), Chicago, Illinois 60604-3590. Comments must be received or postmarked by the last day of the public comment period, which is July 15, 2023, to be part of the official public record.

The public is encouraged to review the supporting documents for the Site at any of the following locations:

Beavercreek Community Library 3618 Dayton Xenia Rd Beavercreek, Ohio 46402 (937) 352-4001 Call for hours	EPA Region 5 Records Center 77 W. Jackson Blvd. (SRC-7J) Chicago, Illinois 60604 (312) 886-4434 Mon-Fri - 8 am to 4 pm Call for appointment

online at: www.epa.gov/superfund/lammers-barrel-factory

Following EPA's review and consideration of all public comments, EPA will announce its final cleanup plan in a document called a ROD Amendment. EPA will respond in writing to all significant public comments in a Responsiveness Summary which will be part of the ROD Amendment. EPA will provide notice of its issuance of the ROD Amendment in local newspapers and will place a copy of the ROD Amendment in the local information repository (Beavercreek Community Library) and the EPA Region 5 Records Center.

SITE BACKGROUND

The Site is in Beavercreek, Greene County, Ohio as shown on Figure 1 (Site Location Map). The Site is the former location of the Dayton-Xenia Railway Company, the Moran Paint Company, the Dayton Oil Company, Lammers Barrel Corp., and the Kohnen and Lammers, Inc. The Dayton-Xenia Railway Company owned the Site property from 1926 to 1944. During that time, they operated a railroad car maintenance and repair facility at the Site. The repair facility included an underground maintenance bay beneath the service tracks where repairs could be made to the undercarriages of the cars.

The Moran Paint Company operated at the Site from 1948 to 1952. The company reportedly manufactured paint, lacquers, paint removers and esterified tall oil at the Site. Subsequently, the Dayton Oil Company conducted operations at the Site beginning in 1952, following the closure of the Moran Paint Company operations at the Site.

A solvent recovery business and a barrel reconditioning business operated at the facility at the Site between 1953 to 1969 under various company names (e.g., Kohnen and Lammers, Inc., Lammers Barrel Corp.).

History of Contamination

Chemicals, including chlorinated volatile organic compounds (CVOCs) and aromatic hydrocarbons, were stored in aboveground storage tanks at the Site. Historical aerial photographs indicate that operations, including chemical storage, were conducted on both the northern and southern portions of the Site.

The solvent recovery facility was destroyed in a fire that began on September 30, 1969. The quantity and specific chemicals released during the fire are unknown. Site restoration activities completed after the fire reportedly included debris removal and placement of an unspecified depth of cover material.

Prior Site Investigations

A summary of previous environmental investigations and actions is presented in Table 1 below:

Table 1: Summary of Previous Environmental Investigations and Actions

Year	Environmental Investigation or Action
1969	Solvent recovery facility destroyed by fire. Site restoration activities completed after the fire included debris removal and placement of an unspecified depth of cover material.
1985-1986	Contamination discovered in area's residential drinking water wells above the MCLs for vinyl chloride, trichloroethene, tetrachloroethene, and cis-1,2-dichloroethane. As a result of these findings, nine residences were connected to an existing water main along East Patterson Road in January 1986.
1992	Ohio EPA Field Unit Site Investigation (June)
1997	Superfund Technical Assessment and Response Team Sampling Event to support the Engineering Evaluation/Cost Analysis (March – August).
2000	An additional four homes were connected to the county water supply due to well water contamination. United States Army Corps of Engineers (USACE) Hydrogeologic Characterization (April) USACE Phase II Hydrogeologic Characterization (August)
2001	USACE Phase III Hydrogeologic Characterization (April)
2002	USEPA signed an Administrative Order on Consent that required a group of 21 Potentially Responsible Parties (PRPs) to conduct a Remedial Investigation/Feasibility Study (RI/FS) for the Site. USEPA published a notice in the Federal Register proposing the Site be added to the National Priorities List.
2003	The Site was officially added to the National Priorities List.

2003-2004	RI activities, including drilling and sampling of on-site soil borings and groundwater monitoring wells, hydraulic characterization tests, groundwater monitoring, sampling of surface water and sediment in Little Beaver Creek, and sampling residential wells in the vicinity of the Site, were conducted in spring 2003 – spring 2004.
2004 - 2006	Supplemental environmental investigations and Early Action Pilot Test of Enhanced Reductive Dechlorination (ERD) were conducted.
2007	Groundwater investigation in March and June.
2008	The 2002 Administrative Order on Consent was amended to include an additional 21 PRPs, bringing the total to 41 PRPs. RI Report and addendum completed and approved for OU1 by USEPA in fall.
2011	OU1 FS Report approved by USEPA in June. OU1 ROD issued in September.
2015	Advanced soil borings at 19 locations along the perimeters of each of the impacted soil areas, as defined during the RI/FS, and at eight additional step-out locations.
2016	Groundwater monitoring conducted in February 2016 to establish baseline parameters of Site groundwater. ERD test performed in April and May.
2019	Additional soil boring investigation completed that included 24 additional borings, three were step-out locations.
2020	Additional soil samples collected from nine locations.
2022	EPA approved the FFS that evaluated In-situ Thermal Treatment (ISTT) technologies to remediate OU1 soils.

Remedy Selection and Remedy Implementation

EPA selected the remedial action for OU1 at the Site in the 2011 ROD. The original cost of the selected remedy was $2,596,000. The selected remedy for impacted soils was In-situ Biological Treatment. The selected remedy for the groundwater was In-situ Groundwater Treatment (ISGT) using Enhanced Reductive Dechlorination (ERD). Institutional controls were also part of the overall remedy to prohibit development of the Site for residential use and prohibit installation of potable wells on the Site. This ROD Amendment is only for the soil remedy portion of the original selected remedy in the 2011 ROD. The groundwater selected remedy remains unchanged.

EPA and several Settling Defendants, a group of PRPs, entered into a Consent Decree (CD) in 2014 for the design and implementation of the Selected Remedy for OU1 at the Site. The CD included a Statement of Work (SOW) that described the work to be completed.

During OU1 pre-design investigations and remedial design, the soil treatment areas described in the September 2011 ROD were expanded laterally and vertically. The volume of soil requiring treatment that was estimated in the 60% Design Document was approximately double the anticipated volume in the 2011 ROD. In addition, the soil treatment extent in one area was expanded based on recent groundwater data.

EPA is proposing to amend the 2011 ROD in response to new waste volume information that has been collected since the 2011 ROD was issued and because the resultant enlarged footprint

and volume created significant challenges to the implementation, effectiveness, and costs of the selected remedy for OU1 soils.

SITE CHARACTERISTICS

Physical Characteristics

The Site occupies approximately 2.5 acres at the northeast corner of the intersection of Grange Hall and East Patterson Roads, in the City of Beavercreek, Greene County, Ohio as shown on Figure 2 (Site Layout Map). The property is bordered on the north by an abandoned railroad right-of-way and several industrial facilities. The Site is bordered on the west by Grange Hall Road, and on the south by East Patterson Road. Further to the south are a gas station, an automotive repair facility, and a residential area (Woodhaven Subdivision). To the southeast is a strip mall (Woodhaven Shopping Center). To the east, the Site is bordered by a plumbing services company. The nearest residences to the Site are located approximately 400 feet to the east and southeast. Little Beaver Creek flows from west to east across the Site.

The Montgomery County Eastern Regional Wastewater Treatment Plant (WWTP), a wastewater treatment plant with a design flow of approximately 13 million gallons per day, is located approximately 1 mile upstream and discharges directly to Little Beaver Creek. The WWTP discharges an average of 8.5 million gallons per day of treated wastewater and comprises approximately 90 percent of the total flow of Little Beaver Creek in the summer months.

Groundwater Use

The aquifer beneath the Site is designated as a Sole Source Aquifer because it is the principal source of drinking water for the population in the region. Several properties in the area are also on public water supply. These properties include nine residential properties which the EPA connected to an 8-inch diameter water main along East Patterson Road in January 1986 and four additional area residential properties that EPA connected to that same water main in February 2000. The public water supply to which these thirteen residences are connected also draws its drinking water from the Sole Source Aquifer. The south Beavercreek well field is located approximately 2.75 miles east/southeast of the Site and supplies approximately one million gallons of water per day. The north Beavercreek well field is located approximately 3.25 miles east of the Site and supplies two million gallons of water per day. Both well fields operate to provide water to the residents of Greene County.

Geology and Hydrogeology

The uppermost soils at the Site are low permeability silts and clays, known as the Upper Till Unit. The thickness of the Upper Till Unit is variable, ranging from about 15 feet thick in the northern portion of the Site to 30 feet thick south of Little Beaver Creek. Permeable deposits of sand and gravel exist within portions of the Upper Till Unit and are present beneath it. The RI identified two groundwater zones that have been characterized in the study area, a shallow perched groundwater zone and the area-wide upper aquifer.

- The Upper Till Unit (unsaturated zone) contains a perched groundwater zone ranging from 2 feet to 10 feet in thickness south of Little Beaver Creek. The perched groundwater zone extends off-site in a southerly direction but ends at a point further to the south. The perched groundwater zone is also present east of the Site. There is not a prominent perched groundwater zone north of Little Beaver Creek.

- The primary water-bearing unit at the Site is the upper aquifer (saturated zone) which averages about 30 feet in thickness and is located at a depth of 13 to 18 feet below land surface (ft bls) north of Little Beaver Creek and at approximately 30 ft bls south of Little Beaver Creek. The upper aquifer is underlain by a Lower Till Unit comprised of low-permeability silts and clays. The perched groundwater zone and upper aquifer merge to form one hydrogeologic unit (the upper aquifer) to the east/southeast of the Site. Private water supply wells in the area are screened within the upper aquifer downgradient of the Site.

- The direction of groundwater flow in the upper aquifer is to the southeast north of Little Beaver Creek and in an eastward direction south of the creek. Further east of the Site, the direction of flow in the upper aquifer becomes more northerly. The direction of groundwater flow in the perched zone is south-southeast.

Groundwater levels in the upper aquifer north of, and near, Little Beaver Creek are slightly higher than surface water levels in Little Beaver Creek. However, since the creek is underlain by low-permeability silts and clays, the hydraulic connection between the upper aquifer north of the creek and the creek is poor. On the south side of Little Beaver Creek, groundwater levels in the perched groundwater zone are lower than water levels in the creek; however, the low-permeability soils underlying Little Beaver Creek minimize recharge from the creek into the perched zone.

Consideration of ISTT as a Remedial Alternative for OU1 Soils

EPA is proposing to amend the soil remedy selected in the 2011 ROD in response to new waste volume information that has been collected since the ROD was issued.

The current remedy (ISBT) will require a significant amount of soil moisture to homogenize impacted soils. This will increase the volume of soil requiring treatment. This bulking factor, in addition to the increase in volume requiring treatment, as delineated and characterized during the remedial design, is expected to lead to an overall treated soil volume that is almost four times larger than anticipated in the ROD. The resultant enlarged footprint and volume created significant challenges to the implementation, effectiveness, and costs of the selected remedy for OU1 soils.

In October 2022, EPA approved the FFS that evaluated ISTT technologies to remediate OU1 soils, in comparison to the ROD-approved ISBT. ISTT, which was not considered in the original OU1 FS given the newness of the technology at the time, may provide a better approach for remediation of OU1 soils.

ISTT typically applies heat to the subsurface using one of three primary technologies: steam-enhanced extraction (SEE), electric resistance heating (ERH), or thermal conductive heating (TCH). For some sites where hydrogeology or contaminant type and/or distribution varies widely, a combination of multiple ISTT technologies can be implemented for maximum remediation effectiveness. SEE is most applicable to permeable soils and so it has not been retained as a stand-alone remedy due to the predominantly low- permeability soils that underlie the Site. Both the TCH and ERH technologies have long and successful case histories of treatment of the Site's contaminants of potential concerns (COPCs) in similar geologic and hydrogeologic conditions.

Arsenic

The ROD lists a preliminary remediation goal (PRG) for arsenic of 3.4 milligram per kilogram (mg/kg). Since the RI, several large-scale background studies of naturally occurring arsenic have been implemented, including a background study by the United States Geologic Survey (USGS) in Greene County (the area of the Site) in 2008 and a study in neighboring Montgomery County by the OEPA in 2014. A summary of the background study results is presented in Table 2 below. The Lammers' dataset includes multiple soil boring locations that have sample results that exceed the arsenic PRG; however, if published background values are used, almost all locations fall within the background ranges. Regardless, for the purpose of the FFS, both the ISBT and the ISTT remedies include costs to install a soil cover to prevent potential direct contact exposures for on-site recreators, thereby eliminating any excess risk from arsenic, as well as any other residual contamination.

Table 2. Summary or Arsenic Background Study Values

Analyte	Unit	Lammers' PRG	Greene County[1], USGS (2008)	Montgomery County[2], OEPA (2014)
Arsenic	mg/kg	3.4	5.762 to 20.606	2.92 to 11.1

1. USGS, National Geochemical Survey by County, online website, updated September 2008. Range 5.762-20.606 mg/kg, mean 9.455 mg/kg, standard deviation 2.368 mg/kg, # data points not provided.
2. Ohio EPA, Evaluation of Background Metal Soil Concentrations in Montgomery County - Dayton Area, July 2014. Range 2.92-11.1 mg/kg, mean 7.00 mg/kg, standard deviation 1.85 mg/kg, 95% UTL 9.90 mg/kg, nonparametric, 100 valid data points.

Consideration of 1,4-Dioxane (OU1 Soil)

EPA has identified 1,4-dioxane as an "emerging contaminant" at many Superfund Sites around the country. As described in the July 2019 Lammers Barrel Factory Site Pre-Design Investigation Report Addendum, Borings SB-2019-01 through 03, SB-2019-12, SB-2019-16, SB-2019-19, and SB-2019-22 were advanced for the purpose of collecting soil samples for analysis of 1,4-dioxane. The borings were drilled adjacent to existing monitoring wells, including AMW-5S, that had previous detections of 1,4-dioxane or 1,1,1-Trichloroethylene (TCE) in groundwater. One analytical sample from each soil boring was collected from the 2-foot interval showing the highest indications of impacted soil as determined in the field based on physical observations and photoionization detector screening. The only detection of 1,4-dioxane in Site soil was in Boring

SB-2019-16, located near MW-5S, with an estimated concentration of 76 µg/kg at a depth of 8.5 to 9.5 ft bls. Additional supplemental sampling was conducted in 2020, with analysis of 1,4-dioxane at several locations. Three of the eight analyzed locations had detections of 1,4-dioxane at relatively low concentrations above reporting limits. A pre-design investigation will be conducted to finalize the delineation of the lateral and vertical extents of the treatment zones at the Site. This investigation will also address 1,4-dioxane. While 1,4-dioxane was detected at relatively low concentrations in soil, the low levels of 1,4-dioxane observed are expected to be treated through the OU1 soil amended remedy.

SCOPE AND ROLE OF THIS ACTION

The technical problems at the Site are complex. As a result, EPA has organized the work into two OUs.

- OU1 – The Lammers Barrel property, including all soil and groundwater contamination within the property boundary.

- OU 2 – The Lammers Barrel off-property groundwater plume that has migrated away from the property to the east. Ongoing off-property groundwater monitoring is being conducted at OU2. After the source control actions for OU1 soils and groundwater are complete, OU2's RI/FS will be updated, and a Proposed Plan and ROD will be developed to select a final remedy for OU2.

The 2011 ROD selected a remedy for OU1 soils and groundwater at the Site consists of:

- Institutional Controls (ICs) in accordance with the Ohio Uniform Environmental Covenant Act (OUECA) to prohibit residential use of the Lammers Barrel Site property and to prohibit the installation of potable wells on the Lammers Barrel property until all groundwater cleanup standards have been achieved.

- In-Situ Biological Treatment (ISBT) of impacted soils using soil mixing to treat principal threat wastes, including chlorinated volatile organic compounds, and benzene, toluene, ethylbenzene, and xylene (BTEX), at the Lammers Barrel Site.

- In-Situ Groundwater Treatment (ISGT) using Enhanced Reductive Dechlorination (ERD) to address contaminated groundwater under the Lammers Barrel Site to address the resulting groundwater contamination.

This Proposed Plan recommends changing the Selected Remedy for OU1 impacted soils from ISBT to ISTT. This proposed change represents a fundamental change to OU1 remedy and does not affect other components of the 2011 selected remedy. More details regarding the proposed change to the OU1 soils remedy is provided in the *Summary of Remedial Alternatives* section of this Proposed Plan. The proposed remedy for OU1 soils will address the principal threats at the Site by treating the contaminated soil at the Site that serves as an ongoing source to groundwater contamination.

SUMMARY OF SITE RISKS

As part of the RI/FS, EPA conducted a baseline risk assessment to determine the current and future effects of contaminants on human health and the environment. According to the zoning board of Beavercreek, Ohio, the Site is zoned for commercial/industrial usage. Therefore, this is the reasonably anticipated future land use for the Site itself. In addition, the potential future use of groundwater will be as a drinking water source for the community once safe cleanup levels have been achieved. It is the EPA's current judgment, as lead agency, that the Preferred Alternative identified 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 from the Site.

Human Health Risk Assessment (HHRA)

A baseline HHRA was completed for the Site that evaluated the potential risks and hazards associated with exposure to Site-related COPCs. Based on anticipated future land use for the Site, five potential on-site exposure scenarios were considered in the HHRA: on-site trespassers, on-site recreators, on-site construction and utility workers, and on-site commercial workers. The HHRA determined that cancer risks for a future commercial worker exposed to surface and subsurface soils, and a future recreator exposed to surface soils exceeded the acceptable benchmark (i.e., 1 in 10,000 or 1×10^{-4}). In addition, the predicted risks to a hypothetical future on-site resident exposed to soil and groundwater exceeded the non-cancer hazard quotient of 1. 1 $\times 10^{-6}$ is EPA's point of departure in determining remediation goals when ARARs are not available. 1. The risks to on-site trespassers, on-site construction workers, and on-site utility workers did not exceed acceptable benchmarks.

The results of the HHRA indicated that under current Site conditions, there is little potential for exposure to Site-related COPCs because the Site is vacant, fenced, and zoned for industrial use. The HHRA concluded that no unacceptable non-cancer hazards or cancer risks exist under current conditions, even in the assumed scenario of an unauthorized trespasser entering onto the property. However, it is the lead agency's current judgment that the Preferred Alternative identified 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 in the future.

EPA's statistical analysis of soil sampling data indicates that probable exposure concentrations for soil at the Lammers Barrel Site are:

TCE	78 ppm
cis-1,2 DCE	22 ppm
benzene	11 ppm
toluene	640 ppm
ethylbenzene	140 ppm
xylenes	720 ppm

These concentrations are associated with excess lifetime cancer risk levels due to contaminated surface and subsurface soil of 1.0×10^{-4} for a resident child and 3.0×10^{-5} for a resident adult. In addition, these concentrations result in a 2.0×10^{-5} risk to an on-site child recreator and 4.0×10^{-5} for an on-site commercial/industrial worker.

Similarly, EPA's statistical analysis of groundwater sampling data found that the exposure concentrations of contaminants in the groundwater at the Site are:

TCE	11,000 ppb
cis-1,2 DCE	1,600 ppb
benzene	390 ppb
toluene	70,000 ppb
ethylbenzene	4,600 ppb
xylenes	25,000 ppb
arsenic	480 ppb

These concentrations are associated with excess lifetime cancer risk levels due to contaminated groundwater of 2.0×10^{-1} for a resident child and 5.0×10^{-2} for a resident adult. In addition, these concentrations result in a 4.0×10^{-6} risk for an on-site construction worker.

These risks and hazard levels indicate that there is significant potential risk to children and adults from direct exposure to contaminated soil and groundwater. These risk estimates are based on current reasonable maximum exposure scenarios and were developed by considering various conservative assumptions about the frequency and duration of an individual's exposure to contaminated soil and groundwater, as well as the toxicity of the various Site contaminants. The last State Public Health Assessment for the Site was released by Agency for Toxic Substances and Disease Registry (ATSDR) on April 10, 2009.

Ecological Risk Assessment (ERA)

A screening ERA indicated that the potential for significant ecological impacts to occur was small. The results of the study indicated there was little potential for significant exposure of wildlife to Site contaminants. The concentrations of contaminants found in Little Beaver Creek were below the sediment and freshwater screening levels.

Conceptual Site Model (CSM)

The CSM describes primary source areas, release mechanisms, affected media, exposure routes, and potential receptors. The CSM is detailed in the HHRA and is summarized in the sections below:

Sources and Release Mechanisms

Sources of COPCs from historical Site operations likely included storage tanks and drums and related equipment. Primary release mechanisms of COPCs likely included leaks from storage tanks and product transfer lines as well as accidental surface spills and the effects of the fire that destroyed the facility in 1969. Following the initial release to the environment, COPCs may have migrated along various pathways into the affected environmental media.

Affected Media

Based on the historical sampling programs conducted at the Site, the affected media include surface soil (0 to 2 feet bls), and subsurface soil (approximately 2 to 20 feet bls), and on and off-site groundwater.

Receptors

The on-site human receptors identified in the HHRA included trespassers, utility workers, future recreators, commercial Site workers, and construction workers. A screening level ERA indicated that the potential for significant ecological impacts to occur was small and that there was little potential for significant exposure of wildlife to Site contaminants.

REMEDIAL ACTION OBJECTIVES (RAOs)

RAOs are goals for protecting human health and the environment and are designed to address the risks posed by current or future exposures to site-related contamination. RAOs were developed for the Site based on the contaminant levels and exposure pathways identified during the RI and in the risk assessment. The following RAOs have been identified for OU1 at the Lammers Barrel Site:

- Prevent exposure (direct contact, dermal contact, and inhalation) of an on-site young child recreator to COPCs in surface soil that presents a cumulative lifetime cancer risk greater than the target cancer risk of 1×10^{-5} or a non-cancer hazard of 1.

- Prevent exposure (direct contact, dermal contact, and inhalation) of an on-site commercial/industrial worker to COPCs in surface and subsurface soils that present a cumulative lifetime cancer risk greater than the target cancer risk of 1×10^{-5} or a non-cancer hazard index of 1.

- Prevent human exposure (direct contact, dermal contact, and inhalation) to COPCs in OU1 groundwater that exceed MCLs, where applicable, or that present a cumulative lifetime cancer risk greater than the target cancer risk of 1×10^{-5} or a non-cancer hazard index of 1.

- Minimize the potential leaching and migration of soil contaminants to groundwater that would result in exceedances of groundwater criteria (MCLs) beneath the Site.

- Restore contaminated groundwater to its beneficial use within a reasonable time frame. Beneficial use of the designated Sole Source Aquifer is potable water.

- Minimize further migration of the groundwater plume.

Preliminary Remediation Goals (PRGs)

PRGs are chemical-specific concentration goals for COPCs in impacted media that help define the extent of contaminated media requiring remedial action. PRGs are developed during the RI/FS and typically consist of risk-based concentrations and/or concentrations taken from federal or state applicable or relevant and appropriate requirements, commonly known as ARARs. PRGs are considered "preliminary" until final cleanup levels are selected in a ROD.

Because there are no Federal or State cleanup standards for soil contamination, EPA established a set of soil cleanup levels in the ROD using the baseline risk assessment. Soil cleanup levels were selected that would both reduce the risk associated with exposure to soil contaminants to an acceptable level and ensure minimal migration of contaminants into the groundwater.

Table 3: Soil Cleanup Levels

Contaminant	PRG (in parts per million [ppm])
Benzo(a)pyrene	0.16
Dibenzo(a,h)anthracene	0.36
Indeno(1,2,3-cd)pyrene	0.93
Tetrachloroethene	1.70
Trichloroethylene	5.60
Vinyl Chloride	0.33
Total Polychlorinated Biphenyls (PCBs)	1.10
Arsenic	3.40

The ROD also listed the following cleanup levels for groundwater:

Table 4: Groundwater Cleanup Levels

Contaminant	MCL(mg/L)
Trichloroethene	0.005
cis-1,2 dichloroethene	0.070
Vinyl chloride	0.002
Ethylbenzene	0.070
Benzene	0.005
Xylenes	10
Arsenic	0.010

These groundwater cleanup levels are based upon the MCLs established under the Safe Drinking Water Act. Final concentrations of contaminants must also achieve the protective risk level of 1×10^{-5} for cumulative exposure after MCLs have been met.

SUMMARY OF REMEDIAL ALTERNATIVES

This Proposed Plan recommends changes to the Selected Remedy for OU1 Soils. EPA evaluated three soils remedial alternatives (No Action, ISBT (Current Remedy), and ISTT) to address the

potential risks associated with impacted OU1 soils and perched water at the Site. EPA is required to evaluate a "No Action" alternative as a basis of comparison for the other alternatives. The other alternatives include "active" measures to remediate the Site. Remedial alternatives for the Lammers Barrel Site are presented below. The alternatives are numbered to correspond with the numbers in the FFS Report.

Common Elements of Alternatives

All of the alternatives require ICs, such as an easement or covenant, to limit the use of the property and to ensure that groundwater is not used for drinking water purposes. These ICs will be implemented in accordance with the OUECA to restrict residential development of the Site. Neither remedy rely exclusively on ICs to achieve protectiveness. Monitoring to ensure the effectiveness of the remedy, including deed restrictions, are a component of each alternative except the "no-action" alternative.

Description of Alternatives

The remedial alternatives that were evaluated in the FFS are described below:

Alternative 1 – No Action

Estimated Capital Cost: $0
Estimated Total O&M Cost: $0
Estimated Present Worth Cost: $0
Estimated Construction Timeframe: None

The NCP requires EPA to evaluate a "No Action" alternative when evaluating remedial options. This alternative serves as a baseline against which the other potential remedial alternatives are compared. Under this alternative, no further active remediation would be performed in any portion of the Site. The potential for human and ecological receptors to be exposed to COPCs would not be addressed. Contaminated materials within the Site would remain in place. The contaminated materials at the Site would neither be removed or controlled with engineered barriers, and existing fencing that restricts access would not be maintained.

Alternative 2 – ISBT (Current ROD Remedy)

ISBT at the Site will involve the mechanical mixing of in-situ impacted soils with zero valent iron (ZVI) and Portland cement (PC). Both ZVI and PC reagents will be mixed with water to form a slurry prior to ISBT. This slurry is added to the in- situ impacted soil, which results in an increase in the total volume of the ISBT soil mixture. As soil within the treatment areas includes very dense clay with low moisture content, a significant amount of water needs to be added to the slurry to make the clay workable (break down soil cohesion), so it can be homogenized. The soil treatability study conducted to determine the optimal ISBT mix is summarized in the 2016 Pre-Design Investigation Report and the 2019 Report Addendum and indicates that volumetric bulking increase of approximately 55% is anticipated during remedy implementation. This bulking factor, in addition to the increase in volume requiring treatment due to additional

delineation and characterization during the remedial design, is expected to lead to an overall treated soil volume that is almost four times that anticipated in the ROD. Two options are being considered to address the additional volume of treated soil: on-site containment that would entail construction of retaining structures along the Creek to retain the additional volume of soil (Alternative 2A), and a combination of on-site containment with off-site disposal (Alternative 2B). Should ISBT be selected as the final remedy, the management of additional soil volume will be addressed in detail in the 95% design document.

ISBT mixing will result in a soil monolith that minimizes leaching and migration of COPCs in the subsurface soil. The Site will be restored with a 2-foot soil cover over the ISBT footprint, which will eliminate potential exposure to the on-site young child recreator and on-site commercial/industrial worker from COPCs. Following placement of the soil cover, an environmental covenant will be established for the Site eliminating the potential exposure to COPCs in the subsurface soils.

Alternative 2A – ISBT Plus On-site Containment/Construction of Retaining Structure Along the Creek to Retain the Additional Volume of Soil

Estimated Capital Cost: $7,740,000
Estimated Total O&M Cost: $0
Estimated Present Worth Cost: $7,740,000
Estimated Construction Timeframe: 12 months

One option for managing the additional volume of treated soil is via on-site containment. For the ISBT treated area north of Little Beaver Creek, Area A, pre-cast concrete blocks will line the perimeter of the treatment area. These concrete blocks (2 ft x 4 ft x 2 ft) would extend above the ground surface to contain the bulked material, thus increasing the Site grade by 2 ft. An additional 2 ft of soil cover and associated concreted blocks will be placed over the ISBT footprint for a total grade increase of 4 ft. For the ISBT treated areas south of Little Beaver Creek, a 21 ft deep sheet pile wall (12 ft below ground and 9 ft above ground, subject to engineering design) will be installed along all treatment area perimeters raising Site grade in treated areas by 9 ft, which will include the elevation change from the bulking along with the additional 2 feet of soil cover that will be placed over the ISBT footprint.

Alternative 2B – ISBT Plus Combination of On-site Containment with Off-site Disposal

Estimated Capital Cost: $7,420,000
Estimated Total O&M Cost: $0
Estimated Present Worth Cost: $7,420,000
Estimated Construction Timeframe: 12 months

A second option for managing the additional volume of treated soil is a combination of off-site disposal and on-site containment. For this option, all treatment areas will be pre-excavated to 3 ft bls and the material disposed off-site at an appropriately licensed facility prior to ISBT implementation. Then pre-cast concrete blocks will be used to line the perimeters of treatment areas to contain the bulked material. In Treatment Area A, one row of blocks will be used (2 ft

increase in grade). In all other Treatment Areas, two rows of blocks will be used (4 ft increase in grade). An additional 2 ft of soil cover and associated concrete blocks will be placed over the ISBT footprint for a total grade increase of 4 to 6 ft.

Alternative 3 – In-situ Thermal Treatment (ISTT) – Amended Remedy

ISTT is the process by which heat is applied to the subsurface using one of several heat delivery methods for the purpose of enhancing conventional mass transport mechanisms such as volatilization, desorption, and mobilization, thereby increasing contaminant recovery rates by one or more orders of magnitude. While the increased mobility and vaporization of contaminants enhances recovery rates, the nature of this process also presents some inherent risks. The risks of enhanced vapor migration, and the subsequent potential effects, such as vapor intrusion, on nearby properties, will be evaluated during a pre-design hazard identification (HAZID) and addressed during the design process. Design elements to monitor and mitigate these hazards might include items such as vapor barriers, Site boundary horizontal vapor recovery trenches and perimeter air monitoring.

Both CVOC and BTEX compounds are highly responsive to thermal treatment at temperatures from 90 to 95 Celsius, which is conceptually achievable using either TCH or ERH technologies, and both technologies have been successful in both vadose and saturated zones.

Irrespective of the heating technology, a wellfield will be installed using a grid of both heater and extraction wells that encompasses the target treatment area. Energy in the form of steam injection, electricity, or natural gas burners will be applied to the heater wells, and the extraction wells will remove soil vapor, steam, dissolved-phase liquids, and non-aqueous phase liquid (NAPL) through induced vacuum and pumping. A supplemental steam injection system will be installed along with the TCH remedy that will consist of a steam boiler, steam conveyance piping installed on common pipes support with the extraction piping, and steam injection wells in locations where higher permeability sands are present at the Site. Extracted fluids will be conveyed to a treatment system that typically consists of phase separation tanks, vapor cooling and condensation using heat exchangers, and liquid and vapor abatement using conventional processes such as air stripping, activated carbon, and/or thermal oxidation. Treated vapors are typically emitted to the atmosphere and treated water is typically discharged to a sanitary sewer.

Regardless of heating technology utilized, both ERH and TCH technologies will heat the Site to a target temperature range of 90 to 95 degrees Celsius. At this temperature, polyvinyl chloride (PVC) monitoring wells and/or ERD injection wells within the zone of thermal influence may plastically deform. As such, wells within the zone of thermal influence will require abandonment prior to implementation of the ISTT remedy. The wells that are removed will be sealed with cementitious grout rather than bentonite to mitigate the heating affecting bentonite monitoring well seals. Due to the potential for “short-circuiting” of electricity if an ERH remedy is selected, it may be recommended that these wells be replaced with non-conductive and temperature-resistant fiberglass casings and screens, or that these wells be replaced with steel components only after the ISTT remedy is complete.

The ISTT remedy for the Site will involve installation of the network of heater and extraction wells using conventional drilling technologies, construction of a temporary thermal and vapor

retarding barrier consisting of low-density cellular concrete that will cover both the north and south treatment areas, and installation of both an above-grade fluids conveyance piping system and a fluids treatment system. Both technologies will require a small utility and pipe bridge that will join the north and south treatment areas to the treatment system. Finally, both technologies will require electrical service to be provided by the local power utility, as well as potable water and sanitary sewer connections to the Greene County Sanitary Engineering Department (GCSED) collection system. As part of the FFS, the GCSED was contacted to discuss the nature of the project and any specific requirements for discharge. GCSED noted that the project would require an application for an industrial wastewater discharge permit for a new industrial user, and pretreatment discharge standards would be determined after review of the permit and the expected operating conditions. After construction of the ISTT system is complete and acceptance testing has been performed, both technologies are expected to require approximately six months of active heating.

With Alternative 3 (ISTT), after the active heating and O&M phase is complete, the Site will have reduced volatile COPC concentrations by an anticipated 95% or more. Achievement of remedial standards will be verified by soil confirmation sampling after asymptotic mass recovery has been demonstrated; and a comprehensive confirmation sampling plan will be included in the remedial design. Following the completion of ISTT, O&M and the removal of installed ISTT components, the Site will be restored with a 2-foot soil cover over the treatment area to address any excess risk from arsenic and any other residual contamination. Following placement of the soil cover, an environmental covenant will be established for the Site.

Alternative 3A – ISTT Using ERH

Estimated Capital Cost: $4,366,523
Estimated Total O&M Cost: $1,723,477
Estimated Present Worth Cost: $6,090.000
Estimated Construction Timeframe: 12 months

With Alternative 3A, ERH will deliver energy to the Site soils using subsurface electrodes that are connected to a power delivery system. The power delivery system will induce an electric current through the soil matrix both between adjacent electrodes as well as from each electrode to adjacent extraction wells. Electrodes will be spaced on approximately 18 to 20-ft centers as noted on Figure 3 (Alternative 3A Conceptual Layout), though this value may vary based on the electrical profile of the Site. The Site-specific resistivity of the soils and groundwater, which will be measured during a pre-design bench test, will govern the amount of electrical energy (heat) that can be successfully delivered to the subsurface. Because the energy delivery is based not on the permeability of the Site, but rather on the electrical profile, heating is often highly effective in fine-grained soils such as those that underlay the Site. A network of extraction wells and conveyance piping and a treatment system for fluids handling will be installed as described above.

Alternative 3B – ISTT Using TCH

Estimated Capital Cost: $4,936,300

Estimated Total O&M Cost: $1,673.700
Estimated Present Worth Cost: $6,610,000
Estimated Construction Timeframe: 12 months

With Alternative 3B, TCH will deliver energy to the Site soils using resistive heater rods or natural gas- fired heaters. In the case of the resistive heater rods, power delivery units supply electricity to the rods, which in turn increase in temperature as a resistive heating element and will heat the well casing to a high temperature. If gas-fired heaters are used, each heater well will be fitted with an individual burner assembly. The high-temperature well casings thermally conduct the energy outward into the formation via a high temperature differential and soil particle to particle contact. This heating approach can be highly effective in lower permeability soils such as those that underlay the Site. TCH heater wells are typically spaced on 12 to 15-ft centers as noted on Figure 4 (Alternative 3B Conceptual Layout), but this value may vary based on the results of a pre-design bench test and thermal modelling to be conducted during the remedial design.

Additional steam injection wells may be installed in the higher permeability perched-zone soils to the south of Little Beaver Creek. A network of extraction wells and conveyance piping, as well as a treatment system for fluids handling, will be installed as described above.

The extent to which supplemental steam injection is necessary to treat the perched zone will depend in part upon the thermal technology that is selected during design. As noted above, it is likely to be required if the TCH method is selected but may not be necessary if ERH is deployed. This is based primarily on two factors: the groundwater flux into the heated zone, and the maximum power output of the two technologies' heater wells. This decision will be made during the design phase based upon the results of thermal modelling.

EVALUATION OF ALTERNATIVES

Section 121(b)(1) of CERCLA presents several factors that EPA is required to consider in its assessment of alternatives. Building upon these specific statutory mandates, the NCP articulates nine evaluation criteria to be used in assessing the individual remedial alternatives. The purpose of this evaluation is to promote consistent identification of the relative advantages and disadvantages of each alternative, thereby guiding selection of remedies offering 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 ARARs (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). The following section describes these nine criteria and discusses how each alternative identified in this Proposed Plan meets or does not meet each criterion.

Explanation of the Nine Evaluation Criteria

Threshold Criteria

1. ***Overall protection of human health and the environment:*** Alternatives are evaluated to determine whether they can protect human health and the environment from unacceptable risks posed by hazardous substances, pollutants, or contaminants by eliminating, reducing, or controlling exposures.
2. ***Compliance with ARARs:*** Alternatives are evaluated to determine whether they attain requirements under federal, tribal, and state environmental laws and regulations, or provide grounds for invoking a waiver. This evaluation includes a review of whether alternatives can meet chemical-specific, action-specific, and location-specific ARARs.

Primary Balancing Criteria

3. ***Long-term effectiveness and permanence:*** Alternatives are evaluated for the degree of long-term effectiveness and permanence they provide and for the degree of certainty that the alternative will prove to be successful. This criterion also incorporates an evaluation of climate resilience.
4. ***Reduction of toxicity, mobility, or volume through treatment:*** Alternatives are evaluated to determine the degree to which they employ treatment to reduce the toxicity, mobility, or volume of the Site contaminants.
5. ***Short-term effectiveness:*** Short-term impacts on the community and workers during implementation of alternatives are evaluated. Such impacts include transportation (including noise, dust, and traffic hazards), protection of workers, and the timeframe for implementing the remedy. This criterion also considers the effectiveness of mitigative measures until protection is achieved through attainment of the RAOs.
6. ***Implementability:*** The ease of implementing alternatives is evaluated, considering technical difficulties and reliability of various technologies, coordination with other offices and agencies, and availability of services and materials.
7. ***Cost:*** Capital costs and ongoing, long-term costs are evaluated. The estimated costs for each alternative have an expected accuracy of +50 percent to -30 percent.

Modifying Criteria

8. ***State Acceptance:*** The State's position and key concerns on the preferred alternative and other alternatives are considered, as well as comments on ARARs or proposed use of waivers. This assessment is completed after the State's comments on the Proposed Plan are received.
9. ***Community Acceptance:*** The community's support of, reservations about, or opposition to components of the alternatives are considered. This assessment is completed after public comments on the Proposed Plan are received.

Comparison of Alternatives

Overall Protection of Human Health and the Environment

Protectiveness is one of the primary requirements that remedial actions must meet under CERCLA. A remedy is protective if it adequately eliminates, reduces, or controls current and potential risks posed by the Site through each exposure pathway. The assessment with respect to this criterion describes how the alternative achieves and maintains protection of human health and the environment.

All the alternatives, except 1 (No Action), provide overall protection of human health and the environment. Alternative 2 (ISBT) with ZVI will reduce CVOC contaminant concentrations, associated leaching potential, and exposure over time. First, CVOC concentrations will be reduced when the soil is mixed with ZVI. Second, by mixing the soil with PC, the mobility and potential leaching of other contaminants (e.g. 1,4- dioxane, polychlorinated biphenyls [PCBs], polycyclic aromatic hydrocarbons [PAHs], etc.) from the soil to groundwater will be reduced. Third, by restoring the Site with a 2-foot soil cover over the ISBT footprint, any potential exposure to the on-site young child recreator and on-site commercial/industrial worker from residual COPCs including arsenic will be eliminated. Finally, following placement of the soil cover, an environmental covenant will be established for the Site eliminating the potential exposure to any residual COPCs in the subsurface soils. Alternative 3 (ISTT) will reduce contaminant concentrations and exposure over time. First, the mass of principal COPCs will be reduced by around 95% or more through volatilization, desorption, and mobilization. The mass reduction will significantly reduce leaching potential to underlying groundwater. In addition, some removal of PAHs and PCBs would be expected due to heating. Treatment of 1,4 dioxane in shallow soils and perched groundwater will also occur due to the compound's relatively low boiling point of 101 °C and the large increase in vapor pressure at the target temperature. Second, by restoring the Site with a 2-foot soil cover over the thermal treatment area, the potential exposure to the on-site young child recreator and on-site commercial/industrial worker from residual COPCs, including arsenic, will be eliminated. Finally, following placement of the soil cover, an environmental covenant will be established for the Site eliminating the potential exposure to any residual COPCs in the subsurface soils. Alternative 1 (No Action) does not achieve overall protection of human health and the environment since this option does nothing to address potential human exposure due to contaminated soil.

Compliance with ARARs

Section 121(d) of CERCLA, 42 U.S.C. § 9621(d), and NCP at 40 C.F.R. § 300.430(f)(l)(ii)(B) require that remedial actions at CERCLA Sites at least attain legally applicable or relevant and appropriate federal and state requirements, standards, criteria, and limitations which are collectively referred to as ARARs, unless such ARARs are waived under CERCLA section 121(d)(4). Applicable requirements are those requirements that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Relevant and appropriate requirements are those requirements that, while not applicable, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular Site. On March 1, 2023, EPA issued a Memorandum on *Documenting Applicable, or Relevant and Appropriate Requirements in Comprehensive Environmental Response, Compensation, and Liability Act Response Action Decisions* that discuses ARARs. As discussed in that Memorandum, the administrative

provisions are not ARARs at the Site. Applicable Site's ARARs for soil treatment are:

Federal ARARs	**Category**
Clean Air Act (CAA) establishes emission levels for certain hazardous air pollutants that may result from treatment processes	Action-specific
Clean Water Act (CWA) sets water quality criteria used to calculate limitations for discharges to surface water that result from remedial actions through the National Pollutant Discharge Elimination System (NPDES)	Action-specific
40 C.F.R. Part 6 Appendix A describes requirements for work within floodplains	Location-specific
Executive Orders No. 11988 and 11990 require the minimization of adverse impacts on floodplains and wetlands	Location-specific
State ARARs	
OAC 3745-1 Regulates discharges to surface water resulting from remedial actions	Action-specific
OAC 3745-9 Sets standards for design, installation, and closure of wells	Action-specific
OAC 3745-15-1 Requires management and conservation practices to control erosion of soil in conjunctions with land disturbance activities	Action-specific
OAC 3745-15-7 Prohibits air pollution nuisances that may endanger public health or cause property damage	Chemical-specific
OAC 3745-17 Regulates emissions of fugitive dust	Chemical-specific
OAC 3745-21 Establishes limitations for emissions of volatile organic compounds from stationary sources	Chemical-specific
OAC 3745-39 Regulates storm water runoff during remedial action	Action-specific
ORC 5301.80 to 530.92 Ohio Uniform Environmental Covenants Act: Regulates use restrictions for property	Action-specific
ORC 3704 05 paragraphs A-I Prohibits violation of air pollution control rules	Action-specific
ORC 6111 04 Prohibits pollution of water of the State	Action-specific

Alternative 1 (No Action) does not include any remedial actions be implemented, so the location, chemical, and action specific ARARs are not relevant.

ARARs for alternative 2 (ISBT) include Federal Clean Air Act (CAA) which establishes emission levels for certain hazardous air pollutants that may result from treatment processes, Federal Clean Water Act (CWA) sets water quality criteria used to calculate limitations for discharges to surface water that result from remedial actions through the National Pollutant Discharge Elimination System (NPDES), 40 CFR Part b Appendix A describes requirements for work within floodplains, Federal Executive Orders No. 11988 and 11990 require the minimization of adverse impacts on floodplains and wetlands, Ohio Admin. Code (OAC) § 3745-17, which regulates emissions of particulates and fugitive dust, and OAC § 3745-15 which prohibits air pollution nuisances. These requirements will be met during clearing and grubbing, removal of concrete foundations at the Site, and soil mixing. Mitigation measures will be incorporated in the design to ensure that storm water runoff from remedial activities and construction will comply with OAC § 3745-39, which addresses Phase II Storm Water Rules for Small Municipal Separate Storm Sewer Systems (MS4s). Use restrictions for the property will

comply with Ohio Revised Code (ORC) § 5301.80 to 5301.92, the Ohio Uniform Environmental Covenants Act.

ARARs for alternative 3 (ISTT) are identical to those for the *in-situ* soil mixing and include OAC § 3745-17, which regulates emissions of particulates and fugitive dust, and OAC § 3745-15, which prohibits air pollution nuisances. These requirements will be met during clearing and grubbing, removal of subsurface utilities and other installations, drilling, and operations and maintenance activities. Storm water run-off from remedial activities and construction will comply with OAC § 3745-39. Use restrictions for the property will comply with ORC § 5301.80 to 5301.92, the Ohio Uniform Environmental Covenants Act.

Long-term Effectiveness and Permanence

This criterion reflects CERCLA's emphasis on implementing remedies that will ensure protection of human health and the environment in the long term. The assessment of alternatives with respect to this criterion evaluates the residual risks at a Site after completing a remedial action or enacting a no-action alternative and includes evaluation of the adequacy and reliability of controls.

Alternative 1 (No Action) has a low degree of effectiveness in ensuring the protection of human health and the environment.

Alternative 2 (ISBT), after the response objectives have been met, the Site will have reduced COPC concentrations, and the Site will contain a treated soil monolith from 2 to 7 feet above ground surface and to a depth of 16 to 20 ft bls, plus a 2-foot soil cover. Direct exposure routes will have been addressed and the potential for leaching to groundwater will be reduced. However, the long-term effectiveness of alternative 2 depends on the successful execution of the soil mixing with ZVI and PC. Should contaminant concentrations not be sufficiently reduced via ZVI treatment, or the COPCs not be sufficiently bound with PC, the potential for soil leaching to groundwater may not be fully eliminated in the long-term. Furthermore, the treatment will add a significant amount of soil moisture, as well as volume, that will affect precipitation run-off. Detailed evaluation and potentially mitigation measures will be required for the following:

- Potential flooding of adjacent streets and properties;
- Localized groundwater mounding leading to potential additional leaching and seeps to the ground surface and/or creek.

Alternative 3 (ISTT), after the active heating and O&M phase is complete, the Site will have reduced volatile COPC concentrations by an anticipated 95% or more. In addition, some removal of PAH and PCB compounds, although less volatile, will also occur through heating. A 2-foot soil cover will be installed over all treatment areas to address risks for residual COPCs. Direct exposure routes will all have been addressed and the potential for leaching will have been significantly reduced by the reduction of COPCs and addition of soil cover. The long-term effectiveness of ISTT remedies on VOCs is typically considered to be very high due to the high reduction in contaminant mass.

The following are results of some of the tool's EPA recommends for evaluating climate change for the Beavercreek area:

1. *Precipitation* (using "Climate Explorer" https://crt-climate-explorer.nemac.org/). Annual precipitation is predicted to increase by around 0.4 inches per year and days with greater than 1 inch of precipitation may increase from an average of 4 days/year to around 4.5 day/year over the next 30 years.

2. *Inland Flooding and Winds* (Using "Risk Factor" https://riskfactor.com/). The Beavercreek area is identified as having a "minor risk of flooding over the next 30 years" and to be at "minor risk based on the projected likelihood and speed of hurricane, tornado or severe storm winds."

Remedial alternatives 3A and 3B would be less vulnerable to these minor climate changes than Alternatives 2A and 2B because they reduce the risk of flooding by eliminating the soil volume increase associated with in-situ mixing. Once implementation is complete the remedy would not be vulnerable to extreme wind events.

Reduction of Toxicity, Mobility, or Volume (TMV) of Contaminants through Treatment
This criterion addresses the statutory preference for remedies that employ treatment as a principal element. The assessment with respect to this criterion evaluates the anticipated performance of the specific treatment technologies an alternative may employ and is specific to evaluating how treatment reduces TMV.

Alternative 1 (No Action) would not reduce TMV of CVOC and BTEX impacted soils since no treatment would be implemented.

Based upon the laboratory treatability study, the ZVI treatment in Alternative 2 (ISBT) will reduce the COPC mass by approximately 57% to 98%. Although the mass of the COPC will be reduced, there will be an approximately 55% increase in volume of the soils containing COPCs as a result of the soil treatment. The toxicity and mobility will be reduced by treatment with ZVI. Solidification with PC will reduce mobility of any remaining compounds, including 1,4-dioxane.

Alternative 3 (ISTT) is expected to result in 95% or more physical mass removal of the principal COPCs from the target area thus reduce the volume of the contaminants. In addition, both biotic and abiotic processes are also enhanced due to the increase in temperature, which will result in a longer-term reduction in toxicity of residual COPCs via breakdown processes. ISTT can also increase permeability in low permeability zones through vaporization of pore water and associated pore space expansion; and higher permeability can lead to increased mobility (which is typically considered a beneficial effect of the process as it relates to extraction efficiency), though the risks posed due to increased mobility are offset by implementing a robust extraction system that can establish pneumatic and hydraulic control.

Short-term Effectiveness
This criterion addresses short-term impacts of the alternatives. The assessment with respect to

this criterion examines the effectiveness of alternatives in protecting human health and the environment during the construction and implementation of a remedy until the response objectives have been met.

Short-term effectiveness is not relevant to Alternative 1 (No Action) as no treatment is implemented.

With Alternative 2 (ISBT), the estimated timeframe to complete ISBT is approximately 12 months. ISBT with ZVI and PC has potential for short-term impacts to human health and the environment during construction and implementation. Construction workers may be exposed to COPCs during soil mixing and excavation activities. These risks could be mitigated through dust control and proper use of personal protective equipment (PPE). While the treatment of Alternative 2A is completed entirely in-situ, Alternative 2B requires some off-site disposal of impacted soils. This presents a potential short-term risk to the community from increased truck traffic.

With Alternative 3 (ISTT), the estimated timeframe to complete ISTT is approximately 12 months and the impact to the surrounding community will be generally low during this period. While heat can potentially cause a short-term impact in increased leaching potential of compounds to shallow groundwater, this will be mitigated with a robust extraction system that will be part of the ISTT implementation.

Implementability

The assessment with respect to this criterion evaluates the technical and administrative feasibility of implementing the alternative and the availability of the goods and services needed to implement it.

Alternative 1 (No Action) poses no Implementability issues as it requires no action to implement.

For Alternative 2 (ISBT), several design obstacles need to be overcome before implementing this remedy successfully. Since the areas and volumes potentially requiring treatment have increased substantially, approximately 18,000 to 22,500 cubic yards of soil need to be managed on-site. If this soil behaves similarly to the bench studies, its volume is expected to expand up to 55% when water and amendments are added for mixing. The management of this material will require significant elevation change and construction controls (concrete retaining blocks and/or sheet pile) to restore Site conditions. This decreases Site long- term re-use options. The adverse effect on-Site grades and associated limitations on site reuse options were not anticipated in the 2011 ROD. Alternatively, to reduce (but not eliminate) on-site grade changes, an estimated 8,050 tons of soil would need to be disposed of off-site, equating to 575 truckloads through the community. Both ISBT options, Alternative 2A (On-site Containment) and Alternative 2B (a Combination of On-site Containment with Off-site Disposal), can have impediments to implementation that are able to be resolved during pre-design investigative and remedial design phases.

For Alternative 3 (ISTT), due to the nature of inducing an electric current, a common obstacle for ERH (Alternative 3A) is that all conductive materials within the formation (e.g., historical steel

piping, utility grounding rods, steel building columns, reinforcing bar, etc.) must be removed prior to the start of O&M activities. This is because conductive materials can cause a short circuit of the induced electrical current that is a primary effect of the heating system. While identifying and removing these items is a critical step in the design process and is rarely an ongoing concern, unidentified conductive materials can cause both performance issues (e.g., uneven heating) and safety issues (e.g., "live" grounds or back feeding the utility). Subsurface features will be identified during Site clearance activities to be conducted during the pre-design investigation phase. These challenges are expected to be addressed during the 30% design phase.

A common implementation challenge for TCH (Alternative 3B) is the presence of saturated materials, such as the perched zone that exists on the south side of Little Beaver Creek. In these cases, cool perched groundwater can limit successful heating of the zone. While the hydraulic gradient and the potential effects on heating rate will be evaluated during the conceptual design phase, a supplemental addition of SEE in the perched zone has been conservatively retained for Alternative 3B if the impact to heating rates becomes problematic. The components of this supplemental steam system would include installing steam injection wells screened within the perched zone, as well as above-grade steam injection piping and steam generating equipment (e.g., electric or gas boiler). Challenges associated with heat loss in the higher permeability sands will be mitigated during the design process. The existing groundwater monitoring wells located within the treatment zone may need to be removed and replaced with monitoring wells that are constructed of materials that can withstand the high temperatures generated by Alternative 3A and Alternative 3B. The heating and extraction wells will be extended to a depth of 20 feet to include the perched zone south of Little Beaver Creek. Because the perched zone is thin, EPA anticipates that a high percentage of the contaminant mass present in the perched zone will volatilize and be removed.

Cost

Cost encompasses all engineering, construction, and O&M costs incurred over the life of the project. There are no capital or O&M costs associated with alternative 1 (No Action). Alternative 2A, which requires no off-site disposal but requires extensive on-site regrading, is projected to cost $7.7M. Alternative 2B, which includes off-site disposal of the top three feet of material from all Treatment Areas, is projected to cost $7.4M. Both Alternatives 3A and 3B are projected to cost approximately $6.0M. A comparison of costs for all remedial options being considered is shown in Table 5, below:

Table 5: Cost Comparison of Alternatives

Alternative	Cost Estimate (in millions of dollars)
No Action	$0
2A: ISS w/ZVI, no off-site Disposal	$7.74M
2B: ISS w/ZVI, off-site Disposal	$7.42M

3A: ISTTR ERH	$6.09M
3B: ISTR TCH	$6.16M

State/Support Agency Acceptance

This criterion evaluates whether the support agency, based on comments submitted after its review of the draft Proposed Plan, concurs with, opposes, or has no comment on EPA's preferred alternatives. OEPA has indicated support for selection of Alternative 3 (ISTT).

Community Acceptance

This criterion refers to the information relayed to the Agencies by the community regarding the Proposed Plan. This criterion will be evaluated based on any comments submitted during the public comment period on the Proposed Plan and will be described in the ROD Amendment.

Comparative Analysis

Alternative 1, no further action, cannot be selected because it is not protective of human health and the environment therefore does not pass the first Threshold Criterion. Alternative 1 cannot be retained for additional evaluation. The remaining four alternatives (2A, 2B, 3A, 3B) pass both Threshold criteria and therefore were retained for further evaluation. Table 5 summarizes estimated costs for all the alternatives, as discussed above.

For the balancing criteria of Long-term Effectiveness and Permanence, the Alternative 3 (ISTT) options are more favorable than the Alternative 2 (ISBT) options due to the increased certainty of contaminant treatment with Alternative 3 and the concerns associated with the additional volume of treated soil and the resulting adverse impacts on future land use associated with Alternative 2 options.

Although Alternative 3 will cause a temporary increase in contaminant mobility associated with thermal treatment, this leads to an overall decrease in impacted soil and groundwater contaminant volume and toxicity through the enhanced mass removal. Alternative 2 will result in a decrease in contaminant mobility and toxicity as a result of the stabilization and reduction treatment processes, respectively, but there will be a substantial overall increase in treated soil volume due to bulking. For these reasons, the Alternative 3 options are more favorable than the Alternative 2 options for the Reduction of Toxicity, Mobility, or Volume through Treatment criterion.

Alternative 2 options are less favorable than either of the Alternative 3 options for the Short-term effectiveness criteria due primarily to the potential for COPC exposure during mixing activities and off-site transportation aspects of Alternative 2B. While the on-site exposure pathway for Alternative 2 can potentially be mitigated through construction workers wearing appropriate PPE, the Alternative 3 options would have engineering controls (vapor barrier and aggressive soil vapor extraction (SVE)) in place to prevent exposure in addition to relying on PPE.

Additionally, Alternative 2 options compare less favorably to Alternative 3 based on the Implementability criterion. While Alternative 3 options have some implementation concerns, these can be overcome with the appropriate design while leaving the Site with the same topography as current conditions. Alternative 2 can also be implemented but will require an extensive modification of the topography that will adversely impact potential future land use options. Lastly, as shown on Table 5 above, Alternative 3 options are more favorable with respect to the Cost criterion than Alternative 2.

EPA's PREFERRED ALTERNATIVE

Based upon all of the above information, and in consultation with OEPA, EPA is proposing to modify the remedy selected in the ROD for the Site. EPA's Preferred Alternative for addressing the contaminated soil and the perched groundwater contamination at the Site is Alternative 3 (ISTT). The proposed remedy changes described in this document do not affect other OU1 groundwater components of the selected remedies for the Site.

Conclusion

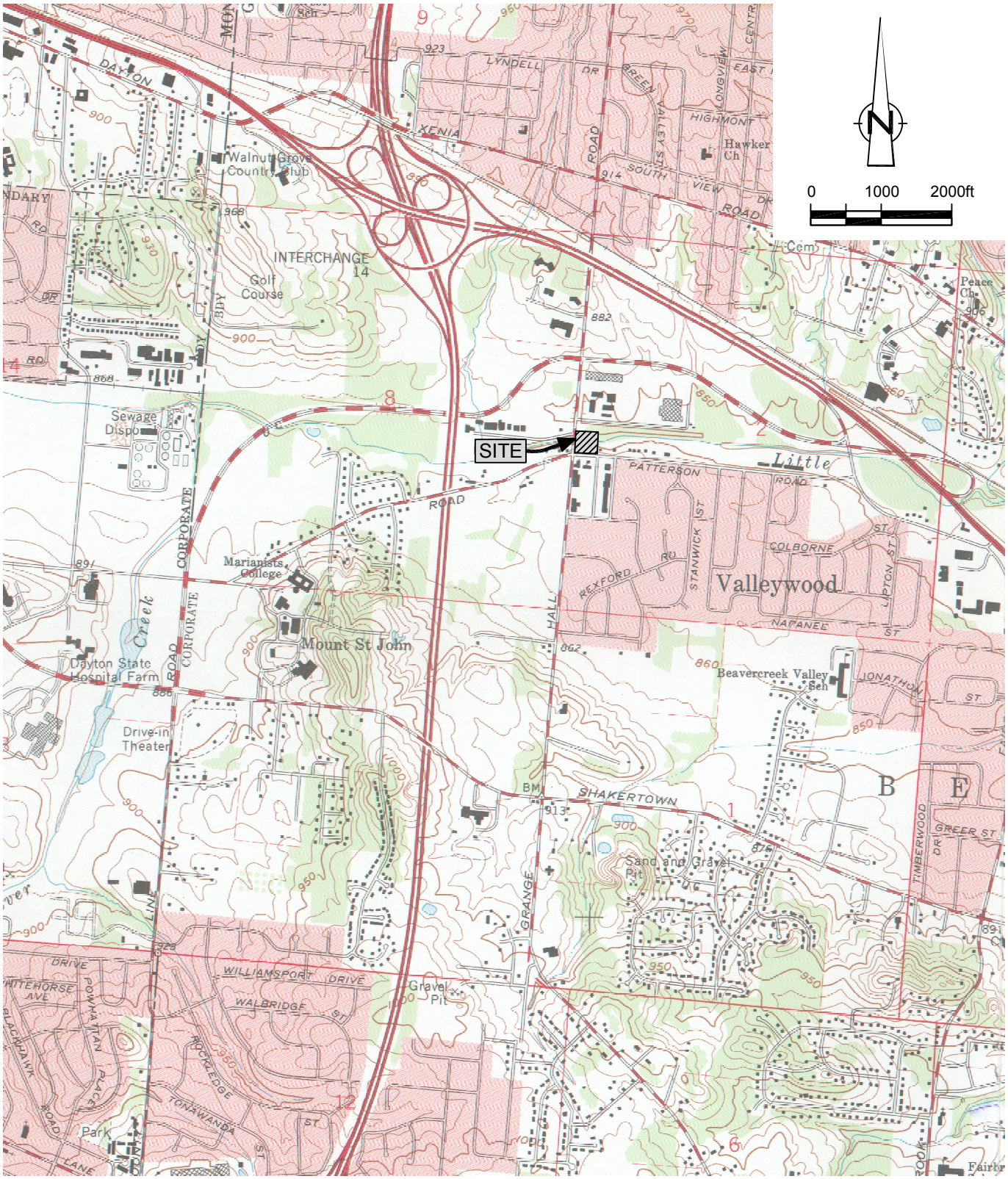
Based on the information currently available, EPA believes the Preferred Alternative meets the threshold criteria and provides the best balance of tradeoffs compared to the other alternatives with respect to the balancing and modifying criteria. EPA expects the Preferred Alternative to satisfy the following 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.

Community Participation

The Introduction section of this Proposed Plan includes information about the 30-day public comment period and how to submit comments. EPA, in consultation with OEPA, will evaluate the public's response to the preferred cleanup alternative during the public comment period before deciding on the final cleanup alternative for the Site. Based on new information or public comments, EPA may modify its Preferred Alternative or choose another alternative. As such, EPA encourages the public to review and comment on the cleanup alternatives.

FIGURES

1. Site Location Map
2. Site Layout Map
3. Alternative 3A Conceptional Layout
4. Alternative 3B Conceptional Layout



SOURCE: USGS QUADRANGLE, BELLBROOK, OHIO, REVISED 1991

ARCADIS
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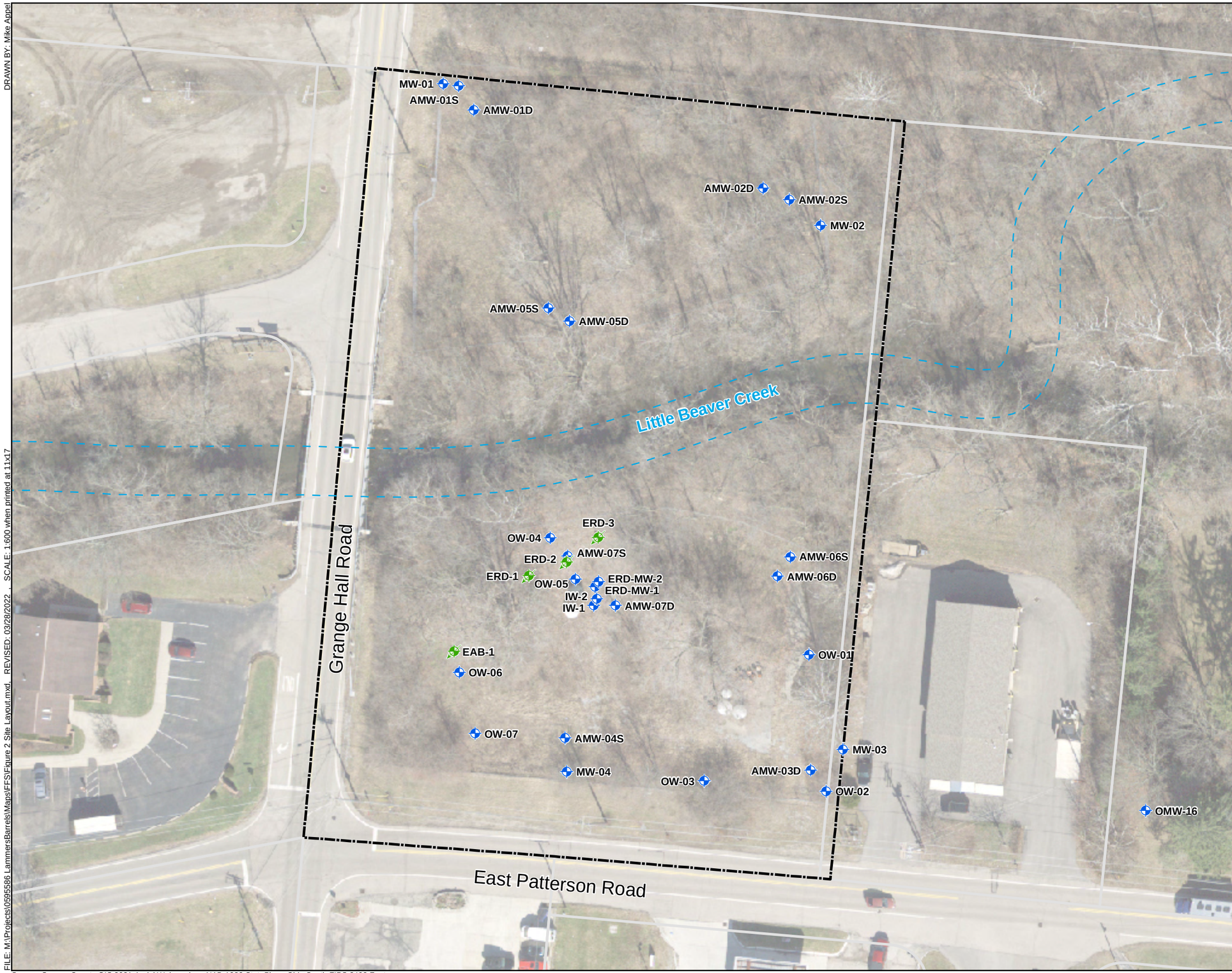
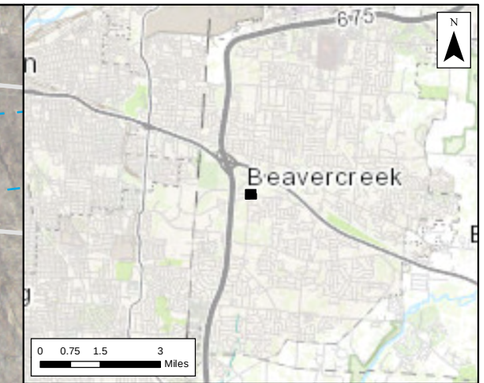
Chicago, Illinois 60601
Tel: 312-263-6703 Fax: 312-263-7897

SITE LOCATION MAP
LAMMERS BARREL FACILITY
BEAVERCREEK, OHIO

DATE	PROJECT MANAGER	DRAWING NAME
3/24/2010	J. KRATZMEYER	RI-WA026
DRAWN	LEAD DESIGN PROF.	CHECKED
R. SMITH	N. GILLOTTI	A. PENNINGTON
PROJECT NUMBER		FIGURE NUMBER
CI001228.0003		1





Legend

- Monitoring or Observation Well
- Injection Well
- Property Parcel Boundary
- Area Parcels (From Greene County)

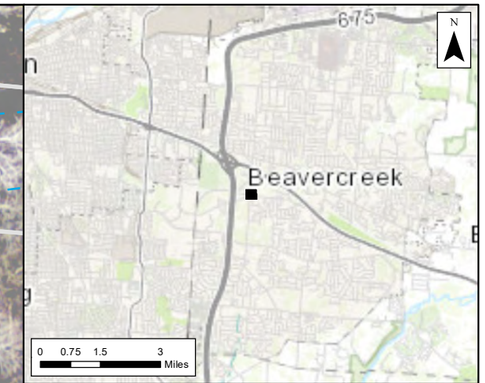
Figure 2
Site Layout
Lammers Barrel Facility
Beavercreek, Ohio

Environmental Resources Management
www.erm.com
ERM

Source: Greene County GIS 2021 Aerial Webservice; NAD 1983 StatePlane Ohio South FIPS 3402 Feet

FILE: M:\Projects\0595586 LammersBarrels\Maps\FFS\Figure 2 Site Layout.mxd, REVISED: 03/28/2022 , SCALE: 1:600 when printed at 11x17

DRAWN BY: Mike Appel



Legend

- ET-ESP™ Electrode Location (148)
- Temperature Monitoring Location (15)
- Extraction Well Location (106)
- Monitoring Well to Be Abandoned (24)
- Extent of Thermal Influence (~38,700 ft^2)
- Area A: 10,079 ft^2 - 16 ft bgs
- Area B: 7836 ft^2 - 20 ft bgs
- Area C: 5349 ft^2 - 20 ft bgs
- Area D: 7538 ft^2 - 20 ft bgs
- Area E: 1523 ft^2 - 20 ft bgs
- Property Parcel Boundary
- Area Parcels (From Greene County)

N

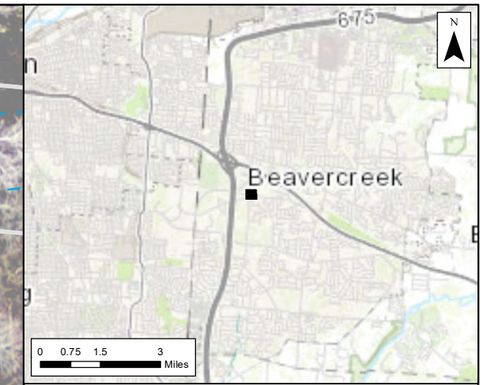
0 50 100
Feet

Figure 6
Alternative 3A Conceptual Layout
Lammers Barrel Facility
Beavercreek, Ohio

Environmental Resources Management
www.erm.com
ERM

Source: Greene County GIS 2020 Aerial Webservice; NAD 1983 StatePlane Ohio South FIPS 3402 Feet

FILE: M:\Projects\0595586 Lammers&Barrels\Maps\FFS\Figure 6 Alternative 3A Concept - ERH.mxd REVISED: 09/30/2021 SCALE: 1:600 when printed at 11x17 DRAWN BY: Mike Appel



Legend

- TCH Heater Location (184)
- TCH Heater with Co-Located Steam Well (44)
- Temperature Monitoring Location (15)
- Vapor Extraction Well (52)
- Monitoring Well to Be Abandoned (24)
- Area A: 10,079 ft^2 - 16 ft bgs
- Area B: 7836 ft^2 - 20 ft bgs
- Area C: 5349 ft^2 - 20 ft bgs
- Area D: 7538 ft^2 - 20 ft bgs
- Area E: 1523 ft^2 - 20 ft bgs
- Property Parcel Boundary
- Area Parcels (From Greene County)

N

0 50 100
Feet

Figure 7
Alternative 3B Conceptual Layout
Lammers Barrel Facility
Beavercreek, Ohio

Environmental Resources Management
www.erm.com
ERM

Source: Greene County GIS 2020 Aerial Webservice; NAD 1983 StatePlane Ohio South FIPS 3402 Feet

FILE: M:\Projects\0595586 LammersBarrels\Maps\FFS\Figure 7 Alternative 3B Concept-TCH .mxd, REVISED: 09/30/2021 , SCALE: 1:600 when printed at 11x17 DRAWN BY: Mike Appel