FIFTH FIVE-YEAR REVIEW REPORT FOR FIKE CHEMICAL, INC. SUPERFUND SITE PUTNAM AND KANAWHA COUNTIES, WEST VIRGINIA

JULY 2017

Prepared by

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LIST OF ABBREVIATIONS & ACRONYMS

1,2-DCA	1,2-Dichloroethane
1,2-DCP	1,2-Dichloropropane
ARAR	Applicable or Relevant and Appropriate Requirement
BCEE	Bis(2-chloroethyl)ether
BCEP	Bis(2-ethylhexyl)phthalate
BCIPE	Bis(2-chloroisopropyl)ether
BHC	Benzene Hexachloride
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIC	Community Involvement Coordinator
COC	Contaminant of Concern
COPC	Contaminant of Potential Concern
CSM	Conceptual Site Model
CST	Cooperative Sewage Treatment Plant
DMTU	1,3-Dimethyl-2-thiourea
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
ESV	Ecological Screening Value
FS	Feasibility Study
FYR	Five-Year Review
HMPA	Hexamethylphosphoramide
IC	Institutional Control
µg/L	Microgram per Liter
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MW	Monitoring Well
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
PRP	Potentially Responsible Party
RAO	Remedial Action Objective
RI/FS	Remedial Investigation and Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
SAC	Special Area of Concern
SVOC	Semi-Volatile Organic Compound
TCDD	2,3,7,8-Tetrachlorodibenzo-p-dioxin
TEF	Toxicity Equivalent Factor
TEQ	Toxicity Equivalence
UCL	Upper Confidence Limit
UU/UE	Unlimited Use and Unrestricted Exposure
VOC	Volatile Organic Compound
WVDEP	West Virginia Department of Environmental Protection

I. INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings and conclusions of reviews are documented in FYR Reports such as this one. In addition, FYR Reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP) (40 Code of Federal Regulations Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the fifth FYR for the Fike Chemical, Inc. Superfund site (the Site). The triggering action for this statutory review is the completion date of the previous FYR. The FYR has been prepared because hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The Site includes four operable units (OUs) that will be addressed in this FYR. OU1 addressed immediate site risks. OU2 addressed risks posed by site structures. OU3 addressed risks posed by buried drums and containers. OU4 addresses risks posed by contaminated soil and groundwater. There are three OUs that are not addressed in this FYR (OU6, OU7 and OU8 – there is no OU5). These OUs were created for administrative purposes and do not have their own Records of Decision (RODs). Potentially responsible parties (PRPs) completed work for OUs 6, 7 and 8 as parts of remedies selected under the RODs for OU2, OU3 and OU4. It is this completed work that is under examination in this Five Year Review.

The FYR was led by EPA Remedial Project Manager (RPM) Bruce Rundell. Participants included Darriel Swatts, EPA Community Involvement Coordinator (CIC); Nathan Doyle, EPA hydrogeologist; Tracy Jeffries, West Virginia Department of Environmental Protection (WVDEP) project manager; Mike Samples and Mike Miller with PRP remedial contractor de maximis, Inc.; Terry Wilfong, local operation and maintenance (O&M) contractor for the RPs with KEMRON Environmental Services, Inc. (KEMRON); Jerome Cibrik, PRP representative with Union Carbide; Ben Amos, PRP contractor with Geosyntec Consultants (Geosyntec); and Amanda Goyne and Melissa Oakley with EPA contractor, Skeo. The review began on 9/23/2016.

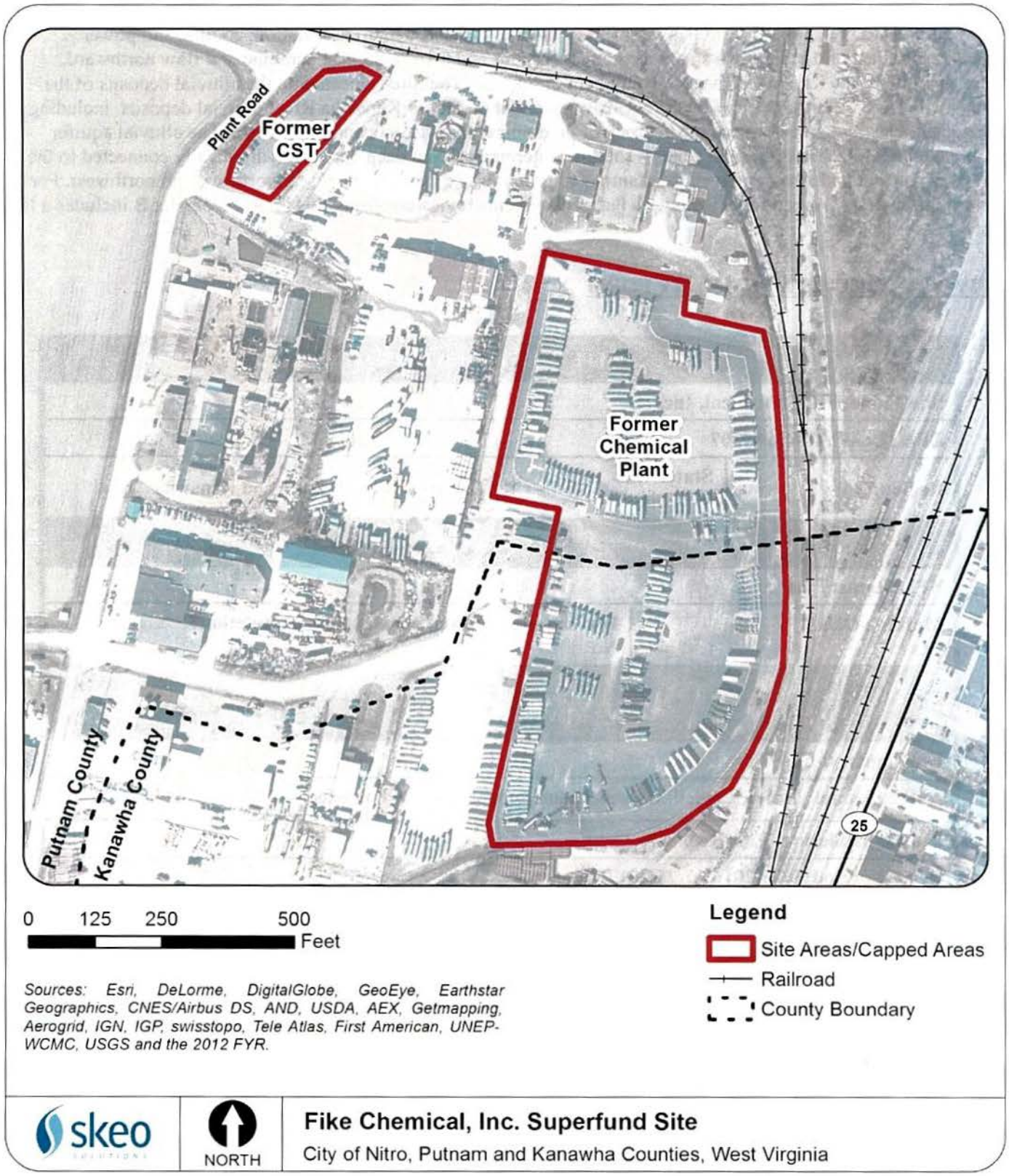
Site Background

The Site is in a heavily industrial area of the Kanawha River Valley in the City of Nitro, in both Kanawha and Putnam Counties in West Virginia (see Figures 1 and D-1). Between 1953 and 1988, companies manufactured small volume batches of chemicals at the Site. The Site consists of an 11.9-acre former batch chemical production plant (former Chemical Plant) property, a 0.9-acre former Cooperative Sewage Treatment Plant (former CST) property about 500 feet west of the Chemical Plant property (see Figure 1), and contaminated groundwater attributed to releases from these two properties. The Chemical Plant initially consisted of chemical production areas, office and laboratory buildings, three waste lagoons, and drum and waste burial areas. The site property owner constructed the CST between 1966 and 1968 to treat sanitary and industrial wastewater and stormwater runoff from the Chemical Plant and an adjacent truck terminal. Facility operators disposed of chemical processing wastes in drums, and stockpiled or buried the drums in a waste disposal area on the southern half of the Chemical Plant property. Facility operations and waste disposal practices contaminated soil and groundwater with hazardous constituents.

Following construction of caps over the former Chemical Plant and CST properties in late 2003, Dana Container Inc. began using the former Chemical Plant property for chemical-hauling tanker truck parking, and the former CST property for employee parking. Future land use at and surrounding the Site is expected to remain industrial. Groundwater at and near the Site is not used for drinking water due to natural high metals concentrations. The area is connected to the municipal water supply, which utilizes the Elk River as the drinking water source. Based on the poor groundwater quality of the Kanawha Valley and groundwater use restrictions in place for the Site and

surrounding area, future use of groundwater is not anticipated.

Figure 1: Detailed Site Map



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site.

The Kanawha River is about 2,000 feet west of the former Chemical Plant property (Figure D-1). The State of West Virginia has designated the Kanawha River as suitable for water-contact recreation, industrial and agricultural water supply, fish propagation and for uses associated with transportation, cooling and power generation. East of the Site, two small tributaries, Armour and Blakes Creeks, combine and flow northward, eventually into the Kanawha River downgradient of the Site. The Site is located on the alluvial deposits of the Kanawha River. The geology of the Site consists of about 60 feet of Kanawha River alluvial deposits, including sand, silt, clay and gravel, overlying bedrock of predominantly siltstone, and some shale. The alluvial aquifer beneath the Site consists of three zones – shallow, intermediate and deep – and is hydraulically connected to the Kanawha River and Armour Creek. Contaminated groundwater flows to the north, northeast and northwest. For more information, Appendix A includes a list of documents reviewed during this FYR. Appendix B includes a list of site events.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Fike Chemical, Inc.		
EPA ID: WVD047989207		
Region: 3	**State:** West Virginia	**City/County:** Nitro / Putnam and Kanawha

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes	**Has the site achieved construction completion?** No

REVIEW STATUS
Lead agency: EPA
Author name: Bruce Rundell, with additional support provided by Skeo
Author affiliation: EPA Region 3
Review period: 9/23/2016 - 7/25/2017
Date of site inspection: 11/15/2016
Type of review: Statutory
Review number: 5
Triggering action date: 7/25/2012
Due date *(five years after triggering action date)*: 7/25/2017

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

EPA documented the basis for taking remedial action in RODs for OUs 1, 2, 3 and 4. These OUs and the basis for taking action for each OU are summarized below.

OU1

The 1988 OU1 ROD identified immediate risks at the Site. Immediate threats included a methyl mercaptan storage tank, an estimated 10,000 drums of labeled and unlabeled hazardous materials, about 300 tanks and reactor vessels with associated piping, about 200 drums containing sodium metal, about 1,000 buried drums, an undetermined number of additional buried laboratory containers and the CST Plant.

OU2

The 1990 OU2 ROD identified risks posed by structures on the Site. Based on site conditions in June 1988, the risks included building collapse, friable asbestos and residual contamination left in various tanks, equipment and structures. The structures created obstacles to future investigations and site work and presented an imminent and substantial danger.

OU3

The 1992 OU3 ROD identified risks posed by buried drums and containers. The drums and containers posed direct health risks to the public and hampered subsurface investigation. The potential also existed for contaminants within the containers to spread to surrounding media.

OU4

The 2001 OU4 ROD identified risks posed by contaminated soil and groundwater. The ROD stated that contaminated soil posed an unacceptable risk to future construction/industrial workers and that contaminated groundwater posed an unacceptable risk to future residents via potential ingestion of drinking water.

The 2001 OU4 ROD identified contaminants of potential concern (COPCs) in soil at the Chemical Plant property and CST property, including dioxins/furans, polychlorinated biphenyls, metals, pesticides/herbicides, volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). The ROD also identified contaminants of concern (COCs) in groundwater, which included metals, pesticides/herbicides, SVOCs and VOCs. Appendix C shows the soil COPCs identified by the 2001 OU4 ROD. Table 1 in the Response Actions section below lists the Site's groundwater COCs and associated cleanup goals.

Response Actions

In the late 1970s, sampling indicated groundwater contamination at the Site. In 1978, the State of West Virginia required site operators to line the CST treatment basins. They did not comply within the time allowed. In March 1982, EPA issued a National Pollutant Discharge Elimination System permit for wastewater discharges from the CST plant. EPA added the Site to the Superfund program's National Priorities List (NPL) on September 1, 1983.

In June 1988, due to the poor condition of storage vessels, incompatible materials storage, large quantities of high hazard materials at the Site, and the apparent abandonment of the Site, the West Virginia Division of Natural Resources, Kanawha County and Putnam County emergency services officials requested EPA assistance. On June 11, 1988, EPA initiated a removal action to mitigate the threats to public health and the environment posed by the Site. The removal action included the removal and off-site disposal of large amounts of hazardous materials. The size and complexity of the Site required additional response actions. On September 29, 1988, EPA signed the OU1 ROD, authorizing remedial action to control, stabilize and eliminate site-related hazards. EPA completed the removal action through implementation of the OU1 remedy, as discussed below in the Status of Implementation section.

OU1

EPA selected a remedy to address the most threatening hazards to human health and the environment in the Site's September 1988 OU1 ROD. The OU1 ROD did not include Remedial Action Objectives (RAOs), but selected the following remedial components:

- Removal and disposal of a tank of methyl mercaptan.
- Removal and disposal of drums of metallic sodium.
- Removal, bulking and disposal of drums on the ground surface.
- Removal, bulking and disposal of the materials found in various tanks, lines and vessels located on the Site.
- Lab-packing and disposal of certain laboratory containers found on the Site.
- Drainage and stabilization of the on-site and CST facility lagoons, treatment of the drained liquids from the lagoons and discharge of those treated liquids to the Kanawha River.
- Excavation, bulking and disposal of buried drums.
- Proper stabilization and/or removal and disposal of asbestos-containing insulation materials found in process lines.
- Proper removal and disposal of cyanides.

OU2

EPA selected a remedy to address risks posed by site structures in the Site's September 1990 OU2 ROD. The selected remedy included the dismantling and decontamination of all tanks and equipment and most of the on-site buildings. The RAOs listed in the OU2 ROD include:

- Eliminate safety hazards associated with unstable components of the facility.
- Eliminate unacceptable health risks posed by asbestos.
- Reduce obstacles to future site investigation.
- Eliminate unacceptable health and environmental risk posed by contaminant residuals.

OU3

In the Site's March 1992 OU3 ROD, EPA selected a remedy of excavation and off-site disposal to address risks posed by buried drums and containers at the Site. The RAOs listed in the OU3 ROD include:

- Eliminate future or continued contamination of soil, groundwater, surface water and the atmosphere from sources contained in the buried drums and containers.
- Eliminate the potential for direct exposure of the surrounding population to hazardous substances contained in buried drums and containers (from subsurface collapses or future excavations).
- Remove buried drums and containers to facilitate future site investigation and remediation.

EPA modified the selected remedy for OU3 in two Explanations of Significant Differences (ESDs) in May 1993 and January 1996. The first ESD eliminated the requirements for a containment dome during the drum excavation. The second ESD revised the plan for treating surface water runoff during the drum removal from the Chemical Plant property.

OU4

EPA selected a remedy to address soil and groundwater contamination in the Site's September 2001 OU4 ROD. The ROD identified the following RAOs for soil:

- Protect human health and the environment by reducing excess cancer risks to within the EPA target risk range for the anticipated future use of the Chemical Plant and CST properties as industrial.

- Remove soils containing elevated levels of arsenic and dioxin.

The ROD identified the following RAOs for sewers:

- Investigate World War I-era sewers that originate near the CST and discharge to the Kanawha River to determine if they contain contaminated sediments.
- Remove potential contaminated sediments from the 12-inch sewer line from the CST to the Kanawha River.

The ROD identified the following RAOs for groundwater:

- Reduce concentrations of COCs in groundwater to levels that result in less than or equal to a 1×10^{-5} cumulative excess cancer risk and a hazard index less than 1.0 and achieve drinking water standards (maximum contaminant levels (MCLs) and non-zero maximum contaminant level goals (MCLGs)). For inorganic compounds, if the MCL or non-zero MCLG is lower than the background level, then the background level will be the cleanup goal.
- Ensure that groundwater is not used for water supply until concentrations of COCs are reduced to levels that result in less than or equal to a 1×10^{-5} cumulative excess cancer risk and a hazard index less than 1.0 and achieve drinking water standards (MCLs and non-zero MCLGs).

The selected remedy included the following components:

- Excavation of former Lagoon 3 and disposal of the excavated material at an off-site facility.
- Construction an asphalt cap over the areas formerly occupied by the CST and Chemical Plant.
- Flushing a 12-inch sewer that runs from the former CST to the Kanawha River.
- Investigation and removal of sediments, if warranted, from a World War I-era 66-inch sewer formerly used by the plant.
- Investigation of the extent of groundwater contamination.
- Design and construction of a pump-and-treat remedy for groundwater.
- Implementation of institutional controls to prevent exposure to contaminated groundwater and ensure that the future use of the land remains industrial use only.

The ROD did not establish soil cleanup goals for soil COPCs (Appendix C).

EPA revised the groundwater component of the OU4 remedy in the Site's December 2006 ROD Amendment. The ROD Amendment eliminated the requirement to extract and treat groundwater and selected in-situ biosparging to address groundwater contamination. The RAOs of the groundwater remedy remained as established in the original OU4 ROD. Based on updated groundwater sampling results, the ROD Amendment modified the list of groundwater COCs to include 22 substances.

The 2006 OU4 ROD Amendment states that groundwater cleanup will continue until COC concentrations in groundwater achieve the following acceptable risk-based cleanup levels when concentrations of COCs are considered cumulatively (same as the 2001 ROD): a carcinogenic risk of 1×10^{-5} and a non-carcinogenic hazard index less than or equal to 1.0. The 2006 OU4 ROD Amendment also requires that organic groundwater COCs meet MCLs and non-zero MCLGs. For inorganic compounds, the 2006 OU4 ROD Amendment requires that groundwater concentrations meet MCLs or non-zero MCLGs, if those values are higher than background levels. If background levels for inorganic COCs are greater than the MCLs or non-zero MCLGs, then the background level will be the cleanup goal. It should be noted that no specific background concentrations had been determined at the time of the 2001 or 2006 ROD. The modified list of the Site's 22 groundwater COCs and associated cleanup goals are provided in Table 1 below.

Table 1: Groundwater COCs Established by the 2006 OU4 ROD Amendment and Associated Cleanup Goals

Groundwater COC[a]	Cleanup Goal (µg/L)[b]
Aldrin	N/A
Arsenic	50
Benzene	5
Alpha-benzene hexachloride (BHC)	N/A
Bis(2-chloroethyl)ether (BCEE)	N/A
Bis(2-chloroisopropyl)ether (BCIPE)	N/A
Bis(2-ethylhexyl)phthalate (BCEP)	N/A
Carbon tetrachloride	5
Chlorobenzene	100
Chloroform	N/A
4,4'-DDT	N/A
1,2-dichloroethane (1,2-DCA)	5
1,2-dichloropropane (1,2-DCP)	5
1,3-dimethyl-2-thiourea (DMTU)	N/A
Heptachlor	0.4
Hexamethylphosphoramide (HMPA)	N/A
Iron	N/A
Manganese	N/A
Tetrachloroethene	5
1,1,2-trichloroethane	5
Trichloroethene	5
Vinyl chloride	2

[a] Groundwater COCs established by the 2006 OU4 ROD Amendment.
[b] The 2006 OU4 ROD Amendment did not list specific cleanup goals. It refers back to the cleanup goals established in the 2001 OU4 ROD. The list of cleanup goals above are from Table 1 in the 2001 OU4 ROD.
µg/L – microgram per liter
N/A – The contaminant had no MCL or MCLG at the time of the 2001 OU4 ROD.

Status of Implementation

Implementation of remedies selected in the OU1, OU2 and OU3 decision documents is complete. Implementation of the remedy for the soil component of OU4 ROD is also complete. The remedy for the groundwater component of OU4 ROD is ongoing. EPA has identified several PRPs for the Site. In 1997, participating PRPs organized as the Fike/Artel Site Trust (the Trust). Except for OU1, the Trust has implemented and continues to implement the selected remedies for the Site.

OU1

As described above, EPA initiated implementation of the OU1 remedy by conducting a removal action to address immediate threats posed by the Site. Following the signature of the OU1 ROD, EPA continued addressing

immediate site threats through implementation of the remedy selected in the OU1 ROD. Cleanup included removal and off-site disposal of tanks, above-ground drums and associated wastes; off-site disposal of laboratory and cyanide wastes; and drainage and stabilization of lagoons. EPA performed the OU1 remedial action between January 1989 and September 1993.

OU2

Between September 1993 and May 1995, PRPs decontaminated and demolished most site buildings, tanks and associated piping, and disposed of these materials off site. They conducted the work in accordance with the OU2 ROD. The scope of work for OU2 initially excluded two areas containing the following materials in aboveground storage: 14 roll-off containers holding 722 drums of OU1 waste, and aboveground tanks containing sludge and contaminated wastewater. Between May 1995 and June 1996, PRPs addressed those materials in a subsequent phase. For management purposes, EPA refers to the work completed during that subsequent phase as OU7. Cleanup included decontamination, demolition and off-site disposal of drums of waste and aboveground tanks containing sludge and wastewater.

OU3

PRPs completed the OU3 remedial action between February 1996 and September 1997. In accordance with the OU3 ROD and subsequent ESDs, cleanup included excavation and off-site disposal of buried drums and containers from the southern part of the Site and construction of a surface water management system for the former Chemical Plant property. For project management purposes, EPA referred to the implementation of the January 1996 OU3 ESD as OU6.

OU4

CST and Chemical Plant Soil

Between May 1996 and September 1997, PRPs performed a removal action to dismantle the CST plant. Cleanup included dismantling CST buildings and tanks, dewatering the three CST lagoons, excavating the underlying sludge and soil, and disposing of all waste materials off site. Before placement of multilayer asphalt caps over the CST and Chemical Plant properties, PRPs excavated soil contaminated with elevated levels of dioxin and arsenic. Following cleanup, the PRPs backfilled the lagoons with clean material. For project management purposes, EPA referred to that 1996-1997 removal action work as OU8. Between September 2002 and October 2003, the Trust constructed the caps in accordance with the OU4 ROD. The Trust designed and constructed the CST and Chemical Plant caps with sufficient load-bearing capacity to support industrial use conditions.

Sewers

In accordance with the OU4 ROD, the Trust investigated and remediated both the 12-inch sewer and the World War I-era 66-inch sewer. Based on the findings of the sewer investigation, the Trust made repairs as necessary. In October and November 1996, the Trust flushed both sewers and disposed of generated wastes off site.

Groundwater

The initial ROD selected further investigation of the nature and extent of groundwater contamination, extraction and treatment of contaminated groundwater, and institutional controls as the remedy for contaminated groundwater. Institutional controls for groundwater selected in the OU4 ROD (and the OU4 ROD Amendment) have been implemented (see the Institutional Controls subsection below). Investigations to determine the nature and extent of groundwater contamination began after issuance of the OU4 ROD and are ongoing. These investigations have found that contaminated groundwater generally flows north, with separation of predominant flow into two lobes – one to the north-northeast and one to the northwest. Investigations from 2002 through 2006 determined that the extent of contamination was more than projected in the initial ROD. Based on this and an evaluation of emerging in-situ treatment technologies, EPA revised the groundwater component of the OU4 remedy in a December 2006 ROD Amendment. The 2006 OU4 ROD Amendment replaced groundwater extraction and treatment with in-situ biosparging and the addition of peroxide and/or nutrients, if necessary.

The Trust operated a Phase I biosparging system from 2007 until April 2015. The purpose of the system was to limit migration of the northeast lobe of the plume. After two years of operation and quarterly groundwater

monitoring, sampling data indicated that biosparging alone was not effective in reducing all COC concentrations, and especially ineffective in reducing concentrations of hexamethylphosphoramide (HMPA). Based on the inability of biosparging to effectively treat all COCs, between 2009 and 2013, the Trust conducted several bench scale and pilot studies to explore innovative technologies to remediate groundwater COCs at the Site. The studies did not identify an effective method to adequately address site groundwater contamination. In October 2014, EPA sent a letter to the Trust stating that the current OU4 remedy will not achieve RAOs for groundwater. In the letter, EPA requested that the Trust fully characterize the extent of the plume in order to develop a current conceptual site model (CSM) and develop a new feasibility study (FS) for the Site to investigate alternative groundwater remedy options.

The Trust submitted an updated groundwater CSM in May 2016, which EPA approved. The Trust used the findings of the updated CSM to develop the Site's November 2016 draft Groundwater FS Report. The 2016 draft FS identified and evaluated groundwater remedial alternatives for the Site. The 2016 draft FS is currently being revised based on EPA and WVDEP comments.

Using the information in the finalized FS, EPA anticipates selecting a new groundwater remedy to address Sitewide groundwater contamination in a forthcoming decision document. The information collected during the CSM update is discussed in the Data Review section of this FYR.

Institutional Controls (OU4)

The Site's 2001 OU4 ROD and 2006 OU4 ROD Amendment require institutional controls to limit land use of the CST and Chemical Plant to industrial use and to prevent groundwater use in the site vicinity until cleanup goals are met. The required institutional controls have been implemented through overlapping land and groundwater use restrictions (Table 2). On an annual basis, the Trust reviews site conditions and institutional controls to determine if the institutional controls remain effective. The Trust submits the findings of these reviews to EPA in annual Institutional Control Reports.

Deed restrictions and restrictive covenants are also in place for the Chemical Plant and CST properties to prohibit groundwater use, limit future land use to industrial use, prohibit activities that could impact the integrity of the remedy, and to define the owner's and Trust's responsibilities related to cap maintenance (Figure 2).

In October 2011, the West Virginia Department of Health and Human Resources established a Special Area of Concern (SAC) to address contaminated groundwater attributed to the Site (Figure 2). Well construction within the SAC is subject to a more stringent permit process that involves the Putnam and Kanawha Counties' health departments, the West Virginia Department of Health and Human Resources and the WVDEP. A West Virginia memorandum dated October 26, 2011, and West Virginia letters to Kanawha and Putnam Counties dated November 1, 2011, document the establishment of the SAC. They also identify the areal extent of the SAC and associated permitting requirements.

In March 2002, the City of Nitro established the City of Nitro Ordinance 02-03 (Figure 2). The Ordinance prohibits the extraction of groundwater in certain areas within the City of Nitro, west of Route 25. There is also a system in place that notifies the Trust anytime someone calls Miss Utility to schedule digging activities at or near the Site.

To help implement this ordinance and the SAC, the WVDEP issues annual letters to certified well drillers in the area. The letters notify the well drillers of drilling restrictions that apply to the SAC, the City of Nitro and surrounding areas, and include a map of where the restrictions apply.

As part of this FYR, the data review process included a comparison of the locations of current groundwater contamination to the extent of existing groundwater institutional controls. As discussed in the Data Review section below, resent sampling results indicated that the Site's existing institutional controls did not cover the entire area impacted by groundwater contamination. The West Virginia Miss Utility Notification area was expanded on July 14, 2017 to encompass the entire area of impacted groundwater (Figure 2).

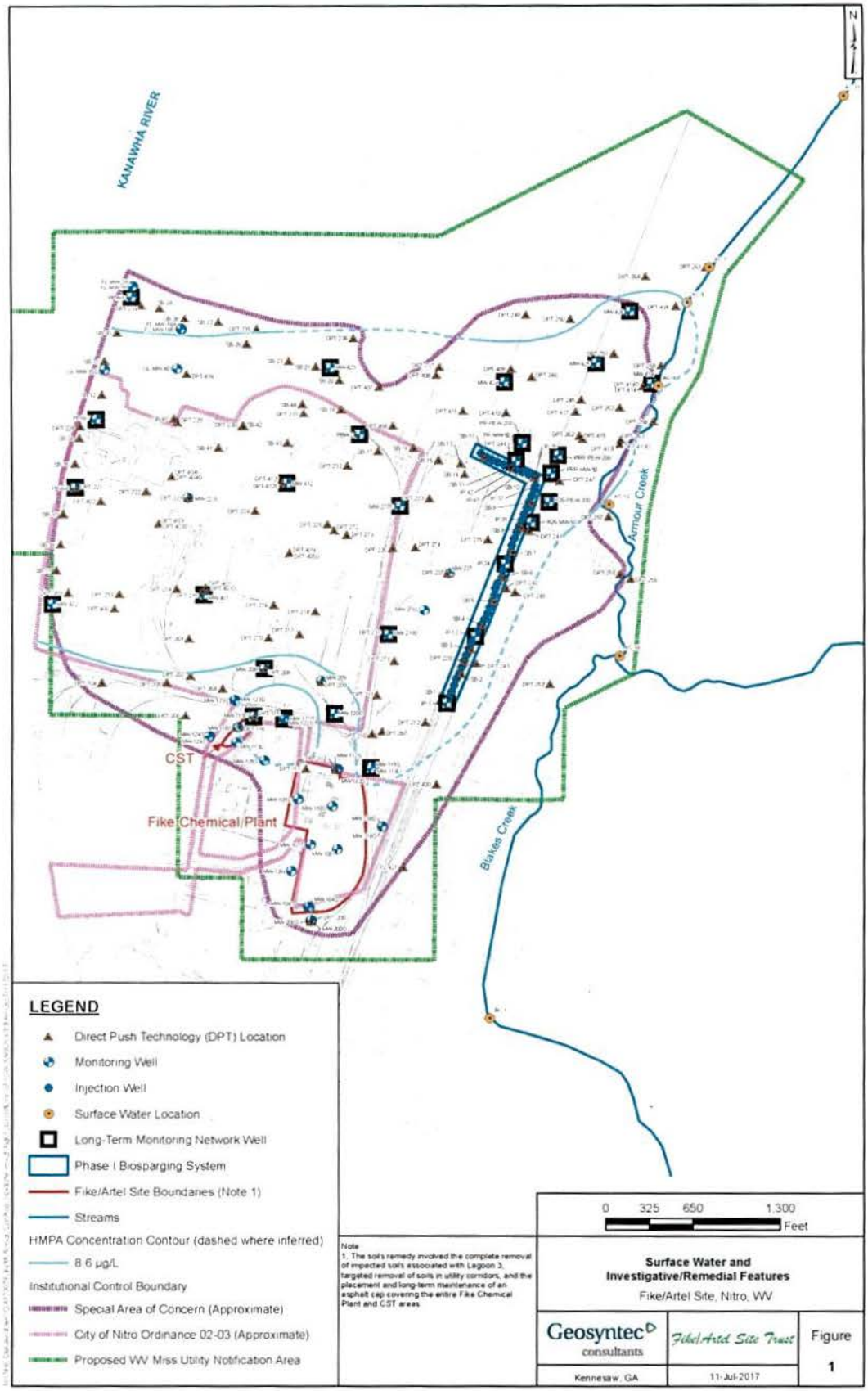
The Site's institutional controls are summarized in Table 2 below and shown in Figure 2. The Site's 2012 FYR includes copies of the institutional control documents.

Table 2: Summary of Implemented Institutional Controls (ICs)

Media that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Areas	IC Objective/Description	Title of IC Instrument Implemented and Date
Soil	Yes	Yes	Former Chemical Plant (parcels 235-95-0000 and Map 2 Parcel 113) and Former CST (parcel 235-91-0001)	Restricts future use of Site to industrial. Grants EPA access to Site. Requires state to file a deed restriction in each county limiting the future use of the former Chemical Plant and CST areas to industrial use.	Notice of Access, Notice of Hazardous Waste Removal Activity and Deed Restriction; Recorded with both Kanawha and Putnam Counties 3/6/1997
Groundwater	Yes	Yes	Former Chemical Plant (parcels 235-95-0000 and Map 2 Parcel 113) and Former CST (parcel 235-91-0001)	Amends October 1998 Declaration of Deed Restrictions to prohibit use of groundwater and well drilling (except for monitoring wells) and to define the owner's and Trust's responsibilities for maintaining the cap.	First Amendment to Deed of Restrictive Covenants: Recorded 10/15/2002
Soil and Groundwater	Yes	Yes	Former Chemical Plant (parcels 235-95-0000 and Map 2 Parcel 113) and Former CST (parcel 235-91-0001)	Transfers ownership of former Chemical Plant and CST areas from Nitro Development Authority to Equipment Care Center of Nitro, LLC. Includes an environmental covenant restricting the property's use to industrial, prohibiting extraction of groundwater (except monitoring wells), prohibiting activities that could potentially impact the integrity of the remedy, and defining the owner's and Trust's responsibilities for maintaining the cap.	Deed and Restrictive Covenant: Recorded 1/22/2008
Groundwater	Yes	Yes	Sitewide	Requires a more stringent well-permitting process for the subject area.	SAC: Established 10/26/2011

Media that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Areas	IC Objective/Description	Title of IC Instrument Implemented and Date
Groundwater	Yes	Yes	Sitewide	Prohibits extraction of groundwater in certain areas within the City of Nitro, west of Route 25.	City of Nitro Ordinance 02-03: Adopted 3/19/2002
Soil and Groundwater	Yes	Yes	Sitewide	Notifies the Trust if someone calls Miss Utility to schedule digging activities at or near the Site.	Miss Utility notification system: Initiated 5/2/2005

Figure 2: Updated Institutional Control Map



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site.

Systems Operations/Operation & Maintenance

Ongoing O&M activities address the soil component of OU4 and, to a limited extent, the groundwater component of OU4. The Site's 2002 O&M Plan for the soil component of the OU4 remedy established a cap system O&M program. The program includes monitoring the condition and performance of the cap system and identifying repair and maintenance required to preserve the integrity of the caps. Trust O&M contractor, KEMRON, performs annual O&M inspections and submits findings to EPA in Annual Soils O&M Inspection Summary reports. After submitting the annual O&M reports, KEMRON addresses report recommendations and documents any needed maintenance or repairs in annual Asphalt Sealing and Repair Inspection Reports. KEMRON submits those reports to EPA for review.

During the annual O&M inspection in April 2016, KEMRON inspected the CST and Chemical Plant properties. The CST and Chemical Plant caps appeared to be in good condition, with no significant cracks. All fences, gates, locks, chains and warning signs were in place and in good condition. KEMRON observed some linear cracking in the Chemical Plant cap, in the northern end of the surface water management retention basin and two places where repair material on the surface water management retention wall was coming loose. KEMRON concluded that the cracks in the cap and degraded repair material on the retention wall are not significant enough to undermine the integrity of the cap or surface water management system. Dana Transport seals the surface of both caps annually, with the most recent sealing event in October 2016. The October 2016 cap sealing addressed the cracks in the Chemical Plant cap noted during the April 2016 O&M inspection.

Per EPA request, the Trust updated the Site's 2002 O&M Plan in January 2013 to include a methane and VOC monitoring program. The objective of the methane monitoring program is to evaluate the potential for methane ingress into six buildings located close to the cap. The methane monitoring program requires in-building manual and automated readings of methane gas concentrations. Methane monitoring results are discussed in the Data Review section of this FYR. The Site's updated January 2013 O&M Plan only requires VOC monitoring under certain conditions. These conditions include when in-building methane readings exceed the action level of 1.25 percent by volume in one monitoring event, or when readings in two consecutive methane monitoring events are between 1 percent and 1.25 percent by volume. In a letter dated April 4, 2016, EPA approved the Trust's request to reduce the frequency of methane monitoring from twice a year to once a year.

Previous groundwater O&M plans are no longer applicable given the current status of the groundwater remedy. Operation of the Phase I biosparging system stopped in 2015. The Trust is currently performing quarterly groundwater sampling to evaluate COC concentration variability while new groundwater remedial alternatives are being considered. The sampling began in July 2016 and will continue until July 2017. The results of the concentration variability evaluation of will be evaluated by EPA and WVDEP. The Trust and EPA will work together to establish O&M requirements for site groundwater after selection of a new groundwater remedy.

III. PROGRESS SINCE THE PREVIOUS REVIEW

This section includes the protectiveness determinations and statements from the previous FYR as well as the recommendations from the previous FYR and the current status of those recommendations.

Table 3: Protectiveness Determinations/Statements from the 2012 FYR

OU #	Protectiveness Determination	Protectiveness Statement
1, 2 and 3	Protective	The remedies for OU1, OU2 and OU3 are in place and protective. There have been no changes in site conditions that call into question the protectiveness of these remedies.

OU #	Protectiveness Determination	Protectiveness Statement
4	Protectiveness Deferred	The remedy for the soil component of OU4 is in place and expected to be protective. Available information for dioxin should be evaluated to confirm that the implemented remedy is protective based on the revised toxicity of dioxin. Otherwise, there are no changes that could call into question the protectiveness of the remedy for the soil component of OU4. The remedy for the groundwater component of OU4 consists of further investigations to determine the nature and extent of contamination, in-situ treatment of groundwater and institutional controls. In-situ treatment of groundwater has not been effective to date. However, institutional controls are in place and appear to be protective as intended. In addition, available information otherwise indicates that impacted groundwater does not present an unacceptable risk to human health and the environment at this time due to a lack of exposure pathway.

Table 4: Status of Recommendations from the 2012 FYR

OU #	Issue	Recommendation	Current Status	Current Implementation Status Description	Completion Date (if applicable)
4	Inspections and maintenance of soil caps have not been conducted per schedules/frequency established in O&M Plan and Environmental Covenant.	Consider and implement measures to ensure that O&M of soil caps is conducted in a timely and effective manner.	Completed	Trust O&M contractor, KEMRON, performs annual O&M inspections of the caps on the CST and Chemical Plant properties and of the surface water management system. The Trust documents the annual O&M inspections in annual O&M reports and submits those reports to EPA. After submitting the annual O&M reports, KEMRON addresses report recommendations and documents any needed maintenance and/or repairs in annual Asphalt Sealing and Repair Inspection Reports. Those reports are submitted to EPA for review. These reports have been submitted annually since the 2012 FYR.	7/9/2012
4	Groundwater institutional controls may need to be modified as new information becomes available regarding the areal extent of groundwater contamination.	Periodically assess the effectiveness of existing groundwater institutional controls.	Ongoing	The West Virginia Miss Utility Notification area was expanded on July 14, 2017 to encompass the entire area of impacted groundwater	Not Applicable

OU #	Issue	Recommendation	Current Status	Current Implementation Status Description	Completion Date (if applicable)
4	In-situ treatment of groundwater has been ineffective in reducing concentrations of groundwater COCs.	Modify the design of in-situ treatment as needed to enhance effectiveness.	Considered But Not Implemented	In October 2014, EPA determined that the OU4 remedy is not effective at achieving RAOs. Therefore, this 2012 FYR recommendation was considered, but not implemented. Using the information in the 2016 draft FS, EPA anticipates selecting a new groundwater remedy to address Sitewide groundwater contamination in a forthcoming decision document.	10/16/2014
4	In-situ treatment of groundwater has targeted only one COC (HMPA) and only a limited area of impacted groundwater.	Modify design of in-situ treatment to address all COCs and all impacted groundwater.	Considered But Not Implemented	See comment above. EPA anticipates selecting a new groundwater remedy to address Sitewide groundwater contamination in forthcoming decision document. The 2016 CSM includes updated information regarding the current extent of groundwater contamination. That information will be used to inform the selection of a more appropriate groundwater remedy. The new remedy will address all groundwater COCs identified in the 2006 OU4 ROD Amendment and all impacted groundwater.	5/20/2016

OU #	Issue	Recommendation	Current Status	Current Implementation Status Description	Completion Date (if applicable)
4	New toxicity criteria have been issued for dioxin.	Evaluate existing site data for dioxin to confirm that implemented soil remedy is protective. Conduct sampling if needed.	Completed	In September 2015, on behalf of the Trust, Geosyntec perform a detailed review of available dioxin/furan soil data for the Site. The purpose of the review was to determine whether the OU4 soil remedy remains protective in light of new toxicity criteria for dioxin. See Appendix J for detailed information regarding the dioxin data evaluation. The evaluation concluded that based on an evaluation of soil data, using updated toxicological data for 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and updated toxicity equivalent factors (TEFs) for dioxin/furan congeners, implementation of the soil component of the OU4 remedy adequately addressed dioxins/furans in site soil, and that remaining concentrations are present at levels consistent with the ROD-specific acceptable risk range. EPA approved the Trust's review of the potential impacts of the new toxicity criteria for dioxin in a letter dated 10/8/2015. EPA concluded that no action is needed at this time, as a result of the new dioxin toxicity criteria.	10/8/2015

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

A public notice was made available in the Charleston Gazette on April 14, 2017 stating that there was a FYR and inviting the public to submit any comments to EPA. The results of the review and the report will be made available at the Site's information repository, located at the Nitro Public Library at 1700 Park Avenue, Nitro, West Virginia 25143.

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. The results of these interviews are summarized below.

Overall, the interviewed three residents who were aware of the Site had a positive impression of the cleanup. They indicated that it would be helpful if EPA could provide the community with site-related information through the mail, newspaper and/or local television news. None of the interviewees have private water wells. One of the interviewees voiced a concern regarding excessive dust blowing toward her house from the general direction of the Site. She was informed that the source of the dust is not site-related. The Site's O&M contractor has a positive impression of the project and indicated that involved stakeholders and agencies have worked cooperatively

throughout the cleanup and reuse process. He requested a reduction in the frequency of cap inspections and maintenance requirements.

Data Review

Per EPA request, the Trust developed an updated CSM in May 2016. This data review briefly summarizes the groundwater data used to develop the 2016 CSM and presents an overview of current groundwater concentrations. The 2016 CSM and ongoing groundwater monitoring compare COC concentrations to the preliminary cleanup goals for groundwater listed in the Site's draft FS. It should be noted that the preliminary cleanup goals listed in the CSM have been updated to include risk based numbers where no MCL or SMCL exists. Specific background levels have not yet been calculated Appendix H includes additional in-depth data review information, including the rationale for EPA's determination that the biosparging groundwater remedy would not achieve the groundwater RAOs. Ten percent of all data presented in the data tables and maps presented in this document were checked for accuracy by SKEO. Only one minor discrepancy was found between data presented on Figure H-11 and Table C-1. This difference noted was for the VC concentration of location SB-25 where the value was reported as 11.4 micrograms per liter on Figure H-11 and 11 micrograms per liter on Table C-1.

Groundwater – Current Conditions

Sampling has detected 22 groundwater COCs in site groundwater, some close to or within site property boundaries and others at distances of up to about one mile downgradient. Groundwater contamination near the former facility is present primarily within the shallow alluvial zone, according to the Site's 2016 CSM. Further downgradient, COCs have migrated from the shallow alluvial zone to the intermediate and deeper zones. A slight upward gradient exists from the bedrock aquifer to the alluvial aquifer, reducing the potential for contamination to impact the deeper bedrock aquifer.

Seven organic constituents – 1,2-dichloropropane (1,2-DCP), benzene, chloroform, vinyl chloride, HMPA, 1,3-dimethyl-2-thiourea (DMTU), and bis(2-chloroethyl)ether (BCEE) – are present in relatively coherent plumes originating from the Site. COC distributions generally indicate a northeast and/or north-northwest flow path, with the greatest plume extents observed to the northeast. Sampling performed during the development of the updated CSM indicated that HMPA is the most widespread COC, and the other COCs exist within the footprint of the HMPA plume.

Data evaluated during the development of the 2016 CSM suggest that the HMPA plume is migrating to the northeast, along a narrow corridor in the deep zone (Appendix H, Figure H-5). The HMPA plume is mostly present in off-site areas with limited presence on site, potentially indicating depletion of the source mass and a detached plume. Data for other COCs suggest relatively stable conditions, with limited migration of the plume to the north-northwest. As part of this FYR, the data review process included a comparison of the locations of current groundwater contamination to the extent of existing groundwater institutional controls. Recent sampling results indicated that the Site's existing institutional controls no longer covered the entire area of groundwater contamination. The West Virginia Miss Utility Notification area was, therefore, expanded on July 14, 2017 to encompass the entire area of impacted groundwater (Figure 2). However, there is no current potable groundwater use near the Site. Potable groundwater use in the Site area is not anticipated, because of overall natural poor groundwater quality in the Kanawha Valley.

Vapor Intrusion

The Site's 2011 vapor intrusion assessment and methane monitoring data indicate that vapor intrusion stemming from site-related groundwater impacts is not occurring. While the 2011 vapor intrusion assessment determined that four site-related COCs were present in indoor air at concentrations that exceeded risk-based screening levels for the industrial and residential scenarios, it was determined that none of the exceedances stemmed from site-related vapor intrusion. The 2011 vapor intrusion assessment led to the development of the ongoing methane monitoring program. Since the initiation of the Site's methane monitoring program in 2013, methane gas has not been detected during any sampling event. Vapor monitoring is currently conducted annually.

Site Inspection

The site inspection took place on 11/15/2016. In attendance were Bruce Rundell (EPA Region 3 RPM), Darriel Swatts (EPA Region 3 CIC), Nathan Doyle (EPA Region 3), Tracy Jeffries (WVDEP), Mike Samples and Mike Miller (de maximis, Inc.), Terry Wilfong (KEMRON), Jerome Cibrik (Union Carbine), Ben Amos (Geosyntec), and Amanda Goyne and Melissa Oakey (Skeo). The purpose of the inspection was to assess the protectiveness of the remedy. See Appendix E for a detailed site inspection checklist. See Appendix F for photos from the site inspection.

The site tour began at the former batch chemical production plant (Chemical Plant) property. Dana Container Inc. uses the Chemical Plant property for tanker truck parking. Except for a few small cracks, the asphalt cap covering the area appeared to be in good condition. The cracks are sealed annually, and on an as-needed basis. The surface water management system that runs along the eastern edge of the Chemical Plant property is paved and includes three sluice gates that can be closed in the event of a spill. The concrete within the surface water management system appeared to be in good condition. The tall fence that surrounds the Chemical Plant property appeared to be in good condition. Signage with institutional control information is posted along the perimeter fence. All signs were in good condition.

The inspection team observed groundwater monitoring wells near the Kanawha River, north of the Site. All wells observed were secured with locks and appeared to be in good condition.

The site inspection team then toured the CST property. Dana Container Inc. uses the property for employee parking. Except for a few small cracks, the asphalt cap covering the area appeared to be in good condition. Flush-mounted monitoring wells in the area were secured with bolts and appeared to be in good condition.

Following the tour of the CST property, the site inspection team observed Armour Creek, north of the Site. The area is the approximate northern extent of groundwater contamination.

On November 14, 2016, Skeo staff visited the Site's local information repository, the Nitro Public Library at 1700 Park Avenue in Nitro, West Virginia. A records review verified a small collection of printed site-related documents available for public viewing, including some administrative record files for OU2 and OU4, primarily dated from the 1990s. The records collection included no documents dated after 2000.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

Question A Summary:

The review of relevant documents, applicable or relevant and appropriate requirements (ARARs) and risk assumptions and the site inspection indicate that the remedies are functioning as designed for OU1, OU2, OU3 and the soil component of OU4. There are no complete exposure pathways at any of the site OUs because contaminated materials left onsite are contained beneath an asphalt cap and impacted groundwater is not currently used as a drinking water source. In addition, the implemented ICs restricting disturbance of the cap and the use of groundwater in the area provide additional protection against potential exposure.

Risks associated with OU1 were addressed through the removal and off-site disposal of hazardous materials stored in drums, cylinders, containers and tanks. The Trust addressed risks posed by OU2 through the dismantling and decontamination of all tanks, equipment and buildings. Risks associated with OU3 were addressed through the excavation and off-site disposal of buried drums and containers from the southern portion of the Site and construction of a modified surface water runoff treatment system. There are no O&M requirements associated with the OU1, OU2 or OU3 remedies.

The excavation and off-site removal of impacted soil from a former lagoon, the flushing/cleaning of the sewers associated with the facility, installation of multi-layer asphalt caps over the former CST and Chemical Plant areas, and implementation of institutional controls addressed the risks associated with impacted soil at OU4. The caps prevent direct exposure to contaminated subsurface soil. Institutional controls restrict land use to industrial purposes and prohibit activities that could potentially impact the integrity of the caps. Routine O&M activities include inspections of the capped areas and the Site's surface water management system, annual cap sealing, and cap maintenance or repairs as needed. No significant O&M issues have been noted since the previous FYR.

In October 2014, EPA determined that the OU4 groundwater remedy is not functioning as intended, and that RAOs will not be achieved with the current remedy. EPA requested that the Trust fully characterize the extent of the plume to develop an updated groundwater CSM and develop a new FS for the Site to investigate alternative groundwater remedy options. The Trust submitted an updated groundwater CSM in May 2016. The Trust used the findings of the updated 2016 CSM to develop the Site's November 2016 draft Groundwater FS Report. This document is being revised based on EPA and WVDEP comments. EPA, in consultation with WVDEP will use the information in the finalized FS to select a new groundwater remedy to address Sitewide groundwater contamination in a forthcoming decision document. The data collected during development of the 2016 groundwater CSM better defined the current extent of groundwater contamination at the Site and concluded that the deep ground water plume has migrated close to the limits of the ICs in some areas. The boundaries of the IC area, particularly the West Virginia Miss Utility Notification Area may require expansion in the future.

Institutional controls for groundwater required by the OU4 ROD and OU4 ROD Amendment have been implemented through overlapping groundwater use restrictions. Restrictive covenants are in place for the former Chemical Plant and CST properties to prohibit the use of groundwater. West Virginia's Department of Health and Human Resources requires a more stringent well-permitting process within its SAC and the City of Nitro Ordinance 02-03 prohibits the groundwater extraction in certain areas within the City of Nitro, west of Route 25. Recent sampling results indicated that the Site's institutional controls no longer covered for the entire area of groundwater contamination. The West Virginia Miss Utility Notification area was expanded on July 14, 2017 to encompass the entire area of impacted groundwater. However, there is no current potable groundwater use near the Site. Potable groundwater use is not anticipated in the future because of the overall, naturally poor groundwater quality in the Kanawha Valley.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Question B Summary:

Exposure assumptions largely remain valid, and while there have been changes in ARARs and toxicity data since the selection of the original site remedies, the implementation of a new groundwater remedy is expected to address those changes. The 2001 OU4 ROD based the soil remedy on industrial land use. The property remains in industrial use, with no anticipated land use changes. Land use restrictions are in place that restrict future land use to industrial purposes for both the former CST and Chemical Plant areas. Groundwater is not used for any purpose at or near the Site, and routine methane monitoring ensures that vapor intrusion does not pose a risk to human health inside on-site structures. Since the initiation of the Site's methane monitoring program in 2013, methane gas has not been detected during any sampling event.

The 1988 OU1 ROD did not include RAOs. RAOs for the OU2 remedy, OU3 remedy and soil component of the OU4 remedy have been met through the completion of the selected remedies for the OUs. The RAOs for the groundwater component of OU4 have been partially met through the implementation of groundwater institutional controls. Based on information gathered during the development of the 2016 CSM and 2016 draft FS, EPA will update the groundwater RAOs upon selection of the Site's new groundwater remedy in a forthcoming decision document.

The 2016 draft FS includes new potential groundwater cleanup goals for each of the 22 groundwater COCs identified in the 2006 OU4 ROD Amendment. The new groundwater cleanup goals will be established in a decision document upon selection of the revised groundwater remedy. The groundwater cleanup goals included in the 2016 draft FS are based on groundwater concentrations protective of human health under an uncontrolled potable use scenario. While toxicity values for some groundwater COCs have changed since the selection of the previous groundwater remedies (2001 OU4 ROD -Appendix H), those changes be will updated and reflected in the Site's new groundwater remedy and associated cleanup goals.

The 2001 OU4 ROD did not establish soil cleanup goals. EPA selected the OU4 soil remedy based on potential risk to receptors and exposure pathways. Following the removal of soil with elevated concentrations of arsenic and lead, the Trust covered remaining soil contamination at the former CST and Chemical Plant areas with multi-layer asphalt caps. The caps eliminate exposure pathways to soil contamination. The Site's 2008 Environmental Covenant further eliminates an exposure pathway for soil beneath the capped areas by prohibiting activities that could impact the integrity of the remedy.

To address an issue and recommendation from the 2012 FYR regarding changes in toxicity criteria for dioxin, Geosyntec performed a detailed review of available dioxin/furan soil data for the areas not addressed by the OU4 remedy. The areas included the CST Ditch and Eastern Ditch (the perimeter ditch system). See Appendix J for detailed information regarding the evaluation. Geosyntec used available soil data for those ditch areas to calculate 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) toxicity equivalence (TEQ) concentrations based on current TEFs. The evaluation concluded that implementation of the soil component of the OU4 remedy adequately addressed dioxins/furans in site soil, and that remaining concentrations are present at levels consistent with the ROD-specific acceptable risk range. EPA accepted and approved the findings of the 2015 dioxin/furan soil data evaluation in a letter to the Trust on October 8, 2015. The letter stated that no further action was required.

QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?

Question C Summary:

No other information has come to light that could call into question the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the FYR:
OU1, OU2 and OU3

Issues and Recommendations Identified in the FYR:

OU(s): OU4	**Issue Category: Remedy Performance**
	Issue: In October 2014, EPA determined that the OU4 remedy is not functioning as designed and that RAOs will not be achieved with the current remedy.
	Recommendation: Complete the final OU4 FS, document the new groundwater remedy in a decision document, and implement the remedy to address remaining site-related groundwater contamination. To address issues identified in this FYR, ensure the new groundwater remedy incorporates current groundwater toxicity

	criteria into groundwater cleanup goals; establishes updated groundwater ARARs; and modifies groundwater institutional controls, as needed, to cover all areas of groundwater contamination.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP/EPA	EPA	9/30/2018

OTHER FINDINGS

In addition, the following are recommendations that were identified during the FYR, but do not affect current and/or future protectiveness:

- Provide the site records repository with copies of recent site-related documents, including but not limited to the 2012 FYR, the 2016 Groundwater CSM and the 2016 FS, once finalized.

VII. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)	
Operable Unit: OU1, OU2 and OU3	*Protectiveness Determination:* Protective
Protectiveness Statement: The remedies for OU1, OU2 and OU3 are protective of human health and the environment. There are no complete exposure pathways at the Site. The completion of remedial actions eliminated unacceptable risks previously associated with those OUs.	

Protectiveness Statement(s)	
Operable Unit: OU4	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The remedy for OU4 is protective of human health and the environment in the short term because exposure pathways that could result in unacceptable risks are being controlled. The soil component of the OU4 remedy has been implemented. Caps over the former CST and Chemical Plant areas and institutional controls eliminate exposure pathways to contaminated soil. EPA anticipates selecting a new groundwater remedy in the near future to address remaining groundwater contamination at the Site. It is anticipated that the new groundwater remedy will address other issues identified during this FYR.	

VIII. NEXT REVIEW

The next FYR Report for the Fike Chemical, Inc. Superfund site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

Amendment to the Record of Decision, Operable Unit 4 - Ground Water Component, Fike/Artel Site. December 28, 2006.

Dioxin/Furan Data Review Memorandum, Fike/Artel Superfund Site, Nitro, West Virginia. Prepared by Geosyntec Consultants for the Fike/Artel Trust. September 11, 2015.

Draft Groundwater Feasibility Study Report, Fike/Artel Superfund Site, Nitro, West Virginia. Prepared by Geosyntec for Fike/Artel Trust. November 2016.

Eleventh Annual Status Report on Institutional Controls. Fike/Artel Trust. December 10, 2012.

EPA Acceptance Letter, Revised Review of Existing Dioxin Data: Fike/Artel Superfund Site, Nitro, West Virginia. October 8, 2015.

EPA Letter, Fike Feasibility Study and Groundwater Conceptual Site Model. October 16, 2014.

EPA Letter, Response to October 14, 2014 Review of Dioxin with New Toxicity Data Letter. February 23, 2015.

EPA Superfund Record of Decision, Fike Chemical, Inc., OU 01, Nitro, West Virginia. U.S. EPA Region 3. September 29, 1988.

EPA Superfund Record of Decision, Fike Chemical, Inc., OU 02, Nitro, West Virginia. U.S. EPA Region 3. September 28, 1990.

EPA Superfund Record of Decision, Fike Chemical, Inc., OU 03, Nitro, West Virginia. U.S. EPA Region 3. March 31, 1992.

EPA Superfund Record of Decision, Fike Chemical, Inc., OU 04, Nitro, West Virginia. U.S. EPA Region 3. September 28, 2001.

Explanation of Significant Differences, Fike/Artel Chemical Site, Operable Unit 3, Nitro, West Virginia. U.S. EPA Region 3. May 19, 1993.

Explanation of Significant Differences, Fike/Artel Chemical Site, Operable Unit 3, Nitro, West Virginia. U.S. EPA Region 3. January 30, 1996.

Fike/Artel Superfund Site, 2012 Annual Soils O&M Inspection Summary. Prepared by KEMRON Environmental Services for Fike/Artel Trust. July 9, 2012.

Fike/Artel Superfund Site, Surface Water Management Area Wall Repair Inspection Summary. Prepared by KEMRON Environmental Services for Fike/Artel Trust. January 31, 2013.

Fike/Artel Superfund Site, 2013 Annual Soils O&M Inspection Summary. Prepared by KEMRON Environmental Services for Fike/Artel Trust. August 9, 2013.

Fike/Artel Superfund Site, 2014 Annual Soils O&M Inspection Summary. Prepared by KEMRON Environmental Services for Fike/Artel Trust. May 28, 2014.

Fike/Artel Superfund Site, 2014 Inspection Summary of Asphalt Sealing and Repairs. Prepared by KEMRON Environmental Services for Fike/Artel Trust. October 27, 2014.

Fike/Artel Superfund Site, 2015 Annual Soils O&M Inspection Summary. Prepared by KEMRON Environmental Services for Fike/Artel Trust. July 15, 2015.

Fike/Artel Superfund Site, 2015 Inspection Summary of Asphalt Sealing and Repairs. Prepared by KEMRON Environmental Services for Fike/Artel Trust. December 4, 2015.

Fike/Artel Superfund Site, 2016 Annual Soils O&M Inspection Summary. Prepared by KEMRON Environmental Services for Fike/Artel Trust. July 8, 2016.

Fike/Artel Superfund Site, 2016 Inspection Summary of Asphalt Sealing and Repairs. Prepared by KEMRON Environmental Services for Fike/Artel Trust. December 2, 2016.

Fourteenth Annual Status Report on Institutional Controls. Fike/Artel Trust. December 22, 2015.

Fourth Five-Year Review Report for Fike Chemical Superfund Site, Nitro, West Virginia. U.S. EPA Region 3. July 25, 2012.

Groundwater Conceptual Site Model, 2016 Update, Fike/Artel Superfund Site, Nitro, West Virginia. Prepared by Geosyntec for Fike/Artel Trust. May 2016.

OU4 Soils Operation and Maintenance Plan – Revision 2, Fike/Artel Superfund Site, Nitro, West Virginia. Prepared by Geosyntec Consultants for Fike/Artel Trust. January 2013.

Report of Phase II Vapor Intrusion Study, Fike/Artel Superfund Site, Nitro, West Virginia. Prepared by Geosyntec Consultants for the Fike/Artel Trust. March 2011.

Review of Dioxin with New Toxicity Data Letter, Fike/Artel Superfund Site, Nitro, West Virginia. Prepared by K&L Gates on behalf of the Fike/Artel Trust, for EPA. October 14, 2014.

Third Five-Year Review Report for Fike/Artel Chemical Superfund Site, Nitro, West Virginia. U.S. EPA Region 3. September 27, 2007.

Twelfth Annual Status Report on Institutional Controls. Fike/Artel Trust. December 18, 2013.

APPENDIX B – SITE CHRONOLOGY

Table B-1: Site Chronology

Event	Date
Chemicals manufacturing took place on site	1953-1988
Monitoring data verified the presence of groundwater contamination at the Site	Late 1970s
EPA proposed the Site for listing on the NPL	December 30, 1982
EPA listed the Site on the NPL	September 8, 1983
EPA began the remedial investigation and feasibility study (RI/FS) for OU1	July 9, 1987
EPA initiated a removal action to mitigate the threats to public health and the environment posed by the Site	June 11, 1988
EPA completed the removal action	June 13, 1988
EPA completed the RI/FS and issued a ROD for OU1	September 29, 1988
EPA began remedial action (continuation of removal action) at OU1	January 11, 1989
EPA began the RI/FS for OU2	May 17, 1989
EPA began the RI/FS for OU3	April 12, 1990
EPA completed the RI/FS and issued a ROD for OU2	September 28, 1990
EPA entered Consent Decree with thirteen PRPs to conduct remedial design and remedial action for OU2	February 20, 1992
PRPs began remedial design at OU2	February 27, 1992
EPA completed the RI/FS and issued a ROD for OU3	March 31, 1992
EPA issued an ESD for OU3	May 13, 1993
EPA issued a Unilateral Administrative Order to 20 PRPs to implement the OU3 remedy	June 30, 1993
PRPs completed remedial design and began remedial action for OU2 (demolition of structures)	September 22, 1993
EPA completed OU1 remedial action	September 30, 1993
PRPs began remedial design for OU3 (buried drums)	October 7, 1993
PRPs began remedial design for dioxin tanks (OU7)	August 22, 1994
EPA entered an Administrative Order on Consent with 13 PRPs to conduct an RI/FS for soils and groundwater (OU4) PRPs began RI/FS for OU4	September 30, 1994
PRPs began remedial design for wastewater treatment (OU6)	December 9, 1994
PRPs completed remedial design and began remedial action (disposal and treatment of dioxin tanks) (OU7)	May 18, 1995
PRPs completed remedial action at OU2 (demolition of structures)	May 31, 1995
PRPs completed remedial design and began remedial action for wastewater treatment (OU6)	August 28, 1995
EPA issued a second ESD for OU3	January 30, 1996
PRPs completed remedial design for OU3 (buried drums) PRPs began remedial action at OU3	February 7, 1996
Unilateral Administrative Order PRPs began a removal action (dismantling of the buildings and equipment at the CST) (OU8)	May 3, 1996
PRPs completed remedial action (disposal and treatment of dioxin tanks) (OU7)	June 5, 1996
EPA issued the first FYR	October 28, 1996
EPA and West Virginia entered Consent Decree with 54 PRPs, which required the PRPs to implement the remedial/removal actions associated with OU3, OU4 and the CST (OU8)	February 19, 1997

Event	Date
WVDEP recorded Notice of Access, Notice of Hazardous Waste Removal Activity and Deed Restriction, implementing institutional controls	March 6, 1997
PRPs completed a Sitewide removal action (dismantling of the buildings and equipment at the CST) (OU8) PRPs completed remedial action at OU3 (buried drums) PRPs completed remedial action (wastewater treatment) (OU6)	September 30, 1997
PRPs completed the RI/FS for OU4 EPA issued the ROD for OU4	September 28, 2001
PRPs began remedial design for the OU4 soil remedy	February 28, 2002
City of Nitro established the City of Nitro Ordinance 02-03 to prohibit the extraction of groundwater in certain areas within the City of Nitro, west of Route 25	March 19, 2002
PRPs completed remedial design for the OU4 soil remedy and began OU4 soil remedy (asphalt caps)	September 10, 2002
EPA issued the second FYR	September 30, 2002
Nitro Development Authority recorded First Amendment to Deed of Restrictive Covenants	October 15, 2002
PRPs completed the OU4 soil remedy (asphalt caps)	October 14, 2003
The Trust submitted a final completion report for the soil component of OU4	December 2003
Miss Utility Notification system initiated	May 2, 2005
EPA issued a ROD amendment for the groundwater component of OU4	December 28, 2006
PRPs began remedial design for OU4 (groundwater component)	December 29, 2006
PRPs completed remedial design for OU4 (groundwater component)	January 10, 2007
Remedy for Phase I of the groundwater component of OU4 became operational	June 12, 2007
EPA issued the third FYR	September 27, 2007
Nitro Development Authority and Equipment Care of Nitro, LLC recorded a Deed and Restrictive Covenant, implementing institutional controls	January 22, 2008
The Trust submitted the Phase I Groundwater Treatment System Evaluation	December 3, 2008
The Trust submitted the Report of Phase II Vapor Intrusion Study	March 9, 2011
The Trust submitted the Assessment of Groundwater-Surface Water Interaction Memorandum	April 25, 2011
West Virginia Department of Health and Human Resources established a SAC to address contaminated groundwater attributable to the Site	June 26, 2011
The Trust submitted an updated Groundwater CSM Report	January 30, 2012
The Trust submitted a revised O&M plan for OU4 soils	March 15, 2012
EPA issued the fourth FYR	July 25, 2012
The Trust submitted a second revised O&M plan for OU4 soils	January 28, 2013
EPA issued a letter to the Trust stating that the groundwater component of the OU4 remedy is neither functional nor protective of human health and the environment and that RAOs will not be achieved with the current remedy; the Trust initiated an FS to explore alternative remedial options to address remaining site groundwater contamination	October 16, 2014
The Trust shut down the OU4 Phase I biosparging system	April 2015
The Trust submitted an updated groundwater CSM to EPA	May 20, 2015
EPA approved the Trust's request to reduce the frequency of methane monitoring from twice a year to once a year	April 4, 2016
The Trust submitted the Site's Groundwater Conceptual Site Model, 2016 Update to EPA	May 20, 2016

Event	Date
The Trust initiated a year-long (quarterly) groundwater monitoring program to evaluate COC concentration variability while new groundwater remedial alternatives are considered	July 2016
The Trust submitted a draft FS to EPA for review	November 2, 2016
Trust updated west Virginia Miss Utility Notification Area boundary	July 14, 2017

APPENDIX C – SOIL COPCs LISTED IN THE 2001 OU4 ROD

Table C-1: Soil COPCs for the Chemical Plant Area

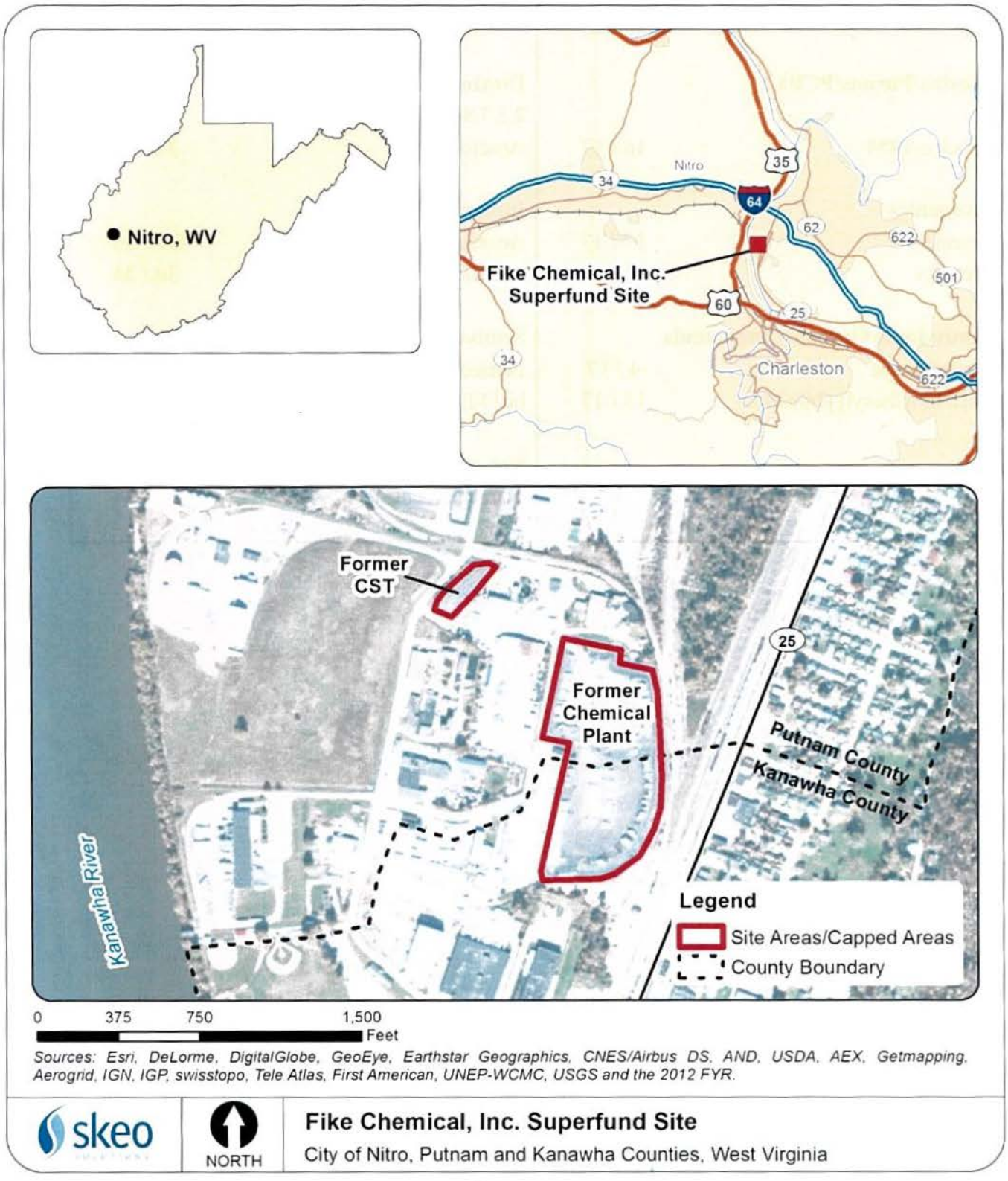
Surface Soil (0-2')		Mixed Soil (0-8')	
Constituent	**Frequency of Detection**	**Constituent**	**Frequency of Detection**
Dioxins/Furans/PCBs		**Dioxins/Furans/PCBs**	
2,3,7,8-TCDD Equiv.	1 / 1	2,3,7,8-TCDD Equiv.	28 / 34
Aroclor-1248	7 / 28	Aroclor-1248	14 / 94
Aroclor-1254	11 / 28	Aroclor-1254	40 / 94
Inorganics		**Inorganics**	
Arsenic	28 / 28	Arsenic	94 / 94
		Chromium	94 / 94
Mercury	28 / 28	Mercury	81 / 94
Pesticides/Herbicides		**Pesticides/Herbicides**	
alpha-BHC	6 / 28	alpha-BHC	17 / 94
Dieldrin	4 / 28	Dieldrin	15 / 94
Heptachlor	2 / 28	Heptachlor	3 / 94
		MCPA	4 / 103
Semivolatile Organic Compounds		**Semivolatile Organic Compounds**	
Benzo[a]anthracene	22 / 28	Benzo[a]anthracene	45 / 94
Benzo[a]pyrene	21 / 28	Benzo[a]pyrene	40 / 94
Benzo[b]fluoranthene	21 / 28	Benzo[b]fluoranthene	43 / 94
Benzothiazole	10 / 26	Benzothiazole	17 / 85
		bis[2-Ethylhexyl] phthalate	67 / 94
Dibenzo[a,h]anthracene	6 / 28	Dibenzo[a,h]anthracene	8 / 94
Indeno[1,2,3-cd]pyrene	22 / 28	Indeno[1,2,3-cd]pyrene	39 / 94
Volatile Organic Compounds		**Volatile Organic Compounds**	
		1,2-Dichloropropane	15 / 94
Benzene	5 / 28	Benzene	28 / 94
Benzyl Mercaptan	3 / 26	Benzyl Mercaptan	8 / 85
		Chloroform	7 / 94
		Tetrachloroethene	35 / 94
		Trichloroethene	29 / 94

Table C-2: Soil COPCs for the CST Area

Surface Soil (0-2')		Mixed Soil (0-8')	
Constituent	**Frequency of Detection**	**Constituent**	**Frequency of Detection**
Dioxins/Furans/PCBs		**Dioxins/Furans/PCBs**	
		2,3,7,8-TCDD Equiv.	5 / 5
Aroclor-1254	16 / 17	Aroclor-1254	31 / 34
Inorganics		**Inorganics**	
Arsenic	17 / 17	Arsenic	34 / 34
Mercury	16 / 17	Mercury	30 / 34
Semivolatile Organic Compounds		**Semivolatile Organic Compounds**	
Benzothiazole	4 / 17	Benzothiazole	6 / 34
bis[2-Ethylhexyl] phthalate	15 / 17	bis[2-Ethylhexyl] phthalate	30 / 34
		Volatile Organic Compounds	
		Tetrachloroethene	17 / 34

APPENDIX D – SITE MAPS

Figure D-1: Site Vicinity Map



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site.

APPENDIX E – SITE INSPECTION CHECKLIST

FIVE-YEAR REVIEW SITE INSPECTION CHECKLIST

I. SITE INFORMATION

Site Name: Fike Chemical, Inc.	**Date of Inspection:** 11/15/2016
Location and Region: Nitro, West Virginia 3	**EPA ID: WVD047989207**
Agency, Office or Company Leading the Five-Year Review: EPA Region 3	**Weather/Temperature:** Sunny and 50 degrees

Remedy Includes: (Check all that apply)

- ☒ Landfill cover/containment
- ☐ Access controls
- ☒ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other: _____
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (check all that apply)

1. **O&M Site Manager** Mike Samples (Name) | Project Manager, de maximis, Inc. (Title) | 11/21/2016 (Date)
   Interviewed ☐ at site ☐ at office ☒ by email Phone: _____
   Problems, suggestions ☐ Report attached: Completed interview questionnaire forms included in Appendix J. Interview responses summarized in Section IV.

2. **O&M Staff** _____ (Name) | _____ (Title) | _____ (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone Phone: _____
   Problems/suggestions ☐ Report attached: _____

3. **Local Regulatory Authorities and Response Agencies** (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices). Fill in all that apply.

   Agency _____
   Contact _____ (Name) | _____ (Title) | _____ (Date) | _____ (Phone No.)
   Problems/suggestions ☐ Report attached: _____

   Agency _____
   Contact _____Name | _____ (Title) | _____ (Date) | _____ (Phone No.)
   Problems/suggestions ☐ Report attached:_____

   Agency _____
   Contact _____ (Name) | _____ (Title) | _____ (Date) | _____ (Phone No.)
   Problems/suggestions ☐ Report attached:_____

   Agency _____
   Contact _____ (Name) | _____ (Title) | _____ (Date) | _____ (Phone No.)
   Problems/suggestions ☐ Report attached: _____

	Agency _____ Contact _____ Name	_____ Title	_____ Date	_____ Phone No.	
	Problems/suggestions ☐ Report attached: _____				
4.	**Other Interviews** (optional) ☒ Report attached: Completed interview questionnaire forms included in Appendix J. Interview responses summarized in Section IV.				
Residential Interview #1					
Residential Interview #2					
Residential Interview #3					
	III. ON-SITE DOCUMENTS AND RECORDS VERIFIED (check all that apply)				
1.	**O&M Documents**				
	☒ O&M manual	☒ Readily available	☒ Up to date	☐ N/A	
	☒ As-built drawings	☒ Readily available	☒ Up to date	☐ N/A	
	☒ Maintenance logs	☒ Readily available	☒ Up to date	☐ N/A	
	Remarks: _____				
2.	**Site-Specific Health and Safety Plan**	☒ Readily available	☒ Up to date	☐ N/A	
	☒ Contingency plan/emergency response plan	☒ Readily available	☒ Up to date	☐ N/A	
	Remarks: All field personnel maintain hard copies of these plans in their trucks. Electronic copies are also maintained.				
3.	**O&M and OSHA Training Records**	☒ Readily available	☒ Up to date	☐ N/A	
	Remarks: Training records are maintained electronically. Personnel complete annual Occupational Safety and Health Administration refresher trainings.				
4.	**Permits and Service Agreements**				
	☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A	
	☐ Effluent discharge	☐ Readily available	☐ Up to date	☒ N/A	
	☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A	
	☐ Other permits: _____	☐ Readily available	☐ Up to date	☒ N/A	
	Remarks: The Site does not operate under any permits.				
5.	**Gas Generation Records**	☐ Readily available	☐ Up to date	☒ N/A	
	Remarks: _____				
6.	**Settlement Monument Records**	☐ Readily available	☐ Up to date	☒ N/A	
	Remarks: There are no settlement markers.				
7.	**Groundwater Monitoring Records**	☒ Readily available	☒ Up to date	☐ N/A	
	Remarks: _____				
8.	**Leachate Extraction Records**	☐ Readily available	☐ Up to date	☒ N/A	
	Remarks: _____				
9.	**Discharge Compliance Records**				
	☐ Air	☐ Readily available	☐ Up to date	☒ N/A	

☐ Water (effluent) ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

10. **Daily Access/Security Logs** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for state

☐ PRP in-house ☒ Contractor for PRP

☐ Federal facility in-house ☐ Contractor for Federal facility

☐ _____

2. **O&M Cost Records**

☐ Readily available ☐ Up to date

☐ Funding mechanism/agreement in place X Unavailable

Original O&M cost estimate: _____ ☐ Breakdown attached

Total annual cost by year for review period if available

From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs during Review Period**

Describe costs and reasons: O&M costs not yet received.

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing Damaged** ☐ Location shown on site map ☐ Gates secured ☐ N/A

Remarks: All fencing appeared to be in good condition. Signage with institutional control information is posted on site fencing. All signs are in good condition.

B. Other Access Restrictions

1. **Signs and Other Security Measures** ☐ Location shown on site map ☒ N/A

Remarks: _____

C. Institutional Controls (ICs)

1. **Implementation and Enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive by): Self-reporting

Frequency: Annual

Responsible party/agency: PRP contractor, de maximis, inc., submits annual institutional control review reports to EPA.

Contact	Name	Title	Date	Phone no.
	Mike Samples	de maximis inc. Project Coordinator	_____	865-691-5052

Reporting is up to date ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A

Violations have been reported ☐ Yes ☐ No ☒ N/A

Other problems or suggestions: ☐ Report attached

2. **Adequacy** ☐ ICs are adequate ☒ ICs are inadequate ☐ N/A

Remarks: Overlapping institutional controls are in place to limit the CST and Chemical Plant properties to industrial use and prohibit groundwater extraction. Additional layers of overlapping institutional controls are in place to prevent groundwater use and well drilling at and surrounding the Site. This FYR determined that the HMPA plume in deep groundwater has expanded to the north and northeast beyond the extent of existing institutional controls. The West Virginia Miss Utility Notification area was expanded on July 14,2016 to encompass the entire area of impacted groundwater However, groundwater is not used at or near the Site, so there is no complete exposure pathway.

D. General

1. **Vandalism/Trespassing** ☐ Location shown on site map ☒ No vandalism evident

Remarks: _____

2. **Land Use Changes On Site** ☒ N/A

Remarks: There have been no land use changes on site since the 2012 FYR.

3. **Land Use Changes Off Site** ☒ N/A

Remarks: There have been no significant land use changes off site since the 2012 FYR.

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads Damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks: _____

B. Other Site Conditions

Remarks: Roads are in good condition.

VII. LANDFILL COVERS ☒ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (low spots) ☐ Location shown on site map ☒ Settlement not evident

	Area extent: _____		Depth: _____
	Remarks: _____		
2.	**Cracks**	☐ Location shown on site map	☐ Cracking not evident
	Lengths: _____	Widths: _____	Depths: _____
	Remarks: The site inspection team observed a few small cracks in the asphalt cap covering the CST property. The cracks are sealed annually, and on an as-needed basis. The small cracks are not significant enough to impact the functionality of the cap.		
3.	**Erosion**	☐ Location shown on site map	☒ Erosion not evident
	Area extent: _____		Depth: _____
	Remarks: _____		
4.	**Holes**	☐ Location shown on site map	☒ Holes not evident
	Area extent: _____		Depth: _____
	Remarks: _____		
5.	**Vegetative Cover**	☐ Grass	☐ Cover properly established
	☐ No signs of stress	☐ Trees/shrubs (indicate size and locations on a diagram)	
	Remarks: Not applicable.		
6.	**Alternative Cover** (e.g., armored rock, concrete)		☐ N/A
	Remarks: The asphalt caps covering the Chemical Plant and CST properties appeared to be in good condition. The site inspection team observed some small cracks in the CST cap, which are sealed annually. The small cracks are not significant enough to impact the functionality of the cap.		
7.	**Bulges**	☐ Location shown on site map	☒ Bulges not evident
	Area extent: _____		Height: _____
	Remarks: _____		
8.	**Wet Areas/Water Damage**	☒ Wet areas/water damage not evident	
	☐ Wet areas	☐ Location shown on site map	Area extent: _____
	☐ Ponding	☐ Location shown on site map	Area extent: _____
	☐ Seeps	☐ Location shown on site map	Area extent: _____
	☐ Soft subgrade	☐ Location shown on site map	Area extent: _____
	Remarks: _____		
9.	**Slope Instability**	☐ Slides	☐ Location shown on site map
	☒ No evidence of slope instability		
	Area extent: _____		
	Remarks: _____		
B. Benches		☐ Applicable	☒ N/A
	(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)		

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

C. Letdown Channels ☐ Applicable ☒ N/A

(Channel lined with erosion control mats, riprap, grout bags or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ No evidence of settlement

Area extent: _____ Depth: _____

Remarks: _____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation

Material type:_____ Area extent: _____

Remarks: _____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion

Area extent: _____ Depth: _____

Remarks: _____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting

Area extent: _____ Depth: _____

Remarks: _____

5. **Obstructions** Type: _____ ☐ No obstructions

☐ Location shown on site map Area extent: _____

Size: _____

Remarks: _____

6. **Excessive Vegetative Growth** Type: _____

☐ No evidence of excessive growth

☐ Vegetation in channels does not obstruct flow

☐ Location shown on site map Area extent: _____

Remarks: _____

D. Cover Penetrations ☒ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☐ Passive

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A

Remarks: _____

2. **Gas Monitoring Probes**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks: _____

3. **Monitoring Wells** (within surface area of landfill)
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A
Remarks: _____

4. **Extraction Wells Leachate**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A
Remarks: _____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☒ N/A
Remarks: _____

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. **Gas Treatment Facilities**
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs maintenance
Remarks: _____

2. **Gas Collection Wells, Manifolds and Piping**
☐ Good condition ☐ Needs maintenance
Remarks: _____

3. **Gas Monitoring Facilities** (e.g., gas monitoring of adjacent homes or buildings)
☐ Good condition ☐ Needs maintenance ☐ N/A
Remarks: _____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
Remarks: _____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
Remarks: _____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. **Siltation** Area extent: _____ Depth: _____ ☐ N/A
☐ Siltation not evident
Remarks: _____

2. **Erosion** Area extent: _____ Depth: _____
☐ Erosion not evident
Remarks: _____

3. **Outlet Works** ☐ Functioning ☐ N/A

Remarks: _____

4. **Dam** ☐ Functioning ☐ N/A

Remarks: _____

H. Retaining Walls ☐ Applicable ☒ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident

Horizontal displacement: _____ Vertical displacement: _____

Rotational displacement: _____

Remarks: _____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident

Remarks: _____

I. Perimeter Ditches/Off-Site Discharge ☒ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☒ Siltation not evident

Area extent: _____ Depth: _____

Remarks: _____

2. **Vegetative Growth** ☐ Location shown on site map ☒ N/A

☐ Vegetation does not impede flow

Area extent: _____ Type: _____

Remarks: _____

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident

Area extent: _____ Depth: _____

Remarks: _____

4. **Discharge Structure** ☒ Functioning ☐ N/A

Remarks: The surface water management system that runs along the eastern edge of the Chemical Plant property is paved and includes three sluice gates that can be closed in the event of a spill. The concrete within the surface water management system appeared to be in good condition.

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident

Area extent: _____ Depth: _____

Remarks: _____

2. **Performance Monitoring** Type of monitoring: _____

☐ Performance not monitored

Frequency: _____ ☐ Evidence of breaching

Head differential: _____

Remarks: _____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps and Pipelines ☐ Applicable ☒ N/A

1. **Pumps, Wellhead Plumbing and Electrical**

☐ Good condition ☐ All required wells properly operating ☐ Needs maintenance ☐ N/A

Remarks: _____

2. **Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances**

☐ Good condition ☐ Needs maintenance

Remarks: _____

3. **Spare Parts and Equipment**

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks: _____

B. Surface Water Collection Structures, Pumps and Pipelines ☐ Applicable ☒ N/A

1. **Collection Structures, Pumps and Electrical**

☐ Good condition ☐ Needs maintenance

Remarks: _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes and Other Appurtenances**

☐ Good condition ☐ Needs maintenance

Remarks: _____

3. **Spare Parts and Equipment**

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks: _____

C. Treatment System ☐ Applicable ☒ N/A

1. **Treatment Train** (check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation

☐ Air stripping ☐ Carbon adsorbers

☐ Filters: _____

☐ Additive (e.g., chelation agent, flocculent): _____

☐ Others: _____

☐ Good condition ☐ Needs maintenance

☐ Sampling ports properly marked and functional

☐ Sampling/maintenance log displayed and up to date

☐ Equipment properly identified

☐ Quantity of groundwater treated annually: _____

☐ Quantity of surface water treated annually: _____

Remarks: _____

2. **Electrical Enclosures and Panels** (properly rated and functional)

☐ N/A ☐ Good condition ☐ Needs maintenance

Remarks: _____

3. **Tanks, Vaults, Storage Vessels**

☐ N/A ☐ Good condition ☐ Proper secondary containment ☐ Needs maintenance

Remarks: _____

4. **Discharge Structure and Appurtenances**

☐ N/A ☐ Good condition ☐ Needs maintenance

Remarks: _____

5. **Treatment Building(s)**

☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair

☐ Chemicals and equipment properly stored

Remarks: _____

6. **Monitoring Wells** (pump and treatment remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: _____

D. Monitoring Data

1. **Monitoring Data**

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. **Monitoring Data Suggests:**

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition

☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: The original groundwater remedy included groundwater extraction and treatment. The OU4 ROD Amendment replaced groundwater extraction and treatment with in-situ biosparging. Based on data collected during subsequent investigations and pilot studies, EPA required the completion and submission of a new FS and groundwater conceptual site model. Both documents have been completed and submitted. The FS is currently under EPA review.

X. OTHER REMEDIES

If there are remedies applied at the site and not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is designed to accomplish (e.g., to contain contaminant plume, minimize infiltration and gas emissions).

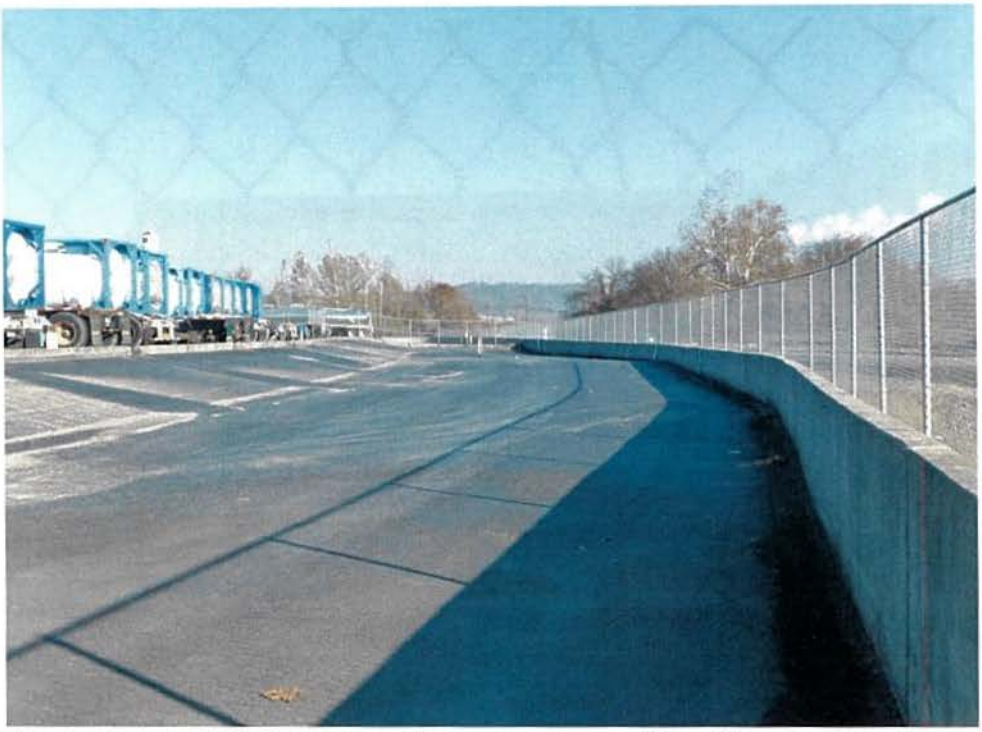
Risks associated with OU1 were addressed through the removal and off-site disposal of hazardous materials stored in drums, cylinders, containers and tanks. The Trust addressed OU2 risks through the dismantling and decontamination of all tanks, equipment and buildings. Risks associated with OU3 were addressed through the excavation of buried drums and containers from the southern portion of the Site and construction of a modified surface water runoff treatment system. The excavation and off-site removal of impacted soil from a former lagoon, the flushing/cleaning of the sewers associated with the facility, installation of multi-layer asphalt caps over the CST and Chemical Plant areas, and implementation of institutional controls addressed the risks associated with impacted soil at OU4. The original groundwater remedy included groundwater extraction and treatment. The OU4 ROD Amendment replaced groundwater extraction and treatment with in-situ biosparging. In October 2014, EPA determined that the OU4 remedy is not functional and that RAOs will not be achieved with the current remedy. EPA required the completion and submission of a new feasibility study and groundwater conceptual site model. Both

	documents have been completed and submitted. The FS is currently under EPA review. Using the information in the 2016 FS, EPA anticipates selecting a new groundwater remedy to address Sitewide groundwater contamination in a forthcoming decision document.
B.	**Adequacy of O&M**
	Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. There are no O&M requirements associated with the OU1, OU2 or OU3 remedies. O&M activities at the Site address the soil component of the OU4 remedy. O&M activities include monitoring the condition and performance of the cap systems and identifying repair and maintenance required to preserve the integrity of the cap systems. KEMRON performs annual site O&M inspections and submits inspection findings to EPA in Annual Soils O&M Inspection Summary reports. Following the submission of the annual O&M reports, KEMRON addresses report recommendations and documents any needed maintenance and/or repairs in annual Asphalt Sealing and Repair Inspection Reports. Previous groundwater O&M plans are no longer applicable given the current status of the groundwater remedy. Operation of the Phase I biosparging system stopped in 2015. O&M requirements for site groundwater will be established following the selection of a new groundwater remedy. Based on site inspection observations and a review of O&M documents, site O&M seems to be adequate. This FYR has not identified any major O&M-related issues.
C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. The new FS is expected to address issues related to the groundwater remedy.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. No opportunities for optimization have been identified.

APPENDIX F – SITE INSPECTION PHOTOS

Dana Transport office, adjacent to the Chemical Plant property.

The Chemical Plant property, looking north. Dana Container Inc. parks clean, empty trailers on the asphalt cap. A small crack in the asphalt is visible.



Stormwater management feature along the eastern edge of the Chemical Plant property cap.

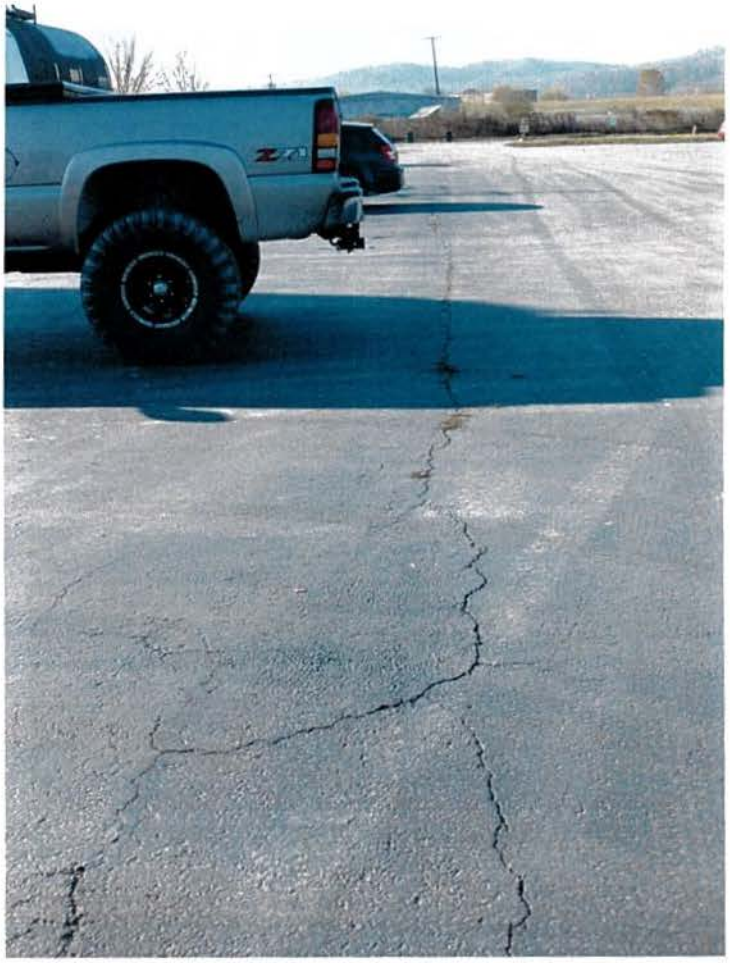
One of the three sluice gates built into the Chemical Plant property stormwater management feature.

Institutional control sign posted along the Chemical Plant property perimeter fence.

Looking west across the Kanawha River.
(Photo taken from northwest of the CST part of the Site).

Groundwater monitoring well PBW-8, located adjacent to the Kanawha River and northwest of the CST part of the Site.

View of the asphalt cap covering the CST property, looking south.



Crack in the CST cap, running north to south.

Back view of the Dana Container, Inc. Cleaning Facility immediately east of the CST property.

Flush-mounted groundwater monitoring well MW-115D, located in CST cap.

APPENDIX G – DETAILED ARARs REVIEW TABLES

ARARs Review

CERCLA Section 121(d)(1) requires that Superfund remedial actions attain "a degree of cleanup of hazardous substances, pollutants, and contaminants released into the environment and of control of further release at a minimum which assures protection of human health and the environment." The remedial action must achieve a level of cleanup that at least attains those requirements that are legally applicable or relevant and appropriate. In performing the FYR for compliance with ARARs, only those ARARs that address the protectiveness of the remedy are reviewed.

Groundwater ARARs

The 2001 OU4 ROD established the following standards as chemical-specific ARARs for groundwater: the National Primary Drinking Water Standards' MCLs and non-zero MCLGs, and West Virginia groundwater standards (WV C.S.R. section 46-12-3.1 to -3.5a). The 2006 OU4 ROD Amendment did not change the groundwater ARARs. This FYR compared the groundwater ARARs identified in the 2001 OU4 ROD to current federal and state standards (Table G-1). The groundwater standards for arsenic, bis(2-ethylhexyl)phthalate (BCEP) and chloroform have become more stringent since the 2001 OU4 ROD. The standards for the other 19 COCs remain unchanged.

Table G-1: Previous and 2016 ARARs for Groundwater COCs

Contaminant	Previous Standard (2001 OU4 ROD) (µg/L)[a]	2017 Federal MCL or non-zero MCLG (µg/L)[b]	West Virginia Groundwater Standard (µg/L)[c]	ARARs Change
Aldrin	N/A	N/A[d]	N/A[e]	None
Arsenic	50	10	10	More stringent
Benzene	5	5	5	None
Alpha-benzene hexachloride (BHC)	N/A	N/A	N/A	None
Bis(2-chloroethyl)ether (BCEE)	N/A	N/A	N/A	None
Bis(2-chloroisopropyl)ether (BCIPE)	N/A	N/A	N/A	None
Bis(2-ethylhexyl)phthalate (BCEP)	N/A	6	6	More stringent
Carbon tetrachloride	5	5	5	None
Chlorobenzene	100	100	N/A	None
Chloroform	N/A	70	N/A	More stringent
4,4'-DDT	N/A	N/A	N/A	None
1,2-dichloroethane (1,2-DCA)	5	5	5	None
1,2-dichloropropane (1,2-DCP)	5	5	5	None
1,3-dimethyl-2-thiourea (DMTU)	N/A	N/A	N/A	None
Heptachlor	0.4	0.4	0.4	None
Hexamethylphosphoramide (HMPA)	N/A	N/A	N/A	None
Iron	N/A	N/A	N/A	None
Manganese	N/A	N/A	N/A	None
Tetrachloroethene	5	5	5	None
1,1,2-trichloroethane	5	5	5	None
Trichloroethene	5	5	5	None
Vinyl chloride	2	2	2	None

Contaminant	Previous Standard (2001 OU4 ROD) (µg/L)[a]	2017 Federal MCL or non-zero MCLG (µg/L)[b]	West Virginia Groundwater Standard (µg/L)[c]	ARARs Change

[a] Cleanup goal as listed in Table 1 of the 2001 OU4 ROD.
[b] MCLs accessed at https://www.epa.gov/ground-water-and-drinking-water/table-regulated-drinking-water-contaminants on January 13, 2017.
[c] West Virginia State Regulation, Title 46 Series 12 accessed at http://apps.sos.wv.gov/adlaw/csr/readfile.aspx?DocId=7200&Format=PDF on January 13, 2017.
[d] In the "2017 Federal MCL or non-zero MCLG" column, "N/A" indicates that the contaminant has no MCL or non-zero MCLG.
[e] In the "West Virginia Groundwater Standard" column, "N/A" indicates that the contaminant has no groundwater quality standard in the Title 46 Series 12 regulation.

Soil ARARs

The 2001 OU4 ROD did not specify chemical-specific ARARs for soil. Cleanup goals for soil COCs were based on a site-specific risk assessment which assumed that the Chemical Plant and CST properties would continue to be used for industrial purposes.

APPENDIX H – DETAILED DATA ANALYSIS AND FIGURES

Per EPA request, the Trust developed an updated CSM in May 2016. This data review evaluates the groundwater data used to develop the 2016 CSM, discusses the rationale for EPA's determination regarding the failure of the groundwater remedy and presents an overview of current groundwater concentrations. The 2016 CSM and ongoing groundwater monitoring compare COC concentrations to the preliminary cleanup goals for groundwater listed in the Site's draft FS. Figures H-1 and H-2 below show current CSM schematics.

Groundwater – Data Indicating Ineffectiveness of Biosparging to Address HMPA

SVOCs, specifically HPMA, are the focus of the groundwater remedial activities at the Site. Data evaluated for the 2016 CSM clearly showed that the biosparging remedy did not effectively address HMPA in site groundwater. At six monitoring locations, the CSM compared HMPA concentrations during biosparging system operations (between February 2014 and February 2015) to HMPA concentrations following shutdown of the system in December 2015 (Table H-1). At four of the six locations, the post-shutdown concentrations are comparable to the upper range of the historical pre-shutdown data. The wells evaluated are located in the center of the HMPA plume, immediately adjacent to and northeast of the biosparging system (Figures H-3 and H-4).

Table H-1: Groundwater Concentrations of HMPA Following Cessation of the Phase I Biosparge Treatment

Preliminary Cleanup Goal for HMPA = 8.6 µg/L	**Pre-Shutdown Concentrations (µg/L)[a]**	**Post-Shutdown Concentrations (µg/L) December 2015**
Well	**Average (Min. – Max.)[b]**	**Concentration**
PR-MW-50	1956 (1700 - 2120)	2420 J
PR-PEW-200	1912 (1600 – 2150)	2250 J
PRR-MW-50	2130 (1970 – 2400)	2440 J
PRR-PEW-200	2408 (2040 – 2660)	2780 J
R25-MW-50	526 (449 – 640)	237 J
R25-PEW-200	604 (552 – 714)	580 J

[a] The Phase I biosparge treatment system operated from 2007 until April 2015. Pre-shutdown results include quarterly data collected between February 2014 and February 2015.
[b] Min. = minimum concentration; Max. = maximum detected concentrations
µg/L – microgram per liter
J – estimated value
MW – monitoring well

Groundwater – Current Conditions

Sampling has detected 22 groundwater COCs in site groundwater, some close to or within site property boundaries and others at distances of up to about one mile downgradient. According to the Site's 2016 CSM, groundwater contamination near the Site is present primarily within the shallow alluvial zone, potentially due to low hydraulic conductivity in the area. Further downgradient, COCs have migrated from the shallow alluvial zone to the intermediate and deeper zones. A slight upward gradient exists from the bedrock aquifer to the alluvial aquifer, reducing the potential for contamination to impact the deeper bedrock aquifer.

Seven organic constituents (1,2-DCP, benzene, chloroform, vinyl chloride, HMPA, DMTU, and BCEE) are present in relatively coherent plumes originating from the Site. COC distributions generally indicate a northeast and/or north-northwest flow path, with the greatest plume extents observed to the northeast. This is consistent with higher observed hydraulic conductivities to the northeast. Review of the distribution of these seven COCs also indicates the potential for off-site sources of select VOCs. This would be consistent with the highly industrialized nature of the Kanawha Valley. Figures H-5 through H-11 show historic and current plume locations for the seven COCs discussed above.

The configurations of COC plumes vary considerably among the COCs due to factors such as potential discharge locations and specific transport characteristics. In some cases (e.g., HMPA), plumes are mostly present in off-site areas with limited presence on site, potentially indicating depletion of source mass and a detached plume. COC concentrations are generally bounded with slight temporal changes along the northern fringe, suggesting limited northern migration of the groundwater plume. Sampling performed during the development of the updated CSM indicated that HMPA is the most widespread COC, and the other COCs exist within the footprint of the HMPA plume. Pesticides are very limited in extent due to their poor mobility. Metals are predominant immediately downgradient of the Site due to localized changes in groundwater geochemistry likely brought about by degradation of VOCs.

Data evaluated during the development of the 2016 CSM suggest that the HMPA plume is migrating to the northeast, along a narrow corridor in the deep zone (Figure H-5). The corridor is bounded to the northwest and southeast by locations of low, non-detected or stable HMPA concentrations. Data for other COCs suggest relatively stable conditions, with limited migration of the plume to the north-northwest. As part of this FYR, the data review process included a comparison of the locations of current groundwater contamination to the extent of existing groundwater institutional controls. Under existing conditions, the Site's institutional controls did not cover the entire area impacted by groundwater contamination. The West Virginia Miss Utility Notification area was expanded on July 14,2016 to encompass the entire area of impacted groundwater (Figure 2). However, potable groundwater use in the vicinity of the Site is not anticipated, because of overall poor groundwater quality in the Kanawha Valley. According to the draft FS, the new groundwater remedy is expected to address the migration of COCs to the northeast, and include monitoring and modification of current institutional controls, as needed.

To better understand concentration variability and support long-term management decisions, the Trust began quarterly groundwater sampling in July 2016. The Trust analyzed VOCs and SVOCs in groundwater samples to further evaluate the variability within the plume. The sampling program will continue until July 2017. A long-term monitoring network consisting of 28 wells has been established to evaluate long-term trends of COCs in Sitewide groundwater.

Evaluation of Groundwater-Surface Water Interaction

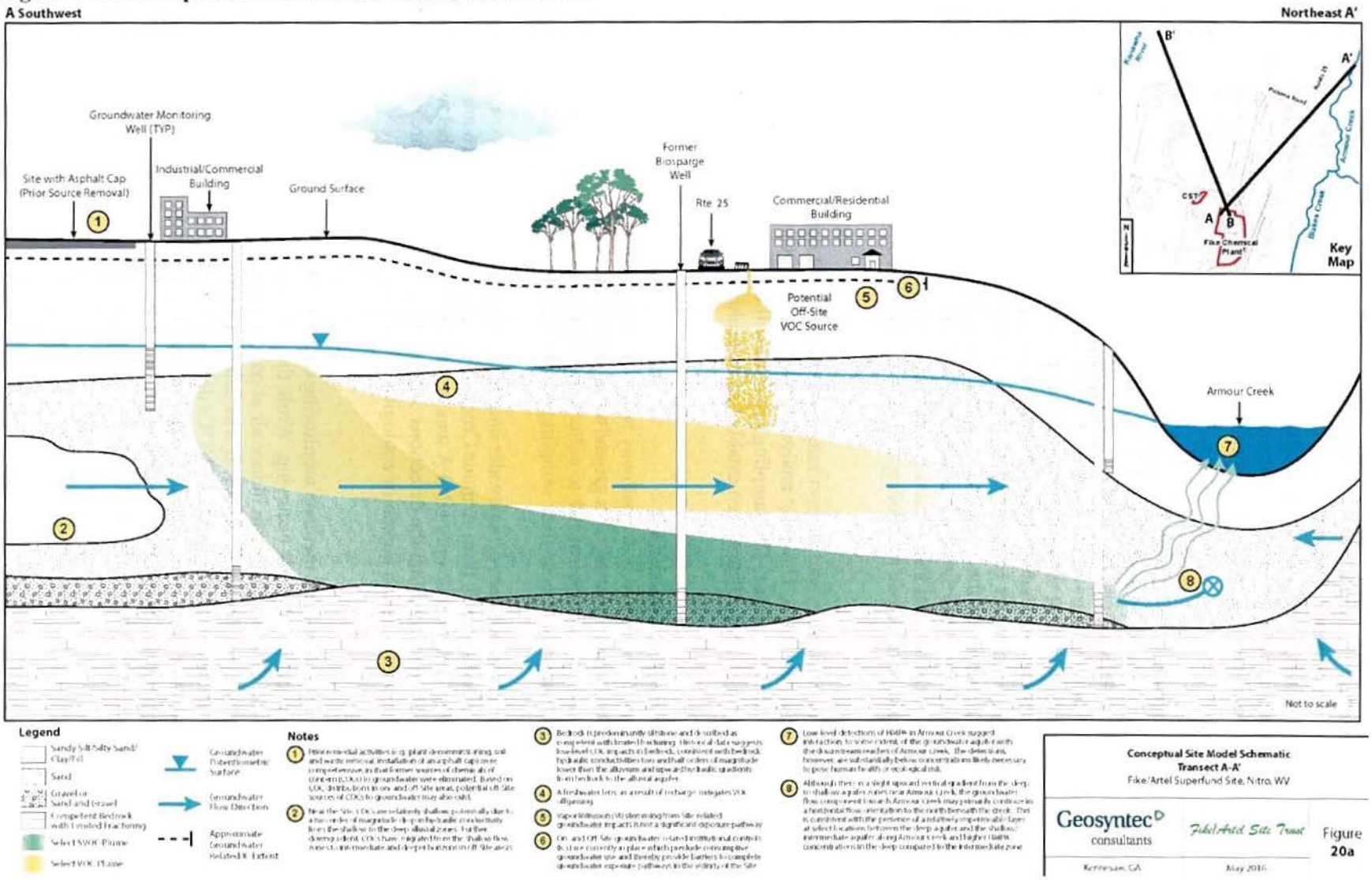
The Trust evaluated the groundwater to surface water pathway between the site groundwater and the Kanawha River in 2011 and 2015. Both evaluations indicated that groundwater contamination is unlikely to discharge to the Kanawha River at levels that would pose ecological risk to either water column or benthic receptors. Table H-2 shows the comparison of the December 2015 near-river sampling results to ecological screening values (ESVs).

The Trust also evaluated the interaction between groundwater and the downstream reaches of Armour Creek. Trust contractor, Geosyntec, collected samples from Armour Creek in late 2015 and early 2016 and analyzed for HMPA, BCEE and DMTU. During both events, only HMPA was detected at low levels, well below the calculated acute and chronic ESVs. The CSM concluded that the detections of HMPA in Armour Creek are substantially below concentrations necessary to pose a risk to human or ecological receptors.

Vapor Intrusion

The Site's 2011 vapor intrusion assessment and methane monitoring data indicate that vapor intrusion stemming from site-related groundwater impacts is not is not occurring. While the 2011 vapor intrusion assessment determined that four site-related COCs were present in indoor air at concentrations that exceeded risk-based screening levels for the industrial and residential scenarios. It was determined that none of the exceedances stemmed from site-related vapor intrusion. The majority of VOCs detected in buildings originated from sources not related to site-specific groundwater migration. The 2011 vapor intrusion assessment led to the development of the ongoing methane monitoring program. Since the initiation of the Site's methane monitoring program in 2013, methane gas has not been detected during any sampling event.

Figure H-1: Conceptual Site Model Schematic, Transect A-A'[1]



[1] Figures in this Appendix are from the Site's Groundwater Conceptual Site Model, 2016 Update.

Figure H-2: Conceptual Site Model Schematic, Transect B-B'

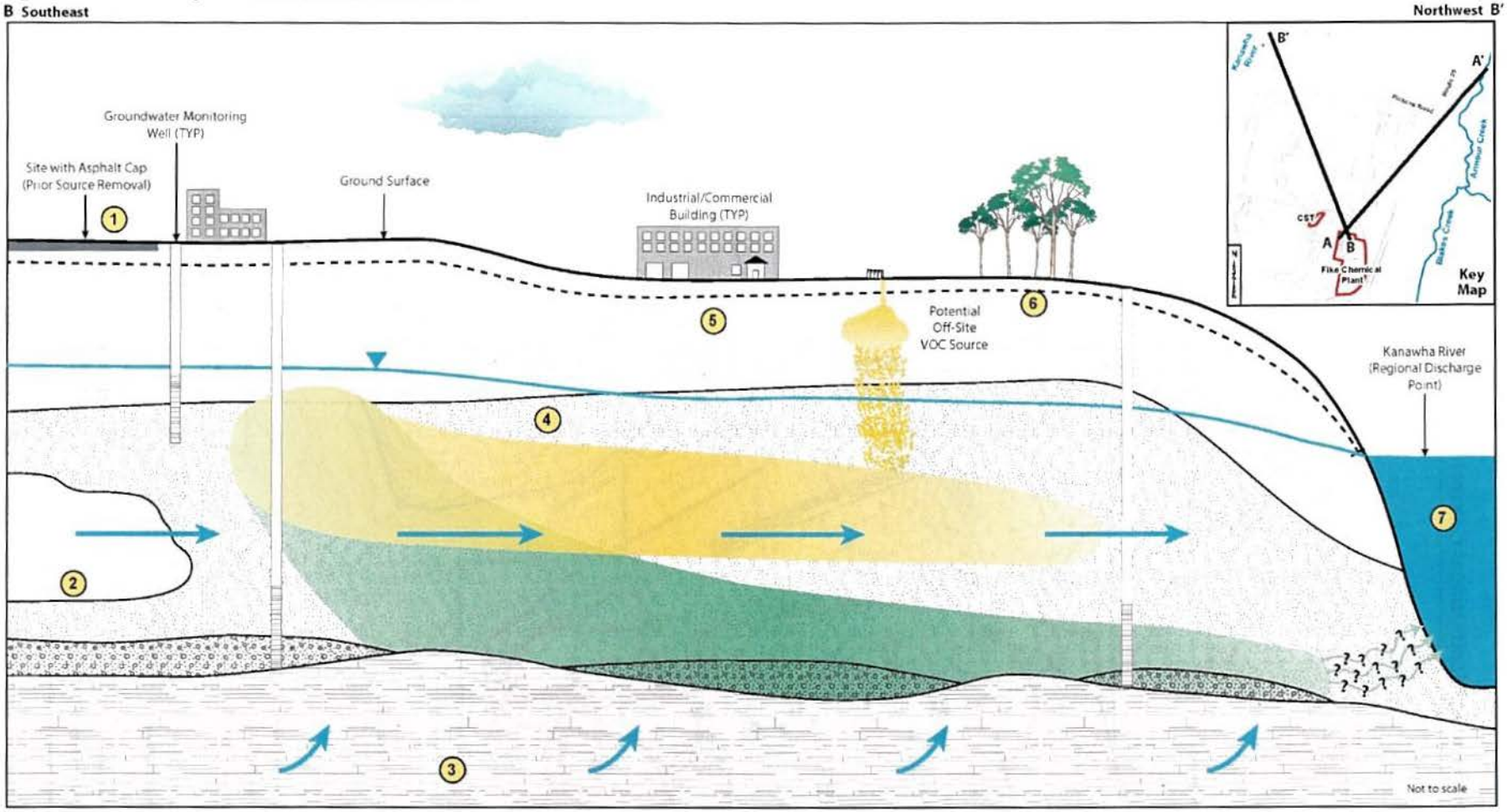


Figure H-3: Site Remedial Features and Institutional Control Boundaries

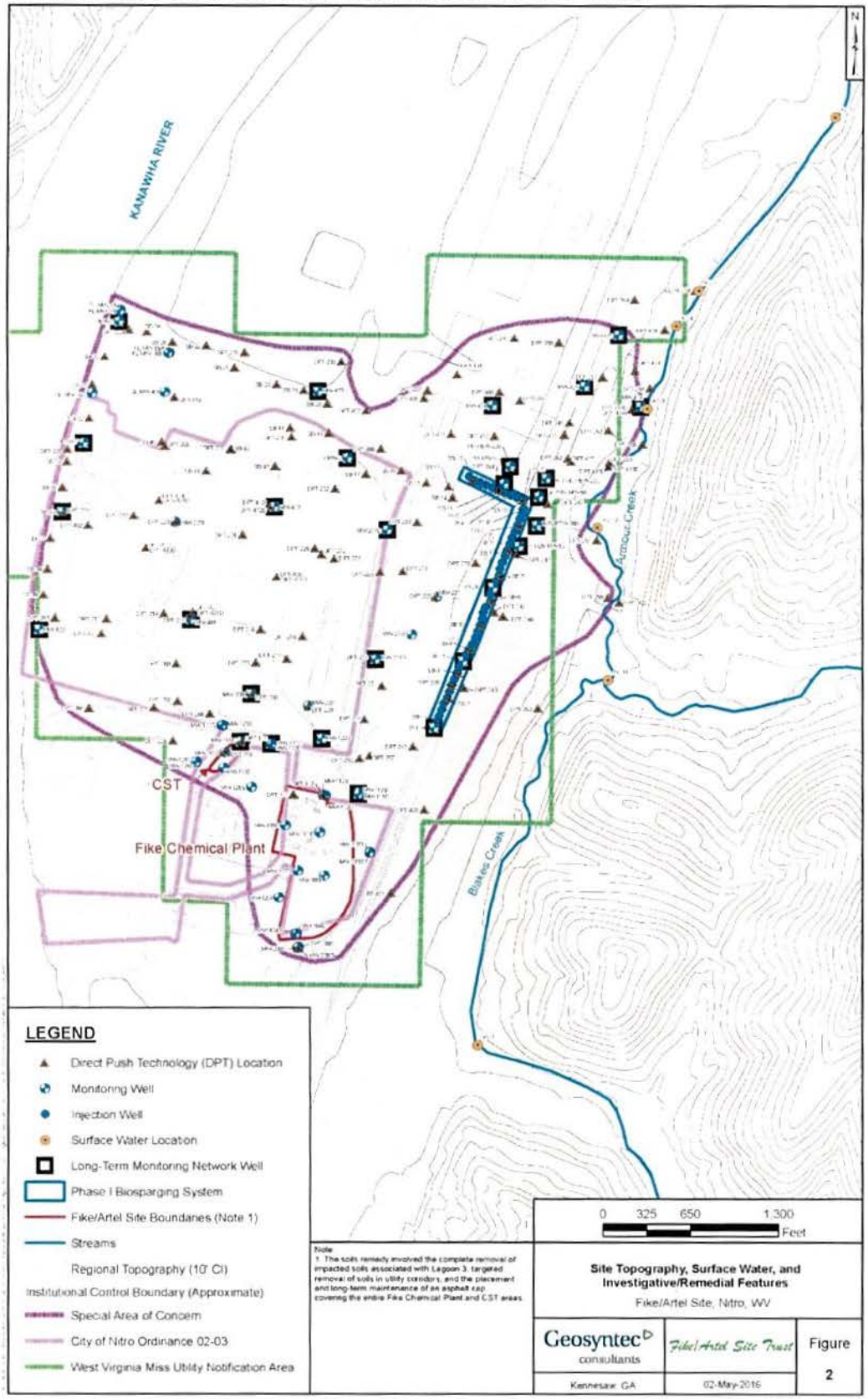


Figure H-4: Locations of Wells Mentioned Specifically in the Detailed Data Analysis

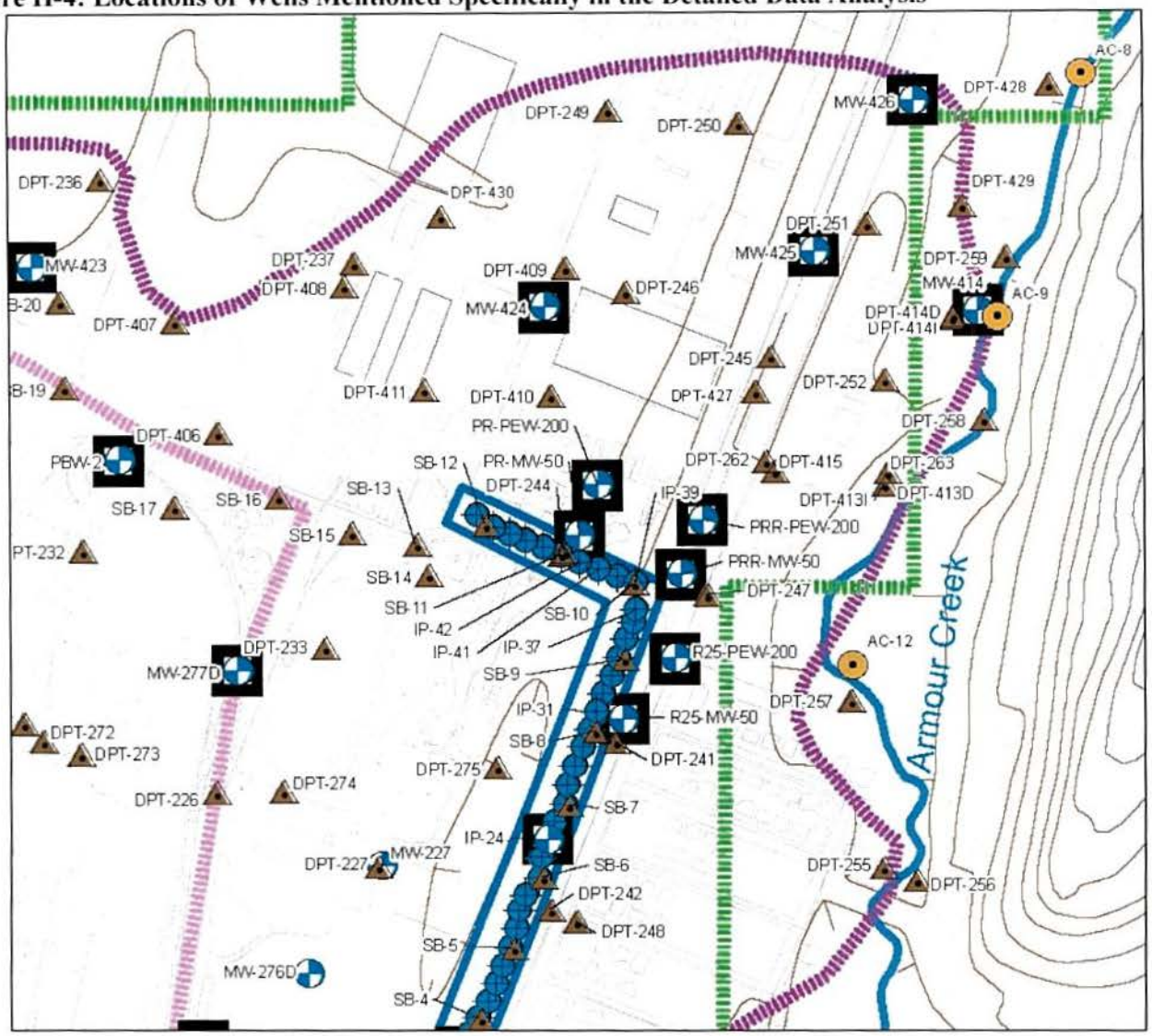


Figure H-5: Prior and Current HMPA Plume Locations in Deep Zone Groundwater and Surface Water

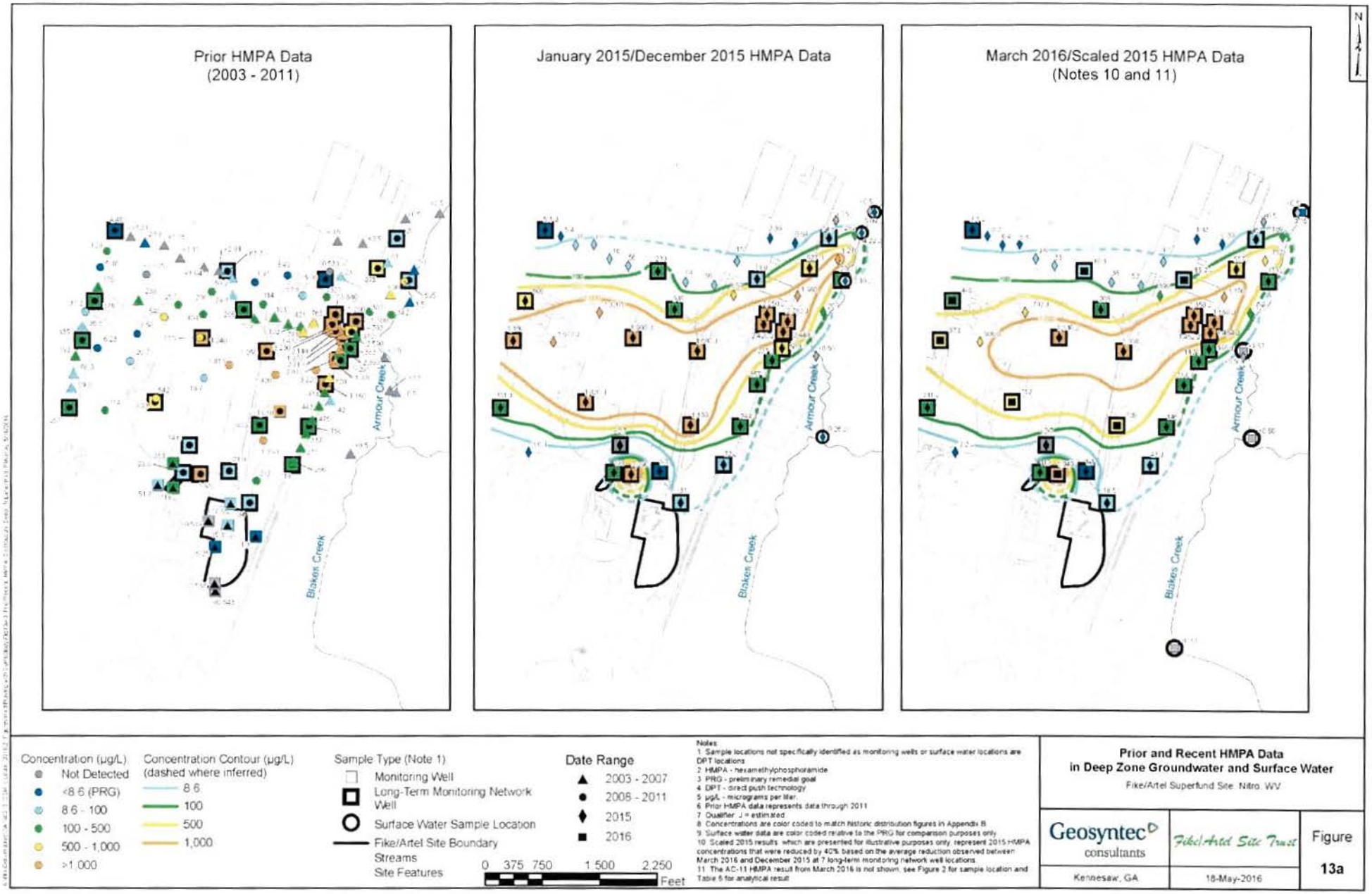


Figure H-6: Historic and 2015 Data for 13DM2TU: Deep Zone Groundwater and Surface Water

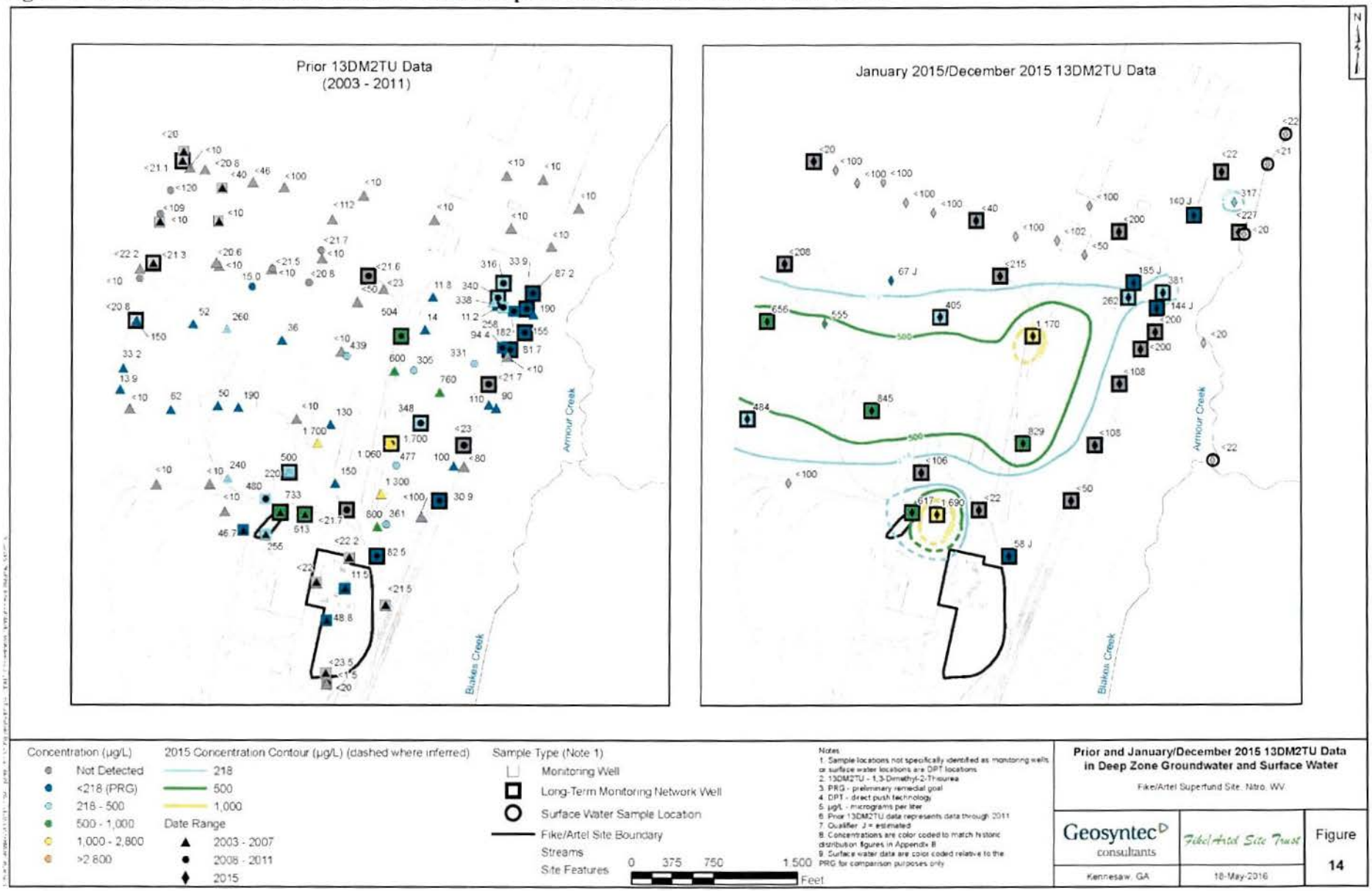


Figure H-7: Historic and 2015 Data for BCEE: Deep Zone Groundwater and Surface Water

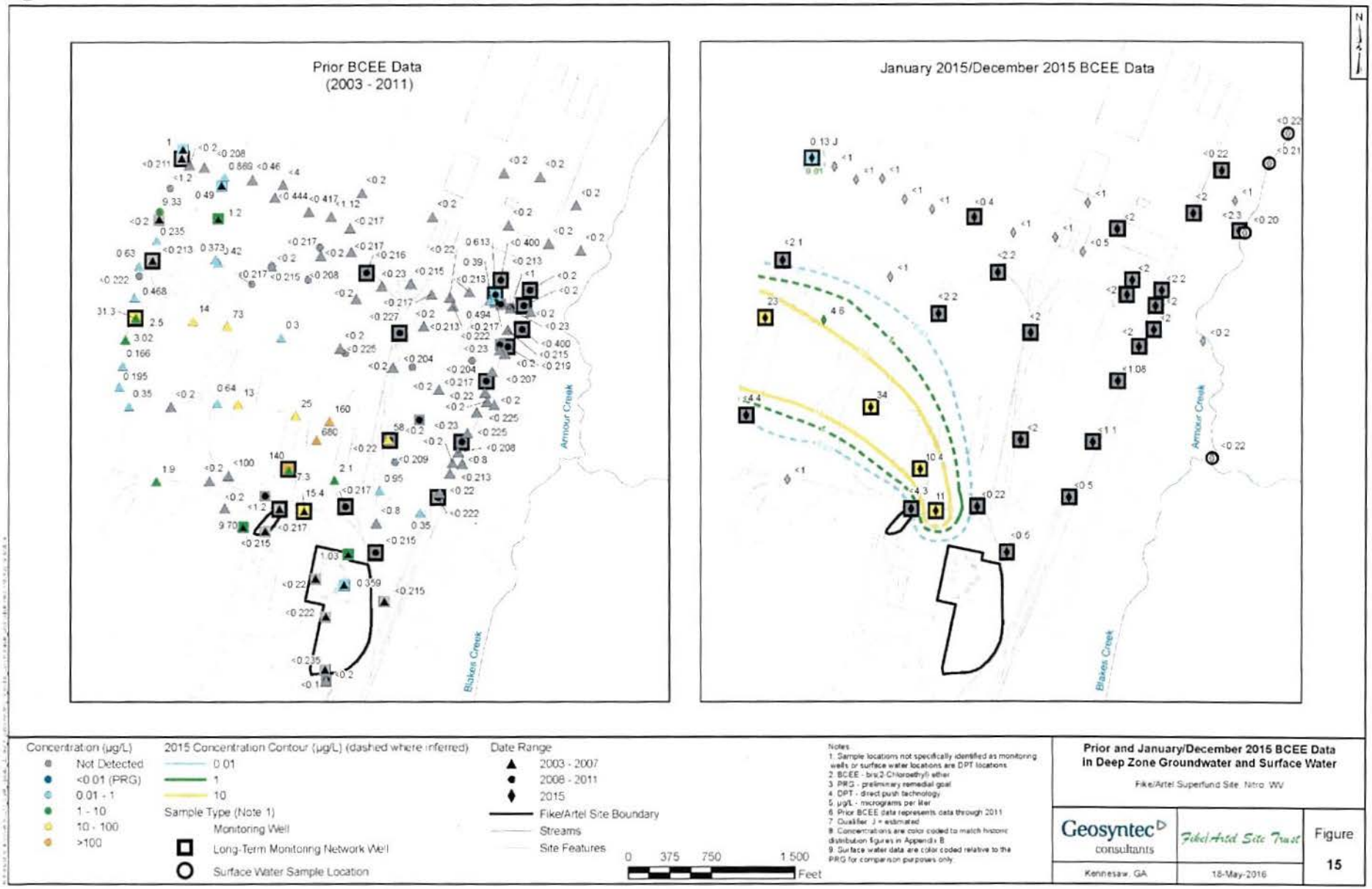


Figure H-8: Historic and 2015 Data for 1,2-DCP: Deep Zone Groundwater

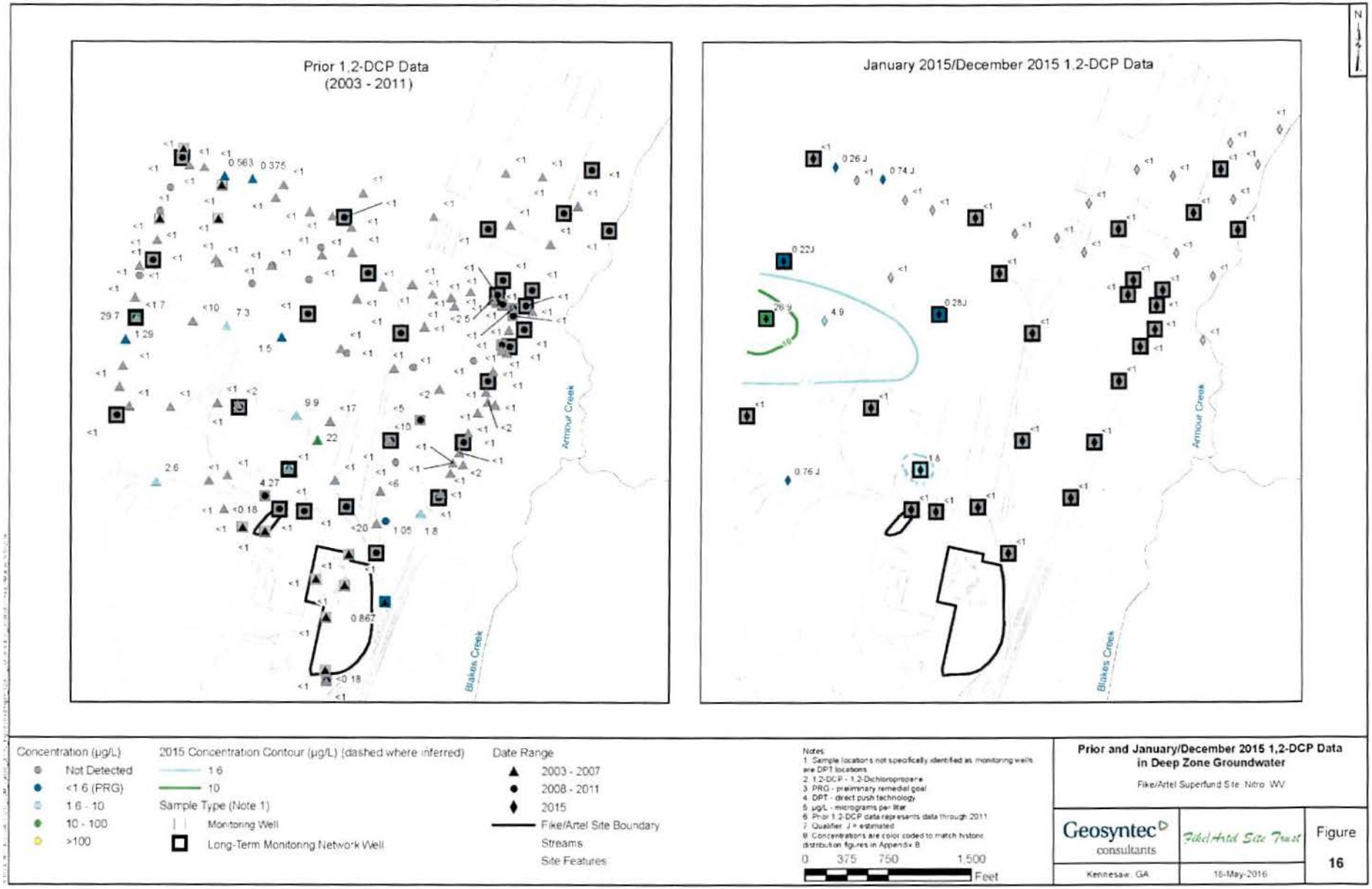


Figure H-9: Historic and 2015 Data for Benzene: Deep Zone Groundwater

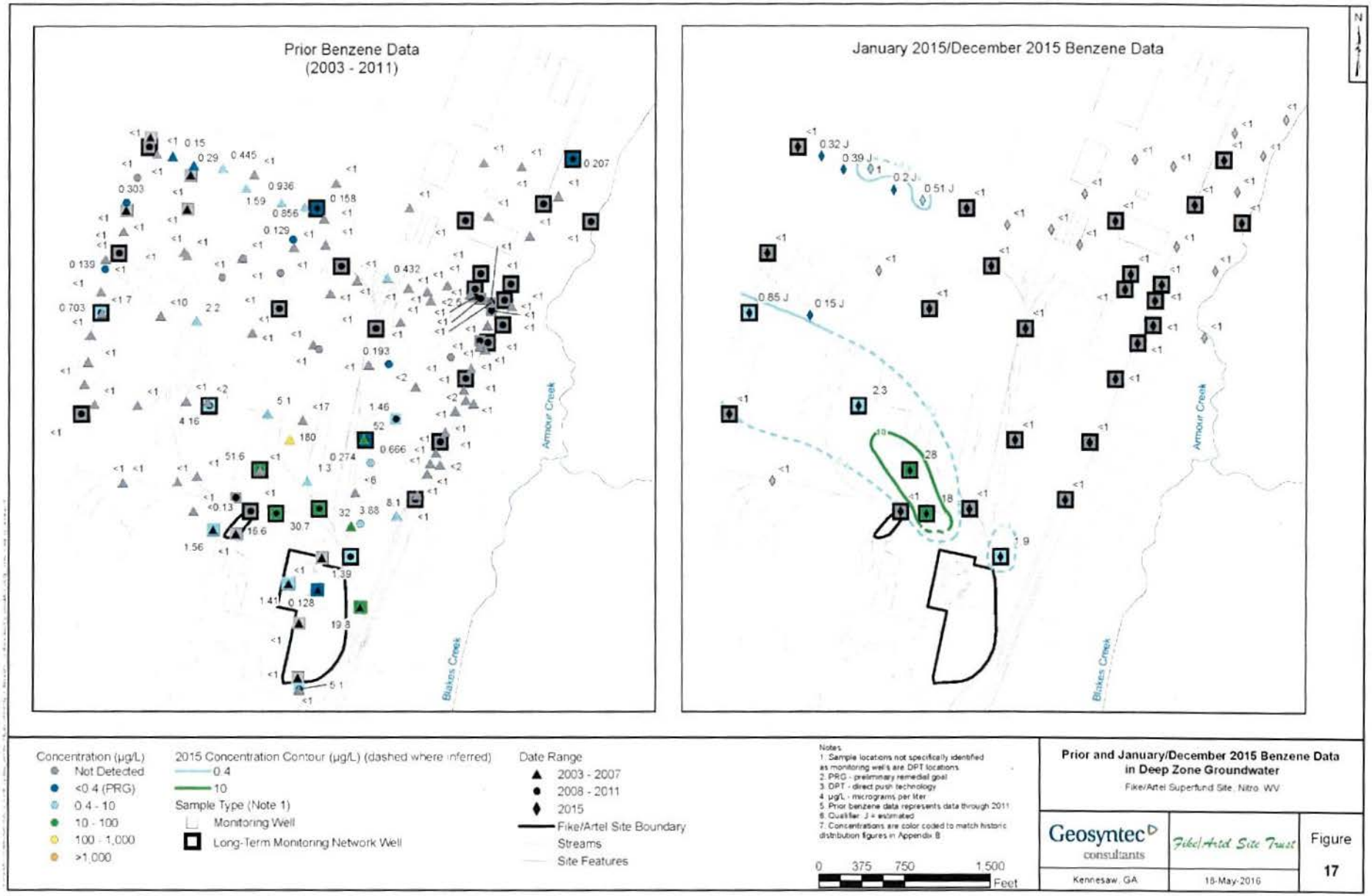


Figure H-10: Historic and 2015 Data for Chloroform: Deep Zone Groundwater

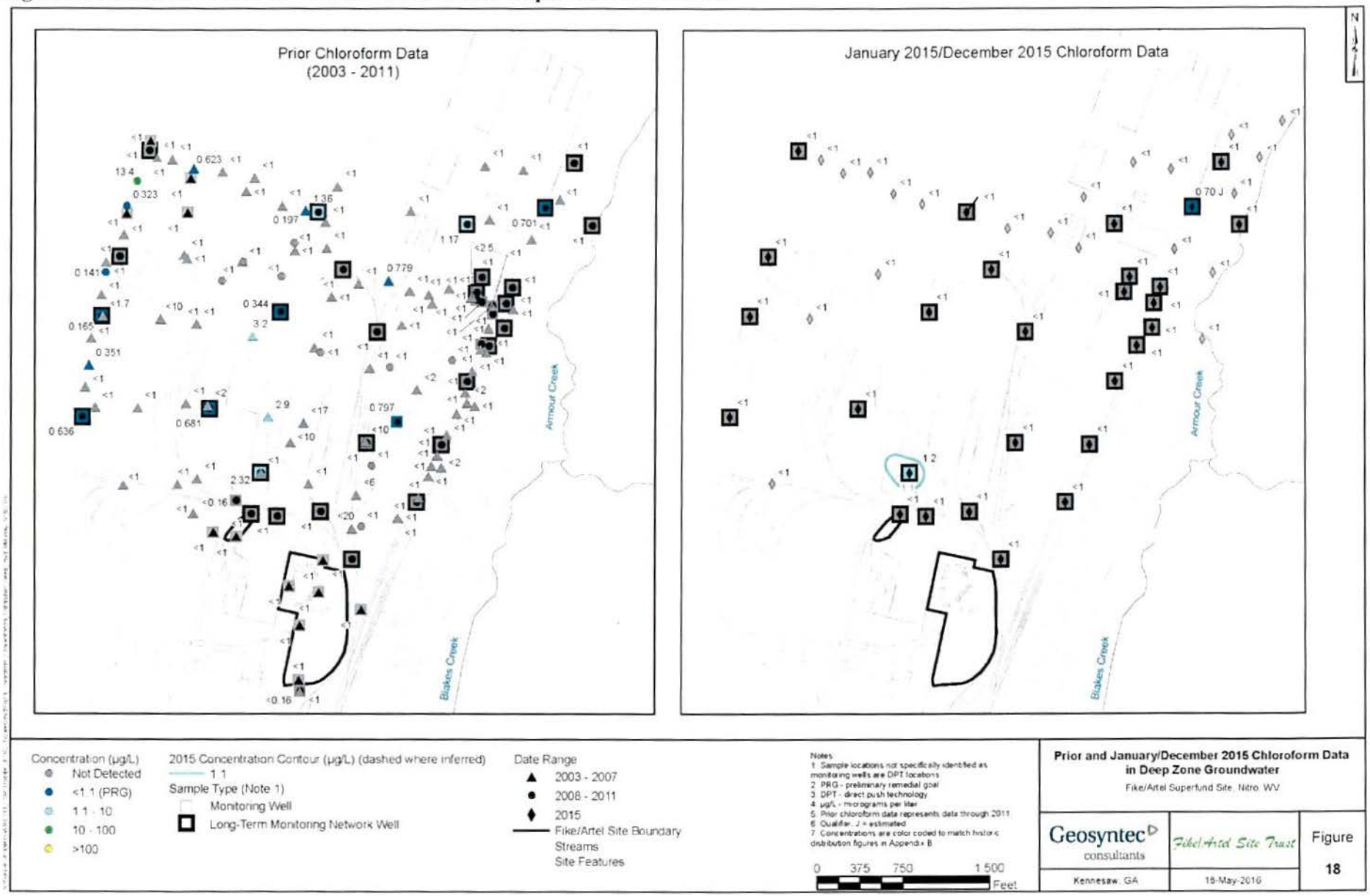


Figure H-11: Historic and 2015 Data for VC: Deep Zone Groundwater

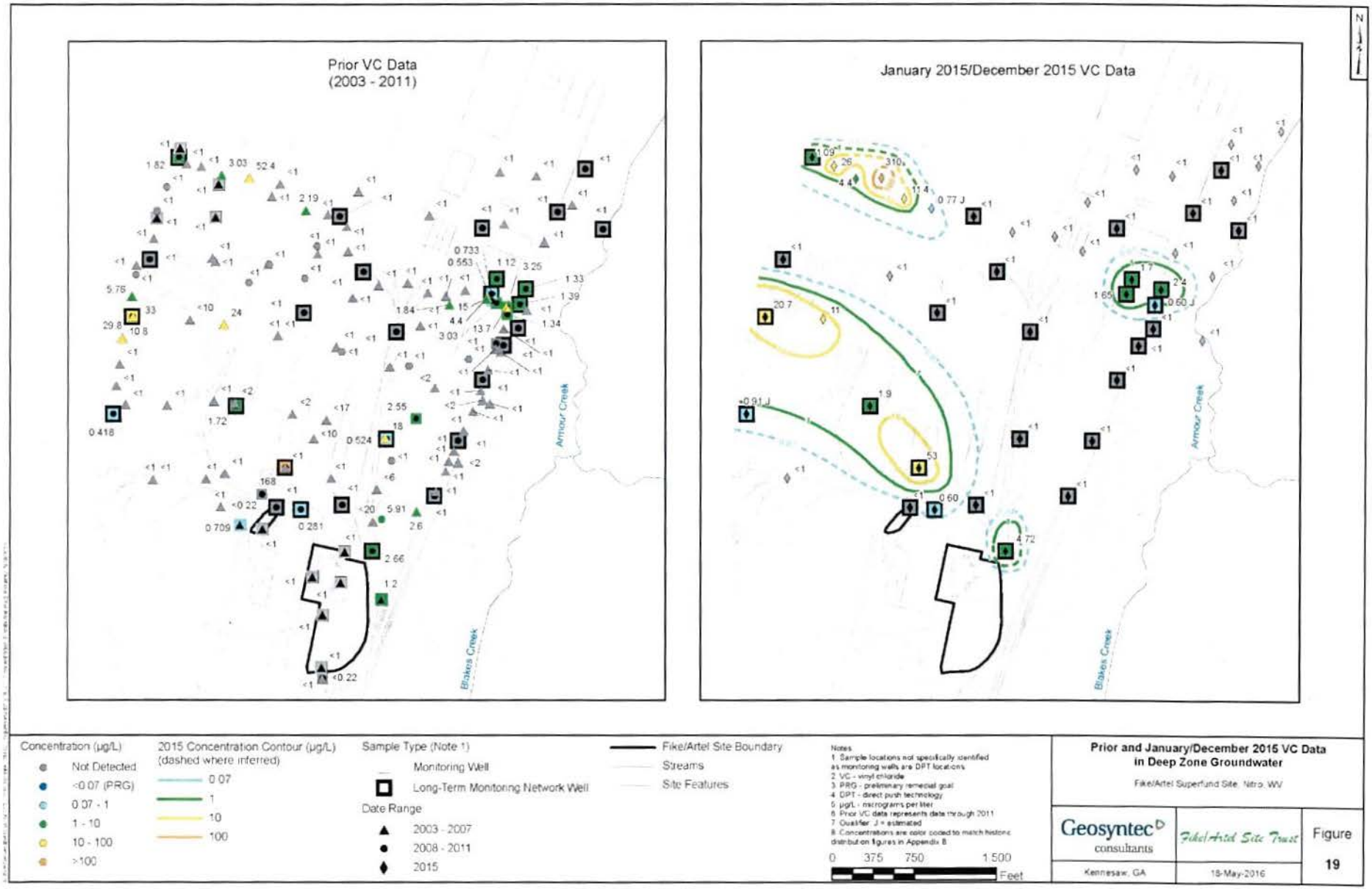


Table H-2: Comparison of the December 2015 Near-River Sampling Data to ESVs and Background Metals Concentrations[2]

				Near River LTMN Well (December 2015)			
Compound Class	Parameter	ESV (µg/L)	Background (µg/L)	PBW-6 (µg/L)	PBW-7 (µg/L)	PBW-8 (µg/L)	MW-422 (µg/L)
VOC	1,1,2-Trichloroethane	1,200	N/A	Not Detected	Not Detected	Not Detected	Not Detected
	1,2-Dichloroethane	100	N/A	Not Detected	**0.299 J**	**7.2**	Not Detected
	1,2-Dichloropropane	4,000	N/A	Not Detected	**0.221 J**	**26.9**	Not Detected
	Benzene	370	N/A	Not Detected	Not Detected	**0.852 J**	Not Detected
	Carbon tetrachloride	13.3	N/A	Not Detected	Not Detected	Not Detected	Not Detected
	Chlorobenzene	1.3	N/A	Not Detected	Not Detected	Not Detected	Not Detected
	Chloroform	1.8	N/A	Not Detected	Not Detected	Not Detected	Not Detected
	Tetrachloroethene	111	N/A	Not Detected	Not Detected	Not Detected	Not Detected
	Trichloroethene	21	N/A	**0.629 J**	Not Detected	Not Detected	Not Detected
	Vinyl chloride	930	N/A	**1.1**	Not Detected	**20.7**	**0.914 J**
SVOC	bis(2-Ethylhexyl) phthalate	16	N/A	Not Detected	Not Detected	Not Detected	Not Detected
	Hexamethylphosphoramide	29,000	N/A	**5.1 J**	**600**	**1,160**	**351 J**
Pesticide	alpha-BHC	2.2	N/A	Not Detected	Not Detected	Not Detected	Not Detected
	Heptachlor	0.0019	N/A	Not Detected	Not Detected	Not Detected	Not Detected
Metal (Note 9)	Arsenic	5	up to 22	**1.9**	**7.9**	**9.0**	**7.4**
	Iron	300	up to 39,800	**33,700**	**35,300**	**39,000**	**77,600**
	Manganese	120	up to 10,500	**5,080**	**2,700**	**1,710**	**5,430**

Notes:
1. LTMN - long-term monitoring network
2. VOC - volatile organic compound
3. SVOC - semivolatile organic compound
4. alpha-BHC = alpha-benzenehexachloride
5. ESV - ecological screening value based on the following:
   - USEPA Region 3 BTAG Freshwater Screening Benchmarks, where available;
   - the NOEC value for 1,2-dichloropropane; and
   - estimated chronic screen value for HMPA (Geosyntec, 2011a)
6. All results presented in micrograms per liter (µg/L)
7. For cases where samples were non-detect, "Not Detected" is reported
8. Bold values indicate a detection and underlined values denote exceedance of the ESV
9. Results for arsenic, iron, and manganese represent dissolved concentrations
10. Qualifier: J = estimated value
11. N/A - not applicable
12. Background metal concentrations are summarized in Geosyntec (2011a)
13. Parameter list is limited to those parameters with an ESV considered in Geosyntec (2011a), consistent with USEPA (2011)

[2] Table I-1 above is Table 4 from the Site's Groundwater Conceptual Site Model, 2016 Update.

APPENDIX I – INTERVIEW FORMS

Fike Chemical, Inc. Superfund Site **Five-Year Review Interview Form**

Site Name: Fike Chemical, Inc. **EPA ID No.:** WVD047989207

Interviewer Name: Darriel Swatts **Affiliation:** EPA CIC
Subject Name: Resident #1 **Affiliation:** _____
Subject Contact Information: _____
Time: 11:40 a.m. **Date:** 11/15/2016
Interview Location: 23rd Street, Nitro, WV

Interview Format (underline one): In Person Phone Mail Other:

Interview Category: Residents

1. Are you aware of the former environmental issues at the Site and the cleanup activities that have taken place to date?

   No.

2. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   I am not really aware of the Site, and have no impression of it.

3. What have been the effects of this Site on the surrounding community, if any?

   None, that I know of.

4. Have there been any problems with unusual or unexpected activities at the Site, such as emergency response, vandalism or trespassing?

   Not that I know of.

5. Do you own a private well in addition to or instead of accessing city/municipal water supplies? If so, for what purpose(s) is your private well used?

   No.

6. Do you have any comments, suggestions or recommendations regarding any aspects of the project?

   No.

Site Name: Fike Chemical, Inc. **EPA ID No.:** WVD047989207

Interviewer Name: Darriel Swatts **Affiliation:** EPA CIC
Subject Name: Resident #2 **Affiliation:** _____
Subject Contact Information: _____
Time: 11:50 a.m. **Date:** 11/15/2016
Interview Location: 24th Street, Nitro, WV

Interview Format (underline one): In Person Phone Mail Other: _____

Interview Category: Residents

1. Are you aware of the former environmental issues at the Site and the cleanup activities that have taken place to date?

   Somewhat.

2. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   The Site does not really bother me. I'm just concerned about the dust that blows toward the house from the direction of the Site.

3. What have been the effects of this Site on the surrounding community, if any?

   Dust blowing into the neighborhood from across the street.

4. Have there been any problems with unusual or unexpected activities at the Site, such as emergency response, vandalism or trespassing?

   I recently heard gunshots near the Site, but think that someone from a street or two over was probably shooting toward the Site.

5. Has EPA kept involved parties and surrounding neighbors informed of activities at the Site? How can EPA best provide site-related information in the future?

   No. EPA could best provide information through the mail or local news.

6. Do you own a private well in addition to or instead of accessing city/municipal water supplies? If so, for what purpose(s) is your private well used?

   No.

7. Do you have any comments, suggestions or recommendations regarding any aspects of the project?

   I'm just concerned about the dust blowing toward my neighborhood from across the street.

Site Name: Fike Chemical, Inc. **EPA ID No.:** WVD047989207

Interviewer Name: Darriel Swatts **Affiliation:** EPA CIC
Subject Name: Resident #3 **Affiliation:** _____
Subject Contact Information: _____
Time: 12:00 p.m. **Date:** 11/15/2016
Interview Location: 24th Street, Nitro, WV

Interview Format (underline one): In Person Phone Mail Other:

Interview Category: Residents

1. Are you aware of the former environmental issues at the Site and the cleanup activities that have taken place to date?

   Yes. Cleanup started around the time I moved here. They removed soil and paved over a few areas.

2. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   I think they did a good job cleaning up the Site.

3. What have been the effects of this Site on the surrounding community, if any?

   None.

4. Have there been any problems with unusual or unexpected activities at the Site, such as emergency response, vandalism or trespassing?

   No.

5. Has EPA kept involved parties and surrounding neighbors informed of activities at the Site? How can EPA best provide site-related information in the future?

   No. EPA could provide information by mail or newspaper.

6. Do you own a private well in addition to or instead of accessing city/municipal water supplies? If so, for what purpose(s) is your private well used?

   No.

7. Do you have any comments, suggestions or recommendations regarding any aspects of the project?

   No.

Site Name: Fike Chemical, Inc. **EPA ID No.:** WVD047989207

Interviewer Name: Darriel Swatts **Affiliation:** EPA CIC
Subject Name: Mike Samples **Affiliation:** de maximis, inc.
Subject Contact Information: (865)691-5052, mikes@demaximis.com
Time: 10:15 a.m. **Date:** 11/21/2016
Interview Location: Office

Interview Format (underline one): In Person Phone Mail Other: Email

Interview Category: O&M Contractor

1. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   Cooperative. Through the efforts of EPA, WVDEP, the Nitro Development Authority, City of Nitro, community leaders and the Fike/Artel Trust, the property is currently being reused by a local company and returned to the City tax base. Reuse was the goal of the community, as communicated to the project team from the onset of the project. Stakeholders who represent the community overall have been involved in the project throughout the process.

2. What is your assessment of the current performance of the remedy in place at the Site?

   The remedy was successfully implemented and is functioning as intended.

3. What are the findings from the monitoring data? What are the key trends in contaminant levels that are being documented over time at the Site?

   Routine monitoring for the potential associated with methane migration into enclosed structures in close proximity to the cap, over several years, has not resulted in any detectable methane.

4. Is there a continuous on-site O&M presence? If so, please describe staff responsibilities and activities. Alternatively, please describe staff responsibilities and the frequency of site inspections and activities if there is not a continuous on-site O&M presence.

   Following remedy implementation, and in working with the local redevelopment authority, the property was sold and is being used. Therefore, there is no continuous O&M presence. However, a local subcontractor is being utilized for routine (i.e., annual) O&M inspections pursuant to an EPA approved O&M Plan.

5. Have there been any significant changes in site O&M requirements, maintenance schedules or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

   None.

6. Have there been unexpected O&M difficulties or costs at the Site since start-up or in the last five years? If so, please provide details.

   None.

7. Have there been opportunities to optimize O&M activities or sampling efforts? Please describe changes and any resulting or desired cost savings or improved efficiencies.

Consistent with the EPA approved O&M Plan, after evaluation of three years of data, which showed no methane, the frequency of manual methane monitoring was decreased from twice a year to an annual event. This change resulted in a slight cost savings, and also minimized any inconvenience to the property owner and business activities.

8. Do you have any comments, suggestions or recommendations regarding O&M activities and schedules at the Site?

   Given the purpose of the cap, and the inconvenience to the property owners' business activities, the frequency of inspections and cap maintenance should be reduced.

APPENDIX J – EVALUATION OF DIOXIN DATA USING CURRENT TOXICITY CRITERIA

The Trust contracted law firm, K&L Gates, to review site information and data to help determine whether the OU4 soil remedy remains protective in light of new toxicity criteria for dioxin. K&L Gates submitted its findings to EPA in a letter dated 10/14/2014. The findings concluded that the remedy selected for OU4 soil was selected based on risk to receptors and exposure pathways, and not on dioxin toxicity levels. The letter stated that the caps that cover soil contamination at the Site eliminate the possibility for complete exposure pathways to soil contamination. Therefore, the letter concluded that the change in toxicity criteria for dioxin does not affect the protectiveness of the soil remedy. Regarding groundwater, the letter stated that because dioxin is not a groundwater COC, the change in toxicity criteria for dioxin does not affect the protectiveness of the groundwater remedy.

In a letter dated February 23, 2015, EPA requested that the Trust perform an actual review of dioxin data for all site areas where dioxin-impacted soil had been previously encountered. In response to that request, the Trust contracted Geosyntec Consultants (Geosyntec) to perform a detailed review of available dioxin and furan soil data for the Site. Geosyntec presented its review findings in a Dioxin/Furan Data Review Memorandum, dated September 11, 2015. The memorandum stated that the OU4 soil remedy included the complete removal of impacted soil associated with Lagoon 3, targeted removal of soil in utility corridors and the placement of asphalt caps over the Chemical Plant and CST areas. Following remedy implementation, the only areas not addressed by the OU4 remedy were those associated with the perimeter ditch system – the CST Ditch and Eastern Ditch.

Geosyntec used available soil data for those ditch areas to calculate 2,3,7,8-TCDD TEQ concentrations based on TEFs currently recommended by EPA. Geosyntec calculated the 95 percent upper confidence limit (UCL) of the mean TCDD TEQ concentration in the perimeter ditch system using EPA ProUCL software. This 95 percent UCL concentration is below the EPA preliminary remediation goal for soils in commercial/industrial settings, which supports the conclusion that the OU4 remedy remains protective for the potential exposures associated with the current and foreseeable future uses of the Site.

Per EPA request, Geosyntec also evaluated the CST Ditch and Eastern Ditch areas as separate exposure areas. The TCDD TEQ concentrations in the three soil samples from the CST Ditch were below the current non-cancer industrial soil RSL. The 95 percent UCL TCDD TEQ concentration for the Eastern Ditch samples was above the industrial soil RSL. However, calculated non-cancer hazard and cancer risk values for the Eastern Ditch are below or within EPA's acceptable criteria, despite point exceedances of the industrial soil RSL in two of the five samples analyzed.

The evaluation concluded that implementation of the soil component of the OU4 remedy adequately addressed dioxins/furans in site soil, and that remaining concentrations are present at levels consistent with the ROD-specific risk range. EPA accepted and approved the findings of the 2015 dioxin/furan soil data evaluation in a letter to the Trust on October 8, 2015. The letter stated that no further action was needed.

While not specifically required by EPA, Geosyntec briefly evaluated TCDD TEQ concentrations in site groundwater as part of its dioxin data evaluation. Based on the findings of the OU4 RI and human health risk assessment, dioxins/furans were not selected as COPCs. During the Site's OU4 RI/FS, dioxin and furan congeners were detected in two out of 34 wells sampled, wells MW-109D and MW-113D. MW-109D is within the Chemical Plant parcel and MW-113D is within the CST parcel. The current EPA RSL for TCDD in tap water is 1.2×10^{-7} micrograms per liter (µg/L). The calculated TCDD concentrations for MW-109D and MW-113D are 2.67×10^{-7} µg/L and 9.96×10^{-7} µg/L, respectively. Therefore, TCDD TEQ concentrations in both wells exceeded the current tap water RSL. However, as pointed out by EPA in its 2015 response to the evaluation, non-cancer and cancer risks for both wells are below or within EPA acceptable criteria. The evaluation also pointed out that no TCDD TEQ concentrations in groundwater exceed the federal MCL of 3.0×10^{-5} µg/L. The evaluation concluded that dioxins/furans are not significant risk drivers for groundwater.

APPENDIX K – PRESS NOTICE

EPA REVIEWS CLEANUP
Fike Chemical Superfund Site

The U.S. Environmental Protection Agency (EPA) is conducting a Five-Year Review of the Fike Chemical, Inc. Superfund Site located in Nitro. EPA inspects sites regularly to ensure that cleanups conducted remain fully protective of public health and the environment. EPA's most recent review of this site, conducted in 2012, determined that while the remedy is protective in the short-term, more study is needed to make a long-term protectiveness determination. Detailed results of this review and Agency recommendations will be made available August 2017.

To access results of the review (starting August 2017):
http://epa.gov/5yr

To read detailed site and contact information:
https://www.epa.gov/superfund/fike

To ask questions or provide site information:
Contact: Darriel Swatts **Phone**: 215-814-5536
Email: swatts.darriel@epa.gov

Protecting public health and the environment