DRAFT CORRECTIVE ACTION DECISION
Brenntag Southwest, Inc. Site
1520 North Barwise
Wichita, Kansas

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TABLE OF CONTENTS

1. PURPOSE OF THE DRAFT CORRECTIVE ACTION DECISION 1
2. SITE BACKGROUND 2
2.1. FACILITY LOCATION 2
2.2. SITE HISTORY 2
3. COMPREHENSIVE INVESTIGATION 3
3.1. GEOLOGICAL AND HYDROGEOLOGICAL SETTING 3
3.2. SUMMARY OF COMPREHENSIVE INVESTIGATION RESULTS 4
4. SOURCE ABATEMENT AND INTERIM MEASURES 5
5. SITE RISKS AND RECEPTORS 6
6. REMEDIAL ACTION OBJECTIVES 7
6.1. CLEANUP LEVELS 7
7. SUMMARY OF REMEDIAL ALTERNATIVES EVALUATED 8
7.1. REMEDIAL ALTERNATIVES RETAINED 8
7.1.1. ALTERNATIVE 1 – NO ACTION 8
7.1.2. ALTERNATIVE 2 – MONITORED NATURAL ATTENUATION 9
7.1.3. ALTERNATIVE 3 – ENHANCED BIODEGRADATION 9
7.2.4. ALTERNATIVE 4 – CHEMICAL OXIDATION 10
8. DESCRIPTION OF THE PREFERRED REMEDY 10
8.1. ELEMENTS OF THE PREFERRED REMEDY 10
9. COMMUNITY INVOLVEMENT 12

TABLES

TABLE 1: SITE-RELATED MAXIMUM SOIL CONTAMINANT CONCENTRATIONS 14
TABLE 2: SITE-RELATED HISTORICAL AND CURRENT MAXIMUM GROUNDWATER CONTAMINANT CONCENTRATIONS 15
TABLE 3: SUMMARY AND ESTIMATED COST OF THE PREFERRED ALTERNATIVE 16

FIGURES

FIGURE 1: SITE LOCATION MAP 18
FIGURE 2: SITE LAYOUT MAP 19
FIGURE 3: GROUNDWATER CONTOUR MAP, APRIL 2015 20
FIGURE 4: PCE AND TCE CONCENTRATIONS IN SHALLOW WELLS, APRIL 2015 21
FIGURE 5: PCE AND TCE CONCENTRATIONS IN DEEPER WELLS, APRIL 2015 22
FIGURE 6: INTERIM REMEDIAL MEASURE – SOIL EXCAVATION AREA 23
FIGURE 7: SUMMARY OF CHEMICAL INJECTION PLAN 24

ACRONYMS AND ABBREVIATIONS USED IN THIS DOCUMENT

1,2-DCA	1,2-dichloroethane
ARARs	Applicable or Relevant and Appropriate Requirements
bgs	below ground surface
CAD	Corrective Action Decision
CAS	Corrective Action Study
CI	Comprehensive Investigation
Cis-1,2-DCE	Cis-1,2-dichloroethene
COPC	Chemicals of Potential Concern
DCE	Dichloroethene
EPA	United States Environmental Protection Agency
EUC	Environmental Use Control
IM	Interim Measure
KDHE	Kansas Department of Health and Environment
mg/kg	milligrams per kilogram
µg/L	micrograms per Liter
MCL	Maximum Contaminant Level
MNA	Monitored Natural Attenuation
NCP	National Contingency Plan
NIC	North Industrial Corridor Site
PCE	Tetrachloroethene
RAO	Remedial Action Objective
RSK	Risk-Based Standards for Kansas
TBC	To Be Considered
TCE	Trichloroethene
VC	Vinyl Chloride
VOC	Volatile Organic Compound

GLOSSARY

Administrative Record (AR) – The body of documents that form the basis for selection of a particular response at a site. Parts of the AR are available in an information repository near the site to permit interested individuals to review the documents and to allow meaningful participation in the remedy selection process.

Aquifer – An underground layer of rock, sand, or gravel capable of storing water within cracks and pore spaces or between grains. When water contained within an aquifer is of sufficient quantity and quality, it can be used for drinking or other purposes. The water contained in the aquifer is called groundwater.

Applicable or Relevant and Appropriate Requirements (ARARs) – The federal and state environmental laws that a remedy will meet. These requirements may vary among sites and alternatives.

Capital Costs – Expenses associated with the initial construction of a project.

Chemical Oxidation – the process of using chemicals called "oxidants" to help break down harmful contaminants.

Comprehensive Investigation (CI) - A study of the source, nature and extent of contamination.

Corrective Action Decision (CAD) – The decision document in which KDHE selects the remedy and explains the basis for selection for a site.

Enhanced Biodegradation – the process of allowing microbes to clean up contaminants enhanced by adding nutrients.

Exposure - Contact made between a chemical, physical, or biological agent and the outer boundary of an organism. Exposure is quantified as the amount of an agent available at the exchange boundaries of the organism (e.g., skin, lungs, gut).

Corrective Action Study (CAS) – A study conducted to evaluate alternatives for clean up of contamination.

Groundwater – Underground water that fills pores in soils or openings in rocks to the point of saturation. Groundwater is often used as a source of drinking water via municipal or domestic wells.

Maximum Contaminant Levels (MCLs) – The maximum permissible level of a contaminant in water that is delivered to any user of a public water system.

Monitoring – Ongoing collection of information about the environment that helps gauge the effectiveness of a cleanup action. For example, monitoring wells drilled to different depths at the site would be used to detect any migration of the plume.

Monitored Natural Attenuation (MNA) – Allowing natural processes to remediate pollution in soil and groundwater while site conditions are routinely monitored.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP) – The federal regulations that guide the

Superfund program. These regulations can be found at 40 Code of Federal Regulations, Part 300.

Operations Maintenance and Monitoring (OM&M) – Activities conducted at a site after the construction phase to ensure that the cleanup continues to be effective.

Plume – A body of contaminated groundwater flowing from a specific source.

Risk - The probability of adverse health effects resulting from exposure to an environmental agent or mixture of agents.

Superfund – Federal authority established by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), to respond directly to releases or threatened releases of hazardous substances that may endanger health or welfare. Also, the common name given by the press for CERCLA because the program was well funded in the beginning.

Tier 2 Level – Calculated risk-based cleanup value for a specific contaminant. These values can be found in Appendix A of the *Risk-Based Standards for Kansas (RSK) Manual.*

Toxicity – A measure of degree to which a substance is harmful to human and animal life.

Vapor Intrusion – The migration of contaminants from the subsurface into overlying and/or adjacent buildings.

Volatile Organic Compounds (VOCs) – Carbon compounds, such as solvents, which readily volatilize at room temperature and atmospheric pressure. Most are not readily dissolved in water, but their solubility is above health-based standards for potable use. Some VOCs can cause cancer.

1. Purpose of the Draft Corrective Action Decision

The primary purposes of the draft Corrective Action Decision (CAD) for the Brenntag Southwest, Inc. Site (the Site) are to: 1) summarize information from the key Site documents including the Comprehensive Investigation[1] (CI) and Corrective Action Study[2] (CAS) reports; 2) briefly describe the alternatives for remediation detailed in the CAS report; 3) identify and describe the Kansas Department of Health and Environment's (KDHE's) preferred remedy for contamination at the Site; and, 4) provide an opportunity for public comment on the preferred remedy.

KDHE will select a final remedy for the Site after reviewing and considering all information submitted during the 30-day public comment period. KDHE may modify the preferred alternative based on new information or public comments; therefore, the public is encouraged to review and comment on the preferred remedy presented in this draft CAD. If during the public comment period a meeting or availability session is requested, one will be held to present information regarding the preferred remedy and solicit public participation. The public may submit written comments to KDHE during the public comment period from November 1 to November 30, 2015. Section 9.0 provides more information on the procedures for providing comments on the draft CAD.

Highlight 1-1: Public Information

Administrative Record File

Kansas Department of Health and Environment
Bureau of Environmental Remediation
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Topeka, Kansas 66612-1367
Contact: Pamela Green
Phone: 785-296-1935
E-mail: pgreen@kdheks.gov

Web:
http://www.kdheks.gov/remedial/site_remediation/index.html

Local Information Repository

City of Wichita Department of Public Works and Utilities
Environmental Health Division
1900 E. Ninth Street
Wichita, Kansas 67214
Contact: Shawn Maloney
Phone: 316-268-8351
E-mail: smaloney@wichita.gov

Foth Infrastructure & Environment, LLC, (Foth) prepared the CI and CAS for the Site on behalf of Brenntag Southwest, Inc. (Brenntag). Work performed during the CI and CAS process followed the terms outlined in the Order dated December 2002 between Brenntag and KDHE[3]. The public is encouraged to review and comment on the technical information presented in the CI and CAS reports and other documents contained in the Administrative Record file. The Administrative Record file includes all pertinent documents and

[1] Foth Infrastructure & Environment, March 2015, *Comprehensive Investigation Report, Brenntag Southwest, Inc., 1520 N. Barwise, Wichita, KS*, prepared on behalf of Brenntag Southwest, Inc., approved May 25, 2015.
[2] Foth Infrastructure & Environment, March 2015, *Corrective Action Study Report, Brenntag Southwest, Inc., 1520 N. Barwise, Wichita, KS*, prepared on behalf of Brenntag Southwest, Inc., approved May 25, 2015.
[3] KDHE, Dec. 2002, *Order Case No. 02-E-0279.*

Site information that form the basis and rationale for selecting the final remedy. The Administrative Record File[4] is available for public review during normal business hours at the KDHE location shown in Highlight 1-1. Also, as shown, for convenience to interested members of the public, copies of the CI and CAS reports, as well as the draft CAD, are also available for review and copying during normal business hours at the local information repository located at the City of Wichita's Environmental Health Division Offices.

2. Site Background

2.1. Facility Location

The Facility is the real property, buildings, and structures located at 1520 N. Barwise in Sedgwick County, Kansas. The Facility consists of a 0.7-acre property located in the west-central part of Wichita, more specifically identified as within the Southwest Quarter of the Southeast Quarter of Section 9, Township 27 South, Range 1 East, Sedgwick County, Kansas, as shown in Figure 1. The Site includes the Facility in addition to all areas to which contamination originating at the Facility have migrated to. The Site is located within the larger North Industrial Corridor (NIC) Site, an area of regional groundwater contamination.

The Facility contains a single building that occupies approximately 25% of the property and includes offices, a warehouse and a loading dock. Figure 2 shows the layout of the Facility, which is zoned for general industrial use.

2.2. Site History

The Facility was acquired by Brenntag in July 2001 from HCI USA Distribution Company, which formerly acquired it from Advance Chemical Distribution, Inc. The Facility has been used for chemical storage and distribution. Yards north and south of the building are used for shipping and receiving of packaged and bulk chemicals. The south yard historically contained aboveground tanks for storing acids, caustic and bleach, and is currently used to receive, store, and ship various materials. Historically solvents were received in bulk and transferred to drums on the south side of the Facility; however, during Brenntag's ownership only pre-packaged solvents have been received for distribution to customers.

Contamination at the Site was identified in 1990 when a Phase I Environmental Assessment was conducted at the Site prior to the sale of the property to Advance Chemical Distribution, Inc. Additional investigations from 1997 through 2000 prior to Brenntag's ownership identified concentrations of trichloroethylene (TCE), tetrachloroethene (PCE), and other Volatile Organic Compounds (VOCs) in soil and in shallow groundwater, exceeding the United States Environmental Protection Agency (EPA) maximum contaminant levels (MCLs) for drinking water.

The Site lies within the larger NIC Site, which comprises approximately 4,000 acres of land. On November 14, 1995, the City of Wichita entered into a Settlement Agreement with the KDHE,

[4] Administrative Record File #C2-087-71721

under which the City agreed to complete the investigation and remediation of the NIC Site. Brenntag is not a party of the NIC Site. In 2002 Brenntag and KDHE entered into an Order for a CI, CAS, Corrective Action Plan, and Corrective Action.

3. Comprehensive Investigation

The CI process was conducted in several phases beginning in 2003 and ending in 2015 with KDHE's approval of the final CI Report. Objectives of the CI process generally included:

- Characterize the lateral and vertical extent of soil and groundwater impacted by VOCs originating at the Site;
- Develop a Site Conceptual Model to identify any human and environmental targets that may be affected by contamination; and
- Collect data to support the evaluation and design of potential response actions.
- Evaluate the upgradient contribution to impacts on the Facility.

3.1. Geological and Hydrogeological Setting

The CI included assessment of the geology and hydrogeology for determining pathways of contaminant migration. Both soil cores and electrical conductivity logging were utilized to evaluate soil characteristics. The Site lies within the Arkansas River alluvial valley. Flat-lying alluvial sediments overlay the Wellington Formation, a shale-rich formation that forms the lower hydrologic confining layer for the alluvial aquifer. Alluvial sediments comprise an upward fining sequence of sand grading to silt and then to silty clay at the surface. Overall, the unconsolidated interval is about 40 feet thick consisting of sand (grading upwards from coarse- to fine-grained sand) about 30 to 34 feet thick which grades to silt and clay in the upper 6 to 10 feet.

Shallow groundwater at the Site occurs in an unconfined alluvial aquifer primarily composed of unconsolidated sand above shale bedrock. The water table at the Site is generally about 11 to 15 feet bgs and readily produces water. Groundwater flow is primarily to the south-southeast and appears to be stratified with shallow groundwater in fine sand moving more slowly than deeper groundwater in coarser sand. Figure 3 depicts the potentiometric surface in monitoring wells at the Site.

No surface water bodies are present on the Facility. The nearest surface water features is Chisholm Creek approximately one-half mile east of the Facility. The Little Arkansas River discharges to the Arkansas River at a confluence point located approximately one mile west of Facility. Primary land use in the site vicinity is commercial, and businesses are connected to the City of Wichita public water supply. The City of Wichita obtains its public water supply from

two sources, surface water from Cheney Reservoir and groundwater pumped from the City's well field completed in the Equus Beds aquifer. Cheney Reservoir is located approximately 25 miles west, and the City's well field is located approximately 15 miles east.

3.2. Summary of Comprehensive Investigation Results

The CI identified contamination in soil and groundwater. The chemicals of potential concern (COPCs) include PCE, TCE, cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride (VC) in both soil and groundwater.

Soil

Investigation results from soil samples collected in 2003 and 2004 showed that the lateral and vertical extent of soil impacted above Tier 2 RSK Levels was determined to be limited to an area on the southern portion of the Facility and did not extend off-Site.[5] In addition to soil chemical characterizations, geotechnical investigations were also conducted, including soil boring and electro-conductivity logging. This work established that impacted soil primarily occurred in silty-clay soil within about six feet of the land surface and not in deeper sandy soil. The highest concentrations detected in soil in the southern portion of the Facility are shown in Table 1. All soil impacts were subsequently addressed through an Interim Measure (see below Section 4).

Groundwater

Groundwater sampling activities have been conducted at the Site to determine the impact and extent of VOCs in groundwater. Groundwater collected during the CI evaluated both hydrogeologic characteristics of the aquifer (i.e., flow direction) as well as fate and transport for contaminants of concern. Vertical migration is a potential for chlorinated solvents; subsequently, groundwater samples were collected from multiple intervals using direct-push technology, generally from 12-17 feet below ground surface (shallow), 16-27 feet below ground surface (middle), and 30-39 feet below ground surface (deep). In addition, groundwater samples have historically been collected from both shallow and deep monitoring well pairs. As depicted in Figure 2, a total of eight wells (four nested shallow and deep wells) are located on the Facility and were installed in 2008 and 2011. Four wells (two nested shallow/deep wells) were also installed in 2011 downgradient of the Facility to the southeast.

Groundwater samples have historically been analyzed for VOCs and select geochemical parameters (i.e., dissolved oxygen, sulfide, ferrous iron, etc.). The following summarizes findings for contaminant fate and transport as it relates to chlorinated solvents, particularly PCE and degradation products (i.e., TCE, *cis*-1,2 DCE, vinyl chloride):

PCE was found to occur primarily in the shallow and middle intervals. Concentrations on the Facility ranged from approximately 12.7 µg/L to 19.4 µg/L. Background data suggested that

[5] KDHE, 2010, *Risk-Based Standards for Kansas (RSK) Manual*,5th Version, Kansas Department of Health and Environment, October.

contribution from upgradient sources was marginal to non-existent. TCE was identified in shallow, middle, and deep intervals. Concentrations on the Facility ranged from 1.1 µg/L in the shallow, to 12 µg/L in the middle, to 6.5 µg/L in the deep intervals. Downgradient concentrations varied but generally increased in concentration with depth. TCE background concentrations were non-detect in the shallow, but increased with depth. Background concentrations for TCE ranged from 1.6 µg/L to 10 µg/L in the deep interval suggesting contribution from upgradient source(s). *Cis*-1,2 DCE was detected in all intervals, but was more prevalent in the deep zone. On the Facility, *cis*-1,2 DCE ranged from 17.4 µg/L to 110 µg/L in the deep interval with background concentrations ranging from 30.7 µg/L to 65.6 µg/L. Background concentrations in the shallow and intermediate intervals were greater than concentrations on the Facility suggesting contributions from upgradient source(s). Vinyl Chloride was present in the shallow, intermediate, and deep levels, but generally increased with depth. Vinyl chloride was not detected in the shallow or intermediate samples on the Facility or upgradient thereof, but was detected in the shallow and intermediate samples downgradient of the Facility. In the deep samples, the background concentrations were greater than on the Facility or downgradient thereof.

Contaminant trends as well as data from upgradient wells (MW-1S/D) established baseline and background concentrations for the Site. There appears to be a contributing factor, particularly TCE and DCE, flowing onto the Brenntag property from upgradient, off-site sources, contributing to the contaminant concentrations found at the Site, especially in the deeper groundwater. The historical maximum concentrations and most recent results are shown in Table 2.

Throughout the Site, concentrations in shallow wells have decreased significantly as shown in groundwater sampling results from 2008 through 2015. However, in off-site in the deeper groundwater zone, DCE and TCE concentrations have remained generally constant since April 2011. Figures 4 and 5 show concentrations of PCE and TCE detected during the April 2015 sampling event in the shallow wells and the deeper wells, respectively.

4. Source Abatement and Interim Measures

Interim measures (IMs) are actions or activities taken to quickly prevent, mitigate, or remedy unacceptable risk(s) posed to human health and/or the environment by an actual or potential release of a hazardous substance, pollutant, or contaminant. An IM for soil was conducted in 2007 which resulted in the excavation and off-Site disposal of soil impacted above the Tier 2 RSK Levels for the soil-to-groundwater pathway. A total of 683.1 cubic yards of soil and concrete were removed. After completion of the excavation, eight confirmation samples were collected. The analytical results indicated concentrations below the Tier 2 RSK level, except for two side wall samples that confirmation samples showed that the cleanup criteria were not met.[6]

[6] Foth Infrastructure & Environment, 2007, *Interim Remedial Measure for Soil Completion Report*, December 17, 2007, prepared on behalf of Brenntag Southwest, Inc., approved January 9, 2008.

Therefore, additional soil was excavated on the south side of the original excavation. At a depth of two feet below ground surface, Brenntag's sidewall confirmation sample result was at 19.1 μg/kg for PCE, below the Tier 2 RSK Level of 121 μg/kg for the soil-to-groundwater pathway, while KDHE's sample result exceeded at 437 μg/kg for PCE. In all events, excavated soil was loaded into transport trucks, covered, and transported to Rolling Meadows Landfill in Topeka, Kansas for disposal. The excavation was backfilled with soil obtained from an off-site quarry. The soil excavation area is depicted in Figure 6.

Concentrations of COPCs in groundwater decreased after excavation was completed, showing that excavation of soil containing PCE was successful in eliminating this prior source of PCE leaching from soil to groundwater. As of April 2015, no COPSs above Tier 2 RSK Levels were detected monitoring wells at the Facility. The highest PCE concentration was 2.4 μg/L, below the Tier 2 RSK level of 5 μg/L. Off-site monitoring wells continue to show concentrations of PCE and TCE above the Tier 2 RSK Levels, as shown in Table 2.

5. Site Risks and Receptors

COPCs for the Site are VOCs in soil and groundwater, particularly PCE and degradation products. All COPCs detected during the CI were compared to their respective concentrations in the Tier 2 Risk-Based Summary Table in Appendix A of the KDHE RSK Manual to determine if the chemical- and media-specific concentrations are protective of human health and the environment.

The soil pathway addresses the impact to human health via ingestion of contaminated soil, inhalation of fugitive emissions or dusts, and dermal contact with contaminated soil. The soil excavation, which was implemented as an interim measure, reduces the potential for exposure to impacted soil. Facility source area soils have been excavated to levels below the Tier 2 RSK Levels for the soil pathway, indicating that there is no unacceptable human health or environmental exposure risks from contact with the soil. In addition, the area was covered with reinforced concrete and a geotextile fabric was place in the excavation, which limits accessibility to the soil with respect to future actions. The KDHE confirmation sample that showed PCE above the Tier 2 RSK Level for the soil-to-groundwater pathway indicates that a continuing source of contamination may still be present, though decreasing groundwater concentrations do not.

Groundwater contaminated with chlorinated solvents poses the primary route for potential exposure. Groundwater impacted with chlorinated solvents at concentrations exceeding their respective Tier 2 RSK Levels could present an unacceptable risk by using groundwater for drinking or other household uses. A water well survey was conducted as a component of the CI/CAS to identify potential receptors that may be in contact with contaminated groundwater. Results from the survey indicate no domestic use of water wells within the Site. The City of Wichita provides potable water. The nearest domestic wells are two lawn and garden wells

located approximately 0.5 miles from the Facility. An Environmental Use Control (EUC) has been recorded with the property deed that prohibits residential land use and the use of shallow groundwater.[7] Groundwater is at a depth of approximately 15 feet bgs and unlikely to be contacted by utility workers or construction workers. Furthermore, the City of Wichita Municipal Code of Ordinances, Title 7, Chapter 7.30, Section 7.30.105 currently prohibits the installation of new wells and use of pre-existing water wells for personal use in contaminated areas (such as the Brenntag Site). Therefore, there is no unacceptable human health or environment exposure risk due to the incomplete groundwater pathway.

Chlorinated solvents are volatile and mobile; subsequently, vapor migration in the subsurface is generally a concern. Unsaturated utility trench backfill material and permeable vadose zone soils are typical vapor migration paths. Underground utilities also present potential conduit routes for vapors to migrate (e.g., storm sewer, electric, and water lines). Potential routes of exposure to COPCs through vapor intrusion were evaluated. Vapor intrusion exposure occurs via the movement of contaminant vapors from soil gas within the unsaturated pore space of the vadose zone through the foundation into the interior air space of the residential structure. Currently, no structures are present over the area of groundwater impact. In addition, vapor intrusion was evaluated to be an incomplete pathway in the NIC site-wide vapor intrusion assessment.[8]

6. Remedial Action Objectives

Remedial Action Objectives (RAOs) are media-specific goals for protecting human health and the environment. RAOs are developed through evaluation of *Applicable and Relevant and Appropriate Requirements* (ARARs) and *To Be Considered* standards with consideration of the findings of the CI. Based on this information, the following RAOs were developed for the Site as presented below.

- Prevent human exposure (ingestion, inhalation, and dermal contact) to contaminated soil and groundwater;
- Prevent contaminated groundwater from migrating downgradient at concentrations exceeding Tier 2 RSK Levels; and
- Reduce the on-site and downgradient contaminant concentrations in groundwater to the Tier 2 RSK Levels as determined by KDHE.

6.1. Cleanup Levels

For groundwater remediation being conducted at sites with drinking water aquifers, federally promulgated MCLs are used as the cleanup levels. For those constituents which federal MCLs have not been established for groundwater, Tier 2 RSK Levels apply and are the final remedial

[7] KDHE, 2013, *Environmental Use Control Agreement*, 13-EUC-0004.
[8] CDM Smith, 2012, *North Industrial Corridor Site-Wide Vapor Intrusion Assessment*, Wichita, May.

cleanup levels for the Site. For soil, KDHE's Tier 2 RSK Levels are the final remedial cleanup levels for the Site.

The conclusions of the CI, the formulation of RAOs, and the determination of MCLs as the cleanup levels for groundwater and Tier 2 RSK Levels as the cleanup levels for soil provide the basis for selecting a preferred remedial alternative. As previously discussed in Section 3.2, Tables 1 and 2 show the Tier 2 RSK Levels for contaminants in soil and groundwater, respectively.

7. Summary of Remedial Alternatives Evaluated

In accordance with KDHE's CI/CAS Scope of Work, several remedial action alternatives were assembled and evaluated in detail during the CAS. Each remedial alternative was evaluated with respect to their ability to satisfy the following criteria as specified in the *National Oil and Hazardous Substances Contingency Plan*[9]*(NCP)*: overall protection of human health and the environment; compliance with federal and state ARARs; long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; short-term effectiveness; implementability; and cost. The remedial action alternatives were then compared against one another to facilitate the identification of the preferred alternative. A detailed description of each remedial action alternative and the individual and comparative analyses is presented in the CAS. Each remedial alternative evaluated also includes the IM already implemented at the Site that is consistent with the technologies evaluated in the CAS.

The objective of the CAS is to identify remedial technologies and practices that can meet the site-specific remedial action objectives and then combine the technologies and practices into a suite of remedial alternatives for further evaluation. Evaluation of remedial alternatives in the CAS focused on technology types and practices potentially applicable to addressing impacted groundwater and saturated soil. Brief summaries of the remedial action alternatives, including the preferred remedial action alternative, are provided below.

7.1. Remedial Alternatives Retained

Four remedial action alternatives were retained for detailed analysis for the Site. These include Alternative 1 – No Action; Alternative 2 – Monitored Natural Attenuation; Alternative 3 – Enhanced Bioremediation; and, Alternative 4 – Chemical Oxidation.

7.1.1. Alternative 1 – No Action

The NCP requires the evaluation of a "No Action" alternative to serve as a baseline for comparison to other remedial action alternatives evaluated. The "No Action" alternative generally assumes that the Site is left unchanged, and no remedial actions are evaluated or taken at the Site; no further actions would be taken to reduce contaminant mass, address potential exposure pathways, or reduce the potential for contaminant migration. Since no remedial action

[9] National Oil and Hazardous Substances Contingency Plan, 40 CFR 300 et seq.

is taken, risks to human health and environment may not be addressed. This alternative is considered as a baseline from which to compare the other alternatives. The present value cost for this alternative is $0 since no action is proposed.

Highlight 7-1 – Monitored Natural Attenuation

Monitored Natural Attenuation (MNA) relies on a suite of natural attenuation processes to reduce contaminant concentrations to acceptable levels. Without the right conditions, however, MNA will not be quick or effective enough to serve as an independent remedy.

7.1.2. Alternative 2 – Monitored Natural Attenuation

This alternative includes groundwater monitoring of concentration trends with time and distance, geochemical conditions, and other site-specific factors to determine if natural processes, either biotic or abiotic, are acting to mitigate impacted groundwater. Natural attenuation processes include those such as biodegradation, dispersion, dilution, absorption, and chemical reactions with subsurface materials to reduce contaminant concentrations in groundwater. The progress of natural attenuation is monitored to ensure that the processes continue to reduce concentrations within an acceptable time frame and that adverse effects do not result.

In August 2008, two shallow and two deep wells were analyzed for relevant geochemical parameters for evaluation of natural attenuation processes (i.e., dissolved oxygen, oxygen-reduction potential, total organic carbon, methane, etc.). Results indicated that reductive dechlorination is naturally occurring, but static PCE levels in groundwater at well MW-3S indicate that short-term effectiveness may be limited. Groundwater monitoring would be conducted semi-annually. Assuming nine years of costs associated with groundwater sampling, analysis, and reporting, the present value cost to implement Alternative 2 is $251,000.

Highlight 7-2 – Enhanced Biodegradation

Enhanced biodegradation is a type of bioremediation that breaks down chlorinated organic compounds such as PCE and TCE in the subsurface through natural biological processes. In order to be successful, the right microbes, nutrients, temperature and amount of oxygen must be present. Products containing carbon and zero-valent iron may be injected into the soil in order to allow microbes to thrive and to speed up the reductive dechlorination process.

7.1.3. Alternative 3 – Enhanced Biodegradation

This alternative consists of enhanced in-situ bioremediation to address on-Site groundwater impacts. Enhanced bioremediation utilizes the injection of a substrate to enhance the biodegradation rates of contaminants located in the subsurface groundwater. A treatability study would be performed to determine the proper substrate and dosage prior to final implementation. Implementation would be performed using either direct-push injection or injection wells designed to treat the shallow groundwater to an approximate depth of 20 feet. This alternative would address both background and on-Site groundwater

impacts by creating conditions favorable to VOC mass reduction in groundwater. Groundwater monitoring would be conducted quarterly for two years to evaluate effectiveness and then semi-annually thereafter to demonstrate attainment of Tier 2 RSK goals. Assuming two years of active remedial action and an additional two years of groundwater monitoring, the present value cost to implement Alternative 3 is $491,000.

7.2.4. Alternative 4 – Chemical Oxidation

This alternative consists of *in-situ* chemical oxidation to address source area impacts. Injections of chemical oxidants would be performed using either direct-push technology or through injection wells. Fourteen injection points would be installed in a grid pattern throughout the chemical oxidation zone to treat the shallow groundwater to an approximate depth of 20 feet. A treatability study would be performed to determine the proper oxidant and dosage prior to final implementation. Groundwater monitoring would be conducted quarterly for two years to evaluate effectiveness and then semi-annually thereafter to demonstrate attainment of Tier 2 RSK goals. Assuming two rounds of chemical injections over two years and an additional two years of groundwater monitoring, the present value cost to implement Alternative 4 is $470,000.

Highlight 7-3 –Chemical Oxidation

Chemical oxidation uses chemicals called "oxidants" to help change harmful contaminants into less toxic ones. It is commonly described as "in situ" because it is conducted in place, without having to excavate soil or pump out groundwater for aboveground cleanup. The oxidants are typically injected underground by pumping them into wells. Once the oxidant is pumped down the wells, it spreads into the surrounding soil and groundwater where it mixes and reacts with contaminants.

8. Description of the Preferred Remedy

After evaluation of the individual analysis of remedial action alternatives, a comparative analysis of the various alternatives was performed with consideration of the threshold and balancing criteria specified in the NCP as discussed in Section 7.0. On the basis of information available in the Administrative Record and summarized above, KDHE has selected **Alternative 4, chemical oxidation, as the preferred remedy for the Site, along with EUCs.** The results of the comparative analysis support the preferred remedy for the Site as outlined below. The total present value cost of the preferred remedy is $470,000 as presented in Table 3. A summary of the chemical injection plan is shown in Figure 7.

Alternative 4 incorporates the IMs implemented at the Site to date, including soil excavation and off-site disposal, as described in Section 4 above. The preferred remedy as outlined below satisfies or meets Federal, State, and local requirements, and will be protective of human health and the environment.

8.1.Elements of the Preferred Remedy

Elements of KDHE's preferred remedy (Alternative 4) are summarized below.

- In-situ chemical oxidation of groundwater impacted by VOCs offers several advantages. Chemical oxidation provides an aggressive treatment with rapid short-term results and permanent reductions of a wide range of VOCs. Fourteen injection points will be installed within the source area in order to provide the oxidant substrate that will physically react with and destroy dissolved VOCs. A treatability study will be performed as part of the remedial design to determine the proper oxidant and dosage. While one year is expected to treat the source area to achieve RAOs, multiple treatments may be required to address VOCs adsorbed to soil, which may act as an ongoing source of groundwater impact.

- *Environmental Use Controls*: KDHE and Brenntag entered into an EUC Agreement (#13-EUC-0004) for the Site on October 14, 2013. The purpose of the EUC Agreement is to protect human health and the environment from risks posed by contaminants remaining at the Site through placement of restrictions, prohibitions, and conditions on land use to reduce or eliminate potential human exposure to Site contaminants. The EUC agreement runs with the property and is binding on the landowner and any other subsequent owners, lessees, and other users of the property. In addition, the City of Wichita Municipal Code of Ordinances, Title 7, Chapter 7.30, Section 7.30.105 currently prohibits the installation of new and use of pre-existing wells for human consumption in contaminated areas. Continued enforcement of this City ordinance will also help ensure protection of human health until cleanup is complete.

- *Groundwater Monitoring:* Groundwater monitoring will be conducted on a quarterly basis for two years and then semi-annually thereafter until the Site meets Closure as identified by criteria outlined in BER Policy No. BER-RS-024. A monitoring network is currently in place with an approved Long-Term Site Monitoring Plan consistent with BER Policy No. BER-RS-036 *Scope of Work for Site Monitoring.* Two new monitoring wells will be installed within the source area to monitor remediation effectiveness and to provide additional groundwater data near the source area boundary. Groundwater monitoring results will be reviewed on a routine basis to evaluate whether impacts are expanding or increasing in concentrations or if additional monitoring wells and/or other modifications to the monitoring program are necessary to satisfy project objectives.

- *Contingent Remedy:* KDHE will review new information as it becomes available to evaluate whether the proposed remedial plan is protective of human health and the environment. If new information suggests that contamination at or emanating from the site poses a threat to human health and the environment, KDHE may require development and implementation of additional contingency measures such as the installation of additional injection transects in areas where primary remedial actions are ineffective. The CAS identifies a contingent remedy of enhanced bioremediation (Alternative 3) should chemical oxidation be ineffective or inadequate to address contamination at the Site.

9. COMMUNITY INVOLVEMENT

A Public Information Strategy for the Site was developed by KDHE. Public input and comment is being encouraged by KDHE throughout the process. Public notice of the availability of the draft CAD will be published in *The Wichita Eagle*. In addition, KDHE has established a webpage dedicated to the Site, available online during the comment period at http://www.kdheks.gov/remedial/site_restoration/index.html. Relevant Site documents, including the draft CAD, are available on the webpage.

KDHE will select a final remedy after reviewing and considering all information submitted during the 30-day public comment period (November 1 to November 30, 2015). KDHE may modify the preferred remedy based on new information or public comments. The public is encouraged to review and comment on the preferred remedy presented in this draft CAD. As per the Public Information Strategy, if requested, KDHE will hold a public meeting during the public comment period to present information regarding the preferred remedy. Notice of the public meeting will be published in *The Wichita Eagle* and posted on KDHE's webpage dedicated to the Site.

Public comments on the draft CAD must be submitted to KDHE in writing during the 30-day public comment period. Written comments must be postmarked by November 30, 2015, and mailed to the name and address specified below:

Kansas Department of Health and Environment
Bureau of Environmental Remediation
Attention: Pamela Green, Environmental Scientist
1000 SW Jackson Street; Suite 410
Topeka, Kansas 66612-1367

Comments on the draft CAD may also be submitted to KDHE by electronic mail to pgreen@kdheks.gov. Comments sent by electronic mail must be received by KDHE by 5:00 p.m. on November 30, 2015. All comments that are received by KDHE prior to the end of the public comment period will be addressed by KDHE in the Responsiveness Summary Section of the Final CAD.

TABLES

Table 1: Site-Related Maximum Soil Contaminant Concentrations

Chemical Compound	Maximum Historical Concentration µg/kg	Confirmation Samples Post-Excavation	KDHE Tier 2 Level‡ (Soil-to-Groundwater Pathway) µg/kg	KDHE Tier 2 RSK Level‡ (Soil Pathway) µg/kg
PCE	**2,300**	103**	121	109,000
TCE	**410**	40.9	84.2	5,850
cis-1,2-DCE	**2,100**	91.7	855	23,000
1,2-Dichloro-ethane	**59,000**	Not detected*	60	6,270

‡Tier 2 RSK Levels for soil and soil-to-groundwater pathway are based on the residential scenario provided from KDHE's Risk Based Standards for Kansas (RSK) Manual, October 2010 and subsequent updates.

µg/kg – micrograms per kilogram

** Not detected above the laboratory reporting limit ranging from 4.2 to 5.0 µg/kg*

***KDHE confirmation sample at sidewall was 437 µg/kg. Further excavation was not feasible.*

Red bold font indicates concentrations above the Tier 2 RSK Level.

Table 2: Site-Related Historical and Current Maximum Groundwater Contaminant Concentrations

Chemical Compound	Maximum Concentration µg/L	Current Maximum Concentration µg/L (April 2015)	MCL or KDHE Tier 2 RSK Level‡ µg/L
PCE	**590**	**42.4***	5
TCE	**170**	**13.9***	5
cis-1,2-DCE	**220**	47.4	70
Vinyl chloride	**4.7**	1.3	2
1,2-DCA	**6.8**	0.24J	5

‡KDHE Tier 2 RSK Levels for these chemical compounds are equivalent to the federal MCLs.
µg/L – micrograms per Liter
**Off-site monitoring wells; highest on-site concentrations in 2015 are 2.4 µg/L of PCE and 3.0 µg/L of TCE, both below the MCL.*
J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit
Red bold font indicates concentrations above the Tier 2 RSK Level.

Table 3: Summary and Estimated Cost of the Preferred Alternative

Preferred Alternative	Contingency	Estimated Cleanup Timeframe	Total Capital Cost	Total O&M Cost	Present Value Cost
Alternative 4: Chemical Oxidation	Enhanced Bioremediation	4 Years[+]	$279,720	$147,600	$470,000**

[+]Includes two years of monitoring to verify remedy effectiveness.
[‡]Costs estimated by Foth. Costs presented in the column "Total Capital Cost" do not include contingency implementation.
[**]Costs for Interim Measures already conducted are not included.

FIGURES

Figure 1: Site Location Map

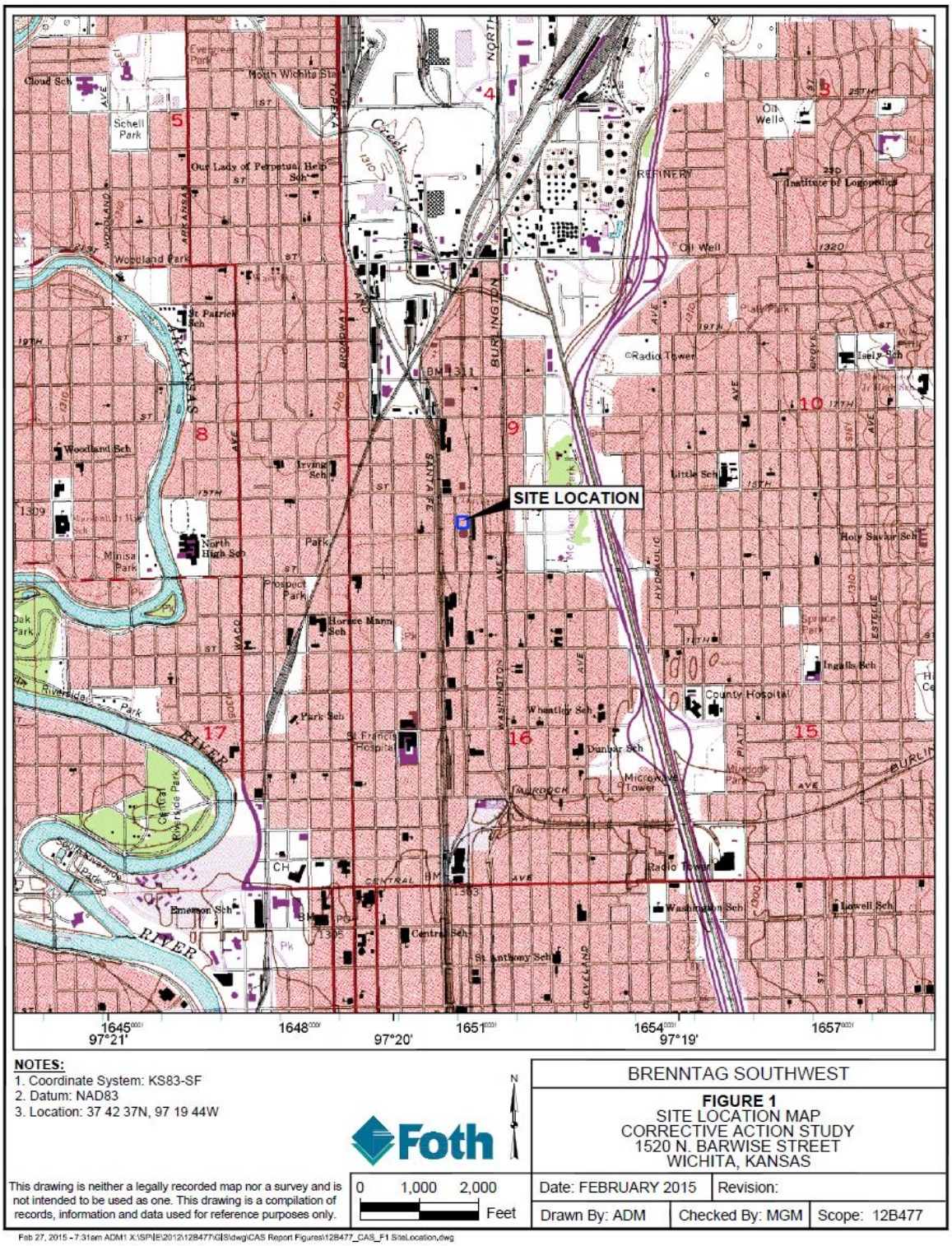

Figure prepared by Foth on behalf of Brenntag Southwest, Inc., based on figure from the Corrective Action Study, March 2015.

Figure 2: Site Layout Map

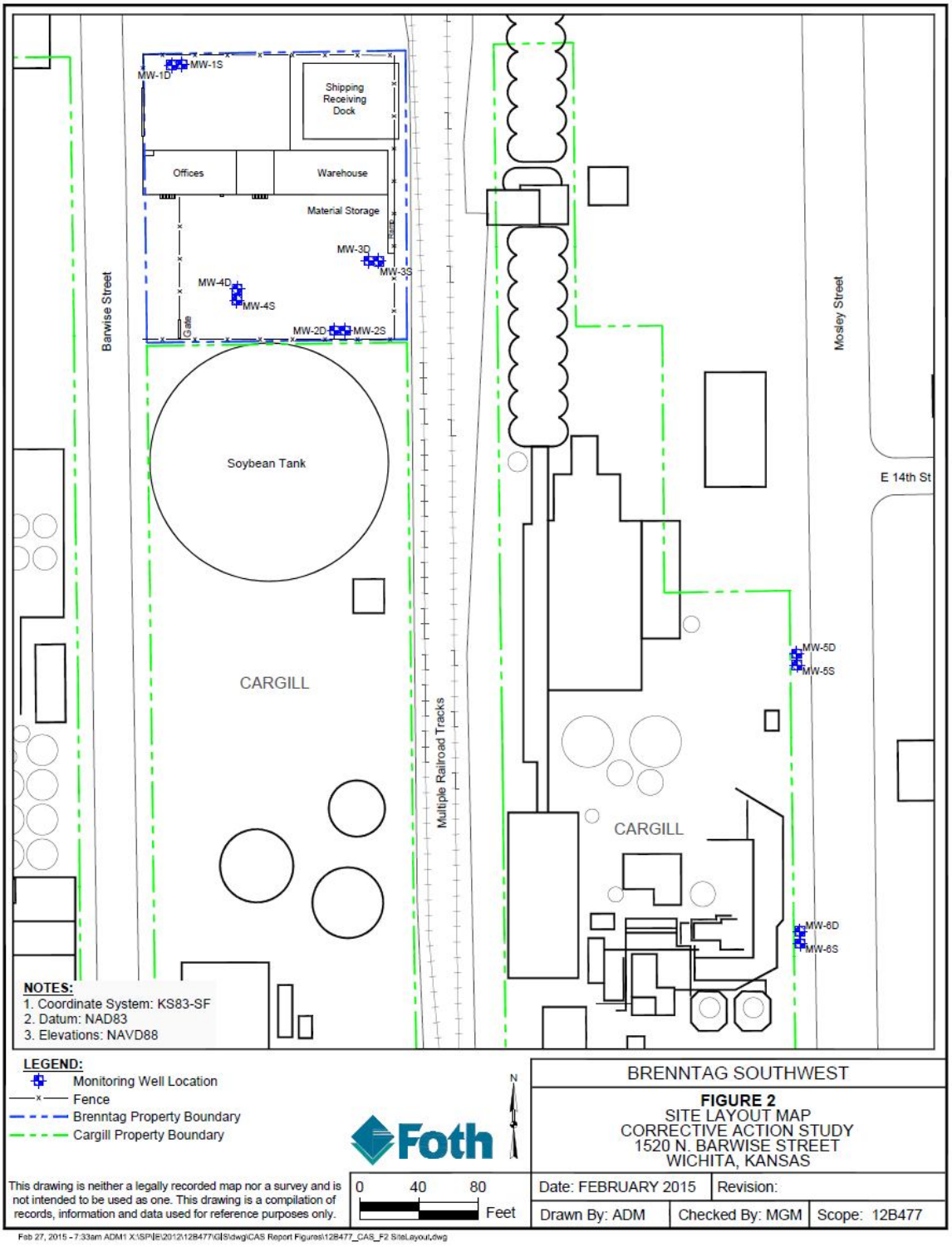

Figure prepared by Foth on behalf of Brenntag Southwest, Inc., based on figure from the Corrective Action Study, March 2015.

Figure 3: Groundwater Contour Map, April 2015

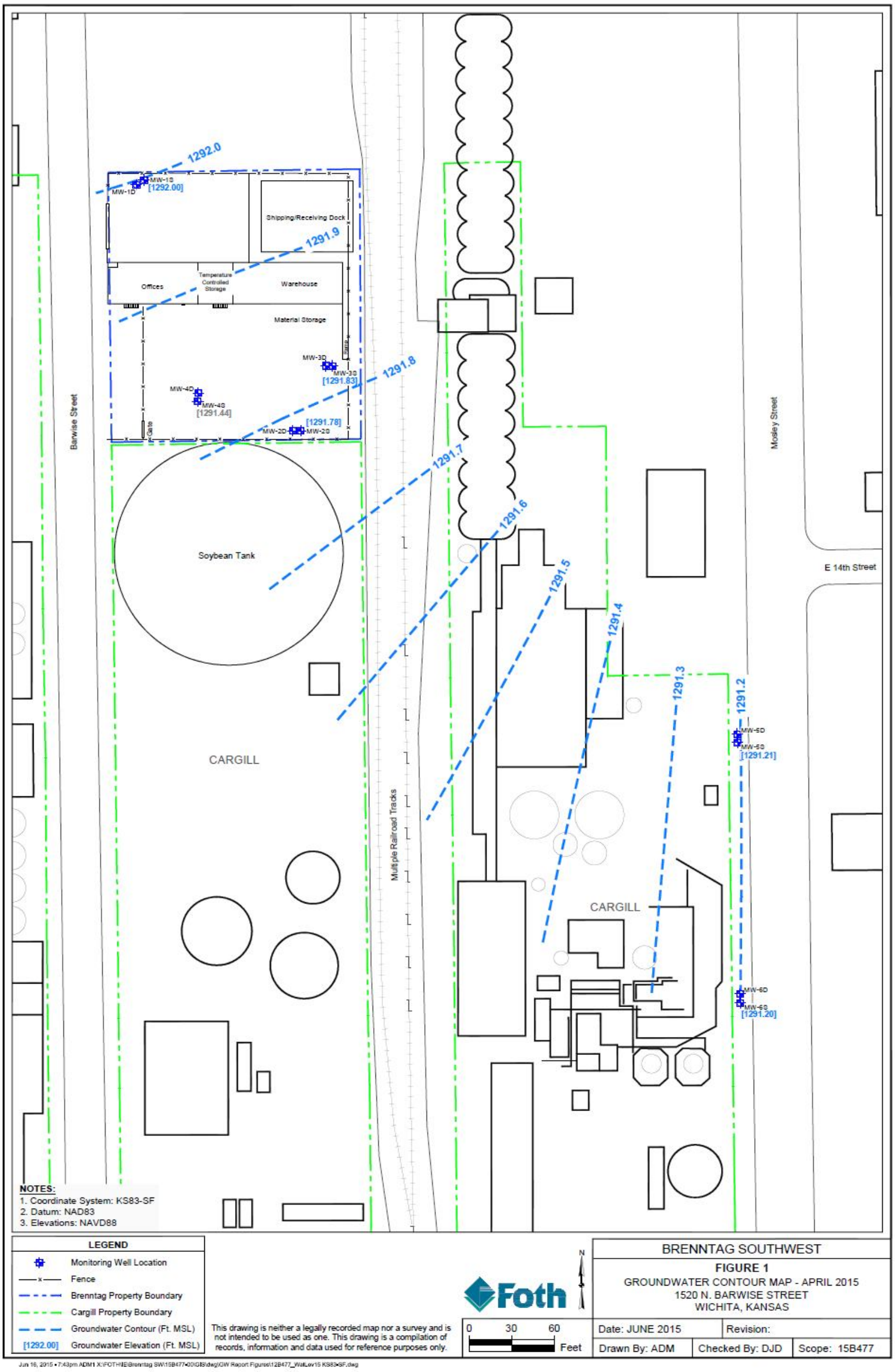

Figure prepared by Foth on behalf of Brenntag Southwest, Inc., based on figure from the First Semi-Annual 2015 Progress Report, July 2015

Figure 4: PCE and TCE Concentrations in Shallow Wells, April 2015

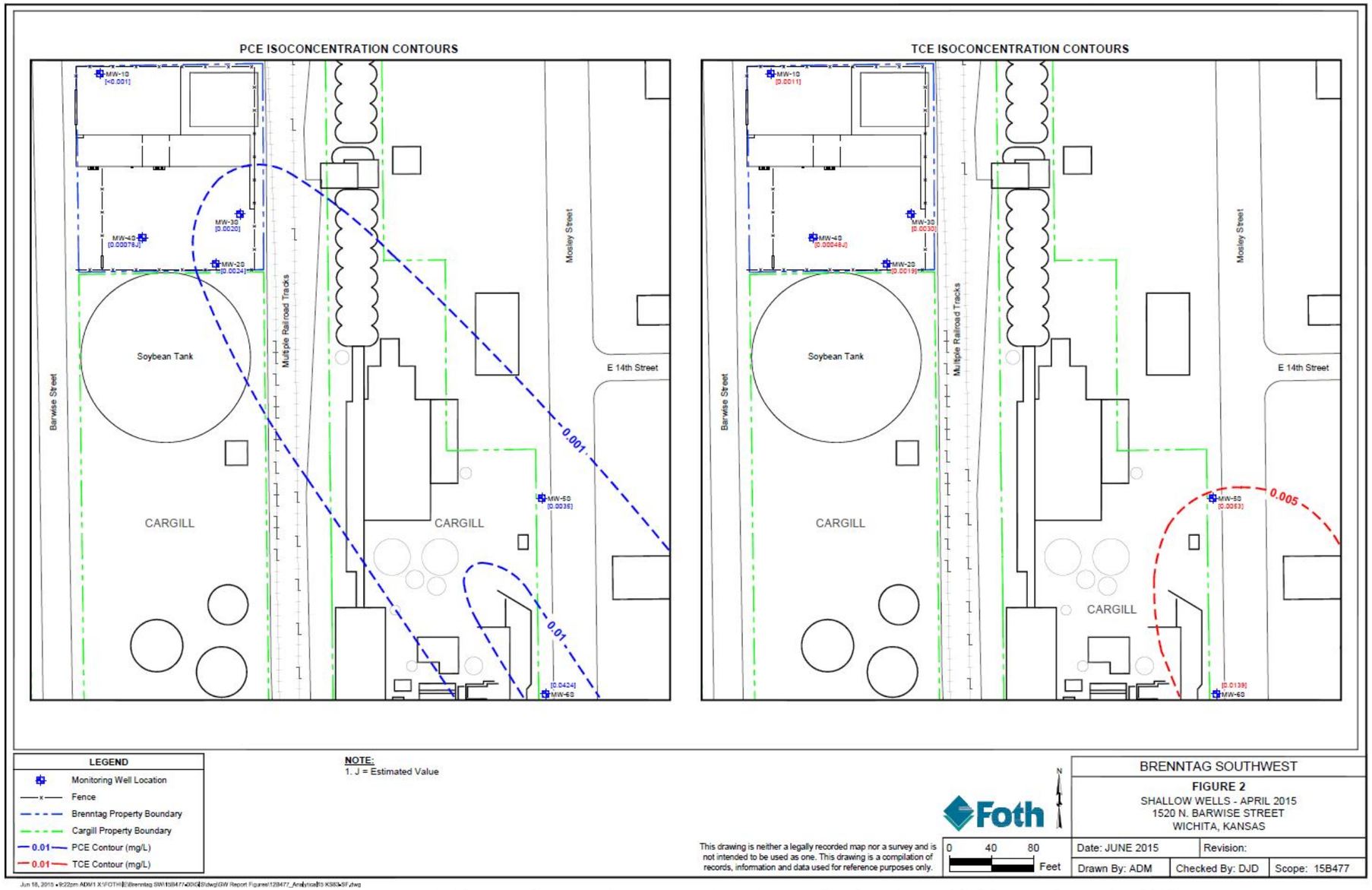

Figure prepared by Foth on behalf of Brenntag Southwest, Inc., based on figure from the First Semi-Annual 2015 Progress Report, July 2015

Figure 5: PCE and TCE Concentrations in Deeper Wells, April 2015

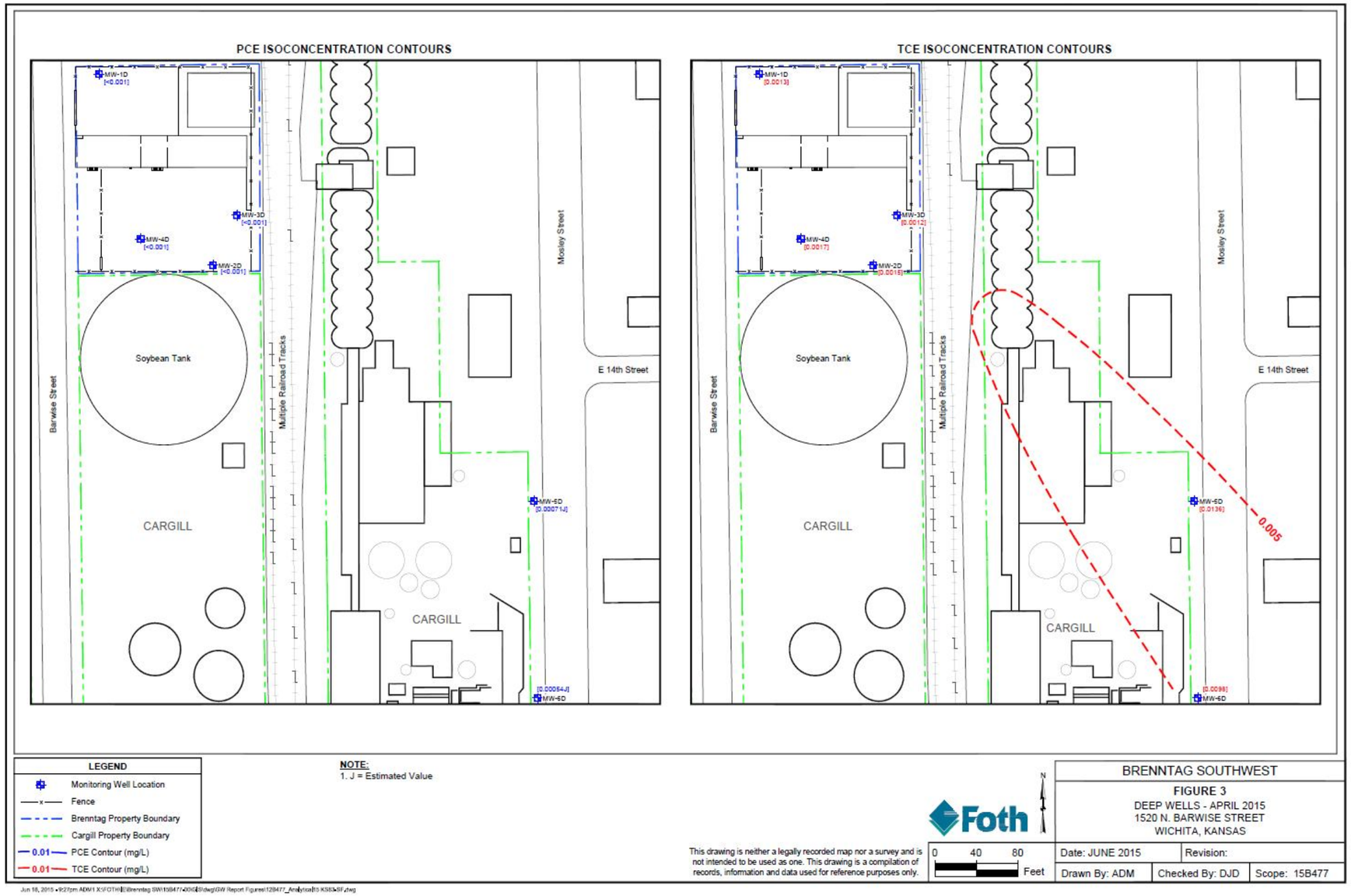

Figure prepared by Foth on behalf of Brenntag Southwest, Inc., based on figure from the First Semi-Annual 2015 Progress Report, July 2015

Figure 6: Interim Remedial Measure – Soil Excavation Area

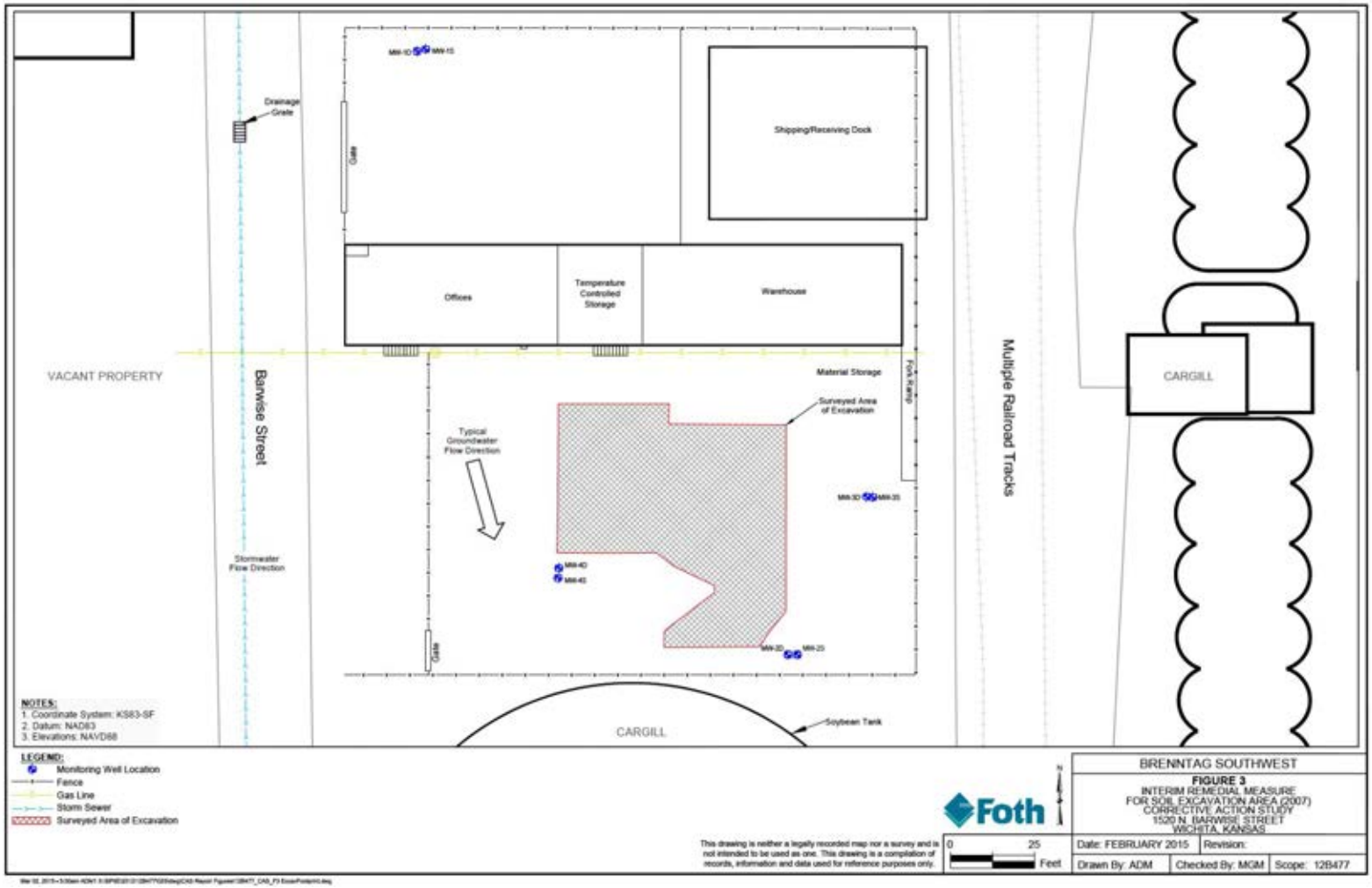

Figure prepared by Foth on behalf of Brenntag Southwest, Inc., based on figure from the Corrective Action Study, March 2015.

Figure 7: Summary of Chemical Injection Plan

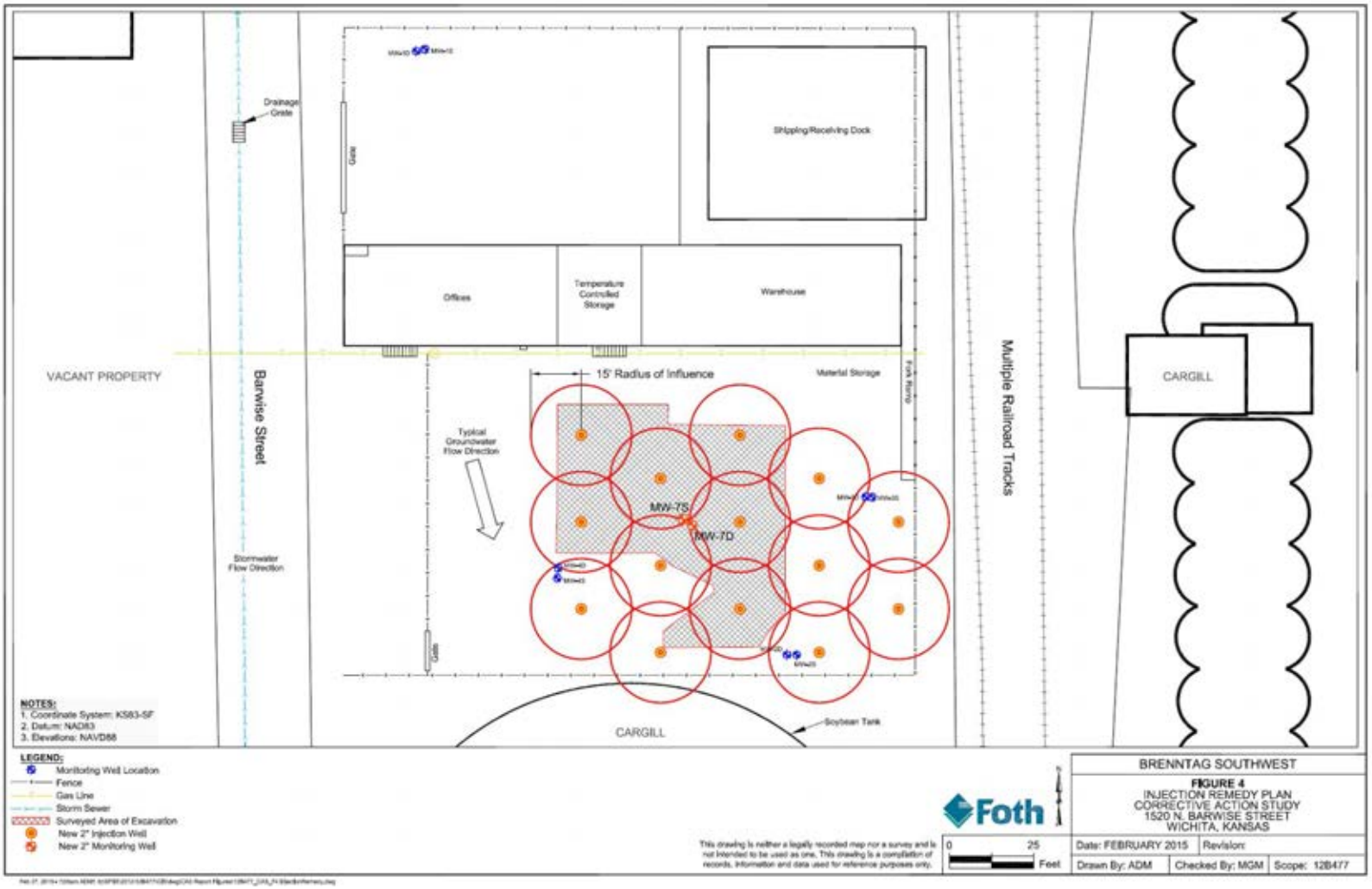

Figure prepared by Foth on behalf of Brenntag Southwest, Inc., based on figure from the Corrective Action Study, March 2015.