HAZARD RANKING SYSTEM (HRS) DOCUMENTATION RECORD COVER SHEET

Name of Site:	Donnelsville Contaminated Aquifer
EPA ID No.:	OHN000510459

Contact Persons

Documentation Record:

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Pathways, Components, or Threats Not Scored

The surface water migration, soil exposure and subsurface intrusion, and air migration pathways were not scored in this Hazard Ranking System documentation record because the ground water migration pathway is sufficient to qualify the site for the National Priorities List (NPL). These pathways are of concern to the U.S. Environmental Protection Agency (EPA) and may be considered during future evaluation. At the time of the listing, the site score is sufficient without the pathways mentioned above.

Surface Water Migration: No surface water samples have been collected. No surface water intakes are located along the 15 mile target distance limit (TDL).

Soil Exposure and Subsurface Intrusion: The listing of the site would not be changed by evaluating this pathway.

Air Migration: The listing of the site would not be changed by evaluating this pathway.

HAZARD RANKING SYSTEM (HRS) DOCUMENTATION RECORD

Name of Site:	Donnelsville Contaminated Aquifer
EPA Region:	5
Date Prepared:	May 2018
Street Address of Site*:	North Hampton Road and U.S. 40
City, County, State, Zip:	Donnelsville, Clark County, Ohio 45319
General Location in the State:	Southwestern portion of state
Topographic Map:	Donnelsville, Ohio 1974
Latitude:	39° 55' 14.01" North
Longitude:	83° 56' 55.42" West

The coordinates above for the Donnelsville Contaminated Aquifer site were measured from sample RW-6 collected within Source 1 during the 2011 Ohio Environmental Protection Agency (EPA) expanded site inspection (ESI) (Ref. 4).

* The street address, coordinates, and contaminant locations presented in this HRS documentation record identify the general area where the site is located. They represent one or more locations the U.S. Environmental Protection Agency (EPA) considers part of the site based on the screening information EPA used to evaluate the site for National Priorities List (NPL) listing. EPA lists national priorities among the known "releases or threatened releases" of hazardous substances; thus, the focus is on the release, and not on precisely delineated boundaries. A site is defined as where a hazardous substance has been "deposited, stored, disposed, or placed, or has otherwise come to be located." Generally, HRS scoring and the subsequent listing of a release merely represent the initial determination that a certain area may need to be addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Accordingly, EPA contemplates that the preliminary description of facility boundaries at the time of scoring will be refined as more information is developed about where the contamination has come to be located.

Pathway	**Pathway Score**
Ground Water[1] Migration	70.12
Surface Water Migration	NS
Soil Exposure and Subsurface Intrusion	NS
Air Migration	NS
HRS SITE SCORE	**35.06**

Notes:

HRS Hazard Ranking System
NS Not scored

[1] "Ground water" and "groundwater" are synonymous; the spelling is different due to "ground water" being codified as part of the HRS, while "groundwater" is the modern spelling.

WORKSHEET FOR COMPUTING HRS SITE SCORE

	S Pathway	**S^2 Pathway**
Ground Water Migration Pathway Score (S_{gw})	70.12	4,916.8144
Surface Water Migration Pathway Score (S_{sw})	NS	NS
Soil Exposure and Subsurface Intrusion Pathway Score (S_{sessi})	NS	NS
Air Migration Pathway Score (S_a)	NS	NS
$S^2_{gw} + S^2_{sw} + S^2_{sessi} + S^2_a$		4,916.8144
$(S^2_{gw} + S^2_{sw} + S^2_{sessi} + S^2_a) / 4$		1,229.2036
$\sqrt{(S^2_{gw} + S^2_{sw} + S^2_{sessi} + S^2_a) / 4}$		**35.06**

Note:

NS = Not scored

Table 3-1 -- Ground Water Migration Pathway Scoresheet
Aquifer Evaluated: Carbonate Bedrock

Factor Categories and Factors	Maximum Value	Value Assigned	
Likelihood of Release to an Aquifer:			
1. Observed Release	550	550	
2. Potential to Release:			
2a. Containment	10	NS	
2b. Net Precipitation	10	NS	
2c. Depth to Aquifer	5	NS	
2d. Travel Time	35	NS	
2e. Potential to Release [lines 2a(2b + 2c + 2d)]	500	NS	
3. Likelihood of Release (higher of lines 1 and 2e)	550		550
Waste Characteristics:			
4. Toxicity/Mobility	(a)	1,000	
5. Hazardous Waste Quantity	(a)	100	
6. Waste Characteristics	100		18
Targets:			
7. Nearest Well	50	50	
8. Population:			
8a. Level I Concentrations	(b)	473.1	
8b. Level II Concentrations	(b)	41.31	
8c. Potential Contamination	(b)	NS	
8d. Population (lines 8a + 8b + 8c)	(b)	514.41	
9. Resources	5	NS	
10. Wellhead Protection Area	20	20	
11. Targets (lines 7 + 8d + 9 + 10)	(b)		584.41
Ground Water Migration Score for an Aquifer:			
12. Aquifer Score [(lines 3 x 6 x 11)/82,500][c]	100		70.12
Ground Water Migration Pathway Score:			
13. Pathway Score (S_{gw}), (highest value from line 12 for all aquifers evaluated)[c]	100		70.12

Notes:

NS = Not scored
[a] = Maximum value applies to waste characteristics category
[b] = Maximum value not applicable
[c] = Do not round to nearest integer

Legend

Approximate Cumulative Historical Extent of Ground Water Plume

Major Road

Refs. 5, pp. 14, 85, 86; 6, pp. 1 through 3; 25, pp. 1, 3, 11; 31, pp. 1, 2, 16; 38, pp. 1, 4; 39, pp. 16, 19, 20; 58; 79, pp. 2, 9

Note: The source of this map is ESRI, used by EPA with ESRI's permission.

Source: USGS 7.5 Minute Topographic Quadrangle Maps: Donnelsville, OH 1974.

United States Environmental Protection Agency Region 5

Donnelsville Contaminated Aquifer
Donnelsville, Clark County, Ohio

Figure 1
Site Location Map

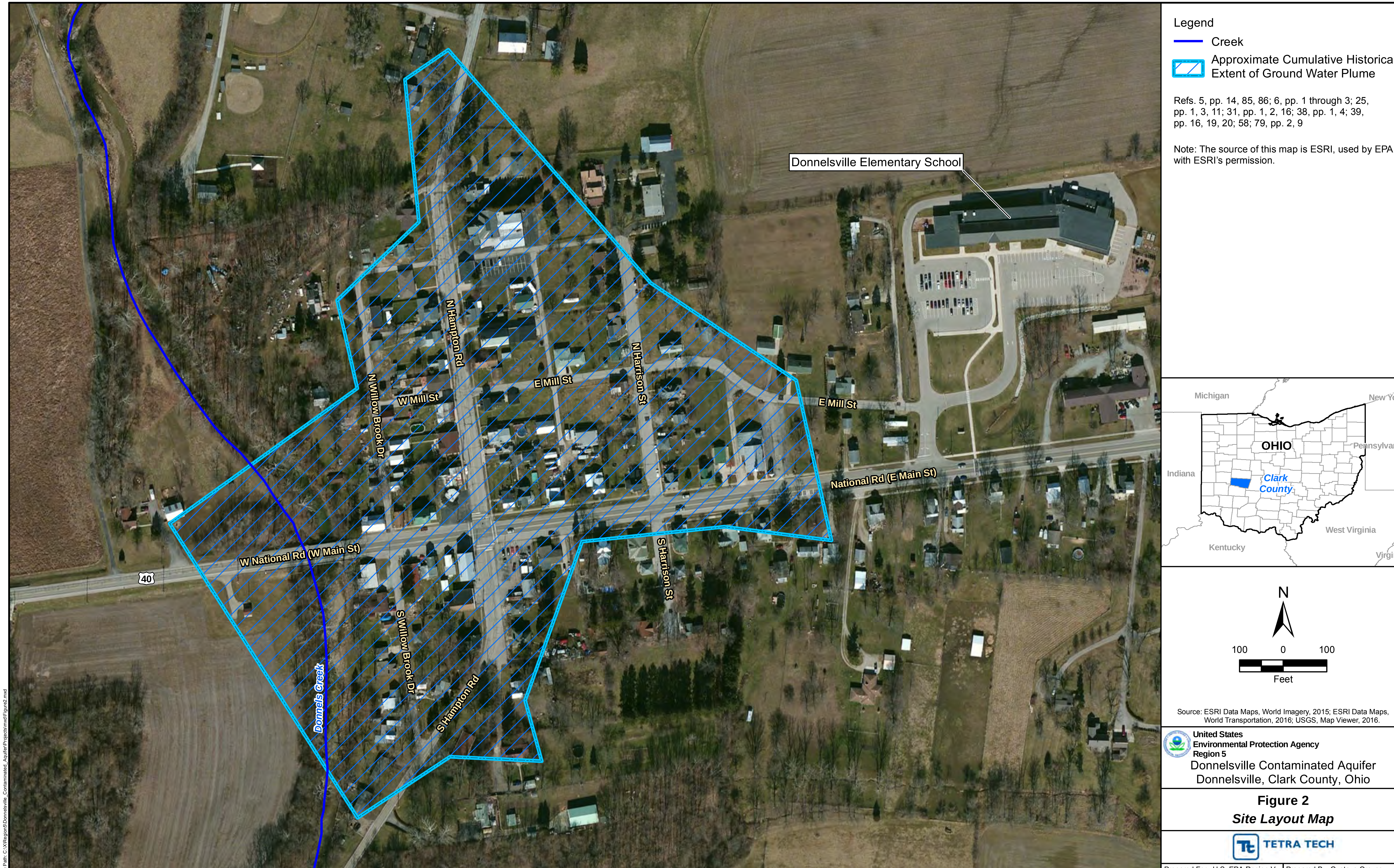
TETRA TECH

Prepared For: U.S. EPA Region V | Prepared By: Gustavo Orozco

File Path: C:\X\Region5\Donnelsville_Contaminated_Aquifer\Projects\mxd\Figure1.mxd

Date Saved: 1/16/2017

Coordinate System: NAD 1983 StatePlane Ohio South FIPS 3402 Feet Projection: Lambert Conformal Conic Datum:North American 1983 Units: Foot US



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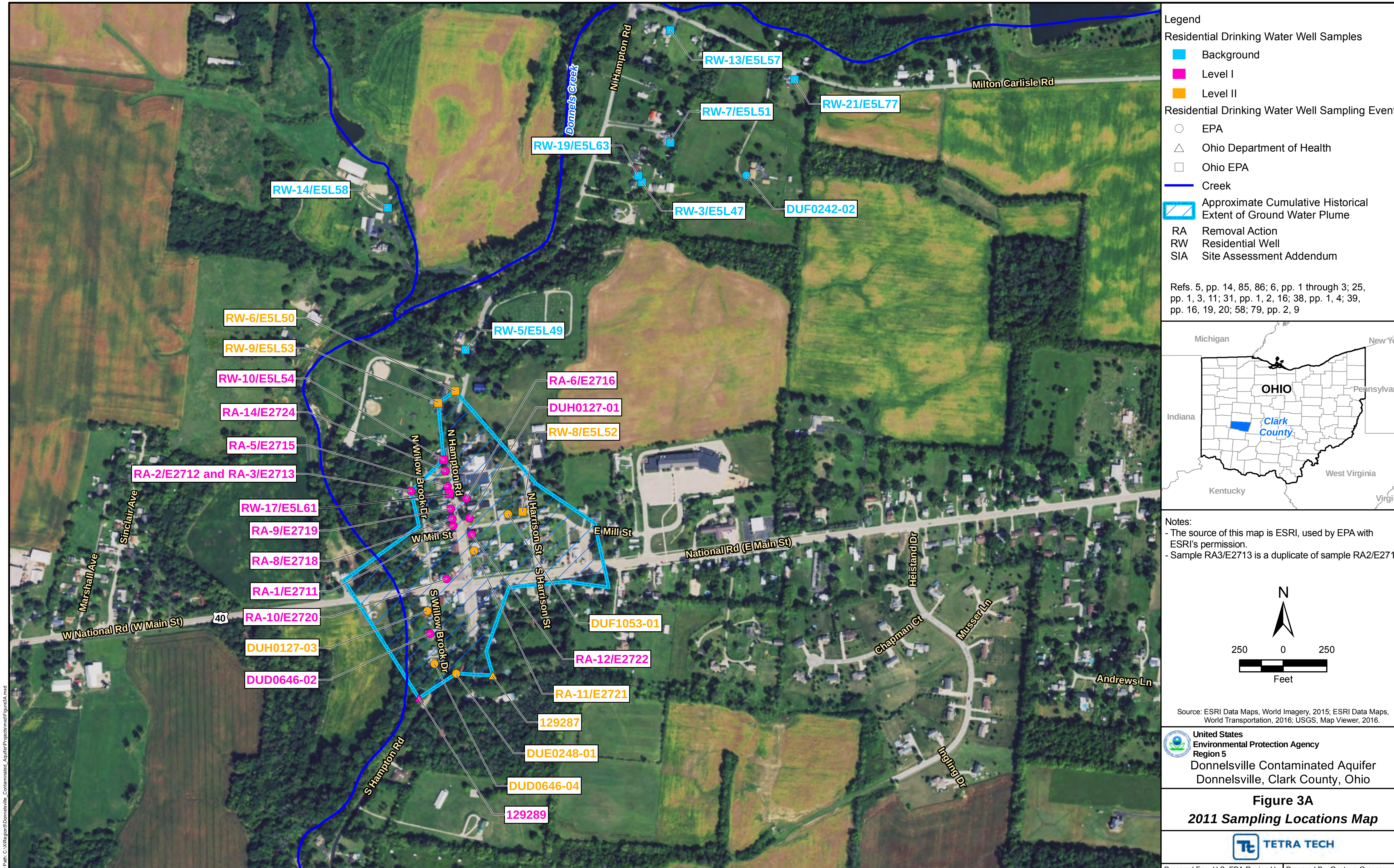

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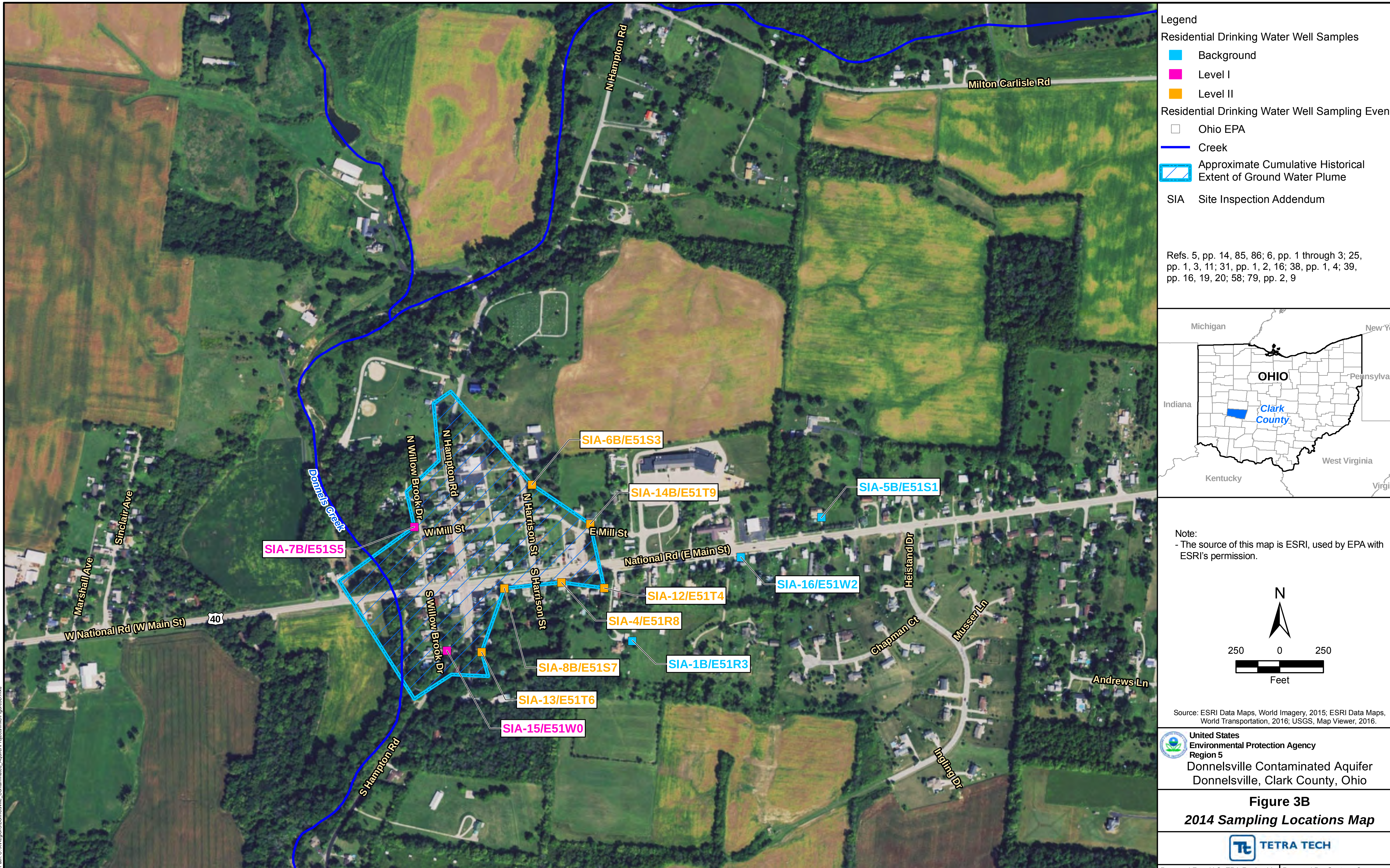

Figure 3B

2014 Sampling Locations Map

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Date Saved: 1/16/2017

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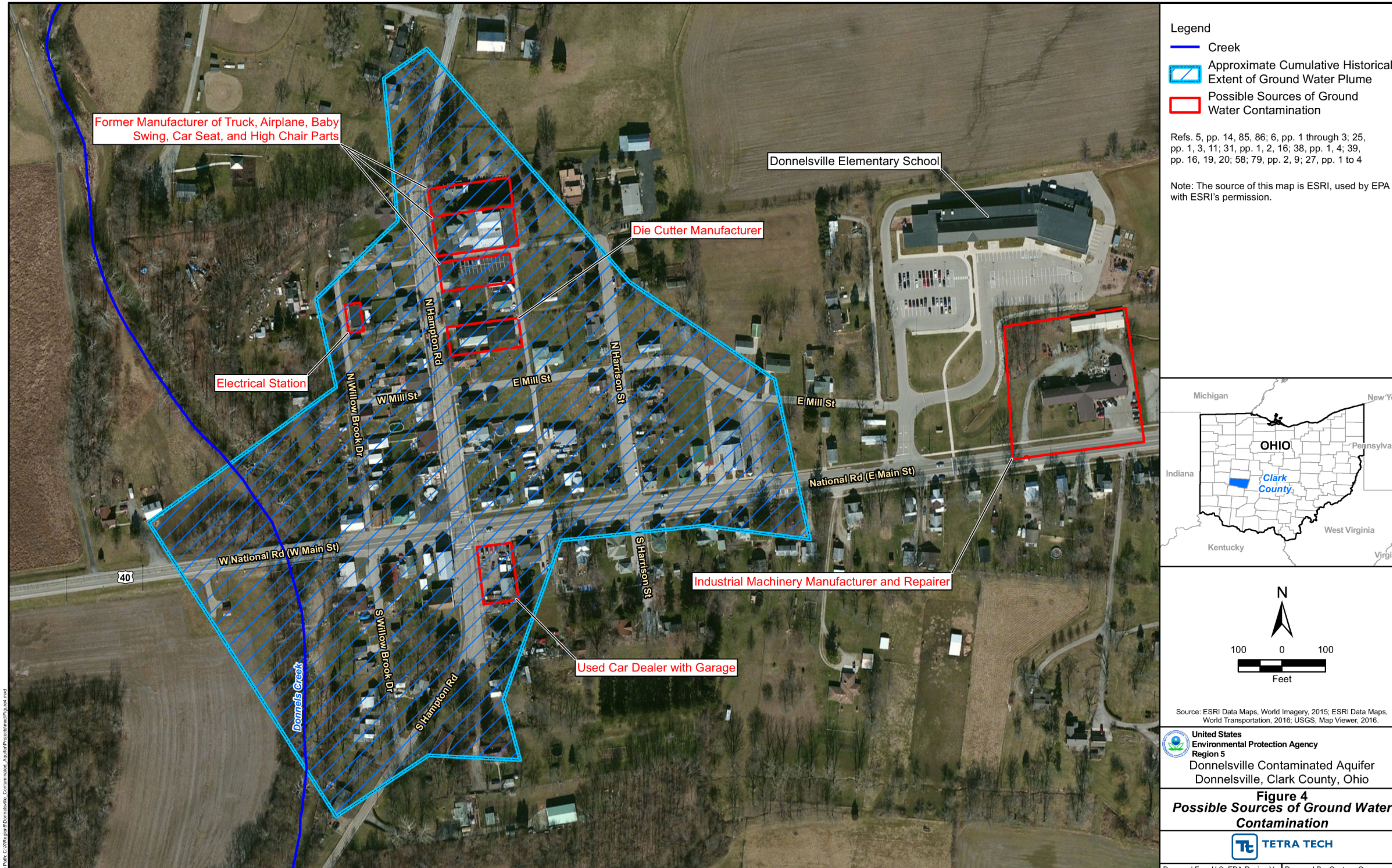

Date Saved: 1/16/2017

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SITE DESCRIPTION

The Donnelsville Contaminated Aquifer (DCA) site is a tetrachloroethylene (PCE), trichloroethylene (TCE), and cis-1,2-dichloroethene (DCE) contaminated groundwater plume originating from one or more unknown sources located in the Village of Donnelsville and portions of Bethel Township, Ohio, with the approximate center of the plume at the intersection of U.S. 40 and North Hampton Road (References [Refs.] 3; 6, pp. 1 through 4; 7) (see Section 2.2.1, Source No. 1 and Figures 1 and 2 of this HRS documentation record). The Village of Donnelsville is one of three villages within Bethel Township (Refs. 56, pp. 708, 709; 57, pp. 1, 2, 3). Municipal water is not available in Donnelsville and portions of Bethel Township. Drinking water is obtained from residential drinking water wells that withdraw water from the carbonate bedrock aquifer (Refs. 6, p. 1; 34). Actual contamination has been documented in residential drinking water wells at Level I and Level II concentrations (see Section 3.1.1, Observed Release, and Table 15 of this HRS documentation record).

The geographic coordinates of the DCA site as measured from sample RW-6 collected from within the plume during the 2011 Ohio EPA expanded site inspection (ESI) are latitude 39° 55' 14.01" north and longitude 83° 56' 55.42" west (Ref. 4). The EPA identification number as recorded in the Superfund Enterprise Management System (SEMS) is OHN000510459 (Ref. 7). Land uses surrounding the DCA site are predominantly residential and agricultural (Ref. 3) (see Figure 2 of this HRS documentation record). Currently, the cumulative historical approximate extent of the groundwater plume is defined by the following samples collected from residential drinking water wells: RA-2/E2712, RA-3/E2713, DUE 0248-01, 129287, 129289, RW-9/E5L53, RW-6/E5L50, RW-10/E5L54, SIA-14B/E51T9, SIA-7B/E51S5, SIA-6B/E51S3, SIA-4/E51S7, SIA-8B/E51S7, SIA-12/E51T4, SIA-13/E51T6, and L16010192-01 (see Figures 3A, 3B, and 3C of this HRS documentation record).

Ohio EPA has made significant efforts to identify the specific source(s) of groundwater contamination through numerous sampling events and by conducting an extensive search of Ohio EPA records as described below in the Site History and Previous Investigations portions of this Site Description and as described in the Attribution section of this HRS documentation record (Ref. 27, pp. 1 through 8) (see Section 3.1.1 of this HRS documentation record). However, no specific source or sources could be found in vicinity of the plume to which groundwater contamination could reasonably be attributed. As a result, the site is being scored as a groundwater plume with no identified source.

SITE HISTORY

In 1990, Donnelsville Elementary School collected a groundwater sample from one of its public drinking water supply wells (Well No. 1) for the Ohio EPA Division of Drinking and Ground Waters (DDAGW) as a part of compliance sampling for non-community public drinking water systems (Refs. 5, p. 2; 12, p. 8; 13, p. 1). The sample contained PCE at 3.3 micrograms per liter (µg/L) (Ref. 12, p. 8). DDAGW sampled the Donnelsville Elementary School drinking water wells (Well No. 1 and Well No. 2) multiple times in 1991 and 1993. Concentrations of PCE ranged from 2.6 µg/L to 4.1 µg/L (Ref. 12, pp. 10 through 18, 21). Well No. 1 was abandoned in 1991 based on the presence of excessive sand content in the well water (Ref. 13, p. 1).

In November 1993, the Ohio EPA Division of Environmental Response and Revitalization (DERR) (formerly the Division of Emergency and Remedial Response) requested that the Ohio EPA DDAGW sample and perform a preliminary site evaluation of the Donnelsville Elementary School public water supply (Refs. 5, p. 2; 13, p. 1). At the time of the sampling event, the school public water supply system served a student and faculty population of 250 people (Ref. 13, p. 1). Groundwater was supplied by one drinking water well (Well No. 2) located in the parking lot on the west side of the school building (Ref. 13, p. 1). A groundwater sample was collected from Well No. 2 and analyzed for volatile organic compounds (VOC) (Ref. 13, p. 2). PCE was detected at 3.1 µg/L (Ref. 13, pp. 2, 3). Ohio EPA DDAGW recommended a site inspection at an industrial machinery manufacturer, a possible source identified during the preliminary site evaluation, and sampling of private drinking water wells in the vicinity of the elementary school (Refs. 13, p. 3; 27, p. 1). The industrial machinery manufacturer is located adjacent to and south of the Donnelsville Elementary School (Refs. 27, pp. 1, 4; 78).

In 1995, Ohio EPA sampled the Donnelsville Elementary School well, two non-residential drinking water wells, and three residential drinking water wells. PCE was detected in four of the six samples collected at concentrations up to 3.7 µg/L (Refs. 5, p. 2; 12, pp. 25 through 36).

In 1997 Ohio EPA DERR collected 13 surface soil samples near the industrial machinery manufacturer identified as a possible source during the 1993 Ohio EPA DDAGW preliminary site evaluation. The samples were analyzed for VOCs, and all samples were non-detect for all analytes (Refs. 5, p. 2; 15, pp. 1, 2, 3; 27, p. 1).

In 2004, Ohio EPA was notified that the Tecumseh Local School District was replacing the old well system at the Donnelsville Elementary School with a new well system. The old well system was replaced because a new elementary school was being built at a new location. Two new wells for Donnelsville Elementary School were completed in December 2004 (Refs. 5, p. 2; 12, p. 6). The two new wells were sampled and analyzed for VOCs, and none were detected in either well. The new Donnelsville Elementary School was completed in 2006 and the new well system went on line (Refs. 5, p. 2; 12, p. 6).

In January 2010, Ohio EPA submitted a Pre-Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) screening assessment report to EPA (Ref. 12, pp. 1, 2). Ohio EPA recommended further assessment for the DCA site because PCE was detected in residential drinking water at concentrations below the Maximum Contaminant Level (MCL) for PCE of 5 µg/L (Refs. 2, p. 2; 12, p. 6). Although the concentrations were below the MCL, Ohio EPA stated that the source and extent of the PCE contamination were not determined and no residential well samples were collected from the Donnelsville area since 1995 (Ref. 12, p. 6).

It should be noted that the Donnelsville Elementary School groundwater wells and associated contamination from the old well system are not being scored as part of the Donnelsville Contaminated Aquifer site for HRS purposes. When the new elementary school opened, the old elementary school was demolished and its system's wells were abandoned and sealed as part of the transition to the new school, and thus the old wells are no longer in use for drinking water purposes (Ref. 5, p. 2). Samples collected from the Donnelsville Elementary School new well system have not shown any VOC contamination.

PREVIOUS INVESTIGATIONS

From 2011 to 2016, numerous sampling events were conducted within Donnelsville and portions of Bethel Township to delineate the extent and source of the groundwater contamination. Thus far, about 81 drinking water wells have been sampled. Of these, 69 samples were collected from residential drinking water wells (Ref. 6, pp. 1 through 4). PCE concentrations detected in residential drinking water wells ranged from 0.2J (estimated) µg/L to 23.7J µg/L (Ref. 6, pp. 1 through 4). Twenty-five air strippers or granulated activated carbon (GAC) water treatment systems have been installed at residential properties where PCE was detected above the MCL of 5 µg/L (Refs. 6, pp. 2, 3, 4; 38, pp. 1, 2, 3).

Table 1 lists sampling events at the DCA site since 2011, including hazardous substances detected in samples collected.

TABLE 1: SAMPLING EVENTS

Agency	Date	Samples Collected	Hazardous Substances Detected	References
Ohio DOH	January 2011	Groundwater from residential drinking water wells	PCE	6, pp. 1 through 4; 18, pp. 3, 4, 29; 83

TABLE 1: SAMPLING EVENTS				
Agency	**Date**	**Samples Collected**	**Hazardous Substances Detected**	**References**
EPA	January to August 2011	Groundwater from residential and non-residential (ex. businesses) drinking water wells	PCE	6, pp. 1 through 4; 39, pp. 5, 20; 46, p. 4; 83
Ohio EPA	November 2011	Groundwater from residential and non-residential drinking water wells; soil and groundwater samples from DPT borings	PCE TCE cis-1,2-DCE	5, pp. 1, 3, 5, 6, 14, 16, 19, 20, 78 through 90; 6, pp. 1 through 4; 25, p. 2; 83
Ohio EPA	November 2014	Groundwater from residential and non-residential drinking water wells	PCE	6, pp. 1 through 4; 31, pp. 1, 2; 83
Ohio EPA	January, May, September and October 2016	Groundwater from residential drinking water wells	PCE, TCE, cis-1,2-DCE	6, pp. 1 through 4, 10, 24; 23, pp. 6, 7; 25, pp. 1, 3; 79, pp. 1, 2; 83
Ohio DOH	March 2016	Groundwater from residential drinking water wells	PCE	6, pp. 1 through 4; 11, pp. 3, 15; 83
EPA	April and May 2016	Groundwater from residential drinking water wells, only post air stripper water treatment system samples were collected	PCE	6, pp. 1 through 4; 65, pp. 2 through 7; 83

Notes:

DOH Department of Health
DPT Direct push technology

During the November 2011 Ohio EPA ESI, soil and/or groundwater samples were collected from 23 direct-push borings in an attempt to locate a source for the PCE contamination (Ref. 5, p. 4). Soil samples were collected from 4 to 24 feet below ground surface (bgs) and contained PCE (up to 8,800 micrograms per kilogram [µg/kg]), TCE (up to 57J [estimated] µg/kg), and cis-1,2-DCE (up to 34 µg/kg) (Ref. 5, pp. 78 through 83). Groundwater samples were collected from 13 direct push borings. The samples contained PCE (up to 250J µg/L) (Ref. 5, p. 18). The greatest concentrations of PCE in soil and groundwater samples were detected in direct-push borings advanced on and adjacent to a former manufacturer of truck, airplane, baby swing, car seat, and high chair parts located at 118 North Hampton Road (Ref. 5, pp. 18, 20; 27, pp. 2, 3, 4). However, the soil samples were collected at or below the water table (Ref. 5, pp. 7, 18, 134 through 143). It is not known if the PCE contamination in the groundwater affected the PCE concentrations detected in the soil samples because the soil samples were collected at or below the water table (Ref. 5, p. 7). The former manufacturer of truck, airplane, baby swing, car seats and high chair parts has stated that VOCs have never been used at its facility located at 118 North Hampton Road (Refs. 16, p. 5; 17, pp. 1, 2; 27, pp. 2, 3) (see Section 3.1.1, Attribution, of this HRS documentation record).

2.2 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Number of source: 1

Name of source: Contaminated Groundwater Plume

Source Type: Other – Ground Water Plume with No Identified Source

Description and Location of Source (with reference to a map of site):

The DCA site consists of a contaminated groundwater plume with no identified source underlying Donnelsville and portions of Bethel Township (Ref. 6, pp. 1 through 4) (see Figure 2 of this HRS documentation record). Currently, the cumulative historical extent of the groundwater plume is defined by the following samples collected from residential drinking water wells: RA-2/E2712, RA-3/E2713, DUE 0248-01, 129287, 129289, RW-9/E5L53, RW-6/E5L50, RW-10/E5L54, SIA-14B/E51T9, SIA-7B/E51S5, SIA-6B/E51S3, SIA-4/E51S7, SIA-8B/E51S7, SIA-12/E51T4, SIA-13/E51T6, and L16010192-01 (see Figures 3A, 3B, and 3C of this HRS documentation record).

PCE contamination in the Donnelsville area was first detected in 1990 during compliance sampling at the Donnelsville Elementary School (Refs. 5, p. 2; 12, p. 8; 13, p. 1). The groundwater sample contained PCE at 3.3 µg/L (Ref. 12, p. 8). The Donnelsville Elementary School drinking water wells (Well No. 1 and Well No. 2) were sampled in 1991 and 1993. Concentrations of PCE ranged from 2.6 µg/L to 4.1 µg/L (Ref. 12, pp. 10 through 18).

In 1993, Ohio EPA DDAGW recommended sampling of private drinking water wells in the vicinity of the elementary school (Ref. 13, p. 3). In 1995, Ohio EPA sampled the Donnelsville Elementary School well, two non-residential drinking water wells, and three residential drinking water wells. PCE was detected in four of the six samples collected at concentrations up to 3.7 µg/L (Ref. 12, pp. 25 through 36).

In January 2010, Ohio EPA submitted a Pre-CERCLIS screening assessment report to EPA (Ref. 12, pp. 1, 2). Ohio EPA recommended further assessment for the DCA site because PCE was detected in residential drinking water wells at concentrations below the PCE MCL of 5 µg/L (Ref. 12, p. 6). Although the concentrations were below the MCL, the source and extent of the PCE contamination were not determined, and no residential well samples were collected from the Donnelsville area since 1995 (Ref. 12, p. 6).

In January 2011, EPA collected samples from 14 residential drinking water wells located in the Donnelsville area. Later that year, an additional 14 samples were collected from residential drinking water wells as access was obtained from the homeowners (Ref. 38, pp. 1, 2, 3). Based on results from the 2011 sampling event, EPA installed air stripper water treatment systems at 19 residential properties where drinking water contained PCE at concentrations greater than the MCL. Once the water treatment systems were installed, drinking water samples were collected post-installation at 7 and 21 days to ensure that PCE concentrations were below the MCL (Ref. 38, pp. 1, 2, 3).

Analytical results of the 2011 EPA investigation indicated that the greatest concentrations of PCE were detected in residential drinking water wells located along North Hampton Road and North Willowbrook Drive, north of West Main Street. In November 2011, Ohio EPA collected samples from residential drinking water wells in Bethel Township, north of Donnelsville, to determine if wells in this area were contaminated with PCE and to provide additional data to verify the extent of the plume (Refs. 25, p. 1; 57, pp. 1, 2, 3). During the November 2011 Ohio EPA ESI, samples were collected from 17 residential drinking water wells. Of these 17 wells, 11 were not previously sampled by EPA (Ref. 25, pp. 1, 2).

None of the residential drinking water wells sampled for the first time contained PCE at concentrations above the MCL (Ref. 25, p. 2).

Additional sampling events were conducted within Donnelsville and portions of Bethel Township in 2011 by the Ohio Department of Health, in 2014 by Ohio EPA, and in 2016 by Ohio Department of Health and Ohio EPA to delineate the extent and source of groundwater contamination. About 81 drinking water wells were sampled between 2011 and 2016. Of these, 69 samples were collected from residential drinking water wells (Ref. 6, pp. 1 through 4). PCE concentrations detected in residential drinking water wells ranged from 0.2 µg/L to 23.7 µg/L (Ref. 6, pp. 1 through 4).

Between 2014 and 2016, Ohio EPA received numerous phone calls from Donnelsville residents stating that their water treatment systems were not working. Ohio EPA asked for EPA's assistance with sampling the residential drinking water wells where EPA installed water treatment systems in 2011. The sampling event occurred in April and May 2016, and only post-treatment residential drinking water well samples were collected (Ref. 38, p. 1). New GAC water treatment systems were installed at nine residential properties where the air stripper water treatment systems were not working (Ref. 38, pp. 1, 2, 3). A GAC water treatment system was also installed at a residential drinking water well that Ohio EPA first sampled in January 2016 (Ref. 38, p. 2).

Source samples collected from Source No. 1 during the 2011 EPA sampling events, the 2011 Ohio EPA ESI, 2011 Ohio Department of Health sampling event, the 2014 Ohio EPA site inspection addendum (SIA), and the 2016 Ohio EPA sampling events contained PCE, TCE, and cis-1,2-DCE (Refs. 6, pp. 1 through 4; 10, pp. 19, 20; 41) (see Section 3.1.1, Observed Release, Tables 10 through 14).

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

Groundwater samples were collected from residential drinking water wells during investigations that EPA, Ohio EPA, and Ohio Department of Health conducted between 2011 and 2016. Table 2 presents samples collected from residential drinking water wells and hazardous substances associated with Source No. 1, a groundwater plume with no identified source. For more detailed analytical results documenting the groundwater plume, see Section 3.1.1 of this HRS documentation record.

TABLE 2: Source No. 1 Groundwater Wells and Associated Hazardous Substances

Sample ID/Client No./ Laboratory Sample ID	Hazardous Substances	References
January through August 2011 EPA Removal Assessment		
RA-11/E2721	PCE	10, pp. 31, 32; 41
RA-12/E2722	PCE	10, pp. 33, 34; 41
RA-1/E2711	PCE	10, pp. 7, 8; 41
DUH0127-01	PCE	32, p. 4; 38, p. 1
RA-8/E2718	PCE	10, pp. 25, 26; 41
RA-9/E2719	PCE	10, pp. 27, 28; 41
RA-6/E2716	PCE	10, pp. 21, 22; 41
RA-5/E2715	PCE TCE cis-1,2-DCE	10, pp. 19, 20; 41
RA-14/E2724	PCE	10, pp. 37, 38; 41
DUE0248-01	PCE	36, p. 5; 38, p. 1
RA-10/E2720	PCE	10, pp. 29, 30; 41
DUF1053-01	PCE	37, p. 5; 38, p. 1
RA-2/E2712 and RA-3/E2713	PCE	10, pp. 13, 14, 15, 16; 41
DUH0127-03	PCE	64, p. 5; 38, p. 1
DUD0646-02	PCE	35, p. 6; 38, p. 1
DUD0646-04	PCE	35, p. 8; 38, p. 1
November 2011 Ohio Department of Health		
129287	PCE	28, pp. 4, 5; 58; 59, pp. 1, 6
129289	PCE	28, pp. 12, 13; 58, 59, pp. 1, 10
November 2011 Ohio EPA Expanded Site Inspection		
RW-17/E5L61	PCE cis-1,2-DCE	5, pp. 86, 817, 818
RW-10/E5L54	PCE TCE	5, pp. 85, 807, 808
RW-9/E5L53	PCE	5, pp. 85, 638, 639
RW-6/E5L50	PCE	5, pp. 84, 632, 633
RW-8/E5L52	PCE	5, pp. 85, 636, 637
November 2014 Ohio EPA Site Inspection Addendum		
SIA-13/E51T6	PCE	8, pp. 68, 69; 31, pp. 1, 2
SIA-15/E51W0	PCE	9, pp. 16, 17; 31, pp. 1, 2
SIA-6B/E51S3	PCE	8, pp. 48, 49; 31, pp. 1, 2
SIA-8B/E51S7	PCE	8, pp. 56, 57; 31, pp. 1, 2
SIA-4/E51R8	PCE	8, pp. 40, 41; 31, pp. 1, 2
SIA-12/E51T4	PCE	8, pp. 66, 67; 31, pp. 1, 2

TABLE 2: Source No. 1 Groundwater Wells and Associated Hazardous Substances		
Sample ID/Client No./ Laboratory Sample ID	**Hazardous Substances**	**References**
SIA-14B/E51T9	PCE	9, pp. 14, 15; 31, pp. 1, 2
SIA-7B/E51S5	PCE	8, pp. 52, 53; 31, pp. 1, 2
January, May, and September 2016 Ohio EPA		
L16010192-13	PCE	66, pp. 13, 14; 25, p. 3
L16010192-01	PCE TCE cis-1,2-DCE	66, pp. 31, 32; 25, p. 3
L16051382-01	PCE	52, pp. 5, 6; 79, p. 2
L16090547-05	PCE	24, pp. 13, 14; 79, p. 2
L16090547-07	PCE	24, pp. 17, 18; 79, p. 2
L16090547-04	PCE	24, pp. 11, 12; 79, p. 2
L16090547-01/ L16090547-02	PCE	24, pp. 7, 8; 79, p. 2

Notes:

DCE Dichloroethene
ID Identification
No. Number
PCE Tetrachloroethylene
RA Removal Assessment
RW Residential well
SIA Site inspection addendum
TCE Trichloroethylene
Sample L16090547-02 is a duplicate of sample L16090547-01 (Refs. 79, p. 2).
Sample RA-3/E2713 is a duplicate of sample RA-2/E2712 (Ref. 41).

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

Samples collected from Source No. 1 contained PCE, TCE, and cis-1,2-DCE. Source No. 1 consists of a contaminated groundwater plume with no identified source underlying Donnelsville and portions of Bethel Township (Refs. 6, pp. 1 through 4; 57, pp. 1, 2, 3) (see Figure 2 of this HRS documentation record). Analytical results for groundwater samples collected from residential drinking water wells indicate that a release of hazardous substances has occurred to the groundwater migration pathway, as documented in Section 3.1.1 of this HRS documentation record. During the Ohio EPA November 2011 ESI, no liners were observed during temporary monitoring well installation and sampling activities (Ref. 25, p. 1). Therefore, a containment factor value of 10, as noted in Table 2, was assigned for the groundwater migration pathway (Ref. 1, Section 3.1.2.1, Table 3-2).

TABLE 3: Containment Factors for Source No. 1

Containment Description	Containment Factor Value	References
Gas release to air	NS	NA
Particulate release to air	NS	NA
Release to ground water: No liner; evidence of migration	10	1, Section 3.1.2.1, Table 3-2; 25, p. 1; see also Section 3.1.1 of this HRS documentation record.
Release via overland migration and/or flood	NS	NA

Notes:

NA Not applicable
NS Not scored

2.4.2.1 HAZARDOUS WASTE QUANTITY

2.4.2.1.1 Hazardous Constituent Quantity

The total hazardous constituent quantity for Source No. 1 could not be adequately determined according to the HRS requirements; that is, the total mass of all CERCLA hazardous substances in the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.1). Insufficient historical and current data [manifests, potentially responsible party (PRP) records, State records, permits, waste concentration data, etc.] are available to adequately calculate the total or partial mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to calculate a total or partial Hazardous Constituent Quantity estimate for Source No. 1 with reasonable confidence. Scoring proceeds to the evaluation of Tier B, hazardous wastestream quantity (Ref. 1, Section 2.4.2.1.1).

Hazardous Constituent Quantity Assigned Value: NS

2.4.2.1.2 Hazardous Wastestream Quantity

The total hazardous wastestream quantity for Source No. 1 could not be adequately determined according to the HRS requirements; that is, the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.2). Insufficient historical and current data (manifests, PRP records, State records, permits, waste concentration data, annual reports, etc.) are available to adequately calculate the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants or the source and the associated releases from the source. Therefore, there is insufficient information to adequately calculate the total or partial mass of the wastestream plus the mass of all CERCLA pollutants and contaminants in the source and the associated release from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous wastestream quantity for Source No. 1 with reasonable confidence. Scoring proceeds to the evaluation of Tier C, Volume (Ref. 1, Section 2.4.2.1.2).

Hazardous Wastestream Quantity Assigned Value: NS

2.4.2.1.3 Volume

For migration pathways, the source is assigned a value using the appropriate Tier C equation from HRS Table 2-5 (Ref. 1, Section 2.4.2.1.3). The hazardous waste quantity for a plume site with no identified source can be determined by measuring the area within all observed release samples combined with the vertical extent of contamination to arrive at an estimate of the plume volume (Ref. 1, Section 2.4.2.1).

However, the lack of vertical extent of contaminant delineation prohibits calculation of a volume measurement. The presence of contaminated groundwater samples shows that the volume is greater than zero. Therefore, the volume of the groundwater plume is assigned a volume hazardous waste quantity value greater than zero. The value of greater than zero reflects that the volume is known to be greater than zero, but the amount is unknown.

Volume Assigned Value: unknown but >0

2.4.2.1.4 Area

Tier D is not evaluated for source type “other” (Ref. 1, Section 2.4.2.1.4).

Area Assigned Value: 0

2.4.2.1.5 Source Hazardous Waste Quantity Value

As described in the HRS, the highest value assigned to a source from among the four tiers of hazardous constituent quantity (Tier A), hazardous wastestream quantity (Tier B), volume (Tier C), or Area (Tier D) was selected as the source hazardous waste quantity value (Ref. 1, Section 2.4.2.1). Tier C was assigned the greatest value of unknown but greater than zero.

Highest assigned value from Ref. 1, Table 2-5: unknown but >0

SUMMARY OF SOURCE DESCRIPTIONS

TABLE 4: Summary of Source Descriptions						
			Containment Factor Value by Pathway			
					Air	
Source No.	**Source Hazardous Waste Quantity Value**	**Source Hazardous Constituent Quantity Complete? (Yes/No)**	**Ground Water (Ref. 1, Table 3-2)**	**Surface Water Overland/ Flood (Ref. 1, Table 4-2)**	**Gas (Ref. 1, Table 6-3)**	**Particulate (Ref. 1, Table 6-9)**
1	>0	No	10	NS	NS	NS

Notes:

> Greater than
NS Not scored

Total Source Hazardous Waste Quantity Value: >0.

Other Possible Sources –

No other possible sources have been identified.

3.0 GROUND WATER MIGRATION PATHWAY

3.0.1 GENERAL CONSIDERATIONS

Ground Water Migration Pathway Description

Regional Geology

The DCA site is located in Donnelsville and portions of Bethel Township, Clark County, Ohio, and lies on the Southern Ohio Loamy Till Plain of the Central Lowland physiographic province (Refs. 5, p. 2; 57, pp. 1, 2, 3; 67, p. K2; 68). The topography of the county is characterized by level to gently rolling terrain dissected by modern drainages. The surficial features of the county are predominantly glacial in origin, with the exception of bedrock outcrops throughout the county (Ref. 69, p. 15). The elevation of the DCA site is about 930 feet above mean sea level (msl) as determined from sample location RW-6 (Refs. 4; 20) (see Figure 1 of this HRS documentation record). Clark County is underlain in descending stratigraphic order by all or some of the following units: Quaternary age glacial deposits, Devonian age sedimentary rocks, Silurian age sedimentary rocks, and Ordovician age sedimentary rocks (Refs. 69, p. 23; 70, pp. 13, 14, 16 through 19; 71; 73, p. 142).

The glacial deposits can be subdivided into three general categories based on lithology: (1) till (sediment consisting of an unsorted mixture of clay, silt, sand, and gravel); (2) outwash (coarse-grained stratified sediment consisting of well sorted sand and gravel); and (3) lacustrine deposits (fine-grained stratified sediment consisting of well-sorted silt and clay layers) (Ref. 70, pp. 18, 19). Till was deposited by advancing glaciers or by melting stagnant ice (Ref. 70, p. 18). Outwash was deposited by advancing glacial meltwater. Specifically, when ice sheets melted, large volumes of meltwater flowed through stream valleys carved out by previous erosional events and filled them with well-sorted sand and gravel (Ref. 70, p. 18). Lacustrine deposits were placed in lacustrine environments formed in valleys or basins dammed by glacial ice (Ref. 70, p. 18). The glacial deposits in the Donnelsville area consist of till and outwash, which are relatively thin (less than 100 feet thick) (Refs. 5, pp. l, 75; 67, p. K6; 70, pp. 18, 19).

Underlying the glacial deposits are Devonian age sedimentary rocks; however, the majority of these rocks have been removed by erosion (Refs. 67, p. K11; 71). Where present, the Devonian rocks consist of Ohio Shale (0 to 15 feet thick) and Columbus Limestone (0 to 105 feet thick). The Ohio Shale is black to brown fissile and pyritic shale. The Columbus Limestone contains light gray to light brown, massive to thinly bedded dolomite with thin beds and nodules of chert (Ref. 73, p. 142).

Silurian age sedimentary rocks underlie Devonian age sedimentary rocks and consist of thick beds of crystalline limestone and dolomite interbedded with thin layers of shale (Refs. 70, p. 16; 73, p. 142). These rocks are divided into the Lockport and sub-Lockport Groups, which are further divided into the Cedarville Dolomite, Springfield Dolomite, and Euphemia Dolomite, of the Lockport Group and Massie Shale, Laurel Dolomite, Osgood Shale, Dayton Formation, and Brassfield Formation, of the sub-Lockport Group (Refs. 5, p. 67; 73, p. 142). The dolomites of the Lockport Group are massive and porous (Cedarville and Euphemia Dolomites) and thinly bedded and dense (Springfield Dolomite) (Ref. 73, p. 142). The dolomites and shales of the sub-Lockport Group are calcareous and dense (Massie Shale); thinly bedded and dense (Laurel Dolomite); calcareous with beds (Osgood Shale); thinly bedded and dense (Dayton Formation); and fossiliferous to irregularly bedded and fine grained (Brassfield Formation) (Ref. 73, p. 142). The Silurian-age sedimentary rocks are less than 100 feet thick (Refs. 70, p. 18; 71).

Underlying the Silurian age sedimentary rocks are Ordovician age sedimentary rocks (Refs. 69, p. 23; 71). Ordovician rocks were derived from marine sediments that formed thick beds of shale interbedded with thin beds of coarse, fossiliferous limestone. The thin limestone beds constitute approximately 20 percent of the sequence and are most common in the upper part of the Ordovician sequence (Ref. 70, p. 16.). These rocks range from approximately 800 to 1,100 feet in thickness (Ref. 70, p. 16).

Regional Aquifer Description

Ohio's aquifers can be divided into three major types: (1) sand and gravel buried aquifers distributed as thin bands throughout the state, (2) sandstone and shale aquifers located in the eastern portion of Ohio, and (3) carbonate aquifers located in the western portion of Ohio (Ref. 72, p. 1). Residential drinking water wells in the Donnelsville area obtain water from the carbonate bedrock aquifer (Refs. 5, p. 4; 34; 72, p. 2). The carbonate bedrock aquifer is also referred to as the Silurian-Devonian aquifer and the Silurian and Devonian carbonate aquifer in regional geology references (Refs. 67, p. K10; 73, pp. 139, 140). However, the aquifer will be referred to as the carbonate bedrock aquifer in this HRS documentation record.

The carbonate bedrock aquifer is the dominant aquifer in western Ohio. The aquifer consists of Silurian and Middle Devonian limestone and dolomite with a thickness of 300 to 600 feet (Ref. 72, p. 3). Higher production units of the carbonate bedrock aquifer are associated with fractures and dissolution features that increase the permeability (Ref. 72, p. 3). The carbonate bedrock aquifer is relied on heavily for domestic water supply (Ref. 73, p. 140). The Devonian rocks are less important hydrologically than the Silurian rocks because much of the lower part of the section of Devonian rocks have been removed by erosion (Ref. 67, p. K11). Groundwater is generally under confined conditions and water moves through fractures, bedding planes, and solution cavities in the dolomites and limestones (Ref. 67, p. K11).

Site Geology/Hydrogeology

In 2010, the Ohio EPA DDAGW Southwest District Office (SWDO) conducted a hydrogeologic investigation of the Donnelsville area based on publically available information and a field visit (Ref. 5, pp. 66 through 76). The findings of the investigation are noted below.

- Donnelsville is underlain by a fractured dolomitic and limestone aquifer of Silurian age (Ref. 5, p. 67).
- Donnelsville is underlain by undivided Massie Shale, Laurel Dolomite, Osgood Shale, Dayton limestone, and Brassfield limestone of the sub-Lockport Group (Refs. 5, p. 67; 73, p. 142). The Dayton limestone and Brassfield limestone are described as Formations in Reference 73, p. 142.
- Bedrock outcrops were noted in the Donnelsville area (Ref. 5, p. 68).
- Donnels Creek, which flows through the area overlying the DCA site, flows on top of bedrock for much of its reach (Refs. 5, p. 68; 48, p. 5) (see Figure 2 of this HRS documentation record).
- A potentiometric surface map was prepared using well logs in the Donnelsville area. The potentiometric map indicated that the general direction of groundwater flow is to the south-southwest (Ref. 5, p. 73).

Well logs are available for two drinking water wells installed at Donnelsville Elementary School in 2004 (Ref. 74, pp. 79, 81; 75, p. 1). Donnelsville Elementary School is located about 400 feet east of the DCA site (see Figure 2 of this HRS documentation record). The elevation at Donnelsville Elementary School is about 960 feet above msl (Ref. 20). The Ohio EPA drinking water source assessment for Donnelsville Elementary School states that the two Donnelsville Elementary School wells withdraw water from the carbonate bedrock aquifer in a potential karst region. Potential karst regions are defined as carbonate aquifers covered by less than 25 feet of glacial material and typically exhibit surficial karst features, such as sinkholes (Ref. 75, p.1). Well logs for the two wells indicate that the school is underlain by 7 feet of clay (960 to 953 feet above msl); 5 feet (953 to 948 feet above msl) to 7 feet (953 to 946 feet above msl) of clay and gravel; 109 feet (948 to 839 feet above msl) to 110 feet (946 to 836 feet msl) of limestone; and 79 feet (839 to 760 feet above msl) to 86 feet (836 to 750 feet above msl) of limestone/shale. First water was encountered at 38 feet bgs (922 feet above msl) (Refs. 20; 74, pp. 79, 81).

Well logs are available for 16 residential drinking water wells located within the DCA site (Refs. 74, pp. 1, 2, 4 through 8, 29, 30, 32, 45, 47, 48, 53, 55, 56, 57, 58) (see Figure 2 of this HRS documentation record). Of the 16 well logs available, four well logs (permit numbers 672184, 933563, 667583, and

895510) are for residential drinking water wells evaluated at Level I or Level II concentrations (samples RA-12/E2722, DUE0248-01, L16090547-04, L16090547-07) (Refs. 10, pp. 33, 34; 38, pp. 1, 2; 41; 61, p. 5; 74, pp. 1, 2, 30, 48; 79, pp. 1, 2, 21, 22, 27, 28; 80). Well logs are also available for four wells located upgradient of the DCA site (Refs. 5, pp. 72, 73; 74, pp. 1, 2, pp. 34 through 43). Of the four upgradient wells, two well logs (permit numbers 218305 and 697697) are for residential drinking water wells evaluated as background wells (samples RW-19/E5L63 and RW-7/E5L51) (Refs. 5, pp. 84, 86; 74, pp. 35, 36; 80).

A description of each well log including the well permit number, well depth, cased length, and depth of first water is presented in Table 5 below.

TABLE 5: Wells Within and Upgradient of DCA Site

Permit No./ Sample No. (if applicable)	Well Depth (ft. bgs)	Cased Length[1] (ft. bgs)	Depth of First Water (ft. bgs)	Well Log Description	References
Wells Within DCA Site					
117466	57	0 to 16	57	Clay - 0' to 4' Gravel - 4' to 16' Limestone - 16' to 57'	74, pp. 1, 2, 29
672184/RA-12/E2722	80	0 to 27	25	Clay, red - 0' to 12' Limestone - 12' to 80'	74, pp. 1, 2, 30; 80
41897	57	0 to between 21 and 36	47	Clay, black and red – 0' to 6' Sand, coarse – 6' to 10' Sand, fine – 10' to 13' Hard pan – 13' to 17' Sand fine and coarse – 17' to 21' Granite rock, yellow – 21' to 25' Crevice, yellow – 25' to 26' Granite, yellow – 26' to 56' Shale, grey – 56' to 57'	74, pp. 1, 2, 31
344519	60	0 to between 23 and 60	25	Clay, black – 0' to 10' Hard pan – 10' to 12' Sand, fine, red – 22' to 23' Limestone, white – 23' to 60'	74, pp. 1, 2, 32
201272	86	0 to between 21 and 65	36	Clay, black – 0' to 6' Gravel – 6' to 16' Hard pan – 16' to 21' Limestone – 21' to 86'	74, pp. 1, 2, 47
933563/DUE0248-01	100	0 to 100	40	Clay, brown – 0' to 7' Limestone – 7' to 100'	74, pp. 1, 2, 48; 80
686987	100	0 to 26	NL	Clay, red – 0' to 10' Limestone, brown – 10 to 45' Limestone, blue shale streaks – 45' to 80' Shale, blue – 80' to 100'	74, pp. 1, 2, 4
94748	73	0 to between 27 and 46	37	Clay, black – 0' to 6' Clay and sand – 6' to 26' Sand, fine – 26' to 27' Limestone – 27' to 73'	74, pp. 1, 2, 5

TABLE 5: Wells Within and Upgradient of DCA Site					
Permit No./ Sample No. (if applicable)	**Well Depth (ft. bgs)**	**Cased Length[1] (ft. bgs)**	**Depth of First Water (ft. bgs)**	**Well Log Description**	**References**
781215	100	0 to 30	25	Clay – 0' to 16' Clay and gravel – 16' to 30' Limestone – 30' to 70' Shale – 70' to 100'	74, pp. 1, 2, 6
317768	97	0 to 30	NL	Clay, yellow – 0' to 6' Clay, blue – 6' to 28' Sand and clay, yellow – 28' to 30' Limestone – 30' to 97'	74, pp. 1, 2, 7
94749	61	0 to between 16 and 39.5	16	Clay, black – 0' to 10' Clay and sand –10' to 14' Gravel –14' to 16' Limestone –16' to 55' Shale – 55' to 61'	74, pp. 1, 2, 55
895510/L16090 547-07	80	0 to 28	20	Clay – 0' to 6' Gravel – 6' to 20' Limestone – 20' to 80'	74, pp. 1, 2, 56; 80
667583/L16090 547-04	80	0 to 26	30	Clay – 0' to 4' Gravel – 4' to 21' Limestone – 21' to 73' Shale –73' to 80'	74, pp. 1, 2, 57; 80
90118	200	0 to 37	40	Clay, brown – 0' to 12' Clay, grey –12' to 22' Limestone – 22' to 85' Shale – 85' to 200'	74, pp. 1, 2, 45
124322	54	0 to 41 and $^{7}/_{12}$	31	Clay, red – 0' to 8' Hard pan – 8' to 16' Clay, blue –16' to 31' Clay, yellow – 31' to 34' Rock – 34' to 54'	74, pp. 1, 2, 58
662473	44	0 to 26	30	Soil, hard pan – 0' to 12' Limestone – 12' to 44'	74, pp. 1, 2, 53
Wells Upgradient of the DCA Site					
848134	77	0 to 77	40	Clay – 0' to 5' Gravel – 5' to 15' Clay and gravel – 15' to 67' Gravel – 67' to 77'	74, pp, 1, 2, 34
218305/RW-19/E5L63	50	0 to between 11 and 39	18	Clay and gravel – 0' to 11' Limestone, brown – 11' to 17' Limestone, white – 17' to 50'	74, pp. 1, 2, 35; 80
697697RW-7/E5L51	140	0 to 27	30	Clay – 0' to 5' Clay and gravel – 5' to 18' Limestone – 18' to 63' Shale - 63' to 140'	74, pp. 1, 2, 36; 80

TABLE 5: Wells Within and Upgradient of DCA Site					
Permit No./ Sample No. (if applicable)	**Well Depth (ft. bgs)**	**Cased Length[1] (ft. bgs)**	**Depth of First Water (ft. bgs)**	**Well Log Description**	**References**
687288	180	0 to 32	37	Clay – 0' to 3' Clay and gravel – 3' to 15' Gravel – 15' to 18' 8″ Dolomite and limestone – 18' 8″ to 78' Shale and limestone, layers – 78' to 180'	74, pp. 1, 2, 43

Notes:

1	Length of the casing within the well
'	Feet
bgs	Below ground surface
DCA	Donnelsville Contaminated Aquifer
ft.	feet
NL	Not listed
No.	Number

Well logs within the DCA site indicate that the site is underlain by clay (4 to 28 feet thick or 926 to 902 feet above msl), glacial deposits consisting of mixed clay, gravel, and sand (0 to 21 feet thick or 926 to 881 feet above msl), limestone (first encountered between 7 and 30 feet bgs or 923 to 900 feet above msl), and shale (first encountered between 55 to 85 feet bgs or 875 to 845 feet above msl) (Refs. 70, pp. 18, 19; 74, pp. 4, 5, 6, 7, 29, 30, 31, 32, 45, 47, 48, 53, 55, 56, 57, 58) (see Table 5 of this HRS documentation record). The msl values above are derived from an average DCA site elevation of 930 feet above msl (Ref. 20) (see Figure 1 of this HRS documentation record). Generally, clay and gravel are the predominant deposits. A layer of dense glacial till consisting of black, brown, yellow, red, or blue clay was encountered in most borings (Ref. 74, pp. 1, 2, 4, 5, 6, 7, 29, 30, 31, 32, 45, 47, 48, 53, 55, 56, 57, 58). The well logs show that the wells within the DCA site are cased at depths ranging from 0 to 100 feet bgs (914 to 830 feet above msl) and are completed as open holes. First water was encountered at depths ranging from 16 to 57 feet bgs (914 to 873 feet above msl) (Refs. 34; 74, pp. 1, 2, 4, 5, 6, 7, 29, 30, 31, 32, 45, 47, 48, 53, 55, 56, 57, 58).

Aquifer Interconnection

Groundwater in the Donnelsville area is obtained from the carbonate bedrock aquifer (Refs. 5, p. 67; 34; 72, p. 2; 73, p. 142). The carbonate bedrock aquifer is tapped heavily for domestic water supply (Ref. 73, p. 140). The DDAGW-SWDO hydrogeologic evaluation of the Donnelsville area indicates that the aquifer surrounding Donnelsville should be considered karst. Contaminants could enter the aquifer and be quickly transported via the subsurface fracture network (Ref. 5, pp. 67, 76). Karst features including near-surface fractured bedrock, springs, and sinkholes have been identified in the Donnelsville area (Ref. 5, pp. 67, 76).

Well logs of wells installed within the DCA site show that the hydrogeology of the aquifer is highly heterogeneous, with extreme lithologic variations over short distances and with depth (see Table 5 of this HRS documentation record). Within the DCA site, water may be encountered within the unconsolidated glacial deposits. However, the shallow groundwater (in the unconsolidated glacial deposits) does not meet the definition of an aquifer because the unconsolidated glacial deposits do not produce enough water to yield economically significant quantities of water to wells or springs (Ref. 34). Where present, the shallow groundwater within the unconsolidated glacial deposits is in direct contact with the carbonate bedrock aquifer and are considered one hydraulic unit (Ref. 34).

Aquifer Discontinuity

The carbonate bedrock aquifer is continuous within a 4-mile radius of the DCA site (Ref. 72, p. 2).

SUMMARY OF AQUIFER BEING EVALUATED

TABLE 6: Summary of Aquifer Being Evaluated				
Aquifer Name	**Is Aquifer Interconnected with Upper Aquifer within 2 Miles? (Yes/No/NA)**	**Is Aquifer Continuous within 4-mile TDL? (Yes/No)**	**Is Aquifer Karst? (Yes/No)**	**References**
Carbonate Bedrock	NA	Yes	Yes	5, pp. 67, 76; 34; 74, pp. 1, 2, 4, 5, 6, 7, 29, 30, 31, 32, 45, 47, 48, 53, 55, 56, 57, 58; 72, p. 2

Notes:

NA Not applicable
TDL Target distance limit

3.1 LIKELIHOOD OF RELEASE

3.1.1 OBSERVED RELEASE

Aquifer Being Evaluated: Carbonate Bedrock Aquifer

- Hazardous Substances in Release: PCE, TCE, and cis-1,2-DCE

<u>Chemical Analysis</u>

An observed release by chemical analysis is established by showing that the hazardous substance in release samples is significantly greater in concentration than the background level and by documenting that at least part of the significant increase is attributed to a release from the site being evaluated. The significant increase can be documented in one of two ways for HRS purposes. If the background concentration is not detected at or above the detection limit, an observed release is established when the sample measurement equals or exceeds the appropriate quantitation limit. If the background sample concentration equals or exceeds the detection limit, an observed release is established when the sample measurement is 3 times or more above the background concentration and above the appropriate quantitation limit (Ref. 1, Table 2-3). An observed release of PCE, TCE, and cis-1,2-DCE is documented in the following sections by comparing the hazardous substance concentrations in similar background and observed release residential drinking water samples (see Tables 8, 10, 12, and 14 in this section). The samples documenting this observed release were collected by EPA, Ohio EPA, and the Ohio Department of Health during numerous sampling events conducted between 2011 and 2016 (Ref. 6, pp. 1 through 4). A total of 21 residential drinking water well samples contained PCE at Level I concentrations, and 17 residential drinking water well samples contained PCE at Level II concentrations (see Table 15 of this HRS documentation record). Data from multiple sampling events are presented to more comprehensively characterize the release; the more recent data (2016) demonstrate that the contamination remains an issue at the site.

The compounds found in the residential drinking water wells are manufactured chemicals, not thought to occur naturally, and non-detected concentrations in all background well samples (collected in 2011, 2014, and 2016) show that they are not ubiquitous throughout Donnelsville and portions of Bethel Township (Refs. 44, pp. 1, 2, 173, 179, 180, 181; 53; 54, p. 81) (see Section 3.1.1 and Tables 8, 12, and 14 of this HRS documentation record). Chlorinated solvents (such as PCE and TCE) are man-made compounds commonly used in commercial/industrial operations such as dry cleaning and metal degreasing, while other contaminants, such as cis-1,2-DCE, are common breakdown products of PCE and TCE (Refs. 44, p. 173; 53; 54, pp. 77, 81; 55, p. 24).

The analytical data sheets contained in References 5, 8, 9, 10, 59, 60, 61, 62, 63, 64, 66, 79 use the terms tetrachloroethene, which is another term for tetrachloroethylene (PCE), and trichloroethene, which is another term for trichloroethylene (TCE) (Ref. 55, p. xiv).

2011 Background Samples

Residential drinking water well samples were collected in 2011 by EPA, Ohio EPA, and the Ohio Department of Health (Refs. 6, pp. 1 through 4). Seven residential drinking water well samples were evaluated to identify similar background residential drinking water well samples for comparison to release residential drinking water well samples (see Table 7 of this HRS documentation record). These seven residential drinking water wells are located northeast and upgradient of the DCA site (Refs. 5, pp. 14, 73, 85, 86) (see Figure 3A of this HRS documentation record). Groundwater samples collected from these drinking water wells did not exhibit detectable concentrations of PCE, TCE, or cis-1,2-DCE (Refs. 5, pp. 84, 85, 86, 625, 626, 629, 630, 633, 634, 643, 644, 645, 646, 820, 821, 822, 823; 38, p. 1; 62, pp. 5, 6).

Of the seven background residential drinking water well samples used to establish background levels, EPA collected one sample in June 2011 and Ohio EPA collected six samples in November 2011. The results for these seven samples are compared to observed release residential drinking water well samples collected in January, April, May, June, August, and November 2011 (see Tables 7 and 9 of this HRS documentation record).

The background and release residential drinking water well samples were collected from wells that withdraw water from the carbonate bedrock aquifer (Refs. 5, pp. 4, 66, 67; 34; 72, p. 2; 75, p. 1). PCE, TCE, and cis-1,2-DCE have been documented in residential wells at shallow depths (39.97 feet bgs) and at deeper depths (up to 100 feet bgs) (Refs. 6, pp. 1, 2, 3, 4; 10, pp. 13 through 16; 38, p. 1; 39, p. 19; 41; 61, p. 5; 74, p. 48). PCE, TCE and cis-1,2-DCE have been documented at different depth intervals within the carbonate bedrock aquifer, which is used for drinking water within Donnelsville and portions of Bethel Township (see Tables 9, 10, 11, 12, 13, and 14 of this HRS documentation record). The background and release wells were used for drinking water at the time of sampling and are still currently used for drinking water purposes (Refs. 25, p. 1; 38, p. 1; 45; 82).

The background and release samples collected by EPA were collected in accordance with Superfund Technical Assessment and Response Team (START) Standard Operating Procedure (SOP) 202, Residential Groundwater Sampling, or the methods presented in Reference 39, pages 5, 6, and 7 (Ref. 45).

The background and release samples collected by Ohio EPA were collected in accordance with the EPA-approved work plan and Ohio EPA Field Standard Operating Procedures (FSOP) 2.2.10, Ground Water Sampling from Faucets, Taps, and Valves, January 2, 2007 (Refs. 19; 25, p. 1; 26, p. 129).

The locations of the background residential drinking water well samples are provided in Table 7 and depicted in Figure 3A of this HRS documentation record. Chain-of-custody forms (which provide the sample identification number and the date and time of sampling) for the background residential drinking water well samples are provided in References 5, pages 673, 674, 846 and Reference 42, page 18.

TABLE 7: Background Groundwater Samples – 2011

Lab Sample ID/ Sample Location/ Sample No.	Aquifer	Date Sampled	Location	References*
EPA – June 2011				
DUF0242-02	Carbonate Bedrock	6/6/2011	About 0.56 mile north of the intersection of North Hampton Road U.S. 40	38, p. 1; 42, p. 18; 43; 62, pp. 5, 6
Ohio EPA – November 2011				
RW-5/E5L49	Carbonate Bedrock	11/14/2011	About 0.25 mile north of the intersection of North Hampton Road and U.S. 40	5, pp. 15, 84, 673
RW-14/E5L58	Carbonate Bedrock	11/15/2011	About 0.42 mile northwest of the intersection of North Hampton Road and U.S. 40	5, pp. 15, 85, 674
RW-3/E5L47	Carbonate Bedrock	11/14/2011	About 0.47 mile northeast of the intersection of North Hampton Road and U.S. 40	5, pp. 15, 84, 673

TABLE 7: Background Groundwater Samples – 2011				
Lab Sample ID/ Sample Location/ Sample No.	**Aquifer**	**Date Sampled**	**Location**	**References***
RW-19/E5L63	Carbonate Bedrock	11/16/2011	About 0.48 mile northeast of the intersection of North Hampton Road and U.S. 40	5, pp. 15, 86, 846
RW-7/E5L51	Carbonate Bedrock	11/14/2011	About 0.51 mile northeast of the intersection of North Hampton Road and U.S. 40	5, pp. 15, 84, 673
RW-21/E5L77	Carbonate Bedrock	11/16/2011	About 0.64 mile northeast of the intersection of North Hampton Road and U.S. 40	5, pp. 15, 86, 846
RW-13/E5L57	Carbonate Bedrock	11/15/2011	About 0.65 mile northeast of the intersection of North Hampton Road and U.S. 40	5, pp. 15, 85, 674

Notes:

*	Also see Figure 3A of this HRS documentation record
EPA	U.S. Environmental Protection Agency
ID	Identification number
No.	Number
Ohio EPA	Ohio Environmental Protection Agency
RW	Residential well

Background Concentrations

EPA – June 2011

The background residential drinking water well sample was analyzed by a private laboratory, TestAmerica, for VOCs by EPA Method 524.2 (Refs. 38, p. 1; 42, pp. 6, 7). The analytical data were reviewed and the data elements in the data package were compared against the EPA Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use and the EPA Contract Laboratory Program (CLP) National Functional Guidelines (NFG) for Superfund Organic Data Review. The data validation effort shows the overall data quality to be acceptable (Ref. 62, pp. 1 through 4). The reporting limits are listed on the analytical data sheets contained in Reference 62. The reporting limits are equivalent to sample quantitation limits (SQL) as defined in Section 1.1, Definitions of the HRS (Refs. 1, Section 1.1; 14).

Ohio EPA – November 2011

The background residential drinking water well samples were analyzed for VOCs by a CLP laboratory in accordance with the EPA CLP Statement of Work (SOW) SOM01.2 (June 2007) and reviewed according to the NFG for SOM01.2 and the standard operating procedures for ESAT/Tech Law validation of CLP organic data (Version 2.6) (Ref. 5, pp. 595, 596, 773). Analytical data sheets and Form I data sheets are contained in Appendix H of Reference 5. The CRQLs are provided on the analytical data sheets contained in Appendix H of Reference 5.

TABLE 8: Analytical Results for Background Samples – 2011

Lab Sample ID/ Sample Location/ Sample No.	Hazardous Substance	Hazardous Substance Concentration	RL/CRQL*	References
EPA - June 2011				
DUF0242-02	PCE	0.5U µg/L	0.5 µg/L	62, p. 6; 38, p. 1
DUF0242-02	TCE	0.5U µg/L	0.5 µg/L	62, p. 6; 38, p. 1
DUF0242-02	cis-1,2-DCE	0.5U µg/L	0.5 µg/L	62, p. 5; 38, p. 1
Ohio EPA – November 2011				
RW-5/E5L49	PCE	0.50U µg/L	0.50 µg/L	5, pp. 84, 629, 630, 725
RW-5/E5L49	TCE	0.50U µg/L	0.50 µg/L	5, pp. 84, 629, 725
RW-5/E5L49	cis-1,2-DCE	0.50U µg/L	0.50 µg/L	5, pp. 84, 629, 724
RW-14/E5L58	PCE	0.50U µg/L	0.50 µg/L	5, pp. 85, 645, 646, 749
RW-14/E5L58	TCE	0.50U µg/L	0.50 µg/L	5, pp. 85, 645, 749
RW-14/E5L58	cis-1,2-DCE	0.50U µg/L	0.50 µg/L	5, pp. 85, 645, 748
RW-3/E5L47	PCE	0.50U µg/L	0.50 µg/L	5, pp. 84, 625, 626, 719
RW-3/E5L47	TCE	0.50U µg/L	0.50 µg/L	5, pp. 84, 625, 719
RW-3/E5L47	cis-1,2-DCE	0.50U µg/L	0.50 µg/L	5, pp. 84, 625, 718
RW-19/E5L63	PCE	0.50U µg/L	0.50 µg/L	5, pp. 86, 820, 821,925
RW-19/E5L63	TCE	0.50U µg/L	0.50 µg/L	5, pp. 86, 820, 925

TABLE 8: Analytical Results for Background Samples – 2011				
Lab Sample ID/ Sample Location/ Sample No.	**Hazardous Substance**	**Hazardous Substance Concentration**	**RL/CRQL***	**References**
RW-19/E5L63	cis-1,2-DCE	0.50U µg/L	0.50 µg/L	5, pp. 86, 820, 924
RW-7/E5L51	PCE	0.50U µg/L	0.50 µg/L	5, pp. 84, 633, 634, 731
RW-7/E5L51	TCE	0.50U µg/L	0.50 µg/L	5, pp. 84, 633, 731
RW-7/E5L51	cis-1,2-DCE	0.50U µg/L	0.50 µg/L	5, pp. 84, 633, 730
RW-21/E5L77	PCE	0.50U µg/L	0.50 µg/L	5, pp. 86, 822, 823, 928
RW-21/E5L77	TCE	0.50U µg/L	0.50 µg/L	5, pp. 86, 822, 928
RW-21/E5L77	cis-1,2-DCE	0.50U µg/L	0.50 µg/L	5, pp. 86, 822, 927
RW-13/E5L57	PCE	0.50U µg/L	0.50 µg/L	5, pp. 85, 643, 644, 746
RW-13/E5L57	TCE	0.50U µg/L	0.50 µg/L	5, pp. 85, 643, 746
RW-13/E5L57	cis-1,2-DCE	0.50U µg/L	0.50 µg/L	5, pp. 85, 643, 745

Notes:

*	RLs are provided for the June 2011 EPA samples. The reporting limits are equivalent to sample quantitation limits as defined in Section 1.1, Definitions of the HRS (Refs. 1, Section 1.1; 14). CRQLs are provided for the November 2011 Ohio EPA samples (Ref. 5, pp. 607, 779).
DCE	Dichloroethene
ID	Identification number
No.	Number
µg/L	Micrograms per liter
PCE	Tetrachloroethylene
RL	Reporting limit
CRQL	Contract required quantitation limit
TCE	Trichloroethylene
U	June 2011 EPA - The analyte was analyzed for, but was not detected at or above the associated value (reporting limit) (Ref. 62, p. 4). November 2011 Ohio EPA – The analyte was analyzed for, but was not detected above the reported contract required quantitation limit (Ref. 5, pp. 601, 778).

Release Samples

Table 9 presents the residential drinking water well samples collected during (1) the EPA January 2011 sampling event as well as subsequent residential drinking water well sampling events that occurred as access to residential properties was granted; (2) the January 2011 Ohio Department of Health sampling event; and (3) the November 2011 Ohio EPA ESI (Refs. 5, pp. 1, 84, 85, 86; 10, pp. 66, 67; 38, pp. 1, 2; 41; 45; 58)

EPA – January, April, May, June, and August 2011

Residential drinking water well samples were collected in accordance with START SOP 202, Residential Groundwater Sampling, or the methods presented in Reference 39, pages 5, 6, and 7 (Ref. 45). The locations of the residential drinking water well samples provided in Table 9 are depicted in References 38, page 4 and Reference 39, page 17 (Ref. 38, pp. 1, 4; 39, pp. 19, 20) (also see Figure 3A of this HRS documentation record). Chain-of-custody forms are provided in References 10, 32, 35, 36, and 37. Logbook notes for the samples collected in January 2011 are provided in Reference 40. The residential drinking water wells were used for drinking water at the time of sampling (Refs. 38, p. 1; 45).

Ohio Department of Health – January 2011

Residential drinking water well samples were collected in accordance with the methods presented in Reference 58. The chain-of-custody form is provided in Reference 59, page 15. The locations of the residential drinking water well samples are provided in Reference 58 (also see Figure 3A of this HRS documentation record). The residential drinking water wells were used for drinking water at the time of sampling (Ref. 58).

Ohio EPA – November 2011

Residential drinking water well samples were collected in accordance with the EPA-approved work plan and the Ohio EPA FSOP 2.2.10, Ground Water Sampling from Faucets, Taps, and Valves, January 2, 2007 (Refs. 19; 25, p. 1; 26, p. 129). The locations of the residential drinking water well samples provided in Table 9 and depicted in References 5, p. 14 (also see Figure 3A of this HRS documentation record). Chain-of-custody forms are provided in References 5, pages 673, 674, 847, 848. The residential drinking water well samples were used for drinking water at the time of sampling (Ref. 25).

TABLE 9: Release Groundwater Samples – 2011

Lab Sample ID/ Sample Location/ Sample No.	Aquifer	Date Sampled	Location	References*
EPA – January, April, May, June, and August 2011				
RA-2/E2712 and RA-3/E2713	Carbonate Bedrock	1/11/2011	About 0.13 mile northwest of the intersection of U.S. 40 and North Hampton Road	10, pp. 13, 14, 15, 16, 66; 39, pp. 16, 19; 40, p. 4; 41; 48, p. 5
RA-1/E2711	Carbonate Bedrock	1/11/2011	About 0.7 mile north of the intersection of U.S. 40 and North Hampton Road	10, pp. 7, 8, 66; 39, pp. 16, 19; 40, p. 3; 41; 48, p. 5
RA-8/E2718	Carbonate Bedrock	1/12/2011	About 0.07 mile north of the intersection of U.S. 40 and North Hampton Road	10, pp. 25, 26, 66; 39, pp. 16, 19; 40, p. 5; 41; 48, p. 5

TABLE 9: Release Groundwater Samples – 2011				
Lab Sample ID/ Sample Location/ Sample No.	**Aquifer**	**Date Sampled**	**Location**	**References***
RA-9/E2719	Carbonate Bedrock	1/12/2011	About 0.08 mile north of the intersection of U.S. 40 and North Hampton Road	10, pp. 27, 28, 67; 39, pp. 17, 19; 40, p. 5; 41; 48, p. 5
RA-6/E2716	Carbonate Bedrock	1/12/2011	About 0.1 mile north of the intersection of U.S. 40 and North Hampton Road	10, pp. 21, 22, 66; 39, pp. 17, 19; 40, p. 4; 41; 48, p. 5
RA-5/E2715	Carbonate Bedrock	1/12/2011	About 0.1 mile northwest of the intersection of U.S. 40 and North Hampton Road	10, pp. 19, 20, 66; 39, pp. 17, 19; 40, p. 4; 41; 48, p. 5
RA-14/E2724	Carbonate Bedrock	1/13/2011	About 0.12 mile northwest of the intersection of U.S. 40 and North Hampton Road	10, pp. 37, 38, 67; 39, pp. 17, 20; 40, p. 6; 41; 48, p. 5
RA-11/E2721	Carbonate Bedrock	1/13/2011	About 0.04 mile northeast of the intersection of U.S. 40 and North Hampton Road	10, pp. 31, 32, 67; 39, pp. 17, 19; 40, p. 5; 41; 48, p. 5
RA-12/E2722	Carbonate Bedrock	1/13/2011	About 0.05 mile northeast of the intersection of U.S. 40 and North Hampton Road	10, pp. 33, 34, 67; 39, pp. 17, 19; 40, p. 5; 41; 48, p. 5
RA-10/E2720	Carbonate Bedrock	1/13/2011	About 0.03 mile northwest of the intersection of U.S. 40 and North Hampton Road	10, pp. 29, 30, 67; 39, pp. 17, 19; 40, p. 5; 41; 48, p. 5
DUD0646-02	Carbonate Bedrock	4/13/2011	About 0.07 mile southwest of the intersection U.S. 40 and North Hampton Road	35, p. 14; 38, pp. 1, 4; 60, p. 6
DUD0646-04	Carbonate Bedrock	4/13/2011	About 0.11 mile southwest of the intersection of U.S. 40 and North Hampton Road	35, p. 14; 38, pp. 1, 4; 60, p. 7
DUE0248-01	Carbonate Bedrock	5/5/2011	About 0.1 mile south of the intersection of U.S. 40 and North Hampton Road	36, p. 11; 38, pp. 1, 4; 61, p. 5
DUF1053-01	Carbonate Bedrock	6/21/2011	About 0.07 mile north of the intersection of U.S. 40 and North Hampton Road	37, p. 11; 38, pp. 1, 4; 63, p. 5

TABLE 9: Release Groundwater Samples – 2011				
Lab Sample ID/ Sample Location/ Sample No.	**Aquifer**	**Date Sampled**	**Location**	**References***
DUH0127-01	Carbonate Bedrock	8/2/2011	About 0.07 mile north of the intersection of U.S. 40 and North Hampton Road	32, p. 17; 38, pp. 1, 4; 64, p. 6
DUH0127-03	Carbonate Bedrock	8/2/2011	About 0.06 mile southwest of the intersection of U.S. 40 and North Hampton Road	32, p. 16; 38, pp. 1, 4; 64, p. 5
Ohio Department of Health – January 2011				
129287	Carbonate Bedrock	1/2011	About 0.1 mile south of the intersection of U.S. 40 and North Hampton Road	28, pp. 2, 4, 5; 58; 59, pp. 1, 6, 15
129289	Carbonate Bedrock	1/2011	About 0.11 mile southwest of the intersection of U.S. 40 and North Hampton Road	28, pp. 9, 10, 12, 13; 58; 59, pp. 1, 10, 15
Ohio EPA – November 2011				
RW-9/E5L53	Carbonate Bedrock	11/14/2011	About 0.2 mile northwest of the intersection of North Hampton Road and U.S. 40	5, pp. 14, 85, 637, 638, 674; 48, p. 5
RW-6/E5L50	Carbonate Bedrock	11/14/2011	About 0.21 mile northwest of the intersection of North Hampton Road and U.S. 40	5, pp. 14, 84, 631, 632, 673; 48, p. 5
RW-8/E5L52	Carbonate Bedrock	11/14/2011	About 0.1 mile northeast of the intersection of North Hampton Road and U.S. 40	5, pp. 14, 85, 635, 636, 674; 48, p. 5
RW-10/E5L54	Carbonate Bedrock	11/15/2011	About 0.14 mile northwest of the intersection of North Hampton Road and U.S. 40	5, pp. 14, 85, 806, 807, 847; 48, p. 5
RW-17/E5L61	Carbonate Bedrock	11/16/2011	About 0.1 mile north of the intersection of U.S. 40 and North Hampton Road	5, pp. 14, 86, 816, 817, 848; 48, p. 5

Notes:

*	Also see Figure 3A of this HRS documentation record
EPA	U.S. Environmental Protection Agency
ID	Identification number
No.	Number
Ohio EPA	Ohio Environmental Protection Agency
RA	Removal assessment
RW	Residential well

Sample RA-3/E2713 is a duplicate of RA-2/E2712 (Ref. 41).

Release Concentrations

EPA – January 2011

The release residential drinking water well samples were analyzed for VOCs by a CLP laboratory in accordance with the EPA CLP SOW SOM01.2 (June 2007) and reviewed according to the NFG for SOM01.2 and the standard operating procedures for ESAT/Tech Law validation of CLP organic data (Version 2.4.1) (Refs. 10, pp. 1, 2; 41). Analytical data sheets and Form I data sheets are contained in Reference 10. The sample-specific contract required quantitation limits (CRQL) are listed on the analytical data sheets provided in Reference 10. The CRQLs are adjusted for dilution and are provided in Reference 76.

Ohio Department of Health – January 2011

The release residential drinking water well samples were analyzed by Ohio EPA Division of Environmental Services for VOCs by EPA Method 524.2 (Refs. 58; 59, pp. 1, 6, 10). The analytical data were reviewed and the data elements in the data package were compared against the EPA Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use and the EPA CLP NFG for Superfund Organic Data Review. The data validation effort shows the overall data quality to be acceptable (Ref. 59, pp. 1 through 4). The reporting limits are listed on the analytical data sheets contained in Reference 59. The reporting limits are equivalent to SQLs as defined in Section 1.1, Definitions of the HRS (Ref. 1, Section 1.1; 77).

EPA – April, May, June, and August 2011

The release residential drinking water well samples were analyzed by a private laboratory, TestAmerica, for VOCs by EPA Method 524.2 (Refs. 38, p. 1; 60, pp. 6, 7; 61, p. 5; 63, p. 5; 64, pp. 5, 6). The analytical data were reviewed and the data elements in the data package were compared against the EPA Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use and the EPA CLP NFG for Superfund Organic Data Review. The data validation effort shows the overall data quality to be acceptable (Refs. 60, pp. 1 through 4; 61, pp. 1 through 4; 63, pp. 1 through 4; 64, pp. 1 through 4). The reporting limits are listed on the analytical data sheets contained in References 60, 61, 63, and 64. The reporting limits are equivalent to SQLs as defined in Section 1.1, Definitions of the HRS (Refs. 1, p. Section 1.1; 14).

Ohio EPA – November 2011

The release residential drinking water well samples were analyzed for VOCs by a CLP laboratory in accordance with the EPA CLP SOW SOM01.2 (June 2007) and reviewed according to the NFG for SOM01.2 and the standard operating procedures for ESAT/Tech Law validation of CLP organic data (Version 2.6) (Ref. 5, pp. 595, 596, 772, 773). Analytical data sheets and Form I data sheets are contained in Appendix H of Reference 5. The CRQLs are listed on the analytical data sheets in Appendix H of Reference 5. The sample-specific CRQLs are adjusted for dilution and are provided in Reference 76 (Refs. 29, p. 2; 50, p. 54).

TABLE 10: Analytical Results for Release Samples – 2011				
Lab Sample ID/ Sample Location/ Sample No.	**Hazardous Substance**	**Hazardous Substance Concentration**	**RL/ Adjusted CRQL***	**References**
EPA – January 2011				
RA-2/E2712	PCE	16 µg/L	0.50 µg/L	10, pp. 13, 14, 88; 41; 76, pp. 1, 2
RA-3/E2713	PCE	17 µg/L	0.50 µg/L	10, pp. 15, 16, 91; 41; 76, pp. 1, 2
RA-1/E2711	PCE	13 µg/L	0.50 µg/L	10, pp. 7, 8, 80; 41; 76, pp. 1, 2
RA-8/E2718	PCE	6.3 µg/L	0.50 µg/L	10, pp. 25, 26, 106; 41; 76, pp. 1, 2
RA-9/E2719	PCE	13 µg/L	0.50 µg/L	10, pp. 27, 28, 109; 41; 76, pp. 1, 2
RA-6/E2716	PCE	15 µg/L	0.50 µg/L	10, pp. 21, 22, 100; 41; 76, pp. 1, 2
RA-5/E2715	PCE	14 µg/L	0.50 µg/L	10, pp. 19, 20, 97; 41; 76, pp. 1, 2
	TCE	0.74 µg/L	0.50 µg/L	10, pp. 19, 20, 97; 41; 76, pp. 1, 2
	cis-1,2-DCE	1.1 µg/L	0.50 µg/L	10, pp. 19, 20, 96; 41; 76, pp. 1, 2
RA-14/E2724	PCE	20 µg/L	0.50 µg/L	10, pp. 37, 38, 124; 41; 76, pp. 1, 2
RA-11/E2721	PCE	2.0 µg/L	0.50 µg/L	10, pp. 31, 32, 115; 41; 76, pp. 1, 2
RA-12/E2722	PCE	9.0 µg/L	0.50 µg/L	10, pp. 33, 34, 118; 41; 76, pp. 1, 2
RA-10/E2720	PCE	6.5 µg/L	0.50 µg/L	10, pp. 29, 30, 112; 41; 76, pp. 1, 2
Ohio DOH – January 2011				
129287	PCE	4.11 µg/L	0.5 µg/L	58; 59, p. 6
129289	PCE	8.23 µg/L	0.5 µg/L	58; 59, p. 10
EPA – April, May, June, and August 2011				
DUD0646-02	PCE	10.2 µg/L	0.5 µg/L	60, p. 6; 38, p. 1
DUD0646-04	PCE	3.92 µg/L	0.5 µg/L	60, p. 7; 38, p. 1
DUE0248-01	PCE	2.5 µg/L	0.5 µg/L	61, p. 5; 38, p. 1
DUF1053-01	PCE	2.1 µg/L	0.5 µg/L	63, p. 5; 38, p. 1

TABLE 10: Analytical Results for Release Samples – 2011				
Lab Sample ID/ Sample Location/ Sample No.	**Hazardous Substance**	**Hazardous Substance Concentration**	**RL/ Adjusted CRQL***	**References**
DUH0127-01	PCE	17 µg/L	0.5 µg/L	64, p. 6; 38, p. 1
DUH0127-03	PCE	2.7 µg/L	0.5 µg/L	64, p. 5; 38, p. 1
Ohio EPA – November 2011				
RW-9/E5L53	PCE	3.6 µg/L	0.50 µg/L	5, pp. 637, 638, 737; 25, p. 2; 76, pp. 1, 3
RW-6/E5L50	PCE	1.5 µg/L	0.50 µg/L	5, pp. 631, 632, 728; 25, p. 2; 76, pp. 1, 3
RW-8/E5L52	PCE	2.7 µg/L	0.50 µg/L	5, pp. 635, 636, 734; 25, p. 2; 76, pp. 1, 2
RW-10/E5L54	PCE	9.6 µg/L	0.50 µg/L	5, pp. 806, 807, 906; 25, p. 2; 76, pp. 1, 2
	TCE	0.6 µg/L	0.50 µg/L	5, pp. 806, 906; 25, p. 2; 76, pp. 1, 2
RW-17/E5L61	PCE	19 µg/L	0.50 µg/L	5, pp. 816, 817, 848, 919; 25, p. 2; 76, pp. 1, 2
	cis-1,2-DCE	1.3 µg/L	0.50 µg/L	5, pp. 816, 817, 848, 918; 25, p. 2; 76, pp. 1, 2

Notes:

* January 2011 EPA Samples - Adjusted CRQLs are provided. The sample-specific CRQLs are adjusted for dilution and are provided in Reference 76.
January 2011 Ohio Department of Health Samples - Reporting limits are provided. The reporting limits are equivalent to sample quantitation limits as defined in Section 1.1, Definitions of the HRS (Ref. 1, Section 1.1; 77).
April, May, June and August 2011 EPA Samples - Reporting limits are provided. The reporting limits are equivalent to sample quantitation limits as defined in Section 1.1, Definitions of the HRS (Refs. 1, Section 1.1; 14).
November 2011 Ohio EPA Samples - Adjusted CRQLs are provided. The sample-specific CRQLs are adjusted for dilution and are provided in Reference 76.

CRQL Contract required quantitation limit
DCE Dichloroethylene
DOH Department of Health
ID Identification number
No. Number
µg/L Micrograms per liter
PCE Tetrachloroethylene
RW Residential well
TCE Trichloroethylene

Sample RA-3/E2713 is a duplicate of sample RA-2/E2712 (Ref. 41).

Ohio EPA 2014 SIA

The background and release residential drinking water well samples listed in Table 11 were collected during the November 2014 Ohio EPA SIA (Ref. 31, pp. 1, 2). The samples chosen to represent background conditions (SIA-5B/E51S1, SIA-1B/E51R3, and SIA-16/E51W2) were collected east of the DCA site (Refs. 31, pp. 2, 16) (see Figure 3B of this HRS documentation record). No residential drinking water wells were sampled upgradient (northeast) of the DCA site during the investigation (Ref. 31, p. 1). The residential drinking water well sampling events are on-going and residential wells are sampled as access to residential properties is received (Ref. 6, p. 1). The background and release residential drinking water wells were used for drinking water at the time of sampling (Ref. 31, p. 1).

All samples were collected in accordance with the final SIA work plan approved by EPA on October 17, 2014, and FSOP 2.2.10, Ground Water Sampling from Faucets, Taps, and Valves, January 2007 (Refs. 26, p. 129; 31, p. 1; 49). The locations of the residential drinking water well samples are provided in Table 11 and depicted in Reference 31, page 16 (also see Figure 3B of this HRS documentation record). The chain-of-custody forms are provided in Reference 31 pages 3 through 6. Logbook notes are provided in Reference 31, pages 7 through 15.

The background and release residential drinking water well samples were collected from depths corresponding to the carbonate bedrock aquifer, during the same sampling event, and in accordance with the same sampling procedures (Refs. 26, p. 129; 31, pp. 1 through 6; 34).

TABLE 11: Residential Drinking Water Well Samples – November 2014

Client ID/Sample No.	Aquifer	Date Sampled	Location	References*
Background Samples				
SIA-5B/E51S1	Carbonate Bedrock	11/18/2014	About 0.36 mile east of the intersection of North Hampton Road and U.S. 40	31, pp. 2, 3, 11, 16
SIA-1B/E51R3	Carbonate Bedrock	11/18/2014	About 0.19 mile southeast of the intersection of North Hampton Road and U.S. 40	31, pp. 2, 3, 10, 16
SIA-16/E51W2	Carbonate Bedrock	11/19/2014	About 0.30 mile east of the intersection of North Hampton Road and U.S. 40	31, pp. 2, 5, 15, 16
Release Samples				
SIA-14B/E51T9	Carbonate Bedrock	11/19/2014	About 0.16 mile east of the intersection of North Hampton Road and U.S. 40	31, pp. 2, 5, 14, 16
SIA-7B/E51S5	Carbonate Bedrock	11/18/2014	About 0.1 mile northwest of the intersection of North Hampton Road and U.S. 40	31, pp. 2, 4, 11, 16
SIA-6B/E51S3	Carbonate Bedrock	11/18/2014	About 0.14 mile northeast of the intersection of North Hampton Road and U.S. 40	31, pp. 2, 3, 11, 16

TABLE 11: Residential Drinking Water Well Samples – November 2014				
Client ID/Sample No.	**Aquifer**	**Date Sampled**	**Location**	**References***
SIA-4/E51R8	Carbonate Bedrock	11/18/2014	About 0.10 mile southeast of the intersection of North Hampton Road and U.S. 40	31, pp. 2, 3, 10, 16
SIA-8B/E51S7	Carbonate Bedrock	11/18/2014	About 0.05 mile east of the intersection of North Hampton Road and U.S. 40	31, pp. 2, 4, 12, 16
SIA-12/E51T4	Carbonate Bedrock	11/19/2014	About 0.15 mile east of the intersection of North Hampton Road and U.S. 40	31, pp. 2, 5, 14, 16
SIA-15/E51W0	Carbonate Bedrock	11/19/2014	About 0.08 mile southwest of the intersection of North Hampton Road and U.S. 40	31, pp. 2, 5, 15, 16
SIA-13/E51T6	Carbonate Bedrock	11/19/2014	About 0.08 mile southeast of the intersection of North Hampton Road and U.S. 40	31, pp. 2, 5, 14, 16

Notes:

*	Also see Figure 3B of this HRS documentation record
ID	Identification number
No.	Number
SIA	Site inspection addendum

Background and Release Concentrations

The background and release samples listed in Table 12 were collected during the November 2014 Ohio EPA SIA (Ref. 31, pp. 1, 2). The samples were analyzed for VOCs by a CLP laboratory in accordance with the EPA CLP SOW SOM01.2 (June 2007) and reviewed according to the NFG for SOM01.2 and the standard operating procedures for ESAT/Tech Law validation of CLP organic data (Version 2.7) (Refs. 8, pp. 1, 2; 9, pp. 1, 2; 31, p. 2). Analytical data sheets are contained in References 8 and 9. The CRQLs are provided on the analytical data sheets contained in References 8 and 9 (Refs. 8, p. 7; 9, p. 7). The sample-specific CRQLs for release samples are adjusted for dilution and are provided in Reference 76.

TABLE 12: Analytical Results for November 2014				
Client ID/Sample No.	**Hazardous Substance**	**Hazardous Substance Concentration**	**CRQL/Adjusted CRQL***	**References**
Background Samples				
SIA-5B/E51S1	PCE	0.50U µg/L	0.50 µg/L	8, pp. 7, 44, 45; 31, p. 2
SIA-1B/E51R3	PCE	0.50U µg/L	0.50 µg/L	8, pp. 7, 34, 35; 31, p. 2
SIA-16/E51W2	PCE	0.50U µg/L	0.50 µg/L	9, pp. 7, 18, 19; 31, p. 2

TABLE 12: Analytical Results for November 2014				
Client ID/Sample No.	**Hazardous Substance**	**Hazardous Substance Concentration**	**CRQL/Adjusted CRQL***	**References**
Release Samples				
SIA-14B/E51T9	PCE	1.4 µg/L	0.50 µg/L	9, pp. 14, 15; 31, p. 2; 76, p. 3
SIA-7B/E51S5	PCE	15 µg/L	0.50 µg/L	8, pp. 52, 53; 31, p. 2; 76, p. 3
SIA-6B/E51S3	PCE	1.4 µg/L	0.50 µg/L	8, pp. 48, 49; 31, p. 2; 76, p. 3
SIA-4/E51R8	PCE	0.88 µg/L	0.50 µg/L	8, pp. 40, 41; 31, p. 2; 76, p. 3
SIA-8B/E51S7	PCE	0.54 µg/L	0.50 µg/L	8, pp. 56, 57; 31, p. 2; 76, p. 3
SIA-12/E51T4	PCE	1.0 µg/L	0.50 µg/L	8, pp. 66, 67; 31, p. 2; 76, p. 3
SIA-15/E51W0	PCE	5.7 µg/L	0.50 µg/L	9, pp. 16, 17; 31, p. 2; 76, p. 3
SIA-13/E51T6	PCE	4.4 µg/L	0.50 µg/L	8, pp. 68, 69; 31, p. 2; 76, p. 3

Notes:

*	CRQLs are provided for the background samples (Refs. 8, p. 7; 9, p. 7). Adjusted CRQLs are provided for release samples. The sample-specific CRQLs are adjusted for dilution and are provided in Reference 76.
CRQL	Contract required quantitation limit
µg/L	Microgram per liter
ID	Identification number
No.	Number
PCE	Tetrachloroethylene
SIA	Site inspection addendum
SQL	Sample quantitation limit
U	The analyte was analyzed for, but not detected above the reported sample quantitation limit (Refs. 8, p. 7; 9, p. 7).

Ohio EPA Sampling Events – 2016

The background and release residential drinking water samples listed in Table 13 were collected during the January, May, and September 2016 Ohio EPA sampling events (Refs. 25, pp. 1, 3; 79, pp. 1, 2). The sample chosen to represent background conditions (L16010192-03) was collected in January 2016 south of the DCA site (Refs. 23, p. 44; 25, pp. 1, 3, 11) (see Figure 3C of this HRS documentation record). No residential drinking water wells were sampled upgradient (northeast) of the DCA site during the sampling events (Refs. 25, p. 1; 79, p. 1). The residential drinking water well sampling events are on-going and residential wells are sampled as access to residential properties is received (Ref. 6, p. 1). The background and release residential drinking water wells were used for drinking water at the time of sampling (Refs. 25, p. 1; 79, p. 1).

All samples were collected in accordance with the FSOP 2.2.10, Ground Water Sampling from Faucets, Taps, and Valves, January 2007 (Refs. 26, p. 129; 25, p. 1; 79, p. 1). The locations of the residential drinking water well samples are provided in Table 13 and depicted in Reference 25, page 11 and Reference 79, page 9. The chain-of-custody forms are provided in Reference 23 page 44 and Reference 79, page 40). Logbook notes are provided in Reference 25, pages 4 through 10 and Reference 79, pages 3 through 8.

The background and release residential drinking water wells were collected from depths corresponding to the carbonate bedrock aquifer and in accordance with the same sampling procedures (Refs. 25, p. 1, 3; 26, p. 129; 34; 79, pp. 1, 2).

TABLE 13: Residential Drinking Water Well Samples – 2016

Laboratory ID	Aquifer	Date Sampled	Location	References*
Background Sample				
L16010192-03	Carbonate Bedrock	1/5/2016	About 0.33 mile southwest of the intersection of North Hampton Road and U.S. 40	23, p. 44; 25, pp. 1, 3, 8, 11
Release Samples				
L16010192-01	Carbonate Bedrock	1/5/2016	About 0.14 mile east of the intersection of North Hampton Road and U.S. 40	23, p. 44; 25, pp. 1, 3, 7, 11
L16010192-13	Carbonate Bedrock	1/5/2016	About 0.05 mile southwest of the intersection of North Hampton Road and U.S. 40	23, p. 44; 25, pp. 1, 3, 9, 11
L16051382-01	Carbonate Bedrock	5/24/2016	About 0.13 mile northeast of the intersection of North Hampton Road and U.S. 40	25, p. 3, 10; 79, pp. 2, 9
L16090547-05	Carbonate Bedrock	9/12/2016	About 0.05 mile north of the intersection of North Hampton Road and U.S. 40	79, pp. 1, 2, 7, 9, 23, 24, 40
L16090547-07	Carbonate Bedrock	9/12/2016	About 0.02 mile west of the intersection of North Hampton Road and U.S. 40	79, pp. 1, 2, 6, 9, 27, 28, 40
L16090547-04	Carbonate Bedrock	9/12/2016	About 0.02 mile west of the intersection of North Hampton Road and U.S. 40	79, pp. 1, 2, 7, 9, 21, 22, 40
L16090547-01	Carbonate Bedrock	9/12/2016	About 0.05 mile west of the intersection of North Hampton Road and U.S. 40	79, pp. 1, 2, 8, 9, 15, 16, 40

TABLE 13: Residential Drinking Water Well Samples – 2016				
Laboratory ID	**Aquifer**	**Date Sampled**	**Location**	**References***
L16090547-02	Carbonate Bedrock	9/12/2016	About 0.05 mile west of the intersection of North Hampton Road and U.S. 40	79, pp. 1, 2, 8, 9, 17, 18, 40

Notes:

* Also see Figure 3C of this HRS documentation record
ID Identification number
Sample L16090547-02 is a duplicate of sample L16090547-01 (Refs. 79, p. 2).

Background and Release Concentrations

The background and release residential drinking water well samples were analyzed for VOCs by a private laboratory, Microbac Laboratories, using EPA Method 8260B/5030B/5030C/5035A (Refs. 24, pp. 5, 6, 7, 8, 11, 12, 13, 14, 17, 18; 25, pp. 1, 3; 52, pp. 5, 6; 66, pp. 13, 14, 25, 26, 31, 32; 79, pp. 1, 2). The analytical data were reviewed and the data elements in the data package were compared against the EPA Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use and the EPA CLP NFG for Superfund Organic Data Review. The data validation effort shows the overall data quality to be acceptable (Refs. 24, pp. 1 through 4; 52, pp. 1 through 4; 66, pp. 1 through 4). The reporting limits are listed on the analytical data sheets contained in References 24, 52, and 66. The reporting limits are equivalent to SQLs as defined in Section 1.1, Definitions of the HRS (Refs. 1, Section 1.1; 30).

TABLE 14: Analytical Results for 2016				
Sample No.	**Hazardous Substance**	**Hazardous Substance Concentration**	**RL**	**References**
Background Sample				
L16010192-03	PCE	1.00U µg/L	1.00 µg/L	66, pp. 25, 26; 25, p. 3
	TCE	1.00U µg/L	1.00 µg/L	66, pp. 25, 26; 25, p. 3
	cis-1,2-DCE	1.00U µg/L	1.00 µg/L	66, pp. 25, 26; 25, p. 3
Release Samples				
L16010192-01	PCE	7.49 µg/L	1.00 µg/L	66, pp. 31, 32; 25, p. 3
	TCE	3.55 µg/L	1.00 µg/L	66, pp. 31, 32; 25, p. 3
	cis-1,2-DCE	1.35 µg/L	1.00 µg/L	66, pp. 31, 32; 25, p. 3
L16010192-13	PCE	1.61 µg/L	1.00 µg/L	66, pp. 13, 14; 25, p. 3
L16051382-01	PCE	1.60 µg/L	1.00 µg/L	52, pp. 5, 6; 79, p. 2
L16090547-05	PCE	6.90 µg/L	1.00 µg/L	24, pp. 13, 14; 79, p. 2
L16090547-07	PCE	6.46 µg/L	1.00 µg/L	24, pp. 17, 18; 79, p. 2
L16090547-04	PCE	7.72 µg/L	1.00 µg/L	24, pp. 11, 12; 79, p. 2
L16090547-01	PCE	8.25 µg/L	1.00 µg/L	24, pp. 5, 6; 79, p. 2
L16090547-02	PCE	8.90 µg/L	1.00 µg/L	24, pp. 7, 8; 79, p. 2

Notes:

DCE	Dichloroethene
No.	Number
µg/L	Micrograms per liter
PCE	Tetrachloroethylene
TCE	Trichloroethylene
RL	Reporting limit. The reporting limits are equivalent to sample quantitation limits as defined in Section 1.1, Definitions of the HRS (Refs. 1, Section 1.1; 30).
U	Not detected at or above adjusted sample detection limit (Ref. 23, p. 43).

Sample L16090547-02 is a duplicate of sample L16090547-01 (Ref. 79, p. 2).

Level I and Level II Samples

Groundwater samples listed in Table 15 were collected between January 2011 and September 2016 from residential drinking water wells that withdraw water from the carbonate bedrock aquifer (Refs. 6, pp. 1, 2, 3, 4; 25, pp. 1, 2, 3; 31, pp. 1, 2; 34; 38, p. 1; 41; 79, pp. 1, 2). Residential drinking water well samples were collected during numerous sampling events that EPA, Ohio EPA, and the Ohio Department of Health conducted. All samples evaluated at Level I and Level II concentrations are included in Tables 9, 10, 11, 12, 13, and 14 of this HRS documentation record. The analyses conducted, validation efforts, and reporting limits or adjusted CRQLs are discussed prior to Tables 10, 12, and 14 of this HRS documentation record. All drinking water wells scored at Level I and Level II concentrations are currently being used for potable use (Ref. 82).

TABLE 15: LEVEL I AND LEVEL II SAMPLES

Sample Location/ Sample No./ Laboratory Sample ID	Hazardous Substance	Concentration and Sample Date	Level I or Level II	Benchmark Exceeded and Benchmark Concentration	References
RA-2/E2712 and RA-3/E2713	PCE	16 µg/L – 1/11/2011 17 µg/L – 1/11/2011	Level I	MCL - 5 µg/L	2, p. 2; 10, pp. 13, 14, 15, 16, 66; 41
RA-1/E2711	PCE	12 µg/L – 1/11/2011	Level I	MCL - 5 µg/L	2, p. 2; 10, pp. 7, 8, 66; 41
RA-8/E2718	PCE	6.3 µg/L – 1/12/2011	Level I	MCL - 5 µg/L	2, p. 2; 10, pp. 25, 26, 66; 41
RA-9/E2719	PCE	13 µg/L – 1-12/2011	Level I	MCL - 5 µg/L	2, p. 2; 10, pp. 27, 28, 67; 41
RA-6/E2716	PCE	15 µg/L – 1/12/2011	Level I	MCL - 5 µg/L	2, p. 2; 10, pp. 21, 22, 66; 41
RA-5/E2715	PCE	14 µg/L – 1/12/2011	Level I	MCL - 5 µg/L	2, p. 2; 10, pp. 19, 20, 66; 41

TABLE 15: LEVEL I AND LEVEL II SAMPLES					
Sample Location/ Sample No./ Laboratory Sample ID	**Hazardous Substance**	**Concentration and Sample Date**	**Level I or Level II**	**Benchmark Exceeded and Benchmark Concentration**	**References**
RA-14/E2724	PCE	20 µg/L – 1/13/2011	Level I	MCL - 5 µg/L	2, p. 2; 10, pp. 37, 38, 67; 41
RA-11/E2721	PCE	2.0 µg/L – 1/13/2011	Level II	NA	10, pp. 31, 32, 67; 41
RA-12/E2722	PCE	9.0 µg/L – 1/13/2011	Level I	MCL - 5 µg/L	2, p. 2; 10, pp. 33, 34, 67; 41
RA-10/E2720	PCE	6.5 µg/L – 1/13/2011	Level I	MCL - 5 µg/L	2, p. 2; 10, pp. 29, 30, 67; 41
DUD0646-02	PCE	10.2 µg/L – 4/13/2011	Level I	MCL - 5 µg/L	2, p. 2; 35, p. 14; 38, p. 1; 60, p. 6
DUD0646-04	PCE	3.92 µg/L – 4/13/2011	Level II	NA	35, p. 14; 38, p. 1; 60, p. 7
DUE0248-01	PCE	2.5 µg/L – 5/5/2011	Level II	NA	36, p. 5; 38, p. 1; 61, p. 5
DUF1053-01	PCE	2.1 µg/L – 6/21/11	Level II	NA	37, p. 11; 38, p. 1; 63, p. 5
DUH0127-01	PCE	17 µg/L – 8/2/2011	Level I	MCL - 5 µg/L	2, p. 2; 32, p. 16; 38, p. 1; 64, p. 6
DUH0127-03	PCE	2.7 µg/L – 8/2/2011	Level II	NA	32, p. 16; 38, p. 1; 64, p. 5
129287	PCE	4.11 µg/L – 1/2011	Level II	NA	58; 59, pp. 1, 6, 15
129289	PCE	8.23 µg/L – 1/2011	Level I	MCL - 5 µg/L	2, p. 2; 58; 59, pp. 1, 10, 15
RW-9/E5L53	PCE	3.6 µg/L – 11/14/2011	Level II	NA	5, pp. 637, 638, 674; 25, p. 2

TABLE 15: LEVEL I AND LEVEL II SAMPLES					
Sample Location/ Sample No./ Laboratory Sample ID	**Hazardous Substance**	**Concentration and Sample Date**	**Level I or Level II**	**Benchmark Exceeded and Benchmark Concentration**	**References**
RW-6/E5L50	PCE	1.5 µg/L – 11/14/2011	Level II	NA	5, pp. 631, 632, 673; 25, p. 2
RW-8/E5L52	PCE	2.7 µg/L – 11/14/2011	Level II	NA	5, pp. 635, 636, 674; 25, p. 2
RW-10/E5L54	PCE	9.6 µg/L – 11/15/2011	Level I	MCL - 5 µg/L	2, p. 2; 5, pp. 806, 807, 847; 25, p. 2
RW-17/E5L61	PCE	19 µg/L – 11/16/2011	Level I	MCL - 5 µg/L	2, p. 2; 5, pp. 816, 817, 848; 25, p. 2
SIA-14B/E51T9	PCE	1.4 µg/L – 11/19/2014	Level II	NA	9, pp. 14, 15; 31, pp. 2, 5
SIA-7B/E51S5	PCE	15 µg/L – 11/19/2014	Level I	MCL - 5 µg/L	2, p. 2; 8, pp. 52, 53; 31, pp. 2, 4
SIA-6B/E51S3	PCE	1.4 µg/L – 11/19/2014	Level II	NA	8, pp. 48, 49; 31, pp. 2, 3
SIA-4/E51R8	PCE	0.88 µg/L – 11/19/2014	Level II	NA	8, pp. 40, 41; 31, pp. 2, 3
SIA-8B/E51S7	PCE	0.54 µg/L – 11/19/2014	Level II	NA	8, pp. 56, 57; 31, pp. 2, 4
SIA-12/E51T4	PCE	1.0 µg/L – 11/19/2014	Level II	NA	8, pp. 66, 67; 31, pp. 2, 5
SIA-15/E51W0	PCE	5.7 µg/L – 11/19/2014	Level I	MCL - 5 µg/L	2, p. 2; 9, pp. 16, 17; 31, pp. 2, 5
SIA-13/E51T6	PCE	4.4 µg/L – 11/19/2014	Level II	NA	8, pp. 68, 69; 31, pp. 2, 5

TABLE 15: LEVEL I AND LEVEL II SAMPLES					
Sample Location/ Sample No./ Laboratory Sample ID	**Hazardous Substance**	**Concentration and Sample Date**	**Level I or Level II**	**Benchmark Exceeded and Benchmark Concentration**	**References**
L16010192-13	PCE	1.6 µg/– 1/15/2016	Level II	NA	23, p. 44; 25, p. 3; 66, pp. 13, 14
L16010192-01	PCE	7.49 µg/L – 1/15/2016	Level I	MCL – 5 µg/L	2, p. 2; 23, p. 44 25, p. 3; 66, pp. 31, 32
	TCE	3.55 µg/L – 1/15/2016	Level I	Cancer Risk – 1.1 µg/L	2, p. 3; 23, p. 44; 25, p. 3; 66, pp. 31, 32
L16051382-01	PCE	1.60 µg/L – 5/24/2016	Level II	NA	52, pp. 5, 6; 79, pp. 2, 57
L16090547-05	PCE	6.90 µg/L – 9/12/2016	Level I	MCL – 5 µg/L	2, p. 2; 24, pp. 13, 14; 79, pp. 2, 40
L16090547-07	PCE	6.46 µg/L – 9/12/2016	Level I	MCL – 5 µg/L	2, p. 2; 24, pp. 17, 18; 79, pp. 2, 40
L16090547-04	PCE	7.72 µg/L – 9/12/2016	Level I	MCL – 5 µg/L	2, p. 2; 24, pp. 11, 12; 79, pp. 2, 40
L16090547-01/ L16090547-02	PCE	8.25 µg/L – 9/12/2016 8.90 µg/L – 9/12/2016	Level I	MCL – 5 µg/L	2, p. 2; 24, pp. 5, 6, 7, 8; 79, pp. 2, 40

Notes:

DCE Dichloroethene
ID Identification number
MCL Maximum contaminant level
µg/L Micrograms per liter
NA Not applicable
No. Number
PCE Tetrachloroethylene
RA Removal assessment
RW Residential well
SIA Site inspection addendum
TCE Trichloroethylene
Sample L16090547-02 is a duplicate of sample L16090547-01 (Ref. 79, p. 2).
Sample RA-3/E2713 is a duplicate of sample RA-2/E2712 (Ref. 41).

Attribution

The DCA site is a contaminated groundwater plume with no identified source(s) where releases of PCE, TCE, and cis-1,2-DCE have been documented in 38 residential drinking water wells (see Section 3.1.1, Tables 8, 10, 12, and 14). Ohio EPA has made significant efforts to identify specific sources of groundwater contamination through numerous sampling events and by conducting an extensive search of Ohio EPA records (Ref. 27, pp. 1 through 8). Despite multiple soil and groundwater sampling investigations, no specific source or sources could be found in the vicinity of the plume to which the groundwater contamination could clearly be attributed.

The compounds found in the wells are manufactured chemicals, not thought to occur naturally, and non-detected concentrations in all background wells show that they are not ubiquitous throughout the Donnelsville and Bethel Township area (Refs. 44, pp. 1, 2, 173, 179, 180, 181; 53; 54, p. 81) (see Section 3.1.1, Tables 8, 12, and 14 of this HRS documentation record). Chlorinated solvents (such as PCE and TCE) are man-made compounds commonly used in commercial and industrial operations such as dry cleaning and metal degreasing, while other contaminants, such as cis-1,2-DCE, are common breakdown products of PCE and TCE (Refs. 44, p. 173; 53; 54, pp. 77, 81; 55, p. 24). The DCA site is located in a mixed industrial, commercial, and residential area where multiple past industrial and commercial activities could have resulted in the groundwater contamination (Ref. 27, pp. 1, 2, 5, 6).

During sampling events, Ohio EPA conducted an extensive level of effort by searching Ohio EPA and EPA records to identify possible sources of the groundwater contamination. See Reference 27 for more information on this search and a figure depicting the facilities identified. Facilities identified that are known to have used or may have used solvents similar to those found in the groundwater plume include an industrial machinery manufacturer and repairer, die cutter manufacturer, used car dealer that included a garage used for repairs, electrical station, and a former manufacturer of truck, airplane, baby swing, car seat, and high chair parts. Tool and die operations as well as a vapor degreaser were located at this former manufacturing location (Ref. 27, pp. 1, 2, 3, 4, 5) (see Figure 4 of this HRS documentation record).

According to Ohio EPA, the former truck, airplane, baby swings, car seats, and high chair parts manufacturer is a source of PCE contamination (Ref. 27, pp. 1, 2, 6) and, therefore, a more focused effort was made to determine whether there was a source at this facility. However, soil samples collected on and adjacent to the manufacturer were collected at depths at or below the water table (Ref. 5, pp. 7, 18, 134 through 143). Therefore, it is not known if PCE contamination in soils contributed to the groundwater contamination or if PCE in the groundwater affected the PCE concentrations detected in the soil samples, and a source could not be clearly documented (Ref. 5, p. 7). A vapor degreaser was used at its facility at 118 North Hampton Road (Ref. 27, pp. 1, 2, 6). The former manufacturing facility denies the use of VOCs at its properties located at 112 to 114 North Hampton Road and 118 to 120 North Hampton Road (Refs. 17, p. 1; 27, p. 2). However, it should be noted that the former manufacturing facility voluntarily paid for the installation of GAC water treatment systems at residential properties first sampled in 2016 that contained PCE at concentrations above the MCL. The former manufacturing facility also paid to replace broken air stripper water treatment systems that EPA installed in 2011 (Refs. 38, pp. 1, 2, 3; 81, p. 1). The former manufacturing facility also provided bottled water to residents in need of drinking water, either due to the presence of PCE at concentrations above the MCL or residences containing broken air stripper units, until GAC systems could be installed (Ref. 21).

Despite multiple soil and groundwater sampling investigations and responses to EPA requests for information, no specific source or sources could be confirmed in the vicinity of the plume to which the groundwater contamination could reasonably be attributed.

Hazardous Substances in the Release
cis-1,2-DCE
PCE
TCE

Ground Water Observed Release Factor Value: 550.00

3.1.2 POTENTIAL TO RELEASE

As specified in the HRS, potential to release was not evaluated because an observed release to the carbonate bedrock aquifer was established (Ref. 1, Section 3.1.1).

3.2 WASTE CHARACTERISTICS

3.2.1 TOXICITY/MOBILITY

The toxicity and mobility factor values for the hazardous substances detected in the source samples with containment factor values of greater than 0 are summarized in Table 16. The combined toxicity and mobility factor values are assigned in accordance with Reference 1, Section 3.2.1. Hazardous substances detected in the observed release to groundwater are assigned a mobility factor value of 1 (Ref. 1, Section 3.2.1.2).

TABLE 16: Ground Water Toxicity/Mobility

Hazardous Substance	Source No.	Toxicity Factor Value	Mobility Factor Value	Does Hazardous Substance Meet Observed Release? (Yes/No)	Toxicity/ Mobility (Ref. 1, Table 3-9)	References
PCE	1	100	1*	Yes	100	1a, Section 2.4.1.1; 2, p. 2
TCE	1	1,000	1	Yes	1,000	1a, Section 2.4.1.1; 2, p. 3
cis-1,2-DCE	1	1,000	1	Yes	1,000	1a, Section 2.4.1.1; 2, p. 1

Notes:

*The default mobility factor value of 1 was used because the substance was detected at observed release concentrations.

DCE Dichloroethene
No. Number
PCE Tetrachloroethylene
TCE Trichloroethylene

Toxicity/Mobility Factor Value: 1,000.00
(Ref. 1, Table 3-9)

3.2.2 HAZARDOUS WASTE QUANTITY

TABLE 17: Hazardous Waste Quantity		
Source No.	**Source Type**	**Source Hazardous Waste Quantity**
1	Other – Groundwater plume with no identified source	Undetermined, but greater than zero

The hazardous constituent quantity for Source No. 1 is not adequately determined. The HWQ is undetermined, but greater than zero. Because Level I contamination is present in residential drinking water wells, the HWQ receives a minimum factor value of 100 for the ground water migration pathway (Ref. 1, Section 2.4.2.2).

Hazardous Waste Quantity Factor Value: 100
(Ref. 1, Section 2.4.2.2)

3.2.3 WASTE CHARACTERISTICS FACTOR CATEGORY VALUE

The waste characteristics factor category was obtained by multiplying the toxicity/mobility and HWQ factor values, subject to a maximum product of 1×10^8 (Ref. 1, Section 3.2.3). Based on this product, a value was assigned in accordance with Reference 1, Table 2-7. TCE and cis-1,2-DCE have the highest toxicity/mobility factor value of 1,000 (Ref. 2, pp. 1, 3).

Toxicity/Mobility Factor Value: 1,000.00
Hazardous Waste Quantity Factor Value: 100

Toxicity/Mobility Factor Value ×
Hazardous Waste Quantity Factor Value: 100,000.00 (1×10^5)

Waste Characteristics Factor Category Value: 18
(Ref. 1, Table 2-7)

3.3 TARGETS

Municipal water is not available in Donnelsville and portions of Bethel Township (Ref. 6, p. 1). Residents in these areas obtain drinking water from groundwater wells (Ref. 6, p. 1). Section 3.3.2 contains Level I and Level II population values for residential drinking water wells located within Donnelsville and portions of Bethel Township. Sampling of residential drinking water wells in Donnelsville and portions of Bethel Township is ongoing as access to residential properties is obtained (Ref. 6, p. 1).

From 2011 to 2016, numerous sampling events were conducted within Donnelsville and Bethel Township to delineate the extent and source of groundwater contamination. Sixty-nine samples have been collected from residential drinking water wells (Ref. 6, pp. 1 through 4). PCE concentrations detected in residential drinking water wells ranged from 0.2 µg/L to 23.7 µg/L (Ref. 6, pp. 1 through 4). Twenty-three air strippers or GAC water treatment systems have been installed at residential properties where PCE was detected above the MCL of 5 µg/L (Refs. 6, pp. 1, 2, 3, 4; 38, pp. 1, 2, 3).

3.3.1 NEAREST WELL

Because actual contamination at Level I concentrations has been documented, a nearest well factor value of 50 is assigned (Ref. 1, Section 3.3.1, Table 3-11).

Level of Contamination (I, II, or potential): I

Nearest Well Factor Value: 50.0
(Ref. 1, Section 3.3.1, Table 3-11)

3.3.2 POPULATION

3.3.2.1 Level of Contamination

3.3.2.2 Level I Concentrations

A total of 47.31 people are subject to actual contamination at Level I concentrations (Refs. 5, pp. 806, 807, 816, 817; 8, pp. 52, 53; 9, pp. 16, 17; 10, pp. 7, 8, 13 through 16, 19, 20, 21, 22, 25, 26, 27, 28, 29, 30, 33, 34, 37, 38; 24, pp. 5, 6, 7, 8, 11, 12, 13, 14, 17, 18; 25, pp. 2, 3; 31, p. 2; 38, p. 1; 41; 51, p. 2; 58; 59, p. 10; 60, p. 6; 64, p. 6; 66, pp. 31, 32; 79, p. 2) (see Section 3.1.1, Observed Release of this HRS documentation record). Level I concentrations are documented in Table 15. Residential drinking water wells that contain PCE and TCE at concentrations above an HRS health-based benchmark are presented in Table 18. Except for the September 2016 Ohio EPA sampling event, the population served by each well at the time of sampling was not obtained from residents (Refs. 25, p. 1; 31, p. 1; 38, p. 1; 79, pp. 1, 2). Therefore, the population data were obtained from the U.S. Census Bureau. The number of people per household in Clark County, Ohio (2010 through 2014), is 2.43 (Ref. 51, p. 2).

TABLE 18: LEVEL I POPULATION

Sample Location/ Sample No./ Laboratory Sample ID	Hazardous Substance	Population (Refs. 51, p. 2; 79, p. 2)	Reference
RA-2/E2712 and RA-3/E2713[1]	PCE	2.43	10, pp. 13, 14, 15, 16, 66; 41
RA-1/E2711	PCE	2.43	10, pp. 7, 8, 66; 41
RA-8/E2718	PCE	2.43	10, pp. 25, 26, 66; 41
RA-9/E2719	PCE	2.43	10, pp. 27, 28, 67; 41

TABLE 18: LEVEL I POPULATION			
Sample Location/ Sample No./ Laboratory Sample ID	**Hazardous Substance**	**Population (Refs. 51, p. 2; 79, p. 2)**	**Reference**
RA-6/E2716	PCE	2.43	10, pp. 21, 22, 66; 41
RA-5/E2715	PCE	2.43	10, pp. 19, 20, 66; 41
RA-14/E2724	PCE	2.43	10, pp. 37, 38, 67; 41
RA-12/E2722	PCE	2.43	10, pp. 33, 34, 67; 41
RA-10/E2720	PCE	2.43	10, pp. 29, 30, 67; 41
129289	PCE	2.43	58; 59, p. 10
RW-17/E5L61	PCE	2.43	5, pp. 816, 817, 848, 25, p. 2
DUD0646-02	PCE	2.43	35, p. 14; 38, p. 1; 60, p. 6
DUH0127-01	PCE	2.43	32, p. 16; 38, p. 1; 64, p. 6
RW-10/E5L54	PCE	2.43	5, pp. 806, 807, 847; 25, p. 2
SIA-7B/E51S5	PCE	2.43	8, pp. 52, 53; 31, pp. 2, 4
SIA-15/E51W0	PCE	2.43	9, pp. 16, 17; 31, pp. 2, 5
L16010192-01	PCE TCE	2.43	66, pp. 31, 32; 23, p. 44; 25, p. 3
L16090547-05	PCE	2	24, pp. 13, 14; 79, pp. 2, 40
L16090547-07	PCE	1	24, pp. 17, 18; 79, pp. 2, 40
L16090547-04	PCE	2	24, pp. 11, 12; 79, pp. 2, 40
L16090547-01/ L16090547-02[2]	PCE	1	24, pp. 5, 6, 7, 8; 79, pp. 2, 40

Notes:

ID Identification
No. Number
PCE Tetrachloroethylene
RA Removal assessment
RW Residential well
SIA Site inspection addendum
[1]Sample RA-3/E2713 is a duplicate of sample RA-2/E2712 (Ref. 41)
[2]Sample L16090547-02 is a duplicate of sample L16090547-01 (Refs. 79, p. 2)

Sum of Population Served by Level I Wells: 47.31 Individuals
Sum of Population Served by Level I Wells × 10: 473.1 Individuals

Level I Concentrations Factor Value: 473.1

3.3.2.3 Level II Concentrations

A total of 41.31 people are subject to actual contamination at Level II concentrations (Refs. 5, pp. 632, 633, 636, 637, 638, 639; 8, pp. 40, 41, 48, 49, 56, 57, 66, 67, 68, 69; 9, pp. 14, 15; 10, pp. 31, 32; 23, pp. 30, 31, 32, 33; 25, pp. 2, 3; 28, p. 4; 31, p. 2; 35, p. 8; 38, p. 1; 41; 51, p. 2; 52, pp. 5, 6; 58; 66, pp. 13, 14; 79, p. 1) (see Section 3.1.1, Observed Release of this HRS documentation record). Level II concentrations are documented in Table 15. Residential drinking water wells that contain PCE at concentrations between the reporting limit and the HRS health-based benchmark are presented in Table 19. The population served by each well at the time of sampling was not obtained from residents. (Refs. 25, p. 1; 31, p. 1; 38, p. 1; 58). Therefore, the population data was obtained from the U.S. Census Bureau. The number of people per household in Clark County, Ohio (2010 through 2014), is 2.43 (Ref. 51, p. 2).

TABLE 19: LEVEL II SAMPLES			
Client ID/ Sample No./ Laboratory ID	**Hazardous Substance**	**Population (Ref. 51, p. 2)**	**References**
RA-11/E2721	PCE	2.43	10, pp. 31, 32, 67; 41
DUD0646-04	PCE	2.43	35, p. 14; 38, p. 1; 60, p. 7
DUE0248-01	PCE	2.43	36, p. 11; 38, p. 1; 61, p. 5
DUF1053-01	PCE	2.43	37, p. 11; 38, p. 1; 63, p. 5
DUH0127-01	PCE	2.43	32, p. 16; 38, p. 1; 64, p. 5
RW-9/E5L53	PCE	2.43	5, pp. 637, 638, 674; 25, p. 2
RW-6/E5L50	PCE	2.43	5, pp. 631, 6323, 673; 25, p. 2
RW-8/E5L52	PCE	2.43	5, pp. 635, 636, 674; 25, p. 2
SIA-14B/E51T9	PCE	2.43	9, pp. 14, 15; 31, pp. 2, 5
SIA-6B/E51S3	PCE	2.43	8, pp. 48, 49; 31, pp. 2, 3
SIA-4/E51R8	PCE	2.43	8, pp. 40, 41; 31, pp. 2, 3
SIA-8B/E51S7	PCE	2.43	8, pp. 56, 57; 31, pp. 2, 4
SIA-12/E51T4	PCE	2.43	8, pp. 66, 67; 31, pp. 2, 5
SIA-13/E51T6	PCE	2.43	8, pp. 68, 69; 31, pp. 2, 5
L16010192-13	PCE	2.43	66, pp. 13, 14; 25, p. 3
129287	PCE	2.43	58; 59, pp. 6, 15

TABLE 19: LEVEL II SAMPLES			
Client ID/ Sample No./ Laboratory ID	**Hazardous Substance**	**Population (Ref. 51, p. 2)**	**References**
L16051382-01	PCE	2.43	52, pp. 5, 6; 79, p. 2

Notes:

ID Identification
No. Number
PCE Tetrachloroethylene
RA Removal assessment
RW Residential well
SIA Site inspection addendum

Sum of Population Served by Level II Wells: 41.31 Individuals
Sum of Population Served by Level II Wells × 1: 41.31 Individuals

Level II Concentrations Factor Value: 41.31

3.3.2.4 Potential Contamination

Potential contamination targets are not scored.

Potential Contamination Factor Value: NS

3.3.2.5 CALCULATION OF POPULATION FACTOR VALUE

A value of 514.41 (Level I and Level II) is assigned for the population factor value (Ref. 1, Section 3.3.2.5).

Total Population Factor Value: 514.41

3.3.3 RESOURCES

No resources were identified.

Resources Factor Value: NS

3.3.4 WELLHEAD PROTECTION AREA

The Wellhead Protection Program is a pollution prevention and management program that is designed to protect underground sources of drinking water from contamination (Refs. 22, p. 1; 33, pp. 2, 4). The federal Safe Drinking Water Act, as amended in 1986, required every state to develop a wellhead protection program. The Ohio Wellhead Protection Program was approved by EPA in May 1992. The Wellhead Protection Program was designed to protect public drinking water supplies using groundwater by determining the area providing water to a well, inventorying potential contaminant sources within that area, and then developing strategies to protect the groundwater from those potential contaminant sources (Ref. 22, p. 1-1).

HRS Section 3.3.4 states that a wellhead protection area factor value of 20 should be used if either a source having a groundwater containment factor value greater than 0 lies either partially or fully within or above a designated Wellhead Protection Area or if observed groundwater contamination attributable to the source lies either partially or fully within the designated Wellhead Protection Area. Table 3 of the HRS documentation record identifies the groundwater containment factor as 10. A wellhead protection area is established for First Lutheran Church – Donnelsville, public water system identification number OH1251512 (Ref. 47, p. 1). The DCA site lies partially within the wellhead protection area (Ref. 47, pp. 1, 7) (see Figure 3a of this HRS documentation record). Therefore, the Wellhead Protection Area factor value of 20 is supported (Ref. 47, pp. 1, 7) (see Table 15 of this HRS documentation record).

Wellhead Protection Area Factor Value: 20.00