HAZARD RANKING SYSTEM (HRS) DOCUMENTATION RECORD COVER SHEET

Name of Site:	Broadway Street Corridor Groundwater Contamination
U.S. EPA ID No.	INN000510915
Date Prepared:	January 2018

Contact Persons

Site Investigation:	Mark Jaworski, Site Investigation Program, Federal Programs Section, Indiana Department of Environmental Management, (317) 233-2407
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Pathways, Components, or Threats Not Scored

Surface Water Migration Pathway, Soil Exposure and Subsurface Intrusion Pathway, and Air Migration Pathway:

The Surface Water Migration Pathway, Soil Exposure and Subsurface Intrusion Pathway, and Air Migration Pathway were not scored as part of this Hazard Ranking System (HRS) evaluation. These pathways were not included because a release to these media does not significantly affect the overall score and because the ground water pathway produces an overall score above the minimum requirement for the Broadway Street Corridor Groundwater Contamination site to qualify for inclusion on the National Priorities List (NPL).

HRS DOCUMENTATION RECORD

Name of Site:	Broadway Street Corridor Groundwater Contamination
EPA Region:	5
Street Address*:	Intersection of Broadway Street and Grand Avenue Anderson, Indiana
Date Prepared:	January 2018
City, County, State, Zip Code:	Anderson, Madison County, Indiana, 46016
General Location in the State:	Central Indiana (Figure 1 of this HRS Documentation Record)
Topographic Maps:	Anderson, Indiana North and Anderson South, Indiana 7.5' Quad (Refs. 89; 90)
Latitude:	40.1184 (Figure 1; Figure 3; Ref. 90)
Longitude:	-85.6789 (Figure 1; Figure 3; Ref. 90)
Reference Point:	Broadway Street and Grand Avenue
Congressional District:	5

*The street address, coordinates, and contaminant locations presented in this HRS documentation record identify the general area the site is located. They represent one or more locations EPA considers to be part of the site based on the screening information EPA used to evaluate the site for NPL listing. EPA lists national priorities among the known "releases or threatened releases" of hazardous substances; thus, the focus is on the release, not 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 CERCLA. Accordingly, EPA contemplates that the preliminary description of facility boundaries at the time of scoring will be refined as more information is developed as to where the contamination has come to be located.

Scores

Air Pathway	Not Scored
Ground Water Pathway1	100.00
Soil Exposure and Subsurface Intrusion Pathway	Not Scored
Surface Water Pathway	Not Scored
HRS SITE SCORE	**50.00**

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	S^2
1.	Ground Water Migration Pathway Score (S_{gw}) (from Table 3-1, line 13)	100.00	10,000.00
2a.	Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	NS*	
2b.	Ground Water to Surface Water Migration Component (from Table 4-25, line 28)	NS	
2c.	Surface Water Migration Pathway Score (S_{sw}) Enter the larger of lines 2a and 2b as the pathway score.	NS	
3.	Soil Exposure and Subsurface Intrusion Pathway Score (S_{sessi}) (from Table 5-1, line 22)	NS	
4.	Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	NS	
5.	Total of $S_{gw}^2 + S_{sw}^2 + S_{sessi}^2 + S_a^2$		10,000.00
6.	**HRS Site Score** Divide the value on line 5 by 4 and take the square root		50.00

Notes: *NS = Not Scored

HRS Table 3-1 –Ground Water Migration Pathway Scoresheet

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 x (2b + 2c + 2d)]	500	NS
3. Likelihood of Release (higher of lines 1 and 2e)	550	550
Waste Characteristics:		
4. Toxicity/Mobility	(a)	10,000
5. Hazardous Waste Quantity	(a)	100
6. Waste Characteristics	100	32
Targets:		
7. Nearest Well	50	50
8. Population:		
8a. Level I Concentrations	(b)	130,500
8b. Level II Concentrations	(b)	NS
8c. Potential Contamination	(b)	1,956
8d. Population (lines 8a + 8b + 8c)	(b)	132,456
9. Resources	5	0
10. Wellhead Protection Area	20	20
11. Targets (lines 7 + 8d + 9 + 10)	(b)	132,526
Ground Water Migration Score For An Aquifer:		
12. Aquifer Score [(lines 3 x 6 x 11)/82,500][c] 550 x 32 x 132,526/82,500 = 28,272.2133	100	100.00
Ground Water Migration Pathway Score:		
13. Pathway Score (S_{gw}), (highest value from line 12 for all aquifers evaluated)[c]	100	100.00

(a) Maximum value applies to waste characteristics category
(b) Maximum value not applicable
[c] Do not round to nearest integer
NS - Not Scored

REFERENCES

No. Description of the Reference

1. U.S. Environmental Protection Agency (U.S. EPA), 40 CFR Part 300, December 14, 1990. Subject: Hazard Ranking System; Final Rule, http://semspub.epa.gov/work/11/174028.pdf. 138 pages.

1a. EPA. Addition of a Subsurface Intrusion Component to the Hazard Ranking System, 40 Code of Federal Regulations Part 300, 82 Federal Register 2760. January 9, 2017. 48 Pages. Available on-line at https://www.regulations.gov/document?D=EPA-HQ-SFUND-2010-1086-0104.

2. U.S. EPA. Superfund Chemical Data Matrix (SCDM), https://www.epa.gov/superfund/superfund-chemical-data-matrix-scdm-query?substanceAuto=&c=000075-34-3&c=000156-59-2&c=000127-18-4&c=000071-55-6&c=000079-01-6&c=000075-01-4&f=f1&b=b1&d=d1&d=d2&d=d3, excerpt, accessed August 18, 2017. 26 pages.

3. Indiana Department of Environmental Management (IDEM), Broadway Avenue Corridor Ground Water Contamination Expanded Site Inspection Report, February 29, 2016. 523 pages.

4. IDEM, Broadway Avenue Corridor Ground Water Contamination Site Inspection Report, February 27, 2015. 1316 pages.

5. In Aqua Veritas, LLC, Wellhead Protection Area Delineation Model, May 31, 2011. 53 pages.

6. U.S. EPA, Region V, Central Regional Laboratory, Ranney Well Field Groundwater Plume (IN), Level 3 Data Validation, Case 45438, SDG E2TN0, August 14, 2015. 150 pages.

7. IDEM, Sample Field Sheets, Ranney Well Field, July 8, 2015. 61 pages.

8. U.S. EPA, Region V, Central Regional Laboratory, Ranney Well Field Groundwater Plume (IN), Level 3 Data Validation, Case 45438, SDG E2TL6, August 28, 2015. 128 pages.

9. IDEM, PreCERCLIS Assessment, Ranney Well Field Ground Water Plume, November 11, 2011. 4 pages.

10. Blue Sky Engineering, Anderson Wellhead Protection Plan, January 30, 2012. 45 pages.

11. Reference Number Reserved

12. U.S. EPA, RCRA Notifier Database Information Update Form, ABC Rail, March 23, 1993. 14 pages.

13. YP.com, Hobbs Electric Motor Solutions, http://www.yellowpages.com/anderson-in/mip/hobbs-electric-moter-solutions-481760675, accessed November 25, 2015. 2 pages.

14. Kirby Risk Corporation Web Page, https://www.kirbyrisk.com/index.jsp?path=aboutES&prev=home, accessed November 25, 2015. 3 pages.

15. Indiana State Board of Health, Notification For Underground Storage Tanks, Clean Glove, March 27, 1986. 3 pages.

16. YP.com, Prairie Farms Dairy, http://www.yellowpages.com/anderson-in/mip/prairie-farms-dairy-1675327, accessed November 25, 2015. 2 pages.

17. Reference Number Reserved

18. IDEM, Telephone Conversation Documentation between Tom Brewer (Superintendent of Anderson Water Department) and Linda McClure (Senior Environmental Manager, IDEM) regarding elevated volatile organic compounds detected in wells supplying water to the Wheeler Treatment Plant, July 11, 2013. 1 page.

19. Mullin-Kille and Hudson, Con Survey City Directory, Volume 8, ABCD No. 470, Anderson, Indiana, excerpts, 1951. 4 pages.

20. Indiana Department of Natural Resources (IDNR), Significant Water Withdrawal Facility Data, https://secure.in.gov/dnr/water/4841.htm, download SWWF data for the entire state, selected pages, accessed May 25, 2016. 3 pages.

21. Mullin-Kille and Hudson, Con Survey City Directory, Volume 9, ABCD No. 557, Anderson, Indiana, excerpts, 1953. 5 pages.

22. Mullin-Kille and Hudson, Con Survey City Directory, Volume 10, ABCD No. 629, Anderson, Indiana, excerpts, 1955. 3 pages.

23. Mullin-Kille and Hudson, Con Survey City Directory, Volume 11, ABCD No. 707, Anderson, Indiana, excerpts, 1957. 4 pages.

24. Mullin-Kille and Hudson, Con Survey City Directory, Volume 12, ABCD No. 828, Anderson, Indiana, excerpts, 1959. 5 pages.

25. Mullin-Kille and Hudson, Con Survey City Directory, Volume 13, ABCD No. 953, Anderson, Indiana, excerpts, 1961. 5 pages.

26. Mullin-Kille and Hudson, Con Survey City Directory, Volume 14, ABCD No. 1089, Anderson, Indiana, excerpts, 1963. 5 pages.

27. Mullin-Kille and Hudson, Con Survey City Directory, Volume 16, ABCD No. 1322, Anderson, Indiana, excerpts, 1967. 5 pages.

28. Mullin-Kille and Hudson, Con Survey City Directory, Volume 17, ABCD No. 1462, Anderson, Indiana, excerpts, 1969. 4 pages.

29. Mullin-Kille and Hudson, Con Survey City Directory, Volume 18, ABCD No. 1632, Anderson, Indiana, excerpts, 1971. 5 pages.

30. Mullin-Kille and Hudson, Con Survey City Directory, Volume 19, ABCD No. 1750, Anderson, Indiana, excerpts, 1973. 3 pages.

31. Johnson's May 1979 City Directory for Anderson, Indiana, excerpts, 1979. 4 pages.

32. Mullin-Kille and Hudson, Con Survey City Directory, Volume 20, ABCD No. 1864, Anderson, Indiana, excerpts, 1975. 4 pages.

33. Mullin-Kille and Hudson, Con Survey City Directory, Volume 21, ABCD No. 1951, Anderson, Indiana, excerpts, 1976. 5 pages.

34. Johnson Publishing Company, Inc., 1978 Anderson, Indiana City Directory, excerpts, 1978. 5 pages.

35. Johnson Publishing Company, Inc., Anderson, Indiana City Directory, excerpts, 1980. 7 pages.

36. Johnson Publishing Company, Inc., City Directory, Anderson, Indiana, excerpts, 1988. 6 pages.

37. US West Marketing Resources, Johnson Directory Division, Anderson, Indiana City Directory, excerpts, 1983. 6 pages.

38. Johnson Publishing Company, Inc., Anderson, Indiana City Directory, excerpts, 1985. 6 pages.

39. US West Marketing Resources, Johnson Directory Division, Anderson, Indiana City Directory, excerpts, 1987. 6 pages.

40. Polk, Polk Cross-Reference Directories, Anderson-Muncie, Indiana, excerpts, 1996. 9 pages.

41. Polk, Polk City Directory, 2000 City Directory, Anderson, Indiana, 2000. 7 pages.

42. Polk, 2012 Polk City Directory, Anderson, Indiana, 2012. 7 pages.

43. Polk, 2015 Polk City Directory, Anderson, Indiana, 2015. 6 pages.

44. IDEM, Affidavit of Linda McClure (Senior Environmental Manager), regarding steps taken to determine the source of the Ranney well field ground water contamination, September 10, 2015. 3 pages.

45. Layne Christensen Company, Collector Well Inspections and Test Drilling Report, The City of Anderson, Indiana, October 2007. 96 pages.

46. IDEM, Preliminary Assessment, Ranney Well Field Ground Water Plume, December 5, 2013. 306 pages.

47 IDEM, Geologic Assessment, City of Anderson Wellfield, July 22, 2013. 4 pages.

48. IDEM, Correspondence Letter, Clean-A-Magic, August 1, 1997. 6 pages.

49. IDEM, Indiana Drycleaner Compliance Assurance Program, June 11, 1996. 7 pages.

50. U.S. EPA, Notification of Hazardous Waste Activity, Clean-A-Magic, July 28, 1997. 2 pages.

51. U.S. EPA, Notification of Hazardous Waste Activity, Anderson Chry/Ply Dodge Inc., May 20, 1989. 2 pages.

52. IDEM, Sample Field Sheets, July 21 through July 24, 2014. 58 pages.

53. Dossett's Garage web site, http://Dossetts.com/, accessed May 11, 2016. 4 pages.

54. State Board Health, Office Memorandum, Clean Glove Division, December 8, 1975. 1 page.

55. IDEM, CERCLIS Executive Summary State Lead, Perry Bertram's Industrial Disposal, February 16, 1987. 5 pages.

56. Drew Parts web site, http://www.drewsparts.com/, accessed May 17, 2016. 1 page.

57. United States Census Bureau, Quick Facts, Anderson City, Indiana, http://www.census.gov/quickfacts/table/PST045215/1801468, accessed May 25, 2016. 4 pages.

58. IDEM, Drinking Water Branch, Water System Details, Anderson Water Department, https://myweb.in.gov/IDEM/DWW/JSP/WaterSystemDetail.jsp?tinwsys_is_number=408371&tinwsys_st_code=IN&wsnumber=IN5248002, accessed May 26, 2016. 3 pages.

59. IDEM, Email from James Sullivan (IDEM) to Mark Jaworski (IDEM) regarding the Anderson WHPP and section 1428 of the SDWA, June 6, 2016. 2 pages.

60. Agency for Toxic Substances and Disease Registry (ATSDR), Division of Toxicology and Environmental Medicine, ToxFAQs, 1,1,1- Trichloroethane, July 2006. 2 pages.

61. Agency for Toxic Substances and Disease Registry (ATSDR), Division of Toxicology and Disease Registry, ToxFAQs, Tetrachloroethylene, September 1997. 2 pages.

62. University of Minnesota, Lynda Ellis and Sean Anderson, Tetrachloroethene Pathway Map (Anaerobic), http://eawag-bbd.ethz.ch/tce2/tce2_map.html, http://eawag-bbd.ethz.ch/index.html, June 30, 2014. 3 pages.

63. Agency for Toxic Substances and Disease Registry (ATSDR), Division of Toxicology and Human Health Services, ToxFAQs, Vinyl Chloride, 2006. 2 pages.

64. Agency for Toxic Substances and Disease Registry (ATSDR), Division of Toxicology and Human Health Services, ToxFAQs, Trichloroethylene, July 2003. 2 pages.

65. Agency for Toxic Substances and Disease Registry (ATSDR), Division of Toxicology and Disease Registry, ToxFAQs, 1,2-dichloroethene, September 1997. 2 pages.

66. Agency for Toxic Substances and Disease Registry (ATSDR), Division of Toxicology and Human Health Services, ToxFAQs, 1,1-dichloroethane, August 2015. 2 pages.

67. Reference Number Reserved

68. City of Anderson, Email from Jeff Hall to Mark Jaworski (IDEM) regarding the water supply sources to the Wheeler Avenue Treatment Plant, March 8, 2017. 1 page.

69. IDEM Site Investigations Program, Broadway Street Corridor Ground Water Contamination, Anderson, Madison County, Indiana, Research and Investigation of Possible Sources/Attribution/Level of Effort Indiana, July 2017. 28 pages.

70. Lapham, Wayne W., et. al., Ground-Water Resources of the White River Basin, Madison County, Indiana, United States Geological Survey Water-Resources Investigations Report No. WRI 81-35: Excerpt, pages 33-35, June 1981. 4 pages.

71. United States Geological Survey (USGS), Hydrogeologic Atlas of Aquifers in Indiana, Water-Resources Investigations Report 92-4142: 1994. 207 pages.

72. IDNR, Division of Water Resources Assessment Section, Bedrock Aquifer Systems of Madison County, Indiana (map), August 2010. 2 pages.

73. IDNR, Division of Water Resources Assessment Section, Bedrock Aquifer Systems of Madison County, Indiana, August 2010. 1 page.

74. Reference Number Reserved

75. Schermerhorn, Edward J., et. al., Soil Survey of Madison County, Indiana, United States Department of Agriculture Soil Conservation Service: March 1967. 96 pages.

76. U.S. Department of Agriculture (USDA) Soil Conservation Services, General Soil Map: Madison County, Indiana, Purdue University Agricultural Experiment Station, November 1965. 1 page.

77. IDNR, Division of Water Resources Assessment Section, Unconsolidated Aquifer Systems of Madison County, Indiana (map), August 2010. 1 page.

78. IDNR, Division of Water Resources Assessment Section, Unconsolidated Aquifer Systems of Madison County, Indiana, August 2010. 4 pages.

79. Layne, Ranney Collector Wells, http://www.layne.com/en/solutions/construction/ranney-collector-wells.aspx?mid=464, accessed May 1, 2017. 4 pages.

80. IDEM, Affidavit of Jeffrey E. Bahling regarding SI and ESI groundwater samples collection, September 20, 2017. 1 page.

81. Classic Touch Cleaners, What Chemicals are Used in Dry Cleaning, http://drycleanersatlanta.com/2014/11/chemicals-used-dry-cleaning/, accessed May 5, 2017. 4 pages.

82. IDEM, Ground Water Glossary, http://www.in.gov/idem/cleanwater/2469.htm, accessed May 8, 2017. 8 pages.

83. Berit Bakke, Patricia A. Stewart and Martha A. Waters, Uses of and Exposure to Trichloroethylene in U. S. Industry: A Systematic Literature Review, Abstract, Journal of Occupational Environmental Hygiene, Vol. 4, Iss. 5, 2007, https://www.ncbi.nlm.nih.gov/pubmed/17454505 (via PubMed.gov), accessed May 11, 2017. 2 pages.

84. Toxipedia, Trichloroethylene, http://www.toxipedia.org/display/toxipedia/Trichloroethylene, accessed May 11, 2017. 8 pages.

85. IDEM, Email from Shane Moore to Mark Jaworski, Potential Sources With WHPA, July 11, 2017. 8 pages.

86. IDEM, Affidavit of Jeff Bahling regarding geologic statements in Reference 69, July 18, 2017. 1 page.

87. IDEM, Affidavit of Linda McClure regarding records review searches for other possible sources, July 13, 2017. 1 page.

88. IDEM, Affidavit of Mark Jaworski regarding a conversation with Anderson Water Department, September 21, 2017. 1 page.

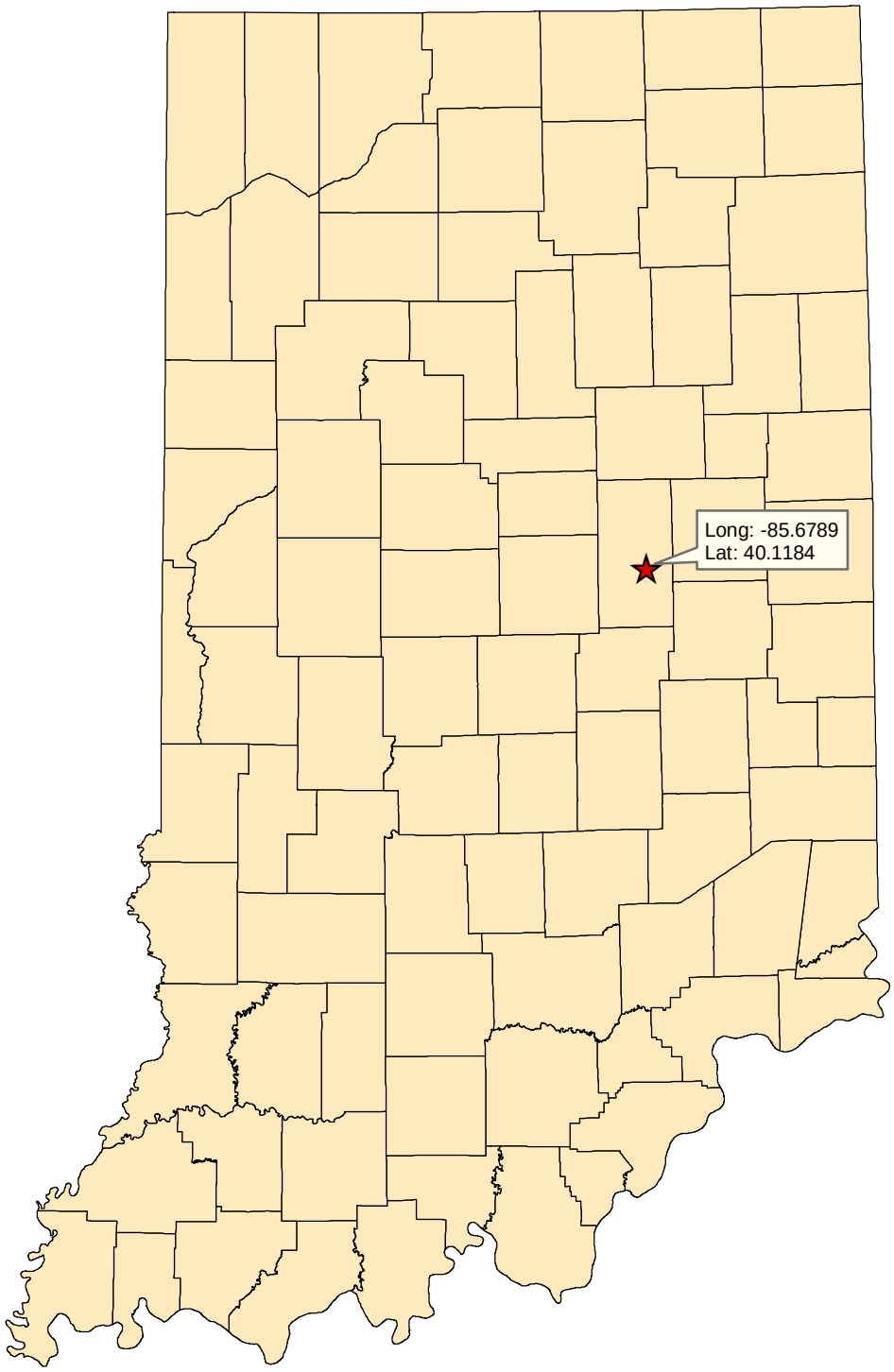
89. U.S. Geological Survey, 7.5-minute Topographic Quadrangle - Anderson North Quadrangle, Indiana-Madison Co., 2013. 1 page.

90. U.S. Geological Survey, 7.5-minute Topographic Quadrangle – Anderson South Quadrangle, Indiana-Madison Co., 2013. 1 page.

LIST OF FIGURES

Site Location Map
Broadway Street Corridor Groundwater Contamination
Anderson, Madison County, Indiana

Fig. 1



Mapped By:
Shane Moore, IDEM, Office of Land Quality, Science Services Branch, Engineering and GIS Services, Nov 13, 2017.

Sources:
Non Orthophotography Data
- Obtained from the State of Indiana Geographic Information Office Library

Map Datum and Projection
NAD83 UTM Zone 16N (meters)

Disclaimer:
This map is intended to serve as an aid in graphic representation only. This information is not warrented for accuracy or other purposes.

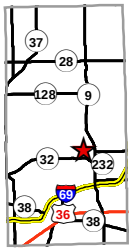
Site Location

N
W E
S

Feet
0 175,000 350,000

0 50,000 100,000
Meters

Madison County



Broadway Street Corridor Groundwater Contamination

Anderson, Madison County, Indiana

July 2014, July 2015 Impacted Ranney Well Results

Fig. 2

Mapped By:
Shane Moore, IDEM, Office of Land Quality, Science Services Branch, Engineering and GIS Services, March 15, 2017.

Sources:
- Well Locations obtained from IDEM OLQ Sampling Database (SampDB)

Orthophotography
- 2011-2013 Statewide Orthophotography Program
- Sample Locations and Results obtained from SampDB

Non Orthophotography Data
- Obtained from the State of Indiana Geographic Information Office Library

Document
- IDEM Site Inspection Report, Broadway Avenue Corridor Ground Water Plume, Feb. 27, 2015, Table 5.1, pp. 22

Map Datum and Projection
NAD83 UTM Zone 16N

Disclaimer:
This map is intended to serve as an aid in graphic representation only. This information is not warrented for accuracy or other purposes.

Ranney Well location designating a separate ground water plume without an identified source

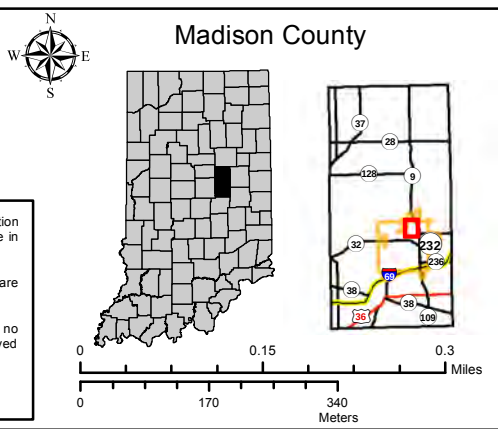
Wellhead 5 Year Delineation

* = Samples have analyte concentrations below the quantitation limit (CRQL) and detected compounds are qualified a J values. Detection below the CRQL is treated as non-quantifiable for HRS purposes. Result was adjusted to "Non-Detect" (ND) using the procedure describe in EPA 540-F-94-028, Using Qualified Data to Document an Observed Release and Observed Contamination, November 1996.

** = Concentrations exceeded the instrument's calibration range. Samples reanalyzed using a dilution factor and the result and CRQL are reported from the diluted analysis.

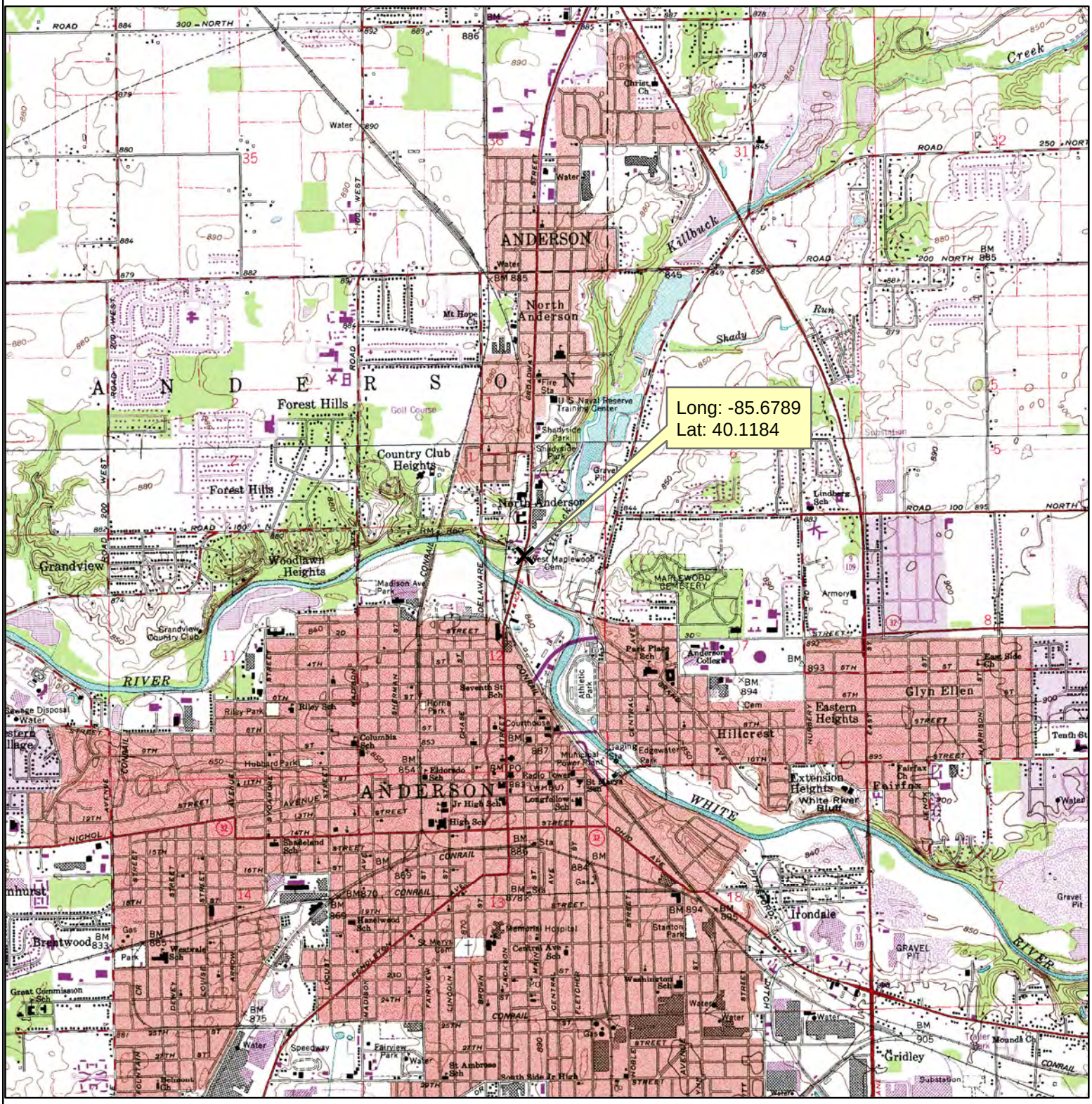
J- = Surrogate recoveries out of control, low and associated compounds are qualified bias low. Results for release samples require no adjustment according to procedures in EPA 540-F-94-028, Using Qualified Data to Document an Observed Release and Observed Contamination, November 1996.

U = Not detected



Topographic Site Location Map
Broadway Street Corridor Groundwater Contamination
Anderson, Madison County, Indiana

Fig. 3



Mapped By:
Shane Moore, IDEM, Office of Land Quality, Science Services Branch, Engineering and GIS Services, Sept. 19, 2017.

Sources:
Non Orthophotography Data
- Obtained from the State of Indiana Geographic Information Office Library

Map Datum and Projection
NAD83 UTM Zone 16N (meters)

Disclaimer:
This map is intended to serve as an aid in graphic representation only. This information is not warrented for accuracy or other purposes.

✕ Site Location

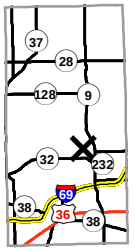
N
W E
S

Feet
0 2,700 5,400

0 770 1,540
Meters

IDEM

Madison County



Broadway Street Corridor
Groundwater Contamination Results
Anderson, Madison County, Indiana
July 2014, July 2015 Water Sample Locations and Results with WHPA

Fig. 4

E2T93
Cis-1,2-DCE 100 ug/L U
1,1-DCA 100 ug/L U
PCE 100 ug/L U
TCA 100 ug/L U
TCE 100 ug/L U
VC 100 ug/L U

E2T64
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

E2T92
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

Ranney 2 (NPV)
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

E2TM6
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

E2T70
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U*
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

E2TM5
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U*
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

GW6/GW11
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

E2T88
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

E2TM3
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U
TCA 0.5 ug/L U*
TCE 1.5 ug/L
VC 0.5 ug/L U

E2T80
Cis-1,2-DCE 6.9 ug/L
1,1-DCA 1.4 ug/L
PCE 0.5 ug/L U
TCA 4.2 ug/L
TCE 59 ug/L **
VC 0.5 ug/L U

E2T87
Cis-1,2-DCE 0.5 ug/L U*
1,1-DCA 0.81 ug/L
PCE 0.5 ug/L U
TCA 0.5 ug/L U
TCE 0.5 ug/L U*
VC 2 ug/L

E2T82
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 22 ug/L **
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

E2T96
Cis-1,2-DCE 5.5 ug/L
1,1-DCA 0.5 ug/L U
PCE 190 ug/L **
TCA 0.5 ug/L U
TCE 9.2 ug/L
VC 0.5 ug/L U

E2TA1
Cis-1,2-DCE 4.4 ug/L
1,1-DCA 0.5 ug/L U
PCE 200 ug/L **
TCA 0.5 ug/L U
TCE 6.8 ug/L
VC 0.5 ug/L U

E2T90
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

GW3/GW4
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 2.1 ug/L
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

GW3/GW4
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 2.4 ug/L
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

E2TL9
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

E2T98
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

E2T95
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

E2TN1
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

E2TN0
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

E2TM7
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

E2T91
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

Ranney 1 (NPV) E2T73
Cis-1,2-DCE 0.77 ug/L
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U
TCA 0.5 ug/L U
TCE 7 ug/L
VC 0.5 ug/L U

Ranney 1 (NPV) E2T72
Cis-1,2-DCE 0.76 ug/L
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U
TCA 0.5 ug/L U
TCE 7.1 ug/L
VC 0.5 ug/L U

E2T68
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

E2T78
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

E2T66
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

E2T79
Cis-1,2-DCE 6.9 ug/L
1,1-DCA 0.5 ug/L U*
PCE 0.5 ug/L U
TCA 0.5 ug/L U
TCE 0.65 ug/L
VC 4.7 ug/L

Ranney 4 (NPV) E2T76
Cis-1,2-DCE 5.1 ug/L
1,1-DCA 0.5 ug/L U*
PCE 0.5 ug/L U*
TCA 0.5 ug/L U*
TCE 1.7 ug/L
VC 1.3 ug/L

E2T81
Cis-1,2-DCE 0.5 ug/L U*
1,1-DCA 0.5 ug/L U
PCE 46 ug/L **
TCA 0.5 ug/L U
TCE 0.99 ug/L
VC 0.5 ug/L U

Ranney 5 (NPV) E2T84
Cis-1,2-DCE 0.5 ug/L U*
1,1-DCA 0.5 ug/L U
PCE 5.4 ug/L
TCA 0.5 ug/L U
TCE 0.5 ug/L U*
VC 0.5 ug/L U

E2T94
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

E2TM0
Cis-1,2-DCE 0.5 ug/L U
1,1-DCA 0.5 ug/L U
PCE 0.5 ug/L U
TCA 0.5 ug/L U
TCE 0.5 ug/L U
VC 0.5 ug/L U

N STATE RD 9
KILLBUCK CREEK
CROSS ST
BROADWAY AVE
ALEXANDRIA PIKE
WHITE RIVER

1,1-DCA -------- 1,1 Dichloroethane
1,1,1- TCA------1,1,1-Trichloroethane
Cis-1,2-DCE----Cis-1,2-Dichloroethylene
PCE ------Tetrachloroethylene
TCE------Trichloroethylene
VC -------Vinyl chloride

Mapped By:
Shane Moore, IDEM, Office of Land Quality, Science Services Branch, Engineering and GIS Services, June 26, 2017.

Sources:
- Well Locations obtained from IDEM OLQ Sampling Database (SampDB)

Orthophotography
- 2011-2013 Statewide Orthophotography Program
- Sample Locations and Results obtained from SampDB

Non Orthophotography Data
- Obtained from the State of Indiana Geographic Information Office Library

Document
- IDEM Site Inspection Report, Broadway Avenue Corridor Ground Water Plume, Feb. 27, 2015, Table 5.1, pp. 22

Map Datum and Projection
NAD83 UTM Zone 16N

Disclaimer:
This map is intended to serve as an aid in graphic representation only. This information is not warrented for accuracy or other purposes.

Ground Water Samples
Ranney 10 year WHPA
Ranney 5 year WHPA

N W E S

Madison County

0 0.2 0.4 Miles
0 210 420 Meters

* = Samples have analyte concentrations below the quantitation limit (CRQL) and detected compounds are qualified a J values. Detection below the CRQL is treated as non-quantifiable for HRS purposes. Result was adjusted to "Non-Detect" (ND) using the procedure describe in EPA 540-F-94-028, Using Qualified Data to Document an Observed Release and Observed Contamination, November 1996.

** = Concentrations exceeded the instrument's calibration range. Samples reanalyzed using a dilution factor and the result and CRQL are reported from the diluted analysis.

U = Not detected

Broadway Street Corridor Groundwater Contamination
Soil Sample Results
Anderson, Madison County, Indiana
July 2014, July 2015 Soil Sample Locations and Results

Fig. 5

E2TB7
Cis-1,2-DCE 4.5 ug/Kg U
1,1-DCA 4.5 ug/Kg U
PCE 4.5 ug/Kg U
TCA 4.5 ug/Kg U
TCE 4.5 ug/Kg U
VC 4.5 ug/Kg U

E2TC0
Cis-1,2-DCE 5 ug/Kg U
1,1-DCA 5 ug/Kg U
PCE 5 ug/Kg U
TCA 5 ug/Kg U
TCE 5 ug/Kg U
VC 5 ug/Kg U

E2TA7
Cis-1,2-DCE 4.5 ug/Kg U
1,1-DCA 4.5 ug/Kg U
PCE 4.5 ug/Kg U
TCA 4.5 ug/Kg U
TCE 4.5 ug/Kg U
VC 4.5 ug/Kg U

E2TB0
Cis-1,2-DCE 5.8 ug/Kg U
1,1-DCA 5.8 ug/Kg U
PCE 5.8 ug/Kg U
TCA 5.8 ug/Kg U
TCE 5.8 ug/Kg U
VC 5.8 ug/Kg U

E2TL7
Cis-1,2-DCE 5.7 ug/Kg U
1,1-DCA 5.7 ug/Kg U
PCE 5.7 ug/Kg U
TCA 5.7 ug/Kg U
TCE 5.7 ug/Kg U
VC 5.7 ug/Kg U

E2TA5
Cis-1,2-DCE 4.9 ug/Kg U
1,1-DCA 4.9 ug/Kg U
PCE 4.9 ug/Kg U
TCA 4.9 ug/Kg U
TCE 4.9 ug/Kg U
VC 4.9 ug/Kg U

E2TL0
Cis-1,2-DCE 5.3 ug/Kg U
1,1-DCA 5.3 ug/Kg U
PCE 5.3 ug/Kg U
TCA 5.3 ug/Kg U
TCE 5.3 ug/Kg U
VC 5.3 ug/Kg U

E2TK9
Cis-1,2-DCE 5.8 ug/Kg U
1,1-DCA 5.8 ug/Kg U
PCE 5.8 ug/Kg U
TCA 5.8 ug/Kg U
TCE 5.8 ug/Kg U
VC 5.8 ug/Kg U

E2TB6
Cis-1,2-DCE 5.2 ug/Kg U
1,1-DCA 5.2 ug/Kg U
PCE 5.2 ug/Kg U
TCA 5.2 ug/Kg U
TCE 5.2 ug/Kg U
VC 5.2 ug/Kg U

E2TB1
Cis-1,2-DCE 6.6 ug/Kg U
1,1-DCA 6.6 ug/Kg U
PCE 6.6 ug/Kg U
TCA 6.6 ug/Kg U
TCE 6.6 ug/Kg U
VC 6.6 ug/Kg U

E2TA6
Cis-1,2-DCE 5.1 ug/Kg U
1,1-DCA 5.1 ug/Kg U
PCE 69 ug/Kg J-*
TCA 5.1 ug/Kg U
TCE 5.1 ug/Kg U
VC 5.1 ug/Kg U

E2TA4
Cis-1,2-DCE 5.2 ug/Kg U
1,1-DCA 5.2 ug/Kg U
PCE 5.2 ug/Kg U
TCA 5.2 ug/Kg U
TCE 5.2 ug/Kg U
VC 5.2 ug/Kg U

E2TB5
Cis-1,2-DCE 6.2 ug/Kg U
1,1-DCA 6.2 ug/Kg U
PCE 6.2 ug/Kg U
TCA 6.2 ug/Kg U
TCE 6.2 ug/Kg U
VC 6.2 ug/Kg U

E2TB2
Cis-1,2-DCE 5.5 ug/Kg U
1,1-DCA 5.5 ug/Kg U
PCE 5.5 ug/Kg U
TCA 5.5 ug/Kg U
TCE 5.5 ug/Kg U
VC 5.5 ug/Kg U

E2TC2
Cis-1,2-DCE 5.4 ug/Kg U
1,1-DCA 5.4 ug/Kg U
PCE 5.4 ug/Kg U
TCA 5.4 ug/Kg U
TCE 5.4 ug/Kg U
VC 5.4 ug/Kg U

E2TK5
Cis-1,2-DCE 5.3 ug/Kg U
1,1-DCA 5.3 ug/Kg U
PCE 5.3 ug/Kg U
TCA 5.3 ug/Kg U
TCE 5.3 ug/Kg U
VC 5.3 ug/Kg U

E2TK6
Cis-1,2-DCE 6 ug/Kg U
1,1-DCA 6 ug/Kg U
PCE 6 ug/Kg U
TCA 6 ug/Kg U
TCE 6 ug/Kg U
VC 6 ug/Kg U

E2TL8
Cis-1,2-DCE 4.9 ug/Kg U
1,1-DCA 4.9 ug/Kg U
PCE 4.9 ug/Kg U
TCA 4.9 ug/Kg U
TCE 4.9 ug/Kg U
VC 4.9 ug/Kg U

E2TL7
Cis-1,2-DCE 6.3 ug/Kg U
1,1-DCA 6.3 ug/Kg U
PCE 6.3 ug/Kg U
TCA 6.3 ug/Kg U
TCE 6.3 ug/Kg U
VC 6.3 ug/Kg U

E2TL6
Cis-1,2-DCE 6.5 ug/Kg U
1,1-DCA 6.5 ug/Kg U
PCE 6.5 ug/Kg U
TCA 6.5 ug/Kg U
TCE 6.5 ug/Kg U
VC 6.5 ug/Kg U

E2TL5
Cis-1,2-DCE 5.9 ug/Kg U
1,1-DCA 5.9 ug/Kg U
PCE 5.9 ug/Kg U
TCA 5.9 ug/Kg U
TCE 5.9 ug/Kg U
VC 5.9 ug/Kg U

E2TL4
Cis-1,2-DCE 6 ug/Kg U
1,1-DCA 6 ug/Kg U
PCE 6 ug/Kg U
TCA 6 ug/Kg U
TCE 6 ug/Kg U
VC 6 ug/Kg U

E2TC3
Cis-1,2-DCE 4.6 ug/Kg U
1,1-DCA 4.6 ug/Kg U
PCE 4.6 ug/Kg U
TCA 4.6 ug/Kg U
TCE 4.6 ug/Kg U
VC 4.6 ug/Kg U

E2TB8
Cis-1,2-DCE 5.9 ug/Kg U
1,1-DCA 5.9 ug/Kg U
PCE 5.9 ug/Kg U
TCA 5.9 ug/Kg U
TCE 5.9 ug/Kg U
VC 5.9 ug/Kg U

E2TL2
Cis-1,2-DCE 6 ug/Kg U
1,1-DCA 6 ug/Kg U
PCE 6 ug/Kg U
TCA 6 ug/Kg U
TCE 6 ug/Kg U
VC 6 ug/Kg U

E2TL1
Cis-1,2-DCE 5 ug/Kg U
1,1-DCA 5 ug/Kg U
PCE 5 ug/Kg U
TCA 5 ug/Kg U
TCE 5 ug/Kg U
VC 5 ug/Kg U

E2TB4
Cis-1,2-DCE 6.4 ug/Kg U
1,1-DCA 6.4 ug/Kg U
PCE 6.4 ug/Kg U
TCA 6.4 ug/Kg U
TCE 6.4 ug/Kg U
VC 6.4 ug/Kg U

E2TA8
Cis-1,2-DCE 5.1 ug/Kg U
1,1-DCA 5.1 ug/Kg U
PCE 5.1 ug/Kg U
TCA 5.1 ug/Kg U
TCE 5.1 ug/Kg U
VC 5.1 ug/Kg U

E2TK8
Cis-1,2-DCE 5.7 ug/Kg U
1,1-DCA 5.7 ug/Kg U
PCE 5.7 ug/Kg U
TCA 5.7 ug/Kg U
TCE 5.7 ug/Kg U
VC 5.7 ug/Kg U

E2TK7
Cis-1,2-DCE 5.9 ug/Kg U
1,1-DCA 5.9 ug/Kg U
PCE 5.9 ug/Kg U
TCA 5.9 ug/Kg U
TCE 5.9 ug/Kg U
VC 5.9 ug/Kg U

E2TC1
Cis-1,2-DCE 5.2 ug/Kg U
1,1-DCA 5.2 ug/Kg U
PCE 31 ug/Kg J-
TCA 5.2 ug/Kg U
TCE 5.2 ug/Kg U
VC 5.2 ug/Kg U

E2TA3
Cis-1,2-DCE 5.2 ug/Kg U
1,1-DCA 5.2 ug/Kg U
PCE 5.2 ug/Kg U
TCA 5.2 ug/Kg U
TCE 5.2 ug/Kg U
VC 5.2 ug/Kg U

E2TA2
Cis-1,2-DCE 6.1 ug/Kg U
1,1-DCA 6.1 ug/Kg U
PCE 6.1 ug/Kg U
TCA 6.1 ug/Kg U
TCE 6.1 ug/Kg U
VC 6.1 ug/Kg U

Ranney 1 (NPV)
Ranney 2 (NPV)
Ranney 4 (NPV)
Ranney 5 (NPV)

KILLBUCK CREEK
CROSS ST
N STATE RD 9
BROADWAY ST
LINDBERG RD
UNIVERSITY BLVD
STATE RD 32
WHITE RIVER

Mapped By:
Shane Moore, IDEM, Office of Land Quality, Science Services Branch, Engineering and GIS Services, March 15, 2017.

Sources:
- Well Locations obtained from IDEM OLQ Sampling Database (SampDB)

Orthophotography
- 2011-2013 Statewide Orthophotography Program
- Sample Locations and Results obtained from SampDB

Non Orthophotography Data
- Obtained from the State of Indiana Geographic Information Office Library

Document
- IDEM Site Inspection Report, Broadway Avenue Corridor Ground Water Plume, Feb. 27, 2015, Table 5.1, pp. 22

Map Datum and Projection
NAD83 UTM Zone 16N

Disclaimer:
This map is intended to serve as an aid in graphic representation only. This information is not warrented for accuracy or other purposes.

Soil Sample
Ranney Municipal Wells

N W E S

* = Samples have analyte concentrations below the quantitation limit (CRQL) and detected compounds are qualified a J values. Detection below the CRQL is treated as non-quantifiable for HRS purposes. Result was adjusted to "Non-Detect" (ND) using the procedure describe in EPA 540-F-94-028, Using Qualified Data to Document an Observed Release and Observed Contamination, November 1996.

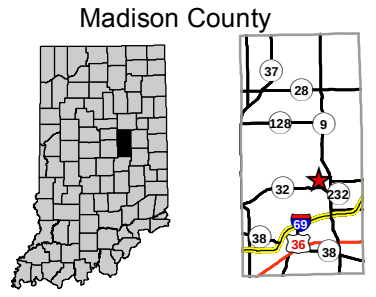
** = Concentrations exceeded the instrument's calibration range. Samples reanalyzed using a dilution factor and the result and CRQL are reported from the diluted analysis.

J- = Surrogate recoveries out of control, low and associated compounds are qualified bias low. Results for release samples require no adjustment according to procedures in EPA 540-F-94-028, Using Qualified Data to Document an Observed Release and Observed Contamination, November 1996.

U = Not detected

1,1-DCA -------- 1,1 Dichloroethane
1,1,1- TCA------1,1,1-Trichloroethane
Cis-1,2-DCE----Cis-1,2-Dichloroethylene
PCE ------Tetrachloroethylene
TCE------Trichloroethylene
VC -------Vinyl chloride

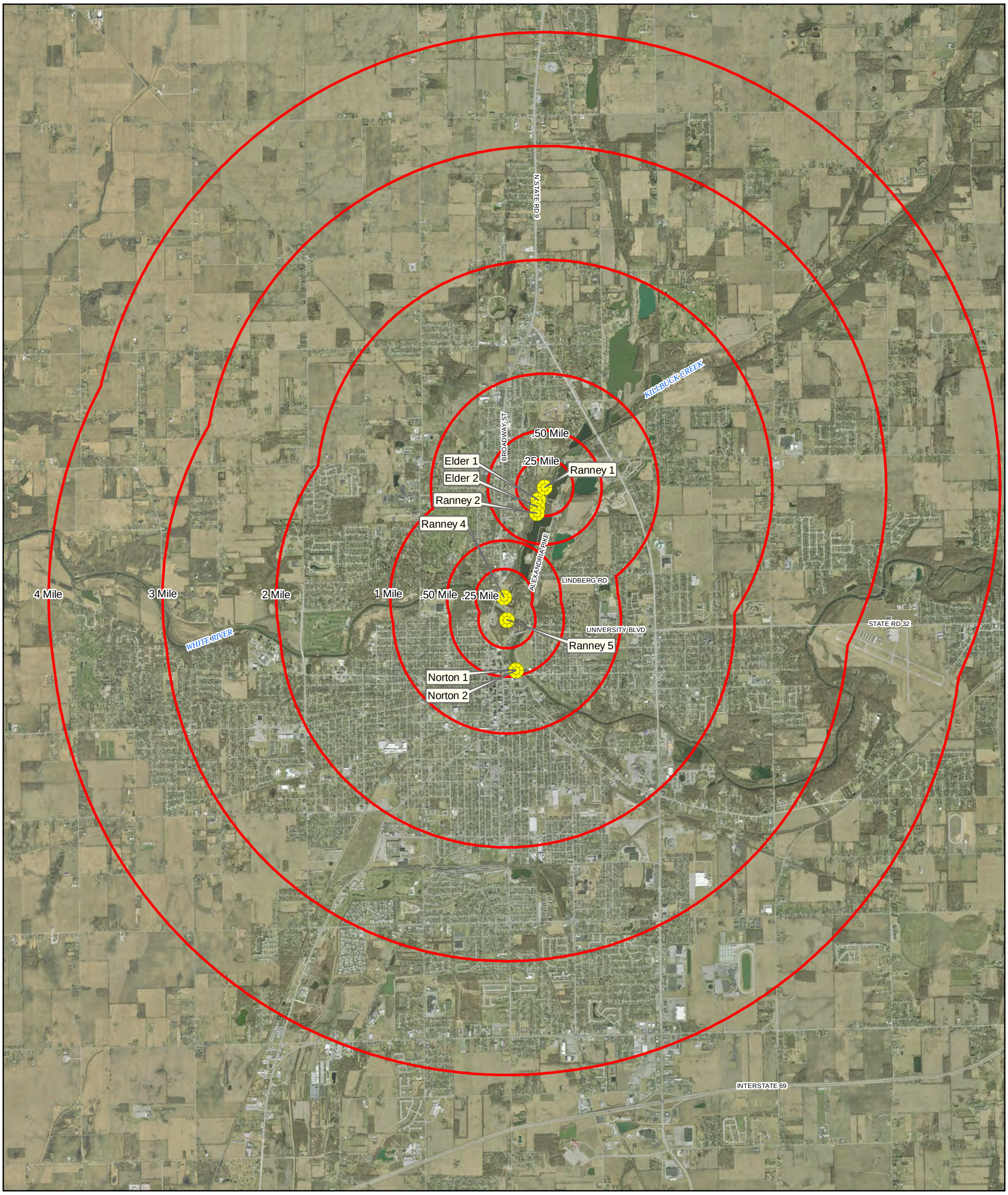
Madison County



0 0.2 0.4 Miles
0 210 420 Meters

Broadway Street Corridor
Groundwater Contamination
Anderson, Madison County, Indiana
Ranney 1, 4, 5 - Four Mile Radius

Fig. 6



Mapped By:
Shane Moore, IDEM, Office of Land Quality, Science Services Branch, Engineering and GIS Services, May 02, 2017.

Sources:
- Well Locations obtained from IDEM OLQ Sampling Database (SampDB)
- Sample Locations and Results obtained from SampDB

Non Orthophotography Data
- Obtained from the State of Indiana Geographic Information Office Library

Orthophotography
- 2011-2013 Statewide Orthophotography Program

Map Datum and Projection
NAD83 UTM Zone 16N

Disclaimer:
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N W E S

0 1 2 Miles

0 1,000 2,000 Meters

IDEM

TDL based on Ranney 1, 4, 5

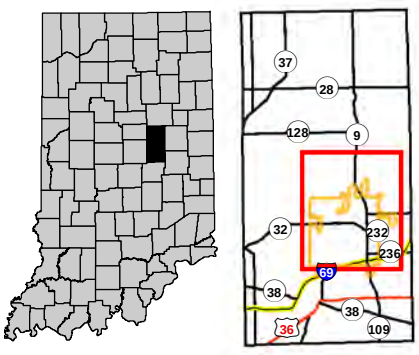
Well

Ranney 1	
Well	Feet
Ranney 1	0
Ranney 2	1252.9
Ranney 4	5442.7
Ranney 5	6383.6
Norton 1	8565.7
Norton 2	8600.7
Elder 1	646
Elder 2	968.8

Ranney 4	
Well	Feet
Ranney 1	5442.7
Ranney 2	4192.6
Ranney 4	0
Ranney 5	1043.6
Norton 1	3395.2
Norton 2	3436.3
Elder 1	4801.8
Elder 2	4473.9

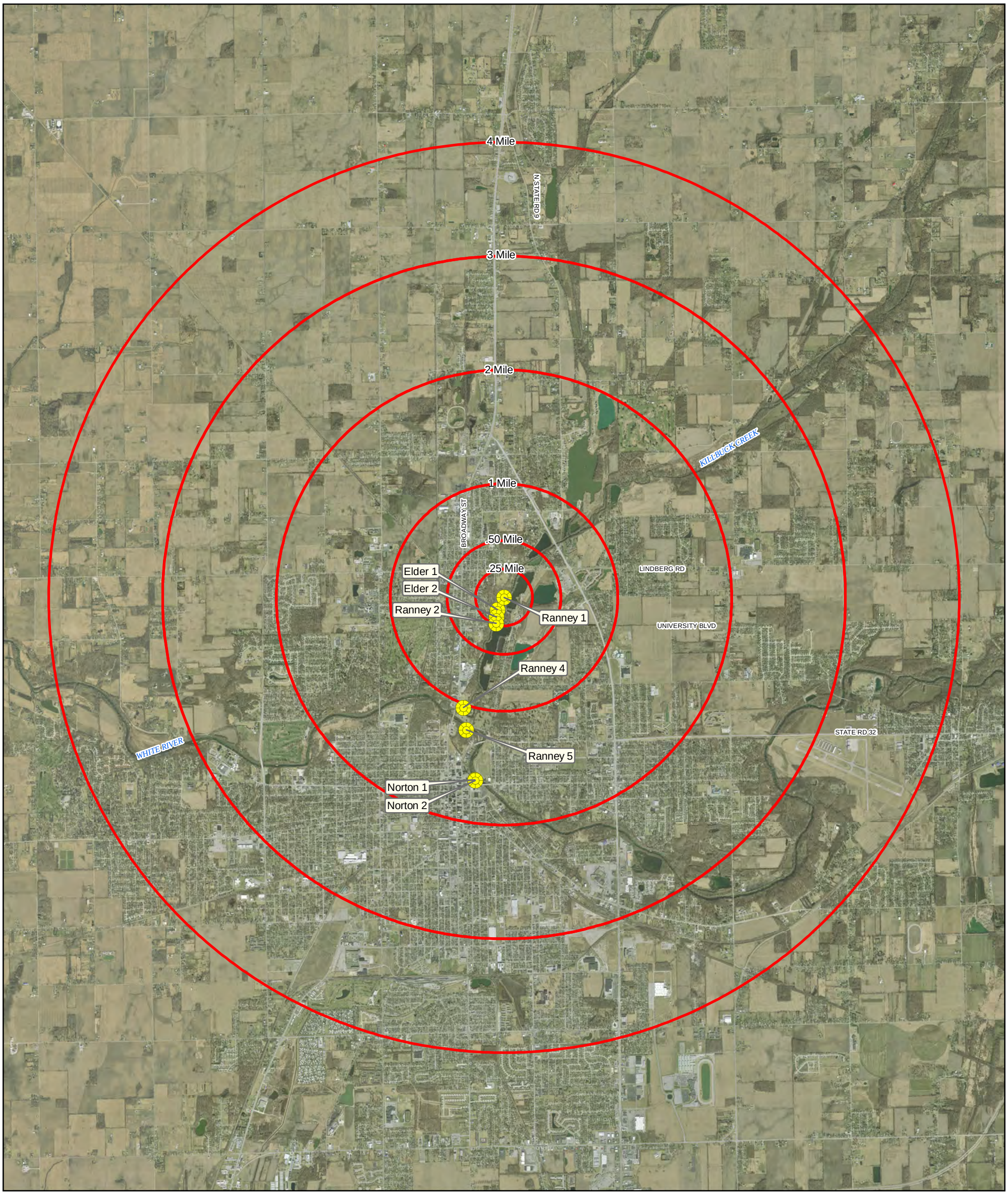
Ranney 5	
Well	Feet
Ranney 1	6383.6
Ranney 2	5130.9
Ranney 4	1043.6
Ranney 5	0
Norton 1	2352
Norton 2	2393.3
Elder 1	5751.3
Elder 2	5418.3

Madison County



Broadway Street Corridor
Groundwater Contamination
Anderson, Madison County, Indiana
Ranney 1 - Four Mile Radius

Figure 7



Mapped By:
Shane Moore, IDEM, Office of Land Quality, Science Services Branch, Engineering and GIS Services, May 02, 2017.

Sources:
- Well Locations obtained from IDEM OLQ Sampling Database (SampDB)
- Sample Locations and Results obtained from SampDB

Non Orthophotography Data
- Obtained from the State of Indiana Geographic Information Office Library

Orthophotography
- 2011-2013 Statewide Orthophotography Program

Map Datum and Projection
NAD83 UTM Zone 16N

Disclaimer:
This map is intended to serve as an aid in graphic representation only. This information is not warrented for accuracy or other purposes.

0 1 2 Miles

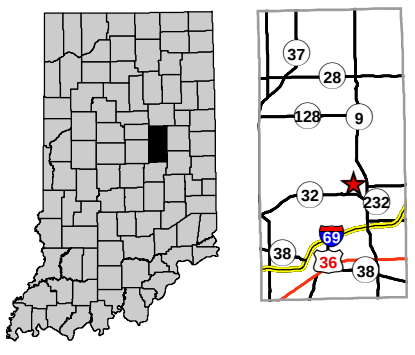
0 1,000 2,000 Meters

N W E S

Well

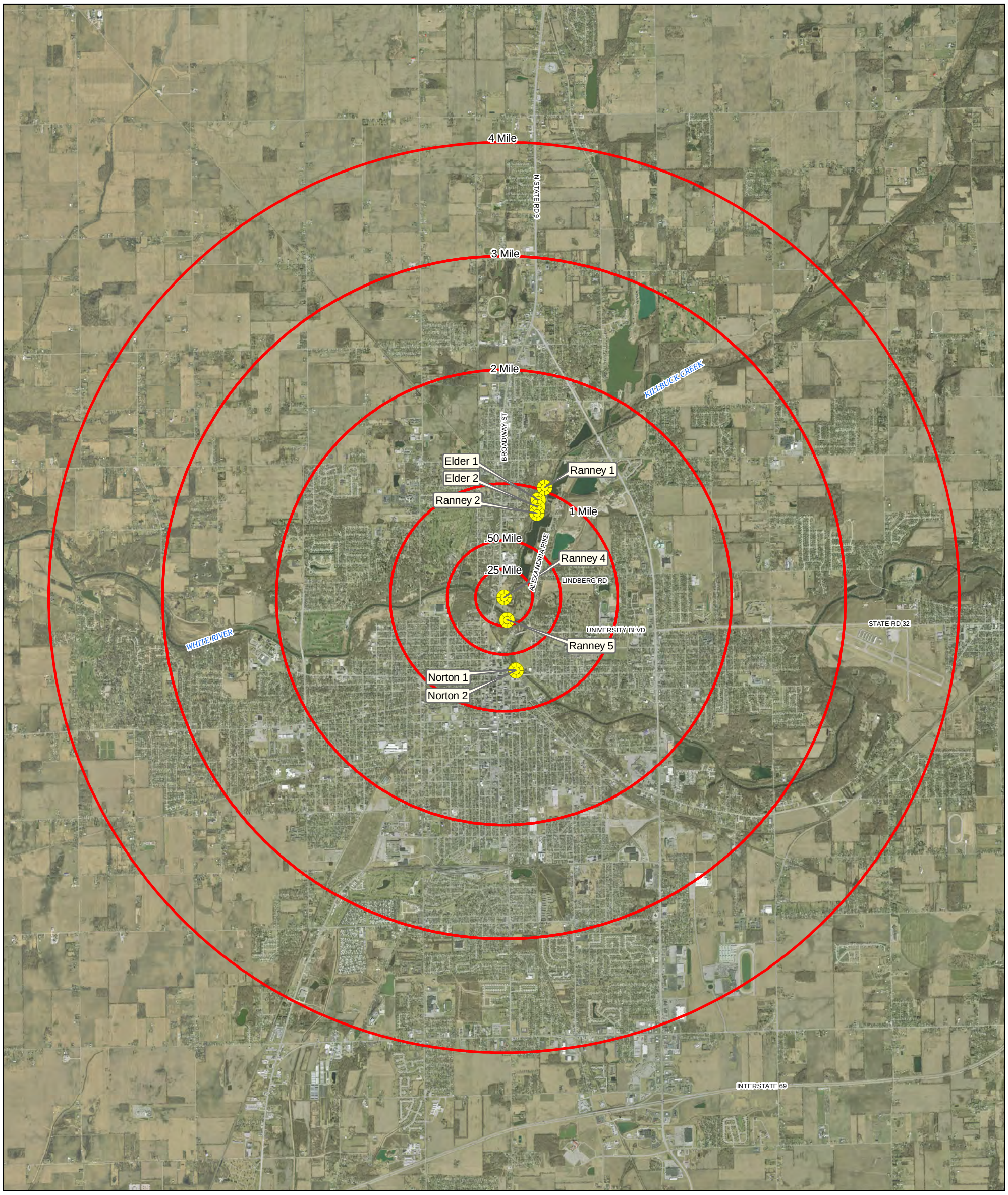
Ranney 1	
Well	**Feet**
Ranney 1	0
Ranney 2	1252.9
Ranney 4	5442.7
Ranney 5	6383.6
Norton 1	8565.7
Norton 2	8600.7
Elder 1	646
Elder 2	968.8

Madison County



Broadway Street Corridor
Groundwater Contamination
Anderson, Madison County, Indiana
Ranney 4 - Four Mile Radius

Figure 8



Mapped By:
Shane Moore, IDEM, Office of Land Quality, Science Services Branch, Engineering and GIS Services, May 02, 2017.

Sources:
- Well Locations obtained from IDEM OLQ Sampling Database (SampDB)
- Sample Locations and Results obtained from SampDB

Non Orthophotography Data
- Obtained from the State of Indiana Geographic Information Office Library

Orthophotography
- 2011-2013 Statewide Orthophotography Program

Map Datum and Projection
NAD83 UTM Zone 16N

Disclaimer:
This map is intended to serve as an aid in graphic representation only. This information is not warrented for accuracy or other purposes.

0 1 2 Miles

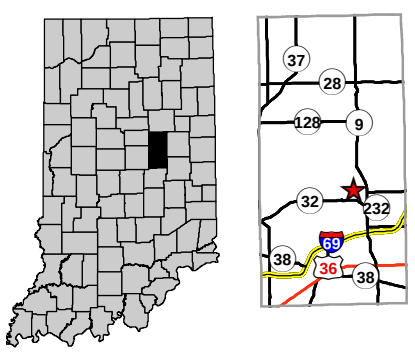
0 1,000 2,000 Meters

N W E S

Well

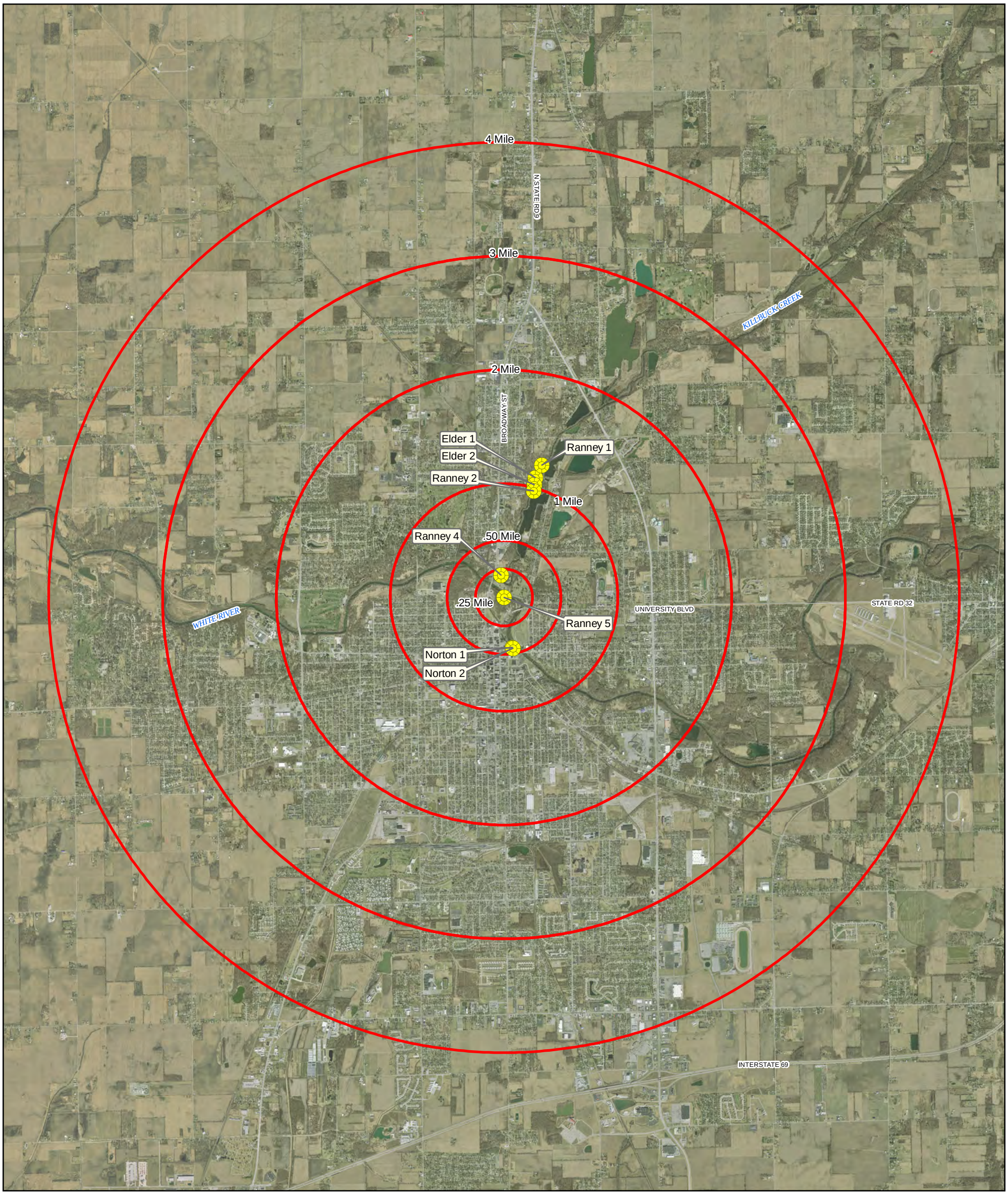
Ranney 4	
Well	**Feet**
Ranney 1	5442.7
Ranney 2	4192.6
Ranney 4	0
Ranney 5	1043.6
Norton 1	3395.2
Norton 2	3436.3
Elder 1	4801.8
Elder 2	4473.9

Madison County



Broadway Street Corridor
Groundwater Contamination
Anderson, Madison County, Indiana
Ranney 5 - Four Mile Radius

Figure 9



Mapped By:
Shane Moore, IDEM, Office of Land Quality, Science Services Branch, Engineering and GIS Services, May 02, 2017.

Sources:
- Well Locations obtained from IDEM OLQ Sampling Database (SampDB)
- Sample Locations and Results obtained from SampDB

Non Orthophotography Data
- Obtained from the State of Indiana Geographic Information Office Library

Orthophotography
- 2011-2013 Statewide Orthophotography Program

Map Datum and Projection
NAD83 UTM Zone 16N

Disclaimer:
This map is intended to serve as an aid in graphic representation only. This information is not warrented for accuracy or other purposes.

0 1 2 Miles

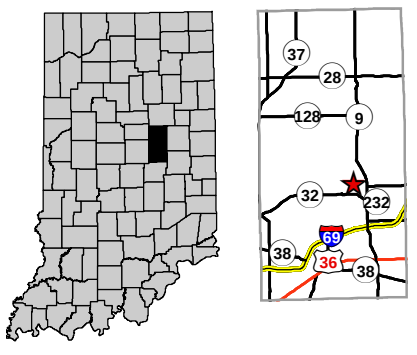
0 1,000 2,000 Meters

N W E S

Well

Ranney 5	
Well	**Feet**
Ranney 1	6383.6
Ranney 2	5130.9
Ranney 4	1043.6
Ranney 5	0
Norton 1	2352
Norton 2	2393.3
Elder 1	5751.3
Elder 2	5418.3

Madison County



SITE SUMMARY

Broadway Street Corridor Groundwater Contamination

The Broadway Street Corridor Groundwater Contamination site consists of three (3) groundwater plumes without an identified source or sources and is located in Anderson, Madison County, Indiana (see Figures 1 and 3 of this HRS Documentation Record). The groundwater plumes have contaminated the drinking water of three (3) municipal wells with chlorinated volatile organic compounds (VOCs) (see Tables J and M of this HRS Documentation Record). The three (3) impacted municipal wells are identified as Ranney Well #1, Ranney Well #4, and Ranney Well #5. The water from these three (3) wells is blended with the water from five (5) other wells that supply water to the Wheeler Avenue Treatment Plant (Refs. 4, p. 46; 68, p. 1). The water from these eight (8) wells is blended at the Wheeler Avenue Treatment Plant (Ref. 4, p. 46). The treatment plant serves 60% of the population of Anderson (Ref. 4, p. 45). Of the 34,800 people served by the Wheeler Avenue Treatment Plant, the three (3) impacted wells supply drinking water to 13,050 people (Ref. 58, p. 2; Section 3.3.2.2 of this HRS Documentation Record). Each Ranney well has its own separate Wellhead Protection Area (WHPA) as shown in the Anderson Water Department's Wellhead Protection Plan (WHPP) (Refs. 5, pp. 46, 52, 53; 59, p. 1; Figure 4 of this HRS Documentation Record). As a result of each Ranney well having its own separate WHPA, each Ranney well draws from a different upgradient area containing multiple different possible sources (Ref. 85; Figure 4 of this HRS Documentation Record). IDEM staff has researched and investigated possible contributors to the impacted municipal wells during the Site Inspection (SI) and Expanded Site Inspection (ESI) activities (Refs. 3, pp. 6, 8, 37-38; 4, pp. 22, 26-28; 44, pp. 1-3; 69, pp. 1-20; 85, pp. 3-6). After these extensive investigations, a specific source causing a significant increase in each separate groundwater plume area has not been identified (see section 3.1.1 of this HRS Documentation Record; Ref. 69). Although there are as many as three (3) separate, distinct groundwater plumes from three (3) separate WHPA source drainage areas, the Broadway Street Corridor Groundwater Contamination is being scored as one (1) site because each of the three (3) wells affect the same targets and so future site evaluations, including selection and implementation of remedial actions, can be performed in a coordinated and efficient manner.

The drinking water in the three (3) Ranney wells has been contaminated primarily with trichloroethylene (TCE), tetrachloroethylene (PCE), cis-1,2-dichloroethene (cis-1,2-DCE) and/or vinyl chloride (VC) (see Contaminated Ground Water from Ranney Municipal Wells Sample Table and Figure 2 of this HRS Documentation Record). The water from the wells within the well field (a total of eight [8] wells) is manifold at the municipality's treatment center (Ref. 4, p. 46; 68, p. 1).

The Broadway Street Corridor Groundwater Contamination site is depicted aerially by the locations of groundwater samples that had detections of chlorinated solvents that meet observed release criteria (see Figure 2; Section 3.1.1 and Contaminated Ground Water from Ranney Municipal Wells Sample Table of this HRS Documentation Record). In addition to the TCE, PCE, cis-1,2-DCE, and VC detected in the three (3) impacted Ranney wells, 1,1,1-trichloroethane, and 1,1-dichloroethane have also been detected in the groundwater samples that were collected by direct push methods near the Ranney wells (Figure 4 of this HRS Documentation Record; Refs. 3, pp. 209-215; 4, pp. 600-614, 618-620, 1155-1160, 11-90-1201; 60; 66). However, this data was not used in the scoring of this site.

This site is being scored as a groundwater plume with no identified source for Ranney Well #1, Ranney Well #4 and Ranney Well #5 because there are too many possible sources (i.e., users of

VOCs) in the vicinity of these plumes to reasonably attribute the significant increase of groundwater contamination to all or any specific sources. Although the site is scored in this manner, Attachments 1 through 3 of this HRS Documentation Record demonstrate that the documented groundwater contamination in each well would qualify for NPL listing independently. Hydrologic and geologic evidence shows that the aquifer associated with Ranney Wells #1, #4, and #5 are completed in one continuous sand and gravel aquifer (Ref. 47, p. 3).

HISTORY

As a result of the elevated levels of chlorinated solvents detected in the groundwater in municipal wells, the IDEM Site Investigation Program conducted a Pre-CERCLIS Screening (PCS) and recommended that the site be entered into CERCLIS (now SEMS) (Ref. 9, p. 1).

The Preliminary Assessment (PA) conducted by IDEM noted that elevated VOC concentrations were detected in the unfinished water in 1988 and 1992 and in the finished water in 2004, 2005, 2006, 2010 and 2011 (Ref. 46, p. 1, 17, 19, 22). In August 2013, the IDEM Site Investigation Program staff sampled the wells that supply water to the Wheeler Avenue Treatment Plant for VOCs (Refs. 46, pp. 2, 22; 69, p. 1). The groundwater sample results indicated concentrations of PCE in Ranney Well #5 at 5 µg/L, TCE in Ranney Well #1 at 11 µg/L, and VC in Ranney Well #4 at 2 µg/L. The PA was finalized in February 2014 (Ref. 46, p. 10).

A Site Inspection (SI) was conducted on July 21 through July 25, 2014 (Ref. 4, p. 22). A total of twenty-seven (27) groundwater samples and twenty (20) soil samples were collected (Ref. 4, p. 22). The groundwater samples were designated E2TA1, E2T66, E2T70, E2T72, E2T73, E2T77, E2T76, E2T78, E2T79, E2T80, E2T81, E2T82, E2T85, E2T87, E2T90, E2T91, E2T92, E2T93, E2T96, E2T98, E2T64, E2T68, E2T88, E2T94 and E2T95. Two (2) of the water samples were trip blanks. The groundwater samples were collected from all municipal wells that supply water to the Wheeler Avenue Treatment Plant as well as from direct push probes. All samples were analyzed for VOCs only (Ref. 4, p. 23). Seventeen (17) subsurface soil samples were also obtained and were designated as E2TA4, E2TA2, E2TA3, E2TA5, E2TA6, E2TB0, E2TB1, E2TB2, E2TB6, E2TB7, E2TB8, E2TC2, E2TC3, E2TB4, E2TB7, E2TC0 and E2TC1. PCE was detected in only two (2) subsurface soil samples, E2TA6 and E2TC1 at concentrations of 69 µg/kg and 31 µg/kg, respectively (Ref. 4, pp. 39, 40, 92). Figure 5 of this HRS Documentation Record illustrates the location of all soil samples and their respective analytical result. Figure 4 of this HRS Documentation Record illustrates the location and analytical result of the groundwater samples described above.

The Ranney Municipal Well Field consists of eight (8) wells, four (4) of which are Ranney collector wells (Ranney Wells 1, 2, 4 and 5). A Ranney collector well (Ranney) is a patented type of radial well used to extract water from an aquifer with direct connection to a surface water source. A caisson is installed into an aquifer with horizontal lateral well screens projected out into the aquifer to collect and filter the groundwater (Ref. 79, p. 1). The other four (4) municipal wells (Elder Wells 1 and 2 and Norton Wells 1 and 2) are not Ranney wells (Refs. 4, pp. 15, 17-18; 82, p. 7). Analysis of the groundwater from the Ranney wells revealed detections of chlorinated solvents in four (4) groundwater samples, E2T72, E2T73, E2T76, and E2T84, collected from three (3) municipal wells. The three (3) municipal wells that were impacted are Ranney Well #1, Ranney Well #4, and Ranney Well #5 (see Contaminated Ground Water from Ranney Municipal Wells Sample Table and Figure 2 of this HRS Documentation Record).

From July 7, 2015 through July 9, 2015, IDEM staff conducted an Expanded Site Inspection (ESI)

(Ref. 3, p. 15). A total of fifteen (15) groundwater samples were collected. The fifteen (15) groundwater samples were designated E2TL9; E2TM0 through E2TM7; E2TM9; E2TN0; and E2TN1 through E2TN4 (Ref. 3, p. 15). Three (3) of the samples were considered trip blanks (Ref. 3, p. 15). Fourteen (14) subsurface soil samples were collected for the ESI. The soil samples were designated as E2TK5 through E2TK9; E2TL0; and E2TL1 through E2TL8 (Ref. 3, pp. 15-16).

Concentrations of TCE and/or PCE were detected in only two (2) locations from three (3) direct push groundwater grab samples (E2TM3 and E2TM1/E2TM2). Sample E2TM2 is a duplicate of E2TM1 (Refs. 3, pp. 22, 111; 7, p. 38). These samples were obtained from the former Guarantee Cleaner property located northwest of Ranney Well #4 (sample E2TM3 with TCE concentration of 1.5 µg/L) and on an area located approximately 200 feet west/northwest of Ranney Well #5 (E2TM1/E2TM2 with PCE concentrations of 2.4 µg/L and 2.1 µg/L, respectively) (Ref. 3, pp. 22, 111). No VOCs were detected in the subsurface soil samples during the ESI. Figure 5 of this HRS Documentation Record illustrates the location of all soil samples and their respective analytical result. Figure 4 of this HRS Documentation Record illustrates the location and analytical results of the groundwater samples described above.

2.2 SOURCE CHARACTERIZATION

2.2.1 Source Identification

Number of Source: 1

Source Name: Groundwater Plume with No Identified Source for Ranney Well #1

Source Type: Other

Description and Location of Source: (see Figure 2 of this HRS Documentation Record)

Source No. 1 consists of a contaminated groundwater plume of cis-1,2-DCE and TCE with no identified source for the Ranney Well #1 municipal well (see Section 3.1.1 of this HRS Documentation Record). Cis-1,2-DCE, and TCE, are degradation products of PCE (Ref. 62, pp. 1-4). These hazardous substances are manufactured chemicals and do not occur naturally in the environment (Refs. 61, p. 1; 63, p. 1; 64, p. 1; 65, p. 1). As explained below, no single identifiable source could be identified as the actual source(s) of the Broadway Street Corridor Groundwater Contamination.

A WHPA Delineation Model report was completed for the municipal wells in Anderson, Indiana (Refs. 5, p. 1; 59, p. 1). In order to delineate WHPAs for the City of Anderson municipal supply well fields, a calibrated computer-based numerical groundwater flow model was constructed to simulate groundwater flow in the aquifers which underlie the area (Ref. 5, p. 6). Groundwater flow simulations were augmented with particle tracking evaluations to delineate the five- and ten-year groundwater time-of travel (TOT) boundaries for each well field (Ref. 5, p. 6). Model delineation for each Ranney well showing groundwater flow lines representing the groundwater flow and the area from which possible contamination contributions could be emanating are shown in the WHPA Delineation Model report (Ref. 5, pp. 46, 52-53). The area depicted by the flow lines show different WHPAs for Ranney Well #1, #4, and #5 (Ref. 5, pp. 46, 52-53). Since each Ranney well has different WHPAs, possible source(s) of contamination are different for each contaminated Ranney Well.

The Anderson Wellhead Protection Plan documented possible sources of contamination mapped within each WHPA (Ref. 10, p. 9). The Anderson Wellhead Protection Plan shows various possible source areas of contamination for the Ranney Well #4 and Ranney Well #5 areas as well as the Ranney Well #1 area, labeled 1R on the plan for the Elder municipal wells, which are in close proximity to Ranney Well #1 (Ref. 10, pp. 12-16, 17-18).

During the SI activities, staff undertook an extensive level of effort by searching IDEM, county, and EPA records to identify additional possible sources of groundwater contamination (Refs. 44, p. 1; 69). Reference 85, page 6, of this HRS Documentation Record shows the location of facilities identified during the search.

Groundwater samples and subsurface soil samples were collected for the SI and ESI to determine possible source areas. However, a specific source(s) for the contamination found in the impacted Ranney Well #1 municipal well could not reasonably be determined. Based on the history of the area and extensive development along the White River and Killbuck Creek, the possible VOC source(s) cannot be defined without further investigation (Ref. 47, p. 3).

2.2.2 Hazardous Substances Associated with a Source

The following hazardous substances are associated with the source (see Section 3.1.1 of this HRS Documentation Record):

Cis-1,2-Dichloroethene	Cis-1,2-DCE
Trichloroethene	TCE

2.2.3 Hazardous Substances Available to a Pathway

Table A

Containment Description	Containment Factor Value	References
Gas release to air: The air migration pathway was not scored; therefore, gas containment was not evaluated.	Not Scored	
Particulate release to air: The air migration pathway was not scored; therefore, gas containment was not evaluated.	Not Scored	
Release to groundwater: The containment factor value of 10 is assigned based on analytical evidence of hazardous substances in groundwater samples from municipal wells (Table J of this HRS Documentation Record). Therefore, based on evidence of release (evidence of hazardous substance migration from a source area), the highest groundwater migration pathway containment factor value of 10 was assigned to Source No. 1 as specified in Table 3-2 of the HRS (Ref. 1, Section 3.1.2.1).	10	Ref. 1, Table 3-2, Section 3.1.2.1; see Section 3.1.1 of this HRS Documentation Record
Release via overland migration and/or flood: The surface water pathway was not scored; therefore, surface water overland/flood migration component containment was not evaluated.	Not Scored	

2.4.2 Hazardous Waste Quantity

2.4.2.1 Source Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity (Tier A)

The hazardous constituent quantity for Source No. 1 could not be adequately determined according to the HRS requirements; that is, the total mass of all Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substances in the source and releases from the sources not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.1). There are insufficient historical and current data (manifests, potentially responsible party (PRP) records, state records, permits, waste concentration data, etc.) 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 evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source No. 1 with reasonable confidence. As a result, the evaluation of hazardous waste quantity 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 (Tier B)

The hazardous wastestream quantity for Source No. 1 could not be adequately determined according to the HRS requirements; that is, the total mass of the hazardous wastestreams plus the mass of any additional CERCLA pollutants and contaminants in the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.2). There are insufficient historical and current data (manifests, PRP records, state records, permits, waste concentration data, etc.) available to adequately calculate the total mass or partial mass of the hazardous wastestreams plus the mass of all CERCLA pollutants and contaminants in the source and the associated releases 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 (Tier C)

Because the horizontal and vertical extent of the plume cannot be determined based on available sampling data, the source volume is unknown, but greater than 0 (Ref. 1, Section 2.4.2.1.3).

Table B

Source Type	Description (# drums or dimensions)	Units (yd^3/gal)	References
Other	Unknown but >0	--	Ref. 1, Table 2-5

Sum (yd^3/gal): > 0
Equation for Assigning Value (Ref. 1, Table 2-5) >0/2.5=>0

Volume Assigned Value: Unknown, but > 0

2.4.2.1.4. Area (Tier D)

The area measure (Tier D) is not evaluated for source type "other" (Ref. 1, Table 2-5).

Area Assigned Value: 0

2.4.2.1.5. Source Hazardous Waste Quantity Value

Volume of groundwater plume: Unknown, but >0
Highest assigned value assigned from Ref. 1, Table 2-5: > 0
Source Hazardous Waste Quantity Value: >0 (Ref. 1, Section 2.4.2.1.5).

2.2.1 Source Identification

Number of Source: 2

Source Name: Groundwater Plume with No Identified Source for Ranney Well #4

Source Type: Other

Description and Location of Source: (see Figure 2 of this HRS Documentation Record)

Source No. 2 consists of a contaminated groundwater plume of VC, cis-1,2-DCE and TCE with no identified source for municipal well Ranney Well #4 (see Section 3.1.1 of this HRS Documentation Record). VC, Cis-1,2-DCE, and TCE, are degradation products of PCE (Ref. 62, pp. 1-4). These hazardous substances are manufactured chemicals and do not occur naturally in the environment (Refs. 61, p. 1; 63, p. 1; 64, p. 1; 65, p. 1). As discussed below, no single identifiable source could be identified as the actual source(s) of the Broadway Street Corridor Groundwater Contamination.

A WHPA Delineation Model report was completed for the municipal wells in Anderson, Indiana (Ref. 5, p. 1; 59, p. 1). In order to delineate WHPAs for the City of Anderson municipal supply well fields, a calibrated computer-based numerical groundwater flow model was constructed to simulate groundwater flow in the aquifers which underlie the area (Ref. 5, p. 6). Groundwater flow simulations were augmented with particle tracking evaluations to delineate the five- and ten-year groundwater time-of travel (TOT) boundaries for each well field (Ref. 5, p. 6). Model delineation for each Ranney well showing groundwater flow lines representing the groundwater flow and the area from which possible contamination contributions could be emanating are shown in the WHPA Delineation Model report (Ref. 5, pp. 46, 52-53). The area depicted by the flow lines show different WHPAs for Ranney Well #1, #4, and #5 (Ref. 5, pp. 46, 52-53). Since each Ranney well has different WHPAs, possible source(s) of contamination are different for each contaminated Ranney Well.

The Anderson Wellhead Protection Plan documented possible sources of contamination mapped within each WHPA (Ref. 10, p. 9). The Anderson Wellhead Protection Plan shows various possible source areas of contamination for the Ranney Well #4 area (Ref. 10, pp. 12-13).

During the SI activities, staff undertook an extensive level of effort by searching IDEM, county, and EPA records to identify additional possible sources of groundwater contamination (Refs. 44, p. 1; 69). Reference 85, page 6, of this HRS Documentation Record shows the location of facilities identified during the search.

Groundwater samples and subsurface soil samples were collected for the SI and ESI to determine possible source areas. However, a specific source(s) for the contamination found in the impacted Ranney Well #4 municipal well could not reasonably be determined. Based on the history of the area and extensive development along the White River and Killbuck Creek, the possible VOC source(s) cannot be defined without further investigation (Ref. 47, p. 3).

2.2.2 Hazardous Substances Associated with a Source

The following hazardous substances are associated with the source (see Section 3.1.1 of this HRS Documentation Record):

Vinyl Chloride	VC
Cis-1,2-Dichloroethene	Cis-1,2-DCE
Trichloroethene	TCE

2.2.3 Hazardous Substances Available to a Pathway

Table C

Containment Description	Containment Factor Value	References
Gas release to air: The air migration pathway was not scored; therefore, gas containment was not evaluated.	Not Scored	
Particulate release to air: The air migration pathway was not scored; therefore, gas containment was not evaluated.	Not Scored	
Release to groundwater: The containment factor value of 10 is assigned based on analytical evidence of hazardous substances in groundwater samples from municipal wells (Ref. 69, p. 16 (Table 3); Table J of this HRS Documentation Record). Therefore, based on evidence of release (evidence of hazardous substance migration from a source area), the highest groundwater migration pathway containment factor value of 10 was assigned to Source No. 2 as specified in Table 3-2 of the HRS (Ref. 1, Section 3.1.2.1).	10	Ref. 1, Table 3-2, Section 3.1.2.1; see Section 3.1.1 of this HRS Documentation Record
Release via overland migration and/or flood: The surface water pathway was not scored; therefore, surface water overland/flood migration component containment was not evaluated.	Not Scored	

2.4.2 Hazardous Waste Quantity

2.4.2.1 Source Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity (Tier A)

The hazardous constituent quantity for Source No. 2 could not be adequately determined according to the HRS requirements; that is, the total mass of all Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substances in the source and releases from the sources not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.1). There are insufficient historical and current data (manifests, potentially responsible party (PRP) records, State records, permits, waste concentration data, etc.) 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 evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source No. 2 with reasonable confidence. As a result, the evaluation of hazardous waste quantity 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 (Tier B)

The hazardous wastestream quantity for Source No. 2 could not be adequately determined according to the HRS requirements; that is, the total mass of the hazardous wastestreams plus the mass of any additional CERCLA pollutants and contaminants in the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.2). There are insufficient historical and current data (manifests, PRP records, State records, permits, waste concentration data, etc.) available to adequately calculate the total mass or partial mass of the wastestreams plus the mass of all CERCLA pollutants and contaminants in the source and the associated releases 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. 2 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 (Tier C)

Because the horizontal and vertical extent of the plume cannot be determined based on available sampling data, the source volume is unknown, but greater than 0 (Ref. 1, Section 2.4.2.1.3).

Table D

Source Type	Description (# drums or dimensions)	Units (yd^3/gal)	References
Other	Unknown but >0	--	Ref. 1, Table 2-5

Sum (yd^3/gal): > 0
Equation for Assigning Value (Ref. 1, Table 2-5) >0/2.5=>0

Volume Assigned Value: Unknown, but > 0

2.4.2.1.4. Area (Tier D)

The area measure (Tier D) is not evaluated for source type "other" (Ref. 1, Table 2-5).

Area Assigned Value: 0

2.4.2.1.5. Source Hazardous Waste Quantity Value

Volume of groundwater plume: Unknown, but >0
Highest assigned value assigned from Ref. 1, Table 2-5: > 0
Source Hazardous Waste Quantity Value: >0 (Ref. 1, Section 2.4.2.1.5).

2.2.1 Source Identification

Number of Source: 3

Source Name: Groundwater Plume with No Identified Source for Ranney Well #5

Source Type: Other

Description and Location of Source: (see Figure 2 of this HRS Documentation Record)

Source No. 3 consists of a contaminated groundwater plume of PCE with no identified source for the Ranney Well #5 municipal well (see Section 3.1.1 of this HRS Documentation Record). PCE is a manufactured chemical and does not occur naturally in the environment (Ref. 61, p. 1). As explained below, no single identifiable source could be identified as the actual source(s) of the Broadway Street Corridor Groundwater Contamination.

A WHPA Delineation Model report was completed for the municipal wells in Anderson, Indiana (Ref. 5, p. 1; 59, p. 1). In order to delineate WHPAs for the City of Anderson municipal supply well fields, a calibrated computer-based numerical groundwater flow model was constructed to simulate groundwater flow in the aquifers which underlie the area (Ref. 5, p. 6). Groundwater flow simulations were augmented with particle tracking evaluations to delineate the five- and ten-year groundwater time-of travel (TOT) boundaries for each well field (Ref. 5, p. 6). Model delineation for each Ranney well showing groundwater flow lines representing the groundwater flow and the area from which possible contamination could be emanating are shown in the WHPA Delineation Model report (Ref. 5, pp. 46, 52-53). The area depicted by the flow lines show different WHPAs for Ranney Wells #1, #4, and #5 (Ref. 5, pp. 46, 52-53). Since each Ranney well has different WHPAs, possible source(s) of contamination are different for each contaminated Ranney well.

The Anderson Wellhead Protection Plan documented possible sources of contamination mapped within each WHPA (Ref. 10, p. 9). The Anderson Wellhead Protection Plan shows various possible source areas of contamination for the Ranney Well #5 areas (Ref. 10, pp. 14-16).

During the SI activities, staff undertook an extensive level of effort by searching IDEM, county, and EPA records to identify additional possible sources of groundwater contamination (Refs. 44, p. 1; 69). Reference 85, page 6, of this HRS Documentation Record shows the location of facilities identified during the search.

Groundwater samples and subsurface soil samples were collected for the SI and ESI to determine possible source areas. However, a specific source(s) for the contamination found in the impacted Ranney Well #5 municipal well could not reasonably be determined. Based on the history of the area and extensive development along the White River and Killbuck Creek, the possible VOC source(s) cannot be defined without further investigation (Ref. 47, p. 3).

2.2.2 Hazardous Substances Associated with a Source

The following hazardous substances are associated with the source (see Section 3.1.1 of this HRS Documentation Record):

Tetrachloroethylene PCE

2.2.3 Hazardous Substances Available to a Pathway

Table E

Containment Description	Containment Factor Value	References
Gas release to air: The air migration pathway was not scored; therefore, gas containment was not evaluated.	Not Scored	
Particulate release to air: The air migration pathway was not scored; therefore, gas containment was not evaluated.	Not Scored	
Release to groundwater: The containment factor value of 10 is assigned based on analytical evidence of hazardous substances in groundwater samples from municipal wells (Ref. 69, p. 16 (Table 3; Table J of this HRS Documentation Record). Therefore, based on evidence of release (evidence of hazardous substance migration from a source area), the highest groundwater migration pathway containment factor value of 10 was assigned to Source No. 3 as specified in Table 3-2 of the HRS (Ref. 1. Section 3.1.2.1).	10	Ref. 1, Table 3-2, Section 3.1.2.1; see Section 3.1.1 of this HRS Documentation Record
Release via overland migration and/or flood: The surface water pathway was not scored; therefore, surface water overland/flood migration component containment was not evaluated.	Not Scored	

2.4.2 Hazardous Waste Quantity

2.4.2.1 Source Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity (Tier A)

The hazardous constituent quantity for Source No. 3 could not be adequately determined according to the HRS requirements; that is, the total mass of all Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substances in the source and releases from the sources not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.1). There are insufficient historical and current data (manifests, potentially responsible party (PRP) records, state records, permits, waste concentration data, etc.) 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 evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source No. 3 with reasonable confidence. As a result, the evaluation of hazardous waste quantity 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 (Tier B)

The hazardous wastestream quantity for Source No. 3 could not be adequately determined according to the HRS requirements; that is, the total mass of the hazardous wastestreams plus the mass of any additional CERCLA pollutants and contaminants in the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.2). There are insufficient historical and current data (manifests, PRP records, State records, permits, waste concentration data, etc.) available to adequately calculate the total mass or partial mass of the wastestreams plus the mass of all CERCLA pollutants and contaminants in the source and the associated releases 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. 3 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 (Tier C)

Because the horizontal and vertical extent of the plume cannot be determined based on available sampling data, the source volume is unknown, but greater than 0 (Ref. 1, Section 2.4.2.1.3).

Table F

Source Type	Description (# drums or dimensions)	Units (yd^3/gal)	References
Other	Unknown but >0	--	Ref. 1, Table 2-5

Sum (yd^3/gal): > 0
Equation for Assigning Value: (Ref. 1, Table 2-5) >0/2.5=>0

Volume Assigned Value: Unknown, but > 0

2.4.2.1.4. Area (Tier D)

The area measure (Tier D) is not evaluated for source type "other" (Ref. 1, Table 2-5).

Area Assigned Value: 0

2.4.2.1.5. Source Hazardous Waste Quantity Value

Volume of groundwater plume: Unknown, but >0
Highest assigned value assigned from Ref. 1, Table 2-5: > 0
Source Hazardous Waste Quantity Value: >0 (Ref. 1, Section 2.4.2.1.5)

SUMMARY OF SOURCE DESCRIPTIONS

Table G

Source No.	Source Haz. Waste Quantity Value	Source Hazardous Constituent Quantity Complete? (Y/N)	Containment Factor Value by Pathway				
			Ground Water (GW) (Ref. 1, Table 3-2)	Surface Water (SW)		Air	
				Overland/ flood (Ref. 1, Table 4-2)	GW to SW (Ref. 1, Table 3-2)	Gas (Ref. 1, Table 6-3)	Particulate (Ref. 1, Table 6-9)
1	> 0	N	10	NS*	NS*	NS*	NS*
2	>0	N	10	NS	NS	NS	NS
3	>0	N	10	NS	NS	NS	NS

*NS (Not Scored)

3.0 GROUND WATER MIGRATION PATHWAY

3.0.1 GENERAL CONSIDERATIONS

Ground Water Migration Pathway Description

Regional Geology/Aquifer Description

The site is within the central Indiana Tipton Till Plain physiographic unit of the White River Basin (Ref. 71, pp. 123, 126, 129). The unconsolidated surface soils were formed by a series of Pleistocene-age glacial outwash deposits that are 50 to 100 feet thick. The bedrock consists of Silurian and Devonian dolomite and limestone underlain by undifferentiated Ordovician shale (Ref. 71, p. 127, 129, 131, 133, 134).

Soils along the White River and Killbuck Creek consist of the Fox-Eel association, the Miami-Celina and Fox till substratum association, and the Brookston-Crosby association. All of these soils are nearly level along outwash plains to strongly sloping on terraces and within flood plains formed in medium-textured glacial drift (Refs. 75, pp. 7-8; 76, p. 1).

Site Geology/Aquifer Description

The site is along the White River and Killbuck Creek in the City of Anderson, Madison County, Indiana (Refs. 89; 90; Figures 2 and 3 of this HRS Documentation Record). There are eight (8) public water supply wells in Township 19 North, Range 7 East, Sections 1 and 12 (see Figure 6 of this HRS Documentation Record; Refs. 71, p. 129; 73, p. 1) and Township 19 North, Range 8 East, Section 6 (see Figure 6 of this HRS Documentation Record; Refs. 71, p. 129; 73, p. 1) that supply the Wheeler Avenue Treatment Plant (PWSID #5248002) (Refs. 58, p. 1; 68, p. 1). The site is underlain by two aquifers: (1) an unconfined Pleistocene-age glacial outwash sand and gravel aquifer and (2) an underlying bedrock aquifer. More specifically, the two (2) aquifers are defined as (1) the Bluffton/New Castle/Tipton Complex Aquifer System and White River and Tributaries Outwash Aquifer System, and (2) the Silurian and Devonian Carbonates Aquifer System. Because of the complicated glacial geology, boundaries of the aquifer systems in this county are commonly gradational and individual aquifers may extend across aquifer system boundaries (see Figure 6; Refs. 71, p. 141; 72, pp. 1-2; 73, p. 1; 77, p. 1; 78, pp. 1-2).

- Aquifer/Stratum 1 (uppermost): Bluffton/New Castle/Tipton Complex Aquifer System and White River and Tributaries Outwash Aquifer System

Description

The Bluffton / New Castle / Tipton Complex Aquifer System and White River and Tributaries Outwash Aquifer System are mapped throughout the central and southern areas of Madison County. Multiple glacial advances resulted in sequences of intertill sand and gravel layers, typically overlain by thick clay, resulting in aquifers that are highly variable in depth, thickness, and lateral extent (Refs. 77; 78, p. 3). The Bluffton/New Castle/Tipton Complex Aquifer System and White River and Tributaries Outwash Aquifer System are generally unconfined along the White River and hydraulically connected to buried sand and gravel aquifers that extend beneath the river (Ref. 71, pp. 132, 133, 134). Based upon the location of the river, local topography, and available geologic cross-sections; the direction of

groundwater flow in the study area is toward Killbuck Creek and the White River (Refs. 70, pp. 2-3; 71, pp. 133, 134, 138). As shown by the City's wellhead protection area (WHPA) delineation model, groundwater then flows the same direction as the White River as it reaches equal hydraulic head elevations with the river stage elevation (Refs. 5, p. 45; 70, p. 3).

Six (6) of the eight public supply wells that supply water to the Wheeler Avenue Treatment Plant (Ranney #1, Ranney #2, Ranney #4, Ranney #5, Elder #1 and Elder #2) draw water from the Bluffton/New Castle/Tipton Complex Aquifer System and White River and Tributaries Outwash Aquifer System aquifer (Refs. 3, p. 22; 47, p. 3; 77; Figure 6 of this HRS Documentation Record).

- Aquifer/Stratum 2 (deepest): Silurian and Devonian Carbonates Aquifer System

Description

Static water levels in wells utilizing the Silurian and Devonian Carbonates Aquifer System typically range from 15 to 36 feet below the land surface. The Silurian and Devonian carbonate rocks, which are now covered by glacial deposits, were once exposed and underwent some karst development near the surface (Refs. 71, p. 136; 72, p. 2). Wells penetrating the Silurian and Devonian Carbonates Aquifer System have reported depths ranging from 25 to 480 feet, but are commonly 90 to 220 feet deep. The amount of rock penetrated in this system typically ranges from 30 to 132 feet (Ref. 72, p. 1). High-capacity well depths range from approximately 100 to 400 feet below the land surface. This aquifer system in localized areas, especially near the White River where the bedrock surface is shallow, is at moderate to high risk to contamination (Refs. 72, p. 2; 73, p. 1).

Two (2) of the eight (8) public supply wells that supply water to the Wheeler Avenue Treatment Plant (Norton #1 and Norton #2) pull water from the Silurian and Devonian Carbonates Aquifer System aquifer (Refs. 3, p. 22; 47, p. 3; 73; Figure 6 of this HRS Documentation Record).

- Aquifer Interconnections/Distance from Source

Description

The lateral flow patterns in the upper sand and gravel aquifer and the underlying bedrock are similar (Ref. 70, pp. 2-3). Comparison of potentiometric heads in adjacent observation wells, one screened in the bedrock aquifer and the other screened in the upper aquifer, indicates that, in the upland areas away from the streams, groundwater flow is generally down from the glacial drift into the bedrock, and, near the streams, groundwater flow is generally up from the bedrock through the glacial drift into the streams (Ref. 70, pp. 2-4). Combined with evidence from geologic cross sections that Bluffton/New Castle/Tipton Complex Aquifer System/White River and Tributaries Outwash Aquifer System aquifer and Silurian and Devonian Carbonate Aquifer System aquifer are in direct contact with no continuous intervening confining layer in between (Refs. 47, p. 3; 71, pp. 133, 134, 138), these observations indicate that three-dimensional groundwater flow prevails in the study area and the two aquifers are interconnected into one hydrologic unit for scoring purposes (Refs. 1, Section 3.0.1.2; 47, p. 3; 70, p. 4).

- Aquifer Discontinuities within Target Distance Limit

Description

The Fortville Fault is approximately 5.5 to 6.0 miles west of the site and outside the 4-mile target distance limit (Ref. 71, p. 129; Figure 6 of the HRS Documentation Record) and has little to no effect on the local or regional groundwater flow (Ref. 70, pp. 2-4). Cross-sections 8C-8C' and 8K-8K' from the USGS Hydrogeologic Atlas of Aquifers in Indiana (Ref. 71) through the area of the site (Ref. 71, pp. 125, 133, 134, 138) show that the White River and Killbuck Creek do not fully transect the upper Bluffton/New Castle/Tipton Complex Aquifer System or the White River and Tributaries Outwash Aquifer System. Therefore, the White River and Killbuck Creek are not considered aquifer boundaries or discontinuities. There are no other aquifer discontinuities or boundaries, such as a mountain range, ocean, etc., within a 4-mile radius of the site (Ref. 1, Section 3.0.1.2.2).

Table H
Summary of Aquifer(s) Being Evaluated

Aquifer No.	Aquifer Name	Is Aquifer Interconnected with Upper Aquifer within 2 miles? (Y/N/NA)	Is Aquifer Continuous within 4-mile TDL? (Y/N)	Is Aquifer Karst? (Y/N)
1	Bluffton/New Castle/Tipton Complex Aquifer System/White River and Tributaries Outwash Aquifer System	This is the Upper Aquifer	Yes	No
2	Silurian and Devonian Carbonates Aquifer System	Yes	Yes	No

3.1 LIKELIHOOD OF RELEASE

3.1.1 Observed Release

Aquifer Being Evaluated: The interconnected Bluffton/New-Castle/Tipton Complex Aquifer System/White River and Tributaries Outwash Aquifer System and Silurian and Devonian Carbonates Aquifer System hydrologic unit

Establishing an observed release by chemical analysis requires analytical evidence of a hazardous substance in the media significantly above background level. Further, some portion of the release must be attributable to the site (Ref. 1, Section 2.3). If the background concentration is not detected (or is less than the detection limit), an observed release is established when the sample measurement equals or exceeds its own Sample Quantitation Limit (SQL) and that of the background sample. If the SQL cannot be established, the U.S. EPA Contract-Required Quantitation Limit (CRQL) is used in place of the SQL (Ref. 1, Table 2-3).

Chemical Analysis

In July 2014, as part of the SI, IDEM Site Investigation Program staff collected a total of twenty-seven (27) groundwater samples, including three (3) duplicate samples, four (4) background samples, and one (1) equipment blank (Ref. 4, p. 22). In July 2015, as part of the ESI, IDEM Site Investigation Program staff collected a total of fifteen (15) groundwater samples, consisting of ten (10) groundwater samples, two (2) duplicate samples, and three (3) trip blanks (Ref. 3, p. 21). The groundwater samples collected included the prescribed Quality Assurance/Quality Control (QA/QC) samples and were analyzed at an EPA Contract Laboratory Program lab. Analyses included CLP SOW SOM01.2 (Trace Volatiles) for the SI data and CLP SOW SOM02.2 (Trace Volatiles) for the ESI data for VOCs (Refs. 3, p. 116; 4, pp. 23, 456). For scoring purposes, however, only the municipal well samples collected as part of the 2014 SI are used to document the likelihood of release at this site.

Background Concentrations

The groundwater from Ranney Well #2 is considered a background groundwater sample to establish background levels to document an observed release in Ranney Wells #1, #4 and #5. This sample was obtained during the July 2014 SI sampling activities. The table below, Background Ground Water Sample Table, depicts the EPA CLP Identification #, date, location, depth, hazardous substance/concentration, CRQL, and references for the sample. The sample was collected from the Bluffton/New Castle/Tipton Complex Aquifer System/White River and Tributaries Outwash Aquifer System aquifer, which, for simplicity, is referred to as the SG (sand and gravel) aquifer matrix in the table (Ref. 4, pp. 16-17; 77; Figure 2 of this HRS documentation record).

This background groundwater sample was non-detect for PCE, cis-1,2-DCE, VC and TCE (see Table I of this HRS Documentation Record). All background and contaminated samples were obtained using similar methods from equivalent geologic materials (sand and gravel) and near the same depths to the contaminated wells (Ref. 80, p. 1).

Table I
Background Groundwater Samples Obtained from Municipal Well Ranney Well #2

EPA CLP ID #	Date	Location	Depth Below Ground Surface/ Aquifer Matrix	Hazardous Substance	Hazardous Substance Concentration (µg/L)	CRQL (µg/L)	Reference
E2T77	7/21/14	Ranney Well #2 (Municipal Well)	*31.8-35 feet/ SG	PCE TCE Cis-1,2-DCE VC	0.5 U 0.5 U 0.5 U 0.5 U	0.5 0.5 0.5 0.5	Refs. 4, pp. 16-17, 90, 455-464, 477-478, 541, 593-595; 52, p. 3; Figure 4 of this HRS Documentation Record

SG - Sand and Gravel
U – The analyte was analyzed for, but was not detected above the reported sample quantitation limit (Ref. 4, p. 464).

* The range depth of the aquifer was calculated by subtracting the elevation of the shallow and deepest lateral of Ranney Well #2 (804.2 – 801.0 feet) from the ground elevation (836.0 feet) (Ref. 45, pp. 4, 41). The range difference is 31.8-35 feet.

Contaminated Samples

From July 21, 2014 through July 25, 2014, IDEM's Site Investigation Program conducted an SI at the Broadway Street Corridor Groundwater Contamination site (Ref. 4, pp. 1, 22). The groundwater collected from some of the municipal wells within the Ranney wellfield during the SI was found to be contaminated with chlorinated VOCs (see Sections 3.1.1 and 3.3.2.2 of this HRS Documentation Record). From July 7, 2015 through July 9, 2015 samples were also collected as part of the ESI (Ref. 3, p. 15).

The groundwater plumes are depicted by groundwater samples obtained from municipal wells (see Figure 2 of this HRS Documentation Record). The extent of this plumes have not been completely delineated at this time but has been investigated with municipal wells and direct push methods data (see Section 3.1.1 and Figure 2 of this HRS Documentation Record).

The following table depicts the samples that meet the observed release criteria (Ref. 1, Table 2-3). This table lists the organic hazardous substances with their concentrations and CRQLs for each sample. The locations are depicted on Figure 2 of this HRS Documentation Record. All groundwater samples collected from the Ranney wells were obtained from the same portion of the aquifer as evidenced by the similar well depths (see Table J of this HRS Documentation Record).

Table J
Contaminated Groundwater Samples from Ranney Municipal Wells

EPA CLP ID #	Date	Municipal Well Name	Depth Below Ground Surface / Aquifer Matrix	Hazardous Substance	Hazardous Substance Concentration (µg/L)	CRQL (µg/L)	Reference
E2T72 (SI)	7/21/14	Ranney Well #1	47.6 feet*/ SG	TCE Cis-1,2-DCE	7.1 0.76	0.5 0.5	Ref. 4, pp. 16-17, 90, 469-470, 455-464, 541, 581-583; 52, p. 1
E2T73 (SI)	7/21/14	Ranney Well #1	47.6 feet */ SG	TCE Cis-1,2-DCE	7.0 0.77	0.5 0.5	Ref. 4, pp. 16-17, 90,455-464, 471-472, 541, 584-586; 52, p. 2
E2T76 (SI)	7/21/14	Ranney Well #4	33.9 feet** / SG	TCE Cis-1,2-DCE VC	1.7 5.1 1.3	0.5 0.5 0.5	Ref. 4, pp. 16-17, 90, 455-464, 475-476, 541, 590-592; 52, p. 4
E2T84 (SI)	7/21/14	Ranney Well #5	48 feet***/ SG	PCE	5.4	0.5	Ref. 4, pp. 16-17, 90, 455-464, 493-495, 542, 615-617; 52, p. 5

SG Sand and Gravel
CRQL Contract Required Quantitation Limit

* The range depth of the aquifer was calculated by subtracting the elevation of the shallow and deepest lateral of the Ranney #1 well (807.6 - 792.7 feet) from the ground elevation (840.3 feet) (Ref. 45, pp. 4, 41). The range difference is 32.7-47.6 feet.
** The depth of the aquifer was calculated by subtracting the elevation of the shallow and deepest lateral of the Ranney #4 well (803.8 - 801.9 feet) from the ground elevation (835.8 feet) (Ref. 45, pp. 4, 41). The range difference is 32 - 33.9 feet.
*** The depth of the aquifer was calculated by subtracting the elevation of the shallow and deepest lateral of the Ranney #5 well (796.9 – 792.4 feet) from the ground elevation (840.4 feet) (Ref. 45, pp. 4, 41). The range difference is 43.5 - 48 feet.

3.1.2 Attribution

The Broadway Street Corridor Groundwater Contamination site has a documented release of TCE, PCE, cis-1,2-DCE, and VC to the groundwater that has contaminated three (3) active municipal wells (see Contaminated Ground Water from Ranney Municipal Wells Sample Table of this HRS Documentation Record).

The compounds found in the wells are manufactured chemicals, not thought to occur naturally, and

non-detected concentrations in a background well show that they are not ubiquitous throughout the region (Refs. 61, p. 1; 63, p. 1; 64, p. 1; 65, p. 1; Background Ground Water Sample Table of this HRS Documentation Record). Chlorinated solvents (e.g., 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 and VC are common breakdown products of PCE and TCE (Refs. 61, p. 1; 62, p. 1; 63, p. 1, 64, p. 1; 65, p. 1; 81, p. 1; 83, p. 1; 84, p. 2). The Broadway Street Corridor Groundwater Contamination site is located in a heavily developed area consisting of industrial, commercial, and residential land, where a variety of past industrial and commercial activities could have resulted in the groundwater contamination (Refs. 4, pp. 66-67, 72-75; 69; 85, p. 6).

During the SI and ESI, staff undertook an extensive level of effort by searching IDEM, county, and EPA records to identify possible sources of groundwater contamination Staff also collected direct push groundwater grab samples and subsurface soil samples on the properties of, or downgradient from, facilities within the WHP areas that were thought to be associated with the contaminants of concern (Ref. 44, p.1; 69, pp. 1-27). Based on the efforts during the SI and ESI, there is insufficient evidence to attribute the groundwater contamination in Ranney Well #1, Ranney Well #4, and Ranney Well #5 municipal wells to sources at nearby facilities. Refer to Reference 69 and its supporting references, which include References 3; 4; 5; 6; 7; 8; 12; 13; 14; 15; 16; 18; 19; 21; 22; 23; 24; 25; 26; 27; 28; 29; 30; 31; 32; 33; 34; 35; 36; 37; 38; 39; 40; 41; 42; 43; 44; 45; 46; 48; 49; 50; 51; 52; 53; 54; 55; 56; 58; 81; 83; 84; 85; 86; and 87, for a detailed summary of the level of effort and determining any attribution associated with facilities and the samples collected.

Hazardous Substances Released (see Section 3.1.1 of this HRS Documentation Record)

- TCE
- cis-1,2-DCE
- VC
- PCE

Groundwater Observed Release Factor Value: 550

3.2 WASTE CHARACTERISTICS

3.2.1 Toxicity/Mobility

The following table, Toxicity/Mobility Table, depicts the toxicity, mobility and combined toxicity/mobility factor values that have been assigned to those substances present in the observed release and have a containment value greater than 0 (Ref. 1, Sections 2.2.3, 3.2.1).

Table K
Toxicity/Mobility

Hazardous Substance	Source No. (and/or Observed Release)	Toxicity Factor Value	Mobility Factor Value*	Does Hazardous Substance meet Observed Release by chemical analysis? (Y/N)	Toxicity/ Mobility (Ref. 1, Table 3-9)	References
cis-1,2-DCE	1, 2, Observed Release	1,000	1	Y	1,000	Ref. 1a, Section 2.4.1.1; Ref. 2, p. 6
TCE	1, 2, Observed Release	1,000	1	Y	1,000	Ref. 1a, Section 2.4.1.1; Ref. 2, p. 18
VC	2, Observed Release	10,000	1	Y	10,000	Ref. 1a, Section 2.4.1.1; Ref. 2, p. 22
PCE	3, Observed Release	100	1	Y	100	Ref. 2, p. 10

*All hazardous substances that meet the criteria for an observed release by chemical analysis to one or more aquifers, regardless of the aquifer being evaluated, are assigned a mobility factor value of 1 (Ref. 1, Section 3.2.1.2).

The hazardous substance with the highest toxicity/mobility factor value available to the ground water migration pathway is vinyl chloride (10,000).

Toxicity/Mobility Factor Value: 10,000
(Ref. 1, Table 3-9)

Table L

3.2.2 Hazardous Waste Quantity Source No.	Source Type	Source Hazardous Waste Quantity
1	Other	Unknown, but >0

3.2.2 Hazardous Waste Quantity Source No.	Source Type	Source Hazardous Waste Quantity
2	Other	Unknown, but >0
3	Other	Unknown, but >0

Sum of Values: Unknown but >0, rounded to 1 (Ref. 1, Section 2.4.2.2, Table 2-6)

The Broadway Street Corridor Groundwater Contamination site has been scored as consisting of three (3) groundwater plumes with no identified sources. According to Section 2.4.2.2 in the HRS (Ref. 1), if any target for that migration pathway is subject to Level I or Level II concentrations and the hazardous constituent quantity is not adequately determined, assign a value from HRS Table 2-6 or a value of 100 whichever is greater, as the hazardous waste quantity factor value for that pathway. Because Level I concentrations were present in a drinking water well (see Sections 3.1.1 and 3.3 of this HRS Documentation Record), a hazardous waste quantity factor value of 100 is assigned for the ground water pathway.

Hazardous Waste Quantity Factor Value: 100
(Ref. 1, Section 2.4.2.4 and Table 2-6)

3.2.3 Waste Characteristics Factor Category Value

As specified in the HRS (Ref. 1, Section 3.2.3), the Hazardous Waste Quantity Factor Value of 100 was multiplied by the highest Toxicity/Mobility Value of 10,000, resulting in a product of 1,000,000. Based on this product, a Waste Characteristics Factor Category Value of 32 was assigned from Table 2-7 of the HRS (Ref. 1, Section 2.4.3.1).

The Toxicity/Mobility Factor Value for VC, which has the highest Toxicity/Mobility Factor Value of the substances listed in Section 3.2.1 of this HRS Documentation Record, is:

Toxicity/Mobility Factor Value: 10,000
Hazardous Waste Quantity Factor Value: 100

Hazardous Waste Quantity Factor Value: 1,000,000

Waste Characteristics Factor Category Value: 32
(Ref. 1, Table 2-7)

3.3 GROUND WATER PATHWAY TARGETS

The Wheeler Avenue Treatment Plant receives water from four (4) Ranney type wells and four (4) other wells (Ref. 82, p. 7), and it feeds drinking water to 60 percent of the 58,000 people served by the Anderson Water Department (Refs. 4, p. 45; 58, p. 2; 88, p. 1). Municipal wells Ranney Well #1, Ranney Well #2, Ranney Well #4, Ranney Well #5, Norton Well #1, Norton Well #2, Elder Well #1 and Elder Well #2 are the only sources of water feeding into the Wheeler Avenue Treatment Plant (Ref. 68, p. 1). Ranney Well #1, Ranney Well #4, and Ranney Well #5 municipal wells are subject to Level I contamination (see Level I Contaminated Ground Water from Public Wells Sample Table of this HRS Documentation Record). The concentrations of VC in Ranney Well #4 and the concentrations of TCE in Ranney Well #1 and Ranney Well #4 municipal wells are above the cancer risk screening concentration health based benchmarks for VC and TCE in drinking water, which are 2.1×10^{-2} µg/L and 1.1 µg/L, respectively. PCE levels exceed the U.S. EPA drinking water Maximum Contaminant Level (MCL) in the Ranney Well #5 municipal well. As such, populations that use Ranney Wells #1, #4, and #5 are subject to Level I hazardous substance concentrations. The table below depicts those municipal wells that are subject to Level I contamination.

Table M
Level I Groundwater Samples from Municipal Wells

EPA CLP ID #	Municipal Well ID	Hazardous Substance	Hazardous Substance Concentration (µg/L)	Benchmark Concentration (µg/L)	Benchmark*	Reference
E2T72	Ranney Well #1	TCE	7.1	1.1	Cancer Risk	Ref. 2, p. 18; Contaminated Ground Water from Ranney Municipal Wells Sample Table of this HRS Documentation Record
E2T73	Ranney Well #1	TCE	7.0	1.1	Cancer Risk	Ref. 2, p. 18; Contaminated Ground Water from Ranney Municipal Wells Sample Table of this HRS Documentation Record
E2T76	Ranney Well #4	TCE VC	1.7 1.3	1.1 0.021	Cancer Risk Cancer Risk	Ref. 2, p. 18, 22; Contaminated Ground Water from Ranney Municipal Wells Sample Table of this HRS Documentation Record
E2T84	Ranney Well #5	PCE	5.4	5.0	MCL	Ref. 2, p. 10; Contaminated Ground Water from

EPA CLP ID #	Municipal Well ID	Hazardous Substance	Hazardous Substance Concentration (µg/L)	Benchmark Concentration (µg/L)	Benchmark*	Reference
						Ranney Municipal Wells Sample Table of this HRS Documentation Record

*As specified in Ref. 1, Section 2.5.2, the lowest applicable benchmark concentration for each substance was applied.

3.3.1 Nearest Well

Well ID: Ranney Well #1 (groundwater samples E2T72 and E2T73), Ranney Well #4 (groundwater sample E2T76), Ranney Well #5 (groundwater sample E2T84)
Level of Contamination (I, II, or potential): I
If potential contamination, distance from source in miles: N/A

As stated above, Ranney Well #1, Ranney Well #4, and Ranney Well #5 wells are subject to Level I contamination (see Level I Contaminated Ground Water from Public Wells Sample Table of this HRS Documentation Record).

As specified in the HRS (Ref. 1, Section 3.3.1, Table 3-11), if one or more drinking water wells are subject to Level I concentrations, a Nearest Well Factor Value of 50 is assigned. Level I VC and TCE concentrations have been documented in the groundwater of Ranney Well #4; Level I PCE concentrations have been documented in the groundwater of Ranney Well # 5; and Level I concentrations of TCE have been documented in Ranney Well #1 (see Section 3.1.1 and 3.3 of this HRS Documentation Record).

Nearest Well Factor Value: 50
(Ref. 1, Table 3-11)

3.3.2 Population

3.3.2.1 Level of Contamination

3.3.2.2 Level I Concentrations

The Ranney wells operate daily and are manifold at the Wheeler Avenue Treatment Plant prior to distribution (Ref. 4, p. 46). The water from Ranney Well #1, Ranney Well #4 and Ranney Well #5 is combined (manifolded) with the water from one (1) additional Ranney well (Ranney Well #2) and four (4) non-Ranney municipal wells (Ref. 4, pp. 15, 17-18, 46; 68, p. 1). The Wheeler Avenue Treatment Plant produces about 60% of the City's daily water (Ref. 4, p. 45). According to the 2010 US census, there are 56,129 people in the City of Anderson, Indiana (Ref. 57, p. 1). However, State of Indiana water system records indicate that the current population served by the Anderson Water Department is 58,000 (Ref. 58, p. 2); therefore, this is the value used to determine the population target values.

HRS Section 3.3.2 states, "assume each well and intake contributes equally and apportion the population accordingly, except: if the relative contribution of any one well or intake exceeds 40

percent" (Ref. 1, Section 3.3.2).

The table below lists the wells that supply water to the Wheeler Avenue Treatment Plant and the capacity for each well. The relative contribution of each well that supplies water to the Wheeler Avenue Treatment Plant does not appear to show that any one well contributes more than 40 percent. As stated in Section 3.3 of this HRS Documentation Record, all of the wells listed in this table are the only wells that supply water to the Wheeler Avenue Treatment Plant.

Table N
Well Capacity

Well ID	Well Capacity (GPM)	References
1R (Ranney Well #1)	1,667	Refs. 20, p. 3; 68, p. 1
2R (Ranney Well #2)	2,847	Refs. 20, p. 3; 68, p. 1
4R (Ranney Well #4)	1,111	Refs. 20, p. 3; 68, p. 1
5R (Ranney Well #5)	1,319	Refs. 20, p. 3; 68, p. 1
1N (Norton Well #1)	385	Refs. 20, p. 3; 68, p. 1
2N (Norton Well #2)	385	Refs. 20, p. 3; 68, p. 1
1E (Elder Well #1)	1,000	Refs. 20, p. 3; 68, p. 1
2E (Elder Well #2)	1,000	Refs. 20, p. 3; 68, p. 1

GPM = Gallons per minute.

Therefore, the HRS dictates that the population be distributed equally among the wells (Ref. 1, Section 3.3.2).

The following example depicts how the population was calculated for each well.

Example Calculation: for each Ranney Well

The Wheeler Avenue Treatment Plant provides drinking water to 60 percent of the 58,000 people served by the Anderson Water Department (Refs. 4, p. 45; 58, p. 2; 88, p. 1). Sixty percent (60%) of population served is 34,800 (Ref. 4, p. 45).

Therefore 34,800 divided by 8 equals 4,350 people per well.

Table O
Population Served by Each Well That Supplies Water to the Wheeler Avenue Treatment Plant

Well ID	Number of People Served
Ranney Well #1	4,350
Ranney Well #2	4,350
Ranney Well #4	4,350
Ranney Well #5	4,350
Norton Well #1	4,350
Norton Well #2	4,350
Elder Well #1	4,350
Elder Well #2	4,350
Total Population served from the above listed wells	**34,800**

Municipal Wells Ranney Well #1, Ranney Well #4 and Ranney Well #5 are considered Level I.

The Sum of Population Served by Level I is:
4,350 (Ranney Well #1) + 4,350 (Ranney Well #4) + 4,350 (Ranney Well #5) = 13,050 people.

Therefore, Level I Concentration Factor Value is determined by multiplying this value by 10 (Ref. 1, Section 3.3.2.2)

13,050 times 10 = 130,500

Level I Concentrations Factor Value: 130,500

3.3.2.3 Level II Concentrations

There are no wells in which observed releases were established that are evaluated as Level II contamination.

Table P
Level II Contaminated Groundwater Samples from Public Wells

EPA CLP#	Date	Location	Depth Below Ground Surface	Hazardous Substance	Hazardous Substance Concentration µg/L	CRQL µg/L	Reference
NS	NS	NS	NS	NS	NS	NS	NS

NS - Not Scored

Level II Concentrations Factor Value: NS

3.3.2.4 Potential Contamination

As stated in Section 3.3.2.2 of this HRS Documentation Record, the population served by the Wheeler Treatment Plant is distributed equally among each of the eight (8) wells in the well field. Therefore 34,800 divided by 8 equals 4,350 people per well. The following table depicts the distances from each potential well to Sources 1, 2 or 3 within the combined target distance limit (TDL) and the population served by each potential well. In addition, the table shows the value assigned for the potential well according to Table 3-12 of the HRS Rule (Ref. 1, Table 3-12).

Table Q
Potentially Contaminated Wells and Population

Distance	Name of Potential Well(s)	Population Served	Value Assigned (HRS Table 3-12)*	References
0-1/4 Mile	Elder Well #1, Elder Well #2,	4350 times 3 = 13,050	16,325	Ref. 1, Table 3-12; Figure 6

Distance	Name of Potential Well(s)	Population Served	Value Assigned (HRS Table 3-12)*	References
	Ranney Well #2			
>¼ -1/2 Mile	Norton Well #1, Norton Well #2	4350 times 2 = 8,700	3,233	Ref. 1, Table 3-12; Figure 6
>½ - 1 Mile				
>1 – 2 Miles				
>2 - 3 Miles				
>3 - 4 Miles				
Total Value			**19,558**	

*Other than karst

The assigned values are added 16,325 + 3,233 = 19,558

19,558 times 0.1 = 1,955.8, which is rounded to the nearest integer per the HRS to equal 1,956. (Ref. 1, Section 3.3.2.4)

Potential Contamination Factor Value: 1,956

3.3.3 Resources

Resource use of the combined aquifers within the target distance limit does not include any documented Resource Factors. Therefore, a Resource Factor value of 0 is assigned (Ref. 1, Section 3.3.3).

Resources Factor Value: 0

3.3.4 Wellhead Protection Area

The groundwater plumes lie within the WHPA (Refs. 10, pp. 12, 14, 17; 5, pp. 46, 52-53; Figures 2 and 4 of this HRS Documentation Record). Indiana's WHPAs and the Anderson, Indiana WHPA are designated by the U.S. EPA in accordance with Section 1428 of the Safe Drinking Water Act (Refs. 59, p. 1). Therefore, the Wellhead Protection Area Factor Value of 20 is assigned (Ref. 1, Section 3.3.4).

Wellhead Protection Area Factor Value: 20

Attachment 1
HRS Scoring and Target Information Showing That Ranney Well #1 Plume Will Score above 28.50

WORKSHEET FOR COMPUTING HRS SITE SCORE
For Ranney Well #1 Plume

		S	S^2
1.	Ground Water Migration Pathway Score (S_{gw})	100.00	10,000
2a.	Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	NS*	
2b.	Ground Water to Surface Water Migration Component (from Table 4-25, line 28)	NS	
2c.	Surface Water Migration Pathway Score (S_{sw}) Enter the larger of lines 2a and 2b as the pathway score.	NS	
3.	Soil Exposure and Subsurface Intrusion Pathway Score (S_{sessi}) (from Table 5-1, line 22)	NS	
4.	Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	NS	
5.	Total of $S_{gw}^2 + S_{sw}^2 + S_{sessi}^2 + S_a^2$		10,000
6.	**HRS Site Score** Divide the value on line 5 by 4 and take the square root		50.00

Notes: *NS = Not Scored

HRS Table 3-1
Ground Water Migration Pathway Scoresheet for Ranney Well #1 Plume

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 x (2b + 2c + 2d)]	500	NS
4. 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)	43,500
8b. Level II Concentrations	(b)	NS
8c. Potential Contamination	(b)	1,926
8d. Population (lines 8a + 8b + 8c)	(b)	45,426
9. Resources	5	0
10. Wellhead Protection Area	20	20
11. Targets (lines 7 + 8d + 9 + 10)	(b)	45,496
Ground Water Migration Score For An Aquifer:		
12. Aquifer Score [(lines 3 x 6 x 11)/82,500][c] 550 x 18 x 45,496 = 450,410,400/82,500 = 5,459.52	100	100.00
Ground Water Migration Pathway Score:		
14. Pathway Score (S_{gw}), (highest value from line 12 for all aquifers evaluated)[c]	100	100.00

(a) Maximum value applies to waste characteristics category
(b) Maximum value not applicable
[c] Do not round to nearest integer
NS - Not Scored

3.1 LIKELIHOOD OF RELEASE

3.1.1 Observed Release

Aquifer Being Evaluated: The interconnected Bluffton/New Castle/Tipton Complex Aquifer System/White River and Tributaries Outwash Aquifer System and Silurian and Devonian Carbonates Aquifer system hydrologic unit.

Establishing an observed release by chemical analysis requires analytical evidence of a hazardous substance in the media significantly above background level. Further, some portion of the release must be attributable to the site (Ref. 1, Section 2.3). If the background concentration is not detected (or is less than the detection limit), an observed release is established when the sample measurement equals or exceeds its own Sample Quantitation Limit (SQL) and that of the background sample. If the SQL cannot be established, the U.S. EPA Contract-Required Quantitation Limit (CRQL) is used in place of the SQL (Ref. 1, Table 2-3).

Chemical Analysis

In July 2014, as part of the SI, IDEM Site Investigation Program staff collected a total of twenty-seven (27) groundwater samples, including three (3) duplicate samples, four (4) background samples, and one (1) equipment blank (Ref. 4, p. 22). In July 2015, as part of the ESI, IDEM Site Investigation Program staff collected a total of fifteen (15) groundwater samples, consisting of ten (10) groundwater samples, two (2) duplicate samples, and three (3) trip blanks (Ref. 3, p. 21). The groundwater samples collected included the prescribed Quality Assurance/Quality Control (QA/QC) samples and were analyzed at an EPA Contract Laboratory Program lab. Analyses included CLP SOW SOM01.2 (Trace Volatiles) for the SI data and CLP SOW SOM02.2 (Trace Volatiles) for the ESI data for VOCs (Refs. 3, p. 116; 4, pp. 23, 456). For scoring purposes, however, only the municipal well samples collected as part of the 2014 SI are used to document the likelihood of release at this site.

- Background Concentrations:

The groundwater from Ranney Well #2 is considered a background groundwater sample to establish background levels to document an observed release in Ranney Well #1. This sample was obtained during the July 2014 SI sampling activities. The table below, Background Ground Water Sample Table, depicts the EPA CLP Identification #, date, location, depth, hazardous substance/concentration, CRQL, and references for the sample. The sample was collected from the Bluffton/New Castle/Tipton Complex Aquifer System/White River and Tributaries Outwash Aquifer System aquifer, which for simplicity, is referred to as the SG (sand and gravel) aquifer matrix in the table (Refs. 4, pp. 16-17; 77; Figure 2 of this HRS documentation record).

This sample was obtained from equivalent geologic materials (sand and gravel) and near the same depths to the contaminated wells (Ref. 84, p. 1)

Table I1
Background Groundwater Samples Obtained from Municipal Well Ranney Well #2

EPA CLP ID #	Date	Location	Depth Below Ground Surface/ Aquifer Matrix	Hazardous Substance	Hazardous Substance Concentration (µg/L)	CRQL (µg/L)	Reference
E2T77	7/21/14	Ranney Well #2 (Municipal Well)	31.8-35 feet/ SG*	Cis-1,2-DCE TCE	0.5 U 0.5 U	0.5 0.5	Refs. 4, pp. 16-17, 90, 455-464, 477-478, 541, 593-595; 52, p. 3; Figure 4 of this HRS Documentation Record

SG - Sand and Gravel
U – The analyte was analyzed for, but was not detected above the reported sample quantitation limit (Ref. 4, 464)

* The range depth of the aquifer was calculated by subtracting the elevation of the shallow and deepest lateral of Ranney Well #2 (804.2 – 801.0 feet) from the ground elevation (836.0 feet) (Ref. 45, pp. 4, 41). The range difference is 31.8-35 feet

- Contaminated Samples:

From July 21, 2014 through July 25, 2014, IDEM's Site Investigation Program conducted an SI at the Broadway Street Corridor Groundwater Contamination site (Ref. 4, pp. 1, 22). The groundwater collected from some of the municipal wells within the Ranney wellfield during the SI was found to be contaminated with chlorinated VOCs (see Sections 3.1.1 and 3.3.2.2 of this HRS Documentation Record).

The groundwater plume is depicted by groundwater samples obtained from Ranney Well #1 (see Figure 2 of this HRS Documentation Record). The extent of this plume has not been completely delineated at this time (see Section 3.1.1 and Figure 2 of this HRS Documentation Record).

The following table depicts the samples that meet the observed release criteria (Ref. 1, Table 2-3). This table lists the organic hazardous substances with their concentrations and CRQLs for each sample. The location is depicted on Figure 2 of this HRS Documentation Record. All groundwater samples collected from the Ranney wells were obtained from the same portion of the aquifer as evidenced by the similar well depths (see Tables I1 and J1 of this HRS Documentation Record).

Table J1
Contaminated Groundwater Samples from Ranney Municipal Well #1

EPA CLP ID #	Date	Well Name	Depth Below Ground Surface/ Aquifer Matrix	Hazardous Substance	Hazardous Substance Concentration (µg/L)	CRQL (µg/L)	Reference
E2T72	7/21/14	Ranney Well #1	32.7 - 47.6 feet* / SG	TCE Cis-1,2-DCE	7.1 0.76	0.5 0.5	Refs. 4, pp. 16-17, 90, 469- 470, 455-464, 541, 581-583; 52, p. 1
E2T73	7/21/14	Ranney Well #1	32.7 - 47.6 feet * / SG	TCE Cis-1,2-DCE	7.0 0.77	0.5 0.5	Refs. 4, pp. 16-17, 90,455-464 471- 472, 541, 584-586; 52, p. 2

SG Sand and Gravel
CRQL Contract Required Quantitation Limit
* The range depth of the aquifer was calculated by subtracting the elevation of the shallow and deepest lateral of Ranney Well #1 (807.6 - 792.7 ft.) from the ground elevation (840.3 ft.) (Ref. 45, pp. 4, 41). The range difference is 32.7-47.6 ft.

Table K1
Level I Groundwater Samples from Municipal Wells

EPA CLP ID #	Municipal Well ID	Hazardous Substance	Hazardous Substance Concentration (µg/L)	Benchmark Concentration (µg/L)	Benchmark*	Reference
E2T72	Ranney Well #1	TCE	7.1	1.1	Cancer Risk	Ref. 2, p. 18; Contaminated Ground Water from Ranney Municipal Wells Sample Table of this HRS Documentation Record
E2T73	Ranney Well #1	TCE	7.0	1.1	Cancer Risk	Ref. 2, p. 18; Contaminated Ground Water from Ranney Municipal Wells Sample Table of this HRS Documentation Record

*As specified in HRS Section 2.5.2, the lowest applicable benchmark concentration for each substance was applied.

Attribution:

The Broadway Street Corridor Groundwater Contamination site – Ranney Well #1 has a documented release of TCE and cis-1,2-DCE to the groundwater that has contaminated one (1) active municipal well (see Contaminated Ground Water from Ranney Municipal Wells Sample Table of this HRS Documentation Record).

The compounds found in this well are manufactured chemicals, not thought to occur naturally, and non-detected concentrations in a background well show that they are not ubiquitous throughout the region (Refs. 64, p. 1; 65, p. 1; Background Ground Water Sample Table of this HRS Documentation Record). Chlorinated solvents (e.g., 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. 61, p. 1; 62, p. 1; 64, p. 1; 65, p. 1; 81, p. 1; 83, p. 1; 84, p. 2). The Broadway Street Corridor Groundwater Contamination site – Ranney Well #1 is located in a heavily developed area consisting of industrial, commercial, and residential land, where a variety of past industrial and commercial activities could have resulted in the groundwater contamination (Refs. 4, pp. 66-67; 69; 85, p. 6).

During the SI and ESI, staff conducted an extensive level of effort by searching IDEM, county, and EPA records to identify possible sources of groundwater contamination. Staff also collected direct push groundwater grab samples and subsurface soil samples on the properties of or downgradient from facilities within the WHP areas that were thought to be associated with contaminants of concern (Ref. 44, p. 1; 69, pp. 1-7). Based on the efforts during the SI and ESI, there is insufficient evidence to attribute the groundwater contamination in Ranney Well #1 to sources at nearby facilities. Refer to Reference 69 and its supporting references, which include References 3; 4; 5; 6; 7; 8; 12; 13; ;14; 15; 16; 18; 19; 21; 22; 23; 24; 25; 26; 27; 28; 29; 30; 31; 32; 33; 34; 35; 36; 37; 38; 39; 40; 41; 42; 43; 44; 45; 46; 48; 49; 50; 51; 52; 53; 54; 55; 56; 58; 81; 83; 84; 85; 86; and 87, for a detailed summary of the level of effort and determining any attribution associated with facilities and the samples collected.

Hazardous Substances Released (Section 3.1.1 of this HRS Documentation Record)

- TCE
  Cis-1,2-DCE

Groundwater Observed Release Factor Value: 550

3.2 WASTE CHARACTERISTICS

3.2.1 Toxicity/Mobility

The following table, Toxicity/Mobility Table, depicts the toxicity, mobility and combined toxicity/mobility factor values that have been assigned to those substances present in the observed release and have a containment value greater than 0 (Ref. 1, Sections 2.2.3, 3.2.1).

Table L1
Toxicity/Mobility

Hazardous Substance	Source No. (and/or Observed Release)	Toxicity Factor Value	Mobility Factor Value*	Does Hazardous Substance meet Observed Release by chemical analysis? (Y/N)	Toxicity/ Mobility (Ref. 1, Table 3-9)	References
Cis-1,2-DCE	1, Observed Release	1,000	1	Y	1,000	Ref. 1a, Section 2.4.1.1; Ref. 2, p. 6
TCE	1, Observed Release	1,000	1	Y	1,000	Ref. 1a, Section 2.4.1.1; Ref. 2, p. 18

*All hazardous substances that meet the criteria for an observed release by chemical analysis to one or more aquifers, regardless of the aquifer being evaluated, are assigned a mobility factor value of 1 (Ref. 1, Section 3.2.1.2).

The hazardous substance with the highest toxicity/mobility factor value available to the groundwater migration pathway is TCE (1,000) and cis-1,2-DCE (1,000).

Toxicity/Mobility Factor Value: 1,000
(Ref. 1, Table 3-9)

Table M1

3.2.2 Hazardous Waste Quantity Source No.	Source Type	Source Hazardous Waste Quantity
1 (Ranney Well #1)*	Other	Unknown, but >0

* See section 2.2 of this HRS documentation record for the source characterization.

Sum of Values: Unknown but >0, rounded to 1 (Ref. 1, Section 2.4.2.2, Table 2-6)

The Broadway Street Corridor Groundwater Contamination site – Ranney Well #1 has been scored as consisting of a groundwater plume with no identified sources. According to Section 2.4.2.2 in the HRS (Ref. 1), if any target for that migration pathway is subject to Level I or Level II concentrations and the hazardous constituent quantity is not adequately determined, assign a value from HRS Table 2-6 or a value of 100 whichever is greater, as the hazardous waste quantity factor value for that pathway. Because Level I concentrations were present in a drinking water well (see Sections 3.1.1 and 3.3 of this HRS Documentation Record), a hazardous waste quantity factor value of 100 is assigned for the groundwater pathway.

Hazardous Waste Quantity Factor Value: 100
(Ref. 1, Section 2.4.2.4 and Table 2-6)

3.2.3 Waste Characteristics Factor Category Value

As specified in the HRS (Ref. 1, Section 3.2.3), the Hazardous Waste Quantity Factor Value of 100 was multiplied by the highest Toxicity/Mobility Value of 1,000, resulting in a product of 100,000. Based on this product, a Waste Characteristics Factor Category Value of 18 was assigned from Table 2-7 of the HRS (Ref. 1, Section 2.4.3.1).

The Toxicity/Mobility Factor Value for TCE and cis-1,2-DCE, which have the highest Toxicity/Mobility Factor Value of the substances listed in Section 3.2.1 of this HRS Documentation Record, is:

Toxicity/Mobility Factor Value: 1,000
Hazardous Waste Quantity Factor Value: 100

Hazardous Waste Quantity Factor Value: 100,000

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

3.3 GROUND WATER PATHWAY TARGETS

The Wheeler Avenue Treatment Plant receives water from the four (4) Ranney Wells and four (4) other municipal wells, and it feeds drinking water to 60 percent of the 58,000 people served by the Anderson Water Department (Refs. 4, p. 45; 58, p. 2; 68, p. 1). Municipal wells Ranney Well #1, Ranney Well #2, Ranney Well #4, Ranney Well #5, Norton Well #1, Norton Well #2, Elder Well #1 and Elder Well #2 are the only sources of water feeding into the Wheeler Avenue Treatment Plant (Ref. 68, p. 1). Ranney Well #1 is subject to Level I contamination (see Level I Contaminated Ground Water from Public Wells Sample Table of this HRS Documentation Record). The concentration of TCE in Ranney Well #1 is above the cancer risk screening concentration health based benchmark for TCE in drinking water, which is 1.1 µg/L. As such, populations that use Ranney Well #1 are subject to Level I hazardous substance concentrations. The table below depicts the municipal well that is subject to Level I contamination.

Table N1
Level I Groundwater Samples from Municipal Wells

EPA CLP ID #	Municipal Well ID	Hazardous Substance	Hazardous Substance Concentration	Benchmark Concentration (µg/L)	Benchmark*	Reference
E2T72	Ranney Well #1	TCE	7.1	1.1	Cancer Risk	Ref. 2, p. 18; Contaminated Ground Water from Ranney Municipal Wells Sample Table of this HRS Documentation Record
E2T73	Ranney Well #1	TCE	7.0	1.1	Cancer Risk	Ref. 2, p. 18; Contaminated Ground Water from Ranney Municipal Wells Sample Table of this HRS Documentation Record

*As specified in Ref. 1, Section 2.5.2, the lowest applicable benchmark concentration for each substance was applied.

3.3.1 Nearest Well

Well ID: Ranney Well #1 (groundwater samples E2T72 and E2T73)
Level of Contamination (I, II, or potential): I
If potential contamination, distance from source in miles: N/A

As stated above, Ranney Well #1 municipal well is subject to Level I contamination (see Level I Contaminated Ground Water from Public Wells Sample Table of this HRS Documentation Record).

As specified in the HRS (Ref. 1, Section 3.3.1, Table 3-11), if one or more drinking water wells are subject to Level I concentrations, a Nearest Well Factor Value of 50 is assigned. Level I TCE concentrations have been documented in the groundwater of Ranney Well #1 (see Sections 3.1.1 and 3.3 of this HRS Documentation Record).

Nearest Well Factor Value: 50
(Ref. 1, Table 3-11)

3.3.2 Population

3.3.2.1 Level of Contamination

3.3.2.2 Level I Concentrations

The Ranney wells operate daily and are manifold at the Wheeler Avenue Treatment Plant prior to distribution (Ref. 4, p. 46). The water from Ranney Well #1, Ranney Well #4 and Ranney Well #5 is combined (manifolded) with the water from one (1) additional Ranney well (Ranney Well #2) and four (4) other municipal wells (Refs. 4, pp. 15, 17-18, 46; 68, p. 1). The Wheeler Avenue Treatment Plant produces about 60% of the city's daily water (Ref. 4, p. 45). According to the 2010 US census, there are 56,129 people in the City of Anderson, Indiana (Ref. 57, p. 1). However, State of Indiana water system records indicate that the current population served by the Anderson Water Department is 58,000 (Ref. 58, p. 2); therefore, this is the value used to determine the population target values.

HRS Section 3.3.2 states, "assume each well and intake contributes equally and apportion the population accordingly, except: if the relative contribution of any one well or intake exceeds 40 percent" (Ref. 1, Section 3.3.2).

The table below lists the wells that supply water to the Wheeler Avenue Treatment Plant and the capacity for each well. The relative contribution of each well does not appear to show that any one well contributes more than 40 percent. As stated in Section 3.3, all of the wells listed in this table are the only wells that supply water to the Wheeler Avenue Treatment Plant.

Table O1
Well Capacity

Well ID	Well Capacity (GPM)	References
1R (Ranney Well #1)	1,667	Refs. 20, p. 3; 68, p. 1
2R (Ranney Well #2)	2,847	Refs. 20, p. 3; 68, p. 1
4R (Ranney Well #4)	1,111	Refs. 20, p. 3; 68, p. 1
5R (Ranney Well #5)	1,319	Refs. 20, p. 3; 68, p. 1
1N (Norton Well #1)	385	Refs. 20, p. 3; 68, p. 1
2N (Norton Well #2)	385	Refs. 20, p. 3; 68, p. 1
1E (Elder Well #1)	1,000	Refs. 20, p. 3; 68, p. 1
2E (Elder Well #2)	1,000	Refs. 20, p. 3; 68, p. 1

GPM = Gallons per minute

Therefore, the HRS dictates that the population be distributed equally among the wells (Ref. 1, Section 3.3.2).

The following example depicts how the population was calculated for each well.

Example Calculation: for each Ranney Well

The Wheeler Avenue Treatment Plant provided drinking water to 60 percent of the 58,000 people served by the Anderson Water Department (Refs. 4, p. 45; 58, p. 2; 88, p 1). Sixty percent (60%) of population served is 34,800 (Ref. 4, p. 45).

Therefore 34,800 divided by 8 equals 4,350 people per well.

Table P1
Population Served by Each Well That Supplies Water to the Wheeler Avenue Treatment Plant

Well ID	**Number of People Served**
Ranney Well #1	4,350
Ranney Well #2	4,350
Ranney Well #4	4,350
Ranney Well #5	4,350
Norton Well #2	4,350
Norton Well #1	4,350
Elder Well #1	4,350
Elder Well #2	4,350
Total Population served from the above listed wells	**34,800**

Municipal Wells Ranney Well #1 is considered Level I.
The Population Served by Level I Ranney Well #1 is 4,350 people.

Therefore, Level I Concentration Factor Value is determined by multiplying this value by 10 (see HRS, Section 3.3.2.2).

4,350 times 10 = 43,500

Level I Concentrations Factor Value: 43,500

3.3.2.3 Level II Concentrations

There are no wells in which observed releases were established that are evaluated as Level II contamination.

Table Q1
Level II Contaminated Groundwater Samples from Public Wells

EPA CLP#	Date	Location	Depth Below Ground Surface	Hazardous Substance	Hazardous Substance Concentration µg/L	CRQL µg/L	Reference
NS	NS	NS	NS	NS	NS	NS	NS

NS - Not Scored

Level II Concentrations Factor Value: NS

3.3.2.4 Potential Contamination

As stated in Section 3.3.2.2, the population served by the Wheeler Avenue Treatment Plant is distributed equally among each of the eight (8) wells in the well field. Therefore 34,800 divided by 8 equals 4,350 people per well. The following table depicts the distances from Ranney Well #1 (the source) to each potential well and the population served by each of the potentially contaminated wells (see Figure 7 of this HRS Documentation Record). In addition, the table shows the value assigned for the potential well according to Table 3-12 of the HRS Rule (Ref. 1, p. 78).

Table R1
Potentially Contaminated Wells and Population Relevant to Ranney Well #1

Distance	Name of Potential Well(s)	Population Served	Value Assigned (HRS Table 3-12)*	References
0-1/4 Mile	Elder Well #1, Elder Well #2, Ranney Well #2	4,350 times 3 = 13,050	16,325	Ref. 1, Table 3-12; Figure 7
>¼ -1/2 Mile				
>½ - 1 Mile				
>1 – 2 Miles	Norton Well #1, Norton Well #2, Ranney Well # 4, Ranney Well #5	4,350 times 4 = 17,400	2,939	Ref. 1, Table 3-12; Figure 7
>2 - 3 Miles				
>3 - 4 Miles				
Total Score			**19,264**	

*Other than karst

The total assigned values = 19,264
17,264 times 0.1 = 1,926.4

Potential Contamination Factor Value: 1,926
[rounded to the nearest integer (Ref. 1, Section 3.3.2.4)]

3.3.3 Resources

Resource use of the combined aquifers within the target distance limit does not include any documented Resource Factors. Therefore, a Resource Factor value of 0 is assigned (Ref. 1, Section 3.3.3).

Resources Factor Value: 0

3.3.4 Wellhead Protection Area

The groundwater plume lies within the WHPA (Refs. 10, p. 17; 5, pp. 46, 52; Figures 2 and 4 of this HRS Documentation Record). Indiana's WHPAs and the Anderson, Indiana WHPA are designated by the U.S. EPA in accordance with Section 1428 of the Safe Drinking Water Act (Ref. 59, p. 1). Therefore, the Wellhead Protection Area Factor Value of 20 is assigned (Ref. 1, Section 3.3.4).

Wellhead Protection Area Factor Value: 20

Scores for Ranney Well #1

Air Pathway	Not Scored
Ground Water Pathway	100.00
Soil Exposure Pathway	Not Scored
Surface Water Pathway	Not Scored
HRS SITE SCORE	**50.00**

Attachment 2
HRS Scoring and Target Information Showing That Ranney Well #4 Plume Will Score above 28.50

WORKSHEET FOR COMPUTING HRS SITE SCORE
For Ranney Well #4 Plume

		S	S^2
1.	Ground Water Migration Pathway Score (S_{gw})	100.00	10,000
2a.	Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	NS*	
2b.	Ground Water to Surface Water Migration Component (from Table 4-25, line 28)	NS	
2c.	Surface Water Migration Pathway Score (S_{sw}) Enter the larger of lines 2a and 2b as the pathway score.	NS	
3.	Soil Exposure and Subsurface Intrusion Pathway Score (S_{sessi}) (from Table 5-1, line 22)	NS	
4.	Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	NS	
5.	Total of $S_{gw}^2 + S_{sw}^2 + S_{sessi}^2 + S_a^2$		10,000
6.	**HRS Site Score** Divide the value on line 5 by 4 and take the square root		50.00

Notes: *NS = Not Scored

HRS Table 3-1
Ground Water Migration Pathway Scoresheet for Ranney Well #4 Plume

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 x (2b + 2c + 2d)]	500	NS
5. Likelihood of Release (higher of lines 1 and 2e)	550	550
Waste Characteristics:		
4. Toxicity/Mobility	(a)	10,000
5. Hazardous Waste Quantity	(a)	100
6. Waste Characteristics	100	32
Targets:		
7. Nearest Well	50	50
8. Population:		
8a. Level I Concentrations	(b)	43,500
8b. Level II Concentrations	(b)	NS
8c. Potential Contamination	(b)	1,138
8d. Population (lines 8a + 8b + 8c)	(b)	44,638
9. Resources	5	0
10. Wellhead Protection Area	20	20
11. Targets (lines 7 + 8d + 9 + 10)	(b)	44,708
Ground Water Migration Score For An Aquifer:		
12. Aquifer Score [(lines 3 x 6 x 11)/82,500][c] 550 x 32 x 44,708 = 786,860,800/82,500 = 9,537.70667	100	100.00
Ground Water Migration Pathway Score:		
15. Pathway Score (S_{gw}), (highest value from line 12 for all aquifers evaluated)[c]	100	100.00

(a) Maximum value applies to waste characteristics category

3.1 LIKELIHOOD OF RELEASE

3.1.1 Observed Release

Aquifer Being Evaluated: The interconnected Bluffton/New Castle/Tipton Complex Aquifer System/White River and Tributaries Outwash Aquifer System and Silurian and Devonian Carbonates Aquifers System hydrologic unit

Establishing an observed release by chemical analysis requires analytical evidence of a hazardous substance in the media significantly above background level. Further, some portion of the release must be attributable to the site (Ref. 1, Section 2.3). If the background concentration is not detected (or is less than the detection limit), an observed release is established when the sample measurement equals or exceeds its own Sample Quantitation Limit (SQL) and that of the background sample. If the SQL cannot be established, the U.S. EPA Contract-Required Quantitation Limit (CRQL) is used in place of the SQL (Ref. 1, Table 2-3).

Chemical Analysis

In July 2014, as part of the SI, IDEM Site Investigation Program staff collected a total of twenty-seven (27) groundwater samples, including three (3) duplicate samples, four (4) background samples, and one (1) equipment blank (Ref. 4, p. 22). In July 2015, as part of the ESI, IDEM Site Investigation Program staff collected a total of fifteen (15) groundwater samples, consisting of ten (10) groundwater samples, two (2) duplicate samples, and three (3) trip blanks (Ref. 3, p. 21). The groundwater samples collected included the prescribed Quality Assurance/Quality Control (QA/QC) samples and were analyzed at an EPA Contract Laboratory Program lab. Analyses included CLP SOW SOM01.2 (Trace Volatiles) for the SI data and CLP SOW SOM02.2 (Trace Volatiles) for the ESI data for VOCs (Refs. 3, p. 116; 4, pp. 23, 456). For scoring purposes, however, only the municipal well samples collected as part of the 2014 SI are used to document the likelihood of release at this site.

Background Concentrations

The groundwater from Ranney Well #2 is considered a background groundwater sample to establish background levels to document an observed release in Ranney Well #4. This sample was obtained during the July 2014 SI sampling activities. The table below, Background Ground Water Sample Table, depicts the EPA CLP Identification #, date, location, depth, hazardous substance, CRQL, and references for the sample. The samples were collected from the Bluffton/New Castle/Tipton Complex Aquifer System/White River and Tributaries Outwash Aquifer System aquifer, which, for simplicity, is referred to as the SG (sand and gravel) aquifer matrix in the table (Refs. 4, pp. 16-17; 77; Figure 2 of this HRS documentation record).

This sample was obtained from equivalent geologic materials (sand and gravel) and near the same depths to the contaminated wells (Ref. 80, p. 1)

Table I2
Background Groundwater Samples Obtained from Municipal Well Ranney Well #2

EPA CLP ID #	Date	Location	Depth Below Ground Surface/ Aquifer Matrix	Hazardous Substance	Hazardous Substance Concentration (µg/L)	CRQL (µg/L)	Reference
E2T77	7/21/14	Ranney Well #2 (Municipal Well)	31.8-35 feet*	Cis-1,2-DCE TCE VC	0.5 U 0.5 U 0.5 U	0.5 0.5 0.5	Refs. 4, pp. 16-17, 90, 455-464, 477-478, 541, 593-595; 52, p. 3; Figure 4 of this HRS Documentation Record

SG - Sand and Gravel
U – The analyte was analyzed for, but was not detected above the reported sample quantitation limit (Ref. 4, p. 464).

* The range depth of the aquifer was calculated by subtracting the elevation of the shallow and deepest lateral of the Ranney #2 well (804.2 – 801.0 feet) from the ground elevation (836.0 feet) (Ref. 45, pp. 4, 41). The range difference is 31.8-35 feet

Contaminated Samples

From July 21, 2014 through July 25, 2014, IDEM's Site Investigation Program conducted an SI at the Broadway Street Corridor Groundwater Contamination site (Ref. 4, pp. 1, 22). The groundwater collected from some of the municipal wells within the Ranney wellfield during the SI was found to be contaminated with chlorinated VOCs (see Sections 3.1.1 and 3.3.2.2 of this HRS Documentation Record).

The groundwater plume is depicted by a groundwater sample obtained from Ranney Well #4 (see Figure 2 of this HRS Documentation Record). The extent of this plume has not been completely delineated at this time but has been investigated with municipal wells and direct push methods data (see Section 3.1.1 and Figure 2 of this HRS Documentation Record).

The following table depicts the samples that meet the observed release criteria (Ref. 1, Table 2-3). This table lists the organic hazardous substances with their concentrations and CRQLs for each sample. The location is depicted on Figure 2 of this HRS Documentation Record. All groundwater samples collected from the Ranney wells were obtained from the same portion of the aquifer as evidenced by the similar well depths (see Tables I2 and J2 of this HRS Documentation Record).

Table J2
Contaminated Groundwater Samples from Ranney Municipal Well #4

EPA CLP ID #	Date	Well Name	Depth Below Ground Surface/ Aquifer Matrix	Hazardous Substance	Hazardous Substance Concentration (µg/L)	CRQL (µg/L)	Reference
E2T76	7/21/14	Ranney Well #4	32 - 33.9 feet** / SG	TCE Cis-1,2-DCE VC	1.7 5.1 1.3	0.5 0.5 0.5	Refs. 4, pp. 16-17, 90, 455-464, 475- 476, 541, 590-592; 52, p. 4

SG Sand and Gravel
CRQL Contract Required Quantitation Limit
** The depth of the aquifer was calculated by subtracting the elevation of the shallow and deepest lateral of the Ranney #4 well (803.8 - 801.9 feet) from the ground elevation (835.8 feet) (Ref. 45, pp. 4, 41). The range difference is 32 - 33.9 feet.

Table K2
Level I Ground Water Samples from Municipal Wells

EPA CLP ID #	Municipal Well ID	Hazardous Substance	Hazardous Substance Concentration (µg/L)	Benchmark Concentration (µg/L)	Benchmark*	Reference
E2T76	Ranney Well #4	TCE VC	1.7 1.3	1.1 0.021	Cancer Risk Cancer Risk	Ref. 2, pp. 18, 22; Contaminated Ground Water from Ranney Municipal Wells Sample Table of this HRS Documentation Record

*As specified in HRS Section 2.5.2, the lowest applicable benchmark concentration for each substance was applied.

Attribution:

The Broadway Street Corridor Groundwater Contamination site – Ranney Well #4 has a documented release of TCE, cis-1,2-DCE, and VC to the groundwater that has contaminated one (1) active municipal wells (see Contaminated Ground Water from Ranney Municipal Wells Sample Table of this HRS Documentation Record).

The compounds found in this well are manufactured chemicals, not thought to occur naturally, and non-detected concentrations in a background well show that they are not ubiquitous throughout the region (Refs. 63, p. 1; 64, p. 1; 65, p. 1; Table I2 of this HRS documentation record). Chlorinated solvents (e.g., 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 and VC are common breakdown products of PCE and TCE (Refs. 61, p. 1; 62, p. 1; 63, p. 1, 64, p. 1; 81, p. 1; 83, p. 1; 84, p. 2). The Broadway Street Corridor Groundwater Contamination site - Ranney Well #4

is located in a heavily developed area consisting of industrial, commercial, and residential land, where a variety of past industrial and commercial activities could have resulted in the groundwater contamination (Refs. 4, pp. 72-73; 69; 85, p. 6).

During the SI and ESI, staff conducted an extensive level of effort by searching IDEM, county, and EPA records to identify possible sources of groundwater contamination. Staff also collected direct push groundwater grab samples and subsurface soil samples on the properties of or downgradient from facilities within the WHP areas that were thought to be associated with contaminants of concern (Refs. 44, p.1; 69, pp. 1- 7). Based on the efforts during the SI and ESI, there is insufficient evidence to attribute the groundwater contamination in Ranney Well #1, Ranney Well #4, and Ranney Well #5 municipal wells to sources at nearby facilities. Refer to Reference 69 and its supporting references, which include References 3; 4; 5; 6; 7; 8; 12; 13; ;14; 15; 16; 18; 19; 21; 22; 23; 24; 25; 26; 27; 28; 29; 30; 31; 32; 33; 34; 35; 36; 37; 38; 39; 40; 41; 42; 43; 44; 45; 46; 48; 49; 50; 51; 52; 53; 54; 55; 56; 58; 81; 83; 84; 85; 86; and 87, for a detailed summary of the level of effort and determining any attribution associated with facilities and the samples collected.

Hazardous Substances Released (Section 3.1.1 of this HRS Documentation Record)

- TCE
- Cis-1,2-DCE
- VC

Groundwater Observed Release Factor Value: 550

3.2 WASTE CHARACTERISTICS

3.2.1 Toxicity/Mobility

The following table, Toxicity/Mobility Table, depicts the toxicity, mobility and combined toxicity/mobility factor values that have been assigned to those substances present in the observed release and have a containment value greater than 0 (Ref. 1, Sections 2.2.3, 3.2.1).

Table L2
Toxicity/Mobility

Hazardous Substance	Source No. (and/or Observed Release)	Toxicity Factor Value	Mobility Factor Value*	Does Hazardous Substance meet Observed Release by chemical analysis? (Y/N)	Toxicity/ Mobility (Ref. 1, Table 3-9)	References
cis-1,2-DCE	2, Observed Release	1,000	1	Y	1,000	Ref. 1a, Section 2.4.1.1; Ref. 2, p. 6
TCE	2, Observed Release	1,000	1	Y	1,000	Ref. 1a, Section 2.4.1.1; Ref. 2, p. 18

Hazardous Substance	Source No. (and/or Observed Release)	Toxicity Factor Value	Mobility Factor Value*	Does Hazardous Substance meet Observed Release by chemical analysis? (Y/N)	Toxicity/ Mobility (Ref. 1, Table 3-9)	References
VC	2, Observed Release	10,000	1	Y	10,000	Ref. 1a, Section 2.4.1.1; Ref. 2, p. 22

*All hazardous substances that meet the criteria for an observed release by chemical analysis to one or more aquifers, regardless of the aquifer being evaluated, are assigned a mobility factor value of 1 (Ref. 1, Section 3.2.1.2).

The hazardous substance with the highest toxicity/mobility factor value available to the groundwater migration pathway is vinyl chloride (10,000).

Toxicity/Mobility Factor Value: 10,000
(Ref. 1, Table 3-9)

Table M2

3.2.2 Hazardous Waste Quantity Source No.	Source Type	Source Hazardous Waste Quantity
2 (Ranney Well #4)*	Other	Unknown, but >0

* See section 2.2 of this HRS Documentation Record for the source characteristics description.

Sum of Values: Unknown but >0, rounded to 1 (Ref. 1, Section 2.4.2.2, Table 2-6).

The Broadway Street Corridor Groundwater Contamination site – Ranney Well #4 has been scored as consisting of a groundwater plumes with no identified sources. According to Section 2.4.2.2 in the HRS (Ref. 1), if any target for that migration pathway is subject to Level I or Level II concentrations and the hazardous constituent quantity is not adequately determined, assign a value from HRS Table 2-6 or a value of 100 whichever is greater, as the hazardous waste quantity factor value for that pathway. Because Level I concentrations were present in a drinking water well (see Sections 3.1.1 and 3.3 of this HRS Documentation Record), a hazardous waste quantity factor value of 100 is assigned for the groundwater pathway.

Hazardous Waste Quantity Factor Value: 100
(Ref. 1, Section 2.4.2.4 and Table 2-6)

3.2.3 Waste Characteristics Factor Category Value

As specified in the HRS (Ref. 1, Section 3.2.3), the Hazardous Waste Quantity Factor Value of 100 was multiplied by the highest Toxicity/Mobility Value of 10,000, resulting in a product of 1,000,000. Based on this product, a Waste Characteristics Factor Category Value of 32 was assigned from Table 2-7 of the HRS (Ref. 1, Section 2.4.3.1).

The Toxicity/Mobility Factor Value for VC, which has the highest Toxicity/Mobility Factor Value of the substances listed in Section 3.2.1 of this HRS Documentation Record, is:

Toxicity/Mobility Factor Value: 10,000
Hazardous Waste Quantity Factor Value: 100

Hazardous Waste Quantity Factor Value: 1,000,000

Waste Characteristics Factor Category Value: 32
(Ref. 1, Table 2-7)

3.3 GROUND WATER PATHWAY TARGETS

The Wheeler Avenue Treatment Plant receives water from four (4) Ranney Wells and four (4) other municipal wells, and it feeds drinking water to 60 percent of the 58,000 people served by the Anderson Water Department (Refs. 4, p. 45; 58, p. 2; 68, p. 1). Municipal wells Ranney Well #1, Ranney Well #2, Ranney Well #4, Ranney Well #5, Norton Well #1, Norton Well #2, Elder Well #1 and Elder Well #2 are the only sources of water feeding into the Wheeler Avenue Treatment Plant (Ref. 68, p. 1). Ranney Well #4 is subject to Level I contamination (see Level I Contaminated Ground Water from Public Wells Sample Table of this HRS Documentation Record). The concentrations of VC and TCE in Ranney Well #4 are above the cancer risk screening concentration health based benchmarks for VC and TCE in drinking water, which are 2.1×10^{-2} µg/L and 1.1 µg/L, respectively. As such, populations that use wells Ranney Well #4 are subject to Level I hazardous substance concentrations. The table below depicts the municipal well that is subject to Level I contamination.

Table N2
Level I Groundwater Samples from Municipal Wells

EPA CLP ID #	Municipal Well ID	Hazardous Substance	Hazardous Substance Concentration (µg/L)	Benchmark Concentration (µg/L)	Benchmark*	Reference
E2T76	Ranney Well #4	TCE VC	1.7 1.3	1.1 0.021	Cancer Risk Cancer Risk	Ref. 2, pp. 18, 22; Contaminated Ground Water from Ranney Municipal Wells Sample Table of this HRS Documentation Record

*As specified in Ref. 1, Section 2.5.2, the lowest applicable benchmark concentration for each substance was applied.

3.3.1 Nearest Well

Well ID: Ranney Well #4 (groundwater sample E2T76),
Level of Contamination (I, II, or potential): I
If potential contamination, distance from source in miles: N/A

As stated above, Ranney Well #4 municipal well is subject to Level I contamination (see Level I Contaminated Ground Water from Public Wells Sample Table of this HRS Documentation Record).

As specified in the HRS (Ref. 1, Section 3.3.1, Table 3-11), if one or more drinking water wells are subject to Level I concentrations, a Nearest Well Factor Value of 50 is assigned. Level I VC and TCE concentrations have been documented in the groundwater of Ranney Well #4 (see Sections 3.1.1 and 3.3 of this HRS Documentation Record).

Nearest Well Factor Value: 50
(Ref. 1, Table 3-11)

3.3.2 Population

3.3.2.1 Level of Contamination

3.3.2.2 Level I Concentrations

The Ranney wells operate daily and are manifold at the Wheeler Avenue Treatment Plant prior to distribution (Ref. 4, p. 46). The water from Ranney Well #1, Ranney Well #4, and Ranney Well #5 is combined (manifolded) with the water from one (1) additional Ranney well (Ranney Well #2) and four (4) other municipal wells (Refs. 4, pp. 15, 16-17, 46; 68, p. 1). The Wheeler Avenue Treatment Plant produces about 60% of the city's daily water (Ref. 4, p. 45). According to the 2010 US census, there are 56,129 people in the City of Anderson, Indiana (Ref. 57, p. 1). However, State of Indiana water system records indicate that the current population served by the Anderson Water Department is 58,000 (Ref. 58, p. 2); therefore, this is the value used to determine the population target values.

HRS Section 3.3.2 states, "assume each well and intake contributes equally and apportion the population accordingly, except: if the relative contribution of any one well or intake exceeds 40 percent" (Ref. 1, Section 3.3.2).

The table below lists the eight (8) wells that supply water to the Wheeler Avenue Treatment Plant and the capacity for each well. The relative contribution of each well does not appear to show that any one well contributes more than 40 percent. As stated in Section 3.3, all of the wells listed in this table are the only wells that supply water to the Wheeler Avenue Treatment Plant.

Table O2
Well Capacity

Well ID	Well Capacity (GPM)	Reference
1R (Ranney Well #1)	1,667	Ref. 20, p. 3
2R (Ranney Well #2)	2,847	Ref. 20, p. 3
4R (Ranney Well #4)	1,111	Ref. 20, p. 3
5R (Ranney Well #5)	1,319	Ref. 20, p. 3
1N (Norton Well #1)	385	Ref. 20, p. 3
2N (Norton Well #2)	385	Ref. 20, p. 3
1E (Elder Well #1)	1,000	Ref. 20, p. 3
2E (Elder Well #2)	1,000	Ref. 20, p. 3

GPM = Gallons per minute.

Therefore, the HRS dictates that the population be distributed equally among the wells (Ref. 1, Section 3.3.2).

The following example depicts how the population was calculated for each well.

Example Calculation: for each Ranney Well

The Wheeler Avenue Treatment Plant provided drinking water to 60 percent of the 58,000 people served by the Anderson Water Department (Refs. 4, p. 45; 58, p. 2; 88, p. 1). Sixty percent (60%) of population served is 34,800 (Ref. 4, p. 45).

Therefore 34,800 divided by 8 equals 4,350 people per well.

Table P2
Population Served by Each Well That Supplies Water to the Wheeler Avenue Treatment Plant

Municipal Well ID	Number of People Served
Ranney Well #1	4,350
Ranney Well #2	4,350
Ranney Well #4	4,350
Ranney Well #5	4,350
Norton Well #1	4,350
Norton Well #2	4,350
Elder Well #1	4,350
Elder Well #2	4,350
Total Population served from the above listed wells	**34,800**

Municipal Well Ranney Well #4 is considered Level I.
The Population Served by Level I Ranney Well #4 municipal well is 4,350 people.

Therefore, Level I Concentration Factor Value is determined by multiplying this value by 10 (see Ref. 1, Section 3.3.2.2).
4,350 times 10 = 43,500

Level I Concentrations Factor Value: 43,500

3.3.2.3 Level II Concentrations

There are no wells in which observed releases were established that are evaluated as Level II contamination.

Table Q2
Level II Contaminated Groundwater Samples from Public Wells

EPA CLP#	Date	Location	Depth Below Ground Surface	Hazardous Substance	Hazardous Substance Concentration µg/L	CRQL µg/L	Reference
NS	NS	NS	NS	NS	NS	NS	NS

NS - Not Scored

Level II Concentrations Factor Value: NS

3.3.2.4 Potential Contamination

As stated in Section 3.3.2.2, the population served by the Wheeler Avenue Treatment Plant is distributed equally among each of the eight (8) wells in the well field. Therefore, 34,800 divided by 8 equals 4,350 people per well. The following table depicts the distances from Ranney Well #4 (a source) to each of the potential wells and the population served by each of the potentially contaminated wells. In addition, the table shows the value assigned for the potential well according to Table 3-12 of the HRS (Ref. 1, Table 3-12).

Table R2
Potentially Contaminated Wells and Population Relevant to Ranney Well #4

Distance	Name of Potential Well(s)	Population Served	Value Assigned from HRS Table 3-12*	References
0-1/4 Mile	Ranney Well #5	4,350	5,214	Ref. 1, Table 3-12; Figure 8
>¼ -1/2 Mile				
>½ - 1 Mile	Elder Well #1, Elder Well #2, Ranney Well #2, Norton Well #1, Norton Well #2	4,350 times 5 = 21,750	5,224	Ref. 1, Table 3-12; Figure 8
>1 – 2 Miles	Ranney Well #1	4,350	939	Ref. 1, p. 78; Figure 8
>2 - 3 Miles				
>3 - 4 Miles				
Total			**11,377**	

* Other than karst.

The total assigned values = 11,377

11,377 times 0.1 = 1,137.7

Potential Contamination Factor Value: 1,138
[rounded to the nearest integer (Ref. 1, Section 3.3.2.4)]

3.3.3 Resources

Resource use of the combined aquifers within the target distance limit does not include any documented Resource Factors. Therefore, a Resource Factor value of 0 is assigned (Ref. 1, Section 3.3.3).

Resources Factor Value: 0

3.3.4 Wellhead Protection Area

The groundwater plume lies within the WHPA (Refs. 10, p. 17; 5, pp. 46, 52; Figures 2 and 4 of this HRS Documentation Record). Indiana's WHPAs and the Anderson, Indiana WHPA are designated by the U.S. EPA in accordance with Section 1428 of the Safe Drinking Water Act (Ref. 59, p. 1). Therefore, the Wellhead Protection Area Factor Value of 20 is assigned (Ref. 1, Section 3.3.4).

Wellhead Protection Area Factor Value: 20

Scores for Ranney Well #4

Air Pathway	Not Scored
Ground Water Pathway	100.00
Soil Exposure Pathway	Not Scored
Surface Water Pathway	Not Scored
HRS SITE SCORE	**50.00**

Attachment 3
HRS Scoring and Target Information Showing That Ranney Well #5 Plume Will Score above 28.50

WORKSHEET FOR COMPUTING HRS SITE SCORE
For Ranney Well #5 Plume

		S	S^2
1.	Ground Water Migration Pathway Score (S_{gw})	100.00	10,000
2a.	Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	NS*	
2b.	Ground Water to Surface Water Migration Component (from Table 4-25, line 28)	NS	
2c.	Surface Water Migration Pathway Score (S_{sw}) Enter the larger of lines 2a and 2b as the pathway score.	NS	
3.	Soil Exposure and Subsurface Intrusion Pathway Score (S_{sessi}) (from Table 5-1, line 22)	NS	
4.	Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	NS	
5.	Total of $S_{gw}^2 + S_{sw}^2 + S_{sessi}^2 + S_a^2$		10,000
6.	**HRS Site Score** Divide the value on line 5 by 4 and take the square root		50.00

Notes: *NS = Not Scored

HRS Table 3-1
Ground Water Migration Pathway Scoresheet for Ranney Well #5 Plume

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 x (2b + 2c + 2d)]	500	NS
6. Likelihood of Release (higher of lines 1 and 2e)	550	550
Waste Characteristics:		
4. Toxicity/Mobility	(a)	100
5. Hazardous Waste Quantity	(a)	100
6. Waste Characteristics	100	10
Targets:		
7. Nearest Well	50	50
8. Population:		
8a. Level I Concentrations	(b)	43,500
8b. Level II Concentrations	(b)	NS
8c. Potential Contamination	(b)	2,093
8d. Population (lines 8a + 8b + 8c)	(b)	45,593
9. Resources	5	0
10. Wellhead Protection Area	20	20
11. Targets (lines 7 + 8d + 9 + 10)	(b)	45,663
Ground Water Migration Score For An Aquifer:		
12. Aquifer Score [(lines 3 x 6 x 11)/82,500][c] 550 x 10 x 45,663 = 251,146,500/82,500 = 3,044.2	100	100.00
Ground Water Migration Pathway Score:		
16. Pathway Score (S_{gw}), (highest value from line 12 for all aquifers evaluated)[c]	100	100.00

(a) Maximum value applies to waste characteristics category
(b) Maximum value not applicable
[c] Do not round to nearest integer
NS - Not Scored

3.1 LIKELIHOOD OF RELEASE

3.1.1 Observed Release

Aquifer Being Evaluated: The interconnected Bluffton/New Castle/Tipton Complex Aquifer System/White River and Tributaries Outwash Aquifer System and Silurian and Devonian Carbonates Aquifers hydrologic unit

Establishing an observed release by chemical analysis requires analytical evidence of a hazardous substance in the media significantly above background level. Further, some portion of the release must be attributable to the site (Ref. 1, Section 2.3). If the background concentration is not detected (or is less than the detection limit), an observed release is established when the sample measurement equals or exceeds its own Sample Quantitation Limit (SQL) and that of the background sample. If the SQL cannot be established, the U.S. EPA Contract-Required Quantitation Limit (CRQL) is used in place of the SQL (Ref. 1, Table 2-3).

Chemical Analysis

In July 2014, as part of the SI, IDEM Site Investigation Program staff collected a total of twenty-seven (27) groundwater samples, including three (3) duplicate samples, four (4) background samples, and one (1) equipment blank (Ref. 4, p. 22). In July 2015, as part of the ESI, IDEM Site Investigation Program staff collected a total of fifteen (15) groundwater samples, consisting of ten (10) groundwater samples, two (2) duplicate samples, and three (3) trip blanks (Ref. 3, p. 21). The groundwater samples collected included the prescribed Quality Assurance/Quality Control (QA/QC) samples and were analyzed at an EPA Contract Laboratory Program lab. Analyses included CLP SOW SOM01.2 (Trace Volatiles) for the SI data and CLP SOW SOM02.2 (Trace Volatiles) for the ESI data for VOCs (Refs. 3, p. 116; 4, pp. 23, 456). For scoring purposes, however, only the municipal well samples collected as part of the 2014 SI are used to document the likelihood of release at this site.

Background Concentrations

The groundwater from Ranney Well #2 is considered a background groundwater sample to establish background levels to document as observed release in Ranney Well #5 This sample was obtained during the July 2014 SI sampling activities. The table below, Background Ground Water Sample Table, depicts the EPA CLP Identification #, date, location, depth, hazardous substance/concentration, CRQL, and references for the sample. The sample was collected from the Bluffton/New Castle/Tipton Complex Aquifer System/White River and Tributaries Outwash Aquifer System, which is referred to as the SG (sand and gravel) aquifer matrix in the table (Refs. 4, pp. 16-17; 77; Figure 2 of this HRS documentation record).

This sample was obtained from equivalent geologic materials (sand and gravel) and near the same depths to the contaminated wells (Ref. 80, p. 1).

Table I3
Background Groundwater Samples Obtained from Municipal Well Ranney Well #2

EPA CLP ID #	Date	Location	Depth Below Ground Surface/ Aquifer Matrix	Hazardous Substance	Hazardous Substance Concentration (µg/L)	CRQL (µg/L)	Reference
E2T77	7/21/14	Ranney Well #2 (Municipal Well)	31.8-35 feet/ SG*	PCE	0.5 U	0.5	Refs. 4, pp. 16-17, 90, 455-464, 477-478, 541, 593-595; 52, p. 3; Figure 4 of this HRS Documentation Record

SG - Sand and Gravel
U – The analyte was analyzed for, but was not detected above the reported sample quantitation limit (Ref. 4, p. 464).

* The range depth of the aquifer was calculated by subtracting the elevation of the shallow and deepest lateral of Ranney Well #2 (804.2 – 801.0 feet) from the ground elevation (836.0 feet) (Ref. 45, pp. 4, 41). The range difference is 31.8-35 feet.

Contaminated Samples

From July 21, 2014 through July 25, 2014, IDEM's Site Investigation Program conducted an SI at the Broadway Street Corridor Groundwater Contamination site (Ref. 4, pp. 1, 22). The groundwater collected from some of the municipal wells within the Ranney wellfield during the SI was found to be contaminated with chlorinated VOCs (see Sections 3.1.1 and 3.3.2.2 of this HRS Documentation Record).

The groundwater plume is depicted by groundwater samples obtained from Ranney Well #5 (see Figure 2 of this HRS Documentation Record). The extent of this plume has not been completely delineated at this time but has been investigated with municipal wells and direct push methods data (see Section 3.1.1 and Figure 2 of this HRS Documentation Record).

The following table depicts the samples that meet the observed release criteria (Ref. 1, Table 2-3). This table lists the organic hazardous substances with their concentrations and CRQLs for each sample. The locations are depicted on Figure 2 of this HRS Documentation Record. All groundwater samples collected from the Ranney wells were obtained from the same portion of the aquifer as evidenced by the similar well depths (see Table I3 and J3 of this HRS documentation record).

Table J3
Contaminated Groundwater Samples from Ranney Municipal Well #5

EPA CLP ID #	Date	Well Name	Depth Below Ground Surface/ Aquifer Matrix	Hazardous Substance	Hazardous Substance Concentration (µg/L)	CRQL (µg/L)	Reference
E2T84	7/21/14	Ranney Well #5	43.5 – 48 feet***/ SG	PCE	5.4	0.5	Refs. 4, pp. 16-17, 493-495, 615-617; 45, p. 1; 52, p. 5

SG Sand and Gravel
CRQL Contract Required Quantitation Limit
*** The depth of the aquifer was calculated by subtracting the elevation of the shallow and deepest lateral of Ranney Well #5 (796.9 – 792.4 feet) from the ground elevation (840.4 feet) (Ref. 45, pp. 4, 41). The range difference is 43.5 - 48 feet.

Table K3
Level I Groundwater Samples from Municipal Wells

EPA CLP ID #	Municipal Well ID	Hazardous Substance	Hazardous Substance Concentration (µg/L)	Benchmark Concentration (µg/L)	Benchmark*	Reference
E2T84	Ranney Well #5	PCE	5.4	5.0	MCL	Ref. 2, p. 10; Contaminated Ground Water from Ranney Municipal Wells Sample Table of this HRS Documentation Record

*As specified in Ref. 1, Section 2.5.2, the lowest applicable benchmark concentration for each substance was applied.

Attribution:

The Broadway Street Corridor Groundwater Contamination site – Ranney Well #5 has a documented release of PCE to the groundwater that has contaminated one (1) active municipal wells (see Contaminated Ground Water from Ranney Municipal Wells Sample Table of this HRS Documentation Record).

The compound found in this well is a manufactured chemical, not thought to occur naturally, and non-detected concentrations in a background well show that it is not ubiquitous throughout the region (Ref. 61, p. 1; Background Ground Water Sample Table of this HRS Documentation Record). Chlorinated solvents (e.g., PCE) are man-made compounds commonly used in commercial/industrial operations such as dry cleaning and metal degreasing (Refs. 61, p. 1; 81, p. 1). The Broadway Street Corridor Groundwater Contamination site – Ranney #5 is located in a heavily developed area consisting of

industrial, commercial, and residential land, where a variety of past industrial and commercial activities could have resulted in the groundwater contamination (Refs. 4, pp. 74-75; 69; 85, p. 6).

During the SI and ESI, staff conducted an extensive level of effort by searching IDEM, county, and EPA records to identify possible sources of groundwater contamination. Staff also collected direct push groundwater grab samples and subsurface soil samples on the properties of or downgradient from facilities within the WHP areas that were thought to be associated with contaminants of concern (Refs. 44, p. 1; 69, pp. 1-7). Based on the efforts during the SI and ESI, there is insufficient evidence to attribute the groundwater contamination in Ranney Well #1, Ranney Well #4, and Ranney Well #5 municipal wells to sources at nearby facilities. Refer to Reference 69 and its supporting references, which include References 3; 4; 5; 6; 7; 8; 12; 13; ;14; 15; 16; 18; 19; 21; 22; 23; 24; 25; 26; 27; 28; 29; 30; 31; 32; 33; 34; 35; 36; 37; 38; 39; 40; 41; 42; 43; 44; 45; 46; 48; 49; 50; 51; 52; 53; 54; 55; 56; 58; 81; 83; 84; 85; 86; and 87, for a detailed summary of the level of effort and determining any attribution associated with facilities and the samples collected.

Hazardous Substances Released (see Section 3.1.1 of this HRS Documentation Record)

- PCE

Groundwater Observed Release Factor Value: 550

3.2 WASTE CHARACTERISTICS

3.2.1 Toxicity/Mobility

The following table, Toxicity/Mobility Table, depicts the toxicity, mobility and combined toxicity/mobility factor values that have been assigned to those substances present in the observed release and have a containment value greater than 0 (Ref. 1, Sections 2.2.3, 3.2.1).

Table L3
Toxicity/Mobility

Hazardous Substance	Source No. (and/or Observed Release)	Toxicity Factor Value	Mobility Factor Value*	Does Hazardous Substance meet Observed Release by chemical analysis? (Y/N)	Toxicity/ Mobility (Ref. 1, Table 3-9)	References
PCE	3, Observed Release	100	1	Y	100	Ref. 1a, Section 2.4.1.1; Ref. 2, p. 10

*All hazardous substances that meet the criteria for an observed release by chemical analysis to one or more aquifers, regardless of the aquifer being evaluated, are assigned a mobility factor value of 1 (Ref. 1, Section 3.2.1.2).

The hazardous substance with the highest toxicity/mobility factor value available to the groundwater migration pathway is PCE (100).

Toxicity/Mobility Factor Value: 100
(Ref. 1, Table 3-9)

Table M3

3.2.2 Hazardous Waste Quantity Source No.	Source Type	Source Hazardous Waste Quantity
3 (Ranney Well #5)*	Other	Unknown, but >0

* See section 2.2 of the HRS documentation for the source characteristics description.

Sum of Values: Unknown but >0, rounded to 1 (Ref. 1, Section 2.4.2.2, Table 2-6).

The Broadway Street Corridor Groundwater Contamination site – Ranney Well #5 has been scored as consisting of a groundwater plume with no identified sources. According to Section 2.4.2.2 in the HRS (Ref. 1), if any target for that migration pathway is subject to Level I or Level II concentrations and the hazardous constituent quantity is not adequately determined, assign a value from HRS Table 2-6 or a value of 100 whichever is greater, as the hazardous waste quantity factor value for that pathway. Because Level I concentrations were present in a drinking water well (see Sections 3.1.1 and 3.3 of this HRS Documentation Record), a hazardous waste quantity factor value of 100 is assigned for the groundwater pathway.

Hazardous Waste Quantity Factor Value: 100
(Ref. 1, Section 2.4.2.4 and Table 2-6)

3.2.3 Waste Characteristics Factor Category Value

As specified in the HRS (Ref. 1, Section 3.2.3), the Hazardous Waste Quantity Factor Value of 100 was multiplied by the highest Toxicity/Mobility Value of 100, resulting in a product of 10,000. Based on this product, a Waste Characteristics Factor Category Value of 10 was assigned from Table 2-7 of the HRS (Ref. 1, Section 2.4.3.1).

The Toxicity/Mobility Factor Value for PCE, which has the highest Toxicity/Mobility Factor Value of the substances listed in Section 3.2.1 of this HRS Documentation Record, is:

Toxicity/Mobility Factor Value: 100
Hazardous Waste Quantity Factor Value: 100

Hazardous Waste Quantity Factor Value: 10,000

Waste Characteristics Factor Category Value: 10
(Ref. 1, Table 2-7)

3.3 GROUND WATER PATHWAY TARGETS

The Wheeler Avenue Treatment Plant receives water from the four (4) Ranney wells and four other municipal wells, and it feed drinking water to 60 percent of the 58,000 people served by the Anderson Water Department (Refs. 4, p. 45; 58, p. 2; 68, p. 1). Municipal wells Ranney Well #1, Ranney Well #2, Ranney Well #4, Ranney Well #5, Norton Well #1, Norton Well #2, Elder Well #1 and Elder Well #2 are the only sources of water feeding into the Wheeler Avenue Treatment Plant (Ref. 68, p. 1). Ranney Well #5 well is subject to Level I contamination (see Level I Contaminated Ground Water from Public Wells Sample Table of this HRS Documentation Record). PCE levels exceed the US EPA drinking water Maximum Contaminant Level (MCL) in the Ranney Well #5 well. As such, populations that use wells Ranney Well #5 are subject to Level I hazardous substance concentrations. The table below depicts the municipal well that is subject to Level I contamination.

Table N3
Level I Groundwater Samples from Municipal Wells

EPA CLP ID #	Municipal Well ID	Hazardous Substance	Hazardous Substance Concentration (µg/L)	Benchmark Concentration (µg/L)	Benchmark*	Reference
E2T84	Ranney Well #5	PCE	5.4	5.0	MCL	Ref. 2, p. 10; Contaminated Ground Water from Ranney Municipal Wells Sample Table of this HRS Documentation Record

*As specified in Ref. 1, Section 2.5.2, the lowest applicable benchmark concentration for each substance was applied.

3.3.1 Nearest Well

Well ID: Ranney Well #5 (groundwater sample E2T84)
Level of Contamination (I, II, or potential): I
If potential contamination, distance from source in miles: N/A

As stated above, Ranney Well #5 is subject to Level I contamination (see Level I Contaminated Ground Water from Public Wells Sample Table of this HRS Documentation Record).

As specified in the HRS (Ref. 1, Section 3.3.1, Table 3-11), if one or more drinking water wells are subject to Level I concentrations, a Nearest Well Factor Value of 50 is assigned. Level I PCE concentrations have been documented in the groundwater of Ranney Well # 5 (see Sections 3.1.1 and 3.3 of this HRS Documentation Record).

Nearest Well Factor Value: 50
(Ref. 1, Table 3-11)

3.3.2 Population

3.3.2.1 Level of Contamination

3.3.2.2 Level I Concentrations

The Ranney wells operate daily and are manifold at the Wheeler Avenue Treatment Plant prior to distribution (Ref. 4, p. 46). The water from Ranney Well #1, Ranney Well #4 and Ranney Well #5 is combined (manifolded) with the water from one (1) additional Ranney Well (Ranney Well #2) and four (4) other municipal wells (Refs. 4, pp. 15, 17-18, 46; 68, p. 1). The Wheeler Avenue Treatment Plant produces about 60% of the city's daily water (Ref. 4, p. 45). According to the 2010 US census, there are 56,129 people in the City of Anderson, Indiana (Ref. 57, p. 1). However, State of Indiana water system records indicate that the current population served by the Anderson Water Department is 58,000 (Ref. 58, p. 2); therefore, this is the value used to determine the population target values.

HRS Section 3.3.2 states, "assume each well and intake contributes equally and apportion the population accordingly, except: if the relative contribution of any one well or intake exceeds 40 percent" (Ref. 1, Section 3.3.2).

The table below lists the wells that supply water to the Wheeler Avenue Treatment Plant and the capacity for each well. The relative contribution of each well that supplies water to the Wheeler Avenue Treatment Plant does not appear to show that any one well contributes more than 40 percent. As stated in Section 3.3, all of the wells listed in this table are the only wells that supply water to the Wheeler Avenue Treatment Plant (Ref. 68, p. 1).

Table O3
Well Capacity

Well ID	Well Capacity (GPM)	Reference
1R (Ranney Well #1)	1,667	Ref. 20, p. 3
2R (Ranney Well #2)	2,847	Ref. 20, p. 3
4R (Ranney Well #4)	1,111	Ref. 20, p. 3
5R (Ranney Well #5)	1,319	Ref. 20, p. 3
1N (Norton Well #1)	385	Ref. 20, p. 3
2N (Norton Well #2)	385	Ref. 20, p. 3
1E (Elder Well #1)	1,000	Ref. 20, p. 3
2E (Elder Well #2)	1,000	Ref. 20, p. 3

GPM = Gallons per minute

Therefore, the HRS dictates that the population be distributed equally among the wells (Ref. 1, Section 3.3.2).

The following example depicts how the population was calculated for each well.

Example Calculation: for each Ranney Well

The Wheeler Avenue Treatment Plant provided drinking water to 60 percent of the 58,000 people served by the Anderson Water Department (Refs. 4, p. 45; 58, p. 2; 88, p. 1). Sixty percent (60%) of population served is 34,800 (Ref. 4, p. 45).

Therefore 34,800 divided by 8 equals 4,350 people per well.

Table P3
Population Served by Each Well that Supplies Water to the Wheeler Avenue Treatment Plant

Well ID	Number of People Served
Ranney Well #1	4,350
Ranney Well #2	4,350
Ranney Well #4	4,350
Ranney Well #5	4,350
Norton Well #1	4,350
Norton Well #2	4,350
Elder Well #1	4,350
Elder Well #2	4,350
Total Population served from the above listed wells	**34,800**

Municipal Well Ranney Well #5 is considered Level I.
The Population Served by Level I Ranney Well #5 is 4,350 people.

Therefore, Level I Concentration Factor Value is determined by multiplying this value by 10 (Ref. 1, Section 3.3.2.2)

4,350 times 10 = 43,500

Level I Concentrations Factor Value: 43,500

3.3.2.3 Level II Concentrations

There are no wells in which observed releases were established that are evaluated as Level II contamination.

Table Q3
Level II Contaminated Groundwater Samples from Public Wells

EPA CLP#	Date	Location	Depth Below Ground Surface	Hazardous Substance	Hazardous Substance Concentration µg/L	CRQL µg/L	Reference
NS	NS	NS	NS	NS	NS	NS	NS

NS - Not Scored

Level II Concentrations Factor Value: NS

3.3.2.4 Potential Contamination

As stated in Section 3.3.2.2, the population served by Wheeler Treatment Plant is distributed equally among each of the eight (8) wells in the well field. Therefore 34,800 divided by 8 equals 4,350 people

per well. The following table depicts the distances from Ranney Well #5 (a source) to each of the potential wells and the population served by each well (see Figure 9 of this HRS Documentation Record). In addition, the table shows the value assigned for the potential well according to Table 3-12 of the HRS (Ref. 1, Table 3-12).

Table R3
Potentially Contaminated Wells and Population Relevant to Ranney Well #5

Distance	Name of Potential Well(s)	Population Served	Value Assigned (HRS Table 3-12)*	Reference
0-1/4 Mile	Norton Well #1, Norton Well #2, Ranney Well #4	4,350 times 3 = 13,050	16,325	Ref. 1, Table 3-12; Figure 9
>¼ -1/2 Mile				
>½ - 1 Mile	Ranney Well #2	4,350	1,669	Ref. 1, Table 3-12; Figure 9
>1 – 2 Miles	Elder Well #1, Elder Well #2, Ranney Well #1	4,350 times 3 = 13,050	2,939	Ref. 1, Table 3-12; Figure 9
>2 - 3 Miles				
>3 - 4 Miles				
Total Score			**20,933**	

*Other than karst

The total assigned values = 20,933
20,933 times 0.1 = 2,093

Potential Contamination Factor Value: 2,093
[rounded to the nearest integer (Ref. 1, Section 3.3.2.4)]

3.3.3 Resources

Resource use of the combined aquifers within the target distance limit does not include any documented Resource Factors. Therefore, a Resource Factor value of 0 is assigned (Ref. 1, Section 3.3.3).

Resources Factor Value: 0

3.3.4 Wellhead Protection Area

The groundwater plume lies within the WHPA (Refs. 10, pp. 12, 14; 5, pp. 46, 52-53; Figures 2 and 4 of this HRS Documentation Record). Indiana's WHPAs and the Anderson, Indiana WHPA are designated by the U.S. EPA in accordance with Section 1428 of the Safe Drinking Water Act (Ref. 59, p.1). Therefore, the Wellhead Protection Area Factor Value of 20 is assigned (Ref. 1, Section 3.3.4).

Wellhead Protection Area Factor Value: 20

Scores for Ranney Well #5

Air Pathway	Not Scored
Ground Water Pathway	100.00
Soil Exposure Pathway	Not Scored
Surface Water Pathway	Not Scored
HRS SITE SCORE	**50.00**