Vincennes Water Utilities

Phase II Wellhead Protection Plan

5- Year Update

July 28, 2023

Prepared for Vincennes Water Utilities
Vincennes, Indiana

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Submitted July 28, 2023

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1.0 Introduction

1.1 Utility Overview

The City of Vincennes (the City) is located in southwest Indiana, along the east bank of the Wabash River, and is the county seat of Knox County (the County) (**Figure 1**). The City is 130 miles southwest of Indianapolis, halfway between Terre Haute and Evansville, Indiana. Vincennes Water Utilities (VWU) operates a groundwater system (PWSID #5242014) that provides water to roughly 30,000 residents throughout the County. Water is pumped from a single well field located along the Wabash River. This well field consists of 7 wells that have an approximate total capacity of 11.52 million gallons per day (mgd). Water is pumped from the wells to the nearby Water Treatment Plant, where it is treated with chlorine, phosphate, and fluoride, and then on to the existing distribution system. In 2021, VWU withdrew 3.34 mgd from their well field (SWWF, 2021).

1.2 Purpose of Wellhead Protection Plan – Phase II 5-year Update

The 1986 Amendments to the federal Safe Water Drinking Act requires States to protect groundwater that supplies public water systems. In Indiana, the 1989 Groundwater Protection Act authorized the Water Pollution Control Board (WPCB) to establish regulations for groundwater protection. The 1996 Wellhead Protection Rule was adopted by the WPCB and mandates the development of a Well Head Protection Program (WHPP) for all Community Public Water Systems. The WHPP is administered by the Indiana Department of Environmental Management (IDEM) Drinking Water Branch – Groundwater Section.

A complete WHPP consists of five main components for the protection of groundwater supplies as listed below;

- Formation of a Local Planning Team
- WHPA Delineation
- Contingency Plan
- Potential Contaminant Source (PCS) Inventory
- Management Plan

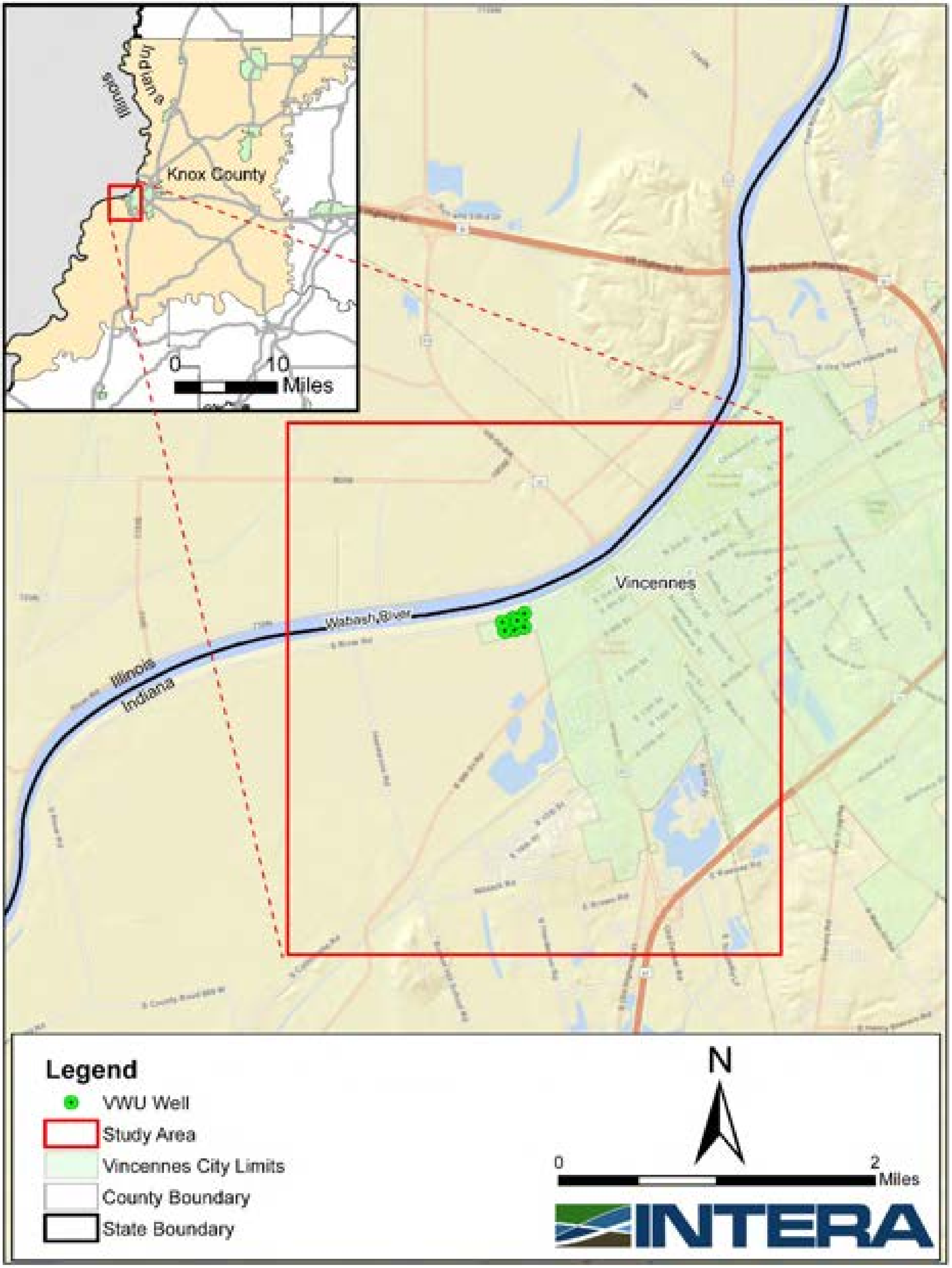
Because implementation of a WHPP may evolve over time, Indiana has established a phased approach for WHPP development. Phase I involves delineation of Wellhead Protection Areas (WHPA), identifying potential contaminant sources (PCS), and creating management and contingency plans for the WHPA. Phase II entails implementing and updating the plan created in Phase I. The Wellhead Protection Rule also requires updates to the Phase II plan every five years, which documents changes from the Phase II plan or the previous 5-year update. This document describes updates to the Phase II plan produced by VWU in 2017, as required every 5 years.

VWU uses a multiple barrier approach to ensure the safety of drinking water for their customers. This multiple barrier approach includes water treatment, water quality monitoring, and distribution system maintenance. VWU's WHPP provides an additional barrier by reducing the risk of contamination to the source water that supplies the water system. This document summarizes VWU's on-going groundwater protection efforts.

VWU completed its Phase I WHPP in 2004, its first Phase II Five-Year Update in 2011, and the most recent Phase II Five-Year update in 2017. This Phase II update is intended to summarize VWU's ongoing wellhead protection activities and satisfy the requirements for its most recent Five-Year update. This report also details VWU's update to their WHPA and time-of-travel boundaries based on new data and modeling.

In this Phase II update report, Chapter 2 discusses updates to the conceptual geologic and hydrologic model, Chapter 3 introduces the updated groundwater flow model and subsequent redelineation effort, Chapter 4 reintroduces the Local Planning Team (LPT). Chapter 5 outlines the contingency plan including current emergency response procedures in the case of a contaminant release. Results of the 2023 potential contaminant survey for the Vincennes WHPA can be found in Chapter 5. Initiatives to manage the WHPA and protect groundwater resources are provided in Chapter 6. Chapter 7 lists the activities the LPT and VWU plan to implement as part of the wellhead protection public outreach program. Lastly, the implementation schedule is included in Chapter 8.

Figure 1: *Location of VWU well field in Knox County, Indiana*



1.3 Production Well Compliance

Well construction rule 310 IAC 16 requires construction permits for wells constructed after January 1, 1988. All wells were built before the rule was enacted. Construction dates for all production wells are shown in **Table 1.**

***Table 1**: Construction dates for VWU's wells*

Well	Date
1	Abandoned
2	1950
3	1950
4	1951
5	1951
6	1969
7	1976
8	1976

1.4 Monitoring for Contaminants

VWU's Standard Monitoring Framework (SMF) for the 2011-2019 compliance cycle is in **Appendix A.** This SMF has not been changed since the 2017 update and rolls over to the next three-year cycle as shown in **Appendix A**. VWU collects 20 samples from monitoring well 7A which are analyzed for Total Coliform and Fecal Coliform monthly (**Appendix A**). VOCs, SOC, IOC, Nitrate, Nitrite, Sodium, Lead, Copper, TTHM and HAA5 are also sampled for on a regular basis.

Monitoring for contaminants will be ongoing and in accordance with IDEM's standardized monitoring framework. The Local Planning Team (LPT) will make sure all parties within the WHPA adhere to the rules for use, application, storage, mixing, loading, transportation, and disposal of pesticides, and rules and guidance thereunder developed by the Pesticide Review Board and the state chemist.

In 2022, VWU conducted additional water quality sampling at monitoring wells within their well field as part of ongoing wellhead protection efforts. Details of this sampling event are presented in **Chapter 2**.

2.0 Wellhead Protection Area Delineation

In Indiana, a Wellhead Protection Area is defined as the surface and subsurface area through which contaminants are likely to move through and reach the well field over a specified period of time. The Indiana Well Head Protection Rule specifies the five-year time-of-travel (TOT) area as the minimum area for modeled WHPAs, though larger TOTs may be considered to suit the hydrogeologic conditions and the needs of the water system. The TOT boundary encompasses areas where groundwater will reach the well fields in that specified time frame or less. VWU uses a 10-year TOT boundary beyond the 5-year TOT to provide a greater level of protection to the system.

Even though there have been no significant changes to the groundwater supply system since 2017, VWU has chosen to re-delineate the WHPA based on new data that has been acquired since the original delineation was created in 1995 (Haitjema, 1995).

As the current 5-year update was being completed, it was apparent that the original delineation did not consider the effects of nearby gravel pits which have been expanding every year. Also, the original delineation appeared to be centered in an incorrect location, northeast of the pumping center. There have also been extensive additions to hydrogeologic data sets that are publicly available that were used to reevaluate the WHPA and time-of-travel boundaries. The original delineation can be seen as compared to the new delineation in **Figure 25**.

Along with adding publicly available datasets, VWU conducted an extensive hydrologic investigation at the well field to further refine the understanding of the hydrologic system near the well field. The investigation included multiple parts: instrumentation of pressure transducers into 7 monitoring wells within the well field, installation of 3 hand driven piezometers into the riverbed adjacent to the well field, instrumentation of pressure/temperature transducers into the piezometers, groundwater/surface water temperature modeling, and groundwater quality sampling from 7 monitoring wells within the well field. Locations of activities are shown in **Figure 2**.

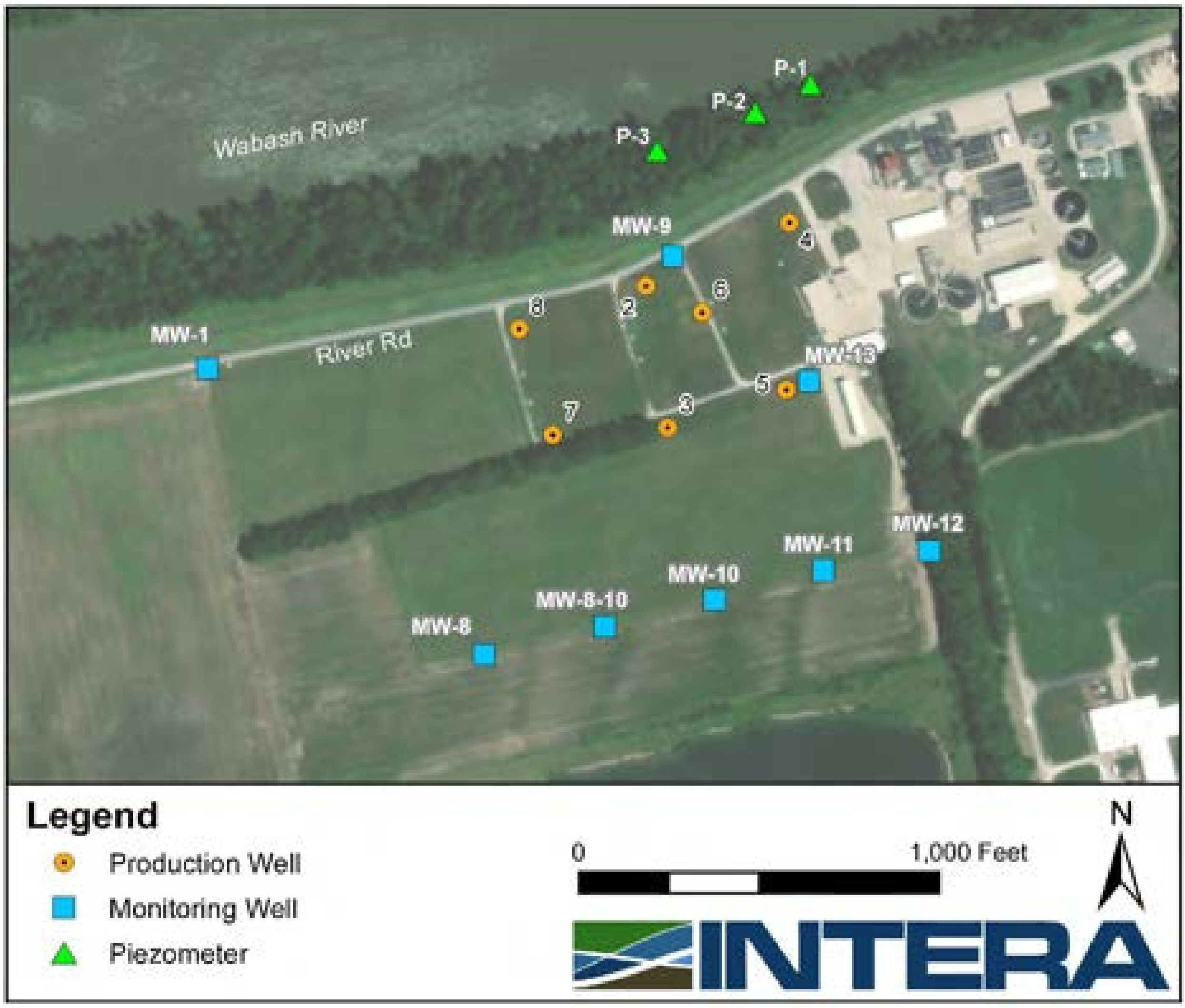
To complete this hydrologic investigation, three hand driven piezometers were driven into the riverbed, directly across from the well field, shown on **Figure 2** as P-1, P-2, and P-3. The screens of the piezometers were set below the riverbed and temperature probes were deployed within the casings at discrete intervals. A pressure transducer was also set at the bottom of each piezometer to record water levels. A pressure/temperature transducer was also set outside of P-1 within the Wabash River. The purpose of the piezometers was to track the vertical profile of diurnal temperature fluctuations through the riverbed sediments to calculate the infiltration rate at the streambed during operations of the well field (Constantz, 2008). Logs of these piezometers are shown in **Appendix H**. Results of this data collection are described in **Section 3.1.2**.

Pressure transducers were also deployed at MW-1, MW-8, MW-9, MW-10, MW-11, MW-12, and MW-13. Locations of the monitoring wells (MW) are shown in **Figure 2**. Surface water level was monitored within the Wabash River at the P-1 site over the same time interval. Data gathered from these investigations were used to further refine the groundwater flow model that was used to delineate the new time-of-travel boundaries as described in **Section 3**.

Also during this investigation, water quality samples were collected and analyzed at MW-8, MW-9, MW-10, MW-8-10, MW-11, MW-12, and MW-13. Each well sample was sent to an outside lab, Eurofins, and analyzed for: Alkalinity, Total Dissolved Solids (TDS), Total Recoverable Metals – 26 elements, and Anions. This data was used to gather a baseline to analyze risk of contamination from different potential sources of contamination.

VWU has selected the use of a numerical groundwater flow model to re-delineate the WHPA. A numerical model was deemed appropriate because of its ability to simulate the complex nature of the groundwater flow system that VWU obtains water from.

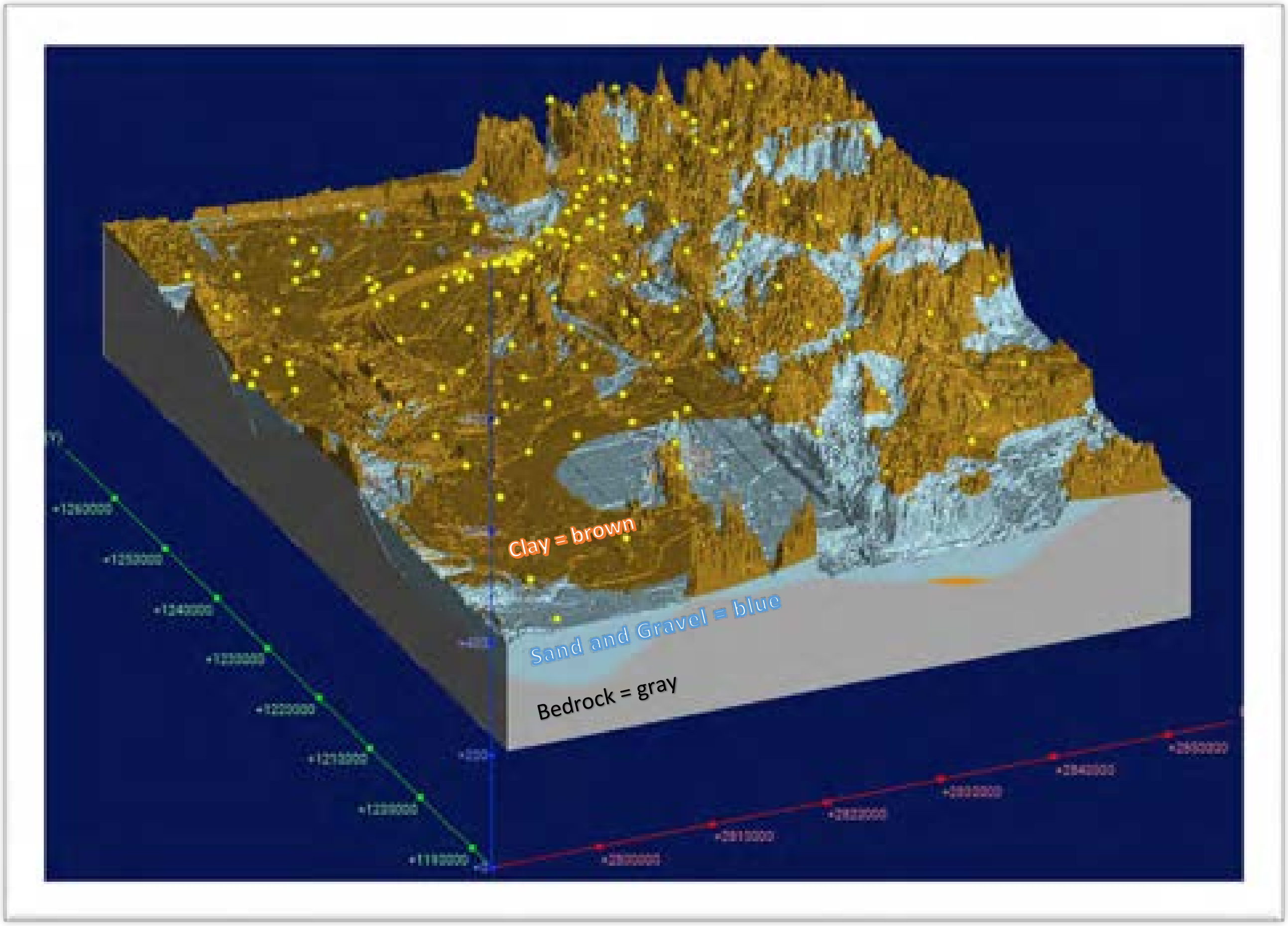
Figure 2: *Monitoring locations near the VWU well field.*



2.1 Conceptual Geologic Model

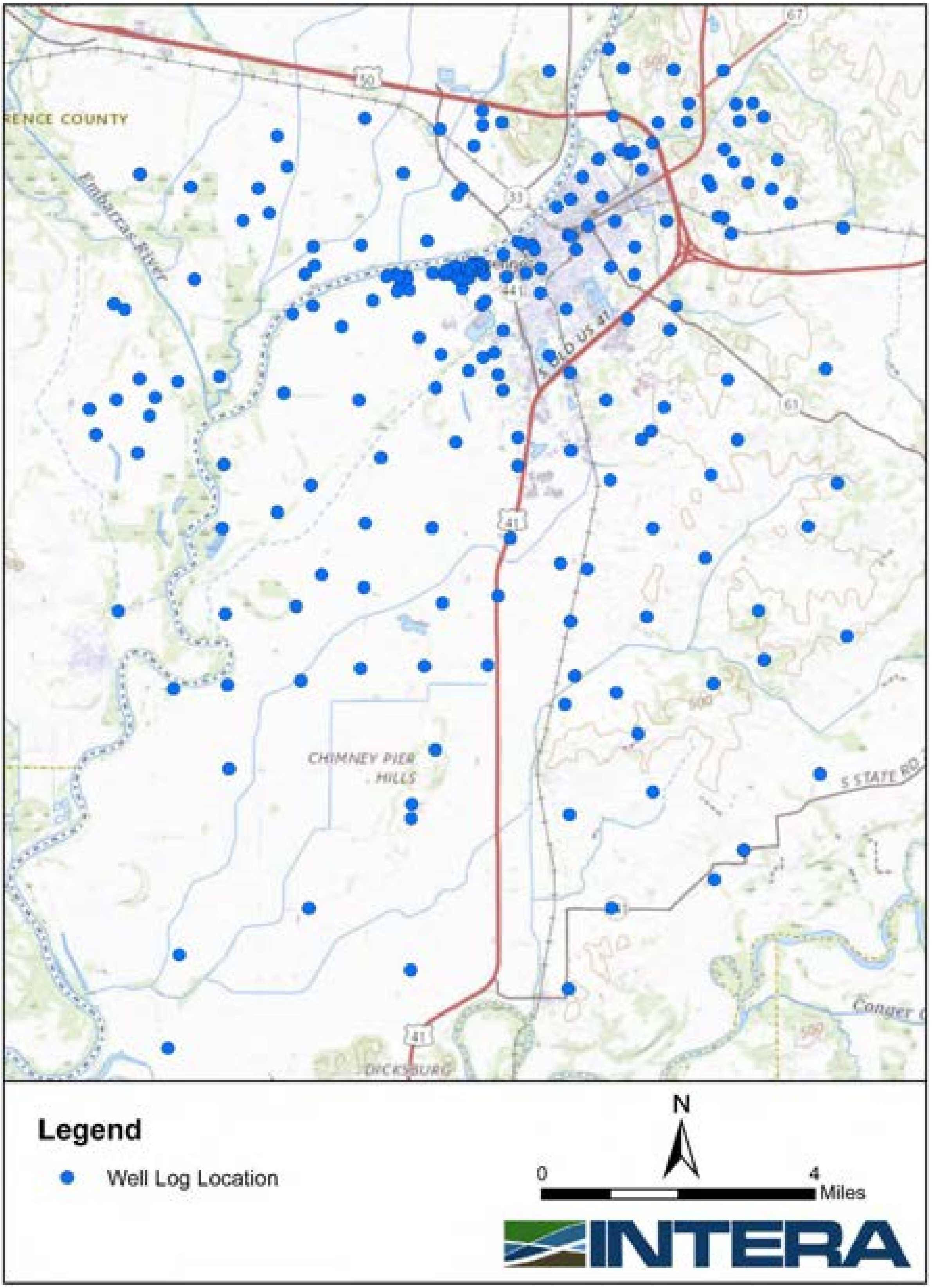
The numerical groundwater flow model is based on a three-dimensional (3D) Conceptual Geologic Model (CGM) that was constructed using publicly available datasets. The 3D CGM was built to illustrate the principal components of the groundwater flow system based on regional, local, and site-specific geologic information. A view of the 3D CGM is shown in **Figure 3.**

Figure 3: *View of the 3D Conceptual Geologic Model. Yellow dots show the location of well logs used in model development.*



The 3D CGM was built with data obtained primarily from the Indiana Well Log Database, as well as the Illinois Well Log Database. 207 well logs were imported into the model. The location of these well logs is shown as yellow dots in **Figure 3** and in map view in **Figure 4**. Lithology described in each well log was grouped based on their hydrologic properties. Sands and gravels were grouped together to represent areas of permeable aquifer material (shown in blue), and clays and silts were grouped together to represent impermeable aquitard material (shown in brown). Bedrock such as shale, limestone, and sandstone were grouped together and displayed as one bedrock volume in gray, as shown in **Figure 3**. The bedrock surface was initially imported from a statewide bedrock elevation dataset created by the Indiana Geologic and Water Survey (IGWS) in 2015 (IGWS, 2015). The bedrock elevation was edited in locations using well logs that were imported to the State database after the creation of the bedrock elevation dataset. Topography of the area was imported to the 3D CGM from the USGS National Map 1/3 arc-second Digital Elevation Model (DEM) raster files. Final modeled volumes include bedrock, basal clay, sand and gravel aquifer, and top clay.

__Figure 4:__ Location of well logs used in model development.



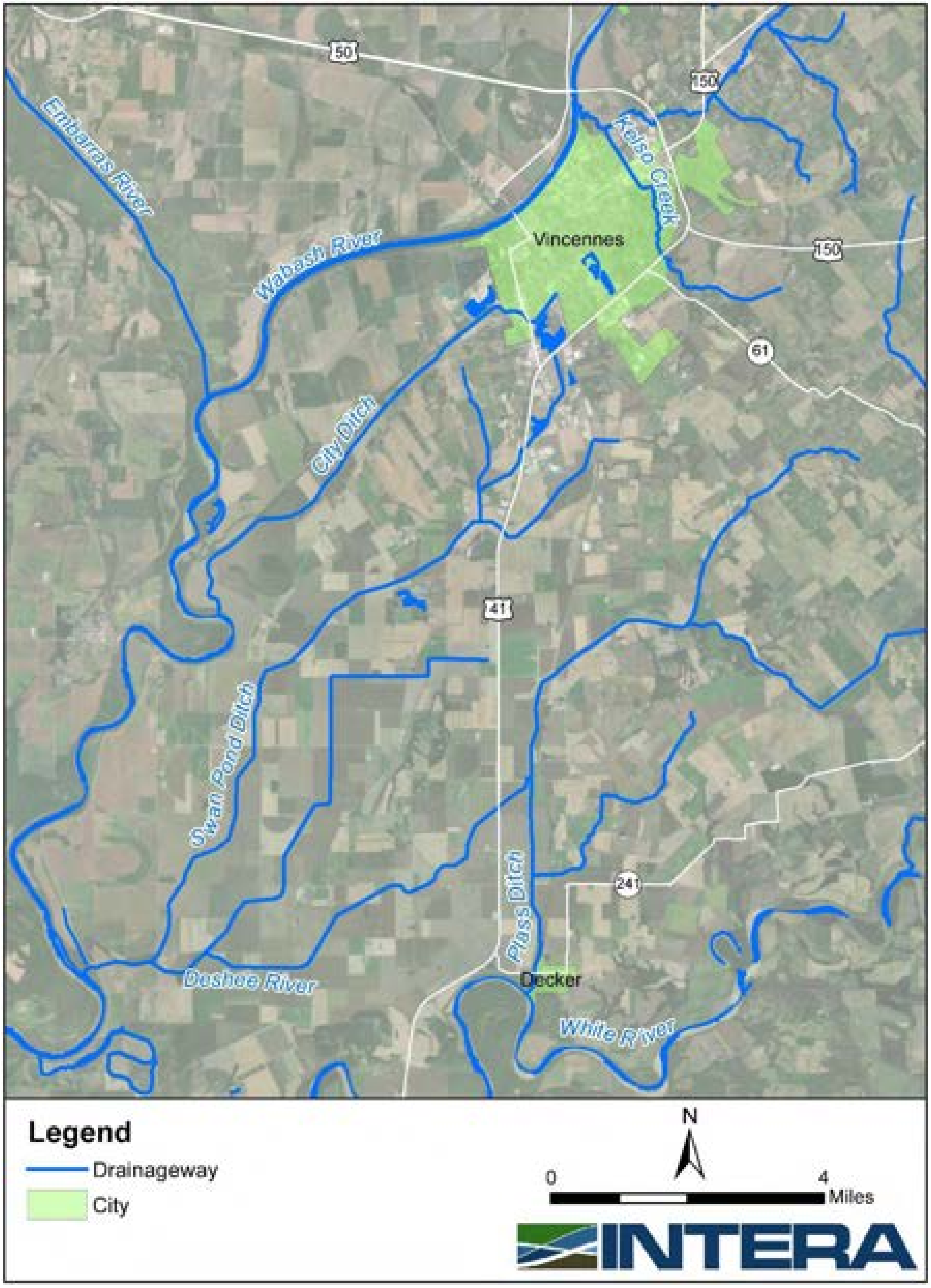
2.2 Physical Setting and Drainageways

The City of Vincennes is located on the east bank of the Wabash River in southwestern Indiana. The City lies approximately 20 miles north of the confluence of the White River and the Wabash River. Vincennes is the county seat of Knox County. VWU's well field is located off River Rd., on the west edge of Vincennes, directly south of the Wabash River. Lawrence County, Illinois is on the northwest side of the Wabash River, across from Vincennes.

The City and surrounding area is drained by a number of prominent surface water features (**Figure 5**). Streams in the area generally flow south and southwest. East of the City, surface waters drain into Plass Ditch, which flows south before draining into the White River. North of Vincennes, water drains into Kelso Creek and its tributaries, which enters the Wabash River just north of the City. City Ditch receives waters to the southwest of the City and discharges into the Wabash River south of the City. Further south and west, River Deshee and its tributaries receive water that flows south to the Wabash River. North of the well field in Illinois, the Embarras River and tributaries flow from northwest to the southeast, entering the Wabash River.

Land use in the area is highly agricultural in the fertile lowlands of the Wabash River. The City is mostly residential and commercial with some industrial areas south of the City along US 41. A few inactive gravel pits are located within the area, as well as some large active pits just south of the well field.

Figure 5: *Major drainageways in the Vincennes area.*



2.3 Geologic Setting

The VWU well field sits within the Wabash River alluvium, as shown in **Figure 6**. The alluvial deposits are on top of older undifferentiated outwash deposits. In the area of the well field, the outwash sands and gravels extend down to the bedrock surface. The alluvial and outwash deposits consist of mainly permeable sands and gravels and are located roughly parallel to the Wabash River.

The bedrock surface underlying most of Knox County is made up of the McLeansboro group and Bond formation as shown in **Figure 7**. The McLeansboros group is of Pennsylvanian age and is primarily made up of shale and sandstone with minor amounts of siltstone, limestone, clay, and coal. The Bond Formation is also of Pennsylvanian age and is primarily limestone and sandstone with some coal. These bedrock units have low permeability and generally are not used as a water source within the County. The bedrock surface topography varies in the study area with a total relief of 243 ft. The bedrock surface ranges in elevation from a high of 516 ft to a low of 273 ft amsl. The bedrock elevation can be seen in **Figure 8**.

Two bedrock valleys are present in the area. One main valley runs north-south, approximately parallel to the Wabash River and a tributary valley that runs east-west, roughly parallel to the White River. The VWU well field is located on the east edge of the main bedrock valley, where the bedrock surface rises up to surface outcrops towards the City, which truncates the aquifer on its east edge. The thickness of unconsolidated materials in the area ranges from 0 ft, where the bedrock outcrops at the surface, to about 178 ft where the bedrock valleys intersect areas with higher topography (**Figure 9**).

Three geologic cross-sections were constructed to depict the regional geology in the area of the well field. These cross-sections were created using the 3D CGM. One section runs east to west (A-A’), one runs north to south (B-B’), and the other runs from northwest to southeast (C-C’). The cross-sections are shown as **Figures 10, 11, and 12** respectively.

Figure 6: *Surficial geology of Indiana near Vincennes.*

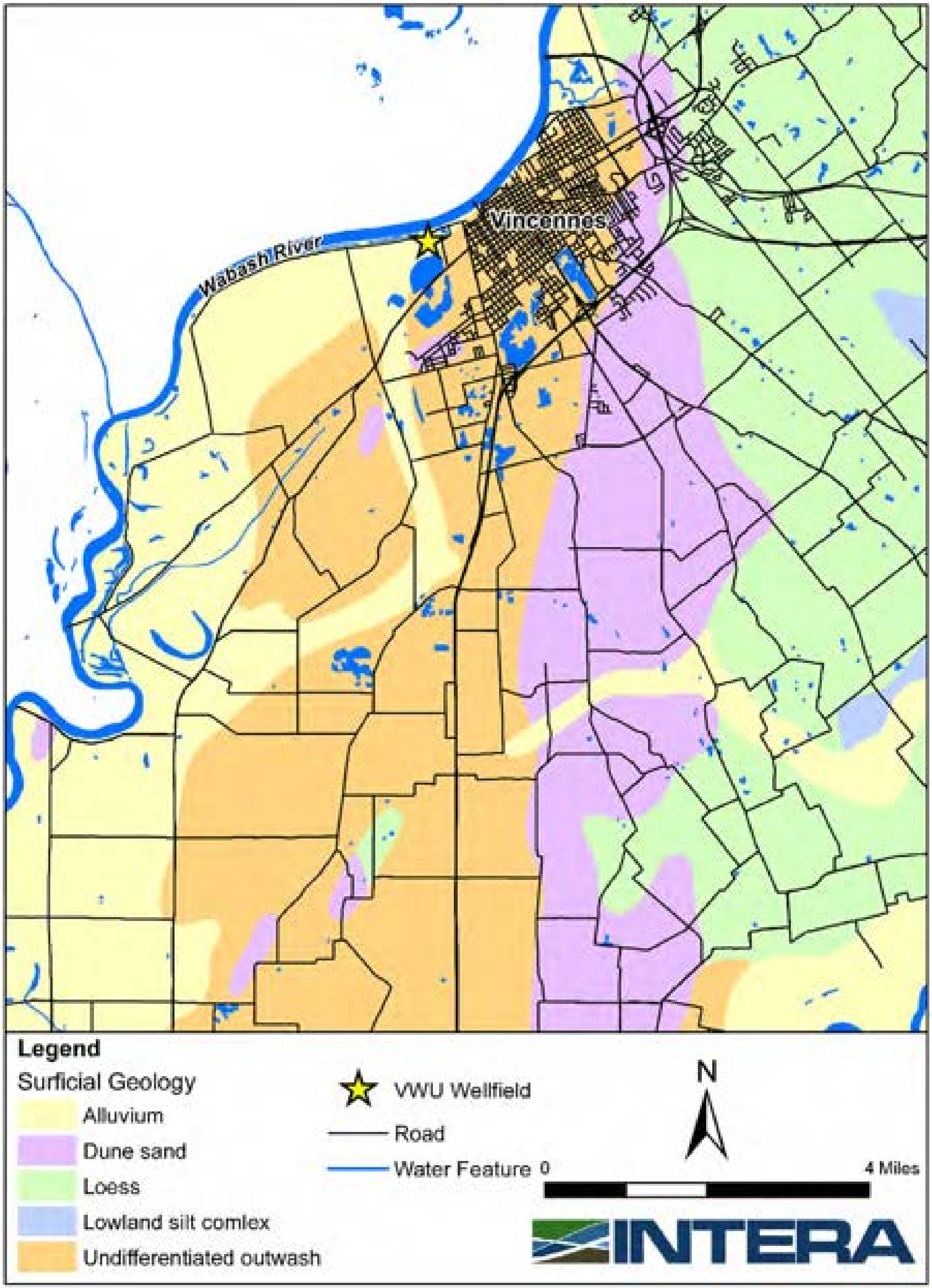


***Figure 7:** Bedrock geology of Indiana near Vincennes.*

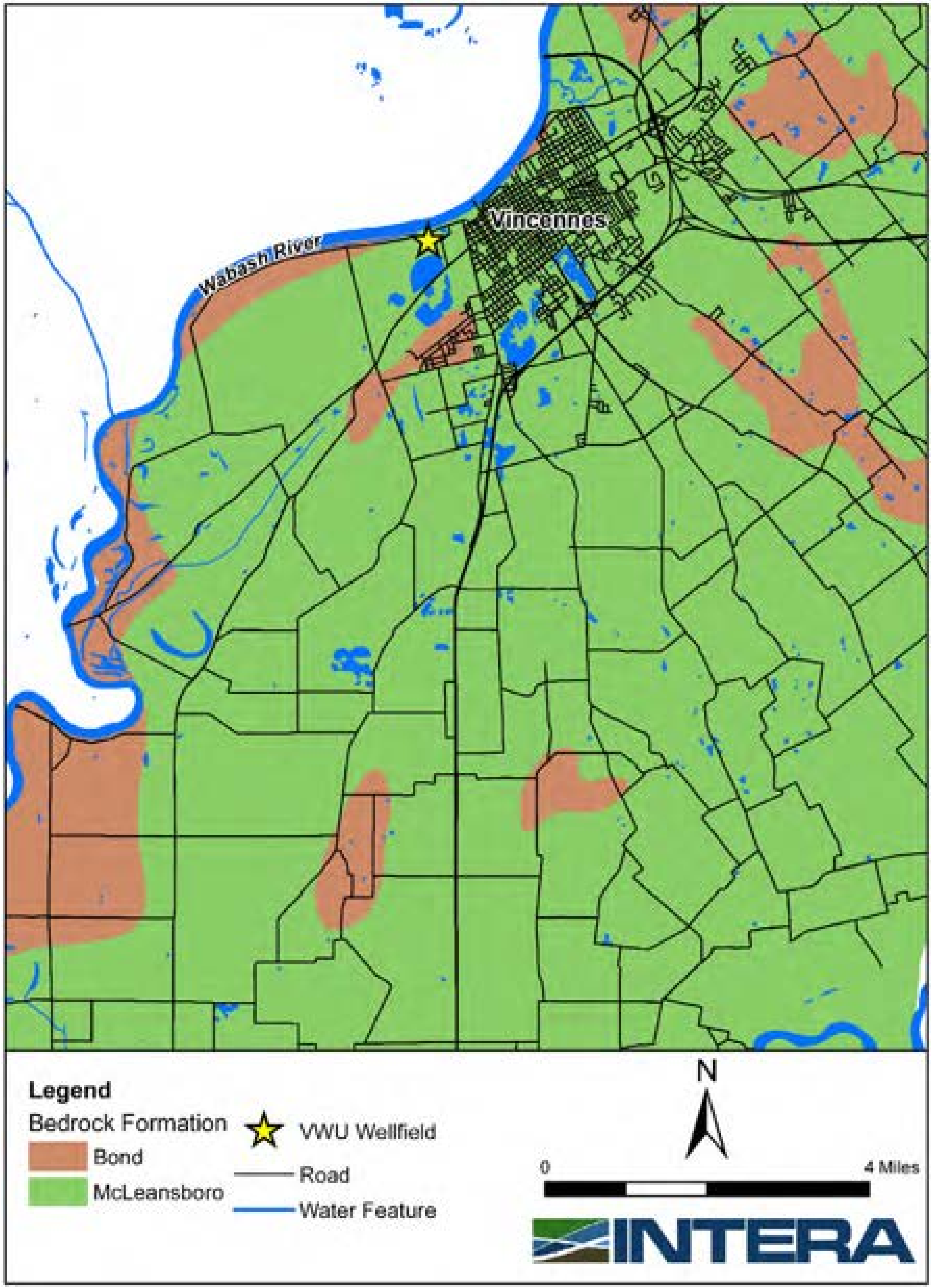


Figure 8: *Bedrock Elevation in the area around Vincennes.*

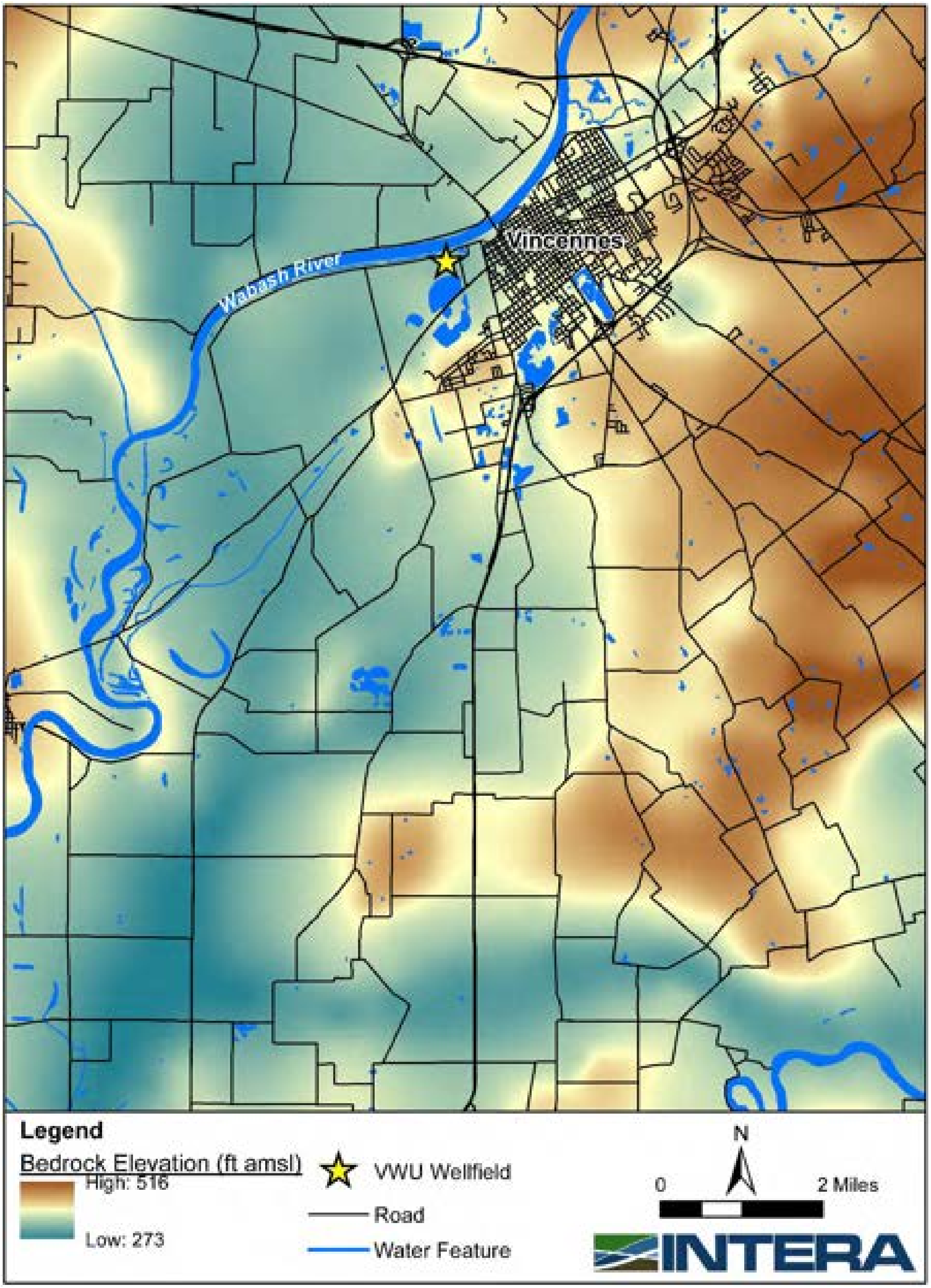


Figure 9: *Thickness of unconsolidated deposits near Vincennes.*

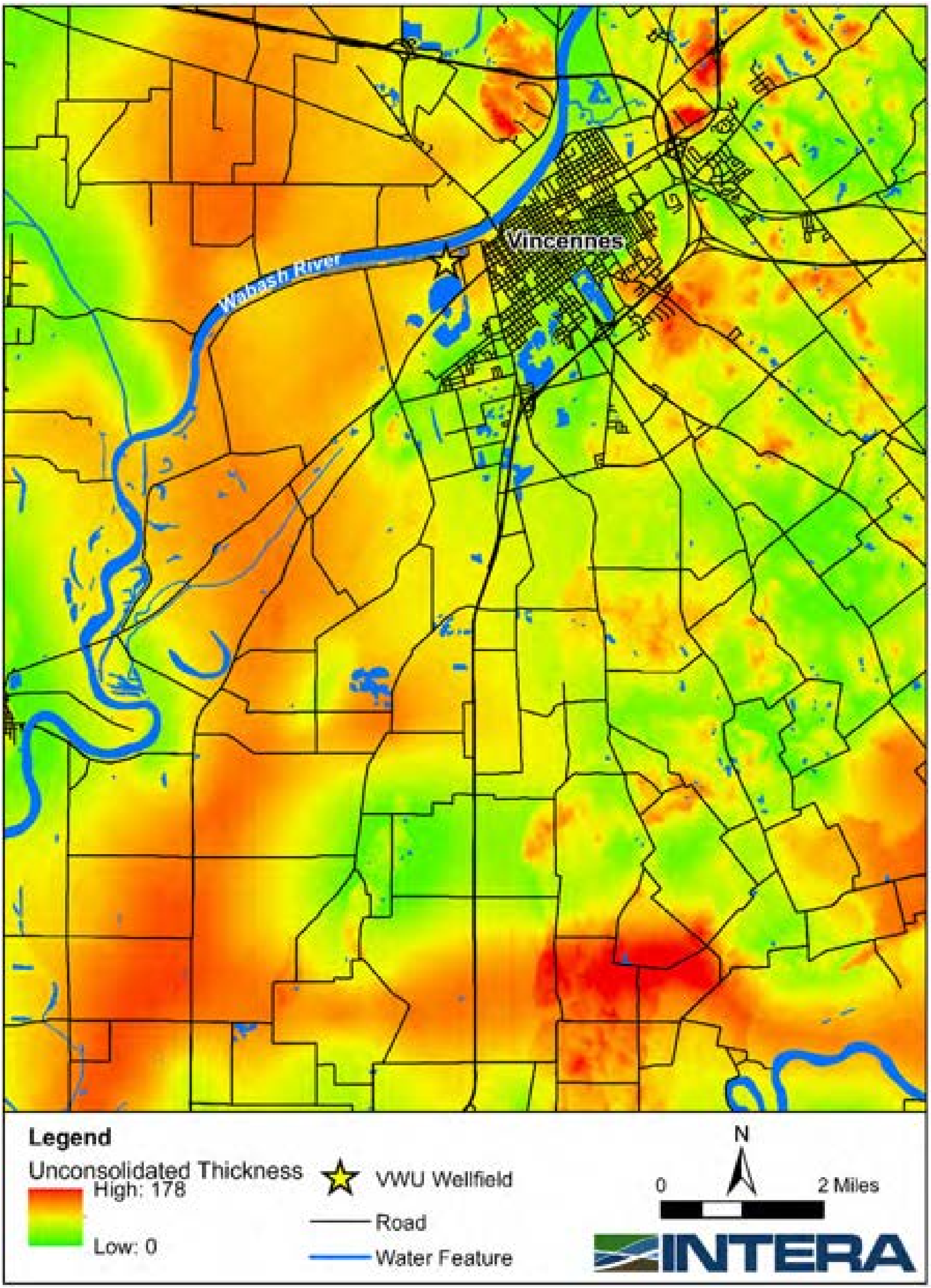


Figure 10: *Cross-section A-A'.*

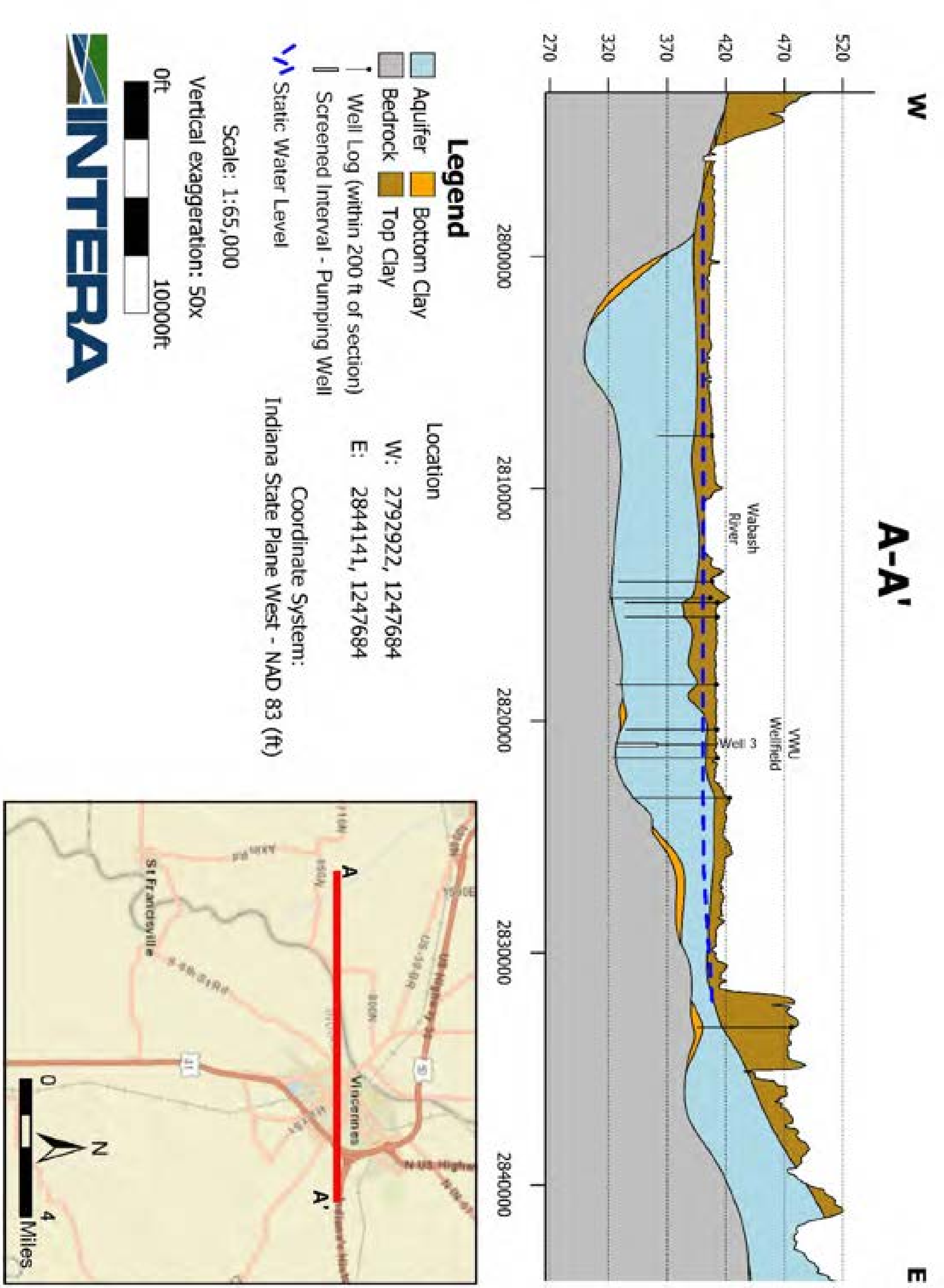


Figure 11: *Cross-section B-B'.*

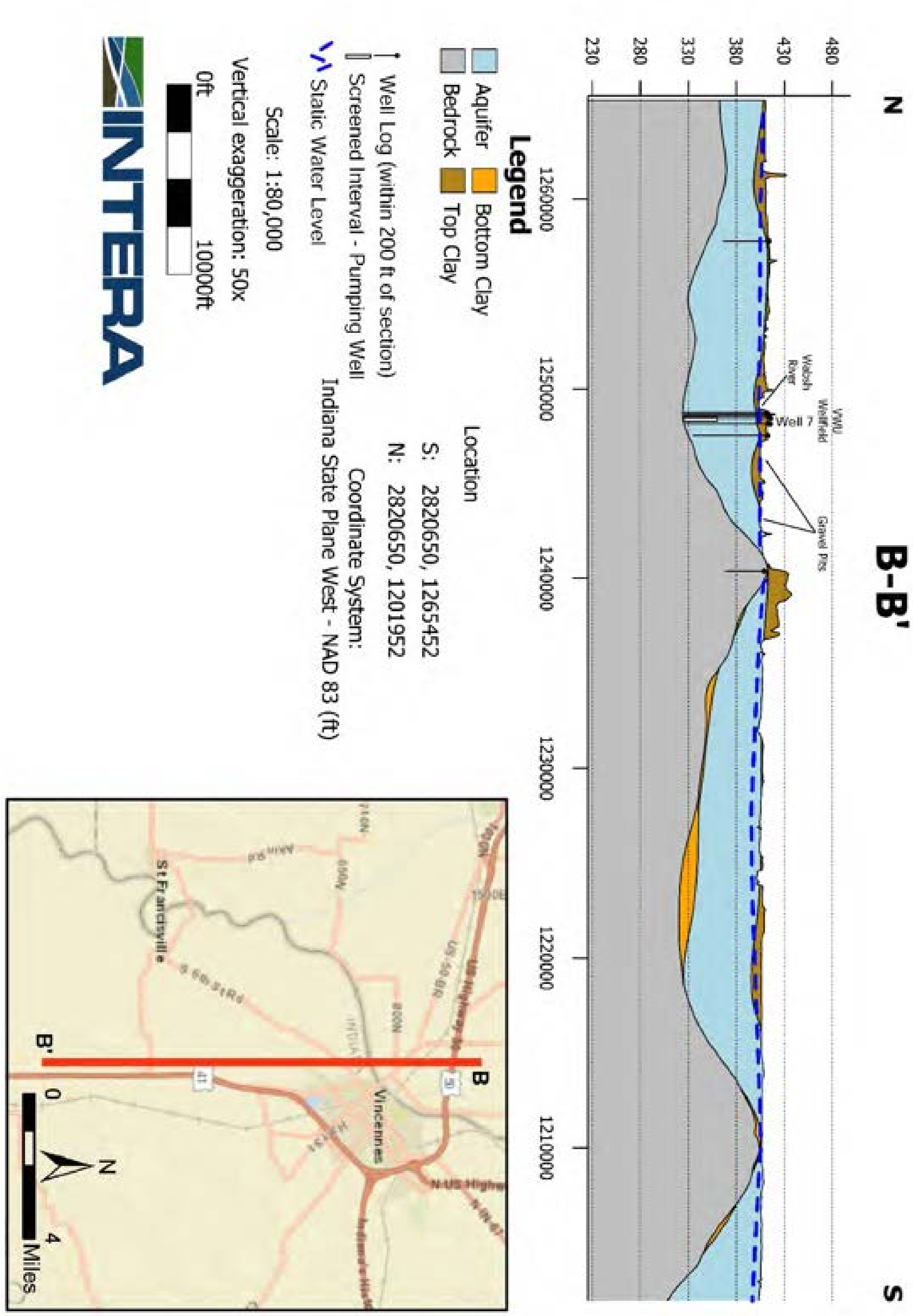
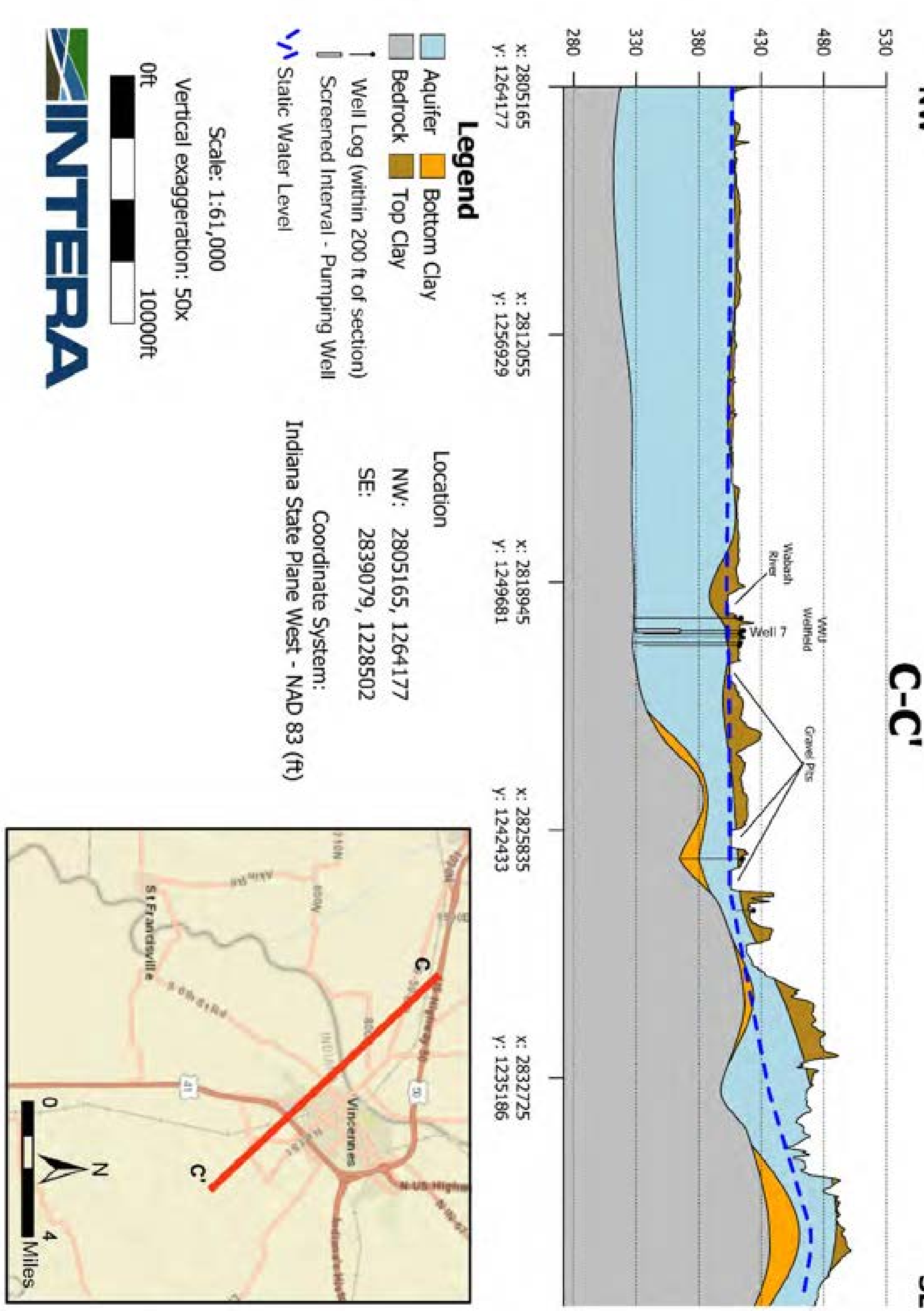


Figure 12: *Cross-section C-C'.*



2.4 Hydrologic Setting

The conceptual hydrogeologic model, and raw data used to develop it, is well described in Shedlock (1980): the highly permeable outwash aquifer overlies a much lower permeability sandstone and shale bedrock, which is assumed to be impermeable. The outwash is bounded to the east and west by bedrock outcrops. A major river and secondary drainages cross the outwash aquifer draining to the Wabash River and control water levels in the river valley. Recharge from precipitation percolates into the outwash aquifer, discharging at surface water features, or is withdrawn by agricultural or public supply wells.

Raw data used to supplement data in Shedlock (1980) include the Indiana Well Log Database (IGWS), and the DNR State Water Withdrawal Facility database (SWWF). New field data includes water levels and temperature time series collected from monitoring wells in the well field, and from piezometers installed in the bed of the Wabash River as described in **Section 2.0**.

2.5 Hydrologic Parameters

Parameters of interests include: the hydraulic conductivity and porosity of the outwash aquifer, variations in bedrock elevations underlying the outwash aquifer, the hydraulic connection between surface water features and the aquifer represented by streambed resistance, and average annual recharge rate. A combination of existing information and new field testing was used to estimate the values of hydrogeologic parameters. In particular, the bed resistance of the Wabash River near the well field was the focus of thermal profiling conducted within the streambed using the 3 piezometers described in **Section 2.0**.

2.5.1 Distribution of Recharge

The average annual recharge is assumed to be distributed uniformly over the outwash aquifer at high rates. Lower rates of recharge were distributed over the sandstone outcroppings.

2.5.2 Current and Planned Pumping Rates

The most recent 5 years of pumping data available from the DNR SWWF database are summarized by well in **Table 2**. The total average annual withdrawals were highest in 2017 at 3.57 MGD. There is currently no plan to increase the water supply for the city.

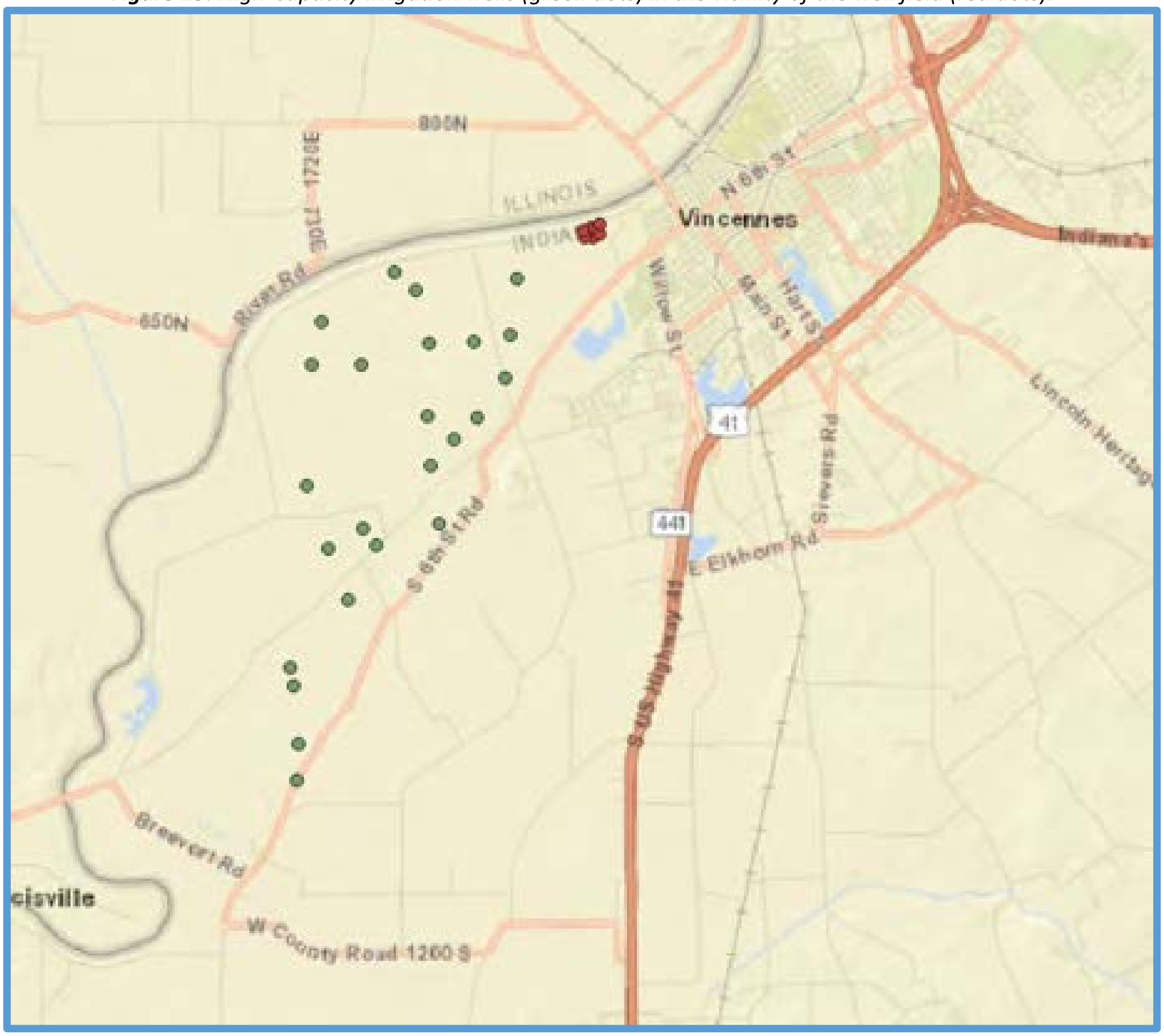
Table 2: *Average annual water withdrawals from the Vincennes well field by well, 2017 to 2021.*

Well	2017 (MGD)	2018 (MGD)	2019 (MGD)	2020 (MGD)	2021 (MGD)
7	0.66	0.68	0.61	0.66	0.75
2	0.73	0.68	0.59	0.64	0.63
3	0.24	0.24	0.23	0.12	0.27
4	0.53	0.54	0.53	0.73	0.54
5	0.10	0.12	0.29	0.23	0.23
6	0.91	0.65	0.47	0.59	0.51
8	0.41	0.42	0.38	0.40	0.42
TOTAL	**3.57**	**3.35**	**3.10**	**3.37**	**3.34**

2.5.3 Pumping Rates of Neighboring High-Capacity Wells

High-capacity wells used for agricultural irrigation exist to the west and south of the VWU well field. These wells all withdraw water from the same outwash aquifer as the VWU well field. Locations of the nearest agricultural wells are illustrated in **Figure 13**. These wells typically operate 3 or 4 months a year during the late spring, summer, and late fall. The irrigation wells pump at individual rates ranging from 0.2 to 1.0 MGD. In the months when the wells are operating, there can be a significant impact on the water levels in the outwash aquifer.

Figure 13: *High-Capacity irrigation wells (green dots) in the vicinity of the well field (red dots).*



3.0 Groundwater Flow Model

The groundwater modeling software, GFLOW, was used to develop the model of the regional unconsolidated aquifer. GFLOW is a two-dimensional, steady-state, analytic element groundwater modeling software program (Kelson and Haitjema, 1994). The regional extent of the model was chosen to make use of calibration data sets in Shedlock (1980) which include 41 groundwater level measurements and two surface water measurements that were made in January 1978. GFLOW was chosen to delineate the wellhead protection area and time-of-travel zones for the VWU well field as it includes the capability to simulate all the hydrogeologic features that are present in and around the well field which impact the capture zones of the production wells.

The groundwater flow model of the VWU well field includes a variable aquifer base to simulate the bedrock surface underlying the outwash aquifer, and zones of constant hydraulic conductivity representing outwash, outwash margins, and sandstone bedrock. An impermeable barrier represents the limits of the model to the west of the Wabash River where the bedrock surface truncates the aquifer. The inhomogeneities in aquifer base, hydraulic conductivity, and the impermeable barrier are illustrated on **Figure 14**.

Gravel pits near the well field are simulated as high conductivity inhomogeneities (10,000 ft/day) with very small porosity (0.0001). The large hydraulic conductivity results in nearly flat gradients across each gravel pit. The small porosity results in vanishingly small travel times through the gravel pit and simulates instantaneous mixing of all groundwater discharging to the pits. In simulating summer conditions, an evaporation rate from the surface of the gravel pits is specified at a rate of 5 inches per month.

Surface waters are represented by strings of line sinks with specified head and bed resistance; surface waters in the model are illustrated in **Figure 15**. Water levels in the stream were obtained from the USGS National Map as elevation in NAVD 88. **Table 3** summarizes the parameters used in the groundwater flow model, the range of values considered during model calibration, the final calibrated value, and for comparison, the values obtained by Shedlock (1980) in a previous modeling study of the region.

Table 3: *Parameter calibration and range of values investigated.*

Parameter	Symbol	Range	Calibrated Value	USGS Value*	Units
Porosity of all aquifer material	n	0.2	--	--	--
Hydraulic conductivity of outwash (regional)	k_{or}	200 - 550	450	355	feet/day
Hydraulic conductivity of outwash (local)	k_{ol}	350 - 550	450	425	feet/day
Hydraulic conductivity of outwash transition zone	k_{ot}	200 - 550	250	215	feet/day
Hydraulic conductivity of sandstone	k_{ss}	10 - 100	20	--	feet/day
Recharge on outwash	N_o	6 - 17	14	12.1	inches/year
Recharge on sandstone	N_{ss}	3 - 7	8	--	inches/year
Resistance of Wabash streambed (regional)	c_{wr}	1 - 33	14	33	days
Resistance of Wabash streambed (local)	c_{wl}	0.5 - 3.0	0.5	1.4	days
Resistance of City Ditch	c_{cd}	0 - 10	0.5	--	days
Resistance of Swan Pond Ditch	c_{spd}	0 - 10	2	--	days
***Model calibrated values reported in Shedlock (1980).**					

Figure 14: *Impermeable barrier (brown line) and inhomogeneity boundaries (green lines) in the regional model.*

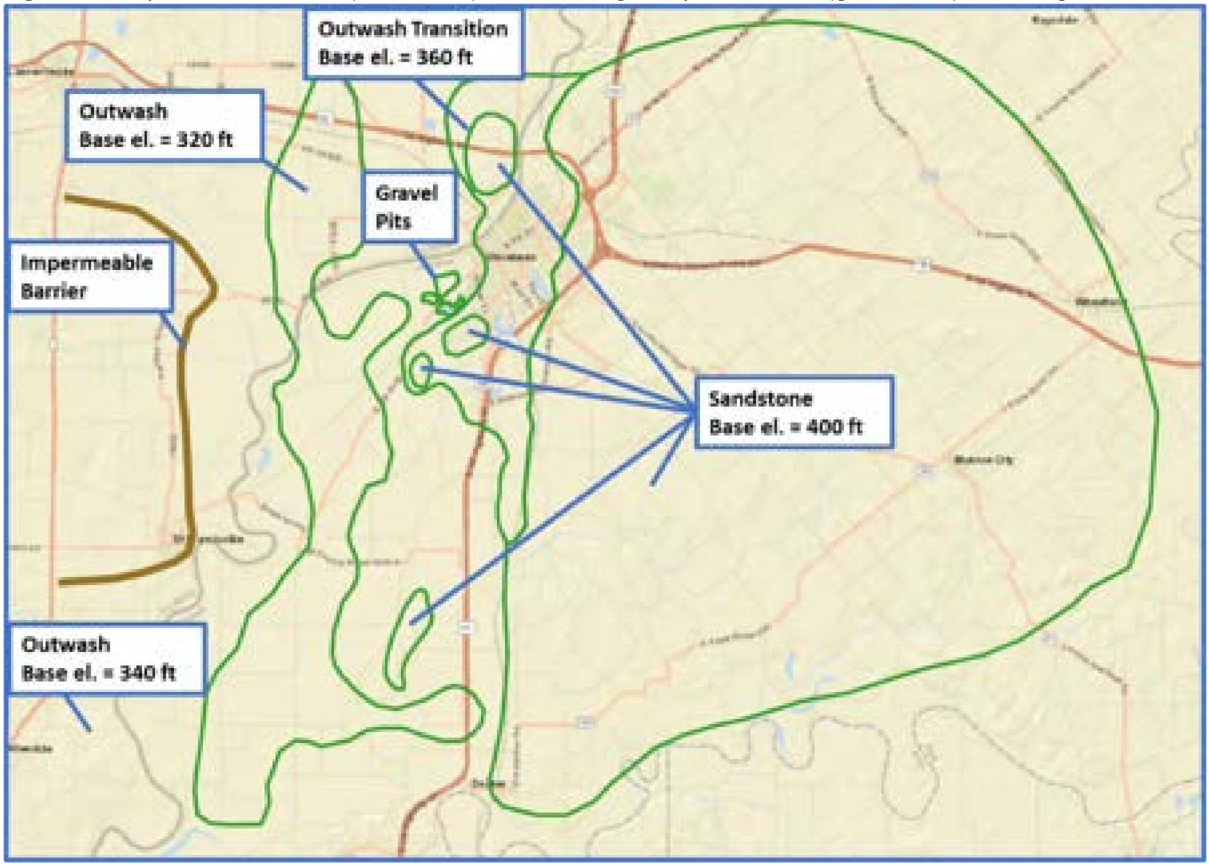
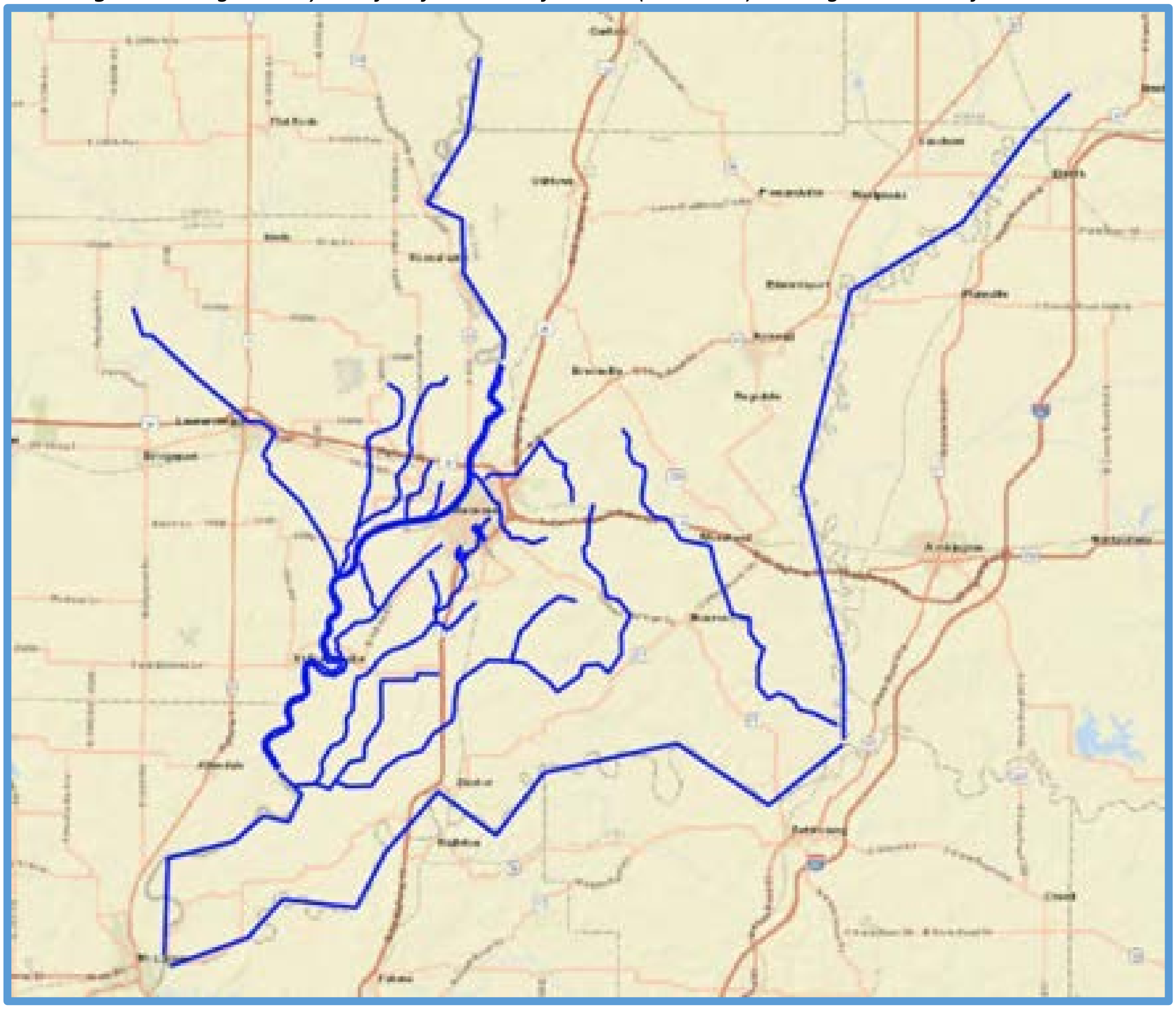


Figure 15: Regional layout of surface water features (blue lines) in the groundwater flow model.



3.1 Model Calibration

The groundwater flow model was calibrated by trial and error, by varying parameter properties over the ranges summarized in **Table 3**. Two data sets were used to calibrate the model: a regional dataset representing conditions in the aquifer January 23-25, 1978, and a local dataset representing conditions in the well field on September 22, 2022.

3.1.1 Regional Calibration

The regional model was calibrated to field data reported in Shedlock (1980), including water-level observations at 41 wells and baseflow measurements in two streams. The locations of observation wells were digitized from figures in the original report and are shown in **Figure 16**. The original vertical datum for the measurements was NGVD 29; the observations were converted to an approximate NAVD 88 datum by a 0.5-foot adjustment. Baseflow measurements are reported for a reach of the City Ditch and a reach of the Swan Pond Ditch; both sites are shown on **Figure 16**.

The gravel pits illustrated in **Figure 14** to the south of the VWU well field are not included in the regional calibration model as they were constructed after 1978. Results of the calibration of the regional model are shown in **Figures 17** and **Table 4**. Regional head contours are shown in **Figure 18**.

Figure 16: *Locations of observations from January 23-25, 1978. Head measurements are indicated by green circles, while flow measurements are indicated by orange triangles. Orange triangle to the northwest is on City Ditch, orange triangle to the southeast is on Swan Pond Ditch.*

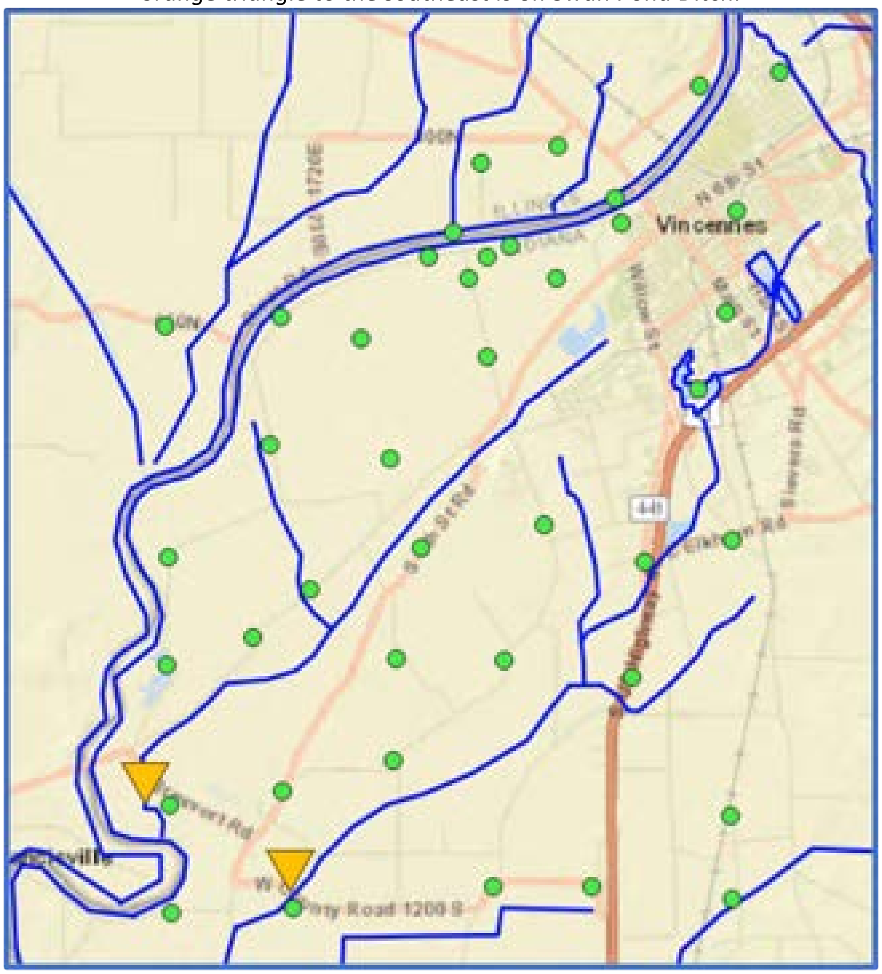


Figure 17: *Results of regional calibration to water levels observed January 23-25, 1978.*

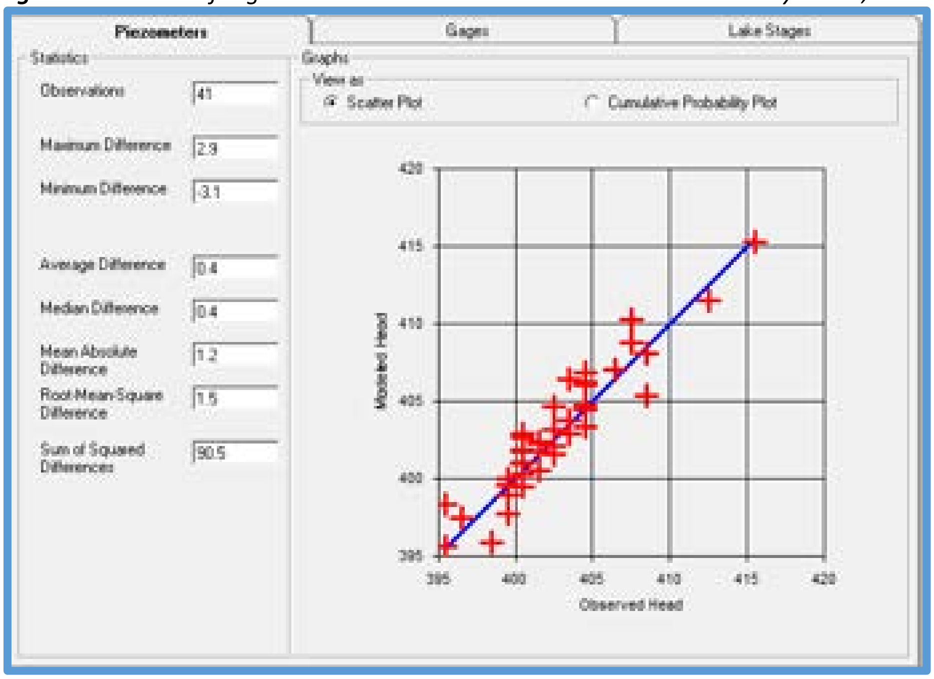
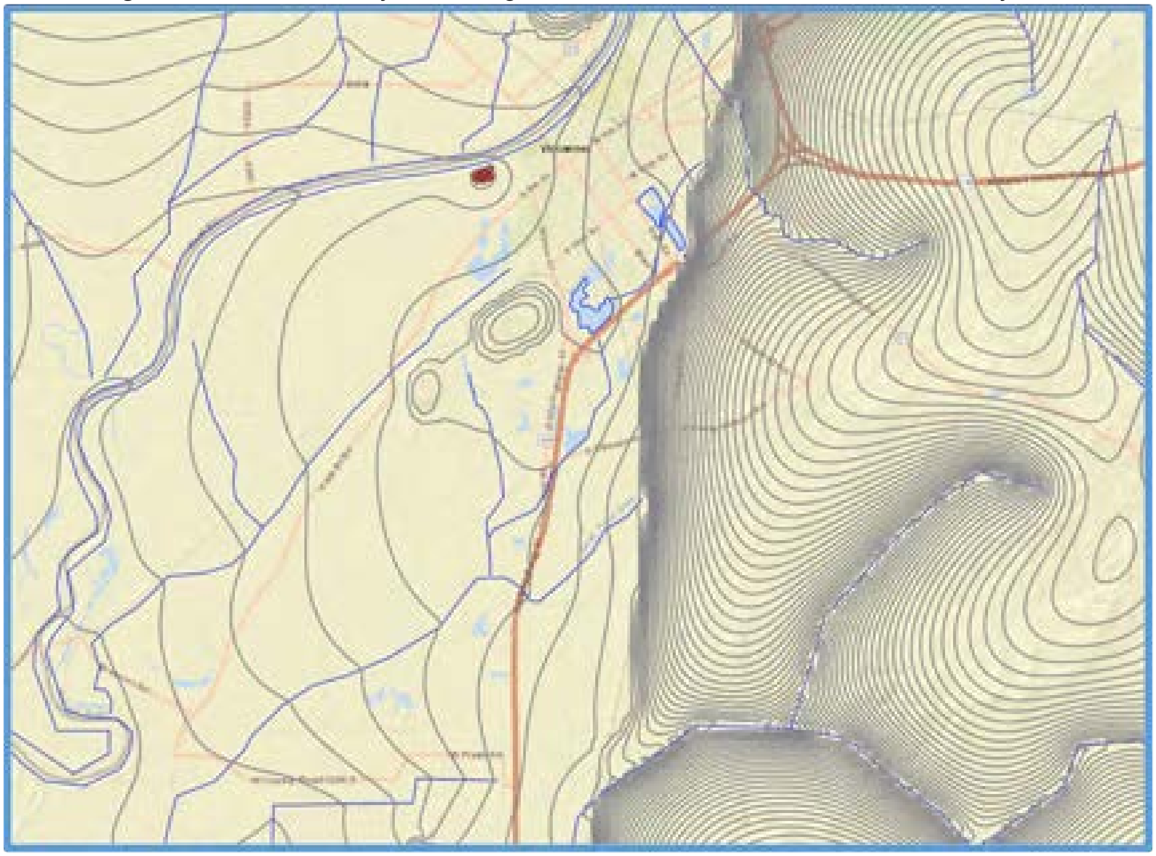


Table 4: *Results of regional calibration to baseflow observed January 23-25, 1978.*

Stream Reach	Measured flow accumulation (cfs)	Modeled flow accumulation (cfs)	Error
City Ditch	7.0	7.0	0%
Swan Pond Ditch	3.2	3.0	6%
***cfs = cubic feet per second.**			

Figure 18: Head contours from the regional calibration model. Contour interval is 2 feet.



3.1.2 Local Calibration

In 2022, INTERA collected additional data at the Vincennes well field as described in **Section 2.0**. The data includes monitoring of well field operations with transducers installed in existing monitoring wells in the well field, a transducer installed in a stilling well in the Wabash River, and pressure transducers and thermal probes placed in three piezometers installed in the riverbed.

The purpose of the piezometers was to track the vertical profile of diurnal temperature fluctuations through the riverbed sediments to calculate the infiltration rate at the streambed during operations of the well field (Constantz, 2008). The measurements indicate a riverbed resistance near the well field between 0.5 and 3.0 days; these values are field estimates and are used as a range to consider during calibration of the local model. Results from the field testing also clearly show that water from the Wabash River is infiltrating into the aquifer when the well field is operating.

Conditions observed on September 22, 2022, at midnight, were chosen to calibrate the local model. At that time, VWU Well 2 was pumping at 1200 gpm and Well 7 at 1330 gpm. Water level observations were made at P1, P2, MW 8, MW 10, MW 12, MW 13, and MW 2D, and the observed river stage was constant at 397.0 ft NAVD 88.

Results of the model calibration include a local hydraulic conductivity of 450 feet/day, and a local resistance of the Wabash riverbed of 0. 5 days. A cross plot of simulated and observed heads and statistics for the local calibration are included in **Figure 19**, and head contours near the well field are shown in **Figure 20**.

Figure 19: *Results of local calibration with new data collected at the well field, September 22, 2023.*

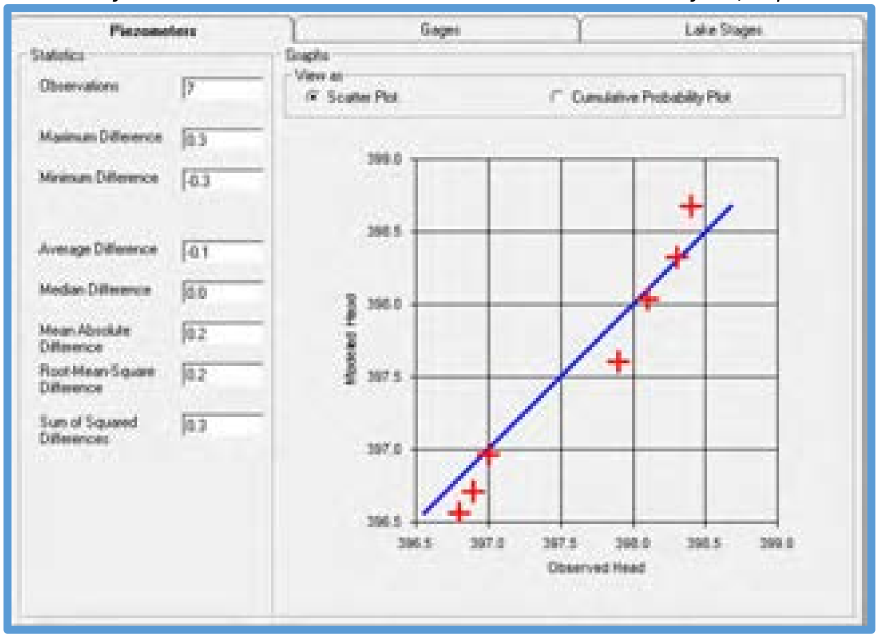
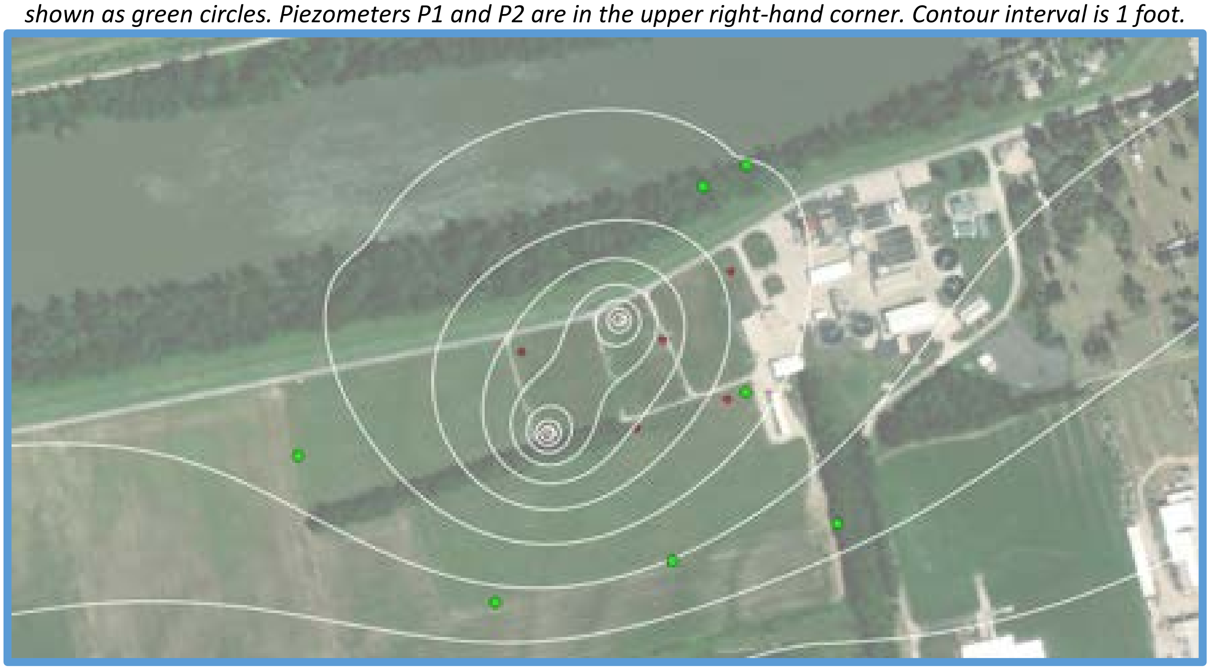


Figure 20: *Local calibration to conditions observed on September 22, 2023, at midnight. Observation points are shown as green circles. Piezometers P1 and P2 are in the upper right-hand corner. Contour interval is 1 foot.*



3.2 WHPA Delineation Model

The final delineation model includes the effects of gravel pits south of the well field evaporating at a rate of 5 inches per month, typical of dry summer conditions. The elevation of the Wabash River near the well field is 400 ft NAVD 88, and a reduced regional recharge rate of 12 inches per year is specified. The pumping rate of each well in the well field is 0.543 MGD (377 gpm), for a total yield of 3.8 MGD (2,640 gpm). This exceeds the most recent 5-year average of water use reported to the DNR (3.35 MGD) by 14%.

Capture zones were developed for two scenarios: first, pumping only from the Vincennes well field, and second, additional summertime pumping of all irrigation wells. Capture zones for 2-, 5-, and 10-year times-of-travel to the well field are illustrated in **Figure 21** for the case without irrigation wells pumping. **Figure 22** shows pathlines from the wells used to create the capture zones; which illustrates the interaction with the gravel pits to the south of the well field has a significant impact on the capture zone.

In **Figure 23**, the capture zones for the scenario with irrigation wells pumping is overlaid on the capture zones from **Figure 21**. The individual rates of the irrigation wells are based on the highest summer month recorded for the well in the period of record (1985 to 2021), representing a conservative scenario. The combined rate of the irrigation wells illustrated in **Figure 13** is 9.4 MGD. Most of the capture zone with irrigation is included within the capture zone without irrigation as shown in **Figure 23**.

3.3 Water Budget

Analytic Element Models like GFLOW do not produce water budgets, as conservation of mass is implicitly satisfied everywhere in the model, and the models are not limited to finite domains.

3.4 Sensitivity Analysis

The delineated capture zones are insensitive to small (10%) changes in the local hydraulic conductivity of the aquifer, and large changes (1 order of magnitude) of the resistance of the bed of the Wabash River. The captures zone is most sensitive to changes in the porosity of the aquifer. A porosity of 20% is specified in the delineation model, while Morris and Johnson (1967) report representative porosities for sand and gravel from 24 to 46%.

Figure 24 shows the 10-year capture zone compared to zones for increased hydraulic conductivity, increased riverbed resistance, and increased porosity. The smallest capture zone represents an increase in porosity from 20 to 30%. The remaining two zones represent an increase in the local hydraulic conductivity of the outwash from 450 to 500 ft/day, and an increase in riverbed resistance from 0.5 to 5 days.

For the final delineation model, we have specified pumping rates at 14% greater than the most recent 5-year average and used a small porosity of 20%. These factors produce a conservative wellhead protection area and time-of-travel zones. **Figure 26** shows the finalized WHPA.

3.5 Results

Overall, the WHPA grew by 15%, going from 2.81 to 3.23 square miles. **Figure 25** shows the new WHPA along with the old WHPA. This figure shows the areas that were added, removed, and remained the same within the WHPA. An area of about 1.0 square miles was removed in the southeast, roughly from S 17th St to US 41. This area that was removed was mostly residential with some old inactive gravel pits and commercial areas. An area of about 1.42 square miles was added to the WHPA in the northeast, northwest, and southwest as shown in **Figure 25**. The newly added area extends east into the City of Vincennes, north into Illinois, past the Wabash River into the Town of Westport, and southwest, nearly to the intersection of S 6th Street Rd. and Henderson Rd. This area is mostly agricultural with some residential and commercial properties. An area of about 1.81 square miles did not change and remains within the new WHPA.

Figure 21: *2-, 5-, and 10-year capture zones.*

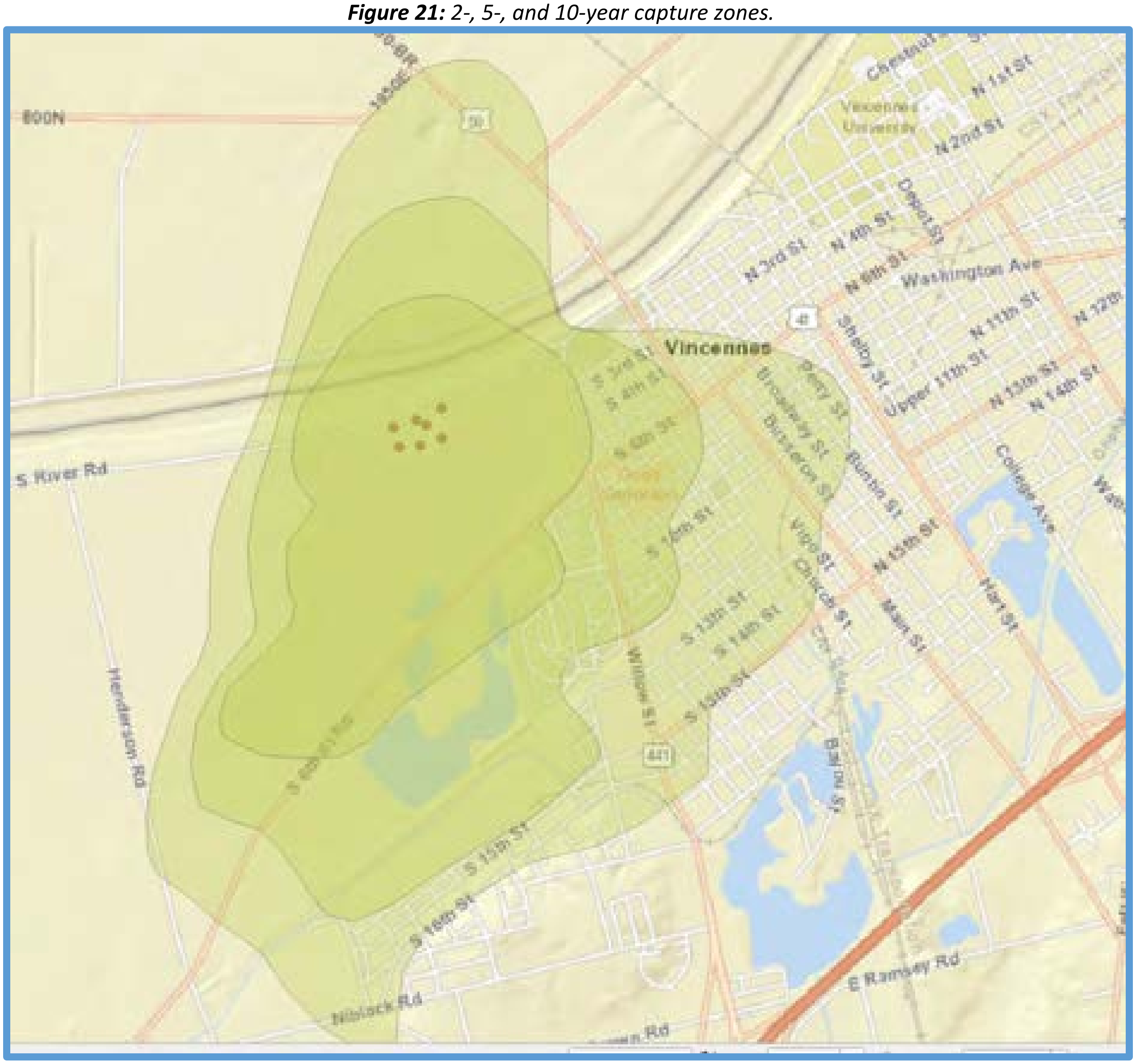


Figure 22: *Pathlines traced backwards from the wells showing the interaction of the well field with the gravel pits to the south.*

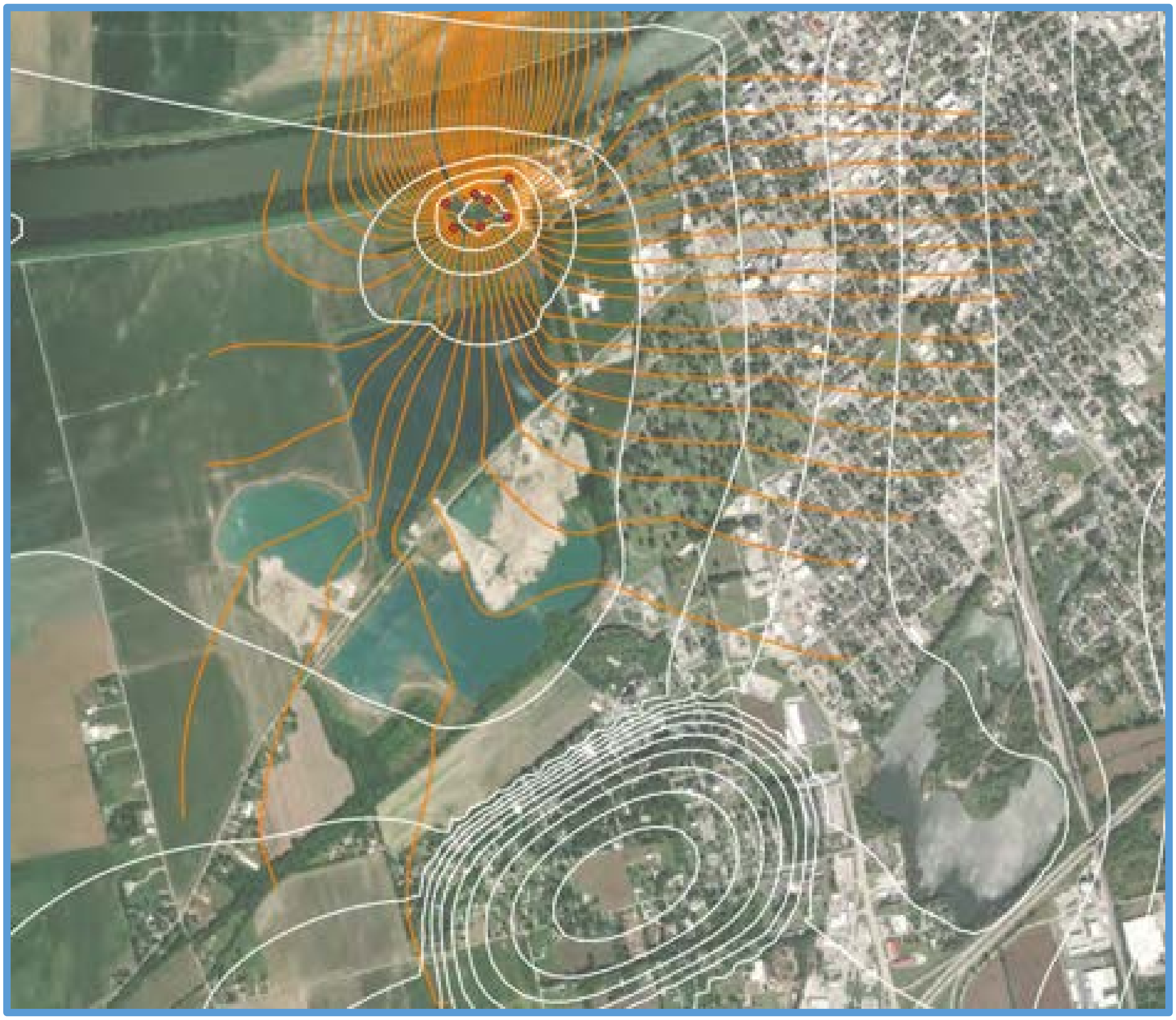


Figure 23: *Comparison of 10-year capture zones with and without irrigation wells operating.*

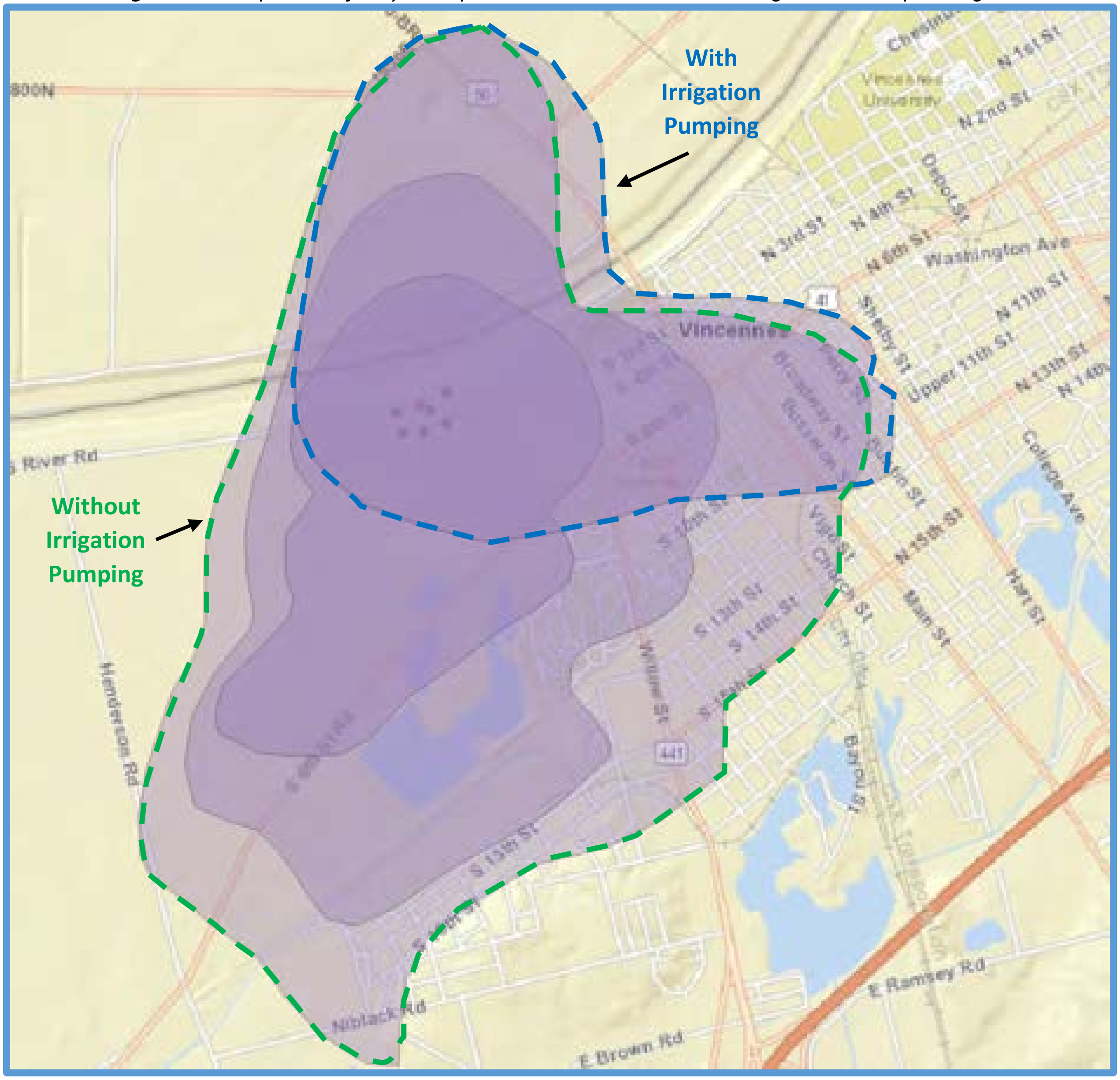


Figure 24: *Sensitivity of 10-year capture zone to local parameter values.*

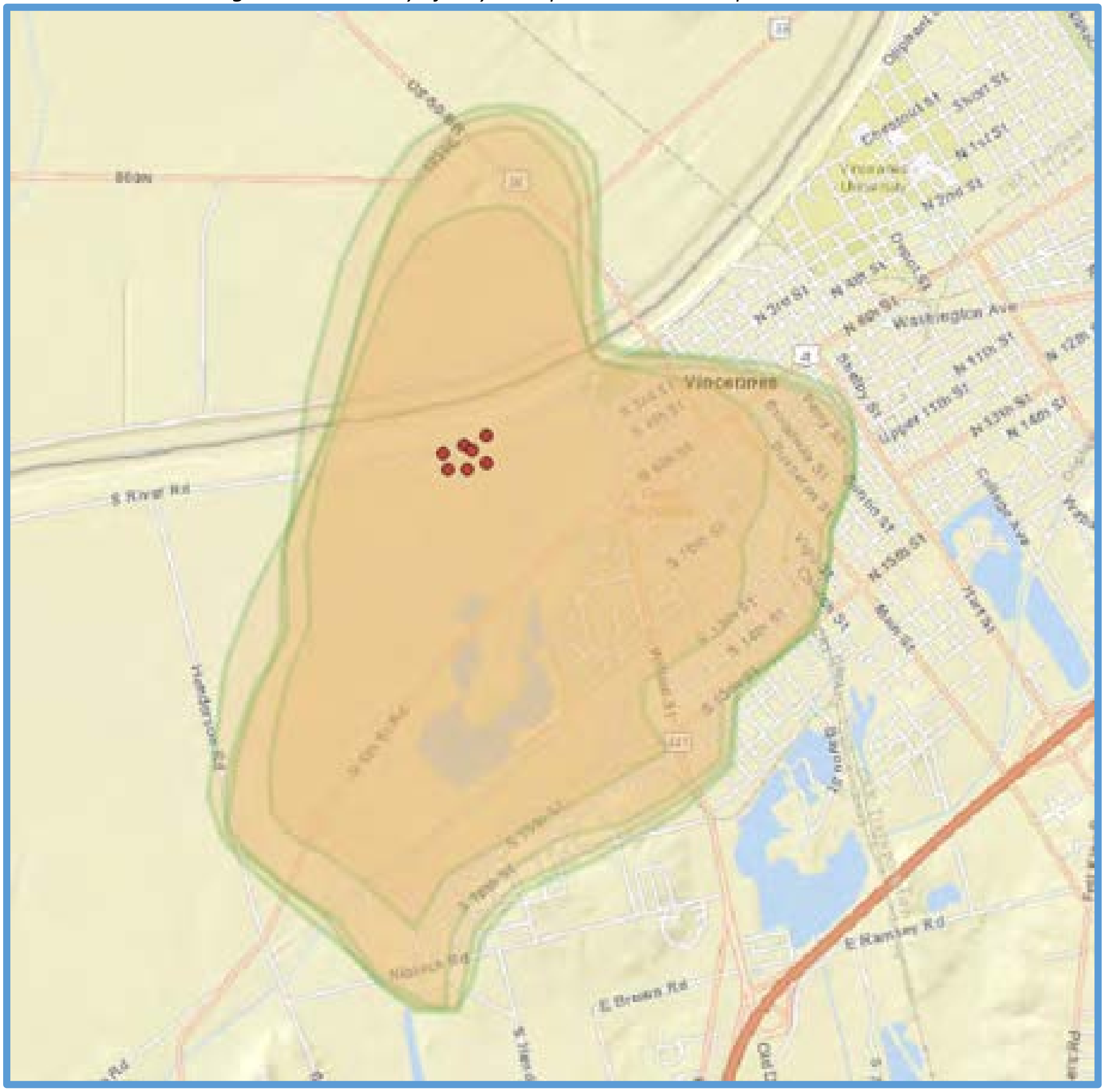
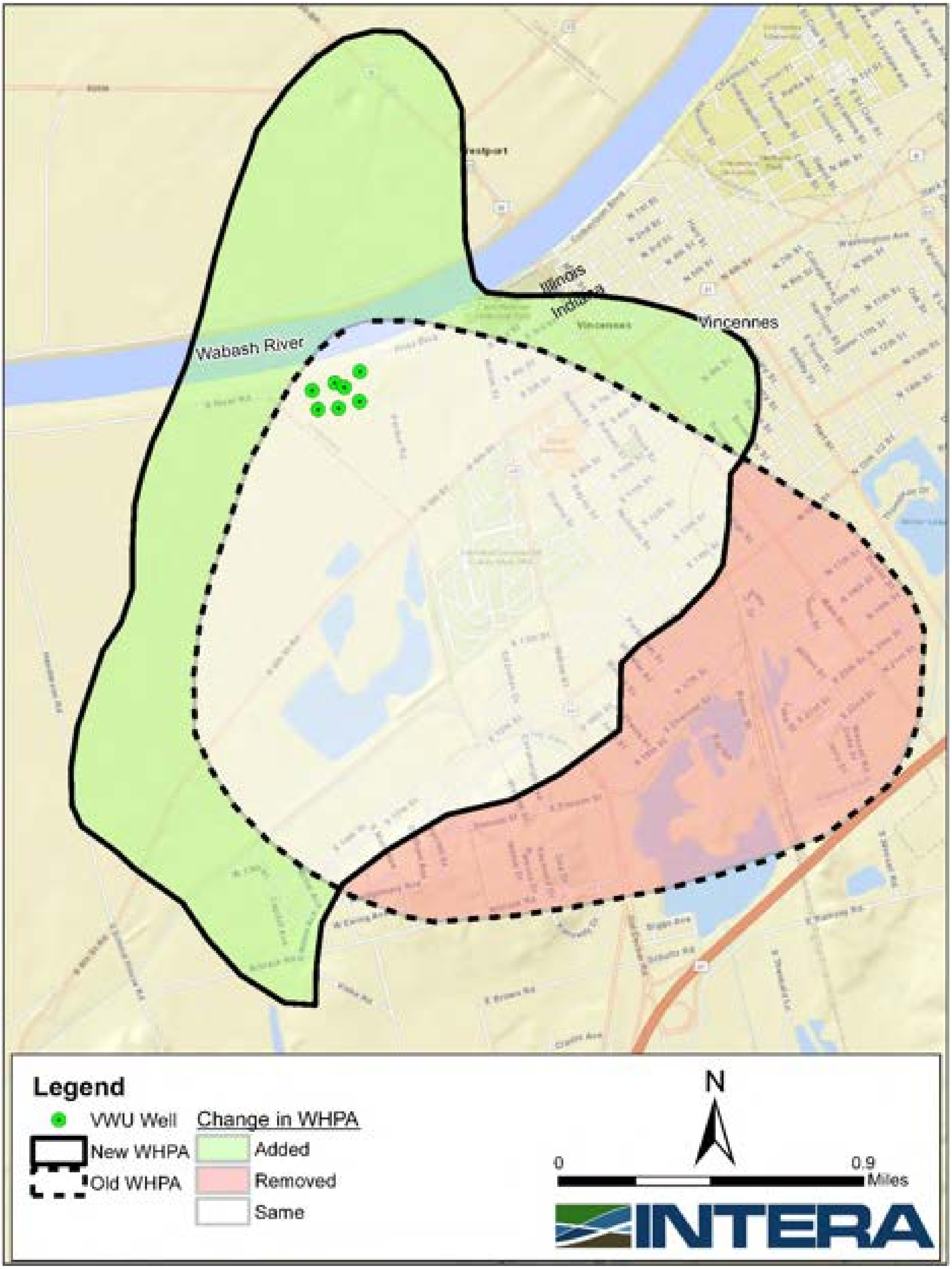


Figure 25: *Comparison of old WHPA to new WHPA.*



4.0 Local Planning Team

A LPT was formed during the implementation of VWU's Phase I WHPP in 2004 in accordance with Indiana's Wellhead Protection Rule. Currently, the LPT has 9 members (**Table 5**). These members represent a best effort to include all perspectives of wellhead protection within the community of Vincennes. The LPT considers and discusses changes to the system outlined in subsequent sections.

Table 5*: Vincennes Water Utility's local planning team members and affiliations*

Name	Affiliation	E-mail	Phone
Hunter Pinnell	Vincennes Water Utility	hunter@vinutilities.com	(812) 882-5326
Andrew Hutchison	Vincennes Water Utility	ahutchison@vinutilities.com	(812) 887-0372
Kirk Bouchie	Vincennes Water Utility	kbouchie@vinutilities.com	(812) 882-7877
Jake Personett	Vincennes Water Utilities	jakep@vinutilities.com	(812) 316-0279
Colt Michaels	Area Plan Commission	cmichaels@knoxcounty.in.gov	(812) 885-2544
Mike Beaman	Knox Co. Health Dept.	mbeaman@knoxcountyhealth.com	(812) 885-8404
Larry Shots	Vincennes Fire Dept.	264@vincennesfire.com	(812) 291-0401
Clem Witteried	Witteried Farms	cwitteried@yahoo.com	(812) 882-1474
Donnie Campbell	Rogers Group Inc.	donnie.campbell@rogersgroupinc.com	

Since its inception, the LPT has not met formally on a regular basis. The LPT met twice in 2011 during the 5-year update process. The LPT then met on March 31, 2017 to overview objectives of the wellhead protection plan and reassess implementation and management plans for the next 5 years. Between 2011 and 2017, LPT members communicated as needed. It was decided at the 2017 meeting that they will begin to meet at least on an annual basis. The 2017 LPT meeting sign-in sheet, meeting agenda, and minutes are in **Appendix B**.

Since 2017, the LPT has communicated on an as-needed basis. There have been no formal meetings of the group since March 2017. The LPT has also lost a few members since then and is in the process of recruiting new members to fill their respective rolls in the team. The LPT is also actively in the process of scheduling a meeting for later this year (2023). Moving forward, the LPT will begin implementing new measures to ensure at least yearly meetings. The LPT will continue its efforts to implement all segments of the comprehensive WHP plan, including: management strategies, emergency planning, communication between local agencies, and educational outreach.

Figure 26: Well Head Protection Area.

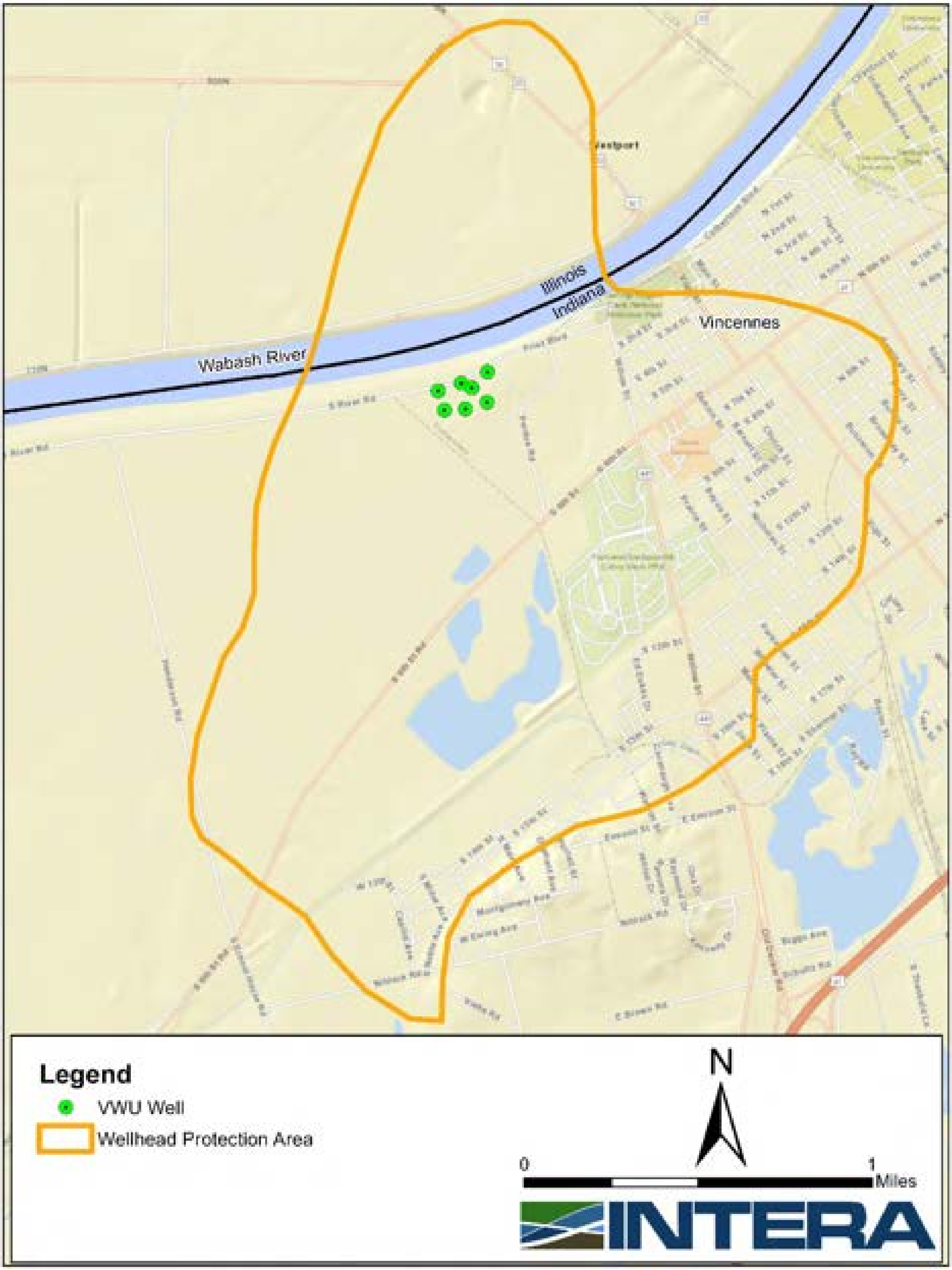


Table 6: Well withdrawal rates from 2010 to 2021

Year	VWU Well Field Withdrawals (mgd)
2010	3.1
2011	3.2
2012	3.6
2013	2.8
2014	3.7
2015	3.6
2016	3.6
2017	3.6
2018	3.4
2019	3.1
2020	3.4
2021	3.3

5.0 Contingency Plan

The contingency plan describes emergency response to a contaminant release in the WHPA, and how the public will be provided with safe drinking water if the water supply became contaminated.

There are several emergency response authorities that operate in the WHPA. Emergency response to a hazardous materials spill is delegated to the Vincennes Fire Department and the Vincennes Township Fire Department. The fire departments have many members that are hazardous materials and items (HAZMAT) trained to the Operations Level. Responders can assess the spill, identify the spill source, isolate the contaminated area, confine the released material, and then call for specialized assistance. Additionally, the local police departments and county emergency management agencies respond to spills. Each entity is contacted by centralized dispatch.

The Knox County Local Emergency Planning Commission (LEPC) maintains hazardous release response plans that coordinate response to a chemical release and provides specialized training for local and county responders. VWU has an emergency response plan that addresses spill response and emergency water treatment. This plan is reviewed annually, updated as needed, and all VWU personnel have access to it.

5.1 Training of Local Responders

Local responders are trained for WHPA specific emergencies through tabletop trainings. Training includes participating in scenario exercises and understanding information on the WHPAs and reporting requirements. Local responders are also trained throughout the year on a variety of emergency response scenarios. The most recent tabletop training was held in May 2017. This training was specifically about emergency response to railroad incidents (**Appendix C**).

5.2 Emergency Response to Leaks, Spills, or Illegal Discharges

The Vincennes Fire Department or Vincennes Township Fire Department will be the first responders to any leak, spill, or illegal discharge. Both departments provide Level-A Hazardous Materials response and mitigation and have multiple members that are trained to both an operations level and to the technician level. Currently, the Vincennes Fire Department and the Vincennes Township Fire Department have letters of agreement to assist VWU in the event of an emergency **(Appendix D).**

5.3 Information to Provide Emergency Responders

Emergency contact numbers (**Table 7**) have been updated and flyers will be sent out to local responders to display. The flyers contain a map of the new WHPA and contact information for use in response to a spill within the WHPA. The flyers can be viewed in **Appendix E**. Also, the WHPA can be accessed as a layer in the central dispatch's GIS, which while not available to all emergency responders, will be when the fire trucks are equipped with computers. The new WHPA will be provided to central dispatch so they can update their GIS map. Currently, only the police vehicles include computers. Materials sent to first responders can be viewed in **Appendix E**.

***Table 7**: Emergency Contact Information*

Contact	Phone Number
Community Public Water Supply System (CPWSS)	
Water Plant Manager (Andrew Hutchison)	Office: 812-882-6620 Mobile: 812-882-6620
MS4 Coordinator (Jake Personett)	Office: 812-882-5326 Mobile: 812-887-0681
CPWSS Owner (Kirk Bouchie, General Manager)	Office: 812-882-6620 Mobile: 812-887-7681
Emergency Spill Response	
IDEM, Office of Emergency Response	1-888-233-SPIL or 317-233-7745
National Response Center	1-800-424-8802
Police/911 Centers	
Knox County 911 Center	911 (Emergency)
Knox County Sheriff Department	812-882-7660 or 911 (Emergency)
Vincennes Police Department	812-882-1630 or 911 (Emergency)
Indiana State Police (Evansville)	812-867-2079 or 911 (Emergency)
Emergency Management	
Knox County EMA	(812) 882-5669 or 911 (Emergency)
Good Samaritan Hospital	
Mark Schutter	812-887-9430 or 911 (Emergency)
Health Department	
Knox County Health Department	812-882-8080
Fire Departments	
Vincennes Fire Department	812-882-2600 or 911 (Emergency)
Vincennes Township Fire Department	812-882-4261 or 911 (Emergency)

5.4 Potential Alternative Sources of Water

While much of the emergency response plan is designed to respond to emergency leaks and spills, it is possible that contamination could occur without notice. The standard monitoring schedule for raw water would identify contamination. If contamination is identified in only one of the wells at the well field, VWU can reconfigure pumping to eliminate use of the contaminated well and shift demand to the other wells. VWU would also attempt to treat the identified contaminant to bring the well back into compliance.

If the entire well field or source area became contaminated, VWU would stop pumping from the contaminated well field. In the event of the entire well field being contaminated, VWU would notify its customers via the local news media or reverse 911 to purchase bottled water from local stores. Additionally, they would commence hauling water from the City of Washington and the City of Princeton.

VWU is continuing to explore the option of having a redundant water supply that is located away from the existing well field. The alternative supply would not only provide redundancy but also support future growth.

5.5 Procedures to Notify Critical Water Users

In the event of a water-quality emergency, VWU's emergency response plan would go into effect. The plan is updated annually and all VWU personnel have access to it. Critical water user notification is part of the standard process of public notice and emergency response **(Table 5).**

Table 8: *List of critical water users*

Critical Water User	Phone Number
Knox County Water	812-726-5330
Vincennes University	812-888-888 (Switchboard) 812-888-4208 (President's office 812-888-4358 (External Relations)
Good Samaritan Hospital	812-882-5220 (Switchboard) 812-885-3195 (Administration)
Gemtron Corporation	812-882-2680
Lewis Bakery	812-425-4642
Vincennes Community Schools	812-882-4844
Willow Manor Nursing Home	812-882-1783
Colonial Assisted Living	812-895-1504
Bridgepointe Health Campus	812-886-9870
Lodge of the Wabash	812-882-8787
Gentle Care Inc.	812-882-8292
Good Samaritan Dialysis Unit	812-882-0546
Vincennes Housing Authority	812-882-5494
Autumn Ridge Apartments	812-886-4612
Futaba Indiana of America Corporation	812-895-4700
1st Street Surgery Center	812-886-6063
Monesmith & Wood Oral Surgery	812-882-8888
Gene B. Co. Apartments	812-886-9304 or 800-723-0420

5.6 Availability of Contingency Plan

A complete copy of the wellhead protection plan is available to the public at VWU's main office (403 Busseron Street Vincennes, IN 47591).

6.0 Potential Contaminant Source Inventory

In 2002, the initial potential contaminant source inventory (PCSI) was compiled through a combination of a database search, a windshield survey, a review of local zoning maps, and discussion regarding historical land use. The PCSI was updated again in 2011 with details from a database search, windshield survey, and a review of areal photos to determine land use. A third PCS inventory was conducted in March 2017 for the last 5-year update, completed by another database search, meeting with the LPT, and a windshield survey.

The fourth PCS inventory was conducted in June 2023 for this current 5-year update. The PCSI was completed by first searching for documentation of potential contaminants in the United States Environmental Protection Agency (EPA) Envirofacts online database and the Indiana Geological Survey (IGS) IndianaMAP online database as well as through meetings with the LPT to during update discussions. A windshield survey was then conducted to confirm locations identified in both the database searches and any other observable potential contaminant sources within the wellhead protection areas. The updated PCSI is shown in **Table 9**. Locations of all inventoried locations are shown in **Figure 29**.

6.1 Potential Saline Water Contamination

In addition to the database searches and windshield survey, an additional potential contaminant source was identified in Shedlock (1980). The title of the Shedlock report is "Saline Water at the Base of the Glacial-Outwash Aquifer Near Vincennes, Knox County, Indiana". This report details the USGS investigation into high chloride concentrations of 500 mg/l discovered in new production wells drilled in 1976. The USGS installed several monitoring wells around the well field and discovered a plume of saline water at the base of the outwash aquifer immediately west of the VWU well field. The plume was mapped as having concentrations of <5,000 mg/l at the highest point. The source of the saline water was identified in the report as coming from the bedrock. The report identifies abandoned oil and gas wells and natural fractures in the bedrock as pathways for upward migration of the saline water through the bedrock. Locations of abandoned oil and gas wells are shown in **Figure 27**. Some of the upward migration may be natural, as saline water occurs naturally within the deep bedrock formations, but there are also several oil fields in the area where saline water is being injected under pressure to increase oil production. The injection pressure may be increasing the head difference between the saline-water reservoir and the outwash aquifer. Two nearby injection wells are shown in **Figure 28**. Changes in saline injection and water quality near the well field will be monitored regularly to reduce the risk of contamination at the well field.

__Figure 27:__ Location of abandoned deep oil and gas wells near the VWU well field

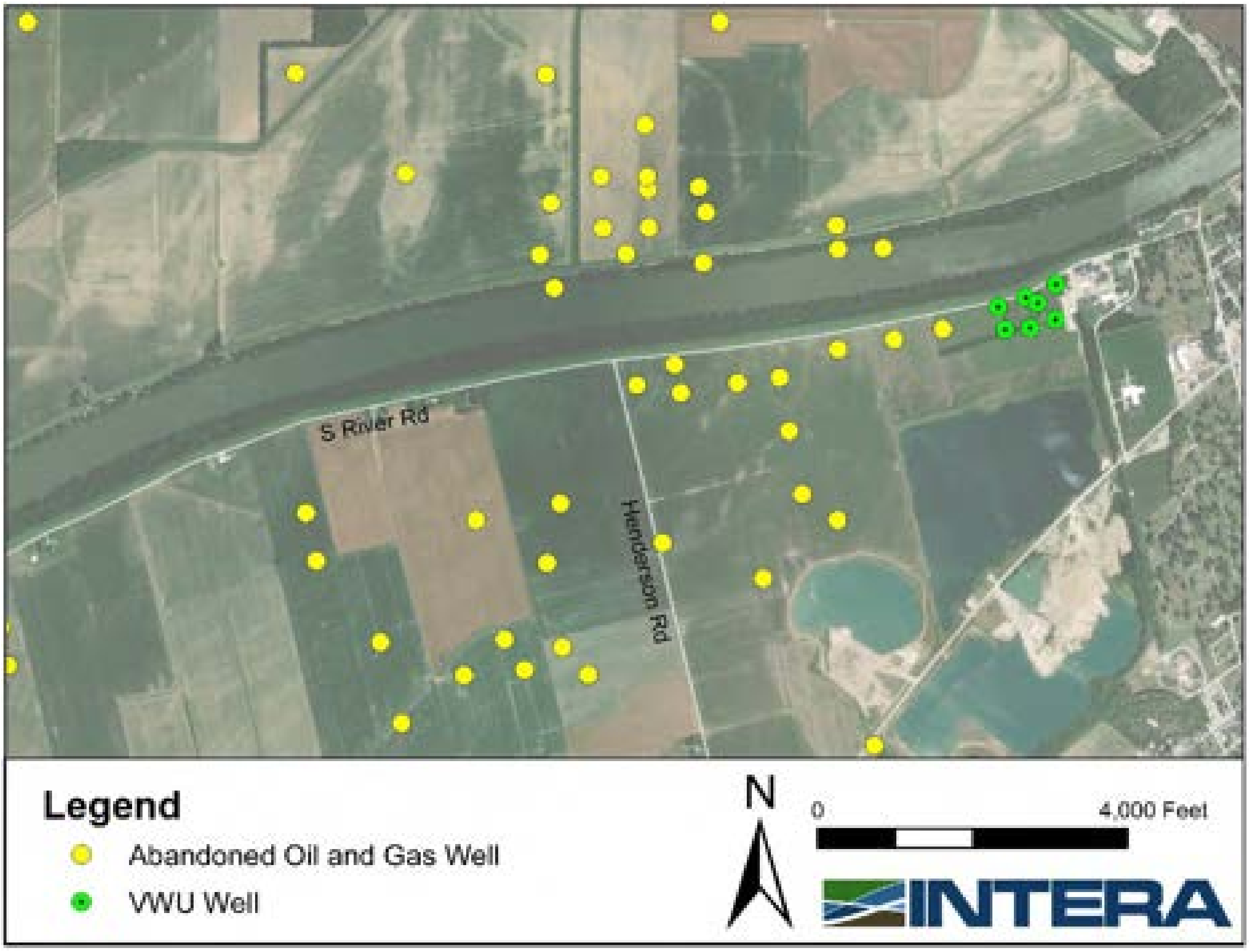
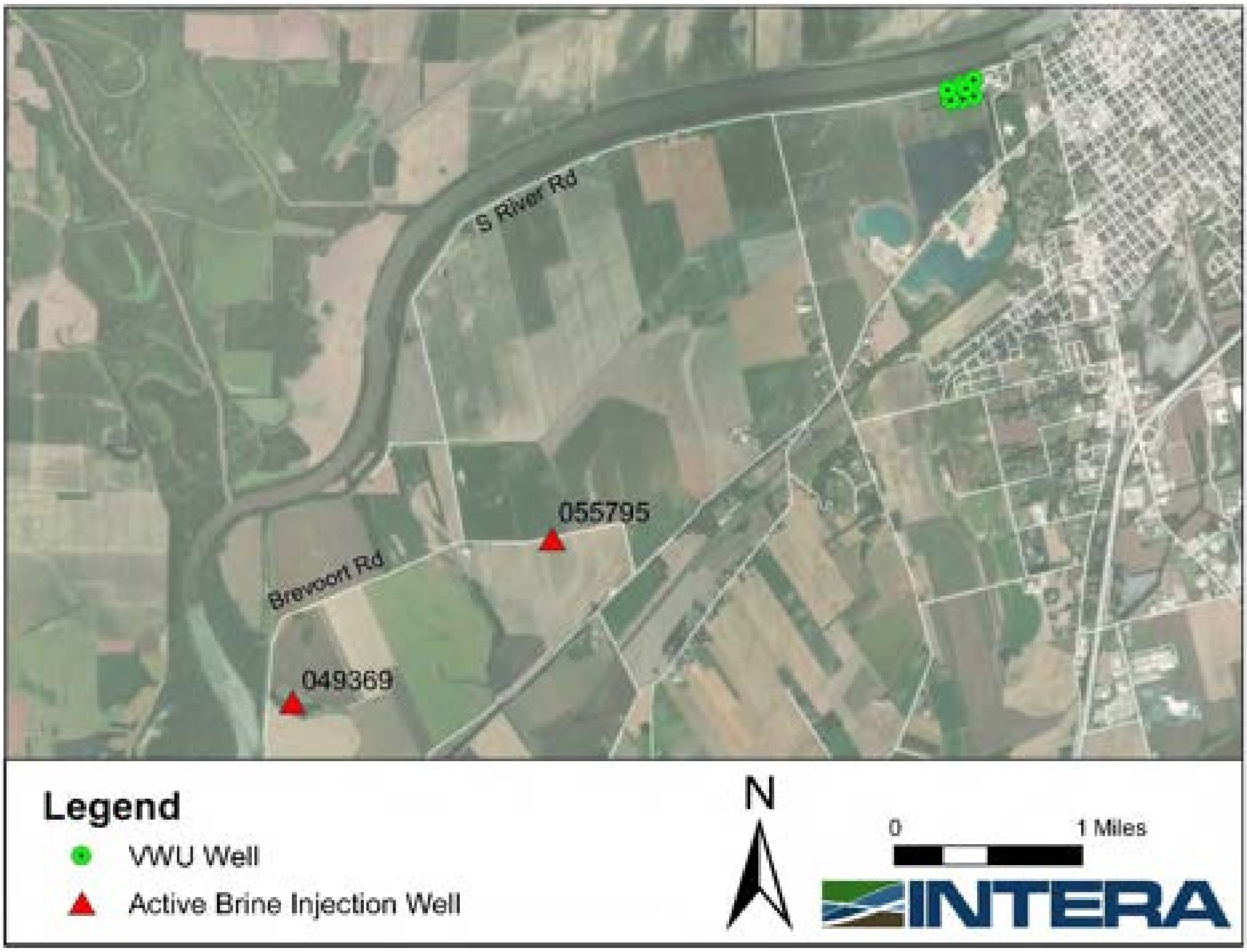


Figure 28: *Location of two nearby active high-pressure brine injection wells*



6.2 Land Use

The primary use of land in the WHPA is residential, commercial, agricultural, cemetery/park/athletic field, surface waters, and industrial usage (**Figure 30**). Based on previous PCS inventories and land uses in the WHPA, the LPT identified the following PCS categories: Residential Uses, Agricultural Use, Commercial Use, Industrial Use, Cemeteries, Parks, and Athletic Fields, Transportation Routes, and Surface Waters.

Each of these categories represents a summary of land uses. General management tools are listed below for each use category.

6.2.1 Residential Uses

The main risk factors identified by the LPT included fertilizers, insecticides, herbicides, household hazardous waste, septic systems, and abandoned wells. On the Indiana side of the Wabash, the residential areas are within the Knox County Solid Waste Management District, which accepts hazardous household waste, herbicides, insecticides, and fertilizers. On the Illinois side, there are no residential areas within the zone itself but waste management trucks must pass through the zone. This area is serviced by Republic Services under contract with the city of Lawrenceville, which accepts hazardous household waste, herbicides, insecticides, and fertilizers. The LPT considers residential areas to pose a low risk to groundwater quality.

Preferred management tools: public participation/education, contingency planning, groundwater monitoring, waste disposal regulations, household hazardous waste program.

Figure 29: Potential Contaminant Source Inventory Map

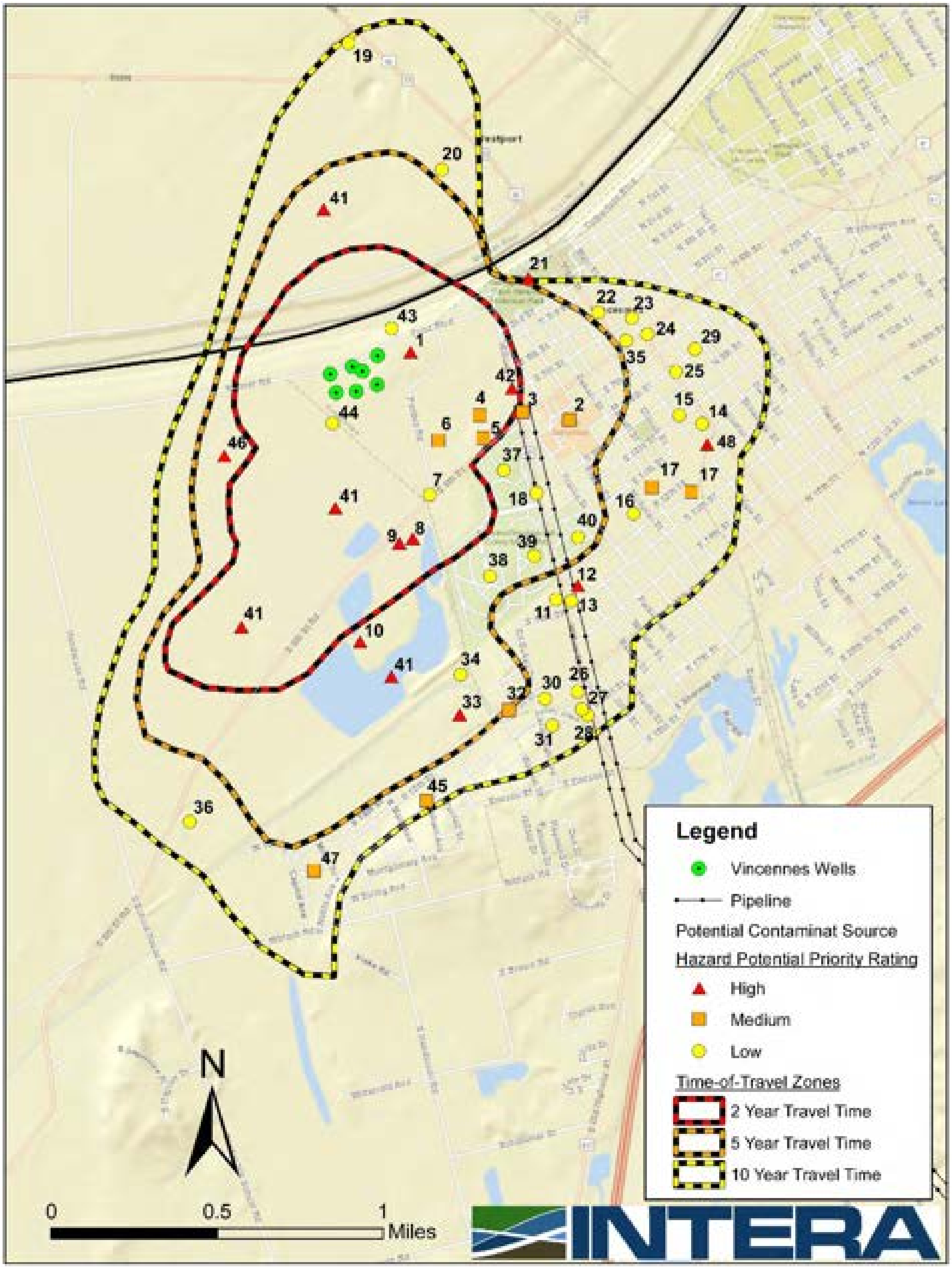
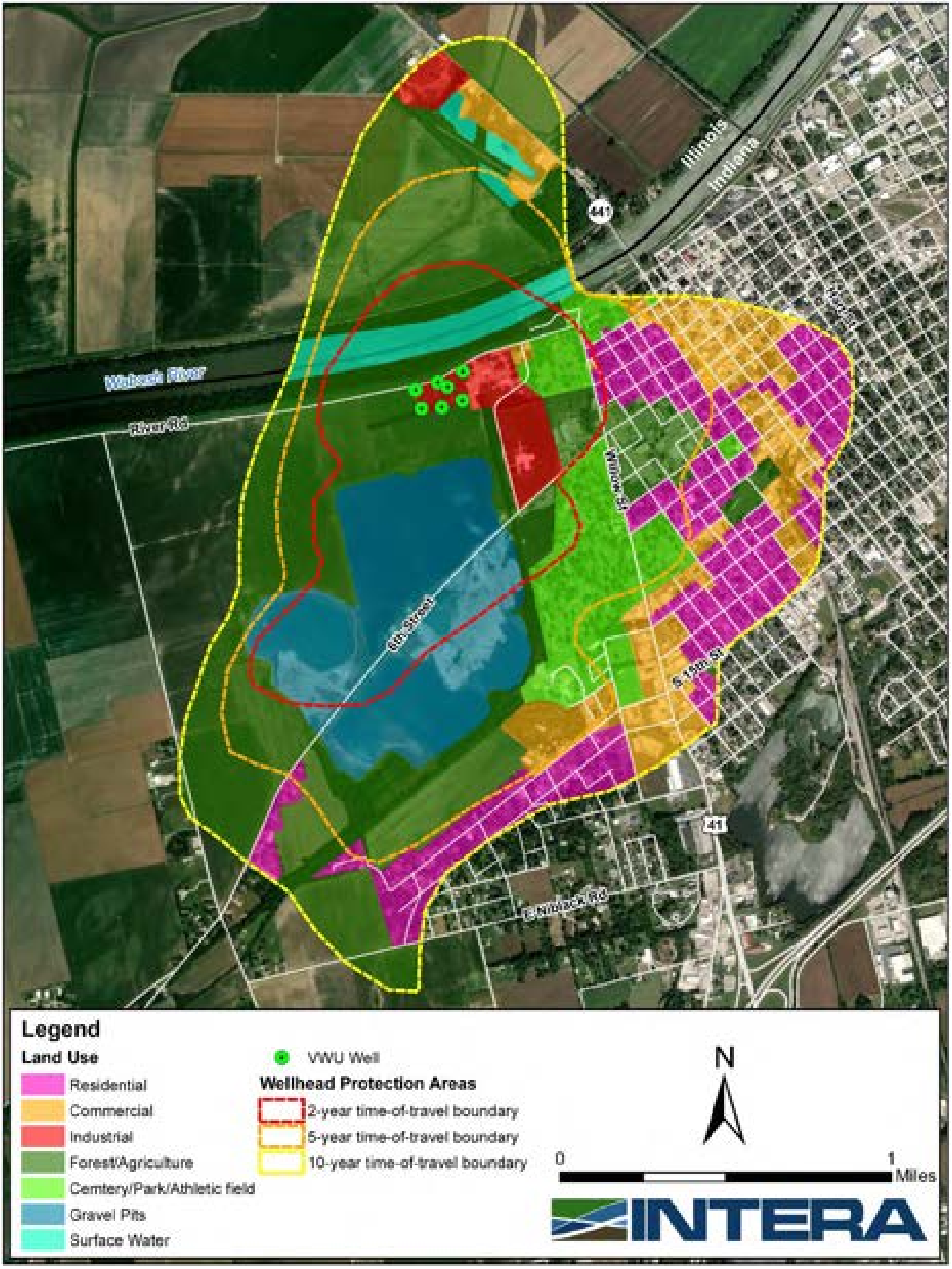


***Table 9**: Potential Contaminant Source Inventory*

FACILITY ID	NAME	ADDRESS	CONTACT	PHONE NO.	Time of Travel Zone	Hazard Potential Priority Rating	RCRIS (A)	RCRA Non-Gen (B)	Underground Storage Tank (C)	Leaking Underground Storage Tank (H)	[illegible]	Windshield Survey/Land Use (W)	PERMIT NUMBERS	POTENTIAL CONTAMINANTS	SITE DESCRIPTION	OPERATIONAL STATUS
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

***Figure 30**: Land Use Map*



6.2.2 Agricultural Use

There are several agriculturally active areas within the WHPA. Common contaminants to groundwater may include pesticides, fertilizer application, poor fuel, and oil storage. The LPT considers agricultural use to be low risk to water quality.

Preferred management tools: existing state/local regulations regarding chemical application and secondary containment, notification letters, contingency planning, nutrient management planning with individual farmers, education and BMPs for pesticide and fertilizer application.

6.2.3 Commercial Use

There are several commercial facilities in the WHPA. A commercial facility's hazard ranking is based on whether it generates or stores hazardous materials and its proximity to the well field. The PCSI ranks all the individual commercial businesses.

Preferred management tools: existing state and local regulations, notification of potential contaminant sources, contingency planning

6.2.4 Industrial Use

There are several industrial facilities in the WHPA. An industrial facility's hazard ranking is based on whether it generates or stores hazardous materials, the amount of potential contaminants the facility produces, the physical integrity of the facility, existing risk mitigations, and its proximity to well field. The PCSI ranks all the individual industrial businesses using these characteristics.

Preferred management tools: existing state and local regulations, notification of potential contaminant sources, contingency planning

6.2.5 Cemeteries, Parks, and Athletic Fields

There are multiple cemeteries, a few parks, and two athletic fields in the WHPA. Pesticide and fertilizer application and poor fuel and oil storage can contaminate groundwater; the LPT considers cemeteries, parks, and athletic field use to be a low to medium risk to water quality.

Preferred management tools: existing state and local regulations regarding chemical application and secondary containment, notification letters, contingency planning, education and BMPs for pesticide and fertilizer application

6.2.6 Transportation Routes

The WHPA includes CSX Railroad, US 41, and IN 441/IL 33. Transportation corridors pose a high contaminant risk to groundwater due to the potential of accidents involving a vehicle transporting hazardous material.

Preferred management tools: existing regulations regarding transporting hazardous materials, notification and education of PCSs, contingency planning, sign placement

6.2.7 Surface Waters

Surface waters at most risk within the WHPA are the Wabash River and several gravel pits. These surface waters pose a threat to the groundwater because of the interactions between surface water and groundwater. The gravel pits themselves pose little threat to the aquifer. However, if something is spilled in the gravel pits, the contaminant may directly become part of the aquifer and therefore put the entire aquifer at risk.

The Wabash River is less connected to the aquifer compared to the gravel pits and has a greater potential for contamination to flow downstream instead of entering the aquifer depending on the groundwater gradient at time of contamination. In normal conditions, the groundwater gradient could be toward the river with groundwater discharging into the river. However, during times of drought or high pumping near the river, water from the river could be lost to the aquifer, in which case the contaminant could also enter the aquifer.

The gravel pits are considered high risk to the WHPA due to their direct connection to the aquifer, while the Wabash River is considered a low risk based on how groundwater in normal conditions is discharged into the river rather than coming from the river.

Preferred management tools: water-quality monitoring, notification letters, LPT participation, contingency planning, education and BMPs

7.0 Management Plan

7.1 Public Participation and Education

The LPT has and will continue to develop education and outreach materials that broaden general awareness about source water protection. Specific education activities are discussed in **Chapter 7**.

7.2 Contingency Planning

VWU's contingency plan relies on existing local emergency management practices. The different elements of the contingency plan are described in **Chapter 4**.

7.3 Groundwater Monitoring

While the contingency plan responds to leaks and spills, it is possible that contamination could occur without notice. However, the contaminant would be detected by VWU's standard monitoring schedule. VWU will continue its water-quality monitoring practices outlined in the standardized monitoring framework for the 2011-2019 cycle and all future cycles (**Appendix A**). VWU will also begin to monitor more frequently, at more locations, and will analyze the samples for more constituents to decrease risk to the well field.

7.4 Source Control Strategies

Source control strategies are specific measures used to reduce the risk of groundwater contamination from potential sources of contamination. These measures include existing state and federal regulations, zoning ordinances, design standards, and operating standards.

7.4.1 Existing State and Federal Regulations

The LPT recognizes that gas stations, dry cleaners, medical facilities, transporting and storing hazardous materials, storing and applying pesticides and fertilizers, and land uses that pose a threat to groundwater quality are governed by federal and state regulations. These regulations are critical for continued protection of the public water supply.

7.4.2 Zoning Ordinances

The LPT recommends creating a groundwater protection overlay district within the zoning ordinances of Knox County and City of Vincennes. A groundwater protection overlay district will prohibit the number of medium and high risk land uses or make the containment and/or management restrictions more stringent. During Phase I and the 5-year update periods a zoning ordinance was not pursued. However, the LPT is still interested in evaluating the applicability of an overlay zone.

7.4.3 Design Standards

Design standards are often incorporated into existing regulations or into overlay zoning requirements. Design standards are used to regulate the design, construction, and operation of various land use activities, which are typically applied to new construction. If an overlay zoning ordinance is pursued during the Phase II 5-year update, it is anticipated that design standards will be included in the ordinance.

7.4.4 Operating Standards

Operating standards are used to ensure that land use activities are conducted in such a way as to protect groundwater. Operating standards generally take the form of best management practices (BMPs). BMPs are usually applicable to a certain industry and provide specific measures for guarding against accidental contamination. The LPT recommends distributing BMPs to all applicable PCS facilities.

7.5 Risk Assessment

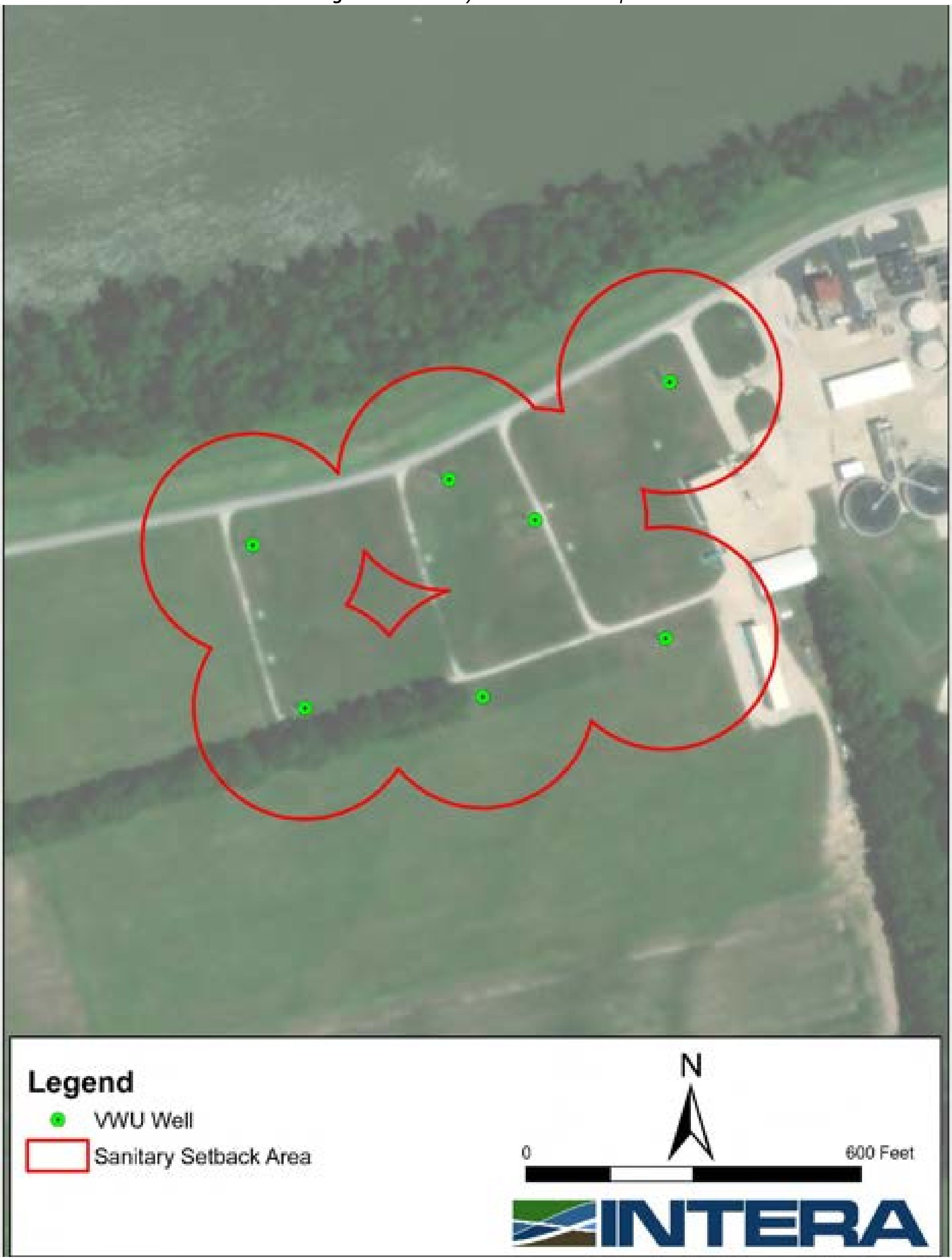
Each different PCS is given a hazard potential priority rating of high, medium, or low. This rating is based upon the land use activity, any hazardous materials and quantities found on site, its history of spills or releases, its location within the wellhead protection area, and the local geology. Each individual PCS must be considered separately for each of these criteria with the exception of the local geology. In the Vincennes area, the aquifer is a sand and gravel aquifer that has a layer of clay above the aquifer that ranges from 14 to 20 feet thick. This layer of clay provides some protection from contamination that occurs on the land surface. The hazard potential priority rating is not intended to be permanent and as new information becomes available the hazard potential priority rating should be reviewed and modified, if necessary.

7.6 Sanitary Setback Area

A sanitary setback area around each well is required to protect groundwater from direct contamination. Within the 200-foot setback area, storing and mixing chemicals are prohibited except for chemicals used for drinking water treatment and pesticides regulated by the Indiana Pesticide Review Board through IC 15-16-4 and IC 15-16-5. VWU and the LPT have specified measures for prohibiting unauthorized use of chemicals, securing the wellheads, and managing existing roads within the setback areas.

The sanitary setback areas of VWU wells are owned by VWU except where River Road crosses the sanitary setback area and to the north of River Road (**Figure 31**). River Road is a local road with limited use and the area north of River Road is undeveloped right-of-way. The sanitary setback area is farmed and the farmer sits on the LPT. There is no storage or mixing of chemicals in the sanitary setback area.

***Figure 31**: Sanitary Setback Area Map*



7.6.1 Well Construction Permits

Production wells with a capacity of 70 gallons per minute (gpm) or greater must be located at least 100 feet from each other in accordance with 327 IAC 8-3.4-9(5)(A). Additionally, no storm or sanitary sewer lines may be located within 50 feet of a production well. All of VWU's wells comply with both of these requirements.

7.6.2 Measures to Prohibit the Storage and Mixing of Chemicals

VWU prohibits the mixing and storage of unregulated chemicals within the sanitary setback area of each well. Generally, there are no water treatment chemicals stored, loaded, or transported with the sanitary setback area.

7.6.3 Security of Wellheads

The wellheads are all located on elevated platforms, and only Vincennes employees are permitted on the platforms to perform routine maintenance and sampling. The wells are not fenced but there is security lighting at the well field, the wells are all within view of VWU's office, and the well field is visually inspected daily.

7.6.4 Transportation Routes

River Road transects the sanitary setback area wells 2, 6, and 8 but is a local access road that has limited traffic. De-icing materials are seldom used on the road because of low traffic volumes. The transportation of pesticides and fertilizers is the biggest concern and even this is just local, limited traffic.

7.7 Wellhead Protection Area

The specific management strategies for the wellhead protection area are included in **Table 10.**

7.8 Management and Monitoring of Potential Contaminant Sources

VWU maintains a PCS inventory of regulated and unregulated contaminants. The inventory was updated in 2002, 2011, 2017, and most recently in 2023. A database search for PCSs was conducted in 2017 using US EPA's EnvironFacts database and the IndianaMap database created by the Indiana Geological Survey, the Indiana Department of Transportation, and the Indiana Geographic Information Council. The following IDEM databases were reviewed:

- National Pollutant Discharge Elimination System Facility
- National Pollutant Discharge Elimination System Pipe Location
- Solid Waste Site
- Industrial Waste Site
- Brownfield Site
- Construction-Demolition Waste Site
- Cleanup Sites
- Composting Facility
- Confined Feeding Operation
- Corrective Action Sites
- Institutional Control Sites
- Leaking Underground Storage Tanks
- Manufactured Gas Plants
- Superfund Sites

- Old Landfills
- Open Dump Sites
- Restricted Waste Sites
- Septage Waste Sites
- Waste Tire Sites
- Waste Transfer Sites
- Waste Transfer Stations
- Underground Storage Tank Sites
- Volunteer Remediation Program Sites

The PCSI is further discussed in **Chapter 6.** During the next 5-year period, VWU and the LPT will update the inventory during their annual meeting.

7.9 Identification of Abandoned Wells

VWU will continue to educate the public in the WHPA on the importance of properly abandoning wells. The LPT recommends adding information to billing statements regarding properly abandoning wells on their property.

7.10 Notification Letter to Property Owners and PCSs

Due to changes in the PCS inventory, the LPT recommends re-sending all PCSs a letter notifying them that they reside within the WHPA. VWU will not send letters to all property owners within the WHPA during this 5-year update, as the WHPA boundary has not changed. VWU may add WHPA information as an addition to a billing statement instead of sending a separate letter to notify them they are located within the WHPA. An example letter is located in **Appendix G**.

7.11 Access to the WHP Plan

All PCS and residents of the WHPA will be able to access the WHP Plan at the Water Department (403 Busseron Street).

7.12 Public Outreach Program

The LPT has and will continue to develop education and outreach materials that broaden general awareness about source water protection. Specific education activities are discussed in **Table 10.**

7.13 Posting of WHPA Signs

VWU decided not to post signs along the border of the WHPA. VWU will continue its current methods of communication to keep the public aware of WHPA boundaries.

8.0 Public Participation and Education

The Indiana Wellhead Protection Rule requires the LPT to establish a public outreach program that educates the community and owners or operators of identified potential sources of contamination about the consequences of groundwater contamination and the methods available for preventing contamination. VWU has a comprehensive public participation and education program. The specific education measures and the plans for Phase II are described in **Table 10**.

9.0 Schedule for Implementation

While many of the management measures were implemented during Phase I and Phase II, many of these activities are ongoing and must be completed as part of the 5-year update. **Table 7** provides the schedule of implementation and specific measures.

***Table 10**: Specific management measures for Phase II implementation*

Measure	Task	Responsible Party	Target Completion
Agricultural Best Management Practices	Continue providing pesticide and fertilizer BMPs to farmers within the WHPA through the SWCD.	LPT	Annually
Household Hazardous Waste Collection	Advertise the Knox County Solid Waste District's household hazardous waste collection via newspaper and radio	LPT	Ongoing
Direct Mailings	Notify property owners and potential contaminant sources within WHPA. WHP Plan available at public library.	VWU	1/1/2024
Consumer Confidence Report	Provide information about Indiana Wellhead Protection Program and Vincennes Wellhead Protection Plan to public	VWU	Annually
Website and Local Access Cable	WHPP information is made available on VWU website. Will continue to be updated on a regular basis	VWU	N/A
Newspaper Articles	Publication of WHPP information. LPT will discuss this measure and what to post at annual meetings.	LPT	Annually
Community Education	Sponsor booths when opportunities present themselves, at events such as the Senior Fair, County Fair, Go Green Event, Recycling in the Garden, Going Green, and Earth Dat. Public presentations.	LPT	Ongoing
Groundwater Education for children	Continue working with the MS4 to educated children.	LPT	Ongoing
BMPs for Cemeteries	Provide cemeteries with WHPA information and BMPs for lawn care and maintenance activates	LPT	1/1/2024
BMPs for Gravel Pits	Establish dialogue with gravel pit owners to discuss WHP and identify BMPs	LPT	1/1/2024
Collaborate with MS4 Program	Work with MS4 Program Coordinator for educational opportunities	LPT	Ongoing
Emergency Response Notification	Provide local responders with updated contact information and new WHPA maps for emergency response situations. Provide GIS files where applicable.	LPT	1/1/2024

Measure	Task	Responsible Party	Target Completion
Hazardous Material Emergency Plans	Vincennes Fire Departments will verify all required Hazardous Materials Emergency Plans within the WHPA are properly maintained and updated	VFD	Annually
Emergency Reponses Training	Emergency responders are trained annually and will have information on the WHPA included in the training.	LPT	Annually
Standardized Monitoring Framework	Continued management of specific monitoring framework (SMF) and groundwater sampling	VWU	Ongoing
Existing Wells	If necessary, VWU will monitoring groundwater quality at monitoring wells down gradient of PCS sites that pose a risk.	VWU	Ongoing
Updating PCSI	Monitor and update records of PCSI at annual LPT meetings	LPT	Annually
Overlay Zoning	Continue to discuss the possibility of adding a WHPA overlay zoning district with the Planning Dept.	LPT	Ongoing
Aboveground Storage Tanks	Continue monitoring above ground storage tanks through existing regulations and data available through IDEM	LPT	Ongoing
Underground Storage Tanks	Continue monitoring USTs through existing regulations and data available through IDEM	LPT	Ongoing
Septic Systems	Work with health department to assure that septic systems within the WHPA are in compliance with applicable state and county regulations	LPT	Ongoing