

# **PUBLIC WATER SUPPLY WELL SITE SELECTION RECOMMENDATIONS**

## **Pressure Zone 4**

Madison, Wisconsin

April 2011

Prepared For:

**Madison Water Utility**  
119 East Olin Avenue  
Madison, Wisconsin 53713-1431

Prepared By:

**BT SQUARED, Inc.**  
2830 Dairy Drive  
Madison, Wisconsin 53718

**BT SQUARED Project #4131**

SMART  
SIMPLE  
SOLUTIONS

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**BT SQUARED**  
CIVIL & ENVIRONMENTAL ENGINEERING

## PROJECT SUMMARY

The 2006 Water Utility Master Plan identified fire flow deficiencies throughout significant portions of Pressure Zone 4 (PZ4). PZ4 is supplied by a single source, Unit Well 9, which makes the zone vulnerable to service interruptions. PZ4 is also expanding rapidly to the southeast so that Unit Well 9 is hydraulically remote from the far reaches of the zone. The growth in PZ4 away from Unit Well 9 makes it difficult to move water efficiently and effectively to where it is needed.

On December 15, 2009, the Madison Water Utility Board voted to accept a staff recommendation to drill a new well as the preferred alternative for solving the fire protection and supply redundancy problems.

The Water Utility hired BT Squared, Inc., to work with the Utility and a Citizen Advisory Panel (CAP) to identify potential locations for a replacement well. The site selection process included development of site selection criteria, preliminary identification of potential sites, and more detailed evaluation of selected sites. Public feedback was solicited throughout the site evaluation phase of the project through implementation of a Public Participation Plan. In addition to several CAP meetings, the Public Participation Plan process has included two public meetings since December 2009.

## SITE SELECTION CRITERIA

Potential sites were evaluated based on criteria developed during the early stages of the project. These criteria included:

- Statutory requirements for property size, floodway restrictions, and minimum setbacks as listed in Wisconsin Administrative Code NR 811.12,
- Water quantity and quality desired by the Water Utility,
- Minimum property size, proximity to existing infrastructure, and availability, and
- Compatibility with surrounding land use.

Potential well sites in the northern half of PZ4 were not considered because of the relative scarcity of available properties in this area and the desirability of locating the new well in the portion of the zone with the greatest identified fire flow deficiencies. Although the minimum site size was originally identified as

one acre, this was increased to one to two acres based on the desire to provide adequate room for treatment facilities should treatment become necessary in the future.

## INITIAL SCREENING

The initial screening process was performed using a well siting factors map created using a Geographical Information System (GIS) and data from Dane County, the City of Madison, the Wisconsin Department of Natural Resources (WDNR), and the Wisconsin Department of Commerce. The current version of this map is attached as **Figure 1**. The limits of PZ4, city-owned properties, roads, and parcel boundaries were plotted on an aerial photo base map. Potential contamination sources with setback distances specified in NR 811 were identified as follows:

- Closed and active sites in the WDNR Bureau for Remediation and Redevelopment Tracking System (BRRTS) online mapping system were overlaid on the map. Sites closed with residual groundwater contamination were assigned a 1,200-foot setback radius from the plotted property location in the WDNR GIS database. These setbacks are shown in “lavender” on the map.
- Landfill and waste disposal sites listed on the 2010 WDNR “Well Info” compact disc were plotted based on property addresses and other location description information and assigned a 1,200-foot setback from the site property boundary. These setbacks are shown in “lime” on the map.
- Although there is not a specified well setback from quarries, NR 812.12(16) specifies well casing depths with 1,200 feet of a quarry, and the WDNR generally prefers not to site municipal wells near quarries. Setbacks of 1,200 feet from known quarries are also shown in “lime” on the map.
- Registered storage tanks in the Wisconsin Department of Commerce database were located using street addresses. Setbacks for each tank type were plotted on the map: residential heating oil (200 feet – orange), commercial/other (600 feet – light blue), and bulk storage (1,200 feet – light red).

The initial mapping did not address all of the WDNR setback requirements but included the potential contamination sources with the greatest impact on selection of locations available for further consideration. Based on visual analysis of the map data and external information about available properties, potential sites were initially identified for consideration and additional evaluation.

## POTENTIAL SITES

Initially, five potential areas in the southern portion of PZ4 were identified for consideration and discussion. These areas are listed as **1, 2, 3, 4,** and **5** in the attached **Table 1 – Summary of Potential Well Areas**. Each area included one or more undeveloped properties. Three of the initial five areas were subsequently ruled out for reasons listed in the summary table. Following the elimination of several of the initial areas and further evaluation of the two remaining originally identified areas, an additional area was added to provide an alternate if neither of the initial two areas proved to be viable.

The areas remaining for consideration include: 1) several parcels in the Tradewinds Business Center and an adjacent Department of Transportation (DOT)-owned parcel along Tradewinds Parkway and Agriculture Drive, 2) several parcels in the World Dairy Center near the intersection of Femrite Drive and Dairy Drive, and 3) one parcel at the intersection of Pflaum Road and Vondron Road. These areas are described in greater detail below.

Based on preliminary information, properties in the identified areas are anticipated to have comparable purchase costs. Infrastructure costs associated with the two primary areas are also expected to be comparable based on their proximity to existing large diameter water mains.

### Zones of Contribution

Zones of contribution (ZOCs) for sites selected for further evaluation were identified using the Dane County regional aquifer flow model developed by the Wisconsin Geological and Natural History Survey and the United States Geological Survey. A separate model run was generated for each area, with an example well added to the model within the limits of the proposed well site area. The model grid was subdivided in the area of the new well to allow better resolution of groundwater “particle” movement in the immediate vicinity of the well. The model was then run with an average pumping rate for a typical Madison unit well. The ZOCs shown on the figures attached to this report illustrate the approximate zones of the aquifer that contribute water to the well over pumping period of 10, 50, and 100 years.

The zones are defined primarily based on horizontal groundwater flow in the deep sandstone aquifer and do not necessarily indicate that any or all of the water recharged at the land surface within the zone would actually enter the well within the period of time indicated on the map. For example, recharge to the water table aquifer west of Stoughton Road and south of the Beltline appears to discharge to Lake Waubesa rather than migrating down to the deep bedrock aquifer.

The ZOCs represent averages of groundwater flow over time and the full thickness of the aquifer units. Local variations in aquifer properties and features such as faults and fractures could significantly increase or decrease the amount of time it would take contaminants to move from a source into a pumping well at any particular location.

### Tradewinds Area

The Tradewinds area includes lots 1 through 16, and 6A in the Tradewinds Business Center and a portion of Wisconsin DOT-owned right-of-way (ROW) northeast of Agriculture Drive. The Tradewinds Business Center parcels are undeveloped and available for sale. It may also be possible to negotiate with DOT to obtain a portion of the DOT ROW north of Agriculture Drive but more than 200 feet south of the Beltline highway.

This area was originally identified for evaluation because it is in a relatively large tract of undeveloped land not immediately adjacent to identified known or potential sources of contamination. It is relatively centrally located in the southern portion of PZ4 and is within 100 to 2,800 feet of the 16-inch water main in Marsh Road. Site-specific information is summarized in **Table 2**.

ZOCs for 10, 50, and 100 year intervals are shown on **Figure 2**. The site appears as if it may be hydrologically down-gradient from the Ohmeda groundwater contamination plume, but the identified extent of the Ohmeda plume is outside the modeled 100-year ZOC. The 50- and 100-year ZOCs include the northern portion of the bulk petroleum storage facilities on Terminal Drive and Triangle Street in McFarland; however, it appears likely that shallow groundwater flow below the petroleum terminals is primarily west toward Lake Waubesa.

A WDNR well variance may be required to construct the well on lots 1 through 4 or 5 because these parcels appear to be within 600 feet of a registered 500-gallon gasoline above ground storage tank at Franklin Fueling Systems. The relatively small volume of gasoline storage at this location is not a significant threat to water quality in the deep aquifer.

Most or all of the available parcels in the Tradewinds Business Park have been filled with materials including dredge spoils from Lake Waubesa. The fill material will need to be evaluated for bearing capacity and potential contaminants with site-specific investigation activities such as soil borings.

### Dairy Center (South)

The Dairy Center (south) area includes lots 34, 35, 36, 37, 52, and 53 in the World Dairy Center located near the intersection of Dairy Drive and Femrite Drive. The south Dairy Center parcels are undeveloped and available for sale.

This area was originally identified for evaluation because it includes several undeveloped parcels and is not immediately adjacent to identified known or potential sources of contamination. It is relatively centrally located in the southern portion of PZ4 and is within 100 to 1,600 feet of the 16-inch water main in Agriculture Drive. Site-specific information is summarized in **Table 3**.

ZOCs for a well in this area are shown on **Figure 3**. The only sites closed with remaining groundwater contamination within the 100-year ZOC are related to petroleum sources that have generally not migrated much beyond the limits of the original source property. The western extent of groundwater contamination from the open Ohmeda investigation site extends west into the 100-year ZOC for a well in the Dairy Center area. Investigation activities completed to date indicate that the plume of trichloroethylene (TCE) contamination in groundwater originating from the Ohmeda site east of the interstate extends approximately 800 feet west of the interstate toward the Dairy Center. The current owner of the former Ohmeda facility, General Electric (GE), is working with the WDNR to investigate and clean up the contamination from the Ohmeda site. GE recently started a groundwater remediation system to help control the spread of contamination and WDNR is waiting to see how the system performs before evaluating whether any additional investigation of the groundwater plume is necessary.

Several of the available properties in the south Dairy Center area are crossed by the ANR gas pipeline, which is currently owned by TransCanada. This pipeline has a 50-foot-wide easement. The pipeline operator has requested that a new well not be located closer than 100 to 150 feet of the pipeline to avoid potential damage to the pipeline should it be necessary to “shoot” the well with explosive charges to improve the well yield.

### Dairy Center (North)

The Dairy Center (north) area includes one vacant parcel, lot 8 of the World Dairy Center. Based on the site selection criteria, this area is less desirable than either the Tradewinds area or south Dairy Center area because only one undeveloped parcel is being marketed in this area and the site is relatively close to several known and potential sources of groundwater contamination. In addition, a variance would be required because of the proximity of lot 8 to registered petroleum storage tanks. Site-specific information is summarized in **Table 4**.

ZOCs for a well in this area are shown on **Figure 4**. The 10-year ZOC for a well located on the north Dairy Center area intersects the 1,200-foot setback for two historic fill sites and two sites closed with residual petroleum contamination in groundwater. In addition, the former Safety-Kleen facility is just beyond the 10-year ZOC. The former Safety-Kleen site is currently being investigated for petroleum and chlorinated solvent contamination; however, it appears that the contamination is relatively limited in extent. The Ohmeda site is also within the modeled 100-year ZOC.

## CONCLUSIONS AND RECOMMENDATIONS

Unlike many areas of Madison, the southern portion of PZ4 offers several undeveloped properties that appear to be suitable for development as a new municipal well site. Based on the information evaluated to date, the Tradewinds area and south Dairy Center area are essentially equally matched in terms of susceptibility to contamination and probable combined costs for property acquisition and infrastructure. The north Dairy Center area appears less attractive from the standpoint of contamination susceptibility, but is likely to be on par with the other two areas for land and infrastructure costs.

We recommend that the Water Utility Board authorize Water Utility staff to pursue negotiations with property owners in both the Tradewinds and south Dairy Center areas to obtain land at the most reasonable cost. If neither of these areas are feasible, then the north Dairy Center area should be considered. Land costs for individual properties will need to be considered in conjunction with cost of connecting the site to the nearest large diameter water main(s) because the individual properties in each area are not equidistant from the mains.

Once an option on a property has been successfully negotiated, we recommend performing the following tasks prior to proceeding with the installation of a test well:

- A site-specific Phase 1 environmental site assessment should be performed to identify potential environmental liabilities associated with the specific property. Based on the results of the Phase 1, it may be necessary to collect soil (and possibly groundwater) samples for chemical analysis, especially if the property has been filled with non-native materials.
- A limited geotechnical investigation should be performed to identify the general physical characteristics of the site soils with respect to suitability and costs for building foundations and other infrastructure.



Any potential site carries the risk that the target aquifer may become contaminated with respect to applicable regulatory standards at some point in the future, either because of migration of contamination in the aquifer or because of changing regulations. We recommend that the Water Utility purchase a property that provides adequate room for installation of treatment equipment so that additional land will not need to be acquired if treatment becomes necessary.

Finally, regardless of the site selected for development, we recommend discussing with GE how migration of the TCE plume in the bedrock aquifer under the stresses introduced by a new high-capacity well will be potentially affected and effectively monitored. It seems reasonable to consider asking GE to install a new groundwater monitoring well between the plume and the new water supply well if one of the existing monitoring wells is not already in such a position.

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## TABLES

- 1 Summary of Potential Well Areas
- 2 Tradewinds Area Summary
- 3 South Dairy Center Area Summary
- 4 North Dairy Center Area Summary

**Table 1**  
**Summary of Potential Well Areas**  
**Madison Water Utility**  
**Pressure Zone 4 Well Siting Study**

	<b>Area</b>	<b>Status</b>	<b>Comment</b>
<b>1</b>	Dairy Center	In consideration	Several suitable properties in this area are available.
<b>2</b>	Tradewinds	In consideration	Several suitable properties in this area are available.
<b>3</b>	Siggelkow Road	Ruled out	The area appears to be too close to a suspected inactive fault zone that may reduce the ability of the aquifer to provide sufficient quantities of water to the proposed well.
<b>4</b>	Progress Road	Ruled out	Undeveloped property is too small.
<b>5</b>	Walton Commons	Ruled out	Land was purchased partly with federal funds and is dedicated to development as part of the Bioag Gateway.
<b>6</b>	North Dairy Center	In consideration as an alternate to Dairy Center or Tradewinds	At least one potentially suitable property in this area is available.

I:\4131\Reports\tables\[Site Comparison\_110415.xls]Table 1-Summary

**Table 2  
Tradewinds Area Summary  
Madison Water Utility  
Pressure Zone 4 Well Siting Study**

<b>Background</b>	This site was originally identified for evaluation because it is in a relatively large tract of undeveloped land not immediately adjacent to identified known or potential sources of contamination.
<b>Advantages</b>	<p>Relatively centrally located in southern portion of pressure zone</p> <p>Within 3,000 feet of a 16-inch water main through largely undeveloped area</p> <p>Properties in the area are for sale</p>
<b>Disadvantages</b>	<p>Hydrogeologically down-gradient from the Ohmeda groundwater contamination plume</p> <p>Proposed lots 1 through 5 in the Tradewinds Business Center may be within 600 feet of a 500-gallon gasoline aboveground storage tank at Franklin Fueling Systems on Marsh Road, an NR 811 variance would be required for these lots.</p> <p>The 50 and 100 year zones of contribution (ZOCs) include the northern portion of the Terminal Drive/Triangle Street tank farms.</p>
<b>Site Buildability</b>	<p>Several of the available proposed lots (3 through 7, 14, 15, and 16) in the Tradewinds Business Center area are currently within the mapped 100-year floodplain. (The floodplain map may need to be revised to reflect the present land surface elevations with the fill materials in place.)</p> <p>Most of the proposed lots on the north side of Tradewinds Parkway are mapped as filled wetlands.</p> <p>Soils in the area have low to moderate bearing capacity and high water table.</p>
<b>Contaminated Sites Summary</b>	<p>Nine sites with groundwater contamination exceeding groundwater quality enforcement standards are shown on the Wisconsin Department of Natural Resources GIS system within the 100-year zone of contribution (ZOC) identified using the Dane County groundwater flow model. The contaminants of concern at all of these sites are petroleum related and do not appear to have migrated much beyond the boundaries of the source properties.</p> <p>Eight additional sites with the 100-year ZOC are currently being investigated for petroleum contamination in groundwater.</p> <p>The Datex-Ohmeda site is currently under investigation for dissolved chlorinated solvents (primarily trichloroethylene and related contaminants) in groundwater. The plume extends at least as far as the existing Madison Water Utility property on Femrite Drive west of the interstate.</p>
<b>Notes</b>	The quality of the fill soils in portions of the Tradewinds area will need to be evaluated for geotechnical properties and potential contamination on an individual site basis.

**Table 3**  
**South Dairy Center Area Summary**  
**Madison Water Utility**  
**Pressure Zone 4 Well Siting Study**

<b>Background</b>	This site was originally identified for evaluation because there are several undeveloped parcels in this area not immediately adjacent to identified known or potential sources of contamination.
<b>Advantages</b>	<p>Relatively centrally located in southern portion of pressure zone.</p> <p>Within 1,600 feet of a 16-inch water main through a partly-developed area.</p> <p>Properties in the area are for sale.</p> <p>The only documented groundwater contamination sites within 10 to 50 year zones of contribution (ZOCs) are limited to two properties with minor petroleum contamination plumes, from leaking underground tanks, that do not extend beyond the respective source properties. The 100-year ZOC intersects a 1,200-foot radius two additional sites with residual petroleum contamination.</p>
<b>Disadvantages</b>	<p>Hydrogeologically down-gradient from the Ohmeda groundwater contamination plume.</p> <p>Somewhat close to two sites closed with residual groundwater contamination.</p>
<b>Site Buildability</b>	<p>None of the available sites are within the mapped 100-year floodplain.</p> <p>Portions of the properties on the lots on the east side of Dairy Drive abut or extend into mapped wetlands.</p> <p>A high pressure gas pipe in this area will likely require a minimum 100 foot setback.</p> <p>Soils in the area have low to moderate bearing capacity and high water table.</p>
<b>Contaminated Sites Summary</b>	<p>Four sites with groundwater contamination exceeding groundwater quality enforcement standards are shown on the Wisconsin Department of Natural Resources GIS system within the 100-year ZOC identified using the Dane County groundwater flow model. The contaminants of concern at all of these sites are petroleum related and do not appear to have migrated much beyond the boundaries of the source properties.</p> <p>Two additional sites with the 100-year ZOC are currently being investigated for petroleum contamination in groundwater.</p> <p>The Datex-Ohmeda site is currently under investigation for dissolved chlorinated solvents (primarily trichloroethylene and related contaminants) in groundwater. The plume extends at least as far as the existing Madison Water Utility property on Femrite Drive west of the interstate.</p>

I:\4131\Reports\tables\[Site Comparison\_110415.xls]Table 1-Summary

**Table 4  
North Dairy Center Area Summary  
Madison Water Utility  
Pressure Zone 4 Well Siting Study**

<b>Status</b>	In consideration as an alternate to Dairy Center or Tradewinds
<b>Background</b>	This site was identified as an alternate for evaluation because there is at least one available undeveloped parcel in this area that may be suitable as a well location. This area was added for consideration after potential limitations were identified on sites in the Dairy Center (south) and Tradewinds areas.
<b>Advantages</b>	<p>Relatively centrally located in southern portion of pressure zone.</p> <p>Within 100 to 500 feet of a 16-inch water main.</p> <p>At least one property in the area is for sale.</p>
<b>Disadvantages</b>	<p>Relatively close to three sites closed with residual groundwater contamination and one active site with petroleum and solvent contamination in groundwater.</p> <p>Variance would be required for proximity to active underground storage tank systems.</p>
<b>Site Buildability</b>	<p>The area is not within the mapped 100-year floodplain.</p> <p>Soils in the area have low to moderate bearing capacity and high water table.</p>
<b>Contaminated Sites Summary</b>	<p>Three sites with groundwater contamination exceeding groundwater quality enforcement standards are shown on the Wisconsin Department of Natural Resources GIS system within the 100-year zone of contribution (ZOC) identified using the Dane County groundwater flow model. The contaminants of concern at all of these sites are petroleum related and do not appear to have migrated much beyond the boundaries of the source properties.</p> <p>Two inactive landfills are located within the 50-year ZOC.</p> <p>The former Safety-Kleen facility on Daniels Street is currently under investigation for petroleum contamination and solvents in soil and groundwater.</p> <p>The Datex-Ohmeda site is currently under investigation for dissolved chlorinated solvents (primarily trichloroethylene and related contaminants) in groundwater. The plume extends at least as far as the existing Madison Water Utility property on Femrite Drive.</p>

I:\4131\Reports\tables\[Site Comparison\_110415.xls]Table 1-Summary

## FIGURES

- 1 Well Siting Factors Map
- 2 Tradewinds Area Map
- 3 Dairy Center Area Map
- 4 North Dairy Center Area Map

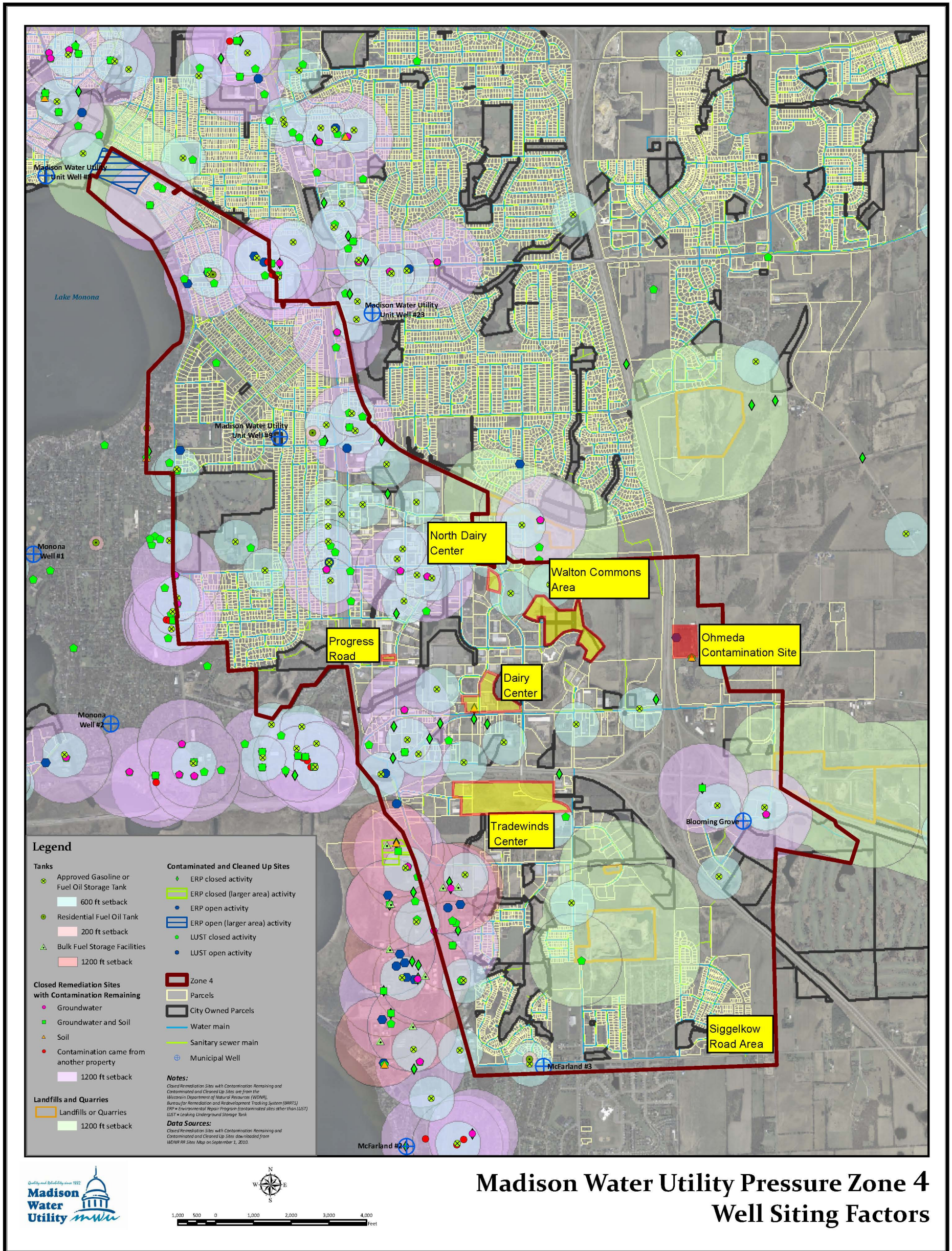
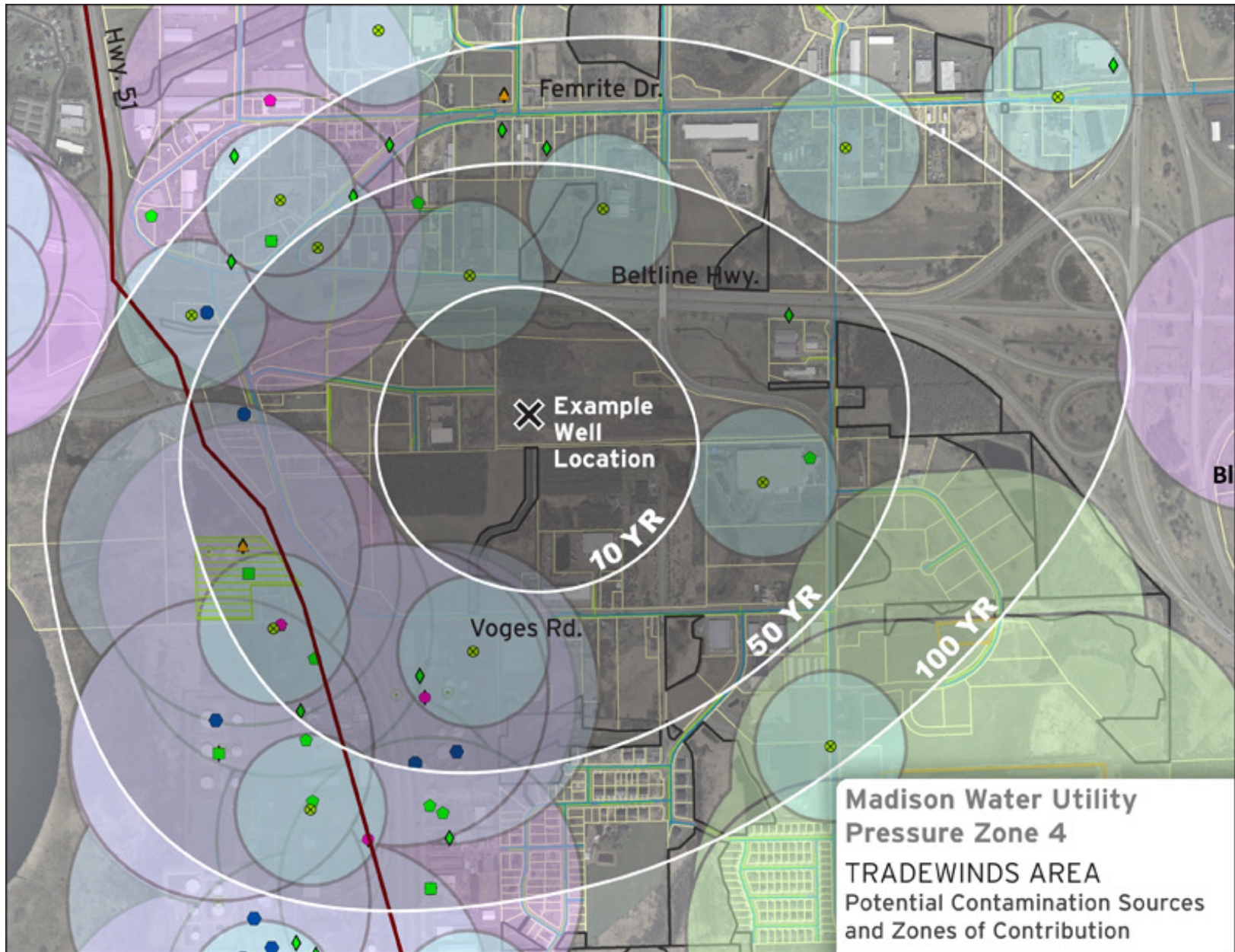
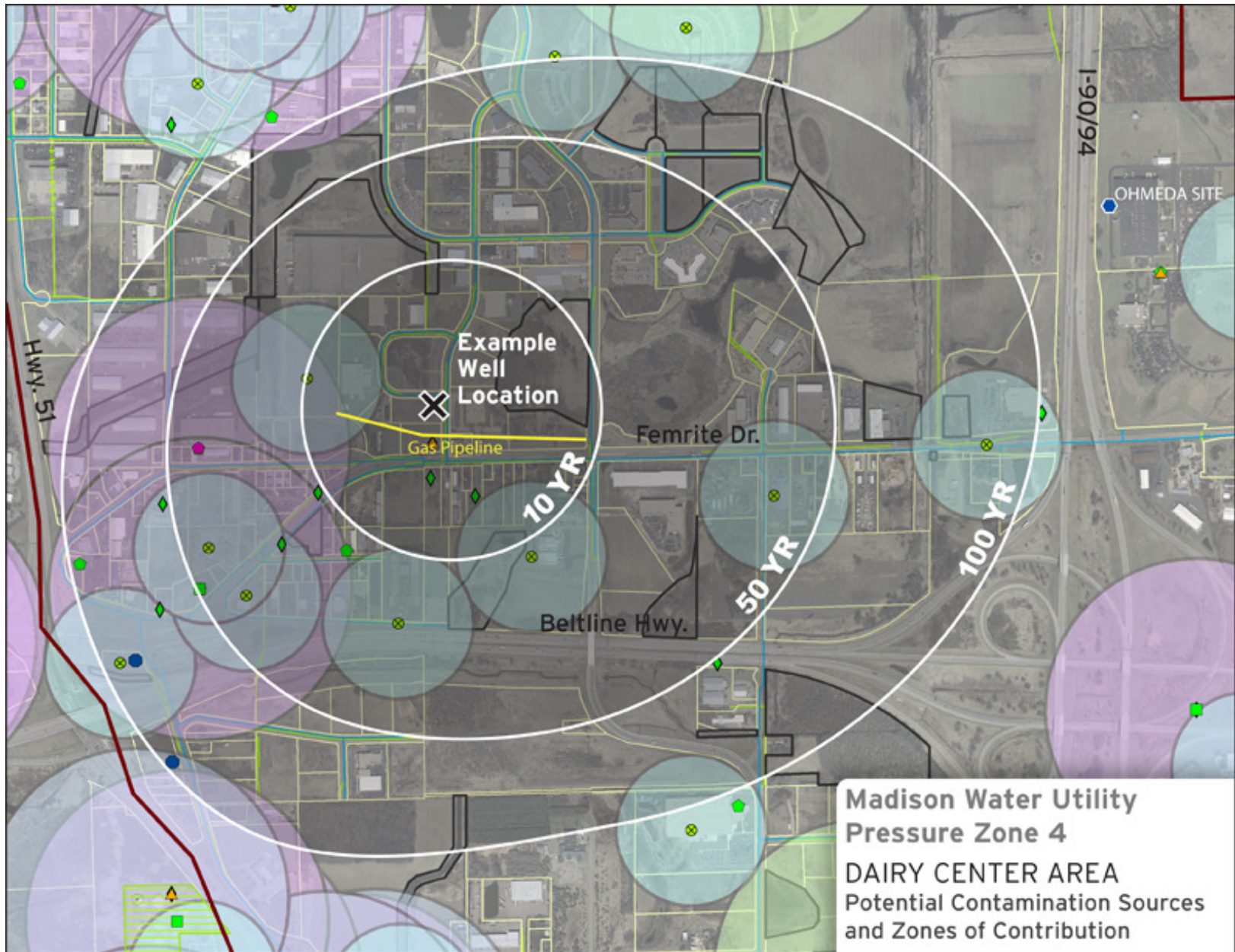


Figure 1

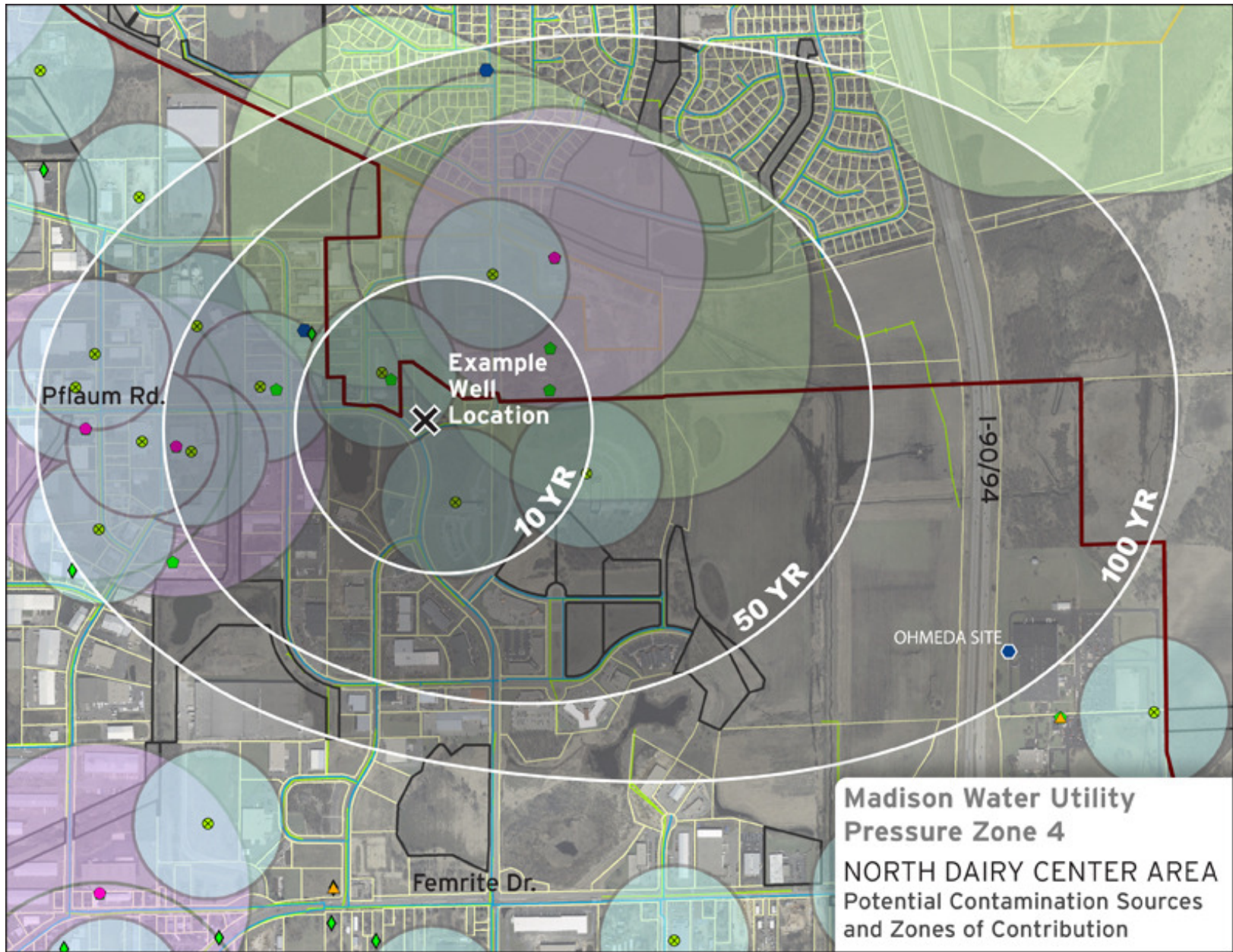




**Figure 2**



**Figure 3**



**Figure 4**