



Wellhead Protection Plan Unit Well 20 City of Madison, Wisconsin



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EXECUTIVE SUMMARY

This report is a Wellhead Protection Plan (WHPP) for City of Madison Unit Well 20. The primary purposes of this WHPP are to define the wellhead protection area (WHPA) for Unit Well 20 and establish specific criteria for protection of Unit Well 20 and groundwater resources in the WHPA including management strategies to maintain a high quality water supply, free of contamination. The primary goal of wellhead protection (WHP) planning is to protect water supply wells from contamination and, thereby, protect people who obtain their water supply from those wells. This WHPP was prepared for Unit Well 20 to conform to the requirements of the Wisconsin Administrative Code, Chapter NR 811, Section 12(6), for WHP planning.

Unit Well 20 is located at 2829 Prairie Road in the southwestern part of the City of Madison. Construction of Unit Well 20 was completed in 1972. Unit Well 20 is 1,009 feet deep. Well 20 is cased to a depth of 415 feet and is open to the lower bedrock (sandstone) aquifer and the upper bedrock aquifer, and has a design capacity of 2,100 gallons per minute (gpm). Unit Well 20 is used year-round.

Land use in the immediate vicinity of Unit Well 20 is residential with some conservancy land located 700 feet north of the well site. The City of Fitchburg boundary is located approximately 1,350 feet east of Unit Well 20, and the Town of Verona is located 4,600 feet south of Unit Well 20.

As part of the Dane County regional hydrologic study, a regional groundwater flow model was prepared for Dane County (Krohelski et. al., 2000) and was used to delineate time-related (5-, 50-, and 100-year time of travel (TOT)) zones of contribution (ZOCs) for municipal wells including Unit Well 20. ZOCs extend southwesterly from Unit Well 20 in the simulated upgradient groundwater flow direction.

The WHPA for Unit Well 20 is illustrated in Figure 3-5. Two zones of protection are within the WHPA. Zone A is defined by the 5-year TOT ZOC. Zone B is defined by a 1,200-foot fixed radius around Unit Well 20. The WHPA will provide a conservative protection zone to account for changes in pumping rates, pumping duration, and interference drawdown from other existing and future wells.

A contaminant source inventory (CSI) was performed for the Unit Well 20 area during November 2010. Known potential and existing contaminant sources and routes within the Unit Well 20 WHPA include sanitary sewer; storm sewer; spill sites; potential spills along roads; in-use and closed aboveground storage tank (AST) sites; in-use and closed underground storage tank (UST) sites; closed leaking underground storage tank (LUST) or Environmental Repair Program (ERP) sites; a gas station; a drycleaner; a stone quarry, road salt use; agricultural land with probable nutrient loading; stormwater retention ponds and drainage ways; private water supply wells; private sewage disposal systems; a site with a listing for a polychlorinated biphenyls (PCB) transformer; sites with general environmental interest; and probable use of pesticide, herbicide, and nutrients on parks, commercial and residential lawns and gardens.

Programs and activities to be used by the City of Madison and others for WHPA management at Unit Well 20 are grouped into five principal categories as follows:

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1. Existing Programs
 - a. Clean Sweep Collection Program
 - b. On-site waste disposal system maintenance
 - c. Well construction and abandonment
 - d. Land application of sludge and septage
 - e. Spill notification and awareness of remedial investigation and cleanup
2. Land Use Controls
 - a. Existing zoning/WHP overlay zoning and ordinance
3. Intergovernmental Cooperation
 - a. Land use planning and site plan review
4. Monitoring
 - a. CSI maintenance
 - b. Water quality monitoring
5. Public Education and Awareness
 - a. Availability of WHPP
 - b. Public informational meeting
 - c. News releases
 - d. Informational materials distributed to residents in WHPA
 - e. Land use and contamination source awareness
 - f. School programs

Some of these programs and activities are currently being performed, while others are new and will be implemented immediately to help protect Unit Well 20.

The Madison Water Utility has an existing water conservation program and encourages water conservation. The Utility has formulated a contingency plan for providing water in the event that Unit Well 20, or one or more of the City's other water supply wells became contaminated or removed from service. Well 20 supplies water to Pressure Zone 7 via gravity flow from a large reservoir located at the Unit Well 20 site. In the event of the loss of Unit Well 20, Unit Well 12 (Pressure Zone 7) and Unit Well 26 (Pressure Zone 8) can serve the area.

The City of Madison has a WHP ordinance and overlay zoning district. The WHP ordinance helps ensure that new contaminant sources are not located in the Unit Well 20 WHPA.

1.0 INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

This report is a WHPP for City of Madison Unit Well 20. The primary purposes of this WHPP are to define the WHPA for Unit Well 20 and establish specific criteria for protection of Unit Well 20 and groundwater resources in the WHPA including management activities to maintain a high quality water supply, free of contamination. The primary goal of WHP planning is to protect water supply wells from contamination and, thereby, protect people who obtain their water supply from those wells.

The term “wellhead” refers to the physical structure (well) at the land surface through which groundwater is withdrawn from a subsurface water-bearing formation (aquifer). A WHPA is defined by federal law as “the surface and subsurface area surrounding a water well or wellfield, through which contaminants are reasonably likely to move toward and reach such water well or wellfield” (United States Environmental Protection Agency (USEPA), 2005).

This WHPP was prepared for Unit Well 20 to conform to the requirements of the Wisconsin Administrative Code, Chapter NR 811, Section 12(6), for WHP planning. A copy of this section of the code is in Appendix A. The project scope included the following:

1. Research available information regarding the geology and hydrogeology of the well sites and aquifer parameters.
2. Research well construction and operation of Unit Well 20.
3. Coordinate with the Capital Area Regional Planning Commission (CARPC) to delineate 5-, 50- and 100-year TOT capture zones for Unit Well 20.
4. Perform a CSI to identify and characterize existing and potential contamination sources within a ½-mile radius and within the recharge area equivalent to the 100-year TOT capture zone for Unit Well 20.
5. Assist with the determination of a WHPA for Unit Well 20.
6. Assist with the development of WHP management activities.

1.2 LOCATION AND BACKGROUND

Unit Well 20 is located at 2829 Prairie Road in the southwestern part of the City of Madison. The site is in the SW¼, NE¼ of the SE¼, of Section 1, Township 6 North, Range 8 East, Dane County, Wisconsin. The location of Unit Well 20 and other water system facilities in the City of Madison are illustrated in Figure 1-1. A portion of the survey plat showing the well site is in Appendix B. Construction of Unit Well 20 was completed in 1972.

The City water system serves approximately 235,000 people and consists of 22 active wells, 29 booster pumping facilities, 25 ground storage reservoirs, 5 elevated water storage tanks, and approximately 840 miles of water transmission and distribution mains. Because of the varying

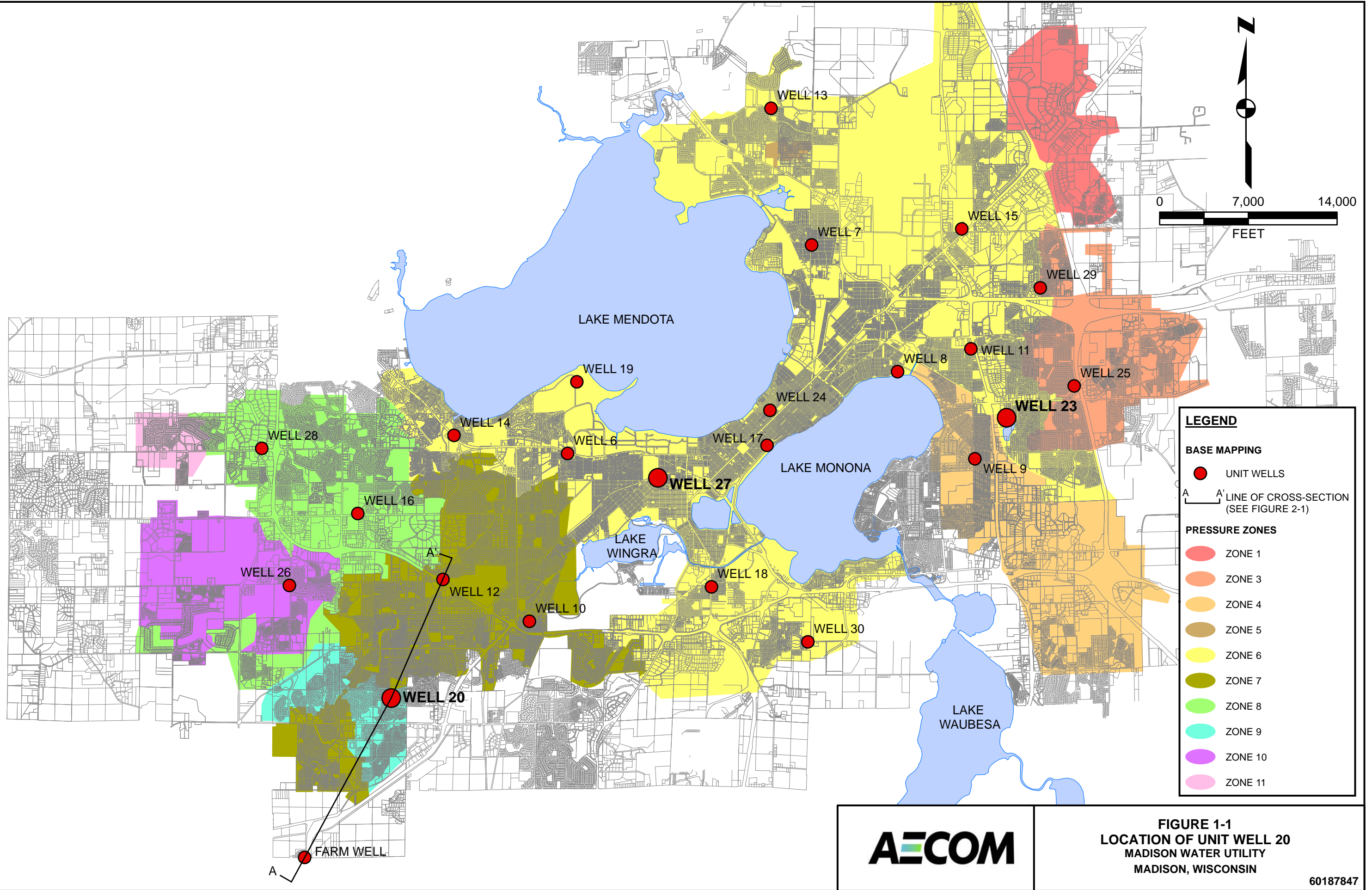


FIGURE 1-1
LOCATION OF UNIT WELL 20
MADISON WATER UTILITY
MADISON, WISCONSIN

topography in the Madison area, the water system is divided into 10 separate pressure zones. Unit Well 20 supplies water to a large reservoir located at the Unit Well 20 site, which provides water via gravity flow to Pressure Zone 7. Booster Pump 120 pumps water from the large reservoir to the elevated storage tank (Smith Tower) located at the Well 20 site, and supplies Pressure Zone 9. Unit Well 20 is located approximately 1.8 miles southwest of Unit Well 12 and 2.3 miles west-southwest of Unit Well 10.

1.3 UNIT WELL 20

Unit Well 20 was drilled to a depth of 1,131 feet, but was backfilled with cement from 1,068 to 1,131 feet. The current depth of Well 20 is 1,009 feet (MWU, 2010). Well 20 is cased with 30-inch diameter steel casing pipe to a depth of 415 feet and is open to the lower bedrock (sandstone) aquifer and the upper bedrock aquifer.

Dolomite is the near surface bedrock and was encountered at a depth of 9 feet. The casing is terminated in sandstone. Shale was encountered in the cased interval over the depths of 180 to 190 feet, 245 to 250 feet, and 290 to 295 feet. A thick shale layer was also encountered in the Eau Claire Formation over the depth of 535 to 555 feet, which is below the cased interval in the well. Sandstone was encountered in the base of the well.

Unit Well 20 was initially test pumped at a rate of 2,400 gpm and had a specific capacity of 18.9 gallons per minute per foot (gpm/ft) of drawdown. At the time of the test pumping, the static (non-pumping) water level in Unit Well 20 was 261 feet below ground. On January 26, 2011, the static water level in Unit Well 20 was 257.6 feet below the measuring point at the wellhead. Unit Well 20 is used year-round. A construction report and formation log prepared by the WGNHS is in Appendix C.

2.0 HYDROGEOLOGIC CONDITIONS

2.1 LAND USE, TOPOGRAPHY, AND DRAINAGE

Unit Well 20 is located on the north slope of a east-west trending hill. Surrounding land uses are residential. Some conservancy land is located 700 feet north and up to 2,000 feet northeast and is associated with a Prairie Restoration Area and Madison/Fitchburg Huegel Jamestown Park. Current zoning at the Unit Well 20 site is single family residential (R1). A portion of the City of Madison zoning map for the Unit Well 20 area is in Appendix D.

Unit Well 20 is located on a till covered surface. The land surrounding Unit Well 20 is sloping and there are small, obscure moraine ridges toward the south and southwest that create a slightly hummocky topography. The ground surface elevation at Unit Well 20 is approximately 1,108 feet above mean sea level (MSL). Surface elevations within a ½-mile radius of Unit Well 20 range from 1,120 feet above MSL on the top of the hill on which Unit Well 20 is located (approximately 175 feet south), to less than 990 feet above MSL at an intermittent drainageway located ½-mile south-southwest of Unit Well 20. Drainage from the Unit Well 20 site is steeply toward the north.

2.2 GEOLOGY

The area was glaciated by the Green Bay Lobe during the last part of the Wisconsin Glaciation. The rocks and unlithified deposits in the area range from Precambrian basement rocks to recent soils. The bedrock from oldest to youngest includes Precambrian granite, Cambrian age sandstone, dolomite, and shale, and Ordovician age Ancell Group and Sinnipee Group strata.

A geological cross-section through Unit Wells 12 and 20 and through the Dane County Farm Well (DN-30) is presented in Figure 2-1. A formation log for strata encountered at Unit Well 20 is in Appendix C. The stratigraphic sequence encountered in the wells is briefly described in the following.

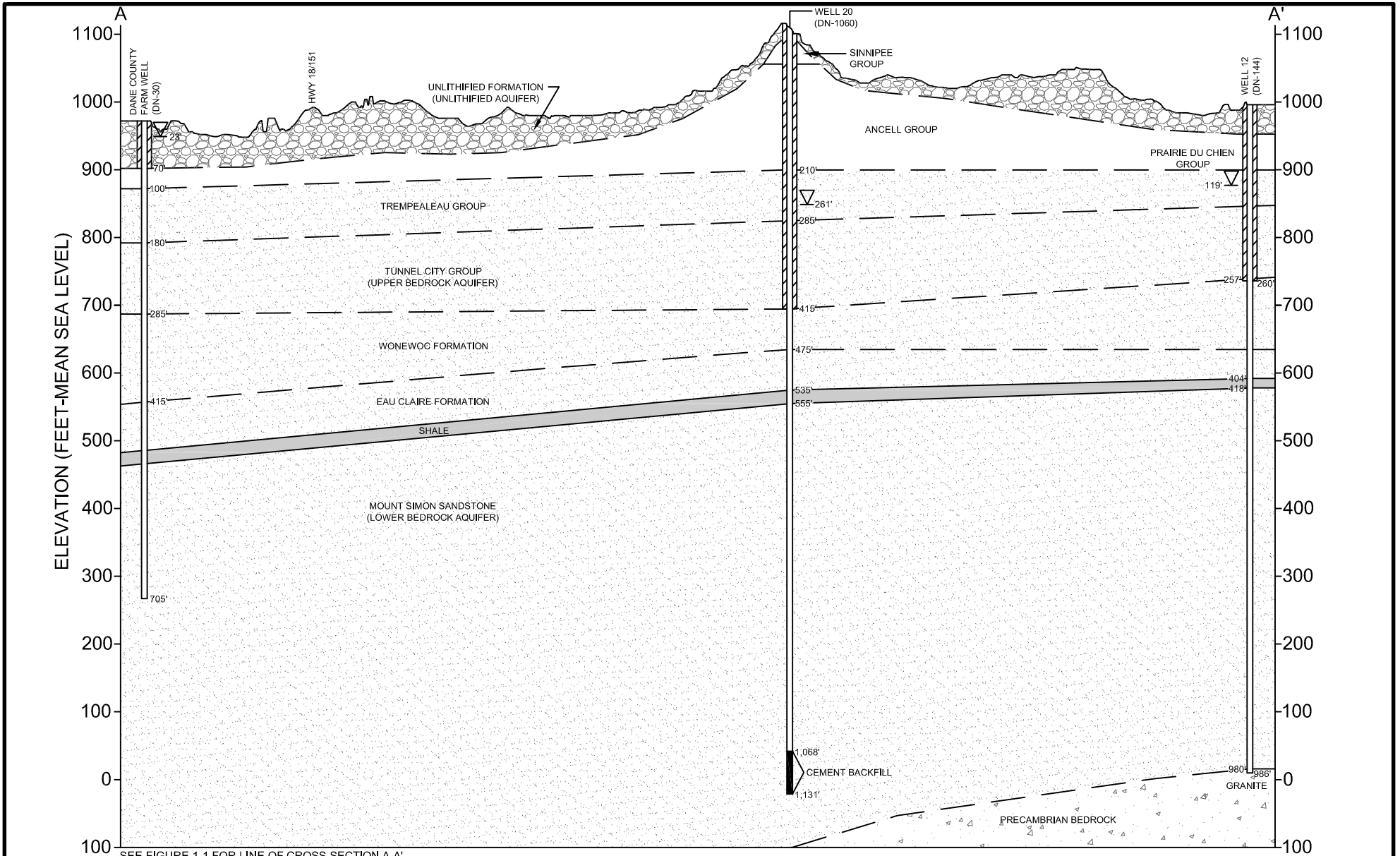
2.2.1 Precambrian Basement Bedrock

Precambrian bedrock was not encountered in Unit Well 20, but was encountered in Unit Well 12 at a depth of 980 feet below ground surface. Unit Well 12 is located approximately 2 miles north-northeast of Unit Well 20. The Precambrian bedrock encountered in Unit Well 12 is pink granite (Wisconsin Geological and Natural History Survey (WGNHS) Well Log DN-144).

2.2.2 Cambrian Bedrock

Cambrian age rocks encountered in Unit Well 20 include, in ascending order, Mount Simon Formation, Eau Claire Formation, Wonewoc Formation, Tunnel City Group, and the Trempealeau Group.

Cambrian age rocks are relatively flat lying in the Madison area in the east-west direction and dip slightly toward the south. The cross-section shows a gentle dip toward Unit Well 20 and the Dane County Farm Well located near Verona. The thicknesses of deep rock units are relatively consistent in the Madison area. A greenish-gray shale layer approximately 15 to 20 feet thick at



SEE FIGURE 1-1 FOR LINE OF CROSS-SECTION A-A'

LEGEND

- WELL
- WELL CASING
- POTENTIOMETRIC SURFACE DEPTH (FEET) (AT TIME OF CONSTRUCTION)
- OPEN BOREHOLE
- 705' WELL DEPTH (FEET)



FIGURE 2-1
GEOLOGICAL CROSS-SECTION THROUGH
MADISON UNIT WELLS 12 AND 20
MADISON, WISCONSIN

Unit Well 20 occurs in the upper part of the Eau Claire Formation over the depth interval of 535 to 555 feet and extends toward the north and Unit Well 12, and toward the southwest and the Dane County Farm Well. Shale layers were also encountered in Unit Well 20 in the Tunnel City and Trempealeau Group strata.

2.2.3 Ordovician Bedrock

Ordovician age strata encountered in Unit Well 20 include rocks of the Ancell Group and the overlying Sinnipee Group. The Sinnipee Group dolomite is the upper bedrock encountered in Unit Well 20 and is 40-feet thick. The Ancell Group strata consists primarily of sandstone with some shale and chert layers. The Prairie du Chien Group is not indicated in the formation log prepared by the WGNHS for Unit Well 20. Apparently, the Ancell Group unconformably overlies the Cambrian Jordan Formation at Unit Well 20. At Unit Well 12 the Prairie du Chien Group bedrock consists of 43 feet of dolomite overlying 7 feet of fine to medium grained sandstone with chert.

The occurrence and thickness of the upper bedrock units (Sinnipee Group, Ancell Group and Prairie du Chien Group) vary, because they are the upper erosional surfaces.

The formation above the Ancell and Sinnipee Group strata near Unit Well 20 consists of unlithified deposits as illustrated in Figure 2-1.

2.2.4 Unlithified Deposits

Bedrock is mantled by unlithified glacial till deposits. Clayton and Attig (1997) classify the local near surface unlithified deposits in the immediate vicinity of Unit Well 20 as part of the Horicon Member of the Holy Hill Formation. The near surface unlithified formation at Unit Well 20 consists of gravelly, clayey, silty, sand and is classified as non-uniform, collapsed supraglacial till and sorted supraglacial debris (Clayton and Attig (1997).

At Unit Well 20, the formation from the top of the dolomite bedrock (encountered at a depth of 9 feet) to the ground surface is described as yellow brown very fine to very coarse sand with silt and a trace of gravel. The formation log includes the descriptor "much soil." The soil at the Unit Well 20 is classified as the Griswold loam (6 to 12 percent slopes). The Ringwood silt loam (2 to 6 percent slopes) occurs on the lower slopes of the hill where Unit Well 20 is located (USDA, 1978). The soils are deep, and well-drained. The upper loam portions of the Griswold loam soil and Ringwood silt loam soil have permeabilities of 0.63 to 2 inches per hour, and the sandy loam substratum parts of the soils have permeabilities of 2 to 6.3 inches per hour (USDA, 1978). The Griswold loam soil and the Ringwood silt loam soil have good contaminant attenuation potential (DCRPC, 1999). The DCRPC assigned a risk classification of moderate from surface activities in the Unit Well 20 area on the basis of several factors including soil properties (DCRPC, 1999). Recharge areas located north of Unit Well 20 were classified as high to extreme risk, whereas recharge areas located south of Unit Well 20 were classified as low to high risk.

2.3 HYDROGEOLOGY

In the study area, groundwater occurs within the lower bedrock aquifer and the upper bedrock aquifer. In the Unit Well 20 area the unlithified formation is not saturated. The upper portion of

the bedrock aquifer is used for relatively low to moderate yield (10 to 50 gpm) private wells. Municipal and industrial wells are constructed into the lower bedrock aquifer. Following is a brief discussion about the aquifers:

2.3.1 Lower Bedrock Aquifer

The lower bedrock aquifer occurs in the Mount Simon Formation and lower part of the Eau Claire Formation. The Precambrian bedrock is the base of the lower bedrock aquifer and the shale layer in the Eau Claire Formation is the upper confining unit. Water occurs within horizontal and vertical fractures, along bedding planes, and between sand grains in the aquifer. The saturated thickness of the lower bedrock aquifer that is open to Unit Well 20 (non-plugged portion) is 513 feet. The hydraulic conductivity of the lower bedrock aquifer is approximately 10 feet per day (ft/day) (Krohelski et. al., 2000). Unit Well 20 is cased and grouted to a depth of 415 feet, which is 120 feet above the Eau Claire shale confining layer; therefore, Unit Well 20 is open to a portion of the upper bedrock aquifer and a significant portion of the lower bedrock aquifer.

The grouted casing in Unit Well 20 terminates in the upper bedrock aquifer above the Eau Claire confining layer. Water levels measured in Unit Well 20 should be representative of the composite upper and lower bedrock aquifers. On January 26, 2011 the static water level in Unit Well 20 was 257.6 feet below the measuring point at the wellhead (approximately 858 feet MSL). Figure E-1 in Appendix E illustrates the simulated potentiometric surface in the lower bedrock (Mount Simon) aquifer and shows the groundwater flow direction toward Unit Well 20 is from the southwest (DCRPC, 2004). The potentiometric surface elevation in the vicinity of Unit Well 20 is approximately 898 feet above MSL as illustrated in Figure E-1. The storativity of the lower bedrock aquifer is approximately 0.0003, and the porosity is approximately 30 percent (Bradbury, 2001). The porosity of the Eau Claire Formation is approximately 5 percent (Bradbury, 2001).

2.3.2 Upper Bedrock Aquifer

The upper bedrock aquifer occurs in the upper part of the Eau Claire Formation above the shale and within the Wonewoc Formation, Tunnel City Group and Trempealeau Group. Water occurs within fractures, along bedding planes, and between sand grains in the sandstone.

At Unit Well 20, the thickness of the bedrock formation above the shale confining layer is 325 feet. The saturated thickness of the upper bedrock aquifer is approximately 274 feet (at the time of construction). Figure F-1 (DCRPC, 2004) in Appendix F shows the simulated potentiometric (water table) surface in the upper bedrock aquifer and un lithified (sand and gravel) aquifer. The elevation of the static water level in Unit Well 20 is assumed to be the elevation of the potentiometric surface (847 feet above MSL) in the combined upper bedrock aquifer and lower bedrock aquifer. The elevation of the simulated potentiometric surface in the upper bedrock aquifer (water table) at Unit Well 20 in 2000 was approximately 932 feet above MSL as illustrated in Figure F-1.

The hydraulic conductivity of the upper bedrock aquifer is approximately 5 ft/day (Krohelski et. al., 2000). The porosity of the upper bedrock formations is approximately 5 percent (Bradbury, 2001).

2.3.3 Unlithified Aquifer

The unlithified formation in the immediate vicinity of Well 20 area is not saturated and does not form an aquifer. Lowland areas located along Highways 18/151 which are 1.3 miles south and 1 mile southeast of Unit Well 20 contain saturated unlithified materials. The elevation of Goose Lake, which is located 1.3 miles south of Unit Well 20 is 951 feet above MSL.

2.3.4 Groundwater Flow System

Average annual precipitation in the City of Madison area is approximately 30 to 30.5 inches per year (Cline, 1965; Cotter et. al., 1969). Cline (1965) estimated that the amount of recharge to the groundwater reservoir in the Upper Yahara River basin was approximately 6 inches/year (in/yr). Swanson (1996) estimated that the recharge rate in Dane County ranges from 0.3 to 6.7 in/yr and has an average value of 2.6 in/yr. Precipitation infiltrates through the till layer, and recharges the unlithified and shallow bedrock aquifers. In some areas, a small percentage of water moves downward from the upper bedrock aquifer through the Eau Claire confining layer and into the lower bedrock aquifer. Figure E-2 in Appendix E illustrates the location of Unit Well 20 and areas of recharge to and discharge from the lower bedrock (Mount Simon) aquifer (Bradbury et. al, 1999; DCRPC 1999). Unit Well 20 is located in a recharge area. Discharge from the unlithified and shallow bedrock aquifers is to pumping wells and/or to surface waters (lakes, streams, and wetlands) located south of Unit Well 20. Discharge from the lower bedrock aquifer is primarily to pumping wells.

3.0 WHPA DELINEATION

This chapter describes methodologies used to define the Zone of Influence (ZOI) and ZOC for Unit Well 20.

3.1 ZOI

The ZOI for Unit Well 20 was estimated in accordance with Wisconsin Department of Natural Resources (DNR) requirements based on 30 days of continuous pumping at the rated pump capacity, assuming no aquifer recharge. The ZOI was determined using the Theis equation. The estimated ZOI for Unit Well 20 to a radius where there is 1 foot of drawdown, is approximately 9.6 miles. The estimated ZOI to a radius of zero drawdown is approximately 20.7 miles. These estimated ZOI are conservatively large, because the Theis equation does not incorporate aquifer recharge or the effects of potential hydraulic boundaries. For the calculation, it was assumed that the open borehole, open to both the lower and upper bedrock aquifers (excluding the Eau Claire shale interval), supplies water to Unit Well 20. Distance–drawdown calculations are in Appendix G.

3.2 GROUNDWATER MODEL DEVELOPMENT AND ZOC DELINEATION

As part of the Dane County regional hydrologic study, a regional groundwater flow model was prepared for Dane County (Krohelski et. al., 2000) and was used to delineate time-related ZOCs for municipal wells including Unit Well 20. The Dane County regional hydrologic study was conducted cooperatively by the WGNHS, DCRPC, and the United States Geological Survey (USGS). The USGS modular groundwater modeling code (MODFLOW (McDonald & Harbaugh, 1988)) was used to simulate groundwater flow. After the calibrated groundwater flow model was prepared, PATH3D (Zheng, 1991) was used to determine time-related ZOCs.

The model domain covers an area of 50 by 60 miles and is divided into 144,000 nodes. Each node has regular spacing of 1,312.4 feet (400 meters) on a side. The grid has 200 rows and 240 columns (Krohelski et. al., 2000).

In 2002, the original groundwater flow model was converted from a three-layer model to a four-layer model. The sand and gravel aquifer is Layer 1. The upper bedrock aquifer is Layer 2. The Eau Claire Formation is Layer 3, and the lower bedrock aquifer is Layer 4. The model was recalibrated and various boundary conditions were modified (DCRPC, 2001). Other aquifer parameters input into the model were as previously described in Chapter 2 and in Krohelski et. al., 2000.

Four groundwater flow simulations were performed for this study by the CARPC (formerly DCRPC), using the calibrated model and different pumping rates for existing and known future municipal supply wells in Dane County. Simulation No. 1 was performed using the projected pumping rates from municipal wells for the year 2030 (Bradbury, 1998). Total City of Madison 2030 pumping is projected to be 44.328 million gallons per day (MGD). For Simulation No. 1, projected 2030 pumping was distributed evenly among the City's existing and planned wells for an average rate of 1.4413 MGD. Pumping at a rate of 1.4413 MGD is equivalent to pumping continuously at a rate of approximately 1,000 gpm.

Simulation No. 2 was performed using the “maximum sustained pumping rate” or “one-half design capacity” (Bradbury, 1998; DCRPC, 2004). The maximum sustained pumping rate (one-half design capacity) for Unit Well 20 is 1.512 MGD. Pumping at a rate of 1.512 MGD is equivalent to pumping continuously at a rate of 1,050 gpm.

Simulation No. 3 was performed using full design capacity. Full capacity for Unit Well 20 is 3.024 MGD. Pumping at a rate of 3.024 MGD is equivalent to pumping continuously at a rate of 2,100 gpm.

Simulation No. 4 was performed using the average pumping rate for Unit Well 20 for the maximum year during the past 10 years (2000-2009). The maximum pumpage year for Unit Well 20 was 2005 when Unit Well 20 was pumped at an average rate of approximately 1.986 MGD. Pumping at a rate of 1.986 MGD is equivalent to pumping continuously at a rate of 1,379 gpm.

PATH3D (Zheng, 1991) was used to determine the time-related ZOCs for Unit Well 20. Particles were input in the model around Unit Well 20 and then tracked backward from the well to points where they enter the groundwater flow system.

3.3 ZOC

The area that recharges or contributes water to Unit Well 20 is defined as the ZOC. The areal extent of the ZOC (capture zone) depends on the pumping rate, amount of horizontal and vertical recharge, aquifer characteristics, pumping duration, and other stresses such as other pumping wells. It is beneficial to know the well capture zone, because contaminants introduced within the zone could reach Unit Well 20.

Figure 3-1 illustrates the 5-, 50-, and 100-year TOT ZOCs for Unit Well 20 based on the projected 2030 pumping rate (Simulation No. 1). Figure 3-2 illustrates the 5-, 50-, and 100-year TOT ZOCs for Unit Well 20 based on the one-half design capacity pumping rate (Simulation No. 2). Figure 3-3 illustrates the 5-, 50-, and 100-year TOT ZOCs for Unit Well 20 based on the full design capacity pumping rate (Simulation No. 3). Figure 3-4 illustrates the 5-, 50-, and 100-year TOT ZOCs for Unit Well 20 based on the average pumping rate for Unit Well 20 for the maximum year (Simulation No. 4).

The capture zones extend primarily toward the southwest in the simulated upgradient groundwater flow direction. Table 3-1 provides a summary of the upgradient and downgradient extent of capture zones for the various pumping simulations. The ZOCs delineated using the Simulation No. 3 pumping rates are more conservatively large compared to the ZOCs delineated using the Simulations Nos. 1, 2, and 4 pumping rates.


Figure 2 in Appendix H illustrates ultimate regional ZOCs for Unit Well 20 and for other municipal wells in Dane County. For the ultimate capture zone simulation, groundwater flow pathlines extend upgradient from Unit Well 20 to the groundwater divide located approximately 4.5 miles south and 8 miles west of Unit Well 20 and are located entirely within Dane County.


LEGEND


BASE MAPPING

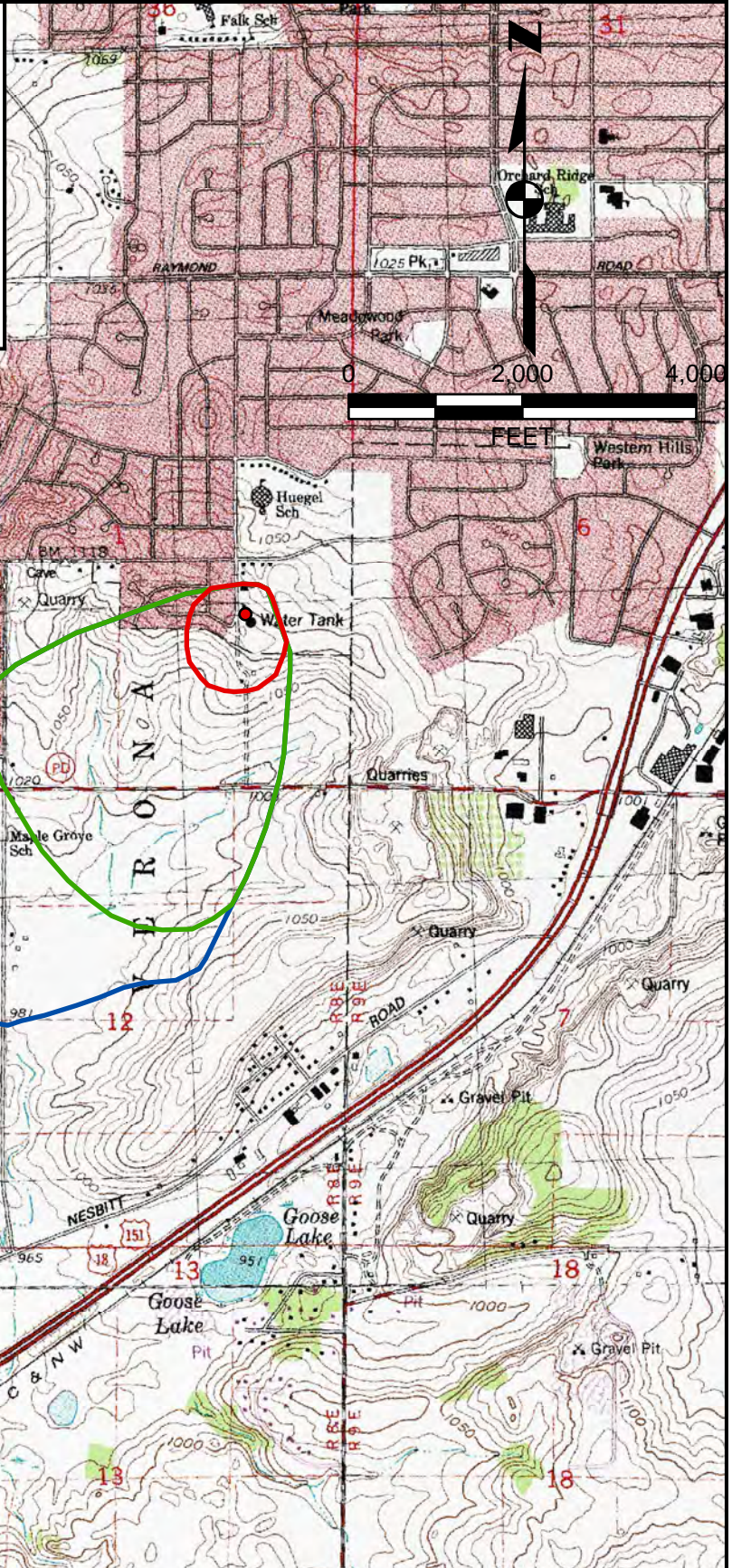
● UNIT WELL 20

CAPTURE AREAS

 5-YEAR T.O.T. (TIME OF TRAVEL) CAPTURE ZONE

 50-YEAR T.O.T. (TIME OF TRAVEL) CAPTURE ZONE

 100-YEAR T.O.T. (TIME OF TRAVEL) CAPTURE ZONE



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FIGURE 3-1
5, 50, 100 YEAR T.O.T. Z.O.C.s ASSUMING
PROJECTED 2030 PUMPING RATE
UNIT WELL 20
MADISON, WISCONSIN

60187847


LEGEND


BASE MAPPING

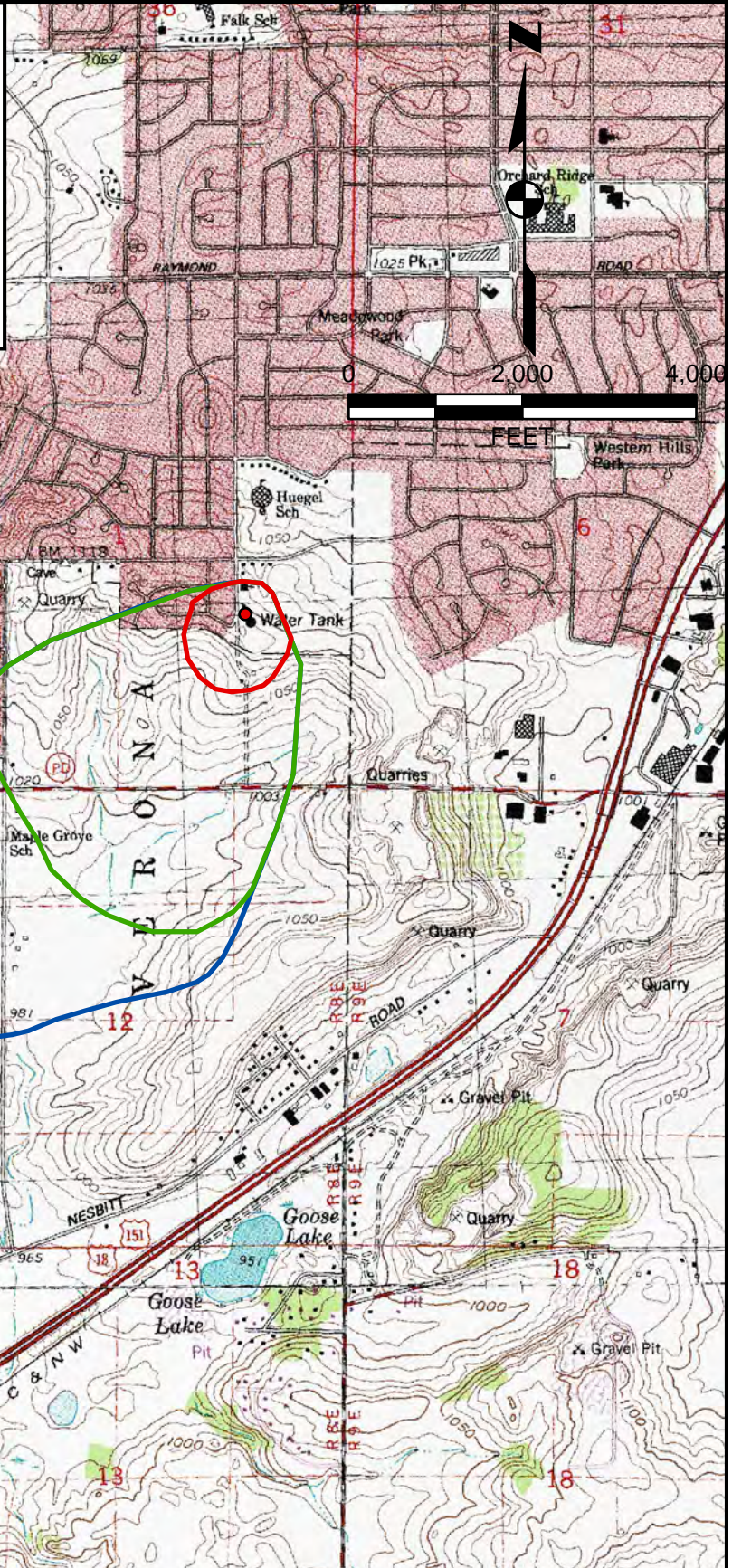
● UNIT WELL 20

CAPTURE AREAS

 5-YEAR T.O.T. (TIME OF TRAVEL) CAPTURE ZONE

 50-YEAR T.O.T. (TIME OF TRAVEL) CAPTURE ZONE

 100-YEAR T.O.T. (TIME OF TRAVEL) CAPTURE ZONE



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FIGURE 3-2
5, 50, 100 YEAR T.O.T. Z.O.C.s ASSUMING
50 PERCENT CAPACITY PUMPING RATE

UNIT WELL 20

MADISON, WISCONSIN


60187847


LEGEND


BASE MAPPING

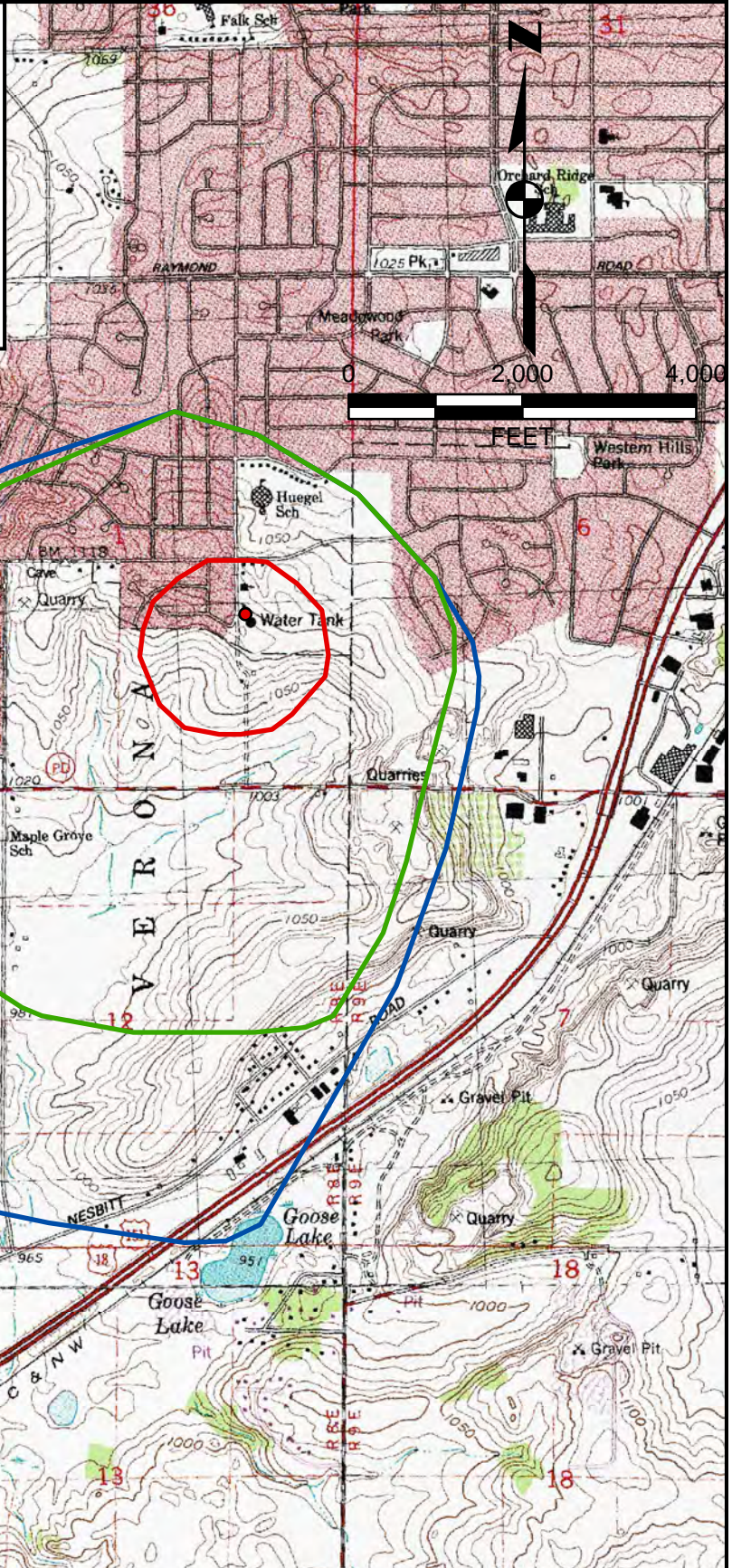
● UNIT WELL 20

ZOC, Id

 5-YEAR T.O.T. (TIME OF TRAVEL) CAPTURE ZONE

 50-YEAR T.O.T. (TIME OF TRAVEL) CAPTURE ZONE

 100-YEAR T.O.T. (TIME OF TRAVEL) CAPTURE ZONE



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FIGURE 3-3
5, 50, 100 YEAR T.O.T. Z.O.C.s ASSUMING
FULL CAPACITY PUMPING RATE
UNIT WELL 20

MADISON, WISCONSIN


60187847


LEGEND


BASE MAPPING

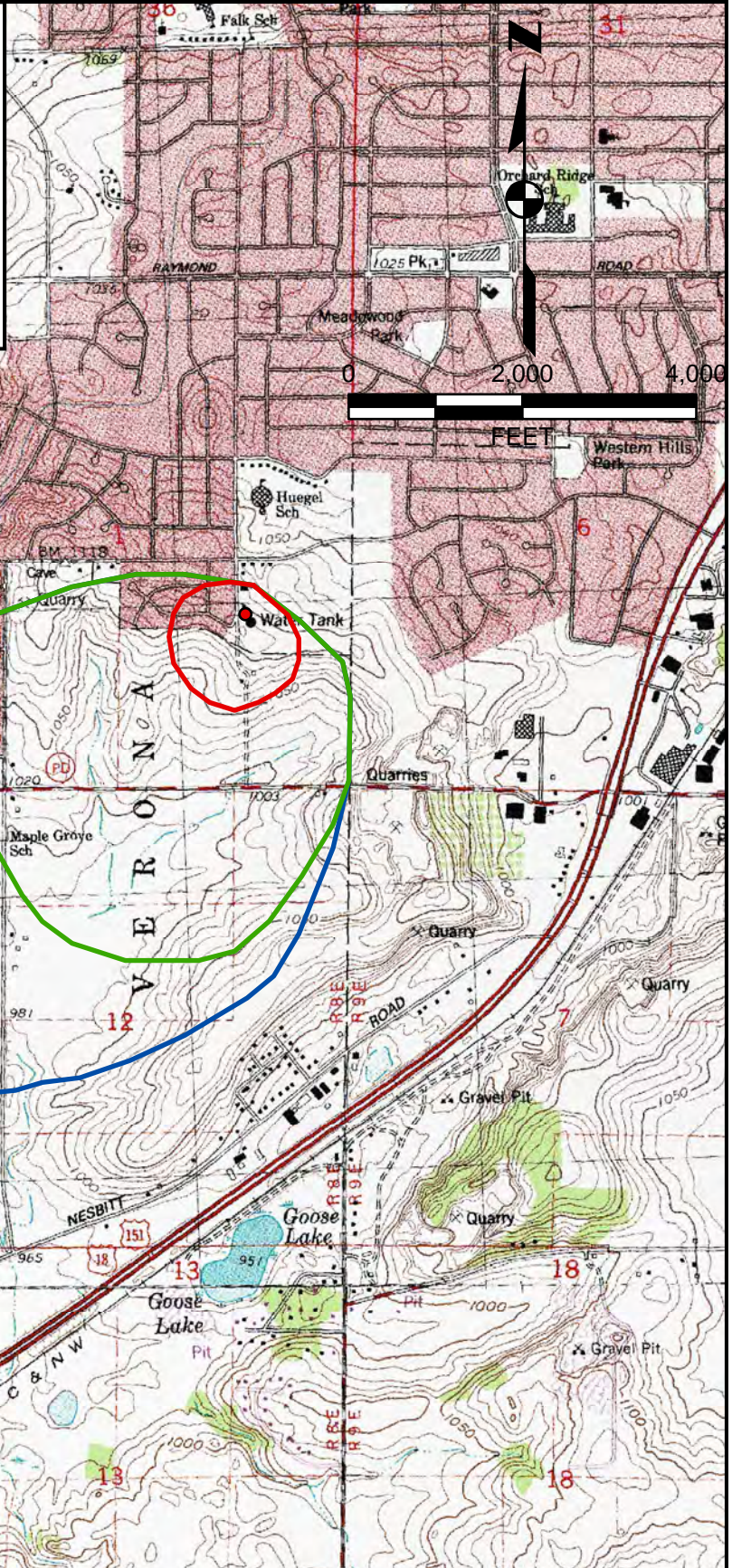
● UNIT WELL 20

CAPTURE AREAS

 5-YEAR T.O.T. (TIME OF TRAVEL) CAPTURE ZONE

 50-YEAR T.O.T. (TIME OF TRAVEL) CAPTURE ZONE

 100-YEAR T.O.T. (TIME OF TRAVEL) CAPTURE ZONE



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FIGURE 3-4
5, 50, 100 YEAR T.O.T. Z.O.C.s ASSUMING
PUMPING AT AVG RATE DURING MAX YEAR
UNIT WELL 20
MADISON, WISCONSIN 60187847

TABLE 3-1
SUMMARY OF EXTENT OF ZOCs (CAPTURE ZONES)
WELLHEAD PROTECTION UNIT WELL 20
MADISON, WISCONSIN

Item	Simulation No. 1 (projected 2030 pumping rate)	Simulation No. 2 (one-half design capacity pumping rate)	Simulation No. 3 (continuous pumping at full capacity)	Simulation No. 4 Average Pumping Rate During Maximum Pumpage Year
Simulated Pumping Rate	1.4413 MGD (1,000 GPM)	1.512 MGD (1,050 GPM)	3.024 MGD (2,100 GPM)	1.986 (MGD) (1,379 GPM)
Upgradient (Southwesterly) Extent of ZOC (feet)				
5-year TOT	900	925	1,450	1,050
50-year TOT	3,800	3,800	5,200	4,250
100-year TOT	5,500	5,650	7,500	6,400
Downgradient (Northeasterly) Extent of ZOC (feet)				
5-year TOT	400	400	600	300
50-year TOT	400	400	1,900	300
100-year TOT	400	400	1,900	300
Notes:				
MGD = Million Gallons per Day				
ZOC = Zone of Contribution				
TOT = Time of Travel				

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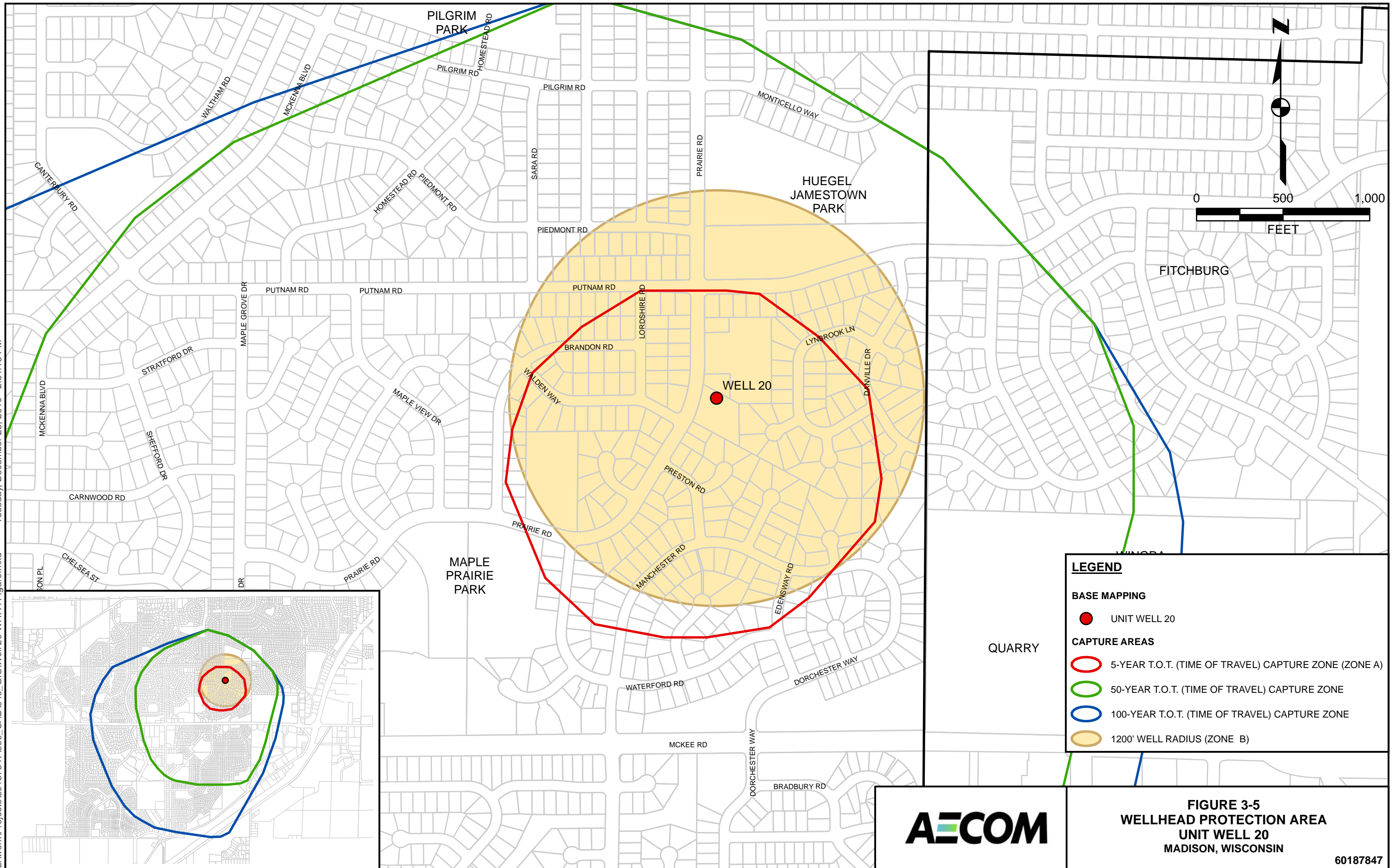
3.4 WHPA

The Wisconsin Administrative Code (Chapter NR 811.12(6)) requires that a WHPA for municipal water supply wells “encompass, at a minimum, that portion of the recharge area equivalent to a 5-year TOT to the well.” Any of the four simulations described above could be used to model the 5-year TOT ZOC for Unit Well 20. It is possible that Unit Well 20 could be pumped at maximum capacity without interruption. Therefore, Simulation No. 3 provides a realistic, but very conservative model of well capture zones for Unit Well 20. Simulation No. 3 was used to generate the long-term capture zones and WHPA for Unit Well 20.

The 5-year TOT ZOC for Unit Well 20 extends up to 1,450 feet southwesterly (upgradient) from the well, and approximately 600 feet northeasterly (downgradient) from the well. The 100-year TOT ZOC extends approximately 7,500 feet southwesterly (upgradient) from Unit Well 20 and approximately 1,900 feet northeasterly (downgradient) from the well. Protecting the entire 100-year TOT ZOC from Unit Well 20 to the upgradient boundary at the same level of protection, as the area within the 5-year TOT ZOC is likely too severe.

The WHPA for Unit Well 20 is illustrated in Figure 3-5. Two zones of protection are within the WHPA. Zone A is the area around Unit Well 20 that is defined by the 5-year TOT ZOC delineated for Simulation No. 3 (full design capacity pumping rate). Zone B is the area around Unit Well 20, beyond Zone A, that is defined by a 1,200-foot fixed radius around Unit Well 20. This radius is selected because the Wisconsin Administrative Code Chapter NR 811.12(5)(d) requires a 1,200-foot separation distance between a municipal water supply well and certain contamination sources.

As illustrated in Figure 3-5, Zone A extends farther upgradient from Unit Well 20 as compared to Zone B, whereas Zone B extends farther downgradient from Unit Well 20 as compared to Zone A. The WHPA will provide a conservative protection zone to account for changes in pumping rates, pumping duration, and interference drawdown from other existing and future wells. The WHPA is located entirely within the City of Madison; however, the 50-year and 100-year TOT ZOCs extend eastward into Fitchburg and southward into the Town of Verona.



LEGEND

BASE MAPPING

- UNIT WELL 20

CAPTURE AREAS

- 5-YEAR T.O.T. (TIME OF TRAVEL) CAPTURE ZONE (ZONE A)
- 50-YEAR T.O.T. (TIME OF TRAVEL) CAPTURE ZONE
- 100-YEAR T.O.T. (TIME OF TRAVEL) CAPTURE ZONE
- 1200' WELL RADIUS (ZONE B)



FIGURE 3-5
WELLHEAD PROTECTION AREA
UNIT WELL 20
MADISON, WISCONSIN

4.0 POTENTIAL CONTAMINANT SOURCES

4.1 CSI

A CSI was performed for the Unit Well 20 area during November 2010. The CSI consisted of a search of government records, interviews, and a reconnaissance survey of the area within a ½-mile radius and the recharge area equivalent to the delineated 100-year TOT ZOC for Unit Well 20. General land use observations and reconnaissance were made on November 2, 18, and 19, 2010.

The location of potential, existing, and former contaminant sources in the WHPA, within a ½-mile radius and the recharge area equivalent to the delineated 100-year TOT ZOC for Unit Well 20 are illustrated in Figure 4-1. Table 4-1 presents a summary of potential contaminant sources that were observed and/or reported to be within the WHPA and review area.

Potential, existing, and former contaminant sources and routes within the WHPA and ZOCs for Unit Well 20 and in close proximity to the ZOCs include 6 former spill sites, potential spills along roads; sanitary and storm sewers; 7 sites with in-use ASTs; 2 sites with closed ASTs; 3 sites with in-use USTs; 11 sites with closed USTs; 4 closed LUST or ERP sites; one drycleaner; a quarry, road salt use; agricultural land use and probable nutrient loading; stormwater ponds and drainage ways; private water supply wells; private sewage disposal systems; a site with a listing for a PCB transformer; several sites with general environmental interest (referenced in environmental lists), and probable use of pesticide, herbicide, and nutrients on parks, commercial and residential lawns and gardens.

Based on the available information, the following are descriptions of known potential, existing, and former contaminant sources in the WHPA, within a ½-mile radius of Unit Well 20 and within the recharge area equivalent to the delineated 100-year TOT of Unit Well 20:

The nearest storm sewer is located 900 feet east-northeast of Unit Well 20. The nearest sanitary sewer main is located 200 feet northwest of Unit Well 20.

Water wells are conduits (routes) to groundwater. A poorly constructed or damaged well may allow contaminants to enter groundwater or to move from one aquifer into another. No private wells were observed at properties located in the City of Madison in the Unit Well 20 area, during the site reconnaissance survey.

The WGNHS 2010 private well database, Dane County private well list, and the Madison Water Utility private well list were reviewed to identify private wells located in the vicinity of Unit Well 20. Twenty records were found for private wells located within, or relatively nearby the area encompassed by the 100 year TOT ZOC for Unit Well 20. A summary of the private wells is included in Appendix I. The status of several of the private wells is not known. Several of the construction reports are missing well and formation data. The majority of the well reports are for wells located in the Town of Verona and City of Fitchburg at locations approximately 1 to 1.5 miles southeast, south and southwest of Unit Well 20. Records were found for several wells located along Nesbitt Road and in a small residential area located west of the intersection of Nesbitt Road and Fitchrona Road. Wells located at the Capitolland Christian Center

TABLE 4-1
CONTAMINANT SOURCE INVENTORY SUMMARY
WELLHEAD PROTECTION UNIT WELL 20
MADISON, WISCONSIN

Map Site No. (EDR Reference No.)	Owner/Location	Database or Reference Source	Existing, Potential, or Former Contaminant Sources	Reported Status	Approximate Distance to Unit Well 20	Location within Capture Zone	Estimated Threat to Supply Wells
1 (23)	Madison Water Utility 2829 Prairie Road Madison, WI	EDR Report- Registered AST (Facility ID 680173) Tier 2	In Use AST: 650 gal. diesel Chlorine gas use	In Use AST	At Unit Well 20	Zone A – 5 yr TOT	Moderate
2 (8)	26 Scranton Court Madison, WI	EDR Report- Spills	Spill 1/1993, hydraulic hose on backhoe broke spilling unknown petroleum product causing soil contamination.	Petroleum Oil Spill 1/1993	1,200 ft South	Zone A – 5 yr TOT	High
3 (25)	Huegel Elementary 2601 Prairie Road Madison, WI	EDR Report- FINDS	Environmental Information system entry. No specific listing reported	Active School	1,500 ft North	50 yr TOT	Low
4 (G32, G33)	Madison Gas & Electric CO. Prairie Substation 5817 Williamsburg Way Madison, WI	EDR Report- PCB Transformer	PCB transformer listing	Active Substation	1,500 ft ENE	50 yr TOT	Low
5 Site Obs.	Stormwater Drainage Ways and Ponds Madison, WI	Site Reconnaissance	Concrete lined and grass lined drainage ways which flow to streams or retention ponds Stormwater runoff may contain contaminants that can accumulate in the streams and ponds	Active Stormwater Drainage Ways and Ponds	Nearest pond is 1,800 ft South	50 yr TOT	Low
6 (J42)	E.Z. Gregory Inc. 6227 McKee Road Madison, WI	EDR Report- Registered UST (Facility ID 72829) BRRTS	Closed/Removed UST: 2,000 gal diesel (Tank ID No. 274335) 9/1989 BRRTS: No detect or insignificant contamination 9/1989	Closed Removed UST 9/1989	2,100 ft South	50 yr TOT	Low
7 (A4)	Madison Gas & Electric Co. 6345 Hartford Drive Madison, WI	EDR Report- Spills	Spill 2/1995, hydraulic filter failure causing hydraulic oil spill Cleaned up using absorbent material. Closed 3/1995	Closed Spill 3/1995	2,600 ft SSW	50 yr TOT	Moderate
8 (68)	Norfolk Circle Madison, WI	EDR Report- Spill	Historic Spill 6/1992, tank overflow spilled pesticides, herbicides and insecticides which flowed into the storm sewer. Closed 6/1992	Closed Spill 6/1992	2,900 ft ENE	> 100 yr TOT	Low
9 (B5, B6)	Jiffy Lube Store #3058 Heartland Automotive Services, Inc. 3140 Maple Valley Drive Madison, WI	EDR Report- Registered AST (Facility ID No. 689816) Tier 2	In use 500 gal. waste/used motor oil (Tank ID 981970)	In Use AST	3,050 ft SW	50 yr TOT	Low
10 (N52, N53, N54, N55, N56, N57, N58, N59, N60, N61)	Wingra Redi Mix Wingra Stone Company Plant #9 2975 Kapec Road Fitchburg, WI	EDR Report- Registered AST (Facility ID 680799) RCRA-Non Gen FINDS LUST Manifest AUL SHWIMS	In Use AST: 10,000 gal. diesel (Tank ID No. 457111) RCRA- No generation of waste, no violations reported Closed/Removed USTs: 10,000 gal diesel, 8,000 gal. unleaded gas, 8,000 gal diesel, 15,000 gal. unleaded gas, 10,000 gal. diesel (Tank ID Nos. 274276, 274277, 274278, 274280, 452899) 10/1998 In Use UST: 2,000 gal fuel oil (Tank ID No. 274279) Conditionally Closed LUST 1/2009, diesel and gasoline contaminated soil and groundwater. Closed with GIS registry	In Use AST In Use UST Closed Removed USTs 10/1998 Conditionally Closed LUST 1/2009 with GIS Registry	3,150 ft SE	> 100 yr TOT	Low
11 (62)	6505 Tottenham Road Madison, WI	EDR Report- Spills	Spill 8/2005, pad mounted transformer was hit by a Madison City Parks lawn mower. Mineral oil spilled causing soil contamination. Closed 9/2005	Closed Spill 9/2005	3,200 ft NW	> 100 yr TOT	Low
12 (C11, C12)	PDQ Food Store #127 3153 Maple Grove Road Madison, WI	EDR Report- Registered UST (Facility ID No. 117514) Visual Inspection	In Use USTs: 3@8,000 gal unleaded gas, 12,000 gal. unleaded gas (Tank ID Nos. 130103635, 130103636, 130103637, 130103638)	In Use USTs	3,200 ft SW	50 yr TOT	Moderate

TABLE 4-1 (cont.)

Map Site No. (EDR Reference N3o.)	Owner/Location	Database or Reference Source	Existing, Potential, or Former Contaminant Sources	Reported Status	Approximate Distance to Unit Well 20	Location within Capture Zone	Estimated Threat to Supply Wells
13 (A1, A2, A3)	Target Corp Store 6321 McKee Road Madison, WI	EDR Report- RCRA-CESQG FINDS Manifest SHWMS	Small quantity generator of hazardous wastes – ignitable and corrosive RCRA – no violations reported	RCRA – No Violations	3,200 ft SSE	50 yr TOT	Low
14 (70)	DEA Drug Pickup 2110 Frisch Road Madison, WI	EDR Report- RCRA NonGen FINDS SHWIMS	RCRA – No violations reported SHWIMS closed listing	Closed Listing	3,250 ft NNW	> 100 yr TOT	Low
15 (7)	Walgreens 6601 McKee Road Madison, WI	EDR Report- SHWIMS	No specific environmental concern specified	Active Store	3,400 ft SW	50 yr TOT	Low
16 Site Obs.	TLC Cleaners 6635 Maple Grove Drive Madison, WI	Site Reconnaissance	Drycleaners	Active Drycleaner Business 2010	3,600 ft SW	50 yr TOT	High
17 (C13, C14)	Verona Alternative High School 3210 Maple Grove Road Verona, WI	EDR Report- Registered UST (Facility ID No. 107075) LUST	Closed/Removed UST: 1,000 gal fuel oil. (Tank ID No. 130900051) 7/1997 Closed LUST 6/2001, petroleum contaminated soil and groundwater in fractured bedrock. Conditional closure with GIS registry	Closed LUST 6/2001 GIS Registry	3,900 ft SW	50 yr TOT	Moderate
18 (22)	Midland Builders 6802 McKee Road Madison, WI	EDR Report- Registered UST (Facility ID 273719)	Closed/Removed UST: 560 gal. leaded gas (Tank ID No. 273719) 10/1993	Closed/Removed UST 10/1993	4,000 ft SW	50 yr TOT	Low
19 (20)	Madison Public Works Department 6201 Westin Drive Madison, WI	EDR Report- Spills	Spill 11/2001, broken hydraulic hose on garbage truck caused hydraulic oil spill which contaminated the storm sewer. Closed 11/2001	Closed Spill 11/2001	4,000 ft South	50 yr TOT	Moderate
20 (C10)	Doerfer Farms LLC 3203 Maple Grove Drive Madison, WI	EDR Report- WI - Registered UST (Facility ID No. 69916)	Closed/Removed UST: 300 gal. leaded gas (Tank ID No. 130900223) 12/1996	Closed/Removed UST 12/1996	4,250 ft SW	50 yr TOT	Low
21 (D15)	Gerald Maurer 3231 Maple Grove Drive Madison, WI	EDR Report- Registered UST (Facility ID No. 65946)	Abandoned with product UST, 500 gal leaded gas (Tank ID. No. 130900060) 1/1974	Abandoned with Product UST 1/1974	4,400 ft SW	50 yr TOT	High
22 (E18, E19)	St Marys Care Center 3401 Maple Grove Drive Madison, WI	EDR Report- Registered AST (Facility ID No. 680084) SHWIMS	In Use AST: 600 gal. diesel (Tank ID No. 680084)	In Use AST	4,400 ft SW	50 yr TOT	Low
23 (I40)	American Health & Safety Inc. 6250 Nesbitt Road Madison, WI	EDR Report- FINDS ICIS	FIFRA 14 enforcement action for comp. and penalties. (old listing) No other details provided	Old FIFRA Enforcement Action	4,500 ft SE	> 100 yr TOT	Low
24 (D16)	Gerald Maurer 3240 Maple Grove Drive Madison, WI	EDR Report- Registered UST (Facility ID No. 82590)	Abandoned with product UST, 500 gal leaded gas (Tank ID. No. 130900059) 3/1963	Abandoned with product UST 3/1963	4,600 ft SW	50 yr TOT	High
25 (17)	Orville Wiemann 3270 Maple Grove Drive Madison, WI	EDR Report- Registered UST (Facility ID No. 275349)	In Use UST: 1,000 gal fuel oil (Tank ID No. 275349)	In Use UST	4,700 ft SW	50 yr TOT	Moderate
26 Site Obs.	Area Between Allegheny Drive and Fitchrona Road Verona, WI	Site Reconnaissance	Junk pile, demolition debris, old vehicles,, tires, pallets. Potential for improper disposal of hazardous materials	Active Junk Pile	4,800 ft SSE	100 yr TOT	Low
27 Site Obs.	Nesbitt Road Area Madison, WI	Site Reconnaissance	Private sewage disposal systems in rural areas beyond Madison City limits	Private Sewage Disposal Systems	8,500 ft SW	> 100 yr TOT	Low
28 (69)	Kathleen Halverson 6192 Verona Road Madison, WI	EDR Report- Registered UST (Facility ID 55607)	Closed/Removed USTs: 500 gal. unleaded gas, 1,111 gal leaded gas (Tank ID Nos. 274244, 274362) 8/1988	Closed Removed USTs 8/1988	5,000 ft SE	> 100 yr TOT	Low

TABLE 4-1 (cont.)

Map Site No. (EDR Reference N3o.)	Owner/Location	Database or Reference Source	Existing, Potential, or Former Contaminant Sources	Reported Status	Approximate Distance to Unit Well 20	Location within Capture Zone	Estimated Threat to Supply Wells
29 (21)	Cesar Chavez Elementary 3502 Maple Grove Drive Madison, WI	EDR Report- FINDS	Registry ID 110036620939 – environmental interest information	Active Site	5,300 ft SW	100 yr TOT	Low
30 (F27, F28, F29)	Rayovac Corporation 6343 Nesbit Road Madison, WI	EDR Report- Registered UST (Facility ID 121454) ERP Spills CRS AUL SHWIMS RCRA-NonGen FINDS Manifest	Closed Removed USTs: 2@1,000-gal leaded and unknown contents, 2,000 gal. unknown contents (Tank ID Nos. 271518, 271519, 271520) 5/1986 Closed ERP 5/1995, Added to GIS registry 12/2008. Deed restriction for soil closure. Residual soil contamination at or above WI standards. Land use control for soil at industrial use level Spill 9/1994, spills during battery production. Metals impacted soil Old spill 4/1989, product mishandled spilling diesel fuel RCRA – small quantities of ignitable and corrosive hazardous wastes, cadmium and mercury	Closed/Removed USTs 5/1986 Closed ERP Added to GIS Registry 12/2008 Closed Spill 9/1994 Old Spill 4/1989	5,300 ft SSE	100 yr TOT	Moderate
31 (F30)	Fellys Greenhouse Al Felly 6353 Nebitt Road Madison, WI	EDR Report- Registered UST (Facility ID 77757) BRRTS Site Reconnaissance	Closed Removed UST: 1,111-gal fuel oil (Tank ID No. 275446) 3/1992 Greenhouses, nutrient mixing, loading and application on plants	Closed/Removed UST 3/1992 Active Green Houses	5,400 ft SSE	100 yr TOT	Low
32 (H34, H35, H36, H37, H38, H39)	Wisconsin Brick & Block Corporation County Materials Corp. 6399 Nesbitt Road Madison, WI	EDR Report- Registered UST (Facility ID 144340) Registered AST SHWIMS FINDS Tier 2 RCRA-CESQG	Closed/Removed USTs: 1,000 gal. waste/used motor oil, 2@1,000 gal. diesel, 500 gal other, 1,000 gal. unleaded gas, 10,000 gal. leaded gas, 1,000 gal gasohol, 3@1,000 gal. leaded gasoline, 10,000 gal diesel (Tank ID Nos. 275380, 275382, 275383, 275385, 275387, 275388, 275420, 275421, 275423, 275424) Closed Filled with Inert Material USTs: 4@ 500 gal. san/gravel/slurry, 3@1,000 gal sand/gravel/slurry (Tank ID Nos. 275384, 275386, 275389, 275390, 275391, 275392, 275393) In Use ASTs: 500 gal waste/used motor oil Closed/Removed ASTs: 3@550 gal other Tier 2 – Crystalline quartz silica sand RCRA small quantity generator of corrosive, non-halogenated, acetic acid ethyl ester, benzene, carbamic acid, and benzene hazardous wastes. No violations reported	Closed/Removed USTs Closed/Filled USTs In Use ASTs Closed/Removed ASTs	5,500 ft SSE	100 yr TOT	Low
33 (26)	James & Edelle Kinsinger 2780 Cortina Drive Madison, WI	EDR Report- Registered UST (Facility ID 90942)	Closed Removed UST: 200 gal. unleaded gas (Tank ID No. 275372) 5/1987	Closed/Removed USTs 5/1987	5,500 ft South	100 yr TOT	Low
34 (K44, K45)	Coop Services Inc. Coop Country Partners 2781 Fitchrona Road Verona, WI	EDR Report- Registered UST (Facility ID 151399) ERP LAST CRS AUL	Closed Removed ASTs: 1,000-gal leaded gas, 9,953 unleaded gas, 9,953 gal fuel oil, 21,327 gal fuel oil (Tank ID Nos. 202611, 202612, 202613, 202614) 11/1998 Closed LAST 1/2003, petroleum contaminated soil and groundwater above standards (soil and NR 140), Conditional NR 726 with GIS registry	Closed/Removed ASTs 11/1998 Closed LAST 1/2003 Conditional with GIS Registry	5,600 ft SSE	> 100 yr TOT	Low
35 Site Obs.	3700-3900 Blocks of Maple Grove Drive Madison, WI	Site Reconnaissance	Corn field – nutrient loading, pesticide and herbicide application	Active Corn Field Nutrient Loading	5,400-7,100 ft SW	100 yr TOT	Low

TABLE 4-1 (cont.)

Map Site No. (EDR Reference N3o.)	Owner/Location	Database or Reference Source	Existing, Potential, or Former Contaminant Sources	Reported Status	Approximate Distance to Unit Well 20	Location within Capture Zone	Estimated Threat to Supply Wells
36 (L46, L49)	Barnes Inc. 6433 Nesbitt Road Madison, WI	EDR Report- SHWIMS Registered AST (Facility ID 680016) Site Reconnaissance	SHWIMS listing no details In Use ASTs: 2@560 gal. unleaded gas, 560 gal. diesel, 1,111 gal. waste/used motor oil, 560 gal. diesel, 1,111 gal. waste/used motor oil, 1,000 gal. unleaded gas (Tank ID Nos. 202626, 202625, 202624, 1182581, 202623, 1182587, 896568) Barrels (unknown contents), bulk materials piles (unknown materials), maintenance shop, trucks, chippers parking and equipment, trailored (portable) ASTs (unknown contents), several in-use ASTs visible, potential for leaks and spills	In Use ASTS SHWIMS List	7,000 ft SSW	100 yr TOT	Low
37 Site Obs.	4228 Nesbitt Road Madison, WI	Site Reconnaissance	2 ASTs: approximately 75 gal. each, unknown contents Private sewage disposal system	In Use ASTs Private Sewage Disposal System	8,400 ft SW	> 100 yr TOT	Low
	Highways, roads, streets throughout the area	Site Reconnaissance	Salt application Potential spills	Active		Zone A – 5 yr TOT	Low

Notes:

- Zone A = Within 5 year TOT ZOC
- Zone B = Beyond Zone A, but within 1200-ft. radius.

AST - Aboveground Storage Tank
AUL - Deed Restriction Data
BRRTS - Wisconsin Bureau of Remediation & Redevelopment Tracking System
CERCLIS - Comprehensive Environmental Response, Compensation, and Liability Information System
COORACTS - Corrective Action Activity
CRS - Closed Remediation Sites
DNR - Wisconsin Department of Natural Resources
EPA - Environmental Protection Agency
ERNS - Emergency Response Notification System
ERP - Wisconsin Environmental Repair Program Database
FINDS - Facility Index System/Facility Registry System
LAST - Leaking Aboveground Storage Tank
LUST - Leaking Underground Storage Tank
MANIFEST - Hazardous Waste Manifest Information
NPL - National Priorities List (NPL)
SHWIMS - Solid & Hazardous Waste Information Management System
RCRA-CESQG - Resource Conservation and Recovery Act- Conditionally Exempt Small Quantity Generator
RCRA-LQG - Resource Conservation and Recovery Act (RCRA) - Large Quantity Generator
RCRA-SQG - Resource Conservation and Recovery Act- Small Quantity Generator
SPILLS - Wisconsin DNR Spills Database
TOT - Time of Travel
UST - Underground Storage Tank
Yr - year
WI - Wisconsin

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(3651 Maple Grove Drive) and at private residences at 3231 Maple Grove Drive and 3240 Maple Grove Drive are located in the City of Madison.

There are no private sewage disposal systems in the Unit Well 20 WHPA. The nearest private sewage disposal systems in the Unit Well 20 recharge area are located approximately 1 to 1.25 miles south of Unit Well 20. Private sewage disposal systems are located at residences and businesses located along Nesbitt Road. A segment of Nesbitt Road between Maple Grove Drive and Fitchrona Road is located beyond the 50-year TOT capture zone, but within the 100-year TOT ZOC for Well 20. The sewage disposal systems are likely low risk to Unit Well 20.

The City of Fitchburg is located 1,200 feet east of Unit Well 20 and provides sewer and water to residents and businesses in the City of Fitchburg.

Based on the site reconnaissance and a review of the Wisconsin registered storage tank list, there are two active UST sites located within the Unit Well 20 ZOCs. The nearest active UST site is located at a gas station at 3153 Maple Grove Road, 3,200 feet southwest of Unit Well 20.

The nearest active AST is at the Unit Well 20 site, where a 650 gallon AST stores diesel fuel for a backup generator. According to the Wisconsin AST database, the AST has a double wall construction.

The nearest site with a closed UST is 2,100 feet south of Unit Well 20. There are no closed UST sites in the Unit Well 20 WHPA.

There are no open or closed LUST sites within 1,200 feet of Unit Well 20. The nearest closed LUST site (within the Unit Well 20 ZOCs) is 3,900 feet southwest at 3210 Maple Grove Road. All four closed LUST sites in the area received conditional closure with residual soil and/or groundwater contamination above applicable standards remaining at the sites.

Based on the review of the Wisconsin Spills List, one reported spill has occurred within 1,200 feet of Unit Well 20. In 1993 a hydraulic hose on a backhoe broke at 26 Scranton Court, spilling an unknown petroleum product and contaminating soil. Two other spills are located within the Unit Well 20 ZOCs. All of the spill sites have closed status.

A drycleaner is located at 6635 Maple Grove Drive, 3,600 feet southwest of Unit Well 20 and within the 50-year TOT ZOC.

Wingra Stone Quarry is located approximately 1,800 feet southeast of Unit Well 20. The western part of the quarry is located within the 50-year and 100-year TOT ZOCs for Unit Well 20. At the quarry the soil has been removed, the bedrock has been fractured by blasting, stone has been removed and the quarry is highly vulnerable to surface contamination.

DNR records show that there are no solid waste disposal sites in the Unit Well 20 ZOCs. The nearest historical landfills are located 1.5 miles southeast and 2 miles southwest of Unit Well 20. A junk pile is located 4,800 feet south-southeast of Unit Well 20. The site is located 300 feet northwest of the intersection of Nesbitt Road and Fitchrona Road and is within the 100-year TOT ZOC for Unit Well 20. The site contains demolition debris, old vehicles, tires, and pallets, and possibly other materials that could cause groundwater contamination.

No cemeteries were observed in the Unit Well 20 ZOCs.

There are no sludge or septage spreading areas in the Unit Well 20 WHPA or in the upgradient 50-year and 100-year TOT ZOCs.

A corn field is located 5,400 to 7,100 feet southwest of Unit Well 20. The agricultural field is located in the Town of Verona, but is surrounded by residential properties in the City of Madison. A concern about agricultural fields is the potential for nutrient loading and mixing and use of pesticides and herbicides.

There are several stormwater detention ponds and concrete-lined and grass drainage ways located within the Unit Well 20 ZOCs. A concern is the accumulation of contaminants in stormwater runoff from streets and parking lots that may concentrate in the drainage ways and ponds and infiltrate into the aquifer. The nearest pond is 1,800 feet south of Unit Well 20 and is within the 50-year TOT ZOC.

No bulk salt storage sheds or bulk pesticide, fertilizer storage, and/or mix-load sites were identified within the ½-mile radius or the recharge area equivalent to the delineated 100-year TOT of Unit Well 20, or within the upgradient recharge area.

Salt is applied to some roadways in the Unit Well 20 ZOCs during the winter, as a deicer.

The separation distances between Unit Well 20 and potential contaminant sources identified in Wisconsin Administrative Code NR 811.12(5)(d) are summarized in Table 4-2. The required separation distances from Unit Well 20 are met for all known contamination sources. A separation distance of 10 feet is required between Unit Well 20 and the double walled AST at the site that supplies fuel to the standby generator, provided that the AST is equipped with continuous electronic interstitial leakage monitoring.

4.2 UNIT WELL 20 WATER QUALITY AND LAND USES

Based on the latest water quality samples, water pumped from Unit Well 20 is hard (280 milligrams per liter (mg/L), and contains low levels of manganese (0.0097 mg/L), nitrate (0.48 mg/L), chloride (2.3 mg/L), sulfate (8.0 mg/L), and radon (220 pico curies per liter (pCi/L) (DNR, 2010). No iron, volatile organic compounds (VOCs) or synthetic organic compounds (SOCs) were detected in water pumped from Unit Well 20 during the last sampling cycles of 2010 for iron and VOCs and 2002 for SOCs (DNR, 2010). Table 4-3 contains a summary of the Unit Well 20 inorganic water quality data. Appendix J contains the historical water quality information for Unit well Unit Well 20.

Select water quality parameters were graphed and reviewed to determine if there are trends in the water quality. Appendix J includes the historical water quality graphs. On the basis of these water quality data, it does not appear that road salt application (chlorides), or nutrient loading (nitrates) on grass areas in the well capture zone areas has significantly affected the quality of groundwater pumped from Unit Well 20. The concentrations are well below the nitrate maximum contaminant level (MCL) of 10 mg/L, and the secondary standard of 250 mg/L for chloride. Similarly constructed wells have noted an increase in chloride level due to infiltration

**TABLE 4-2
MINIMUM SEPARATION REQUIREMENTS
BETWEEN PUBLIC WELLS AND
POTENTIAL CONTAMINANT SOURCES
WELLHEAD PROTECTION PLAN, UNIT WELL 20
MADISON, WISCONSIN**

Potential Contamination Source	Minimum Separation Distance
Emergency or Standby Power System for Well	10 feet
Storm Sewer	50 feet
Sanitary Sewer	200 feet ¹
Sanitary Lift Station	200 feet
Single Family Residential Fuel Oil Tank	200 feet
Private on Site Water Treatment System (POWTS) Treatment Tank or Holding Tank Component and Associated Piping	200 feet
Double Walled Below or Above Ground Gasoline or Fuel Oil Tank Following Most Restrictive Com 10.260 Standards and Approved by Comm 10.110	300 feet
Cemetery	400 feet
Stormwater Retention or Detention Pond	400 feet
POWTS Dispersal Component With a Capacity of Less Than 12,000 gpd	400 feet
Double Walled Below or Above Ground Gasoline or Fuel Oil Tank Following Com 10.260 Double Walled Tank Standards and Approved by Comm 10.110	600 feet
Land Application of Municipal, Commercial, or Industrial Waste	1,000 feet
Boundaries of Land Spreading Facility Regulated Under Chapter NR 718	1,000 feet
Agricultural, Industrial, Commercial, or Municipal Wastewater Treatment Plant Treatment Units, Lagoons, or Storage Structures	1,000 feet
Manure Stacks or Storage Structures	1,000 feet
POWTS Dispersal Component With a Capacity of 12,000 gpd or More	1,000 feet
Solid Waste Storage, Transportation, Transfer, Incineration, Air Curtain Destructor, Processing, Wood Burning, or One-Time Disposal or Small Demolition Facility	1,200 feet
Sanitary Landfill	1,200 feet
Property with Residual Groundwater Contamination Exceeding Chapter NR 140 Enforcement Standards	1,200 feet
Coal Storage Area	1,200 feet
Salt or Deicing Material Storage	1,200 feet
Gasoline or Fuel Oil Storage Tanks Not Constructed Per Comm 10.260 / Not Approved by Comm 10.110	1,200 feet
Pesticide or Fertilizer Handling or Storage Facilities	1,200 feet
Reference: Wisconsin Administrative Code, NR 811, November 2010.	
Footnote:	
¹ Lesser separation for sanitary sewer may be allowed if the sewer is constructed of water main materials and pressure tested. Less than 50 feet separation is not allowed.	

TABLE 4-3
SUMMARY OF WATER QUALITY DATA
WELLHEAD PROTECTION PLAN, UNIT WELL 20
MADISON, WISCONSIN

Parameter	Value	Maximum Contaminant Limit (MCL) Or Secondary Standard
Alkalinity (mg/L)	260 - 272	None
Hardness (mg/L)	270 – 280	None
pH	7.55 – 8.15	6.5 – 8.5
Iron (mg/L)	Non Detect	0.3
Manganese (mg/L)	Non Detect – 0.0048	0.05
Chloride (mg/L)	0.5 – 2.3	250
Nitrate – Nitrogen (mg/L)	Non Detect – 0.48	10.0
Sulfate (mg/L)	6 – 9	250
Barium (mg/L)	0.0072 – 0.011	2.0
VOCs (Concentration greater than MCL)	None	Varies
SOCs (Concentration greater than MCL)	None	Varies

of road salt; however, this well is located in a residential area with lower road salt usage which may attribute to the stabilized chloride levels within the well.

Unit Well 20 is not cased through the Eau Claire shale confining layer; therefore, Unit Well 20 is open to approximately 120 feet of the upper bedrock aquifer, which is more vulnerable to contamination from near-surface contaminant sources compared to the lower bedrock aquifer.

4.3 LAND USES AND WHP PLANNING

Well 20 is located in a residential area that generally is compatible with WHP planning. Land uses in Unit Well 20 ZOCs that are not compatible with WHP planning, include major highways (high potential for spills), gas stations, in-use ASTs and USTs, drycleaning, agricultural land with nutrient loading, stormwater detention ponds (fed by parking lot and street runoff), quarrying, and a junk pile. Land uses summarized in Table 4-2 should be prohibited in the vicinity of Unit Well 20, within the respective minimum separation distances shown. Also, it is not desirable to have commercial, manufacturing, or industrial districts located in WHPAs. Land uses summarized in Table K-1 in Appendix K should be prohibited from WHPA Zones A and B. Where any of the uses listed in Table K-1 currently exist within Zones A and B, owners should be allowed to upgrade the facilities to facilitate or enhance groundwater protection.

Tables 4-4 and 4-5 in Appendix K summarize several potential sources of groundwater contamination and land uses, and their relative risk to groundwater, respectively.

5.0 MANAGEMENT ACTIVITIES

5.1 ALTERNATIVE MANAGEMENT ACTIVITIES

Table 5-1 summarizes key elements of a management plan developed for the City of Madison. Activities were identified for resource management within the delineated WHPA and within far upgradient ZOCs.

The various activities can be grouped into five principal categories as follows:

1. Existing programs
2. Land use controls
3. Intergovernmental cooperation
4. Monitoring
5. Public education and awareness

All landowners in the Unit Well 20 area, whether residing in the City of Madison or in surrounding areas, rely on groundwater resources for water supply. Emphasis should be placed on management activities that provide a mutual benefit to the City of Madison residents and other property owners who rely on the groundwater resources.

5.1.1 Category 1 - Existing Programs

5.1.1.1 Hazardous Waste Collection/Disposal Program (Clean Sweep)

Public Health Madison and Dane County operates the Clean Sweep Collection Program. The Clean Sweep Program involves collection and disposal of residential, agricultural, and small business hazardous chemicals and wastes and product exchange of unwanted hazardous products when applicable. Disposal of household residential hazardous wastes is free; however, some household hazardous wastes cannot be accepted by the Clean Sweep Program. The Clean Sweep website should be consulted about specific items being disposed. Small quantities of hazardous materials and wastes from small businesses are accepted on Thursday mornings, by appointment only, and there is a per pound charge for materials. Costs are summarized on the Clean Sweep website. There are similar charges for disposal of hazardous materials disposed of by producers of agricultural crops and commodities; however, Dane County farmers receive a subsidy. Collections are held between 7:30 a.m. and 2:00 p.m. on Tuesdays, Wednesdays, Fridays, and Saturdays; May 1 through October 30. The Clean Sweep site is located at the north end of the Dane County Highway Garage property, 2302 Fish Hatchery Road, Madison, Wisconsin.

Information about the Clean Sweep Collection Program can be obtained by calling (608) 243-0368. Clean Sweep Collection Program website is www.danecountycleansweep.com

The Clean Sweep Collection Program is advertised using public service announcements and materials distributed by municipalities including direct mail to select customer groups, press releases, publications and newsletters, television coverage, and brochures. The program also maintains a website as noted above and an informational hotline. Funding for the program is

TABLE 5-1
SUMMARY OF MANAGEMENT ACTIVITIES
WELLHEAD PROTECTION PLAN - UNIT WELL 20
MADISON, WISCONSIN

Program Category	Activity	Description	Responsible Unit(s) of Government	Implementation Schedule	
				Date	Action Item
1. Existing Programs	a. Hazardous Waste Collection (CLEAN SWEEP)	<ul style="list-style-type: none"> Hazardous waste collection and disposal. Residential, agricultural, and small business hazardous waste. Commercial with small fee. May through October collections in Madison. Target local property owners and residents to participate. 	<ul style="list-style-type: none"> Public Health Madison and Dane County 	1. 2011	1. Madison Water Utility send information about the Clean Sweep Collection Program to property owners in the WHPA, to encourage participation in the program.
				2. As needed	2. Dane County sponsors advertising and feature articles.
	b. On Site Waste Disposal System (Septic) Maintenance	<ul style="list-style-type: none"> Maintenance/servicing contract currently required for system owners on record. Orders issued to confirm failing system owners. Include all property/septic system owners in WHPA in notification database. Conduct Public Education. 	<ul style="list-style-type: none"> Public Health Madison and Dane County Environmental Health Services 	1. 2011, then annually	1. Madison Water Utility request that Public Health Madison and Dane County Health Services provide information to owners of private sewage disposal systems about sewage system maintenance, and the types of waste that should not be disposed of in a septic system.
				2. 2011	2. Madison Water Utility prepare an article for newspaper release about septic system dos and don'ts.
				3. Every 3 years	3. Public Health Madison and Dane County Environmental Health Services ensure that system maintenance and pumping are performed.

TABLE 5-1 (cont.)

Program Category	Activity	Description	Responsible Unit(s) of Government	Implementation Schedule	
				Date	Action Item
1. Existing Programs (cont.)	c. Well Construction and Abandonment	<ul style="list-style-type: none"> Dane County review applications and require construction permits for new private water supply wells. Enforce well abandonment ordinance(s) (Dane County Chapter 45, and City of Madison General Ordinance Sec. 13.21) and review new well construction. Madison Water Utility review applications for private well operation permits. City of Madison require proper abandonment of unused and unsafe wells. Update well inventory in WHPA. Familiarize with WI Admin. Codes, Chapters NR 141, 811, and 812. 	<ul style="list-style-type: none"> Wisconsin DNR Public Health Madison & Dane County Environmental Health Services City of Madison Madison Water Utility 	<ol style="list-style-type: none"> Ongoing Ongoing 2011, then annually Ongoing Every 5 years in conjunction with well permits review/renewal Ongoing Ongoing 2011 Ongoing 2011 	<ol style="list-style-type: none"> Dane County Environmental Health Division continue to review well applications and require construction permits for new private water supply wells. Madison Water Utility continue to review applications for private wells operation permits. Madison Water Utility request that Public Health Madison & Dane County Environmental Health Services provide the names and addresses of owners of private wells located in the Unit Well 20 WHPA. Madison Water Utility determine the location of other private water supply wells that may be located within the WHPA and which are not recorded in the County database. Madison Water Utility send private well owners within the WHPA, DNR pamphlets about well upkeep and proper abandonment procedures in the event the owners abandon their existing wells. Madison Water Utility update the private well inventory for wells located in the WHPA. City of Madison and Dane County enforce existing well abandonment ordinances, to ensure that all private wells are permitted, or properly abandoned if unused. Madison Water Utility request that Dane County consider proximity and depth of proposed private wells relative to Unit Well 20 prior to issuing permits for construction of new private water supply wells. Madison Water Utility direct residents to the DNR private well code (Chapter NR 812) or to the Wisconsin DNR private well section (608) 266-0821) when questions arise about private water supply wells. Madison Water Utility provide information about proper abandonment of unused wells in the annual Consumer Confidence Report (CCR).

TABLE 5-1 (cont.)

Program Category	Activity	Description	Responsible Unit(s) of Government	Implementation Schedule	
				Date	Action Item
1. Existing Programs (cont.)	d. Land Application of Sludge and Septage	<ul style="list-style-type: none"> Enforce existing rules. 	<ul style="list-style-type: none"> Wisconsin DNR Dane County Madison Metropolitan Sewerage District (MMSD) 	1. 2011	1. Madison Water Utility provide a copy of the WHPA and ultimate recharge area maps to the MMSD and request that sludge not be spread in the Unit Well 20 ultimate recharge area.
				2. 2011	2. Madison Water Utility provide a copy of the WHPA and ultimate recharge area maps to the DNR Watershed Management office (608-267-7694 (central office) 608-275-3325 (Fitchburg office)) and request that new permits for sludge and septage spreading not be issued for properties located in the Unit Well 20 recharge area equivalent to the 100-year TOT capture zone.
				3. Ongoing	3. Madison Water Utility encourage development of additional authorized septage discharge points in the City of Madison wastewater treatment system.
				4. Ongoing	4. DNR enforce rules, particularly in WHPAs.
				5. 2011	5. Dane County develop regulatory program including ordinance.
	e. Spill Notification and Awareness of Remedial Investigation and Cleanup	<ul style="list-style-type: none"> Monitor and keep informed of potential contamination sources in the WHPA and recharge areas. Work with DNR to achieve investigation and cleanup of known contamination sources. 	<ul style="list-style-type: none"> Wisconsin DNR Dane County Emergency Management Wisconsin DATCP and COMM City of Madison Fire Department 	1. 2011	1. Madison Water Utility request that DNR, City Police, and the Dane County Emergency Management Office inform the City about future events (spills, leaks, investigations, etc.) that occur in the Unit Well 20 WHPA or in upgradient recharge areas.
				2. 2011, then ongoing	2. Madison Water Utility monitor the status of existing and potential contamination sources in the WHPA, investigations regarding nature and extent of releases, and the status of cleanup activities, then determine if Utility action is needed.
				3. 2011	3. Madison Water Utility provide WHPA map to DNR and request that contaminated sites located in the Unit Well 20 WHPA be carefully reviewed before being granted closure.
2. Land Use Controls	a. Existing Zoning/Wellhead Protection Overlay Zoning and Ordinance	<ul style="list-style-type: none"> Enforce existing zoning. Discourage conditional uses or zoning changes that increase risk to groundwater. 	<ul style="list-style-type: none"> City of Madison Dane County Planning and Development 	1. April 2011	1. City of Madison amend WHP ordinance and add WP-20 Wellhead Protection District No. 20.
				2. 2011	2. City of Madison provide Dane County with a copy of the WHP ordinance and WHPA map.
				3. 2011	3. Dane County consider developing WHP Overlay District ordinance.

TABLE 5-1 (cont.)

Program Category	Activity	Description	Responsible Unit(s) of Government	Implementation Schedule		
				Date	Action Item	
3. Intergovernmental Cooperation	a. Land Use Planning and Site Plan Review	<ul style="list-style-type: none"> • Cooperate in land use planning to protect groundwater resources and WHPAs. • Keep apprised of development in WHPA. • Ensure development complies with separation distances between the well and potential contamination sources as required by WI Admin. Code, Chapter NR 811.12. 	<ul style="list-style-type: none"> • City of Madison Planning and Development Department • Dane County Planning and Development Department • City of Fitchburg • Town of Verona 	1.	2011	<p>1. City of Madison provide Dane County, the City of Fitchburg and the Town of Verona with a copy of:</p> <ul style="list-style-type: none"> a. The WHPP and maps showing the Unit Well 20 WHPA, ZOCs and ultimate recharge areas. b. A summary of separation distances required between municipal water supply wells and potential contamination sources (Wisconsin Administrative Code, Chapter NR 811.12(5)(d)). c. A list of potential contamination sources that can threaten groundwater. d. A list of high risk land uses that should be prohibited from WHPAs.
				2.	2011 – Ongoing	<p>2. City of Madison Planning and Development Department ensure that development complies with separation distances required between municipal water supply wells and potential contamination sources.</p>
				3.	2011 – Ongoing	<p>3. City of Madison encourage the City of Fitchburg, Town of Verona, and Dane County Boards and Councils to help protect the Unit Well 20 recharge areas when evaluating proposed development.</p>
				4.	2011	<p>4. City of Madison Planning and Development Department will use an Environmental Permits Checklist for site plan review. The checklist will help ensure compliance with local, County, and State permits and will raise awareness about groundwater protection.</p>
				5.	2011 – Ongoing	<p>5. City of Madison Planning and Development Department provide a copy of the WHPA map and Site Plan Review Environmental Permits Checklist to developers and property owners and require that the developer indicate on the environmental permits checklist and hazardous substances reporting form whether the proposed development is in a WHPA.</p>

TABLE 5-1 (cont.)

Program Category	Activity	Description	Responsible Unit(s) of Government	Implementation Schedule	
				Date	Action Item
4. Monitoring	a. Contaminant Source Inventory (CSI) Maintenance	<ul style="list-style-type: none"> Update CSI and conduct windshield survey 	<ul style="list-style-type: none"> Madison Water Utility 	1. November 2010, then every 5 years (November 2015)	1. Madison Water Utility update the CSI by conducting a windshield survey of properties located in the WHPA and by performing State and Federal database checks.
	b. Water Quality Monitoring	<ul style="list-style-type: none"> Conduct sampling of supply wells. 	<ul style="list-style-type: none"> Madison Water Utility 	1. As required – Ongoing 2. Ongoing	1. Madison Water Utility perform water quality monitoring as required by DNR and as otherwise needed. 2. Madison Water Utility continue to post water quality data online at (http://www.madisonwater.org or http://www.cityofmadison.com/water/) for public review
5. Public Education and Awareness	a. Availability of WHPP	<ul style="list-style-type: none"> Provide copies to Water Utility Office, Public Library, City Hall, City of Fitchburg, Town of Verona, and Dane County. 	<ul style="list-style-type: none"> City of Madison 	1. 2011 2. 2011 3. 2011	1. City of Madison provide copies of the WHPP for review by the public at the Water Utility Office, Madison Public Library, and City Hall. 2. City of Madison provide a copy of the WHPP to the City of Fitchburg, Town of Verona, and Dane County. 3. Madison Water Utility communicate the availability of the plan through a newspaper article.
	b. Public Informational Meeting	<ul style="list-style-type: none"> Perform as part of a City Committee meeting or Common Council Meeting. 	<ul style="list-style-type: none"> City of Madison 	1. 2011 2. 2011	1. City of Madison conduct a public informational meeting as part of a City committee meeting or the Common Council meeting during the review phase of the WHPP. 2. City of Madison provide WHPA maps for public review and an information sheet or brochure available for public use.
	c. News Releases	<ul style="list-style-type: none"> Issue early in program implementation, and reinforce annually, as necessary. 	<ul style="list-style-type: none"> City of Madison 	1. 2011, then annually	1. Madison Water Utility will provide a news release to the local newspaper about the WHPP for Unit Well 20.

TABLE 5-1 (cont.)

Program Category	Activity	Description	Responsible Unit(s) of Government	Implementation Schedule	
				Date	Action Item
5. Public Education and Awareness (cont.)	d. Informational Materials Distributed To Residents in WHPA	<ul style="list-style-type: none"> Hazardous Waste Collection (Clean Sweep) Program Materials describing proper use and application of fertilizers and pesticides. 	<ul style="list-style-type: none"> City of Madison Wisconsin DNR University Extension Office 	1. 2011, then ongoing	<p>1. Madison Water Utility prepare informational materials and/or obtain from the Wisconsin DNR Bureau of Drinking Water and Groundwater, Dane County or UW Extension fliers, brochures and pamphlets, including:</p> <ul style="list-style-type: none"> a. Information about hazardous waste collection/disposal program (Clean Sweep) activities. b. Materials describing the proper use and application of lawn fertilizers and pesticides. c. Wellhead protection planning d. Annual Consumer Confidence Report (CCR) containing information about WHP planning. <p>2. Madison Water Utility update information in website (http://www.madisonwater.org or http://www.cityofmadison.com/water/) about WHP planning.</p>
	e. Land Use and Contaminant Source Awareness	<ul style="list-style-type: none"> Notify and offer guidance to owners of potential high risk land uses in WHPA. 	<ul style="list-style-type: none"> City of Madison 	1. 2011	<p>1. Madison Water Utility provide information to owners of property with existing or potential contamination sources located within the WHPA to emphasize the importance of awareness of the WHPA, the owner's location with respect to the WHPA, and potential contamination source(s) of concern. Specific information to be provided includes:</p> <ul style="list-style-type: none"> a. Leaking USTs and ASTs. b. Upgrading existing ASTs and USTs systems. c. Materials describing the proper use and application of lawn fertilizers and pesticides. <p>2. Madison Water Utility send a letter to Wingra Stone Company to inform them that their quarry is located in the Unit Well 20 ZOC.</p>
	f. School Programs	<ul style="list-style-type: none"> Participate in school programs. 	<ul style="list-style-type: none"> City of Madison University Extension Office Madison Public Schools 	1. 2011	<p>1. Madison Water Utility inform schools about the availability of tours at water supply facilities.</p>
				2. 2011	<p>2. Madison Water Utility prepare a water/groundwater fact sheet for school education.</p>

primarily provided by a percentage of tipping fees collected at local landfills. Additional information about the Clean Sweep Collection Program is in Appendix L.

The Clean Sweep Collection Program will be coupled with the City of Madison's WHP planning efforts. The following will be completed for this management activity:

1. Madison Water Utility will send information about the Clean Sweep Collection Program to property owners in the WHPA, to encourage participation in the program.

5.1.1.2 On-Site Waste Disposal System Maintenance

The nearest private sewage disposal systems in the Unit Well 20 recharge area are located in the Town of Verona approximately 1 to 1.25 miles south of Unit Well 20. Private sewage disposal systems are located at residences and businesses located along Nesbitt Road. A segment of Nesbitt Road between Maple Grove Drive and Fitchrona Road is located beyond the 50-year TOT capture zone, but is within the 100-year TOT ZOC for Well 20. The sewage disposal systems located 1 to 1.25 miles south of Unit Well 20 are likely low risk to Unit Well 20, and nitrate concentrations in groundwater pumped from Unit Well 20 are well below the nitrate MCL of 10 mg/L. However, nutrient loading to groundwater is a regional concern, and it is prudent to be proactive regarding management of private sewage disposal systems.

The Public Health Madison and Dane County has an existing program for the inventorying and servicing of private on-site waste disposal (septic) systems located in Dane County. Data for private waste disposal systems are recorded in a central database. All owners of septic systems are required every three years to have their septic tanks pumped and inspected and any required maintenance performed. The Public Health Madison and Dane County charges the owners of septic systems an annual fee of \$8.67 per system, to support the Public Health inventory program. The purpose of the inventory is to ensure that private systems are maintained and operating correctly, so that they do not endanger the groundwater resources (Public Health Madison, 2010).

The Public Health Madison and Dane County Environmental Health Services investigates complaints about non-complying sewage disposal systems and issues replacement orders to owners of failing systems.

For this management activity, the City will perform the following:

1. Request that Public Health Madison and Dane County provide information to owners of private sewage disposal systems located in Dane County, about sewage system maintenance, and the types of waste that should not be disposed of in a septic system.
2. Prepare an article for the newspaper about private sewage disposal systems do's and don'ts.

5.1.1.3 Well Construction and Abandonment

The proposed activities under this category for WHP include public education and private well inventory maintenance. Education will improve awareness on the part of private well owners of

the importance of proper well construction and abandonment (filling and sealing) of unused wells.

The City of Madison (General Ordinance Section 13.21) and Dane County (Chapter 45) have well abandonment ordinances for non-complying, unsafe, and unused wells. A copy of the City of Madison Well Abandonment Ordinance and the Dane County ordinance "Relating to Private Water Systems" are in Appendix M. Other information about private wells and well abandonment is in Appendix N. As of June 1, 2008, only licensed well drillers and pump installers can fill and seal wells in Wisconsin (Wisconsin DNR, 2010).

Dane County and the Wisconsin DNR have regulatory authority for proper construction and abandonment of unused wells (Wisconsin Administrative Code, Chapters NR 811 and 812). A DNR notification number is required prior to well construction. Dane County also requires a permit prior to construction. After a well is constructed, Public Health Madison and Dane County sanitarians inspect the well.

Madison General Ordinance Section 13.21 requires an owner of a private well located in the City of Madison, or on premises served by the Madison Water Utility to abandon the private well, or obtain a well operation permit from the Madison Water Utility. Madison Water Utility oversees (witnesses) the abandonment of unsafe, unused, or non-complying wells that are located in the City. Dane County oversees the abandonment of unsafe, unused, or non-complying wells that are located in the County. The Public Health Madison and Dane County Environmental Health Division administers a county reimbursement program for abandoning these categories of wells. The City of Madison offers partial reimbursement of the cost (up to fifty percent of the cost, up to \$1,000) to abandon a private domestic well.

The following will be completed for this management activity:

1. Dane County Environmental Health Division will continue to review well applications and require construction permits for new private water supply wells.
2. Madison Water Utility will continue to review applications for private wells operation permits.
3. Madison Water Utility will request that the Dane County Environmental Health Division provide the names and addresses of owners of private wells located in the Unit Well 20 WHPA.
4. Madison Water Utility will determine the location of other private water supply wells that may be located within the WHPA and which are not recorded in the County database.
5. Madison Water Utility will send information to property owners located within the Unit Well 20 WHPA, about proper abandonment procedures in the event the property owners have an unused well on their property.
6. Madison Water Utility will update the private well inventory for wells located in the WHPA.

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7. The City of Madison and Dane County will enforce the existing City and Dane County well abandonment ordinances, to ensure that all private wells are permitted or properly abandoned if unused.
8. Madison Water Utility will request that Dane County consider proximity and depth of proposed private wells relative to Unit Well 20 prior to issuing permits for construction of new private water supply wells.
9. Madison Water Utility will direct residents to the DNR private well code (Chapter NR 812) or to the Wisconsin DNR private well section (Bureau of Drinking Water and Groundwater) (608) 266-0821) when questions arise about private water supply wells.
10. Madison Water Utility will provide information in the annual Consumer Confidence Report (CCR) about proper abandonment of unused wells.

5.1.1.4 Land Application of Sludge and Septage

There are no permitted septage application sites located within the Unit Well 20 ZOCs. The Wisconsin DNR issues permits for septage and sludge disposal sites in Wisconsin. Currently approved sludge and septage application sites are low risk to Unit Well 20. Nutrient loading to groundwater is a regional concern, and it is prudent to be proactive regarding management of sludge and septage disposal.

The following will be completed for this management activity:

1. Madison Water Utility will provide a copy of the WHPA and ultimate recharge area maps to the MMSD and request that sludge and septage not be spread in the Unit Well 20 ultimate recharge areas.
2. Madison Water Utility will provide a copy of the WHPA and recharge area maps to the DNR Watershed Management office (608) 267-7694 (central office) (608) 275-3325 (Fitchburg office) and request that new permits for sludge and septage spreading not be issued for properties located in the Unit Well 20 ultimate recharge area.
3. Madison Water Utility will encourage development of additional authorized septage discharge points in the City of Madison wastewater treatment system.

5.1.1.5 Spill Notification and Awareness of Remedial Investigation and Cleanup

There is one in-use AST in the WHPA (at the Unit Well 20 site), and one known historical spill site within the Unit Well 20 WHPA. The following will be completed for this management activity:

1. Madison Water Utility will request that the City Police, DNR, and the Dane County Emergency Management Office inform the Utility about future events (spills, leaks, investigations, etc.) that occur in the Unit Well 20 WHPA or in upgradient recharge areas.

2. Madison Water Utility will monitor the status of existing and potential contamination sources in the WHPA and upgradient recharge areas, investigations regarding nature and extent of releases, and the status of cleanup activities.
3. Madison Water Utility will provide the DNR a map showing the location of Unit Well 20 WHPA and request that contaminated site(s) located in the Unit Well 20 WHPA be carefully reviewed before being granted closure.

5.1.2 Category 2 - Land Use Controls

5.1.2.1 Existing Zoning/Wellhead Protection Overlay Zoning and Ordinance

The City of Madison and Dane County have land subdivision and zoning ordinances to control and direct development. Land subdivision and zoning ordinances are used to safeguard flood plains, wetlands, shore lands, highway access, air quality, surface water, and other concerns. Existing zoning regulations will be enforced to help protect municipal well recharge areas and groundwater.

The City of Madison has a WHP ordinance. The ordinance prohibits incompatible development with the establishment of an overlay district for the 5-year TOT ZOC (Zone A) and the 1,200-foot radius ZOC (Zone B). The WHP ordinance helps ensure that future potential contamination sources are not located in the Unit Well 20 WHPA. A copy of the WHP ordinance is in Appendix O.

The following will be completed for this management activity:

1. The City of Madison will amend Section 28.06 of the Madison General Ordinances and add Wellhead Protection District No. 20.
2. The City of Madison will provide Dane County with a copy of the WHP ordinance and Unit Well 20 WHPA map.

5.1.3 Category 3 - Intergovernmental Cooperation

5.1.3.1 Land Use Planning and Site Plan Review

Land use planning is performed to control and direct development. Land use planning and site plan review should also be used to help protect WHPAs. The following will be completed for this management activity:

1. The City of Madison will provide the City of Fitchburg, Town of Verona and Dane County with a copy of:
 - a. The WHPP and maps showing the Unit Well 20 WHPA and ZOCs.
 - b. A summary of separation distances required between municipal water supply wells and potential contamination sources (Wisconsin Administrative Code, Chapter NR 811.12(5)(d)).

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- c. A list of potential contamination sources that can threaten groundwater.
 - d. A list of high-risk land uses that should be prohibited from WHPAs.
2. The City of Madison Planning and Development Department will ensure that development complies with separation distances required between municipal water supply wells and potential contamination sources (Wisconsin Administrative Code, Chapter NR 811.12(5)(d)).
 3. The City of Madison will encourage the City of Fitchburg, Town of Verona and the Dane County Boards and Councils to review proposed development in the ZOCs in their jurisdiction, with regard to the Unit Well 20 recharge areas.
 4. The City of Madison Planning and Development Department will use an Environmental Permits Checklist for site plan review for proposed development in the Unit Well 20 recharge area. The checklist will help ensure compliance with local, county, and state permits; and will raise awareness about groundwater protection.
 5. The City of Madison Planning and Development Department will provide a copy of the WHPA map and Site Plan Review Environmental Permits Checklist to developers and property owners and require that the developer indicate on the environmental permits checklist and hazardous substances reporting form whether the proposed development is in a WHPA.

5.1.4 Category 4 - Monitoring

5.1.4.1 CSI Maintenance

As part of this study, a CSI was conducted within the delineated WHPA and ZOCs. It will be important to maintain current knowledge of land use, potential contamination sources, and development within the WHPA. The following will be completed for this management activity:

1. Madison Water Utility will update the CSI by conducting a windshield survey of properties located in the WHPA and by performing state and federal database checks on an interval of once every five years.

5.1.4.2 Water Quality Monitoring

Currently, each of the City of Madison's supply wells are tested annually, some are tested more often depending on the analytes and the detected level. VOCs are tested annually and quarterly for several wells. SOCs are tested every three years. Inorganic testing is done at a minimum of every three years. Microbiological testing, total coliform bacteria, are tested for weekly. Results are summarized and reviewed for conformance with regulatory drinking water standards, for comparison with current water quality results, and to identify any potential trends in contaminant concentrations.

City of Madison property owners and residents can go to the Madison Water Utility's website at www.madisonwater.org or <http://www.cityofmadison.com/water/> and look up the wells that serve

their address, and can review the water quality data for the previous year for the well(s) of interest.

The following will be completed for this management activity:

1. Madison Water Utility will perform water quality monitoring as required by DNR and as otherwise needed.
2. Madison Water Utility will continue to post water quality data online for public review.

5.1.5 Category 5 - Public Education and Awareness

The City of Madison will implement an education program to inform area residents of the need to protect the public water supply. Education is the best way to help people understand that human activities on the land and in the atmosphere influence the water cycle and affect the quality of our groundwater and surface water resources. The public education program will consist of the following:

1. Make available copies of the WHPP
2. Public Informational Meeting
3. News releases
4. Make available and distribute information materials
5. Land Use and Contaminant Source Awareness
6. School programs

5.1.5.1 Availability of WHPP

The following will be completed for this management activity:

1. The City of Madison will provide copies of the WHPP for review by the public at the Water Utility Office, Madison Public Library, and City Hall.
2. The City of Madison will provide a copy of the WHPP to the City of Fitchburg, Town of Verona and Dane County.
3. Madison Water Utility will communicate the availability of the plan through a newspaper article.

5.1.5.2 Public Informational Meeting

The purpose of a public informational meeting will be to inform residents of the WHPP, and provide an opportunity for public education and awareness.

The following will be completed for this management activity:

1. The City of Madison will conduct a public informational meeting as part of a City committee meeting or the Common Council meeting during the review phase of the WHPP.

2. The City of Madison will provide WHPA maps available for public review and an information sheet or brochure available for public use.

5.1.5.3 News Releases

The purposes of news releases are to elevate public awareness, educate the public on the need for WHP, and provide examples of prudent WHP measures. Initially, a news release will inform the public that a WHPP has been developed for Unit Well 20 and will indicate the locations where the WHPP will be available for review.

The following will be completed for this management activity:

1. Madison Water Utility will provide a news release to the local newspaper, at the beginning of the WHP project for Unit Well 20, then annually.

5.1.5.4 Informational Materials Distributed to Residents in WHPA

Informational materials will be prepared and distributed to residents living within the WHPA to educate and inform property owners about various topics such as WHP planning activities, and best waste management procedures.

The following will be completed for this management activity:

1. Madison Water Utility will prepare informational materials and/or obtain from the Wisconsin DNR Bureau of Drinking Water and Groundwater, Dane County or University of Wisconsin Extension fliers, brochures, and pamphlets, including:
 - a. Information about hazardous waste collection/disposal program (Clean Sweep) activities
 - b. Materials describing the proper use and application of lawn fertilizers and pesticides
 - c. WHP planning
 - d. Annual Consumer Confidence Report (CCR) containing information about WHP planning
2. Madison Water Utility will add WHP planning information to their website homepage (<http://www.madisonwater.org> or <http://www.cityofmadison.com/water/>).

5.1.5.5 Land Use and Contaminant Source Awareness

During the CSI, properties were identified with land uses and existing or potential contaminant sources that pose, or may pose, a threat to groundwater. To increase awareness and minimize risk to groundwater and Unit Well 20, it is important to inform property owners about existing and potential contaminant sources on their properties. An initial mailing will be made at the beginning of the WHP program. In this mailing, property owners will be advised to contact the City if they have questions, or require additional information.

The following will be completed for this management activity:

1. Madison Water Utility will provide information to owners of property located within the WHPA to emphasize the importance of awareness of the WHPA, the owner's location with respect to the WHPA, and potential contaminant source(s) of concern. Specific information to be provided includes:
 - a. Leaking USTs and ASTs
 - b. Upgrading existing ASTs and USTs systems
 - c. Materials describing the proper use and application of lawn fertilizers and pesticides
2. The Madison Water Utility will send a letter to Wingra Stone Company to inform them that their quarry is located within the Unit Well 20 ZOC.

5.1.5.6 School Programs

The City of Madison will participate in school education programs. The following will be completed for this management activity:

1. Madison Water Utility will inform schools about the availability of tours at water supply facilities. During tours, students will be exposed to important concepts related to groundwater and WHP.
2. Madison Water Utility will prepare a water/groundwater fact sheet for school education programs.

5.2 WATER CONSERVATION PROGRAM

The Madison Water Utility has an existing water conservation program that includes addressing the needs for both water accountability in the distribution system, and water conservation by the public. The 2008 Water Conservation Plan (Appendix P) provides further details on the conservation plans developed.

During 2009, the Utility maintained water accountability in the distribution system of 89 percent. The Utility maintains this high level of water accountability by regularly servicing water meters, reviewing water accountability records, and conducting water leak detection surveys when needed.

The Utility currently has brochures available free to the public describing useful water conservation measures. The brochures are also distributed to the public and discussed in speaking engagements with local organizations and schools by Water Utility staff.

The Madison Water Utility also has information about water conservation at its website (<http://www.madisonwater.org> or <http://www.cityofmadison.com/water/>). Water conservation information is in Appendix Q.

The Utility has the authority to impose water use restrictions when necessary.

5.3 CONTINGENCY PLAN

The Utility has formulated a contingency plan for providing water in the event that Unit Well 20 or one or more of the City's other water supply wells became contaminated or removed from service. The plan primarily relies on the capacity of the system without the capacity of any given well or wells to meet the supply needs of the City of Madison.

The City's water system was designed to supply the maximum water demand for an indefinite period with the largest well out of service. As a result, if Unit Well 20, or any other supply well of the water system, is out of service for a short period of time, the reliable water supply capacity is sufficient to meet demands. Unit Well 20 provides reliable supply to the water system and fire protection for Pressure Zone 7 neighborhoods. In the event of the loss of Unit Well 20, Unit Well 12 (Pressure Zone 7) and Unit Well 26 (Pressure Zone 8) can serve the area.

Additionally, the City's wells and wellfields are widely spaced and generally have different recharge areas, thereby making them less vulnerable to potential localized contamination. In the event of a power failure, several of Madison's supply well pumping stations are equipped with standby generators or power plugs for connecting portable generators.

The contingency plan also relies on communication with first responders and a plan of action in the event of a water system emergency. Dane County Emergency Management Office will be requested to notify the Water Utility if there is an occurrence in the vicinity of the Unit Well 20 WHPA. As well, the Wisconsin Contingency Plan for Hazardous Substance Discharges specifically includes protection of potable water system within the plan immediately following prevention of human injury (DNR 1998).

A list of emergency contact numbers was compiled to provide Utility staff immediate access to the appropriate agencies in the event of an emergency. This list is provided in Table 5-2.

5.4 MANAGEMENT PLAN

A management plan was formulated to help protect the Unit Well 20 WHPA from existing and potential future sources of contamination. Table 5-1 summarizes major elements of the management plan.

Public education is an important element in the management plan, particularly because the Unit Well 20 ZOCs include property in the City of Madison, the City of Fitchburg and the Town of Verona. Educational activities will provide a mutual benefit to the City of Madison and other property owners located within the WHPA and ZOCs.

The hazardous waste collection/disposal program (Clean Sweep) is also an important part of the management plan. The program provides a means for residents and businesses in the WHPA and throughout the area to properly dispose of hazardous chemicals. Residents and producers of agricultural crops and commodities can dispose of hazardous materials and wastes free of charge. Small quantities of commercial wastes from small businesses can be

**TABLE 5-2
EMERGENCY CONTACT NUMBERS
WELLHEAD PROTECTION PLAN, UNIT WELL 20
MADISON, WISCONSIN**

Emergency Contact	Name	Phone No.
Water Utility Emergency Service	On-call	Office: 608-266-4665
Water Utility Manager	Tom Heikkinen	Office: 608-266-4651
Principal Engineer	Alan Larson	Office: 608-266-4653
Civil Engineer	Dennis Cawley	Office: 608-261-9243
Police Department	Emergency Dispatch Non-Emergency Dispatch	911 608-255-2345
Fire Department	Emergency Dispatch Administration	911 608-266-4420
Dane County Emergency Response	On-Call	911
Dane County Emergency Management Office	Hazardous Materials Planning Office (General)	608-266-4330
Dane County Environmental Health	Office	608-242-6515
Local – DNR Water Supply Contact Person	Tom Stunkard Fitchburg	608-275-3300
Central Office – DNR Water Supply	Norman Hahn Madison	608-267-7661
Well Driller	Municipal Well & Pump Tracy Greenfield	Office: 920-324-3400 Cellular: 262-424-2328
Well Driller	Layne Northwest Jeff Gibson	Office: 262-246-4646 After Hours: 262-246-4646
Pump Installer	Municipal Well & Pump Tracy Greenfield	Office: 920-324-3400 Cellular: 262-424-2328
Pump Installer	Layne Northwest Jeff Gibson	Office: 262-246-4646 After Hours: 262-246-4646
City of Fitchburg, Mayor	Thomas Clauder	608-276-9107
City of Fitchburg, Administrator	Tony Roach	608-270-4209
Town of Verona	David Combs, Chair	608-845-7187
State Patrol	Emergency Administration	911 608-266-3212
Hazardous Material Response Team Wisconsin Division of Emergency Mgt.	DNR - Leroy Conner	1-800-943-0003 (Menu)
Electric Utility	Madison Gas & Electric Emergency Service	608-252-1111

disposed of for a nominal fee. The City will promote the Clean Sweep Programs using the public education activities summarized in this plan.

Local governmental agencies (city, township, and county) recognize the need for planning to protect WHPAs. Intergovernmental cooperation is an important part of the plan as agencies work together to consider the needs for WHP during planning and permitting processes. The City of Madison will provide the City of Fitchburg, Town of Verona and Dane County with a copy of the WHPP and maps showing the Unit Well 20 WHPA, ZOCs and ultimate capture zones, the separation distances required between municipal water supply wells and potential contamination sources (Wisconsin Administrative Code, Chapter NR 811.12(5)(d)), and a list of potential contamination sources that can threaten groundwater. The City will encourage county, and other city boards and councils to help protect the ZOCs and ultimate upgradient recharge areas when evaluating proposed development. The Madison Planning and Development Department will also consider the Unit Well 20 WHPA and ZOCs when evaluating proposed development in the City of Madison.

The City of Madison has a WHP ordinance and overlay zoning district. The WHP ordinance helps ensure that new potential contamination sources located within the City of Madison are not located in the Unit Well 20 WHPA.