
Staff Analysis of Proposed Amendment to the *Dane County Water Quality Plan* **Revising the Sewer Service Area Boundary and Environmental Corridors in the Central Urban Service Area** *“Ziegler Farm”*

History of the Central Urban Service Area

The Central Urban Service Area (USA) was established in 1971 with the adoption of the first sewer service plan and originally included about 29,000 acres. The first City of Madison amendment to the Central Urban Service Area occurred in 1987. There have been 123 amendments to this service area since its creation totaling roughly 12,800 acres of developable land and 4,900 acres of Environmental Corridor. City of Middleton has applied for 16 amendments totaling 1,000 developable acres and 560 acres of Environmental Corridor. The most recent amendment of the service area was recommended by the Commission and approved by the Wisconsin DNR (WDNR) in 2023.

Planning in Middleton

The City of Middleton updated their comprehensive plan in 2023. The document was originally adopted in 2021. The Comprehensive Plan is substantially consistent with the adopted [2050 Regional Development Framework](#) (Framework). The requested amendment is located adjacent to areas planned for development that should be considered through the lens of designing “Complete Neighborhoods.”

Existing Conditions

Land Use

The City of Middleton is requesting an amendment to the Central USA on the northern edge of Middleton, in an area recently annexed by the City and adjacent the towns of Middleton and Springfield. The primary driver of the amendment request is to provide sanitary sewer, potable water, and other urban services to the proposed Ziegler Farm development. The proposed development covers six total parcels, three of which are included in the amendment area. One additional parcel is included in the amendment area, which is an existing 1.5-acre, single-family residence adjacent to the northwest of the primary amendment area. This parcel has been included in the amendment area at the request of CARPC staff to create contiguity in the boundary (i.e., avoid creating a “hole” in the USA).

The amendment area is identified on the City’s future land use map as a “Planned Neighborhood.” The amendment area is bounded on the east by Pheasant Branch Road and the Pheasant Branch Conservancy, and on the west by Graber Pond. Current land uses are primarily agricultural and some open land.

Surrounding Planned Land Uses, Southwest:

- **North:** Mixed housing types
- **West:** Natural area and low-density residential

- **South:** Low-density residential
- **East:** Mixed housing types, Conservancy

Table 1
Existing and Planned Land Use

Land Use Category	Existing Land Use Acres (see Map 3)	Proposed Land Use Acres (see Map 4)
Agriculture	53.6	
Communication/Utilities		5.7
Low-density Residential	1.4	22.9
Medium-density Residential		0.6
Open land	10.8	26.9
Transportation	1.8	11.5
	67.6	67.6

Cultural and Historic Sites

The Wisconsin Historical Society (WHS) has been contacted regarding the presence of any known archaeological sites or cemeteries within the amendment area. WHS was unable to respond during the preparation of this report due to a records system migration. As of 2020, no sites had been recorded in or immediately adjacent to the amendment areas.

Natural Resources

The proposed amendment area is in the Pheasant Branch Subwatershed (HUC 12: 070900020603) (see Map 5). There were no mapped high-quality woodlands or floodplains present, however there are mapped wetlands present within and adjacent to the amendment area.

Wastewater from the amendment area will be treated at the Madison Metropolitan Sewerage District (MMSD) Wastewater Treatment Facility (see Map 5). The treated effluent is currently discharged to Badfish Creek and Badger Mill Creek, bypassing the Yahara chain of lakes.

Wetlands

WDNR's Wisconsin Wetland Inventory (WWI) shows classified wetlands. One wetland east of High Road was classified: as Palustrine, Forested-Broad-Leaved Deciduous, Emergent-Persistent, partly drained/ditched, Seasonally Saturated (PFO1/EM1Bd). The other wetland, located just east of Graber Pond, on the far western portion of the amendment was classified as: Palustrine, Emergent-Persistent, Excavated, Seasonally Saturated (PEM1Bx).

A wetland delineation (Map 11) was conducted within the amendment area in 2024 by Heartland Ecological Group, Inc., a DNR-qualified assured delineator. The site investigation and delineation identified two distinct wetlands within the amendment area totaling 28.3 acres. There is a required 75' vegetated buffer around the wetlands to be designated as Environmental Corridor per the adopted policies and criteria for environmental corridors ([link to document](#)) However, the Graber Pond Master Plan ([link to document](#)) requires a 100' vegetated buffer around the wetlands associated with Graber Pond.

Unnamed Creek

There is a unnamed intermittent creek (WBIC 503509) originating within the amendment. This creek flows approximately 0.5 miles until it combines with a tributary to the Pheasant Branch Creek east of the amendment area.

Pheasant Branch Creek

Pheasant Branch Creek ([WBIC 805900](#) / WATERSID 11696) is 9.1 miles long and flows through the northwestern portion of the City of Middleton, ultimately draining east into Lake Mendota. The 22.7 square mile watershed encompasses predominantly agricultural lands until its confluence with the South Fork at the western edge of the City of Middleton and Highway 12.

The existing biological use of the first mile of Pheasant Branch between Lake Mendota and the Pheasant Branch Marsh is designated a warmwater sport fishery. Above the confluence with the channel coming in from the west, the marsh is designated as a coldwater fishery. Pheasant Branch is included on the 2022 state 303d list of impaired waters for chronic toxicity due to chloride, degraded habitat due to sediment, and low dissolved oxygen due to phosphorus. It is also included in the Rock River Basin Total Maximum Daily Load (TMDL) project for sediment and phosphorus. Pheasant Branch Creek has cool-cold and cool-warm headwater natural communities. There has been a Rock River Coalition / Yahara WINs monitoring location on Pheasant Branch Creek at the County Highway M east bridge ([Station ID 133313](#)) since 2015. Field measurements from 2022 indicated dissolved oxygen levels of 3.5 to 8.33 mg/L, and transparency of 29 to 120 cm. Laboratory analysis of samples from 2022 showed ammonia (NH₃) levels from no detection to 0.27 mg/L, total phosphorus (P) from no detection to 0.19 mg/L, and total suspended solids (TSS) from no detection to 6.6 mg/L. The active USGS baseflow monitoring station ([USGS 05427948](#)) in this watershed indicated chloride levels ranging from 99.9 to 116 mg/L in 2018.

Graber Pond

The WDNR Surface Water Data Viewer classifies Graber Pond (WBIC 873950 / WATERS ID 11697) as a 10-acre seepage lake. The Wisconsin wetland inventory identifies 12.6-acres of open water surrounded by about 4.7 acres of emergent wet meadow wetland. According to the City's Graber Pond Master Plan (2006), the area of open water at Graber Pond decreased to about 6.5 acres in 2005. The decrease in area of open water correlated to the termination of discharge of cooling water from Springs in the late 1990's. An aerial photo from 1957 shows that little to no open water existed in the glacial depression at that time. Graber Pond is an example of one of many kettles that formed in this till plain region after the last glaciation. A kettle pond is a small, closed basin that has no surface outlet under average rainfall conditions. From a hydrologic perspective, closed basins often possess significant seasonal and inter-annual variability in water levels. The only mechanisms for water to leave the basin under average

rainfall conditions are by infiltration and evapotranspiration. These two processes can be quite slow compared to watershed runoff entering the basin. For example, it might take weeks for the pond to infiltrate and evaporate runoff from a single storm event that may have lasted only several hours. The vegetation communities that often inhabit these glacial depressions, which are wet in many years but dry up during periods of drought, are sometimes referred to as prairie pothole communities.

Springs

Springs represent groundwater discharge visible to the casual observer. The Wisconsin Geological and Natural History Survey (WGNHS) maintains an inventory of springs in Dane County, and throughout the state. There are no known springs in the proposed amendment area. From 2014 and 2017, the WGNHS surveyed springs statewide that were expected to have flow rates at least 0.25 cubic feet per second (cfs). The Lake Mendota-Yahara River watershed contains one inventoried spring located within Pheasant Branch Conservancy (east of the amendment area)—Dane County Spring #7 (see Map 5). This spring is well known locally as Frederick Springs and has been studied by the USGS ([link to report](#)). It was surveyed in 2014 with a discharge rate of 2.72 cfs, specific conductance of 881 $\mu\text{S}/\text{cm}$, temperature of 50° F, and a pH of 5.81.

Groundwater

Groundwater modeling, using the 2016 Groundwater Flow Model for Dane County developed by the WGNHS ([link to website](#)), shows that baseflow in Pheasant Branch Creek at Century Avenue (see location on Map 5) has decreased from 12.3 cfs during pre-development conditions (no well pumping) to 7.2 cfs in 2010 (refer to Table 4). This decrease is primarily due to the combined impacts of high-capacity well groundwater withdrawals contributing to reduced stream baseflow.

In 2012, the WGNHS published a report, *Groundwater Recharge in Dane County, Wisconsin, Estimated by a GIS-Based Water-Balance Model*, ([link to report](#)) estimating the existing groundwater recharge rates in Dane County based on the soil water balance method. The study estimates that the existing groundwater recharge rate in the proposed amendment area ranges from 9 to 10 inches per year.

Old Growth Woodlands

The Dane County Mature Forest [web map](#) shows mature forest (present since 1939). There are no old growth or remnant old growth forests patches identified within the vicinity of the sewer service amendment area.

Endangered Resources

The WDNR Bureau of Endangered Resources maintains a database representing the known occurrences of rare plants, animals, and natural communities that have been recorded in the Wisconsin Natural Heritage Inventory ([link to website](#)). A screening review of this database was conducted by CARPC staff for species designated as endangered, threatened, or of special concern. Identified special concern species include one insect, two reptile, one amphibian, one mammal, one fish, and one plant species; identified threatened species include one mammal and one bird species; identified endangered species include one plant species; there were five natural communities within a 1 to 2-mile radius of the amendment area. The applicant also provided the results of an Endangered Resources Review (ERR) completed by DNR staff for the amendment area. Based on the presence of the Rusty Patched Bumble Bee, Swamp Darner (dragonfly) Little Brown Bat, Plains Gartersnake, and Blanding's Turtle, the ERR includes zero required actions and recommended actions for six species.

The entire amendment area is within the High Potential Zone (species likely present) for the federally endangered Rusty Patched Bumble Bee ([link to web map](#)). Section 7 of the Endangered Species Act requires consultation with the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service when any action that is carried out, funded, or permitted by a federal agency may affect a federally listed endangered or threatened species. The WDNR typically recommends that projects within the High Potential Zone include native trees, shrubs, and flowering plants (plants that bloom spring through fall) and the removal and control of invasive species in any habitat used for foraging, nesting, and overwintering. The USFWS developed a list of plants favored by Rusty Patched Bumble Bee ([link to list](#)). Implementing these conservation measures should be coordinated with the WDNR Endangered Resources Review Program as needed.

Soils and Geology

The amendment area is located within the West Johnstown-Milton Moraines Land Type and the Waunakee Moraines Associations of Wisconsin. The West Johnstown-Milton Moraines Association classifies the surficial geology of this area as rolling hummocky moraine and outwash plain complex with scattered bedrock knolls. The Waunakee Moraines Association classifies the landform pattern as rolling till plain and irregular drumlins with scattered bedrock knolls, lake plains, and outwash plains. Soils are predominantly well drained silt and loam over calcareous sandy loam till or bedrock.

Surface elevations within the amendment area range from around 860 feet to 940 feet. There are some areas of steep (>12%) and very steep (>20%) slopes in the amendment area (see Map 6). The very steep slopes are primarily associated with Graber Pond and require inclusion in the proposed environmental corridor. The steep slopes in the amendment area which are not riparian do not require inclusion in environmental corridors.

According to the Natural Resource Conservation Service (NRCS) Soil Survey of Dane County, the soils in most of the amendment area are in the Batavia-Houghton-Dresden association. These soils are well to poorly drained, deep-to moderately deep silt loams and mucks that are underlain by silt, sand, and gravel. The soils in the remainder of the amendment areas are in the Dodge-St. Charles-McHenry association. These soils are well to moderately well drained deep silt loams. Table 2 shows detailed classifications for soils in the amendment area while Table 3 shows important soil characteristics for the amendment area.

There are two hydric soils within the amendment area (see Map 7). The Orion soil (the Os map unit) makes up 20.8% of the area and the Houghton muck (the Ho map unit) makes up 0.5% of the area. Hydric soils are good indicators of existing and former (drained) wetlands.

According to the Soil Survey Geographic data for Dane County developed by the NRCS ([link to web soil survey](#)), the Batavia, Dresden, Radford, and Troxel soils (the Brb, RaA, DsC2 and TrB map units) are not hydric, but they do have a seasonal (April to June) zone of water saturation within 5 feet of the ground surface.

Table 2
Soils Classification

Soil	% of Area	General Characteristics
Dresden Silt Loam; DsC2	29.4	Well drained, gently sloping to steep slopes on benches in stream valleys. Soils have medium fertility, moderate permeability, and a severe hazard of erosion. Poses moderate limitations for development due to slope.
Troxel Silt Loam; TrB	4.7	Deep, well drained and moderately well drained, gently sloping soils in draws, on fans, and in drainageways. Soils have high fertility, moderate permeability, and a moderate hazard of erosion. Poses severe limitations for development due to low bearing capacity.
Dresden loam; DrD2	6.8	Well-drained, gently sloping to steep soils on benches in stream valleys. Soils have medium fertility, moderate permeability, and a very severe hazard of erosion. Poses severe limitations for development due to slope.
Kegonsa Silt Loam; KeB	4.9	Well drained, nearly level and gently sloping, moderately deep soils on benches on outwash plains. Soils have medium fertility, moderate to rapid permeability, and moderate hazard of erosion. Poses no limitations for development.
Radford Silt Loam; RaA	8.9	Deep, somewhat poorly drained, nearly level and gently undulating alluvial soils in low drainage ways and stream channels. Soils have high fertility and moderate permeability, but are subject to flooding. Poses very severe limitations for development due to high water table and very low bearing capacity.
Orion Silt Loam, wet; Os	20.8	Deep, somewhat poorly drained soils on low bottoms of stream valleys. High fertility and moderate permeability. Severe to very severe limitation for development due to high water table and flooding
Batavia Silt Loam; BbB	15.0	Deep, well drained, nearly level to sloping soils on high benches. Soils have high fertility, moderate permeability, and a moderate hazard of erosion. Poses moderate limitations for development due to shrink/swell potential.
Boyer Sandy Loam; BoD2	7.1	Well drained, gently sloping to moderately steep soils on benches in valleys. Soils have low fertility, moderately rapid to rapid permeability, and a severe hazard of erosion. Poses moderate limitations for development due to slope.

Source: Soil Survey Geographic data for Dane County developed by the USDA Natural Resources Conservation Service

Table 3
Soils Characteristics

Characteristic	Soil Map Symbols (see Map 7)	% of Area
Prime Agricultural Soils	TrB, BbB, KeB	24.6
Hydric Soils (Indicates Potential / Restorable Wetlands)	Os, Ho	20.8

Poorly Drained Soils with Seasonal High Water Table (< 5')	BrB, RaA, DsC2, TrB	58
Soils Associated with Steep Slopes (> 12%)	BoD2, DrD2	13.9
Soils Associated with Shallow Bedrock (< 5')	DsC2, KeB, BoD2	41.4
Best Potential for Infiltration in Subsoils	BoD2, DrD2, DsC2, KeB	48.2

Source: Soil Survey Geographic data for Dane County developed by the USDA Natural Resources Conservation Service

According to WGNHS data, bedrock within the majority of the amendment area is in the Tunnel City Group. Bedrock in the Tunnel City Group is characterized as medium to very fine-grained quartz sandstone, locally very glauconitic and up to 150 feet (46 m) thick. Lone Rock Formation: very fine shaly and glauconitic, feldspathic sandstone. Mazomanie Formation: fine to medium grained, and not glauconitic. The far western portion of the amendment area has bedrock in the Trempeleau Group which is characterized as quartz sandstone, dolomitic siltstone, silty dolomite, and sandy dolomite. This group consists of two formations, the Jordan and the underlying St. Lawrence, which were combined as one mapping unit. Thickness is about 75 feet (23 m) where not eroded.

As is common throughout much of the upper Midwest, karst features such as enlarged bedrock fractures are prevalent in the local dolomite uplands. Karst features such as vertical fractures and conduits provide primary pathways for groundwater movement and can dramatically increase groundwater susceptibility when present. The location of karst features is difficult to predict, and the thickness and type of the overlying soil greatly affects how much water drains into them. Where clay soils are thick, infiltration rates are likely to be very low. However, where bedrock fractures are near the surface infiltration rates can be very high. Karst features may be encountered in the amendment area at depths ranging from 0 to an estimated 50 feet, with the shallowest depths coinciding with the shallow bedrock in the far western portion of the amendment area. This can pose a concern for potential groundwater contamination if improperly managed. Proposed stormwater management practices in the western portion of the amendment area could be affected by the potentially shallow karst.

The *WDNR Conservation Practice Standard 1001 – Wet Detention Pond* (2007) and *WDNR Conservation Practice Standard 1002 – Site Evaluation for Stormwater Infiltration* (2017) requires field verification for areas of the development site considered suitable for stormwater management. This includes a site assessment for karst features in this area. If shallow karst features are found, adequate protection measures are required to address any potential for groundwater contamination.

Per Dane County ordinance, infiltration practices receiving runoff from source areas that contain impervious surfaces must be located to allow a separation distance of at least 5 feet between the bottom of the infiltration system and the elevation of seasonal high groundwater, or the top of bedrock, along with certain soil filtering characteristics. There is no minimum separation distance for roofs draining to surface infiltration practices. Soil test pits are required as part of the stormwater management plan to ensure that infiltration practices are sited in locations that will not adversely affect groundwater quality.

Proposed Urban Services

Parks and Open Space

The proposed development includes approximately 14.5 acres of stormwater management area, park, and other open space within the amendment area (see Map 2 and 4). All such areas are proposed for placement in Environmental Corridors.

Wastewater

Overview

Sanitary sewer service will be provided to the proposed development within the amendment area by connection to the City of Middleton sanitary sewer collection system, which then flows to the Madison Metropolitan Sewerage District (MMSD) wastewater collection and treatment system. The proposed lots within the amendment area and within the existing Central Urban Service Area will gravity drain via 8-inch sewer main to the City-owned Pheasant Branch Interceptor (PBI). Three lots in the northwest edge of the amendment area will drain via existing sewer along Misty Valley Dr before connecting to the PBI. The local sewers will connect to the 18-inch PBI at several points, including along Misty Valley Drive, at two locations along High Road, and near the northwest end of Whittlesey Road (Map 9). Sewer from the development east of High Road is anticipated to be extended further eastward to provide service to portions of the adjacent Redtail Ridge development ([link to 2209 Middleton USAA Staff Report](#)). The PBI flows east and then south until connecting to MMSD's 36-inch West Interceptor sewer in Middleton Springs Drive near Century Ave. Ultimately, wastewater flow from the proposed development area will flow via the West Interceptor sewer to Pump Station 15 within the MMSD system, and eventually to the Nine Springs Wastewater Treatment Facility.

Collection System

The proposed development consists of approximately 145 single-family residential units within the amendment area and 28 single-family residential units within the existing Central Urban Service Area contributing to wastewater flows. Note: the 1.5-acre parcel northwest of the primary amendment area will not be included in the capacity calculations for this section because it is not currently proposed for annexation or redevelopment and has negligible additional flow generation. The City's application estimates that the proposed development will generate an annual average of approximately 48,400 gallons per day (gpd) of wastewater, or 33.6 gallons per minute (gpm). This assumes 2.8 persons per single-family dwelling unit and an average wastewater generation rate of 100 gallons per capita per day (gpcd) for residential land uses. The City estimates that the proposed development area will generate a peak daily flow rate of approximately 194,000 gpd (0.19 MGD), or 135 gpm (0.300 cfs), utilizing a peaking factor 4.0 for residential land uses.

The proposed 8-inch sanitary sewers within the proposed development area are anticipated to provide sufficient capacity based on minimum slope requirements per NR 110. The sewersheds for the four proposed connections to the PBI will each generate peak flows between 2.33 gpm and 61.4 gpm, remaining within the City's estimate for receiving interceptor sewer capacity as provided in Appendix J of the City's application. The receiving sewer for the three northwestern lots currently only receives flow from 10 single-family residential parcels, estimated as having an existing flow of 2 gpm. In total, local sewers from the proposed development will discharge peak flows of approximately 135 gpm to the 18-inch section of the PBI. This section is reported to have a capacity of 4,650 gpm and receives current

peak flows of 1,705 gpm, including estimated peak flows from the recent Belle Farms ([link to 2103 Middleton USAA Staff Report](#)) and Redtail Ridge developments which also flow to this interceptor. Immediately downstream of the proposed development area the PBI increased in size to 30-inch, providing additional capacity. The Pheasant Branch Interceptor is anticipated to easily serve the proposed development in addition to the forecasted flows from developments approved after the City's *2019 Utility Master Plan* study.

Flow from the Pheasant Branch Interceptor discharges to the 36-inch MMSD West Interceptor south of Century Ave in Middleton Springs Drive. The *2018 MMSD Collection System Evaluation*, prepared by CARPC and MMSD staff, shows that all receiving MMSD interceptor sewers and pump stations have sufficient capacity to serve the amendment area, except for sections of the West Interceptor along Shorewood Blvd. Capacity upgrades to the West Interceptor are in progress and are scheduled for completion in 2025.

Based on the estimated wastewater loading and capacity of the existing sewers, the City has shown that there is sufficient existing or planned wastewater collection system capacity to serve the proposed amendment area.

Wastewater Treatment Facility

Madison Metropolitan Sewerage District (MMSD) will provide wastewater treatment for the amendment area. The amendment area will need to be annexed into the MMSD service boundary. The Nine Springs Wastewater Treatment Facility (WWTF) is located on Moorland Road, Madison, and currently discharges treated effluent to Badfish Creek within the Badfish Creek Watershed (Lower Rock River Basin) and Badger Mill Creek within the Upper Sugar River Watershed (Sugar-Pecatonica Basin). The rated monthly design flow capacity of the facility is 56.0 million gallons per day (MGD) and the maximum daily design flow capacity is 68.6 MGD. In the year 2023, the facility received an average monthly influent hydraulic loading of 36.9 MGD (66% of the 56.0 MGD design capacity), including infiltration and inflow, according to the 2023 Compliance Maintenance Annual Report (CMAR) ([link to 2023 CMAR](#)). It is expected to reach 90% of current hydraulic design capacity around 2026 based on current projected growth rate assumptions. This already occurs on occasion, although average flows did not exceed 74% design capacity for any month in 2023. MMSD completed a facility plan in 2017, titled [Liquid Processing Facilities Plan](#), that recommended improvements to the liquid treatment processes at the plant, including the addition of hydraulic capacity. These improvements are being implemented in multiple phases between 2018 and 2030. For the 20-year planning period, treatment for this area is expected to remain at the existing wastewater treatment facility location with expanded capacity of the system as the need is foreseen. MMSD staff were contacted regarding this amendment and noted this area has been included in their planning studies and did not have concerns about serving this additional area.

MMSD did not have issues meeting its WPDES permit limits for the quality of effluent discharged to Badfish Creek and Badger Mill Creek, according to their 2023 CMAR. Permit limits are specific to each outfall; however, effluent sampling is performed upstream of the flow split to each outfall. Effluent quality summarized here refers to Badfish Creek, where approximately 95% of discharge is released. Below is a summary of the major effluents reported in the 2023 CMAR for the Badfish Creek outfall:

- The biochemical oxygen demand (BOD) effluent quality for 2023 was well below the monthly average limit, with a monthly average of 3.2 mg/L (17% of the limit) and a maximum concentration of 4 mg/L (21% of the limit) for the months of February, April, June, July, and December.
- The total suspended solids (TSS) effluent quality for 2023 was below the monthly average limit, with a monthly average of 6.6 mg/L (33% of the limit) and a maximum concentration of 13 mg/L (65% of the limit) for the month of July.
- The ammonia (NH₃) effluent quality for 2023 was below the monthly average limits (limits vary by month), with a monthly average of 0.155 mg/L (3-13% of the limit) and a maximum concentration of 0.236 mg/L (13% of the limit) for the month of July.
- The phosphorus (P) effluent quality for 2023 was below the monthly average limit, with a monthly average of 0.37 mg/L (22-71% of the limit) and a maximum concentration of 0.71 mg/L (71% of the limit) for the month of July.

Badfish Creek is a tributary to the Rock River, and thus the WPDES permit for MMSD includes phosphorus and TSS limits for effluent to Badfish Creek to comply with the Total Maximum Daily Load (TMDL) developed for the Rock River Basin to protect and improve water quality. In addition to the TMDL limits, future water quality-based effluent limits (WQBEL) have been considered in the WPDES permit. The interim limit for phosphorus discharged to Badfish Creek is a 1.0 mg/L monthly average required beginning May 2020 (previous limit was 1.5 mg/L), with a final WQBEL of 0.225 mg/L. Additionally, an interim limit of 0.6 mg/L, expressed as a six-month average (May through October and November through April) is required beginning May 2020, with a final WQBEL of 0.075 mg/L. To meet the WQBEL for phosphorous, MMSD has implemented a Watershed Adaptive Management (WAM) approach, leading a diverse group of partners called Yahara Watershed Improvement Network (Yahara WINs) in implementing phosphorus reducing practices in the Yahara Watershed ([link to Yahara WINs website](#)).

The Nine Springs WWTF does not remove chloride from influent. A 2015 study completed by AECOM determined that while possible, treatment would be cost-prohibitive, energy intensive, and involve other environmental impacts ([link to report](#)). MMSD has been granted a variance from the chronic water quality standard for chloride of 395 mg/L required by NR 105. With this variance, the WPDES permit sets interim (variance) monthly limits above the chronic water quality standard and requires MMSD to implement chloride source reduction measures. One such source reduction initiative which MMSD participates in is the Wisconsin Salt Wise Partnership ([link to Salt Wise website](#)).

Water System

Overview

Water will be provided to the amendment areas by connection to the City's municipal water system. The Middleton Municipal Water Utility provides municipal water through a public water distribution system which includes approximately 496,489 lineal feet of water main, 11 booster pumps, and six active high-capacity wells within the City. Three of the wells pump directly into the distribution system and three pump into reservoirs. The active wells are at depths ranging from approximately 330 to 856 feet, with an

average capacity of 350 to 1,550 gallons per minute (gpm). In total, the gross capacity of all municipal well pumps is approximately 10.1 million gallons per day (MGD) or 6,980 gpm. The firm capacity (with the largest well assumed to be out of service) is approximately 7.82 MGD or 5,430 gpm, although the City also maintains backup equipment on standby in the event of failure. The City has two ground-level reservoirs and two elevated tanks, with a combined storage capacity of 2.35 million gallons.

Nearby municipal wells are shown on Map 10. The proposed development area is partially within the 50-year and 100-year zones of contribution for City Well No. 4 (see [Zones of Groundwater Contribution for Municipal Wells](#) mapping on CARPC's [Open Data Portal](#)). The well is located west of High Road, approximately 950 feet south of the proposed development area.

Water supply will be provided by connecting to existing 8-inch and 12-inch water mains in the adjacent roadways (Map 9). Water mains within the development area will provide internal looping. Additionally, water main will be extended towards the eastern boundary of the amendment area for external looping through the adjacent Redtail Ridge development.

System Evaluation

According to the 2023 Annual Report to the Public Service Commission of Wisconsin ([link to 2023 Annual Report](#)), the City pumped an average of 1,433 gpm, or 2.06 MGD, in 2023, which is approximately 26% of its firm pumping capacity. In 2023, the maximum amount pumped in any one day was 2,653 gpm, or 3.82 MGD. The City estimates the 2023 average daily water demand within the system is 1,782 gpm or 2.57 MGD, with an estimated peak hourly demand of 4,954 gpm, based on historical information from the City's *2019 Utility Master Plan* and calculations provided by the City's Public Works Department.

Water losses in the City's distribution system were an average of 16,238 gpm (0.02 MGD) in 2023, which accounted for 1% of the net water supplied. All water losses were due to reported leaks. In 2023, there were 9 main breaks and 3 service breaks which were repaired. Water losses in the City's distribution system were 5% in 2022 and 4% in 2020. The Wisconsin Administrative Code PSC 185.85(4)(b) requires a utility with more than 1,000 customers to submit a water loss control plan to the Public Service Commission (PSC) if the utility reports its percentage of water losses exceeds 15%.

The proposed development consists of 173 single-family dwelling units contributing to water demand. Note: the 1.5-acre parcel northwest of the primary amendment area will not be included in the calculations for this section because it is not currently proposed for annexation or redevelopment and due to the negligible additional demand. The City anticipates the annual average daily water demand for the amendment area to be approximately 48,400 gallons per day, or 33.6 gpm. This assumes 484 persons in the residential units using an average daily demand of approximately 100 gallons per day (gpd), based on the City's application and the *2019 Utility Master Plan*. The estimated peak daily demand is approximately 67.3 gpm, using a peak daily demand factor of 2.0, based on the City's application. The estimated peak hourly demand is approximately 93.5 gpm, using a peak hourly demand factor of 2.78 (per City's application, based on data from the *2019 Utility Master Plan*). The estimated peak daily water demand and peak hourly demand represent an increase of approximately 2% of the current demands on the system. This brings the forecasted peak hourly demand above 90% of the firm capacity of the existing water supply system. With the collective additional demand on the water supply system from the recent Belle Farms and Redtail Ridge developments and this proposed Ziegler Farms

development, it is possible that future developments may exceed firm capacity; in which case if the largest well is down, water from storage may be required to meet the peak hourly demands on the system. Nonetheless, the water distribution system appears to have sufficient capacity to handle the additional demand from the proposed development area. Furthermore, the City's application reports that available pressure and fire flow will meet the Middleton Fire Department goal of 1,000 gpm at a residual pressure of 20 psi and a static pressure of 40 psi, as well as WDNR's minimum pressure and fire flow requirements. Overall, it is anticipated that the existing water supply system will support the additional demand from the proposed amendment areas.

Stormwater Management System

The proposed amendment area is within the Pheasant Branch Subwatershed (HUC 12: 070900020603) and represents approximately 0.5% of the 14,440 acre watershed. The southern edge of the proposed development, which is already within the USA, represents open space lands not previously intended for development; as such, this analysis will consider the entirety of the development.

The 1.5-acre parcel northwest of the primary amendment area is not part of the proposed development plans associated with this amendment request but is being added to the urban service area to create contiguity in the boundary. The existing improvements were constructed prior to August 22, 2001, and so none of the existing impervious surfaces are subject to the Dane County stormwater ordinance. There are no existing engineered stormwater management controls within this parcel. Any future development on the parcel resulting in a cumulative addition of 20,000 sf of impervious surface after August 22, 2001, will require stormwater control measures to be implemented in accordance with the Dane County stormwater ordinance. Although no redevelopment or new development is planned, small-scale stormwater practices can be implemented as a way of mitigating the existing pollution coming from the existing site. Roof downspouts can be directed to pervious surfaces onsite to promote infiltration and limit the potential for stormwater runoff. Rain gardens, water harvesting (e.g., rain barrels), and native vegetation are additional measures that can be taken within the area to improve stormwater management.

Existing Conditions

The amendment area consists of mostly row cropland, some remnant edge-of-field trees, and one existing farmstead near High Road. There is also a wetland complex associated with an unnamed, intermittent stream which begins near High Road then runs south and then east along the southern edge. On the western edge of the amendment area are additional wetlands associated with Graber Pond which lies immediately to the west. The proposed Ziegler Farm development is split by High Road running north-south; however, drainage is defined by a ridge which runs north-south between High Road and Graber Pond. East of this ridge, runoff crosses High Road via two culverts and flows along the aforementioned intermittent stream and wetlands. This stream and wetland complex continues east, bending in and out of the Town of Middleton, before converging with another intermittent stream and then converging with Pheasant Branch Creek in the Pheasant Branch Conservancy.

The western portion of the amendment area is within the internally drained watershed of Graber Pond, which is considered a closed basin (or glacial kettle depressions). From a hydrologic perspective, internally drained watersheds often possess significant seasonal and inter-annual variability in water

levels as there is no natural outlet and the only mechanisms for water to leave the basin under average rainfall conditions are by infiltration and evapotranspiration, causing concern for flooding as its watershed develops. These two processes can be quite slow compared to water entering from precipitation. Thus, the natural water level of a glacial depression typically varies seasonally and from year to year, often creating a dynamic balance of open water and surrounding wetland communities. The vegetation communities that often inhabit these areas, which are wet in many years but dry up during periods of drought, are sometimes referred to as prairie pothole communities. Internally drained watersheds require developing stormwater management systems that avoid unintended impacts on surrounding properties and water resources. Changes to the watershed resulting in increased volumes of runoff (e.g., from an increase in impervious surfaces) can potentially impact surrounding and downstream properties and water resources if the volume increase is not mitigated.

The City of Middleton has taken a proactive approach to managing Graber Pond and the surrounding watershed, participating in several hydraulic studies and planning efforts over the years. Two of these include the *Graber Pond Hydrologic Study and Management Plan*, by Montgomery Associates Resource Solutions, dated December 2010 (hereinafter, *2010 Graber Pond Hydrologic Study*), and the *Graber Pond Master Plan*, by Ken Saiki Design, et al, dated December 5, 2006 (hereinafter, *2006 Graber Pond Master Plan*). One of the overarching goals of these two reports is to preserve the existing prairie pothole vegetation community through appropriate stormwater management practices and possibly restore it to pre-settlement conditions.

Proposed Stormwater Plan

A stormwater management plan has been developed and is being reviewed by the City; a summary of the plan was submitted with this application. In the proposed condition, the amendment area will continue to drain to Graber Pond and the intermittent stream which drain to Pheasant Branch Creek. To meet stormwater management requirements, the stormwater management plan utilizes a combination of bioretention basins, wet ponds, infiltration basins, and soil remediation techniques (see Map 9B).

The intermittent stream and wetlands within the amendment site receive stormwater runoff from significant areas to the west and north, including that from the recent Redtail Ridge development and the overflow from Graber Pond. This runoff will generally continue to be conveyed through this drainage corridor, although some offsite runoff will enter the proposed stormwater facilities for the Ziegler Farms development.

New development within the amendment area will need to meet or exceed current stormwater regulations for peak rate control and attenuation, water quality (TSS reduction), volume control (infiltration), thermal control, and oil/grease control. For the portions of the site in the Graber Pond closed basin watershed, it will be necessary to meet the 90% stay-on requirement without exemption, and meet additional requirements for sites subject to inundation, pursuant to Dane County ordinance. Additionally, pretreatment of stormwater runoff prior to entering the wetlands will be required in accordance with NR 151 regulations.

The City's application proposes meeting a 100% stay-on requirement for the area which drains toward Graber Pond. Based on the preliminary stormwater management plan, 103.0% stay-on is achieved without accounting for infiltration of runoff from off-site sources (see Appendix H of City's application).

The remainder of the site will meet the typical 90% stay-on requirement and will achieve 94.1% stay-on per the preliminary plan. Although water from offsite sources is not typically allowed to be credited toward meeting infiltration/stay-on volume goals since there is typically little to guarantee that water will always flow onto the site (e.g., it could be diverted away with future development and no longer captured for infiltration), since the offsite areas are already developed the development team is proposing to the City to allow credit for this offsite water being infiltrated. Including this offsite water, the achieved stay-on is 103.2% for the Graber Pond drainage area and 100.1% for the remainder of the development area.

Detailed stormwater management plan review and approval is required prior to beginning any development construction and is typically reviewed by CARPC staff as the time of sewer extension review. The plan will be required to meet all stormwater management and performance standards of the City of Middleton, Dane County, and WDNR current at the time of development. Temporary stormwater management and erosion control using appropriate best management practices during construction will also be required.

The proposed stormwater facilities for the conceptual development are not within 400 feet of a community water supply well (see Map 10), per NR 811 regulations. The final design of the proposed stormwater facilities near the existing farmstead will need to account for private (non-community) wells and maintain proper setbacks in accordance with NR 812 regulations. Existing onsite private wells will need to be abandoned and sealed in accordance with applicable DNR and local requirements.

The amendment area is outside of the recommended 5,000-foot separation distance from an airport serving piston-powered aircraft described in *Advisory Circular 150/5200-33C: Hazardous Wildlife Attractants on or near Airports*, published by the US Federal Aviation Administration (hereinafter, referred to as *FAA Advisory Circular Guidance*; [link to document here](#)), but is within the recommended 10,000-foot separation distance from an airport serving turbine-powered aircraft. It is understood that the Middleton Municipal Airport, located approximately 5,600 feet away from the edge of the amendment area, primarily serves piston-powered aircraft but does sell Jet-A fuel and, therefore, is capable of also serving turbine-powered aircraft. The *FAA Advisory Circular Guidance* provides guidance on certain land uses that have the potential to attract hazardous wildlife on or near public-use airports. Per the guidance publication, land uses applicable to this proposed amendment area and considered to be a potential attractant include bodies of open water with a permanent pool of water and emergent and submergent vegetation. The *FAA Advisory Circular Guidance* recommends that these practices be avoided or mitigated to reduce the likelihood of wildlife-aircraft strikes. The proposed wet detention basins may be considered an attractant by this guidance. There are many other potential attractants within the recommended separation distance, including Graber Pond nearby to the west, the expansive wetlands to the south and southeast within Pheasant Branch Conservancy, as well as other natural and manmade bodies of water. CARPC Staff is not aware of any issues caused by existing stormwater management basins, and by comparison to the extensive natural attractants within the recommended separation distances to the airport, the proposed wet detention basins are not considered to have a significant impact on wildlife movement. The Advisory Circular also identifies several mitigation strategies that could be incorporated into the stormwater management plan design including the use of riprap-edged ponds or narrow/linear geometry of ponds.

Performance Standards

The City of Middleton stormwater management and performance standards are contained within Chapter 26 of the City of Middleton Code of Ordinances. Additionally, the City of Middleton has the Water Resources Management and Stormwater Utility Commission to oversee stormwater management activities within the City and provide recommendations for specific development proposals. Dane County stormwater standards are detailed within the Dane County Code of Ordinances, Chapter 14. WDNR stormwater standards are within Administrative Code Chapters NR 151 and NR 216. Development within the amendment area will be required to follow the more protective requirements contained within the respective standards.

The City proposes stormwater management performance measures for the amendment area to meet, or exceed, applicable stormwater standards currently required by the State of Wisconsin, Dane County, and City of Middleton, and include:

- a. Peak runoff rate control is required for the 1-, 2-, 10-, 100-, and 200-year, 24-hour design storms to limit post-development runoff to “pre-development” levels, in accordance with City of Middleton and Dane County Stormwater Ordinances. Further, City ordinances require the use of predevelopment curve numbers which represent “pre-settlement” conditions.
- b. Sediment control is required to achieve at least 80% sediment control for the amendment area based on the average annual rainfall period, with sediment control pretreatment occurring prior to infiltration for runoff from parking lots and new road construction within commercial, industrial, and institutional land uses, in accordance with City of Middleton and Dane County Stormwater Ordinances.
- c. Runoff volume control is required to maintain the post-development infiltration (stay-on) volume to at least 90% of the pre-development infiltration (stay-on) volume for the average annual rainfall period, without exception for sites determined to be within a closed basin watershed, in accordance with City of Middleton and Dane County Stormwater Ordinances.
- d. Maintain predevelopment groundwater recharge rates (approximately 9.0 - 10.0 inches/year for the amendment area) determined from the Wisconsin Geological and Natural History Survey’s 2012 report, *“Groundwater Recharge in Dane County, Wisconsin, Estimated by a GIS-Based Water-Balance Model”*, or by a site-specific analysis, if allowed by ordinance as an elective alternative to meeting the 90% stay-on requirement if more than two percent (2%) of the site is required to be used as effective infiltration area, in accordance with City of Middleton and Dane County Stormwater Ordinances.
- e. Thermal control is required to reduce the temperature of stormwater runoff from development sites within thermally sensitive watersheds, in accordance with City of Middleton and Dane County Stormwater Ordinances.
- f. Oil and grease control are required to treat the first 0.5 inches of runoff using best management practices at commercial and industrial sites and any other uses where the

potential for pollution by oil or grease, or both, exists, in accordance with City of Middleton and Dane County Stormwater Ordinances.

Impacts and Effects of Proposal

Environmental Corridors

The proposed amendment area includes a total of approximately 33 acres of Environmental Corridor (see Map 12). This will include intermittent stream with associated buffer, park, open space, and proposed stormwater management areas in accordance with the Environmental Corridor Policies and Criteria ([link to document](#)) adopted in the *Dane County Water Quality Plan*. Proposed Environmental Corridors include all areas currently mapped as Protection Areas and some areas which coincide with mapped Stewardship Areas.

Protection Areas are required for inclusion in Environmental Corridors when those areas are added to the urban service area. Protection Areas include natural resource features such as the 1% annual chance floodplain; waterbodies, streams and wetlands, plus their required vegetative buffers; riparian steep slopes; existing public lands, parks, and conservancy areas; and existing stormwater management facilities. Protection areas are mapped based on regionally available information, such as the Wisconsin Wetland Inventory data.

The proposed amendment area includes 16 acres mapped as Stewardship Area, including potentially restorable wetlands, current Ice Age Trail Corridor, and internally drained areas, of which 0.2 acres are proposed to be designated as Environmental Corridor that are not also already mapped as a protection area with this amendment (see Map 12). Stewardship Areas are natural resources that are not legally protected from development, but still provide important benefits to the region, and are advised to be considered for inclusion in Environmental Corridors, above the minimum requirements. This concept is described more in the [2050 Regional Development Framework](#) (Framework) and is aimed at achieving the goal of conserving water resources and natural areas. The Stewardship Area recommendations include natural resource features such as the 0.2% annual chance floodplain, potentially restorable wetlands, internally drained areas, hydric soils, current/potential Ice Age Trail Corridor, and Natural Resource Area boundaries identified in the Dane County Parks and Open Space Plan.

Meeting Projected Demand

CARPC projections from 2020 suggested that an additional 114,000 residents, 59,000 housing units, and 72,000 jobs can be expected in the Central Urban Service Area over the next 30 years. Modeling in Urban Footprint for the Regional Development Framework (Framework) located a future neighborhood center at the intersection of CTH-Q and Onken Road, approximately two miles northeast of the proposed amendment area. Areas to the west and east are identified as opportunities for planning “complete neighborhoods.” Middleton’s comprehensive plan identifies lands to the north as “Planned Neighborhood,” presenting additional opportunities to develop in a way that helps achieve the goals of the Framework and meet projected demand. The amendment area would add 173 residential units.

Phasing

The proposed amendment is under 100 acres and does not require a phasing plan. However, the City anticipates full build out of the neighborhood over the next 5 to 6 years in four phases. Development will occur west of High Road and then proceed to the east.

Surface Water Impacts

Development creates impervious surfaces (e.g., streets, parking areas, and roofs) and typically alters the natural drainage system (e.g., natural swales are replaced by storm sewers). Without structural best management practices (e.g., detention basins and infiltration basins) this would result in increased stormwater runoff rates and volumes, as well as reduced infiltration. Without structural best management practices for erosion control, development would also cause substantial short-term soil erosion and off-site siltation from construction activities. Scientific research has well documented that without effective mitigation measures, the potential impacts of development on receiving water bodies can include the following:

- Flashier stream flows (i.e., sudden higher peaks)
- Increased frequency and duration of bank-full flows
- Reduced groundwater recharge and stream base flow
- Greater fluctuations in water levels in wetlands
- Increased frequency, level (i.e., elevation), and duration of flooding
- Additional nutrients and urban contaminants entering the receiving water bodies
- Geomorphic changes in receiving streams and wetlands

Natural drainage systems attempt to adapt to the dominant flow conditions. In the absence of mitigation measures, the frequency of bank-full events often increases with urbanization, and the stream attempts to enlarge its cross section to reach a new equilibrium with the increased channel forming flows. Higher flow velocities and volumes increase the erosive force in a channel, which alters streambed and bank stability. This can result in channel incision, bank undercutting, increased bank erosion, and increased sediment transport. The results are often wider, straighter, sediment laden streams, greater water level fluctuations, loss of riparian cover, and degradation of shoreland and aquatic habitat.

Since 2002, there have been stormwater management standards in effect at the state, county, and local level to require stormwater management and erosion control plans and structural best management practices designed to address the impacts of development on water quality, runoff volumes, peak flows, water temperature, and groundwater recharge. In 2011, county and local standards for runoff volume control were increased beyond state standards to further address the potential stormwater impacts of development. Since 2010 many communities adopted even higher standards for volume control through their own ordinances or as part of USA amendment agreements. However, in 2017, State statute 281.33(6)(a)(1) was changed to limit the ability of local governments to provide more protective standards for runoff volume through local ordinances. In 2021, Dane County adopted peak rate control requirements for the 200-year storm event in their ordinance as well as requirements for closed basins, which made these requirements universal to all communities in Dane County.

The City of Middleton proposes to mitigate the urban nonpoint source impacts of the proposed development by requiring the implementation of stormwater best management practices that will be designed and constructed to meet or exceed current Dane County standards for pollutant reduction, runoff volumes, peak flows, water temperature, and groundwater recharge. Such practices will help to address the potential water quality impacts of stormwater runoff from the proposed development on the receiving waters.

Regional partners are actively working to address chlorides through the [Wisconsin Salt Wise Partnership](#). WI Salt Wise's chloride reduction training courses are open to all municipal and private winter maintenance professionals in the region. City of Middleton staff have attended winter salt certification classes and training for winter road maintenance and are encouraged to stay current on the latest trainings and development. The City of Middleton is also a participant in the Madison Area Municipal Storm Water Partnership (MAMSWaP), which is a coalition of Dane County municipalities and organizations working together to promote practices that reduce and improve stormwater runoff into Dane County lakes, rivers, and streams. The MAMSWaP Information and Education (I&E) Committee works to develop and implement projects and plans through regional outreach and messaging throughout the communities, including maintaining the www.ripple-effects.com website, distributing tools and articles to municipalities, community groups, and neighborhood associations, and providing presentations to focused audiences. Specific goals include promoting proper leaf management, proper lawncare practices, reduction in chlorides pollution from over-use of salt, and rainwater harvesting for beneficial reuse.

Groundwater Impacts

Without effective mitigation practices, as natural areas are converted to urban development, the ground/surface water balance in streams and wetlands shifts from a groundwater-dominated system to one dominated more and more by surface water runoff. This can result in subsequent reductions in stream quality and transitions to more tolerant biological communities.

Groundwater modeling indicates that the cumulative effects of well withdrawals have resulted in a 5.1-cfs decrease in baseflow in Pheasant Branch Creek at Century Avenue (see location Map 5) from pre-development conditions (no pumping) to 2010 conditions (refer to Table 4). An additional 0.2-cfs decline compared to 2010 conditions is anticipated for the year 2040, according to modeling, reducing the baseflow to 7.0 cfs.

Table 4
Modeled Baseflow Results Due to Current and Anticipated
Future Municipal Well Water Withdrawals
 (All Municipal Wells)

Stream	Pre-Development	2010	2040
Pheasant Branch Creek	12.3 cfs	7.2 cfs	7.0 cfs

Source: 2016 Groundwater Flow Model for Dane County, developed by the WGNHS ([link to website](#))

Generally, groundwater discharge occurs along the entire length of perennial streams and is the source of stream baseflow. The loss of baseflow from the cumulative effects of well water pumping and urbanization is a regional issue, beyond the boundaries of a single USA Amendment or even a single municipality. This issue is discussed along with potential management options in the updated *Dane County Groundwater Protection Planning Framework* ([link to report](#)). Maintaining pre-development groundwater recharge by infiltrating stormwater runoff helps to replenish groundwater, maintain baseflow, and mitigate this impact. The regional groundwater model is a useful tool for evaluating different configurations and scenarios of municipal groundwater well withdrawals on these stream systems.

Comments at the Public Hearing

A public hearing was held on the proposed amendment at the December 12, 2024, meeting of the Capital Area Regional Planning Commission. Representatives from the City of Middleton spoke in favor of the amendment. There were no registrants opposed to the amendment. Commissioners asked questions seeking clarification on the information presented by the applicant, including on intended land use and which parcels are included in the amendment area. One Commissioner spoke positively about the large acreage of land being included in the environmental corridor. The applicant provided responses to each of the inquiries during the meeting.

Conclusions and Staff Water Quality Recommendations

There is sufficient existing treatment plant system capacity at MMSD's Nine Springs Wastewater Treatment Facility and sufficient existing or planned wastewater collection system capacity to serve the proposed amendment area.

The City of Middleton proposes to mitigate the potential urban nonpoint source impacts of the proposed development on the receiving waters by requiring the implementation of stormwater best management practices that are designed and constructed to meet or exceed current standards for pollutant reduction, runoff volumes (stay-on), peak flow rates, water temperature, and groundwater recharge.

It is CARPC staff's opinion that the proposed amendment is consistent with water quality standards under Wis. Stat. § 281.15, and the adopted Policies and Criteria for the Review of Sewer Service Area Amendments to the *Dane County Water Quality Plan*, with the existing state and local requirements identified below. In addition to the existing state and local requirements, the City of Madison and development team have agreed to pursue additional water resource management measures for the amendment area and additional actions have also been recommended below to further improve water quality and environmental resource management.

State and Local Requirements

CARPC staff recommend approval of this amendment in recognition of the state and local requirements for the following:

1. Environmental Corridors are required to be delineated to meet the Environmental Corridor Policies and Criteria adopted in the *Dane County Water Quality Plan*. Additionally, in accordance

with the 2006 Graber Pond Master Plan, a 100-foot vegetated buffer shall be provided for wetlands associated with Graber Pond and shall be included within Environmental Corridor.

2. Sediment and erosion control practices are required to be installed prior to other land disturbing activities. Infiltration practices are required to be protected from compaction and sedimentation during land disturbing activities.
3. Easements and perpetual legal maintenance agreements with the City of Middleton, to allow the City to maintain stormwater management facilities if owners fail to do so, are required for any facilities located on private property.
4. State and local review and approval of stormwater management plan(s) is required, including Regional Planning Commission staff review and approval as part of the sewer extension review process.
 - a. Peak runoff rate control is required for the 1-, 2-, 10-, 100-, and 200-year, 24-hour design storms to limit post-development runoff to “pre-development” levels, in accordance with City of Middleton and Dane County Stormwater Ordinances. Further, City ordinances require the use of predevelopment curve numbers which represent “pre-settlement” conditions.
 - b. Sediment control is required to achieve at least 80% sediment control for the amendment area based on the average annual rainfall period, with sediment control pretreatment occurring prior to infiltration for runoff from parking lots and new road construction within commercial, industrial, and institutional land uses, in accordance with City of Middleton and Dane County Stormwater Ordinances.
 - c. Runoff volume control is required to maintain the post-development infiltration (stay-on) volume to at least 90% of the pre-development infiltration (stay-on) volume for the average annual rainfall period, without exception for sites determined to be within a closed basin watershed, in accordance with City of Middleton and Dane County Stormwater Ordinances.
 - d. Maintain predevelopment groundwater recharge rates (approximately 9.0 - 10.0 inches/year for the amendment area) determined from the Wisconsin Geological and Natural History Survey’s 2012 report, *“Groundwater Recharge in Dane County, Wisconsin, Estimated by a GIS-Based Water-Balance Model”*, or by a site-specific analysis, if allowed by ordinance as an elective alternative to meeting the 90% stay-on requirement if more than two percent (2%) of the site is required to be used as effective infiltration area, in accordance with City of Middleton and Dane County Stormwater Ordinances.
 - e. Thermal control is required to reduce the temperature of stormwater runoff from development sites within thermally sensitive watersheds, in accordance with City of Middleton and Dane County Stormwater Ordinances.
 - f. Oil and grease control are required to treat the first 0.5 inches of runoff using best management practices at commercial and industrial sites and any other uses where the

potential for pollution by oil or grease, or both, exists, in accordance with City of Middleton and Dane County Stormwater Ordinances.

Additional Agreements for the Amendment Area

In addition to the existing state and local requirements, the City of Middleton and development team have agreed to pursue the following measures for the amendment area:

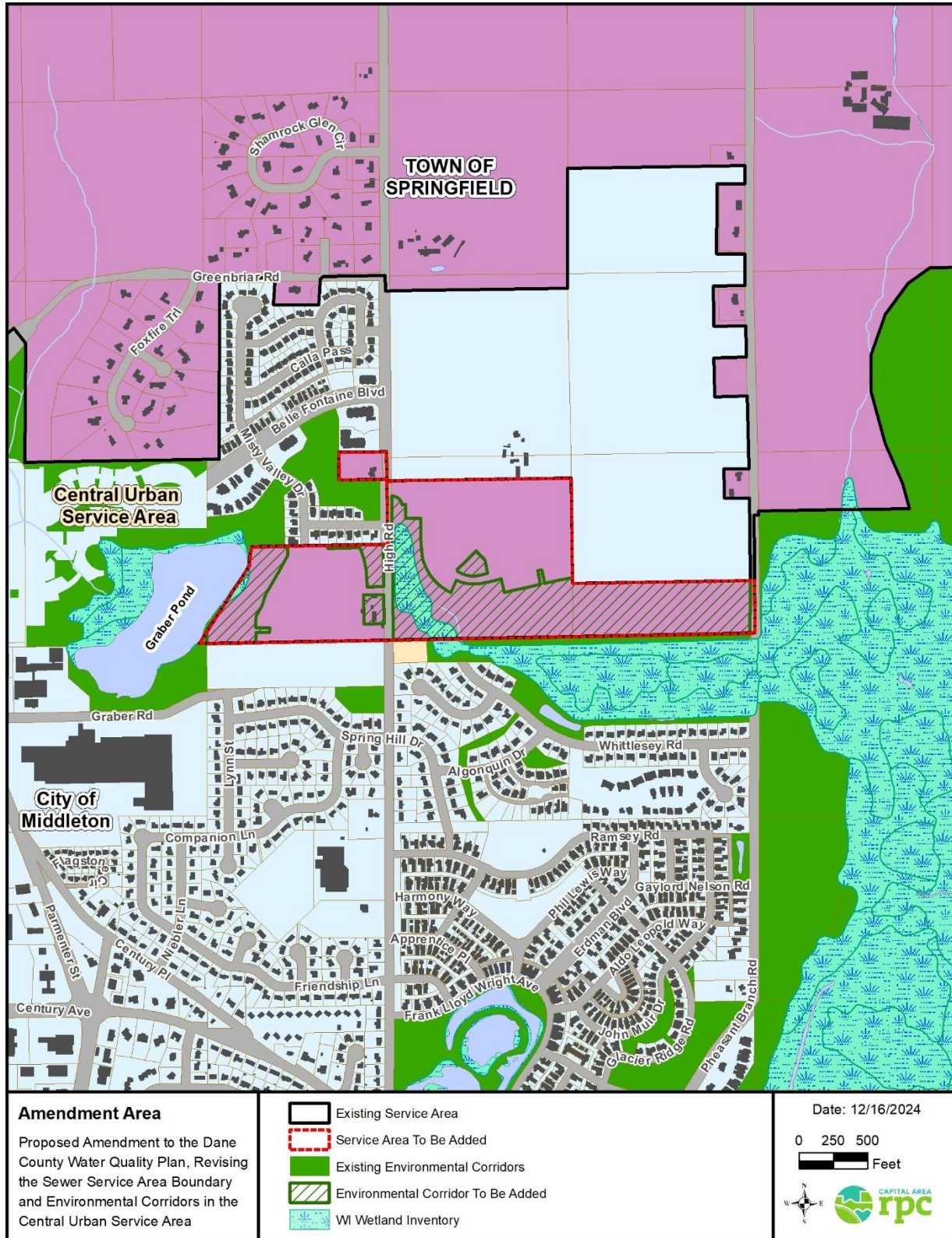
1. Runoff volume control will be provided to maintain the post-development infiltration (stay-on) volume to 100% of the pre-development infiltration (stay-on) volume for the average annual rainfall period, for sites within a closed basin watershed (Graber Pond), regardless of the effective area of the infiltration system.

Recommendations

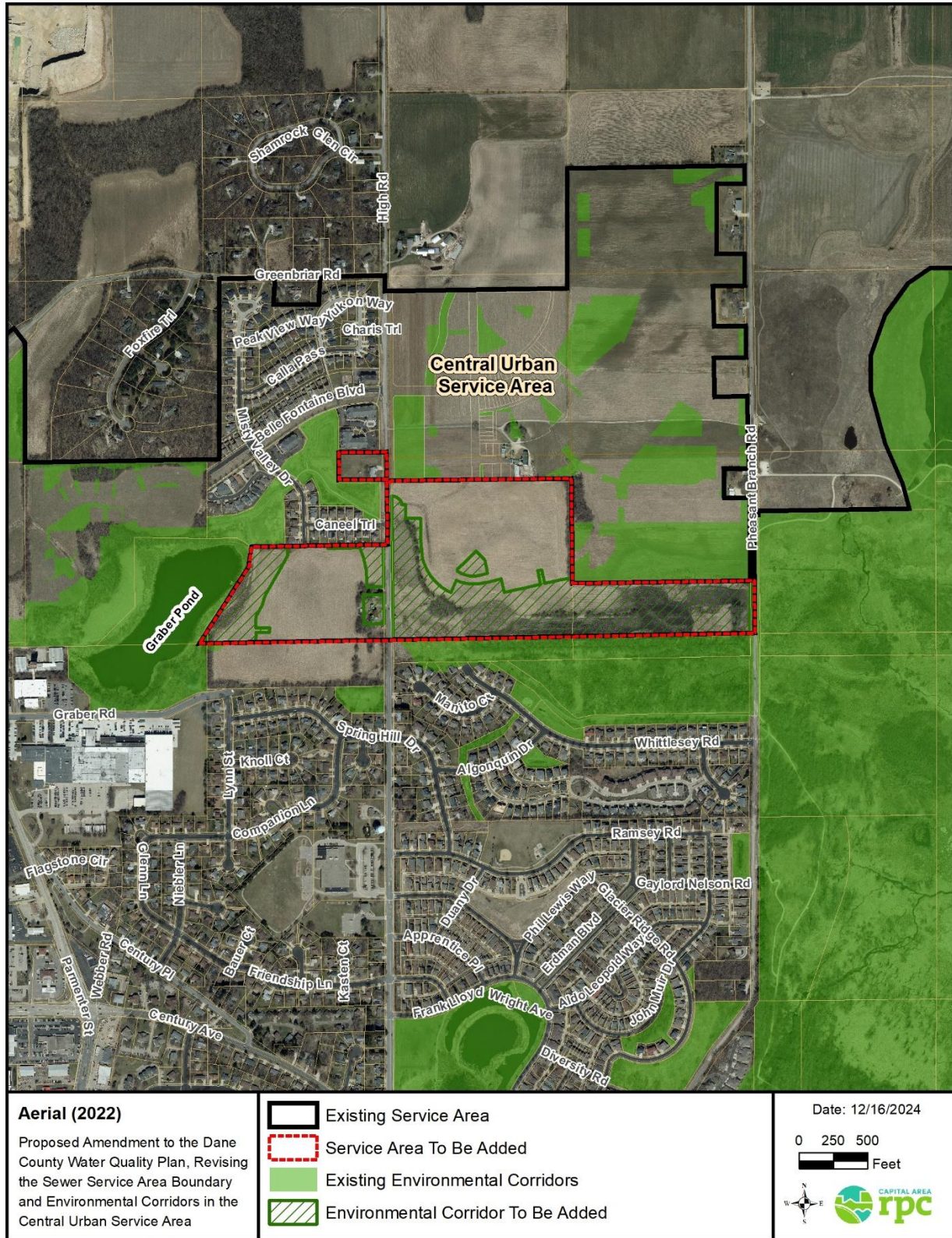
It is recommended that the City of Middleton pursue the following to further improve water quality and environmental resource management:

1. Continue to participate in regional water quality initiatives including Wisconsin Salt Wise, the Madison Area Municipal Storm Water Partnership (MAMSWaP), and Yahara WINS.
2. Encourage the removal and control of invasives and the use of native flora favored by the federally endangered Rusty Patched Bumble Bee in landscaping to provide suitable habitat for this pollinator, where appropriate, for the entire amendment area within the High Potential Zone for the bee.
3. Consider implementing the recommended actions listed in the WDNR Bureau of Natural Heritage Conservation's Endangered Resources Review to protect any occurrences of rare plants, animals, and natural communities.

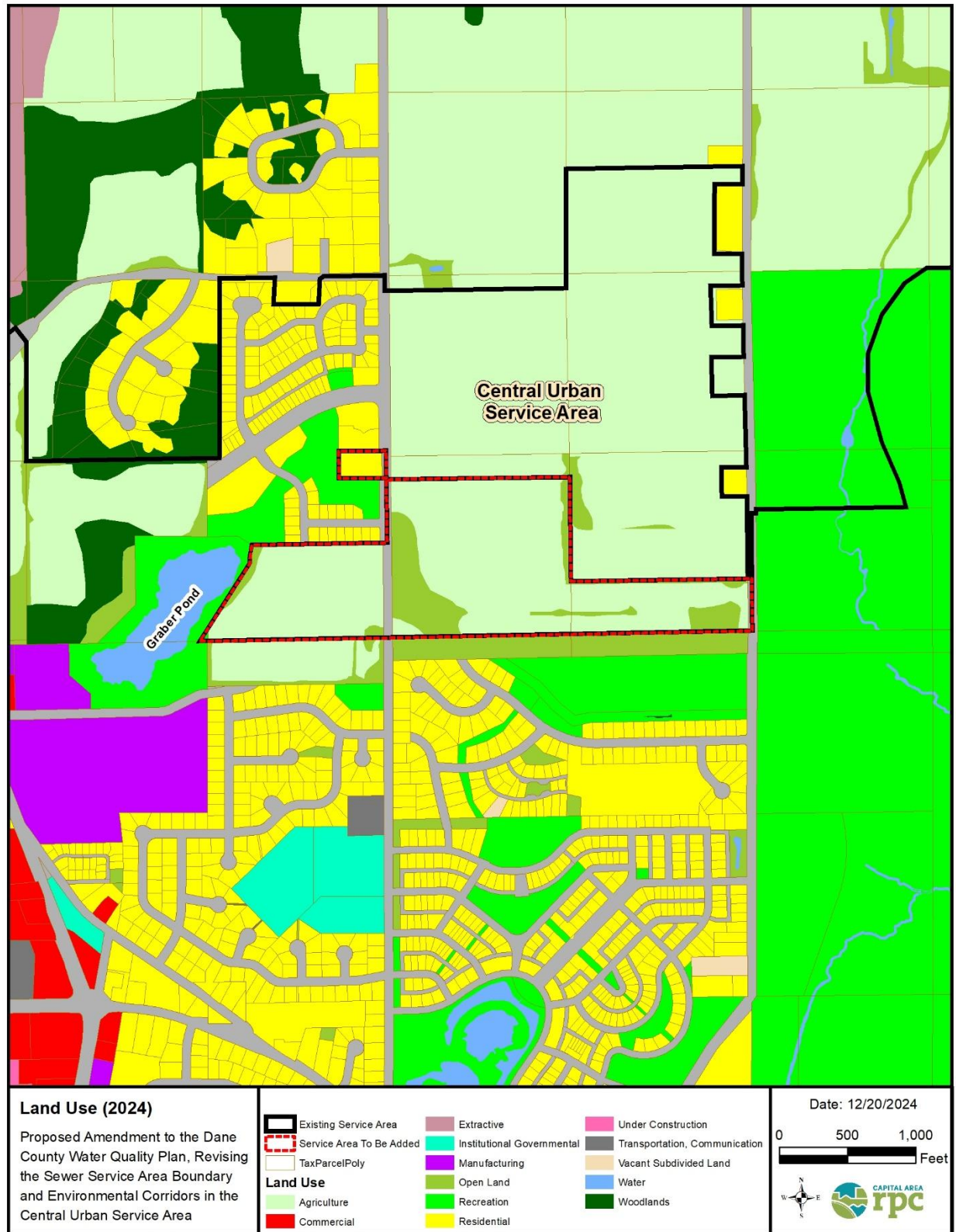
Map 1 – Amendment Area



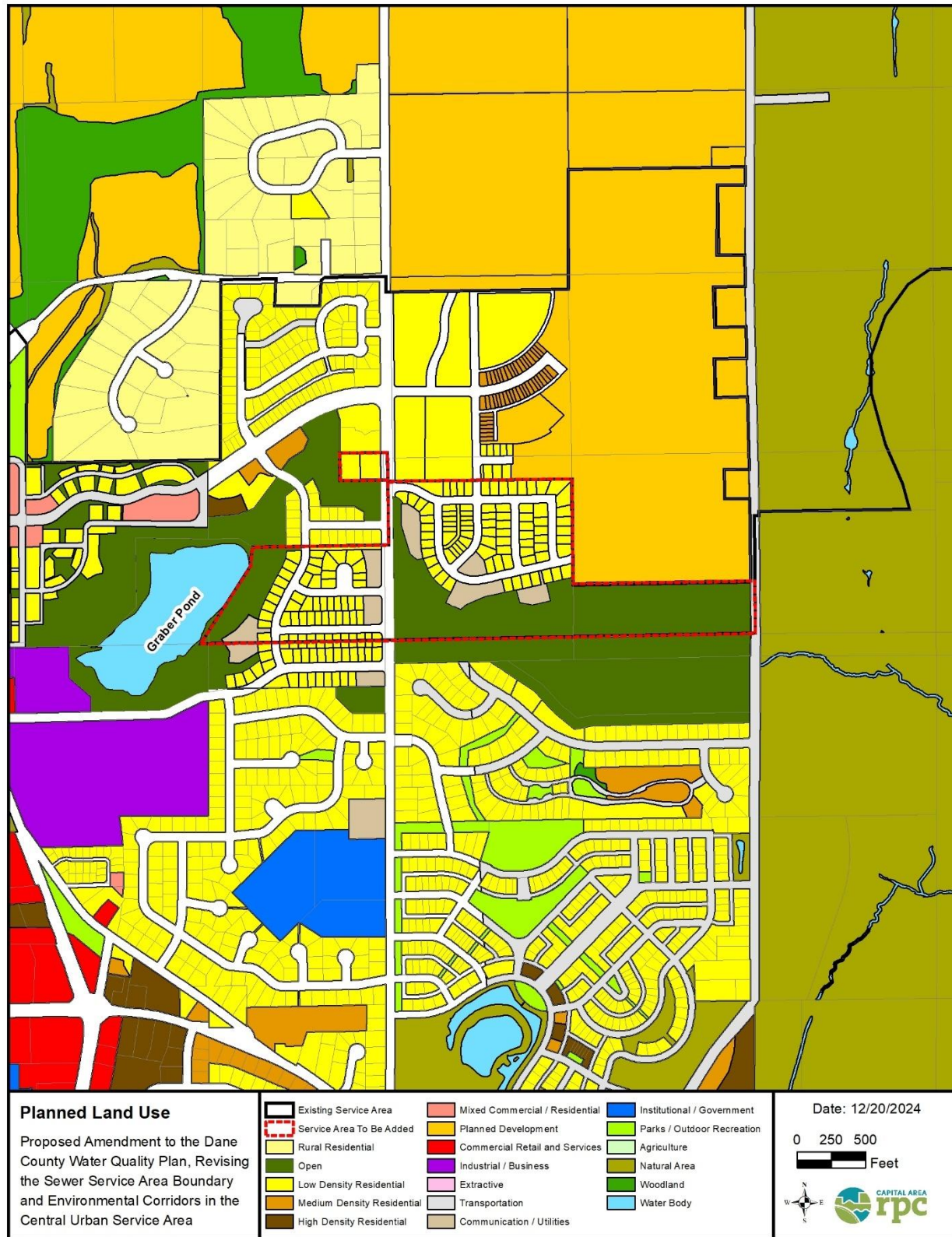
Map 2 – Aerial



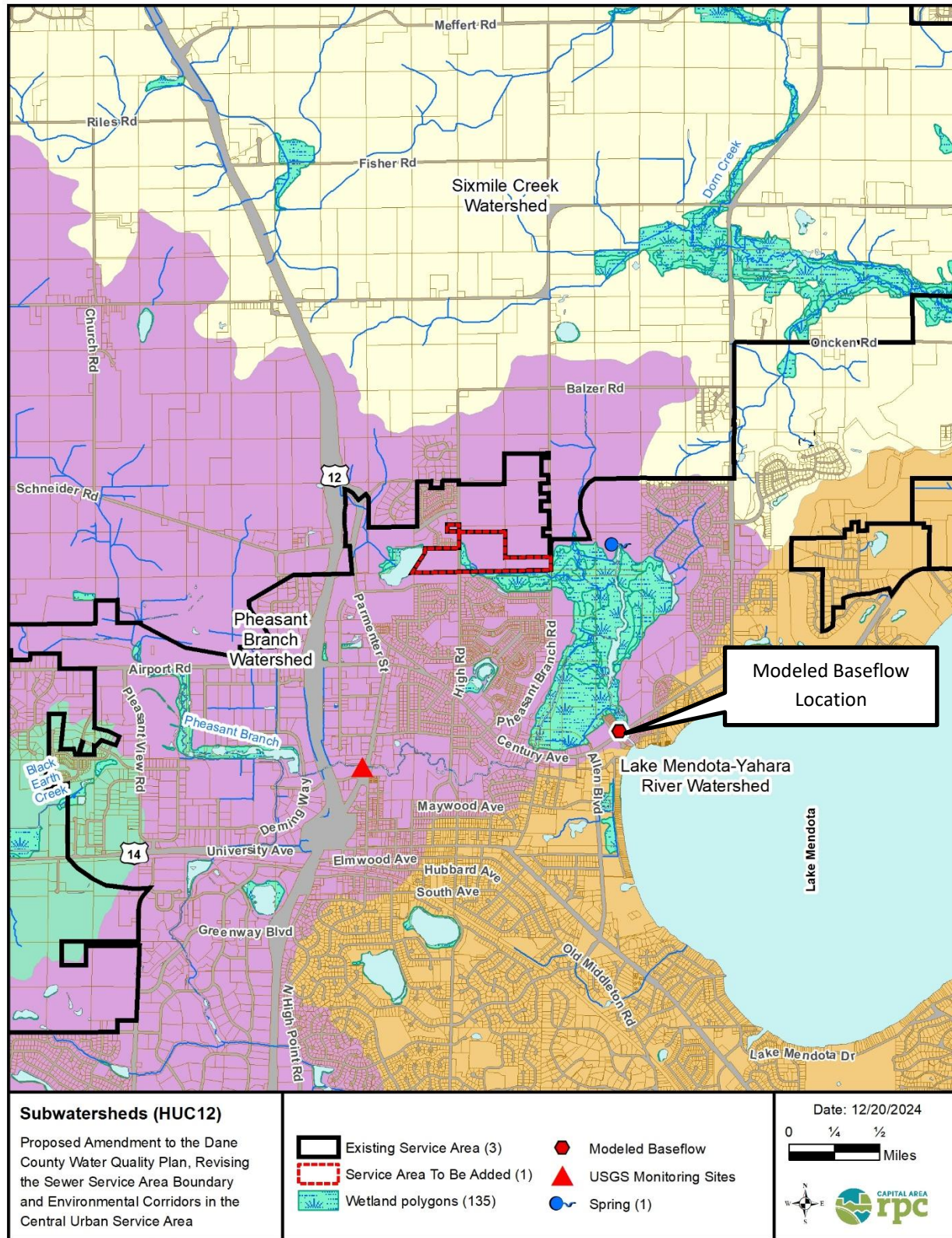
Map 3 – Existing Land Use



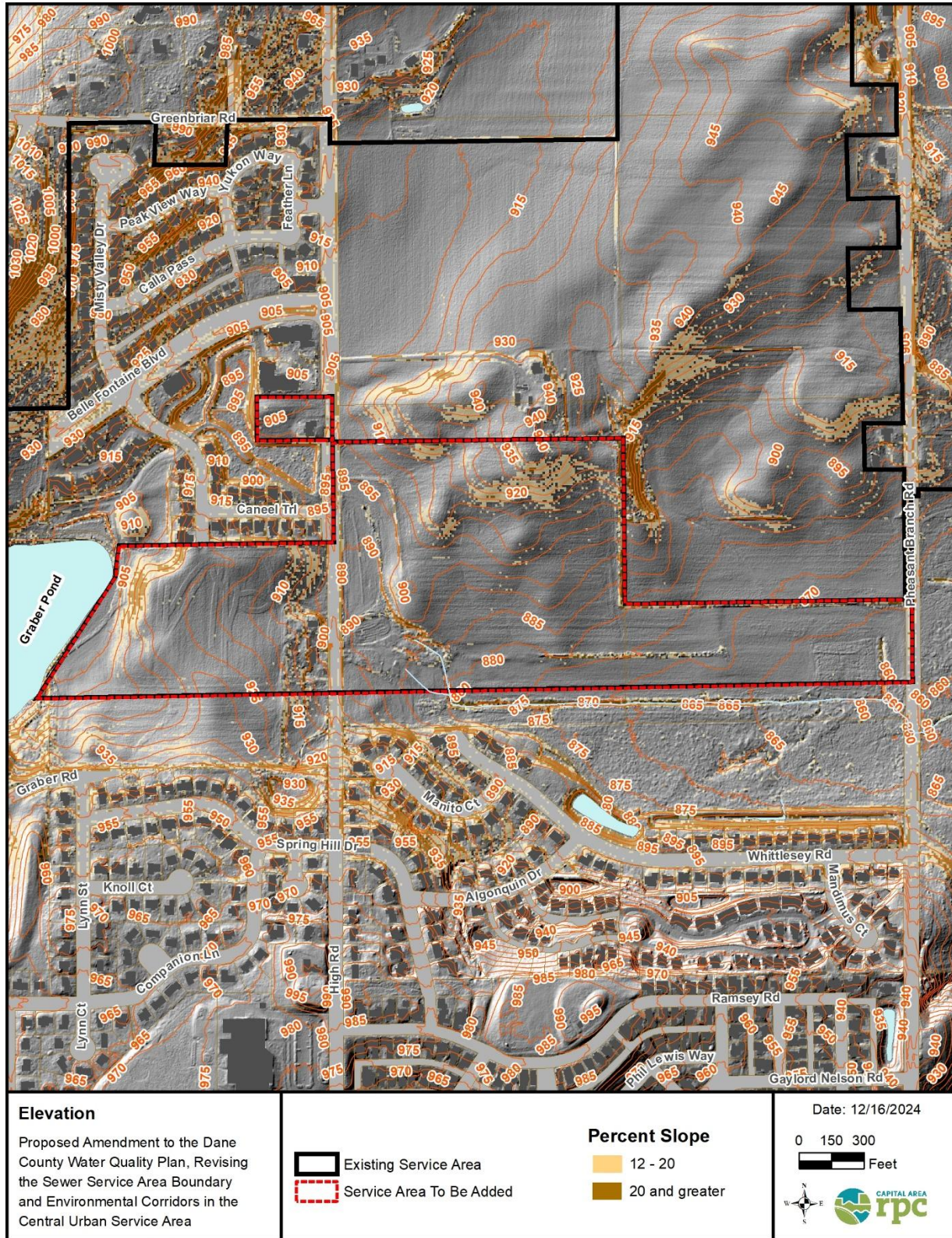
Map 4 – Planned Land Use



Map 5 – Subwatersheds



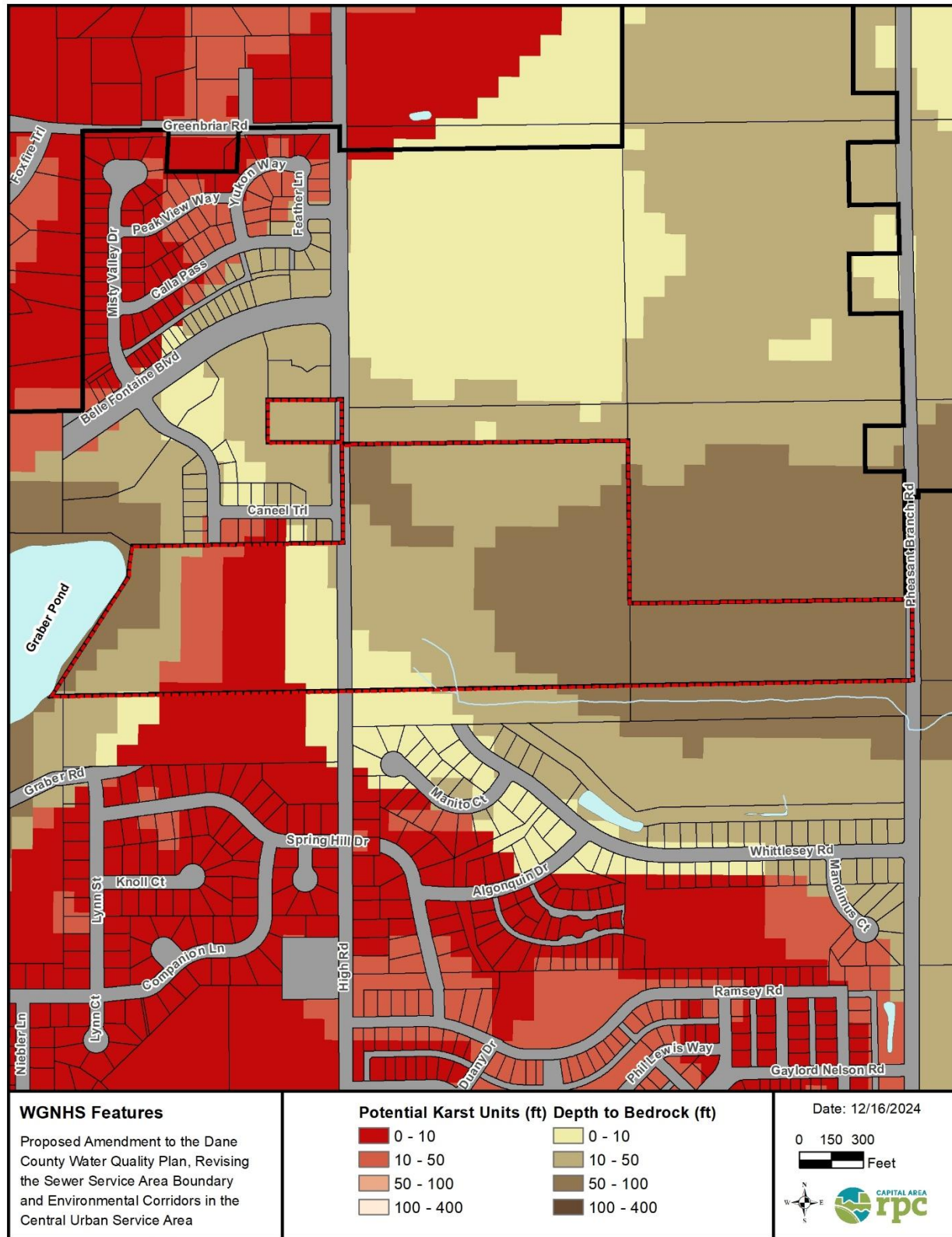
Map 6 – Elevations



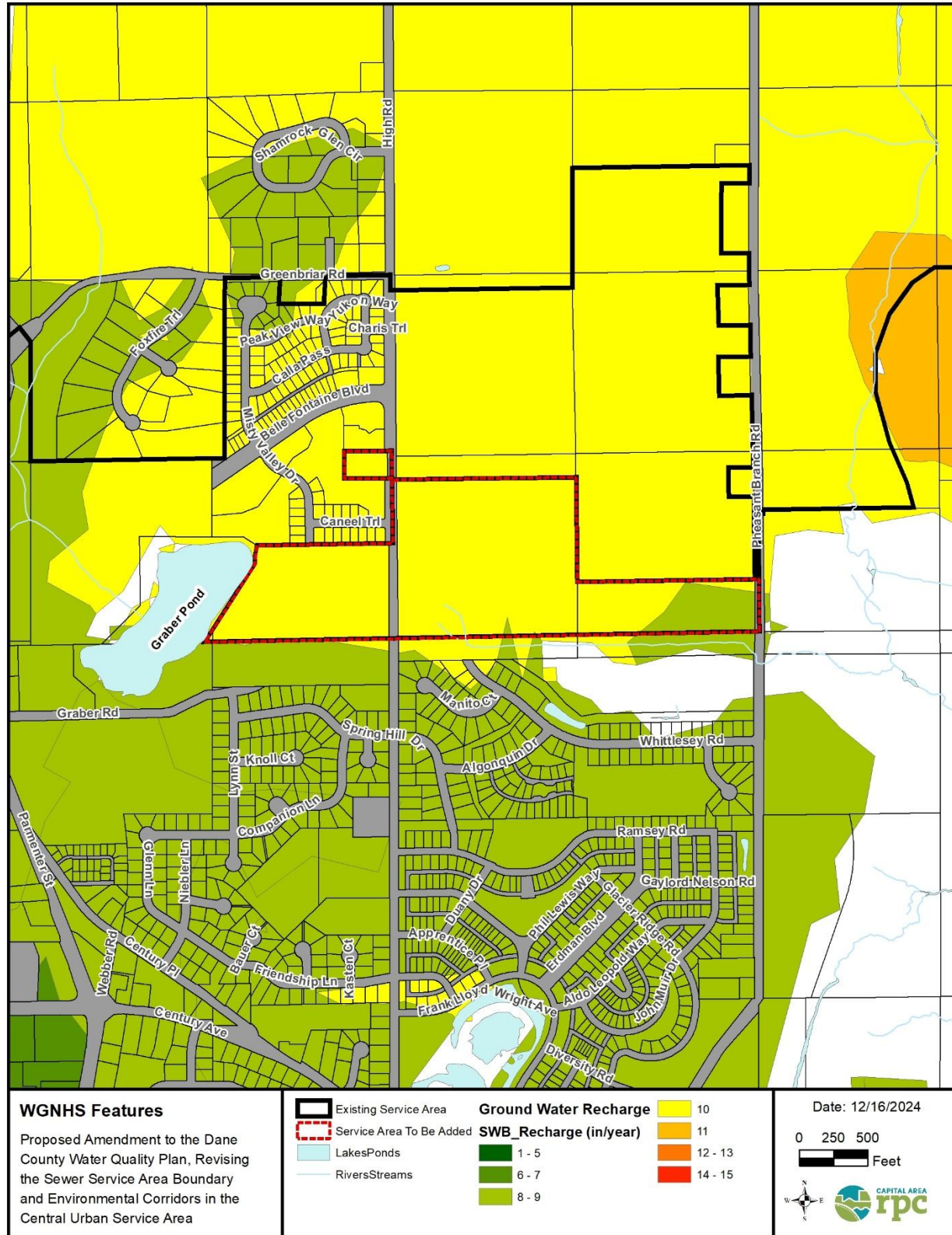
Map 7 - Soil Type



Map 8a – WGNHS Bedrock Depth and Potential Karst Features



Map 8b – WGNHS Groundwater Recharge



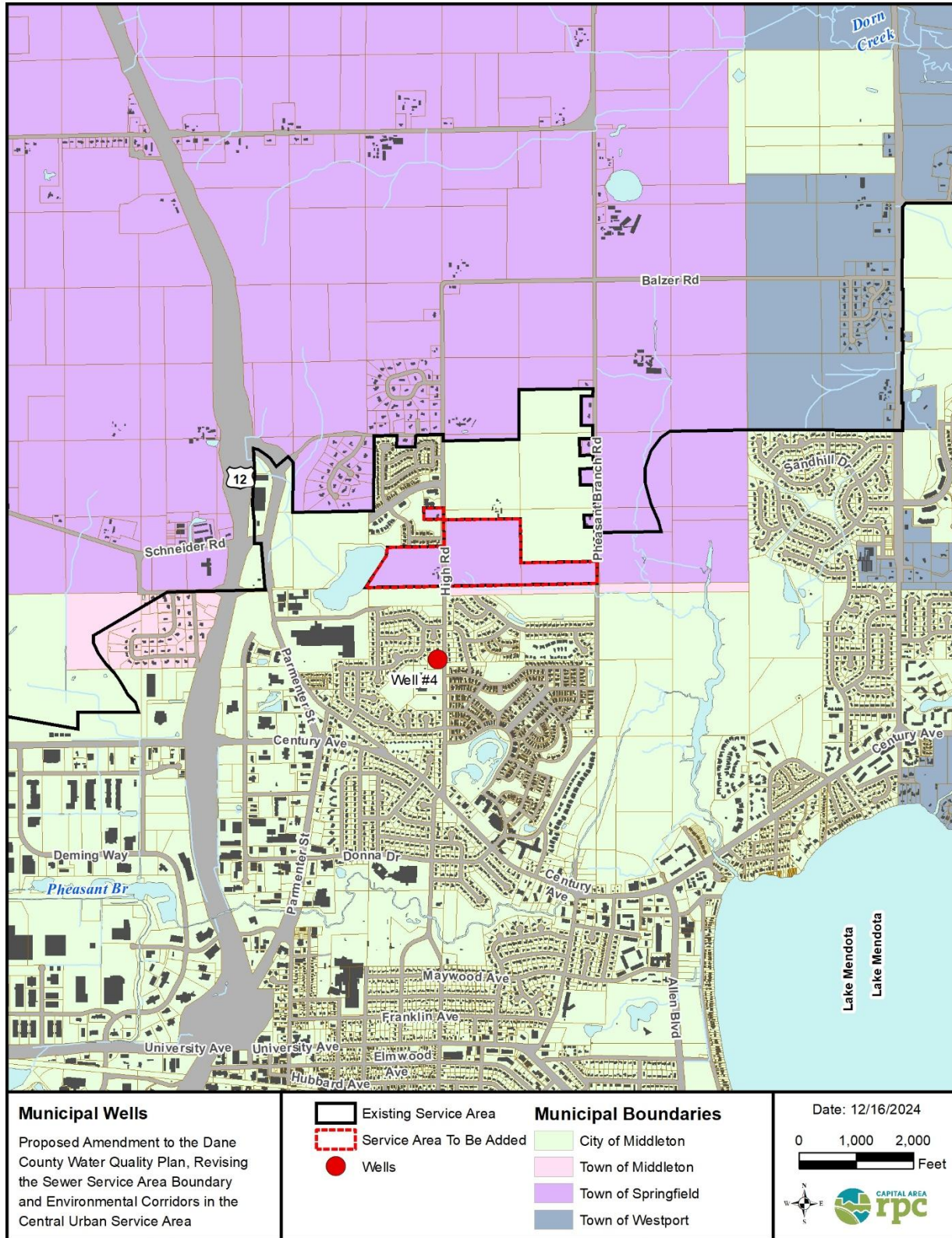
Map 9a – Proposed Sanitary Sewer and Water Main



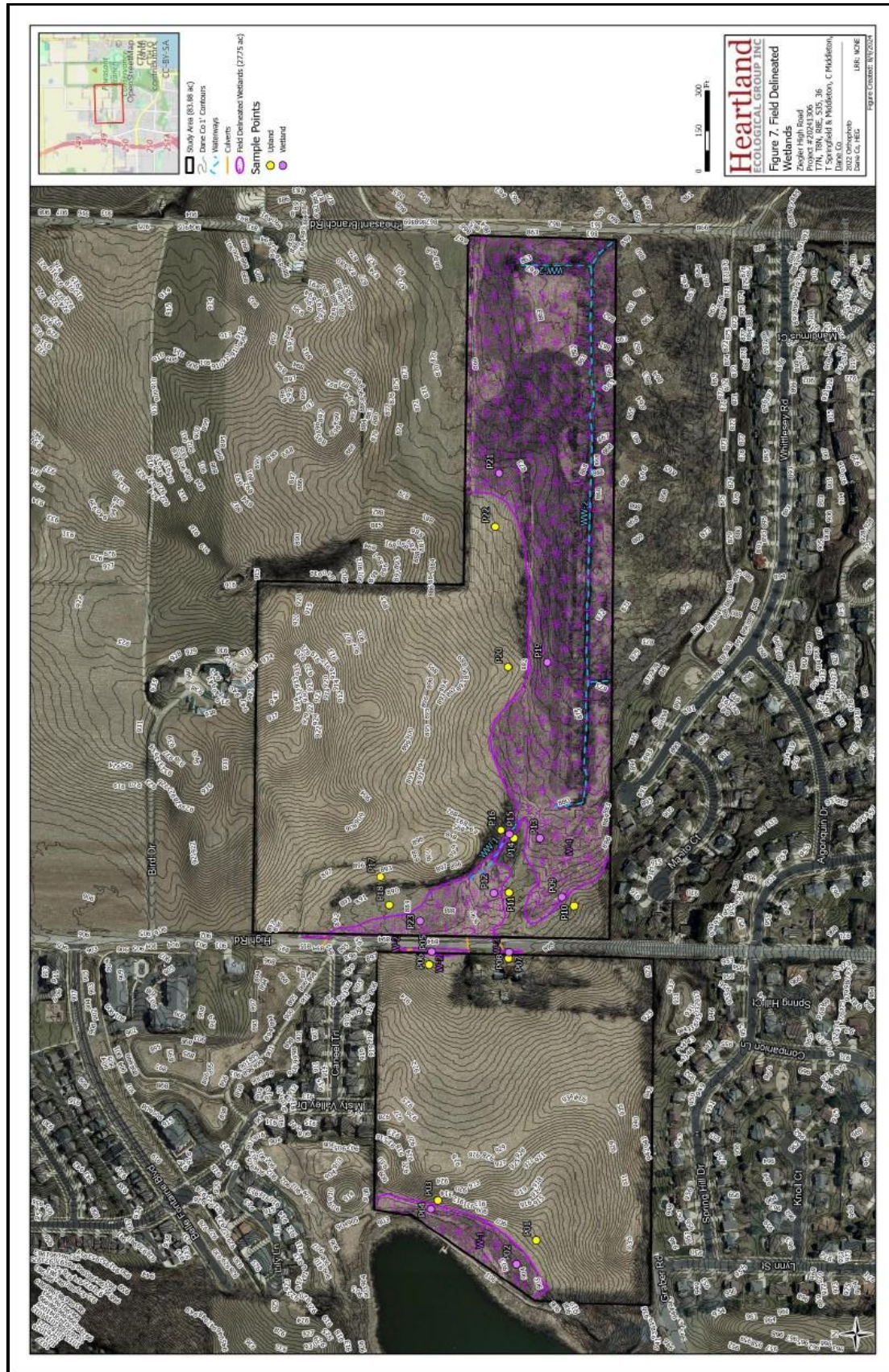
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FIGURE 5.3: PERCENTAGE OF STAY-ON VOLUME PROVIDED BY EACH WATERSHED AND INFILTRATION FACILITY

Map 10 – Municipal Wells



Map 11 – Wetland Delineation



Map 12 – Proposed Environmental Corridor

