CITY OF MIDDLETON

URBAN SERVICE AREA AMENDMENT REQUEST: ZIEGLER FARM

NOVEMBER 11, 2024

CARPC PUBLIC HEARING DRAFT

CITY OF MIDDLETON

VANDEWALLE & ASSOCIATES

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Introduction

The City of Middleton is requesting a 67.5-acre addition to its Urban Service Area (USA) to provide sanitary sewer, potable water, and other urban services to a site on either side of High Street, north of Pheasant Branch Ridge Park. As depicted on Map 1, this would include 67.5 acres immediately adjacent to the City's current USA boundary. The development site is currently located within the Townships of Springfield and Middleton. However, the area proposed for development on the existing Town of Middleton parcels are already included within the USA boundary. The proposed use for the site will include 156 traditional single-family homes and 17 alley-loaded single-family homes, totaling 173 new housing units. The subject parcels and their status related to development proposed, municipal boundaries, and USA boundaries is as follows:

- 4 parcels proposed to be added to the USA boundary (three of which are proposed for development and annexation. The fourth parcel is a 1.5-acre residential parcel that is not included in the proposed development concept and is not currently proposed for annexation into the City's municipal boundary).
- 1 parcel within the City of Middleton and within the USA boundary at the Terminus of Graber Road. This parcel is part of the proposed development.
- 2 parcels within the Town of Middleton and within the existing USA boundary, east of High Road and west of Pheasant Branch Road. These parcels are part of the proposed development and are proposed for annexation. There are two city-owned parcels east of Pheasant Branch Road that are not part of this annexation.

In total, seven parcels are related to this request, however only four are proposed for addition to the USA Boundary. Please see attached maps for further explanation, which show these parcels relative to existing boundaries (USA boundaries and municipal boundaries).

Annexation processes are currently under way for the township parcels proposed for development. This includes three parcels within the Town of Springfield. It also includes the two parcels within the Town of Middleton (which are already within the USA boundary). The existing 1.5-acre residential parcel to the north and west of High Road is not currently proposed for annexation or development. However, it is included within the Urban Service Area Boundary to avoid creation of remnant parcels that would require further amendment actions in the future. The annexation petition was approved by the Middleton Common Council on November 6, 2024.

The proposed amendment area includes three parcels owned by "Ziegler Living TR, Leonard A & Ruth E" and a fourth parcel outside of the proposed development area owned by Thomas G Adler. The parcels span both sides of High Road, located between existing and emerging neighborhoods as a missing link in the neighborhood fabric. The site is predominantly used for agricultural purposes with a farmstead located along the western side of High Road. The remainder of the site consists of wetlands along Graber Pond as well as a creek/wetland corridor east of High Road. Veridian Homes, the developer, is proposing a residential neighborhood within the proposed amendment area called "Ziegler Farm".

In addition to CARPC and WisDNR review and approval of an Urban Service Area amendment, the proposed amendment area will require a zoning map amendment and preliminary and final plat approvals from the City of Middleton.

On October 22, 2024, the City of Middleton Plan Commission recommended a Resolution to the City Council to initiate an Urban Service Area Amendment for the 67.5 acres which included a finding that the proposed development within the Urban Service Area Amendment is consistent with the City's Comprehensive Plan. On November 6, 2024, the City of Middleton City Council adopted the recommended Resolution (Attachment A).

Plan Consistency and Need

1.1. Document Consistency

The proposed USA addition is depicted as "Planned Neighborhood" on the City's Future Land Use Map (Map 3), which is part of the City's 2021 Comprehensive Plan (updated in 2023). A portion of the amendment area along the amendment area's south boundary is also designated as "Environmental Corridor." "Planned Neighborhood" is described in the Comprehensive Plan as: "For developing areas of the city, carefully planned and integrated neighborhoods that encourages a mix of residential types and sizes and lot sizes; building types could include single-family detached dwellings, single-family attached dwellings (townhomes/condos and 2-4 unit structures), and multifamily dwellings; buildings can also include small-scale public and institutional uses (e.g. schools, churches) and neighborhood business types."

The Ziegler Farm Neighborhood reflects broader Comprehensive Plan recommendations applicable to "Planned Neighborhoods".

> "Middleton will establish a land use pattern that promotes compact development, protection of natural resources, a range of housing options, mobility, and economic growth in order to maintain an exceptional quality of life." – Land Use Introduction, 2023 Comprehensive Plan.

Built within this framework, the neighborhood delivers a range of single-family homes with floor plans, formats, and price points that compliments the adjoining mixed residential neighborhoods by offering additional single family housing choices and transitioning from higher density housing to the existing neighborhoods. The proposed single-family homes will have varying lot sizes and multiple configurations, with both traditional front and alley-loaded homes. Completion of the Ziegler Farm presents a natural completion of the urban network and complements a greater mix of housing unit types and sizes immediately outside of the amendment area boundary. The project will be designed to meet the requirements of the City's standard zoning districts and does not request any exceptions to the adopted plan or code.

The proposed development plan will also help complete the local road network in this area. At the southern end of the site, a new north-south road will align and connect with Graber Road to the south. This will tie the development into the existing road network that provides easy access to Parmenter Street and Highway 12. Through the middle of both sites, new east-west roads will connect to the existing High Road, which acts as a north-south corridor in the area. At the far western side of the development, the Graber Pond Trail will connect to a new multi-use trail running through the site. The proposed road network balances protection of natural resources and connection to the larger network, along with accommodating development constraints to deliver the most suitable mix of housing to meet the City's needs.

The neighborhood design works with the surrounding character and on-site conditions to facilitate the creation of a new residential addition to Middleton that integrates the following elements:

- Respect and enhance the natural features of Graber Pond
- Extend the street grid where feasible
- Extend regional trail network
- Preserving the existing wetlands corridor and maintain appropriate buffers
- Integrating careful stormwater management meeting the 100% stay on requirements
- Add new parks & open space corridors

Additional Comprehensive Plan consistency, includes:

- Road Network Map (p.40): The Road Network map within the Comprehensive Plan shows the extension of Whittlesey Way. However, this would require extending the road through delineated wetlands. Instead, the proposed development furthers the goals of the Comprehensive Plan by balancing natural resource protection with a road network that is better suited to the site's development potential after refined site planning efforts at a smaller scale compared to the Comprehensive Plan.
- Environmental Features Map (p.121): Planned environmental corridor surrounding Graber Pond that is reflected in the proposed development.
- Overall, throughout the Comprehensive Plan a wide variety of goals, strategies, and recommendations align with the proposed development related to sustainability, transportation, housing, land use, economic development, and community character. Additionally, both the City's overarching vision statement and key community values align with the proposed development and its objectives.

Middleton Comprehensive Outdoor Recreation Plan (2020-2025):

- Overall, the proposed development aligns with community goals, helps meet the projected future needs and demands, and implements the recommendations for future park and trail locations.

Middleton Sustainable City Plan (2010):

- City's established vision for water quality, transportation, energy, and land use are advanced by the proposed development and its incorporation of sustainable elements.

Graber Pond Master Plan (2006):

- Recommendations for Graber Pond include protecting the vegetation and wetland surrounding the pond, conducting an official wetland delineation for the area and providing a 100-foot buffer from known wetlands, creating a pedestrian link to the area, utilizing stormwater best management practices, designing stormwater systems to meet City standards for runoff and infiltration, and creating retention basins to provide storage capacity and treatment. All are reflected within the proposed development.

1.2. Applicable Neighborhood Plan or Studies

The developer, Veridian Homes, has been working with Wyser Engineering, Vandewalle and Associates, and the City of Middleton in developing the conceptual layout for this site. The concept plan for the proposed amendment area includes single-family detached homes of varying size and configuration. This is consistent with the "Planned Neighborhood" land use category. Section 1.1 further reviews consistency other applicable plans and studies.

1.3. Need for the Addition to the USA

Like many other Dane County communities, Middleton has experienced sustained growth for several decades. With this continuing growth pressure has come several different intergovernmental agreements with surrounding jurisdictions, including the Town of Middleton, Town of Springfield, and City of Madison. The result is limited areas for the City to grow and expand, forcing the City to look inward for infill and redevelopment opportunities. Overall, the City has a very low inventory of available developable residential or commercial lots. In total, there are approximately 250 vacant platted parcels in the City as of August 2024. See Attachment L from the City's 2020 Housing Affordability Report Map.

In the 2023 Comprehensive Plan (Adopted in 2021 and updated in 2023), it was projected that by 2035 the City could increase by over 4,000 new residents, 4,000 new housing units, and 8,800 new jobs. Of the new 4,000 housing units needed, it was projected that approximately 3,000 would be developed within the City's existing boundary and 1,000 beyond the City's existing boundary.

In addition, a housing and population yield analysis for the City showed that between 2023 and 2035, the area north of the Northside and Middleton Hills neighborhoods could grow by 1,340 housing units. The addition of these 173 units contribute to providing supply towards this housing demand. Together with the 880 units constructed in the new Belle Farms subdivision, this development would be crucial step forward for what is effectively infill development.

Other ongoing or near-term residential infill and affordable housing projects in the City include up to 4,340 housing units recently completed, under construction, or under review, of various housing types, further specified as follows:

- Recently Completed: The West Edge (169 multi-family units), Beaver Brook (40 multi-family units), Lake 61 (65 multi-family units), The Cariad (79 units), The Trotta (125 multi-family units, including affordable units); The Mill Apartments (50 multi-family units, including affordable units), Autumn Ridge (130 units, including affordable units);
- Under Construction: Redtail Ridge subdivision (893 total housing units, of those 444 are multi-family), Belle Farm subdivision (880 total housing units, of those 730 are multi-family), Greenway Mixed-Use (243 multi-family units);
- Projects Under Review: The Garden District (Bruce Company Redevelopment) (mixed-use with 800 multi-family units), 6300 University Avenue (mixed-use with 136 multi-family units), Castle Rock Redevelopment (90 multi-family units), Conservancy Bend Apartments (additional 44 multi-family units), Middleton Shores Redevelopment (110 units of multi-family in the first phase), Aspen Commons Apartments (143 units of multi-family), Rockridge Development (376 units of multi-family), 7107 University Townhomes (additional 7 units).

Under construction subdivisions, including those for Belle Farm and Redtail Ridge, have 10-20+ year buildouts and therefore the number of actual available final platted lots is much less. These are the only two residential neighborhoods currently under construction in Middleton. A pipeline of development projects in approved, under review, and under construction stages is necessary to provide a balanced inventory of lots available for development over a longer time period.

With the addition of diverse new housing opportunities in the Ziegler Farm neighborhood, it is anticipated that some turnover in the existing housing stock could take place as existing residents move into the proposed development. Some of the existing housing stock vacated by residents moving to the new development could provide availability of naturally occurring affordable housing units within the existing municipal boundaries. Additionally, the diverse housing sizes in the proposed new development will accommodate different price points, lifestyles, and demographics for new residents to the community. In order to support the projected population increase over the next 10 years, the addition of 67.5 acres and 173 new housing units in this subdivision are needed to help meet demand and continue to diversify the community's available housing stock.

In total, the City is actively working to meet residential housing demand through a mix of housing styles, types, and affordability levels, all of which are either under construction today or ready to be constructed to meet the community's residential demand in the near future (the City had a 3.8% housing vacancy rate in 2020, below a healthy community's housing vacancy rate of 5%). Furthermore, the City's Housing Affordability Report for 2020 found that the City's multifamily housing vacancy rate is at 1.72%, whereas a healthy rate is between 5% and 8%. The City continues

to experience a low vacancy and housing shortage. While multifamily units are not proposed for this project, increasing housing supply overall to meet demand is a crucial step in increasing the availability, and affordability, of housing community-wide.

Intergovernmental Cooperation

2.1. Document Notification of Adjacent Local Governmental Units

The City of Middleton issued notification to both the Towns of Springfield and Middleton on September 9, 2024, and invited feedback and comment. These notifications act to gather information, comments, questions, and concerns from Town residents over this proposed development. As of the date of submittal, there has been no response from either township regarding this notification or project.

Land Use

3.1. Proposed USAA Boundary and Existing Rights-of-Way Map

See Map 1. The proposed addition to the USA is comprised of three existing parcels for the proposed development area and a fourth 1.5-acre parcel to the north and west of High Road. This is an existing residential parcel which is not part of the proposed Ziegler Farm development. Inclusion of this parcel will simply close the Urban Service Area Boundary to avoid the need for future amendment applications for this single parcel in the future. The proposed development area parcels are owned by "Ziegler Living TR Leonard A & Ruth E" and the intended developer of this subdivision is Veridian Homes. The site is predominantly used for agricultural purposes with a farmstead located along the western side of High Road. The development connects to existing roadways including High Road, Graber Road, Misty Valley Drive, and Waxwing Way, and provides a new internal street network.

3.2. USA Amendment Area Data

	Total Acres	Existing Developed Acres On-Site	Existing Enviro Corridor Acres	Existing Housing Units
Existing Land Use				
Agriculture/Open Space	64.2	0.0	0.0	0
Single-Family Detached	1.8	1.5	0.0	1
Right-of-Way	2.6	0.0	0.0	0
Total	**67.5**	**1.5**	**0.0**	**1**

	Total Acres**	Existing Developed Acres On-Site	Future Enviro Corridor Acres	Projected Housing Units
Proposed Land Use				
Single-Family Detached	23.1	1.5	0.1	173
Wetlands	18.6	0.0	18.4	0
Stormwater Outlot	6.3	0.0	6.3	0
Right-of-Way	11.3	0.0	0.0	0
Park / Open Space	8.2	0.0	8.2	0
Total	**67.5 acres**	**1.5 acres**	**33 acres**	**173 units**

**Total acres as shown on the concept plan (Map 3a).

3.3. Existing and Planned Land Use Map

Map 2 depicts Existing Land Use for the amendment area and Map 1a depicts the conceptual layout for the proposed parcels within the planned development. See Introduction and Section 3.1 for more information. Map 3 and 3a depicts Planned Land Use. Approximately 23.1 acres of the site is planned for detached single-family dwelling units on lots averaging +/- 0.16 acres in size (based on the concept plan as shown in Map 3a). Other open spaces throughout the development area that will be preserved for delineated wetlands total approximately 18.4 acres, inclusive of acreage covering existing right-of-way corridors for High Road and Pheasant Branch Road. Finally, 11.3 acres of right-of-way are anticipated primarily to serve the planned residential development.

Concurrently with the CARPC and WisDNR approval process, the developer will be seeking zoning and subdivision review and approval from the City of Middleton. It is anticipated that the entire development will be zoned Single Family Residential – Medium (SR-M) for conventional lots and Single Family Residential – High (SR-H) for alley-loaded lots. The proposed lots in the Ziegler Farm subdivision are compliant with the standards in the SR-M and SR-H zoning districts and no exceptions are requested. These zoning districts encourage housing affordability as well as more compact and sustainable housing development. The intended approximate gross densities for these two zoning districts range from 8-14 dwelling units per acre.

3.4 Proposed Quantity and Type of Housing Units

As shown on Map 3a, 173 lots are proposed within the planned development, with all those being single-family detached homes of varying sizes. The remaining parcels make up right-of-way, parks, and open space.

Single family homes within the project will include both carriage lane accessed, and street accessed configuration that can accommodate a wide range of housing types, architectural treatments, landscaping, floor plans and price points. This will create an integrated and diverse neighborhood that blends easily into the surrounding neighborhoods. Price points within the neighborhood will range from entry level/first time home buyer to move up and luxury housing options.

- Alley Accessed Single Family: 17
- Street Accessed Single Family: 156
- Total: 173

Carriage Lane Accessed Single Family:

Carriage lane homes enhance the variety of housing and neighborhood character thought the use of single-family home sites served by alleys. These homes are designed with integrated architecture and reduced setbacks which create an unbroken front façade of houses without garages that emphasize a human-based scale and texture in which the pedestrian and front porches become the focus.

Conventional Single Family:

Conventional single-family homes within the neighborhood will span from entry level/first time homebuyer, to luxury, and downsizer opportunities. These homes are designed with garage/home proportions and garage setbacks that focus the architecture on the front door/front façade of the home while downplaying the garage components to create a more pedestrian oriented streetscape. Conventional street access single family form a majority of the houses within the neighborhood due to grade constraints.

3.5 Land Use Phasing

The requested amendment is under 100 developable acres, and thus does not require a 10-year staging map for this application. This development is anticipated to begin construction in 2025, following CARPC and WisDNR approval, and City platting and zoning processes. Construction of the project is planned for four phases over the course of the next 5-6 years.

- Phase 1 – West of High Street; 36 new housing units and 2 new stormwater management areas.
- Phase 2 – West of High Street; 47 new housing units, 2 new stormwater management areas, and 1 existing protected wetland area.
- Phase 3 – East of High Street; 46 new housing units, 4 new stormwater management areas, extension of the existing trail network, and 2 existing protected wetland areas.
- Phase 4 – East of High Street; 44 new housing units, 1 new stormwater management area, and 1 new dedicated park.

Natural Resources:

4.1. Natural Features.

Per CARPC mapping, the site has both Protection and Stewardship Areas shown. These maps utilize State and County data to determine where environmental protection areas are located. However, in instances where site-specific analysis has been completed, that data is utilized to inform the precise location of the environmental features and protection areas.

The developer has conducted a wetland delineation for the site which depicted the precise locations of the wetlands surrounding Graber Pond and wetland areas east of High Road. Per the Graber Pond Master Plan, a 100' buffer is planned to surround the wetlands and surface water. A 75' buffer is used elsewhere.

Detailed site grading plans will be reviewed during the required City's Zoning, Site Plan, and Subdivision processes. A stormwater management plan has been prepared for the site.

The Wisconsin DNR Bureau of Natural Heritage Conservation for Endangered Resources Review Preliminary Assessment (completed August 26, 2024) indicates that the project will require further DNR review to ensure compliance. An Endangered Resources Review Request was submitted following the preliminary assessment. The Wisconsin DNR provided a complete review on August 30, 2024. The Endangered Resources Review may contain Natural Heritage Inventory data, including specific locations of endangered resources, which are considered sensitive and are not subject to Wisconsin's Open Records Law. Information contained in the Review may be shared with individuals who need this information to carry out specific roles in the planning, permitting, and implementation of the proposed project. Specific locations of endangered resources may not be released or reproduced in any publicly disseminated documents. Any required, recommended, or suggested actions are listed below:

- Required Actions: 0 Species
- Recommended Actions: 6 Species
- No Follow-Up Actions: 12 Species
- Additional Recommendations Specified: No

4.2. Parks and Stormwater Management Facilities Map

See Map 3a. One neighborhood park, including recreational open spaces is planned for the amendment area, totaling 8.2 acres. Each will provide access for residents within the proposed development. Sidewalks will also be provided throughout the proposed development to link the parks, open space, and residential spaces together.

Multiple smaller stormwater ponds are dispersed throughout the site. This total area dedicated to stormwater management facilities is 6.3 acres. The stormwater area is described in greater depth in Section 5.9.

Park and open space components within the neighborhood are designed to build upon the environmental framework of the site by offering trail extensions and park space while preserving and buffering the Graber Pond area with 100' buffers and other wetland corridors with 75' buffers and carefully placed stormwater management.

Parks:

- Park space in the western portion of the site creates additional buffering to Graber Pond. The eastern park space offers recreational space adjacent to the greater wetland and trail corridor. Park spaces will be dedicated to the City of Middleton and will exclude stormwater management and wetlands.

Trails:

- Trails utilize the wetland buffer to create a new east-west corridor connection along the larger environmental corridors. This system is connected to the High Road frontage, through the utilization of a short boardwalk section, filling the missing links of the "Misty Valley Trail" an off-street path from Graber Pond through the Caneel Corner Conservancy and across the site to the west segment of the Pheasant Branch Trail. The project also proposes the extension of the existing trail from the north of Whittlesey Road with a boardwalk section, co-located with the required utilities to minimize wetland impacts.

Wetland:

- The design of the neighborhood seeks to preserve the existing wetlands with minimal disturbances and 100' buffers around Graber Pond and 75' buffers in other wetland locations. The resulting preserved wetlands offer a publicly dedicated environmental corridor between Graber Pond and Pheasant Branch Conservancy.

4.3. Environmental Corridors

In total, 33 acres are proposed as Environmental Corridor, including areas designated as open space and parks, stormwater management areas, and wetlands, described in Section 4.2. The proposed corridor contains approximately 48.7% of the amendment area, a significant increase from nearly all existing row cropping on-site today without any area designated within an environmental corridor. Exact locations of stormwater areas and park land may be refined through the platting process and the corridor may need to be adjusted accordingly prior to plat approval.

4.4. Proposed Environmental Corridors Map

See Map 4.

4.5. Environmental Corridors Requirements

The proposed corridor achieves the intended goals outlined for Environmental Corridors in the Water Quality Plan for Dane County. It protects water quality and public health by including the groundwater recharge area as part of the corridor, as well as an additional planned stormwater retention area. It also provides and encourages outdoor recreation options by including planned neighborhood parks and open space. The proposed environmental corridors meet the minimum requirements for designation of CARPC protection areas. Note that a small portion of the protection area is modified based on actual field conditions shown via wetland delineation. Because wetlands and other natural features are not present in this area, environmental corridors are not designated. The proposed environmental corridors provide additional protection for all areas within the stewardship areas which are not required but are recommended to be included within a corridor designation.

Utilities and Stormwater Management

5.1. Proposed Sanitary Sewer

For purposes of utility calculations, this report accounts for the three development parcels to be added to the USA boundary, as well as the two development parcels that are within the existing USA boundary. The calculations include all five parcels to accurately describe available capacity and proposed capacity based on the new development area.

The sanitary sewer in this amendment area will drain into the Pheasant Branch Interceptor (PBI) sewer. The sewer pipe varies from 18 inches to 30 inches. This system continues south along the Pheasant Branch Creek before heading east, north of Century Ave, and ultimately connecting into a 36" MMSD main south of Century Ave in Middleton Springs Drive. The PBI was installed to serve areas in the City's northwest quadrant planning area including this proposed development and to relieve the City's Valley Interceptor from future capacity concerns. Per the 2021 Water and Sewer Utility System Analysis (updated from 2019), the PBI has design capacities ranging from 9.4 cubic feet per second (cfs) to 12.32cfs depending on location and segment slopes.

The conceptual utility plans show proposed sanitary sewer main connections to the PBI in three locations. Per the developer's engineer, wastewater will be handled within the development by 8" sanitary sewer mains that connect into the existing 18" interceptor at a few locations throughout the site and the 30" interceptor at the end of Whittlesey Road (see Map 5).

A "Middleton Collection System Map" is provided as Attachment J showing downstream sewers. As noted in the 2019 Utility Master Plan, this area was included in the design area for the main at a rate of 293 single-family households. The proposed development will be less than that design rate with a proposed 173 single-family households.

On the west side of the development, gravity flow will generally be from west to east through the proposed development. On the east side of the development, gravity flow will generally be from north to south. Each leg of the proposed sewer main within the development will provide a maximum capacity of 40gpm.

The development connection to the PBI at Whittlesey Road where sewer capacity is higher is planned to be extended to the east end of the plat. It is anticipated that portions of the adjacent Red Tail Ridge preliminary single family residential plat area will drain into this sewer. Coordination with the adjacent landowner and this development will determine if a 10-inch main is required for the flow capacity in this pipe.

5.2. USAA Average Daily and Peak Wastewater Flow

A peaking factor of 4.0 for residential and 2.5 for nonresidential was used to determine the projected peak sanitary sewer flows from the proposed development. Using the total average daily water demand values noted below (See Section 5.6), the total anticipated sanitary sewer flows from this development are estimated to have a peak flow of 0.31 cubic feet per second (cfs) and an average daily wastewater flow of 35gpm for the USAA.

5.3. Average Wastewater Treatment Plant Daily Flow

Established in 1930 to protect the lakes and streams of the upper Yahara watershed, Madison Metropolitan Sewerage District (MMSD) serves about 380,000 people in 26 Madison-area customer communities covering about 186 square miles, including the City of Middleton. The District owns and operates 142 miles of pipe and 18 regional pumping stations that convey approximately 41 million gallons of wastewater to the Nine Springs Wastewater Treatment Plant daily. Source: Madison Metropolitan Sewerage District webpage. The current average daily flow for the Pheasant Branch Interceptor is 1.05cfs (471.24gpm). The future peak flow of the Pheasant Branch interceptor including downstream flows is 3.55cfs (471.24gpm)

5.4. Wastewater Treatment Plant Capacity

MMSD has indicated to the City that the Nine Springs Wastewater Treatment Plant has a sufficient rated capacity and reserve capacity to meet the projected demand from this development.

Based on the water use assumptions and peaking factors (See Section 5.6), there appears to be sufficient capacity in the existing and proposed new sanitary sewer mains to serve the proposed development. Based on the City's recent 2019 Utility Master Plan, the 18-inch diameter PBI has a design capacity of 9.41cfs immediately upstream of the proposed development and is only seeing a current peak flow of approximately 1.09cfs when the 2019 Utility Master Plan study was drafted. Similarly, the 30-inch diameter PBI has a design capacity of 10.36cfs immediately downstream of the development and is only seeing a current peak flow of approximately 1.09cfs when the 2019 Utility Master Plan study was drafted. The PBI interceptor has more than sufficient capacity to take all potential development for this area and was designed for full buildout of this area of the City, including capacity that has been attributed to the Belle Farms and Redtail Ridge developments which were approved after the Utility Master Plan study.

5.5. Proposed USAA Public Water Supply

See Map 4a. The development is anticipated to connect into existing public water mains at eight locations. The west side of the development will have three connections into to the existing 12-inch water main located in High Road and three connections into the existing 8-inch water main located in an easement between Misty Valley Drive and Graber Road. The east side of the development will connect into the existing 12-inch water main in High Road and the existing 8-inch main at the end of Waxwing Way. This will complete several loops on the west side of High Road and will create a loop from Waxwing to High Road. It is also planned to extend to the limits of the east side of the plat where it will tie into the future Red Tail Ridge development for additional looping.

5.6. Estimated USAA Daily and Peak Hourly Water Demand

The additional water use for the proposed development was conservatively estimated using values from the 2019 Utility Master Plan and water industry standards of water use. It was assumed that 2.1 people occupy an average multi-family unit based on the mix of studio, one-bedroom, two-bedroom, and three-bedroom apartments. It was assumed that 2.8 people occupy an average single-family unit based on the mix of single-family detached units, which include the Town, Shotguns,

Nest, Cottage, and Estate Homes of the development. These values match the values presented in Table. 2.02-1 in the 2019 Utility Master Plan for future growth population per development type. A water use of 100 gallons per capita per day was also assumed and is based off the 2019 Utility Master Plan for the total water use per person in the City.

The total average daily demand from the development was assumed to be approximately 50,000 gallons per day, or 35 gallons per minute (gpm). This was calculated assuming 173 lots, consisting of 17 cottage homes and 156 single-family homes using the assumed occupancy above and 100 gallons per capita per day. Multiplying the average day demand by the average to maximum day demand ratio of 2.0, the assumed total demand of 70gpm was used for the maximum day demand. Multiplying the average day demand by the average peak hour ratio of 2.78, an additional 95gpm was added to the 2022 maximum day peak hour demands.

5.7. Average Daily and Peak Hourly Water Demand

The 2019 Utility Master Plan Update indicates the City's calculated average daily water demand as 1,528gpm. Calculating that for the WisDOA estimated 2023 population of 23,868, and assuming the same projected per capita sales of 100gcd, divided by the sales to pumpage ratio of 0.93, would lead to a calculated 2021 average daily water demand of 1,782gpm.

Additionally, the City's current peak hourly water demand is 4,560gpm. This is based on the reported maximum hour water demand (maximum rate for any hour on the maximum day) of 4,249gpm on August 22, 2018 from the City's 2019 Utility Master Plan, divided by the calculated average daily water demand (1,528gpm) to get an average peak factor of 2.78, and multiplying that by the calculated 2021 average daily water demand of 1,782gpm. All calculations and data sources have been provided by the City's Public Works Department.

5.8. Water Supply System Capacity

Calculations for the proposed development include both the area within the existing Urban Service Area Boundary where new development is proposed, and within the area of proposed new Urban Service Area. The City's engineer studied the different demand projections from the 2019 Utility Master Plan before development and now with proposed development.

Well #2 was rehabilitated in the Spring of 2024. The life expectancy of this well after rehabilitation is extended to 2034. At that time, reevaluation of the well will be a part of larger water system improvements that year. As recommended in the 2019 Utility Master Plan, no additional storage is needed to meet the 2040 projected maximum day plus fire demands even if Well No. 2 decommissioned as there is not reserve capacity deficit.

The City's engineer also studied fire flow demand conditions based on information from the 2019 Utility Master Plan. Overall, the recommendations from the 2019 Utility Master Plan are still applicable. Pressure and available fire flow throughout the system with the added development appear to be acceptable and are above the minimum Wisconsin Department of Natural Resources minimum requirements of 35 psi static pressure and 500gpm at 20 psi available fire flow. The minimum fire flow available in this area under 2040 conditions while maintaining 20 psi in the system is approximately 2,100gpm. The minimum static pressure in this area under 2040 conditions is 44psi. Therefore, the Fire Department's previously indicated goal of 1,000gpm at a residual pressure of 20 psi and a static pressure of 40 psi has been met for the new development. It should be noted that future growth to the northeast will likely continue to decrease fire flow for water main on High Street until looping can be fully completed though the development to Pheasant Branch Road, requiring further review. However, this development does provide additional looping capacity

west of High Road and will create a loop with the water main that currently dead ends north of the development area which will increase the fire flow capacity in the area.

5.9. Proposed Stormwater Management Standards

The City of Middleton has taken a proactive approach to addressing stormwater management needs. The City recognizes the necessity for properly managing stormwater runoff from existing and new development because of its location adjacent to Lake Mendota and the low water table in the area.

Middleton has a Stormwater Runoff Control Ordinance, Erosion Control Ordinance, and Stormwater Utility Ordinance. Additionally, the City has established the Water Resources Management and Stormwater Commission to oversee and plan for stormwater. In 2010, the City also conducted a Hydraulic Study and Management Plan for Graber Pond.

The City enforces a policy of stormwater management on all new development and redevelopment, in addition to a stormwater utility on existing development. These requirements address both stormwater quantity and quality.

Map 5 depicts the stormwater management areas and storm sewer provided within the proposed development.

5.10. Stormwater Management Plan

There are two subareas within the development: the western portions which drain to Graber Pond, and the remaining eastern portions that drain south to Pheasant Branch.

A full stormwater management plan has been developed and submitted to City staff and will be reviewed by relevant City of Middleton Committees such as the Water Resources Management Commission in late November. An executive summary (Attachment H) of the stormwater management plan is included as an attachment (details may change as design progression occurs). The stormwater report will show 100% stay-on is being provided for the Graber Pond Watershed and the eastern watershed separately. It is being requested at the Water Resources Management and Stormwater Commission to allow credit for the infiltration for run-on from offsite sources. The offsite run-on volume has been reduced to assume the offsite area is meeting 100% and 90% stay-on for the offsite Graber Pond watershed and the offsite eastern watershed respectively. Without accounting for infiltration provided to run-on from offsite sources, the Graber Pond watershed will meet 100% of the predevelopment infiltration volume and the eastern watershed will meet 90% of the predevelopment infiltration volume.

For the areas of the development that drain to Graber Pond, stormwater management for the Ziegler subdivision is designed for 100% infiltration of the average annual predevelopment volume, meeting peak control for the 1-year though 200-year storm events, and employing a water quality standard of 92% TSS removal, all of which exceed City of Middleton standards. For the remainder of the development area that drains to Pheasant Branch, stormwater management requirements meet minimum City of Middleton standards.

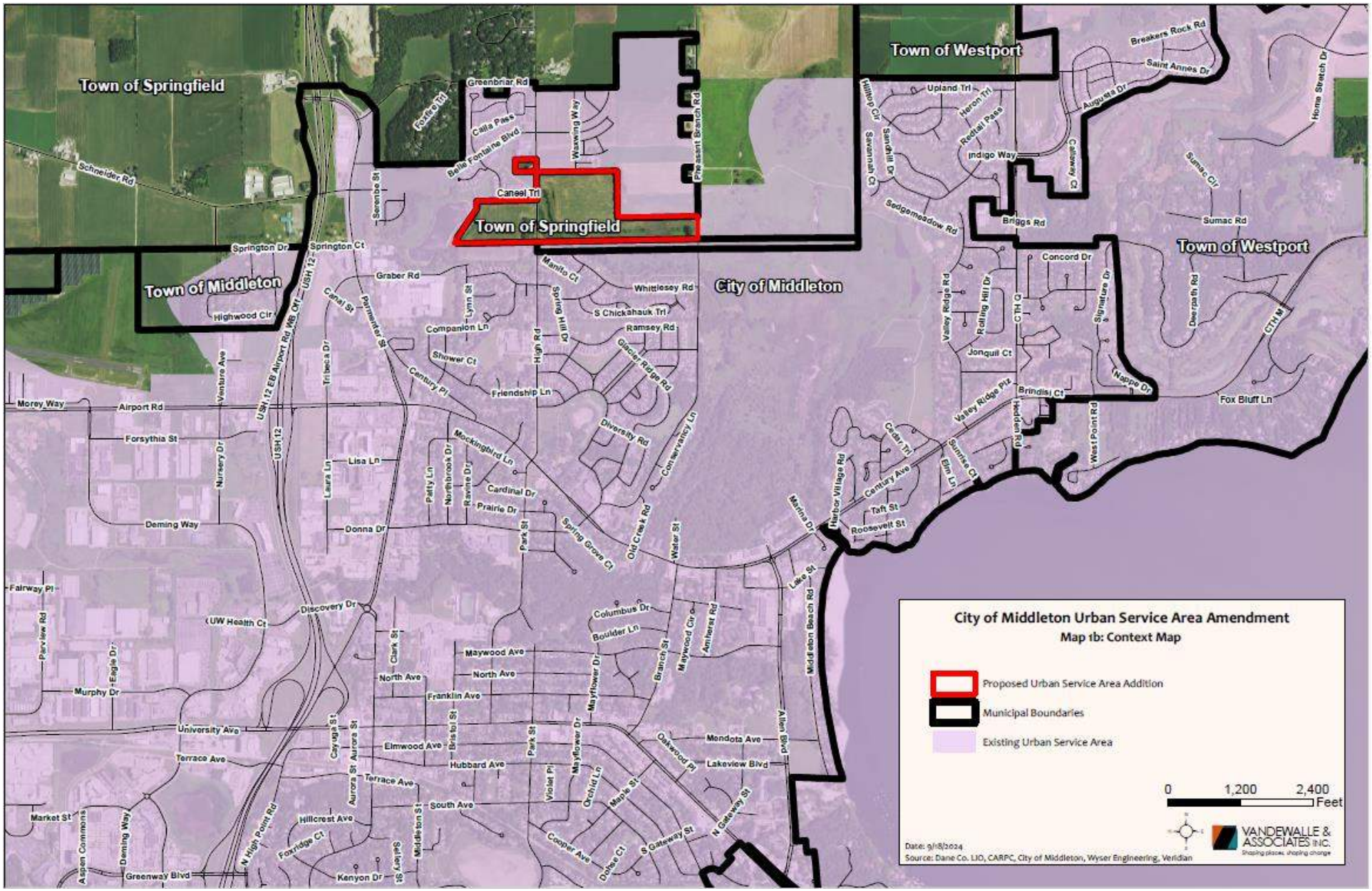
As shown on Map 4, the proposed stormwater plan includes two bioretention basins, two infiltration basins, and one wet detention basin on the west side of High Road and two bio retention basins, one infiltration basin, and one wet pond on the east side of High Road. Each are located outside of the 100' wetland buffer or the wetlands themselves, per the Graber Pond Master Plan.

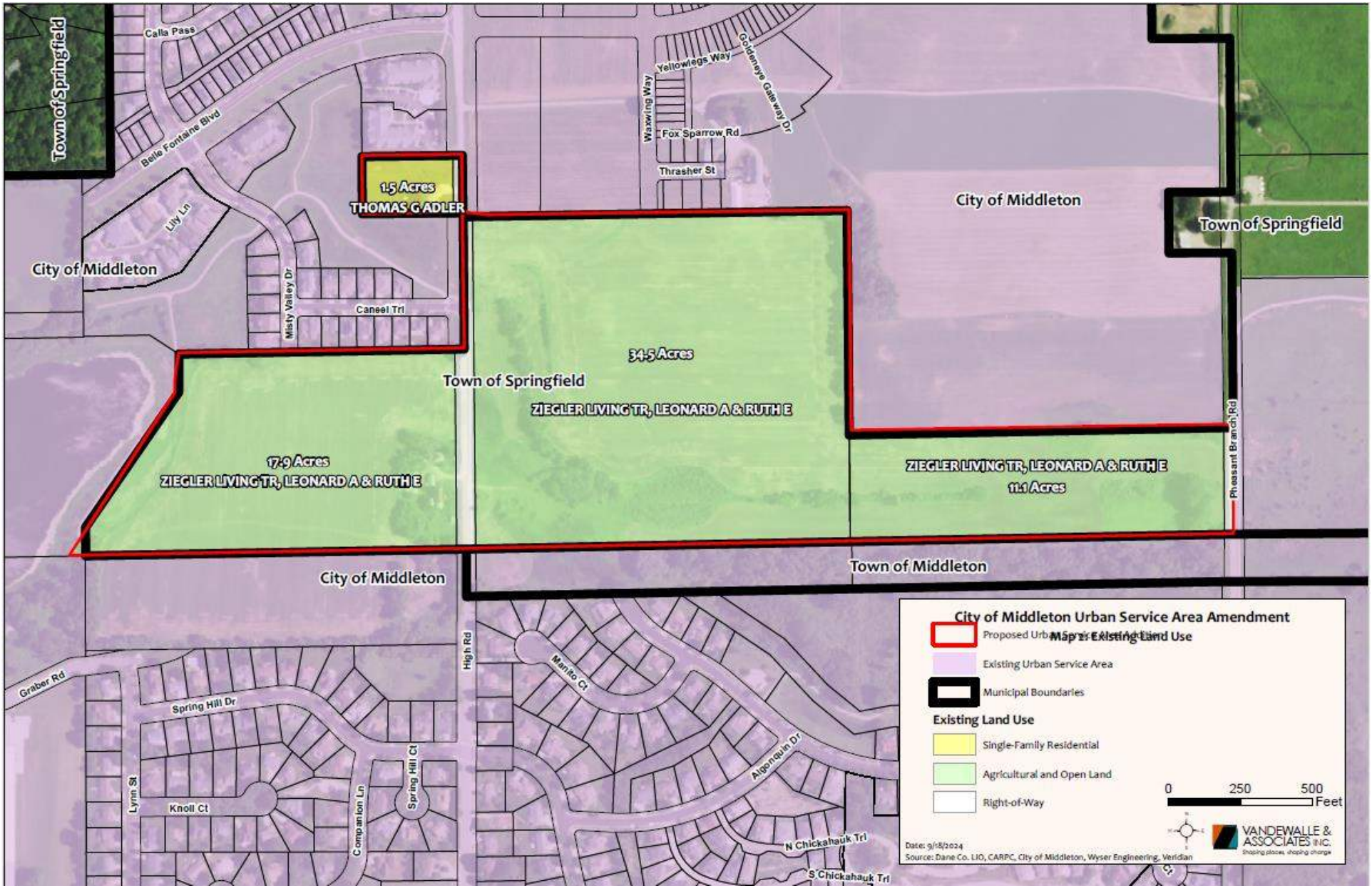
Finally, all public and private streets will utilize the detention basins as their primary treatment device. Any outfalls from the streets into the basins will discharge into small bioretention forebays to provide TSS and infiltration before overtopping into the main area of the dry ponds.

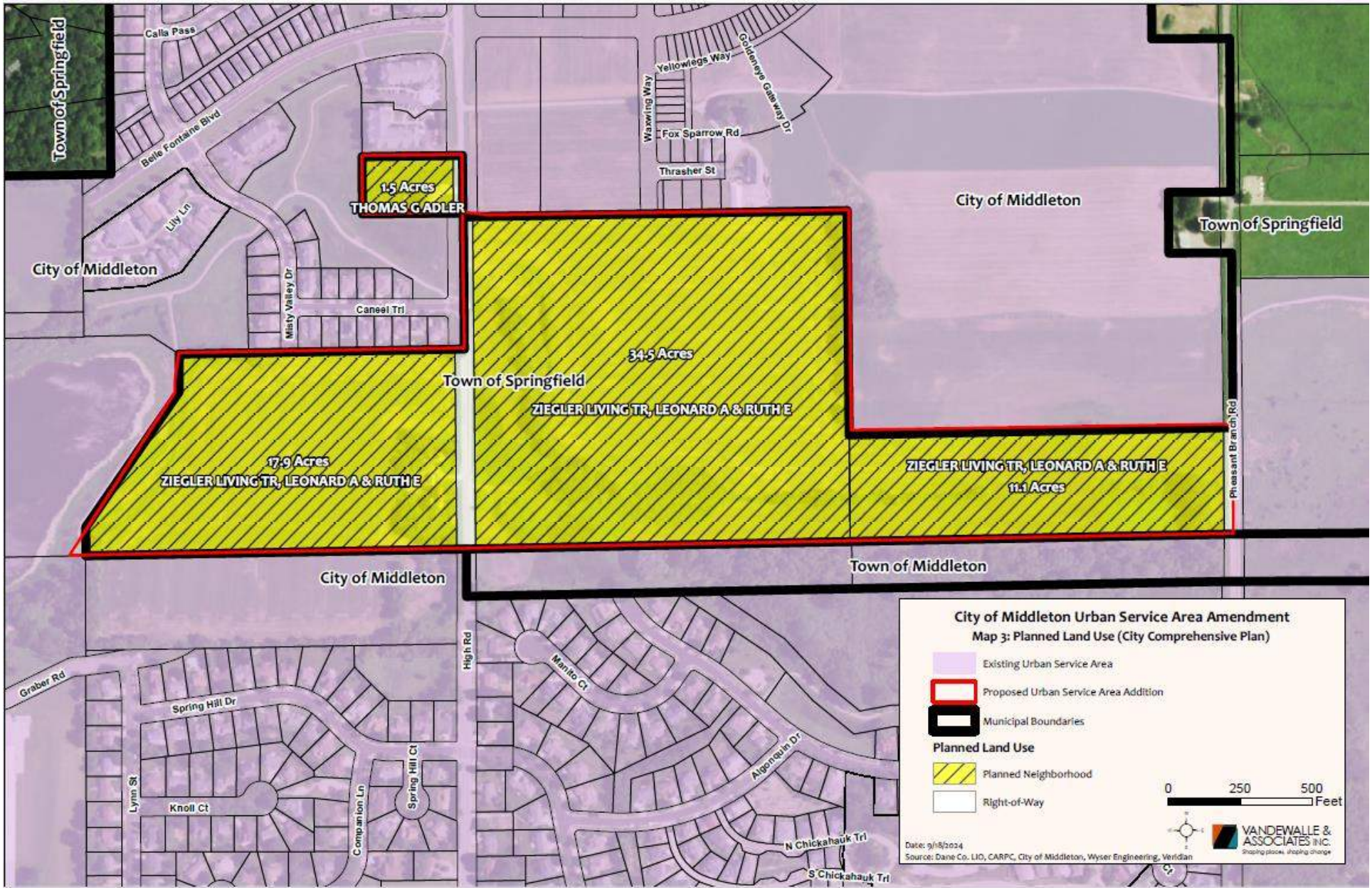
Existing off-site runoff from upstream lands currently drains through the proposed development site. That runoff is planned to be collected in a separate storm sewer pipe system and routed through east side of the development toward the wetlands to the south and added stormwater management facilities on-site.

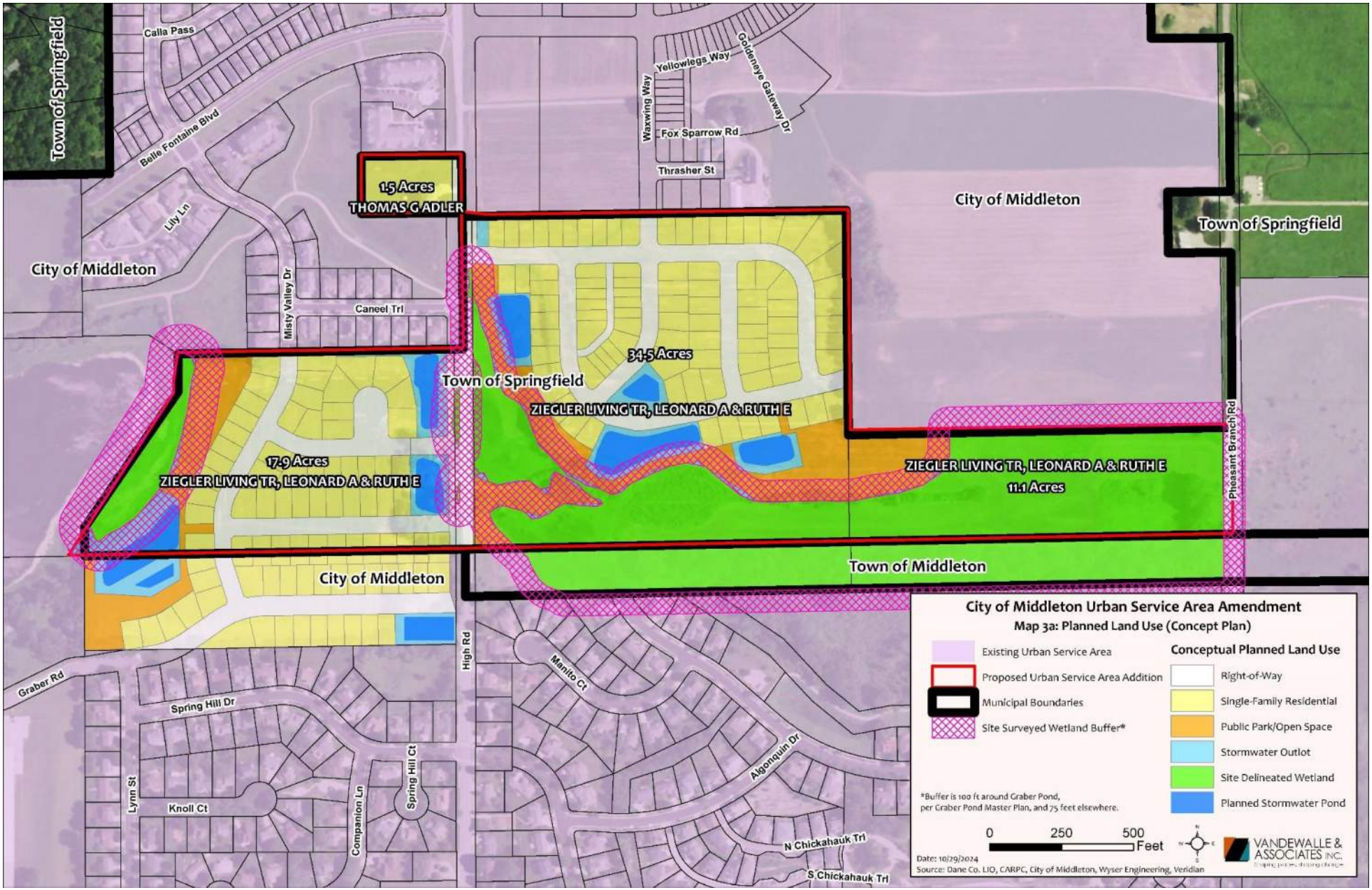
Long-term maintenance and ownership of all on-site stormwater management devices in the proposed development will be handled privately through recorded agreements, outlined in the covenants, deed restrictions, and Homeowners Association.

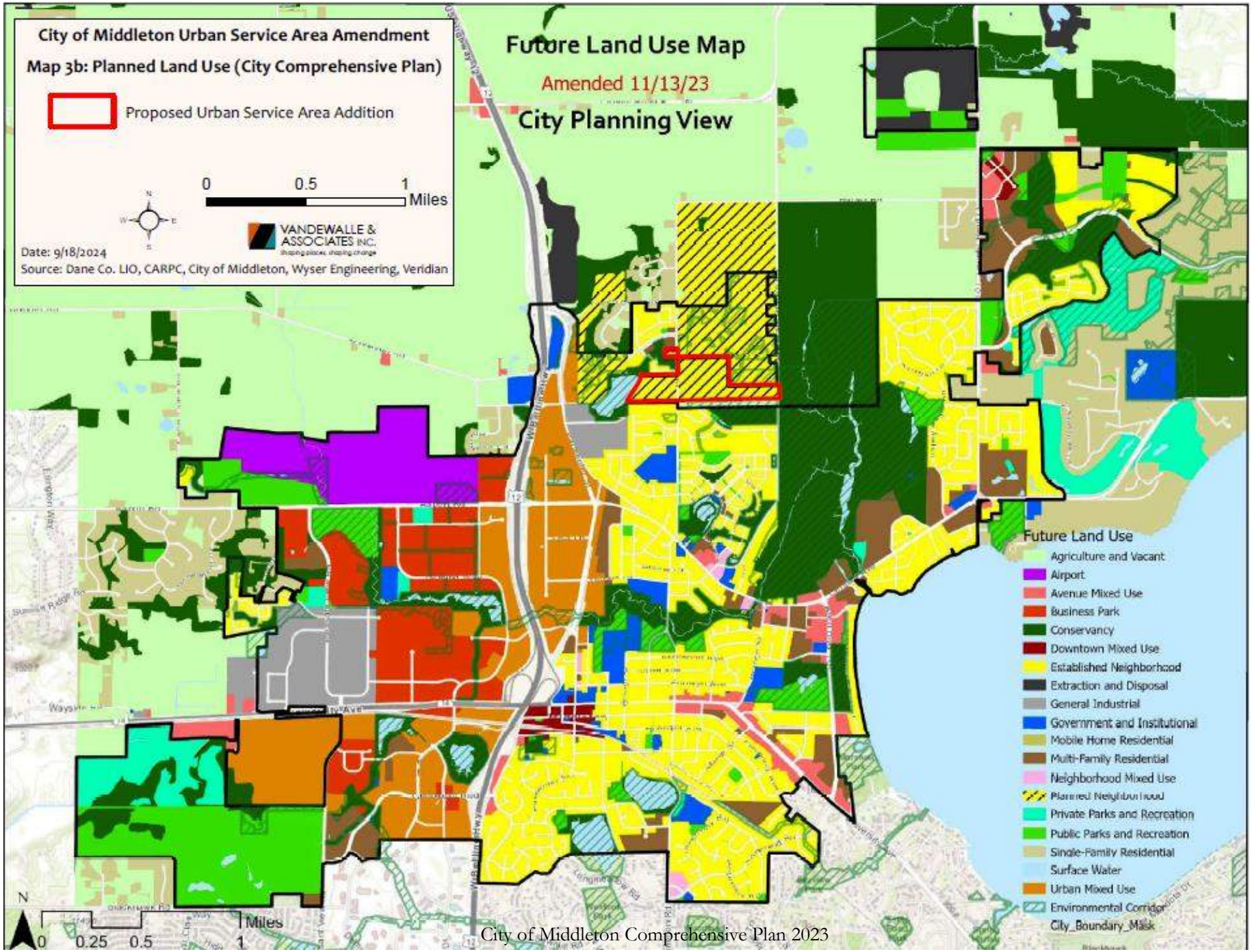

Town of Springfield
Calla Pass
Belle Fontaine Blvd
Lily Ln
City of Middleton
1.5 Acres
THOMAS G ADLER
Misty Valley Dr
Caneel Trl
Yellowlegs Way
Goldeneye Gateway Dr
Waxwing Way
Fox Sparrow Rd
Thrasher St
City of Middleton
Town of Springfield
34.5 Acres
Town of Springfield
ZIEGLER LIVING TR, LEONARD A & RUTH E
17.9 Acres
ZIEGLER LIVING TR, LEONARD A & RUTH E
ZIEGLER LIVING TR, LEONARD A & RUTH E
11.1 Acres
Pheasant Branch Rd
Town of Middleton
City of Middleton
High Rd
Graber Rd
Spring Hill Dr
Spring Hill Ct
Lynn St
Knoll Ct
Companion Ln
Manito Ct
Algonquin Dr
N Chickahauk Trl
S Chickahauk Trl
City of Middleton Urban Service Area Amendment
Map 1: Proposed Urban Service Amendment Area
Existing Urban Service Area
Proposed Urban Service Area Addition
Municipal Boundaries
0
250
500
Feet
Date: 9/18/2024
Source: Dane Co. LIO, CARPC, City of Middleton, Wyser Engineering, Veridian
VANDEWALLE & ASSOCIATES INC.
Shaping places, shaping change


Town of Springfield
Town of Westport
Town of Springfield
Town of Middleton
City of Middleton
Town of Westport
City of Middleton Urban Service Area Amendment
Map 1b: Context Map
Proposed Urban Service Area Addition
Municipal Boundaries
Existing Urban Service Area
0
1,200
2,400
Feet
VANDEWALLE & ASSOCIATES INC.
Date: 9/18/2024
Source: Dane Co. LIO, CARPC, City of Middleton, Wyser Engineering, Veridian

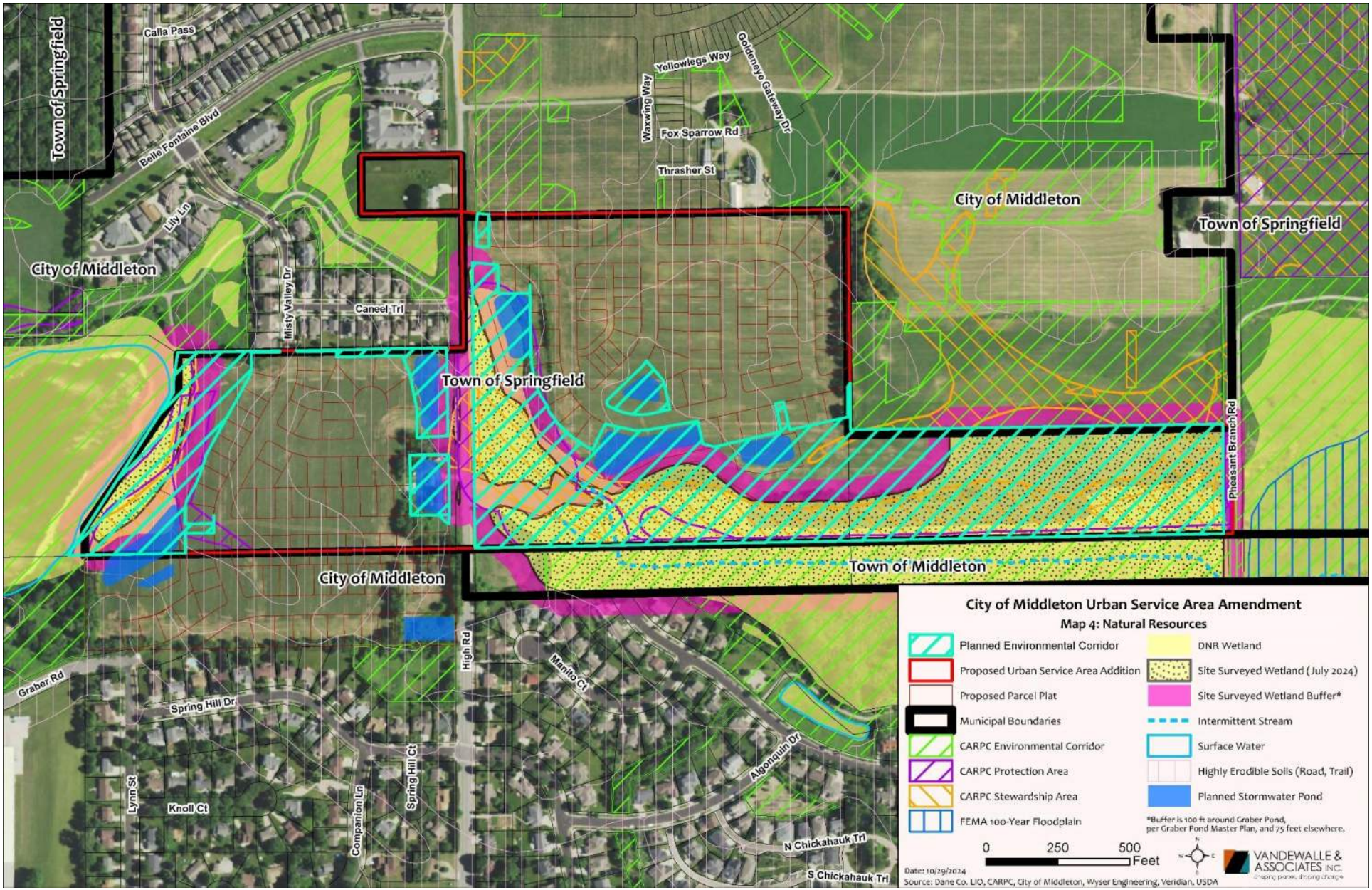

Town of Springfield
Calla Pass
Belle Fontaine Blvd
Lily Ln
City of Middleton
1.5 Acres
THOMAS G ADLER
Misty Valley Dr
Caneel Trl
Yellowlegs Way
Goldeneye Gateway Dr
Waxwing Way
Fox Sparrow Rd
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City of Middleton
Town of Springfield
34.5 Acres
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ZIEGLER LIVING TR, LEONARD A & RUTH E
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Pheasant Branch Rd
City of Middleton
Town of Middleton
Graber Rd
Spring Hill Dr
Lynn St
Knoll Ct
Companion Ln
Spring Hill Ct
High Rd
Manito Ct
Algonquin Dr
N Chickahauk Trl
S Chickahauk Trl
City of Middleton Urban Service Area Amendment
Map 2: Existing Land Use
Proposed Urban Service Area
Existing Urban Service Area
Municipal Boundaries
Existing Land Use
Single-Family Residential
Agricultural and Open Land
Right-of-Way
0
250
500
Feet
Date: 9/18/2024
Source: Dane Co. LIO, CARPC, City of Middleton, Wyser Engineering, Veridian
VANDEWALLE & ASSOCIATES INC.

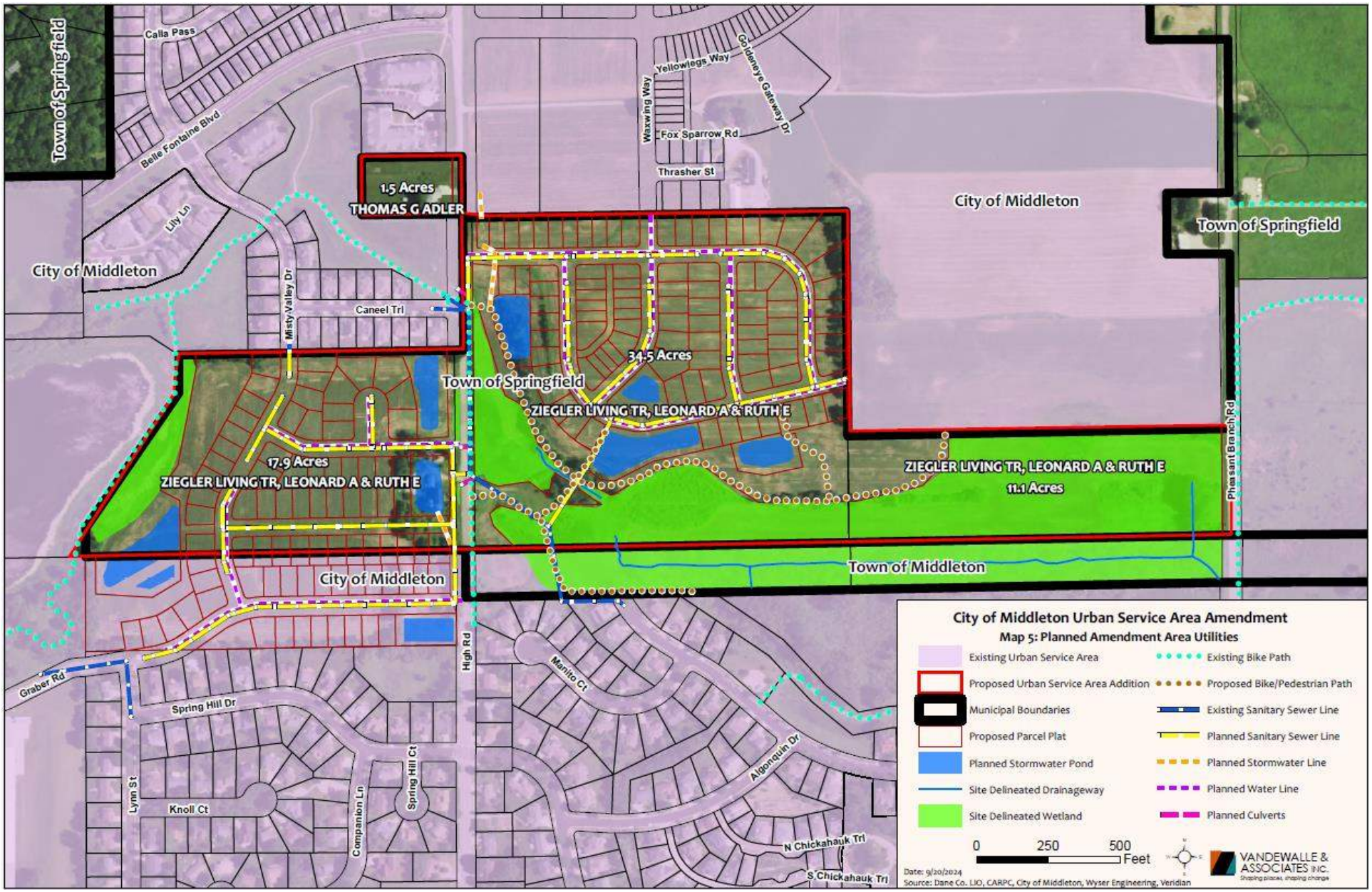

Town of Springfield
Calla Pass
Belle Fontaine Blvd
Lily Ln
City of Middleton
1.5 Acres
THOMAS G ADLER
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Yellowlegs Way
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Pheasant Branch Rd
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Knoll Ct
Companion Ln
Spring Hill Ct
High Rd
Manito Ct
Algonquin Dr
N Chickahauk Trl
S Chickahauk Trl
City of Middleton Urban Service Area Amendment
Map 3: Planned Land Use (City Comprehensive Plan)
Existing Urban Service Area
Proposed Urban Service Area Addition
Municipal Boundaries
Planned Land Use
Planned Neighborhood
Right-of-Way
0 250 500 Feet
VANDEWALLE & ASSOCIATES INC.
Shaping places, shaping change
Date: 9/18/2024
Source: Dane Co. LIO, CARPC, City of Middleton, Wyser Engineering, Veridian


Town of Springfield
Calla Pass
Belle Fontaine Blvd
Lily Ln
City of Middleton
Misty Valley Dr
Caneel Trl
1.5 Acres
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Spring Hill Dr
Manito Ct
Algonquin Dr
Lynn St
Knoll Ct
Companion Ln
Spring Hill Ct
N Chickahauk Trl
S Chickahauk Trl
City of Middleton Urban Service Area Amendment
Map 3a: Planned Land Use (Concept Plan)
Existing Urban Service Area
Proposed Urban Service Area Addition
Municipal Boundaries
Site Surveyed Wetland Buffer*
*Buffer is 100 ft around Graber Pond, per Graber Pond Master Plan, and 75 feet elsewhere.
Conceptual Planned Land Use
Right-of-Way
Single-Family Residential
Public Park/Open Space
Stormwater Outlot
Site Delineated Wetland
Planned Stormwater Pond
0 250 500 Feet
Date: 10/29/2024
Source: Dane Co. LIO, CARPC, City of Middleton, Wyser Engineering, Veridian
VANDEWALLE & ASSOCIATES INC.



City of Middleton Comprehensive Plan 2023


Town of Springfield
Calla Pass
Belle Fontaine Blvd
Lily Ln
City of Middleton
Misty Valley Dr
Caneel Trl
Yellowlegs Way
Waxwing Way
Goldeneye Gateway Dr
Fox Sparrow Rd
Thrasher St
City of Middleton
Town of Springfield
Pheasant Branch Rd
Town of Springfield
Town of Middleton
City of Middleton
Graber Rd
Spring Hill Dr
High Rd
Manito Ct
Algonquin Dr
Lynn St
Knoll Ct
Companion Ln
Spring Hill Ct
N Chickahauk Trl
S Chickahauk Trl
City of Middleton Urban Service Area Amendment
Map 4: Natural Resources
Planned Environmental Corridor
Proposed Urban Service Area Addition
Proposed Parcel Plat
Municipal Boundaries
CARPC Environmental Corridor
CARPC Protection Area
CARPC Stewardship Area
FEMA 100-Year Floodplain
DNR Wetland
Site Surveyed Wetland (July 2024)
Site Surveyed Wetland Buffer*
Intermittent Stream
Surface Water
Highly Erodible Soils (Road, Trail)
Planned Stormwater Pond
*Buffer is 100 ft around Graber Pond, per Graber Pond Master Plan, and 75 feet elsewhere.
0 250 500 Feet
Date: 10/29/2024
Source: Dane Co. LIO, CARPC, City of Middleton, Wyser Engineering, Veridian, USDA
VANDEWALLE & ASSOCIATES INC.


Town of Springfield
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Belle Fontaine Blvd
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1.5 Acres
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Goldeneye Gateway Dr
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Town of Springfield
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Knoll Ct
Companion Ln
Spring Hill Ct
Manito Ct
Algonquin Dr
N Chickahauk Trl
S Chickahauk Trl
City of Middleton Urban Service Area Amendment
Map 5: Planned Amendment Area Utilities
Existing Urban Service Area
Proposed Urban Service Area Addition
Municipal Boundaries
Proposed Parcel Plat
Planned Stormwater Pond
Site Delineated Drainageway
Site Delineated Wetland
Existing Bike Path
Proposed Bike/Pedestrian Path
Existing Sanitary Sewer Line
Planned Sanitary Sewer Line
Planned Stormwater Line
Planned Water Line
Planned Culverts
0
250
500
Feet
Date: 9/20/2024
Source: Dane Co. LIO, CARPC, City of Middleton, Wyser Engineering, Veridian
VANDEWALLE & ASSOCIATES INC.

Attachments

Attachment A: Plan Commission and City Council USA Amendment Resolutions

Attachment B: Future Park Facilities Map from Park and Open Space Plan

Attachment C: Town of Springfield Future Land Use and Farmland Preservation Map

Attachment D: Wisconsin DNR Bureau of Natural Heritage Conservation for Endangered Resources Review Preliminary Assessment

Attachment E: 2020 City of Middleton Housing Affordability Map

Attachment F: Dane County Groundwater Recharge Map

Attachment G: US Geological Survey – Dane County Depth to Bedrock Map

Attachment H: Executive Summary of Stormwater Report

Attachment I: Utility Plan (2019)

Attachment J: Collection Systems Map

Attachment K: Wetland Delineation by Heartland

Attachment L: 2020 Housing Affordability Report

Appendix A

PLAN COMMISSION RESOLUTION 2024-46
Recommending Approval of an Urban Service Area Amendment in the City of Middleton for the Ziegler Farm Development

Resolution regarding the recommendation of the Common Council to initiate an Amendment to the Middleton Urban Service Area to include 67.5 acres of property owned by Ziegler Living Trust and Thomas G Adler located west and east of High Road (parcel numbers 0808-354-9740-8, 0808-363-9150-1, 0808-363-9710-3, 0808-354-9501-7) to accommodate the proposed Ziegler Farm development.

Whereas, the City of Middleton has been approached by developers to develop the existing agricultural property located on the north side of the City, on full public water and sanitary sewer services to accommodate a development; and,

Whereas, the extension of the public water and sanitary sewer lines to serve the proposed residential development will require an amendment of the Middleton Urban Service Area to extend its boundary to include the 4 parcels; and,

Whereas, the proposed development is consistent with the City of Middleton Comprehensive Plan, adopted in 2023, which depicts the area in the Planned Neighborhood land use category, which allows for developing areas of the city, carefully planned and integrated neighborhoods that encourage a mix of residential types and lot sizes, and neighborhood business types; and,

Whereas, the Capital Area Regional Planning Commission (CARPC), acting as the regional agent of the Wisconsin Department of Natural Resources, requires the City Council to pass a resolution requesting the amendment of the Middleton Urban Service Area; and,

Whereas, the City of Middleton Plan Commission advises the City Council on all development-related matters, as consistent with Wisconsin Statutes; and

NOW THEREFORE BE IT RESOLVED that the Plan Commission of the City of Middleton and Mayor Kuhn hereby recommend the City Council pass the required resolution to formally request the Capital Area Regional Planning Commission (CARPC) consider and approve the requested amendment to the Middleton Urban Service Area to include within its boundary the 4 parcels totaling 67.5 acres, located west and east of High Road in the primary growth area of the City of Middleton.

This resolution was adopted at a regular meeting of the Middleton Plan Commission on the 22nd day of October, 2024.

Kurt J Sonnentag

Kurt Sonnentag, Plan Commission Chair

ATTEST:

Lorie J. Burns

Lorie J. Burns, City Clerk

Appendix A

COMMON COUNCIL RESOLUTION 2024-47

Recommending Approval of an Urban Service Area Amendment in the City of Middleton for the Ziegler Farm Development

Resolution regarding the recommendation of the Common Council to initiate an Amendment to the Middleton Urban Service Area to include 67.5 acres of property owned by Ziegler Living Trust and Thomas G Adler located west and east of High Road (parcel numbers 0808-354-9740-8, 0808-363-9150-1, 0808-363-9710-3, 0808-354-9501-7) to accommodate the proposed Ziegler Farm development.

Whereas, the City of Middleton has been approached by developers to develop the existing agricultural property located on the north side of the City, on full public water and sanitary sewer services to accommodate a development; and,

Whereas, the extension of the public water and sanitary sewer lines to serve the proposed residential development will require an amendment of the Middleton Urban Service Area to extend its boundary to include the 4 parcels; and,

Whereas, the proposed development is consistent with the City of Middleton Comprehensive Plan, adopted in 2023, which depicts the area in the Planned Neighborhood land use category, which allows for developing areas of the city, carefully planned and integrated neighborhoods that encourage a mix of residential types and lot sizes, and neighborhood business types; and,

Whereas, the Capital Area Regional Planning Commission (CARPC), acting as the regional agent of the Wisconsin Department of Natural Resources, requires the City Council to pass a resolution requesting the amendment of the Middleton Urban Service Area; and,

NOW THEREFORE BE IT RESOLVED that the Common Council of the City of Middleton hereby request the Capital Area Regional Planning Commission (CARPC) consider and approve the requested amendment to the Middleton Urban Service Area to include within its boundary the 4 parcels totaling 67.5 acres, located west and east of High Road in the primary growth area of the City of Middleton.

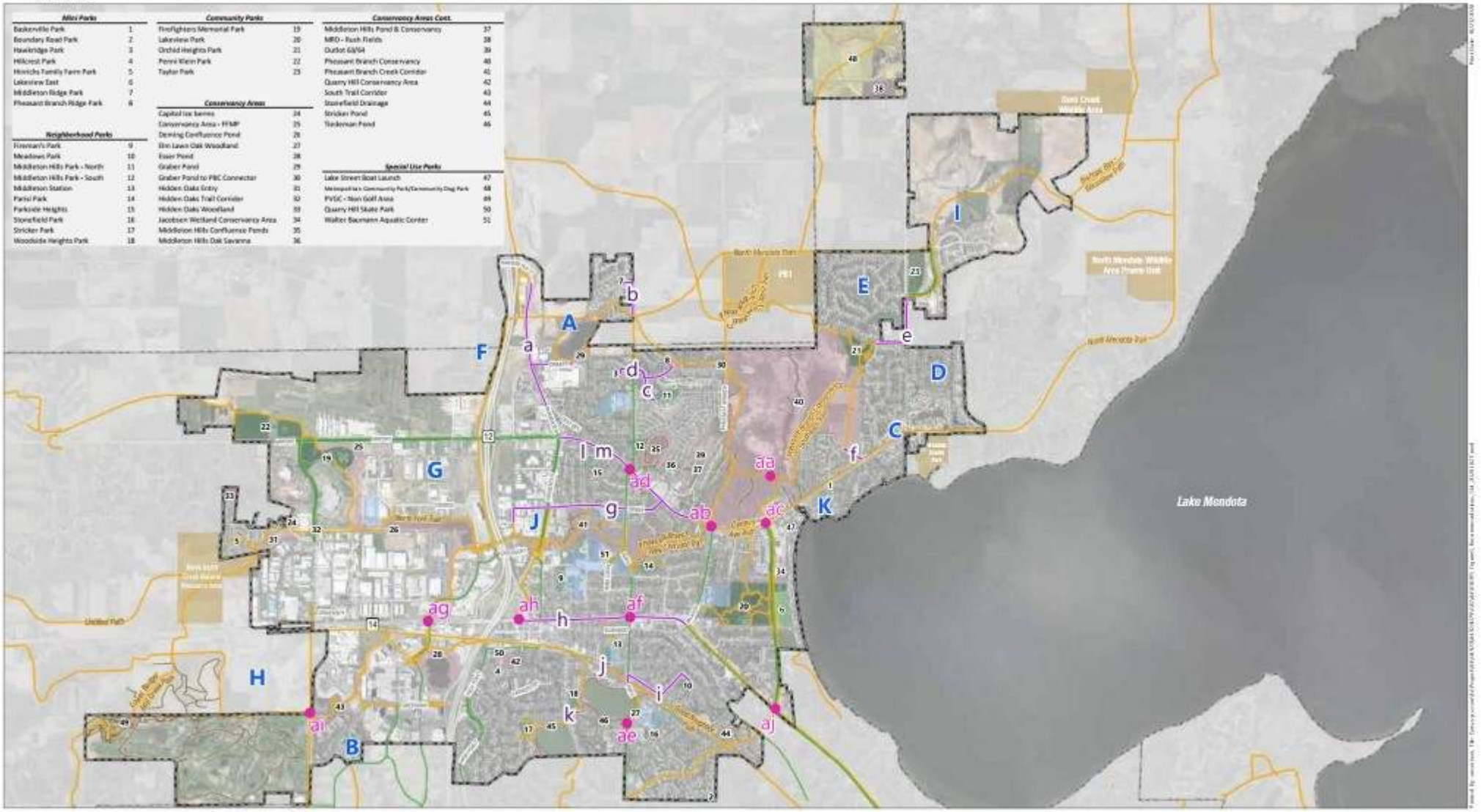
This resolution was adopted at a regular meeting of the Middleton Common Council on the 6th day of November, 2024.

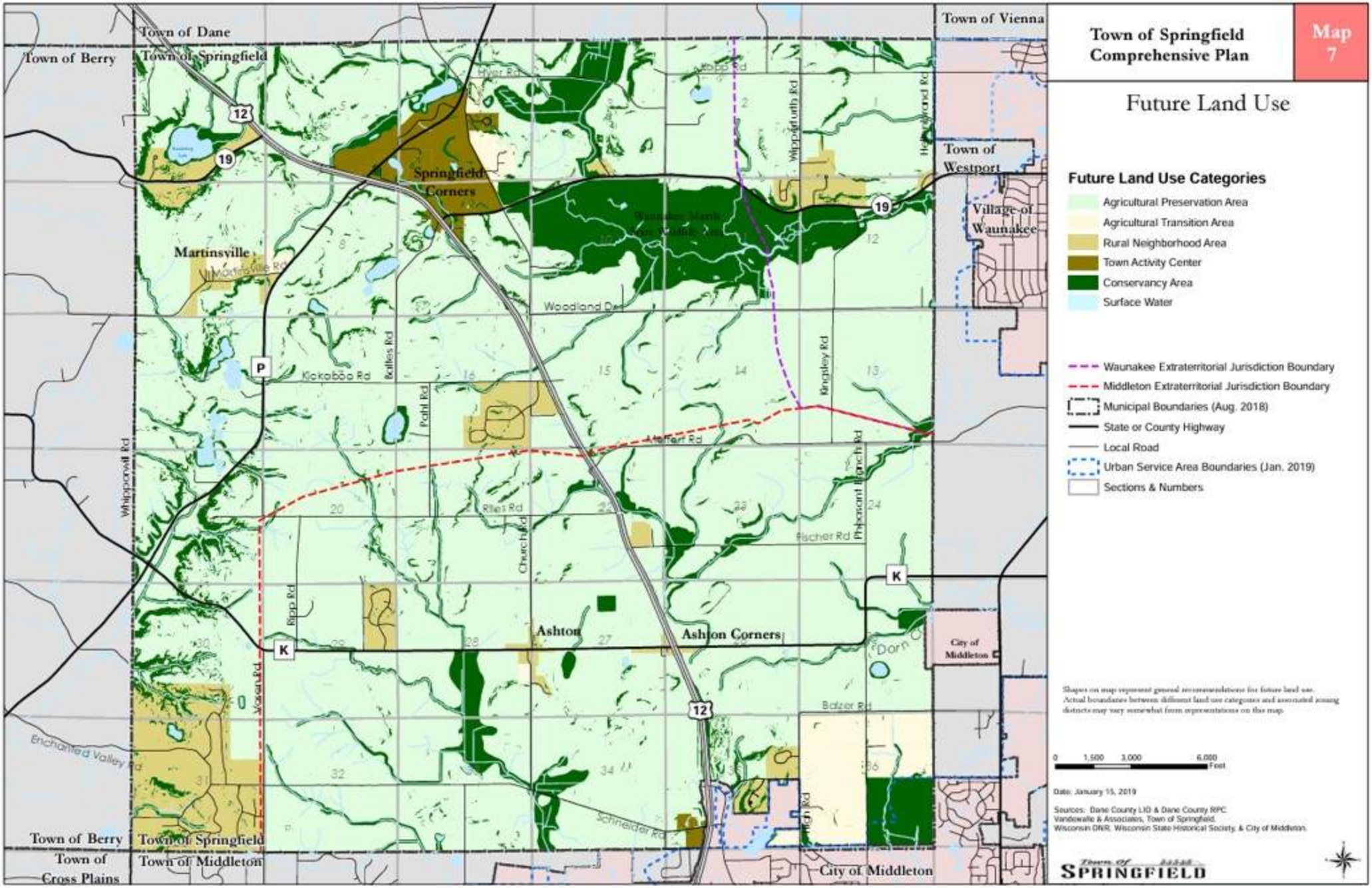
Emily Kuhn, Mayor

ATTEST:

Lorie J. Burns, City Clerk

Figure 5.1: New Park and Trail Recommendations
Source: MSA




Town of Springfield
Comprehensive Plan
Map 7
Future Land Use
Future Land Use Categories
Agricultural Preservation Area
Agricultural Transition Area
Rural Neighborhood Area
Town Activity Center
Conservancy Area
Surface Water
Waunakee Extraterritorial Jurisdiction Boundary
Middleton Extraterritorial Jurisdiction Boundary
Municipal Boundaries (Aug. 2018)
State or County Highway
Local Road
Urban Service Area Boundaries (Jan. 2019)
Sections & Numbers
Shapes on map represent general recommendations for future land use. Actual boundaries between different land use categories and associated zoning districts may vary somewhat from representations on this map.
0 1,500 3,000 6,000 Feet
Date: January 15, 2019
Sources: Dane County LIO & Dane County RPC
Vandewalle & Associates, Town of Springfield,
Wisconsin DNR, Wisconsin State Historical Society, & City of Middleton
Town of Springfield
Town of Vienna
Town of Berry
Town of Dane
Town of Westport
Village of Waunakee
City of Middleton
Town of Cross Plains
Town of Middleton
Springfield Corners
Martinsville
Ashton
Ashton Corners
Woodland Dr
Kokaboo Rd
Riley Rd
Fischer Rd
Schneider Rd
Enchanted Valley Rd
Whippoorwill Rd
Bird Rd
Church Rd
Pheasant Branch Rd
Kingsley Rd
Pahl Rd
Bolles Rd
Hyer Rd
Whippletree Rd
Holland Rd
Belzer Rd
Dorn Creek
12
19
P
K

State of Wisconsin / DEPARTMENT OF NATURAL RESOURCES

Tony Evers, Governor
Telephone 608-266-2621
Toll Free 1-888-936-7463
TTY Access via relay - 711

101 S. Webster St.
Box 7921
Madison, WI 53707-7921

August 30, 2024

Evan Hoier
Vandewalle and Associates
120 E Lakeside Street
Madison, WI 53715

SUBJECT: Endangered Resources Review (ERR Log # 24-963)
Proposed Veridian Homes Subdivision, Dane County, WI (T08N R08E S36, T07N R08E S01, T08N R08E S35, T07N R08E S02)

Dear Evan Hoier,

The Bureau of Natural Heritage Conservation has reviewed the proposed project described in the Endangered Resources (ER) Review Request received August 28, 2024. The complete ER Review for this proposed project is attached and follow-up actions are summarized below:

Required Actions: 0 species
Recommended Actions: 6 species
No Follow-Up Actions: 12 species
Additional Recommendations Specified: No

This ER Review may contain Natural Heritage Inventory data (http://dnr.wi.gov/topic/NHI), including specific locations of endangered resources, which are considered sensitive and are not subject toWisconsin's Open Records Law. Information contained in this ER Review may be shared with individuals who need this information in order to carry out specific roles in the planning, permitting, and implementation of the proposed project. **Specific locations of endangered resources may not be released or reproduced in any publicly disseminated documents.**

The attached ER Review is for informational purposes and only addresses endangered resources issues. **This ER Review does not constitute DNR authorization of the proposed project and does not exempt the project from securing necessary permits and approvals from the DNR and/or other permitting authorities.** Please contact the ER Review Program whenever the project plans change, new details become available, or more than a year has passed to confirm if results of this ER Review are still valid.

Please contact me at 608-266-5241 or via email at angelal.white@wi.gov if you have any questions about this ER Review.

Sincerely,

Angela White
Endangered Resources Review Program

cc:

Appendix D

Section A. Location and brief description of the proposed project

Based on information provided by the ER Review Request form and attached materials, the proposed project consists of the following:

Location	Dane County - T08N R08E S36, T07N R08E S01, T08N R08E S35, T07N R08E S02
Project Description	Veridian Homes is proposing the construction of a 173 lot subdivision, with two halves of this development being bisected by High Road. This subdivision would naturally infill the space between the current boundary of the Northside and Middleton Hills neighborhoods to the south and the Belle Farms subdivision to the north. The size of the proposed subdivision is 63.5 acres. The new neighborhood will include a wide range of lot sizes and home sizes for potential buyers. It will also include parks, open space, wetlands, and associated stormwater management spaces.
Project Timing	TBD
Current Habitat	Currently, the vast majority of the land (~85%) is used for agriculture (corn). There is an abandoned farmstead (~2%) on the west side of High Road. The rest of the land (~13%) is both thick brush and forested.
Impacts to Wetlands or Waterbodies	All three individual parcels have wetlands identified by the DNR. 75 foot setback buffer to be maintained. The parcel to the west of High Road has a portion of Graber Pond within its boundary. Both parcels to the east of High Road have wetlands indicated on their southern side because of a small creek that runs through the property to the south.
Property Type	Public, Private
Federal Nexus	Unknown

It is best to request ER Reviews early in the project planning process. However, some important project details may not be known at that time. Details related to project location, design, and timing of disturbance are important for determining both the endangered resources that may be impacted by the project and any necessary follow-up actions. Please contact the ER Review Program whenever the project plans change, new details become available, or more than a year has passed to confirm if results of this ER Review are still valid.

Section B. Endangered resources recorded from within the project area and surrounding area

	Group	State Status	Federal Status
Rusty Patched Bumble Bee Federal High Potential Zone	Bee	NA	HPZ
Rusty Patched Bumble Bee *(Bombus affinis)*	Bee	SC/FL	LE
Henslow's Sparrow *(Centronyx henslowii)*	Bird	THR	SOC
Bald Eagle *(Haliaeetus leucocephalus)*	Bird~		
Shrub-carr	Community~	NA	
Southern Sedge Meadow *(Southern sedge meadow)*	Community~	NA	
Springs and Spring Runs, Hard *(Springs and spring runs, hard)*	Community~	NA	
Stream--Fast, Hard, Warm *(Stream--fast, hard, warm)*	Community~	NA	
Emergent Marsh *(Emergent marsh)*	Community~	NA	
Swamp Darner *(Epiaeschna heros)*	Dragonfly~	SC/N	
Lake Sturgeon *(Acipenser fulvescens)*	Fish~	SC/H	
Pickerel Frog *(Lithobates palustris)*	Frog~	SC/H	
Prairie Vole *(Microtus ochrogaster)*	Mammal	SC/N	
Little Brown Bat *(Myotis lucifugus)*	Mammal~	THR	
Azure Bluets *(Houstonia caerulea)*	Plant	SC	
Hairy Wild Petunia *(Ruellia humilis)*	Plant	END	
Plains Gartersnake *(Thamnophis radix)*	Snake~	SC/H	
Blanding's Turtle *(Emydoidea blandingii)*	Turtle~	SC/P	SOC

For additional information on the rare species, high-quality natural communities, and other endangered resources listed above, please visit our Biodiversity (http://dnr.wi.gov/topic/EndangeredResources/biodiversity.html) page. For further definitions of state and federal statuses (END=Endangered, THR=Threatened, SC=Special Concern), please refer to the Natural Heritage Inventory (NHI) Working List (http://dnr.wi.gov/topic/nhi/wlist.html).

Section C. Follow-up actions

Actions that need to be taken to comply with state and/or federal endangered species laws: None

Actions recommended to help conserve Wisconsin's Endangered Resources:

• Rusty Patched Bumble Bee Federal High Potential Zone - Bee

State Status: NA **Federal Status:** HPZ

Impact Type	Impact possible
Recommended Measures	Other
Description of Recommended Measures	This project overlaps the Rusty Patched Bumble Bee (RPBB) High Potential Zone and occurs within 1 mile of a RPBB EO and contains suitable habitat (adjacent woodlands, wetlands, agricultural landscapes), for the bee. While take of the bee is prohibited per the federal Endangered Species Act, this project has no federal nexus. Therefore, recommended (voluntary) follow-up actions for the Rusty patched bumble bee may include: • use native trees, shrubs and flowering plants in landscaping, • provide plants that bloom from spring through fall (Wisconsin Native Plant Species List: https://p.widencdn.net/tanvm9/NH0936), • remove and control invasive plants in any habitat used for foraging, nesting, or overwintering

• Rusty Patched Bumble Bee (*Bombus affinis*) - Bee

State Status: SC/FL **Federal Status:** LE

Impact Type	Impact possible
Recommended Measures	Other
Description of Recommended Measures	See follow-up actions in the Rusty Patched Bumble Bee (RPBB) High Potential Zone. Same applies for this species.

• Swamp Darner (*Epiaeschna heros*) - Dragonfly~

State Status: SC/N

Impact Type	Impact possible
Recommended Measures	Erosion Control
Description of Recommended Measures	Suitable habitat for the Swamp Darner (shady ponds, ditches, or sloughs bordering woods) may be impacted by the project or be present in adjacent habitat. Implementing erosion control to minimize impacts when adjacent to suitable habitat is recommended.

• Little Brown Bat (*Myotis lucifugus*) - Mammal~

State Status: THR

Impact Type	Impact possible
Recommended Measures	Time of year restriction
Description of Recommended Measures	The Little Brown bat has been recorded in the vicinity of the project area. Tree removal occurring as part of this project is covered for take by the Cave Bat Broad Incidental Take Permit and there are no required actions for this species. However, it is recommended that special consideration be given to protecting snags or dying trees (if present), particularly from June 1 – August 15.

Confidential–Commercial Data

• Plains Gartersnake (*Thamnophis radix*) - Snake~

State Status: SC/H

Impact Type	Impact possible
Recommended Measures	Time of year restriction,Exclusion Fencing,Other
Description of Recommended Measures	Plains Gartersnake (Thamnophis radix), a Special Concern species in Wisconsin, prefers almost any open-canopy wetland type (not open water) and adjacent open to semi-open canopy upland, including prairies, old fields, and weedy vacant lots. It also prefers low-canopy vegetation (<24"), although will occupy habitats with taller vegetation such as reed canary grass. This species can be active from mid-March through early-November, usually emerging shortly after frost-out and remaining active until daytime temperatures fall consistently below 50 deg. F. Breeding usually occurs in April or early-May but can also occur in fall, live young are born mid-July to mid-August. Since suitable habitat for the Plains Gartersnake is present within and adjacent to the project site, the following measures can voluntarily be implemented to avoid take: Wetlands – Plains Gartersnakes are typically present in open to semi-open canopy wetlands year-round. Because this species can be found in this habitat throughout the year, impacts to these wetlands should be minimized at all times. Uplands – For semi-open canopy uplands within 300 ft (91 m) of a wetland, conduct work outside of the Plains Gartersnake active season (March 5 – November 15). The installation and maintenance of exclusion fencing using the WDNR Amphibian and Reptile Exclusion Fencing Protocol is an avoidance option that can be used during this period as long as the exclusion fencing is installed between November 16 and March 4. Work can then be conducted within the fenced area at any time of year as long as the fencing is maintained. Otherwise, if a snake is found, please carefully move it to suitable habitat outside the project area and photodocument if possible, for verification.

• Blanding's Turtle (*Emydoidea blandingii*) - Turtle~

State Status: SC/P**Federal Status:** SOC

Impact Type	Impact possible
Recommended Measures	Time of year restriction,Exclusion Fencing
Description of Recommended Measures	Blanding's turtles inhabit a variety of wetland types as well as streams, rivers, lakes and ponds and can migrate long distances between suitable habitat. Nesting typically occurs in well drained or sandy soils in open or semi-open canopy habitat within 900 ft (274 m) of a wetland or waterbody. Egg laying occurs from May 20-July 5 with hatchlings emerging from August 7-October 15. Blanding's turtles typically overwinter in standing water at least 3 ft (0.9 m) deep. Because Blanding's turtles can be found in wetlands and waterbodies throughout the year, take typically cannot be avoided for projects impacting wetlands or waterbodies. Since suitable nesting and foraging habitat for the Blanding's Turtle is present adjacent to the project site, the following measures can voluntarily be implemented to avoid impacts: Non-overwintering areas – For wetlands / water bodies shallower than three feet at the deepest point, conduct work outside of the Blanding's turtle's active season (March 5 – November 15). The installation and maintenance of exclusion fencing using the WDNR Amphibian and Reptile Exclusion Fencing Protocol is an avoidance option that can be used during this period as long as the exclusion fencing is installed between November 16 and March 4. Work can then be conducted within the fenced area at any time of year as long as the fencing is maintained. Upland nesting habitat – Avoid work in suitable upland nesting habitat (sandy and/or well-drained soils) within 275 m (900 ft) of a wetland or water body during the Blanding's turtle's nesting period (May 20 – October 15). The installation and maintenance of exclusion fencing using the WDNR Amphibian and Reptile Exclusion Fencing Protocol is an avoidance option that can be used during this period as long as the exclusion fencing is installed between October 16 and May 19. Work can then be conducted within the fenced area at any time of year as long as the fencing is maintained. If avoidance dates and fencing cannot be implemented due to the large project size, it is recommended to walk through or gently disturb the project area immediately prior to disturbance. While this will not protect nests, it may allow turtles to move out of the area and avoid take. If a turtle is found, please carefully move it to suitable habitat outside the project area. Please note, inactive dates are updated frequently in the Fall, and can be checked here: https://dnr.wi.gov/topic/Wildlifehabitat/HerpRegulations.html

Remember that although these actions are not required by state or federal endangered species laws, they may be required by other laws, permits, granting programs, or policies of this or another agency. Examples include the federal Migratory Bird Treaty Act, Bald and Golden Eagle Protection Act, State Natural Areas law, DNR Chapter 30 Wetland and Waterway permits, DNR Stormwater permits, and Forest Certification.

Confidential–Commercial Data

No actions are required or recommended for the following endangered resources:

Appendix D

• Henslow's Sparrow (*Centronyx henslowii*) - Bird

State Status: THR **Federal Status:** SOC

Impact Type	No impact or no/low broad ITP/A
Reason	Lack of Suitable Habitat within Project Boundary
Justification	Suitable habitat for the Henslow's Sparrow (prefers old fields, open grasslands, wet meadows, unmowed highway rights-of-way, undisturbed pastures) will not be directly impacted by the proposed project.

• Bald Eagle (*Haliaeetus leucocephalus*) - Bird~

State Status: Federal Status:

Impact Type	No impact or no/low broad ITP/A
Reason	Other - Justification Required
Justification	This project is within 1 mile of a bald eagle nest. However, based on the distance to a known nest location and the absence of suitable nesting habitat in the project area, we do not anticipate any impacts.

• Shrub-carr - Community~

State Status: NA

Impact Type	No impact or no/low broad ITP/A
Reason	Lack of Suitable Habitat within Project Boundary
Justification	The mapped shrub-carr natural community is not within or adjacent to the project area. Therefore, no impacts are expected.

• Southern Sedge Meadow - Community~

State Status: NA

Impact Type	No impact or no/low broad ITP/A
Reason	Lack of Suitable Habitat within Project Boundary
Justification	The mapped sedge meadow natural community is not within or adjacent to the project area. Therefore, no impacts are expected.

• Springs and Spring Runs, Hard - Community~

State Status: NA

Impact Type	No impact or no/low broad ITP/A
Reason	Lack of Suitable Habitat within Project Boundary
Justification	The mapped springs natural community is not within or adjacent to the project area. Therefore, no impacts are expected.

• Stream--Fast, Hard, Warm - Community~

State Status: NA

Impact Type	No impact or no/low broad ITP/A
Reason	Lack of Suitable Habitat within Project Boundary
Justification	The mapped stream natural community is not within or adjacent to the project area. Therefore, no impacts are expected.

• Emergent Marsh - Community~

State Status: NA

Impact Type	No impact or no/low broad ITP/A
Reason	Lack of Suitable Habitat within Project Boundary
Justification	The mapped marsh natural community is not within or adjacent to the project area. Therefore, no impacts are expected.

• Lake Sturgeon (*Acipenser fulvescens*) - Fish~

State Status: SC/H

Impact Type	No impact or no/low broad ITP/A
Reason	Lack of Suitable Habitat within Project Boundary
Justification	No suitable aquatic habitat for the lake sturgeon will be impacted by this project.

• **Pickerel Frog (*Lithobates palustris*) - Frog~**

State Status: SC/H

Impact Type	No impact or no/low broad ITP/A
Reason	Lack of Suitable Habitat within Project Boundary
Justification	No suitable aquatic habitat for the pickerel frog will be impacted by this project.

• **Prairie Vole (*Microtus ochrogaster*) - Mammal**

State Status: SC/N

Impact Type	No impact or no/low broad ITP/A
Reason	Lack of Suitable Habitat within Project Boundary
Justification	Suitable habitat for the Prairie Vole (dry sand prairies, along fence lines, in open fields, sandy grassland terraces of large rivers, bluff prairies, abandoned farm fields, and seldom in barrens areas) will not be impacted by the proposed project.

• **Azure Bluets (*Houstonia caerulea*) - Plant**

State Status: SC

Impact Type	No impact or no/low broad ITP/A
Reason	Lack of Suitable Habitat within Project Boundary
Justification	Suitable habitat for the Azure Bluets (dry prairies and woodlands, as well as damp meadows) will not be impacted by the project.

• **Hairy Wild Petunia (*Ruellia humilis*) - Plant**

State Status: END

Impact Type	No impact or no/low broad ITP/A
Reason	Lack of Suitable Habitat within Project Boundary
Justification	Suitable habitat for the Hairy Wild Petunia (prairies and upland oak woods) will not be impacted by the project.

Section D. Next Steps

1. Evaluate whether the **'Location and brief description of the proposed project'** is still accurate. All recommendations in this ER Review are based on the information supplied in the ER Review Request. If the proposed project has changed or more than a year has passed and you would like your letter renewed, please contact the ER Review Program to determine if the information in this ER Review is still valid.
2. Determine whether the project can incorporate and implement the **'Follow-up actions'** identified above:
    - 'Actions that need to be taken to comply with state and/or federal endangered species laws' represent the Department's best available guidance for complying with state and federal endangered species laws based on the project information that you provided and the endangered resources information and data available to us. If the proposed project has not changed from the description that you provided us and you are able to implement all of the 'Actions that need to be taken to comply with state and/or federal endangered species laws', your project should comply with state and federal endangered species laws. Please remember that if a violation occurs, the person responsible for the taking is the liable party. Generally this is the landowner or project proponent. For questions or concerns about individual responsibilities related to Wisconsin's Endangered Species Law, please contact the ER Review Program.
    - If the project is unable to incorporate and implement one or more of the 'Actions that need to be taken to comply with state and/or federal endangered species laws' identified above, the project may potentially violate one or more of these laws. Please contact the ER Review Program immediately to assist in identifying potential options that may allow the project to proceed in compliance with state and federal endangered species laws.
    - 'Actions recommended to help conserve Wisconsin's Endangered Resources' may be required by another law, a policy of this or another Department, agency or program; or as part of another permitting, approval or granting process. Please make sure to carefully read all permits and approvals for the project to determine whether these or other measures may be required. Even if these actions are not required by another program or entity for the proposed project to proceed, the Department strongly encourages the implementation of these conservation measures on a voluntary basis to help prevent future listings and protect Wisconsin's biodiversity for future generations.
3. If federally-protected species or habitats are involved and the project involves federal funds, technical assistance or authorization (e.g., permit) and there are likely to be any impacts (positive or negative) to them, consultation with USFWS will need to occur prior to the project being able to proceed. If no federal

funding, assistance or authorization is involved with the project and there are likely to be adverse impacts to the species, contact the USFWS Twin Cities Ecological Services Field Office at 612-725-3548 (x2201) for further information and guidance.

Appendix D

Section E. Standard Information to help you better understand this ER Review

Endangered Resources (ER) Reviews are conducted according to the protocols in the guidance document Conducting Proposed Endangered Resources Reviews: A Step-by-Step Guide for Wisconsin DNR Staff.

How endangered resources searches are conducted for the proposed project area: An endangered resources search is performed as part of all ER Reviews. A search consists of querying the Wisconsin Natural Heritage Inventory (NHI) database for endangered resources records for the proposed project area. The project area evaluated consists of both the specific project site and a buffer area surrounding the site. A 1 mile buffer is considered for terrestrial and wetland species, and a 2 mile buffer for aquatic species. Endangered resources records from the buffer area are considered because most lands and waters in the state, especially private lands, have not been surveyed. Considering records from the entire project area (also sometimes referred to as the search area) provides the best picture of species and communities that may be present on your specific site if suitable habitat for those species or communities is present.

Categories of endangered resources considered in ER Reviews and protections for each: Endangered resources records from the NHI database fall into one of the following categories:

- Federally-protected species include those federally listed as Endangered or Threatened and Designated Critical Habitats. Federally-protected animals are protected on all lands; federally-protected plants are protected only on federal lands and in the course of projects that include federal funding (see Federal Endangered Species Act of 1973 as amended).

- Animals (vertebrate and invertebrate) listed as Endangered or Threatened in Wisconsin are protected by Wisconsin's Endangered Species Law on all lands and waters of the state (s. 29.604, Wis. Stats.).

- Plants listed as Endangered or Threatened in Wisconsin are protected by Wisconsin's Endangered Species Law on public lands and on land that the person does not own or lease, except in the course of forestry, agriculture, utility, or bulk sampling actions (s. 29.604, Wis. Stats.).

- Special Concern species, high-quality examples of natural communities (sometimes called High Conservation Value areas), and natural features (e.g., caves and animal aggregation sites) are also included in the NHI database. These endangered resources are not legally protected by state or federal endangered species laws. However, other laws, policies (e.g., related to Forest Certification), or granting/permitting processes may require or strongly encourage protection of these resources. The main purpose of the Special Concern classification is to focus attention on species about which some problem of abundance or distribution is suspected before they become endangered or threatened.

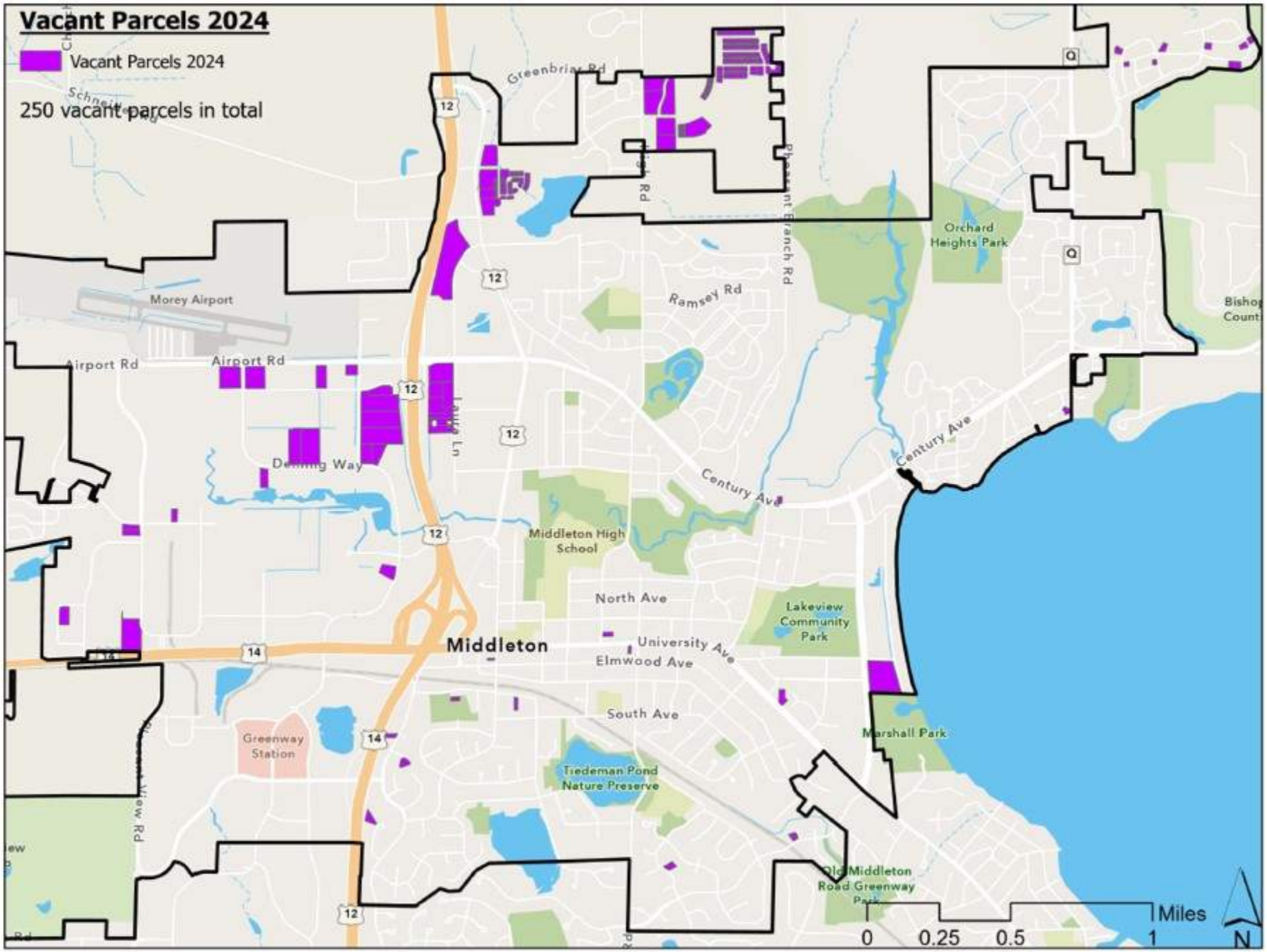
- State Natural Areas (SNAs) are also included in the NHI database. SNAs protect outstanding examples of Wisconsin's native landscape of natural communities, significant geological formations, and archeological sites. Endangered species are often found within SNAs. SNAs are protected by law from any use that is inconsistent with or injurious to their natural values (s. 23.28, Wis. Stats.).

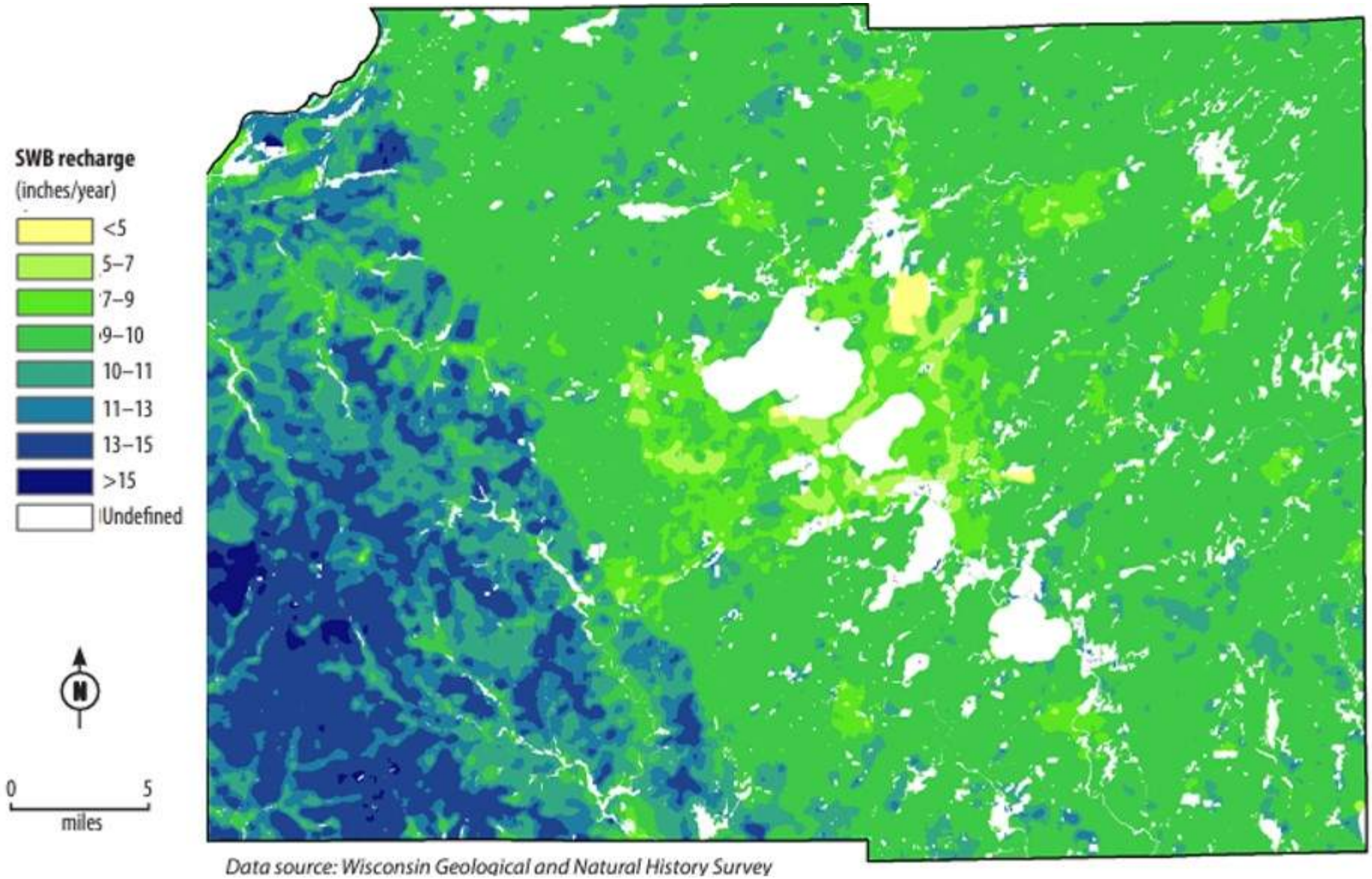
Please remember the following:

1. This ER Review is provided as information to comply with state and federal endangered species laws. By following the protocols and methodologies described above, the best information currently available about endangered resources that may be present in the proposed project area has been provided. However, the NHI database is not all inclusive; systematic surveys of most public lands have not been conducted, and the majority of private lands have not been surveyed. As a result, NHI data for the project area may be incomplete. Occurrences of endangered resources are only in the NHI database if the site has been previously surveyed for that species or group during the appropriate season, and an observation was reported to and entered into the NHI database. As such, absence of a record in the NHI database for a specific area should not be used to infer that no endangered resources are present in that area. Similarly, the presence of one species does not imply that surveys have been conducted for other species. Evaluations of the possible presence of rare species on the project site should always be based on whether suitable habitat exists on site for that species.

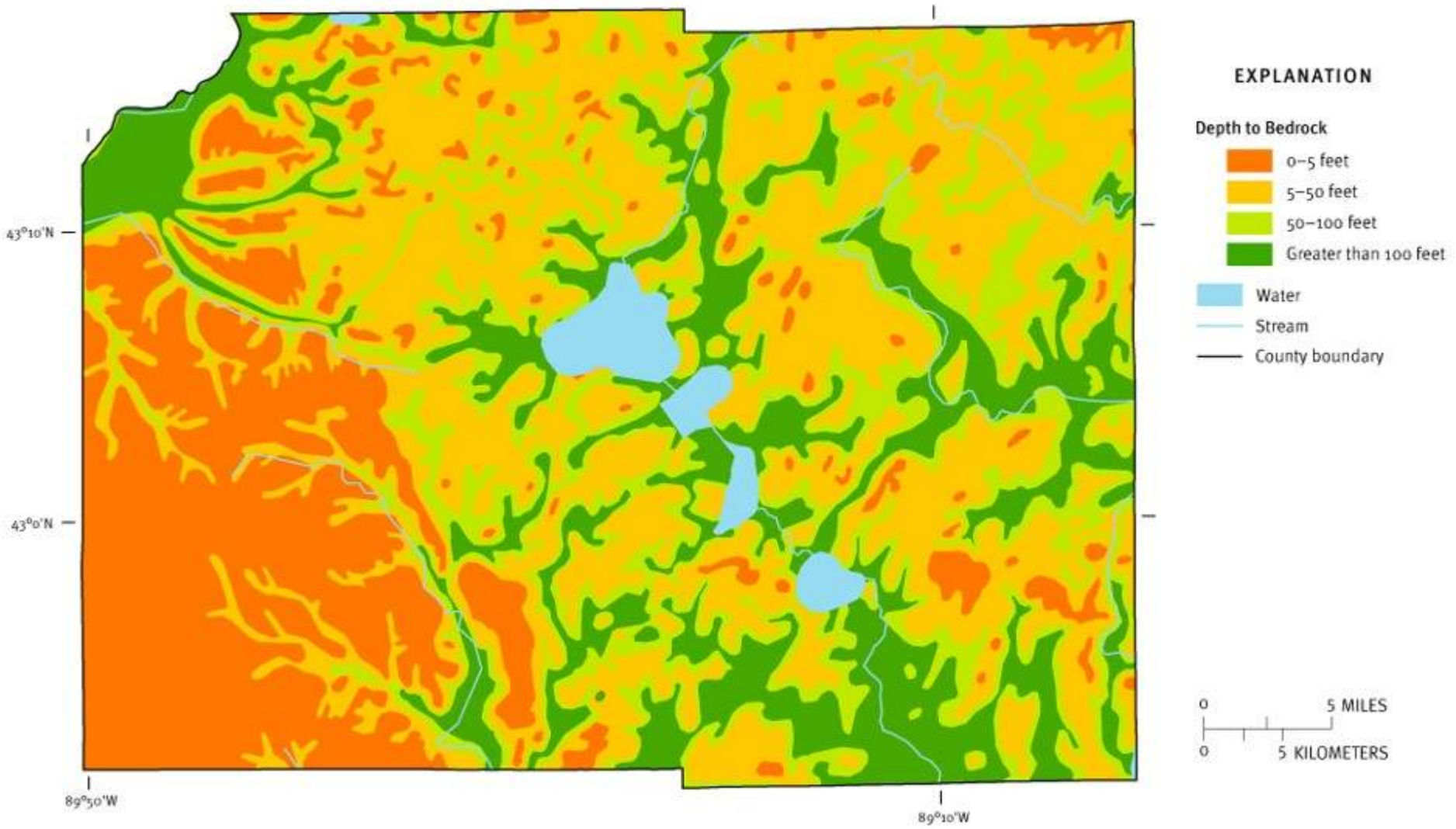
2. This ER Review provides an assessment of endangered resources that may be impacted by the project and measures that can be taken to avoid negatively impacting those resources based on the information that has been provided to ER Review Program at this time. Incomplete information, changes in the project, or subsequent survey results may affect our assessment and indicate the need for additional or different measures to avoid impacts to endangered resources.

3. This ER Review does not exempt the project from actions that may be required by Department permits or approvals for the project. Information contained in this ER Review may be shared with individuals who need this information in order to carry out specific roles in the planning, permitting/approvals, and implementation of the proposed project.


Vacant Parcels 2024
Vacant Parcels 2024
250 vacant parcels in total
Greenbriar Rd
Pheasant Branch Rd
Orchard Heights Park
Morey Airport
Airport Rd
Airport Rd
Ramsey Rd
Deming Way
Century Ave
Century Ave
Middleton High School
North Ave
Lakeview Community Park
Middleton
University Ave
Elmwood Ave
South Ave
Greenway Station
Marshall Park
Tiedeman Pond Nature Preserve
Old Middleton Road Greenway Park
12
14
Miles
0
0.25
0.5
1
N



Data source: Wisconsin Geological and Natural History Survey


43°10'N
43°0'N
89°50'W
89°10'W
EXPLANATION
Depth to Bedrock
0–5 feet
5–50 feet
50–100 feet
Greater than 100 feet
Water
Stream
County boundary
0
5 MILES
0
5 KILOMETERS

1.0 Executive Summary

Veridian Homes, Inc. is proposing a single family residential development in the City of Middleton. The parcel area is 83.14 acres and is split by High Road. The following is a stormwater report for the proposed Ziegler Farm Development Master Plan. The site meets new development requirements per the City of Middleton Ordinances and Commissions, Dane County Ordinances, Wisconsin Administrative Code, and CARPC resolutions. A combination of bioretention basins, wet ponds, infiltration basins, and soil remediation techniques have been implemented to meet the stormwater requirements.

Total Suspended Solids

The site provides a reduction of about 92% of total suspended solids as compared to no runoff management controls for the average annual rainfall.

Peak Discharge

Post developed peak runoff rates for the 1, 2, 5, 10, 25, 100, and 200-year, 24-hour design storm. The individual watersheds and the overall site maintain the predevelopment peak runoff rates.

Rainfall for 24-hour storm event (inches)		Graber Pond		High Road		E Drainage Way		Combined Site	
		Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)
1-year	2.49	1.28	0.49	10.20	9.38	1.09	1.32	11.81	9.71
2-year	2.84	1.62	0.60	12.95	11.43	2.91	1.90	16.50	12.30
5-year	3.49	2.42	0.84	18.70	17.54	10.53	3.30	30.46	19.50
10-year	4.09	4.61	2.46	25.69	24.66	20.12	4.98	49.12	27.76
25-year	5.01	10.05	6.40	38.26	34.98	37.63	10.88	84.35	45.32
100-year	6.66	23.12	17.55	66.74	65.21	74.88	57.34	159.90	124.78
200-year	7.53	31.08	27.41	84.66	81.84	96.59	86.74	207.10	176.90

Infiltration

Stay-on has been calculated separately for the Graber Pond watershed (west) and the High Road and E Drainage Way watersheds (east).

West Watershed	Areas (ac)	Runoff (cf)	Stay-on (cf)
Pre-Development	8.89	764	929,230

	Areas	Post Development, No Controls		Post Development, With Controls		Pre vs. Post Development Stay-on
	(ac)	Runoff (cf)	Stay-on (cf)	Runoff (cf)	Stay-on (cf)	
New Development	9.40	340,816	642,001	26,125	956,692	103.0%
Infiltration Provided Onsite to Offsite Areas	1.19	0	0	167	2,407	-
Total Infiltration Provided Onsite	10.59	340,816	642,001	26,292	959,099	103.2%

East Watershed	Areas (ac)	Runoff (cf)	Stay-on (cf)
Pre-Development	39.02	25,361	4,055,806

	Areas	Post Development, No Controls		Post Development, With Controls		Pre vs. Post Development Stay-on
	(ac)	Runoff (cf)	Stay-on (cf)	Runoff (cf)	Stay-on (cf)	
New Development	38.52	1,571,656	2,456,688	212,255	3,816,088	94.1%
Infiltration Provided Onsite to Offsite Areas	22.23	0	0	20,274	242,302	-
Total Infiltration Provided Onsite	60.75	1,571,656	2,456,688	232,529	4,058,391	100.1%

2.0 Introduction

Veridian Homes, Inc. is proposing a single family residential development in the City of Middleton. The parcel area is 83.14 acres and is split by High Road. The existing site is predominantly agricultural fields that were owned by the Ziegler Family. There are wetlands on the far west property edge along Graber Pond and on the south side of the parcel section between High Road and Pheasant Branch Road. A major drainage swale runs through the parcel on the east side of High Road from the High Road right-of-way to Pheasant Branch Road.

The residential development includes plans for medium and high density single family residential as seen in Figure 2.1 below. The proposed improvements also include new public roads with varying right of way widths and areas for stormwater management/open space areas. The project will be completed in phases to reach full development. Each phase will meet stormwater requirements. The purpose of this report is to act as the stormwater management plan required for the full development. The final, approved stormwater management plan and associated permit will be applicable to future phases of development.

3.0 Existing Conditions

The project site is located on the north side of Middleton to the east of Graber Pond and west of the Pheasant Branch Road. More specifically, the site is located in the Range 8, Township 8, southwestern ¼ of section 36 and southeastern ¼ of section 35, and Range 8, Township 7, northwestern ¼ of section 1 and northeastern ¼ of section 2.

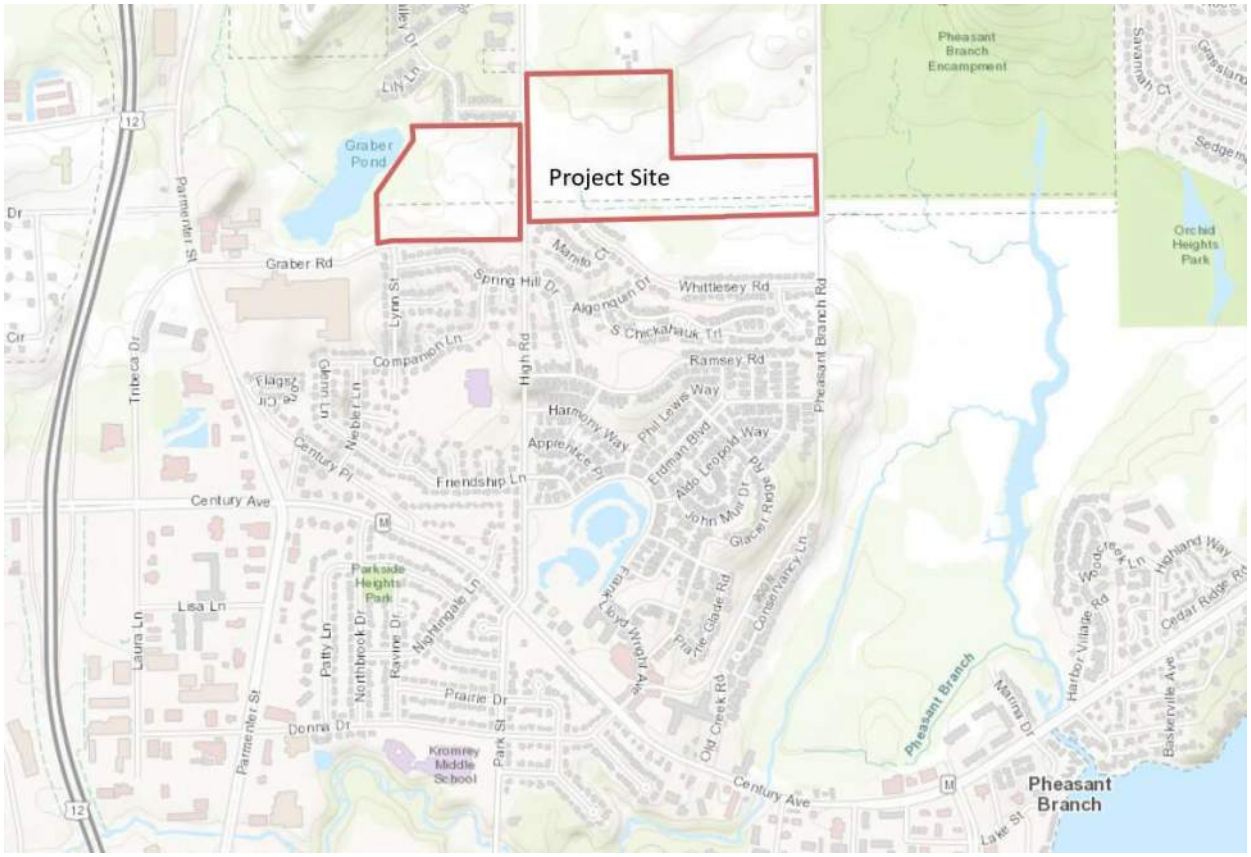


Figure 3.1: Site Location

Appendix H

LOT TYPE	UNITS	%
Single Family Detached		
Single Fam - 51	22	13%
Single Fam - 59	92	53%
Single Fam - 65	31	18%
Single Fam - 69	11	6%
Alley Family Detached		
Alley - 31	3	2%
Alley - 37	10	6%
Alley - 45	4	2%
TOTAL RESIDENTIAL	173	100%

VERIDIAN HOMES

ZIEGLER FARM PROPERTY

Middleton, Wisconsin

ILLUSTRATIVE PLAN

Belle Fontaine Blvd
Misty Valley Dr
Thrasher Street
Caneel Trail
Roadway 'D'
Waxwing Wy
Roadway 'E'
Hooded Merganser Dr
Pheasant Branch Rd
Storm-water
Trail Network
Stormwater
Park
Graber Pond
Wetlands
Roadway 'B'
Roadway 'A'
Misty Valley Dr
High Rd
Roadway 'C'
Graber Rd
Boardwalk
Pheasant Branch Conservancy
Manito Ct
Whittlesey Rd
Lynn St
Spring Hill Dr
Algonquin Dr

Revised: 9.9.2024

VANDEWALLE & ASSOCIATES INC.
© 2024

0' 150' 300'

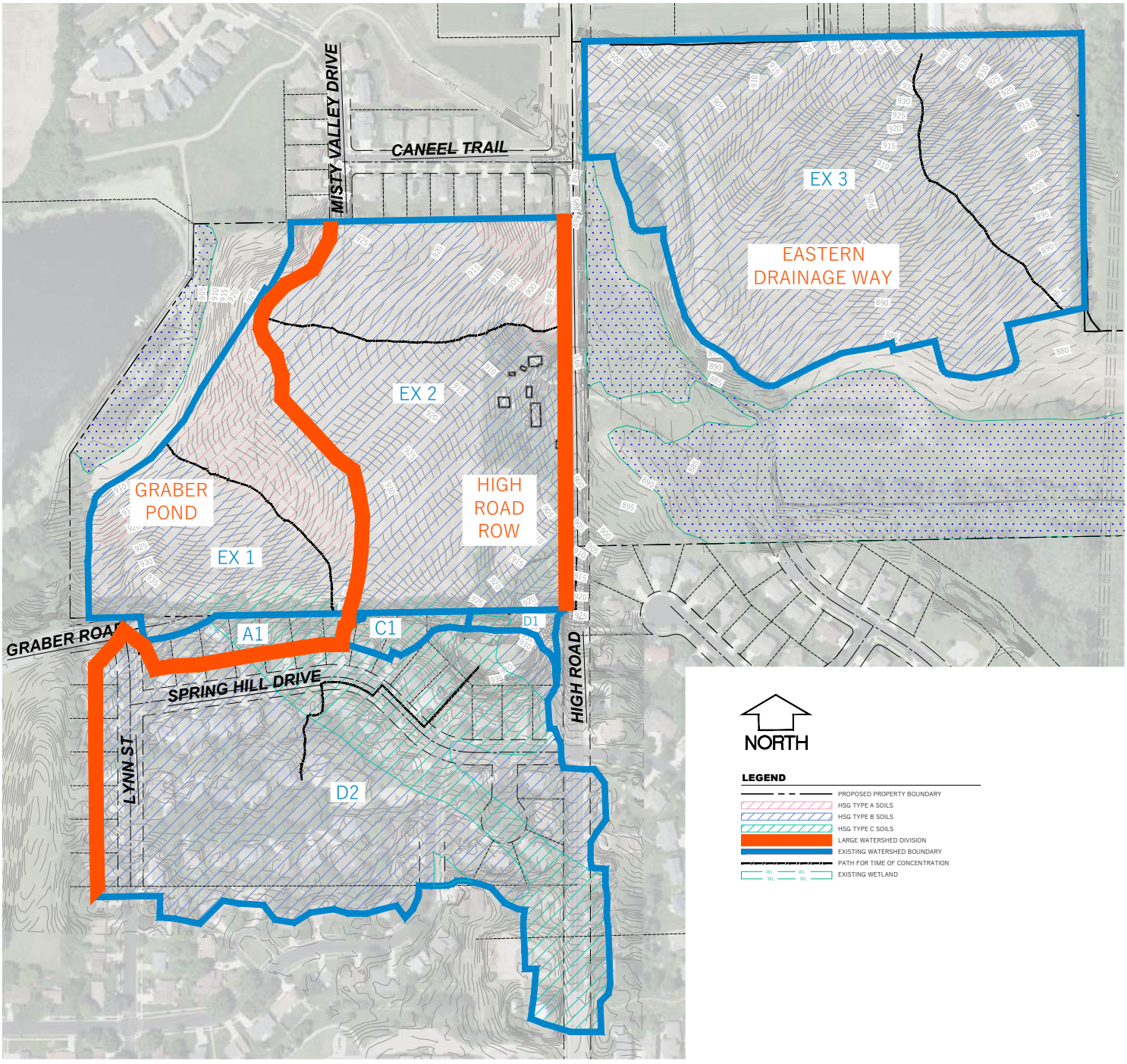


FIGURE 3.1: EXISTING WATERSHED MAP

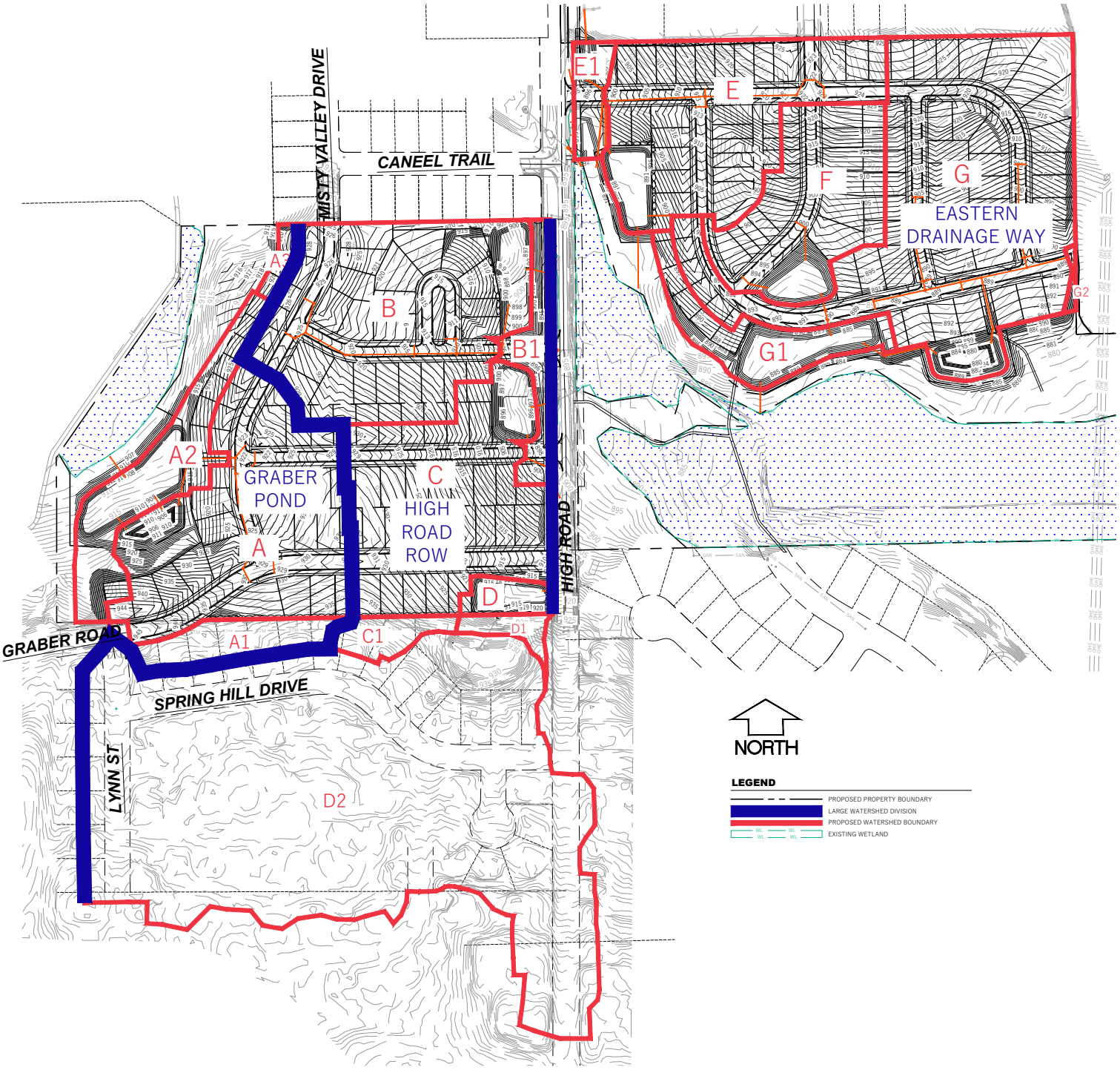


FIGURE 5.1: POST DEVELOPMENT WATERSHED MAP



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

Appendix I

Professional

Engineering

Services

Utility Master Plan Update, City Project 19-113



Report

City of

Middleton, WI

October 2019

STRAND ASSOCIATES®

Appendix I

Report for
City of Middleton, Wisconsin

Utility Master Plan Update, City Project 19-113





Prepared by:

STRAND ASSOCIATES, INC.®
910 West Wingra Drive
Madison, WI 53715
www.strand.com

October 2019

STRAND ASSOCIATES®

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EXECUTIVE SUMMARY

As the City of Middleton (City) continues to proactively plan for future growth of the service area, routine maintenance and replacement rather than additional infrastructure are the main focus to keep the Water and Sewer Utilities operating in good condition.

A. Service Area and Population

The Sewer Service Area and the Water Service Area are bounded primarily by the existing City corporate limits. Growth to the south is limited by the City of Madison, and growth to the west is limited because of existing intermunicipal agreements and ground elevations restricting the extension of gravity collection systems. Future growth is primarily located in the Community of Bishops Bay (COBB) neighborhood in the northeastern part of the City in addition to large areas of developable land north of the City.

Future growth estimates were based on City planning documents. It is estimated that approximately 2,828 household units are to be developed by 2040 and 8,124 household units be developed by 2070. Given the number and type of future households and typical development densities of 2.8 people per single-family household, 2.5 people per duplex or condo household, and 2.1 people per apartment household, the design populations were estimated. The current population of the City is estimated be 20,472 people in 2019. Adding the future growth population to the current population estimate, the design population for years 2040 and 2070 are estimated to be 26,823 and 39,948, respectively.

B. Wastewater Collection System

The City Sewer Utility maintains and operates local trunk and intercepting sewers and nine wastewater pumping stations that collect and transmit wastewater to the Madison Metropolitan Sewer District (MMSD) treatment plant in the City of Madison.

Wastewater flow rates in the sewers were estimated based on design criteria, including peaking factors for residential, industrial, and commercial facilities. Infiltration and inflow (I/I), which can be a significant problem in conjunction with calculated flow rates, were evaluated and appeared to not be a significant or recurring problem at most of the pumping stations. Therefore, it can be accounted for as part of the design flow rates used. The calculated capacity of all intercepting sewers exceeded the projected peak flow rates and no additional capacity is required.

Existing and calculated future flow rates were determined for each pumping station. In general, the rated capacities of the pumping stations exceeded the existing and projected future average and peak flow rates. The Esser Pond Pumping Station has both existing and future peak flows that exceed capacity of the existing station; however, a third pump can be added to the pumping station to accommodate the excess flows.

The City's collection system appears to be well maintained and functioning as intended and provides the proper level of service to its customers. It is recommended to continue flow metering at key locations to accommodate planned development areas. Pumping station runtimes for the High Point Road and Esser Pond Pumping Stations should be monitored and evaluated. A COBB Pumping Station is anticipated to be constructed to serve portions of the COBB development. The Middleton

Beach Road Pumping Station is approximately 75 years old and should be replaced as part of a future road reconstruction project.

The opinion of probable cost for the recommended collection improvements are summarized in Table ES.00-1 below.

Improvement	Cost (2019 Dollars)
Middleton Beach Road Pumping Station	$350,000
Esser Pond Pumping Station Pump Addition	$100,000
COBB Pumping Station	$7,000,000
Total	$7,450,000

Table ES.00-1 Collection System Improvements

C. Water System

The City Water Utility maintains and operates six active wells, two booster stations, two elevated tanks, and two ground-level reservoirs that supply water through approximately 93 miles of water main ranging from 4 inches to 16 inches in diameter.

Historical water use trends were analyzed using four decades worth of data and were used to project future water use. In general, residential customer water use has recently been declining likely because of water conservation methods. Water demands in gallons per capita were estimated and used to project future water demands for each design year.

Only one additional groundwater well is needed to meet future growth water demands by 2070. It is anticipated that a well facility will be constructed for Well No. 7, which is currently inactive, and will be used to meet future water demands, which is estimated to be around 2047.

Four of the six active wells (Well Nos. 2, 3, 4, and 5) are anticipated to be decommissioned by 2070 because of the anticipated lifespan of a groundwater well facility of 100 years. It is recommended that a replacement well facility with similar pumping capacity is constructed as each well is decommissioned. By 2070, four total wells, including Well No. 7 facility, should be constructed to replace the decommissioned wells and accommodate future growth. It is recommended that all wells be rehabilitated and evaluated on a normal basis to prolong the well's lifespan and identify when replacement is needed.

Tower 1 is anticipated to be decommissioned around 2060 because of the anticipated lifespan of an elevated multi-legged tank. A new 500,000-gallon elevated tank should be constructed to replace Tower 1 and accommodate future demands.

A computerized model was created and calibrated to simulate existing system and future build-out scenarios. The model was used to simulate future growth and the resulting pressures and available fire flows. Current ground elevations show that a high-pressure zone supplied by a booster station is required for some of the area in the northern-most part of the future growth area. Based on the

number of future households and relative ground elevations, an elevated tank would be required for the high-pressure zone.

The distribution system water main was assessed based on available data from the City. Most of the active water main is made of ductile iron and is less than 50 years old. There is some water main constructed of cast iron and is older than 50 years old and should have priority for replacement. The number of water main breaks that were recorded by the City show an average pipe break per mile rate of approximately 0.09 breaks per mile, which is significantly less than the national average pipe break rate of 0.21 to 0.27 breaks per mile. It is recommended that water main that is made of cast iron and has a history of breaks is given priority to be replaced.

The City adopted a five-year street improvement program, which plans to reconstruct approximately 10.8 miles of street than has water main below it. Based on the program, approximately 61 percent of all existing cast iron pipe in the system are planned to be replaced. The program appears to address a large portion of priority water main. It is recommended that the street improvement program incorporate priority water main replacement.

The City's water distribution system appears to be well maintained and functioning as intended and provides the proper level of service to its customers. No additional capacity is currently needed and likely will not be needed in the future until the current infrastructure reaches the end of its lifespan and is decommissioned. It is recommended to continue to perform maintenance improvements on the existing well and storage facilities.

The opinion of probable cost for the recommended water system improvements are summarized in Table ES.00-2 below.

Improvement	Cost (2019 Dollars)	Approximate Construction Date
Well No. 7 Facility	$1,500,000	2047
Well No. 8 Treatment Facility	$3,000,000	As Needed
High Zone Elevated Tank	$2,500,000	2040 to 2070
Booster Station	$1,500,000	2040 to 2070
Well No. 9 (Well No. 3 Replacement)	$2,000,000	2054
Well No. 10 (Well No. 4 Replacement)	$2,000,000	2060
Tower 3 (Tower 1 Replacement)	$2,500,000	2060
Well No. 11 (Well No. 5 Replacement)	$2,000,000	2064
Total	**$17,000,000**	

Table ES.00-2 Water System Improvements

SECTION 1
INTRODUCTION

1.01 BACKGROUND AND PURPOSE

This report presents the Utility Master Plan Update for the City of Middleton (City) Water and Sewer Utility. The last completed planning report for the wastewater collection system was the *Comprehensive Sanitary Sewer Plan for Middleton, Wisconsin,* prepared by Strand Associates, Inc.® (Strand) in December 1982. Planning reports prepared by Strand for the City's water supply system have been updated independently on a more routine basis with the last update occurring in 2001. Other planning studies for utilities in the Community of Bishops Bay (COBB) have recently been completed. This plan will combine information from previous reports and studies and incorporate updates from both the wastewater collection and water supply systems into one report. The report will track and predict population growth and development trends within the City, review their impact on existing utility infrastructure, and identify elements necessary to sustain and accommodate these trends.

The purpose of this report is to provide the City with a means of planning for improvements and expansions of its wastewater collection system and water supply system in a cost-effective manner. This plan will provide the City with a tool for analyzing and accommodating future development proposals, developing a capital improvement program for budgeting purposes, and identifying operating and maintenance (O&M) needs and associated costs.

1.02 SCOPE

The tasks completed in preparation of this report were in accordance with the following scope of services.

1. Incorporate information from recent reports and letters into one main plan update.

2. Summarize the existing wastewater collection system infrastructure and capacities with respect to sewer sizes, design flows, and pumping station capacities.

3. Present capacity requirements for wastewater collection facilities for current and future wastewater flows and develop opinions of probable costs for recommended improvements.

4. Summarize the existing water supply infrastructure and capacities with respect to water sources, pumping facilities, and storage facilities.

5. Present water demand forecasts for design years 2019, 2040, and 2070 in accordance with City-provided service area and population growth trends.

6. Demonstrate water system capacity needs for design years 2019, 2040, and 2070 with respect to average day, maximum day, and maximum day plus fire demands.

7. Create and calibrate a water system model. Review existing and future system performance and identify areas of deficiency.

8. Evaluate the distribution system water main based on information provided by the City.

9. Prepare opinions of probable cost and an implementation schedule for the identified water system improvements developed from the water model and additional required capacity analysis.

1.03 ABBREVIATIONS AND DEFINITIONS

AC	asbestos cement
AMSL	above mean sea level
ARI	Airport Road Interceptor
cfs	cubic feet per second
City	City of Middleton
COBB	Community of Bishops Bay
CTH	County Highway
du	dwelling unit
EPI	Esser Pond Interceptors
FUDA	Future Urban Development Area
gcd	gallons per capita per day
GIS	geographic information system
gpad	gallons per acre per day
gpd	gallons per day
gpm	gallons per minute
HDPE	high density polyethylene
HP	horsepower
I/I	Infiltration/Inflow
ISO	Insurance Service Office
ISS	Intercepting Sewer System
LOM	limit of detection
LOQ	limit of quantitation
MCL	maximum contaminant level
mg	million gallons
mgd	million gallons per day
mg/L	milligrams per liter
MMSD	Madison Metropolitan Sewerage District
MMSD Evaluation	MMSD 2009 Collection System Evaluation
ND	no data
O&M	operation and maintenance
OHI	Orchid Heights Interceptor
OPPC	opinion of probable project cost
PBI	Pheasant Branch Interceptor
pCi/L	picocuries per liter
PF	peaking factor
PSC	Public Service Commission of Wisconsin
psi	pounds per square inch
PVC	polyvinyl chloride
RPM	revolutions per minute
sf	square feet

SCADA	supervisory control and data acquisition
SMCL	secondary maximum contaminant levels
SSA	Sewer Service Area
SSS	sanitary sewer system
Strand	Strand Associates, Inc.®
TDH	total dynamic head
TIF	Tax Incremental Financing
ug/L	micrograms per liter
uS/cm	microSiemens per centimeter
VFD	variable frequency drive
VI	Valley Interceptor
WDNR	Wisconsin Department of Natural Resources
WDOA	Wisconsin Department of Administration
WI	West Interceptor
WPA	Work Progress Administration
WPCF	water pollution control facility
WUD	Westport Utility District

SECTION 2
SERVICE AREA CHARACTERISTICS

2.01 SERVICE AREA

A. Existing Wastewater Service Area

The current Sewer Service Area (SSA) for the City is bounded by existing corporate limits. Growth south of the City cannot occur because of the City of Madison. Limited growth is expected to the west of the City because of intermunicipal agreements establishing long-term agricultural land use initiatives and elevations restricting the extension of gravity collection systems. Development to the west would also require a WDNR mandated study of the Black Earth Creek Watershed before approval of any sewer extensions.

B. Existing Water Service Area

The current water service area is bounded primarily by the existing corporate limits except for a small area in the northeastern part of the City where the Town of Westport currently purchases a small amount of water from the City in areas within the COBB neighborhood. Similar to the wastewater service area, growth south of the City cannot occur because of the City of Madison. Limited growth is expected to the west of the City because elevations do not permit the area to be served by gravity sewer. If the area is able to be permitted to be served by gravity sewer, the area will most likely be able to be served by the existing water distribution service area. Additional evaluation will be required depending on growth extents.

C. Future Service Areas

The estimated service areas for design years 2040 and 2070 are based on the Potential Future Madison Metropolitan Sewerage District (MMSD) Service Area figure from the MMSD 2009 *Collection System Evaluation* (MMSD Evaluation) and current future growth development areas provided by the City. Both City-provided growth areas and the MMSD figure illustrate that development will occur in the southwest corner of the City west of Pleasant View Road, north of the City limits, and northeast of the City within the COBB neighborhood.

Figures 3-39 and 3-41 from the MMSD Evaluation show where new households are likely to develop in the City through 2030 and 2060. The evaluation was published in 2009, only evaluated years 2030 and 2060, and has not been updated since. Therefore, the most up to date projections from this source were used. Figure 2.01-1 summarizes the extents of these main areas of anticipated development. According to the MMSD Evaluation, the area west of the City (labeled 16-A) is expected to see 350 and 400 new households in 2030 and 2060, respectively. The area north of the City limits, immediately east of Highway 12, (labeled 15-C) is expected to see 900 and 1,100 new households in 2030 and 2060, respectively. The area north of the City limits (labeled 15-B) is expected to see 900 and 600 new households in 2030 and 2060, respectively. Lastly, the area east of the City limits around the COBB neighborhood (labeled 15-A) is expected to see 1,600 new households in the year 2030. No additional new households are expected in COBB through 2060.

The City also provided a map of all areas anticipated to be developed or redeveloped in the future. Figure 2.01-2 details each of the properties anticipated for development or redevelopment. The extents of the properties for development are generally comparable to the future service areas shown in the

MMSD AREAS OF ANTICIPATED NEW DEVELOPMENT

UTILITY MASTER PLAN
CITY OF MIDDLETON
DANE COUNTY, WISCONSIN

Legend

- Existing Service Area Boundary
- Area 15-A
- Area 15-B
- Area 15-C
- Area 16-A

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0 0.125 0.25 0.5
Miles

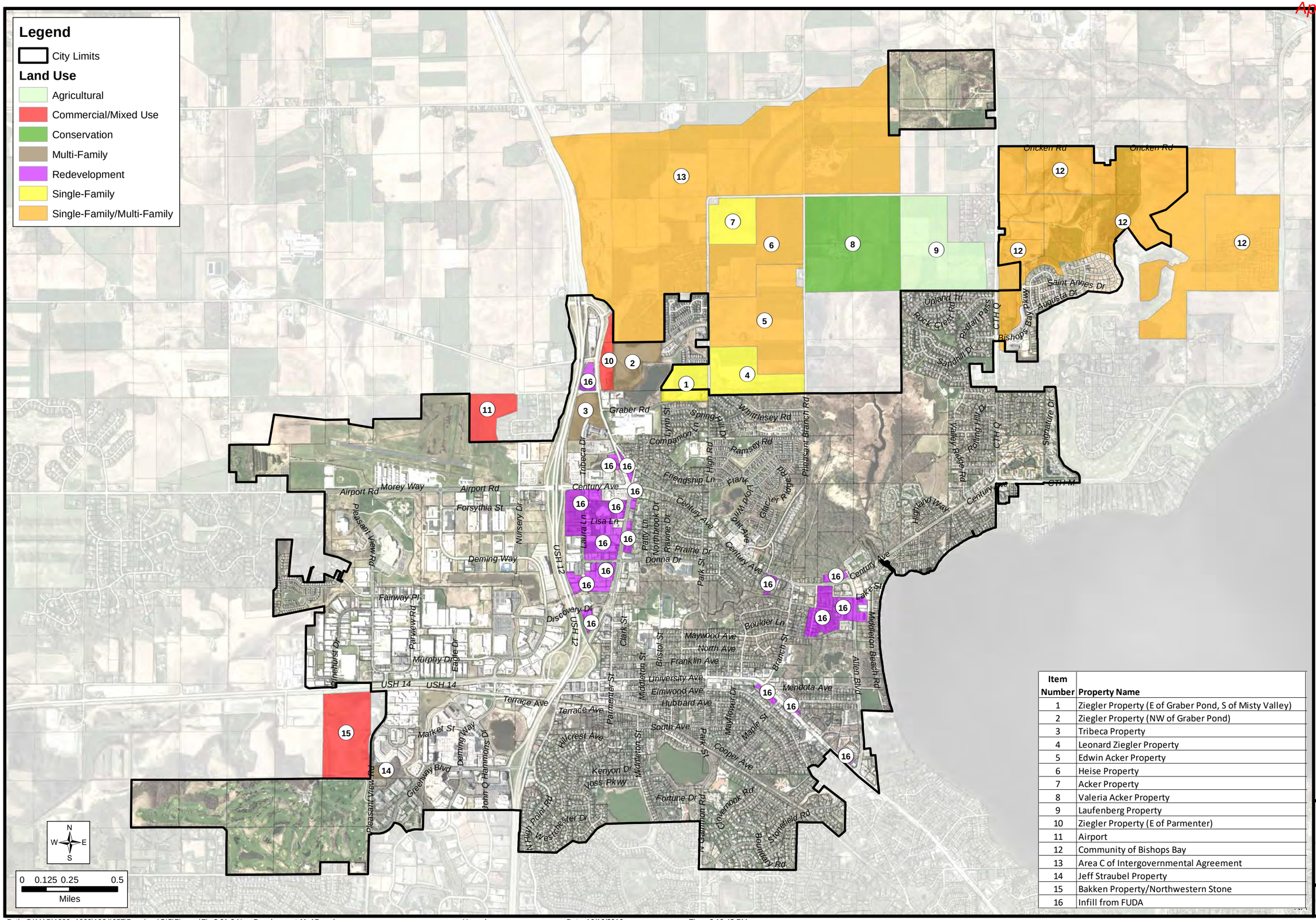
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FIGURE 2.01-1
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Appendix I



Item Number	Property Name
1	Ziegler Property (E of Graber Pond, S of Misty Valley)
2	Ziegler Property (NW of Graber Pond)
3	Tribeca Property
4	Leonard Ziegler Property
5	Edwin Acker Property
6	Heise Property
7	Acker Property
8	Valeria Acker Property
9	Laufenberg Property
10	Ziegler Property (E of Parmenter)
11	Airport
12	Community of Bishops Bay
13	Area C of Intergovernmental Agreement
14	Jeff Straubel Property
15	Bakken Property/Northwestern Stone
16	Infill from FUDA

AREAS OF ANTICIPATED NEW DEVELOPMENT

UTILITY MASTER PLAN
CITY OF MIDDLETON
DANE COUNTY, WISCONSIN

STRAND ASSOCIATES®

FIGURE 2.01-2
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MMSD Evaluation. The area west of the City has considerably less anticipated development compared to the MMSD Evaluation. Table 2.01-1 shows the anticipated units of development and redevelopment for each identified property. Figure 2.01-3 shows the current service area and the estimated location of the 2040 and 2070 development and redevelopment areas.

Property Number	Property Name	Land Type	Period of Development	Number of Household Units
1	Ziegler Property (East of Graber Pond, South of Misty Valley)	Single-Family/ Multi-Family	5 to 10 years	113
2	Ziegler Property (Northwest of Graber Pond)	Multi-Family	5 to 10 years	675
3	Tribeca Property	Multi-Family	5 to 10 years	138
4	Leonard Ziegler Property	Single-Family/ Multi-Family	20 to 40 years	180
5	Edwin Acker Property	Single-Family/ Multi-Family	20 to 40 years	567
6	Heise Property	Single-Family/ Multi-Family	20 to 40 years	441
7	Acker Property	Single-Family/ Multi-Family	20 to 40 years	171
8	Valeria Acker Property	Conservation	5 to 10 years	0
9	Laufenberg Property	Agricultural	20 to 40 years	0
10	Ziegler Property (East of Parmenter)	Commercial/ Mixed Use	20 to 40 years	0
11	Airport	Commercial/ Mixed Use	5 to 10 years	0
12	COBB	Single-Family/ Multi-Family	5 to 40 years	2,695
13	Area C of Intergovernmental Agreement	Single-Family/ Multi-Family	20 to 40 years	2,385
14	Jeff Straubel Property	Multi-Family	5 to 10 years	280
15	Bakken Property/Northwestern Stone	Commercial/ Mixed Use	20 to 40 years	0
16	Infill from FUDA	Redevelopment	5 to 40 years	479
			Total Household Units (2040)	2,828
			Total Household Units (2070)	8,124

Note: FUDA=Future Urban Development Area

Table 2.01-1 Anticipated Development Units

Legend

- City Limits
- 2040 Development
- 2070 Development

Oncken Rd
Saint Annes Dr
Augusta Dr
Upland Trl
Rock Crest Rd
Sandhill Dr
Federal Pass
CTH Q
Bishops Bay Pkwy
Graber Rd
Spring Hill Pl
Lynn St
Companion Ln
Whittlesey Rd
Ramsey Rd
Tribeca Dr
Parmenter St
Century Pl
Friendship Ln
High Rd
Glacier Ridge Rd
Pheasant Branch Rd
Valley Ridge Rd
Rolling Hill Dr
Signature Dr
CTH M
Airport Rd
Morey Way
Forsythia St
Nursery Dr
USH 12
Century Ave
Laura Ln
Lisa Ln
Patty Ln
Northbrook Dr
Ravine Dr
Prairie Dr
Donna Dr
Lord Wing Ave
Frank Lloyd Wright Ave
Highland Way
Deming Way
Pleasant View Rd
Fairway Pl
Parview Rd
Discovery Dr
Park St
Lake St
Amherst Rd
Maywood Ave
Middleton Beach Rd
Clark St
Park Lawn Pl
Mayflower Dr
Branch St
Alen Blvd
Pinehurst Dr
Murphy Dr
USH 14
Terrace Ave
Bristol St
North Ave
Franklin Ave
University Ave
Mendota Ave
Lakeview Blvd
Hubbard Ave
Market St
John Q Hammons Dr
Hillcrest Ave
South Ave
Maple St
Elmwood Ave
Cooper Ave
Greenway Blvd
Kenyon Dr
Voss Pkwy
Middleton St
Fortune Dr
Clovernook Rd
Stonefield Rd
Boundary Rd
N High Point Rd
Westchester Dr
N Gammon Rd

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CURRENT AND FUTURE SERVICE AREAS

UTILITY MASTER PLAN
CITY OF MIDDLETON
DANE COUNTY, WISCONSIN

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FIGURE 2.01-3
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2.02 POPULATION

Population data was available from Census Data, Wisconsin Department of Administration (WDOA), the City's 2006 Comprehensive Plan, and the MMSD 2009 Collection System Evaluation. Census data included is from 1970 to 2010.

The WDOA Demographic Services Center provides population projection data through the year 2040 and estimates it to be 23,230. If the WDOA population is projected linearly to the year 2070, the WDOA projected population would be 27,190.

The City's 2006 Comprehensive Plan estimates the City population in the year 2025 to be 19,608. At the time of this plan, the City was updating the Comprehensive Plan and an updated population estimate from the plan could not be provided.

MMSD did not estimate the population of each community, but instead estimated the number of additional households. The number of additional households through year 2030 was based on the City's total number of households in the year 2000, aerial photo data from 2005, and current parcel data and availability of parcels for development. MMSD estimates for 2060 data were based on communities' comprehensive plans and discussions with each community about the comprehensive plans and long-term growth. To determine the population projection for the City based on the MMSD plan, the number of additional households proposed by the plan were multiplied by the average number of people per household. The MMSD 2009 Collection System Plan stated that 2.21 was the average household size in the City in 2000. Using this estimate, the 2030 population is projected to be 23,909, and the 2060 population is projected to be 28,579.

The City Planning Department provided future development assumptions that included all anticipated future growth areas and specifications. Figure 2.01-2 shows several parcels of land that were identified by the City. Information from the City included excerpts from the FUDA Study, an Intergovernmental Agreement Figure for the Town of Springfield, a summary from the Master Development Plan for the COBB, and other sources. Details from the documents included type of land development, number of acres, development density, number of units, and estimated time period of development. The number of units to be developed was calculated based on the acreage of the parcel and assumed units per acre. The number of people per unit for each development was assumed to be 2.8 people for a single-family dwelling unit, 2.5 people for a duplex dwelling unit, and 2.1 people for an apartment dwelling unit. The people per unit was multiplied by the number of units and rounded to the nearest whole number. All additional growth information provided by the City Planning Department was added to the current estimated 2019 population to project the population to the year 2040 and 2070. Table 2.02-1 summarizes the results.

	Single Family	Duplex/Condo	Apartment
Additional Units	2,890	981	4,253
People per Unit	2.8	2.5	2.1
Total Additional People	8,092	2,453	8,931

Table 2.02-1 Future Growth Population Per Development Type

The projected population for the COBB neighborhood was estimated in a similar manner using projected land uses from the developer's Concept Plan for development adopted in 2011. The COBB neighborhood is partially located in the City and partially in the Town of Westport. Because the City water distribution system supplies the Town of Westport-portion of the COBB neighborhood, the additional Town of Westport population was added to the future population projections and used to project future water use. Conversely, the City sanitary sewer system is not anticipated to serve the Town of Westport-portion of the COBB neighborhood. Therefore, the additional Town of Westport population was not used for calculating future wastewater flows. Residential land use was broken down into single-family, duplex, and apartment, and the dwelling sizes were assumed to be the same as stated above. The existing population that was documented at the end of 2017 was then subtracted from the total estimated population to estimate the projected population for COBB.

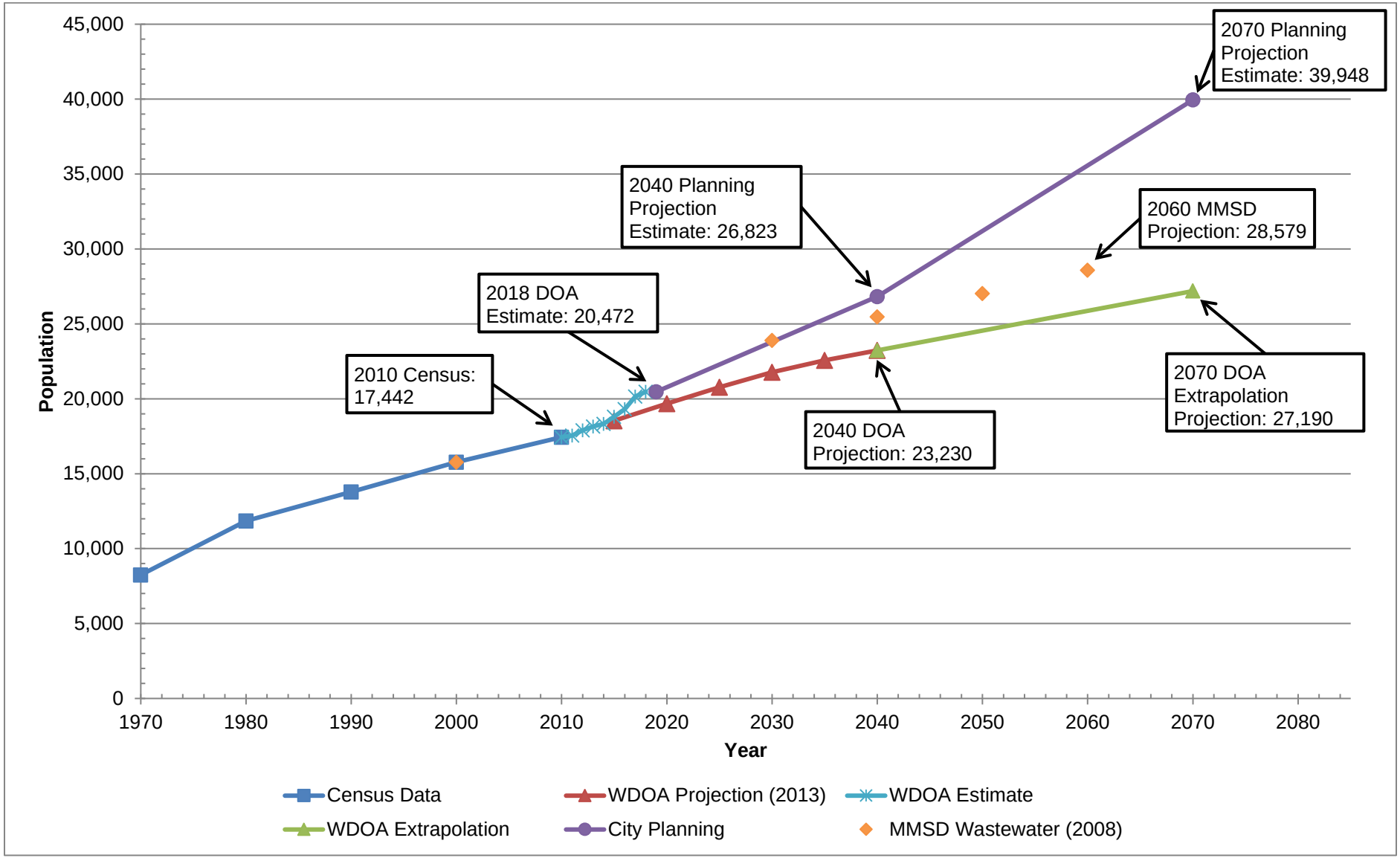
Combining all future development areas together including the Town of Westport-portion of COBB to be served by the water distribution system, the 2040 and 2070 population estimates for the City is 26,823 and 39,948, respectively. Because the MMSD Evaluation took place more than ten years ago, the City elected to use the calculated population estimate by using the anticipated future growth areas to create the 2040 and 2070 population projections.

Figure 2.02-1 presents all population projections from the above-mentioned information sources. Table 2.02-2 presents the population data that was used to project 2019, 2040, and 2070 wastewater flows and water use.

Year	Population
2019	20,472
2040	26,823
2070	39,948

Table 2.02-2 Population Projections Used to Estimate Future Demand

Figure 2.02-1 Population Data



SECTION 3
WASTEWATER DESIGN CONDITIONS

3.01 RESIDENTIAL DESIGN CRITERIA

Table 3.01-1 summarizes the population density and flow values used in determining design flows from the City's future service area as well as design flows from existing developed areas.

Residential Type	Population per Dwelling Unit	Population per Gross Acre	Design Flow per Capita (gcd)
Single Family	3.0	8	95
Duplex	2.5	11.5	95
Apartment	2.1	24	65

Note: gcd=gallons per capita per day

Table 3.01-1 Population and Design Flow Criteria

Population in existing developed residential areas was estimated by counting the housing units in a particular area and then multiplying that count by the particular population value for that housing unit type. Projected flows from future development were estimated using the same process.

3.02 INDUSTRIAL/COMMERCIAL DESIGN CRITERIA

Design criteria for industrial/commercial development typically reflects the variability of potential flows from such areas. To account for the highly variable nature of these operations and allow for some higher flow generating industries, a rate of 2,000 gallons per acre per day (gpad) was used to project an average design flow for industrial/commercial areas. This will be conservative in some cases, but will provide the City with infrastructure to accept potential high flow generating businesses should it want to locate in the City. Business and commercial-type uses are generally assigned use rates between 1,000 to 1,500 gpad.

3.03 PEAKING FACTORS

Peaking factors are significant in the design of wastewater facilities. Peak factors multiplied times the average daily flow result in design values for these facilities. Variance in peak factors directly affects the facility size.

In general, as the population and/or area served increases, the peaking factor (PF) declines. The rate of decline and the maximum peaking factor are generally contained within a narrow range for the various agencies establishing such factors. MMSD peaking factors range from a constant value of 3.0 to a formula based on the flow of $PF = 4/Q^{0.158}$, where Q is in millions of gallons per day (mgd). The 3.0 peak factor does not recognize the reduction of peak rate for increasing populations and area, something that the Wisconsin Department of Natural Resources (WDNR) design criteria requires.

A survey conducted of state agencies establishing standards for peak factors indicates that a peak value of 4 is used for house sources and 2.5 for the design of major sewers. For purposes of estimating peak wastewater flow rates the peak factors shown in Table 3.03-1 will be used.

Area Served	Peak Factor
0 to 250 acres	4
250 to 500 acres	3.5
500 acres	2.5
Industrial/Commercial	2.5

Table 3.03-1 Peak Factors

The peak factor of 2.5 for industrial/commercial flow recognizes that, normally, such flows do not vary as widely as residential flows and typically occur during nonpeak hours, thus resulting in a lower peak factor.

3.04 INFILTRATION/INFLOW

Infiltration/Inflow (I/I) is another component of flow in the City's wastewater collection system. Because I/I is an extraneous source, any amounts beyond the original design allowance deprive the City of planned for service capacity in its sewers.

As part of this study, pumping station runtimes were evaluated. These records seem to indicate that I/I is not a significant or recurring problem at most of the pumping stations and can be accounted for as part of the design flow rates used.

SECTION 4
EXISTING WASTEWATER COLLECTION SYSTEM

4.01 LOCAL SYSTEM

Wastewater generated within the City is collected by the City's sanitary sewer system (SSS), which then discharges to the MMSD system for conveyance to the MMSD water pollution control facility (WPCF).

Figure 4.01-1 shows the existing City SSS and MMSD intercepting sewers and pumping stations.

Most existing sewers flow to the Valley and the Lakeview drainage areas located in the central area of the City. Approximately the southern third of the City eventually flows through the Elm Lawn drainage area to MMSD's Gammon Extensions and Esser Pond Interceptors (EPI). There are a few instances where wastewater generated outside of the current corporate boundaries of the City is collected and conveyed into the City's SSS. A small area in the City of Madison on Countryside Drive adjacent to the southeast side of the City flows into City SSS on University Avenue. A similar situation occurs near Mendota Park adjacent to the northeast side of the City. Sewers tributary to the Mendota County Park Pumping Station are part of the Town of Westport Utility District (WUD). Through annexation, certain portions of MMSD are now in the City limits. The sewers are, however, still under the jurisdiction of the WUD.

4.02 REGIONAL SYSTEM

MMSD intercepting sewer facilities are integral to the City SSS. All City sewers are tributary to these facilities and their locations are centralized in the City's drainage basins.

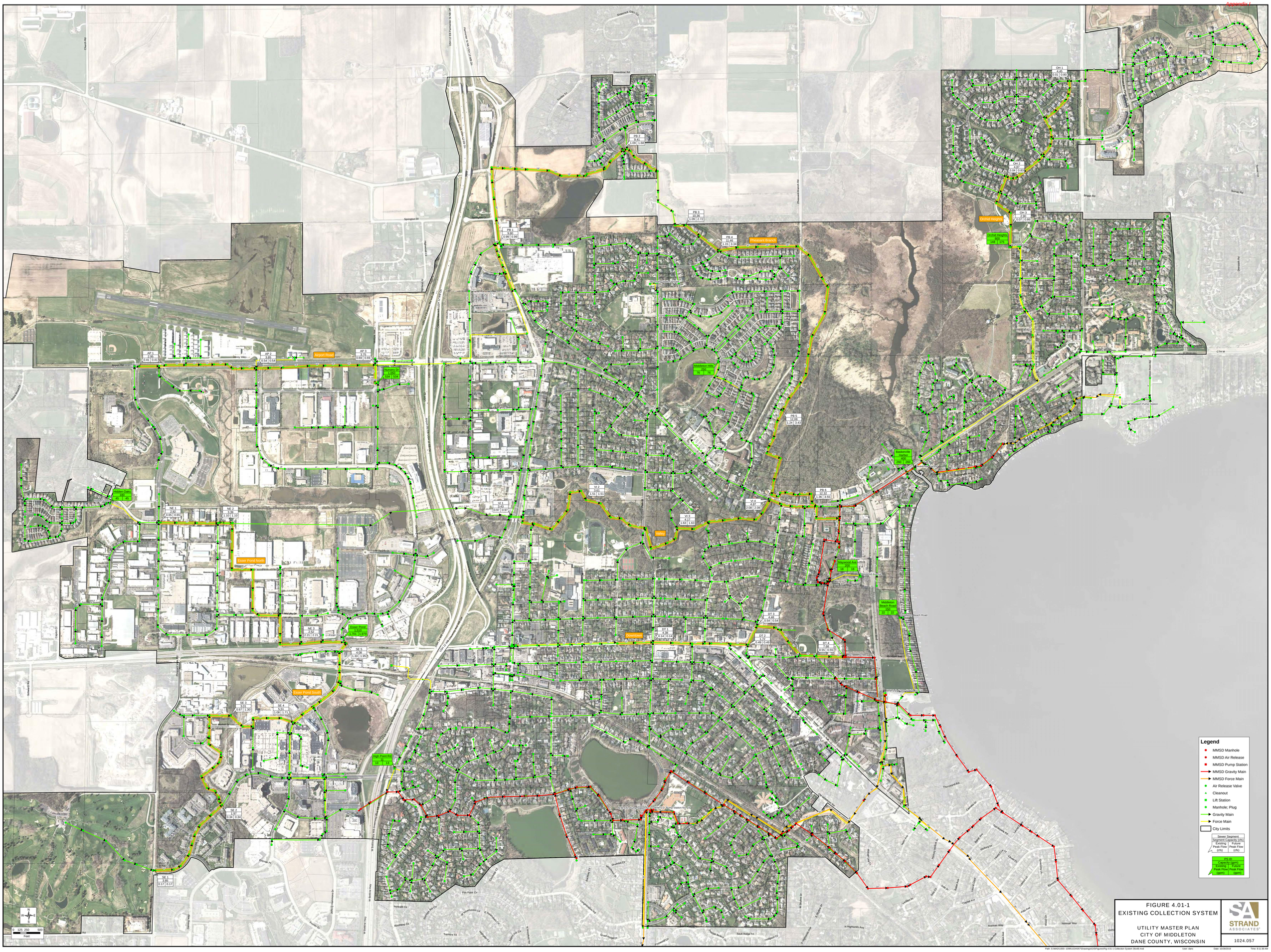
The West Interceptor (WI) runs through the center of the Lakeview drainage area. It accepts pumped flow from the City's drainage areas to the east and gravity flow from the City's SSS extending through the Valley drainage area to the west and the Pheasant Branch drainage area to the north and west. Wastewater from the majority of the developed lands in the City drains to the MMSD WI.

The WI connects to the MMSD Pumping Station No. 15 on Allen Boulevard near Lakeview Boulevard for continued conveyance from the City to MMSD WPCF.

The WI consists of 14- and 18-inch force mains and 18- to 42-inch gravity sewers. The 36- and 42-inch sewers were installed from Middleton Springs Drive to Mendota Avenue to upgrade a segment of piping that was in poor condition.

MMSD Pumping Station No. 15 has a peak flow capacity of 15.17 mgd (23.5 cfs). A 12-inch spur off the WI from Pumping Station No. 15 to Lakeview Boulevard also is part of MMSD's system. The upper segments of this sewer (upstream of manhole [MH] S12168), which years ago were connected to the Old Middleton Treatment Plant, were abandoned or deeded over to the City when the City connected to the WI at Mendota Avenue and Gateway Street.

The Gammon Extension and EPIs are located through the center of the southerly portion of the City's SSS. MMSD Pumping Station No. 16 has been located along the route of this interceptor to accept flow from the interceptor west of Gammon Road. The interceptor east of Gammon Road serves only the Elm Lawn drainage area.



Path: S:\MAD\1000-1099\1024\057\Drawings\GIS\Figures\Fig 4.01-1 Collection System 36x48.mxd User: danc Date: 10/28/2019 Time: 8:11:36 AM

The MMSD EPI from the Beltline to Middleton Street has been sized to include the Sauk Trail area, which includes the area west of Pleasant View Road and north of Old Sauk Road. The interceptor from Middleton Street to Pumping Station No. 16 will convey this flow plus that from the City's adjacent service area.

4.03 INTERCEPTING SEWERS

The existing collection system, including the City's Intercepting Sewer System (ISS) is shown on Figure 4.01-1. The sewers that are included in the ISS are highlighted on Figure 4.01-1. Figure 4.03-1 highlights the areas that are tributary to each of the ISS sewers.

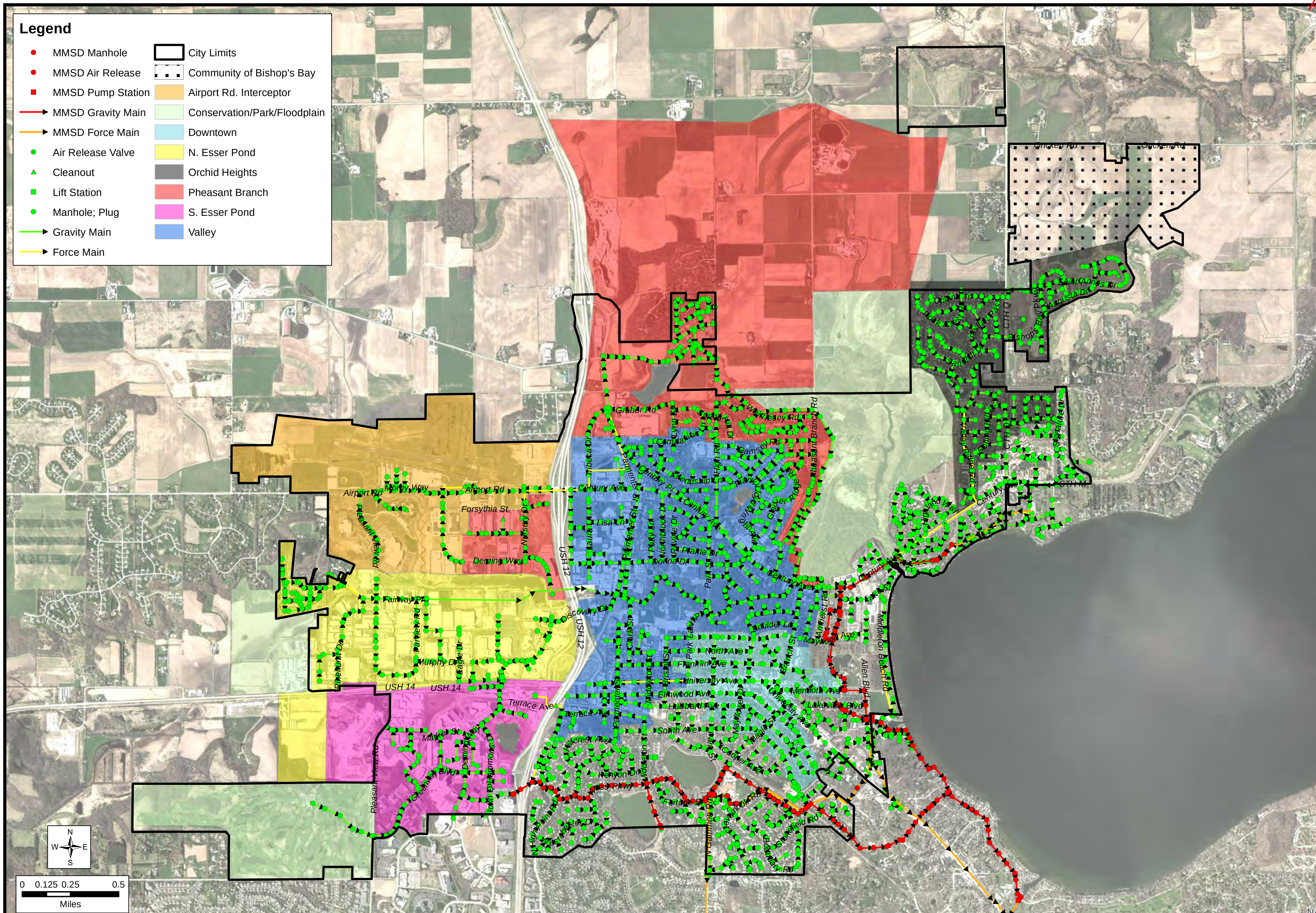
The ISS includes the following interceptors:

- Valley
- University Avenue/Downtown
- Esser Pond North
- Esser Pond South
- Pheasant Branch
- Airport Road
- Orchid Heights

For purposes of this study, each of the interceptors was broken down into segments, with each segment containing pipes of the same size and similar capacity. Figure 4.01-1 provides the following information for each sewer segment:

- Segment ID
- Segment Capacity (cfs) based on full pipe flow
- Existing Peak Flow (cfs) based on existing development tributary to the segment
- Future Peak Flow (cfs) based on projected future development tributary to the segment

Appendix A contains a breakdown of each interceptor and the calculated capacity of the segments shown on Figure 4.01-1. Additional information for each of the interceptors that make up the ISS is presented following.



INTERCEPTOR TRIBUTARY AREAS

UTILITY MASTER PLAN
CITY OF MIDDLETON
DANE COUNTY, WISCONSIN

STRAND ASSOCIATES®

FIGURE 4.03-1
1024.057

Path: S:\MAD\1000--1099\1024\057\Drawings\GIS\Figures\Fig 4.03-1 Interceptor Tributary Areas 11x17.mxd User: danc Date: 10/17/2019 Time: 8:34:38 AM

A. Valley Interceptor (VI)

The VI includes sewers ranging in size from 10 to 16 inches. The initial segments of the VI along Century Avenue (CTH M) were constructed in approximately 1956. The remainder of the VI was constructed in approximately 1960. Asbestos cement (AC) pipe was used for a majority of the sewer with some iron pipe used in the difficult construction areas along Century Avenue, especially at the creek crossing. The sewer appears to be in good condition. A feature of this interceptor is that the manhole castings and a portion of each barrel section of all manholes along the interceptor route paralleling the creek are raised above surrounding ground. This lessens the chances of inflow into the manhole, especially at the manhole casting.

Table 4.03-1 provides a summary of the segments that make up the VI, along with the existing and future flows in the system. Land use assumptions and associated design flows for this interceptor are summarized in Appendix B.

Segment Identification	Segment Capacity (cfs)	Existing Flow Rates		Future Flow Rates	
		Average (cfs)	Peak (cfs)	Average (cfs)	Peak (cfs)
VI 1	3.43	0.34	0.97	0.34	0.97
VI 2	3.61	0.52	1.51	0.52	1.51
VI 3	4.17	0.55	1.63	0.55	1.63
VI 4	4.87	0.67	2.08	0.67	2.08

Table 4.03-1 Valley Interceptor–Capacity and Flow Rates

B. University Avenue/Downtown Interceptor

The University Avenue Interceptor includes sewers ranging in size from 12 to 16 inches, and serves the central portion of the City including the downtown area. This interceptor originally discharged into the Old Middleton Treatment Plant located immediately east of Branch Street.

Table 4.03-2 provides a summary of the segments that make up the University Avenue Interceptor, along with the existing and future flows in the system. Land use assumptions and associated design flows for this interceptor are summarized in Appendix B.

Segment Identification	Segment Capacity (cfs)	Existing Flow Rates		Future Flow Rates	
		Average (cfs)	Peak (cfs)	Average (cfs)	Peak (cfs)
DT 1	4.38	0.04	0.14	0.04	0.14
DT 2	1.72	0.14	0.49	0.14	0.49
DT 3	4.48	0.16	0.54	0.16	0.54
DT 4	7.68	0.16	0.55	0.16	0.55

Table 4.03-2 University Avenue Interceptor–Capacity and Flow Rates

C. Esser Pond Interceptors (EPI)

The North and South EPIs include sewers ranging in size from 10 to 15 inches. The EPIs discharge to the Esser Pond Pumping Station located near US 14 and Deming Way, which in turn conveys the collected wastewater through a 16-inch force main to the MMSD Interceptor near Greenway Boulevard and US 12. The EPI sewers were installed in the late 1980s and early 1990s in multiple phases to provide sewer service for an expansion of commercial and industrial areas. Approximately 10,000 feet of 12- to 18-inch sanitary sewer was installed in four phases. The connection of these sewers to the MMSD interceptor was established to divert existing and future wastewater flows that had been and would be collected in the Golf Green Industrial Park from the existing VI because of capacity concerns in the VI.

Tables 4.03-3 and 4.03-4 provide a summary of the segments that make up the EPIs, along with the existing and future flows in the system. Land use assumptions and associated design flows for this interceptor are summarized in Appendix B.

Segment Identification	Segment Capacity (cfs)	Existing Flow Rates		Future Flow Rates	
		Average (cfs)	Peak (cfs)	Average (cfs)	Peak (cfs)
NE 1	2.82	0.25	0.65	0.25	0.65
NE 2	3.39	0.43	1.10	0.43	1.10
NE 3	2.52	0.87	2.21	0.87	2.21

Table 4.03-3 North Esser Pond Interceptor–Capacity and Flow Rates

Segment Identification	Segment Capacity (cfs)	Existing Flow Rates		Future Flow Rates	
		Average (cfs)	Peak (cfs)	Average (cfs)	Peak (cfs)
SE 1	3.85	0.04	0.17	0.04	0.17
SE 2	1.97	0.09	0.34	0.09	0.34
SE 3	3.01	0.22	0.67	0.45	1.30
SE 4	5.51	0.38	1.08	0.61	1.71
SE 5	4.08	0.48	1.33	0.71	1.95

Table 4.03-4 South Esser Pond Interceptor–Capacity and Flow Rates

D. Pheasant Branch Interceptor (PBI)

The PBI includes sewers ranging in size from 18 to 30 inches and was installed in 1997. The PBI extends northerly from MMSD's WI near Century Avenue and Allen Boulevard to Graber Road at US 12. It provides service to the City's Northwest Quadrant Planning Area and the Airport Road service area. The PBI was installed to divert existing and future wastewater flows from the VI because of capacity concerns. Land use assumptions and associated design flows for this interceptor are summarized in Appendix B.

Table 4.03-5 provides a summary of the segments that make up the PBI, along with the existing and future flows in the system. Land use assumptions and associated design flows for this interceptor are summarized in Appendix B.

Segment Identification	Segment Capacity (cfs)	Existing Flow Rates		Future Flow Rates	
		Average (cfs)	Peak (cfs)	Average (cfs)	Peak (cfs)
PB 1	9.80	0.39	0.99	0.39	0.99
PB 2	9.41	0.41	1.09	0.58	1.68
PB 3	10.36	0.42	1.09	0.84	2.72
PB 4	11.46	0.43	1.15	0.99	3.34
PB 5	12.08	0.45	1.24	1.02	3.43
PB 6	12.32	0.49	1.36	1.05	3.55

Table 4.03-5 Pheasant Branch Interceptor–Capacity and Flow Rates

E. Airport Road Interceptor (ARI)

The ARI includes sewers ranging in size from 15 to 18 inches and was completed in 1999. The project was constructed to serve a developing area on the west side of the City, adjacent to Morey Airport, as part of the City's Tax Incremental Financing (TIF) initiative. The ARI discharges to the Airport Road Pumping Station that further conveys the collected wastewater through a 14-inch force main to the head end of the PBI, near US 12 and Graber Road.

Table 4.03-6 provides a summary of the segments that make up the ARI, along with the existing and future flows in the system. Land use assumptions and associated design flows for this interceptor are summarized in Appendix B.

Segment Identification	Segment Capacity (cfs)	Existing Flow Rates		Future Flow Rates	
		Average (cfs)	Peak (cfs)	Average (cfs)	Peak (cfs)
AP 1	2.95	0.16	0.41	0.16	0.41
AP 2	3.85	0.21	0.54	0.21	0.54
AP 3	3.75	0.28	0.69	0.28	0.69

Table 4.03-6 Airport Road Interceptor–Capacity and Flow Rates

F. Orchid Heights Interceptor (OHI)

The OHI includes sewers ranging in size from 12 to 15 inches. The OHI was installed in 1998 to provide sewer service to the Orchid Heights, Northlake Subdivision, and COBB neighborhood areas. This interceptor discharges to the Orchid Heights Pumping Station. The original Orchid Heights Pumping

Station was replaced to accommodate the expanded service area of the OHI. This pumping station further conveys the collected wastewater through an 8-inch force main to the head end of the MMSD WI.

Table 4.03-7 provides a summary of the segments that make up the OHI, along with the existing and future flows in the system. Land use assumptions and associated design flows for this interceptor are summarized in Appendix B.

Segment Identification	Segment Capacity (cfs)	Existing Flow Rates		Future Flow Rates	
		Average (cfs)	Peak (cfs)	Average (cfs)	Peak (cfs)
OH 1	4.45	0.003	0.01	0.20	0.80
OH 2	4.87	0.01	0.04	0.21	0.83
OH 3	2.90	0.02	0.07	0.22	0.86

Table 4.03-7 Orchid Heights Interceptor–Capacity and Flow Rates

4.04 CITY MAIN TRUNK SEWERS

Main trunk sewers are central sewers that connect to interceptors and collect wastewater from the local street sewers and discharge them to interceptors. These sewers are typically smaller in size than interceptors. In some cases, they may be as small as 8 inches in diameter, which is the minimum size for any sewer. Main trunk sewers are more important for their location in the wastewater collection than for their size.

The 8- and 10-inch sewer from High Road and Park Street to the VI are important in that they provide service to the primarily residential High Road drainage area and, at present, accept the backwash water from the iron removal facility at the City Well No. 4 on High Road. The 8-inch sewer from the 12-inch University Avenue Interceptor at Branch Street along University Avenue and Maple Street and through backyards to Elmwood Avenue is important because it receives the backwash water from the iron removal facility at City Well No. 5 on Elmwood Avenue, as well as primarily residential flow from this older developed area of the City.

There are two main trunk sewers connected to the head end of the VI at US 12, one along the east side and one along the west side of US 12. These sewers parallel US 12 to the north to serve the residences and businesses on both sides of the highway. The trunk sewer on the east side is 8- and 10-inch-diameter from the VI north to Century Place. This trunk sewer had been important because of the large volume of wastewater from Graber Manufacturing that had discharged into this sewer along with wastewater from the mixed residential and commercial East US 12 drainage area of the City. These flows have since been diverted to the PBI. The trunk sewer along the west side of US 12 had served a portion of the Green Acres Commercial Park and the residential area north of Airport Road.

A portion of these flows have likewise been diverted to the PBI via the ARI. The reduced service area and associated wastewater flows are significant in that they now have reserve capacity available to

provide service for an increase in density in their remaining service areas, as redevelopment within TIF District No. 5 occurs.

4.05 WASTEWATER PUMPING STATIONS

The City operates and maintains nine wastewater pumping stations located within City limits. The location of each of these pumping stations is shown on Figure 4.01-1. Figure 4.05-1 shows the tributary areas to each pumping station. Table 4.05-1 gives the approximate capacities for the major pumping stations in the City based on previous observations or published data.

The COBB Pumping Station and the discharge force main, which will serve portions of the COBB development, have been designed and will be constructed when development proceeds. Details of these facilities are presented in Section 5.

Pumping Station	Pump[1]	Capacity (gpm)	Motor HP	TDH	RPM
Middleton Beach Road	4 inches–5k284d118	150	5	–	1,150
Baskerville Harbor	4 inches–5442	400	7.5	–	1,750
Orchid Heights	4 inches–5442c	600	25	81	1,765
Maywood Avenue	4 inches–5410	200	3	21	1,150
High Point Road	Farrel 214	11	–	–	–
Esser Pond	6 inches–5444	1,510	40	66	1,180
Nursery Drive	6 inches–5444	1,050	25	48	1,185
Hidden Oaks	4 inches–5444	180	3	16	870
Middleton Hills	4 inches–5432c	250	7.5	–	1,150

Notes:
[1]Fairbanks Morse unless noted.
gpm=gallons per minute
HP=horsepower
TDH=total dynamic head
RPM=revolutions per minute

Table 4.05-1 Pumping Station Equipment Summary

A. Middleton Beach Road Pumping Station

It is not known when the Middleton Beach Road Pumping Station was installed. No original information is available on this pumping station. There are reports that this pumping station and its sewers may have been installed in 1935 or 1936 under the old Works Progress Administration (WPA) program, making it approximately 75 years old.

This pumping station is a wet well/dry well-type pumping station. A rectangular concrete wet well shares a common wall with the adjacent, below-grade dry well or pump pit. An above-grade, uninsulated concrete-block pumphouse with a concrete roof covers the motors, electrical controls, and rectangular opening in the floor over the dry well. Two vertical, open-shaft centrifugal pumps are mounted in the dry well.

Appendix I

Legend

- MMSD Manhole
- MMSD Air Release
- MMSD Pump Station
- MMSD Gravity Main
- MMSD Force Main
- Air Release Valve
- Cleanout
- Lift Station
- Manhole; Plug
- Gravity Main
- Force Main
- City Limits
- Community of Bishop's Bay
- Nursery Drive
- Baskerville Harbor
- Esser Pond
- Hidden Oaks
- High Point Rd
- Maywood Ave
- Middleton Beach Road
- Middleton Hills
- Orchid Heights

Hidden Oaks
Nursery Drive
Esser Pond
High Point Road
M.M.S.D. Pump Station No. 16
Middleton Hills
Orchid Heights
Baskerville Harbor
Maywood Avenue
Middleton Beach Road
M.M.S.D. Pump Station No. 15

N W E S

0 0.125 0.25 0.5
Miles

NA

PUMPING STATION TRIBUTARY AREAS

UTILITY MASTER PLAN
CITY OF MIDDLETON
DANE COUNTY, WISCONSIN

STRAND ASSOCIATES®

FIGURE 4.05-1
1024.057

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Previous inspection showed the condition of this station to be structurally fair. However, pumps and piping in the dry well limit ease of access for maintenance. The dry well also has had issues with infiltration. City staff have indicated that this pumping station and force main will be upgraded in conjunction with future road construction.

Elevation data indicates the Middleton Beach Road Pumping Station cannot be eliminated, as both nearby MMSD and City sewers are higher in elevation than the incoming sewer to this pumping station.

While this pumping station is quite old, it has historically performed reasonably well. Recent running time meter data suggests these pumps operate 2.55 hours per day.

Table 4.05-2 summarizes pump station capacity, along with existing and future flows tributary to the pumping station.

Pumping Station	Capacity (gpm)	Existing Flow Rates				Future Flow Rates			
		Average		Peak		Average		Peak	
		(cfs)	(gpm)	(cfs)	(gpm)	(cfs)	(gpm)	(cfs)	(gpm)
Middleton Beach Road	150	0.01	4	0.05	22	0.01	4	0.05	22

Table 4.05-2 Middleton Beach Road–Capacity and Flow Rates

B. Baskerville Harbor Pumping Station

The Baskerville Harbor Pumping Station was constructed in 1957 and modified in 1973. Two self-priming pumps and controls are housed in an above-grade pumphouse building, which is located over the wet well. The building previously housed a pneumatic ejector-type pumping system prior to modification. Previous inspection has found this pumping station in relatively good condition both structurally and mechanically.

Recent running time meter data indicates these pumps each run 2.21 hours per day.

Table 4.05-3 summarizes pumping station capacity, along with existing and future flows tributary to the pumping station.

Pumping Station	Capacity (gpm)	Existing Flow Rates				Future Flow Rates			
		Average		Peak		Average		Peak	
		(cfs)	(gpm)	(cfs)	(gpm)	(cfs)	(gpm)	(cfs)	(gpm)
Baskerville Harbor	400	0.16	72	0.58	260	0.16	72	0.58	260

Table 4.05-3 Baskerville Harbor–Capacity and Flow Rates

C. Orchid Heights Pumping Station

The Orchid Heights Pumping Station was constructed during summer 1998. This pumping station is a wet well/dry well type with a factory-fabricated steel dry well and 10-foot-diameter concrete wet well. Two pedestal-mounted centrifugal pumps are located in the dry well. This pumping station is in good condition both structurally and mechanically. Recent running time meter data indicates these pumps each run 2.19 hours per day.

Table 4.05-4 summarizes pumping station capacity, along with existing and future flows tributary to the pumping station.

Pumping Station	Capacity (gpm)	Existing Flow Rates				Future Flow Rates			
		Average		Peak		Average		Peak	
		(cfs)	(gpm)	(cfs)	(gpm)	(cfs)	(gpm)	(cfs)	(gpm)
Orchid Heights	600	0.09	40	0.33	148	0.10	45	0.39	175

Table 4.05-4 Orchid Heights–Capacity and Flow Rates

D. Maywood Avenue Pumping Station

The Maywood Avenue Pumping Station was constructed in spring 1973. This pumping station is a wet well/dry well type with a fabricated-steel dry well and 5-foot-diameter concrete wet well. The dry well contains two pedestal-mounted pumps. Previous inspections have found this pumping station to be in good condition both structurally and mechanically. Recent running time meter data indicates an average runtime of 4.64 hours per day.

Table 4.05-5 summarizes pumping station capacity, along with existing and future flows tributary to the pumping station.

Pumping Station	Capacity (gpm)	Existing Flow Rates				Future Flow Rates			
		Average		Peak		Average		Peak	
		(cfs)	(gpm)	(cfs)	(gpm)	(cfs)	(gpm)	(cfs)	(gpm)
Maywood Avenue	200	0.01	4	0.04	18	0.01	4	0.04	18

Table 4.05-5 Maywood Avenue–Capacity and Flow Rates

E. High Point Road Pumping Station

The High Point Road Pumping Station was constructed in spring 1979 and consists of a factory-assembled, duplex grinder pump module installed in a 6-foot-diameter manhole. Two identical progressive capacity pumps, each with an integral shredding and grinding mechanism at the pump intake, are suspended in a 120-gallon, fiberglass-reinforced polyester tank. The tank and pumps are located at the bottom of a standard manhole with cast iron frame and cover. This pumping station is in good condition both structurally and mechanically. The High Point Road Pumping Station is a temporary station to be replaced when further development occurs in the area. No run times are available for this pumping station.

Table 4.05-6 summarizes pumping station capacity, along with existing and future flows tributary to the pumping station. Note that the projected peak flow rates are approximately the same as the existing capacity of the pumping station. City staff have not indicated that there have been any issues with this pumping station, however.

Pumping Station	Capacity (gpm)	Existing Flow Rates				Future Flow Rates			
		Average		Peak		Average		Peak	
		(cfs)	(gpm)	(cfs)	(gpm)	(cfs)	(gpm)	(cfs)	(gpm)
High Point Road	11	0.01	4	0.03	13	0.01	4	0.03	13

Table 4.05-6 High Point Road–Capacity and Flow Rates

F. Esser Pond Pumping Station

The Esser Pond Pumping Station was installed in 1990. This pumping station is a wet well/dry well station with a factory-fabricated steel dry well. The dry well is oval shaped with two pedestal-mounted pumps. Space is available for installation of a third pump. The wet well is 10-foot-diameter concrete.

Recent running time meter data for this pumping station indicates the pumps are each running approximately 3.07 hours per day.

Table 4.05-7 summarizes pumping station capacity, along with existing and future flows tributary to the pumping station. Note that both the existing and future peak flow rates exceed the existing capacity of the pumping station. There is room in the pumping station to add a third pump.

Pumping Station	Capacity (gpm)	Existing Flow Rates				Future Flow Rates			
		Average		Peak		Average		Peak	
		(cfs)	(gpm)	(cfs)	(gpm)	(cfs)	(gpm)	(cfs)	(gpm)
Esser Pond	1,510	1.46	655	3.79	1,701	1.69	759	4.41	1,979

Table 4.05-7 Esser Pond–Capacity and Flow Rates

G. Nursery Drive

The Nursery Drive Pumping Station was installed in 1999. This pumping station is a wet well/dry well with a factory-fabricated steel dry well, and a 10-foot-diameter concrete wet well. This pumping station experienced significant surface flooding in August 2018 as a result of a major rainfall event.

Recent running time meter data for this pumping station indicates the pumps are each operating approximately 0.72 hours per day.

Table 4.05-8 summarizes pumping station capacity, along with existing and future flows tributary to the pumping station.

Pumping Station	Capacity (gpm)	Existing Flow Rates				Future Flow Rates			
		Average		Peak		Average		Peak	
		(cfs)	(gpm)	(cfs)	(gpm)	(cfs)	(gpm)	(cfs)	(gpm)
Nursery Drive	1,050	0.45	202	1.19	534	0.45	202	1.19	534

Table 4.05-8 Nursery Drive–Capacity and Flow Rates

H. Hidden Oaks Pumping Station

The Hidden Oaks Pumping Station was installed in 2007. This pumping station is a wet well/dry well station with a 6-foot precast concrete wet well and factory-fabricated steel dry well.
Recent running time meter data for this pumping station indicates the pumps are each operating approximately 0.89 hours per day.

Table 4.05-9 summarizes pumping station capacity, along with existing and future flows tributary to the pumping station.

Pumping Station	Capacity (gpm)	Existing Flow Rates				Future Flow Rates			
		Average		Peak		Average		Peak	
		(cfs)	(gpm)	(cfs)	(gpm)	(cfs)	(gpm)	(cfs)	(gpm)
Hidden Oaks	180	0.03	13	0.10	45	0.03	13	0.10	45

Table 4.05-9 Hidden Oaks–Capacity and Flow Rates

I. Middleton Hills

The Middleton Hills Pumping Station was installed in 1998. This pumping station is a wet well/dry well station with a 6-foot-diameter precast concrete wet well and factory-fabricated steel dry well.

Recent running time meter data for this pumping station indicates the pumps are each operating approximately 1.16 hours per day.

Table 4.05-10 summarizes pumping station capacity, along with existing and future flows tributary to the pumping station.

Pumping Station	Capacity (gpm)	Existing Flow Rates				Future Flow Rates			
		Average		Peak		Average		Peak	
		(cfs)	(gpm)	(cfs)	(gpm)	(cfs)	(gpm)	(cfs)	(gpm)
Middleton Hills	250	0.04	18	0.17	76	0.04	18	0.17	76

Table 4.05-10 Middleton Hills–Capacity and Flow Rates

SECTION 5
COLLECTION SYSTEM–CONCLUSIONS AND RECOMMENDATIONS

5.01 CONCLUSIONS

A. Regional System

MMSD has an ongoing program to periodically assess the operation of the MMSD-owned collection system that serves the City and surrounding communities. Implementation of this program has resulted in the planning and construction of interceptor and pumping station upgrades over the last several years. This process has consistently stayed ahead of the City's development.

B. Intercepting Sewers

Section 4.03 presented a summary of each of the intercepting sewers analyzed as part of this study, along with segment capacities and projected existing and future average and peak flow rates. In all instances, the calculated capacity of the interceptors exceeded the projected peak flow rates.

C. Trunk Sewers

Section 4.04 briefly discussed the main trunk sewers included in the City's SSS. There are no known issues with the trunk sewers. In some instances, recent projects and flow diversions have addressed potential issues in the collection system.

D. Pumping Stations

Section 4.05 provided a summary of each of the nine pumping stations in the City's collection system. In general, the rated capacities of the pumping stations exceed the projected existing and future average and peak flow rates. Three comments are warranted pertaining to the pumping stations:

- The Middleton Beach Road Pumping Station is approximately 75 years old. City staff have indicated that this pumping station and the associated force main will be upgraded as part of a future road reconstruction project. Upgrading to a new submersible station will have an estimated cost of $350,000.

- The High Point Road Pumping Station capacity is approximately equal to the projected peak flow rates. This is a temporary pumping station, however, and is to be replaced when further development occurs in the area.

- The Esser Pond Pumping Station has both existing and future peak flows that exceed the capacity of the existing station. The station design, however, has space to add a third pump when required due to future flows. The new pump is anticipated to cost approximately $100,000.

5.02 RECOMMENDATIONS

Overall, the City's collection system appears to be well maintained and functioning as intended, providing the proper level of service to users. Significant recommendations for changes or improvements do not seem to be warranted at this time. The following general recommendations are provided for consideration:

- Continue to maintain communications with MMSD regarding future development, thereby allowing MMSD to factor the City's plans into MMSD's planning efforts.

- Temporary flow metering may be considered at key locations within the collection system, particularly downstream of planned development areas. The City is already tracking operational parameters and pumping station runtimes, which provide important information on the operation of the system.

- Runtimes for the High Point Road and Esser Pond Pumping Stations should be closely monitored, and planning for modifications to each station initiated well in advance of potential operational issues.

- The COBB Pumping Station and discharge force main will serve portions of the COBB development. The facilities have been designed and will be constructed when development proceeds. The pumping station is expected to be located just south of Oncken Road, approximately 1,700 feet east of CTH Q. The peak design flow for the COBB Pumping Station is projected to be 1,940 gpm. The facility will be a wet well/dry well-type station with three conventional centrifugal wastewater pumps that are capable of accommodating the design peak flow with one pump out of service. The force main for this facility will extend through public streets so that it is fully accessible for any future repairs. Based on previous cost estimates and bid results, the anticipated cost for this station could range between $6,500,000 and $7,000,000.

SECTION 6
EXISTING WATER SYSTEM

6.01 SYSTEM OVERVIEW

The City Water Utility maintains six active wells, two booster stations, two elevated tanks, and two ground-level reservoirs that supply water through approximately 93 miles of water main ranging from 4 inches to 16 inches in diameter. The distribution system provides water to residents within the City, City of Madison, and the Town of Westport. Table 6.01-1 summarizes the quantity of water main in the distribution system as reported to the Wisconsin Public Service Commission (PSC) at the end of 2018. Figure 6.01-1 presents a map of the current distribution system with locations of key water system components.

Water Main Diameter (inches)	Length (feet)	Percentage of Total
4	162	0.1%
6	97,673	19.9%
8	208,956	42.5%
10	84,418	17.2%
12	90,849	18.5%
14	3,968	0.8%
16	5,677	1.2%
Total	491,703	100%

Table 6.01-1 Existing Distribution System Water Main Inventory

6.02 WELL SUPPLY

Six wells supply water to the distribution system. Table 6.02-1 presents the current and rated well capacity of each well and the total and firm well capacity of the system. Appendix C contains drilling and construction reports for each of the wells. Current capacities are those reported by the City and will be used for evaluating the ability of the system to meet present day and future projected demands. The total current well capacity is 6,295 gpm. The current firm well capacity, defined as the total well capacity with the largest-producing well out of service, is 4,880 gpm. Well No. 7 was previously drilled but has since been capped, and a well facility and distribution piping have not yet been constructed.

Well No.	Rated Capacity (gpm)	Current Capacity (gpm)	Current Capacity (mgd)
2	350	330	0.475
3	1,050	960	1.382
4	1,200	1,220	1.757
5	1,325	1,400	2.016
6	1,550	1,415	2.038
7	N/A	N/A	N/A
8	1,500	970	1.397
Total Capacity	6,975	6,295	9.065
Total Well Nos. 4, 5, and 8	4,025	3,590	5.170
Well Nos. 4, 5, and 8 Percentage*	57.7%	57.0%	57.0%
Firm Capacity**	5,425	4,880	7.027
Well Nos. 4, 5, and 8 Percentage*	74.2%	73.6%	73.6%

* See Wisconsin Department of Natural Resources' (WDNR's) note in Section 7.02
**Assumes Well No. 6 pump out of service

Table 6.02-1 Existing Well Capacity

Legend

- Metering Station
- Private Hydrant
- Public Hydrant
- Reservoir
- Wells
- Booster Station
- Elevated Tank
- Municipal Limits

Water Main Diameter (Public)
- 4"
- 6"
- 8"
- 10"
- 12"
- 14"
- 16"

Water Main Diameter (Private)
- 4"
- 6"
- 8"
- 10"
- 12"

Metering Station
Well No. 4
Tower 1
Tower 2
Well No. 8
Quarry Reservoir
Well No. 2
Well No. 3
Well No. 5
Well No. 6 Reservoir
Well No. 6
Greenway Booster No. 2
Greenway Booster No. 1
Greenway Booster No. 3
Well No. 7

N
W E
S
0 250 500 1,000
Feet

WATER DISTRIBUTION SYSTEM MAP

UTILITY MASTER PLAN
CITY OF MIDDLETON
DANE COUNTY, WISCONSIN

STRAND ASSOCIATES®

FIGURE 6.01-1
1024.057

NA

In January 2008, the WNDR approved a reduced pumping rate for the combined pump rate of Well Nos. 4, 5, and 8. The reduced pumping rate limits the combined well pumpage to 70 percent of the maximum projected total system pump rate to minimize impacts on the nearby Frederick Springs. The combined pump rate must be 70 percent total system pump rate or less, except when one of the other system wells, excluding Well Nos. 4, 5, or 8, is offline for more than 60 days. In this case, Well Nos. 4, 5, and 8 will be allowed to operate at 76.2 percent of the maximum projected total system pump rate. Based on the total and firm capacities above, the City appears to be in accordance with the mandated reduced pumping rates.

A. Well No. 2

Well No. 2 is located at 1702 Reservoir Road just off Hillcrest Avenue. The well was drilled in 1940 to a depth of 330 feet. The production portion of the well is 12 inches in diameter. In 1981, a StaRite submersible pump replaced the original vertical turbine pump. In 2008, a Grundfos vertical turbine pump with a submersible motor was installed. The well pump has a design flow of 350 gpm at 235 feet of head. The well discharges to the Quarry Reservoir. Chlorine gas and fluoride are added to the discharge piping from the well to the reservoir.

B. Well No. 3

Well No. 3 is located at 7716 Hillcrest Avenue approximately 100 feet south of the Quarry Reservoir. The well was drilled in 1954 to a depth of 600 feet. The production portion of the well is 15 inches in diameter. In 2008, a new Christensen vertical turbine pump and variable frequency drive (VFD) were installed. The well pump has a design flow of 1,200 gpm at 250 feet of head. The well discharges to the Quarry Reservoir. Chlorine gas and fluoride are added to the discharge piping from the well to the reservoir.

C. Well No. 4

Well No. 4 is located at 3640 High Road adjacent to the 500,000-gallon Tower 1. The well was drilled in 1960 to a depth of 847 feet. The production portion of the well is 23 inches in diameter. In 1971, a Layne vertical turbine pump was installed. The pump has a design flow of 1,220 gpm at 358 feet of head. The well pump can also be driven directly by a diesel engine. The well discharges through an iron removal plant to the distribution system that can be bypassed if necessary. Chlorine gas is added upstream of the iron removal plant, whereas fluoride is added downstream.

The well was out of service from February 1961 to 1971 while the iron removal plant was constructed. In 1994, the well was out of service for repairs because the couplings were heavily corroded and were replaced with stainless steel couplings. During this time, the well was also blasted to increase capacity.

D. Well No. 5

Well No. 5 is located at 6409 Elmwood Avenue on the south side of the City. The well was drilled in 1964 to a depth of 809 feet. The production portion of the well is 19 inches in dimeter to 480 feet and 15 inches in diameter from 480 feet to 809 feet. In 1986, an American Turbine vertical turbine pump was installed. The pump has a design flow of 1,425 gpm at 320 feet of head. The well discharges through an iron removal plant to the distribution system. Chlorine gas is added both upstream and downstream of the

iron removal plant. Fluoride is added downstream of the iron removal plant. In 1997, the well pump was pulled to replace several length of pump column, rebuild the pump and motor, and add 10 feet of suction pipe. In 2002, the pump was removed to repair a hole in the column pipe.

E. Well No. 6

Well No. 6 is located at 8490 Greenway Boulevard east of the South Branch of Pheasant Branch Creek. The well was drilled in 1986 to a depth of 856 feet. The production portion of the well is 19 inches in diameter from 220 feet to 450 feet and 17 inches in diameter from 450 feet to 856 feet. A Layne vertical turbine pump was installed after the well was drilled in 1986. The pump has a design flow of 1,600 gpm at 155 feet of head. The well discharges to a 100,000-gallon ground-level reservoir located adjacent to the well. Chlorine gas and fluoride are added in the discharge piping from the well to the reservoir. The well was rehabilitated in 2016. It was found that the bore hole appeared to be soft and not structurally sound between 365 and 485 feet below ground.

F. Well No. 7

Well No. 7 is located at 6711 Stonefield Road on the south side of the City but is not in operation. A well house and distribution system piping has not yet been constructed. The well remains intended for future use. The well was drilled in 1999 to a depth of 836 feet. The production portion of the well is 19 inches in diameter from 460 feet to 836 feet. Because of alignment problems, the City did not accept the original well (EJ-763) that was drilled and a new well (MU-984) was drilled 45 feet to the northwest of the original site. In 2015, the well was granted a variance for five years to be kept by the City. The City will reportedly apply for an additional variance upon the expiration date in 2020. The well is intended to be used in the future as future growth develops and as current infrastructure is removed from service.

G. Well No. 8

Well No. 8 is located at 3222 West Point Road east of Mendota County Park. The well was drilled in 2008 to a depth of 740 feet. The production portion of the well is 19 inches in diameter from 300 feet to 740 feet. The pump has a design flow of 1,500 gpm at 395 feet of head. The well discharges directly to the distribution system. Chlorine gas and fluoride are added to the well discharge piping. The well is scheduled to be rehabilitated in 2019. The well facility includes a 350-HP natural gas-fired backup generator.

H. Well Maintenance Schedule

Table 6.02 summarizes the year drilled, current capacity, date and type of most recent rehabilitation, next scheduled rehabilitation, and the opinion of probable project cost (OPPC) of the scheduled rehabilitation. Wells generally have an expected lifespan of approximately 80 to 100 years. Depending on specific capacity and maintenance of the well, the well might remain productive for a longer or shorter duration. Well No. 2 is toward the end of its life expectancy. It is recommended to keep the well until the capacity is not able to be maintained through regular rehabilitation.

The City has typically performed maintenance on each of the wells every 10 years. A 10- to 15-year rehabilitation cycle is recommended to be implemented for each of the active wells. The actual frequency of well rehabilitation will depend on current capacity, age of well, and static water levels.

Well No.	Year of Drilling	Current Capacity (gpm)	Previous Rehab. Year	Previous Rehab. Activity	Estimated Scheduled Rehab.	OPPC (2019 Dollars)	Anticipated Decommission Date
2	1940	330	2008	Pulled and replaced pump, wire brushed well.	2020*	$30,000	2040
3	1954	960	2008	Pulled pump, wire brushed well.	2021*	$50,000	2054
4	1960	1,220	2009	Pulled pumps, wire brushed well, replaced iron filter media.	2022*	$50,000	2060
5	1964	1,400	2012	Pulled pumps, wire brushed well, replaced iron media. (2014)	2023*	$50,000	2064
6	1986	1,415	2016	Pulled pumps, wire brushed well, fixed formation.	2026*	$50,000	2086
7	1999	1,500	N/A	N/A	N/A	N/A	2099
8	2008	970	2019	To be completed fall 2019.	2029*	$50,000	2108

*10- to 15-year maintenance recommended.

Table 6.02-2 Well Maintenance Schedule

Well maintenance OPPCs were estimated based on previous well activities and well depth. Costs may change as other maintenance items are required. Well decommission dates are listed at 100 years after well construction as the average useful life of a deep-aquifer well is 80 to 100 years.

I. Water Quality

Table 6.02-3 presents a summary of the most recently available water quality data for Well Nos. 2, 3, 4, 5, 6, and 8 and include both primary maximum contaminant level (MCL) and secondary maximum contaminant level (SMCL) parameters. Data presented were obtained from the City based on samples collected in 2017. Water quality across all wells is generally good.

The wells have relatively very hard water, or concentrations above 180 mg/L as calcium carbonate ($CaCO_3$), and is very typical of the area and aquifer formations. Well Nos. 2, 3, and 8 have generally high manganese and are close to the SMCL of 0.05 mg/L. At this level, water can appear to be slightly black to brown in color, can potentially stain surfaces, and might have a bitter

or metallic taste. Adding pressure filtration treatment to these wells, similar to the equipment at Well Nos. 4 and 5, can reduce the amount of manganese. Alternatively, adding polyphosphates to the well can sequester the manganese and delay the precipitation of oxidized manganese. Iron levels for each well are below the SMCL and do not require treatment to reduce the levels, which is sometimes necessary for wells located in the same aquifer formation.

It was indicated in the 2019 Middleton Consumer Confidence Report that the maximum combined Radium 226 and Radium 228 was 4.0 picocuries per liter (pCi/l) at Well No. 5, a number close to the MCL standard. After review of the laboratory results from when the measurement was reported, it appears this number was reported incorrectly and should be corrected to 1.68 mg/L as shown in Table 6.02-3.

Parameter	Units	MCL	SMCL	Well No. 2	Well No. 3	Well No. 4	Well No. 5	Well No. 6	Well No. 8
Aluminum	ug/L	--	5-200	ND	ND	ND	ND	20	ND
Antimony	ug/L	6	--	ND	ND	ND	ND	ND	ND
Arsenic	ug/L	10	--	ND	ND	[0.80]	ND	ND	ND
Barium	ug/L	2,000	--	37	39	78	32	23	3.7
Beryllium	ug/L	4	--	ND	ND	ND	ND	ND	ND
Cadmium	ug/L	5	--	ND	ND	ND	ND	ND	ND
Calcium	mg/L	--	--	84	84	62	66	72	56
Chloride	mg/L	250	--	110	130	[3.0]	8.2	70	ND
Chromium	ug/L	100	--	1.5	1.7	ND	ND	1.4	ND
pH	SU	--	6.5-8.5	7.21	7.10	7.40	7.28	7.46	7.35
Alkalinity	mg/L	--	--	300	310	290	290	280	300
Fluoride	mg/L	4.0	2.0	0.43	0.8	0.11	[0.091]	0.83	0.72
Hardness	mg/L	--	--	390	390	290	310	340	300
Iron	mg/L	--	0.3	[0.059]	0.088	ND	ND	0.098	[0.021]
Magnesium	mg/L	--	--	45	44	33	34	40	39
Manganese	ug/L	300	50	42	46	27	ND	ND	40
Mercury	ug/L	2	--	ND	ND	ND	ND	ND	ND
Nitrite	mg/L	1	--	ND	ND	ND	ND	ND	ND
Nitrate plus Nitrite	mg/L	10	--	4.3	4.4	ND	ND	3.7	ND
Nickel	ug/L	100	--	1.6	2.0	1.3	1.0	1.1	1.6
Radioactivity, Gross Alpha	pCi/L	15	--	No Data	No Data	1.63 +/- 1.17	2.92 +/- 1.60	-0.335 +/- 1.22	4.14
Radium 226 + 228, Combined	pCi/L	5	--	No Data	No Data	0.869 +/- 0.363	1.68 +/- 0.433	1.01 +/- 0.347	0.9870
Selenium	ug/L	50	--	ND	ND	ND	ND	ND	ND
Silver	ug/L	--	100	ND	[0.19]	ND	ND	ND	ND
Sodium	mg/L	--	--	42	46	3.1	3.9	26	3.0
Sulfate	mg/L	250	--	20	18	ND	17	16	8.2
Thallium	ug/L	2	--	ND	ND	ND	ND	ND	[0.19]
Total Dissolved Solids	mg/L	--	500	560	560	340	330	410	330
Turbidity	NTU	--	--	ND	ND	ND	ND	ND	ND
Zinc	ug/L	--	5	ND	[0.0054]	ND	[0.0062]	13	[0.0072]

ND=not detected
[ ]=results greater than limit of detection (LOD) but less than the limit of quantitation (LOQ)

Table 6.02-3 Water Quality Summary

6.03 BOOSTER PUMPS

There are 11 booster pumps located in three facilities that pump to the distribution system. Table 6.03-1 presents the design and shop tested flow rate and head for each pump.

Pump	Design		Shop Test	
	Flow (gpm)	Head (feet)	Flow (gpm)	Head (feet)
Well No. 6				
High Lift Pump	1,600	114	N/A	N/A
Quarry Reservoir				
Low Zone				
Booster No. 1	1,000	95	1,000	100
Booster No. 2	1,000	95	1,000	100
Booster No. 3	1,000	95	1,000	100
Booster No. 4	1,000	95	1,000	100
Hillcrest High Zone				
Booster No. 1	350	60	350	60.8
Booster No. 2	350	60	350	60.8
Booster No. 3	1,100	50	1,100	49.5
Greenway Station				
Booster No. 1	750	145	750	152.7
Booster No. 2	750	145	750	152.7
Booster No. 3	2,500	136	2,500	156.0

Table 6.03-1 Booster Pump Equipment Summary

A. Well No. 6 Booster Pump

The Well No. 6 Booster Pump is located within the Well No. 6 facility. Water from Well No. 6 discharges into the Well No. 6 Reservoir. The booster pump then pumps water into the distribution system. The pump is a vertical centrifugal turbine pump that was installed in 1986 when the reservoir was constructed. The pump was refurbished in 2003.

B. Quarry Reservoir Booster Station

The Quarry Reservoir Booster Station is located at 7729 Terrace Avenue adjacent to the Quarry Reservoir. The booster station was constructed in 1997 when the Quarry Reservoir was constructed. Water is pumped from the Quarry Reservoir into both the Low Zone and the Hillcrest High Zone.

1. Low Zone

Four booster pumps are used to pump into the Low Zone. The Low Zone pumps are controlled by water levels in the elevated tanks in the Low Zone or by a low-suction pressure alarm from the Greenway Booster Station. If required, water from the Low Zone can flow back into the Quarry Reservoir if Well Nos. 2 and 3 are out of service.

2. Hillcrest High Zone

Three booster pumps are used to pump from the Low Zone into the Hillcrest High Zone. The booster pumps draw water from the low zone piping and maintain pressures in the Hillcrest Zone. If power is lost to the booster station, a bypass valve opens and allows water to flow from the Low

Zone into the Hillcrest High Zone and maintains a minimum pressure of 20 psi. Two of the three pumps provide domestic supply to residential homes on the hill south of the Quarry Reservoir. The third booster pump provides fire protection for the high zone.

C. Greenway Booster Station

The Greenway Booster Station is located at 8491 Greenway Boulevard in the western part of the City. The booster station was constructed in 1994 to provide domestic water service and fire protection to areas located west of the South Fork of Pheasant Branch Creek that have ground elevations above 980 feet. The Greenway Booster Station is designed to maintain a hydraulic gradient of 1,229 feet in the Greenway High Zone. There are two domestic supply pumps and a third larger fire flow pump in the facility. There is an auxiliary power generator capable of supplying power to operate the entire booster station during an emergency. If primary and auxiliary power is lost to the booster station, a bypass valve opens and allows water to flow from the Low Zone into the Greenway High Zone and maintains positive pressure throughout the zone.

6.04 STORAGE

System storage includes two elevated storage tanks and two ground-level reservoirs. Table 6.04-1 presents the year constructed, capacity, and overflow elevation for each facility. The total volume of storage for all storage facilities is 2.35 million gallons (mg).

Storage Facility	Year Constructed	Capacity (gallons)	Overflow Elevation (feet*)
Tower 1	1960	500,000	1,080
Tower 2	1984	750,000	1,080
Well No. 6 Reservoir	1986	100,000	969.5
Quarry Reservoir	1997	1,000,000	996.1
	Total Storage	2,350,000	

*Elevation above mean sea level (AMSL)

Table 6.04-1 Storage Facility Summary

A. Tower 1

Tower 1 is located on High Road adjacent to Well No. 4 in the north central part of the City. Tower 1 is a 500,000-gallon ellipsoidal steel elevated storage tank with four legs. The tank was constructed in 1960 and has an overflow elevation of 1,080 feet. The tank was repainted in 2018; the interior wet surface was cleaned and spot painted only, and the exterior was overcoated with a four-coat polyamide epoxy and polyurethane system. Tower 1 may be decommissioned and replaced because of age between 2040 and 2070. The City will continue to monitor the condition of the tank during the five-year WDNR inspections.

B. Tower 2

Tower 2 is located at 5626 Highland Way. Tower 2 is a 750,000-gallon single pedestal spheroid. The tank was constructed in 1984 and has an overflow elevation of 1,080 feet. The tank was last repainted in 2013; the interior wet was blasted clean and a new three-coat polyamide epoxy system was applied, and the exterior was overcoated with a three-coat polyamide epoxy and polyurethane system.

C. Well No. 6 Reservoir

Well No. 6 Reservoir is located adjacent to Well No. 6 at 8490 Greenway Boulevard. The reservoir is a 100,000-gallon concrete ground-level reservoir. The reservoir was constructed in 1986 and has an overflow elevation of 969.5 feet. Well No. 6 discharges into the reservoir and the Well No. 6 Booster Pump delivers water to the distribution system. Chlorine gas and fluoride are added to the well discharge pipe before the reservoir. The reservoir was last inspected in 2016, and as part of that inspection, cracks on the roof and sidewalls were repaired and the interior ladder and silt stop were replaced with stainless steel materials.

D. Quarry Reservoir

Quarry Reservoir is located adjacent to the Quarry Reservoir Booster Station at 7729 Terrace Avenue. The reservoir is a 1,000,000-gallon concrete ground-level reservoir. The reservoir was constructed in 1997 and has an overflow elevation of 996.1 feet. Well Nos. 2 and 3 discharge to the reservoir and the Quarry Reservoir Booster Station pumps water from the reservoir to the Low and Hillcrest High Zones. Chlorine gas and fluoride are added in the well discharge pipes before the reservoir. The reservoir was last inspected in 2017. The membrane roof was replaced in 2018 because of age and observed water leakage.

E. Storage Maintenance and Improvement Schedule

Table 6.04-2 summarizes the improvement schedule for each storage facility that includes tank size and style, previous improvement history, scheduled improvement details, and the estimated OPPC.

Tank No.	Tank Size/Style	Previous Improvement Year	Location	Previous Improvement	Scheduled Improvements	Improvements OPPC (2019 Dollars)
Tower 1	500,000-Gallon Ellipsoidal Four-Legged	2018	Interior Coating	Cleaned and spot painted.	Full interior wet, spot repaint interior dry–2038.	$470,000
			Exterior Coating	Overcoat, four-coat epoxy, polyurethane coating.	Replacement coating–2038.	
Tower 2	750,000-Gallon Pedestal Spheroid	2012	Interior Coating	Blasted, three-coat polyamide epoxy coating.	Full interior wet replacement coating–2033.	$500,000
			Exterior Coating	Overcoat, three-coat epoxy/polyurethane coating.	Replacement coating–2033.	
Quarry Reservoir	1,000,00-Gallon Ground-Level Concrete	2018	Exterior Roof Coating	Replacement exterior roof membrane coating.	Replacement roof system–2050.	$275,000
Well No. 6 Reservoir	100,000-Gallon Ground-Level Concrete	N/A	N/A	N/A	Install roof membrane and crack injection–2030.	$70,000

Table 6.04-2 Storage Facility Improvement Schedule

Table 6.04-3 summarizes the storage facility inspection schedule that includes year of construction, the previous inspection date, and type and the next scheduled inspection. According to Wisconsin Administration Code NR 810.14, each storage facility shall be inspected every five years.

Tank No.	Year of Construction	Previous Inspection	Previous Inspection Type	Scheduled Inspection	Inspection OPPC
Tower 1	1960	2018	Full Drain	2023	$5,000
Tower 2	1984	2014	Full Drain	2019	$5,000
Quarry Reservoir	1997	2017	Full Drain	2022	$6,000
Well No. 6 Reservoir	1986	2016	Full Drain	2021	$6,000

Table 6.04-3 Storage Facility Inspection Schedule

SECTION 7
WATER DEMAND FORECASTS

7.01 GENERAL

Water demand rate terminology used in this report is defined as follows:

Average day	The total volume of water pumped in a year divided by the number of days in the year.
Maximum day	The day of the year on which the maximum amount of water is pumped.
Maximum hour	The maximum rate of demand for any hour on the maximum day.
Fire demand	Estimate of the amount of water required in a community to fight a fire. This demand is generally specified as a rate of flow, in gpm, for a given period of time, in hours. The Insurance Services Office (ISO) has prepared a guide for determining fire demand. The calculated fire demand is added to the average domestic demand during the maximum day to obtain the demand on a day that a major fire occurs. Fire demand generally increases the volume of storage that must be available on a maximum day.

The estimation of future water demands is not precise. The best forecast of future water demands is obtained by projecting average daily demand based on population or customer growth and water use within the service area. Future maximum daily demands are then estimated by analyzing past ratios of maximum to average day demand and applying the resulting factor to average day projections. Maximum hour demands were based on typical maximum day demand curve taken from past water use information provided by the City.

Prudent operation of a water system requires that system capacity always be in excess of system demands. Hence, recommended future improvements may be deferred until they become necessary, or they may have to be implemented sooner if demands increase at a rate faster than projected.

7.02 BASIS FOR DETERMINATION OF DEMANDS

A. Water Utility Records

The City Water Utility annual PSC records for the years 1980 to 2018 are summarized in Table 7.02-1.

B. Utility Trends

1. Sales to Pumpage Efficiency

Figure 7.02-1 presents the plotted sales to pumpage efficiency from the PSC records. The ratio remained consistent around 80 percent between 1986 to 1994. Since then, the ratio has ranged from 89 percent up to 97 percent in 2017. The City Water Utility attributed this improved efficiency to a better water metering program and an emphasis placed on identifying and replacing inaccurate customer meters. The PSC recommends that a water system should be maintained at

a minimum sales to pumpage efficiency of 85 percent. The average of the last five years' data of 93 percent is the basis for future projections in this report. Efforts to maintain high sales to pumpage efficiency should be continued. If the efficiency cannot be maintained at 93 percent, future water supply facilities will need to have additional capacity or may be required sooner to make up for the decreased efficiency.

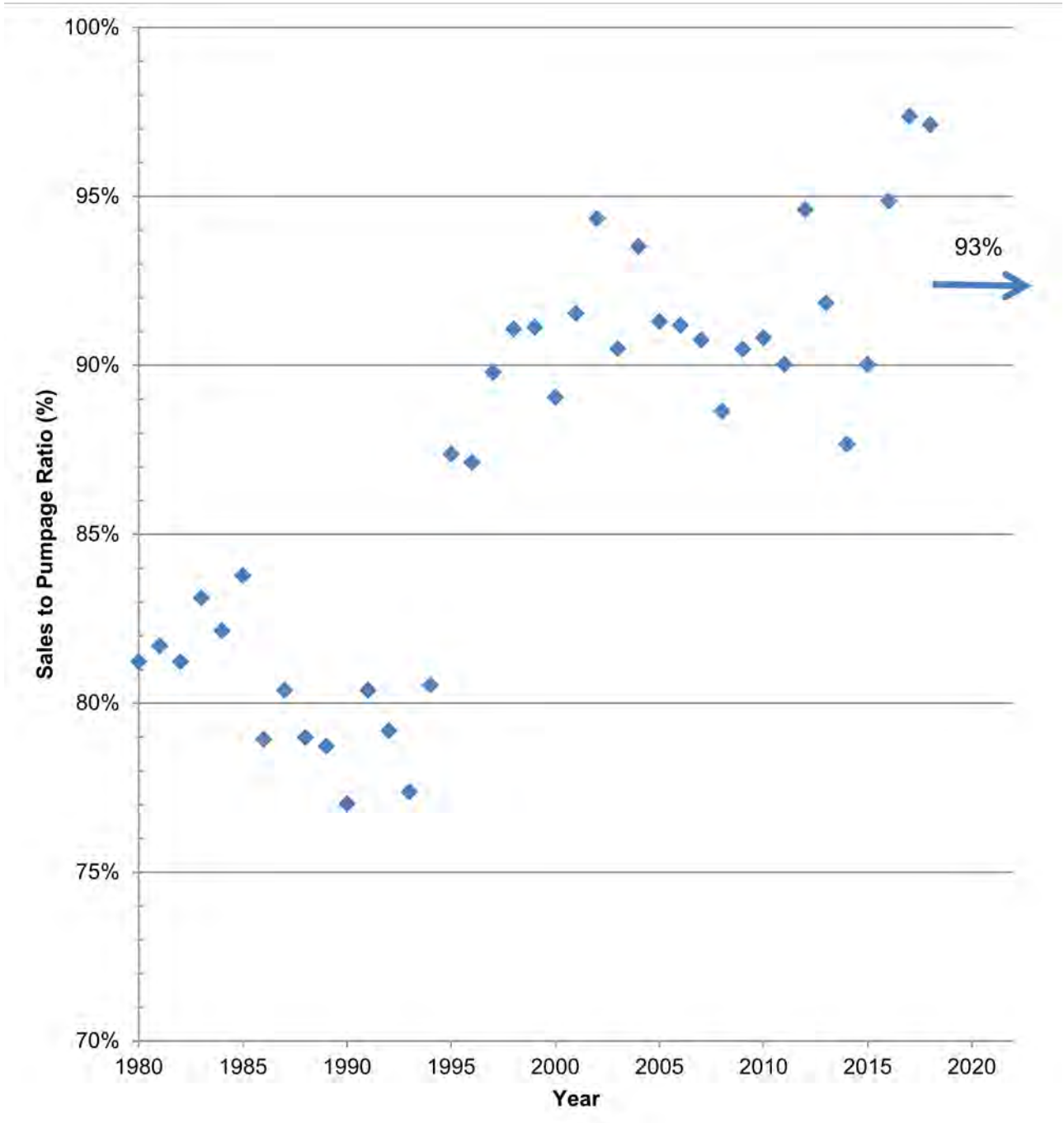


Figure 7.02-1 Sales to Pumpage Ratio

Table 7.02-1 City Water Utility Records and Projections

Year	Annual Pumpage (gal)	Annual Sales (gal)	Maximum Day Pumpage (gpd)	Average Day Pumpage (gpd)	Maximum to Average Day Ratio	Sales to Pumpage Ratio	Residential Sales (gal)	Commercial Sales (gal)	Industrial Sales (gal)	Public Sales (gal)	Multifamily Sales (gal)	Population	Residential Sales per Capita	Commercial Sales per Capita	Industrial Sales per Capita	Public Sales per Capita	Multifamily Sales per Capita	Total Sales Per Capita
1980	609,400,000	495,000,000	2,999,000	1,670,000	1.80	81%	221,800,000	160,400,000	100,600,000	12,200,000	0	11,779	51.6	37.3	23.4	2.8	0.0	115.1
1981	644,000,000	526,100,000	3,024,000	1,764,000	1.71	82%	223,400,000	166,500,000	122,200,000	14,000,000	0	11,930	51.3	38.2	28.0	3.2	0.0	120.7
1982	626,800,000	209,000,000	2,889,000	1,717,000	1.68	81%	214,900,000	160,700,000	120,500,000	13,000,000	0	12,081	48.7	36.4	27.3	2.9	0.0	115.4
1983	681,300,000	566,300,000	3,408,000	1,867,000	1.83	83%	253,200,000	183,700,000	114,400,000	15,000,000	0	12,232	56.7	41.1	25.6	3.4	0.0	126.8
1984	694,900,000	571,600,000	3,268,000	1,904,000	1.72	82%	232,600,000	182,800,000	141,300,000	14,100,000	0	12,383	51.4	40.4	31.2	3.1	0.0	126.2
1985	696,000,000	583,100,000	3,998,000	1,907,000	2.10	84%	253,300,000	186,100,000	129,300,000	14,400,000	0	12,534	55.3	40.7	28.2	3.1	0.0	127.4
1986	692,300,000	546,800,000	2,996,000	1,897,000	1.58	79%	235,600,000	176,600,000	123,100,000	11,100,000	0	12,685	50.9	38.1	26.6	2.4	0.0	117.9
1987	743,000,000	598,100,000	3,820,000	2,018,000	1.89	80%	270,200,000	183,300,000	133,300,000	10,400,000	0	12,836	57.6	39.1	28.4	2.2	0.0	127.4
1988	815,900,000	544,500,000	4,359,000	2,236,000	1.95	79%	321,500,000	186,300,000	124,100,000	12,500,000	0	12,987	67.8	39.3	26.2	2.6	0.0	135.8
1989	756,700,000	595,800,000	4,349,000	2,073,151	2.10	79%	285,100,000	183,100,000	117,700,000	9,800,000	0	13,138	59.4	38.2	24.5	2.0	0.0	124.1
1990	776,700,000	598,200,000	3,485,000	2,127,945	1.64	77%	257,400,000	189,400,000	140,000,000	11,500,000	0	13,289	53.0	39.0	28.8	2.4	0.0	123.3
1991	809,500,000	651,900,000	3,618,000	2,217,808	1.63	80%	282,200,000	211,600,000	145,200,000	11,700,000	0	13,984	55.3	41.4	28.4	2.3	0.0	127.4
1992	832,400,000	659,100,000	4,136,000	2,280,548	1.81	79%	284,400,000	215,600,000	146,100,000	13,000,000	0	14,182	54.9	41.6	28.2	2.5	0.0	127.2
1993	812,000,000	628,200,000	2,982,000	2,224,658	1.34	77%	256,800,000	216,700,000	143,200,000	11,600,000	0	14,381	48.9	41.3	27.3	2.2	0.0	119.6
1994	835,000,000	672,400,000	4,342,000	2,287,671	1.90	81%	280,100,000	226,900,000	153,400,000	12,000,000	0	14,579	52.6	42.6	28.8	2.3	0.0	126.3
1995	774,100,000	676,500,000	4,047,000	2,120,822	1.91	87%	283,000,000	235,900,000	145,300,000	12,200,000	0	14,778	52.4	43.7	26.9	2.3	0.0	125.3
1996	798,500,000	695,800,000	3,501,000	2,187,671	1.60	87%	282,000,000	236,400,000	165,900,000	11,400,000	0	14,976	51.6	43.2	30.3	2.1	0.0	127.2
1997	779,490,000	699,885,000	4,211,000	2,135,589	1.97	90%	268,147,000	235,711,000	185,441,000	9,456,000	0	15,175	48.4	42.7	33.5	1.7	0.0	126.3
1998	790,932,000	720,273,000	4,366,000	2,166,937	2.01	91%	279,348,000	250,223,000	180,004,000	10,698,000	0	15,373	49.8	44.6	32.1	1.9	0.0	128.3
1999	818,348,000	745,731,000	4,559,000	2,242,049	2.03	91%	287,613,000	261,722,000	186,978,000	9,418,000	0	15,572	50.6	46.0	32.9	1.7	0.0	131.1
2000	853,729,000	760,327,000	4,741,000	2,338,984	2.03	89%	302,539,000	265,726,000	180,551,000	11,511,000	0	15,770	52.5	46.1	31.3	2.0	0.0	132.0
2001	810,797,000	742,190,000	4,368,000	2,221,362	1.97	92%	308,237,000	263,010,000	159,901,000	11,012,000	0	15,969	53.0	45.2	27.5	1.9	0.0	127.5
2002	830,902,000	783,896,000	4,146,000	2,276,444	1.82	94%	330,255,000	275,957,000	164,456,000	13,228,000	0	16,168	56.1	46.9	28.0	2.2	0.0	133.3
2003	808,439,000	731,515,000	4,516,000	2,214,901	2.04	90%	347,876,000	292,150,000	77,819,000	13,670,000	0	16,367	58.5	49.2	13.1	2.3	0.0	123.1
2004	755,489,000	706,470,000	3,264,000	2,069,833	1.58	94%	299,500,000	311,407,000	84,215,000	11,348,000	0	16,567	49.9	51.9	14.0	1.9	0.0	117.7
2005	881,010,000	804,310,000	4,566,000	2,413,726	1.89	91%	350,540,000	355,956,000	83,780,000	14,034,000	0	16,766	57.8	58.7	13.8	2.3	0.0	132.6
2006	846,361,000	771,734,000	3,658,000	2,318,797	1.58	91%	306,621,000	377,860,000	74,795,000	12,458,000	0	16,965	50.0	61.7	12.2	2.0	0.0	126.0
2007	887,967,000	805,828,000	4,456,000	2,432,786	1.83	91%	327,841,000	380,627,000	82,264,000	15,096,000	0	17,164	53.0	61.5	13.3	2.4	0.0	130.2
2008	833,673,000	739,025,000	3,559,000	2,282,472	1.56	89%	300,517,000	361,137,000	56,792,000	20,579,000	0	17,108	48.1	57.8	9.1	3.3	0.0	118.3
2009	796,852,000	720,926,000	3,524,000	2,181,662	1.62	90%	295,664,000	351,763,000	48,016,000	25,483,000	0	17,275	46.9	55.8	7.6	4.0	0.0	114.3
2010	763,583,000	693,387,000	3,674,000	2,090,576	1.76	91%	270,543,000	336,783,000	60,786,000	25,275,000	0	17,442	42.5	52.9	9.5	4.0	0.0	108.8
2011	775,086,000	697,780,000	3,953,000	2,122,070	1.86	90%	280,819,000	328,078,000	65,853,000	23,030,000	0	17,555	43.8	51.2	10.3	3.6	0.0	108.8
2012	822,799,000	778,448,000	4,552,000	2,252,701	2.02	95%	326,631,000	353,351,000	74,217,000	24,249,000	0	17,903	50.0	54.0	11.3	3.7	0.0	119.0
2013	782,493,000	718,663,000	3,619,000	2,142,349	1.69	92%	281,249,000	337,309,000	77,333,000	22,772,000	0	18,146	42.4	50.9	11.7	3.4	0.0	108.4
2014	796,520,000	698,326,000	3,334,000	2,180,753	1.53	88%	265,344,000	233,796,000	79,205,000	24,770,000	95,211,000	18,323	39.6	34.9	11.8	3.7	14.2	104.3
2015	777,143,000	699,598,000	4,003,000	2,127,702	1.88	90%	262,898,000	216,279,000	90,596,000	25,406,000	104,419,000	18,810	38.3	31.5	13.2	3.7	15.2	101.8
2016	759,417,000	720,392,000	3,167,000	2,079,170	1.52	95%	260,412,000	223,650,000	104,192,000	24,393,000	107,745,000	19,317	36.9	31.7	14.8	3.5	15.3	102.1
2017	734,127,000	714,834,000	3,053,000	2,009,930	1.52	97%	260,768,000	220,206,000	102,157,000	18,896,000	112,807,000	20,151	35.4	29.9	13.9	2.6	15.3	97.1
2018	723,211,000	702,375,000	3,248,000	1,980,044	1.64	97%	254,936,000	219,215,000	89,284,000	20,105,000	118,835,000	20,472	34.1	29.3	11.9	2.7	15.9	93.9
2019*	804,021,290	747,739,800	4,402,581	2,201,290	2.00	93%	276,663,726	239,276,736	97,206,174	22,432,194	112,160,970	20,472	37.0	32.0	13.0	3.0	15.0	100.0
2040*	1,121,553,145	1,043,044,425	6,141,290	3,070,645	2.00	93%	385,926,437	333,774,216	135,595,775	31,291,333	156,456,664	28,557	37.0	32.0	13.0	3.0	15.0	100.0
2070*	1,637,537,500	1,522,909,875	8,966,667	4,483,333	2.00	93%	563,476,654	487,331,160	197,978,284	45,687,296	228,436,481	41,695	37.0	32.0	13.0	3.0	15.0	100.0

*Design Year Projections.

2. Maximum Day to Average Day Ratios

Figure 7.02-2 presents the plotted ratio of maximum day to average day sales since 1980. The overall average is 1.78 and the maximum is 2.10, which occurred in 1985 and 1989. For estimation of future maximum day demands, a ratio of 2.00 was applied to the average day demands to develop projected maximum day demands.

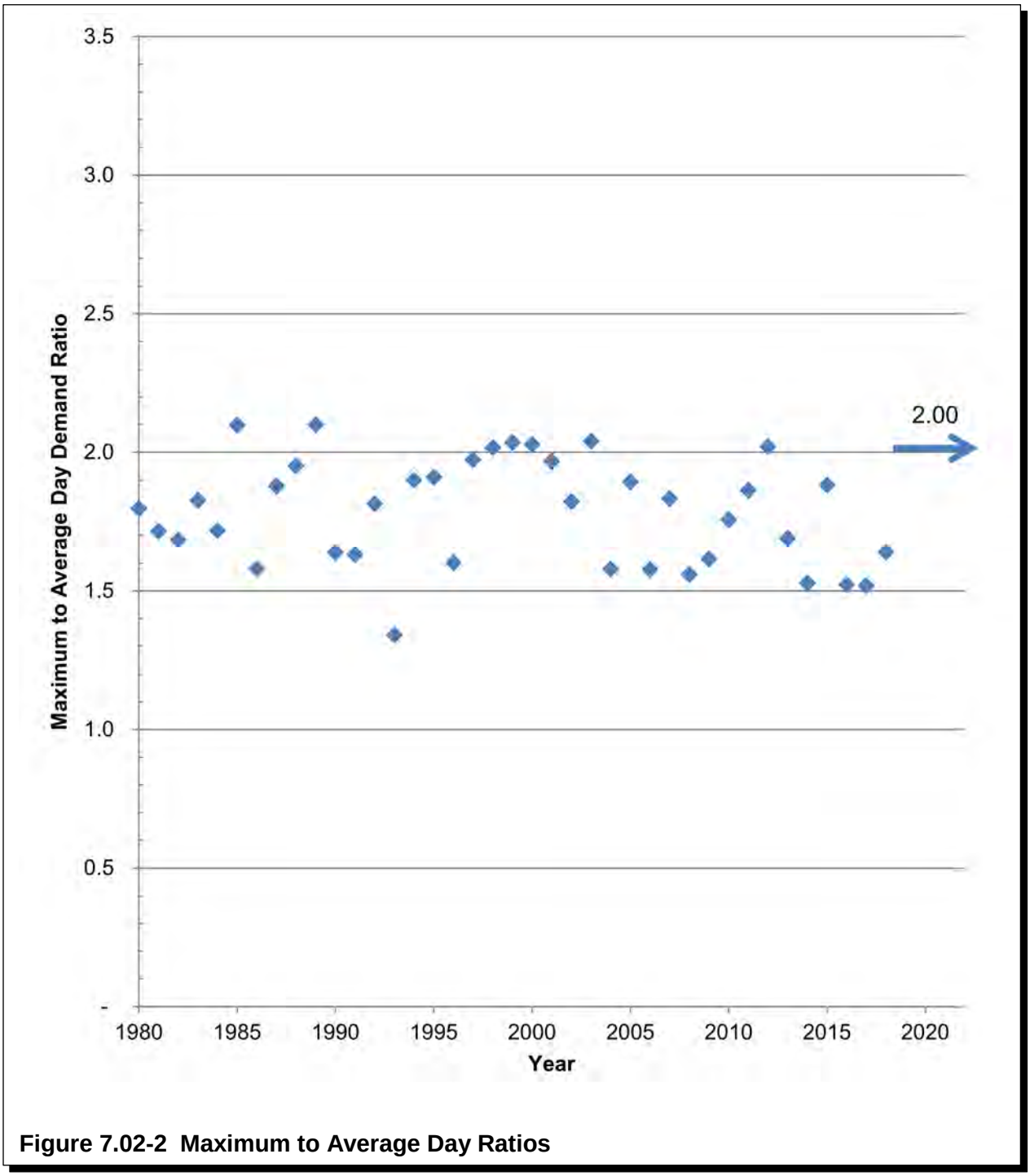


Figure 7.02-2 Maximum to Average Day Ratios

3. Per Capita Residential Sales

Figure 7.02-3 presents the plotted residential sales of gcd. The residential sales have gradually declined from 59 gcd to 48 gcd from 1989 to 1997. From 1997 to 2003 sales increased from 48 gcd to 58 gcd. From 2003 to 2018, residential sales have continually decreased at a consistent rate from 58 gcd down to 34 gcd in 2018. The consistent decrease in water sales could likely be contributed to local water conservation efforts, though the decline in sales should eventually bottom out. The decrease in sales could also be contributed to greater rainfall totals through the previous few years, which results in residents reducing lawn sprinkling. The five-year average of 37 gcd was used for 2019, 2040, and 2070 projected residential sales.

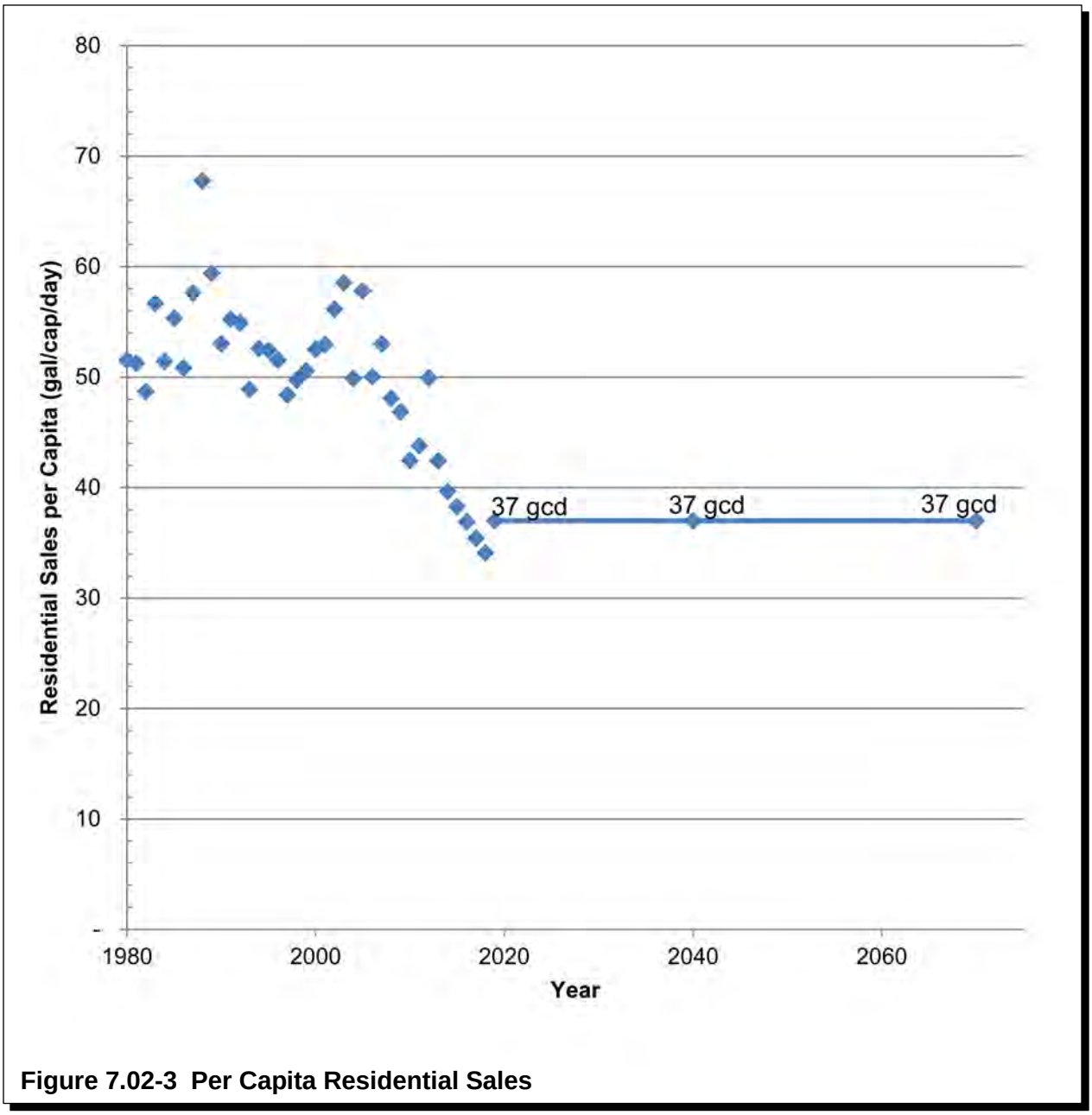


Figure 7.02-3 Per Capita Residential Sales

4. Per Capita Commercial Sales

Figure 7.02-4 presents the plotted historical commercial sales per capita per day. The figure shows an increase from 1989 to 2006 from 37 gcd to 61 gcd. From 2006 to 2013 there was a slight decreasing trend from 61 gcd in 2006 to 51 gcd in 2013. There was a significant drop between 2013 and 2014 due to the addition of the multi-family category in PSC reporting, which was previously being accounted for in the commercial sales. Sales have since leveled out and the average of the last five years, or 32 gcd, was used for projected future commercial sales.

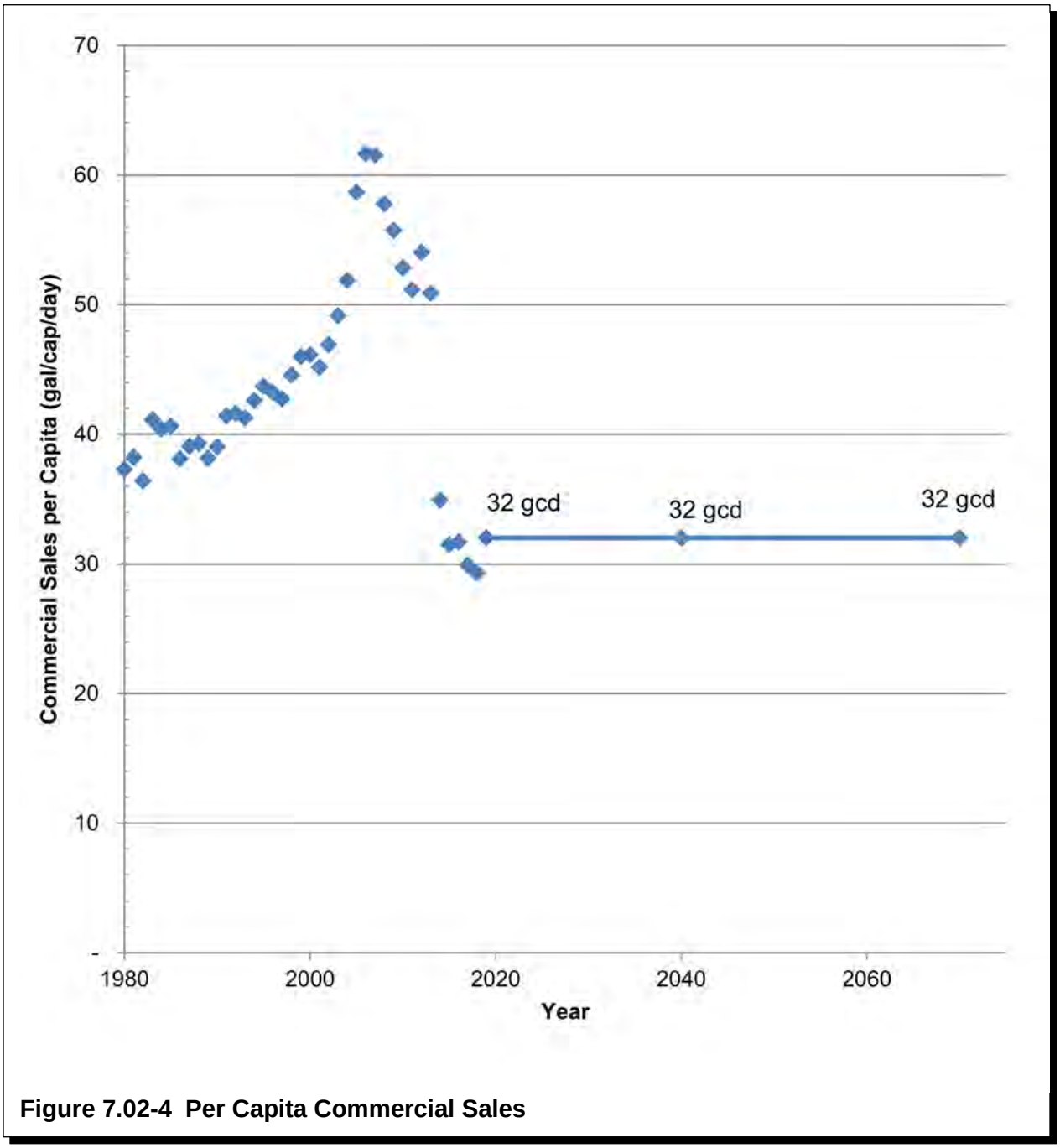


Figure 7.02-4 Per Capita Commercial Sales

5. Per Capita Industrial Sales

Often industrial sales do not correlate well with population as the amount of industrial demand is highly dependent upon the processes and water conservation efforts used by industry. In addition, the population that supports the industry usually extends beyond the limits of the water system, decreasing the effect population has on the industrial usage.

Industrial per capita per day sales are shown in Figure 7.02-5. Historically, industrial sales increased steadily from 1989 to 1997 where sales topped out at 33 gcd. From 1997 to 2002 sales gradually decreased to 28 gcd and dramatically decreased to 13 gcd in 2003 and to 8 gcd in 2008. This is a result of decreased use by one of City's largest industrial users, Springs Window Fashions Division, Inc. Historically, Springs Window Fashions Division, Inc. consumed a large percentage of the City's water. The company now uses cooling towers to recycle water, which has greatly cut its consumption. The company remains the largest user of water in the City. The average from the last five years, or 13 gcd, was used for projected industrial sales.

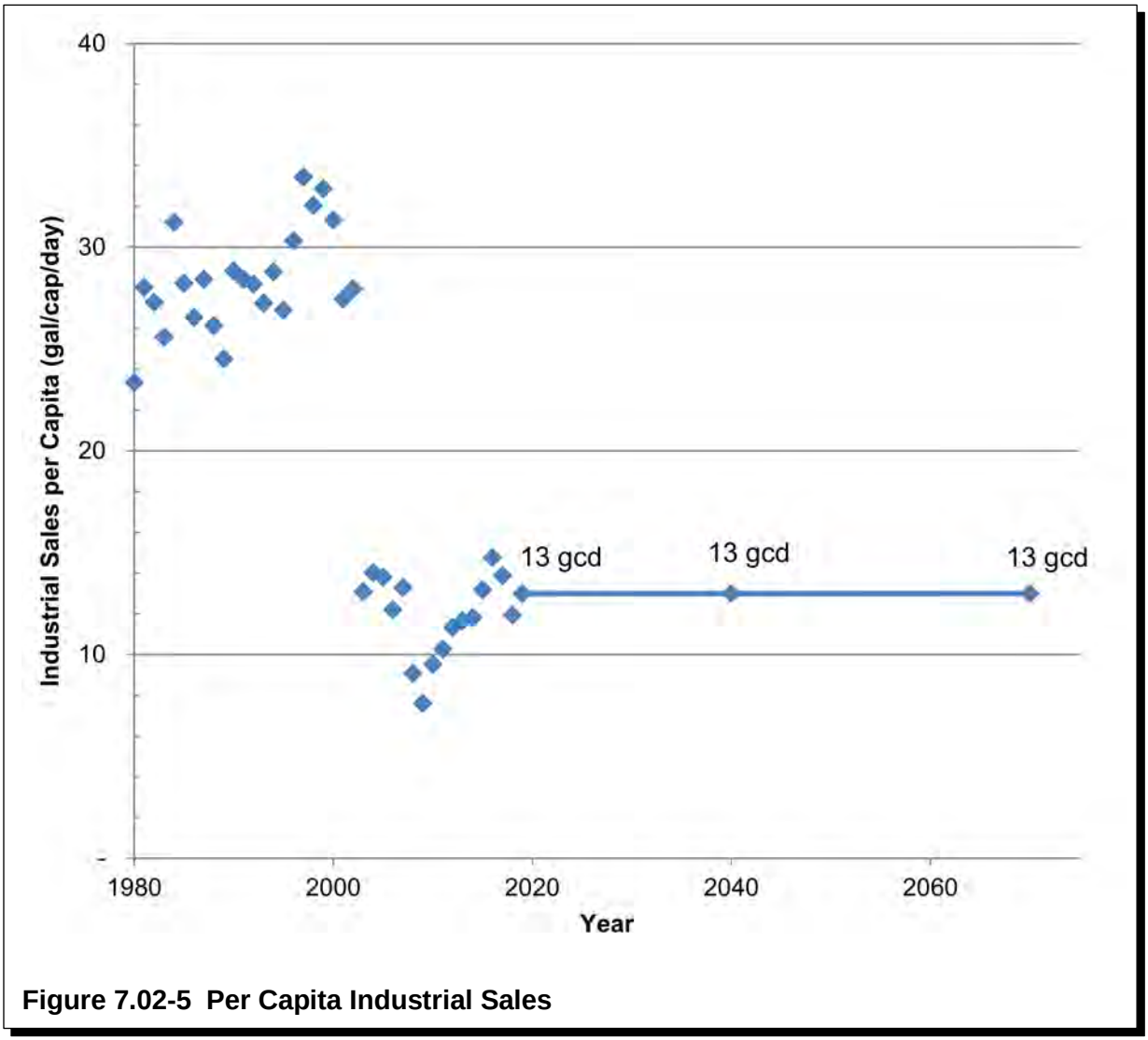


Figure 7.02-5 Per Capita Industrial Sales

6. Per Capita Public Sales

Figure 7.02-6 presents the plotted public sales per capita per day. Public sales remained steady from 1.5 gcd to 2.5 gcd from 1986 to 2007. From 2008 to 2016 there was an increase to around 3.5 gcd, but then there was a drop in 2017 and 2018 to below 3 gcd. The average from the last five years, or 3 gcd, was used for projected public sales.

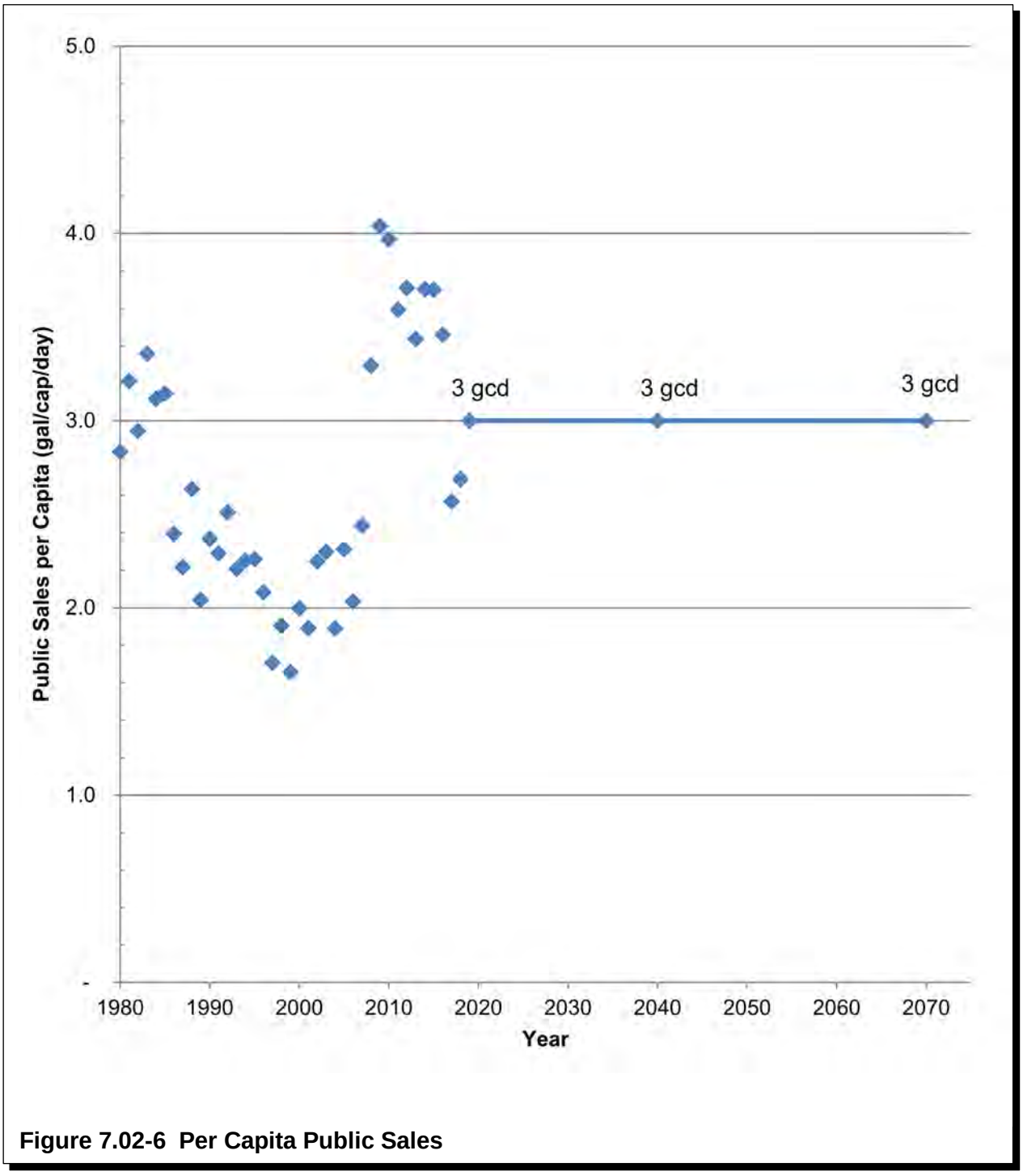


Figure 7.02-6 Per Capita Public Sales

7. Per Capita Multi-family Sales

Figure 7.02-7 presents the plotted multi-family sales per capita per day. Because the PSC started separating out multi-family sales in 2014, limited data was available. Sales have ranged between 14 and 16 gcd for the last five years. The average of 15 gcd was used for projected multi-family sales.

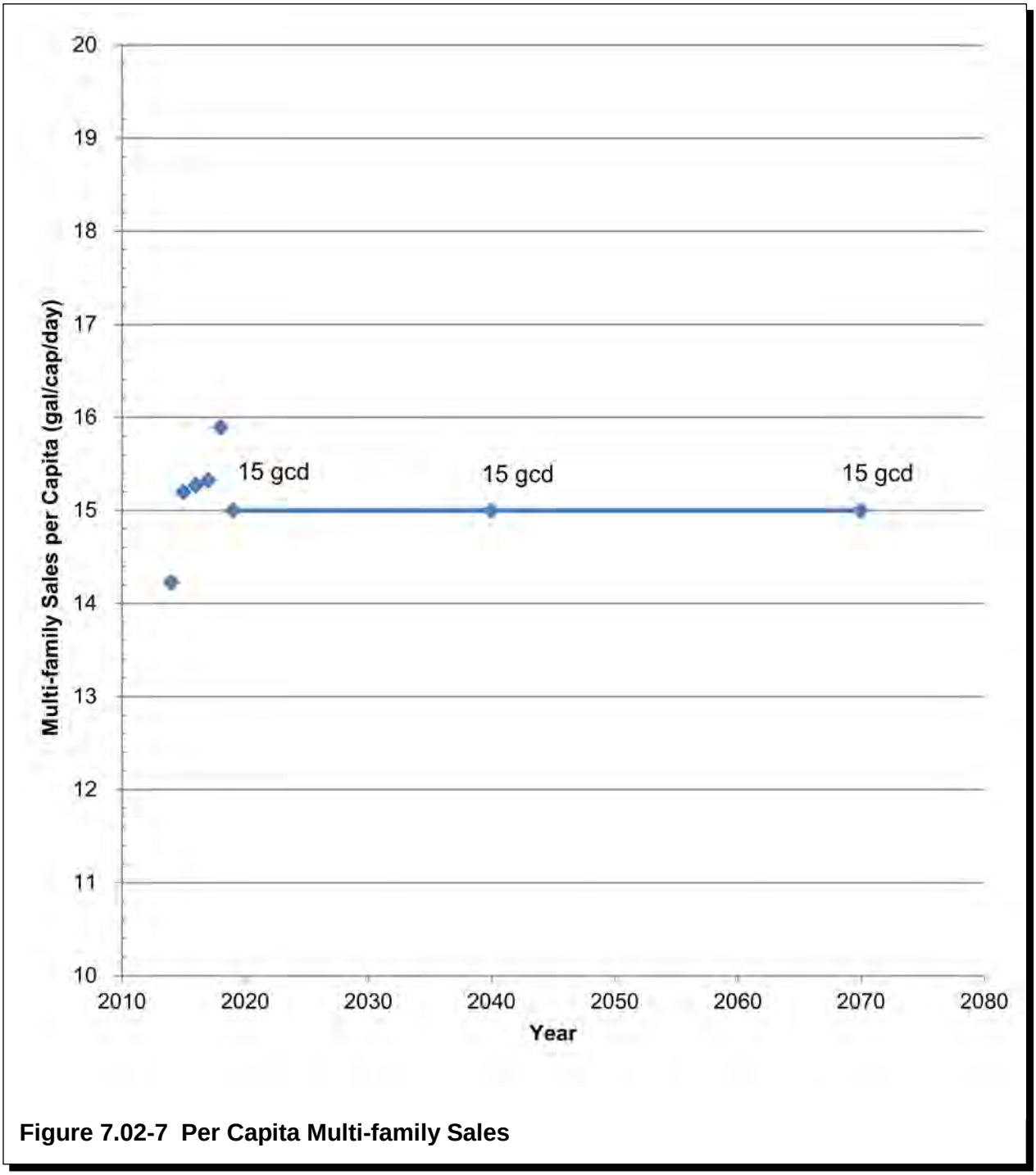


Figure 7.02-7 Per Capita Multi-family Sales

8. Per Capita Total Sales

Figure 7.02-8 presents the total per capita per day sales resulting by combining each of the preceding categories. Total sales were steady from 1980 to 2007, then began a consistent decline to present. A water conservation effort and improved billing accuracies have likely caused the recent decline. The average from the last five years, or 100 gcd, was used for projected future sales. Total future demands are discussed further in the following sections.

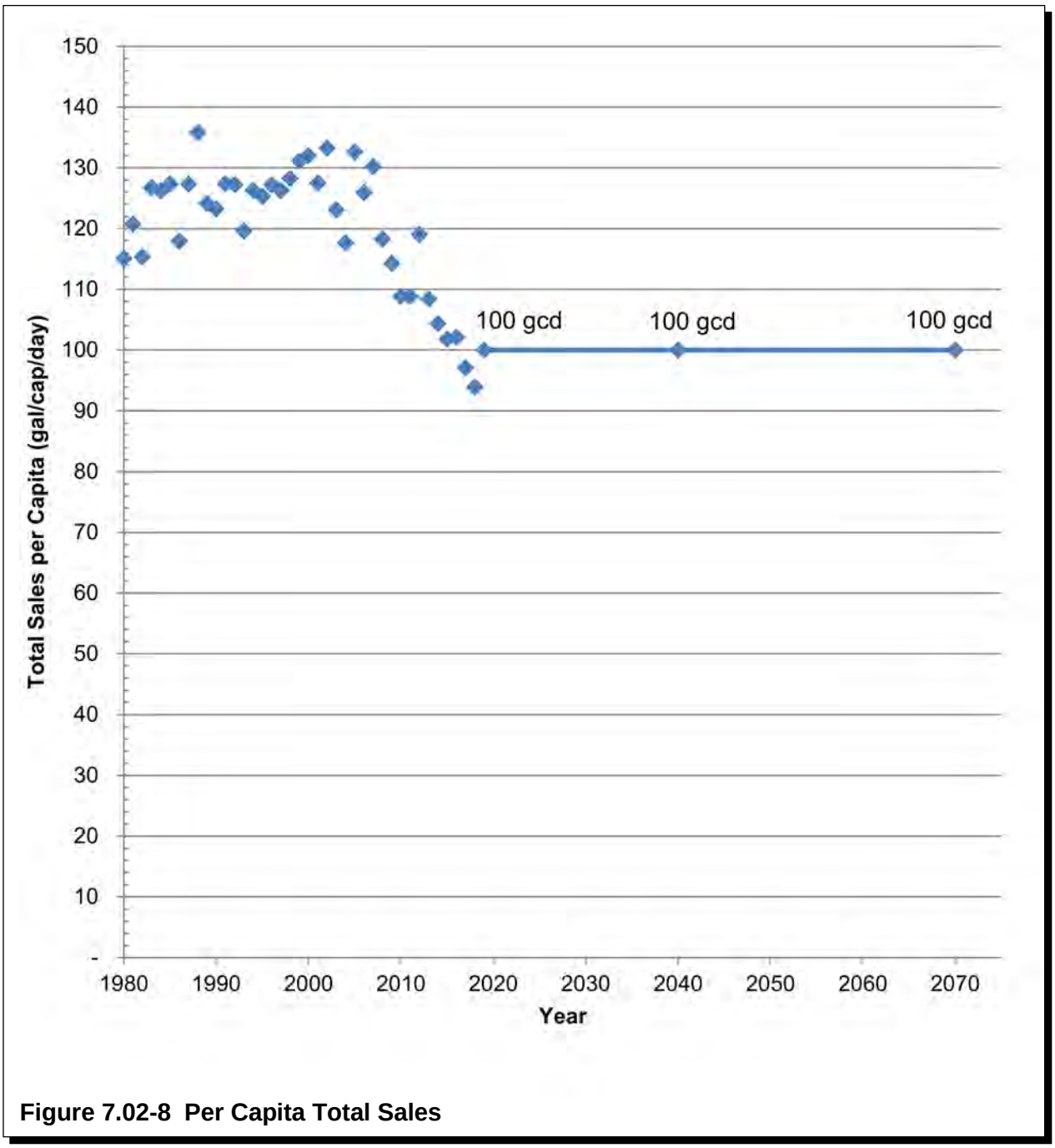


Figure 7.02-8 Per Capita Total Sales

7.03 2019 PROJECTED DEMANDS

The 2019 demands were developed from past water utility data. Demands in this section refer to pumpage, not sales. When this section refers to 2019 demands, they may not necessarily occur in 2019 but were calculated as a reasonable estimate of the demands that might currently be expected.

A. 2019 Average Day

The average day pumpage in 2019 was estimated to be 2.201 mgd (1,528 gpm). This was calculated by multiplying the projected 2019 population of 20,472 by the projected total per capita per day sales (100 gcd) and dividing by the corresponding sales to pumpage ratio (0.93).

B. 2019 Maximum Day

1. Domestic

The calculated 2019 maximum day pumpage is 4.402 mgd (3,057 gpm). This is found by taking the 2019 average day pumpage of 2.201 mgd and multiplying by the projected maximum day to average day ratio of 2.0.

2. Domestic Plus Fire

ISO information for the City of Middleton requires a fire flow of 3,500 gpm for a duration of three hours to be used for calculation purposes. Water supply requirements during a fire flow are based on the amount of water the City should be able to supply on the maximum day to obtain maximum credit for the community water system.

The total volume of water, in mg, required to fight a fire on the maximum day would be:

Domestic	4.402 mg
Fire (3 hours at 3,500 gpm)	0.630 mg
Total	5.032 mg

The average rate at which this water would be used during the fire should be:

Domestic	3,057 gpm	=	4.402 mgd
Fire	3,500 gpm	=	5.040 mgd
Total	6,557 gpm	=	9.442 mgd

C. 2019 Maximum Hour

The maximum hour demand was determined by first creating a demand diurnal curve. Supervisory control and data acquisition (SCADA) records for the elevated tanks and operating wells were obtained from the maximum demand day in 2018. The maximum day used for this report was from August 22, 2018. This day is different than the maximum day provided on the 2018 PSC report as hydrant flushing occurred on that day and does not represent a true maximum domestic demand

day. Systemwide demands for each hour were calculated by subtracting total volume stored from total volume supplied to the system. The hourly demands were then divided by the average hourly demand to determine hourly demand multipliers. These multipliers were then used to simulate a demand pattern throughout a maximum day demand. The maximum hour demand was found to be between 10 A.M. and 11 A.M. with a multiplier of 1.39.

Figure 7.03-1 is a graph of the projected hourly domestic demand throughout the maximum day. The 2019 maximum hour demand is estimated to be 6.119 mgd (4,249 gpm) by multiplying the maximum day demand of 4.402 mgd by 1.39. The maximum hydraulic design criteria for the distribution system is based on the more severe of the two following conditions:

1. Average hour of the maximum day plus fire.
2. Maximum hour of the maximum day.

By comparing maximum hour of the maximum day to the demands developed for domestic plus fire, the average hour of the maximum day plus fire was the more critical condition and was used for distribution analysis and design.

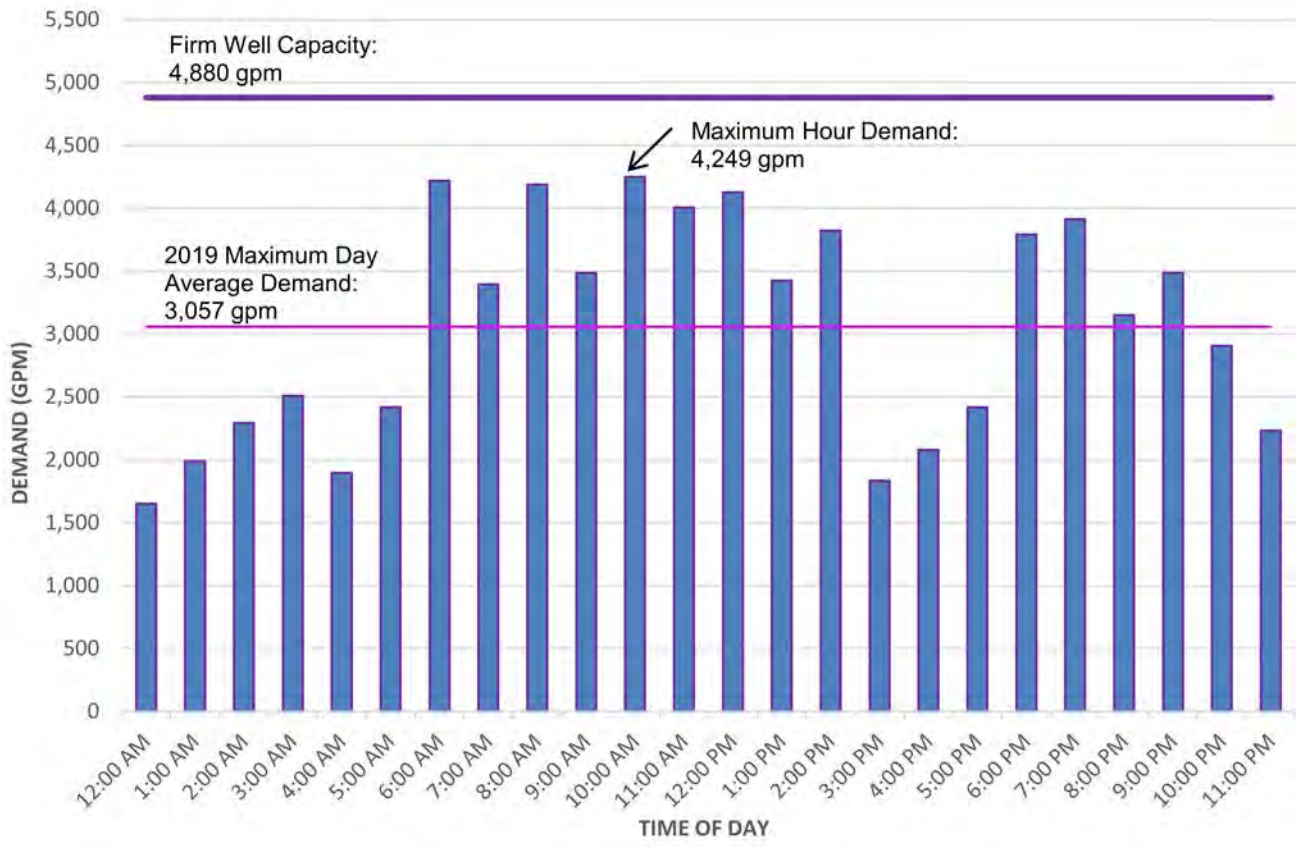


Figure 7.03-1 2019 Maximum Hour

7.04 2040 PROJECTED DEMANDS

A. 2040 Average Day

The average day pumpage in 2040 was estimated to be 2.884 mgd (2,003 gpm). This was calculated by multiplying the projected 2040 population of 26,823 by the projected total per capita per day sales (100 gcd) and dividing by the corresponding sales to pumpage ratio (0.93).

B. 2040 Maximum Day

1. Domestic

The calculated 2040 maximum day pumpage is 5.768 mgd (4,006 gpm). This is found by taking the 2040 average day pumpage of 2.884 mgd and multiplying by the projected maximum day to average day ratio of 2.0.

2. Domestic Plus Fire

A fire flow of 3,500 gpm for a duration of 3 hours was used for calculation purposes. Water supply requirements during a fire flow are based on the amount of water the City should be able to supply on the maximum day to obtain maximum credit for the community water system.

The total volume of water, in million gallons, required to fight a fire on the maximum day would be:

Domestic	5.768 mg
Fire (3 hours at 3,500 gpm)	0.630 mg
Total	6.398 mg

The average rate at which this water would be used during the fire should be:

Domestic	4,006 gpm	=	5.768 mgd
Fire	3,500 gpm	=	5.040 mgd
Total	7,506 gpm	=	10.808 mgd

C. 2040 Maximum Hour

Figure 7.04-1 graphs the projected hourly domestic demand throughout the projected 2040 maximum day. The 2040 maximum hour demand is estimated to be 8.018 mgd (5,568 gpm) by multiplying the maximum day demand of 5.768 mgd by 1.39. By comparing maximum hour of the maximum day to the demands developed for domestic plus fire, the average hour of the maximum day plus fire was the more critical condition and was used for distribution analysis and design.

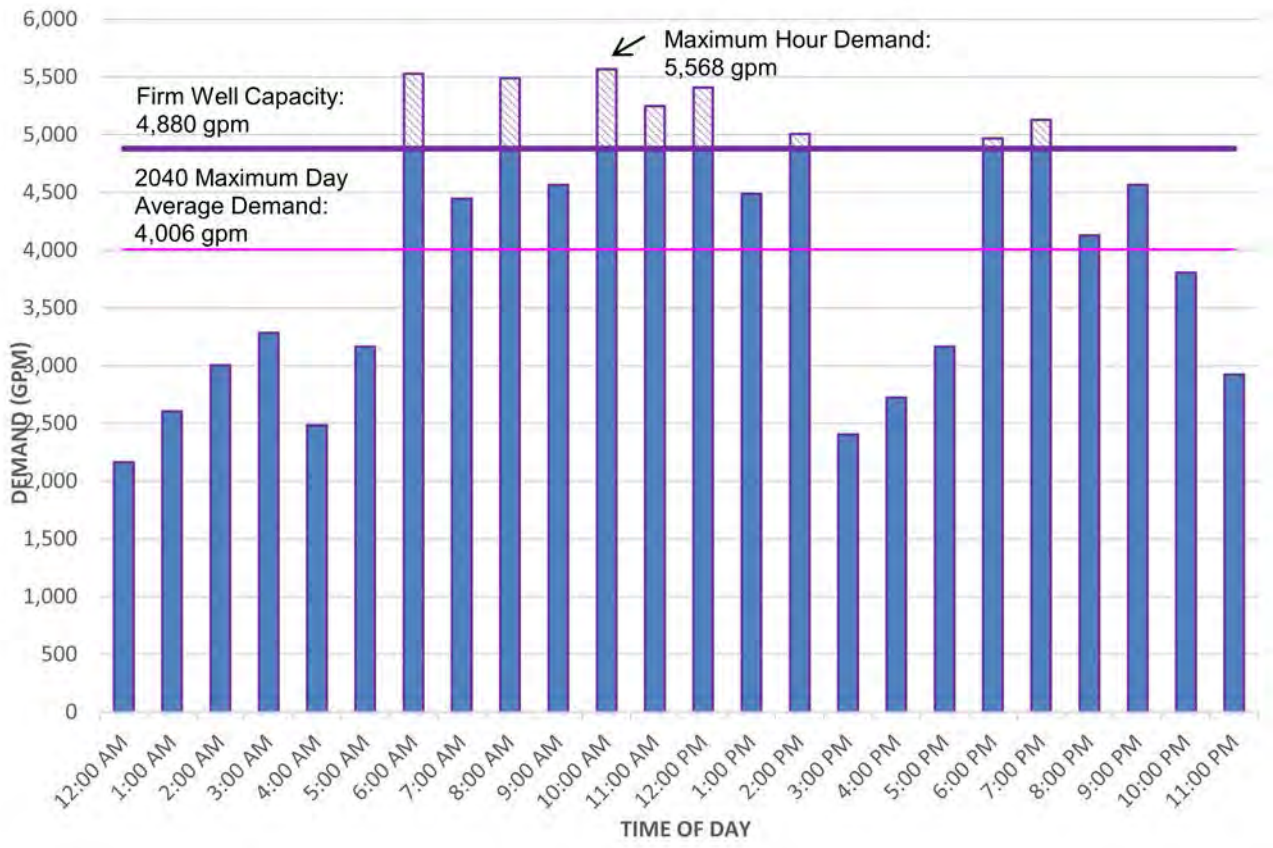


Figure 7.04-1 2040 Maximum Hour

7.05 2070 PROJECTED DEMANDS

A. 2070 Average Day

The average day pumpage in 2070 was estimated to be 4.295 mgd (2,983 gpm). This was calculated by multiplying the projected 2070 population of 39,948 by the projected total per capita per day sales (100 gcd) and dividing by the corresponding sales to pumpage ratio (0.93).

B. 2070 Maximum Day

1. Domestic

The calculated 2070 maximum day pumpage is 8.590 mgd (5,965 gpm). This is found by taking the 2070 average day pumpage of 4.295 mgd and multiplying by the projected maximum day to average day ratio of 2.0.

2. Domestic Plus Fire

A fire flow of 3,500 gpm for a duration of three hours was used for calculation purposes. Water supply requirements during a fire flow are based on the amount of water the City should be able to supply on the maximum day to obtain maximum credit for the community water system.

The total volume of water, in mg, required to fight a fire on the maximum day would be:

Domestic	8.590 mg
Fire (3 hours at 3,500 gpm)	0.630 mg
Total	9.220 mg

The average rate at which this water would be used during the fire should be:

Domestic	5,965 gpm	=	8.590 mgd
Fire	3,500 gpm	=	5.040 mgd
Total	9,465 gpm	=	13.630 mgd

C. 2070 Maximum Hour

Figure 7.05-1 is a graph of the projected hourly domestic demand throughout the projected 2070 maximum day. The 2070 maximum hour demand is estimated to be 11.940 mgd (8,292 gpm) by multiplying the maximum day demand of 8.590 mgd by 1.39. By comparing maximum hour of the maximum day to the demands developed for domestic plus fire, the average hour of the maximum day plus fire was the more critical condition and was used for distribution analysis and design.

Figure 7.05-2 presents projected average and maximum day demands through 2070. The historical data for average day pumpage is consistent while the historical data for the maximum day pumpage has moderate variations, likely caused by hydrant flushing. The demand projections for the average and maximum day pumpage generally reflect historical data points. The projected 2040 and 2070 average day pumpage reflects the same trend as seen between 1980 and 1990. The projected 2040 and 2070 maximum day pumpage reflect the worse-case scenario of pumpage either during hydrant flushing or a maximum day event.

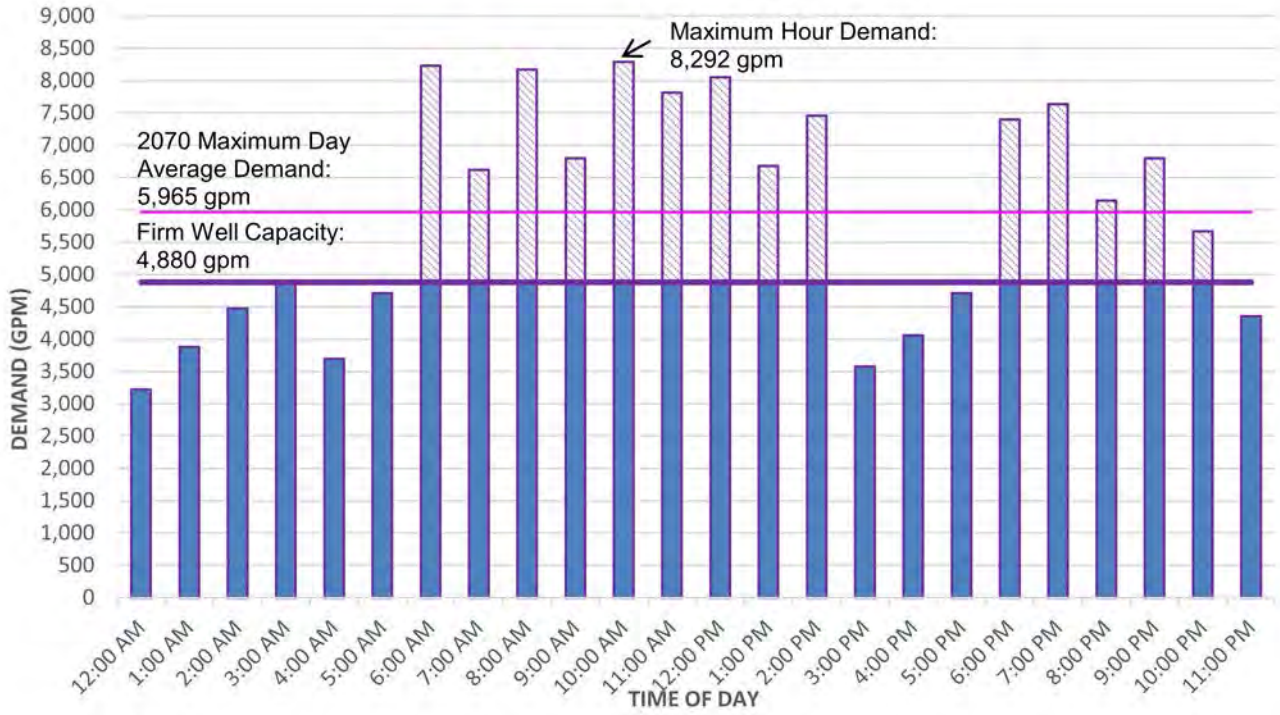


Figure 7.05-1 2070 Maximum Hour

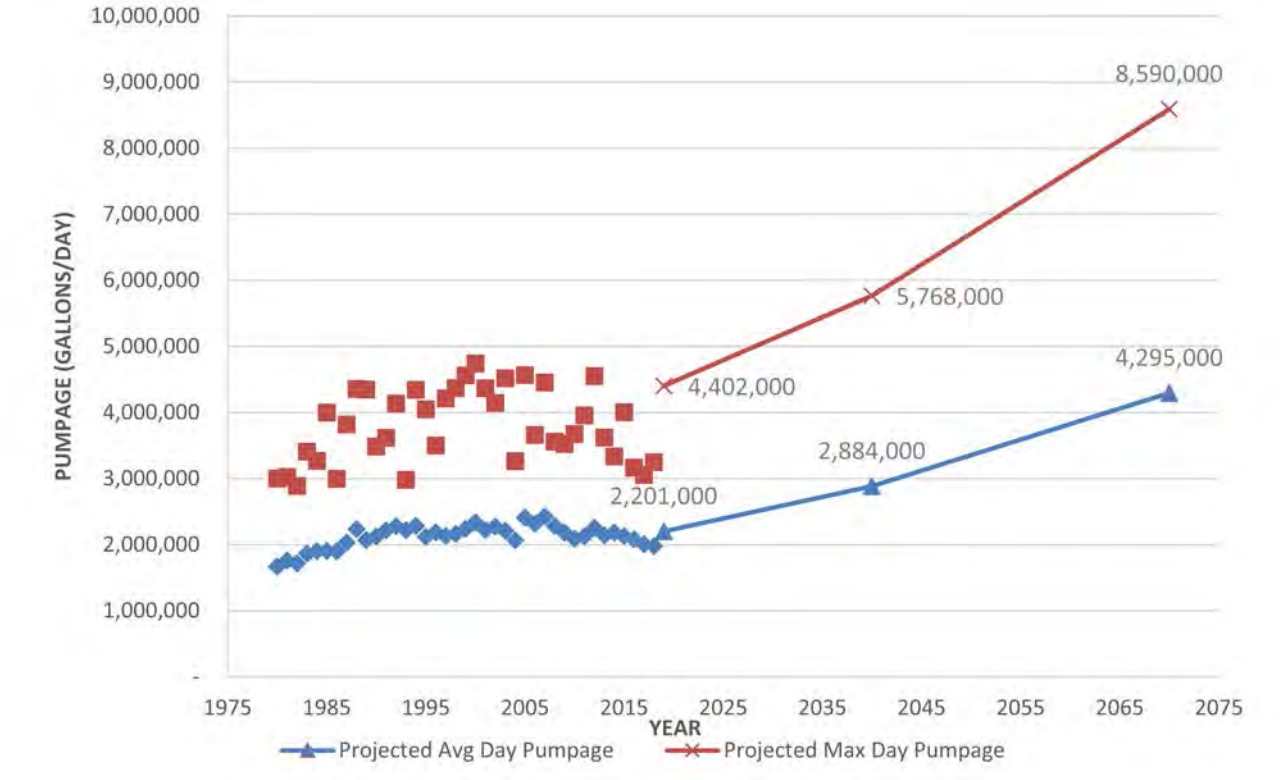


Figure 7.05-2 Average Demand Maximum Day Pumpage

SECTION 8
ADDITIONAL REQUIRED CAPACITY

8.01 GENERAL

Days of maximum demand can and do occur on several days in succession, especially during the warm summer months. As a result, water withdrawn from storage during any maximum day must be replaced before the following day to ensure an adequate supply of water for the next day. Therefore, total demand on the maximum day determines the minimum amount of water that must be available the next day. It is recommended the system be designed to meet maximum domestic demand under firm well capacity. If the firm well capacity is less than the maximum day demand, storage will be depleted and an inadequate amount of water may be available for the following day. Alternatively, if the firm well capacity of the system meets or exceeds the total demands, all storage tanks may be refilled during any 24-hour period and water will be available to meet the following day's demands.

The maximum hourly demands can be met by withdrawal from storage, by direct pumping from well and booster pumps, or a combination of both. Therefore, hourly demands on the maximum day determine the storage necessary to supplement direct pumping if the well supply equals maximum day demand. If no storage is provided, the water must be obtained from the pumped supply at the same rate as the maximum demand.

If the firm well capacity just equals the maximum day domestic demand, the amount of storage required would be equal to fire requirements plus peak domestic storage demands plus an operational buffer. Water withdrawn from storage to meet fire demand need not be replaced the same day or the day following the fire. However, it is recommended to replenish this volume of storage as soon as possible. Refer to Table 6.02-1 for a listing of current well capacities.

8.02 2019 CAPACITY

A. 2019 Average Day Demand

The estimated 2019 average design day equals 1,528 gpm (2.201 mgd). Firm well capacity with the largest well out of service (Well No. 6) equals 4,880 gpm (7.027 mgd). The City has a reserve well supply of 3,352 gpm and no additional well capacity is needed to meet the estimated 2019 average day demands.

B. 2019 Maximum Day Domestic Demand

The estimated 2019 maximum design day demand equals 3,057 gpm (4.402 mgd). Firm well capacity equals 4,880 gpm (7.027 mgd). The City has a reserve well supply of 1,823 gpm and no additional well capacity is required at this time to meet 2019 maximum day demands.

Figure 7.03-1 shows the hourly demand distribution on the 2019 design maximum day. The firm well supply pumping rate is also plotted in this graph. Whenever the hourly demand rate exceeds the firm well supply, the difference between the two rates must be made up from elevated storage. The volume of elevated storage required is the area under the demand curve that is above the firm well supply. For the 2019 maximum day demand, each hourly demand rate never exceeds the firm well capacity and no additional storage is needed to meet demands.

C. 2019 Maximum Day Plus Fire

The total amount of water available to satisfy the maximum day plus fire demand is equal to the firm well capacity plus the water available from useable storage. Section 8 discusses the 2019 fire demand conditions for the City.

It is assumed that 20 percent of the existing 1,250,000 gallons of elevated storage, or 250,000 gallons is allocated for operational needs. Therefore, only 1,000,000 gallons of elevated storage is considered usable when calculating available capacity.

Although there is 800,000 usable gallons at the Quarry Reservoir, storage is only available at the capacity of the booster pumps that is in excess of the well pump capacity. The booster pumps have a firm capacity of 4,700 gpm with the largest booster pump out of service. Well Nos. 2 and 3 have a total capacity of 1,290 gpm. Therefore, the rate at which the water can be withdrawn from the reservoir is the difference of these two rates and is equal to 3,410 gpm.

The total storage available under firm capacity conditions only includes the two elevated tanks and the Quarry Reservoir. Because Well No. 6 is the largest capacity well, it is assumed to be unavailable and is not included in the total well capacity. Similarly, because the well is assumed to be out of service, the Well No. 6 reservoir would not be able to be filled and is not included as available storage.

A demand rate of 6,557 gpm (3,057 gpm domestic demand plus 3,500 gpm fire demand) for three hours must be satisfied to provide the necessary fire protection. Because a fire can start at any time during the day, domestic use must be considered when calculating the available supply.

Maximum Day Demand	- 3,057 gpm
Fire Demand	- 3,500 gpm
Firm Well Capacity	+ 4,880 gpm
Quarry Reservoir Capacity	+ 3,410 gpm
Elevated Tank Storage Capacity*	+ 5,556 gpm
Total	+ 7,289 gpm

*Storage capacity = 1,000,000 gallons/180 minutes

During a 180-minute fire event, the system is projected to have a reserve capacity of 7,289 gpm or approximately 1,312,000 gallons. Therefore, no additional storage is needed to meet the 2019 projected maximum day plus fire demand.

8.03 2040 CAPACITY

This analysis assumes that no well or storage capacity will be lost between 2019 and 2040. even if existing infrastructure will exceed its anticipated lifespan.

A. 2040 Average Day Demand

The estimated 2040 average design day equals 2,003 gpm (2.884 mgd). Firm well capacity with the largest well out of service (Well No. 6) equals 4,880 gpm (7.027 mgd). The City has a reserve well supply of 2,887 gpm and no additional well capacity is needed to meet the estimated 2040 average day demands.

B. 2040 Maximum Day Domestic Demand

The estimated 2040 maximum design day demand equals 4,006 gpm (5.768 mgd). Firm well capacity equals 4,880 gpm (7.027 mgd). The City has a reserve well supply of 544 gpm and no additional well capacity is required at this time to meet 2040 maximum day demands.

Figure 7.04-1 shows the hourly demand distribution on the 2040 design maximum day. Because there are periods of time where the projected hourly demand is greater than the firm well capacity, as indicated in the areas above the firm well capacity line, storage must be used to satisfy demands. Approximately 198,000 gallons are required from elevated storage to meet these peak hourly demands.

Assuming 250,000 gallons is allocated for operational needs, the total amount of storage needed to meet projected hourly demands and operational fluctuations is 448,000 gallons. The system is projected to have a reserved elevated storage capacity of 802,000 gallons and no additional elevated storage is required to meet 2040 maximum day domestic demands.

C. 2040 Maximum Day Plus Fire

A demand rate of 7,506 gpm (4,006 gpm domestic demand plus 3,500 gpm fire demand) for three hours must be satisfied to provide the necessary fire protection. Because a fire can start at any time during the day, domestic use must be considered when calculating available capacity.

Maximum Day Demand	- 4,006 gpm
Fire Demand	- 3,500 gpm
Firm Well Capacity	+ 4,880 gpm
Quarry Reservoir Capacity	+ 3,410 gpm
Elevated Tank Storage Capacity*	+ 4,456 gpm
Total	+ 5,240 gpm

*Storage capacity = 802,000 gallons/180 minutes

During a 180-minute fire event, the system is projected to have a reserve capacity of 5,240 gpm or approximately 943,000 gallons. Therefore, no additional storage is needed to meet the 2040 projected maximum day plus fire demand.

8.04 2040 CAPACITY–WELL NO. 2 DECOMMISSIONED

This analysis assumes Well No. 2 is decommissioned by 2040 due to age. All other existing wells and storage facilities are assumed to be in service.

A. 2040 Average Day Demand

The estimated 2040 average design day equals 2,003 gpm (2.884 mgd). Firm well capacity with the largest well out of service (Well No. 6) and Well No. 2 decommissioned equals 4,550 gpm (6.552 mgd). The City has a reserve well supply of 2,547 gpm and no additional well capacity is needed to meet the estimated 2040 average day demands.

B. 2040 Maximum Day Domestic Demand

The estimated 2040 maximum design day demand equals 4,006 gpm (5.768 mgd). Firm well capacity equals 4,550 gpm (6.552 mgd). The City has a reserve well supply of 544 gpm and no additional well capacity is required at this time to meet 2040 maximum day demands.

Approximately 359,000 gallons are required from elevated storage to meet peak hourly demands with Well No. 2 decommissioned. Assuming that 250,000 gallons are allocated for operational needs, the total amount of storage needed to meet projected hourly demands and operational fluctuations is 609,000 gallons. The system is projected to have a reserved elevated storage capacity of 641,000 gallons and no additional elevated storage is required.

C. 2040 Maximum Day Plus Fire

A demand rate of 7,506 gpm (4,006 gpm domestic demand plus 3,500 gpm fire demand) for three hours must be satisfied to provide the necessary fire protection. Because a fire can start at any time during the day, domestic use must be considered when calculating available capacity.

Maximum Day Demand	- 4,006 gpm
Fire Demand	- 3,500 gpm
Firm Well Capacity	+ 4,550 gpm
Quarry Reservoir Capacity	+ 3,410 gpm
Elevated Tank Storage Capacity*	+ 3,561 gpm
Total	+ 4,015 gpm

*Storage capacity = 641,000 gallons/180 minutes

During a 180-minute fire event, the system is projected to have a reserve capacity of 4,015 gpm or approximately 723,000 gallons. Therefore, no additional storage is needed to meet the 2040 projected maximum day plus fire demand with Well No. 2 decommissioned.

8.05 2070 CAPACITY

This analysis assumes no well or storage capacity will be lost between 2019 and 2070 even if existing infrastructure will exceed its anticipated lifespan.

A. 2070 Average Day Demand

The estimated 2070 average design day equals 2,983 gpm (4.295 mgd). Firm well capacity with the largest well out of service (Well No. 6) equals 4,880 gpm (7.027 mgd). The City has a reserve well supply of 1,897 gpm and no additional well capacity is needed to meet the estimated 2070 average day demands.

B. 2070 Maximum Day Domestic Demand

The estimated 2070 maximum design day demand equals 5,965 gpm (8.590 mgd). Firm well capacity equals 4,880 gpm (7.027 mgd). The City has a well supply deficit of 1,085 gpm and additional well capacity is required to meet 2070 maximum day demands.

Figure 7.05-1 shows the hourly demand distribution on the 2070 design maximum day. Approximately 2,007,000 gallons are required from storage to meet these peak hourly demands. Subtracting this from the usable elevated storage of 1,000,000 gallons results in a storage capacity deficit of 1,007,000 gallons. If the Quarry Reservoir is assumed to be available, only 800,000 gallons of usable storage is available from the reservoir and there is still a storage capacity deficit of 207,000 gallons. Additional well, booster, elevated storage capacity, or any combination thereof, is needed to meet 2070 maximum day demands.

8.06 2070 CAPACITY–WELL NOS. 2, 3, 4, AND 5 AND TOWER 1 DECOMMISSIONED

This analysis assumes Well Nos. 2, 3, 4, and 5 and Tower 1 are decommissioned by 2070 because of age without constructing new facilities to replace them. All other existing wells and storage facilities are assumed to be in service.

A. 2070 Average Day Demand

The estimated 2070 average design day equals 2,983 gpm (4.295 mgd). Firm well capacity with the largest well out of service (Well No. 6) and Well Nos. 2, 3, 4, and 5 decommissioned equals 970 gpm (1.397 mgd). The City has a well supply deficit of 2,013 gpm and additional well capacity is needed to meet the estimated 2070 average day demands.

B. 2070 Maximum Day Domestic Demand

The estimated 2070 maximum design day demand equals 5,965 gpm (8.590 mgd). Firm well capacity equals 970 gpm (1.397 mgd) and only consists of Well No. 8. The City has a well supply deficit of 4,995 gpm and additional well capacity is required to meet 2070 maximum day demands.

Approximately 7,204,000 gallons are required from storage to meet these peak hourly demands. Subtracting this from the usable elevated storage of 600,000 gallons, with the decommissioning of Tower 1, results in a storage capacity deficit of 6,604,000 gallons. If the Quarry Reservoir is assumed to be in operation, only 800,000 gallons of usable storage is available from the reservoir and there is still a storage capacity deficit of 5,804,000 gallons. Additional well, booster, elevated storage capacity, or any combination thereof, is needed to meet 2070 maximum day demands.

Because the maximum day demand far exceeds the firm supply capacity, a maximum day plus fire demand condition was not evaluated.

8.07 2070 CAPACITY–WELL AND ELEVATED STORAGE CAPACITY REPLACEMENT

For this evaluation, it is assumed that Well No. 7 was added to the distribution system once maximum day demands exceeded firm well supply capacity, which is estimated to be around 2047. It also assumes additional well capacity was added as each of the wells are decommissioned because of a firm well supply deficit after each well abandonment. Figure 8.07-1 shows firm well supply capacity compared to project maximum day demands both with and without the additional wells. A total of four 1,500 gpm wells, including Well No. 7, were added to have the firm supply capacity exceed the maximum day demands. A 500,000-gallon elevated tank was also added to replace the decommissioned Tower 1.

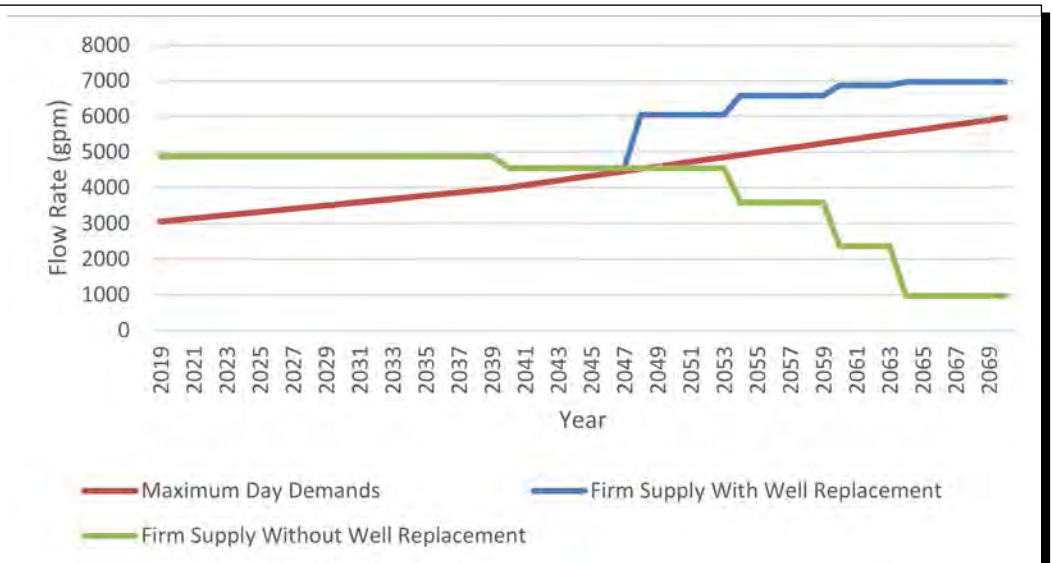


Figure 8.07-1 Firm Supply Capacity

A. 2070 Maximum Day Domestic Demand

The estimated 2070 maximum design day demand equals 5,965 gpm (8.590 mgd). After adding four 1,500 gpm wells, the firm well capacity equals 6,885 gpm (9.914 mgd) with the largest well out of service (Well No. 7). The City has a well reserve capacity of 920 gpm and no additional well capacity is needed to meet the estimated 2070 maximum day demands.

With the added well supply, approximately 478,000 gallons are required from elevated storage to meet peak hourly demands. Subtracting this from the usable elevated storage of 1,000,000 gallons results in a reserve storage capacity of 522,000 gallons and no additional storage capacity is required to meet 2070 maximum day demands.

B. 2070 Maximum Day Plus Fire–One Additional 1,500 gpm Well

A demand rate of 9,465 gpm (5,965 gpm domestic demand plus 3,500 gpm fire demand) for three hours must be satisfied to provide the necessary fire protection. Because a fire can start at any time during the day, domestic use must be considered when calculating available capacity.

There is 80,000 usable gallons at the Well No. 6 Reservoir with 20 percent of the total capacity allocated for operational fluctuations. Storage is only available at the capacity of the high-lift pump that is in excess of the well pump capacity. The high-lift pump has capacity of 1,600 gpm. Well No. 6 has a total capacity of 1,415 gpm. Therefore, the rate at which the water can be withdrawn from the reservoir is the difference of these two rates and is equal to 185 gpm. Additionally, it is assumed that one of the 1,500 gpm wells was constructed near the Quarry Reservoir and water is pumped directly into the reservoir. The capacity of the Quarry Reservoir is the difference between the firm booster pump capacity of 4,700 gpm and the well capacity of 1,500 gpm, which equals 3,200 gpm.

Maximum Day Demand	- 5,965 gpm
Fire Demand	- 3,500 gpm
Firm Well Capacity	+ 6,885 gpm
Quarry Reservoir Capacity	+ 3,200 gpm
Well No. 6 Reservoir Capacity	+ 185 gpm
Elevated Tank Storage Capacity*	+ 2,900 gpm
Total	+ 3,705 gpm

*Storage capacity = 522,000 gallons/180 minutes

During a 180-minute fire event, the system is projected to have a reserve capacity of 3,705 gpm or approximately 667,000 gallons. Therefore, no additional storage is needed to meet the 2070 projected maximum day plus fire demand assuming four 1,500 gpm wells and a 500,000-gallon elevated tank have been added to the system.

8.08 SUMMARY OF ADDITIONAL REQUIRED CAPACITY

Based on the estimated demand projections and assuming Well No. 2 is decommissioned, an additional well source is needed by 2047. Estimated maximum day demands will exceed firm well capacity at this time and an additional well is required. When Well Nos. 3, 4, and 5 are decommissioned, a 1,500 gpm well is needed to replace each well as maximum demands will exceed firm well capacity as each well is decommissioned. An additional 500,000-gallon elevated tank is required to replace the decommissioned Tower 1.

Table 8.08-1 presents a summary of additional required capacity.

Item	Approximate Construction Year
Add Well No. 7 (1,500 gpm)	2047
Add Well No. 9 (1,500 gpm)	2054
Add Well No. 10 (1,500 gpm)	2060
Add Tower 3 (500,000 gallons)	2060
Add Well No. 11 (1,500 gpm)	2064

Table 8.08-1 Summary of Additional Required Capacity

SECTION 9
DISTRIBUTION SYSTEM PERFORMANCE EVALUATION

9.01 GENERAL

This section summarizes the services completed in creating and calibrating the City's water system model, including the results of the model calibration and system-wide pressures and available fire flows.

9.02 MODEL CREATION

A computer model of the City's water distribution system was created using WaterGEMs V8i software. The existing distribution system was imported into the model using geographic information system (GIS) shapefiles provided by the City. The shapefile information included water main diameter and length and hydrant location. Well and booster pump and storage facility information was added separately to the model from information provided by the City. Each model junction, defined as a point where two pipes connect, was assigned an elevation by importing 1-foot topographic contours using the model's Terrain Extractor tool.

Water demands were entered in the model using 2019 projected average and maximum day demands using information from the PSC annual reports. The demands were geo-spatially allocated to the model based on the physical address of the City's 2018 annual water meter records. This method accurately reflects where the system demands are present in the distribution system.

Using SCADA records from the maximum pumpage day on August 22, 2018, a diurnal curve was generated by analyzing the volume of water supplied by wells and booster pumps and the volume of water entering or leaving the elevated tanks or reservoirs for every hour of that day.

9.03 MODEL CALIBRATION

To successfully calibrate the computer model, predicted results in the model were confirmed against observed conditions in the distribution system. This was completed by performing field testing of hydrant flows in various parts of the distribution system. Nine fire flow tests and two static pressure tests were completed on April 19, 2019. Test locations were chosen to provide data that was thought to be representative of the entire distribution system.

The flow test used one monitoring hydrant and one flowing hydrant. The monitoring hydrant was used to observe the static pressure when the flowing hydrant was closed, and to observe residual pressure when the flowing hydrant was open. A pressure gauge was attached to the monitoring hydrant and air was purged from the hydrant and gauge manifold before taking a static pressure reading.

After the flowing hydrant was fully opened using a single outlet, the residual pressure reading was taken at the monitoring hydrant. A pressure drop of approximately 10 pounds per square inch (psi) is desired to provide distinguishable results between static and residual pressures and to provide better accuracy when calibrating the model. If a pressure drop of approximately 10 psi was not achieved, another hydrant outlet should be opened. The residual pressure drop at most of the tests was greater than 10 psi only using a single flowing outlet. The City requested to only use one flowing outlet to prevent water main breaks and disturbance within the distribution system. After obtaining all of the readings, the hydrants were closed and the caps were replaced.

The flow from the hydrants was calculated after the field tests were completed. The flow from each outlet was determined based on the pitot gauge reading observed and the diameter of the hydrant outlet. Discharge rates were obtained using the equation in Figure 9.03-1. Because one 2-1/2 inch diameter hydrant outlet was opened, an outlet discharge coefficient of 0.90 was used, which assumes a full and relatively smooth flow from the hydrant outlet.

$$Q = 29.83 * C * D^2 * P^{0.5}$$

where Q = flow (gpm)
C = outlet discharge coefficient (unitless)
D = diameter (inches)
P = pressure (psi)

Figure 9.03-1 Hydrant Flow Equation

The model was calibrated from a steady-state perspective by modifying the roughness coefficients of the pipes, or C-factors, within the distribution system based on size, location, and age. As a starting point, all C-factors were set to 130 to simulate brand new piping. A computer model is typically considered to be calibrated when the static and residual pressures predicted by the model at the specific flow test locations are within 5 psi of the field measurements.

Operating data was obtained from the City after the fire flow tests were conducted and used to set the boundary conditions, such as elevated tank water levels and well and booster pump flows in the model. The model was then used to simulate the flow tests under the observed conditions. Table 9.03-1 presents the flows and pressures measured in the field compared to the final model-simulated pressures at the testing locations in the distribution system under both static and residual flow conditions. Hydrant tests 10 and 11 only consisted of testing and comparing the static pressures. Conducting a fire flow test within a small boosted zone results in evaluating the performance of the booster pumps themselves rather than the distribution system. Therefore, only static pressure tests were performed at these locations.

Test Number	Flowing Hydrant Location	Field Static Pressure (psi)	Modeled Static Pressure (psi)	Field Residual Pressure (psi)	Modeled Residual Pressure (psi)	Calculated Field Measured Fire Flow (gpm)
1	Sleepy Hollow Circle	44	43.1	32	36.0	993
2	Amherst Road and Maywood Avenue	88	88.5	84	84.5	1,404
3	Savannah Court and Teal Court	80	80.7	73	68.6	1,278
4	Calla Pass	69	70.4	57	61.3	1,244
5	Patty Lane	70	65.1	60	60.3	1,244
6	Costco	66	67.0	56	60.5	1,244
7	White Coral Way and Sand Pearl Trail	56	57.3	39	46.7	1,061
8	John Q Hammons Drive	60	60.1	51	55.6	1,186
9	Breakers Rock Road and Crystal Downs Way	50	50.3	29	37.2	1,061
10	Stratford Court and High Point Road	70	69.7	-	-	-
11	Pleasant View Road	83	80.2	-	-	-

Table 9.03-1 Final Model Calibration Results–Test Hydrants

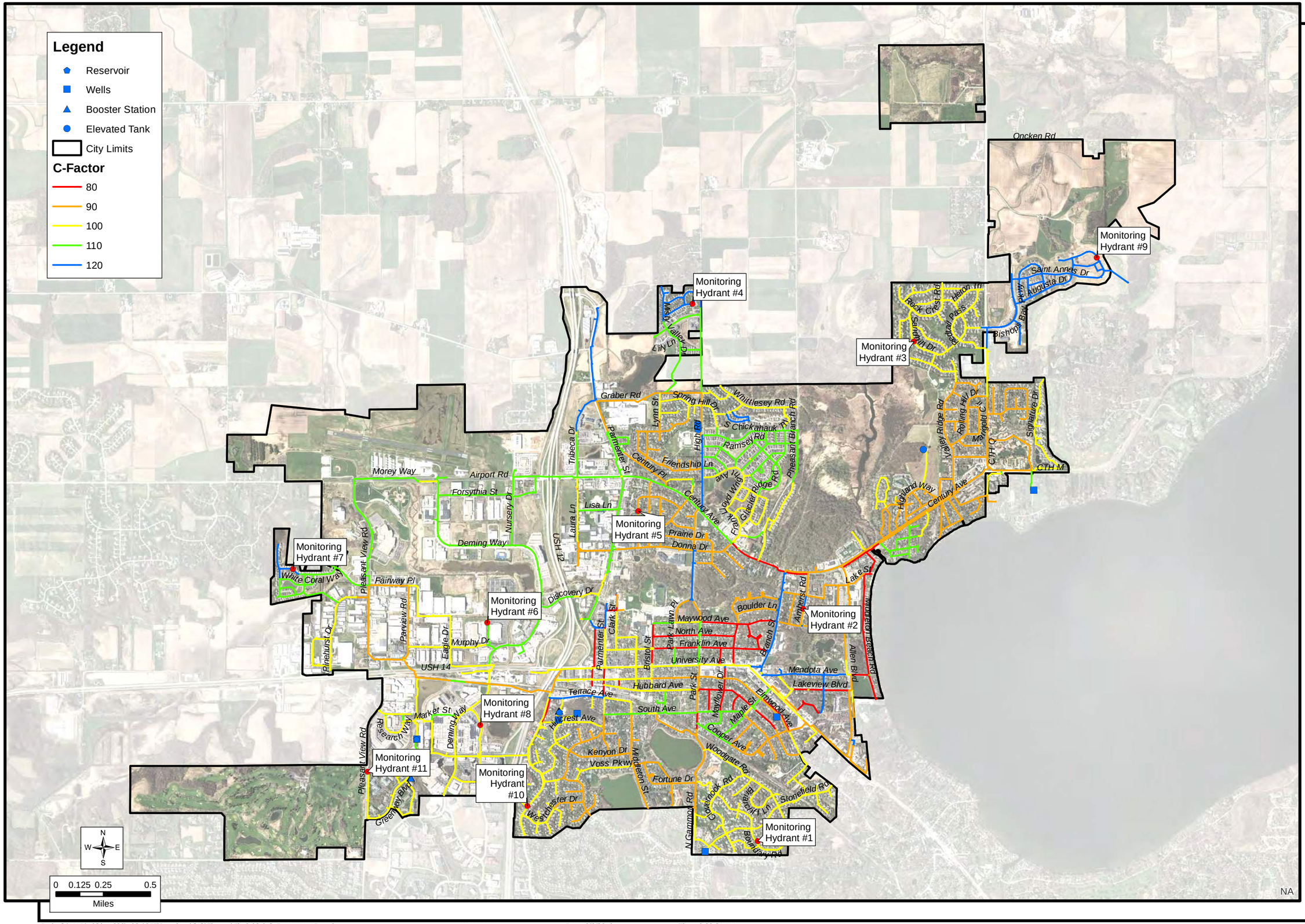
Extensive efforts were made to bring all differences between the model-simulated and field-collected pressures to within 5 psi through adjustment of C-factors. This was first accomplished by verifying all pipe configurations, sizes, and ages. Based on the age of the pipe, a different C-factor is typically applied. Over time, older pipes change their physical characteristics and generally exhibit lower C-factors. Table 9.03-2 presents the C-factors that were applied to the pipes in the distribution system. Figure 9.03-2 shows the water distribution system with all water main color coded based on the assigned C-factors and the location of the fire flow tests.

Installation Year	C-Factor
1940 to 1950	70
1950 to 1960	70
1960 to 1970	80
1970 to 1980	80
1980 to 1990	100
1990 to 2000	100
2000 to 2010	110
2010 to 2019	120

Table 9.03-2 Model Pipe C-Factors

Comparing the static pressures obtained in the field to the modeled results, all the fire flow tests, except for Test No. 5, was within 3 psi. The larger difference seen in the comparison of Test No. 5

Appendix I



WATER MAIN C-FACTORS AND FIRE FLOW TEST LOCATIONS

UTILITY MASTER PLAN
CITY OF MIDDLETON
DANE COUNTY, WISCONSIN

STRAND ASSOCIATES®

FIGURE 9.03-2
1024.057

Path: S:\MAD\1000--1099\1024\057\Drawings\GIS\Figures\Fig 9.03-2 C-Factor 11x17.mxd User: natee Date: 9/3/2019 Time: 9:03:21 AM

static pressures could have been a result of human error or an incorrect hydrant elevation. However, all test results had pressures within the 5 psi tolerance range.

Comparing the residual pressures obtained in the field to the modeled results, two tests could not be brought into tolerance. If the C-factors were adjusted to calibrate these two tests, other fire flow tests would be pushed out of tolerance.

Test No. 9, which took place within the COBB neighborhood, took place at the same time Well No. 8 turned on. This event could have created pressure fluctuations in the distribution system and caused misreadings of pressure gauges. Additionally, fire flow tests that were conducted in June 2017 included a fire flow test at the same flowing hydrant. The pressures observed from the previous test under similar boundary conditions matches closely to what the model is currently presenting rather than the field conditions. Therefore, it was determined that the results for this test do not represent normal system conditions.

Test No. 7, located on the western part of the distribution system, had a modeled residual pressure reading that was higher than the field result. One explanation for the difference could have been caused by closed valves in the distribution system. Several scenarios of nearby closed valves in the system were modeled to identify which potential valves may have been shut in the field during testing. The City was asked to verify if these valves were accidently closed in the field. The City checked all valves in the general testing area and found that all valves were open. However, other valves may still be closed around the test area. Because Test No. 7 was localized to small-diameter water main within a residential neighborhood away from large transmission main, no further calibration efforts were performed as the additional benefit was thought to be minimal and the model was considered to be fully calibrated. It is recommended the City continue to verify the state of isolation valves in the Test No. 7 neighborhood to potentially improve local available fire flows.

9.04 2019 MODEL ANALYSIS

A. General

The current day 2019 water model was analyzed under various demand and flow conditions. Two general types of steady-state simulations were performed with the model: domestic (non-fire) and fire flow.

A steady-state simulation evaluates the operational behavior of the system at a specific point in time under steady-state (unchanging) conditions. Using this type of analysis, the behavior of pump, tank, and supply/storage relationships can be determined. It can be useful for determining pressures and flow rates within the distribution system main supporting fire hydrants under various demand conditions.

A fire flow simulation provides an instantaneous snapshot of the amount of water available at hydrants within the system while maintaining a minimum 20 psi residual pressure at all points in the distribution system. The model simulates a separate fire event at each junction in the system and increases the flow until either the hydrant itself or any point in the system reaches the 20 psi residual

pressure threshold. Very high available fire flows (over 5,000 gpm) are not considered realistic but indicate areas of very strong hydraulic connectivity to sources of supply or storage.

B. Average Day–Domestic Demand

The 2019 average day domestic demand condition, equaling 1,528 gpm, was modeled using a steady-state analysis with Well No. 5 and the high zone booster pumps operating and the elevated tank levels set 5 feet below overflow (1,075 feet). The model projected system operating pressures to be between approximately 36 and 96 psi in the main zone, as shown by the pressure contours generated by the model in Figure 9.04-1. Operating pressures in the Hillcrest High Zone ranges from 55 to 83 psi and from 79 to 116 psi in the Greenway Boosted Zone.

Areas of lower pressures appear around Tower 1 and on the eastern side of the COBB neighborhood. This is primarily caused by higher land elevations. Areas of higher pressure occur within the Greenway Boosted Zone and areas along Lake Mendota on the eastern side of the City. The pressures in the eastern side of the City are primarily caused by lower land elevations. Pressures in the Greenway Boosted Zone are primarily caused by the gradient that the station is operating at. The Greenway Booster Station was designed to provide a minimum pressure to the Pleasant View Golf Course, currently located in an area with high elevations.

C. Maximum Day–Domestic Demand

The 2019 maximum day domestic demand condition, equaling 3,057 gpm, was modeled using a steady-state analysis with Well No. 5 and the high zone booster pumps operating and the elevated tank levels set 5 feet below overflow (1,075 feet). The model projected system operating pressures to be between approximately 35 and 95 psi in the main zone, as shown by the pressure contours generated by the model in Figure 9.04-2. Operating pressures in the Hillcrest High Zone ranged from 53 to 80 psi and from 79 to 116 psi in the Greenway Boosted Zone. The areas of lowest and highest pressure appear to be in the same locations as the average day.

According to WDNR NR 811.70(4), water main shall be designed to have a minimum pressure requirement of 35 psi at normal static pressure at ground level. According to the model, there are several areas throughout the distribution system that are close to this minimum. It is recommended that the utility keep the water level in the elevated tanks at or above 5 feet below overflow to keep pressures above the minimum 35 psi under maximum demand conditions.

D. Maximum Day–Domestic Demand with Fire Flow

The model was operated in a similar manner to the maximum day domestic-only scenario when simulating available fire flows throughout the distribution system and is anticipated to provide a conservative estimate for planning purposes. The model projected available fire flow, which was based on a minimum 20 psi residual pressure threshold, ranged from approximately 615 gpm to greater than 5,000 gpm, as shown by the available fire flow contours generated by the model in Figure 9.04-3.

Legend

- City Limits
- Reservoir
- Wells
- Booster Station
- Elevated Tank
- Existing Water Main

Pressure (psi)

- <= 40
- <= 50
- <= 60
- <= 70
- <= 80
- <= 90
- <= 100
- <= 110
- <= 115

N W E S

0 0.125 0.25 0.5
Miles

2019 AVERAGE DAY PRESSURE CONTOURS

UTILITY MASTER PLAN
CITY OF MIDDLETON
DANE COUNTY, WISCONSIN

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FIGURE 9.04-1
1024.057

NA

Path: S:\MAD\1000--1099\1024\057\Drawings\GIS\Figures\Fig 9.04-1 2019 Ave Pressure 11x17.mxd User: Danc Date: 8/1/2019 Time: 1:03:38 PM

Legend

- Reservoir
- Wells
- Booster Station
- Elevated Tank
- Existing Water Main
- City Limits

Pressure (psi)

- <= 40
- <= 50
- <= 60
- <= 70
- <= 80
- <= 90
- <= 100
- <= 110
- <= 115

N W E S

0 0.125 0.25 0.5
Miles

2019 MAXIMUM DAY PRESSURE CONTOURS

UTILITY MASTER PLAN
CITY OF MIDDLETON
DANE COUNTY, WISCONSIN

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FIGURE 9.04-2
1024.057

NA

Path: S:\MAD\1000--1099\1024\057\Drawings\GIS\Figures\Fig 9.04-2 2019 Max Pressure 11x17.mxd User: Danc Date: 8/2/2019 Time: 7:37:10 AM

Legend

- Reservoir
- Wells
- Booster Station
- Elevated Tank
- Existing Water Main
- City Limits

Flow (gpm)

- <= 1,000
- <= 1,500
- <= 2,000
- <= 2,500
- <= 3,000
- <= 3,500
- <= 4,000
- <= 4,500
- <= 5,000

0 0.125 0.25 0.5
Miles

N
W E
S

2019 MAXIMUM DAY AVAILABLE FIRE FLOW

UTILITY MASTER PLAN
CITY OF MIDDLETON
DANE COUNTY, WISCONSIN

STRAND ASSOCIATES®

FIGURE 9.04-3
1024.057

NA

Path: S:\MAD\1000--1099\1024\057\Drawings\GIS\Figures\Fig 9.04-3 2019 Fire Flow 11x17.mxd User: Danc Date: 8/2/2019 Time: 7:15:07 AM

The hydrant with the lowest modeled available fire flow of 615 gpm is located at the west end of Westchester Drive. This is caused by higher land elevations and being located at the end of an 8-inch dead-end water main. Several areas with low available fire flows are in similar locations. A handful of hydrants were modeled to have an available fire flow of 5,000 gpm or greater. These hydrants are located along the 12-inch water main that leads from Tower 2 to the distribution system. It should be noted that this amount of fire flow is typically not available from a single hydrant because of hydrant head loss, but signifies a strong hydraulic connection within the distribution system.

In general, the available fire flow in the suburban business park and office park located on the City's west side range between 2,000 and 3,500 gpm. Typical commercial and light industrial needed fire flows range between 1,000 and 3,000 gpm and appear to be met during 2019 maximum day demands based on the model output.

9.05 2040 MODEL ANALYSIS

A. Expansion of the Distribution System

A 2040 water system model was created to simulate and analyze future domestic (non-fire) and fire flow demand conditions.

The infrastructure improvements were added based on locations provided in the future growth analysis discussed in Section 2.01. A broad schematic of water main was added to the water model distribution system to generally represent future development in the areas and develop future fire flow and pressure contour projections. The difference in demand from 2019 to 2040 was allocated to these new areas by spreading the demand evenly to each future model node. When future road and development designs are completed, the model should be updated to determine actual future demand conditions. This scenario also assumes the existing well, booster pumps, and reservoir and storage facilities remained in place.

B. Average Day–Domestic Demand

The 2040 average day domestic demand condition, equaling 2,003 gpm, was modeled using a steady-state analysis with Well No. 5 and the high zone booster pumps operating and the elevated tank levels set 5 feet below overflow (1,075 feet). The model projected system operating pressures to be between approximately 36 and 96 psi in the main zone, as shown by the pressure contours generated by the model in Figure 9.05-1. Operating pressures in the Hillcrest High Zone range from 55 to 83 psi and from 79 to 116 psi in the Greenway Boosted Zone.

Areas of low and high pressures appear in the same locations as mentioned in Section 9.04. All areas of future growth and development appear to be in areas that provide adequate pressures.

C. Maximum Day–Domestic Demand

The 2040 maximum day domestic demand condition, equaling 4,006 gpm, was modeled using a steady-state analysis with Well No. 5 and the high zone booster pumps operating and the elevated tank levels set 5 feet below overflow (1,075 feet). The model projected system operating pressures

Legend

- Reservoir
- Wells
- Booster Station
- Elevated Tank
- 2040 Water Main
- City Limits

Pressure (psi)

- <= 40
- <= 50
- <= 60
- <= 70
- <= 80
- <= 90
- <= 100
- <= 110
- <= 115

N
W E
S

0 0.125 0.25 0.5
Miles

2040 AVERAGE DAY PRESSURE CONTOURS

UTILITY MASTER PLAN
CITY OF MIDDLETON
DANE COUNTY, WISCONSIN

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FIGURE 9.05-1
1024.057

NA

Path: S:\MAD\1000--1099\1024\057\Drawings\GIS\Figures\Fig 9.05-1 2040 Ave Pressure 11x17.mxd User: Danc Date: 8/2/2019 Time: 7:20:48 AM

Appendix I

2040 MAXIMUM DAY PRESSURE CONTOURS

UTILITY MASTER PLAN
CITY OF MIDDLETON
DANE COUNTY, WISCONSIN

Legend

- Reservoir
- Wells
- Booster Station
- Elevated Tank
- 2040 Water Main
- City Limits

Pressure (psi)

- <= 40
- <= 50
- <= 60
- <= 70
- <= 80
- <= 90
- <= 100
- <= 110
- <= 115

N
W E
S

0 0.125 0.25 0.5
Miles

NA

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FIGURE 9.05-2
1024.057

Path: S:\MAD\1000-1099\1024\057\Drawings\GIS\Figures\Fig 9.05-2 2040 Max Pressure 11x17.mxd User: Danc Date: 8/2/2019 Time: 7:22:21 AM

Appendix I

Legend

- Reservoir
- Wells
- Booster Station
- Elevated Tank
- 2040 Water Main
- City Limits

Flow (gpm)

- <= 1,000
- <= 1,500
- <= 2,000
- <= 2,500
- <= 3,000
- <= 3,500
- <= 4,000
- <= 4,500
- <= 5,000

N W E S

0 0.125 0.25 0.5
Miles

2040 MAXIMUM DAY AVAILABLE FIRE FLOW

UTILITY MASTER PLAN
CITY OF MIDDLETON
DANE COUNTY, WISCONSIN

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FIGURE 9.05-**3**
1024.057

NA

Path: S:\MAD\1000--1099\1024\057\Drawings\GIS\Figures\Fig 9.05-3 2040 Fire Flow 11x17.mxd User: Danc Date: 8/2/2019 Time: 7:25:32 AM

to be between approximately 34 and 93 psi in the main zone, as shown by the pressure contours generated by the model in Figure 9.05-2. Operating pressures in the Hillcrest High Zone range from 55 to 83 psi and from 79 to 116 psi in the Greenway Boosted Zone.

D. Maximum Day–Domestic Demand with Fire Flow

The model was operated in a similar manner to the maximum day domestic-only scenario when simulating available fire flows throughout the distribution. The model projected available fire flow ranged from approximately 594 gpm to greater than 5,000 gpm, as shown by the available fire flow contours generated by the model, which can be seen in Figure 9.05-3.

The locations with the lowest and highest modeled available fire flow appeared to be in the same locations as described in Section 9.04. Some of the COBB development was assumed to be constructed by 2040 and was modeled to have available fire flows range from 750 to 1,500 gpm. Typical residential needed fire flows range between 500 and 1,000 gpm. Although not required, it is recommended that available fire flow is increased in this area. This can be addressed by constructing a secondary connection point to the area, which is modeled in the full build-out scenario in the following section. This project has been previously identified by the City as the Pheasant Branch Connector, a water main routing that would route span from Pheasant Branch Road to County Highway Q near COBB.

9.06 2070 MODEL ANALYSIS

A. Expansion of the Distribution System

A 2070 water system model was created to simulate and analyze future domestic (non-fire) and fire flow demand conditions.

The infrastructure improvements were added based on locations provided in the future growth analysis discussed in Section 2.01. Similar to the 2040 scenario, a broad schematic of water main was added to the water model distribution system to generally represent future development in the areas and develop future fire flow and pressure contour projections. The difference in demand from 2040 to 2070 was allocated to these new areas by spreading the demand evenly to each future model node.

B. Average Day–Domestic Demand

The 2070 average day domestic demand condition, equaling 2,983 gpm, was modeled using a steady-state analysis with Well Nos. 5 and 6 and the high zone booster pumps operating and the elevated tank levels set 5 feet below overflow (1,075 feet). The model projected system operating pressures to be between approximately -8 and 96 psi in the main zone, as shown by the pressure contours generated by the model in Figure 9.06-1. Operating pressures in the Hillcrest High Zone range from 55 to 83 psi and from 79 to 116 psi in the Greenway Boosted Zone.

The areas of negative pressure occur in the northwest portion of the new development in Area C of the Intergovernmental Agreement. This is primarily caused by high ground elevations compared to

the rest of the distribution system. A high-pressure zone (NW High Zone) is required to feed this portion of the new development. Depending on the number of units that are developed in this area, an elevated tank might be needed to meet WDNR code requirements (NR 811.62). For the purposes of this report, an elevated tank will be included in addition to the booster pumping station to serve the NW High Zone.

Operating under the same conditions as above, except with an additional elevated tank at an overflow elevation of approximately 1,190 feet, projected system operating pressures range between 36 and 96 psi in the main zone and 38 and 99 psi in the NW High Zone. Zone boundaries of the NW High Zone shall encompass all ground level elevations greater than 1,098 feet to maintain sufficient pressure. Figure 9.06-2 shows the updated pressure contours with the NW High Zone implemented.

C. Maximum Day–Domestic Demand

The 2070 maximum day domestic demand condition, equaling 5,965 gpm, was modeled using a steady-state analysis with Well Nos. 5 and 6 and the high zone booster pumps operating and the elevated tank levels set 5 feet below overflow (1,075 feet in the Main Zone and 1,185 feet in the new NW High Zone). The model projected system operating pressures to be between approximately 33 and 93 psi in the main zone, as shown by the pressure contours generated by the model in Figure 9.06-3. Operating pressures in the Hillcrest High Zone range from 55 to 83 psi, 79 to 116 psi in the Greenway Boosted Zone, and 37 to 98 psi in the new NW High Zone.

D. Maximum Day–Domestic Demand with Fire Flow

The model was operated in a similar manner to the maximum day domestic-only scenario when simulating available fire flows throughout the distribution. The model projected available fire flow ranged from approximately 530 gpm to greater than 5,000 gpm, as shown by the available fire flow contours generated by the model, which can be seen in Figure 9.06-4.

The locations with the lowest and highest modeled available fire flow appeared to be in the same locations as described in Section 9.06. All new development occurring between 2040 and 2070 exhibit sufficient available fire flows. The addition of the secondary connection, the Pheasant Branch Connector, increased available fire flows in COBB significantly to flows ranging from 2,000 to 2,700 gpm.

Appendix I

Legend

- Reservoir
- Wells
- Booster Station
- Elevated Tank
- 2070 Water Main
- City Limits

Pressure (psi)

- <= 40
- <= 50
- <= 60
- <= 70
- <= 80
- <= 90
- <= 100
- <= 110
- <= 115

N
W E
S

0 0.125 0.25 0.5
Miles

2070 AVERAGE DAY PRESSURE CONTOURS

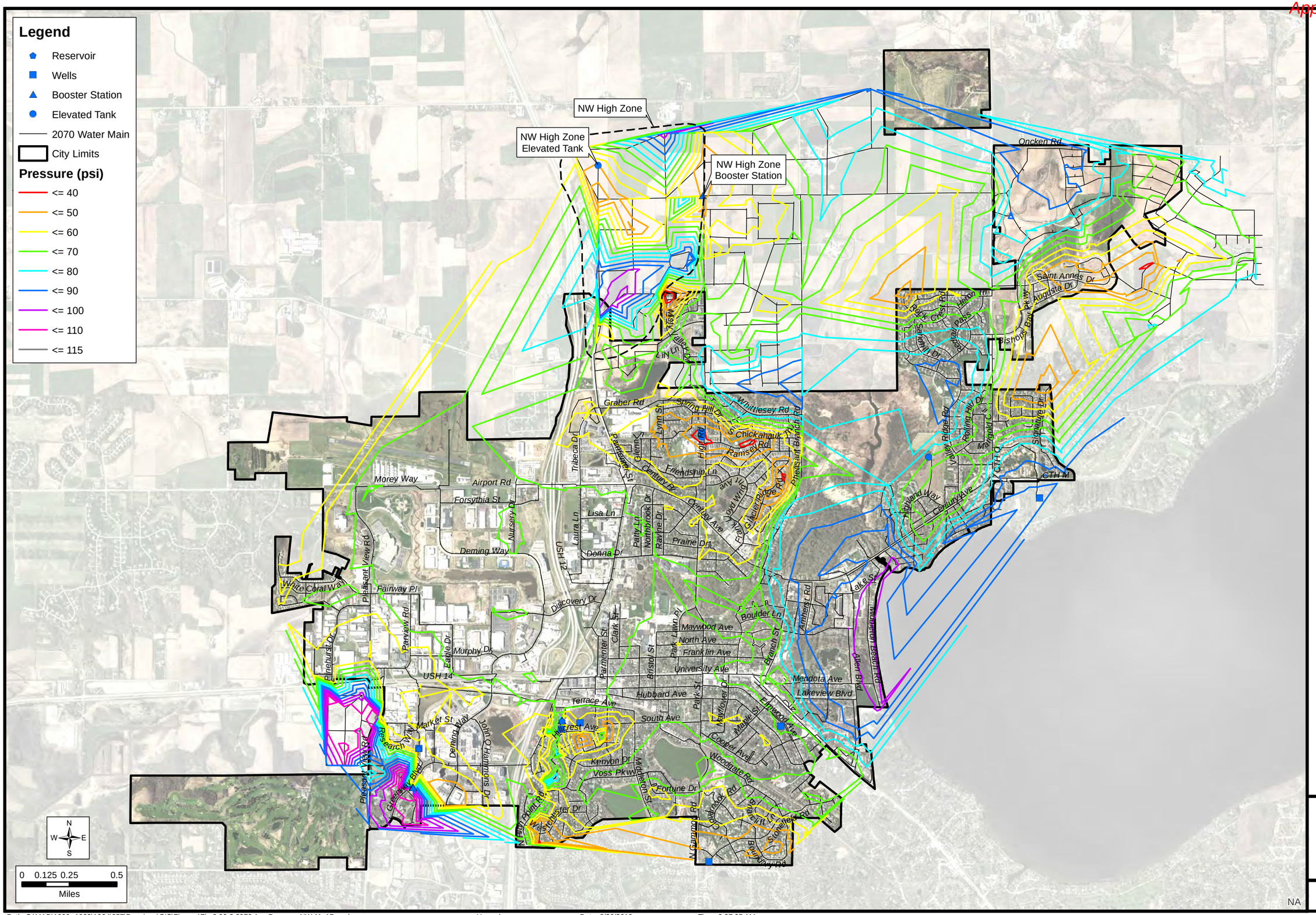
UTILITY MASTER PLAN
CITY OF MIDDLETON
DANE COUNTY, WISCONSIN

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FIGURE 9.06-1
1024.057

NA

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2070 AVERAGE DAY PRESSURE CONTOURS - NW HIGH ZONE

UTILITY MASTER PLAN
CITY OF MIDDLETON
DANE COUNTY, WISCONSIN

NA

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FIGURE 9.06-2
1024.057

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Appendix I

Legend

- Reservoir
- Wells
- Booster Station
- Elevated Tank
- 2070 Water Main
- City Limits

Pressure (psi)

- <= 40
- <= 50
- <= 60
- <= 70
- <= 80
- <= 90
- <= 100
- <= 110
- <= 115

NW High Zone

NW High Zone Elevated Tank

NW High Zone Booster Station

Oncken Rd

Saint Annes Dr

Augusta Dr

Bishops Bay Pk Way

Bishops Bay Pass

Bishops Bay Ct

Bishops Bay Trl

Heron Trl

Pebble Creek Pl

Summit Dr

Crest Rd

Valley View Dr

Graber Rd

Spring Hill Dr

Whittlesey Rd

S Chickahauk Rd

Ramsey Rd

Pheasant Branch Rd

Lynn St

Glenn St

Parliament St

Century Pl

Friendship Ln

High Rd

Tribeca Dr

Rolling Hill Dr

Ridge Rd

Glacier Ridge Rd

Wyld Wing Trl

Frank Ave

Century Ave

Highland Way

Mongiardi Ct

CTH Q

CTH M

Morey Way

Airport Rd

Forsythia St

Nursery Dr

Deming Way

USH 12

Laura Ln

Lisa Ln

Patty Ln

Northbrook Dr

Ravine Dr

Prairie Dr

Donna Dr

Pleasant View Rd

White Coral Way

Fairway Pl

Discovery Dr

Parview Rd

Eagle Dr

Murphy Dr

Pinehurst Dr

USH 14

Clark St

Parmenter St

Bristol St

Park Lawn Pl

Maywood Ave

North Ave

Franklin Ave

University Ave

Hubbard Ave

Terrace Ave

South Ave

Park St

Boulder Ln

Branch St

Ammers Rd

Lake St

Allen Blvd

Mendota Ave

Lakeview Blvd

Elmwood Ave

Maple St

Mayflower Dr

Cooper Ave

Woodgate Rd

Middleton Beach Rd

Market St

Deming Way

John Q Hammons Dr

Hillcrest Ave

Kenyon Dr

Voss Pkwy

Middleton St

Fortune Dr

Pleasant View Rd

Greenway Blvd

Gammon Rd

Golfview Rd

Cliff Ln

Bowman Rd

Schneider Rd

N Point Rd

Westchester Dr

N

W E

S

0 0.125 0.25 0.5

Miles

NA

2070 MAXIMUM DAY PRESSURE CONTOURS - NW HIGH ZONE

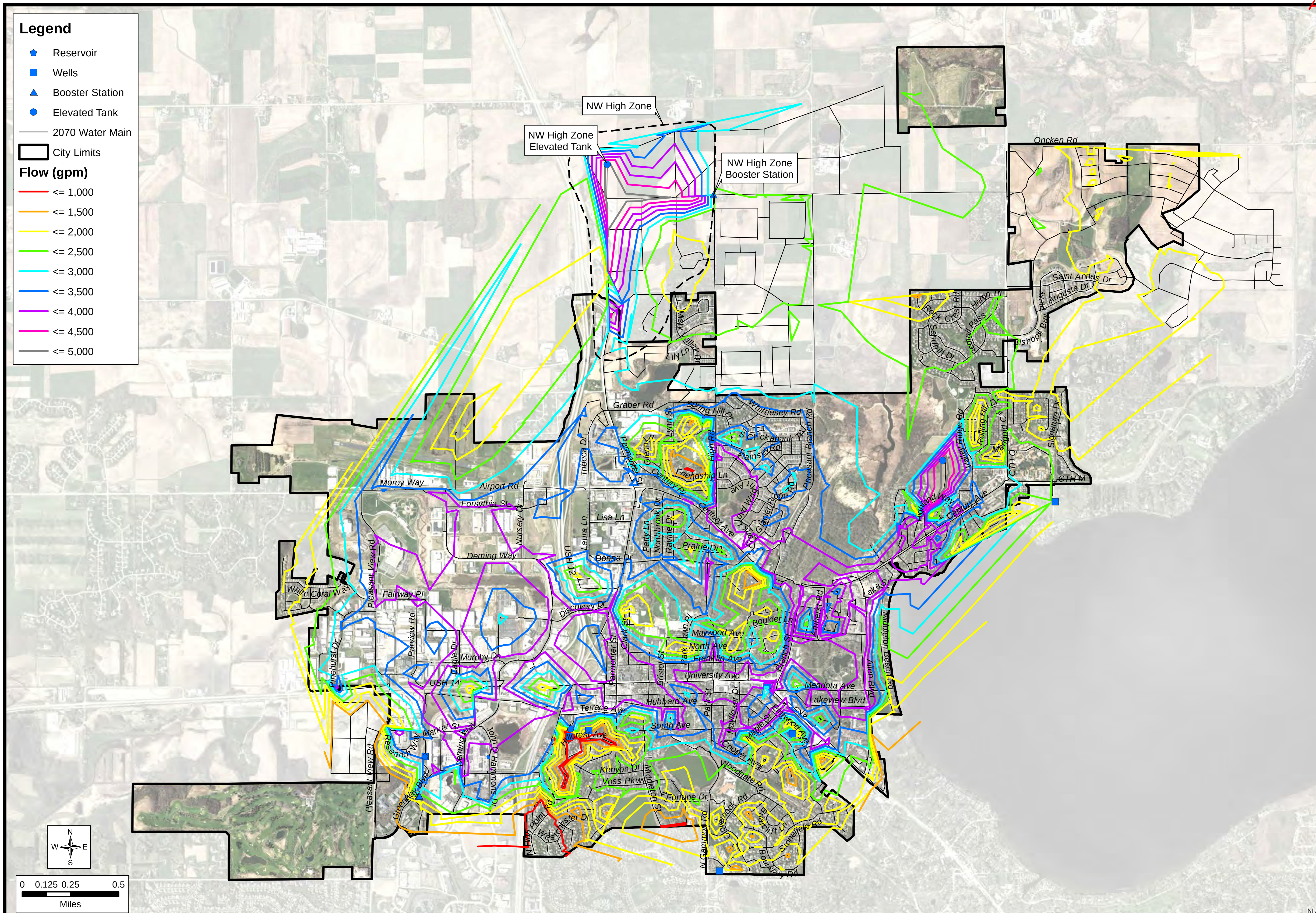
UTILITY MASTER PLAN
CITY OF MIDDLETON
DANE COUNTY, WISCONSIN

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FIGURE 9.06-3
1024.057

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Appendix I



2070 MAXIMUM DAY AVAILABLE FIRE FLOW - NW HIGH ZONE

UTILITY MASTER PLAN
CITY OF MIDDLETON
DANE COUNTY, WISCONSIN

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FIGURE 9.06-3
1024.057

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SECTION 10
PIPELINE ASSESSMENT

10.01 GENERAL

This section summarizes the water supply pipeline inventory and condition assessment. The report presents the results of the evaluation of main breaks in the distribution system and procedures for selecting, organizing, and prioritizing replacement projects. It also presents the City's current five-year streets improvement program and compares the program to the water main that was identified as needing replacement.

10.02 INVENTORY

The water main inventory used for this project was obtained from the City's GIS database. Installation year, pipe material, and pipe diameter size were included for almost all the pipes located within the City. Water main break data was also supplied from the City's GIS, in addition to a list of locations and dates of more recent water main breaks.

A. Installation Year

Figure 10.01-2 displays a plot of cumulative length versus installation year of current distribution main piping. The installation years were grouped together in five-year increments. Approximately 89 percent of the current water main has been installed after 1965 with no lengths of water main installed before 1940. Typical lifespans for water main rage from 80 to 100 years depending on several characteristics, including bury depth, backfill soil type, water quality, and maintenance flushing. The existing cast iron pipe within the system is the oldest and tends to have a slightly lower life expectancy than other materials. It is recommended to replace the older cast iron pipes as they reach the end of their useful life or experience a high number of breaks.

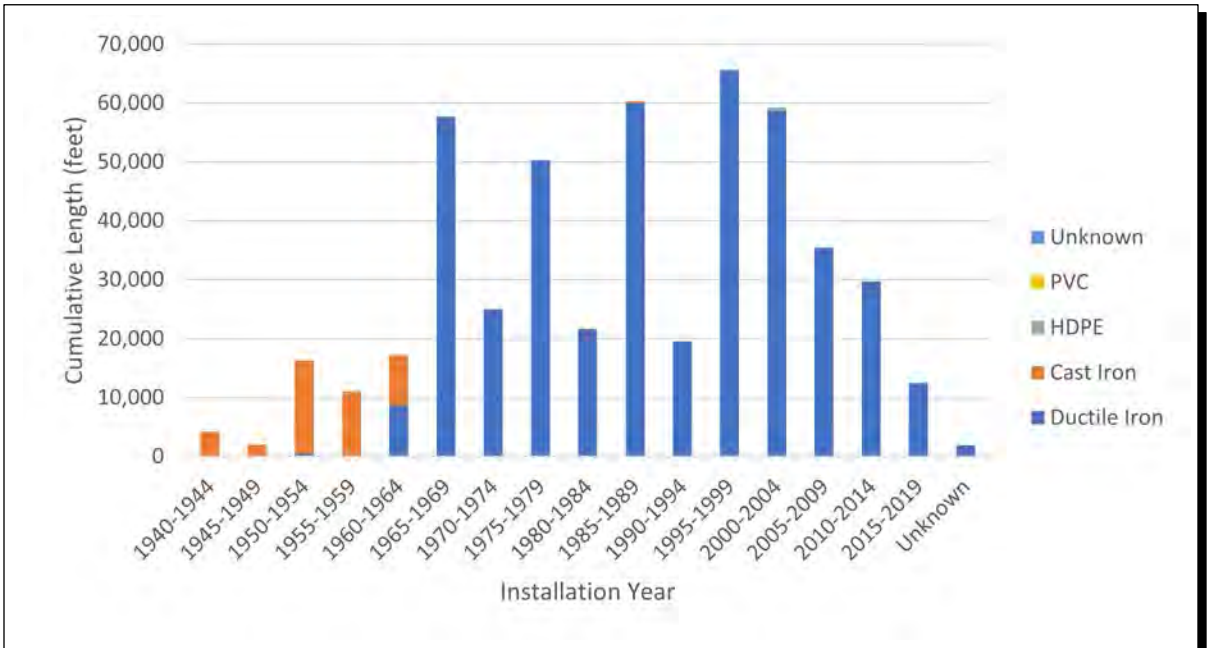


Figure 10.02-1 Cumulative Length of Pipe vs. Year Installed

B. Material

Figure 10.02-2 displays a plot of the cumulative length versus material. Approximately 91 percent of the existing water main is constructed of ductile iron, just less than 9 percent is cast iron and less than one percent is high-density polyethylene (HDPE), polyvinyl chloride (PVC) and unknown material.

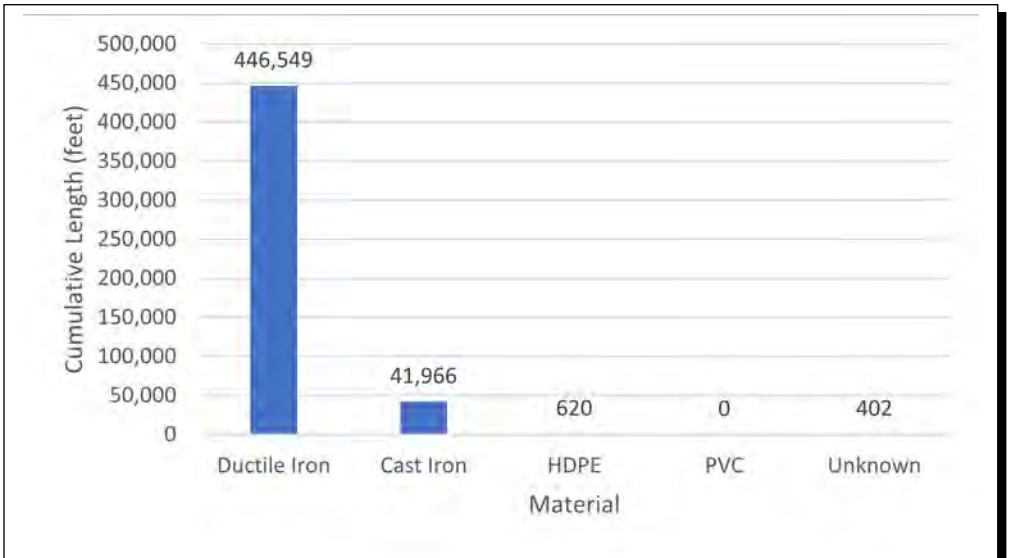


Figure 10.02-2 Cumulative Length of Pipe vs. Material

C. Size

Table 10.02-1 summarizes detailed information regarding length of pipe by diameter and material. Figure 10.02-3 displays a plot of the cumulative length versus pipe diameter in inches. Approximately 146 feet of water main is 4-inch diameter. The 6-, 8-, and 10-inch diameter pipes account for approximately 390,445 feet (79.7 percent) of the system and 12-inch diameter and larger pipes account for 99,522 feet (20.3 percent). 4-inch diameter pipes are considered undersized and should be prioritized for replacement

Diameter (inches)	Cast Iron (feet)	Ductile Iron (feet)	HDPE (feet)	PVC (feet)	Unknown (feet)	All Materials (feet)
4	0	146	0	0	0	146
6	35,246	62,123	145	0	64	97,590
8	4,692	202,488	475	0	74	207,729
10	1,912	82,623	0	0	15	84,550
12	116	89,725	0	0	0	89,841
14	0	3,974	0	0	0	3,974
16	0	5,458	0	0	249	5,707
All Diameters	**41,966**	**446,537**	**620**	**0**	**402**	**489,537**

Table 10.02-1 Length of Pipe by Material and Diameter

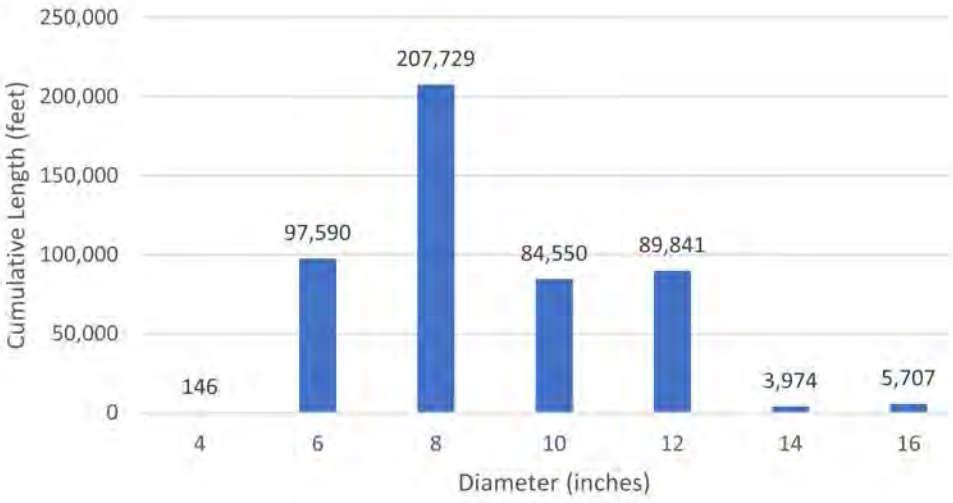


Figure 10.02-3 Cumulative Length of Pipe vs. Diameter

D. Main Breaks

Figure 10.02-4 displays a plot of the number of main breaks that have been documented by the City since 2006. On average, approximately nine breaks occurred during years that had documented water main breaks, or about 0.09 breaks per mile of system water main per year. According to a Water Research Foundation survey, the average pipe break rate for water utilities is between 0.21 to 0.27 breaks per mile of pipe per year, or about three times as many breaks per year as the City.

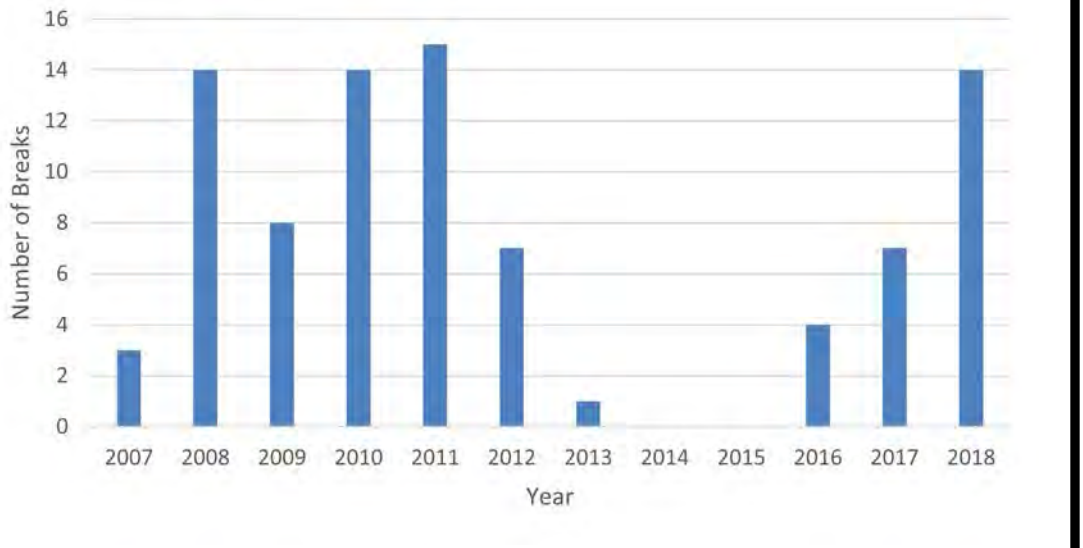


Figure 10.02-4 Water Main Break per Year

E. Summary of Water Main

The City's water distribution system appears to be in good condition based on the age distribution, type of main material, and number of breaks per year that occur. Figure 10.02-5 shows water main that is either 4 inches in diameter, made of cast iron, or has had one or more main breaks in the past 13 years. It appears that most of the water main breaks have occurred on pipes shown in the figure. Generally, cast iron pipes are the oldest pipes in the system and are the most prone to water main breaks. It is recommended that these pipes are prioritized to be replaced within the near future.

10.03 CITY FIVE-YEAR STREET IMPROVEMENT PLAN

The City adopted a five-year street improvement plan on March 19, 2019. The plan illustrates by color which streets are to be reconstructed for each of the next five years. Depending on the type and condition of the utilities beneath the roadway, the utilities will be replaced. See Appendix D for a copy of the improvement plan figure. Figure 10.03-1 displays the five-year street improvements overlapped with the improvements discussed in Section 10.02.

Using the five-year street improvement plan, it is estimated that approximately 57,000 feet (10.8 miles) of street that has water main below it is planning to be replaced. Some additional new water main is also planned to be constructed along Pleasant View Road. Assuming all water main below the street is replaced, approximately 11.6 percent of the total distribution system will be replaced in the next five years, or about 2.32 percent per year. If all water main identified in the improvement plan is replaced, approximately 25,751 feet of existing cast iron pipe, or approximately 61 percent of all existing cast iron pipe in the distribution system will be replaced.

10.04 DISTRIBUTION SYSTEM IMPROVEMENTS

In addition to pipe replacement and street reconstruction improvements, there are some identified pipeline projects that should be completed to extend the water system to anticipated development areas and to provide redundant looping. The projects are summarized below.

A. System Expansion

As future growth developments are constructed, the distribution system should be expanded to accommodate water demands. One specific area includes the COBB development.

Additional water main should be constructed along CTH Q north to provide a redundant connection into COBB. 16-inch water main should be extended from the intersection of Bishops Bay Way and CTH Q and route north past Balzer Road. When additional development is constructed, water main should be routed east from the intersection of CTH Q and Oncken Road depending how water main is routed throughout the development.

B. Looping

Looping improvements should be complete to provide redundant connections and provide improve available fire flow in some areas throughout the distribution system.

Legend

- Main Break
- 4 Inch Pipe
- Cast Iron Pipe
- Reservoir
- Wells
- Booster Station
- Elevated Tank
- Existing Water Main
- Municipal Limits

Street Project 5 Year Plan

- 2020
- 2021
- 2022
- 2023
- 2024

Well No. 4
Tower 1
Tower 2
Well No. 8
Well No. 2
Well No. 5
Well No. 6
Well No. 6 Reservoir
Greenway Booster No. 2
Greenway Booster No. 1
Greenway Booster No. 3
Well No. 7

N W E S

0 250 500 1,000 Feet

COMBINED WATER SYSTEM IMPROVEMENTS

UTILITY MASTER PLAN
CITY OF MIDDLETON
DANE COUNTY, WISCONSIN

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FIGURE 10.03-1
1024.057

NA

Legend

- Main Break
- 4 Inch Pipe
- Cast Iron Pipe
- Reservoir
- Wells
- Booster Station
- Elevated Tank
- Existing Water Main
- Municipal Limits

Well No. 4
Tower 1
Tower 2
Well No. 8
Well No. 2
Well No. 1
Well No. 5
Well No. 7
Well No. 6
Well No. 6 Reservoir
Greenway Booster No. 2
Greenway Booster No. 1
Greenway Booster No. 3
Quarry Hill Booster 1
Quarry Hill Booster 2

0 250 500 1,000 Feet

WATER DISTRIBUTION SYSTEM PRIORITIZED PIPES

UTILITY MASTER PLAN
CITY OF MIDDLETON
DANE COUNTY, WISCONSIN

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FIGURE 10.02-5
1024.057

1. Tower 2

A secondary water main should be routed from Tower 2 east to connect to Valley Ridge Road to improve flow to the east side of the system. Approximately 700 feet of 12-inch pipe should be constructed through easements to make the connection.

2. Pheasant Branch Connector

The western portion of the distribution system is poorly connected to the central distribution system as it only connected via two parallel water mains along Century Avenue. An additional connection should be made in the northern part of the City to increase available fire flows, provide a redundant connection, and improve the hydraulics in the area. The current recommended route is extending water main from the intersection of High Road and Charis Trail north to Balzer Road. The connection then routes from High Road to CTH Q and connects with a future water main extension along CTH Q that should be installed to expand the system to COBB. Approximately 11,000 feet of 16-inch water main should be constructed.

3. Greenview Drive Extension

Some industrial facilities located on Greenview Drive in the west side of the City currently have one 10-inch water main loop providing supply to them. A looping connection should be constructed from the dead-end water main south of the intersection of Greenview Drive and Pinehurst Drive and extend east toward Pleasant View Road. Approximately 1,500 feet of 12-inch pipe should be constructed.

SECTION 11
WATER CONCLUSIONS AND RECOMMENDATIONS

11.01 GENERAL

The following sections summarize the findings of the Water Utility-related content of this report and describe the recommended improvements for the City. The following opinions of probable cost are based on 2019 dollars.

11.02 WATER SUPPLY AND SYSTEM DEMANDS

A. Summary

There are currently six active groundwater wells supplying water to the distribution system (Well Nos. 2, 3, 4, 5, 6, and 8). Well No. 7 was previously drilled and capped, but a facility was never constructed. Well Nos. 2 and 3 pump directly to the Quarry Reservoir and Well No. 6 pumps to the Well No. 6 reservoir.

B. 2019 Demands

The estimated 2019 maximum day demand equals 4.402 mgd, or 3,057 gpm. The current firm well capacity with the largest well out of service (Well No. 6) equals 7.027 mgd, or 4,880 gpm. During a maximum day demand, the system is projected to have a reserve well capacity of 1,823 gpm. Therefore, no additional well capacity is required to meet 2019 maximum day demands.

C. 2040 Demands

The estimated 2040 maximum day demand equals 5.768 mgd or 4,006 gpm. Two different evaluations were conducted.

1. Current Well and Storage Capacities

Using the current well capacities, the projected firm well capacity equals 7.027 mgd or 4,880 gpm. During a maximum day demand, the system is projected to have a reserve well capacity of 874 gpm. Therefore, no additional well capacity is required to meet 2040 maximum day demands.

2. Well No. 2 Decommissioned

Assuming Well No. 2 has been decommissioned by 2040, the projected firm well capacity equals 6.552 mgd or 4,550 gpm. During a maximum day demand, the system is projected to have a reserve well capacity of 544 gpm. Therefore, no additional well capacity is required to meet 2040 maximum day demands.

D. 2070 Demands

The estimated 2070 maximum day demand equals 8.590 mgd or 5,965 gpm. Three different evaluations were conducted.

1. Current Well Capacities

Using the current well capacities, the projected firm well capacity equals 7.027 mgd or 4,880 gpm. During a maximum day demand, the system is projected to have a well supply deficit of 1,085 gpm. Additional well capacity is required to meet 2070 maximum day demands.

2. Well Nos. 2, 3, 4, and 5 Decommissioned

Assuming Well Nos. 2, 3, 4, and 5 have been decommissioned by 2070 and no additional capacity is added, the projected firm well capacity equals 1.397 mgd or 970 gpm. During a maximum day demand, the system is projected to have a well supply deficit of 4,995 gpm. Additional well capacity is required to meet 2070 maximum day demands.

3. Well and Elevated Storage Capacity Replacement

Assuming Well No. 7 becomes active and replacement wells are constructed to replace Well Nos. 3, 4, and 5, the projected firm well capacity equals 9.914 mgd or 6,885 gpm. During a maximum day demand, the system is projected to have a reserve well supply of 920 gpm. No additional well capacity is required to meet 2070 maximum day demands.

E. Water Quality

Well Nos. 2, 3, and 8 have generally high manganese levels and are close to the SMCL drinking water standards. One option to reduce manganese levels includes dosing polyphosphate chemical to all sources in the distribution system, but this process adds phosphorous to the wastewater stream which is generally not preferred. Alternatively, adding pressure filtration treatment removes the manganese from the source water. Because Well Nos. 2 and 3 are the oldest wells in the City and may be decommissioned in the near future, a treatment facility is not recommended to be installed for these locations.

F. Improvements

1. Additional Required Capacity

An additional well is projected to be required around 2047 to meet maximum day demands. It is assumed that Well No. 7 would be active to meet these demands. Well No. 7 was drilled and capped, but a facility has not yet been constructed. An opinion of probable cost to construct a well facility and associated site piping is approximately $1,500,000 in 2019 dollars. If it is determined that the well requires treatment, the opinion of probable cost to construct a facility with filtration equipment is approximately $2,500,000 in 2019 dollars including 35 percent for contingency and technical services.

Four wells (Well Nos. 2, 3, 4, and 5) are anticipated to be decommissioned by 2070. To meet maximum day demands as each of the wells are decommissioned, additional wells should be constructed as replacements. An opinion of probable cost to drill a well and construct a

well facility and associated site piping is approximately $2,000,000 in 2019 dollars. If it is determined that the well requires treatment, the opinion of probable cost to construct a facility filtration equipment is approximately $3,000,000 in 2019 dollars including 35 percent for contingency and technical services.

Tower 1 is anticipated to be decommissioned around 2060. To maintain the same level of service, a 500,000-gallon elevated tank is recommended to be constructed as a replacement. An opinion of probable cost to construct a 500,000-gallon elevated tank is approximately $2,500,000 in 2019 dollars.

2. Future Growth Development

An additional elevated tank and booster station were assumed to be needed to provide pressure in the northwest area of the City. A new high-pressure zone will be created. An opinion of probable cost to construct a small booster station is approximately $1,500,000 and elevated tank is $2,500,000 in 2019 dollars including 35 percent for contingency and technical services.

3. Water Quality

One filtration treatment facility can be added to the existing Well No. 8 facility and another filtration treatment facility can be added to treat both Wells No. 2 and 3 concurrently. However, it is not recommended to install a treatment facility for the oldest two wells in the City. The probable cost to add a pressure filtration facility to treat Well No. 8 is approximately $3,000,000 including 35 percent for contingency and technical services.

11.03 STORAGE CAPACITY

A. Summary

The total amount of elevated storage within the City equals 1,250,000 gallons and includes Tower 1 (500,000 gallons) and Tower 2 (750,000 gallons). The total amount of ground-level storage within the City equals 1,100,000 gallons and includes the Quarry Reservoir (1,000,000 gallons) and Well No. 6 Reservoir (100,000 gallons).

B. 2019

The estimated 2019 maximum day plus fire flow demand rate equals 9.442 mgd or 6,557 gpm. The elevated storage capacity rate equals 8.000 mgd or 5,556 gpm and Quarry Reservoir storage capacity rate equals 4.910 mgd or 3,410 gpm after removing the volume for operation requirements and supplying peak hourly demand. Because Well No. 6 is excluded during firm well supply, the storage in Well No. 6 is assumed to be unavailable. During a 180-minute fire event, the system is projected to have a reserve capacity of 7,289 gpm or approximately 1,312,000 gallons. Therefore, no additional storage is needed to meet 2019 maximum day plus fire demands.

C. 2040

The estimated 2040 maximum day plus fire flow demand rate equals 10.808 mgd or 7,506 gpm. Two different storage evaluations were conducted.

1. Current Storage Capacities

The elevated storage capacity equals 6.417 mgd or 4,456 gpm and Quarry Reservoir storage capacity rate equals 4.910 mgd or 3,410 gpm after removing the volume for operation requirements and supplying peak hourly demand. Because Well No. 6 is excluded during firm well supply, the storage in Well No. 6 is assumed to be unavailable. During a 180-minute fire event, the system is projected to have a reserve capacity of 5,240 gpm or approximately 943,000 gallons. Therefore, no additional storage is needed to meet 2040 maximum day plus fire demands.

2. Well No. 2 Decommissioned

Assuming Well No. 2 is decommissioned by 2040, the elevated storage capacity equals 5.128 mgd or 3,561 gpm and Quarry Reservoir storage capacity rate equals 4.910 mgd or 3,410 gpm. The system is projected to have a reserve storage capacity of 4,015 gpm, or approximately 723,000 gallons during a 180-minute fire event. Therefore, no additional storage is needed to meet 2040 maximum day plus fire demands.

D. 2070

The estimated 2070 maximum day plus fire flow demand equals 13.630 mgd or 9,465 gpm. Two different storage evaluations were conducted.

1. Current Storage Conditions

Using the current well and storage capacities, the elevated storage deficit equals 8.058 mgd or 5,596 gpm and Quarry Reservoir storage capacity equals 5.177 mgd or 3,410 gpm after removing the volume for operation requirements and supplying peak hourly demand. During a 180-minute fire event, the system is projected to have a storage capacity deficit of 6,771 gpm, or approximately 1,219,000 gallons. Additional well supply or storage is needed to meet 2070 maximum day fire demands.

2. Well and Storage Capacity Replacement

Assuming Well No. 7 becomes active and replacement wells are constructed to replace Well Nos. 3, 4, and 5, the elevated storage capacity rate equals 4.176 mgd or 2,900 gpm, Quarry Reservoir storage capacity rate equals 4.608 mgd or 3,200 gpm and Well No. 6 Reservoir storage capacity rate equals 0.266 mgd or 185 gpm. The system is projected to have a reserve storage capacity of 3,705 gpm or approximately 667,000 gallons during a 180-minmute fire event. Therefore, no additional storage is needed to meet 2070 maximum

day plus fire demands assuming the well and storage capacity replacement projects are constructed.

11.04 DISTRIBUTION SYSTEM

The current water distribution system appears to be in good condition based on age, type of main material, and number of water main breaks per year. It appears that the water main breaks that have occurred are located on older pipes and pipes that were made of cast iron. The City's five-year street improvement program appears to address a large portion of higher-priority water main including existing cast iron pipes in the distribution system. It is anticipated that the street improvement program will continue to be updated. It is recommended to incorporate replacing any water main that is 4 inches in diameter, made of cast iron, or had one or more main breaks in the past 13 years.

11.05 SUMMARY OF IMPROVEMENTS

Table 11.05-1 summaries the opinion of probable cost for maintenance improvement items for the well and storage facilities. Table 11.05-2 summarizes the opinion of probable cost for system improvements discussed in this section, which include 35 percent for contingency and technical services. All improvements summarized below, including water main improvements, are shown in Figure 11.05-1. Well siting studies will be required to determine actual new well locations.

Improvement	Cost (2019 Dollars)	Approximate Construction Date
Tower 1 Coating	$470,000	2038
Tower 2 Coating	$500,000	2033
Quarry Reservoir Roof Replacement	$275,000	2050
Well No. 6 Roof Repair	$70,000	2030
Tower 1 Inspection	$5,000	2023
Tower 2 Inspection	$5,000	2019
Quarry Reservoir Inspection	$6,000	2022
Well No. 6 Reservoir Inspection	$6,000	2021
Total	**$1,337,000**	

Table 11.05-1 Well and Storage Facility Maintenance Improvements

Improvement	Cost (2019 Dollars)	Approximate Construction Date
Well No. 7 Facility	$1,500,000	2047
Well No. 8 Treatment Facility	$3,000,000	As Needed
High Zone Elevated Tank	$2,500,000	2040 to 2070
Booster Station	$1,500,000	2040 to 2070
Well No. 9 (Well No. 3 Replacement)	$2,000,000	2054
Well No. 10 (Well No. 4 Replacement)	$2,000,000	2060
Tower 3 (Tower 1 Replacement)	$2,500,000	2060
Well No. 11 (Well No. 5 Replacement)	$2,000,000	2064
Total	**$17,000,000**	

Table 11.05-2 Water System Improvements

Legend

- Metering Station
- 2070 Service Area
- City Limits
- Reservoir
- Wells
- Booster Station
- Elevated Tank
- Existing Water Main

Proposed Water Main

- 2040 Improvements
- 2070 Improvements

Proposed NW High Zone Elevated Tank
NW High Zone
Proposed NW High Zone Booster Station
Proposed Tower 3 (Tower No. 1 Replacement)
Proposed Well No. 10 (Well No. 4 Replacement)
Proposed Well No. 8 Treatment Facility
Proposed Well No. 9 (Well No. 3 Replacement)
Proposed Well No. 11 (Well No. 5 Replacement)
Greenway High Zone
Hillcrest High Zone
Proposed Well No. 7 Facility

Oncken Rd
Saint Annes Dr
Pt Augusta Dr
Bishops Bay Pkwy
Upland Trl
Heron Trl
Rock Crest Pass
Sandhill Dr
CTH Q
Graber Rd
Whittlesey Rd
Companion Ln
S Chickahauk Trl
Rolling Hill Dr
Valley Ridge Rd
Signature Dr
CTH M
Tribeca Dr
Century Ave
Century Pl
Friendship Ln
High Rd
Glacier Ridge Rd
Pheasant Branch Rd
Highland Way
Airport Rd
Morey Way
Forsythia St
Nursery Dr
Lisa Ln
Laura Ln
Parmenter St
Patty Ln
Northbrook Dr
Ravine Dr
Prairie Dr
Donna Dr
Park St
Lake St
Pleasant View Rd
Deming Way
USH 12
White Coral Way
Fairway Pl
Panview Rd
Eagle Dr
Murphy Dr
Pinehurst Dr
Discovery Dr
Clark St
Park Lawn Pl
Maywood Ave
North Ave
Franklin Ave
University Ave
Elmwood Ave
Hubbard Ave
Terrace Ave
South Ave
Middleton St
Bristol St
Mayflower Dr
Beech St
Allen Blvd
Amherst Rd
Boulder Ln
Monroe Street
Beard Rd
Mendota Ave
University Ave
Maple St
Cooper Ave
Woodgate Rd
Kenyon Dr
Loss Pkwy
Fortune Dr
Gammon Rd
Gallahan Rd
Blair Ln
Stonefield Rd
Boundary Rd
Market St
Research Way
Deming Way
John Q Hammons Dr
Greenway Blvd
USH 14
Mistic Valley Dr

12" 16" 10"

N W E S

0 0.125 0.25 0.5 Miles

NA

SUMMARY OF SYSTEM IMPROVEMENTS

UTILITY MASTER PLAN
CITY OF MIDDLETON
DANE COUNTY, WISCONSIN

STRAND ASSOCIATES®

FIGURE 11.05-1
1024.057

APPENDIX A
INTERCEPTING SEWER CAPACITY SUMMARY

Basin	Upstream Manhole Invert	Downstream Manhole Invert	Elevation change in pipe (ft)	Manning's n	Pipe Length	Slope	Diameter in	Diameter ft	Area	Hydraulic Radius (full-flow)	Design Full Flow
SE 1	1002.3	945.21	57.09	0.013	1861	0.031	10	0.83	0.55	0.21	3.85
SE 2	945.21	926.16	19.05	0.013	2360	0.008	10	0.83	0.55	0.21	1.97
SE 3	926.16	923.08	3.08	0.013	1428	0.002	15	1.25	1.23	0.31	3.01
SE 4	923.08	907.73	15.35	0.013	2122	0.007	15	1.25	1.23	0.31	5.51
SE 5											4.08
NE 1	920.15	912.91	7.24	0.013	1162	0.006	12	1.00	0.79	0.25	2.82
NE 2	915.91	904.98	10.93	0.013	4001	0.003	15	1.25	1.23	0.31	3.39
NE 3											2.52
AP 1	908.51	903.4	5.11	0.013	2465	0.002	15	1.25	1.23	0.31	2.95
AP 2	903.4	901.08	2.32	0.013	1733	0.001	18	1.50	1.77	0.38	3.85
AP 3											3.75
PB 1	942.35	920.91	21.44	0.013	1272	0.017	18	1.50	1.77	0.38	13.67
PB 2	920.85	888.55	32.3	0.013	4050	0.008	18	1.50	1.77	0.38	9.41
PB 3	888.49	869.01	19.48	0.013	2015	0.010	18	1.50	1.77	0.38	10.36
PB 4	868.05	867.44	0.61	0.013	785	0.001	30	2.50	4.91	0.63	11.46
PB 5	867.4	862.93	4.47	0.013	5178	0.001	30	2.50	4.91	0.63	12.08
PB 6	862.92	860.42	2.5	0.013	2788	0.001	30	2.50	4.91	0.63	12.32
VI 1											9.22
VI 2											12.88
VI 3											13.20
VI 4											15.39
DT 1	114.14	80	34.14	0.013	2269	0.015	12	1.00	0.79	0.25	4.38
DT 2	907.8	906.91	0.89	0.013	385	0.002	12	1.00	0.79	0.25	1.72
DT 3	906.84	890	16.84	0.013	1070	0.016	12	1.00	0.79	0.25	4.48
DT 4											7.68
OH 1	901.84	862.86	38.98	0.013	2513	0.016	12	1.00	0.79	0.25	4.45
OH 2	862.76	857.45	5.31	0.013	938	0.006	15	1.25	1.23	0.31	4.87
OH 3											2.90

APPENDIX B
TRIBUTARY AREA FLOW DEVELOPMENT

Use Type	Size (units or acres)	GPCD or GPAD Factor	Average Flow (gpm)	Peaking Factor	Peak Flow (gpm)		Future Additions (units or acres)	Future GPCD or GPAD Factor	Future Average Flow (gpm)	Peaking Factor	Future Peak Flow (gpm)
Single Res.	385.00	95.00	25.40	4.00	101.60		0.00	95.00	0.00	4.00	0.00
MF Res.	193.00	65.00	8.71	4.00	34.85		0.00	65.00	0.00	4.00	0.00
Comm.	76.87	2000.00	106.77	2.50	266.93		0.00	2000.00	0.00	2.50	0.00
Mfg.	3.83	2000.00	5.33	2.50	13.31		0.00	2000.00	0.00	2.50	0.00
Ind.	6.00	2000.00	8.33	2.50	20.82		0.00	2000.00	0.00	3.50	0.00
		Total	154.54		437.51			**Total**	154.54		437.51
Use Type	**Size (units or acres)**	**GPCD or GPAD Factor**	**Average Flow (gpm)**	**Peaking Factor**	**Peak Flow (gpm)**		**Future Additions (units or acres)**	**Future GPCD or GPAD Factor**	**Future Average Flow (gpm)**	**Peaking Factor**	**Future Peak Flow (gpm)**
Single Res.	249.00	95.00	16.43	4.00	65.71		0.00	95.00	0.00	4.00	0.00
MF Res.	368.00	65.00	16.61	4.00	66.44		0.00	65.00	0.00	4.00	0.00
Comm.	22.57	2000.00	31.34	2.50	78.35		0.00	2000.00	0.00	2.50	0.00
Mfg.	7.75	2000.00	10.76	2.50	26.90		0.00	2000.00	0.00	2.50	0.00
Ind.	1.06	2000.00	1.48	2.50	3.70		0.00	2000.00	0.00	3.50	0.00
		Total	76.62		241.10			**Total**	76.62		241.10
Use Type	**Size (units or acres)**	**GPCD or GPAD Factor**	**Average Flow (gpm)**	**Peaking Factor**	**Peak Flow (gpm)**		**Future Additions (units or acres)**	**Future GPCD or GPAD Factor**	**Future Average Flow (gpm)**	**Peaking Factor**	**Future Peak Flow (gpm)**
Single Res.	186.00	95.00	12.27	4.00	49.08		0.00	95.00	0.00	4.00	0.00
MF Res.	25.00	65.00	1.13	4.00	4.51		0.00	65.00	0.00	4.00	0.00
Comm.	0.06	2000.00	0.08	2.50	0.21		0.00	2000.00	0.00	2.50	0.00
Mfg.	0.00	2000.00	0.00	2.50	0.00		0.00	2000.00	0.00	2.50	0.00
		Total	13.48		53.81			**Total**	13.48		53.81
Use Type	**Size (units or acres)**	**GPCD or GPAD Factor**	**Average Flow (gpm)**	**Peaking Factor**	**Peak Flow (gpm)**		**Future Additions (units or acres)**	**Future GPCD or GPAD Factor**	**Future Average Flow (gpm)**	**Peaking Factor**	**Future Peak Flow (gpm)**
Single Res.	334.00	95.00	22.03	4.00	88.14		0.00	95.00	0.00	4.00	0.00
MF Res.	449.00	65.00	20.27	4.00	81.07		0.00	65.00	0.00	4.00	0.00
Comm.	9.26	2000.00	12.86	2.50	32.16		0.00	2000.00	0.00	2.50	0.00
Mfg.	0.00	2000.00	0.00	2.50	0.00		0.00	2000.00	0.00	2.50	0.00
		Total	55.17		201.37			**Total**	55.17		201.37

Projected Land Use	Quantity	Unit	Average Day Flow (cfs)	Peaking Factor	Peak Day Flow (cfs)
Existing					
Single Family Residential	1154.00	du	0.17	4.00	0.68
Multi-Family Residential	1035.00	du	0.10	4.00	0.42
Commercial	108.76	Acres	0.34	2.50	0.84
Manufacturing and Industrial	18.64	Acres	0.06	2.50	0.14
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00
Sub-Total			0.67		2.08
Future					
Single Family Residential	0.00	du	0.00	4.00	0.00
Multi-Family Residential	0.00	du	0.00	4.00	0.00
Commercial	0.00	Acres	0.00	2.50	0.00
Manufacturing and Industrial	0.00	Acres	0.00	2.50	0.00
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00
Sub-Total			0.00		0.00
Total			0.67		2.08

Use Type	Size (units or acres)	GPCD or GPAD Factor	Average Flow (gpm)	Peaking Factor	Peak Flow (gpm)		Future Additions (units or acres)	Future GPCD or GPAD Factor	Future Average Flow (gpm)	Peaking Factor	Future Peak Flow (gpm)
Single Res.	141.00	95.00	9.30	4.00	37.21		0.00	95.00	0.00	4.00	0.00
MF Res.	132.00	65.00	5.96	4.00	23.83		0.00	65.00	0.00	4.00	0.00
Comm.	0.57	2000.00	0.79	2.50	1.98		0.00	2000.00	0.00	2.50	0.00
Mfg.	0.00	2000.00	0.00	2.50	0.00		0.00	2000.00	0.00	2.50	0.00
		Total	16.05		63.03			**Total**	16.05		63.03
Use Type	**Size (units or acres)**	**GPCD or GPAD Factor**	**Average Flow (gpm)**	**Peaking Factor**	**Peak Flow (gpm)**		**Future Additions (units or acres)**	**Future GPCD or GPAD Factor**	**Future Average Flow (gpm)**	**Peaking Factor**	**Future Peak Flow (gpm)**
Single Res.	288.00	95.00	19.00	4.00	76.00		0.00	95.00	0.00	4.00	0.00
MF Res.	125.00	65.00	5.64	4.00	22.57		0.00	65.00	0.00	4.00	0.00
Comm.	16.68	2000.00	23.16	2.50	57.91		0.00	2000.00	0.00	2.50	0.00
Mfg.	0.23	2000.00	0.32	2.50	0.79		0.00	2000.00	0.00	2.50	0.00
		Total	48.12		157.27			**Total**	48.12		157.27
Use Type	**Size (units or acres)**	**GPCD or GPAD Factor**	**Average Flow (gpm)**	**Peaking Factor**	**Peak Flow (gpm)**		**Future Additions (units or acres)**	**Future GPCD or GPAD Factor**	**Future Average Flow (gpm)**	**Peaking Factor**	**Future Peak Flow (gpm)**
Single Res.	58.00	95.00	3.83	4.00	15.31		0.00	95.00	0.00	4.00	0.00
MF Res.	0.00	65.00	0.00	4.00	0.00		0.00	65.00	0.00	4.00	0.00
Comm.	1.69	2000.00	2.34	2.50	5.86		0.00	2000.00	0.00	2.50	0.00
Mfg.	0.00	2000.00	0.00	2.50	0.00		0.00	2000.00	0.00	2.50	0.00
		Total	6.17		21.16			**Total**	6.17		21.16
Use Type	**Size (units or acres)**	**GPCD or GPAD Factor**	**Average Flow (gpm)**	**Peaking Factor**	**Peak Flow (gpm)**		**Future Additions (units or acres)**	**Future GPCD or GPAD Factor**	**Future Average Flow (gpm)**	**Peaking Factor**	**Future Peak Flow (gpm)**
Single Res.	13.00	95.00	0.86	4.00	3.43		0.00	95.00	0.00	4.00	0.00
MF Res.	0.00	65.00	0.00	4.00	0.00		0.00	65.00	0.00	4.00	0.00
Comm.	0.00	2000.00	0.00	2.50	0.00		0.00	2000.00	0.00	2.50	0.00
Mfg.	0.00	2000.00	0.00	2.50	0.00		0.00	2000.00	0.00	2.50	0.00
		Total	0.86		3.43			**Total**	0.86		3.43
Projected Land Use	**Quantity**	**Unit**	**Average Day Flow (cfs)**	**Peaking Factor**	**Peak Day Flow (cfs)**						
Existing											
Single Family Residential	500.00	du	0.07	4.00	0.29						
Multi-Family Residential	257.00	du	0.03	4.00	0.10						
Commercial	18.94	Acres	0.06	2.50	0.15						
Manufacturing and Industrial	0.23	Acres	0.00	2.50	0.00						
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00						
Sub-Total			0.16		0.55						
Future											
Single Family Residential	0.00	du	0.00	4.00	0.00						
Multi-Family Residential	0.00	du	0.00	4.00	0.00						
Commercial	0.00	Acres	0.00	2.50	0.00						
Manufacturing and Industrial	0.00	Acres	0.00	2.50	0.00						
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00						
Sub-Total			0.00		0.00						
Total			0.16		0.55						

Use Type	Size (units or acres)	GPCD or GPAD Factor	Average Flow (gpm)	Peaking Factor	Peak Flow (gpm)		Future Additions (units or acres)	Future GPCD or GPAD Factor	Future Average Flow (gpm)	Peaking Factor	Future Peak Flow (gpm)
Single Res.	120.00	95.00	7.92	4.00	31.67		0.00	95.00	0.00	4.00	0.00
MF Res.	0.00	65.00	0.00	4.00	0.00		0.00	65.00	0.00	4.00	0.00
Comm.	21.87	2000.00	30.37	2.50	75.93		0.00	2000.00	0.00	2.50	0.00
Mfg.	27.27	2000.00	37.88	2.50	94.69		0.00	2000.00	0.00	2.50	0.00
Ind.	20.94	2000.00	29.08	2.50	72.69		0.00	2000.00	0.00	3.50	0.00
WRT	7.30	1200.00	6.09	2.50	15.21		0.00	1200.00	0.00	4.50	0.00
		Total	111.33		290.19			**Total**	111.33		290.19
Use Type	**Size (units or acres)**	**GPCD or GPAD Factor**	**Average Flow (gpm)**	**Peaking Factor**	**Peak Flow (gpm)**		**Future Additions (units or acres)**	**Future GPCD or GPAD Factor**	**Future Average Flow (gpm)**	**Peaking Factor**	**Future Peak Flow (gpm)**
Single Res.	0.00	95.00	0.00	4.00	0.00		0.00	95.00	0.00	4.00	0.00
MF Res.	0.00	65.00	0.00	4.00	0.00		0.00	65.00	0.00	4.00	0.00
Comm.	32.59	2000.00	45.27	2.50	113.18		0.00	2000.00	0.00	2.50	0.00
Mfg.	16.54	2000.00	22.98	2.50	57.44		0.00	2000.00	0.00	2.50	0.00
Ind.	4.41	2000.00	6.13	2.50	15.33		0.00	2000.00	0.00	3.50	0.00
WRT	9.51	1200.00	7.92	2.50	19.81		0.00	1200.00	0.00	4.50	0.00
		Total	82.30		205.76			**Total**	82.30		205.76
Use Type	**Size (units or acres)**	**GPCD or GPAD Factor**	**Average Flow (gpm)**	**Peaking Factor**	**Peak Flow (gpm)**		**Future Additions (units or acres)**	**Future GPCD or GPAD Factor**	**Future Average Flow (gpm)**	**Peaking Factor**	**Future Peak Flow (gpm)**
Single Res.	0.00	95.00	0.00	4.00	0.00		0.00	95.00	0.00	4.00	0.00
MF Res.	0.00	65.00	0.00	4.00	0.00		0.00	65.00	0.00	4.00	0.00
Comm.	73.73	2000.00	102.41	2.50	256.02		0.00	2000.00	0.00	2.50	0.00
Mfg.	53.79	2000.00	74.71	2.50	186.79		0.00	2000.00	0.00	2.50	0.00
Ind.	14.95	2000.00	20.77	2.50	51.91		0.00	2000.00	0.00	3.50	0.00
		Total	197.89		494.72			**Total**	197.89		494.72
Projected Land Use	**Quantity**	**Unit**	**Average Day Flow (cfs)**	**Peaking Factor**	**Peak Day Flow (cfs)**						
Existing											
Single Family Residential	120.00	du	0.02	4.00	0.07						
Multi-Family Residential	0.00	du	0.00	4.00	0.00						
Commercial	128.20	Acres	0.40	2.50	0.99						
Manufacturing and Industrial	137.91	Acres	0.43	2.50	1.07						
Wholesale and Retail Trade	16.81	Acres	0.03	2.50	0.08						
Sub-Total			0.87		2.21						
Future											
Single Family Residential	0.00	du	0.00	4.00	0.00						
Multi-Family Residential	0.00	du	0.00	4.00	0.00						
Commercial	0.00	Acres	0.00	2.50	0.00						
Manufacturing and Industrial	0.00	Acres	0.00	2.50	0.00						
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00						
Sub-Total			0.00		0.00						
Total			0.87		2.21						

Use Type	Size (units or acres)	GPCD or GPAD Factor	Average Flow (gpm)	Peaking Factor	Peak Flow (gpm)		Future Additions (units or acres)	Future GPCD or GPAD Factor	Future Average Flow (gpm)	Peaking Factor	Future Peak Flow (gpm)
Single Res.	1.00	95.00	0.07	4.00	0.26		0.00	95.00	0.00	4.00	0.00
MF Res.	0.00	65.00	0.00	4.00	0.00		0.00	65.00	0.00	4.00	0.00
Comm.	0.00	2000.00	0.00	2.50	0.00		0.00	2000.00	0.00	2.50	0.00
Mfg.	0.00	2000.00	0.00	2.50	0.00		0.00	2000.00	0.00	2.50	0.00
		Total	0.07		0.26			**Total**	0.07		0.26
Use Type	**Size (units or acres)**	**GPCD or GPAD Factor**	**Average Flow (gpm)**	**Peaking Factor**	**Peak Flow (gpm)**		**Future Additions (units or acres)**	**Future GPCD or GPAD Factor**	**Future Average Flow (gpm)**	**Peaking Factor**	**Future Peak Flow (gpm)**
Single Res.	0.00	95.00	0.00	4.00	0.00		0.00	95.00	0.00	4.00	0.00
MF Res.	854.00	65.00	38.55	4.00	154.19		0.00	65.00	0.00	4.00	0.00
Comm.	0.05	2000.00	0.07	2.50	0.17		0.00	2000.00	0.00	2.50	0.00
Mfg.	0.00	2000.00	0.00	2.50	0.00		0.00	2000.00	0.00	2.50	0.00
		Total	38.62		154.37			**Total**	38.62		154.37
Use Type	**Size (units or acres)**	**GPCD or GPAD Factor**	**Average Flow (gpm)**	**Peaking Factor**	**Peak Flow (gpm)**		**Future Additions (units or acres)**	**Future GPCD or GPAD Factor**	**Future Average Flow (gpm)**	**Peaking Factor**	**Future Peak Flow (gpm)**
Single Res.	2.00	95.00	0.13	4.00	0.53		0.00	95.00	0.00	4.00	0.00
MF Res.	0.00	65.00	0.00	4.00	0.00		280.00	65.00	12.64	4.00	50.56
Comm.	40.96	2000.00	56.88	2.50	142.21		66.00	2000.00	91.67	2.50	229.17
Mfg.	0.00	2000.00	0.00	2.50	0.00		0.00	2000.00	0.00	2.50	0.00
Ind.	1.40	2000.00	1.94	2.50	4.86		0.00	2000.00	0.00	3.50	0.00
		Total	58.96		147.60			**Total**	163.27		427.32
Use Type	**Size (units or acres)**	**GPCD or GPAD Factor**	**Average Flow (gpm)**	**Peaking Factor**	**Peak Flow (gpm)**		**Future Additions (units or acres)**	**Future GPCD or GPAD Factor**	**Future Average Flow (gpm)**	**Peaking Factor**	**Future Peak Flow (gpm)**
Single Res.	0.00	95.00	0.00	4.00	0.00		0.00	95.00	0.00	4.00	0.00
MF Res.	0.00	65.00	0.00	4.00	0.00		0.00	65.00	0.00	4.00	0.00
Comm.	53.07	2000.00	73.71	2.50	184.28		0.00	2000.00	0.00	2.50	0.00
Mfg.	0.00	2000.00	0.00	2.50	0.00		0.00	2000.00	0.00	2.50	0.00
		Total	73.71		184.28			**Total**	73.71		184.28
Use Type	**Size (units or acres)**	**GPCD or GPAD Factor**	**Average Flow (gpm)**	**Peaking Factor**	**Peak Flow (gpm)**		**Future Additions (units or acres)**	**Future GPCD or GPAD Factor**	**Future Average Flow (gpm)**	**Peaking Factor**	**Future Peak Flow (gpm)**
Single Res.	0.00	95.00	0.00	4.00	0.00		0.00	95.00	0.00	4.00	0.00
MF Res.	0.00	65.00	0.00	4.00	0.00		0.00	65.00	0.00	4.00	0.00
Comm.	24.59	2000.00	34.15	2.50	85.38		0.00	2000.00	0.00	2.50	0.00
Mfg.	1.01	2000.00	1.41	2.50	3.52		0.00	2000.00	0.00	2.50	0.00
Ind.	3.17	2000.00	4.40	2.50	11.01		0.00	2000.00	0.00	3.50	0.00
WRT	5.06	1200.00	4.21	2.50	10.53		0.00	1200.00	0.00	4.50	0.00
		Total	44.18		110.45			**Total**	44.18		110.45
Projected Land Use	**Quantity**	**Unit**	**Average Day Flow (cfs)**	**Peaking Factor**	**Peak Day Flow (cfs)**						
Existing											
Single Family Residential	3.00	du	0.00	4.00	0.00						
Multi-Family Residential	854.00	du	0.09	4.00	0.34						
Commercial	118.67	Acres	0.37	2.50	0.92						
Manufacturing and Industrial	5.58	Acres	0.02	2.50	0.04						
Wholesale and Retail Trade	5.06	Acres	0.01	2.50	0.02						
Sub-Total			0.48		1.33						
Future											
Single Family Residential	0.00	du	0.00	4.00	0.00						
Multi-Family Residential	280.00	du	0.03	4.00	0.11						
Commercial	66.00	Acres	0.20	2.50	0.51						
Manufacturing and Industrial	0.00	Acres	0.00	2.50	0.00						
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00						
Sub-Total			0.23		0.62						
Total			0.71		1.95						

Use Type	Size (units or acres)	GPCD or GPAD Factor	Average Flow (gpm)	Peaking Factor	Peak Flow (gpm)		Future Additions (units or acres)	Future GPCD or GPAD Factor	Future Average Flow (gpm)	Peaking Factor	Future Peak Flow (gpm)
Single Res.	76.00	95.00	5.01	4.00	20.06		0.00	95.00	0.00	4.00	0.00
MF Res.	48.00	65.00	2.17	4.00	8.67		0.00	65.00	0.00	4.00	0.00
Comm.	68.06	2000.00	94.53	2.50	236.32		0.00	2000.00	0.00	2.50	0.00
Mfg.	48.19	2000.00	66.93	2.50	167.32		0.00	2000.00	0.00	2.50	0.00
Ind.	0.92	2000.00	1.28	2.50	3.19		0.00	2000.00	0.00	3.50	0.00
WRT	5.27	1200.00	4.39	2.50	10.97		0.00	1200.00	0.00	4.50	0.00
		Total	174.30		446.52			**Total**	174.30		446.52
Use Type	**Size (units or acres)**	**GPCD or GPAD Factor**	**Average Flow (gpm)**	**Peaking Factor**	**Peak Flow (gpm)**		**Future Additions (units or acres)**	**Future GPCD or GPAD Factor**	**Future Average Flow (gpm)**	**Peaking Factor**	**Future Peak Flow (gpm)**
Single Res.	70.00	95.00	4.62	4.00	18.47		700.00	95.00	46.18	4.00	184.72
MF Res.	72.00	65.00	3.25	4.00	13.00		200.00	65.00	9.03	4.00	36.11
Comm.	1.32	2000.00	1.83	2.50	4.58		13.57	2000.00	18.85	2.50	47.12
Mfg.	0.00	2000.00	0.00	2.50	0.00		0.00	2000.00	0.00	2.50	0.00
Ind.	1.33	2000.00	1.85	2.50	4.63		0.00	2000.00	0.00	3.50	0.00
		Total	11.55		40.67			**Total**	85.60		308.63
Use Type	**Size (units or acres)**	**GPCD or GPAD Factor**	**Average Flow (gpm)**	**Peaking Factor**	**Peak Flow (gpm)**		**Future Additions (units or acres)**	**Future GPCD or GPAD Factor**	**Future Average Flow (gpm)**	**Peaking Factor**	**Future Peak Flow (gpm)**
Single Res.	14.00	95.00	0.92	4.00	3.69		1756.00	95.00	115.85	4.00	463.39
MF Res.	0.00	65.00	0.00	4.00	0.00		0.00	65.00	0.00	4.00	0.00
Comm.	0.00	2000.00	0.00	2.50	0.00		0.00	2000.00	0.00	2.50	0.00
Mfg.	0.00	2000.00	0.00	2.50	0.00		0.00	2000.00	0.00	2.50	0.00
		Total	0.92		3.69			**Total**	116.77		467.08
Use Type	**Size (units or acres)**	**GPCD or GPAD Factor**	**Average Flow (gpm)**	**Peaking Factor**	**Peak Flow (gpm)**		**Future Additions (units or acres)**	**Future GPCD or GPAD Factor**	**Future Average Flow (gpm)**	**Peaking Factor**	**Future Peak Flow (gpm)**
Single Res.	104.00	95.00	6.86	4.00	27.44		952.00	95.00	62.81	4.00	251.22
MF Res.	0.00	65.00	0.00	4.00	0.00		0.00	65.00	0.00	4.00	0.00
Comm.	0.00	2000.00	0.00	2.50	0.00		0.00	2000.00	0.00	2.50	0.00
Mfg.	0.00	2000.00	0.00	2.50	0.00		0.00	2000.00	0.00	2.50	0.00
		Total	6.86		27.44			**Total**	69.67		278.67
Use Type	**Size (units or acres)**	**GPCD or GPAD Factor**	**Average Flow (gpm)**	**Peaking Factor**	**Peak Flow (gpm)**		**Future Additions (units or acres)**	**Future GPCD or GPAD Factor**	**Future Average Flow (gpm)**	**Peaking Factor**	**Future Peak Flow (gpm)**
Single Res.	109.00	95.00	7.19	4.00	28.76		0.00	95.00	0.00	4.00	0.00
MF Res.	45.00	65.00	2.03	4.00	8.13		0.00	65.00	0.00	4.00	0.00
Comm.	0.00	2000.00	0.00	2.50	0.00		0.00	2000.00	0.00	2.50	0.00
Mfg.	0.00	2000.00	0.00	2.50	0.00		0.00	2000.00	0.00	2.50	0.00
		Total	9.22		36.89			**Total**	9.22		36.89
Use Type	**Size (units or acres)**	**GPCD or GPAD Factor**	**Average Flow (gpm)**	**Peaking Factor**	**Peak Flow (gpm)**		**Future Additions (units or acres)**	**Future GPCD or GPAD Factor**	**Future Average Flow (gpm)**	**Peaking Factor**	**Future Peak Flow (gpm)**
Single Res.	81.00	95.00	5.34	4.00	21.38		0.00	95.00	0.00	4.00	0.00
MF Res.	106.00	65.00	4.78	4.00	19.14		0.00	65.00	0.00	4.00	0.00
Comm.	3.96	2000.00	5.50	2.50	13.74		0.00	2000.00	0.00	2.50	0.00
Mfg.	0.00	2000.00	0.00	2.50	0.00		0.00	2000.00	0.00	2.50	0.00
		Total	15.62		54.25			**Total**	15.62		54.25
Projected Land Use	**Quantity**	**Unit**	**Average Day Flow (cfs)**	**Peaking Factor**	**Peak Day Flow (cfs)**						
Existing											
Single Family Residential	454.00	du	0.07	4.00	0.27						
Multi-Family Residential	271.00	du	0.03	4.00	0.11						
Commercial	73.34	Acres	0.23	2.50	0.57						
Manufacturing and Industrial	50.44	Acres	0.16	2.50	0.39						
Wholesale and Retail Trade	5.27	Acres	0.01	2.50	0.02						
Sub-Total			0.49		1.36						
Future											
Single Family Residential	3408.00	du	0.50	4.00	2.00						
Multi-Family Residential	200.00	du	0.02	4.00	0.08						
Commercial	13.57	Acres	0.04	2.50	0.10						
Manufacturing and Industrial	0.00	Acres	0.00	2.50	0.00						
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00						
Sub-Total			0.56		2.19						
Total			1.05		3.55						

Use Type	Size (units or acres)	GPCD or GPAD Factor	Average Flow (gpm)	Peaking Factor	Peak Flow (gpm)		Future Additions (units or acres)	Future GPCD or GPAD Factor	Future Average Flow (gpm)	Peaking Factor	Future Peak Flow (gpm)
Single Res.	0.00	95.00	0.00	4.00	0.00		0.00	95.00	0.00	4.00	0.00
MF Res.	16.00	65.00	0.72	4.00	2.89		0.00	65.00	0.00	4.00	0.00
Comm.	11.68	2000.00	16.22	2.50	40.56		0.00	2000.00	0.00	2.50	0.00
Mfg.	40.55	2000.00	56.32	2.50	140.80		0.00	2000.00	0.00	2.50	0.00
		Total	73.27		184.25			**Total**	73.27		184.25
Use Type	**Size (units or acres)**	**GPCD or GPAD Factor**	**Average Flow (gpm)**	**Peaking Factor**	**Peak Flow (gpm)**		**Future Additions (units or acres)**	**Future GPCD or GPAD Factor**	**Future Average Flow (gpm)**	**Peaking Factor**	**Future Peak Flow (gpm)**
Single Res.	0.00	95.00	0.00	4.00	0.00		0.00	95.00	0.00	4.00	0.00
MF Res.	0.00	65.00	0.00	4.00	0.00		0.00	65.00	0.00	4.00	0.00
Comm.	16.19	2000.00	22.48	2.50	56.21		0.00	2000.00	0.00	2.50	0.00
Mfg.	0.27	2000.00	0.37	2.50	0.92		0.00	2000.00	0.00	2.50	0.00
		Total	22.85		57.13			**Total**	22.85		57.13
Use Type	**Size (units or acres)**	**GPCD or GPAD Factor**	**Average Flow (gpm)**	**Peaking Factor**	**Peak Flow (gpm)**		**Future Additions (units or acres)**	**Future GPCD or GPAD Factor**	**Future Average Flow (gpm)**	**Peaking Factor**	**Future Peak Flow (gpm)**
Single Res.	0.00	95.00	0.00	4.00	0.00		0.00	95.00	0.00	4.00	0.00
MF Res.	0.00	65.00	0.00	4.00	0.00		0.00	65.00	0.00	4.00	0.00
Comm.	20.14	2000.00	27.97	2.50	69.92		0.00	2000.00	0.00	2.50	0.00
Mfg.	0.00	2000.00	0.00	2.50	0.00		0.00	2000.00	0.00	2.50	0.00
		Total	27.97		69.92			**Total**	27.97		69.92

Projected Land Use	Quantity	Unit	Average Day Flow (cfs)	Peaking Factor	Peak Day Flow (cfs)
Existing					
Single Family Residential	0.00	du	0.00	4.00	0.00
Multi-Family Residential	16.00	du	0.00	4.00	0.01
Commercial	48.01	Acres	0.15	2.50	0.37
Manufacturing and Industrial	40.82	Acres	0.13	2.50	0.32
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00
Sub-Total			0.28		0.69
Future					
Single Family Residential	0.00	du	0.00	4.00	0.00
Multi-Family Residential	0.00	du	0.00	4.00	0.00
Commercial	0.00	Acres	0.00	2.50	0.00
Manufacturing and Industrial	0.00	Acres	0.00	2.50	0.00
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00
Sub-Total			0.00		0.00
Totals			0.28		0.69

Use Type	Size (units or acres)	GPCD or GPAD Factor	Average Flow (cfs)	Peaking Factor	Peak Flow (cfs)		Future Additions (units or acres)	Future GPCD or GPAD Factor	Future Average Flow (cfs)	Peaking Factor	Future Peak Flow (cfs)
Single Family Residential	374	95	0.05	4	0.22		111	95	0.02	4	0.07
Multi-Family Residential	198	65	0.02	4	0.08		0	65	0.00	4	0.00
Commercial	0.63	2000	0.00	2.5	0.00		0	2000	0.00	2.5	0.00
Manufacturing	0	2000	0.00	2.5	0.00		0	2000	0.00	2.5	0.00
Industrial	0	2000	0.00	2.5	0.00		0	2000	0.00	2.5	0.00
Governmental		1200	0.00	2.5	0.00			1200	0.00	2.5	0.00
Wholesale and Retail Trade	4.5	1200	0.01	2.5	0.02		0	1200	0.00	2.5	0.00
		Total	0.09		0.33				0.02		0.07
Projected Land Use	**Quantity**	**Unit**	**Average Day Flow (cfs)**	**Peaking Factor**	**Peak Day Flow (cfs)**						
Existing											
Single Family Residential	374.00	du	0.05	4.00	0.22						
Multi-Family Residential	198.00	du	0.02	4.00	0.08						
Commercial	0.63	Acres	0.00	2.50	0.00						
Manufacturing and Industrial	0.00	Acres	0.00	2.50	0.00						
Wholesale and Retail Trade	4.50	Acres	0.01	2.50	0.02						
Sub-Total			0.09		0.33						
Future											
Single Family Residential	111.00	du	0.02	4.00	0.07						
Multi-Family Residential	0.00	du	0.00	4.00	0.00						
Commercial	0.00	Acres	0.00	2.50	0.00						
Manufacturing and Industrial	0.00	Acres	0.00	2.50	0.00						
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00						
Sub-Total			0.02		0.07						
Totals			0.10		0.39						

Use Type	Size (units or acres)	GPCD or GPAD Factor	Average Flow (cfs)	Peaking Factor	Peak Flow (cfs)		Future Additions (units or acres)	Future GPCD or GPAD Factor	Future Average Flow (cfs)	Peaking Factor	Future Peak Flow (cfs)
Single Family Residential	77	95	0.01	4	0.05		0	95	0.00	4	0.00
Multi-Family Residential	0	65	0.00	4	0.00		0	65	0.00	4	0.00
Commercial	0	2000	0.00	2.5	0.00		0	2000	0.00	2.5	0.00
Manufacturing	0	2000	0.00	2.5	0.00		0	2000	0.00	2.5	0.00
Industrial	0	2000	0.00	2.5	0.00		0	2000	0.00	2.5	0.00
Governmental		1200	0.00	2.5	0.00			1200	0.00	2.5	0.00
Wholesale and Retail Trade	0	1200	0.00	2.5	0.00		0	1200	0.00	2.5	0.00
		Total	0.01		0.05				0.00		0.00

Projected Land Use	Quantity	Unit	Average Day Flow (cfs)	Peaking Factor	Peak Day Flow (cfs)
Existing					
Single Family Residential	77.00	du	0.01	4.00	0.05
Multi-Family Residential	0.00	du	0.00	4.00	0.00
Commercial	0.00	Acres	0.00	2.50	0.00
Manufacturing and Industrial	0.00	Acres	0.00	2.50	0.00
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00
Sub-Total			0.01		0.05
Future					
Single Family Residential	0.00	du	0.00	4.00	0.00
Multi-Family Residential	0.00	du	0.00	4.00	0.00
Commercial	0.00	Acres	0.00	2.50	0.00
Manufacturing and Industrial	0.00	Acres	0.00	2.50	0.00
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00
Sub-Total			0.00		0.00
Totals			0.01		0.05

Use Type	Size (units or acres)	GPCD or GPAD Factor	Average Flow (cfs)	Peaking Factor	Peak Flow (cfs)		Future Additions (units or acres)	Future GPCD or GPAD Factor	Future Average Flow (cfs)	Peaking Factor	Future Peak Flow (cfs)
Single Family Residential	480	95	0.07	4	0.28		0	95	0.00	4	0.00
Multi-Family Residential	470	65	0.05	4	0.19		0	65	0.00	4	0.00
Commercial	14.22	2000	0.04	2.5	0.11		0	2000	0.00	2.5	0.00
Manufacturing	0	2000	0.00	2.5	0.00		0	2000	0.00	2.5	0.00
Industrial	0	2000	0.00	2.5	0.00		0	2000	0.00	2.5	0.00
Governmental		1200	0.00	2.5	0.00			1200	0.00	2.5	0.00
Wholesale and Retail Trade	0	1200	0.00	2.5	0.00		0	1200	0.00	2.5	0.00
		Total	0.16		0.58				0.00		0.00
Projected Land Use	**Quantity**	**Unit**	**Average Day Flow (cfs)**	**Peaking Factor**	**Peak Day Flow (cfs)**						
Existing											
Single Family Residential	480.00	du	0.07	4.00	0.28						
Multi-Family Residential	470.00	du	0.05	4.00	0.19						
Commercial	14.22	Acres	0.04	2.50	0.11						
Manufacturing and Industrial	0.00	Acres	0.00	2.50	0.00						
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00						
Sub-Total			0.16		0.58						
Future											
Single Family Residential	0.00	du	0.00	4.00	0.00						
Multi-Family Residential	0.00	du	0.00	4.00	0.00						
Commercial	0.00	Acres	0.00	2.50	0.00						
Manufacturing and Industrial	0.00	Acres	0.00	2.50	0.00						
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00						
Sub-Total			0.00		0.00						
Totals			0.16		0.58						

Use Type	Size (units or acres)	GPCD or GPAD Factor	Average Flow (cfs)	Peaking Factor	Peak Flow (cfs)		Future Additions (units or acres)	Future GPCD or GPAD Factor	Future Average Flow (cfs)	Peaking Factor	Future Peak Flow (cfs)
Single Family Residential	374	95	0.05	4	0.22		1347	95	0.20	4	0.79
Multi-Family Residential	198	65	0.02	4	0.08		0	65	0.00	4	0.00
Commercial	0.63	2000	0.00	2.5	0.00		0	2000	0.00	2.5	0.00
Manufacturing	0	2000	0.00	2.5	0.00		0	2000	0.00	2.5	0.00
Industrial	0	2000	0.00	2.5	0.00		0	2000	0.00	2.5	0.00
Governmental		1200	0.00	2.5	0.00			1200	0.00	2.5	0.00
Wholesale and Retail Trade	4.5	1200	0.01	2.5	0.02		0	1200	0.00	2.5	0.00
		Total	0.09		0.33				0.20		0.79
Projected Land Use	**Quantity**	**Unit**	**Average Day Flow (cfs)**	**Peaking Factor**	**Peak Day Flow (cfs)**						
Existing											
Single Family Residential	374.00	du	0.05	4.00	0.22						
Multi-Family Residential	198.00	du	0.02	4.00	0.08						
Commercial	0.63	Acres	0.00	2.50	0.00						
Manufacturing and Industrial	0.00	Acres	0.00	2.50	0.00						
Wholesale and Retail Trade	4.50	Acres	0.01	2.50	0.02						
Sub-Total			0.09		0.33						
Future											
Single Family Residential	1347.00	du	0.20	4.00	0.79						
Multi-Family Residential	0.00	du	0.00	4.00	0.00						
Commercial	0.00	Acres	0.00	2.50	0.00						
Manufacturing and Industrial	0.00	Acres	0.00	2.50	0.00						
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00						
Sub-Total			0.20		0.79						
Totals			0.28		1.12						

Use Type	Size (units or acres)	GPCD or GPAD Factor	Average Flow (cfs)	Peaking Factor	Peak Flow (cfs)		Future Additions (units or acres)	Future GPCD or GPAD Factor	Future Average Flow (cfs)	Peaking Factor	Future Peak Flow (cfs)
Single Family Residential	12	95	0.00	4	0.01		0	95	0.00	4	0.00
Multi-Family Residential	0	65	0.00	4	0.00		0	65	0.00	4	0.00
Commercial	3.87	2000	0.01	2.5	0.03		0	2000	0.00	2.5	0.00
Manufacturing	0	2000	0.00	2.5	0.00		0	2000	0.00	2.5	0.00
Industrial	0	2000	0.00	2.5	0.00		0	2000	0.00	2.5	0.00
Governmental		1200	0.00	2.5	0.00			1200	0.00	2.5	0.00
Wholesale and Retail Trade	0	1200	0.00	2.5	0.00		0	1200	0.00	2.5	0.00
		Total	0.01		0.04				0.00		0.00

Projected Land Use	Quantity	Unit	Average Day Flow (cfs)	Peaking Factor	Peak Day Flow (cfs)
Existing					
Single Family Residential	12.00	du	0.00	4.00	0.01
Multi-Family Residential	0.00	du	0.00	4.00	0.00
Commercial	3.87	Acres	0.01	2.50	0.03
Manufacturing and Industrial	0.00	Acres	0.00	2.50	0.00
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00
Sub-Total			0.01		0.04
Future					
Single Family Residential	0.00	du	0.00	4.00	0.00
Multi-Family Residential	0.00	du	0.00	4.00	0.00
Commercial	0.00	Acres	0.00	2.50	0.00
Manufacturing and Industrial	0.00	Acres	0.00	2.50	0.00
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00
Sub-Total			0.00		0.00
Totals			0.01		0.04

Use Type	Size (units or acres)	GPCD or GPAD Factor	Average Flow (cfs)	Peaking Factor	Peak Flow (cfs)		Future Additions (units or acres)	Future GPCD or GPAD Factor	Future Average Flow (cfs)	Peaking Factor	Future Peak Flow (cfs)
Single Family Residential	5	95	0.00	4	0.00		0	95	0.00	4	0.00
Multi-Family Residential	0	65	0.00	4	0.00		0	65	0.00	4	0.00
Commercial	1.51	2000	0.00	2.5	0.01		0	2000	0.00	2.5	0.00
Manufacturing	0.64	2000	0.00	2.5	0.00		0	2000	0.00	2.5	0.00
Industrial	1.06	2000	0.00	2.5	0.01		0	2000	0.00	2.5	0.00
Governmental		1200	0.00	2.5	0.00			1200	0.00	2.5	0.00
Wholesale and Retail Trade	0	1200	0.00	2.5	0.00		0	1200	0.00	2.5	0.00
		Total	0.01		0.03				0.00		0.00

Projected Land Use	**Quantity**	**Unit**	**Average Day Flow (cfs)**	**Peaking Factor**	**Peak Day Flow (cfs)**
Existing					
Single Family Residential	5.00	du	0.00	4.00	0.00
Multi-Family Residential	0.00	du	0.00	4.00	0.00
Commercial	1.51	Acres	0.00	2.50	0.01
Manufacturing and Industrial	1.70	Acres	0.01	2.50	0.01
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00
Sub-Total			0.01		0.03
Future					
Single Family Residential	0.00	du	0.00	4.00	0.00
Multi-Family Residential	0.00	du	0.00	4.00	0.00
Commercial	0.00	Acres	0.00	2.50	0.00
Manufacturing and Industrial	0.00	Acres	0.00	2.50	0.00
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00
Sub-Total			0.00		0.00
Totals			0.01		0.03

Use Type	Size (units or acres)	GPCD or GPAD Factor	Average Flow (cfs)	Peaking Factor	Peak Flow (cfs)		Future Additions (units or acres)	Future GPCD or GPAD Factor	Future Average Flow (cfs)	Peaking Factor	Future Peak Flow (cfs)
Single Family Residential	6	95	0.00	4	0.00		0	95	0.00	4	0.00
Multi-Family Residential	951	65	0.10	4	0.38		280	65	0.03	4	0.11
Commercial	268.61	2000	0.83	2.5	2.08		66	2000	0.20	2.5	0.51
Manufacturing	112.12	2000	0.35	2.5	0.87		0	2000	0.00	2.5	0.00
Industrial	46.01	2000	0.14	2.5	0.36		0	2000	0.00	2.5	0.00
Governmental		1200	0.00	2.5	0.00			1200	0.00	2.5	0.00
Wholesale and Retail Trade	21.8	1200	0.04	2.5	0.10		0	1200	0.00	2.5	0.00
		Total	1.46		3.79				0.23		0.62
Projected Land Use	**Quantity**	**Unit**	**Average Day Flow (cfs)**	**Peaking Factor**	**Peak Day Flow (cfs)**						
Existing											
Single Family Residential	6.00	du	0.00	4.00	0.00						
Multi-Family Residential	951.00	du	0.10	4.00	0.38						
Commercial	268.61	Acres	0.83	2.50	2.08						
Manufacturing and Industrial	158.13	Acres	0.49	2.50	1.22						
Wholesale and Retail Trade	21.80	Acres	0.04	2.50	0.10						
Sub-Total			1.46		3.79						
Future											
Single Family Residential	0.00	du	0.00	4.00	0.00						
Multi-Family Residential	280.00	du	0.03	4.00	0.11						
Commercial	66.00	Acres	0.20	2.50	0.51						
Manufacturing and Industrial	0.00	Acres	0.00	2.50	0.00						
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00						
Sub-Total			0.23		0.62						
Totals			1.69		4.41						

Use Type	Size (units or acres)	GPCD or GPAD Factor	Average Flow (cfs)	Peaking Factor	Peak Flow (cfs)		Future Additions (units or acres)	Future GPCD or GPAD Factor	Future Average Flow (cfs)	Peaking Factor	Future Peak Flow (cfs)
Single Family Residential	244	95	0.04	4	0.14		0	95	0.00	4	0.00
Multi-Family Residential	49	65	0.00	4	0.02		0	65	0.00	4	0.00
Commercial	78.32	2000	0.24	2.5	0.61		0	2000	0.00	2.5	0.00
Manufacturing	50.36	2000	0.16	2.5	0.39		0	2000	0.00	2.5	0.00
Industrial	0.91	2000	0.00	2.5	0.01		0	2000	0.00	2.5	0.00
Governmental		1200	0.00	2.5	0.00			1200	0.00	2.5	0.00
Wholesale and Retail Trade	5.27	1200	0.01	2.5	0.02		0	1200	0.00	2.5	0.00
		Total	0.45		1.19				0.00		0.00
Projected Land Use	**Quantity**	**Unit**	**Average Day Flow (cfs)**	**Peaking Factor**	**Peak Day Flow (cfs)**						
Existing											
Single Family Residential	244.00	du	0.04	4.00	0.14						
Multi-Family Residential	49.00	du	0.00	4.00	0.02						
Commercial	78.32	Acres	0.24	2.50	0.61						
Manufacturing and Industrial	51.27	Acres	0.16	2.50	0.40						
Wholesale and Retail Trade	5.27	Acres	0.01	2.50	0.02						
Sub-Total			0.45		1.19						
Future											
Single Family Residential	0.00	du	0.00	4.00	0.00						
Multi-Family Residential	0.00	du	0.00	4.00	0.00						
Commercial	0.00	Acres	0.00	2.50	0.00						
Manufacturing and Industrial	0.00	Acres	0.00	2.50	0.00						
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00						
Sub-Total			0.00		0.00						
Totals			0.45		1.19						

Use Type	Size (units or acres)	GPCD or GPAD Factor	Average Flow (cfs)	Peaking Factor	Peak Flow (cfs)		Future Additions (units or acres)	Future GPCD or GPAD Factor	Future Average Flow (cfs)	Peaking Factor	Future Peak Flow (cfs)
Single Family Residential	177	95	0.03	4	0.10		0	95	0.00	4	0.00
Multi-Family Residential	0	65	0.00	4	0.00		0	65	0.00	4	0.00
Commercial	0.04	2000	0.00	2.5	0.00		0	2000	0.00	2.5	0.00
Manufacturing	0	2000	0.00	2.5	0.00		0	2000	0.00	2.5	0.00
Industrial	0	2000	0.00	2.5	0.00		0	2000	0.00	2.5	0.00
Governmental		1200	0.00	2.5	0.00			1200	0.00	2.5	0.00
Wholesale and Retail Trade	0	1200	0.00	2.5	0.00		0	1200	0.00	2.5	0.00
		Total	0.03		0.10				0.00		0.00

Projected Land Use	Quantity	Unit	Average Day Flow (cfs)	Peaking Factor	Peak Day Flow (cfs)
Existing					
Single Family Residential	177.00	du	0.03	4.00	0.10
Multi-Family Residential	0.00	du	0.00	4.00	0.00
Commercial	0.04	Acres	0.00	2.50	0.00
Manufacturing and Industrial	0.00	Acres	0.00	2.50	0.00
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00
Sub-Total			0.03		0.10
Future					
Single Family Residential	0.00	du	0.00	4.00	0.00
Multi-Family Residential	0.00	du	0.00	4.00	0.00
Commercial	0.00	Acres	0.00	2.50	0.00
Manufacturing and Industrial	0.00	Acres	0.00	2.50	0.00
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00
Sub-Total			0.00		0.00
Totals			0.03		0.10

Use Type	Size (units or acres)	GPCD or GPAD Factor	Average Flow (cfs)	Peaking Factor	Peak Flow (cfs)		Future Additions (units or acres)	Future GPCD or GPAD Factor	Future Average Flow (cfs)	Peaking Factor	Future Peak Flow (cfs)
Single Family Residential	264	95	0.04	4	0.16		0	95	0.00	4	0.00
Multi-Family Residential	49	65	0.00	4	0.02		0	65	0.00	4	0.00
Commercial	0	2000	0.00	2.5	0.00		0	2000	0.00	2.5	0.00
Manufacturing	0	2000	0.00	2.5	0.00		0	2000	0.00	2.5	0.00
Industrial	0	2000	0.00	2.5	0.00		0	2000	0.00	2.5	0.00
Governmental		1200	0.00	2.5	0.00			1200	0.00	2.5	0.00
Wholesale and Retail Trade	0	1200	0.00	2.5	0.00		0	1200	0.00	2.5	0.00
		Total	0.04		0.17				0.00		0.00

Projected Land Use	Quantity	Unit	Average Day Flow (cfs)	Peaking Factor	Peak Day Flow (cfs)
Existing					
Single Family Residential	264.00	du	0.04	4.00	0.16
Multi-Family Residential	49.00	du	0.00	4.00	0.02
Commercial	0.00	Acres	0.00	2.50	0.00
Manufacturing and Industrial	0.00	Acres	0.00	2.50	0.00
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00
Sub-Total			0.04		0.17
Future					
Single Family Residential	0.00	du	0.00	4.00	0.00
Multi-Family Residential	0.00	du	0.00	4.00	0.00
Commercial	0.00	Acres	0.00	2.50	0.00
Manufacturing and Industrial	0.00	Acres	0.00	2.50	0.00
Wholesale and Retail Trade	0.00	Acres	0.00	2.50	0.00
Sub-Total			0.00		0.00
Totals			0.04		0.17

APPENDIX C
WELL LOGS AND CONSTRUCTION REPORTS

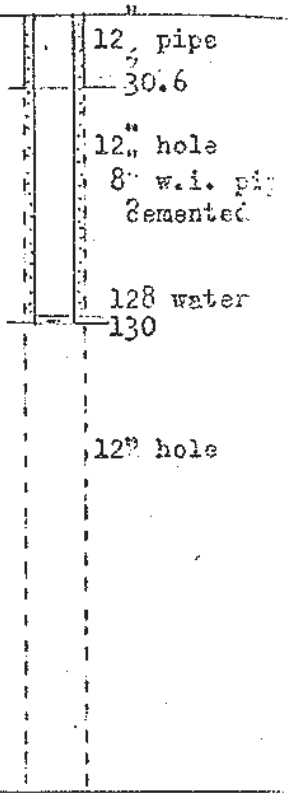
Well No. 2

Appendix I

VILLAGE WELL, MIDDLETON, WIS.
Layne-Northwest Co. reaming job, 1940
Samples examined by F. T. Thwaites, Nos. 108929-108948
SW¼,SE¼,SE¼,SW¼,NE¼,SW¼, sec. 11, T. 7 N., R. 8 E.

Alt.=1033'ETM

D	30	0-30	30		No samples, probably drift
LM	25	30-55	25		Dolomite, light gray, sandy at bottom
TREMPEALEAU FRANCONIA		55-70	15		Sandstone, medium, yellow-gray, dolomitic
		70-80	10		Sandstone, medium, yellow-gray, dolomitic
		80-195	115		No samples; includes remainder of Trempealeau and possibly some Franconia (see Crestwood well)
		195-225	30		Sandstone, fine, gray, very dolomitic
		225-250	25		Sandstone, fine to coarse, gray, dolomitic
		250-290	40		Sandstone, fine to coarse, gray, dolomitic, glauconitic
		290-300	10		Sandstone, fine, gray, dolomitic
	265	300-320	20		Sandstone, fine to coarse, lt.gray, dol, hard
D	10	320-330	10		Sandstone, medium, light gray



Formations: Drift; Lower Magnesian (Prairie du Chien); Trempealeau; Franconia; Dresbach (Galesville)
Specific capacity = 6.2 g.p.m. Reported as about 2 g.p.m./ft. in 1949

7818

Well No. 3

Appendix I

VILLAGE WELL NO. 3, MIDDLETON, WIS.

SW¼, NW¼, NW¼, NW¼, SE¼, SW¼ sec. 11, T. 7 N., R. 8 E.

Green Engineering Co. Layne-Northwest Co., Contractors, 1954

Samples examined by F. T. Thwaites, Wisconsin Geological Survey, Nos. 163489-163537, 167926-167997

Alt.=1012'ETM

D	6	0-6	6		Soil, silty, brown; till, brown-gray, dol.
L		6-16	10		Dolomite, light gray, sandy; chert, white
M	34	16-35	19		Dolomite, light gray
		35-40	5		Dol, yel-gy, sandy; chert, white, oolitic
T		40-50	10		Sandstone, fine, yellow-gy, very dolomitic
R		50-70	20		Sandstone, fine, light gray, dolomitic
E		70-80	10		Sandstone, fine to medium, light gray
M		80-90	10		Siltstone, some sand, yellow-gy, red, dol.
P	70	90-105	15		Siltstone, gray, yellow-gy, dol., glauconitic
		105-110	5		Dolomite, light gray
F		110-140	30		Sandstone, fine, gray to light gray, dolomitic, glauconitic
R		140-150	10		Sandstone, fine, light yellow-gy, dol, glauc.
A		150-165	15		Ss, very fine to fine, lt.yel-gy, dol, glauc.
N		165-170	5		Sandstone, fine, lt. yel-gy, dolomitic, hard
C		170-215	45		Sandstone, very fine to fine, light gray, dolomitic, some glauconite
O					
N					
I					
A	125	215-225	10		Sandstone, fine to coarse, light gray, dol.
		225-235	10		Sandstone, coarse to fine, white
D		235-310	75		Sandstone, medium to fine, some layers fine to medium, white
R					
E					
S					
B					
A					
C		310-355	45		Sandstone, fine to medium, light gray to very light gray
H	120				
		355-365	10		Sandstone, medium to fine, lt.yel-gy, dol.
		365-375	10		Sandstone, very fine to fine, lt.gray, dol.
		375-390	15		Shale, light gray, gray-pink, dolomitic
		390-395	5		Siltstone, sandy, gray, pink, glauc., dol.
E		395-405	10		Sandstone, fine to medium, lt.gy, glauc, dol.
A		405-415	10		Sandstone, medium to fine, very light gray
U		415-430	15		Sandstone, very fine to fine, light gray
		430-440	10		Sandstone, very fine to medium, very light gray
C		440-450	10		Sandstone, fine to medium, very light gray
L		450-475	25		Sandstone, medium to fine, very light gray, some pyrite
A		475-485	10		Sandstone, fine to medium, light gray, pyrite
I		485-565	80		Sandstone, fine to medium, light gray; layersyellow-gray to gray, dolomitic
R					
E					
	215	565-570	5		Sandstone, very fine to fine, very light gray
M		570-600	30		Sandstone, medium to fine, part fine to medium, very light gray
S	30				

22" pipe 8

34" hole

16" pipe cemented

100

110 water

113

15" hole

Formations: Drift; Lower Magnesian (Prairie du Chien); Trempealeau; Franconia; Dresbach (Galesville); Eau Claire; Mt. Simon

Tested 12 hours at 700 g.p.m. specific capacity = 10.45 g.p.m./ft.

Additional copies may be secured from Wisconsin Geological Survey, Science Hall, Madison 6, Wis.

Samples from 0 - 240' were collected during drilling of the test hole (DN-107).

7817

Well No. 4

Corrected copy 2-2-61

Wel 6

Appendix I

WELL CONSTRUCTOR'S REPORT TO WISCONSIN STATE BOARD OF HEALTH

See Instructions on Reverse Side

DN-698-G

1. County Dane — Town ☐ Village ☒ Middleton City ☐ (Check one and give name)

2. Location ~~S.E.Cor.S.E. 1/4 NE1/4 T7, N R8E~~ SE,SE,SE,SE,SE,NE,NE,Sec 2, T7, N R8E
Name of street and number of premise or Section, Town and Range numbers

3. Owner ☒ or Agent ☐ Village of Middleton
Name of individual, partnership or firm

4. Mail Address City Hall, Middleton, Wis.
Complete address required

5. From well to nearest: Building ____ ft; sewer ____ ft; drain ____ ft; septic tank ____ ft; dry well or filter bed ____ ft; abandoned well ____ ft.

6. Well is intended to supply water for: Village

7. DRILLHOLE:

Dia. (in.)	From (ft.)	To (ft.)	Dia. (in.)	From (ft.)	To (ft.)
30	0	38.8	23	205.1	851
29	39	205.1			

8. CASING AND LINER PIPE OR CURBING:

Dia. (in.)	Kind and Weight	From (ft.)	To (ft.)
30 o.d.	1/2" wall	0	38.8
24 o.d.	1/2" "	0	205.1

9. GROUT:

Kind	From (ft.)	To (ft.)
Cement	0	205
Cement	835.3	851

10. FORMATIONS:

Kind	From (ft.)	To (ft.)
Drift	0	39
Sandstone	39	851

RECEIVED
FEB 3 1961
SANITARY ENGINEERING

11. MISCELLANEOUS DATA:

Yield test: 24 Hrs. at 2100 GPM.

Depth from surface to water-level: 114 ft.

Water-level when pumping: 200 ft.

Water sample was sent to the state laboratory at: Madison (City) on 3/22/60 19____

Construction of the well was completed on: March 28 19 60

The well is terminated 18 inches ☒ above, below ☐ the permanent ground surface.

Was the well disinfected upon completion? Yes x No ____

Was the well sealed watertight upon completion? Yes x No ____

Signature Ralph Milaeger
Registered Well Driller

MILAEGER WELL AND PUMP CO. INC.
1245 N. 62nd St., Milwaukee 13, Wis.
Complete Mail Address

Please do not write in space below

Rec'd ____ No. ____

Ans'd ____

Interpretation ____

cc: DIST 2/3/61
: FILE

7681

	10 ml	10 ml	10 ml	10 ml	10 ml
Gas—24 hrs.					
48 hrs.					
Confirm					772262
B. Coli					

Examiner ____

Well No. 5

Appendix I

Corrected copy 2-2-61 Wal 6

WELL CONSTRUCTOR'S REPORT TO WISCONSIN STATE BOARD OF HEALTH

See Instructions on Reverse Side

DN-698-G

1. County Dane — Town ☐ Village ☒ Middleton City ☐ (Check one and give name)

2. Location ~~S.E.Cor.S.E. ¼ NE¼ T7, N R8E~~ SE,SE,SE,SE,SE,NE,NE,Sec 2, (Name of street and number of premise or Section, Town and Range numbers)

3. Owner ☒ or Agent ☐ Village of Middleton (Name of individual, partnership or firm)

4. Mail Address City Hall, Middleton, Wis. (Complete address required)

5. From well to nearest: Building ____ft; sewer ____ft; drain ____ft; septic tank ____ft; dry well or filter bed ____ft; abandoned well ____ft.

6. Well is intended to supply water for: Village

7. DRILLHOLE:

Dia. (in.)	From (ft.)	To (ft.)	Dia. (in.)	From (ft.)	To (ft.)
30	0	38.8	23	205.1	851
29	39	205.1			

8. CASING AND LINER PIPE OR CURBING:

Dia. (in.)	Kind and Weight	From (ft.)	To (ft.)
30 O.D.	1/2" wall	0	38.8
24 O.D.	1/2" "	0	205.1

9. GROUT:

Kind	From (ft.)	To (ft.)
Cement	0	205
Cement	835.3	851

10. FORMATIONS:

Kind	From (ft.)	To (ft.)
Drift	0	39
Sandstone	39	851

RECEIVED
FEB 3 1961
SANITARY ENGINEERING

Construction of the well was completed on: March 28 19 60

The well is terminated 18 inches ☒ above, below ☐ the permanent ground surface.

Was the well disinfected upon completion? Yes x No

Was the well sealed watertight upon completion? Yes x No

11. MISCELLANEOUS DATA:

Yield test: 24 Hrs. at 2100 GPM.

Depth from surface to water-level: 114 ft.

Water-level when pumping: 200 ft.

Water sample was sent to the state laboratory at: Madison (City) on 3/22/60 19

Signature Ralph Milaeger (Registered Well Driller)

MILAEGER WELL AND PUMP CO. INC.
1245 N. 62nd St., Milwaukee 13, Wis. (Complete Mail Address)

Please do not write in space below

Rec'd ____ No. ____

Ans'd ____

Interpretation ____

cc: DIST 2/13/61
FILE

7681

	10 ml	10 ml	10 ml	10 ml	10 ml
Gas—24 hrs.					
48 hrs.					
Confirm					772362
B. Coli					

Examiner ____

plot

Appendix I

Middleton Well #5, Middleton, Wis. Elev. =927' (ETN)
SW¼, SW¼, SE, NE, SW, Sec. 12, T 7N, R 8E
Layne-Northwest, Driller - Aug., 1964
Sample Nos. 252612-252767, Examined by M. E. Ostrom - 3-5-65

	0-8	8	Snd &st, dk yl bn, M, fn, Srnd, Psrtg, Si:P, trC, tr	+26" +4"
	8-15	7	Snd, Myl bn, mxd, M, fn, Srnd, Psrtg, trC	
	15-20	5	Snd, Vlt yl rd, mxd, M, fn, Srnd, Psrtg, trC, tr glauc	
	20-30	10	Snd, Vlt yl rd, mxd, M, fn, Srnd, Psrtg, trVfn, tr glauc	
	30-45	15	Snd, lt yl, mxd, M, fn, Srnd, Psrtg, trVfn, tr glauc	30" Steel Pipe
	45-55	10	Snd, lt yl, mxd, fn, Vfn, Srnd, Psrtg, trM, trVfn, cl	
	55-60	5	Snd, Myl, M, fn, Srnd, Psrtg, trC	71'3"
	60-70	10	Snd, lt yl, rd mxd, M, fn, Srnd, Psrtg, trC	Water L
	70-85	15	Snd, mxd, M, C, rnd, Psrtg, tr fn, VC	
	85-95	10	Snd, mxd, M, fn, rnd, Psrtg, trVfn, tr glauc	
	95-115	20	Snd, mxd, fn, Vfn, rnd, Psrtg, trM, tr glauc	
DRIFT	115-125	10	Snd, mxd, M, C, rnd, Psrtg, tr fn, Vfn	126'
	125-135	10	Snd, mxd, M, fn, rnd, Psrtg, trC	
	135-140	5	Snd, mxd, M, C, rnd, Psrtg, trVC, trVfn, fn gvl	
	140-145	5	Snd, mxd, M, C, rnd, Psrtg, trVC, fn, trVfn, fn gvl	
	145-150	5	Snd, mxd, M, C, rnd, Psrtg, trVC	
	150-155	5	Snd, mxd, M, C, rnd, Psrtg, trVC, fn, Vfn, trVfn gvl	
	155-160	5	Snd, mxd, fn, Vfn, rnd, Psrtg, trM, mch st	
	160-180	20	Snd, mxd, M, C, rnd, Psrtg, trVC	24" Steel Pipe
	180-200	20	Snd, mxd, M, C, rnd, Psrtg, trVC	
	200-210	10	Snd, Vlt yl bn, M, C, rnd, Psrtg, tr fn	
	210-215	5	Snd, mxd, M, C, rnd, Psrtg, tr fn	
	215-220	5	Snd, lt yl bn, M, C, rnd, Psrtg, tr fn	
	220-225	5	Snd, Vlt yl bn, M, C, rnd, Psrtg, tr fn	
	225-230	5	Snd, lt yl bn, M, C, rnd, Psrtg, tr fn, Vfn	
	230-240	10	Snd, lt yl bn, M, C, rnd, Psrtg, tr fn	
	240-265	25	Snd, lVlt yl bn, M, C, rnd, Psrtg, tr fn	
275	265-275	10	Snd, Vlt yl bn, M, fn, rnd, Psrtg, trC	278'
E	275-295	20	Ss, lt yl bn, fn, Vfn, rnd, Psrtg, Dolic:P, trM	20" Steel P 293'7"
C	295-297	2	Ss, lt rd, M, fn, rnd, Psrtg, Dolic:P, trM, mch sh	
	297-302	5	Snd, lt rd, fn, Vfn, rnd, Psrtg, Dolic:P, trM, mch gry gn sh	
	302-313	11	Sh, lt gry bn, Dolic:P, mch st, Ss, tr dol	
	313-315	2	Sh, lt rd yl bn, Dolic:P, mch st, Ss, glauc	19" Hole
45	315-320	5	Sh, lt rd yl bn, Dolic:P, mch st, Ss, glauc, dol	
M	320-340	20	Ss, Vlt yl bn, M, C, Srnd, Psrtg, tr fn, Vfn	
	340-345	5	Ss, Vlt gry, M, C, Srnd, Psrtg, tr fn, Vfn	
	345-350	5	Ss, Vlt gry, M, C, Srnd, Psrtg, Dol:P, tr fn	

Appendix I

Middleton Well #5, Middleton, Wis.
Sample Nos. 252612-252767

350-355	5		Ss, Vlt gry, M, C, Srnd, Dolc:P, tr fn
355-360	5		Ss, Vlt pnk bn, M, C, rnd, Psrtg, Dolc:P, tr fn
360-365	5		Ss, wh, M, C, rnd, Psrtg, Dolc:P, tr fn
365-400	35		Ss, wh, M, C, rnd, Psrtg, Dolc:P, tr fn, tr pyr
400-415	15		Ss, wh, M, C, rnd, Psrtg, Dolc:P, tr fn, Vfn, tr pyr, foss
415-450	35		Ss, Vlt pnk, M, fn, rnd, Psrtg, Dolc:F, trC, Vfn, mch dol, tr pyr
450-455	5		Ss, Vlt pnk, M, fn, rnd, Psrtg, Dolc:F, trC, mch dol, tr pyr, mch dol
455-465	10		Ss, Vlt pnk bn, M, fn, rnd, Psrtg, Dolc:F, trC, trVfn tr dol, pyr
465-480	15		Ss, Vlt pnk bn, M, fn, rnd, Psrtg, Dolc:F, trC, Vfn,
480-485	5		Ss, Vlt or, M, fn, rnd, Psrtg, Dolc:F, trC, Vfn, tr do
485-490	5		Ss, Vlt or, M, fn, Srnd, Psrtg, trVfn, C, mch lim-cem
490-505	15		Ss, wh, M, fn, Srnd, Psrtg, Dolc:P, trVfn, C, tr lim-cem, foss
505-510	5		Ss, wh, fn, Vfn, Srnd, Psrtg, Dolc:P, trM
510-520	10		Ss, wh, M, fn, Srnd, Psrtg, Dolc:P, trC, Vfn, tr pyr, dol
520-530	10		Ss, wh, fn, Vfn, Srnd, Psrtg, D olc:P, trM, C, tr pyr
530-535	5		Ss, wh, fn, Vfn, Srnd, Psrtg, Dolc:P, trM, C, tr foss
535-545	10		Ss, wh, fn, Vfn, Srnd, Psrtg, Dolc:P, trM
545-550	5		Ss, wh, M, fn, Srnd, Psrtg, Dolc:P, trVfn, C, tr sh
550-555	5		Ss, wh, M, fn, Srnd, Psrtg, Dolc:P, trVfn, C, tr sh, foss
555-580	25		Ss, wh, M, fn, Srnd, Psrtg, Dolc:P, trVfn, C, tr dol, pyr
580-590	10		Ss, wh, M, fn, Srnd, Psrtg, Dolc:P, trVfn, C
590-595	5		Ss, wh, M, fn, Srnd, Psrtg, Dolc:P, trVfn, C, tr pyr
595-600	5		Ss, wh, M, fn, Srnd, Psrtg, Dolc:P, trVfn, C, tr pyr, sh
600-605	5		Ss, wh, M, fn, Srnd, Psrtg, Dolc:P, trVfn, C, tr pyr
605-615	10		Ss, wh, M, fn, Srnd, Psrtg, Dolc:P, trVfn, C, tr pyr, foss, sh,
615-620	5		Ss, wh, fn, M, Srnd, Psrtg, Dolc:P, trVfn, C, tr pyr
620-635	15		Ss, wh, M, fn, Srnd, Psrtg, Dolc:P, trVfn
635-640	5		Ss, wh, M, fn, Srnd, Psrtg, trVfn, C
640-645	5		Ss, wh, M, fn, Srnd, Psrtg, trVfn
645-670	25		Ss, wh, M, fn, Srnd, Psrtg, trVfn, C
670-675	5		Ss, Vlt yl bn, M, fn, Srnd, Psrtg, trVfn, C
675-685	10		Ss, Vlt gry bn, M, fn, Srnd, Psrtg, trVfn, C, tr pyr, sh
685-690	5		Ss, Vlt yl rd bn, M, C, Srnd, Psrtg, trVfn, fn, tr pyr
690-695	5		Ss, Vlt yl rd bn, M, C, Srnd, Psrtg, Slt-F, trVfn, fn
695-700	5		Ss, Vlt yl rd bn, M, C, Srnd, Psrtg, trVfn, C

480'

15" Hole

Appendix I

Middleton Well #5, Middleton, Wis.
Sample Nos. 252612-252767

700-710	10		Sh, Vlt yl bn, Si:F, mch st, Ss	
715-735	20		Ss, Vlt yl bn, C, VC, Srnd&Sang, Psrtg, Si:F, tr fn, Vfn, M, tr cong	
735-745	10		Ss, Vlt yl bn, M, C, Srnd&Sang, Psrtg, tr fn, Vfn, M	
745-755	10		Ss, Vlt yl bn, M, C, Srnd&Sang, Psrtg, tr fn, Vfn	
755-760	5		Ss, Vlt yl bn, M, C, Srnd&Sang, Si:P, tr fn, Vfn, tr	foss
760-765	5		Ss, Vlt yl bn, M, C, Srnd&Sang, Si:P, tr fn, Vfn, VC,	
765-767	2		Ss, Vlt yl bn, M, C, Sang, Psrtg, tr fn, Vfn, VC, tr cong	
767-770	3		Ss, Vlt rd, M, C, Sang, Psrtg, tr fn, Vfn, VC, tr cong	
770-780	10		Ss, Vlt yl, pnk bn, M, C, Sang, Psrtg, tr fn, VC, Vfn	
780-785	5		Ss, Vlt yl, pnk bn, M, C, Sang, Psrtg, tr fn, VC, tr cong	
785-800	15		Ss, Vlt yl, pnk bn, M, C, Sang, Psrtg, tr fn, VC, Vfn, tr sh	
800-802	2		Ss, Vlt rd, M, C, Sang, Psrtg, tr fn, Vfn	809'
802-807	5		Ss, mxd, M, C, Sang, Psrtg, tr fn, Vfn, VC, mch sh	

Formations: Drift, Franconia, Galesville, Eau Claire, Mt. Simon

Well tested for 48 hrs. at 1800 gpm with 127'3½" of drawdown.
Specific capacity = 14.1 gpm per ft. of drawdown.

Formations revised by E. M. Peters - 6/11/84.

Well No. 6

~950' ETM

P169 — Dn-1183

Appendix I

Wisconsin
Department of Natural Resources
Box 7921
Madison, Wisconsin 53707

NOTE:
White Copy – Division's Copy
Green Copy – Driller's Copy
Yellow Copy – Owner's Copy

WELL CONSTRUCTION REPORT

Form 3300–15 Rev. 12-76

AUG 15 1985

COUNTY: Dane

CHECK (✓) ONE: ☐ Town ☐ Village ☒ City

Name: Middleton Well #6

NW, SW, SE

2. LOCATION. ¼ Section: NE¼ SW¼ | Section: 10 | Township: 7N | Range: 8E

OR – Grid or Street No.: | Street Name: Pleasantview Rd.

AND – If available subdivision name, lot & block No.:

3. NAME ☐ OWNER ☐ AGENT AT TIME OF DRILLING CHECK (✓) ONE: City of Middleton

ADDRESS:

POST OFFICE: Middleton

4. Distance in feet from well to nearest: (Record answer in appropriate block)

Building	Sanitary Bldg. Drain		Sanitary Bldg. Sewer		Floor Drain Connected To:		Storm Bldg. Drain		Storm Bldg. Sewer	
	C.I.	Other	C.I.	Other	C.I. Sewer	Other Sewer	C.I.	Other	C.I.	Other

Street Sewer		Other Sewers		Foundation Drain Connected to:		Sewage Sump		Clearwater Sump	Septic Tank	Holding Tank	Sewage Absorption Unit
San.	Storm	C.I.	Other	Sewer	Sewage Sump	C.I.	Other				Seepage Pit
				Clearwater Dr.	Clearwater Sump						Seepage Bed
											Seepage Trench

Privy	Pet Waste Pit	Pit: Nonconforming Existing	Subsurface Pumproom	Barn Gutter	Animal Barn Pen	Animal Yard	Silo With Pit	Glass Lined Storage Facility	Silo w/o Pit	Earthen Silage Storage Trench Or Pit
		Well	Nonconforming Existing							
		Pump								
		Tank								

Temporary Manure Stack	Watertight Liquid Manure Tank	Solid Manure Storage Structure	Subsurface Gasoline or Oil Tank	Waste Pond or Land Disposal Unit (Specify Type)	Other (Give Description)

5. Well is intended to supply water for: City Well No. 6

6. DRILLHOLE

Dia. (in.)	From (ft.)	To (ft.)	Dia. (in.)	From (ft.)	To (ft.)
26	Surface	220	17	450	856
9	220	450			

7. CASING, LINER, CURBING AND SCREEN

Dia. (in.)	Material, Weight, Specification & Method of Assembly	From (ft.)	To (ft.)
26	Bl. New Steel P.E. A-53 136.2 1B Welding	Surface	51
20	Bl. New Steel P.E. A-53 78.60 1B Welding	+1.5'	220

8. GROUT OR OTHER SEALING MATERIAL

Kind	From (ft.)	To (ft.)
Neat Cement	Surface	220

9. FORMATIONS

Kind	From (ft.)	To (ft.)
Sand & boulders	Surface	51
Limestone	51	75
Sandstone	75	856

10. TYPE OF DRILLING MACHINE USED

☒ Cable Tool ☐ Rotary-air w/drilling mud ☐ Rotary-w/drilling mud ☐ Rotary-hammer w/drilling mud & air ☐ Rotary-hammer & air ☐ Reverse Rotary ☐ Jetting with ☐ Air ☐ Water

Well construction completed on March 30 19 85

11. MISCELLANEOUS DATA

Yield Test: 12 Hrs. at 2000 GPM

Depth from surface to normal water level 62 Ft.

Depth of water level when pumping 166 Ft. Stabilized ☒ Yes ☐ No

Well is terminated 18 inches ☒ above ☐ below final grade

Well disinfected upon completion ☒ Yes ☐ No

Well sealed watertight upon completion ☒ Yes ☐ No

Water sample sent to Wisc. State Lab of Hygiene Sp. cap = 19.2 9pm/ft laboratory on March 20 19 85

Your opinion concerning other pollution hazards, information concerning difficulties encountered, and data relating to nearby wells, screens, seals, method of finishing the well, amount of cement used in grouting, blasting, etc., should be given on reverse side.

Signature: Layne-Northwest
Wm Majeski
Registered Well Driller

cc: SPS 365 WELL LOG BOOK

Complete Mail Address:
6005 W. Martin Dr.
Milwaukee, WI 53213

Appendix I p169

DN-1183

WISCONSIN GEOLOGICAL and NATURAL HISTORY SURVEY
3817 Mineral Point Road • Madison, WI 53705

Log No.

Well name Middleton #6

County:

Owner....
Address..

Completed...
Field check.
Altitude....
Use.....
Static w.l..
Spec. cap...

R.
T.
N.
Sec.

Quad.

Drill Hole						Casing & Liner Pipe or Curbing							
Dia.	from	to	Dia.	from	to	Dia.	Wgt.& Kind	from	to	Dia.	Wgt.& Kind	from	to

Grout	from	to

Drilling method:
Samples from to Rec'd:

Studied by:

Formations:

Remarks:

Issued:

PRELIMINARY COPY
Subject to Review and Approval
Not For Release

LOG OF WELL:

Depths	Graphic Section	Rock Type	Color	Grain Size Mode	Grain Size Range	Miscellaneous Characteristics
0-5		Sand	Dk yl bn	M	Vfn/VC	Mch gvl(Gran/S peb,& 4 VL pebs),st. Tr cl,Fn-glauc,org mat.
5-10		Silt & sand	Yl brown	"	"	Dolic(?-st). Mch gvl(Gran/VL peb),clay. Tr silt/Vfn-glauc.
10-15		Sand	Lt yl bn	M/C	"	Mch gvl(Gran/M peb,& 1 VL peb). Ltl silt. Tr cl,st/Vfn-glauc.
15-20		"	Bn yellow	Fn/M	"	Mch st. Ltl cl. Tr gvl(Gran/S peb),Vfn-glauc. /cl. Tr Vfn gla
20-25		Silt & gvl	"	VLP	Gran/VL peb	Dolic(st). Dol cemtd glaucic sts,dol,sts,cht,trap. Mch snd. L
25-30		Silt & sand	"	Fn/M	Vfn/VC	Dolic(silt). Mch gvl(Gran/L peb). Ltl clay. Tr Vfn-glauconits
30-35		Sand	"	M	"	Trace gravel(Gran/S peb),eilt,Fn/M-glauconite.
35-40		Silt & sand	Yl brown	"	"	Dolomitic(silt). Little clay. Trace Vfn-glauconite.
40-45		"	"	"	"	Dolic(silt). Mch clay. Ltl gravel(Gran/L peb). Tr Vfn-glauc.
45-50		"	"	"	"	Same. /bedrock. Mch gvl(Gran/L peb-sts),cl
50-55		"	Strg brown	"	"	Dolic(et). Redder than abv because of hem stng. Not quite
55-60		Siltstone	Bn yellow	—	—	Mch G to VG dol cem,Vfn/C qtz snd. Ltl st/Vfn-glauc. Tr hem
60-65		Sandstone	Lt ol yl bn	Vfn	Vfn/C	Ang. Almost a sts. Mch G dol cem,st,st/Fn-glauc. Ltl \stng
65-70		"	"	"	"	Same. \cl matx. Tr hem stng,lim,mica
70-75		"	Olive	Vfn/Fn	"	Same but angular to subangular.
75-80		"	"	Fn	"	Sang. Mch F to G dol cem,st,st/C-glauc. Ltl cl matx. Tr hem
80-85		"	"	"	"	Same. \stng,lim,mica,Vfn/Fn-feld grns,wh fos frags
85-90		"	"	"	"	"
90-95		"	Ol yellow	Fn/M	"	Sang. Mch G dol cem,st. Ltl Fn/C-glauc. Tr hem stng,lim,mica,
95-100		"	Lt yl ol bn	"	"	Same but ltl clay matrix. \Fn-feld grns,wh fos frags,cl matx
100-105		"	Bn yellow	"	"	Same but trace glauconite.
105-110		"	"	M	"	Sang to srnd. Mch G to VG dol to calc cem,st. Tr Fn/C-glauc,F
110-115		"	Lt bn yl	Fn/M	"	Same. \feld grns,lim,hem stng,cl matx,Fn-zr,mica
115-120		"	"	"	"	"
120-125		"	"	Fn	"	"
125-130		"	"	"	"	Sang to srnd. Mch G to VG dol to calc cem,st. Tr Fn/C-glauc,F
130-135		"	"	"	"	Same. \feld grns,lim,pyro,hem stng,cl matx,Fn-zr,pl gn sh,mic
135-140		"	"	"	"	Same but little clay matrix.
140-145		"	"	"	"	Same.
145-150		"	"	"	"	Same plus ltl lt yl cl. /Fn-zr,pl gn sh,Fn-feld grns,mica
150-155		"	Lt yl bn	"	"	Sang. Mch G dol to calc cem,st,cl matx. Tr Fn/C-glauc,lim,py
155-160		"	Ol bn yl	Fn/M	"	Sang to srnd. Mch G dol to calc cem,st. Ltl Fn/C-glauc,cl ma \Tr lim,pyro,hem stng,pl gn sh,Fn-zr,Fn-feld grns,mic

Appendix I

Log No.

WISCONSIN GEOLOGICAL and NATURAL HISTORY SURVEY
3817 Mineral Point Road • Madison, WI 53705

Well name:

Depths	Graphic Section	Rock Type	Color	Grain Size Mode	Grain Size Range	Miscellaneous Characteristics
160–165		Sandstone	Ol yellow	Fn	Vfn/C	Sang. Mch G dol to calc cem,st. Ltl Fn/C-glauc,cl matx. Tr lim,
165–170		"	"	"	"	Same. \ pyro,pl gn sh,Fn-zr,Fn-feld grns,mica.
170–175		"	Lt bn yl	C	Vfn/VC	Wrnd. Mch G to VG dol cem,frstg,st. Tr G lim cem,pyro,Fn/C-glauc,
175–180		"	"	"	Vfn/Gran	Same. \ hem stng,mfc incl,cl matx,Fn/M-feld grns,mica.
180–185		"	Yellow	M/C	"	Rnd to Wrnd. Ltl F to G dol cem. Mch st,frstg. Tr G lim cem,pyro,
185–190		"	"	"	"	Same. \ mfc incl,cl matx,Fn/C-glauc,Fn/M-zr.
190–195		"	Pale yellow	"	"	Sams but slightly less dolomite csmsnt & silt.
195–200		"	"	"	"	Rnd to Wrnd. Tr F to G dol cem,G lim csm,mfc incl,Fn/M-zr,wh
200–205		"	"	"	"	Same. \ silce sh,Fn-glauc. Mch st,frstg.
205–210		"	"	"	Vfn/VC	Same plus trace pale green shale.
210–215		"	Lt bn yl	"	"	Rnd to Wrnd. Mch G dol to calc cem,frstg,st. Tr G lim cem,mfc
215–220		"	"	"	"	Sams. \ incl,Fn/M-zr,pyro.
220–225		"	"	"	"	Sams plus much neat cement.
225–230		"	"	"	"	Same.
230–235		"	"	"	"	Same but little neat cement.
235–240		"	"	"	"	Rnd to Wrnd. Ltl G dol to calc cem. Mch frstg,st. Tr G lim cem,
240–245		"	"	"	"	Same but mch cement. \ mfc incl,Fn/M-zr,neat cem.
245–250		"	"	"	"	Rnd to Wrnd. Tr G dol to calc cem,G lim cem,mfc incl,Fn/M-zr,
250–255		"	"	C	"	Same but ltl G dol to calc cement. \ neat cem. Mch frstg,st,
255–260		"	"	"	"	Wrnd. Tr G dol to calc cem,G lim cem,mfc incl,cvd mat. Mch frstg
260–265		"	"	"	"	Same. \ Ltl st.
265–270		"	"	M	"	Srnd to rnd. Ltl G dol to calc cem. Mch frstg,st. Tr G lim cem,
270–275		"	"	"	"	Sams but tr dol to calc cement. \ mfc incl,wh silcs sh,cvd mat.
275–280		"	"	Fn/M	"	Same.
280–285		"	"	"	"	Srnd. Tr G dol cem,G lim cem,mfc incl,Fn-zr,cvd mat. Mch frstg.
285–290		"	"	"	"	Same but much silt. \ Ltl st.
290–295		"	Bn yellow	Fn	"	Same.
295–300		"	"	"	Vfn/C	Srnd. Ltl G dolomite cement. Mch silt. Tr limonite,Fn-zircon.
300–305		"	"	"	"	Same plue trace white M/C VG calcite cemented sandstone.
305–310		"	"	"	"	Same. / mfc incl.
310–315		"	"	"	"	Same but mch wh M/C VG calc cemtd ss. / lim sh,pl gn sh,Fn-zr,
315–320		"	"	M	Vfn/VC	Rnd. Ltl G to VG dol(yl) to calc(wh) cem. Mch st. Tr G lim cem,
320–325		"	Pink gray	Vfn&M	"	Ang & srnd. Mch VG dol cem(w/fns),pk hem stng,st,frstg(coarser).
325–330		"	Lt bn gray	Vfn/Fn	"	See end of log. \ Tr pl gn sh,Vfn-glauc,Fn-zr,pyr,cvd mat.
330–335		Shals	Gray	—	—	Silcs. Mch qtz snd(Vfn/M);qtz st. (Mors st than snd). Tr pyr,st/
335–340		"	Dark gray	—	—	Silcs. Mch qtz st. Ltl qtz snd(Vfn/M). Tr \ Vfn-glauc,fos,mica.
340–345		"	"	—	—	Same but glauc is silt/Fn. \ pyr,st/Vfn-glauc,fos,mica.
345–350		"	Olive gray	—	—	Silcs. Mch qtz st. Ltl qtz snd(Vfn/M),st/Fn-glauc. Tr pyr,mica,
350–355		Sandstone	Light gray	M	Vfn/VC	See snd of log. \ fos.
355–360		"	"	M/C	"	Rnd to Wrnd. Tr F to G dol cem,Fn-glauc,pyr,pl gn sh,gy sh,sts.
360–365		"	"	C	"	See snd of log. \ Mch frstg,st. Few sec qtz grw.
365–370		"	"	M/C	"	Rnd to Wrnd. Tr F to G dol cem,Fn/M-glauc,mfc incl,Fn-zr,pl gn
370–375		"	V pl brown	"	"	See end of log. \ sh,dk gy sh. Mch frstg,st. Ltl cl matx.
375–380		"	V lt bn gy	"	"	Same as 370'-375' plus ltl cl matx. / gn sh,pyr,Fn-zr,cvd mat.
380–385		"	"	"	"	Rnd to Wrnd. Ltl G dol csm,cl matx. Mch frstg,st. Tr mfc incl,pl
385–390		"	Light gray	"	"	Rnd to Wrnd. Ltl F to G dol cem. Mch frstg,st. Tr G pyr csm,Fn-
390–395		"	V pl brown	"	"	Same but tr dol cem,plus mch cl matx, \ zr,mfc incl,pl gn sh,cvd
395–400		"	"	"	"	Same but little clay matrix. \ mat.
400–405		"	"	"	"	Same.
405–410		"	Light gray	"	"	Rnd to Wrnd. Tr F dol cem,pyr,Fn-zr,mfc incl,cvd mat. Mch frstg,
410–415		"	"	"	"	Same. \ st,cl matx.
415–420		"	"	"	"	Same but trace G dolomite cement.
420–425		"	Gray	M	"	Rnd. Ltl G pyr cem. Tr F dol cem,mfc incl,Fn-zr,neat cem. Mch
425–430		"	"	"	"	Same minus nsat cement. \ frstg,st,cl matx.
430–435		"	Lt gy bn	"	"	Same but trace pyrite cement. / st,cl matx.
435–440		"	Light gray	Fn/M	"	Srnd to rnd. Tr G pyr cem,G dol cem,mfc incl,Fn-zr. Mch frstg,
440–445		"	"	M	"	Rnd. Mch G dol cem,frstg,st,cl matx. Tr G pyr cem,mfc incl,Fn-zr,
445–450		"	"	M/C	"	Sse end of log. \ wh silcs sh,pk stng.
450–455		"	"	"	"	Srnd to Wrnd. Mch G dol cem(but most of the remaining chips are
455–460		"	"	"	"	Same. \ slgtly sndy dol),frstg,st,cl matx. Ltl pk stng. Tr G pyr
460–465		"	"	C	"	See end of log. \ cem,gn gy sh,mfc incl,Fn-zr,wh silcs sh.
465–470		"	"	"	"	Same as 460'-465' but the dol chips are only slgtly sndy,plus tr
470–475		"	Gray	M/C	"	Rnd to Wrnd. Tr G pyr cem,dk gy sh,mfc incl,pl gn sh, \ cvd mat.
475–480		"	"	M	"	Same. \ Fn-zr. Mch et,frstg,cl matx,cvd pk dol chips.
480–485		"	"	"	"	"
485–490		"	Pink gray	M/C	"	See end of log.

Appendix I

Log No.

WISCONSIN GEOLOGICAL and NATURAL HISTORY SURVEY
3817 Mineral Point Road • Madison, WI 53705

Well name:

Depths	Graphic Section	Rock Type	Color	Grain Size Mode	Grain Size Range	Miscellaneous Characteristics
490–495		Sandstone	Lt pk gray	M	Vfn/VC	Rnd. Mch G to F dol cem,frstg,st,cl matx. Tr dk pk stng,pl gn sh,wh silcs sh,pyr,Fn-zr,mfc incl.
495–500		"	Light gray	"	"	Same.
500–505		"	"	"	"	"
505–510		"	"	M/C	"	"
510–515		"	"	"	"	"
515–520		"	"	"	"	"
520–525		"	"	"	"	"
525–530		"	V pl bn gy	M	"	"
530–535		"	"	Fn/M	"	Sang to rnd. Mch F to P dol cem,frstg,st,cl matx. Tr pl gn sh,
535–540		"	"	"	"	Sams but ltl dol csm. pyr,mfc incl,Fn-zr,wh silcs sh,pk stng.
540–545		"	"	"	"	Same.
545–550		"	"	"	"	"
550–555		"	V pl brown	"	"	Sams but much F to G dolomite cement.
555–560		"	"	"	"	Same.
560–565		"	"	"	"	"
565–570		"	"	"	"	"
570–575		"	"	"	"	"
575–580		"	"	Fn	"	Sams but trace F to P dolomite cem,plus much F to P silica cem.
580–585		"	"	"	"	Sang to rnd. Ltl F to P ail cem. Mch frstg,st,cl matx. Tr Vfn/Fn zr,pl gn sh,mfc incl.
585–590		"	"	"	"	Same.
590–595		"	Lt pl bn	M/C	"	Srnd to Wrnd. Tr G pyr cem,G lim cem,F dol cem,mfc incl,pl gn sh,
595–600		"	"	"	"	Sams. Fn/M-zr. Mch frstg,st. Ltl cl matx.
600–605		"	Light gray	Fn/M	"	Sang to rnd. Tr G pyr cem,P sil cem,mfc incl,Fn-zr,pl gn sh,cvd mat. Mch frstg,st,cl matx.
605–610		"	"	"	"	Same.
610–615		"	"	"	"	"
615–620		"	"	"	"	Same plus trace white dolomitic shale.
620–625		"	"	"	"	Same but the white shale is siliceous.
625–630		"	"	"	"	Same.
630–635		"	"	"	"	"
635–640		"	"	"	"	Same minus white shale.
640–645		"	"	"	"	Same.
645–650		"	White	Fn	"	Same plus tracs white siliceous shale.
650–655		"	"	"	"	Same.
655–660		"	"	"	"	" cvd mat. Mch frstg,st.
660–665		"	"	"	"	Sang to srnd. Tr P sil cem,mfc incl,Fn-zr,wh silcs sh,cl matx.
665–670		"	Lt yl gray	Fn/M-VC	"	Sang to Wrnd. Tr P sil cem,mfc incl,Fn-zr,wh silcs sh,pl gn sh,
670–675		"	"	"	"	Same. cvd mat. Mch frstg,st,cl matx.
675–680		"	"	"	"	"
680–685		"	Light gray	Fn/M	"	Same but subangular to rounded.
685–690		"	"	"	"	Sams.
690–695		"	"	"	"	"
695–700		"	"	"	"	"
700–705		"	Brown	"	"	Same but evsn more silt & clay(both brown),but minus both shales
705–710		"	"	"	"	Same.
710–715		"	Lt bn gray	"	"	Sang to rnd. Tr P sil cem,mfc incl,Fn-zr. Mch frstg,st,cl matx.
715–720		"	"	"	"	Same.
720–725		"	Pale brown	"	Vfn/Gran	"
725–730		"	Lt yl gray	M/C	"	Same but subangular to well rounded.
730–735		"	"	"	"	Sams.
735–740		"	V pl brown	C/VC	"	Same but rounded to well rounded.
740–745		"	"	"	"	Same plus trace light gray micaceous shale.
745–750		"	"	M&VC	"	Sang to Wrnd. Tr P sil cem,mfc incl,Fn-zr,cvd mat. Mch frstg,st, cl matx.
750–755		"	"	"	"	Sams.
755–760		"	"	"	"	Same plus tr wh silcs sh,gn gy sh. st,cl matx,
760–765		"	"	"	"	Sang to Wrnd. Tr P sil cem,mfc incl,hemic sh,cvd mat. Mch frstg,
765–770		"	"	"	"	Sang to Wrnd. Tr P sil cem,mfc incl,cvd mat,Fn/M-zr. Mch frstg, st,cl matx
770–775		"	"	M/C	"	Same.
775–780		"	"	C/VC	"	"
780–785		"	"	"	"	Sams plus trace whits shals.
785–790		"	"	"	"	Sams. mat. Mch frstg,st,cl matx.
790–795		"	"	M/C	"	Srnd to rnd. Tr P sil csm,mfc incl,Fn/M-zr,wh micus sh,pyr,cvd
795–800		"	Lt pk brown	C/VC	"	Srnd to Wrnd. Tr G sil cem,mfc incl,Fn/M-zr,rock frags. Mch
800–805		"	Pink	"	"	Same. frstg,st,cl matx.
805–810		"	"	C	"	"
810–815		Conglomsrate	Pk pk brown	Gran	Gran/S peb	Rnd to Wrnd. Mch frstg,otz snd,st,cl matx. Tr wh micus sh,gn
815–820		"	"	"	"	Same. rock frags,Fn/C mfc snds,mfc incl.

Appendix I

Log No. 7167

WISCONSIN GEOLOGICAL and NATURAL HISTORY SURVEY
3817 Mineral Point Road • Madison, WI 53705

Well name:

Depths	Graphic Section	Rock Type	Color	Grain Size Mode	Grain Size Range	Miscellaneous Characteristics
820–825		Sandstone	Pl pk bn	C/VC	Vfn/Gran	Rnd to Wrnd. Tr G sil cem,rd bn hemic sh,wh micus sh,ign rock
825–830		"	"	C	"	Same minus shales, frags,Fn/M-mfc snds,mfc incl. Mch frstg,st, cl matx.
830–835		"	"	C/VC	"	Same.
835–840		"	V pl brown	"	"	Rnd to Wrnd. Tr G sil cem,Fn/M-mfc snds,mfc incl. Mch frstg,st, cl matx.
840–845		"	"	"	"	Same but little clay matrix.
845–850		Shale	Dk yl rd	—	—	Hemic. Silcs. Mch rnd qtz snd(Vfn/Gran),st,wea ign rock frags
850–856		"	Dk rd bn	—	—	Same but ltl rnd qtz snd(Vfn/Gran), (almost sap). Tr wh silcs sh.
			END OF LOG			
		"See end of log" samples.				
325–330	G	Sandstone	Lt bn gray	Vfn/Fn	Vfn/VC	Ang. Mch G to VG dol cem,st(almost a sts). Tr gy sh,pk hem stng, pl gn sh,pyr,st/Vfn-glauc,cvd mat.
350–355	G	Sandstone	Light gray	M	Vfn/VC	Srnd to rnd. Chips rng from silty dol to sndy dol to dol cemtd ss. Mch VG dol cem,dolic sts,st,pk to rd bn hem stng,frstg. Ltl Fn/M-glauc. Few sec qtz grw. Tr pyr,pl gn sh,gy shale.
360–365	G	Sandstone	Light gray	C	Vfn/VC	Rnd to Wrnd. Mch G dol cem,frstg,st. Tr pk hem stng,pyr,mfc incl,pl gn sh,gy sh,Fn-zr.
370–375	G	Sandstone	V pl brown	M/C	Vfn/VC	Rnd to Wrnd. Tr F to G dol cem,mfc incl,pl gn sh,bl gy sh,cvd gy sh. Mch frstg,st.
445–450	G	Sandstone	Light gray	M/C	Vfn/VC	Srnd to Wrnd. Chips range from a slgtly sndy dol to a dom cemtd ss. Mch G to VG dol cem,pk stng(of dol),frstg,st,cl matx. Tr G pyr cem,pl gn sh,mfc incl,Fn-zr,cvd mat.
460–465	G	Sandstone	Light gray	C	Vfn/VC	Rnd to Wrnd. Mch VG dol cem(chips are sandier),frstg,st,cl matx, Ltl pk stng. Tr G pyr cem,Fn-zr,mfc incl,gn gy sh,mssv glauc.
485–490	G	Sandstone	Pink gray	M/C	Vfn/VC	Rnd to Wrnd. Mny slgtly sndy dol chips. Mch G dol cem,frstg,st, cl matx,pk stng of dol. Tr pyr,mfc incl,pl gn sh,wh silcs sh. Probably represents a dol cemtd ss between layers of a slgtly sndy to sndy dol.

WISCONSIN UNIQUE WELL NUMBER — WELL CONSTRUCTION

MU984

Well No. 7

State of Wi-Private Water Systems-DG/2
Department Of Natural Resources, Box 7921
Madison, WI 53707

Form 3300-77A
(Rev 02/02)bw

Appendix I

Depth 820 FT

Property Owner: MIDDLETON, CITY OF — Telephone Number: - -

Mailing Address: 7426 HUBBARD AVE

City: MIDDLETON — State: WI — Zip Code: 53562

County of Well Location: 13 DANE SC — Co Well Permit No W — Well Completion Date: March 22, 1999

Well Constructor: MARK J TRAUT — License #: 5911

Address: 141 28TH AVE SO

City: WAITE PARK — State: MN — Zip Code: 56387

Hicap Permanent Well #: 2317 — Common Well #: 007

Facility ID (Public): 113024230

Public Well Plan Approval#: 92-0152

Date Of Approval: 10/09/1997

Specific Capacity: 15.4 gpm/ft

1. Well Location

T=Town C=City V=Village: C of MIDDLETON — Fire#:

Street Address or Road Name and Number: 6711 STONEFIELD RD

Subdivision Name: — Lot#: 165 — Block #:

Gov't Lot — or SW 1/4 of NW 1/4 of

Section 13 T 7 N R 8 E

2. Well Type 2 (See item 12 below)

1=New 2=Replacement 3=Reconstruction

of previous unique well # EJ763 constructed in 1997

Reason for replaced or reconstructed Well?

ALIGNMENT PROBLEM/NEVER P

3. Well Serves M # of homes and or (eg: barn, restaurant, church, school, industry, etc.)

M=Munic O=OTM N=NonCom P=Private Z=Other X=NonPot A=Anode L=Loop H=Drillhole

High Capacity: Well? Y Property? Y

1 1=Drilled 2=Driven Point 3=Jetted 4=Other

4. Is the well located upslope or sideslope and not downslope from any contamination sources, including those on neighboring properties? Y

Well located in floodplain? N

Distance in feet from well to nearest: (including proposed)

1. Landfill
2. Building Overhang
3. 1=Septic 2= Holding Tank
4. Sewage Absorption Unit
5. Nonconforming Pit
6. Buried Home Heating Oil Tank
7. Buried Petroleum Tank
8. 1=Shoreline 2= Swimming Pool
9. Downspout/ Yard Hydrant
10. Privy
11. Foundation Drain to Clearwater
12. Foundation Drain to Sewer
13. Building Drain 1=Cast Iron or Plastic 2=Other
14. Building Sewer 1=Gravity 2=Pressure 1=Cast Iron or Plastic 2=Other
50 15. Collector Sewer: ___ units ___ in . diam.
16. Clearwater Sump
17. Wastewater Sump
18. Paved Animal Barn Pen
19. Animal Yard or Shelter
20. Silo
21. Barn Gutter
22. Manure Pipe 1=Gravity 2=Pressure 1=Cast iron or Plastic 2=Other
23. Other manure Storage
24. Ditch
25. Other NR 812 Waste Source

5. Drillhole Dimensions and Construction Method

Dia.(in.)	From (ft)	To (ft)
26.0	surface	155
25.0	155	375
19.0	375	820

Upper Enlarged Drillhole — Lower Open Bedrock

-- 1. Rotary - Mud Circulation
-- 2. Rotary - Air
-- 3. Rotary - Air and Foam
-- 4. Drill-Through Casing Hammer
-- 5. Reverse Rotary
X -- 6. Cable-tool Bit _ n. dia
-- 7. Temp. Outer Casing _ in. dia. _____ depth ft. Removed ?

Other

6. Casing Liner Screen

Dia. (in.)	Material, Weight, Specification Manufacturer & Method of Assembly	From (ft.)	To (ft.)
26.0	WELDED 26 OD X 500 WALL AP15L-B/X42	surface	155
20.0	WELDED 20 OD X .375 WALL AP15L-B/X42	0	375

Dia.(in.)	Screen type, material & slot size	From	To

7. Grout or Other Sealing Material

Method PUMP THRU TRIMIE

Kind of Sealing Material	From (ft.)	To (ft.)	# Sacks Cement
NEAT CEMENT	surface	375.0	130 Y

8. Geology

Geology Codes	Type, Caving/Noncaving, Color, Hardness, etc	From (ft.)	To (ft.)
__Y_	GLACIAL DRIFT/SAND & GRAVEL	0	113
__YN	SANDSTONE/LAYERS OF SAND &	113	120
__N_	IRONTON GALESVILLE	120	340
G_H_	EAU CLAIRE/GRAY SHALE	340	405
IMN_	SANDSTONE/WHITE/MED HARD	405	438
__NH	SANDSTONE/SHALE LAYERS/WHITE	438	515
G_NH	SANDSTONE/SHALE LAYERS/GRAY	515	757
T_N_	SANDSTONE/TAN/CLEAN	757	820

9. Static Water Level

132.0 feet B ground surface (A=Above B=Below)

10. Pump Test

Pumping level 272.4 ft. below surface

Pumping at 2165.0 GP M 24.0 Hrs

11. Well Is:

24 in. A Grade (A=Above B=Below)

Developed? Y

Disinfected? Y

Capped? Y

12. Did you notify the owner of the need to permanently abandon and fill all unused wells on this property? Y

If no, explain

13. Initials of Well Constructor or Supervisory Driller: MJT — Date Signed: 3/22/99

Initials of Drill Rig Operator (Mandatory unless same as above) — Date Signed: 3/22/99

Additonal Comments?

Owner Sent Label? Y

Variance Issued?

More Geology?

WELL

Batch 783

WISCONSIN UNIQUE WELL NUMBER **WL773**

Well No. 8

State of Wi-Private Water Systems-DG/2
Department Of Natural Resources, Box 7921
Madison, WI 53707

Form 3300-77A (Rev 02/02)bw

Appendix I

Depth **740** FT

Property Owner: City of Middleton		Telephone Number: 608 -836-7144	
Mailing Address: 7426 Hubbard Avenue			
City: Middleton	State: WI	Zip Code: 53562	
County of Well Location: 13 DANE	SC	Co Well Permit No: W	Well Completion Date: September 29, 2008

1. Well Location

T=Town C=City V=Village: T of WESTPORT

Fire#:

Street Address or Road Name and Number: WESTPOINT ROAD

Subdivision Name | Lot# | Block #

Gov't Lot or NW 1/4 of NE 1/4 of

Section 6 T 7 N R 9 E

Well Constructor: MUNICIPAL WELL & PUMP/MIDWEST		License #: 13	Facility ID (Public): 113024230
Address: 1212 STOREBECK DR			Public Well Plan Approval#: 2007-0735
City: WAUPUN	State: WI	Zip Code: 53963	Date Of Approval: 01/28/2008
Hicap Permanent Well #: 70066	Common Well #: 8		Specific Capacity: 11.2 gpm/ft

2. Well Type 1 (See item 12 below)

1=New 2=Replacement 3=Reconstruction

of previous unique well # _____ constructed in _____

Reason for replaced or reconstructed Well?

1 1=Drilled 2=Driven Point 3=Jetted 4=Other

3. Well Serves M # of homes and or City (eg: barn, restaurant, church, school, industry, etc.)

M=Munic O=OTM N=NonCom P=Private Z=Other X=NonPot A=Anode L=Loop H=Drillhole

High Capacity: Well? Y Property? Y

4. Is the well located upslope or sideslope and not downslope from any contamination sources, including those on neighboring properties? Y

Well located in floodplain? N

Distance in feet from well to nearest: (including proposed)

1. Landfill
2. Building Overhang
3. 1=Septic 2= Holding Tank
4. Sewage Absorption Unit
5. Nonconforming Pit
6. Buried Home Heating Oil Tank
7. Buried Petroleum Tank
8. 1=Shoreline 2= Swimming Pool
9. Downspout/ Yard Hydrant
10. Privy
11. Foundation Drain to Clearwater
12. Foundation Drain to Sewer
13. Building Drain 1=Cast Iron or Plastic 2=Other
14. Building Sewer 1=Gravity 2=Pressure 1=Cast Iron or Plastic 2=Other
15. Collector Sewer: ___ units ___ in . diam.
16. Clearwater Sump
17. Wastewater Sump
18. Paved Animal Barn Pen
19. Animal Yard or Shelter
20. Silo
21. Barn Gutter
22. Manure Pipe 1=Gravity 2=Pressure 1=Cast iron or Plastic 2=Other
23. Other manure Storage
24. Ditch
25. Other NR 812 Waste Source

5. Drillhole Dimensions and Construction Method

Dia.(in.)	From (ft)	To (ft)
29.0	surface	27
25.0	27	300
19.0	300	740

Upper Enlarged Drillhole — Lower Open Bedrock

X -- 1. Rotary - Mud Circulation

-- 2. Rotary - Air X

-- 3. Rotary - Air and Foam

-- 4. Drill-Through Casing Hammer

-- 5. Reverse Rotary

-- 6. Cable-tool Bit _ n. dia

-- 7. Temp. Outer Casing _ in. dia. _____ depth ft. Removed ?

Other

6. Casing Liner Screen Material, Weight, Specification Manufacturer & Method of Assembly

Dia. (in.)	Material, Weight, Specification, Manufacturer & Method of Assembly	From (ft.)	To (ft.)
26.0	New 0.500 IN. Wall ASTM A53B	surface	27
20.0	New 0.375 wall ASTM A53B	0	300

Dia.(in.)	Screen type, material & slot size	From	To

7. Grout or Other Sealing Material

Method Tremie Pipe - Pumped

Kind of Sealing Material	From (ft.)	To (ft.)	# Sacks Cement
Neat cement grout	surface	300.0	482 S

Geology Codes	8. Geology Type, Caving/Noncaving, Color, Hardness, etc	From (ft.)	To (ft.)
_C_	Clay	0	15
YHN_	Yellow, Hard/Firm, Sandstone	15	180
R_H_	Red, Shale	180	220
YHN_	Yellow, Hard/Firm, Sandstone	220	265
ISN_	White, Soft/Loose, Sandstone	265	325
GHN_	Gray, Hard/Firm, Sandstone	325	375
T_N_	Tan/Brown, Sandstone	375	420
IHN_	White, Hard/Firm, Sandstone	420	460
T_NH	TAN/BROWN, SANDSTONE, SHALEY	460	720
R_H_	RED, SHALE	720	740

9. Static Water Level

8.0 feet B ground surface

A=Above B=Below

10. Pump Test

Pumping level 209.0 ft. below surface

Pumping at 2250.0 GP M 24.0 Hrs

11. Well Is: 60 in. A Grade

A=Above B=Below

Developed? Y

Disinfected? Y

Capped? Y

12. Did you notify the owner of the need to permanently abandon and fill all unused wells on this property? N

If no, explain None

13. Initials of Well Constructor or Supervisory Driller TG Date Signed 10/13/08

Initials of Drill Rig Operator (Mandatory unless same as above) DS Date Signed 10/13/08

Additonal Comments?

Owner Sent Label? Y

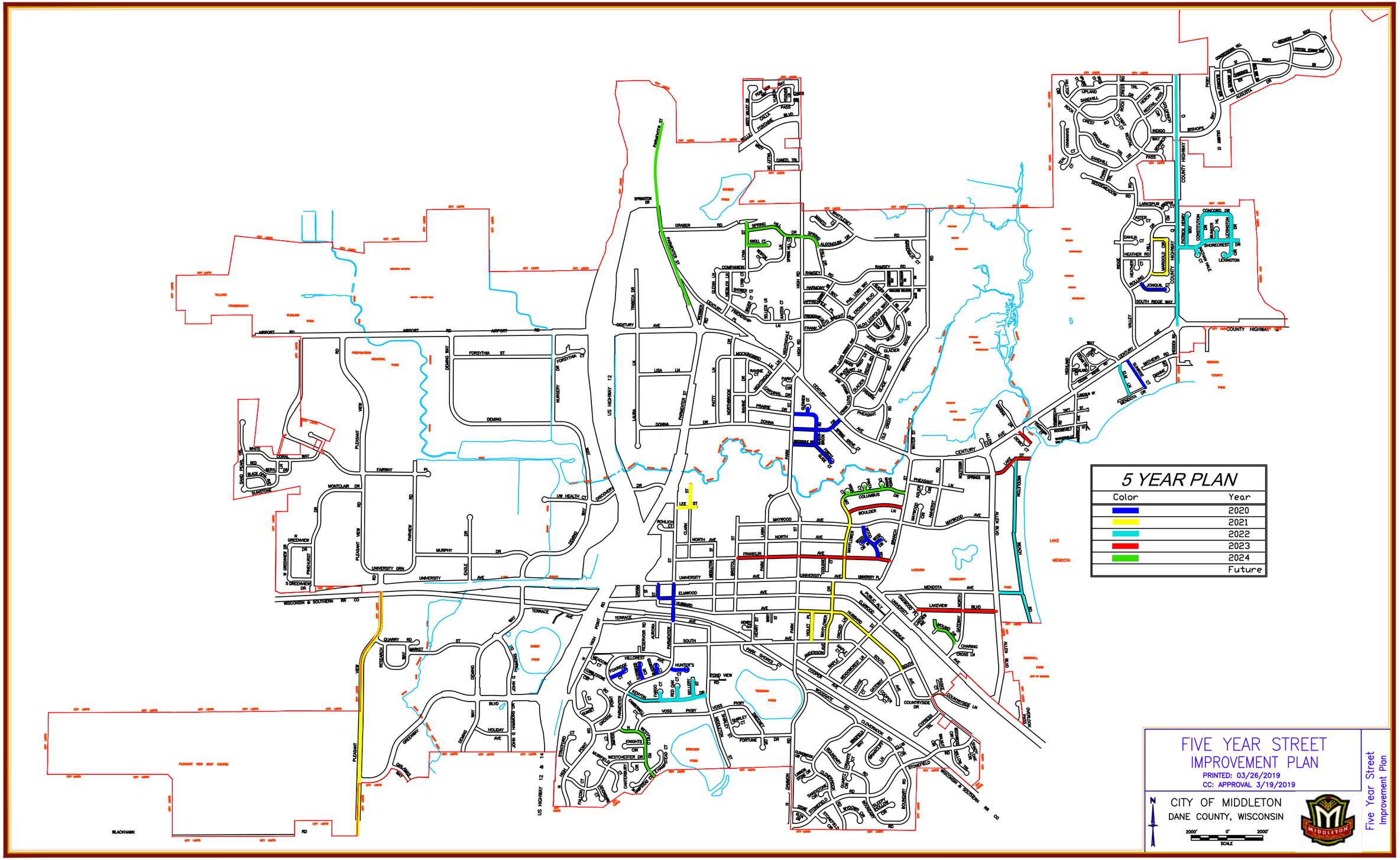
Variance Issued? N

More Geology?

ELECTRONIC

Batch 888888888

APPENDIX D
FIVE-YEAR STREET IMPROVEMENT PLAN


5 YEAR PLAN
Color
Year
2020
2021
2022
2023
2024
Future
FIVE YEAR STREET IMPROVEMENT PLAN
PRINTED: 03/26/2019
CC: APPROVAL 3/19/2019
CITY OF MIDDLETON
DANE COUNTY, WISCONSIN
2000' 0' 2000'
SCALE
Five Year Street Improvement Plan
PARMENTER ST
US HIGHWAY 12
US HIGHWAY 12 & 14
COUNTY HIGHWAY
AIRPORT RD
DEMING WAY
FORSYTHIA ST
CENTURY AVE
HIGH RD
MIDDLETON
PLEASANT VIEW GOLF COURSE
BLACKHAWK RD
WISCONSIN & SOUTHERN RR CO
LAKE MENDOTA

For more location information please visit www.strand.com

Office Locations

Brenham, Texas | 979.836.7937

Cincinnati, Ohio | 513.861.5600

Columbus, Indiana | 812.372.9911

Columbus, Ohio | 614.835.0460

Indianapolis, Indiana | 317.423.0935

Joliet, Illinois | 815.744.4200

Lexington, Kentucky | 859.225.8500

Louisville, Kentucky | 502.583.7020

Madison, Wisconsin* | 608.251.4843

Milwaukee, Wisconsin | 414.271.0771

Phoenix, Arizona | 602.437.3733

*Corporate Headquarters

STRAND ASSOCIATES®

Appendix J

Legend
- MMSD Manhole
- MMSD Air Release
- MMSD Pump Station
- MMSD Gravity Main
- MMSD Force Main
- Air Release Valve
- Cleanout
- Lift Station
- Manhole; Plug
- Gravity Main
- Force Main
- City Limits

Sewer Segment
Segment Capacity (cfs)
Existing Peak Flow (cfs)
Future Peak Flow (cfs)

PS ID
Capacity (gpm)
Existing Peak Flow (gpm)
Future Peak Flow (gpm)

0 125 250 500 Feet

FIGURE 4.01-1
EXISTING COLLECTION SYSTEM

UTILITY MASTER PLAN
CITY OF MIDDLETON
DANE COUNTY, WISCONSIN

STRAND ASSOCIATES®

1024.057

Path: S:\MAD\1000+\1061\024\057\Drawings\[4]Figure\Fig 4_01* Collection System Map.dwg
User: dsmc
Date: 10/29/2019
Time: 8:11:36 AM

Appendix K



Study Area (83.88 ac)
Dane Co 1' Contours
Waterways
Culverts
Field Delineated Wetlands (28.33 ac)

Sample Points
- Upland
- Wetland

Approx. updated wetland boundary

Bird Dr
Belle Fontaine Blvd
Lily Ln
Misty Dr
High Rd
Pheasant Branch Rd
Graber Rd
Spring Hill Dr
Lynn St
Knoll Ct
Companion Ln
Spring Hill Ct
Manito Ct
Algonquin Dr
Whittlesey Rd
Mandimus Ct

P01 P02 P03 P04 P05 P06 P07 P08 P09 P10 P11 P12 P13 P14 P15 P16 P17 P18 P19 P20 P21 P22

W-1 W-2 W-3 W-4 WW-1 WW-2 WW-2

0 150 300 Ft

N

Heartland ECOLOGICAL GROUP INC

Figure 7. Field Delineated Wetlands
Ziegler High Road
Project #20241306
T7N, T8N, R8E, S35, 36
T Springfield & Middleton, C Middleton, Dane Co
2022 Orthophoto
Dane Co, HEG LRR: NCNE

Figure Created: 7/23/2024

Appendix L

Housing Affordability Report

City of Middleton, WI

2020

AS REQUIRED UNDER SECTION 66.10013 OF THE WISCONSIN STATUTES

Prepared by Abby Attoun, Director of Planning & Community Development

June 26, 2024

Background

This report is written to satisfy the requirements as outlined in Section 66.10013 of the Wisconsin Statutes. Section 66.10013 reads as follows:

> (1) In this section, "municipality" means a city or village with a population of 10,000 or more.
>
> (2) Not later than January 1, 2020, a municipality shall prepare a report of the municipality's implementation of the housing element of the municipality's comprehensive plan under s. 66.10001. The municipality shall update the report annually, not later than January 31. The report shall contain all of the following:
>
> > (a) The number of subdivision plats, certified survey maps, condominium plats, and building permit applications approved in the prior year.
> >
> > (b) The total number of new residential dwelling units proposed in all subdivision plats, certified survey maps, condominium plats, and building permit applications that were approved by the municipality in the prior year.
> >
> > (c) A list and map of undeveloped parcels in the municipality that are zoned for residential development.
> >
> > (d) A list of all undeveloped parcels in the municipality that are suitable for, but not zoned for, residential development, including vacant sites and sites that have potential for redevelopment, and a description of the zoning requirements and availability of public facilities and services for each property.
> >
> > (e) An analysis of the municipality's residential development regulations, such as land use controls, site improvement requirements, fees and land dedication requirements, and permit procedures. The analysis shall calculate the financial impact that each regulation has on the cost of each new subdivision. The analysis shall identify ways in which the municipality can modify its construction and development regulations, lot sizes, approval processes, and related fees to do each of the following:
> >
> > > 1. Meet existing and forecasted housing demand.
> > >
> > > 2. Reduce the time and cost necessary to approve and develop a new residential subdivision in the municipality by 20 percent.
>
> (3) A municipality shall post the report under sub. (2) on the municipality's Internet site on a web page dedicated solely to the report and titled "Housing Affordability Analysis."

Section A: Number of Approvals in the Prior Year (Plats, CSMs, permits)

The chart below includes the number of subdivision plats, certified survey maps (CSMs), condominium plats, and building permit applications approved in the year 2019.

	2019
Subdivision Plats	0
Certified Survey Maps (CSMs)	3
Condominium Plats	0
Building Permit Applications	1463*

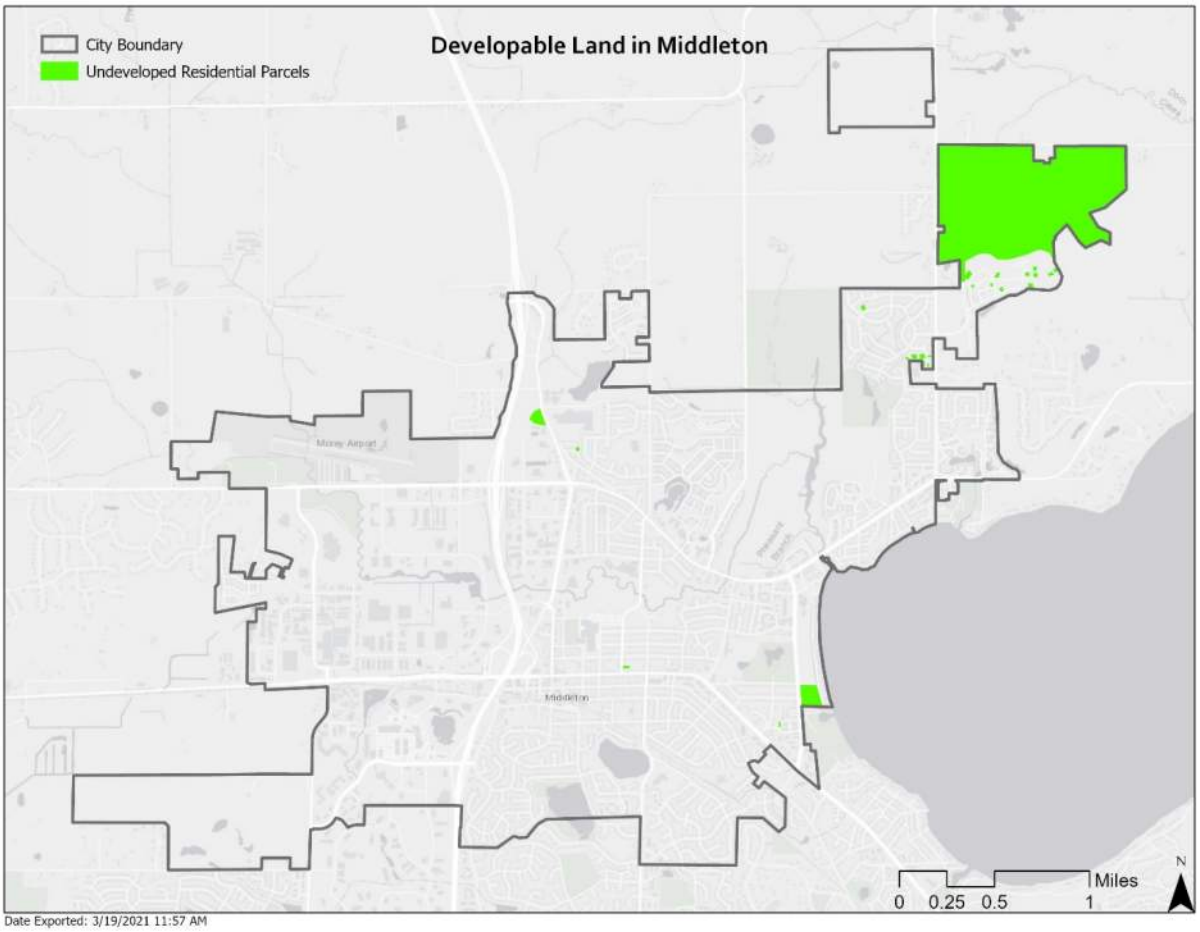
* See Appendix A for a full listing.

Section B: Number of Residential Dwelling Units Approved in the Prior Year

The City issued building permits for a total of 97 residential units in 2019.

Section C: List and Map of Undeveloped Parcels

The following includes a map of undeveloped parcels in the municipality that are zoned for residential development.



Section D: List and Map of Undeveloped Parcels

The City has two active tax increment districts (TID). The project plans for each TID include areas that include areas that are suitable for, but not zoned for, residential development, including vacant sites and sites that have potential for redevelopment. These project plans are linked below.

TID District #3

TID District #5

A description of the zoning requirements is linked below.

Zoning Ordinance

An availability of public facilities and services for properties are linked below.

Geographic Information Systems Mapping

Section E: Residential Development Regulations

1. Zoning regulations. The zoning ordinance for the City of Middleton is Chapter 10 of the City's Code of Ordinances and can be found here: https://www.cityofmiddleton.us/DocumentCenter/View/20/middch10?bidId=. The current zoning map for the City of Middleton can be found here: https://www.cityofmiddleton.us/DocumentCenter/View/125/Zoning-Map?bidId=. The summary table of zoning districts is found at page 117 of the City Zoning Ordinance.

The purpose of this section is to examine the residential zoning ordinances currently in the City of Middleton, based on the standard in the Comprehensive Planning Law to "provide a range of housing choices that meet the needs of persons of all income levels and of all age groups and persons with special needs." (Wis. Stat. 66.1001(2)(b) The purpose of this section is to discuss the general requirements of the zoning ordinance relative to housing supply. However, more detailed regulations and zoning requirements do apply to each parcel, and this report does not offer any legal interpretation of the applicability of the zoning ordinance to any parcel in the city. The zoning ordinance is a legally binding ordinance which governs development on any parcel. Furthermore, this report does not analyze those areas outside of the City of Middleton currently under extraterritorial zoning in the Joint Planning Area with the Town of Westport.

There are currently 4 zoning districts designated as "residential" zoning districts with an "R"-prefix: R1, R2, R3, and R3a. In the R1 district, single-family detached dwelling units are permitted uses by right. In the R2 district, single-family and two-family detached dwelling units are permitted uses by right. In the R3 district, 3-8 family dwelling unit structures, along with single-family and two-family detached dwelling units are permitted uses by right. R3A zoning is

limited to existing multifamily dwellings prior to the 1984 zoning ordinance that were zoned "R3 or R4" under the pre-1984 ordinance.

Accessory apartments on single-family detached dwellings are conditional uses in the R1, R2 and R3 zoning districts. Group homes for fewer than 8 persons are permitted by right in the R1 and R2 district, and for 9 or more persons as a conditional use. In the R3 district, group homes for up to 15 persons are permitted by right, and for 16 or more persons as a conditional use. Zero-lot-line duplexes are a conditional use.

In addition to parking requirements, the zoning regulations of minimum lot area, frontage/lot width requirements, lot coverage, building height, density, of the residential zoning districts would affect the price, availability, and type of housing supplied. The following table is taken from the zoning ordinance.

Illustration 10: Summary of Zoning Districts

Zoning District	Description	Min. Lot Area	Max. Lot Coverage	Minimum Setback			Max. Building Height	Max. Density D.U/ Acre	Min. Lot Width
				Front	Rear	Side			
R-1	Residential, Single-family Detached Units	7,200 Sq. ft	0.35	24 ft*	30 ft	8 ft *	35' or 3 stories, whichever is less	4.8	60 ft
R-2	Residential, Two-family Attached Units	10,000 Sq. ft	0.35	24 ft *	30 ft	8 ft *	35' or 3 stories, whichever is less	6.9	80 ft
R-3	Residential Structures Having 3-5 Dwelling Units	Depends on number of D.U.	0.35	30 ft	30 ft	10 ft (20 feet if abut R-1)	35' OR 3 stories, whichever is less	8.2	120 ft
R-3A	High Density Residential ****	12,000 Sq. ft	N/A	30 ft	40 ft	15 ft or 1/2 bldg. height (greater of)	60' OR 5 stories, whichever is greater	-	120 ft

Nearly all new residential subdivisions and multifamily buildings constructed in the City of Middleton in the past 20 years, however, have utilized the Planned Development District (PDD) under section 10.82 of the city zoning ordinance.

2. Private law residential development regulations. Nearly all residential neighborhoods consisting of mostly single-family houses in the city have recorded covenants and restrictions as part of the neighborhood plat which limits development to single-family detached houses. In some cases, minimum lot areas and set-back requirements in the recorded covenants exceed city zoning standards. Many recorded covenants would prohibit construction of accessory apartment units or 2- or 3-family buildings on single-family parcels.

3. Land division and subdivision regulations. Chapter 19 of the City's Code of Ordinances contains the Land Division and Subdivision Regulations, which also includes preliminary and final plat approval procedures, as well as CSM (certified survey map or "minor subdivision") procedures. These regulations can be found here: https://www.cityofmiddleton.us/DocumentCenter/View/29/middch19?bidId=. The City's Land Division and Subdivision Regulations also include plat submission requirements, required improvements, and design standards as well as procedures for assessing fees and land dedication.

4. Comparison of fees to neighboring jurisdictions. The City of Fitchburg recently completed a housing study to compare development fees in comparable jurisdictions, including the City of Middleton. In this study, they created a sample development of 30 single-family homes, 16 duplexes, and 60 multi-family units in one building. The following figure from the "Fitchburg Housing Plan" shows how fees in Middleton compare to neighboring cities. For the sample development analyzed, fees in Middleton would be higher than in Madison, Sun Prairie, DeForest, and Waunakee, but less than in Fitchburg or Verona.

Figure 26. Peer Community Fees for Sample Development Project

	City of Fitchburg	City of Madison	City of Middleton	City of Sun Prairie	City of Verona	Village of DeForest	Village of Waunakee
Total Fee per Single Family Dwelling Unit	$8,687	$6,971	$6,598	$3,578	$8,321	$6,540	$5,438
Total Fee per Duplex Dwelling Unit	$7,579	$6,331	$5,860	$3,126	$7,362	$6,259	$4,826
Total Fee per Multifamily Dwelling Unit	$5,359	$4,179	$3,829	$2,629	$4,090	$4,679	$3,675
DEVELOPMENT TOTAL (30 single family, 16 duplex units, 60 multifamily)	$703,414	$560,771	$521,445	$315,102	$612,830	$577,070	$460,883
Development Total Without Parks Fees	$209,054	$122,212	$181,555	$134,902	$320,730	$117,268	$145,840

Source: Fitchburg Housing Plan, 2019. Urban Assets/MSA Professional Services.

5. Meeting existing and forecasted housing demand.

a) *Population forecasts*. The City has just completed the 2021 Comprehensive Plan, and new population and housing unit forecasts are part of the plan. The adopted plan can be found here: https://www.cityofmiddleton.us/366/2021-Comprehensive-Plan-Update. The current comprehensive plan includes a forecasted population through 2035 of 24,865 people. As of January 1, 2020, the City's estimated population is 21,050 (Wisconsin Dept. of Administration, Demographic Services Center). Thus, during the recent decade, Middleton has met or exceeded its forecasted housing demand.

The population projections prepared by Wisc. Dept. of Admin. in 2013 (Vintage 2013 projections), project a 2020 population for Middleton of 19,670, so housing unit growth in the past 6 years has already met forecasted demand. These same Vintage-2013 projections show a 2040 population of Middleton of 23,230 people in 11,410 households.

b) *Range of housing choices*. We interpret the law requiring a plan for a range of housing choices to include small-lot single-family housing, 1- to 4-family housing, smaller multi-family buildings (5-9 units), and larger multi-family buildings (10+ units). These categories generally overlap with Census data on housing structures.

The table below is from the Dane County Housing Needs Assessment (2019 update), which compares the distribution of the housing stock in Middleton with other Dane County cities. Middleton does provide a range of housing choices consistent with the distribution of housing unit types in other urban cities in the county.

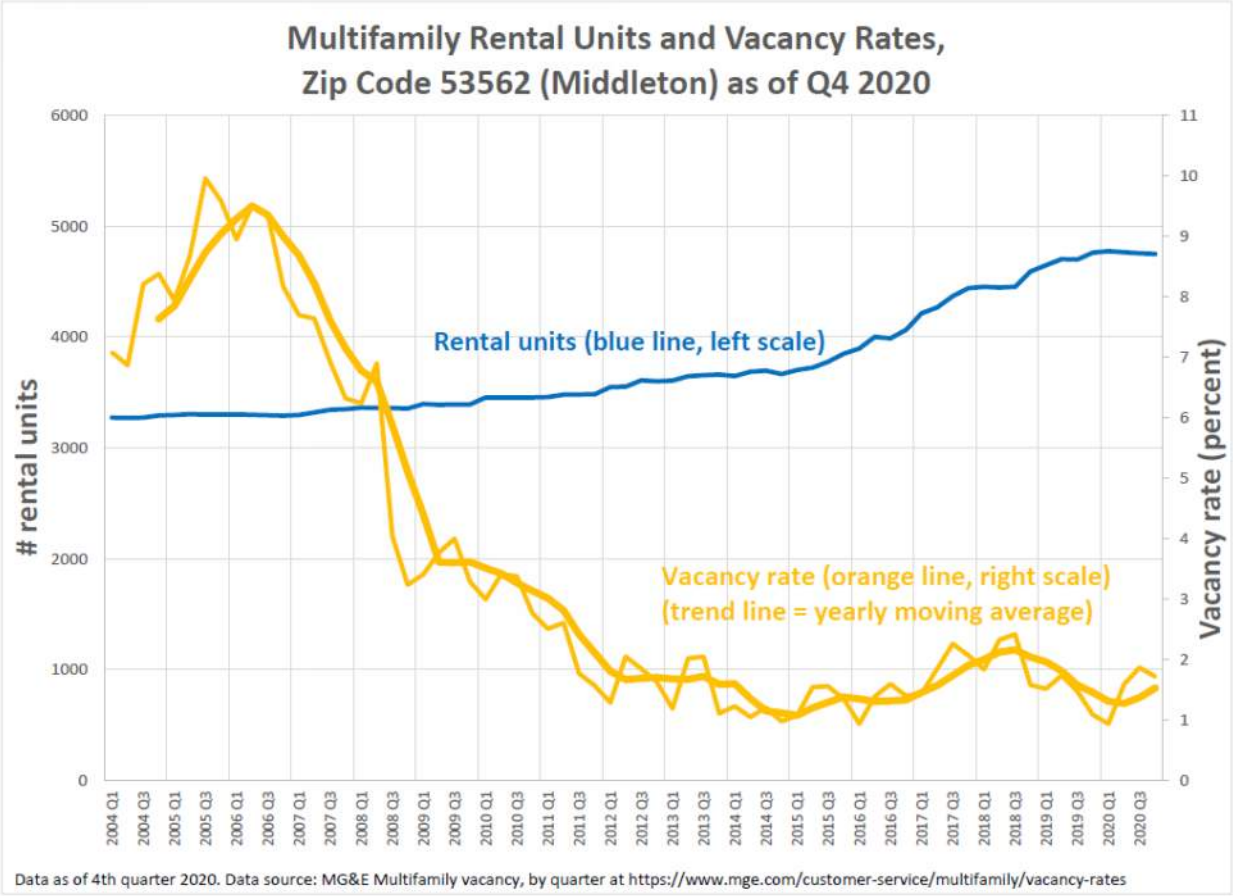
Table 22. Housing unit type (percent of housing stock) distribution, Dane County municipalities (2017)

	Single-family detached	***1 (attached) - 4 units***	***5-9 units***	***10+ units***
Cities				
Madison	42.8%	17.7%	*8.5%*	31.0%
Sun Prairie	45.2%	26.3%	*6.5%*	21.9%
Fitchburg	41.9%	16.7%	*8.4%*	33.0%
Middleton	42.7%	16.0%	*8.9%*	32.4%
Stoughton	63.1%	20.1%	*5.3%*	11.6%
Verona	58.0%	19.4%	*4.4%*	18.3%
Monona	55.4%	8.5%	*4.1%*	32.0%
Cities Total	***44.4%***	***18.2%***	***8.0%***	***29.4%***

In terms of lot sizes, it is a goal of the city of offer a wider range of housing options within each neighborhood. Two of the more recently platted neighborhoods within the city, Hidden Oaks and Middleton Ridge/Misty Valley offer a range of lot sizes, including many smaller options. Lot

sizes in Middleton Ridge/Misty Valley range from 4,000 ft^2 to 15,000 ft^2, and lot sizes in Hidden Oaks range from 3,600 ft^2 to 12,000 ft^2.

c) *Existing housing demand.* Vacancies for housing in Middleton are currently very low, relative to historical trends and targeted vacancy percentages. According to the most recent US Census data available (2019), the vacancy rate for owner-occupied housing in Middleton is 3.0 percent. The chart below shows the number of multi-family rental units and the vacancy rate for those units over time for the 53562 zip code, based on data from the Madison Gas and Electric (MG&E) company. As of the end of the fourth quarter in 2020, the multifamily rental vacancy rate for Middleton was 1.72 percent.



6. *Analysis of financial impact.* Based on our analysis of development regulations within Middleton, the following table illustrates the possible effect on housing prices of reduced minimum lot sizes from 7,200 ft^2 (current R1 zoning) to 3,600 ft^2 (as in some areas of newer subdivisions permitted under PDD zoning). The estimate of per-square foot land costs was based on the average assessed value per square foot of single-family lots in the city, and the construction cost data is from the national construction cost estimating company R.S. Means. This simple comparison assumes construction of an average quality, 3-bedroom 2-bath home.

Of course, this comparison likely understates the effects of land costs on housing quality, as developers will produce a higher finish-level house when land costs for a development lot are expensive. This analysis shows that reducing lot requirements by half in this case does reduce housing costs more than 20 percent. In this example, the finished lot cost is less because of the smaller lot size, and the hard costs of construction the house are smaller because of the assumption that a developer will build a smaller house on a smaller lot.

INPUTS	**Option 1 (Middleton)**	**Option 2 (Middleton)**
Finished Lot Size (sq. ft).	7200	3600
Finished House Size (sq.ft)	2000	1600
Overhead/Contractor Profit Percentage	0.2	0.2
2nd bathroom?	Y	Y
PARAMETERS		
Ave. Finished Land Value per square foot	$12.21	$12.21
Ave. Sq. Ft. Costs (average quality, no basement, 2 story, 1 bath, stucco) (RS Means)	$119.68	$128.42
Garage (1 car, attached)	$17,000.00	$17,000.00
2nd bathroom cost	$9,000.00	$9,000.00
OUTPUTS		
Finished lot value	$87,912	$43,956
Finished house cost (base cost)	$239,360	$205,472
Contractor overhead/profit	$47,872	$41,094
Municipal Impact Fees	$6,000	$6,000
Garage	$17,000	$17,000
2nd bathroom	$9,000	$9,000
HOUSE PRICE	**$407,144**	**$322,522**

The following includes a description of fees related to land use controls, site improvement requirements, fees and land dedication requirements, and permit costs.

Chapter 11 - Building Code		
Building Permits & Inspection	***Permit Fee Schedule Under 11.05(14)***	
New Construction	Building permits - Base fee	$150.00
New Construction	Building permits - fee determined by building group & size-Group 1	$.090 per square foot
New Construction	Building permits - fee determined by building group & size-Group 2	$.120 per square foot
New Construction	Building permits - fee determined by building group & size-Group 3	$.080 per square foot
New Construction	Building permits - Erosion control (single-family, residential)	$150.00

New Construction	Building permits - Erosion control (two-family, residential)	$200.00
New Construction	Electrical permits - base fee	Residential: $50.00 Commercial: $100.00
New Construction	Electrical permits - fee determined by building group & size - Group 1	$.050 per square foot
New Construction	Electrical permits - fee determined by building group & size - Group 2	$.070 per square foot
New Construction	Electrical permits - fee determined by building group & size - Group 3	$.050 per square foot
New Construction	Plumbing permits - base fee	Residential: $50.00 Commercial: $100.00
New Construction	Plumbing permits - fee determined by building group & size - Group 1	$.050 per square foot
New Construction	Plumbing permits - fee determined by building group & size - Group 2	$.070 per square foot
New Construction	Plumbing permits - fee determined by building group & size - Group 3	$.050 per square foot
New Construction	Heating-ventilation-AC permits - base fee	Residential: $50.00 Commercial: $100.00
New Construction	Heating-ventilation-AC permits - fee determined by building group & size - Group 1	$.050 per square foot
New Construction	Heating-ventilation-AC permits - fee determined by building group & size - Group 2	$.070 per square foot
New Construction	Heating-ventilation-AC permits - fee determined by building group & size - Group 3	$.050 per square foot
Alterations & Repairs to Existing Buildings	Building permits - Base fee	Minimum fee plus $5.00 per $1000.00 cost or fraction thereof
Alterations & Repairs to Existing Buildings	Building permits - minimum fee	Residential: $50.00 Commercial: $100.00
Alterations & Repairs to Existing Buildings	Electrical permits - base fee	Residential: $50.00 Commercial: $100.00
Alterations & Repairs to Existing Buildings	Electrical permits - permanent service	$20.00 for each 100 AMP

Alterations & Repairs to Existing Buildings	Electrical permits - feeders or circuits	$3.00 for each 0-30 AMP; $6.00 for each 30-60 AMP; $10.00 for each 61-100 AMP and $14.00 for each additional 100 AMP
Alterations & Repairs to Existing Buildings	Plumbing permits - base fee	Residential: $50.00 Commercial: $100.00
Alterations & Repairs to Existing Buildings	Plumbing permits - water service	$100.00 per 100 feet
Alterations & Repairs to Existing Buildings	Plumbing permits - sewer	$100.00 per 100 feet
Alterations & Repairs to Existing Buildings	Plumbing permits -- meter couplings	$15.00 each
Alterations & Repairs to Existing Buildings	Plumbing permits – fixtures	$6.00 each
Alterations & Repairs to Existing Buildings	Plumbing permits - sprinkler (lawn)	$25.00 + $6.00 for each fixture
Alterations & Repairs to Existing Buildings	Plumbing permits – Air admittance valves	$50.00 each
Alterations & Repairs to Existing Buildings	Heating-Ventilating-Air Conditioning Permits - base fee	Residential: $50.00 Commercial: $100.00
Alterations & Repairs to Existing Buildings	Heating-Ventilating-Air Conditioning Permits – cost based fee; cost includes labor and materials as determined by Building Inspector	$4.00 per $1,000, roundest to nearest 1,000
Alterations & Repairs to Existing Buildings	Heating-Ventilating-Air Conditioning Permits – gas connections	$6.00 each
Misc. Fees & Requirements	Temporary Electrical Service	Residential: $50.00 Commercial: $100.00
Misc. Fees & Requirements	Swimming pools (requires electrical & plumbing permits)	$60.00 (above ground) $80.00 (below ground)

Misc. Fees & Requirements	Permit to start construction – residential (per permit)	$250.00
Misc. Fees & Requirements	Permit to start construction – commercial (per permit)	$500.00
Misc. Fees & Requirements	Moving of buildings or structure	$250.00 per structure
Misc. Fees & Requirements	Demolition, whole building	$100.00 per building
Misc. Fees & Requirements	Failure to obtain occupancy permit	Residential: $250.00 Commercial: $500.00
Misc. Fees & Requirements	Automatic Fire Suppression System and/or Fire Alarm System - see attached document.	
Misc. Fees & Requirements	Wisconsin Uniform Building Permit Seal	$45.00 per seal
Misc. Fees & Requirements	Fences & sheds	$30.00 each
Misc. Fees & Requirements	Additional & misc. inspections	$50.00 per inspection
Misc. Fees & Requirements	Blocking street or alley (30 days, 6 months maximum)	$30.00 per 30 days
Misc. Fees & Requirements	Residential Plan Review Single family Two family	 $150.00 $200.00

Misc. Fees & Requirements	Commercial Plan Review: Building Area (sq. ft.)	
	Less than 2,500	$350.00
	2,501-5,000	$400.00
	5,001-10,000	$600.00
	10,001-20,000	$800.00
	20,001-30,000	$1,200.00
	30,001-40,000	$1,500.00
	40,001-50,000	$2,000.00
	50,001-75,000	$2,700.00
	75,001-100,000	$3,400.00
	100,001-200,000	$5,500.00
	200,001-300,000	$9,600.00
	300,001-400,000	$14,100.00
	400,001-500,000	$16,800.00
	Over 500,000	$18,100.00
Misc. Fees & Requirements	HVAC Plan Review: Building Area (sq. ft.)	
	Less than 2,500	$250.00
	2,501-5,000	$300.00
	5,001-10,000	$400.00
	10,001-20,000	$500.00
	20,001-30,000	$600.00
	30,001-40,000	$900.00
	40,001-50,000	$1,200.00
	50,001-75,000	$1,500.00
	75,001-100,000	$2,100.00
	100,001-200,000	$2,700.00
	200,001-300,000	$6,200.00
	300,001-400,000	$8,900.00
	400,001-500,000	$10,900.00
	Over 500,000	$12,200.00

Misc. Fees & Requirements	Premature Inspections (developer/contractor calls for inspection of incomplete work)	$50.00 per inspection
Misc. Fees & Requirements	Delinquent permit penalty	Equal to 100% of amount of permit not obtained
Misc. Fees & Requirements	Automatic Fire Suppression and/or Fire Alarm System Permit (Base) Automatic Fire Suppression and/or Fire Alarm System (Fee by Group-Group I) Automatic Fire Suppression and/or Fire Alarm System (Fee by Group-Group II) Automatic Fire Suppression and/or Fire Alarm System (Fee by Group-Group III)	$100.00 $.030 per square foot $.040 per square foot $.020 per square foot

Misc. Fees & Requirements	Automatic Fire Suppression and/or Fire Alarm System Plan Review	
	Fire Suppression Building Area (sq. ft.) System Plans	Fire Alarm System Plans
	Less than 2,500 $130.00	$130.00
	2,501 – 5,000 $160.00	$160.00
	5,001 – 10,000 $200.00	$200.00
	10,001 – 20,000 $250.00	$250.00
	20,001 – 30,000 $300.00	$300.00
	30,001 – 40,000 $450.00	$450.00
	40,001 – 50,000 $600.00	$600.00
	50,001 – 75,000 $800.00	$800.00
	75,001 – 100,000 $1,100.00	$1,100.00
	100,001 – 200,000 $1,300.00	$1,300.00
	200,001 – 300,000 $3,100.00	$3,100.00
	300,001 – 400,000 $4,500.00	$4,500.00
	400,001 – 500,000 $5,700.00	$5,700.00
	Over 500,000 $6,700.00	$6,700.00
Misc. Fees & Requirements	Plumbing Plan Application with Building Inspection)	(see application on file

Impact Fees Under 11.05(15)

Law Enforcement Impact Fee	11.05(15)(a)	Single Family Multi Family Studio and One Bedroom Apt. Commercial Development Industrial Development	$742.00 per dwelling unit $556.00 per dwelling unit $371.00 per dwelling unit $0.23 per square foot $0.14 per square foot
Fire Facilities Impact Fee	11.05(15)(b)	Single Family Multi Family Studio and One Bedroom Apt. Commercial Development Industrial Development	$238.00 per dwelling unit $179.00 per dwelling unit $119.00 per dwelling unit $0.07 per square foot $0.05 per square foot
EMS Facilities Impact Fee	11.05(15)(c)	Single Family Multi Family Studio and One Bedroom Apt. Commercial Development Industrial Development	$260.00 per dwelling unit $195.00 per dwelling unit $130.00 per dwelling unit $0.08 per square foot $0.05 per square foot

Park Improvement Fees Under 10.128(1)			
Improvements of land for parks – multi-family housing units with one bedroom or less			$746.00
Improvement of land for public parks – all other dwelling types			$1,244.00
Parkland Fees in Lieu of Dedication Under 10.33(11)			
Parkland Dedication	10.33(11)	All dwelling types	1,450 square feet of land* *subject to recommendation of the Park, Recreation, and Forestry Commission
Parkland Fees in Lieu	10.33(11) 10.85(4)(b), and 10.94(4)(c)(ii)	Multi-family housing units with one bedroom or less All other dwelling types	$1,741.00 $2,901.00

Fees for Dividing Land			
Procedure for Dividing Land	19.04(7)	Fees for lots shown on Certified Survey Map (CSM)	$200 + $25 per lot
Procedure for Dividing Land	19.04(7)	Fees to defray administrative expenses – subdivider to pay City of Middleton for Preliminary Plat review	$400 + $50/acre
Procedure for Dividing Land	19.04(7)	Fees to defray administrative expenses – subdivider to pay City of Middleton for each lot shown on Final Plat prior to approval	$400 + $50/lot
Procedure for Dividing Land	19.04(7)(b)	Fees to defray administrative expenses – GIS and records update, Plats	$500.00 + $30.00 per lot
Procedure for Dividing Land	19.04(7)(b)	Fees to defray administrative expenses – GIS and records update, CSM	$200.00 + $30.00 per lot
Procedure for Dividing Land	19.04(7)(b)	Fees to defray administrative expenses – GIS and records update, Public improvements	$.75 x total pipe length (i.e., the total footage of all public pipes plus private storm water conveyances)

Storm Water Runoff Control			
Fees in Lieu of Compliance	26.10(4)(d)	Fee based on cost of implementing controls necessary to achieve full compliance and percentage of area developed as impervious	See “Stormwater Fees in Lieu Chart” located at end of this schedule and on file with City Engineer
Stormwater Permit	26.10(3)(a)	Application fee	$250.00
Stormwater Permit	26.10(3)(b)	Review fees	Actual cost to City

Per City of Middleton Ordinance pertaining to storm water management, section 26.06 (6):

> For developments where on-site compliance is not feasible or not desirable as determined by the City Engineer in consultation with the Water Resources Management Commission (WRMC) and Applicant is not able to provide off-site storm water management for the development, fees shall be paid in lieu of installing on-site storm water management practices in accordance with section 26.10(4). The fee in lieu of any storm water management practice for redevelopment shall be half that for new development.

The current schedule for fees in lieu of on-site storm water management are as follows:

	NEW	REDEVELOPMENT
	per s.f. new Imperv	per s.f. disturbed
1. Peak Flow Rate Control	$0.75	$0.375
2. Infiltration/Recharge	$0.20	$0.10
3. Sediment Control	$0.20	$0.10
4. Temperature Control	$0.10	$0.05

Section E Continued:

The following items could reduce the time and cost necessary to approve and develop a new residential subdivision in Middleton:

- Amend the Zoning Ordinance to reduce the minimum residential lot size for single family homes, increase the maximum building height for multi-family homes, and other modifications to the dimensional standards, where appropriate.
- Allow “missing middle” housing types, characteristics, and assembly in modifications to existing subdivisions.
- Revise the Zoning Ordinance to allow an increase in density by encouraging accessory dwelling units (ADUs), ‘missing middle’ housing, and multi-family housing that make efficient use of land.
- Ensure that all land annexed to the City for housing is planned as a complete neighborhood that includes a range of housing types, including cost, and access to services, transit and open space.
- Integrate lower priced housing into all new subdivisions by including choices such as multi-family residential, smaller homes on smaller lots, tiny homes, ADUs, and other creative options.
- Proactively communicate expectations with property owners through annexation agreements.

- Utilize tax increment district (TID) 3 and 5 funding for affordable workforce housing to match other funding sources. Encourage that all residential projects receiving a tax increment financing (TIF) subsidy have a percentage of affordable units.
- Incentivize housing developers to include workforce housing units in new developments, through the use of TID 3 and 5 funding, through impact fee waivers, through the deferral of parkland fees, and through possible reductions in required number of parking spaces for affordable units.
- Work aggressively to seek State (LIHTC, etc.) and County funding (CDBG, HOME, The Affordable Housing Development Fund) for private (including non-profit) affordable development projects and rental rehabilitation projects in Middleton.
- Encourage production of affordable housing in or near those areas identified by WHEDA (Wisconsin Housing and Economic Development Authority) as "High Need" or "Employment Center" Census-tracts (see map on following page).
- Work with developers to provide support for affordable housing projects (including recommendations for available land, financing sources, and letters of support).