

2040

Brown County Sewage Plan and Amendment Process



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and Amendment Process**

Brown County Planning Commission
Planning and Land Services Department
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Cover photo: Green Bay Metropolitan Sewerage District at Mouth of Fox River, Green Bay WI

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2040 Brown County Sewage Plan Executive Summary

This report represents Brown County's sixth sewage plan and is intended to be a comprehensive update of the previous plans prepared in 1972, 1982, 1987, 1995, 2002, and a partial update related to environmentally sensitive areas in 2011. This plan identifies the current status of, and anticipated changes to, sewer service area planning within Brown County and its immediate environs.

The *2040 Brown County Sewage Plan* will serve as the sewer service area planning element of the areawide water quality management plan which covers the four river basins (Lower Fox River, Twin-Door-Kewaunee River, Upper Green Bay, Manitowoc River) in the Brown County area, pursuant to the Federal Clean Water Act, Wisconsin State Statutes Chapters 144.025 and 147.25, and Wisconsin Administrative Code NR 121. As such, this plan will serve as a guide for all public sanitary sewer extensions (as set forth in Administrative Code NR 121) and all private sanitary sewer extensions (as set forth in Administrative Code Com 82) to the year 2034.

The *2040 Brown County Sewage Plan* has two main objectives: to identify sewer service areas (those areas tributary to a publicly-owned sewage treatment plant to which sanitary sewer service could be provided within the next 20 years) and to identify environmentally sensitive areas (those lands located within a sewer service area within which public sanitary sewer service and associated development should not be allowed).

This planning process is designed to identify existing sewer serviced areas, anticipate future needs for wastewater treatment, and to protect communities from adverse water quality impacts through development of cost-effective and environmentally-sound sewerage systems and sewer serviced development.

In the most simple of terms the sewer service area plan and NR 121 gives Brown County the authority to review the following:

- Waste Water Facility Plans
- Sanitary Sewer Extensions (Water Quality Management letters)
- Large Private Onsite Wastewater Treatment Systems
- Area Wide Water Quality Management Reviews
- Sewer Service Area Amendments
- Environmentally Sensitive Area Amendments
- Water Quality related technical assistance, information, and education
- Subdivision erosion control and storm water management plans
- Certified Survey Map erosion control and storm water management plans
- Sewer Service Area Amendment erosion control and storm water management plans
- Environmentally Sensitive Area Amendment erosion control and storm water management plans.
- Sewer Extension Plans and Pre-Construction Conferences related to erosion control and storm water management facilities

The Brown County Planning Commission is the appointed local management agency for sewer service area planning within the Brown County area. As such, it has prepared this plan and, under the oversight of the Wisconsin Department of Natural Resources, will be responsible for its implementation and its update and refinement over time.

Both agencies recognize that the conditions and factors upon which this plan is based can and do change over time. It is recommended that this plan be reviewed and, if necessary, revised every five to ten years. Both agencies also recognize the importance of local input into this planning process and recommend that any revisions of the plan properly reflect local, as well as areawide, planning and development objectives. By adhering to such a process, it is believed that conflicts regarding public sanitary sewer service extensions can be minimized, and the development of the county and environs can proceed in a smooth and efficient manner.

The plan acreage allocations and new sewer service designations of the Brown County Sewage Plan have been reviewed by county municipalities and sanitary districts, the Brown County Planning Commission staff and approved by the Brown County Planning Commission Board of Directors, Brown County Planning Development and Transportation Committee, and the Brown County Board. Approval of the *2040 Brown County Sewage Plan* by the Wisconsin Department of Natural Resources (WDNR) will enable the continued extension of public sanitary sewer and the cost effective, environmentally sound continued expansion of sewer serviced development within Brown County.

2040 Brown County Sewage Plan Content

Chapter 1 includes a summarized description of the need and history of sewage planning in Brown County. Chapter 1 also briefly identifies the reviews that are covered by the plan.

Chapter 2 includes a general description of the sewage plan planning area.

Chapter 3 includes a breakdown of sewer service acreage allocations for each municipality in Brown County, as well as new areas being added to the existing sewer service area by each municipality through the plan. Chapter 3 also identifies any remaining acres allocated to each municipality for future amendments.

Chapter 4 includes a more refined description and review process for sewer service areas.

Chapter 5 includes a refined description and review process for environmentally sensitive areas.

Chapter 6 includes the process for an Amendment to the Brown County Sewage Plan.

Chapter 7 includes steps for plan implementation.

The goals, objectives, and policies of this plan are presented at the beginning of each pertinent chapter. The goals, objectives, and policies were formulated by a steering committee for the 2002 Sewage Plan and updated by staff to meet the needs of the *2040 Brown County Sewage Plan*.

Chapter 1: Sewage Plan History, Need, and Review Authority

History of Brown County Sewage Planning Actions

1972

In 1972, Congress passed the Clean Water Act, a significant revision of the federal water pollution control laws. The Clean Water Act set forth two national goals:

The elimination of pollutant discharges into the nation's waters.

1. The attainment of water quality levels that would be fishable and swimmable.

More specifically, the Clean Water Act required that there be (*see Appendix A*):

- Three phases of nationally uniform industrial effluent limitations.
- Special controls over severely toxic pollutants.
- National Pollutant Discharge Elimination System (NPDES) permits for all point sources of pollution.
- National effluent limitations for municipal discharges and provisions for an expanded federal program of financial assistance to local governments for planning and construction of wastewater treatment facilities.
- Comprehensive river basin and regional water quality planning for both point and non-point sources of pollution.

Brown County also completed its first comprehensive study of wastewater collection, treatment, and disposal. The findings and recommendations of that study were set forth in a report entitled *Brown County Sewage and Solid Waste Plan – 1972*, prepared by the Brown County Regional Planning Commission, Robert E. Lee & Associates, and Roy F. Weston, Inc. The report, which was approved by the Brown County Regional Planning Commission in April 1972 and by the Wisconsin Department of Natural Resources in March 1973, addressed the long-range sewage and solid waste needs of the county and identified sewer service areas for the county.

1974

In response to the Clean Water Act, Wisconsin Governor Patrick J. Lucy directed that areawide water quality management planning be undertaken for certain areas of the state. Under Wisconsin Administrative Code, Chapter NR 121, those areas (Dane County, Southeast Wisconsin, and the Lower Fox River Valley), along with additional areas later designated by the Wisconsin Department of Natural Resources (DNR), were to undertake such planning. This currently includes the initial 3 areas, 18 specific river basins located throughout the state (including the 4 river basins that comprise Brown County), communities with a population greater than 10,000 people, and communities with a wastewater treatment facility that treats more than 1.0 million gallons of sewage per day.

As set forth in NR 121, areawide water quality management planning consists of a continual planning process for the management of the quality of the waters of the state, including consideration of the relationship of water quality to land and water resources and uses. Such plans are to also include a sewer service area planning element that consists of the identification and delineation of a sewer service area for existing and proposed wastewater treatment systems for a 20-year planning period that is based upon cost-effectiveness and environmental protection.

1977 - 1980

Areawide water quality management plans for Brown County's four river basins (Lower Fox River, Twin-Door-Kewaunee River, Upper Green Bay, Manitowoc River) were prepared.

1978

A Memorandum of Understanding (MOU) was entered into in February between the Fox Valley Water Quality Planning Agency, the Brown County Planning Commission (BCPC), and the DNR regarding each agency's role in sewer service area planning. Pursuant to the MOU, the BCPC was appointed as the management agency responsible for sewer service area planning and sewer extension reviews within that portion of Brown County tributary to the Fox River.

1982

The WDNR appointed the BCPC as the management agency responsible for sewer service area planning and sewer extension reviews for the remaining portions of Brown County in January.

Also, Donohue & Associates, Inc., completed the first update of the Brown County sewage and solid waste plan. The report, entitled *Brown County Sewage Plan Update*, was approved by the BCPC in January 1982 and by the DNR in July 1982 as the sewer service area planning element of the areawide water quality management plans for the four river basins encompassing Brown County. It can also be noted that this update for the first time in Brown County included an identification of environmental corridors (lands within which sewered development was generally prohibited).

1987 and 1995

Two updates to the Brown County sewage plan were prepared and approved by the BCPC and the WDNR. These updates further refined the sewer service area boundaries through use of more up-to-date land use and population data and more detailed mapping. In addition, the 1995 update revised the definition of environmental corridors (through the addition of setbacks and buffers to floodways and wetlands) and subsequently termed these areas environmentally sensitive areas (ESAs). Meanwhile, updates of the areawide water quality management plans for the four river basins within Brown County were also prepared by the DNR.

2002

The Brown County Planning Commission entered into MOUs with the WDNR, the East Central Wisconsin Regional Planning Commission, and the Bay Lake Regional Planning Commission designating the BCPC as the sewer service area planning agency for those areas located outside

of, but immediately adjacent to, Brown County, tributary to wastewater treatment plants located within Brown County.

2006

Brown County applied for a Municipal Separate Storm Sewer System (MS4) permit. The permit addressed storm water and included the following:

- Identification of storm water outfalls on highways in the urbanized areas of Brown County.
- Establishment of public education regarding storm water and water quality.
- Process to rectify an illicit discharge.
- Development of updated erosion control, post construction, and illicit discharge ordinances.
- Annual reporting of status of MS4 system to the Wisconsin Department of Natural Resources.

2011

Brown County reviewed and updated setbacks to environmentally sensitive areas so that requirements of the Brown County Sewage Plan, Brown County Land Division Ordinance, and Brown County Shoreland Zoning were either the same or as similar as possibly could be. This was done in an effort to minimize confusion for the public when trying to understand various regulations that were enforced by the same governing body. The 2011 partial update affected ESA setbacks for navigable and non-navigable waterways, wetlands, and floodways. Certain development restrictions were also clarified. The 2011 update was approved by the Wisconsin Department of Natural Resources on June 8, 2011.

Today

The Clean Water Act still remains the federal government's primary law for the protection of the nation's waters (see Appendix A).

Need

A properly prepared sewer service area plan is intended to ensure that the provision of public sanitary sewer service is accomplished in a cost-effective and environmentally-sound manner, in conformance with local, county, regional, state, and federal plans, rules, and regulations.

The benefits of sewer service area planning are numerous and include, but are not limited to:

- Identification of the wastewater collection and treatment needs of local communities and regions.
- Provision of efficient and environmentally-sound sewage collection and treatment systems.
- Identification of potential onsite sewage disposal problem areas.
- Protection of lakes, streams, wetlands, and groundwater from potential pollution associated with sewered development.

- Provision of a means for the state and local communities to plan for future growth and development rather than react to it and its demands for wastewater treatment after the fact.

Review Authority

As referenced in Chapter 1, in the most simple of terms the sewer service area plan and NR 121 gives Brown County the authority to review the following:

- Waste Water Facility Plans
- Sanitary Sewer Extensions (Water Quality Management letters)
- Large Private Onsite Wastewater Treatment Systems
- Area Wide Water Quality Management Reviews
- Sewer Service Area Amendments
- Environmentally Sensitive Area Amendments
- Water Quality related technical assistance, information, and education
- Subdivision erosion control and storm water management plans
- Certified Survey Map erosion control and storm water management plans
- Sewer Service Area Amendment erosion control and storm water management plans
- Environmentally Sensitive Area Amendment erosion control and storm water management plans
- Sewer Extension Plans and Pre-Construction Conferences related to erosion control and storm water management facilities
- Onsite Inspections, Education, and Monitoring related to erosion control and storm water management

Planning Process

A sewer service area plan is usually developed locally by a regional planning commission (in this case, the Brown County Planning Commission) with oversight from the Wisconsin Department of Natural Resources. Input from local communities, sanitary districts, sewerage districts, and utility districts are obtained so that insight on local growth and wastewater treatment issues can be reflected in the plan. However, while the WDNR and the BCPC attempt to achieve a consensus of the affected local units of government on the formulation of the goals, objectives, and policies of the sewer service area plan, it is recognized that in some cases unanimous support may not be achieved. In those cases, the WDNR and the BCPC will have to weigh the positions of the affected parties and make a final recommendation concerning the issues involved based upon cost-effectiveness and environmental impact.

Sewer service area plans use 20-year population projections, local development trends and density standards, and an inventory of environmentally sensitive areas (ESAs) to project and evaluate the wastewater collection and treatment needs of the area for the next 20 years. Sewer service area plans also rely upon local comprehensive plans and local employment and development trends to project the future residential, commercial, and industrial land needs of the community. This information, together with an identification of ESAs, determines the boundaries of the sewer service areas.

Once the BCPC and the WDNR approve the county sewage plan/sewer service area plan, that plan becomes an element of the areawide water quality management plan. A similar process is also undertaken for facility plans for publicly-owned wastewater treatment plants. Subsequently, all new facility plans and sanitary sewer extensions must be in conformance with the areawide water quality management plan and the sewer service area element of that plan.

Like other long-range plans, county sewage and sewer service area plans should periodically be reviewed to ensure that they continue to properly reflect local and regional objectives and needs. This review should occur on at least a five to ten year basis or even sooner if warranted by local growth and development pressures and trends. If it is determined that an update is necessary, the process noted above is undertaken once again. In addition, amendments to the plan are also possible. Amendments are intended to address unanticipated situations that, while worthy of consideration, do not warrant a comprehensive update of the entire plan. With amendments, any inclusion of additional lands to a sewer service area must be documented and justified and any ESA lands identified and set aside from development.

Recent Significant Community Changes

Many changes have occurred since the preparation of the previous *2002 Brown County Sewage Plan*. However, there are no significant changes that would drastically impact the recommendations developed for the *2040 Brown County Sewage Plan*. For reference purposes, some of the changes since 2002 include:

- The Towns of Bellevue, Hobart, and Suamico incorporated into the Villages of Bellevue, Hobart, and Suamico.
- The City of De Pere Treatment Area and Green Bay Metropolitan Sewerage District (also known as New Water) merged and were connected with a sewer interceptor that runs along Ashland Avenue. The system is now referenced as all being GBMSD in the *2040 Brown County Sewage Plan*.
- The cooperative efforts and understanding among municipality staff and sanitary districts related to sewer service area expansions was drastically improved by improving the involvement of municipalities in the planning and approval process.
-

Chapter 2: Planning Area

The planning area selected for the Brown County sewage plan update is shown on Map 1. As indicated in Table 2-1, it encompasses 643.3 square miles and includes all of Brown County, as well as adjacent portions of Kewaunee, Oconto, Outagamie, and Shawano Counties. Within this area lie 30 communities, including 2 cities, 9 villages, and 19 towns.

The planning area includes lands located outside of Brown County due to the existing and planned sewage collection, treatment, and disposal needs of the unincorporated communities of Dyckesville and Oneida and the Villages of Pulaski and Wrightstown. It does not, however, include the Village of Luxemburg in Kewaunee County. Although the Village's wastewater is treated by the Green Bay Metropolitan Sewerage District, the responsibility for its sewer service area planning lies with plans developed by the Bay-Lake Regional Planning Commission (see *Village of Luxemburg Sewer Service Area Plan*).

Physical Setting

The planning area is located in the northeast portion of the State of Wisconsin adjacent to the Bay of Green Bay. Kewaunee County lies immediately to the east, Manitowoc County and Calumet County to the south, Outagamie County and Shawano County to the west, and Oconto County and the Bay of Green Bay to the north.

Geology

The bedrock within the planning area was formed during the Precambrian and Paleozoic eras. The underlying Precambrian bedrock is 1.5 billion years old. There are no known outcrops or exposures of this bedrock in Brown County. Overlying the Precambrian bedrock is Paleozoic bedrock, which is 375 to 600 million years old. Exposures of the Paleozoic bedrock are found along the Niagara Escarpment, within several larger quarries, and along some of the planning area's waterways.

The Paleozoic bedrock is sedimentary in origin and formed at the bottom of ancient shorelands and seas. Over time and under pressure, the deposits of sands, silts, and clays transformed into sandstone, limestone, dolomite, and shale. Over the past 350 million years, erosion removed much of the younger rock units so that today the youngest that remain are the Alexandrian and Niagaran dolomites located in the eastern portion of the planning area. The boundary between this bedrock and the next oldest period of bedrock can be seen along the Niagara Escarpment.

Topography

The planning area has been greatly influenced by glacial action and the area's underlying bedrock. The area is generally characterized by gently sloping topography. The thick, prominent Niagara limestone that underlies the eastern part of the planning area gave rise to the eastern ridges of Wisconsin, and scouring by glacial ice has resulted in the removal of glacial material in some areas and the deposition of such materials in other areas. The bedrock formations also strongly influenced the drainage patterns in this area.



Map 1: Planning Area 2040 Brown County Sewage Plan

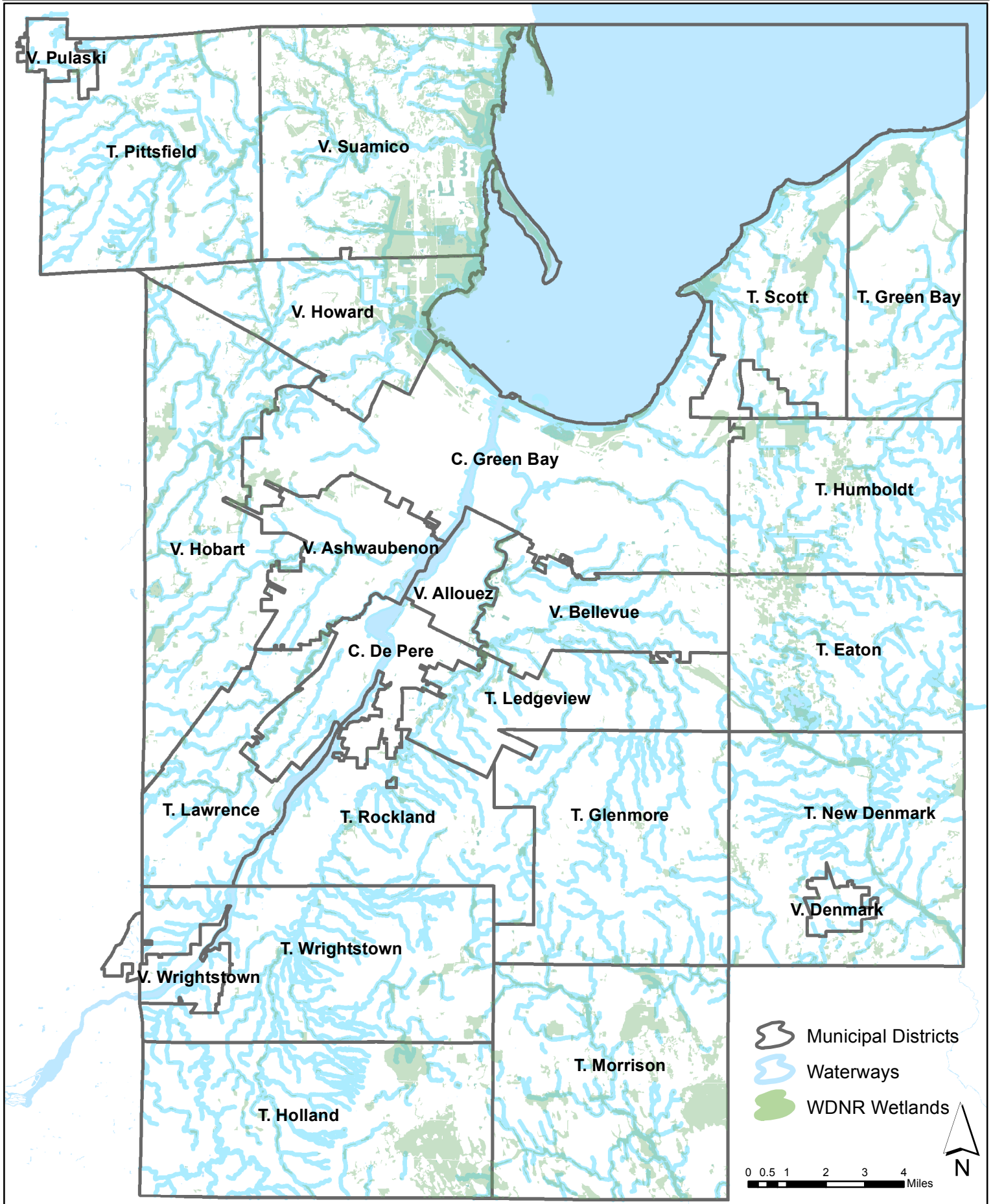


Table 2-1
Planning Land Area and Water Area

Municipality	Land Area in Square Miles	Water Area in Square Miles	TOTAL
City of De Pere	11.58	0.72	12.30
City of Green Bay	45.47	10.49	55.96
Village of Allouez	4.61	0.54	5.15
Village of Ashwaubenon	12.39	0.36	12.75
Village of Bellevue	14.34	0.05	14.39
Village of Denmark	1.93	0.00	1.93
Village of Hobart	32.95	0.11	33.06
Village of Howard	18.10	4.98	23.08
Village of Pulaski	2.73	0.04	2.77
Village of Suamico	36.36	23.06	59.42
Village of Wrightstown	4.09	0.21	4.30
Town of Angelica (Part in Shawano County)	1.94	0.00	1.94
Town of Chase (Part in Oconto County)	2.00	0.00	2.00
Town of Eaton	24.20	0.10	24.30
Town of Glenmore	32.70	0.00	32.70
Town of Green Bay	22.10	8.50	30.60
Town of Holland	36.00	0.00	36.00
Town of Humboldt	23.90	0.00	23.90
Town of Kaukauna (Part in Outagamie County)	6.50	0.00	6.50
Town of Lawrence	15.40	0.60	16.00
Town of Ledgeview	17.60	0.10	17.70
Town of Maple Grove (Part in Shawano County)	1.75	0.00	1.75
Town of Morrison	35.10	1.40	36.50
Town of New Denmark	34.70	0.10	34.80
Town of Oneida (Part in Outagamie County)	6.00	0.00	6.00
Town of Pittsfield	32.10	0.00	32.10
Town of Red River (Part in Kewaunee County)	4.50	0.00	4.50
Town of Rockland	22.30	0.60	22.90
Town of Scott	19.70	34.60	54.30
Town of Wrightstown	33.50	0.20	33.70
Total Square Miles	556.54	86.76	643.30

Source: United States Bureau of the Census, Brown County Planning Commission

The western two-thirds of the planning area is associated with the roughly 4-mile-wide Fox River Valley, a continuation of the same depression forming Green Bay. This area slopes gently northeastward from Lake Winnebago in east central Wisconsin, drains to Green Bay, and is generally level to gently rolling. This lowland area contains many glacial landforms, including eskers, moraines, and remnants of extinct glacial lakes. During glacial times, the flat marshy land west and south of Green Bay had been covered by the bay. Most streams in the area flow northeastward to Green Bay. Most streams also possess shallow channels, except in a few instances where the streams have cut through softer underlying glacial landforms, such as the Fox River in the Wrightstown area.

Forming the eastern boundary of the Fox River Valley is the Niagara Escarpment, which rises relatively abruptly as high as 200 to 250 feet above the valley floor. The Niagara Escarpment was formed by the erosion of older, softer bedrock underlying harder, more resistant bedrock and has been accentuated by the scouring action of glaciers. East of and alongside most of the escarpment is a narrow strip of level land. East of that is generally a slightly rolling plain which drains east and southeast toward Lake Michigan. The headwaters of a number of streams that drain to Lake Michigan are located within this area. However, gaps in the escarpment allow two streams—Baird Creek and Bower Creek—to flow westward to the Bay of Green Bay. The area is generally well drained but in places has many small, wet depressions.

Due to its location between two lobes of the last glacier to advance through Wisconsin, the southeastern portion of the planning area is extremely hilly and has many poorly drained depressions. This area, which extends into southeastern Wisconsin, is called the Kettle Moraine area of the state.

Land relief within the planning area ranges from 600 feet to 1,000 feet above sea level. The low point in Brown County, at an elevation of about 580 feet, is located in the City of Green Bay where the mouth of the Fox River enters the Bay of Green Bay. The highest point in Brown County is located in the Town of Holland, southeast of the unincorporated community of Greenleaf, at an elevation of about 1,020 feet.

Soils

Most of the soils in the planning area formed in glacial till and lake sediment that were high in clay. The characteristic soils are slowly permeable clay loam to clays. These soils have slight to moderate limitations for farming, with wetness and tilth the greatest management concerns. The slow permeability and a relatively high shrink-swell potential also impose moderate to severe limitations for many residential- and industrial-related uses, including road construction and conventional septic system siting.

There are also areas of loamy or sandy glacial till, outwash sand and gravel, and lacustrine sediments. These soils are generally friable and have moderate to rapid permeability. These conditions create slight to moderate limitations for farming and most residential and industrial uses.

Groundwater

Groundwater is available in the planning area from three general sources: The sandstone aquifer, the Niagara dolomite aquifer, and the shallow sand and gravel aquifers. The only rock units that contain little or no recoverable water are the Maquoketa Formation and Precambrian granite.

Most municipal water systems in the planning area obtain water from Lake Michigan via pipelines constructed in the mid 1950s and 2000s. The remainder of the planning area obtains water from the sandstone aquifer, as well as shallow sand and gravel aquifers.

The communities with municipal water systems include the Cities of De Pere and Green Bay, the Villages of Allouez, Ashwaubenon, Bellevue, Denmark, Hobart, Howard, Pulaski, Suamico, and Wrightstown, and the Towns of Lawrence, Ledgeview, and Scott. With the exceptions of Hobart, Lawrence, Ledgeview, Scott, and Suamico, the municipal water systems extend throughout the majority of the community.

Surface Water

Within the State of Wisconsin, waterways are generally governed as a component of the State's Public Trust Doctrine, as described in Article IX Section 1 of the Wisconsin Constitution and interpreted over time by Wisconsin courts and the state Attorney General's office. According to the Wisconsin Department of Natural Resources (WDNR), the public trust doctrine declares that all navigable waters are "common highways and forever free," and are held in trust by the WDNR for the public. As a result of subsequent citizen action and court decisions, *"...the public interest, once primarily interpreted to protect public rights to transportation on navigable waters, has been broadened to include protected public rights to water quality and quantity, recreational activities, and scenic beauty."*

Wisconsin's Public Trust Doctrine requires the state to intervene to protect public rights in the commercial or recreational use of navigable waters. The WDNR, as the state agent charged with this responsibility, can do so through permitting requirements for water projects, through court action to stop nuisances in navigable waters, and through statutes authorizing local zoning ordinances that limit development along navigable waterways. The court has ruled WDNR staff, when they review projects that could impact Wisconsin lakes and rivers, must consider the cumulative impacts of individual projects in their decisions. In the 1966 Wisconsin Supreme Court Case, Hixon V. PSC, the justices wrote in their opinion the following: "A little fill here and there may seem to be nothing to become excited about. But one fill, though comparatively inconsequential, may lead to another, and another, and before long a great body may be eaten away until it may no longer exist. Our navigable waters are a precious natural heritage, once gone, they disappear forever."

Fox River / Bay of Green Bay

Except for portions of southern and eastern portions of Brown County, the majority of surface water, including major rivers such as the Fox River, East River, Duck Creek, and the Suamico

River, flows into the Bay of Green Bay. The Fox River flows in a northeasterly direction through the approximate middle of Brown County.

Due to past point-source pollution, the Lower Green Bay and the 32.2 mile long Fox River has been designated as an Area of Concern (AOC) under the United States – Canada Great Lakes Water Quality Agreement (Annex 2 of the 1987 Protocol). According to the U.S. Environmental Protection Agency, an AOC is a geographic area within the Great Lakes, *“...that fail to meet the general or specific objectives of the agreement where such failure has caused or is likely to cause impairment of beneficial use of the area's ability to support aquatic life.”* The causes of impairment of the Fox River and Lower Green Bay have historically been thought of the result of point sources of pollution (end of pipe), such as industrial discharges and sewage treatment plants. Although additional progress remains to be made on point sources, nonpoint source pollution is now (post Clean Water Act) recognized as the major contributor to poor water quality in the Fox River and Lower Green Bay.

In addition to being designated as an AOC, the Lower Fox River (defined as the river stretch between the Lake Winnebago outlet through the Lower Bay of Green Bay) is listed on the federal “303(d)” impaired waters list due to excessive total phosphorus (TP) and total suspended solids (TSS) loadings from nonpoint sources. Excessive TP and TSS loadings cause low dissolved oxygen levels, degraded habitat, and poor water quality. According to the U.S. Environmental Protection Agency, nonpoint source pollutants may include:

- Excess fertilizers, herbicides, and insecticides from agricultural lands and residential areas;
- Oil, grease, and toxic chemicals from urban runoff (streets, parking lots, roofs) and energy production;
- Sediment from improperly managed construction sites, crop and forest lands, and eroding stream banks;
- Bacteria and nutrients from livestock, pet wastes, and faulty septic systems.

The Lower Green Bay Remedial Action Plan (RAP), first developed in 1987, includes the Fox River below the De Pere Dam and the lower bay south of a line between Long Tail Point and Point au Sable. The RAP identified a total of 11 use impairments and two suspected use impairments, and identifies opportunities to mitigate some of these issues. For example, the restoration of the Cat Island Chain of Islands in the Lower Bay to hold clean dredge materials and create an expanse of aquatic and wildlife habitat was a concept first discussed in the RAP. Reversing the hypereutrophic (high levels of silt, algae, and other non-point source pollutants) conditions in the river and bay is a top priority for the AOC and the RAP set the stage for the development of a Total Maximum Daily Load (TMDL) report for the Lower Fox River.

On May 18, 2012, the U.S. Environmental Protection Agency approved the TMDL report for the Lower Fox River. A TMDL is required under the Clean Water Act for all 303(d) impaired waters. According to the TMDL, 63.0 percent of the sources of total phosphorus and 97.6 percent of the total suspended solids within the Lower Fox River Basin are from nonpoint sources, such as

residential yards, streets, parking lots, farm fields, and barnyards. Proper management of Brown County's shoreland zones and environmentally sensitive areas will be a critical component of reducing total phosphorus and total suspended solids to attain the goals identified in the TMDL.

Lower Fox River TMDL restoration goals include:

- *Reduce excess algal growth.* Aesthetic reasons aside, reducing blue-green algae will reduce the risks associated with algal toxins to recreational users of the river and bay. In addition, a decrease in algal cover will also increase light penetration into deeper waters of the bay.
- *Increase water clarity in Lower Green Bay.* Achieving an average Secchi depth measurement of at least 1.14 meters will allow photosynthesis to occur at deeper levels in the bay, as well as improve conditions for recreational activities such as swimming.
- *Increase growth of beneficial submerged aquatic vegetation in Lower Green Bay.* This will help reduce the re-suspension of sediment particles from the bottom of the bay up into the water column, which will increase water clarity.
- *Increase dissolved oxygen levels.* This will better support aquatic life in the tributary streams and main stem of the Lower Fox River.
- *Restore degraded habitat.* This will better support aquatic life.

During the early spring snowmelt period or immediately following spring and summer rain storms, the effect of nonpoint sources of pollution becomes very apparent in the Fox River. The water turns dark brown, loaded with suspended solids which carry excess nutrients and other pollutants from a multitude of nonpoint sources. The solids are carried into the lower bay and as the water flow slows, the solids drop out of the water column and are deposited in the lower bay. The photo documenting a Fox River sediment plume was taken in April 2011 and is included in the Brown County Land and Water Conservation Department 2011 Annual Report and 2012 Work Plan.

Although the excess total phosphorus and total suspended solids generally enter the bay from the Fox River, tributaries to the Fox River and those that drain directly into the Bay of Green Bay also contributes significant nonpoint source pollution loads. Specifically, additional 303(d) listed rivers and streams within Brown County and their subject pollutants include Apple Creek (TP and TSS), Ashwaubenon Creek (TP and TSS), Baird Creek (TP and TSS), Bower Creek (TP and TSS), Branch River (Polychlorinated biphenyls (PCBs)), Duck Creek (TP, TSS, and Mercury), Dutchman Creek (TP and Ammonia), East River (TP, TSS, and Unspecified Metals), Kewaunee River (PCBs), Neshota River (TP), and Plum Creek (TP and TSS).

In order to address TP within the Fox River and Bay of Green Bay, the Brown County Executive established a working committee to identify different methodologies that could find cost-effective means to achieve the TMDL goals, while mitigating compliance impacts and costs to municipalities, utilities, and businesses. The committee, consisting of a broad cross-section of the community, including county, local, and tribal government, industry, business interests,

higher education, and utilities reviewed the existing literature and data related to the Fox-Wolf River Watershed and provided the following recommendations in a white paper report to reduce total phosphorus loading in the Fox River and Bay:

1. Build a broad based coalition of stakeholders.
2. Reduce nonpoint source loads from agricultural operations through the use of demonstration best management practices (BMPs) on lands that contribute the most phosphorus to the surface waters.
3. Facilitate implementation of adaptive management that would allow point source dischargers to install BMPs within their boundaries and partnering with stakeholders outside of their boundaries to meet TMDL water quality criteria.
4. Investigate the feasibility of a private waste transformation facility that will recover energy and reuse phosphorus and organic matter.
5. Explore the creation of a program for implementation of nutrient credit trading.
6. Create a nutrient / erosion compliance framework that includes a combination of voluntary incentives and progressive rule enforcement.
7. Work with legislators to expand confined animal feeding operation (CAFO) designation to cover all but the smallest operations, and seek their assistance for staffing and enforcement funding.
8. Explore cropland preservation initiatives in Brown County to maintain existing agricultural operations.

In spite of continued pollution-related challenges, a significant part of Brown County's identity is defined by the Fox River and Bay of Green Bay. Improving the quality of the water of these features through proper urban and agricultural shoreland management along the innumerable tributaries will ensure the surface water quality of the bay and river does not degrade, but rather, continues to improve. The health of the Fox River, Bay of Green Bay, and other rivers, creeks, and streams tributary to them have a profound impact on the regional economy.

Although much work remains to be done in the area of nonpoint source pollution, since the advent of the Clean Water Act, the waters of the Fox River and lower bay have improved to the point where it is now a world-class walleye fishery, hosting anglers from throughout the United States during the spring spawning run. The Bay of Green Bay is now a well-known location for trophy-sized northern pike, muskellunge, and smallmouth bass. According to the American Sportfishing Association, sport fishing provides \$2.27 billion in economic impact per year in the State of Wisconsin. By continuing to improve the water quality of the Fox River and Bay of Green Bay, Brown County can continue to capture its share of this economic resource.

Other Surface Water Features

Other significant surface water resources in Brown County include its three named natural lakes: the small Lily, Middle, and Third Lakes located adjacent to one another in the eastern portion of the County. Also included are the numerous smaller rivers and streams, the biggest of which include Duck Creek, the East River, and the Suamico River.

Lily Lake

Lily Lake is a 43 acre seepage lake that is up to 21 feet in depth at its deepest point. The entire shoreline is buffered by woodlands and wetlands and contains a county park at its northern end.

Due to the generally shallow nature of the lake, periodic winterkills of fish have occurred during severe winters with extended cold snaps and heavy snow, most recently during the winter of 2013-2014. Brown County utilizes an aerator to maintain dissolved oxygen levels during the winter months. However, an aerator can only maintain dissolved oxygen levels in relatively close proximity to the aerator, and during especially severe winters may not be adequate to prevent winterkill in other parts of the lake. According to the Wisconsin Lakes Book, the lake contains northern pike, largemouth bass, and panfish. The lake is popular for day fishing trips either from the fishing docks or from a non-motorized (except electric trolling motor) watercraft. The lake is also popular with kayakers, canoeists, and bird watchers.

From 2006 through 2009, the Brown County Planning Commission, with funding provided from the Wisconsin Department of Natural Resources, prepared a series of reports about Lily Lake. The reports started from a watershed perspective, with the final report focusing exclusively on Lily Lake and its water, vegetative, and fishery characteristics. The series of reports found that Lily Lake is becoming more eutrophic in nature due to increasing aquatic vegetation and increasing dissolved phosphorus levels. The report recommends the installation of stormwater management facilities at the parking lot and boat launch to capture stormwater runoff rather than running directly down the boat launch and into the lake. Additional recommendations include:

- Replicating the study every 5 to 10 years to determine whether the lake is continuing to become more eutrophic in nature.
- Install rain gardens in the picnic area to capture overland sheet flow of stormwater before it reaches the lake.
- Monitor the lake for the introduction of new exotic, invasive plant species.
- Establish a boat washing facility to remove invasive plants from boats and trailers.
- Developing an educational kiosk to inform visitors of the Lily Lake fishery and aquatic vegetation.

Middle Lake

Middle Lake is a seven acre seepage lake located immediately south of Lily Lake, separated by approximately 450 feet of wooded wetlands. The northern shoreline is within the boundaries of Lily Lake County Park, while the southern shoreline is parceled into two separate residential lots. The entire shoreline of Middle Lake, including the privately-held lands, is heavily wooded due to the wetlands that surround it. Since wetlands surround Middle Lake, there is currently no improved public access to the lake. The maximum depth of Middle Lake is seven feet.

Third Lake

Third Lake is a six acre seepage lake and is the southernmost lake in the Lily Lake system, lying approximately 1,200 feet to the southwest of Middle Lake. All of the shoreline of Third Lake is

in private ownership, however, as with Middle Lake, Third Lake is surrounded by a heavily wooded wetland, providing a buffer to impacts from neighboring residential and agricultural activities. Third Lake has an intermittent tributary that drains the lake from its southern end, eventually reaching the Neshota River. The maximum depth of Third Lake is 15 feet.

Duck Creek

Duck Creek is a 5.0 mile long tributary to the Bay of Green Bay and is located in the Villages of Hobart and Howard in the western portion of the County. From its headwaters in Outagamie County, it flows northeasterly until it flows into the bay in the Village of Howard. It is a slow-moving stream and is classified as a Warm Water Sport Fishery. Agricultural and limited rural development are located along the majority of this stream; although, significant amounts of urban development outside its floodway and wetlands are present in the Village of Howard and the extreme northeastern portion of the Village of Hobart. Key threats to the health of this waterway are sedimentation due to erosion from construction sites and farm fields and excessive nutrients caused by nonpoint source pollution due to storm runoff from lawns, farms, and other sources.

East River

The East River is a 14.0 mile long major tributary of the Fox River. It is a navigable river that flows northward 39 miles from its headwaters in northern Calumet County to one mile upstream of the Bay of Green Bay/Fox River mouth, and it is east of and generally parallel to the Fox River. In Brown County, it extends about 33 miles from the Brown County/Calumet County border east of STH 32/57 to its downstream end at the Fox River one mile south of the Bay of Green Bay and drains about 148 square miles of the County. It is a sluggish, hard water, and very turbid stream. The northernmost third of the river is classified as a Warm Water Sport Fishery. While urban development is adjacent to approximately the northern third of the stream, agricultural lands are adjacent to the remainder of the stream. Many of its banks have been pastured and are badly eroded. Sediments have blanketed the streambed (filling in pools and riffles), thereby degrading habitat for fish species and associated fauna. The East River continues to be exposed to many adverse environmental impacts, including sedimentation, excessive nutrient inputs, low levels of dissolved oxygen for a Warm Water Sport Fishery, loss of in-stream habitat, excessive suspended solids leading to turbidity, and fish kills due to nonpoint source pollution, cropland erosion, and barnyard runoff. For these reasons, the East River has also been identified as an Impaired Water.

In 1987, the East River was designated as a priority watershed under the Wisconsin Nonpoint Source Water Pollution Abatement Program. Subsequently in March 1993, a report titled “Nonpoint Source Control Plan for the East River Priority Watershed Project” was prepared by a consortium of state, county, and local agencies. The intent of the plan is to guide the implementation of nonpoint source control measures within the East River watershed and to provide the basis for the WDNR to enter into cost-share and local assistance grants to implement water quality improvement measures. The plan’s implementation recommendations, including education, installation of vegetative buffer strips, and other

techniques, should continue to be implemented throughout the East River Watershed to continue the East River's improvement in overall water quality.

Suamico River

The Suamico River is a major river in northwestern Brown County and drains to the bay. It is a navigable river that flows eastward 16 miles from its headwaters in Shawano and Outagamie Counties to the bay in the Village of Suamico. In Brown County, it is a sluggish, hard water, and very turbid stream. The easternmost portion of the river is classified as a Warm Water Sport Fishery with bottom materials comprised of sand and silt. The remainder is classified as a Full Fish and Other Aquatic Life Water with bottom materials comprised of rubble and gravel. Agricultural and rural residential land uses are adjacent to the majority of the stream. The Suamico River continues to be impacted by nonpoint source pollutants including fine sediments carried by stormwater and excess phosphorus.

Branch River

The 16.6 mile long Branch River begins in southeastern Brown County and continues to flow to the southeast, eventually joining the Manitowoc River, where it flows into Lake Michigan in Manitowoc. The Branch River is a sluggish, hard water, turbid stream. Bottom materials largely consist of silt, sand, and gravel. The river flows through primarily agricultural areas of southeastern Brown County and northwestern Manitowoc County, and therefore, is occasionally negatively affected by nonpoint source agricultural runoff.

Neshota River

The 14.2 mile long Neshota River begins at its headwaters in the Town of Ledgeview in central Brown County and flows to the southeast, to the West Twin River and Lake Michigan in Two Rivers. The Neshota River is a sluggish, hard water, turbid stream. Bottom materials consist of silt, rubble, and gravel. Although its shoreline is largely wooded, its small tributaries, and therefore, the Neshota River are negatively affected by fine sediments carried by stormwater and other nonpoint source pollutants.

In addition to the above referenced rivers, there are a number of smaller creeks that provide critical aquatic and shoreland habitat in Brown County, including:

- South Branch of the Little Suamico River: 3.5 miles long, fair fish & aquatic life.
- Middle Branch of the Little Suamico River: 9.0 miles long, fair fish & aquatic life.
- North Branch of the Little Suamico River: 5.0 miles long, unknown fish & aquatic life.
- Little Suamico River, 23.8 miles long, unknown fish & aquatic life.
- Trout Creek: 12.8 Miles Long, poor fish & aquatic life.
- Plum Creek: 16.5 miles long, poor fish & aquatic life.
- Dutchman's Creek: 16.0 miles long, poor fish & aquatic life.
- Ashwaubenon Creek: 15.0 miles long, poor fish & aquatic life.
- North Branch Ashwaubenon Creek: 7.0 miles long, unknown fish & aquatic life.
- South Branch Ashwaubenon Creek: 6.0 miles long, unknown fish & aquatic life.
- Baird Creek: 13.1 miles long, poor fish & aquatic life.
- Bower Creek: 13.0 miles long, poor fish & aquatic life.
- Wequiock Creek: Unknown fish & aquatic life.

- King Creek: 5.7 miles long, unknown fish & aquatic life.
- Denmark Creek: 16.0 miles long, poor fish & aquatic life.
- Apple Creek: 23.9 miles long, poor fish & aquatic life.
- Bay Beach Lagoons: Manmade 49.8 acre lakes, unknown fish & aquatic life.
- Beaver Dam Creek: 5.8 mile long, unknown fish & aquatic life.
- Dead Horse Bay: 28.8 acre bay, unknown fish & aquatic life.
- Devils River: 9.8 miles long, unknown fish & aquatic life.
- Gilson Creek: 3.6 miles long, unknown fish & aquatic life but a Class I trout stream.
- Inner Bay of Green Bay: 13,867.4 acre bay, poor fish & aquatic life.
- Haller Creek: 6.28 miles long, unknown fish & aquatic life but a Class II trout stream.
- Hemlock Creek: 7.0 miles long, unknown fish & aquatic life.
- Kewaunee River: 11.5 miles long, good fish & aquatic life.
- Mud Creek: 10.4 miles long, unknown fish & aquatic life.
- Peats Lake: 248 acre bay, unknown fish & aquatic life.
- Potter Creek: 8.6 miles long, suspected poor fish & aquatic life.
- Scarboro Creek: 8.0 miles long, unknown fish & aquatic life.
- School Creek: 8.5 miles long, unknown fish & aquatic life.
- Trout Creek: 12.77 miles long, poor fish & aquatic life.
- Twin Hill Creek: 5.9 miles long, unknown fish & aquatic life.

Drainage

The planning area is located within the Great Lakes-St. Lawrence drainage basin. Approximately one-fourth of the area is drained by streams tributary to Lake Michigan. The remainder of the area is drained by streams tributary to Green Bay and through Green Bay to Lake Michigan. As shown on Map 2, portions of four river basins and ten watersheds are located within the planning area.

Lower Fox River Basin

About 311.2 square miles, or about 58 percent of the planning area, is located within the Lower Fox River Basin. Portions of the Apple and Ashwaubenon Creeks Watershed, the Duck Creek Watershed, the East River Watershed, and the Plum Creek Watershed are located within the planning area. These lands generally drain northeastward to Green Bay.

The East River Watershed encompasses about 203.0 square miles, or about 38 percent of the planning area. Major streams within this area include the East and Fox Rivers and Baird and Bower Creeks.

The Apple and Ashwaubenon Creeks Watersheds encompass about 47.0 square miles, or about 9 percent of the planning area. Major streams within this area include Apple, Ashwaubenon, and Dutchman Creeks.

The Plum Creek Watershed encompasses about 13.3 square miles, or about 2 percent of the planning area. Major streams within this area include Plum Creek.

The Duck Creek Watershed encompasses about 47.9 square miles, or about 9 percent of the planning area. Major streams within this area include Duck and Trout Creeks.

Twin-Door-Kewaunee River Basin

About 114.9 square miles, or about 21 percent of the planning area, is located within the Twin-Door-Kewaunee River Basin. Portions of the Kewaunee River Watershed, the Red River and Sturgeon Bay Watershed, and the West Twin River Watershed are located within the planning area. The lands within the Kewaunee River Watershed and the West Twin River Watershed generally drain southeastward to Lake Michigan, while the lands within the Red River and Sturgeon Bay Watershed generally drain northwestward to Green Bay.

The West Twin River Watershed encompasses about 74.8 square miles, or about 14 percent of the planning area. Major streams within this area include the Devils and Neshota Rivers and King Creek.

The Kewaunee River Watershed encompasses about 27.3 square miles, or about 5 percent of the planning area. The stream within this area is School Creek.

The Red River and Sturgeon Bay Watershed encompasses about 12.8 square miles, or about 2 percent of the planning area. Major streams within this area include Red River and Gilson and Macco Creeks.

Upper Green Bay Basin

About 69.2 square miles, or about 13 percent of the planning area, is located within the Upper Green Bay Basin. A portion of the Suamico and Little Suamico Rivers Watershed is located within the planning area. These lands generally drain eastward to Green Bay. A major stream within this area is the Suamico River.

Manitowoc River Basin

About 41.9 square miles, or about 8 percent of the planning area, is located within the Manitowoc River Basin. Portions of the Branch River Watershed and the Lower Manitowoc River Watershed are located within the planning area. These lands generally drain southeastward to the Manitowoc River just west of the City of Manitowoc.

The Branch River Watershed encompasses about 40.0 square miles, or about 7 percent of the planning area. A major stream within this area is the Branch River.

The Lower Manitowoc River Watershed encompasses about 1.9 square miles, or about 1 percent of the planning area. A major stream within this area is Mud Creek.

Vegetation

Vegetation is largely determined by the interaction of humans, climate, soil, and slope. In turn, vegetation determines what forms of animal life will be present, which then can modify the micro-environment and local vegetation. The vegetation of a region may be broken down into various types of plant communities. Each plant community is a grouping of plant species that has adapted to the local environmental conditions. Particular groupings of plant species are often found to reoccur throughout a region. In general, these groupings will possess certain dominant species but will rarely occur in pure stands. There are typically no discrete

boundaries between plant communities, and where such boundaries do occur, an abrupt change in topography, soil type, or man-made change is present.

If left under natural conditions, most upland areas in the planning area would be vegetated with hardwood forests. Such areas that had been previously cleared but allowed to return to a “natural state” will experience a succession of varied plant growth. This succession can include an initial invasion of hardy annual weeds followed by perennial species, such as woody shrubs and pioneer trees. Next appears more shade-tolerant tree species, and a forest begins to be established. Over time, the local soil is built up with humus, and if the area remains undisturbed, the forest will eventually reach a climax state. Within the planning area, a climax forest is a mature hardwood forest often dominated by sugar maple, basswood, hemlock, and American beech. These once dominated the area’s landscape.

The other major historic plant community within the planning area was the inland and coastal wetlands. These wetlands were commonly located on organic soils of ancient glacial lake basins and drainageways, along the floodplains of rivers and streams, and along the shore of Green Bay. The wetland community type depended upon vegetation and water depth and included seasonally flooded basins, inland fresh meadows, shallow fresh water marshes, deep fresh water marshes, open fresh water, shrub swamps, wooded swamps, and bogs.

Wetlands are thought to have once been widespread throughout the planning area, subsequent to the retreat of the last glacier and prior to human habitation of the area. These wetlands were most likely quite extensive within both the northern and southern portions of the planning area but less so within the central portion of the planning area. The few wetlands that remain today are scattered throughout the planning area, with the largest remaining wetland complex located along the west and southwest shore of Green Bay. Smaller wetland complexes are located in the southeastern and northeastern portions of the planning area.

There are few, if any, climax plant communities left within the planning area. Most areas were either burned by native Indians or by fires during times of drought, lumbered by early settlers, or cleared for agriculture. Today, woodlands are much less extensive, less ecologically diverse, and more disturbed. They typically consist of isolated stands of successional stages of woody growth or mature second growth. The largest remaining areas of upland woodlands are located in the northern portion of the planning area.

Municipality	Census Population				Numerical Change				Percent Change			
	1980	1990	2000	2010	1980-1990	1990-2000	2000-2010	1980-2010	1980-1990	1990-2000	2000-2010	1980-2010
City of De Pere	14,892	16,594	20,559	23,800	1,702	3,965	3,241	8,908	11.4%	23.9%	15.8%	59.8%
City of Green Bay	87,899	96,466	102,313	104,057	8,567	5,847	1,744	16,158	9.7%	6.1%	1.7%	18.4%
Village of Allouez	14,882	14,431	15,443	13,957	-451	1,012	-1,486	-925	-3.0%	7.0%	-9.6%	-6.2%
Village of Ashwaubenon	14,486	16,376	17,634	16,963	1,890	1,258	-671	2,477	13.0%	7.7%	-3.8%	17.1%
Village of Bellevue	4,101	7,541	11,828	14,570	3,440	4,287	2,742	10,469	83.9%	56.8%	23.2%	255.3%
Village of Denmark	1,475	1,612	1,958	2,123	137	346	165	648	9.3%	21.5%	8.4%	43.9%
Village of Hobart	3,765	4,284	5,090	6,182	519	806	1,092	2,417	13.8%	18.8%	21.5%	64.2%
Village of Howard	8,240	9,874	13,546	17,399	1,634	3,672	3,853	9,159	19.8%	37.2%	28.4%	111.2%
Village of Pulaski	1,875	2,200	3,013	3,321	325	813	308	1,446	17.3%	37.0%	10.2%	77.1%
Village of Suamico	4,003	5,214	8,686	8,686	1,211	3,472	0	4,683	30.3%	66.6%	0.0%	117.0%
Village of Wrightstown	1,169	1,262	1,934	2,676	93	672	742	1,507	8.0%	53.2%	38.4%	128.9%
Town of Angelica (Part in Shawano County)	164	153	176	199	-11	23	23	35	-6.7%	15.0%	13.1%	21.3%
Town of Chase (Part in Oconto County)	290	318	481	577	28	163	96	287	9.7%	51.3%	20.0%	99.0%
Town of Eaton	1,106	1,128	1,414	1,508	22	286	94	402	2.0%	25.4%	6.6%	36.3%
Town of Glenmore	1,046	1,057	1,187	1,135	11	130	-52	89	1.1%	12.3%	-4.4%	8.5%
Town of Green Bay	1,106	1,292	1,772	2,035	186	480	263	929	16.8%	37.2%	14.8%	84.0%
Town of Holland	1,268	1,237	1,339	1,519	-31	102	180	251	-2.4%	8.2%	13.4%	19.8%
Town of Humboldt	1,281	1,334	1,338	1,311	53	4	-27	30	4.1%	0.3%	-2.0%	2.3%
Town of Kaukauna (Part in Outagamie County)	446	420	510	542	-26	90	32	96	-5.8%	21.4%	6.3%	21.5%
Town of Lawrence	1,431	1,328	1,548	1,548	-103	220	0	117	-7.2%	16.6%	0.0%	8.2%
Town of Ledgeview	1,535	1,568	3,363	3,363	33	1,795	0	1,828	2.1%	114.5%	0.0%	119.1%
Town of Maple Grove (Part in Shawano County)	225	205	185	165	-20	-20	-20	-60	-8.9%	-9.8%	-10.8%	-26.7%
Town of Morrison	1,565	1,493	1,651	1,651	-72	158	0	86	-4.6%	10.6%	0.0%	5.5%
Town of New Denmark	1,420	1,370	1,482	1,482	-50	112	0	62	-3.5%	8.2%	0.0%	4.4%
Town of Oneida (Part in Outagamie County)	619	683	708	753	64	25	45	134	10.3%	3.7%	6.4%	21.6%
Town of Pittsfield	2,219	2,165	2,433	2,433	-54	268	0	214	-2.4%	12.4%	0.0%	9.6%
Town of Red River (Part in Kewaunee County)	567	557	585	594	-10	28	9	27	-1.8%	5.0%	1.5%	4.8%
Town of Rockland	882	974	1,522	1,522	92	548	0	640	10.4%	56.3%	0.0%	72.6%
Town of Scott	1,929	2,044	3,712	3,712	115	1,668	0	1,783	6.0%	81.6%	0.0%	92.4%
Town of Wrightstown	1,705	1,750	2,013	2,013	45	263	0	308	2.6%	15.0%	0.0%	18.1%
Total	177,591	196,930	229,423	241,796	19,339	32,493	12,373	64,205	10.9%	16.5%	5.4%	36.2%

Existing Population

It is estimated that 241,796 people resided within the planning area in 2010, per the U.S. Census. This includes 238,966 people within Brown County, 594 people within Kewaunee County, 577 people within Oconto County, 1,295 people within Outagamie County, and 364 people within Shawano County. See Table 2-2 for a summary of population by community.

A review of the 1980 through 2010 population data for the communities within the planning area indicates that population levels have generally increased steadily since 1980 and have, in many cases, increased dramatically between 2000 and 2010. It can be noted that Brown County has consistently ranked among the 5 most populous counties in the state, has consistently had the third greatest numerical increase in population, and has consistently ranked among the 20 fastest growing counties in terms of rate of population growth.

Existing Wastewater Collection, Treatment, and Disposal Systems

Both onsite and offsite wastewater collection, treatment, and disposal systems are utilized within the planning area. Offsite systems are typically located within the urban and urbanizing portions of the planning area, while onsite systems are generally located in the rural portions. In this regard, it can be noted that both cities, all 9 villages, and 13 of the 19 towns within the planning area provide offsite wastewater collection, treatment, and disposal. It can also be noted that the cities and villages typically provide such service to their entire community, while the towns provide this service to only a portion of their community. Within the 13 towns, 2 (the Towns of Lawrence and Ledgeview) have created town-wide utility districts. The remaining 11 towns have created sanitary districts that take up only a portion of their community.

Offsite systems are generally comprised of a wastewater treatment plant and its associated interceptor sewers, forcemains, lift stations, and gravity sewers. The entire system may be owned and operated by one entity, such as in the case of the Village of Wrightstown, or the wastewater treatment plant and the interceptor sewer system may be owned and operated by one entity, such as the Green Bay Metropolitan Sewerage District (GBMSD) and the local collection system is owned and operated by the local unit of government.

The largest offsite system is owned and operated by the Green Bay Metropolitan Sewerage District and extends into portions of 14 communities. The smallest is owned and operated by the Town of Wrightstown Sanitary District No. 2 and encompasses one residential subdivision.

Onsite systems consist of conventional onsite waste systems, alternative onsite waste systems (usually mound systems), and holding tanks. The systems are typically located within the rural portions of the planning area. Exceptions include urban or suburban portions of the Village of Bellevue, Hobart, and Suamico, and the Towns of Green Bay, Holland, Lawrence, Ledgeview, Pittsfield, Red River, Rockland, and Wrightstown, which have areas also served by public offsite systems.

Offsite Systems

Within the planning area, most communities with wastewater treatment plants completed an upgrade of their treatment facilities under the United States Environmental Protection Agency

(USEPA) Construction Grants Program in the late 1970s and early 1980s. Since then, every plant has also completed modifications to meet new and more stringent water quality standards. In addition, four plants (the Village of Pulaski, Village of Suamico, the unincorporated community of Oneida, and the Royal Scott Sanitary District) have abandoned their facilities and connected via forcemain to Green Bay Metropolitan Sewerage District facilities. Likewise, the City of De Pere is now connected to GBMSD. It can be noted that the Village of Luxemburg wastewater treatment plant in Kewaunee County was also abandoned and connected by forcemain to the GBMSD. Furthermore, phosphorus and ammonia nitrogen removal is now required in many of the Wisconsin Pollution Discharge Elimination System (WPDES) permits.

To gain a broader perspective of the extent of the offsite wastewater collection, treatment, and disposal systems within the planning area, Table 2-3 have been developed. Much of the planning area (about 240.0 square miles or about 42 percent) is located within one or another of the 14 sanitary districts and 1 metropolitan sewerage district. In addition, about 127.9 square miles, or about 23 percent of the planning area, is located within the *1995 Brown County Sewage Plan's* 25 adopted sanitary sewer service areas.

This chapter provides a discussion of the wastewater collection and treatment facilities for the present sewered areas. There are nine publicly-owned wastewater treatment plants within the planning area.

Green Bay Metropolitan Sewerage District Wastewater Treatment Plant

The Green Bay Metropolitan Sewerage District wastewater treatment plant (GBMSD) was originally constructed in 1935 and was one of the first wastewater treatment plants (WWTP) constructed within Brown County. GBMSD was constructed during the mid 1970s, and its last major upgrade was in 1990. The De Pere plant, built in 1976, was connected to GBMSD to become one wastewater treatment plant in 2008. A Solids Management Facility Plan was developed in 2011 to prepare for future expansions. Process changes included the addition of two new clarifiers, two additional aeration basins, and an improved solids handling system. Other improvements included retrofitting many parts of the plant to accommodate new processes, such as improved ammonia removal (nitrification) and de-chlorination. To address the removal of more phosphorous, the district incorporated the biological nutrient removal process (BNR) as part of the plant's expansion and upgrade. The process is designed to enhance phosphorous removal by limiting chemical additions. Septage-, sludge-, and grease-receiving sites were also constructed and put into service in March of 1994. Septage wastes are routed directly to primary treatment and are no longer sent through plant return. Digester sludge from surrounding treatment plants is blended with Gravity Belt Thickener (GBT). Thickened sludge is then pumped to the de-watering process. Construction of a hydrogen peroxide system was recently completed, as well. Hydrogen peroxide is utilized in the de-watering process for odor and hydrogen sulfide control.

The GBMSD WWTP is an activated sludge treatment plant designed to treat domestic and industrial wastes. Treated effluent is discharged to the mouth of the Fox River, and sludge

disposal is accomplished through incineration. The GBMSD WWTP has a design hydraulic loading capacity of 49.2 million gallons per day (mgd) on an average annual flow basis.

The GBMSD acts as a wastewater treatment wholesaler for an estimated population of 154,926 people (see Table 4) and encompasses 285.0 square miles. The GBMSD includes the Cities of Green Bay, De Pere, the Villages of Allouez, Ashwaubenon, Bellevue, Hobart, Howard, Luxemburg (in Kewaunee County), Pulaski, Suamico, and the Towns of Lawrence, Ledgeview, Pittsfield, and Scott. In addition, portions of the Town of Oneida in Outagamie County and the Towns of Green Bay, Pittsfield, Red River (in Kewaunee County), and Scott are included, as well. Wastewater from parts of the Villages of Ashwaubenon and Hobart and parts of the Towns of Ledgeview, Lawrence, and the Oneida Reservation is treated at the GBMSD plant in De Pere. The GBMSD WWTP accepts significant industrial processed wastes from within the service area and has an industrial pretreatment program in place.

Since the last update of the county sewage plan, the GBMSD has:

- Connected GBMSD with the MSD facilities in the City of De Pere, via an interceptor along Ashland Avenue so the entire system is part of GBMSD.
- Prepared for future expansions with the annexation of additional lands within the Town of Red River in Kewaunee County.
- Prepared a Solids Management Facility Plan in 2011.
- Prepared Facility Plans for USH 41 Capacity Expansion and Impact on West Side Interceptors in 2009.
- Developed a plan to build a future Resource Recovery and Electrical Energy (R2E2) facility.

According to its 2013 Compliance Maintenance Annual Report (CMAR), last updated on June 10, 2014, GBMSD met its permit conditions.

Village of Denmark Waste Water Treatment Facility

The Village of Denmark Wastewater Treatment Facility (WWTF) was originally constructed in 1917 and was the first publicly owned sewage treatment facility in Brown County. The facility was constructed in 1980, and its last major upgrade was in 1993. The changes in 1993 consisted of the construction of a trickling filter pretreatment system, septate receiving facilities, and increased sludge storage facilities.

The WWTF is a rotating biological contactor (RBC) treatment plant designed to treat domestic and industrial wastes. Effluent is discharged to the Neshota River. Sludge disposal is accomplished through land application.

The existing sewer service area consists of most of the Village of Denmark. No major changes have occurred since the last update of the county sewage plan. A comprehensive facilities plan for the Denmark WWTP was last prepared in 1990.

According to its 2013 Compliance Maintenance Annual Report (CMAR), last updated on May 12, 2014, the Village of Denmark Wastewater Treatment Facility met its permit conditions.

However, the average monthly BOD loadings exceeded the maximum design flow during January.

Village of Wrightstown Sewer and Water Utility

The Village of Wrightstown Sewer and Water Utility was originally constructed in 1948. The plant was constructed in 1980, and its last major upgrade was in 1998. Such changes included a new fine bar screen for grit removal, a biological phosphorus removal system with chemical addition backup, ultraviolet light disinfection, a rotary drum sludge thickener, and a new SCADA system.

The sewer and water utility is an activated sludge treatment facility. Effluent is discharged to the Fox River. Sludge disposal is accomplished through land application.

Since the last update of the county sewage plan, the Village of Wrightstown has annexed and extended service to lands formerly within the Town of Wrightstown immediately south of STH 96 along CTH D as well as lands within the Town of Kaukauna in Outagamie County.

A comprehensive facilities plan for the sewer and water utility was prepared in 1977. An infiltration and inflow study was prepared in 1977, and a sewer system evaluation survey was prepared in 1978. An amendment to the facilities plan was prepared in 1996 to address the disinfection, biosolids storage, and total phosphorus requirements of the WPDES permit.

According to its 2013 Compliance Maintenance Annual Report (CMAR), last updated on June 2, 2014, the Village of Wrightstown Wastewater Treatment Facility met its permit conditions. However, the average monthly BOD loadings exceeded the maximum design flow during March, April, May, and November.

Town of Holland Sanitary District No. 1 Wastewater Treatment Facility

The Holland Sanitary District No. 1 Wastewater Treatment Facility (WWTF) was originally constructed in 1964. The current plant was constructed in 1977, and its last major upgrade was in 2002. Such changes included a fine bar screen for the raw sewage pumps, construction of a mixed and aerated equalization base, biological phosphorus removal with a chemical addition backup, a new fine bubble aeration and plug flow aeration, an aeration diffuser addition to the onsite storage tank which was converted to an aerobic digester, addition of a belt filter press for sludge dewatering, and construction of a 180-day sludge storage building.

The WWTF is an activated sludge treatment facility. Effluent is discharged to an unnamed tributary of Plum Creek. Sludge disposal is accomplished through land application.

It should be noted that prior to its recent upgrade, the WWTF frequently exceeded its design flow capacity, its design BOD loading capacity, and its effluent permit levels for BOD, TSS, and phosphorus. The problems have been attributed to influent loading fluctuations and occasional toxicity episodes. Plans have begun for another facility upgrade and hydraulic resizing but the site is presently under-loaded due to a nearby industry shutting down.

According to its 2013 Compliance Maintenance Annual Report (CMAR), last updated on June 5, 2014, the Town of Holland District No. 1 Wastewater Treatment Facility met its permit conditions. However, the average monthly BOD loadings exceeded the maximum design flow during March, April, May, and November.

Town of Morrison Sanitary District No. 1

The Town of Morrison WWTP is an activated sludge treatment facility. The Morrison WWTP was constructed in 1994. Effluent is discharged to an unnamed tributary of the Branch River. Sludge is disposed of on surrounding agricultural lands. The existing sewer service area includes a portion of the Town of Morrison. A comprehensive facilities plan was prepared in 1985 and amended in 1986, 1988, and 1991.

According to its 2013 Compliance Maintenance Annual Report (CMAR), last updated on June 16, 2014, the Town of Morrison Sanitary District No. 1 WWTP met its permit conditions. However, the average monthly BOD loadings exceeded the maximum design flow during April, May, and July.

Town of Wrightstown Sanitary District No. 1 (Greenleaf)

The Greenleaf WWTP was originally constructed in 1962. The plant was constructed in 1995. The wastewater facility is an activated sludge treatment facility. Effluent is discharged to a tributary of the East River. Sludge disposal is accomplished by land application onto surrounding agricultural lands.

According to its 2013 Compliance Maintenance Annual Report (CMAR), last updated on May 12, 2014, the Town of Wrightstown Sanitary District No. 1 WWTP met its permit conditions.

Town of Wrightstown Sanitary District No. 2 (Birch Creek)

The Birch Creek WWTP was constructed in 1970. According to its 2013 Compliance Maintenance Annual Report (CMAR), last updated on May 12, 2014, the Town of Wrightstown Sanitary District No. 2 WWTP met its permit conditions. However, the average monthly BOD loadings exceeded the maximum design flow during April. The site may need to consider future regionalization due to being a small discharger and the need to address phosphorous issues.

Private Onsite Wastewater Systems

Private onsite wastewater systems are those which store, treat, or dispose of wastewater (or perform a combination of these functions) on the site at which the wastewater is generated. Onsite wastewater systems are used in those areas that are not served by offsite systems. Within the planning area, this includes the Towns of Angelica, Chase, Eaton, Glenmore, Kaukauna, Maple Grove, and New Denmark, and portions of the Towns of Green Bay, Holland, Humboldt, Lawrence, Ledgeview, Morrison, Oneida, Pittsfield, Red River, Rockland, Scott, and Wrightstown. Approximately 60 percent of the planning area is served by onsite wastewater systems. Small portions of the City of Green Bay and the Villages of Ashwaubenon and Howard and large portions of the Villages of Bellevue, Hobart, and Suamico also contain widely scattered onsite wastewater systems.

The planning area continues to experience rapid growth in many of its rural communities. Many of these communities, including portions of the Village of Hobart and Suamico, and the Towns of Green Bay, Lawrence, Ledgeview, Pittsfield, and Rockland, have experienced significant suburban growth utilizing onsite systems. This growth is accompanied by an increasingly important need to properly treat and dispose of wastewater. As of October 31, 2014, the Brown County Zoning Administrator's Office inventoried 1,436 holding tanks, 4,428 pressure systems, and 5,127 gravity flow systems. These systems account for those installed after 1977. Brown County Zoning Department staff estimates that 10,991 onsite systems exist countywide. These systems represent the options to accommodate development where public sewer does not exist.

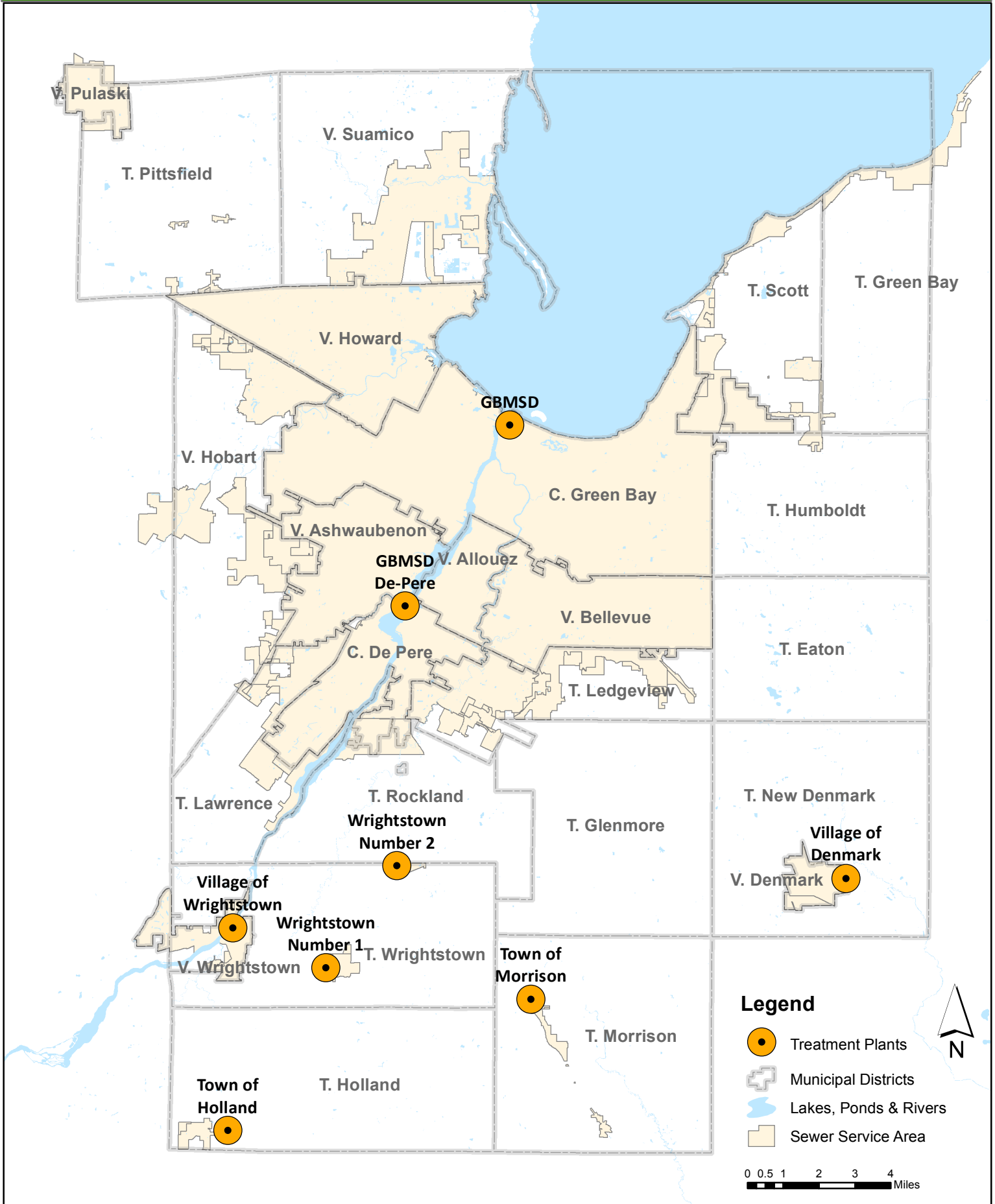
Table 2-3

Wastewater Treatment Plants in Brown County

Wastewater Treatment Plant	Original Date Constructed	Current Date Constructed	Treatment Type	Sludge Disposal	Receiving Water	Design Flow (mgd)	Average Flow (mgd)
Green Bay Metropolitan Sewerage District	1935-1937	Mid 1970's	Activated Sludge	Incineration	Fox River Mouth	63.69	35.02
Village of Denmark	1917	1980	Rotating Biological Contact	Land Application	Tributary to Neshota River	0.73	0.41
Village of Wrightstown	1948	1980	Activated Sludge	Land Application	Fox River	0.36	0.15
Town of Holland Sanitary District	1964	1977	Activated Sludge	Land Application	Tributary to Plum Creek	0.46	0.32
Town of Morrison Sanitary District	-	1993	Activated Sludge	Land Application	Tributary to Branch River	0.06	0.04
Town of Wrightstown Sanitary District #1	1962	1995	Activated Sludge	Land Application	Tributary to East River	0.13	0.05
Town of Wrightstown Sanitary District #2	-	1970	Stabilization Pond	Land Application	Tributary to East River	0.01	0.009



Map 3: Waste Water Treatment Sites 2040 Brown County Sewage Plan



Chapter 3: Municipality Acreage Allocations

History

Historically, in Brown County, individual municipalities have been assigned an acreage allocation, based on the area's population, population projection, proposed growth, and environmental features. That acreage allocation resulted in a lengthy algorithm that was difficult to monitor, maintain, and update. For the new *2040 Brown County Sewage Plan*, the process for using an acreage allocation was retained. However the method for calculating the acreage for each municipality was simplified to include the following elements which were factored in to the acreage allocation for each municipality:

- 2010 Census Population
- Proposed WDOA 2040 Population
- Gross Needed Housing Stock
- Net Needed Housing Stock (includes existing Housing Stock Vacancy Rate)
- Gross Needed Commercial and Industrial Area (per Comprehensive Plans)

The above was used to establish the base acres that would be needed for each municipality, should each municipality develop and increase in population at the rate projected at the time of the writing of this plan. The simplified calculations for this plan allow for new census data to be added every ten years, which immediately will update the acreage allocations.

Environmental and Right-of-Way Credits

In the previous plan, a credit was awarded to each municipality based on the amount of environmentally sensitive areas (ESAs) located within each municipality. A general credit allocation was also awarded for proposed right-of-ways.

Because some ESA's are approximate and proposed right-of-ways are unknown, ESA's and right-of-ways have not been calculated into the new acreage allocation as a credit. Rather, a credit will be awarded at the time of any amendment request as the acres for ESA's and right-of-way can be more accurately calculated at that time.

Acres Proposed to be added as Part of this Sewage Plan

The following pages represent the acreage allocations for each municipality located within Brown County. A small chart represents the population, methodology, and total acreage allocation assigned each municipality. Maps are included that reference existing sanitary districts, existing sewer service areas, and approximate environmentally sensitive areas. The acreage allocation can be updated as population projections are updated and amendments occur. The ESA's on the map should be used for reference only as some ESA's are approximates. The most up-to-date version of the sewer service area map can be viewed online at the following website:

<http://maps.gis.co.brown.wi.us/geoprime/#ymin=459180;xmax=251917.5;xmin=-51187.5;ymax=638370>



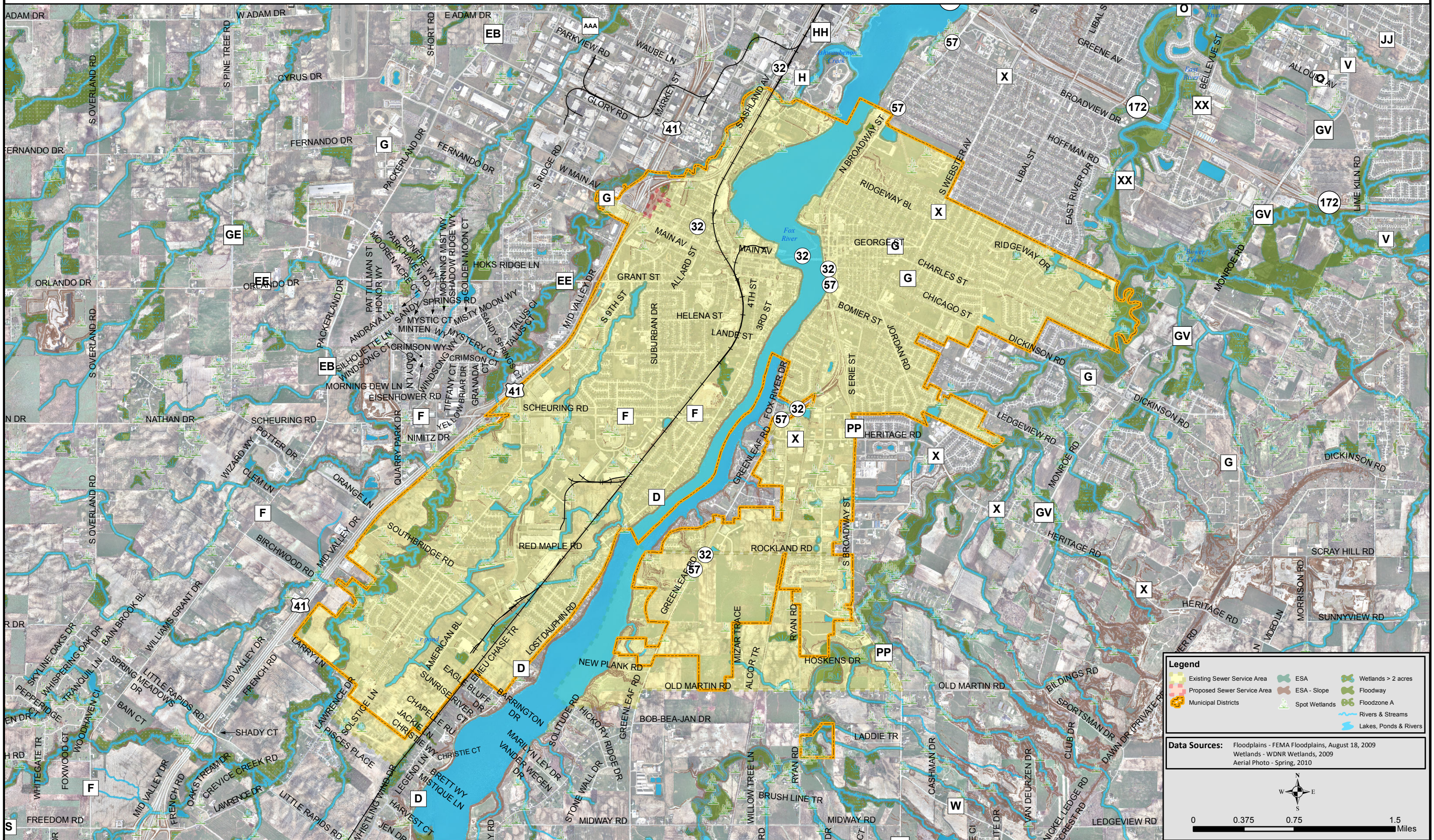
Date Printed: 1/27/2014

Brown County Sewage Plan - Existing & Proposed Sewer Service Area

City of DePere, Brown County, Wisconsin

DISCLAIMER

All data portrayed on this map is approximate. If development activity is proposed in or near a shaded area, the Village and Brown County Planning and Land Services - Planning Division should be contacted. It is the responsibility of the land owner to determine if there are any regulated environmental features (wetland, floodplain, stream, etc.) on the property prior to development. No warranties are implied.



City of De Pere Acreage Allocation

Past Population Increase	
2010 Census Population	23,800
2000 Census Population	20,599
<i>Subtract 2010 population from 2000 population</i>	3,201
2010-2040 Future Population Increase	
Proposed WDOA 2040 Population	31,280
2010 Census Population	23,800
<i>Subtract WDOA population from Census population</i>	7,480
Gross Needed Housing Stock	
2010-2040 Future Population Increase	7,480
2010 Census Average Household Size	2.39
<i>Divide future population increase by avg. household size</i>	3,130
Net Needed Housing Stock: Vacancy Rate Factor	
Gross Needed Housing Stock	3,130
2010 Census Vacant Housing Units	488
2010 Census Vacant Seasonal/Recreational Housing	36
<i>Subtract vacant from gross housing and add seasonal</i>	2,678
Sub-Total: Acres Needed for 2040 Proposed Housing	
Approximate Sewered Lot Size of 0.25 Acres	0.25
Net Needed Housing Stock	2,678
<i>Multiply sewer lot size by needed housing stock</i>	669
Sub-Total: Comp Plan Projected NON-Residential Acres	
2010 Estimated Commercial & Industrial Acres	1,488
2040 Projected Growth of Commercial & Industrial Acres	2,050
<i>Subtract estimated acres from projected growth acres</i>	562
Total Acreage Allocation	
Sub-Total: Acres Needed for 2040 Proposed Housing	669
Sub-Total: Comp Plan Projected NON-Residential Acres	562
Market Flexibility Factor	0.75
<i>Add subtotals and multiply by market flexibility factor</i>	923
TOTAL ACREAGE ALLOCATION	923