

APPENDIX A: WATER INFRASTRUCTURE SYSTEMS TECHNICAL MEMORANDUM

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City of Wahpeton

Comprehensive Plan Update

Final

TECHNICAL MEMORANDUM

Water Infrastructure Systems

August 2011

Prepared by

Craddock Consulting Engineers

In Association with

Hoisington Koegler Group, Inc.

Introduction

The City of Wahpeton recognizes the importance of their water utility systems to provide a safe and healthy environment and economically productive community. It is critical to have a water supply system that meets all health standards, provides for basic residential and commercial demands, supports emergency fire needs, and will not limit the ability to attract industries. The wastewater system must continue to be “hidden” – to avoid basement backups or discharges without adequate treatment to protect the international Red River of the North and minimize nuisance odors. The control of stormwater runoff is required to prevent local flooding and protect the quality of the Red River, Wild Rice River, and associated waterways. The City’s flood protection system needs to be maintained to minimize property damage and safety concerns with regional flooding.

The City has managed their water utility systems to meet the needs associated with changes in the community structure. However, as with municipalities all across the country, the water infrastructure needs and the associated costs are rapidly increasing and pose significant challenges for providing the service that community members have come to expect. City-wide development planning must integrate the scheduled capital improvements for the existing water infrastructure with extension infrastructure needs for new development. This vision is necessary to continue to provide cost-effective water utility services that meet the community’s expectations and the public and environmental goals required of the various systems.

This technical memorandum presents a review of the City’s water infrastructure systems conducted for the Comprehensive Plan Update and includes:

- an updated asset inventory/description
- a summary of existing facility needs and improvement plans
- system considerations for potential future development of the focus areas identified as part of the comprehensive plan update

This document summarizes the findings and conclusions for each of these topics. The attached sections provide more detail on the existing facilities and needs identified in previous studies and/or incorporated in the City’s capital improvement plan (CIP).

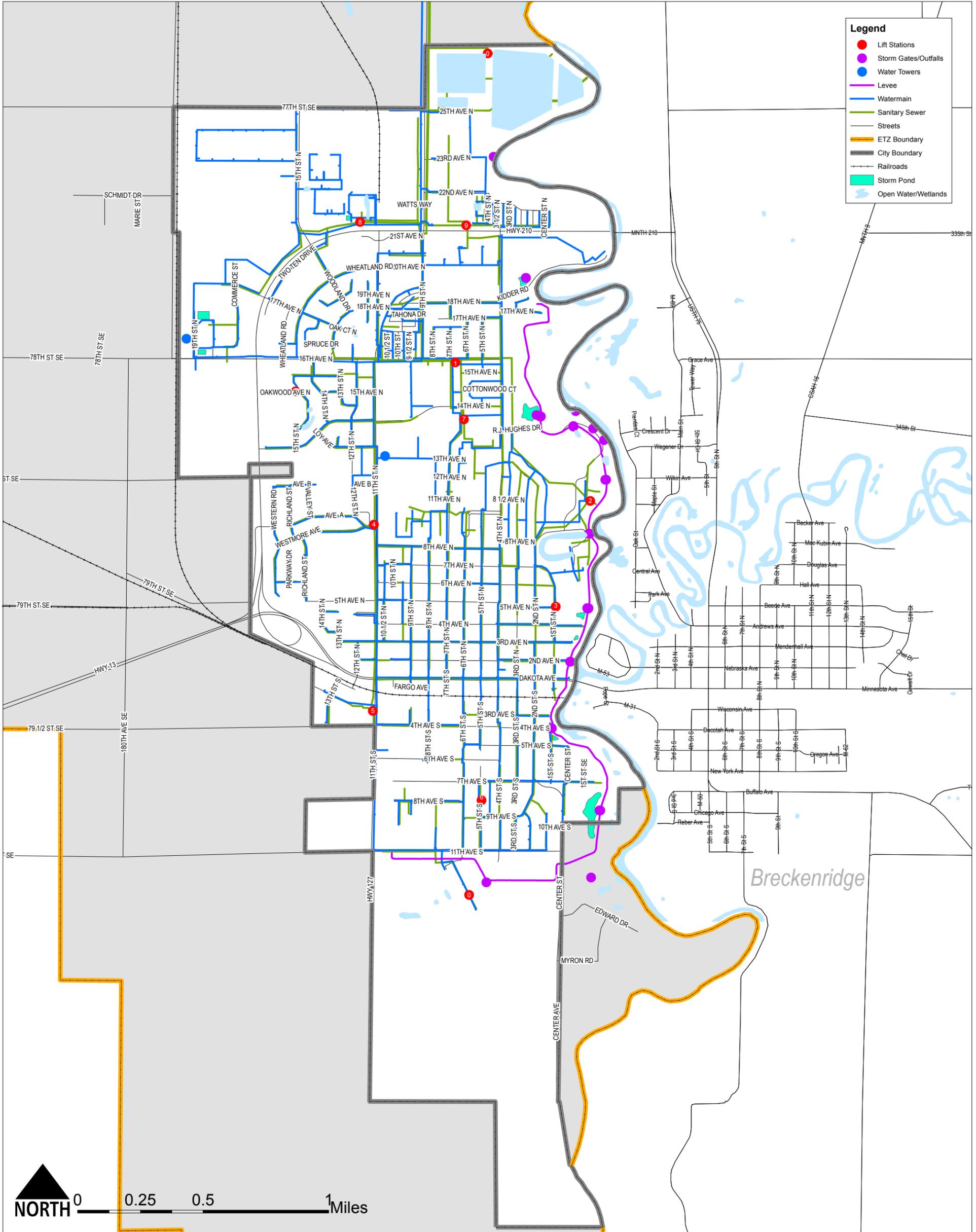
Existing Facilities Summary

The City operates and maintains four major water infrastructure systems as shown in Figure 1:

- Water Supply
- Wastewater
- Stormwater
- Flood Protection

The water supply for the City is supplied by three wells located north of the City (not shown in Figure 1). A 3 million gallon per day (mgd) capacity water treatment plant provides for iron, manganese and hardness removal, in addition to disinfection and other treatment to meet health-based standards. The distribution system contains two storage facilities to deliver water to the community.

Figure 1



Water Infrastructure Systems

Comprehensive Plan

The wastewater system consists of interceptors and 10 lift stations that convey wastewater to a six-cell lagoon treatment facility, with initial treatment at facilities located at the northeast city boundary and additional treatment in lagoons about three miles north. Stormwater is collected and discharged to either the Wild Rice River to the west or the Red River to the east, with the drainage divide along 11th Street. A levee system protects the City from flooding of the Red River and is equipped with gates and pumps to allow stormwater to be pumped out during high river periods.

A more detailed account of the water infrastructure system assets and improvements planned is provided through text, tables, and maps in the following sections:

- Section A – Water Supply System
- Section B – Wastewater System
- Section C – Stormwater and Flood Protection Systems
- Section D – Public Utility Infrastructure Asset Summary

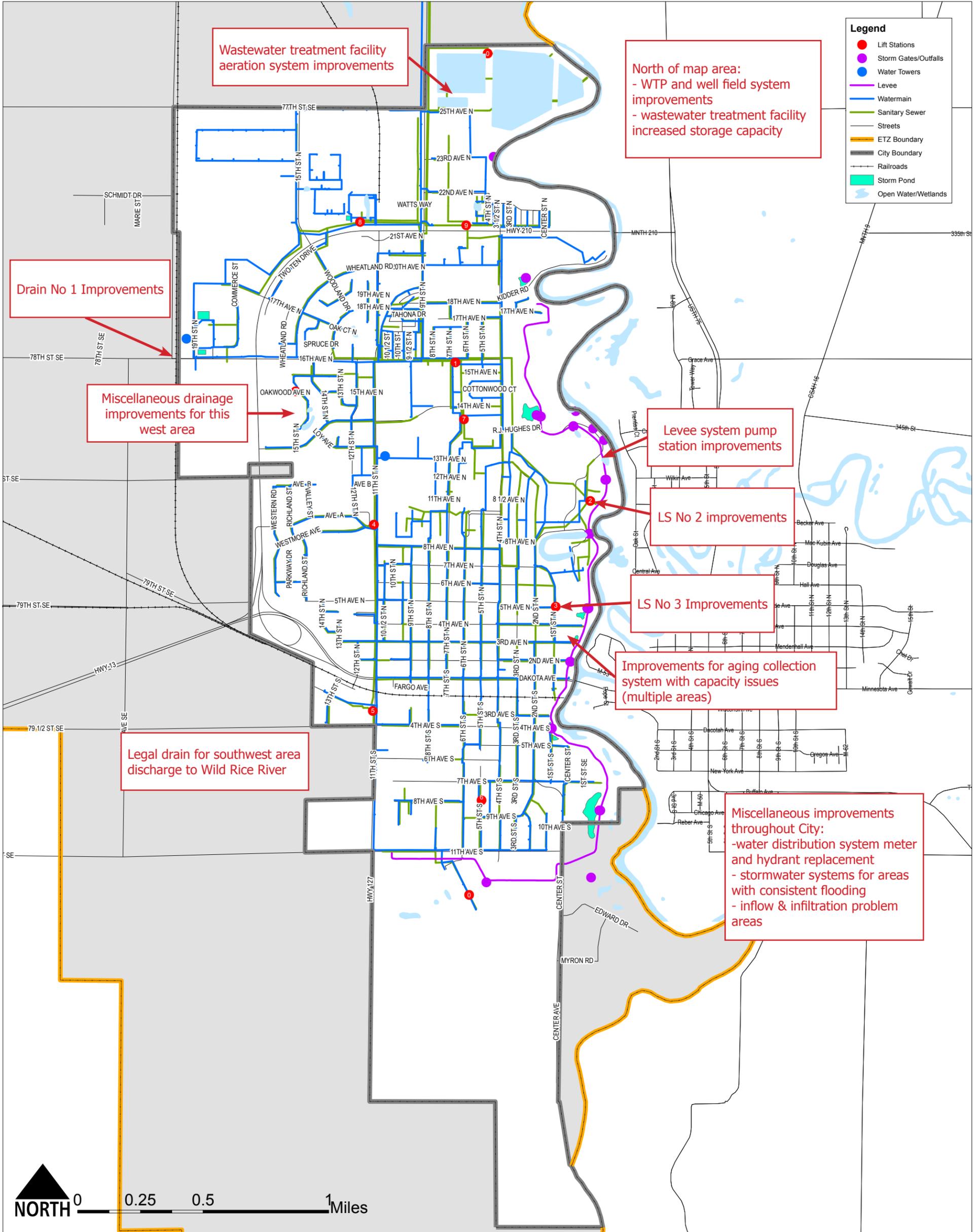
Existing Facilities Needs and Improvements Plan Summary

The City has a comprehensive capital improvement plan to address water infrastructure system requirements to continue to provide and improve service to the community. Many of the improvement needs are related to age and deterioration of the system asset, collectively considered to be required because the asset has reached its useful life, or because of capacity limitations. Table 1 highlights the existing water infrastructure system component needs and improvements identified by the City and Figure 2 summarizes the major planned improvements. The primary objective driving the planned improvements is identified below with the associated needs for each system. Sections A-D provide more detail.

Table 1. Water Infrastructure Needs and Planned Improvements for Existing Assets

System	Item	Useful Life	Capacity
Water	Treatment Plant	Equipment and building elements need replacing	Some existing component limitations; additional supply needed for increased demand
	Well Field	New well to offset potential loss of quality supply; rehab old components	Reliability; plan for increased, reliable capacity for total system
	Distribution System	Water main looping, meter replacement and radio reading, hydrant replacement; various replacements with street improvements	
Wastewater	Sanitary Sewer	Age and corrosion issues	Critical areas with bypasses each year and basement backups
	Lift Stations	Major Improvements- No. 3 & No. 2; other minor & post-5 yr projects	
	Treatment	Aeration system improvement	Storage issues – risks with state control of discharge dependent on multiple factors
Stormwater	Multiple Facilities	Replacement with street improvements; major improvements for Drain No.1	Areas with consistent flooding; legal drain for southwest area
Flood Protection		Some equipment deficiencies for designed protection	

Figure 2



Water Infrastructure Planned Improvements

Comprehensive Plan

Water Supply

Objective: *Provide a reliable and high quality water supply with capacity available to serve new industry and business.*

Needs for Existing Infrastructure Based on Current Land Use & Population:

- Water treatment plant (WTP) improvements
- New well upgradient of existing well field and industrial and municipal lagoons to address quality reliability
- Miscellaneous distribution system improvements

Wastewater

Objective: *Invest in existing wastewater system assets to meet regulatory requirements and minimize personal property damage.*

Needs for Existing Infrastructure Based on Current Land Use & Population:

- Increase capacity in areas currently the cause of bypasses and basement backups
- Increase lift station capacity and rehabilitate old equipment and structures
- Increase storage and upgrade processes of the wastewater treatment plant

Stormwater and Flood Protection

Objective: *Provide a stormwater system that minimizes flooding, prevents property damages for 100 year events, and provides environmental protection.*

Needs for Existing Infrastructure Based on Current Land Use & Population:

- Improvements for areas with consistent flooding
- Major drainage system improvements (Drain No. 1 to Wild Rice River and to Red River)
- Conveyance to the Wild Rice River (southwest)
 - 4 miles natural drain
 - Legal drain for maintenance purposes
- Planned levee improvements
- Continued maintenance and various improvements for levee pump stations and gates

System Considerations for Focus Area Development

The comprehensive plan update visioning sessions identified three focus areas for future development:

- Highway 210
- Southwest
- Downtown

Development in all three focus areas will require the system improvements identified for the existing facilities and summarized in Figure 2. Additional improvements are required or longer-term planned improvements would need to be accelerated and/or modified for development of the Highway 210 and Southwest focus areas as summarized in Figure 3. The Downtown focus area development should not require improvements beyond those needed for the existing development. Any local system capacity limitations with higher density or commercial development should be addressed in the early planning stages and can be coordinated with planned street improvements. The water infrastructure needs assessment for the Highway 210 and Southwest focus areas are listed below with major street improvement needs also identified, as they are necessary to provide for development in these areas.

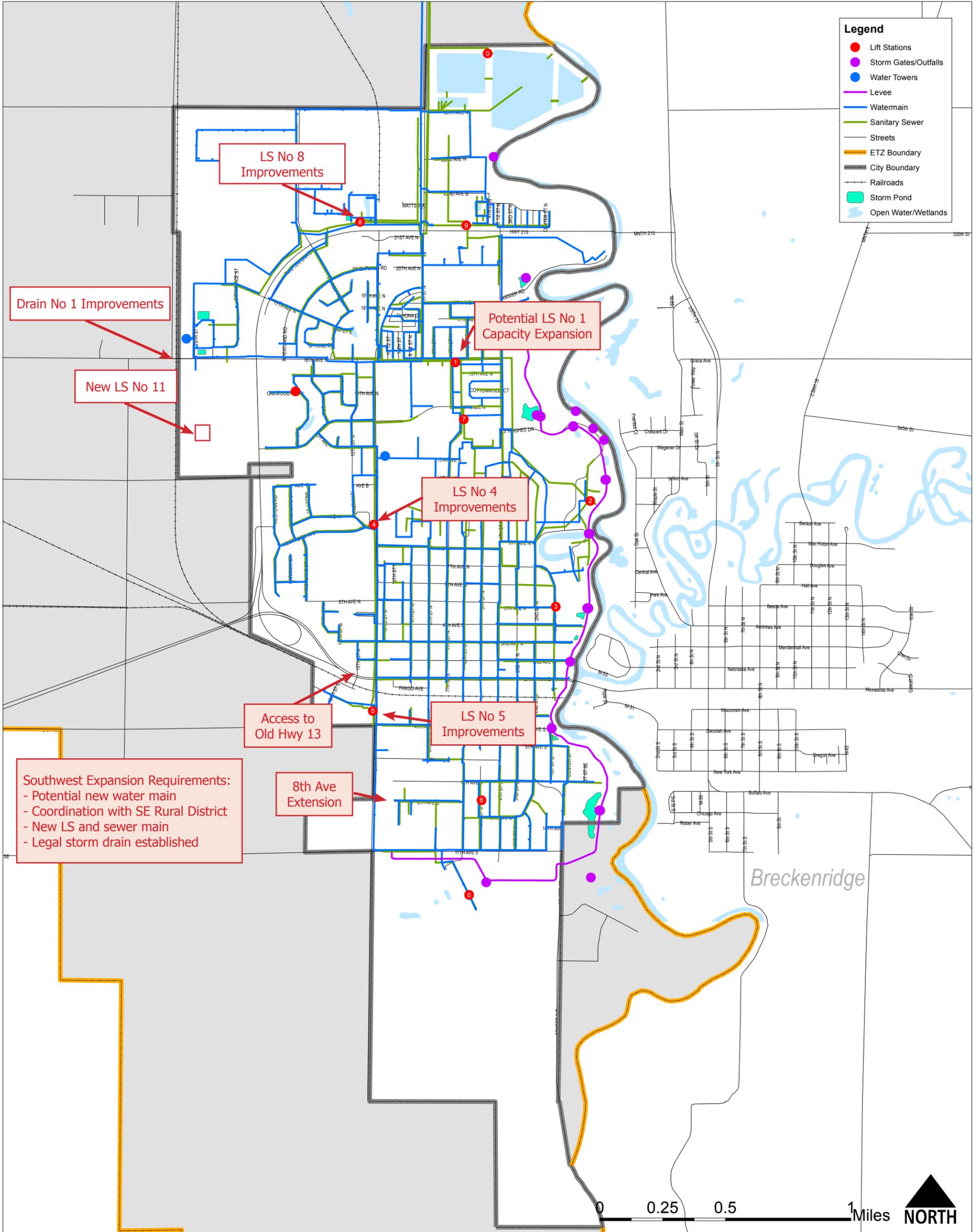
Highway 210 Focus Area Water Infrastructure Needs Assessment

- Water Supply
 - Storage is sufficient
 - Transmission mains are adequate
- Wastewater
 - Lift Station (LS) No. 8 improvements required due to age and capacity issues
 - New LS No. 11 is required with the capacity as planned in the Westside Facility Plan
 - Sewer mains and downstream capacity are sufficient
- Stormwater
 - Drain No. 1 improvements needed for added capacity, and for deterioration issues (corroded culverts, bank erosion) – coordinate with existing system planned projects
 - Natural drain improvements and establishment of a maintenance district with taxing authority is needed – coordinate with existing system planned projects
- Streets, Levees, and Geotechnical Considerations
 - The existing streets/roadways do not require any improvements to support new development
 - This area is outside the levee protected floodplain and requires no improvements for flooding
 - There are no known hazardous sites or subsurface geologic conditions requiring special investigation or installation requirements

Southwest Focus Area Water Infrastructure Needs Assessment

- Water Supply
 - Capacity on 6" main on Hwy 127/11th St is probably insufficient for any significant development in the area
 - Southeast Rural Water District jurisdictional issues will need to be addressed
- Wastewater
 - New LS and sewer main – could go north to LS No. 11 and should be considered in planning for any new facilities
 - Potential acceleration of LS No. 1, No. 4 and No. 5 improvements planned to replace aging/deteriorating equipment and structures – additional capacity may be required

Figure 3



Hwy 210 and Southwest Focus Area Infrastructure Needs

Comprehensive Plan Technical Memo

- Additional sewer main capacity needed on 11th St. downstream of LS No. 4 discharge
- Stormwater
 - Immediate improvements for drainage to the Wild Rice River - currently a longer-term plan
 - Longer-term plan: Establish a legal drain for maintenance purposes and construct a natural drain (approximately 4 miles)
- Levee
 - The area is adjacent to the West Breakout Reach
 - However, most of the area is outside the 500 yr flood plain, so a flood protection levee is not likely to be needed
- Streets
 - Extend 8th Ave west to 11th St to provide better access to existing development, serve as access to property abutting east side of ND 127/11th St, and to serve as collector street for existing local street system.
 - Internal street system needed with connection to old Hwy 13 in vicinity of current city limits/12th St S
- Geotechnical considerations
 - For the area north of old Hwy 13, south of new Hwy 13 and west of 12th St S
 - Some of this area was used for inert waste disposal many years ago and was reclaimed with topsoil and vegetative cover
 - Exact extent of disposal site is unknown to current City staff, may be available from ND Dept of Health; development potential dependent on areal extent of disposal

Summary

The City has a detailed CIP to address age and capacity issues in its water infrastructure systems given today's current population and industry base. These are all projects required to meet established goals regardless of a change in the development pattern of the City.

The review of water infrastructure requirements for the three focus areas indicates that the fewest improvements are needed for the Downtown area development and the Southwest area requires the most improvements. The Highway 210 area just south of 16th Ave and west of Highway 210 was part of the Westside expansion project area and most facilities have already been planned (through a predesign phase) for inclusion in the CIP for development at a future date. This area provides the most flexibility to staging improvements in the wastewater system, given that wastewater flows do not go through the main lift station (LS No. 1). Development of the southwest area will entail improvements to all water infrastructure systems, as well as streets. Future development of the southwest area could be coordinated with planned improvements to LS No. 1, 4 and 5 to time useful life replacement with capacity expansion.

Section A

Water Supply System

Existing Facilities and Planned Improvements

Facility Description

The drinking water supply for the City is provided from three wells north of the City. The three wells have a total capacity of 3,500 gallons per minute (gpm) with two wells rated at 1,400 gpm and the third at 700 gpm. The groundwater is treated at a lime softening plant rated at 3 million gallons per day (mgd). Residual solids from the plant are stored in two lime sludge lagoons with a 12,000 ton capacity and require biennial removal of solids to the landfill.

The City's distribution system is shown by pipe size and age in Exhibits A-1 and A-2. The treated water is distributed to the city via a 14-inch transmission line. The distribution system includes two storage tanks: one located on 11th Street North on the southwest corner of the NDSCS campus and the other installed with the Westside Improvements, just west of Wal-Mart.

The distribution system pipe materials include asbestos cement, cast iron, polyvinyl chloride (PVC), ductile iron, polyethylene (PE) and high density polyethylene (HDPE). The older pipe is asbestos cement and cast iron, with PVC installations beginning in the late 1970s. Installations since 2000 have been ductile iron, PVC, PE and HDPE (only one segment), with PVC the most common.

Exhibits A-3 and A-4 provide summary asset information.

Water Use/Demand

The water supply system's existing rated water treatment plant capacity (WTP) is adequate to meet the annual demands for the various scenario populations forecasted to 2030, assuming the following: (1) the same mix of residential, commercial, and industrial community members, and peak day needs and (2) the planned improvements for the treatment plant are completed (improvements to increase some unit process capacity issues, where current conditions do not provide the rated WTP capacity, and extend the useful life of equipment and structures). Distribution system capacity is addressed in the current capital improvement plan.

Table A.1 provides historic data, estimated demand for 2010, and forecasted demand for the 2030 stabilizing and slight population growth after 2015 scenarios. Annual average day demand was nearly 1 mgd in 1990 and dropped to 0.85 mgd in 2010. The 2030 forecasted demand of 0.81 – 0.97 mgd could be higher if a new industry connects to the City's supply. However, per capita residential use is expected to drop with increased conservation practices and plumbing efficiencies. A consistent per capita use rate was applied to provide an allocation for larger commercial or smaller industrial customers. The forecasted demand does not include any new large industrial customers.

Table A.1. City of Wahpeton Water Demand

	1990	2009	2010	2030-A	2030-B
Population	8,751	7,418	7,766	7,400	8,800
Water Demand, gallons	356,600,000	302,713,000	311,800,000	297,110,000	353,320,000
Avg Daily Demand, mgd	0.98	0.83	0.85	0.81	0.97
Per Capita Use*, gpcd	110	110	110	110	110

Sources: 1990 data - adapted from 1997 Comprehensive Plan citing the 1989 Facility Plan; 2009-City records reported for water permit are basis of per capita use based on estimated 2009 population; 2010-estimated demand based on 2011 Comp Plan Update population and 110 gpcd use; 2030-A&B-based on range of growth scenarios forecasted in the 2011 Comp Plan Update and 110 gpcd use.

*Includes residential, commercial, and industrial water use; total water supplied by the City/population

System Needs and Planned Improvements

This section supports the City of Wahpeton Water Infrastructure Systems Technical Memorandum, prepared as part of 2011 Comprehensive Plan Update. It provides a compilation of needs identified through previous studies and contained in the City’s CIP. Past studies referenced include: 1997 Comprehensive Plan; Facility Plan for Westside Development (Interstate Engineering, Inc., February 2001); and 2009 water permit records. Discussions and input from City staff identified the key system improvements required to sustain the water supply infrastructure system and provide services to meet short- and long-term community goals. This update is not considered a needs assessment, but rather a reporting of the needs and improvements developed through other engineering studies and/or by City staff.

Exhibit A-3 lists the key assets of the water supply system, needs and any planned improvements. A major focus of the 5-year CIP for the water infrastructure systems is to upgrade the water supply system facilities, specifically the WTP. The projects include (CIP Project Number):

- WTP Lime Storage & Slaker Additions (126)
- WTP Evaluation & Master Plan (133)
- WTP Residuals Handling & Disposal Improvements (162)
- Water Supply Security System (168)
- WTP Miscellaneous Improvements (Floor Tile, 170; Site Drainage, 290)
- Water Meter Replacement & Radio Reading (218)
- Hydrant Replacements, Various Locations (264)
- WTP Influent Pipe Replacement (288)
- WTP HVAC & Energy Improvements (297)
- Well House No. 1 & 3 Reconstruction (253, 252)
- Well No. 4 & Well House Construction (265)
- Water Main Looping, Various Locations (298)

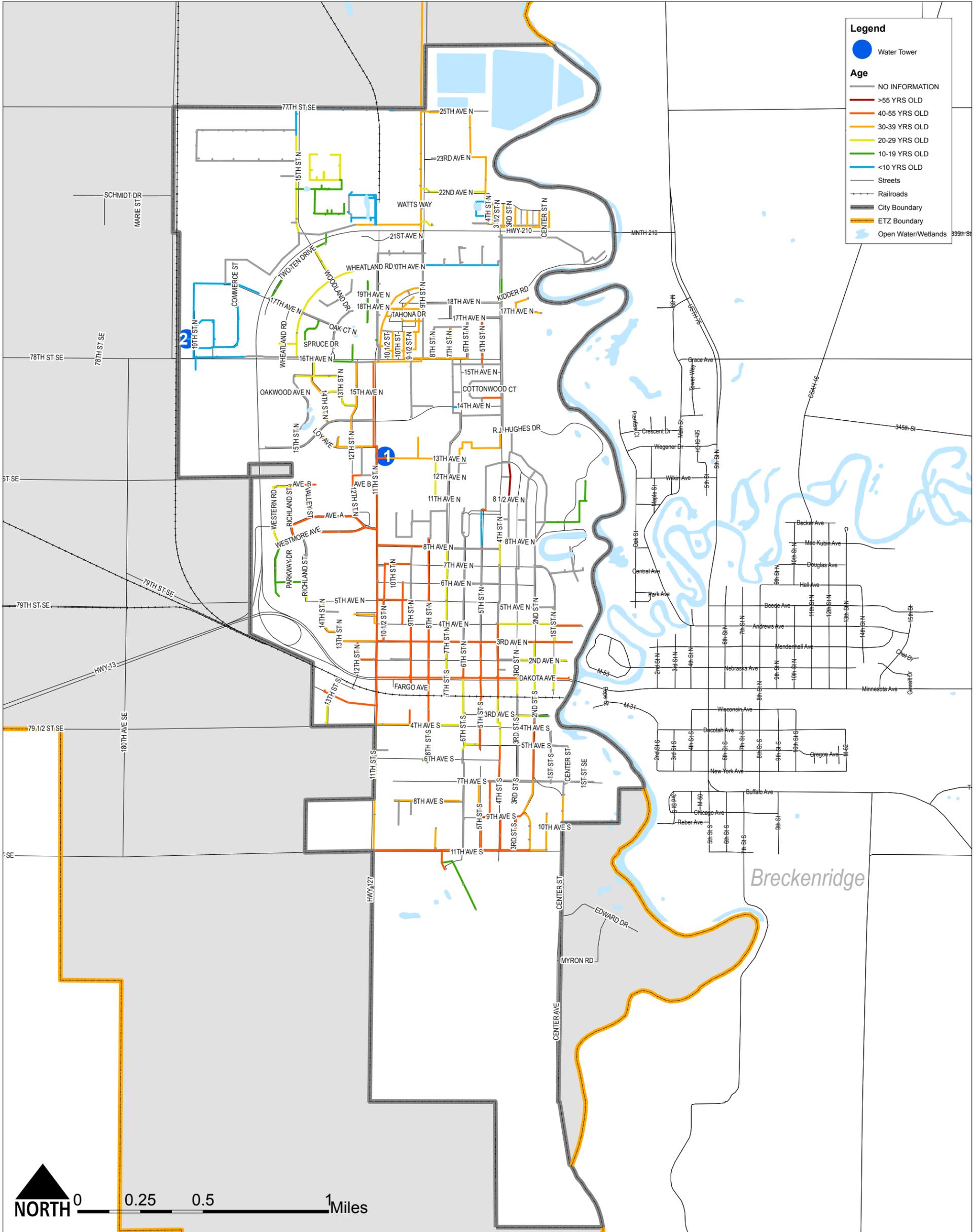
The WTP requires replacement of aging equipment and structures, as well as improvements to increase the capacity and reliability of specific unit process equipment. The computer and data acquisition system requires upgrades to provide alarm and security systems. There are also ongoing projects in the distribution system for general system improvements, water meter replacement and radio reading, and hydrant replacement.

The City is exploring options for siting a new well to add reliability offered with another supply, as well as to provide capacity if the existing well water quality deteriorates (ammonia detected). The City wants a reliable supply with some excess capacity to attract industries. The City is also exploring water reuse opportunities with a feasibility study initiated in 2011. Table A.2 highlights the key needs and planned improvements for the water supply system.

Table A.2. Key Water Supply Infrastructure Needs and Planned Improvements

Item	Useful Life	Capacity
Treatment Plant	Equipment and building elements need replacing	Some existing component limitations; plan for increased, reliable capacity for total system
Well Field	New well to offset potential loss of quality supply; rehab old components	Reliability; plan with industrial growth requirements
Distribution System	Water main looping, meter replacement and radio reading, hydrant replacement; various replacements with street improvements	

Exhibit A-2



Water Supply System - Age

Comprehensive Plan

Exhibit A-3

City of Wahpeton Water Supply Infrastructure Assets and Planned Improvements

Asset	Unit	Quantity	Description	Improvements	CIP No.	Total Cost	Other
Well and Pump House							
No. 1	gpm	1,400		Replace building and well casing seal, interior piping, flow meter, valving, HVAC and electrical; related sitework.	253	\$170,000	
No. 2	gpm	1,400					
No. 3	gpm	700		Replace building and well casing seal, interior piping, flow meter, valving, HVAC and electrical; related sitework.	252	\$170,000	
No. 4 (New Well)			New Well	Plan and install new well north of existing well site; includes electrical, controls and piping; raw water line to WTP; land acquisition & site development	265	\$500,000	
WTP	gpm	2,100	Lime softening plant with sand gravity filters and disinfection	Lime storage/handling; residuals facilities; building/site; influent pipe, HVAC&energy, master plan	126, 133, 162, 168, 170, 290, 297		Multiple projects, see CIP
Storage Reservoirs							
11th St North (SW corner NDSCS campus)	mgal	1					
West Side (West of Wal-Mart)	mgal	?					
WTP Forcemain, 14"	LF	incl below		Replace 50' of raw water influent pipe in the WTP and related piping/sitwork.	288	\$57,500	
Distribution system, 4"-12"	LF	241,448		Misc improvements	298	\$140,000	
Water Valves (each)	Ea	629					
Hydrants (each)	Ea	342		Replace 25 hydrants with preferred nozzle type	264	\$160,000	Older nozzles leak and freeze in winter -water losses; parts obsolete
Misc							
Water Meters	LS	1		Replace meters > 15 yrs old and replace remote read-out equipment with radio read on newer meters.	218	\$300,000	Started in 2008 but deferred due to revenue loss of industries and staff availability
Security System	Ea	1	Security system with intrusion alarms connected to SCADA	To install at wells and water towers and connect all to SCADA	168		

Exhibit A-4

Well Characteristics (documented December 2010)

	Well No. 1	Well No. 2	Well No. 3
Pump House Floor El. (ft)	962.83	972.07	970.55
Casing Diameter (in)	16	16	16
Grouted Depth (ft)	110	110	110
Casing Depth (ft)	242	240	251
Top of Screen (ft)	242	240	251
Bottom of Screen (ft)	302	267	291
Screen Diameter (in)	12	12	12
Drop Pipe Diameter (in)	8	6	8
Drop Pipe Material	black steel	stainless steel	black steel
Pump Inlet Setting (ft)	168	229	168
Motor HP	125	75	75
Design Q (gpm)	1400	700	1400
TDH (ft)	290	330	175
Static Level (ft)			
Transducer Setting (ft)	164		

Based on 7-02 survey by Interstate Engineering

Well may have had a 12" casing installed and annular space grouted in 1992.

Installed 14" liner Oct 2010, without grouting. Original corroded at 165 ft depth.

Original screen depth was 300 ft, but was cemented to 267 ft in July 2001, due to damage caused by vehicle colliding with pumphouse.

In 2006 installed 4 stage pump with VFD, operating between 285 gpm at 260 ft TDH and 700 gpm at 320 ft TDH

Section B

Wastewater System

Existing Facilities and Planned Improvements

Facility Description

The City of Wahpeton’s wastewater system consists of 41 miles of sanitary sewer, 10 lift stations, and a 6-cell lagoon treatment system shown in Exhibits B-1 and B-2. Exhibit B-3 identifies the collection system areas, shown numbered by lift station. Exhibit B-4 lists the key assets of the wastewater system.

The wastewater collection system is comprised of 34 miles of gravity sewer ranging from 8 to 27 inches in diameter, with an original 33.5 by 44 inch brick sewer section, and 7 miles of forcemain sewer ranging from 6 to 21 inches in diameter. Exhibit B-1 identifies the different size pipe and Exhibit B-2 provides the age of the pipe (where data are available). The wastewater is conveyed through 10 lift stations, each equipped with two pumps, except for Lift Station (LS) No. 1 which has four pumps. Wastewater from the central community area is collected and conveyed to Lift Station No. 1 and then pumped through a 21-inch forcemain to the wastewater treatment facility. Lift stations No. 8 and 9 pump wastewater collected from the west and north parts of the City and discharge into a 14-inch forcemain that goes directly to the wastewater treatment facility.

Lift station flow is estimated by the City based on recorded pump run-times. An estimate of flow from September 2003 to September 2004 (City of Wahpeton Wastewater System Needs Assessment, December 2006. Prepared by AE2S) is summarized in Table 1.

Table 1. Lift Station Flows (2003-04)

Lift Station No.	Average Daily Flow kgal/day
1	859.6
2	120.7
3	350.2
4	82.8
5	35.4
6	45.6
7	32.4
8	80.5
9	14.2
10*	18.6

Source: City of Wahpeton Wastewater System Needs Assessment, Dec 2006. Prepared by AE2S.

*Based on 2005 records

The majority of the conveyance system is made of vitrified clay and polyvinyl chloride. The original system served by LS No. 3 is made of brick and mortar (33.5x44 inch) and clay pipe, and was originally a combined sanitary and storm sewer that was separated. This area has the highest incidence of infiltration and inflow (I&I).

The wastewater treatment facility is a lagoon system with coarse-bubble aeration (AerResearch, Inc system) in Cell #1, and weir controlled flow to Cell #2. Transfer pipes with valves control flow to Cell #3 and to the transfer pump station that conveys wastewater to Cells #5 and #6 located three miles north. Cell #4 (located east of Cell #3) has been abandoned. The main discharge to the Red River of the North is from Cell #6, with the capability to discharge from Cell #3 and #5 under permitted conditions. Additional details on the wastewater treatment facility equipment and structures is contained in the City of Wahpeton Wastewater System Needs Assessment (AE2S, December 2006).

System Needs and Planned Improvements

This section supports the City of Wahpeton Water Infrastructure Systems Technical Memorandum, prepared as part of 2011 Comprehensive Plan Update. It provides a compilation of needs identified through previous studies and contained in the City's CIP. Past studies include: 1997 Comprehensive Plan; Facility Plan for Westside Development (Interstate Engineering, Inc., February 2001); and the Wastewater System Needs Assessment (AE2S, December 2006). Discussions and input from City staff identified the key system improvements required to sustain the wastewater infrastructure system and provide services to meet short- and long-term community goals. This update is not considered a needs assessment, but rather a reporting of the needs and improvements developed through other engineering studies and/or by City staff.

The needs assessment of the wastewater treatment facility in 2006 identified considerations for increased capacity and a range of improvements to provide a more reliable collection system and treatment process. The major issues and recommendations from the assessment are summarized below.

Collection System Issues – 2006 Assessment

- Inadequate flow monitoring to accurately plan for capacity needs and identify infiltration and inflow (I&I) areas.
- Limitations with the current data acquisition system for lift station monitoring which impede use of data for troubleshooting and capacity assessment.
- Need for additional alarming at the lift station to provide quick attention and offset damage that can occur with equipment failure or other conditions
- Capacity issues that cause sanitary sewer overflows to the storm sewer system at LS No. 3 (always reported to the regulatory authorities). Excessive I&I is a problem in this area, but efforts to date have not identified all the sources for storm water entering the sanitary system.

- LS No. 1 odors are not effectively removed by the existing odor control unit. The media requires frequent replacement.

Treatment System Issues – 2006 Assessment

- Inadequate flow monitoring in context with water quality sampling of the treatment facility influent. Better flow and loading data will provide for more accurate selection of process improvements and sizing of equipment and facilities for the treatment facility.
- While the facility has not had any issues in meeting effluent quality limits, with a system near capacity a better understanding of the influent loadings will provide for more optimum system O&M and planning for capital improvements. Currently, industrial contributions to the system are not managed with monitored/reported water quality and flow. A program to monitor and report water quality characteristics and flow will provide better information for operations of the treatment facility, planning for future improvements, and implementation of a rate structure to apply to industrial, residential, and commercial customers.
- Storage capacity: During a wet year the City had a 210-day storage capacity, providing a one-month safety factor. During dry years the safety factor increases to two months. Storage limitations result in reduced treatment and exceedance of effluent discharge limits, particularly if I&I continues to enter the collection system.
- Treatment Process Issues
 - Potential short-circuiting in Cell #1 results in incomplete aeration and likely produces dead zones and odor issues.
 - Inability to control the distribution of air into the Cell #1 aeration system and the need to shut the system down for any maintenance. There is also no way to monitor the effectiveness of the aeration system.
 - The existing blowers provide a constant output and are turned on and off based on run-time. A consistent air supply is best for treatment and energy efficiencies could be realized.

Recommendation – 2006 Assessment

- System-Wide Flow Monitoring: A plan should be implemented to measure and monitor lift station and influent flows. This information will assist in determining the capacity limitations of the system and provide a more targeted effort to reduce infiltration and inflow (I&I). It will also provide for more accurate selection of process improvements and sizing of equipment and facilities for the treatment facility. The plan should provide water quality sampling in relation to flow for the treatment facility influent.
- Facility Plan: After flow and water quality monitoring are established, a facility plan will provide direction for the collection system and treatment facility to meet near and long-term capacity and discharge effluent requirements.

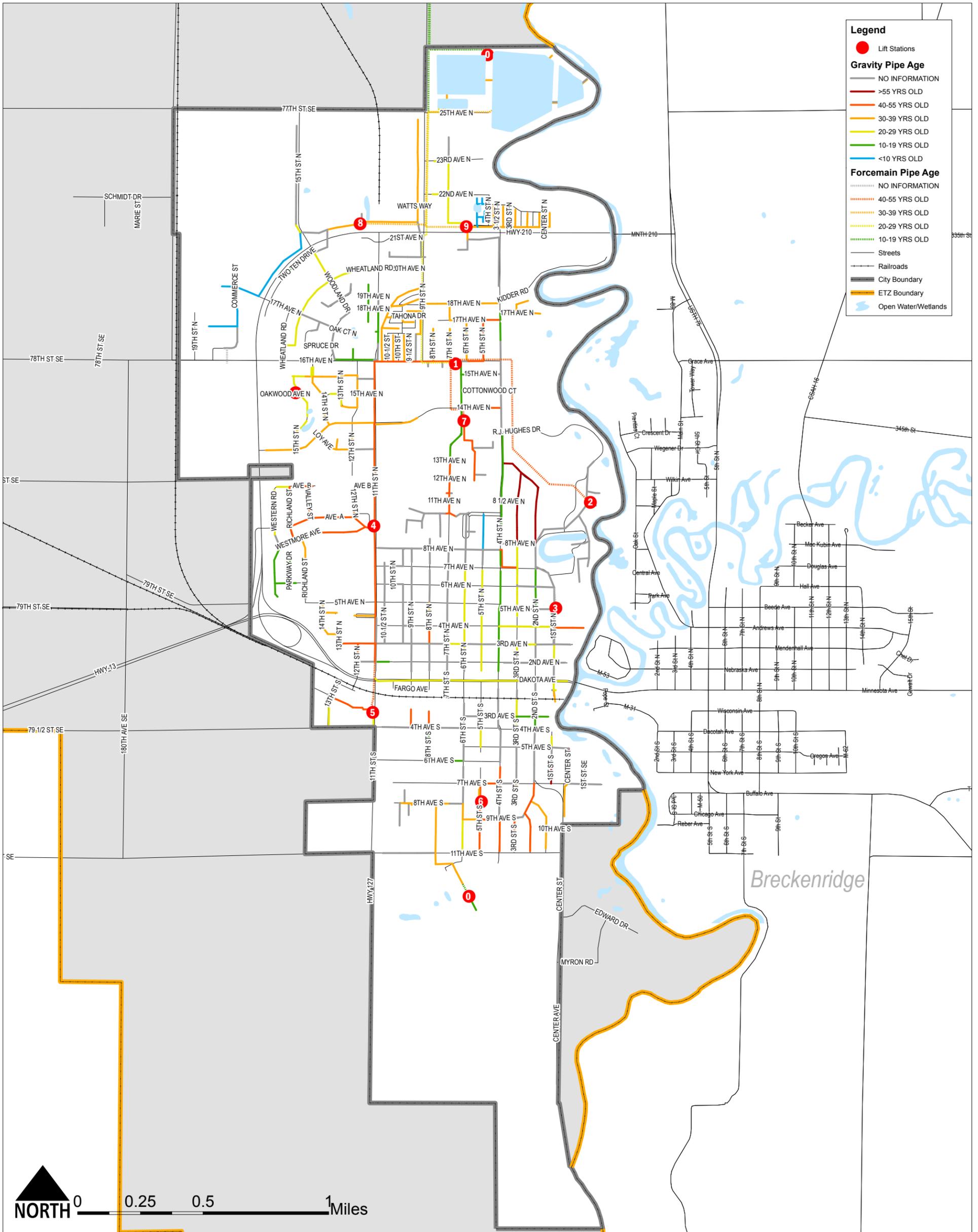
- Sanitary Sewer Evaluation Study: A study and system testing aimed at I&I reduction.
- Implementation of an industrial pretreatment program and wastewater utility rate structure system.
- Treatment System Improvements
 - Cell #1 short circuiting analysis
 - LS No. odor evaluation
 - Control system needs assessment
 - Influent forcemain evaluation

Planned Improvements

The 5-year CIP contains numerous projects for the wastewater system. These are projects that have been carried through from the Westside Expansion project, were identified in the 2006 Needs Assessment, and/or have been projects targeted by City staff. The major projects include (CIP Project Number):

- Sanitary Sewer Manhole Rehabilitation (112)
- Lift Station No. 3 Reconstruction (116)
- 1st Street N 12" Sanitary Sewer Replacement (117)
- Facility Plan - Southside & Old Town Sewers & LSs (186)
- Lift Station Flow Metering Improvements (249)
- Lift Station No. 3 Forcemain Replacement, Phase 1 (259)
- Lift Station No. 2 Reconstruction (260)
- Wastewater Treatment Facility Aeration System Improvements

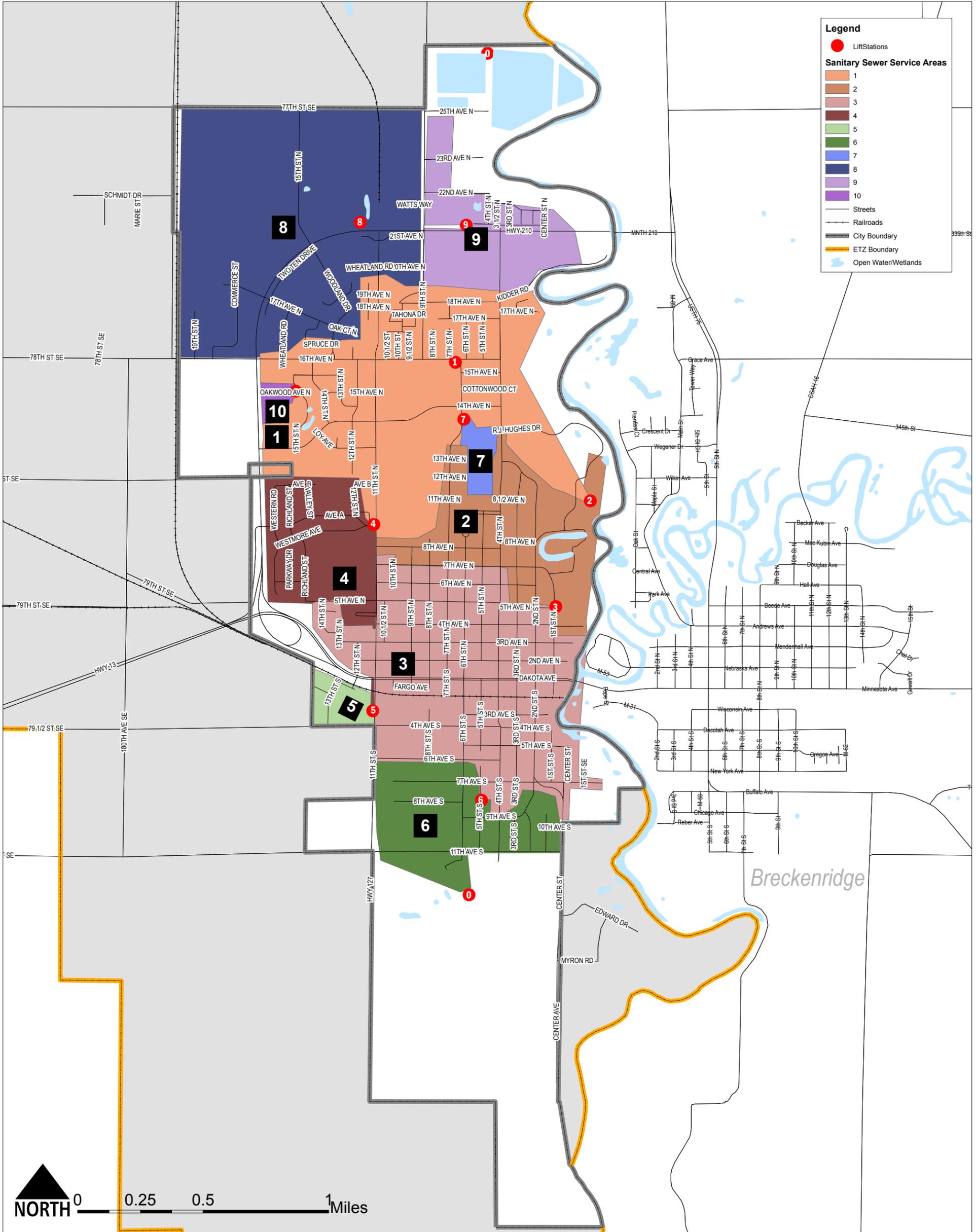
Exhibit B-2



Wastewater System - Age

Comprehensive Plan

Exhibit B-3



Sanitary Sewer Collection Areas

Comprehensive Plan

Exhibit B-4

City of Wahpeton Wastewater Infrastructure System Assets

Asset	Unit	No.	Description
WWTP			
Lagoon No. 1 Aeration System	Ea	1	Coarse-bubble (AerResearch Inc)
Lagoons (6-cell)	acre-ft	1,136	4-cells on City's north border (east); 2-cells 3 miles north
Collection System			
Manholes	Ea	580	
Lift Station	Ea	10	listed below
Gravity Sewer			
8" Gravity Sewer	LF	79,100	
10" Gravity Sewer	LF	40,500	
12" Gravity Sewer	LF	35,200	
15" Gravity Sewer	LF	6,150	
18" Gravity Sewer	LF	7,900	
20" Gravity Sewer	LF	1,100	
24" Gravity Sewer	LF	4,050	
27" Gravity Sewer	LF	1,500	
33.5"x 44" Gravity Sewer	LF	1,200	
Forcemain			
6" Forcemain	LF	1,600	
8" Forcemain	LF	3,250	
12" Forcemain	LF	4,200	
14" Forcemain	LF	4,800	
21" Forcemain	LF	6,330	
21" Transfer Main	LF	16,000	
Lift Stations			
No. 1 - Master Lift	Ea	1	4 pumps @ 2400 gpm ea & 38.5 ft TDH
No. 2 - Golf Course	Ea	1	2 pumps @ 1800 gpm ea & 52 ft TDH
No. 3 - Downtown	Ea	1	2 pumps @ 1100 gpm ea & 28 ft TDH
No. 4 - High School	Ea	1	2 pumps @ 1100 gpm ea & 31 ft TDH
No. 5 - South West	Ea	1	2 pumps @ 650 gpm ea & 52 ft TDH
No. 6 - South West	Ea	1	2 pumps @ 300 gpm ea & 23 ft TDH
No. 7 - NDSCS	Ea	1	2 pumps @ 250 gpm ea & 20 ft TDH
No. 8 - Otter Tail	Ea	1	2 pumps @ 1050 gpm ea & 67 ft TDH
No. 9 - North East	Ea	1	2 pumps @ 500 gpm ea & 58 ft TDH
No. 10 - Oakwood	Ea	1	2 pumps @ 200 gpm ea & 16 ft TDH

Section C

Stormwater and Flood Protection System

Existing Facilities and Planned Improvements

Facility Description

The natural drainage in Wahpeton is shallow with a flat grade all around the city. Stormwater is collected and discharged to either the Red River to the east or the Wild Rice River to the west, with the drainage divide along 11th Street. The original drainage system is an extensive storm sewer system east of 11th Street North that is managed through a discharge into the Red River of the North. A large drainage ditch beginning at the intersection of 16th Avenue North and Highway 210 carries stormwater west along 16th Avenue and then north along Richland County Highway 10 with discharge into the Wild Rice River through Drain No. 1 (legal drain) northwest of the city. The southwest area of Wahpeton discharges to the Wild Rice River through unnamed natural drainageways.

Table C-1. Wahpeton Stormwater System Assets

Asset	Unit*	No.
Storm Sewer	lf	165,255
Storm Sewer Manholes	ea	441
Storm Inlets	ea	981
Storm Ditch	lf	88,882
Storm Drain No. 1	ea	1
Culverts	lf	7,871

*lf = linear feet; ea=each

Eight pump stations were installed with the levee system in 1997. During normal river flow periods stormwater discharges into the Red River through gates in the levee. At high flow periods, the pumps lift stormwater over the levee to the Red River. Pads were added in 2003 and 2008 to provide for temporary pump use in critical areas.

System Needs and Planned Improvements

This section supports the City of Wahpeton Water Infrastructure Systems Technical Memorandum, prepared as part of 2011 Comprehensive Plan Update. It provides a compilation of needs identified through previous studies and contained in the City's CIP. Past studies include: 1997 Comprehensive

The City's stormwater and flood protection systems are shown by pipe size and age in Exhibits C-1 and C-2. Exhibit C-3 identifies the stormwater basins. Table C-1 presents a summary of the stormwater system assets and Table C-2 presents the equipment related to flood protection.

Table C-2. Wahpeton Flood Protection System Assets

Asset	Installation Year
Pump Station 1	1997
Pump Station 2	1997
Pump Station 3	1997
Pump Station 4	1997
Pump Station 5	1997
Pump Station 6	1997
Pump Station 7	2003
Pump Station 1A	2003
Portable Pump Pad 2A	2003
Portable Pump Pad 4	2003
Portable Pump Pad 4A	2003
Portable Pump Pad 8	2008

Plan and Facility Plan for Westside Development (Interstate Engineering, Inc., February 2001). Discussions and input from City staff identified the key system improvements required to sustain the stormwater and flood protection infrastructure systems and provide services to meet short- and long-term community goals. This update is not considered a needs assessment, but rather a reporting of the needs and improvements developed through other engineering studies and/or by City staff.

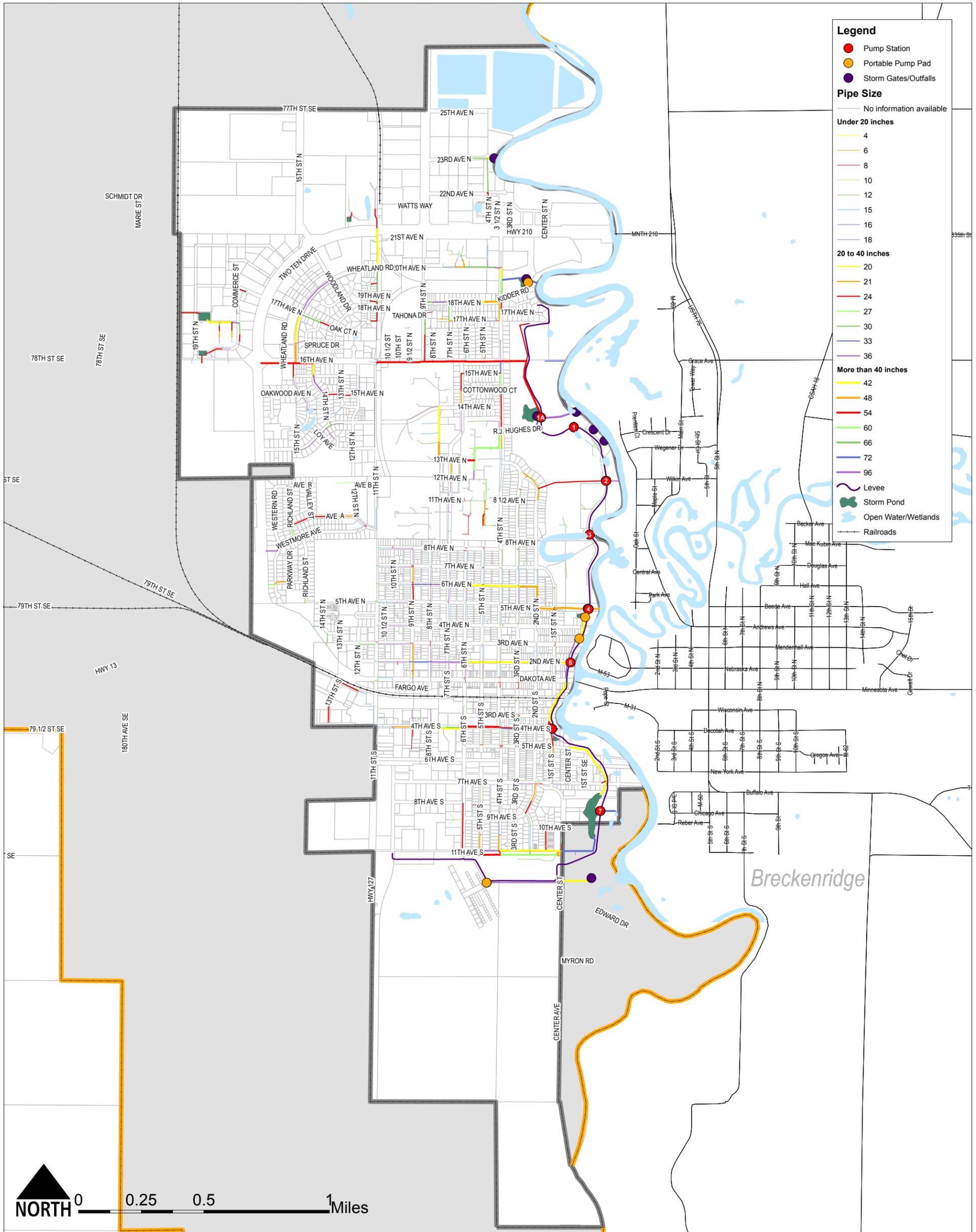
The main stormwater issues for the City are street flooding and associated property damage during summer storms and spring thaw/precipitation events and the potential for exceeding pumping capacity during high river flows when flood gates are closed.

One of the larger projects for stormwater improvements involves replacement of deteriorating systems and capacity issues on the west side and the main drain to Drain No. 1 (Wild Rice River). These improvements were coordinated with the Westside expansion and continue through 2013. A second phase of improvements focus on the southside drainage systems. Another area with targeted improvements to address both age and capacity issues is in the Old Town area. Minor modifications/improvements to the pump stations along the levees will increase the capacity to provide a higher level of protection during high river flows. A longer-term issue concerns drainage of the southwest area. A legal drain needs to be established to provide for proper maintenance and would include a newly constructed system (4 miles) to the Wild Rice River.

The 5-year CIP contains several projects for the stormwater and flood protection systems. The major projects include (CIP Project Number):

- Drainage Improvements, Misc (208)
- Loy Ave & Concord Storm Sewer (235)
- Southside Drainage Improvements, Phase B (266)
- Westside Drainage Improvement, Phase A (269)
- Westside Drainage Improvement, Phase B (282)
- City Drain No. 1 (120)
- Levee Pump System Improvements

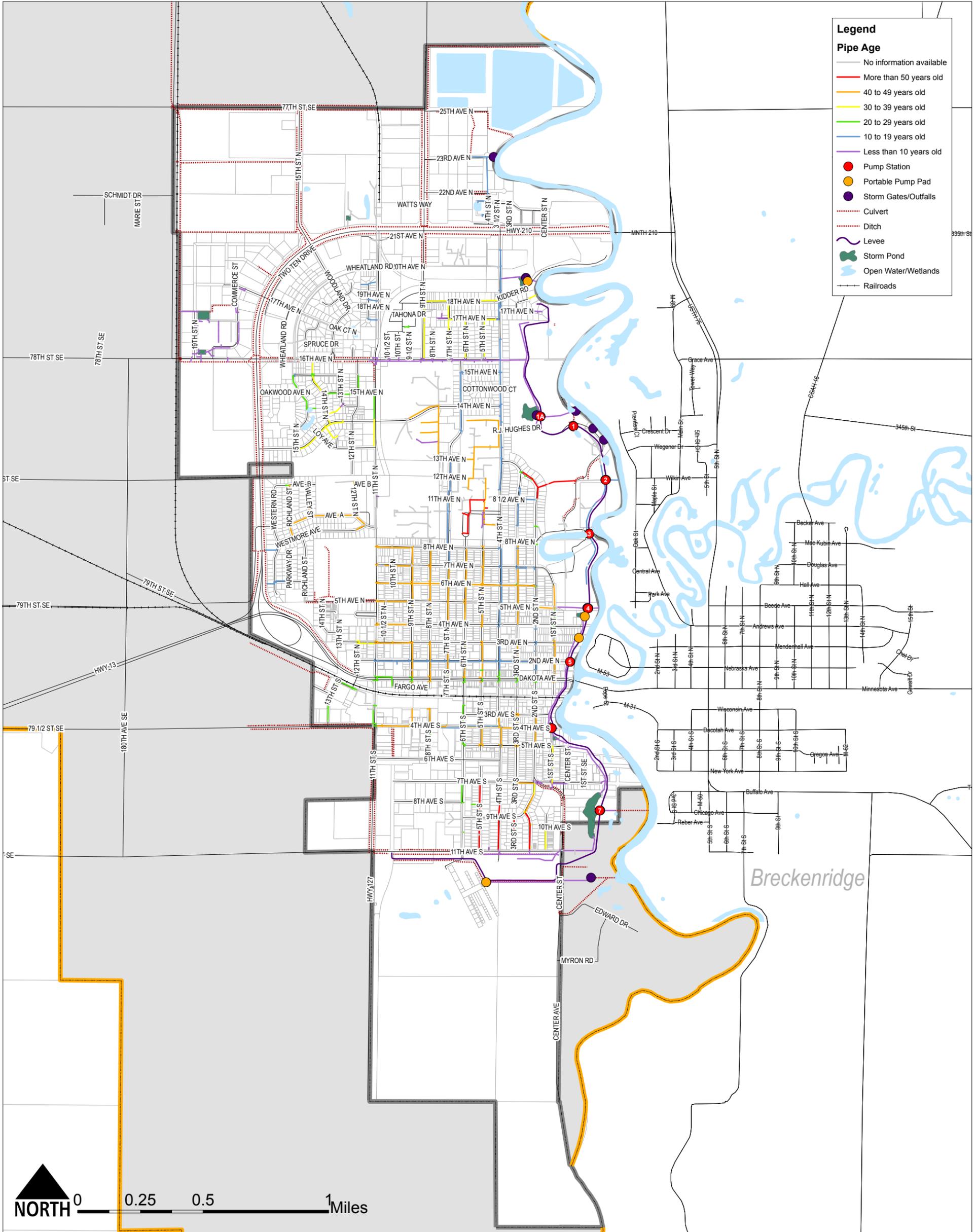
Exhibit C-1



Stormwater and Flood Protection System - Size

Comprehensive Plan

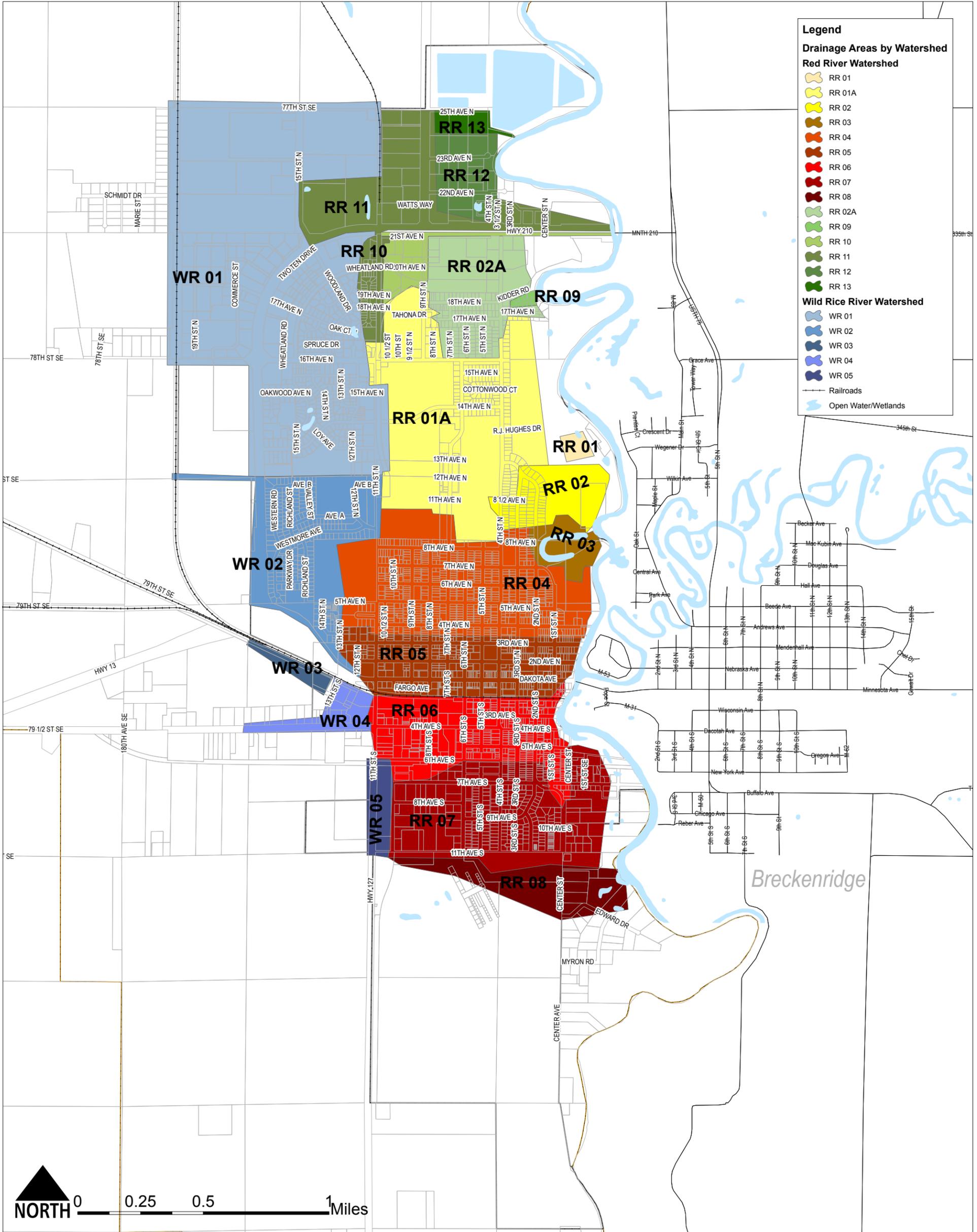
Exhibit C-2



Stormwater and Flood Protection System - Age

Comprehensive Plan

Exhibit C-3



Stormwater Drainage Areas

Comprehensive Plan

Section D

Public Utility Infrastructure Asset and CIP Summary

A summary of the City's public utility assets and the estimated costs and replacements for these assets is provided in Exhibit D-1.

The list of CIP projects related to water infrastructure and the related streets/trail systems is extensive and the latest list should be obtained from the City. To assist in planning for specific areas, a map of all the improvements planned by the City in the next five years is included as Exhibit D-2.

Exhibit D-1. Draft-City of Wahpeton Infrastructure Asset Inventory and Estimated Replacement Costs, 2010

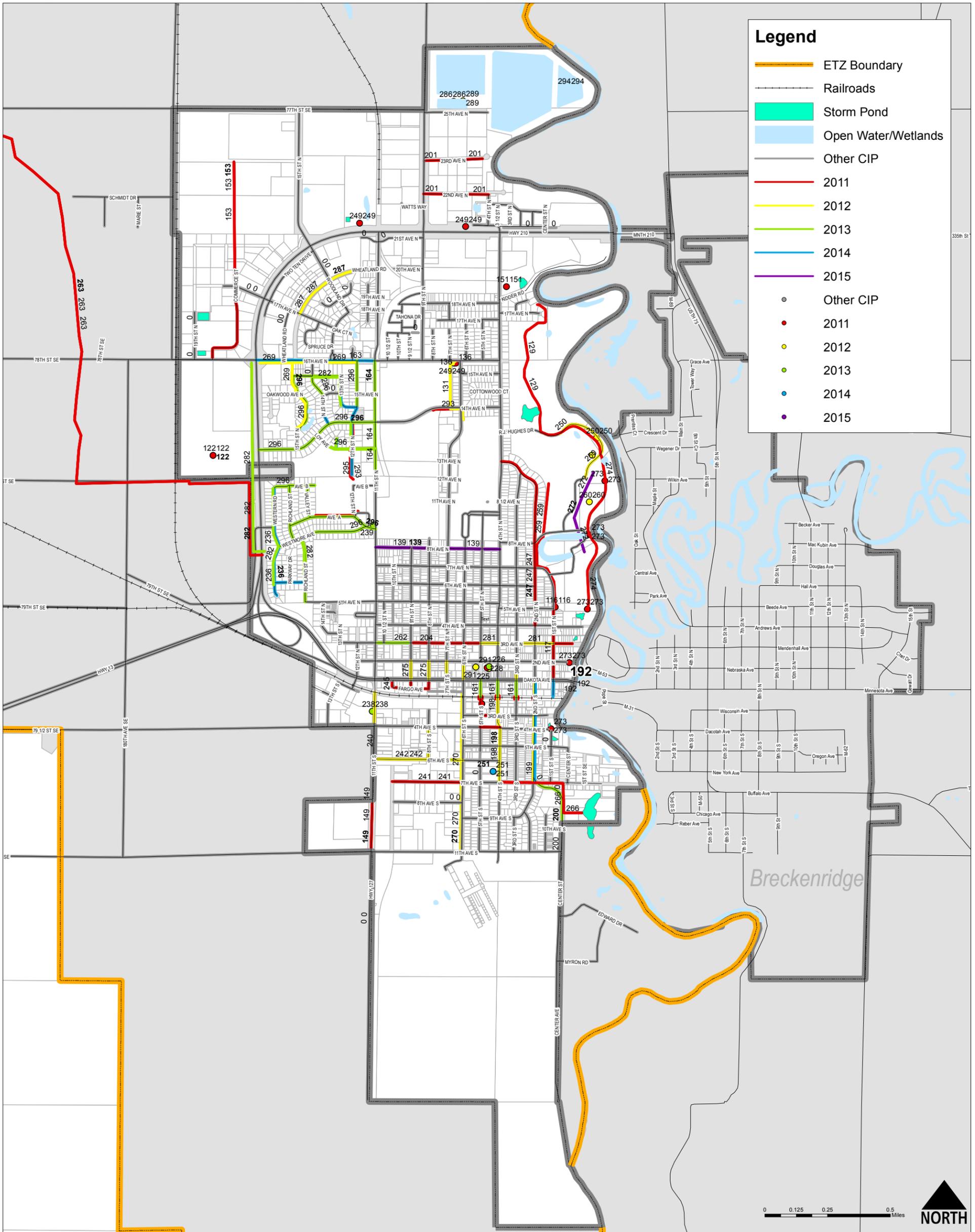
Item	Total System Quantity	Length (miles)	Useful Life (years)	Replacement Unit Cost	System Value at Replacement Cost	Average Annual Replacement Quantity	Average Annual Replacement Cost	Average Annual Replacement Cost
Streets								
Streets (feet)	235,191	44.5	40	\$275	\$64,677,525	5,880	\$1,616,938	\$1,617,000
Alleys (feet)	33,722	6.4	40	\$80	\$2,697,760	843	\$67,444	\$67,000
Traffic Signs (each)	4,704		20	\$350	\$1,646,337	235	\$82,317	\$82,000
Traffic Signals (intersection)	6		40	\$200,000	\$1,200,000	0.2	\$30,000	\$30,000
Subtotal					\$70,221,622			\$1,796,000
Sidewalks & Paths								
Shared Use Path (feet)	23,148	4.4	40	\$50	\$1,157,400	579	\$28,935	\$29,000
Sidewalk (feet)	183,047	34.7	40	\$25	\$4,576,175	4,576	\$114,404	\$114,000
Subtotal					\$5,733,575			\$143,000
Storm System								
Storm Sewer (feet)	165,255	31.3	75	\$60	\$9,915,300	2,203	\$132,204	\$132,000
Storm Sewer Manholes (each)	441		75	\$3,000	\$1,323,000	6	\$17,640	\$18,000
Storm Inlets (each)	981		35	\$2,500	\$2,452,500	28	\$70,071	\$70,000
Storm Ditch (feet)	88,882	16.8	50	\$25	\$2,222,050	1,778	\$44,441	\$44,000
Storm Drain No. 1	21,648	4.1	50	\$80	\$1,731,840	433	\$34,637	\$35,000
Culverts (feet)	7,871	1.5	35	\$20	\$157,420	225	\$4,498	\$4,000
Subtotal					\$17,802,110			\$303,000
Flood Protection System								
Levees (feet)	19,206	3.6	100	\$750	\$14,404,500	192	\$144,045	\$144,000
Pump Stations (each)	7		50	\$500,000	\$3,500,000	0.1	\$70,000	\$70,000
Subtotal					\$17,904,500			\$214,000
Wastewater System								
Sanitary Sewer Main (feet)	176,463	33.4	75	\$60	\$10,587,780	2,353	\$141,170	\$141,000
Sanitary Manholes (each)	599		75	\$3,500	\$2,096,500	8	\$27,953	\$28,000
Lift Station (each)	10		40	\$350,000	\$3,500,000	0.3	\$87,500	\$88,000
Lift Station No. 1	1		40	\$800,000	\$800,000	0.0	\$20,000	\$20,000
Forcemain (feet)	38,802	7.3	50	\$75	\$2,910,150	776	\$58,203	\$58,000
Lagoon No. 1 Aeration System	1		40	\$250,000	\$250,000	0.0	\$6,250	\$6,000
Lagoons (acre-ft)	1,136		100	\$5,500	\$6,248,000	11	\$62,480	\$62,000
Subtotal					\$26,392,430			\$403,000
Water System								
Water Main (feet)	241,448	45.7	75	\$50	\$12,072,400	3,219	\$160,965	\$161,000
Water Valves (each)	629		75	\$1,500	\$943,500	8	\$12,580	\$13,000
Hydrants (each)	342		40	\$3,000	\$1,026,000	9	\$25,650	\$26,000
Well & Pump House (each)	3		40	\$550,000	\$1,650,000	0.1	\$41,250	\$41,000
Water Storage Tower (each)	2		75	\$1,700,000	\$3,400,000	0.0	\$45,333	\$45,000
Water Treatment Plant	1		50	\$6,000,000	\$6,000,000	0.0	\$120,000	\$120,000
Subtotal					\$25,091,900			\$406,000
Other Facilities								
Street Shop-Bldgs/Site Impr.	1		50	\$1,500,000	\$1,500,000	0.0	\$30,000	\$30,000
Public Parking Lots (sf)	135,378		50	\$6.50	\$879,957	2,708	\$17,599	\$18,000
					\$2,379,957			\$48,000
Total Estimated Replacement Cost of City Infrastructure, excluding public buildings					\$163,146,000			\$3,265,000

Notes:

1. Street replacement unit cost based on 2004 16th Ave N Reconstruction. Pavement width was 44 ft., cost was \$375/ft. Street replacement unit cost assumes 32 ft pavement width.
2. Water and sewer unit cost based on assumption that street and utilities are replaced at same time.
3. Streets length excludes DOT, NDSCS, Sunset Trailer Court, Briarwood Trailer Court and alleys; includes County segments.
4. Shared use path length includes paths on levees and in Airport Park.
5. Alley replacement cost based on \$160/LF for paved alley, with 50% of total alley quantity having gravel surfacing.
6. Number of traffic signs based on one sign per 50 LF of street.
7. Wastewater lagoon volume based on 8 ft. depth.
8. Public Parking Lots include Town Center Square, Penny's, Community Center, 3rd Ave S, 2nd Ave N.

Version: Provided by City - 8/31/10 Draft

Exhibit D-2



2010 Five-Year CIP Projects

Comprehensive Plan