SANITARY SEWER

CHAPTER

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Chapter 13: Sanitary Sewer

The City of Hastings' Comprehensive Sanitary Sewer System Plan details the existing conditions and future needs for the City's wastewater collection and treatment system. The Comprehensive Sanitary Sewer System Plan, prepared by WSB, provides a land use analysis, growth projects, description of the existing sanitary sewer system, describes the future sanitary sewer system and provides a summary of planned capital improvements for the sanitary sewer system.

COMPREHENSIVE SANITARY SEWER PLAN

COMPREHENSIVE SANITARY SEWER PLAN

HASTINGS | MINNESOTA

September 23, 2020

Prepared for:
City of Hastings
101 – 4th Street East
Hastings, MN 55033

WSB PROJECT NO. 010720-000

COMPREHENSIVE SANITARY SEWER SYSTEM PLAN

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Prepared for:

City of Hastings
101 – 4th Street East
Hastings, MN 55033

September 24, 2020

Prepared by:

wsb

CERTIFICATION

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly licensed professional engineer under the laws of the State of Minnesota.

Greg Johnson, P.E.

Date: September 24, 2020 Lic. No. 26430

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1.0 EXECUTIVE SUMMARY

The City of Hastings Comprehensive Sanitary Sewer Plan (study) is intended to provide an inventory of the City's existing sanitary sewer facilities (trunk sewer system), an analysis of the adequacy of existing facilities, a plan to expand the existing trunk sewer system to collect wastewater flow from future development, and a Capital Improvement Plan (CIP) for funding future trunk sewer system expansions. The trunk sewer system is defined as gravity sewer mains greater than or equal to 10-inches in diameter, lift stations with upstream gravity sewer mains greater than or equal to 10-inches in diameter, and forcemains associated with trunk lift stations.

The report, analysis, and figures related to the existing trunk sewer system were based on data (as-builts, development extents, and wastewater flow data) as of August 31, 2017. Recommended future trunk sewer system improvements were based on data (wastewater flow projections and development extents) from the draft 2040 Comprehensive Land Use Plan (land use plan) and planning discussions with City staff.

The existing trunk sewer system and future development plans will change over time and could develop differently from this plan in certain areas. Therefore, it is recommended to update the SewerCAD model completed with this study as development occurs in order to maintain an accurate "existing system" SewerCAD model.

The existing area to which the City provides sanitary sewer service has been divided into eight (8) sewer districts. Each sewer district was also divided into sub-districts. The existing sewer districts are mostly developed, and the existing land uses are shown in **Figure 3-1**. Wastewater is collected by the City's trunk sewer system, and then conveyed to the Metropolitan Council Environmental Services (MCES) Hastings Wastewater Treatment Plant (treatment plant). MCES plans to relocate the existing treatment plant to provide additional capacity as the City grows. The existing sanitary sewer system and sanitary sewer districts are shown in **Figure 5-1** and **Figure 5-2**. Sanitary sewer sub-districts are displayed in **Figure 5-3**.

Capacity analysis for the existing trunk sewer system was completed by updating the model of the existing trunk sewer system using SewerCAD software (SewerCAD V8i) and as-builts provided by the City. The location of existing wastewater flows and their discharge points to the trunk sewer system were estimated to analyze the capacity of the existing trunk sewer system. Wastewater flows were estimated based on typical MCES recommendations per land use and then calibrated against MCES wastewater flow data.

Results from the modeling indicate that the existing trunk sewer system has adequate capacity for existing peak flows, as shown in **Figure 5-5**. City staff confirmed that there are no existing trunk sewer system "bottlenecks" where overflows occur or where peak wastewater flows exceed the capacity of lift station pumps.

Future wastewater flows will increase as the population grows and development occurs. Growth projections have been developed in accordance with the Metropolitan Council System Statement for the City of Hastings. The future land use plan, shown in **Figure 3-2**, provides sufficient development area to meet the City's growth needs in accordance with the Metropolitan Council Thrive MSP 2040 framework.

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Planning for expansion of the trunk sewer system is typically based on developable acres because the location of development is critical for determining the capacity of downstream sewers. For that reason, the extents of the developable land area have been termed the "2040 sewer service area." Growth rates will continually change with time; however, the capacity of the trunk sewer system depends on the development of specific areas at specific locations.

Planning for the trunk sewer system beyond the 2040 boundary was important to identify potential trunk sewer corridors and to preserve those corridors as development occurs. Analysis of the topography surrounding Hastings indicated that existing gravity sewers could be extended beyond the 2040 sewer service area. Therefore, the extents of the ultimate sewer service area were not defined based on topography, but by existing trunk sewer system capacity limitations and the ultimate wastewater treatment plant capacity. Ultimate sewer districts are shown in **Figure 6-1**. Some trunk sewers could be difficult to reconstruct or upsize; therefore, the boundaries of ultimate sewer districts were influenced by the capacity limitations of individual trunk sewer sections.

It is anticipated that development will initially occur within the 2040 sewer service area and the existing trunk sewer system could be extended to serve new development. However, once wastewater flow increases to 5.5 million gallons per day (MGD) peak flow in the main interceptor, it is recommended to increase the capacity of the main interceptor. Main interceptor capacity could be added by construction of a parallel interceptor, by increasing the size of the existing interceptor, or by a combination of both, as shown in **Figures 6-2** and **6-3**. For the purpose of this study, it was assumed that the construction of a parallel interceptor or the reconstruction of an existing interceptor would occur at the same grade as the existing interceptor sewer. A detailed evaluation is recommended to determine the most cost-effective construction method for adding interceptor capacity.

In addition to increasing existing interceptor capacity, further improvements are necessary to route wastewater flows to the future treatment plant. A 600 gallon per minute (GPM) lift station would need to be constructed at the existing treatment plant to pump wastewater to the relocated plant. The main interceptor could be extended to the future treatment plant as a 48 to 54-inch interceptor along Ravenna Trail as shown in **Figures 6-2** and **6-3**. If development occurs in accordance with the projections shown in **Figure 4-2**, both the treatment plant relocation and capacity increase of the main interceptor would need to be completed pre-2040. The City expects the Metropolitan Council to cover the capital costs of these regional collection improvements.

Development growth is expected to continue to the 2040 sewer service area boundary in all districts in accordance with the future land use plan (**Figure 3-2**) and land use phasing plan (**Figure 4-2**). However, once growth has encompassed the 2040 sewer service area, expansion of the sewer service area could be limited to the available capacity throughout the existing system. The ultimate sewer districts were sized not to exceed 10.0 MGD average flow since that is the planned ultimate treatment plant capacity.

Initial development in the east and east-southeast districts will likely generate minimal flow relative to the capacity of the ultimate 27-inch east interceptor. The ultimate trunk sewer would likely be difficult to maintain when conveying minimum initial wastewater flows. Therefore, it is recommended to preserve the corridor for ultimate trunk sewer construction, but initially a

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smaller diameter may be constructed. As development plans materialize in this district a more detailed evaluation can be completed to determine phasing of the east interceptor.

The existing topography of the undeveloped areas was studied to determine the route of gravity sewer areas for future trunk facilities. The intention with laying out the future system was to minimize the number of trunk lift stations, while keeping the maximum depth of gravity sewers to less than 30 feet deep. Future sewers were designed at minimum grade as a conservative measure in the event that some sections would be constructed at minimum grade. The City's topography generally slopes from southwest to northeast, making it possible to avoid constructing many lift stations. The layout of the ultimate trunk sewer system is shown in **Figure 6-3**. The 2040 trunk sewer system is shown in **Figure 6-2** and would be a phase of the ultimate trunk sewer system. The layout is general in nature and exact routing will be determined at the time of final design. It is important that the general concept and sizing be adhered to for assurance of an economical and adequate ultimate system.

The land use plan identifies which properties are likely to develop and when based on current development pressure through 2040 as shown in **Figure 4-2**. Phasing for expansion of the 2040 trunk sewer system was developed in accordance with development phasing as shown in **Figure 7-1**. Also, the phasing shown in **Figure 7-1** was used to project future construction costs in the CIP summarized in **Table 1-1** below.

Construction cost estimates were developed for the completion of the 2040 trunk sewer system. Typically, developers are required to construct sewers and lift stations necessary to serve their development at their own cost. Some gravity trunk sewers included in the ultimate system for this plan were as small as 8 inches in diameter, which is the minimum sewer size that MPCA allows. It was assumed that developers would fund and construct all 8-inch sewers, so the estimated quantity of 8-inch diameter trunk sewers has been included, but not the cost. Additionally, the City will only cover the oversizing cost of trunk sewers greater than 8-inch diameter, in other words the cost difference between the larger trunk and an 8-inch sewer. Developers are also required to pay the full costs of lift stations when needed to serve new development.

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Table 1-1 below shows the CIP summary. Future improvement costs were based on 2017 construction prices, including a 10% construction contingency and a 20% overhead markup (i.e., legal, engineering, and administrative). Street and easement costs and other miscellaneous costs that may be related to final construction are not included. Detailed cost estimates for each five-year period of the CIP are included in **Appendix 3**.

Table 1-1
Capital Improvement Plan Summary

Year	Estimated Cost
2020-2025	$5,503,537
2025-2030	$2,417,712
2030-2035	$3,282,977
2035-2040	$3,827,253
Total	***$15,031,479***

1. Costs are for budgeting purposes only and are subject to change as projects are studied, designed, and constructed.
2. Costs are estimated based on 2017 construction costs.
3. Land acquisition costs are not included.

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2.0 PURPOSE AND SCOPE

The City of Hastings is located in northeastern Dakota County in the southeast suburbs of the Twin Cities Metropolitan Area. Hastings has experienced moderate growth in recent years and anticipates similar growth to continue. It continually experiences development pressures due to its location relative to transportation arterials (MN 55 and US 61) and its proximity to the Twin Cities.

The purpose of this study is to update the City's existing Comprehensive Sanitary Sewer System Plan in accordance with Minnesota Statute 473.513. The study provides an inventory of existing sanitary sewer facilities, an analysis of the adequacy of the existing trunk sewer system, a plan to expand the existing trunk sewer system to collect wastewater flow from future development, and a CIP for funding future trunk sewer system expansions. The trunk sewer system is defined as gravity sewer mains greater than 10-inches in diameter, lift stations with upstream gravity sewer mains greater than 10-inches in diameter, and forcemains associated with trunk lift stations.

This study provides flow projections for the City of Hastings through the year 2040 and has been developed in accordance with the Thrive MSP 2040 regional development framework adopted by the Metropolitan Council. The Thrive MSP 2040 framework includes forecasts of population, households, employment, and wastewater flows for communities within the Metropolitan Council Service Area. The Metropolitan Council projects Hastings' 2040 average wastewater flow will reach 1.78 MGD.

A capacity analysis of the existing trunk sewer system was completed by updating the model of the existing trunk sewer system using SewerCAD software (SewerCAD V8i) and as-builts provided by the City. Future trunk sewer system improvements were determined by modeling the expansion of the existing trunk sewer system to serve future development based on data (wastewater flow projections and development extents) from the 2040 Comprehensive Land Use Plan and planning discussions with City staff.

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3.0 LAND USE

3.1 Land Use Categorization

Figure 3-1 shows existing land use for the City of Hastings as included in the land use plan. Existing land use is separated into fifteen (15) different land use categories.

Figure 3-2 shows the City's 2040 land use plan. The 2040 land use plan includes fourteen (14) land use categories.

Land use is a critical factor in determining existing trunk sewer system capacity and sizing future trunk sewer extensions because different land uses generate different wastewater flow rates. Further detail regarding wastewater flows generated by land use categories is discussed in Sections 5 and 6.

3.2 Developable Areas

As discussed in the land use plan, the future land use plan provides sufficient development area to meet the City's growth needs in accordance with the Thrive MSP 2040 framework. Growth projections included in the land use plan indicate that not all of the land shown in **Figure 3-2** will be developed by 2040.

Planning for sewer service is typically based on developable acres because the location of development is critical for determining the capacity of individual downstream sewers. For that reason, the extents of the developable land area have been termed the "2040 sewer service area boundary." Growth rates will continually change with time; however, the capacity of the trunk sewer system is based on the development of specific areas at specific locations.

The area within the City's 2040 sewer service area boundary is approximately 12.4 square miles or 7,967 acres. The existing sewer service area, approximately 5,343 acres, is defined as developed property with sewer service, or partially developed property to which sewer service has been extended. The existing sewer service area is shown in **Figure 3-3**.

The 2040 developable area is defined as the difference between the 2040 sewer service area boundary and the existing sewer service area, less any undevelopable land uses within that area. Land uses considered undevelopable were right of way, conservation land, floodplain, and parks. Typically, golf course land use is considered undevelopable land. However, given the possibility of redevelopment of this area, it was assumed that half of the total acreage of the existing golf course would be redeveloped to accommodate a low density residential land use for ultimate flow conditions. The difference between the 2040 sewer service area boundary and the existing sewer service area is approximately 2,681 acres, and there are approximately 392 acres of undevelopable land use within that area. Therefore, there are approximately 2,283 acres of new perimeter developable area.

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The developable land use area was identified as "Gross" Developable Acreage because it includes roads and common or public areas potentially included in developments. Roads, common areas, and parks typically consume 25% to 30% of the gross area within a development. The Gross Developable Acreage by land use categories is summarized in **Table 3-1**.

Table 3-1
Gross Developable Acreage[1]

Land Use	Acres
Low Density Residential	1,414
Medium Density Residential	370
High Density Residential	162
Mixed Use Residential	219
Business Park	85
Commercial	5
Industrial	7
Institutional	15
Agricultural	6
Total	**2,283**

[1] Gross developable acreage is based on the land area shown in **Figure 3-3** to the extents of the 2040 sewer service area boundary which corresponds to the existing and future land use shown in **Figures 3-1** and **3-2**.

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4.0 GROWTH PROJECTIONS

4.1 Projected Growth

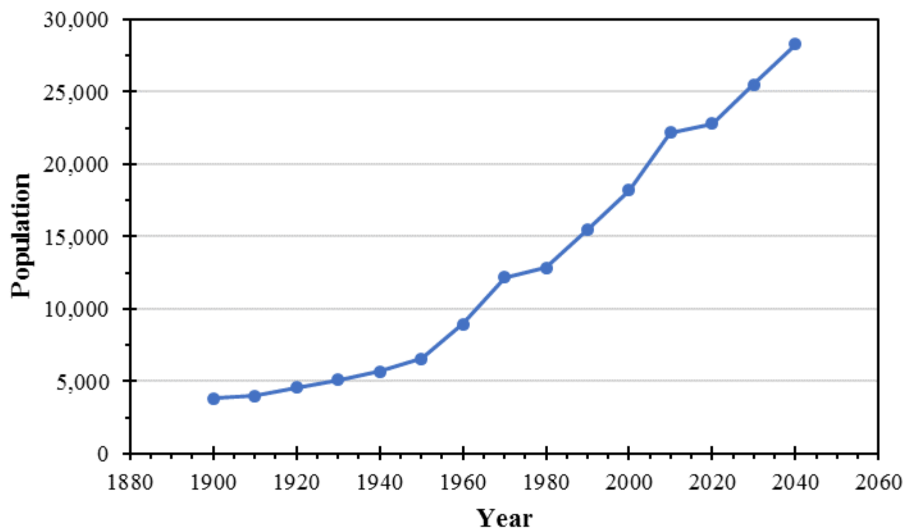
Historical population data for the study area from the Minnesota State Demographer's office and future population projections from the Metropolitan Council System Statement are shown in **Table 4-1** and **Figure 4-1**. Hastings exhibited consistent growth prior to 1950, and the population has more than tripled since 1950.

The land use plan projects residential growth based on the Metropolitan Council System Statement. **Table 4-1** below shows the future residential population and employment projections provided by the Metropolitan Council in the City's System Statement.

Table 4-1
City of Hastings' Metropolitan Council System Statement

	2010	Thrive MSP 2040		
		2020	2030	2040
Population	22,172	22,800	25,500	28,300
Households	8,735	9,200	10,600	12,000
Employment	8,532	8,100	9,100	9,600

Figure 4-1
Historical and Projected Population



Hastings is home to a variety of businesses including a thriving downtown area with many small businesses, county and local government, and several large companies. As shown in **Table 4-1**, Hastings' employment base is expected to grow steadily over the next thirty years.

4.3 Projected Land Use Phasing and Summary

For sewer planning purposes, it is critical to project which areas will develop within a particular time frame. The future land use plan identifies which areas are likely to develop and when. The potential service areas at each interval are shown in **Figure 4-2** and summarized in **Table 4-2**. The potential service area is shown for the years 2020, 2025, 2030, 2035, and 2040. The existing sewer service area shown in **Figure 4-2** is approximately 5,343 acres. The greatest development pressure is expected to occur in the northwest, west, southwestern, and southeastern areas of the City.

Table 4-2
Potential Service Area

	2020	2025	2030	2035	2040
Inside City Limits (acres)	5,343	5,370	5,455	5,455	5,455
Outside City Limits (acres)	0	320	1,101	1,721	2,502
Total Service Area (acres)	5,343	5,690	6,556	7,176	7,957

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5.0 EXISTING SANITARY SEWER SYSTEM

5.1 Existing Service Areas

Sanitary sewer systems consist of two elements: collection and treatment. The existing City sanitary sewer system is a collection system only; Metropolitan Council Environmental Services (MCES) is responsible for treatment.

The MCES Hastings Wastewater Treatment Plant is located along the Mississippi River in downtown Hastings. Due to the site limitations of the existing wastewater treatment plant, MCES is planning to relocate the treatment plant southeast of downtown.

The existing sewer service area is defined as the area from which wastewater flows are collected and is approximately 5,343 acres. It was broken down into eight sewer districts based on its connection points to existing City trunk sewers and lift station service areas. **Figure 5-1** shows the existing sewer service area, sewer districts (and sub-districts), sanitary sewer system, and lift stations.

5.1.1 Individual Sewage Treatment Systems

There are several properties located within the City limits that are not connected to the City's sanitary sewer collection system. Wastewater treatment at the unserved properties located within the City limits is accomplished by Individual Sewage Treatment Systems (ISTS). There are currently 25 ISTS within the City limits without sewer service. **Figure 5-4** shows the existing ISTS within the existing City service area. The current ordinance governing the permitting, installation and maintenance of these systems is included in **Appendix 1**.

5.2 Existing Wastewater Flows

An analysis of the existing wastewater flow was completed to create a SewerCAD model of the existing trunk sewer system. To create an accurate representation of the existing trunk sewer system, the location of where existing wastewater is generated and where it enters the trunk sewer system was estimated. The following sections discuss the method and data used in estimating the location of existing wastewater flows within the trunk sewer system.

5.2.1 Existing Sewer District Wastewater Flows

Wastewater flow generation rates for each individual sewer and sub-sewer district were not available for existing sewer flow analysis since the sewer collection system for the City of Hastings is only equipped with one MCES flow meter (flow meter M602), which is located at the Hastings wastewater treatment plant. Therefore, the existing sewer flows generated in each district had to be estimated to be able to generate a SewerCAD model for the City of Hastings. The process by which an estimation of the sewer flows generated in each district were calculated is described in the following sections. Flow meter data for the treatment plant was received from MCES and is shown in **Table 5-1**.

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Table 5-1
M602 Historical Wastewater Flow

Year	Avg. Daily Flow (MGD)	Peak Flow (MGD)	Peak Factor
2012	1.46	3.47	2.38
2013	1.46	3.00	2.06
2014	1.46	3.09	2.11
2015	1.42	2.90	2.04
2016	1.39	3.96	2.85
2017 (Jan. through Aug.)	1.39	3.86	2.78
Average	**1.43**	**3.38**	**2.37**

5.2.2 Estimated Unit and District Wastewater Flows

To provide a detailed trunk sewer system model, wastewater flows were estimated within each of the 8 sewer districts and their sub-districts. Therefore, unit wastewater flows for each land use type were estimated to determine the total flow generated in each sub-district.

Table 5-2 below displays the estimated wastewater flow generation rates for each existing land use. These estimated wastewater flow generation rates were applied to the sub-districts within each sewer district to develop a detailed SewerCAD model. Typical values of 180 gpd/unit for residential developments and 800 gallons per acre per day (gpad) for non-residential developments were assumed for most land use types. The residential densities for existing residential land use types are the calibrated densities from the City's 2030 Comprehensive Sanitary Sewer System Plan.

Table 5-2
Estimated Wastewater Flow Generation Rates

Land Use Category	Units/Acre	Flow/Unit (gpud)	Flow/Acre (gpad)
Farmstead			0
Single Family Housing	2	180	360
Single Family Attached	3	180	540
Multifamily Housing	4	180	720
Manufactured Housing Park	4	180	720
Office			800
Retail and Commercial			800
Industrial and Utility			800
Institutional			800

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Mixed Use Residential			1,500
Park, Recreational or Preserve			10
Golf Course			10
Railway			0
Roadway/Highway			0
Agricultural			0
Undeveloped			0
Open Water			0

Estimated wastewater flow generation rates were multiplied by the total number of acres of each land use category within each sewer district to be able to estimate the existing wastewater flows for each district. Such flow estimations are shown in **Table 5-3**. A map displaying the layout of the existing sewer districts can be found in **Figure 5-2**. This approach estimated a total wastewater flow for the City of Hastings of 1.457 MGD, which is similar to the average MCES meter reading of 1.432 MGD. Upon estimating the total wastewater flow using the generation rates displayed in **Table 5-2**, the estimated percentage that each district contributes to the total wastewater flow of the City was calculated. These percentages are listed in **Table 5-3**.

Table 5-3
Estimated Percentage of Wastewater Flow by Sewer District

Sewer District	Area (acres)	Estimated Existing Flow (MGD)	Percent of Total Flow
North	823	0.298	20.4 %
North East	455	0.165	11.3 %
North West	554	0.226	15.5 %
South	161	0.025	1.7 %
South Central	174	0.064	4.4 %
South East	1280	0.382	26.2 %
South West	101	0.021	1.4 %
West Central	912	0.276	19.0 %
Grand Total	4460	1.457	100 %

The estimated percentages displayed in the table above were multiplied by the average wastewater flow measured by MCES meter M602 to assign an adjusted existing flow value to each sewer district based on actual flow data. The adjusted existing district wastewater flows are displayed in **Table 5-4**.

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Table 5-4
Adjusted Wastewater Flow by Sewer District

Sewer District	Percent of Total Flow	Adjusted Existing Flow (MGD)
North (N)	20.4 %	0.292
North East (NE)	11.3 %	0.162
North West (NW)	15.5 %	0.223
South (S)	1.7 %	0.025
South Central (SC)	4.4 %	0.063
South East (SE)	26.2 %	0.375
South West (SW)	1.4 %	0.020
West Central (WC)	19.0 %	0.271
Grand Total	**100 %**	**1.432**

A similar approach was performed to identify the adjusted flow generated within each sub-district. The percentages associated to each sub-district shown in **Figure 5-3** can be found in **Appendix 2.** Based on the adjusted existing wastewater flows assigned to each sub-district and lift station service areas, a likely existing average daily wastewater flow pumped by each lift station was calculated. The adjusted existing wastewater district flows displayed in **Table 5-4** as well as the lift station flows shown in **Table 5-5** were used for analysis in the SewerCAD model.

Table 5-5
Adjusted Wastewater Flow by Lift Station

LS Service Area	Average LS Flow (GPM)[1]	Peak LS Flow (GPM)[2]
E 10th St. (NE-3)[3]	23.75	95
Glendale Hts. (SE-1)	10	23
Highway 55 (NW)	164	391
Riverdale (NW-23)	9	21
Tuttle (SE-24)	20	38
Westwood (SC-11)	16	38
General Sieben Drive (WC-31)	8	19

[1] Calculated by multiplying existing land use in each sub-district by the initial estimated flow rates generated/acre. The percentage contribution of each sub-district was calculated and multiplied by the MCES metered flow to obtain adjusted sub-district flows, which were used to determine the LS flows based on the LS service areas.
[2]Calculated by multiplying the average LS flow by the peaking factor obtained from the MCES meter data.
[3]The data displayed for the E 10th St. Lift Station was obtained from a capacity analysis study conducted by WSB & Associates in 2017. The study identified the average and peak wastewater flows pumped by the lift station, the lift station capacity, and its existing residual capacity. The technical memorandum for that particular project can be found in **Appendix 4**.

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5.3 Evaluation of Existing Facilities

The existing system capacity analysis was completed by modeling the existing trunk sewer system using SewerCAD software. A SewerCAD model was developed for the existing trunk sewer system based on as-built information provided by the City. Wastewater flows were estimated for each sewer district as discussed in the preceding sections. However, the adjusted average flows calculated for each district (shown in **Table 5-4**) were the ones included in the model.

The SewerCAD model was completed based on the existing trunk sewer system as shown in **Figure 5-1** which shows existing trunk sewers, lift stations, forcemains, MCES facilities, and sewer districts. The trunk sewer system was divided into pipe lengths with collection points. Each district was broken down into sub-districts and flows were divided evenly within each sub-district.

To determine the sub-district flows, the average wastewater flow rates were estimated based on land use and the typical flows for each land use type listed in **Table 5-2**. These estimates were used to calculate the approximate percentage of flow within each sewer district, as shown in **Table 5-4**, and each sewer sub-district, as shown in **Appendix 2**. These percentages were then applied to the MCES meter data to arrive at the existing average wastewater flow by sub-district. The average flows were then multiplied by the peaking factor listed in **Table 5-1** to give the peak flows used in the SewerCAD model.

5.3.1 Wastewater Treatment

As discussed previously, the City of Hastings is responsible for wastewater collection only. Treatment is provided by MCES at the Hastings wastewater treatment plant that will be relocated in the future. Based on discussion with MCES, the existing treatment plan has approximately 0.91 MGD residual capacity. MCES indicated that they plan to relocate the treatment plant as the City's wastewater flow increases to the plant's treatment capacity of 2.34 MGD. The treatment plant will be relocated to the southeast of the existing wastewater plant as shown in **Figure 6-2**.

There are 25 remaining ISTS within the City limits. The location of these ISTS are shown in **Figure 5-4**. Property owners with ISTSs are required to connect to the City collection system within one year of City service becoming available.

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5.3.2 Lift Stations

The City currently has eight lift stations in service, seven of which are trunk lift stations, and their locations are shown in **Figure 5-1**. The East Hastings Lift Station was not considered a trunk lift station because its service area does not include gravity sewers greater than 8 inches in diameter. The total capacity, existing flow, and residual capacity for each trunk lift station is listed in **Table 5-6**. Existing peak wastewater flows were estimated based on the average peak factor shown in **Table 5-1**.

Table 5-6
Existing Lift Station Capacities and Existing Flows

Lift Station	Existing LS Capacity		Estimated Existing LS Average Flow		Estimated Existing LS Peak Flow		Residual LS Capacity
	(GPD)	(GPM)	(GPD)	(GPM)	(GPD)	(GPM)	(GPM)
E 10th St.[1]	257,760	179	34,200	23.75	136,800	95	84
Glendale Hts.	460,800	320	13,893	10	32,944	23	297
Highway 55	1,728,000	1,200	237,600	165	563,040	391	810
Riverdale	432,000	300	12,465	9	29,557	21	279
Tuttle	763,200	530	28,398	20	67,338	47	483
Westwood	432,000	300	22,846	16	54,174	38	262
General Sieben Dr.	172,800	120	11,520	8	27,317	19	101

[1]The data displayed for the E 10th St. Lift Station was obtained from a capacity analysis study conducted by WSB & Associates in 2017. The study identified the average and peak wastewater flows pumped by the lift station, the lift station capacity, and its existing residual capacity. The technical memorandum for that particular study can be found in **Appendix 4**.

Results from modeling indicated all existing lift stations have adequate capacity to convey existing peak wastewater flows. As shown in **Table 5-6**, all lift stations except the East 10th St Lift Station are utilizing approximately 50% or less of their existing capacity.

5.3.3 Trunk Mains

The existing City of Hastings sanitary sewer system is comprised of gravity sewers ranging in size from 6 inches to 27 inches in diameter. The City sanitary sewer mains flow to the wastewater treatment plant. **Figure 5-1** shows the existing City sanitary sewers and the existing wastewater treatment plant.

As discussed previously, a SewerCAD model was developed to determine any deficiencies within the City's existing trunk sewer system. **Table 5-7** below shows the estimated peak flows used to evaluate the adequacy of the existing trunk sewer system. All peak flows shown in **Table 5-7** are based on peaking factors calculated from MCES meter data, shown in **Table 5-1**.

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Table 5-7
Existing System Peak Flows

District Served	Trunk Main Size	Trunk Main Capacity (MGD)	Estimated Average Flow (MGD)	Estimated Maximum Flow (MGD)	Residual Capacity (%)	Residual Capacity (REU[1])
N	18"	3.387	0.295	0.699	79%	6,301
NW	16"	2.707	0.224	0.532	80%	5,098
NW and WC	24"	4.887	0.487	1.153	76%	8,753
SW	12"	1.442	0.020	0.049	97%	3,265
S and SW	12"	1.109	0.045	0.107	90%	2,349
SE	16"	3.236	0.378	0.896	72%	5,485
NW, WC, S, SC, SE, and SW	27"	7.354	0.973	2.307	69%	11,831

[1]*REU = residential equivalent unit*

Figure 5-5 shows the results of the trunk sewer system model. Trunk mains have been color coded to identify residual pipe capacity, and the locations of lift stations are identified. **Table 5-7** above shows only one section of trunk sewer main capacity while there are other sections of trunk mains with greater and lower capacities than shown in the table. **Figure 5-5** shows the residual capacity of each section of the trunk sewer system based on the estimated wastewater flow and as-builts of each trunk sewer.

Results from the modeling indicate that the existing trunk sewer system has adequate capacity for conveying existing peak flows. There are a few sections of sewer main shown in **Figure 5-5** that are nearing their capacity (less than 10% remaining); however, these "bottlenecks" are minimal and typical of most sewer systems. Due to the large upstream and downstream capacity on either side of each bottleneck section, only minimal surcharging is likely to occur under peak flow events. City staff confirmed that no sanitary overflows have been observed within the City.

5.3.4 Summary of Existing System Evaluation

The SewerCAD model created for analysis of the existing system included the following parameters:

- Existing trunk mains 10-inches and larger (as-built information)
- Existing lift stations and forcemains
- Existing peak wastewater flows (estimated per land use type and calibrated with MCES flow meter data)

Results from modeling indicated that the existing system infrastructure has adequate capacity to serve existing system flows. The existing trunk sewer system model evidenced no existing system deficiencies.

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5.4 Infiltration/Inflow

5.4.1 General

Infiltration is water that enters the sanitary sewer system through defects in the sewer pipes, joints, manholes, and service laterals. Water that enters the sewer system from cross connections with storm sewer, sump pumps, roof drains, foundation drains, or manhole covers is considered inflow.

Water from infiltration and inflow (I/I) can consume available capacity in the wastewater collection system and increase the hydraulic load on treatment facilities. In extreme cases, the added hydraulic load can cause bypasses or overflows of raw wastewater. This extra hydraulic load also requires larger capacity collection and treatment components, which results in increased capital, operation and maintenance, and replacement costs. As sewer systems age and deteriorate, I/I can become an increasing problem. Therefore, it is imperative that I/I be reduced whenever it is cost effective to do so.

In 2006, MCES began an Ongoing I/I Program that requires communities within their service area to eliminate excessive I/I. MCES establishes annual I/I goals for each community discharging wastewater into the Metropolitan Disposal System based on average daily flows, adjustments for community growth, and I/I mitigation peak factors. The City of Hastings has not been identified by MCES as a community with excessive I/I.

5.4.2 I/I Analysis

The Metropolitan Council establishes an I/I Goal for the City of Hastings annually as part of the Ongoing I/I Program. The City of Hastings has had no trouble staying within its I/I Goal, expressed as a peak hourly flow rate, in the past.

The Hastings sanitary sewer system currently consists of approximately 87 miles of gravity main, eight lift stations, and two miles of forcemain. Approximately seven percent of the private sanitary services in the City have been lined and/or replaced in the last ten years. Approximately 34 percent of the residential housing in the City was constructed before 1970. None of the pre-1970 era private services have been deliberately evaluated for susceptibility to I/I because historical meter data has never indicated excessive I/I in the City, although a portion of the seven percent of the private sanitary services mentioned above were pre-1970 era.

The amount of clearwater flow generated within the City was estimated by calculating the average annual and peak month I/I rates, equal to the average wastewater flow minus the base sanitary flow, using data from 2012-2016. The average flow, both annual and monthly, was calculated from MCES meter data. The peak month flow was determined for each year from 2012-2016, and then those peak month flows were averaged to give the value listed in **Table 5-8**.

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The base flow was estimated using water pumping records obtained from the Minnesota DNR Permitting and Reporting System (MPARS). The wastewater baseflow was estimated by multiplying the average winter water usage by the historical fraction of annual average wastewater flow divided by annual average water pumped. Winter water usage was considered to be the amount of water pumped by the City of Hastings' wells during the months of December, January, and February.

Table 5-8
Estimated I/I Rate

Parameter	M602
Average Flow (MGD)	1.438
Peak Month Flow (MGD)	1.542
Base Flow (MGD)	1.047
Average Annual I/I Rate (MGD (%))	**0.390 (27%)**
Peak Month I/I Rate (MGD (%))	**0.495 (32%)**

5.4.3 I/I Reduction

The City's strategy for preventing excess I/I is based on requiring development to conform to City standards as new sewers are constructed, as well as eliminating existing I/I through its annual street reconstruction program. As a part of street reconstruction projects, sanitary sewers are televised and replaced, or lined if they are in poor condition.

The City's ordinance prohibiting the discharge of clearwater to the sanitary sewer system is excerpted below.

> *City Code – Rules and Regulations; Water and Sewer – 51.05.C.4: It is unlawful for any person to make or maintain a connection, between eave troughs, rain spouts, footing drains, or any other conductor used to carry natural precipitation or ground water, and the sewerage system or any part thereof.*

Any connection to the sanitary sewer must be reviewed and approved by the City prior to construction. City Code requires that notification be provided to the City so any construction or altering of sewer service lines can be inspected prior to final completion. Construction of all sanitary sewers is observed to verify construction is in accordance with plans and City standards. All newly constructed sanitary sewers are televised and leak tested to confirm they have been constructed in accordance with City standards. In addition, the City is considering implementing asset management software to document and manage these public works activities.

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5.4.3 I/I Mitigation Plan

The City of Hastings does not have excessive I/I, nor is there any indication from flow data that I/I is increasing in the system. The City's ordinance, inspections, and maintenance activities have constrained I/I to reasonable levels. The City plans to continue its policies and asset management practices with incremental improvements as new technologies and best practices become available. The City is committed to monitoring and reducing I/I whenever economically feasible.

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6.0 FUTURE SANITARY SEWER SYSTEM

6.1 Future Service Areas

The design of a cost effective future trunk sewer system is completed by defining a future sewer service area, determining how existing sewers would be extended to collect future wastewater flows from the future sewer service area, and analyzing the impact of future wastewater flows on the existing downstream sewers. The extension of the existing trunk sewer system to the future sewer service area is based on dividing the future sewer service area into major sewer districts and sub-districts. The delineation of future sewer districts and sub-districts is generally governed by existing topography, other existing features such as roadways and conservation areas, and the future wastewater treatment plant location.

Two future sewer service areas were defined:

1. The 2040 sewer service area as discussed in Section 3 and shown in **Figure 3-3**.
2. The ultimate sewer service area based on capacity limitations of the existing trunk sewer system and planned future treatment plant capacity as shown in **Figure 6-1**.

Planning for the trunk sewer system beyond the 2040 boundary was important to identify potential trunk sewer corridors and preserve the corridors as development occurs. Analysis of the topography surrounding Hastings indicated existing gravity sewers could be extended beyond the 2040 sewer service area. Therefore, the extents of the ultimate sewer service area were not defined entirely based on topography, but also by existing trunk sewer system capacity limitations and the ultimate wastewater treatment plant capacity. Ultimate sewer districts are shown in **Figure 6-1**.

Some trunk sewers could be difficult to reconstruct or upsize because of sewer location and depth in existing neighborhoods. Reconstruction of these trunk sewers could cause disruption to well established neighborhoods and could be very costly. As trunk sewers reach capacity, a more detailed analysis should be completed to determine whether or not to increase the capacity of or to route wastewater flow around existing trunk sewers.

The existing sewer service area consists of eight sewer districts, six of which are not physically confined and are able to expand as growth occurs. The topography of the ultimate sewer service area indicated the six unconfined existing sewer districts could be expanded to collect wastewater flows from the ultimate sewer service area as shown in **Figure 6-1**. The Sand Coulee natural area to the east limited expansion of the southeast district. The east and east-southeast sewer districts were added to the east of the Sand Coulee natural area to allow for expansion of the City's sewer service area as the treatment plant's capacity is increased.

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The following is a brief summary of the steps taken to develop the ultimate and 2040 trunk sewer system:

1. Regional topography was analyzed to determine which trunk sewers could be extended to serve future development and their potential extents based on slope.

2. Potential future collection areas (preliminary sewer districts and sub-districts) were identified based on which trunk sewers would be extended.

3. Wastewater flow projections were developed for the preliminary sewer districts and sub-districts based on the 2040 land use. If the preliminary district was beyond the 2040 land use area, the future land use was assumed to be residential neighborhood.

4. The SewerCAD model for the existing trunk sewer system was used to model several potential trunk sewer extensions to the preliminary sewer districts and the effect of future wastewater flows on the existing trunk sewer system.

5. The ultimate potential service area was defined by limiting development extents depending on the remaining capacity of downstream critical sections of the trunk sewer system and the ultimate treatment plant capacity. Critical sections of trunk sewer for each sewer district are discussed further in this section.

6. The ultimate service area was divided into districts and sub-districts based on gravity sewer constraints, roadway boundaries, and conservation area constraints. Trunk sewers were routed with minimal crossing of the Vermillion River, Sand Coulee natural area, and with an outlet at the relocated wastewater treatment plant.

7. Ultimate trunk sewer extensions were laid out based on existing ground contours that govern how far the gravity trunk sewers can feasibly be extended. All trunk sewers were designed to be no deeper than 30 feet, no shallower than 7.5 feet from the existing ground surface, and to convey future peak wastewater flows at approximately 85% full or less.

8. The SewerCAD model of the existing trunk sewer system was expanded to include the ultimate trunk sewer extensions and ultimate wastewater flow projections. Gravity trunk sewers, lift stations, and forcemains necessary to accommodate the ultimate service area were then sized for peak sanitary sewer flows from those sub-districts tributary to each particular trunk gravity sewer main or lift station.

9. A 2040 trunk sewer system was designed based on the 2040 land use plan, with the intent of being a phase of the ultimate trunk sewer system. The 2040 trunk sewer system extended sewer only to the limits of the 2040 land use plan.

The remaining developable area for the 2040 sewer service area, summarized in **Table 3-1** and shown in **Figure 3-3**, has been further broken down by sewer district and is shown in **Table 6-2**. **Table 6-2** shows the amount of developable area in each sewer district by land use category.

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6.2 Future Wastewater Flows

6.2.1 Estimated Unit Wastewater Flows

To provide a detailed trunk sewer system model, wastewater flows were estimated within each of the sewer districts and their sub-districts. Unit wastewater flows for each land use type were estimated to determine the total flow generated.

Table 6-1 below shows the estimated wastewater flow generation rates for each future land use. These estimated wastewater flow generation rates were applied to the sub-districts within each sewer district to develop a detailed SewerCAD model. Typical values of 180 gpd/connection for residential development and 800 gpd/acre for non-residential development were assumed for most land use types. The residential densities for residential land use types are the calibrated densities from the City's previous Comprehensive Sanitary Sewer System Plan.

It is recommended to review wastewater flow generation rates for each new development to ensure conformance to the Comprehensive Sanitary Sewer Plan or make adjustments in the plan to accommodate future development. To ensure the existing trunk sewer system and its future extensions have adequate capacity, the following estimated flows per acre were assumed for future development:

Table 6-1
Estimated Wastewater Flow Generation Rates

Land Use Category	Units/Acre	Flow/Unit (gpud)	Flow/Acre (gpad)
Farmstead			0
Low Density Residential	2	180	360
Medium Density Residential	3	180	540
High Density Residential	4	180	720
Business Park			800
Commercial			800
Industrial			800
Institutional			800
Mixed Use Residential			1,500
Future Neighborhood[1]	4	180	720
Park, Recreational or Preserve			10
Golf Course			10
Railway			0
Roadway/Highway			0
Agricultural			0
Undevelopable Land			0
Open Water			0

[1] Future Neighborhood development projected future flow per acre was based on a conservative density assumption of 4 units/acre.

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Table 6-2
Summary of 2040 Gross Developable Acres by Sewer District

Sewer District	Low Density Residential	Medium and High Density Residential	Mixed Use Residential	Industrial	Business Park and Commercial	Institutional	Total
Inside Current City Boundary							
Northwest	21	48	1	0	0	0	70
West Central	105	29	0	0	0	0	134
Southwest	12	13	0	0	0	0	25
South	0	37	0	0	0	0	37
Southeast	57	38	0	0	0	0	95
Northeast	16	0	0	0	0	0	16
North	0	0	27	0	0	0	27
South Central	0	0	0	0	0	0	0
Sub-Total	*211*	*165*	*28*	*0*	*0*	*0*	*404*
Outside Current City Boundary							
Northwest	168	99	69	8	0	8	352
West Central	482	171	149	0	90	0	892
Southwest	297	0	0	0	0	0	297
South	158	81	0	0	0	0	239
Southeast	227	169	0	7	0	7	410
Northeast	0	0	0	0	0	0	0
North	0	0	0	0	0	0	0
South Central	0	0	0	0	0	0	0
Sub-Total	*1,332*	*520*	*218*	*15*	*90*	*15*	*2,190*
Total	***1,543***	***685***	***246***	***15***	***90***	***15***	***2,594***

Table 6-2 does not include land uses that do not generate wastewater flow (e.g. conservation land, water, right-of-way). Also, land uses were not included in **Table 6-2** for which no growth was projected within the 2040 service area (e.g. Downtown, Commercial, Retail). As discussed previously in Section 3, there are areas of inconsistent land use between the existing and future land use plans. City staff indicated that only future perimeter growth should be included in this plan since no major areas of redevelopment are projected. The existing trunk sewer system model will be maintained, and if redevelopment occurs within the existing sewer service area it will be reviewed for the existing system's ability to convey future flows. East and East-Southeast districts were not included because they are not projected to generate wastewater flow prior to 2040.

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6.2.2 Future Sewer District Flows

The estimated unit wastewater flows previously described were tied to the remaining developable acres (**Figure 3-3** and **Table 6-2**) and potential service area (**Figure 4-2** and **Table 4-2**) to project the future average flows through 2040 in five-year increments as shown below in **Table 6-3**. The East and East-Southeast districts were not included because they are not projected to generate wastewater flow prior to 2040.

Table 6-3
Future Wastewater Flows by Sewer District Through 2040

Sewer District	**2020 Avg. Flow (MGD)**	**2025 Avg. Flow (MGD)**	**2030 Avg. Flow (MGD)**	**2035 Avg. Flow (MGD)**	**2040 Avg. Flow (MGD)**
Inside Current City Boundary					
Northwest	0.253	0.261	0.270	0.278	0.287
West Central	0.315	0.326	0.345	0.345	0.345
Southwest	0.030	0.036	0.042	0.042	0.042
South	0.041	0.046	0.051	0.056	0.061
Southeast	0.403	0.433	0.444	0.444	0.444
North	0.296	0.307	0.317	0.327	0.337
South Central	0.063	0.063	0.063	0.063	0.063
Northeast	0.166	0.168	0.171	0.171	0.171
Sub-Total	*1.57*	*1.64*	*1.70*	*1.73*	*1.75*
Outside Current City Boundary					
Northwest	0.000	0.064	0.128	0.192	0.255
West Central	0.000	0.120	0.233	0.365	0.497
Southwest	0.000	0.000	0.037	0.062	0.087
South	0.000	0.000	0.069	0.104	0.138
Southeast	0.000	0.030	0.207	0.207	0.207
North	0.000	0.000	0.000	0.000	0.000
South Central	0.000	0.000	0.000	0.000	0.000
Northeast	0.000	0.000	0.000	0.000	0.000
Sub-Total	*0.00*	*0.21*	*0.67*	*0.93*	*1.18*
Total Future Flow	***1.57***	***1.85***	***2.38***	***2.66***	***2.93***

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6.3 Future Trunk Sanitary Sewer System

The 2040 trunk sewer system layout is shown in **Figure 6-2**. The ultimate trunk sewer system is shown in **Figure 6-3**. Both figures show the proposed trunk sewers, lift stations, forcemains, and sewer districts.

The existing system SewerCAD model was expanded for the future trunk system based on estimated collection points for each future sewer district. Trunk sewers were extended from the existing trunk sewer system and sized based on the peak wastewater flow generated from the future sewer districts. The SewerCAD model was also used to identify any downstream capacity limitations in the existing trunk sewer system when future wastewater flow was generated.

The sanitary sewer collection system must be capable of handling not only average flows, but also the anticipated peak flows. These peak flows can be calculated by applying a variable ratio to average daily flow rates, called the peak factor. The same peak factor used to calculate existing peak flows was used to calculate 2040 and ultimate peak flows. That peak factor was based on historical wastewater flows and is equal to 2.37.

6.3.1 North District

The north sewer district includes a wide variety of existing land uses and is generally located in the north central area of the City. Land uses for the area include mostly single family residential with the exception of the US 61 corridor and downtown. The US 61 corridor and downtown consist of commercial, industrial, and institutional land uses. There are no plans for redevelopment in the district included in the future land use plan.

Existing sanitary sewers range in size from 8 to 15-inches in diameter and flow to the northeast corner of the district where the treatment plant is located.

No additional trunk sewer improvements will be necessary in this district since there are no potential changes in wastewater flows. Existing system analysis, discussed in Section 5, indicated the existing trunk sewer system has adequate capacity to convey existing wastewater flows.

The existing wastewater treatment plant is located on the border of the north and northeast districts; however, trunk sewer improvements necessary for treatment plant relocation are discussed in the northeast district section.

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6.3.2 South Central District

The south central sewer district consists mostly of single family land use, although there are a few parcels of institutional and commercial land uses near the US 61 corridor. The district is located in the central area of the City. Planned redevelopment includes the addition of commercial, mixed use, and higher than present residential land use densities. These redevelopment efforts are expected to take place in the northeastern portion of the district, along Vermillion St. Existing sanitary sewers range in size from 8 to 24 inches in diameter and flow south to the City's main interceptor. The main interceptor flows from southwest to northeast along CR 47 near the southern boundary of the district. Wastewater flows from the northern part of the district flow to the Westwood Lift Station, and are then pumped south through a 6-inch forcemain to the main interceptor. The Westwood Lift Station has a capacity of 300 GPM and receives an estimated peak flow of 38 GPM; therefore, the lift station has 262 GPM of residual capacity.

Significant trunk sewer improvements will be necessary in this district although there are no major changes in wastewater flows generated within the district. As discussed in a later section (Section 6.3.4), after peak wastewater flows increase to 5.5 MGD in the main interceptor as a result of development in other districts, construction of additional capacity for the main interceptor will be triggered. Main interceptor capacity could be added by construction of a parallel interceptor, increasing the size of the existing interceptor, or a combination of both, as shown in **Figures 6-2** and **6-3**. A detailed evaluation is recommended to determine the most cost effective construction method for adding interceptor capacity and project phasing as wastewater flows increase to the trigger point.

For this study, it was assumed that pipe reaming construction methods could be used to increase the capacity of the main interceptor sewer section in the south central district. The existing main interceptor is 24-inch diameter and could be increased to 36-inch to accommodate for ultimate peak wastewater flows. It could be difficult to construct a parallel interceptor through this section due to the proximity of established neighborhoods and the Vermillion River.

6.3.3 Northwest District and Expansion

The northwest sewer district consists of a variety of land uses although single family land use is the most common. Other land uses in the district include institutional, commercial, office, park, and multifamily housing. The district is located in the northwest part of the City and is at the northwest extents of the existing sewer service area.

Existing sanitary sewers range in size from 8 to 16-inches in diameter and flow generally from northwest to southeast. Wastewater flow from this district is collected at the Highway 55 Lift Station, which pumps wastewater via a 12-inch forcemain to the west central sewer district. Wastewater flows generated north of CR 42 are collected by the Riverdale Lift Station and pumped south through an 8-inch forcemain along Pleasant Drive. Wastewater pumped by Riverdale Lift

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Station flows southeast though the northwest district towards existing 15-inch trunk sewer ultimately flowing to the Highway 55 Lift Station.

Future development is expected to expand west from the existing sewer service area. For planning purposes, it was assumed that once a trunk sewer or a lift station reached 75-90% of total capacity, the structure would require upsizing depending on the its importance. In the case of the northwest district, the Highway 55 Lift Station pumps the entire wastewater flow generated in the district, so this lift station was carefully analyzed.

As shown in **Table 6-3**, wastewater flows are expected to reach an average of 0.542 MGD and a peak of 1.284 MGD by the year 2040. The Riverdale Lift Station is expected to pump a peak wastewater flow of approximately 65 GPM by the year 2040. Given that the Riverdale Lift Station has a capacity of 300 GPM, an increase of pumping capacity is not probable through the planning period.

The Highway 55 Lift Station is expected to pump a peak wastewater flow of 913 GPM by the year 2040. Given its current pumping capacity of 1,200 GPM, an increase of pumping capacity of this lift station is not required. As shown in **Figure 6-2**, a 10-inch diameter trunk sewer could be extended west from the existing trunk to collect flows from the 2040 sewer service area. Based on the expected land development phasing, the 10-inch trunk sewer is phased to be built between 2020 and 2025 (see **Figure 7-1** for construction phasing).

The ultimate peak wastewater flow estimated for the northwest district, given the sewer district layout provided in **Figure 6-1**, is 1.405 MGD (975 GPM). Given these flow estimates, the Highway 55 Lift Station would have a residual capacity of 224 GPM. Growth beyond the ultimate boundary of the northwest district displayed in **Figure 6-1** could potentially trigger an increase of the Highway 55 Lift Station's pumping capacity. No trunk mains located within northwest district would require upsizing if future development is maintained within the northwest sewer boundary shown in **Figure 6-1**.

6.3.4 West Central District and Expansion

The west central sewer district consists mainly of single family land use but also includes some office, institutional, retail, industrial, multifamily housing, and golf course land uses. The district is located at the western extents of the existing sewer service area. Given the possible long-term redevelopment of golf course land uses, it was assumed that half of the gross golf course acres would be redeveloped as low density residential under ultimate conditions.

The main trunk sewer flows from the northern edge of the district to the southeast corner of the district along Louis Lane. The upstream end of the trunk sewer is 15-inch diameter, which increases to 24-inch diameter prior to the downstream connection with the City's main interceptor. Lateral sanitary sewers range in size from 8 to 15-inches in diameter and flow from the west towards the main trunk sewer (Louis Lane) running from north to south. The only lift station in the district is the General Sieben Drive Lift Station. This lift station is located in the

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southwest corner of the district, near the Vermillion River. This lift station currently has a very small service area and pumps through a 4-inch forcemain to a 10-inch trunk sewer running along Southview Drive. The existing capacity of the General Sieben Drive Lift Station is 120 GPM.

As shown in **Table 6-3**, wastewater flows are expected to reach an average of 0.842 MGD and a peak of 1.995 MGD by the year 2040. The size of the downstream City interceptor is 24 inches, which travels south down Louis Lane and has a capacity of 4.9 MGD. This trunk sewer does not simply convey the wastewater generated in the west central district, but also the wastewater flows generated in the northwest district.

It is important to note that by the year 2040, the 24-inch trunk main will not carry any of the flow pumped by General Sieben Drive Lift Station as seen in **Figure 6-2**. A more detailed explanation as to why the lift station flows will not be conveyed by this trunk main can be found towards the end of this section. Given these adjustments, the average and peak wastewater flows estimated to be conveyed by the trunk main along Louis Lane by the year 2040 are 0.833 MGD and 1.975 MGD, respectively. Similarly, ultimate wastewater flows (0.878 MGD average flow and 2.081 MGD peak flow) through this 24-inch trunk sewer are well below the capacity of the main (4.9 MGD). This trunk main starts traveling northeast when it reaches the Vermillion River. There are several sections of this portion of the interceptor that may require upsizing before 2040. A detailed explanation is provided in subsequent paragraphs.

The upstream section of the Louis Lane trunk consisting of 15-inch main may pose long term capacity concerns. SewerCAD modeling indicated that this section of the trunk main may be under capacity with ultimate flow conditions. Since this trunk main has sufficient capacity under existing and 2040 flow conditions, and the ultimate estimated flow is only projected to exceed this main's capacity by six percent, no improvements are being proposed at this time.

The downstream City interceptor along CR 47 is 27 inches in diameter. The capacity of this interceptor is approximately 7.4 MGD in the capacity-limiting sections. Once future flows from the cumulative northwest, west central, south, southeast, and southwest districts reach 5.5 MGD, or 75% of the capacity of the existing main interceptor, it could trigger the construction of a parallel interceptor sewer or the upsizing of the existing interceptor. The 27-inch interceptor has a 24-inch trunk main located both upstream and downstream of it.

Two alternatives were considered when increasing conveyance capabilities along the main interceptor. The first alternative would be to use pipe reaming techniques to upsize the existing interceptor. If selected, it is recommended to upsize the existing 27-inch to a 42-inch diameter main and the downstream 24-inch to a 36-inch. The 24-inch trunk main just upstream of the 27-inch, which travels from Louis Lane along CR 47 before it meets the 27-inch trunk section, would have to be upsized from a 24-inch to a 36-inch main.

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The second alternative would be to construct a parallel interceptor alongside the existing main interceptor where feasible. If selected, it is recommended to construct a 36-inch trunk parallel to the existing 27-inch and a 30-inch trunk parallel the existing 24-inch just downstream of the existing 27-inch interceptor. Additionally, the 24-inch trunk main located just upstream of the existing 27-inch interceptor would need to be upsized to a 36-inch interceptor using pipe reaming techniques.

Given the land development phasing proposed in this report, upsizing of these sections or construction of a parallel interceptor will be required between 2035 and 2040, as shown in **Figure 7-1**. These recommendations are subject to the rate of future development. Additionally, all upsizing was based on ultimate peak wastewater flows. The second alternative, constructing a parallel interceptor where feasible (assuming it can be timed with street improvement projects), is the more economical alternative when using 2017 construction and material costs. Thus, this alternative is the only one shown in **Figures 6-2** and **6-3** and in the cost estimate in **Appendix 3**.

In addition to the main interceptor, the west central district's ultimate boundary is limited by the capacity of General Sieben Drive Lift Station. Given that the existing capacity of this lift station is 120 GPM, the pumping capacity of the lift station will have to be increase significantly to accommodate the wastewater flow generated throughout the ultimate west central district shown in **Figure 6-1**.

As previously introduced in this report, wastewater flows generated in the west central district are expected to reach an average of 0.842 MGD and a peak flow of 1.995 MGD by the year 2040. Of this average flow, only 0.339 MGD is expected to be generated inside the existing west central district boundary. The remaining average flow of 0.503 MGD is expected to be generated west of the General Sieben Drive Lift Station. When including the lift station service area within the existing west central district, it is projected that the General Sieben Lift Station will pump an average of 0.525 MGD and a peak flow of 1.370 MGD (952 GPM) by 2040. Given these flow estimates, the General Sieben Drive Lift Station's pumping capacity would have to increase to at least 1,000 GPM to accommodate the expected 2040 wastewater flow. In addition to increasing the pumping capacity of the General Sieben Drive Lift Station, its forcemain would also have to be upsized to accommodate the added flow. Reconstructing the existing 10-inch trunk sewer along Southview Drive might be difficult because of the potential disruption within a well-established neighborhood. Instead, wastewater flows could be routed via a new 10-inch forcemain along CR 46 and 47 to the City's main interceptor, which would be extended southwest along CR 46 and 47 as 36-inch and 42-inch trunk sewer as seen in **Figure 6-2**. The size of the forcemain and the trunk sewer extension are expected to be adequate to convey wastewater flows generated under 2040 conditions. Ultimate flow conditions require a larger forcemain, likely 18-inch in diameter. As seen in **Figure 7-1**, upsizing of the General Sieben Lift Station and re-routing of its forcemain is expected to occur between 2025 and 2030. The existing wet well will be adequate for the projected 2040 peak flow. The ultimate wastewater flow estimated for the

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west central district, given the sewer district layout provided in **Figure 6-1**, is 3.085 MGD average flow and 7.331 MGD peak flow. Of this flow, the General Sieben Drive Lift Station is expected to pump an average flow of 2.421 MGD and a peak flow of 6.625 MGD (4,600 GPM). Given these flow estimates, the General Sieben Drive Lift Station's pumping capacity would have to be increased to at least 4,600 GPM to accommodate the wastewater flow generated under ultimate flow conditions. Growth beyond the ultimate boundary of the west central district displayed in **Figure 6-1** would require a lift station capacity greater than 4,600 GPM. Adequacy of existing wet well size and other lift station components should be evaluated at the time of upsizing. Trunk sewers extending west from the General Sieben Drive Lift Station would need to range from 10 to 30-inches in diameter to accommodate the wastewater generated within the district's ultimate boundary.

Two additional lift stations would be necessary to collect wastewater generated from the northern area of the ultimate district (WC-U 1 and WC-U 2). These two lift stations are necessary because, although the northwest district mains could serve the northern area of the future development, capacity of existing downstream sections in the northwest district limit the capacity of upstream development. Lift Station WC-U 1 is expected to have a design capacity of 300 GPM and would pump wastewater south through a 6-inch forcemain. Lift Station WC-U 2 will be located downstream of Lift Station WC-U-1. This lift station is expected to have a design capacity of 625 GPM and would pump wastewater south through an 8-inch forcemain. Both of these lift stations may only serve a small area by the year 2040, but were sized to accommodate ultimate flows.

The 2040 sewer service area would essentially be a phase of the ultimate trunk sewer system. Since the ultimate service area would extend beyond the 2040 service area, trunk sewers would be installed that could be extended to serve the ultimate service area as shown in **Figure 6-2**.

6.3.5 Southwest District and Expansion

Only single family, single family attached, parks, and conservation land uses are included in the exiting southwest district. This district is located in the southwest corner of the City, south of the Vermillion River, and is at the southwest extents of the existing sewer service area.

Existing sewer service in the southwest district consists largely of 8-inch collection mains that flow northeast to the 12-inch trunk sewer conveying wastewater flows out of the district and ultimately to the main City interceptor along CR 47. There are no existing lift stations in the Southwest district. The existing wastewater flow in the district was estimated to be 0.020 MGD average flow and 0.049 MGD peak flow. Future development is expected to take place southwest of the existing district's service area. As shown in **Table 6-3**, wastewater flows are expected to reach an average of 0.129 MGD and a peak of 0.307 MGD by the year 2040. The existing 12-inch trunk will be capable of conveying this flow since it has a capacity of 1.442 MGD.

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In addition to the wastewater flow being generated throughout the southwest district, this 12-inch trunk will also have to convey the flow pumped by the General Sieben Drive Lift Station once its forcemain is rerouted sometime between 2025 and 2030. It is expected that the General Sieben Drive Lift Station will pump a peak wastewater flow of 1,000 gpm (1.440 MGD) by the year 2040, and a peak wastewater flow of 4,600 gpm (6.624 MGD) when the ultimate west central district displayed in **Figure 6-1** is fully developed. Moreover, this 12-inch trunk is expected to convey the wastewater collected in the southwest portion of the ultimate south district as shown in **Figure 6-3**, thus leaving the 12-inch interceptor severely under capacity if not upsized before 2040.

To accommodate this added wastewater flow generated in the west central and south ultimate districts, the 12-inch trunk would have to be replaced with a 36-inch trunk sewer using pipe reaming techniques (having a capacity of 16.7 MGD in the capacity limiting sections). When taking into consideration the wastewater flow generated upstream of the proposed 36-inch trunk main, its residual capacity will be 6.4 MGD. This excess capacity will be needed when the development in the west central, southwest, and south districts expand beyond their ultimate district boundaries displayed in **Figure 6-1**. It was assumed that the proposed 36-inch trunk sewer located in the southwest district would be constructed at the same grade as the existing 12-inch main.

Given the 2040 wastewater projections and the land development phasing, the existing trunk sewer would have to be extended southwest to collect future wastewater flows from the 2040 sewer service area. A 27-inch sewer trunk would provide sufficient capacity to convey the wastewater flows generated within the district's 2040 sewer service area and the ultimate districts boundary. An initial section of the 27-inch trunk is expected to be constructed between 2025 and 2030, while an extension of this trunk main would not be needed until 2035, as shown in **Figure 7-1**.

6.3.6 South District and Expansion

Existing land uses in the south district include single family housing, single family attached, parks, and conservation. The south district is located at the southern extents of the existing sewer service area and south of the Vermillion River.

The south district sanitary sewer system consists of 8-inch collection mains flowing into an 18-inch trunk main flowing from south to north where it ties into the existing 24-inch main City interceptor along CR 47. There are no existing lift stations in the south district.

The future land use plan indicates development in the district will expand south from the existing sewer service area. The ultimate sewer service boundary was established based on the ultimate capacity of the future treatment plant (10.0

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MGD). Wastewater generated in the south district could flow to the main interceptor flowing southwest to northeast along CR 47.

The existing wastewater flow in the district was estimated to be 0.025 MGD average flow and 0.059 MGD peak flow through the existing 18-inch trunk sewer. As shown in **Table 6-3**, wastewater flows are expected to reach an average of 0.199 MGD and a peak of 0.471 MGD through the year 2040. The 18-inch trunk main has a capacity of 2.691 MGD. Thus, the existing trunk sewer has sufficient capacity to convey the wastewater generated within the 2040 sewer service boundary layer.

An 18-inch diameter trunk sewer could be extended south from the existing 18-inch trunk to collect flows from the 2040 sewer service area. Also, an 80 GPM lift station may be required to collect wastewater generated in the western part of the district within the 2040 sewer service area. This lift station is expected to pump a peak wastewater flow of 64 GPM by the year 2040. It is not expected that this lift station would require upsizing for ultimate peak flow conditions.

As seen in **Figure 6-3**, wastewater generated by the ultimate sewer service area could be collected by two future trunk sewers, ranging in size from 10 to 15-inches flowing south to north. The east portion of this ultimate sewer service area could flow north through a 15-inch trunk that would extend from the proposed 18-inch trunk located within the district's 2040 sewer service area. The wastewater collected within west portion of the ultimate sewer service area could flow north through a series of 10 and 15-inch trunks towards a new lift station. This lift station could be designed with a pumping capacity of 1,300 GPM and a 10-inch forcemain and it could pump wastewater towards the southwest district. A lift station design capacity of 1,300 GPM would be enough to safely pump wastewater under peak ultimate flow conditions for the given ultimate sewer district layout displayed in **Figure 6-1**.

6.3.7 Southeast District and Expansion

Existing land uses in the southeast district vary and include single family housing, manufactured housing park, multifamily housing, single family attached, retail and commercial, institutional, industrial and utility, office, and conservation. The southeast district is located at the southeastern extents of the existing sewer service area, south of the Vermillion River and west of the Hastings Sand Coulee Scientific and Natural Area (SNA).

The sewer conveying existing wastewater flows in the southeast district consists of 8-inch collection mains flowing into a west trunk main (10-inch diameter) and an east trunk main (10-inch to 18-inch diameter) that ultimately flow northwest to the main City interceptor along CR 47. There are two existing lift stations in the Southeast district. The Tuttle Lift Station is located in the far southeast corner and has an existing capacity of 530 GPM. The Glendale Hts. Lift Station is near the eastern extents of the district and has a capacity of 320 GPM.

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The future land use plan indicates development in the district will expand south and east from the existing sewer service area. The majority of the growth projected inside the existing southeast district includes the expansion of the commercial area along Red Wing Boulevard, and the expansion of the industrial area north of Spiral Boulevard. A lift station may be necessary to provide service to a portion of the future industrial park located north of Olympic Way. The need for a lift station will be determined at the time of development.

The ultimate sewer service boundary was established based on the residual pumping capacity of Tuttle Lift Station. Wastewater generated in the southeast district could be conveyed to the main interceptor flowing southwest to northeast along CR 47.

The existing wastewater flow in the district was estimated to be 0.378 MGD average flow and 0.896 MGD peak flow. As shown in **Table 6-3**, wastewater flows are expected to reach an average of 0.651 MGD and a peak of 1.543 MGD by the year 2040. The capacity of the district's trunk main is 3.236 MGD. Thus, the existing trunk sewer has sufficient capacity to convey the wastewater generated within the 2040 sewer service boundary layer.

Given the 2040 wastewater projections within the 2040 sewer boundary area, projected future wastewater flows can be conveyed with 8-inch gravity sewer. Thus, it is not expected that the existing trunk sewer would need to be extended to collect future wastewater flows generated within the 2040 sewer service area.

6.3.8 Northeast District

The northeast sewer district is located directly east of the existing north district and includes mostly single-family housing land use, as well as industrial and utility, institutional, and commercial land uses. There are no plans for redevelopment in the district included in the future land use plan, with the exception of the future wastewater treatment plant. The future wastewater treatment plant is identified as institutional land use in the future land use plan shown in **Figure 3-2**.

Existing sanitary sewers in the district are typically 8-inch collection mains, with the exception of the main interceptor flowing from south to north through the district. The existing main interceptor ranges in size from 21 to 27-inch diameter, flowing to the existing treatment plant located in the northwest corner of the district.

The existing treatment plant has a capacity of 2.34 MGD and is confined in the downtown area. MCES plans to relocate the treatment plant southeast of the City as wastewater flows approach the plant capacity. Based on discussions with MCES, the treatment plant would be constructed initially with an average flow capacity of 4.0-5.0 MGD, but ultimately expandable to 10.0 MGD average flow capacity. It is expected that relocation of existing treatment plant may take place between 2030 and 2035.

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Although there are no significant plans for redevelopment within this district, future trunk sewer system improvements may be required. Future development in other sewer districts will likely increase the existing main interceptor wastewater flows beyond capacity. In addition, the existing trunk sewer system will have to be reconfigured to convey wastewater flows to the future treatment plant location. The ultimate district boundary was expanded to include the future wastewater treatment plant, but future wastewater flows would not be generated in this district as shown in **Table 6-2**.

The existing wastewater flow in the district was estimated to be 0.164 MGD average flow and 0.389 MGD peak flow. As shown in **Table 6-3**, wastewater flows are expected to reach an average of 0.181 MGD and a peak of 0.429 MGD by the year 2040. The capacity of the district's trunk main is 3.236 MGD. Thus, the existing 21-inch trunk sewer has sufficient capacity to convey the wastewater generated within the 2040 sewer service boundary layer.

As discussed in the west central district section, after peak wastewater flows increase to 5.5 MGD, an increase in main interceptor capacity could be triggered. Two possibilities arise when it comes to providing additional capacity to the City's main interceptor west of MN 316. One alternative would be to construct a 36 and 30-inch inch trunk sewer parallel to the existing 27 and 24-inch main interceptor section from MN 316 to E 18th Street (Veterans Drive). The parallel trunk main could connect back to the existing main interceptor at the manhole where the existing 24-inch trunk feeds into the 21-inch interceptor. The addition of the parallel interceptor would not require any modification of the existing 27 and 24-inch interceptor. Another alternative is to replace the existing 27 and 24-inch interceptor extending from MN 316 to E 18th Street (Veterans Drive) for a 42 and 36-inch interceptor. Given the land development phasing projected in this plan, it is expected that this section of the City interceptor would require upsizing sometime between 2035 and 2040. For modeling purposes, it was assumed that both the parallel and the replacement interceptors would be constructed at the same grade as the existing main interceptor.

Additional trunk sewer improvements would be required to route flows to the future wastewater treatment plant location near the intersection of Ravenna Trail and CSAH 91 (Glendale Road). The existing 21-inch interceptor could flow southeast along Ravenna Trail through a main interceptor ranging from 48 to 54 inches in diameter to the relocated treatment plant.

Also, a lift station would need to be constructed at the existing treatment plant location to pump wastewater south flowing to the future treatment plant. The lift station would pump wastewater generated in the north district and the northern part of the northeast sewer district. It is expected that this lift station would need to have a firm pumping capacity of 600 GPM to be able to pump peak wastewater flows generated within these districts. Additionally, the lift station would require an 8-inch force main to maintain required wastewater velocities under peak wastewater flow conditions. The construction of this lift station would need to be

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coordinated with the relocation of the existing treatment plant. Thus, it is expected that this lift station will be built between 2030 and 2035. Both the lift station and the new interceptor were sized to convey peak ultimate wastewater flows. As mentioned previously, the City anticipates that the Metropolitan Council will cover the capital costs of the regional collection system improvements associated with the relocation of the treatment plant.

6.3.9 East-Southeast District

The east-southeast district is an ultimate sewer district. There is no existing east-southeast district, as shown in **Figure 6-1**. Existing land uses in the east-southeast district include agriculture and conservation. Existing land uses generate minimal wastewater, and there is no existing sanitary sewer in the district. The future land use plan does not include any land uses that would generate wastewater in the district. The sanitary sewer system will not be extended into this district until the WWTP is relocated, and development is not expected to occur before that time.

Once the wastewater treatment plant is relocated, an east interceptor could be extended from the treatment plant south along Nicolai Avenue, which would allow development in the east-southeast district. Wastewater generated by the ultimate sewer service are could be collected by the east interceptor, which would be range from 24 to 27 inches in in diameter flowing south to north along Nicolai Avenue through the district to the future treatment plant location.

Wastewater generated by the southwest portion of the east-southeast district could be collected by a trunk sewer, ranging in size from 10 to 12 inches flowing south to north. Due to the sensitivity of the Sand Coulee area, the wastewater collected in this section of the east-southeast district could travel south west along MN 316 and flow to a lift station located on the east side of the Sand Coulee prairie area. The lift station would have a capacity of 1,400 GPM and pump wastewater flows north through a 10-inch forcemain to the 24-inch interceptor along Nicolai Avenue.

It is important to keep in mind that the 2040 land use plan does not include any land uses that would generate wastewater in this district. Thus, the lift station and the east-southeast interceptor were sized based on a future neighborhood wastewater generation rate of 720 gpd/acre. Consequently, these parameters will likely vary when a better understating of the land uses in these ultimate districts is obtained. Although it is not clear the exact timing of these infrastructure needs, it will be highly unlikely to take place pre-2040.

Initial development will likely generate minimal flow relative to the capacity of the ultimate 27-inch trunk main, making maintenance difficult. Therefore, it is recommended to preserve the corridor for ultimate trunk sewer construction, but initially a smaller diameter trunk sewer may be constructed when the new plant is constructed. As development pressures increase in this district, a more detailed evaluation can be completed to determine the phasing of the east interceptor.

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No improvements would be necessary in this district for the 2040 sewer service area. It is possible to convey wastewater flows from the 2040 sewer service area and the ultimate west central district through the main interceptor to the future wastewater treatment plant prior to extending the east interceptor to increase development in the east-southeast district.

6.3.10 East District

Similar to the east-southeast district, the east district is an ultimate sewer district. Existing land uses in the east-southeast district consist of agriculture and conservation. Existing land uses generate minimal wastewater and there is no existing sanitary sewer in the district. The future land use plan does not include land uses that would generate wastewater.

Service to the east district is mostly dependent on relocation of the treatment plant. Relocation of the treatment plant is anticipated to occur as development reaches the trigger point for additional plant capacity is necessary, which is projected for the timeframe of 2030-2035.

Wastewater generated by the ultimate east district could be collected by a trunk sewer ranging in size from 12 to 27-inch diameter and flowing south to north through the district to the future treatment plant relocation. Also, a 680 GPM capacity lift station would be necessary to collect wastewater flows from the far southern area of the east district.

No improvements would be necessary in this district for the 2040 sewer service area. It is possible to convey wastewater flows from the 2040 sewer service area and the ultimate west central district through the main interceptor to the future wastewater treatment plant before expanding development in the eastern districts.

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7.0 CAPITAL IMPROVEMENTS PLAN (CIP)

7.1 Estimated Cost of Trunk System Improvements

The development of the projected 2040 trunk sewer system was broken down into phases in accordance with development phasing as included in **Table 4-2** and shown in **Figure 4-2**. The overall cost associated with trunk system components over the next 22 years is estimated to be approximately $15,031,479 in 2017 dollars. **Table 7-1** summarizes the trunk improvement and lift station costs necessary for each phase of development based on the parallel interceptor alternative. Detailed cost estimates for each development phase are available in **Appendix 3**. Furthermore, phasing of trunk sewer construction to serve the 2040 sewer service area is shown **Figure 7-1**.

Future improvement costs were based on 2017 construction prices, including 10% construction contingency and 20% overhead (i.e., legal, engineering, and administrative). Street and easement costs and other miscellaneous costs that may be related to final construction are not included.

Table 7-1
Capital Improvement Plan Summary

Year	Cost
2020-2025	$5,503,537
2025-2030	$2,417,712
2030-2035	$3,282,977
2035-2040	$3,827,253
Total	***$15,031,479***

1. Costs are for budgeting purposes only, and are subject to change as projects are studied, designed, and constructed.
2. Costs are estimated based on 2017 construction costs.
3. Land acquisition costs are not included.

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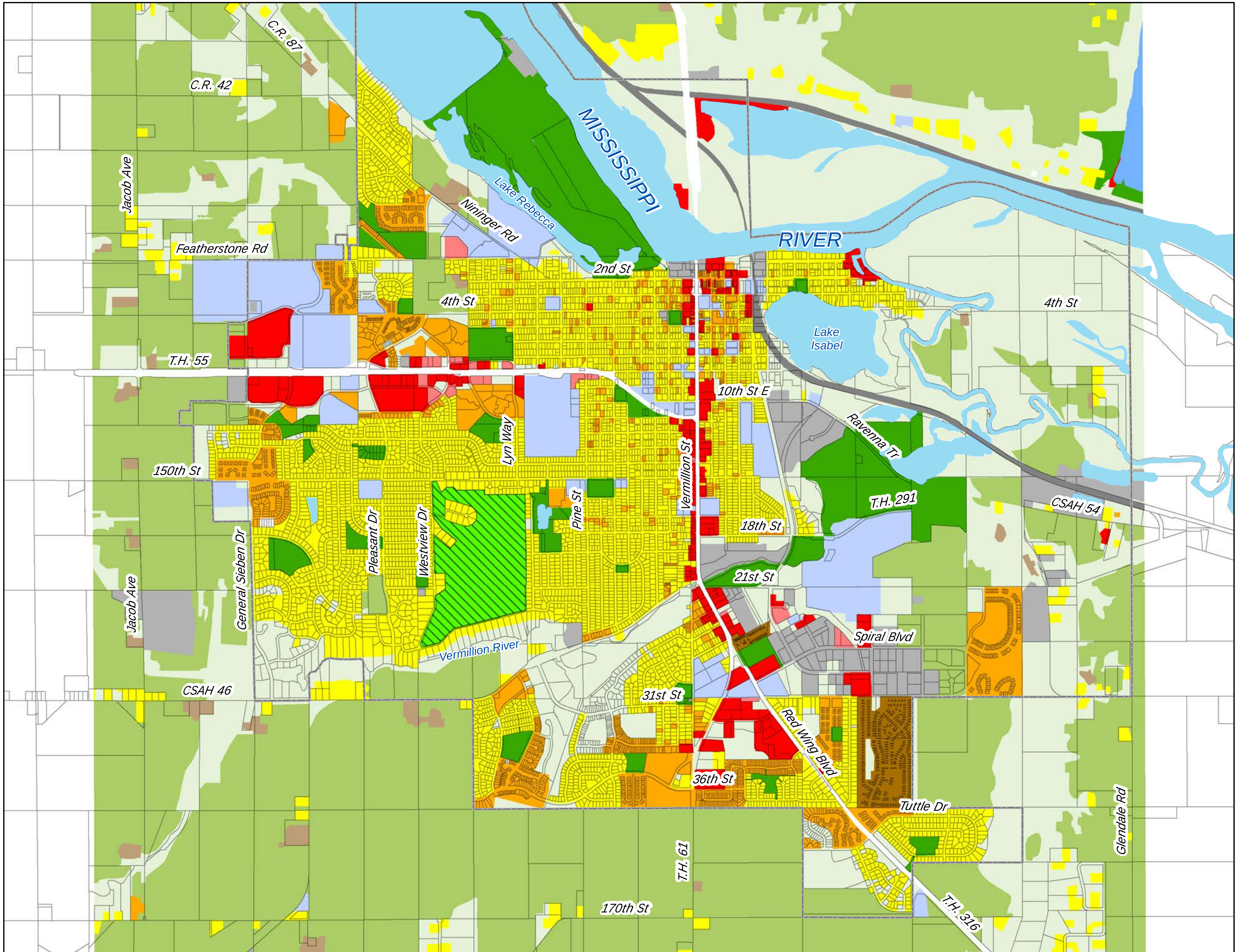
FIGURES



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City of Hastings Comprehensive Sanitary Sewer Plan

Figure 3-1
Existing Land Use

Legend

- City Boundary
- Farmstead
- Single Family Detached
- Manufactured Housing Park
- Single Family Attached
- Multifamily
- Office
- Retail and Other Commercial
- Industrial and Utility
- Institutional
- Park, Recreational or Preserve
- Golf Course
- Railway
- Agricultural
- Undeveloped
- Open Water

N
0 2,250 Feet

wsb

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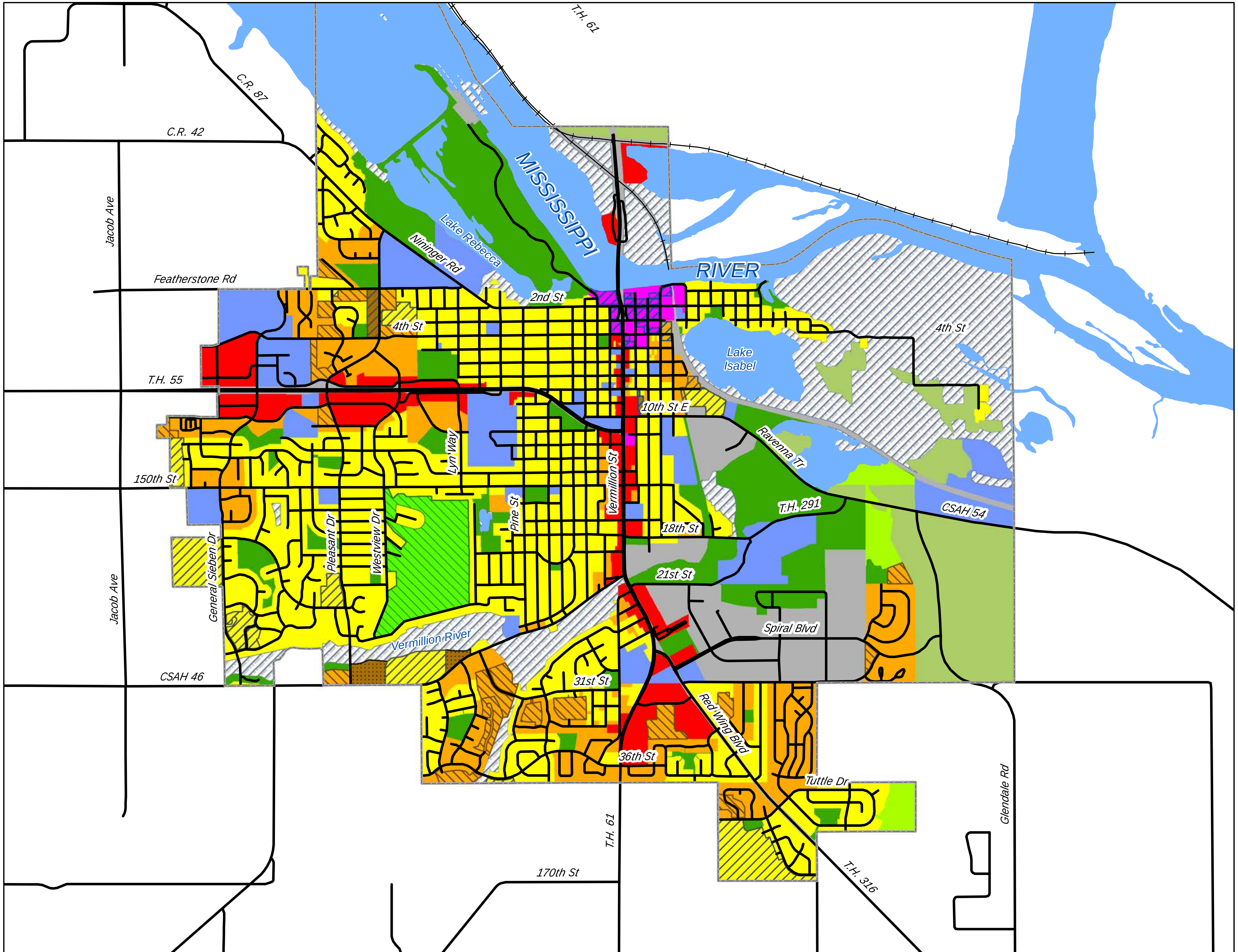

City of Hastings Comprehensive Sanitary Sewer Plan

Figure 3-2
Future Land Use

Legend

- City Boundary
- Floodplain & Wetland Protection
- Agriculture
- Low Density Residential
- Medium Density Residential
- High Density Residential
- Mixed Use
- Commercial
- Industrial & Utility
- Institutional
- Parks
- Upland Conservation Area
- Golf Course

Forecasted Residential Growth Areas

- New Low Density Residential Growth
- New Medium Density Residential Growth
- New High Density Residential Growth
- Mixed Use Redevelopment
- Upper Story Redevelopment (Commercial on Ground Floor)

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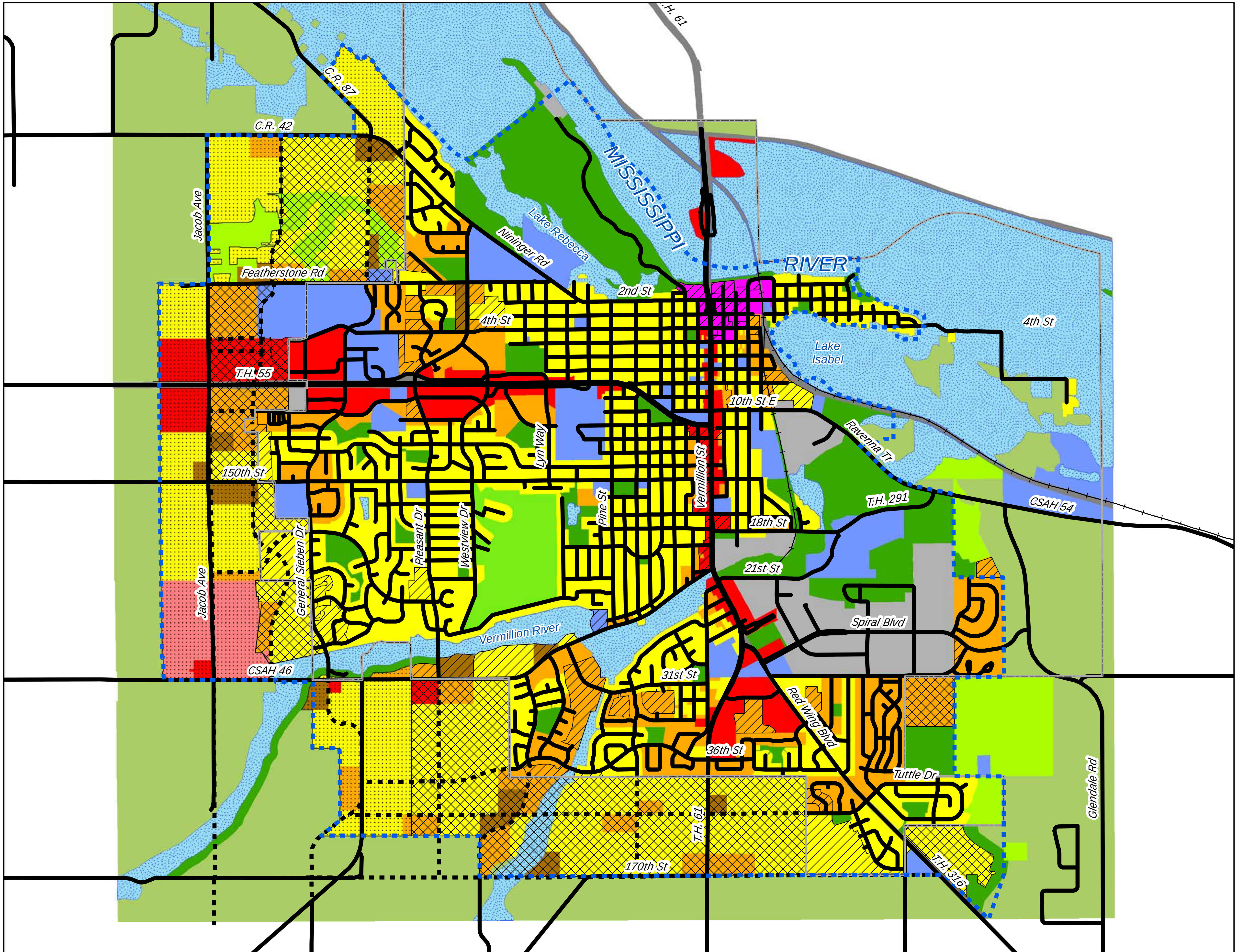

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City of Hastings Comprehensive Sanitary Sewer Plan

Figure 3-3
Developable Land

Legend

- Stage 1 Development (Inside Current Municipal Area)
- Stage 2 Development
- Stage 3 Development
- Proposed Roadway
- Streets & Roadways
- City Boundary
- 2040 Sewer Service Area
- Agriculture
- Low Residential
- Medium Residential
- High Residential
- Mixed Use
- Commercial
- Business Park
- Industrial
- Institutional
- Park
- Upland Conservation Area
- Floodplain & Wetland Protection
- Golf Course
- Road/ROW

N

0 2,500 Feet

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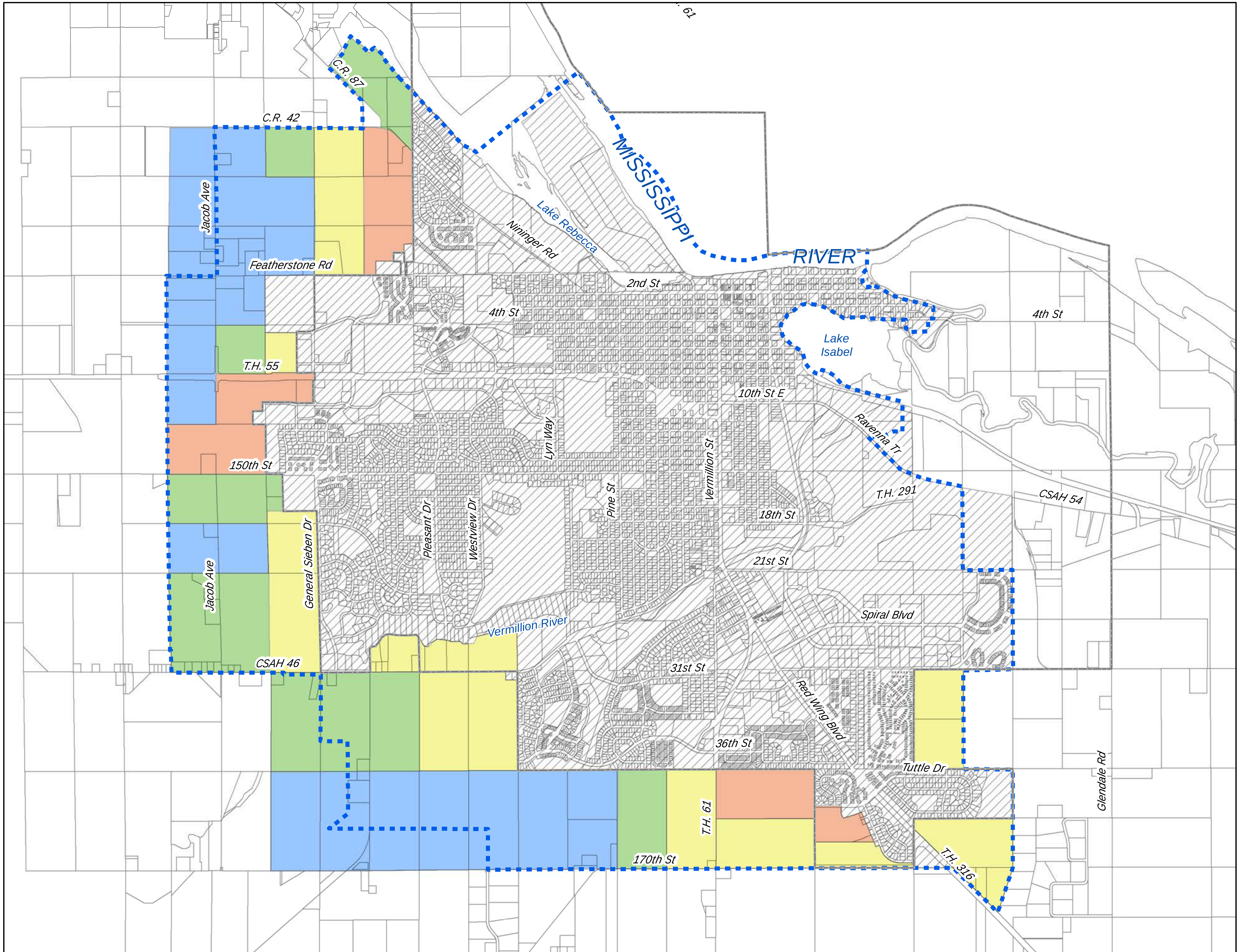

City of Hastings Comprehensive Sanitary Sewer Plan

Figure 4-2
Future Development Phasing

Legend

- City Boundary
- 2040 Sewer Service Area

Development Phasing

- Current
- 2020-2025
- 2025-2030
- 2030-2035
- 2035-2040

N

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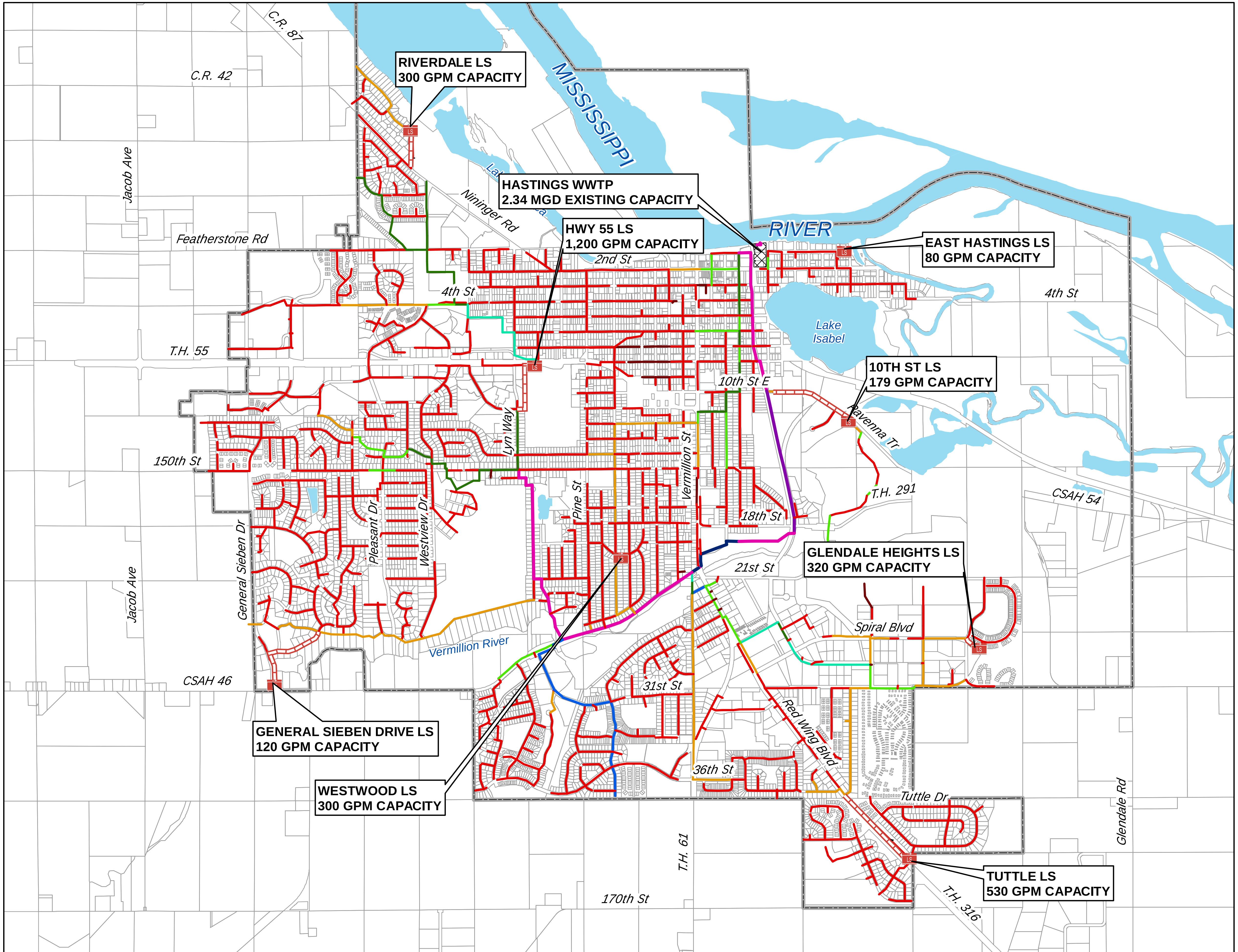

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City of Hastings Comprehensive Sanitary Sewer Plan

Figure 5-1
Existing Sanitary Sewer System

Legend

- Lift Station
- Forcemain

Gravity Main

Diameter

- 6"
- 8"
- 10"
- 12"
- 15"
- 16"
- 18"
- 21"
- 24"
- 27"
- Existing WWTP
- City Boundary
- Open Water

N

0 2,250 Feet

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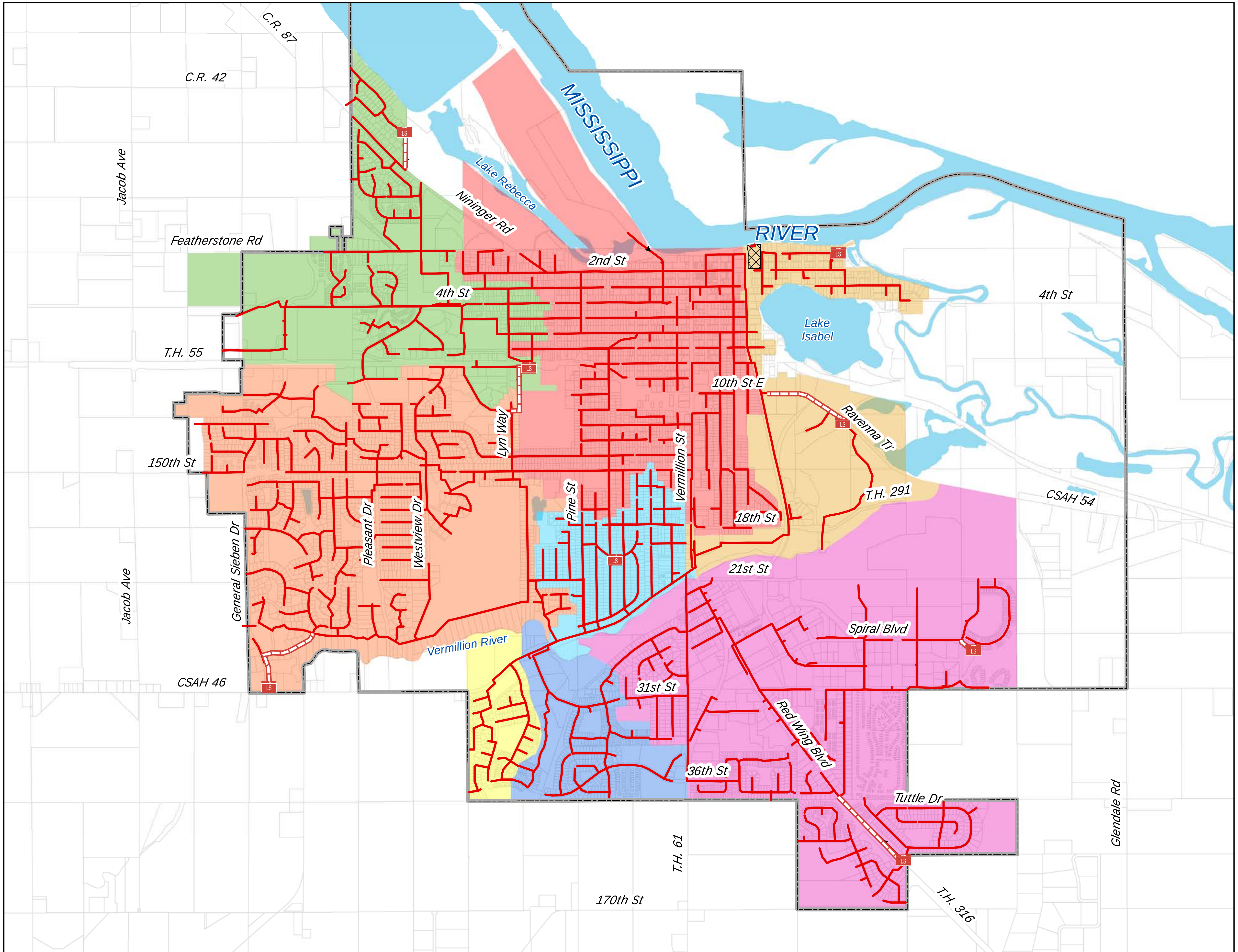

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City of Hastings Comprehensive Sanitary Sewer Plan

Figure 5-2
Sanitary Sewer Districts

Legend

- City Boundary
- Open Water
- Existing WWTP
- Lift Station
- Forcemain
- Gravity Main

Sewer District

- North
- North East
- North West
- South
- South Central
- South East
- South West
- West Central

N

0 2,250 Feet

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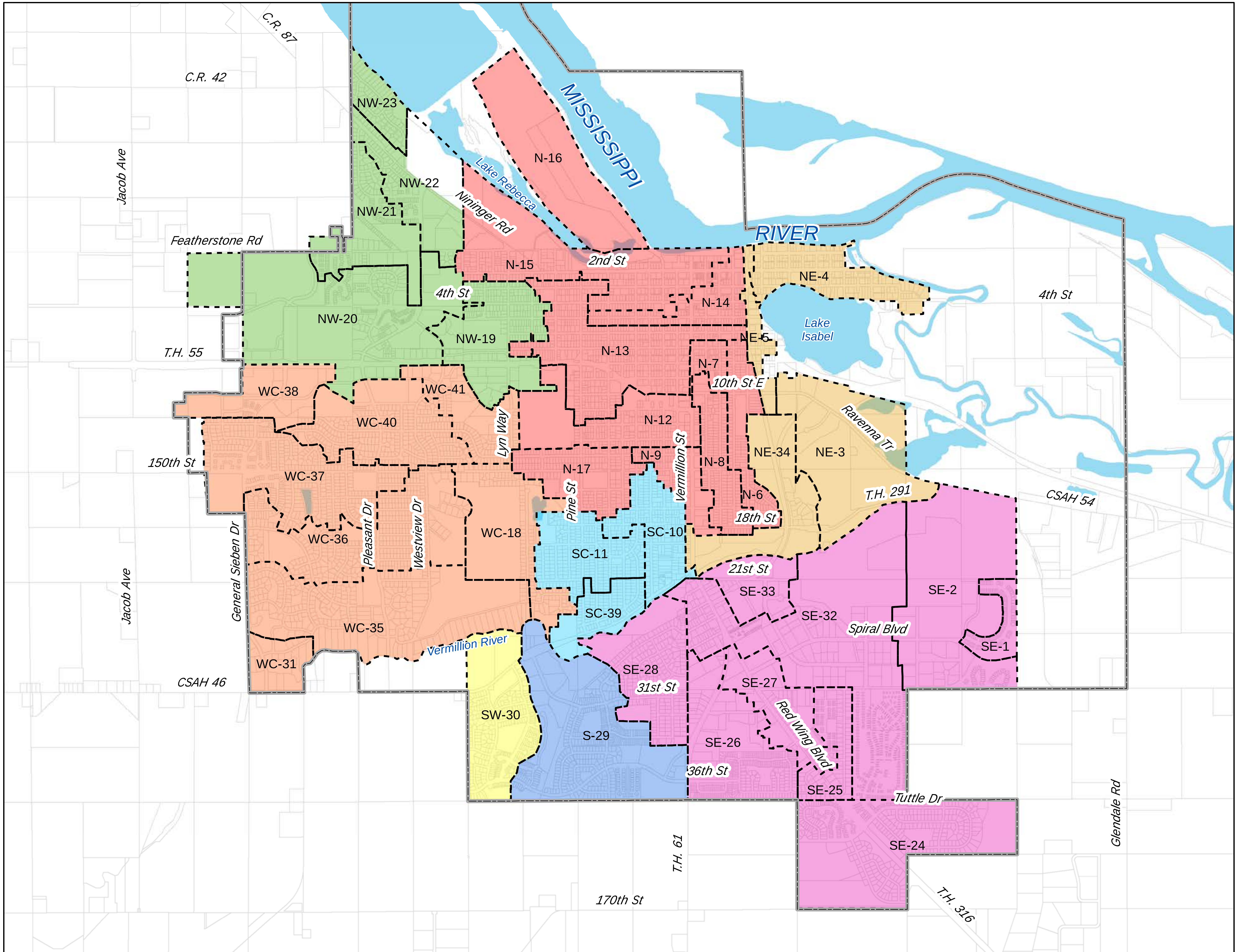

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City of Hastings Comprehensive Sanitary Sewer Plan

Figure 5-3
Sanitary Sewer Sub-Districts

Legend

- City Boundary
- Open Water

Sewer District

- North
- North East
- North West
- South
- South Central
- South East
- South West
- West Central
- Sewer Sub-District

N

0 2,250 Feet

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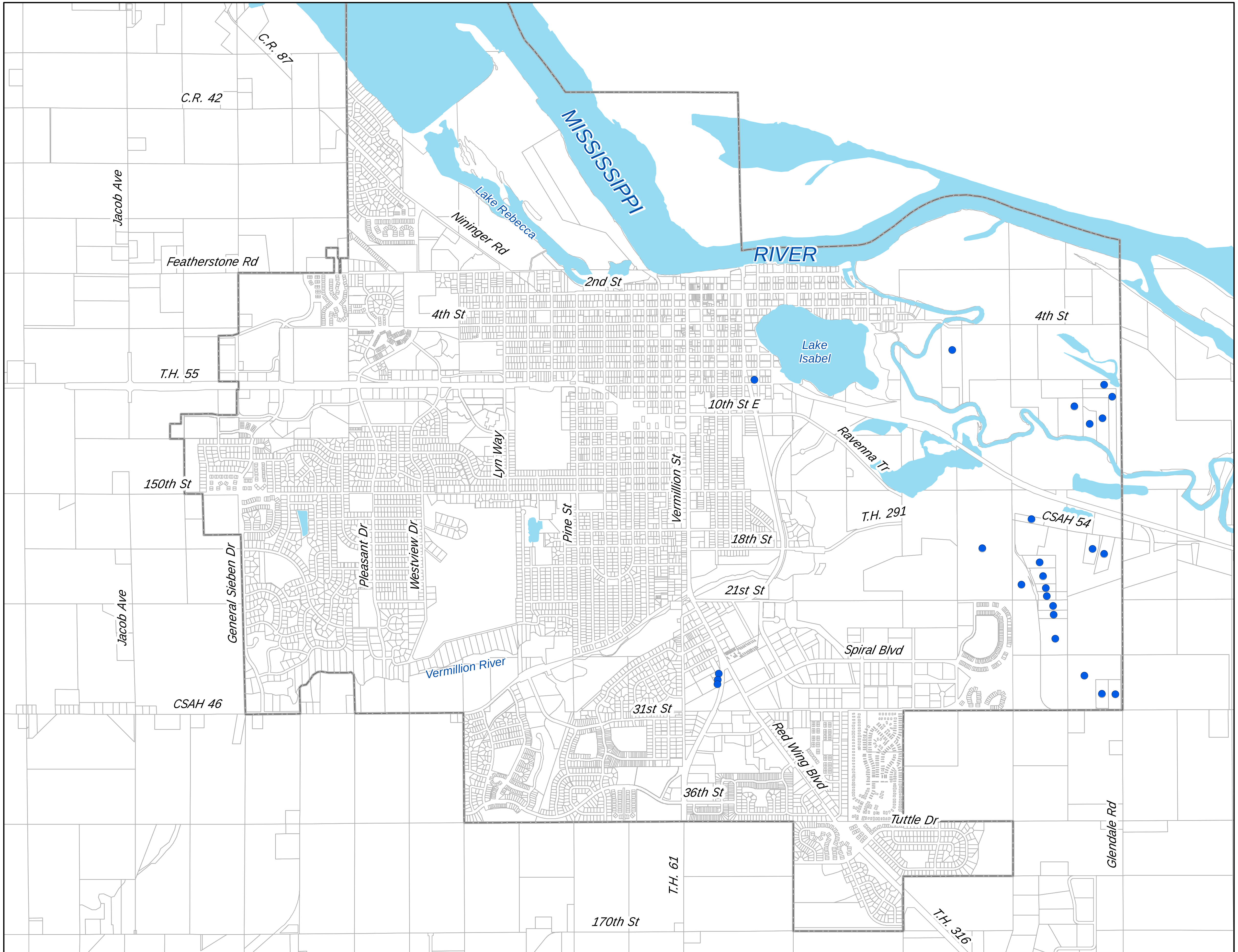

City of Hastings Comprehensive Sanitary Sewer Plan

Figure 5-4
Individual Sewage Treatment Systems (ISTS)

Legend

- City Boundary
- Open Water
- ISTS

N

0 2,250 Feet

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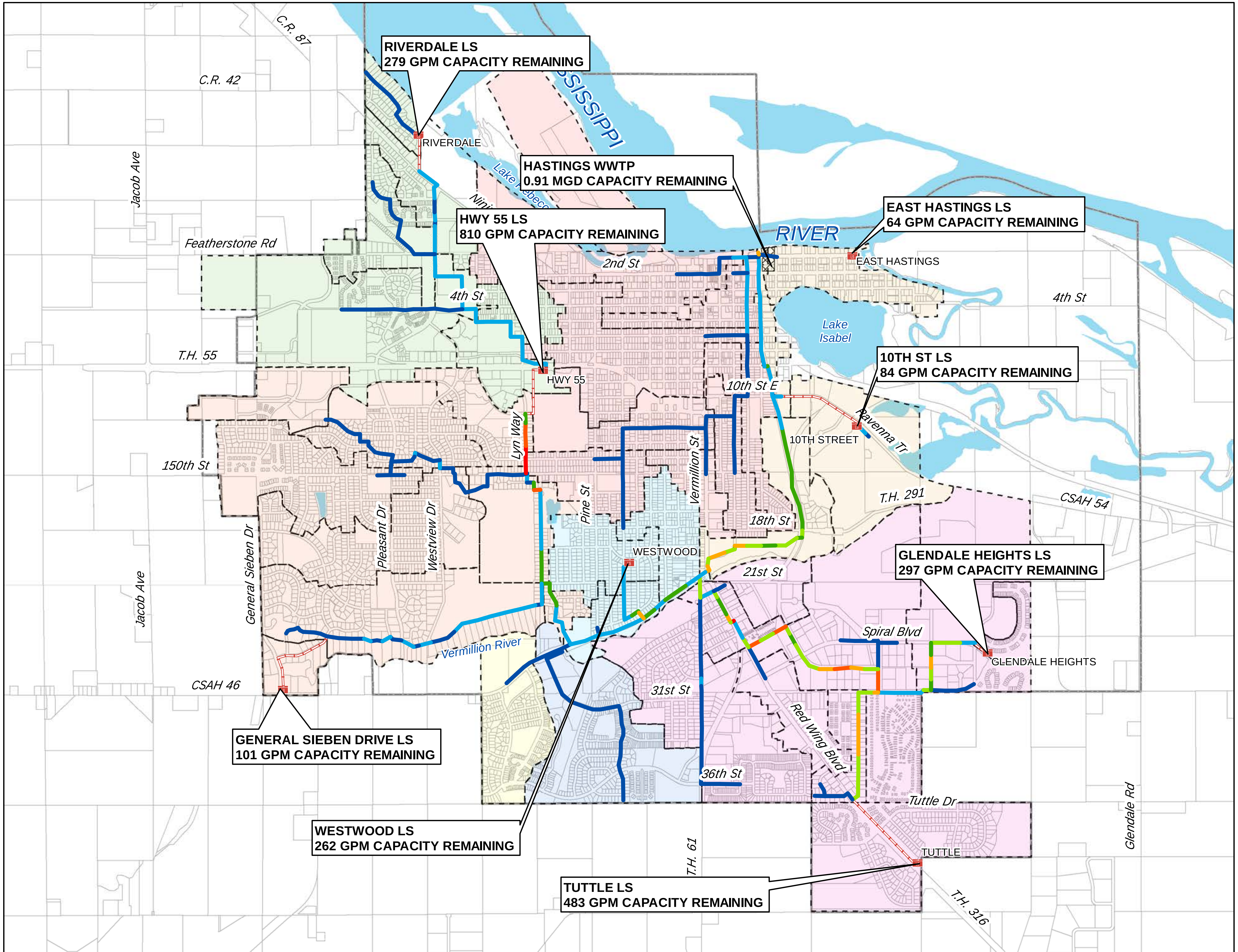

City of Hastings Comprehensive Sanitary Sewer Plan

Figure 5-5
Existing Residual Sewer Capacity

Legend

- City Boundary
- Existing WWTP
- Lift Station
- Forcemain
- Sewer Sub-Districts

Sewer District

- North
- North East
- North West
- South
- South Central
- South East
- South West
- West Central

Residual Capacity

- <10%
- 11% - 20%
- 21% - 30%
- 31% - 40%
- 41% - 50%
- 51% - 75%
- 76% - 100%

N

0 2,250 Feet

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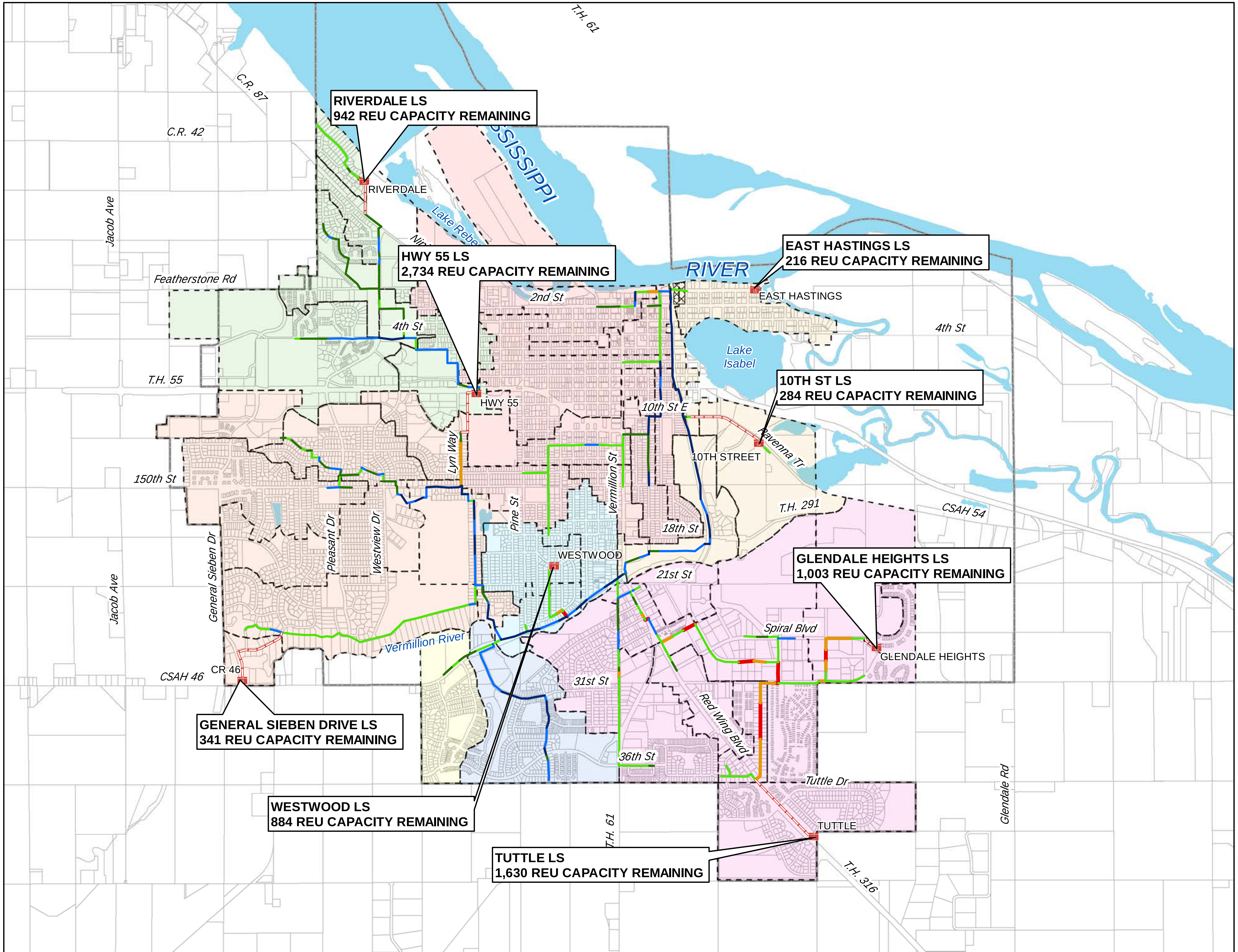

City of Hastings Comprehensive Sanitary Sewer Plan

Figure 5-6
Existing Residual Sewer Capacity in REUs

Legend

- City Boundary
- Existing WWTP
- Lift Station
- Forcemain
- Sewer Sub-Districts

Sewer District

- North
- North East
- North West
- South
- South Central
- South East
- South West
- West Central

Residual Capacity (REUs)

- < 500
- 500-1,000
- 1,000-3,000
- 3,000-5,000
- 5,000-10,000
- > 10,000

N
0 2,250 Feet

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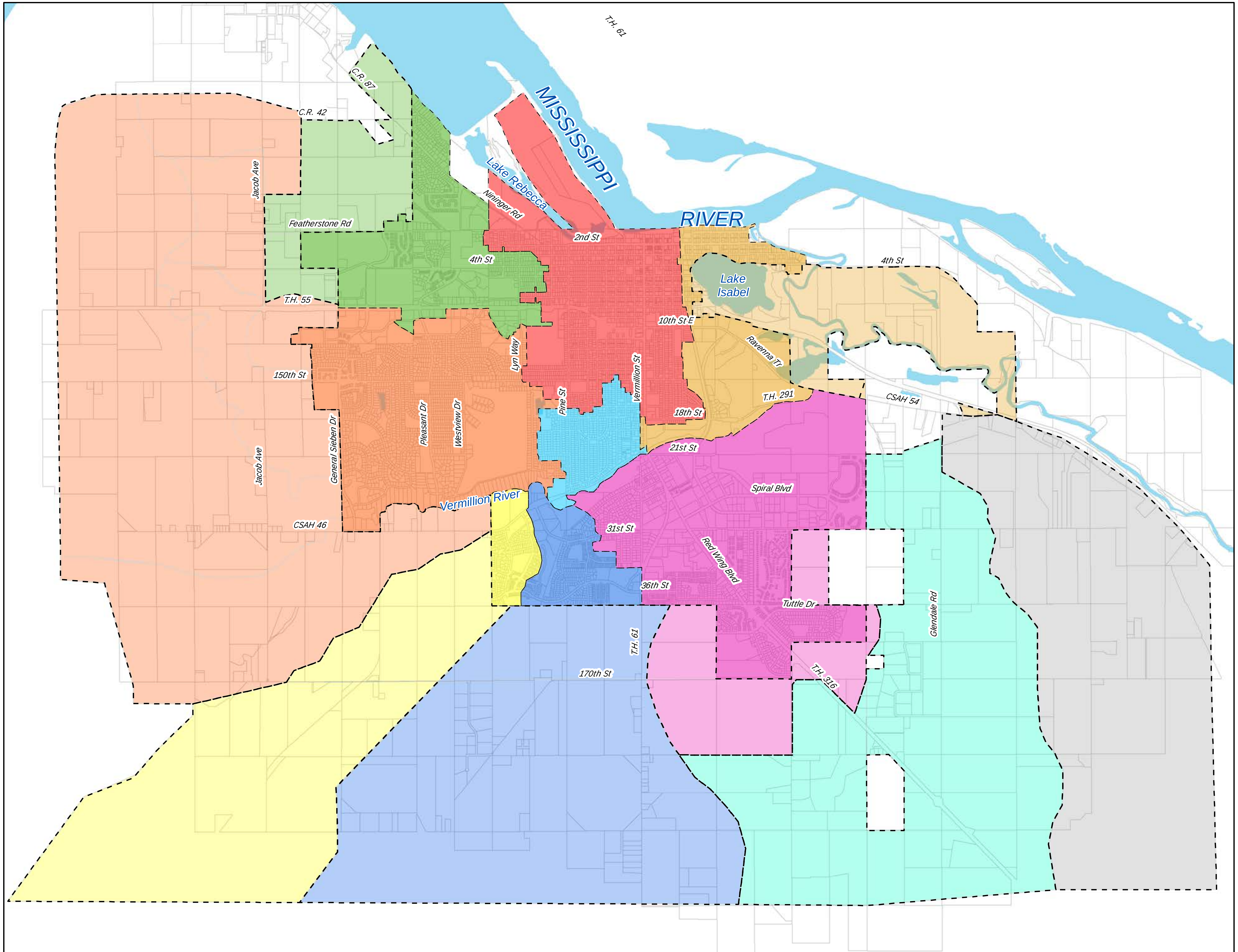

City of Hastings Comprehensive Sanitary Sewer Plan

Figure 6-1
Ultimate Sewer Districts

Legend

Sewer District

Existing District

- North
- North East
- North West
- South
- South Central
- South East
- South West
- West Central

Ultimate District

- E Ultimate
- ESE Ultimate
- NE Ultimate
- NW Ultimate
- S Ultimate
- SE Ultimate
- SW Ultimate
- WC Ultimate

N

0 3,300
Feet

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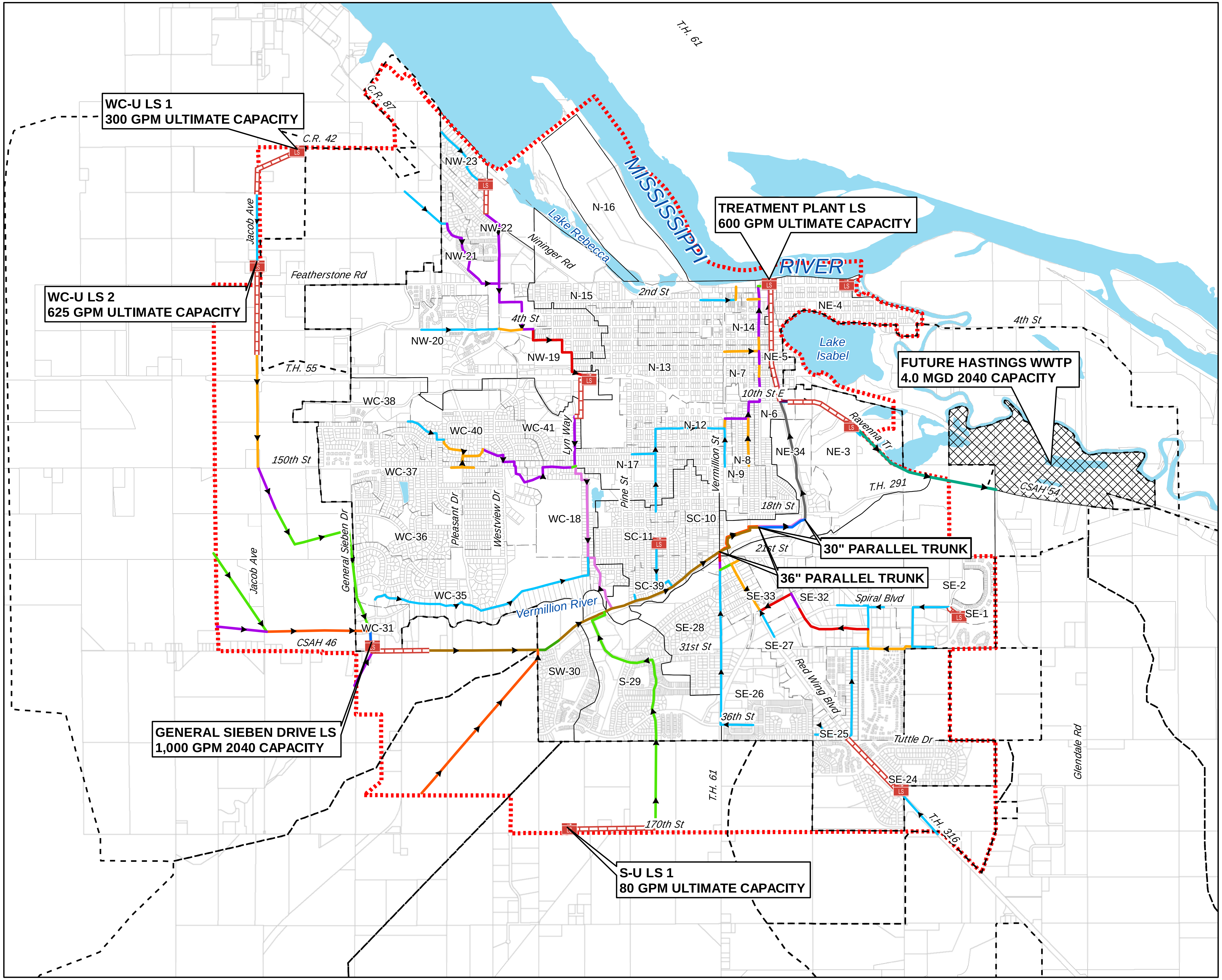

Hastings
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MINNESOTA

City of Hastings Comprehensive Sanitary Sewer Plan

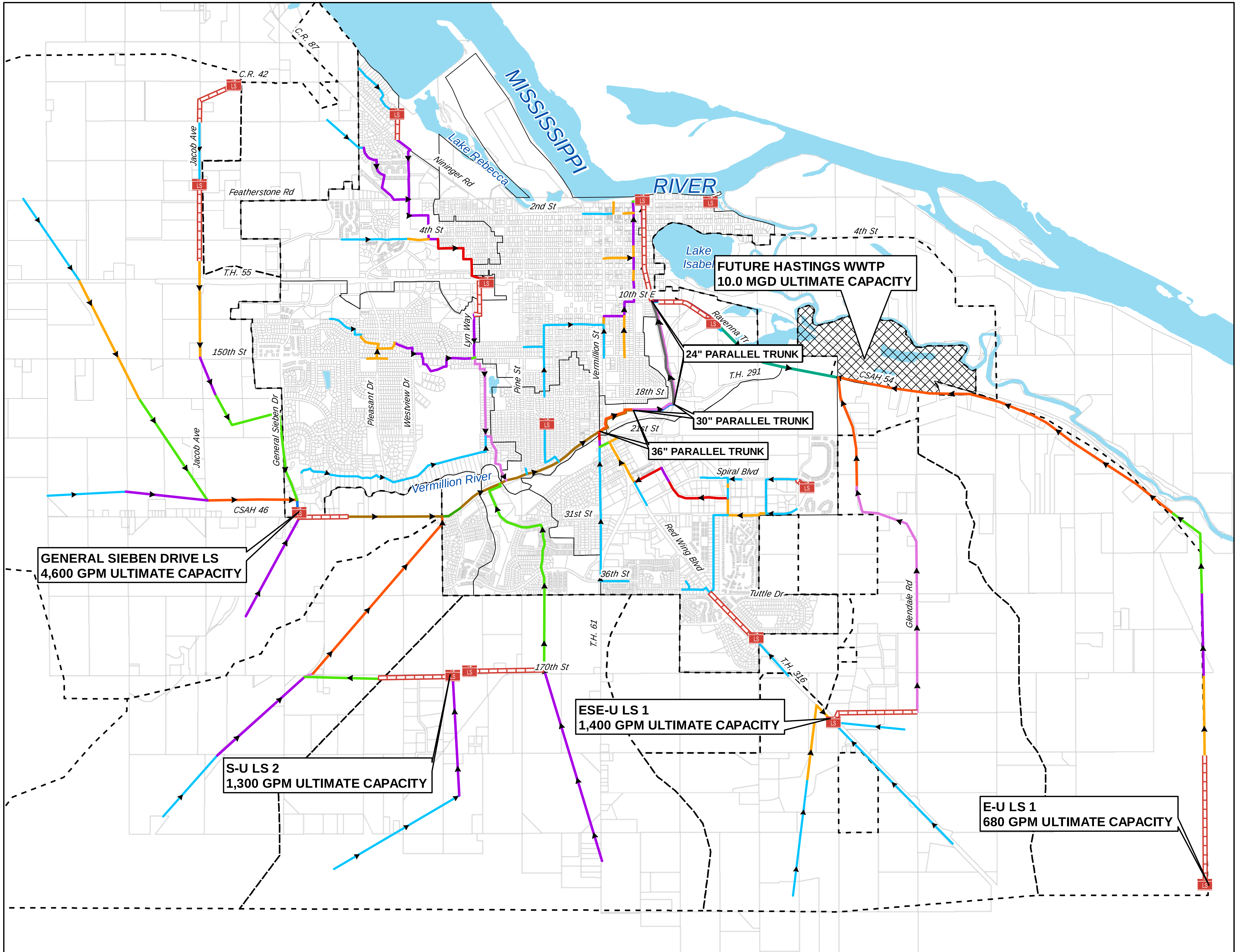
Figure 6-2
2040 Trunk System

Legend

2040 Sewer Service Area Boundary
Ultimate District
Existing District
Existing Sub-District
Future WWTP Site
2040 Lift Station
2040 Force Main

Diameter
10"
12"
15"
16"
18"
21"
24"
27"
30"
36"
42"
48"
54"

wsb



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City of Hastings Comprehensive Sanitary Sewer Plan

Figure 6-3
Ultimate Trunk System

Legend

- Ultimate District
- Existing District
- Future WWTP Site
- Ultimate Lift Station
- Ultimate Force Main

Diameter

- 10"
- 12"
- 15"
- 16"
- 18"
- 21"
- 24"
- 27"
- 30"
- 36"
- 42"
- 48"
- 54"

N

0 3,125 Feet

wsb

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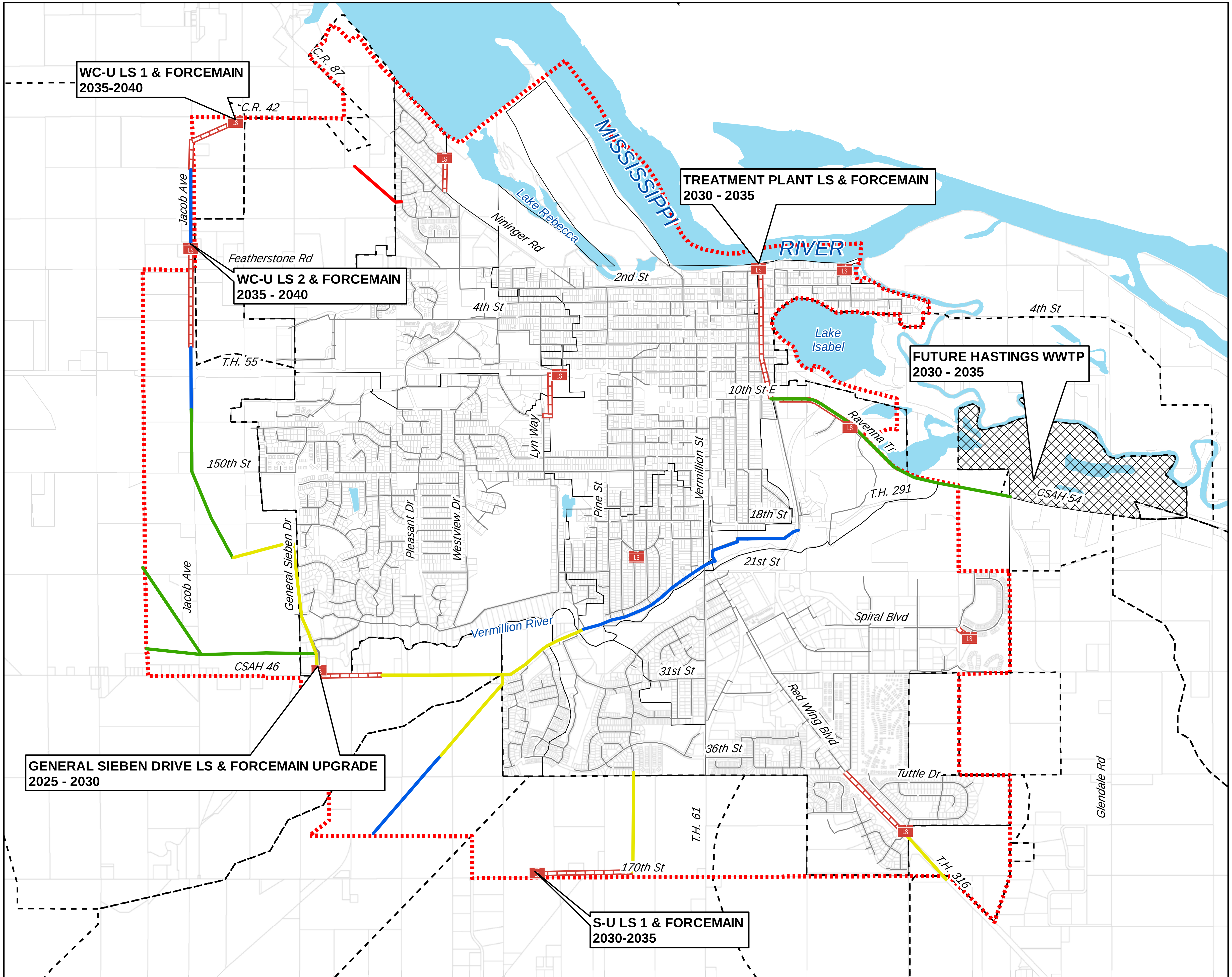
City of Hastings Comprehensive Sanitary Sewer Plan

Figure 7-1
2040 System Phasing



Legend

- 2040 Sewer Service Area Boundary
- Ultimate District
- Existing District
- Future WWTP Site
- Existing Sanitary Main
- 2040 Lift Station
- 2040 Force Main

2040 Trunk System Phasing

- 2020 - 2025
- 2025 - 2030
- 2030 - 2035
- 2035 - 2040

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APPENDIX 1

Individual Sewage Treatment System Ordinance

§ 50.05 ON-SITE SEWER REQUIREMENTS.

(A) *Adoption of Subsurface Sewage Treatment Systems (SSTS).* Standards for the installation and repair of individual on-site sewer systems are established by the Minnesota Pollution Control Agency. Commonly referred to as the Subsurface Sewage Treatment Systems Program – Chapters 7080 – 7083, published by the Minnesota Pollution Control Agency, these standards along with Dakota County Ordinance No. 113 are hereby adopted by reference as though set forth verbatim herein. The stricter provisions of Dakota County Ordinance No. 113 shall apply.

(B) *Permit required.* No person shall install, repair, alter, or pump an on-site sewer system without first obtaining a permit as provided herein. Applications, provided by the City, must be completed in writing prior to issuance of a permit. Permit fees shall be as provided in this code.

(C) *SSTS License required.* Installation and repair of on-site sewer systems requires licensing by the respective county jurisdiction. Persons applying for a permit for installation or repair of an on-site sewer system must provide evidence of licensure with Dakota County if the property where work will be performed is in Dakota County or licensure with Washington County if the property where work will be performed is in Washington County. All design, installation, alteration, repair, maintenance, operation, pumping, and inspection activities for SSTS located in Hastings must be completed by a business licensed by the MPCA under Minnesota Rules Chapters 7080-7083.

(D) *Required conditions.*

(1) Soil percolation tests must be completed by an independent party and must be favorable for the operation of an on-site sewer system before a permit will be issued.

(2) Installations, alterations, repairs, and maintenance shall be performed in accordance with MPCA Rules Chapter 7080-7083.

(3) No private on-site sewer system shall be permitted without approval by the City Council. City Council may deny approval of an on-site sewer on property situated within the Municipal Urban Service Area (MUSA) due to the pending availability of City sanitary sewer service.

(Prior Code, § 4.12) Penalty, see § 10.99 (Ord. 2012-14, 3rd Series, passed 10-15-12)

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APPENDIX 2

Adjusted Wastewater Flow by Sewer Sub-District

District	Sub-District	Estimated Existing Flow (gpd)	Estimated Percentage of Flow (%)	Adjusted Existing Flow (gpd)
North West	NW-23	12,582	0.86%	12,366
	NW-22	25,739	1.77%	25,297
	NW-21	16,150	1.11%	15,873
	NW-20	137,174	9.42%	134,822
	NW-19	34,832	2.39%	34,235
West Central	WC-31	11,521	0.79%	11,323
	WC-35	45,328	3.11%	44,550
	WC-36	40,071	2.75%	39,384
	WC--37	60,802	4.17%	59,759
	WC-38	22,528	1.55%	22,141
	WC-40	49,837	3.42%	48,983
	WC-18	18,991	1.30%	18,665
	WC-41	27,128	1.86%	26,663
South West	SW-30	20,689	1.42%	20,334
South	S-29	25,059	1.72%	24,630
South Central	SC-39	16,296	1.12%	16,017
	SC-11	23,061	1.58%	22,666
	SC-10	24,496	1.68%	24,076
South East	SE-1	14,024	0.96%	13,783
	SE-2	12,462	0.86%	12,249
	SE-24	28,665	1.97%	28,173
	SE-25	12,504	0.86%	12,289
	SE-27	35,823	2.46%	35,209
	SE-26	55,537	3.81%	54,585
	SE-28	23,816	1.63%	23,408
	SE-32	184,785	12.68%	181,617
	SE-33	14,176	0.97%	13,933
North East	NE-3	85,580	5.87%	84,113
	NE-5	6,987	0.48%	6,867
	NE-4	19,745	1.36%	19,407
	NE-34	52,992	3.64%	52,084
North	N-16	2,078	0.14%	2,042
	N-15	68,385	4.69%	67,212
	N-13	52,328	3.59%	51,430
	N-14	22,289	1.53%	21,906
	N-7	6,963	0.48%	6,844
	N-17	23,433	1.61%	23,031
	N-9	18,192	1.25%	17,880
	N-12	63,018	4.33%	61,938
	N-8	20,983	1.44%	20,623
	N-6	19,852	1.36%	19,512
Grand Total		1,456,900	100.00%	1,431,918

Existing sub-district boundaries shown in the table above are displayed in Figure 5-2.

APPENDIX 3

Development Phase Cost Estimates

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Comprehensive Sanitary Sewer System Plan
City of Hastings, MN
2020-2025 Proposed Sanitary Sewer Improvements

No.	Description	Unit	Quantity	Unit Cost	Incremental Unit Cost	Total Cost
1	LIFT STATION CONTROL PANEL UPDATES*	-	-	$22,000.00	$22,000.00	$22,000.00
2	LIFT STATION PUMP REPLACEMENT PROGRAM*	-	-	$32,000.00	$32,000.00	$32,000.00
3	STATIONARY LIFT STATION BACKUP GENERATOR REPLACEMENT*	-	-	$35,000.00	$35,000.00	$35,000.00
4	TOWABLE BACKUP GENERATOR REPLACEMENT*	-	-	$35,000.00	$35,000.00	$35,000.00
5	SANITARY SEWER LINING PROGRAM* *The City plans to spend $150,000/year in sewer lining activities through the year 2025.*	-	-	$900,000.00	$900,000.00	$900,000.00
6	INFRASTRUCTURE PROJECTS* *The sanitary sewer portion of infrastructure projects through the year 2025.*	-	-	$3,106,300.00	$3,106,300.00	$3,106,300.00
7	8" PVC PIPE SEWER *Located west of sub-district SE-26 and west of sub-district WC-38 (* ***Figure 6-2*** *).*	LF	6,534	$30.00	$0.00	$0.00
8	10" PVC PIPE SEWER *Located northwest of sub-district NW-21 (* ***Figure 6-2*** *).*	LF	1,564	$57.00	$27.00	$42,228.00
					Sub-Total	*$4,137,528.00*
					Construction Contingency (10%)	$413,752.80
					Sub-Total	*$4,586,280.80*
					Indirect Costs (20%)	$917,256.16
					TOTAL	***$5,503,537.00***

*Costs obtained from the City's 2017 Utility Rate Study.

1. Costs are for budgeting purposes only and are subject to change as projects are studied, designed, and constructed.
2. Costs are estimated based on 2017 construction costs.
3. Land acquisition costs are not included.

Comprehensive Sanitary Sewer System Plan

City of Hastings, MN

2025-2030 Proposed Sanitary Sewer Improvements

No.	Description	Unit	Quantity	Unit Cost	Incremental Unit Cost	Total Cost
1	GENERAL SIEBEN DRIVE LIFT STATION UPGRADE (1,000 gpm 2040 capacity) *Located in sub-district WC-31 (* ***Figure 6-2*** *).*	LS	1	$159,000.00	$159,000.00	$159,000.00
2	SANITARY SEWER LINING PROGRAM* *The City plans to spend $150,000 in 2026 on sewer lining activities.*	-	-	$150,000.00	$150,000.00	$150,000.00
3	LIFT STATION PUMP REPLACEMENT PROGRAM*	-	-	$8,000.00	$8,000.00	$8,000.00
4	10" PVC FORCEMAIN *General Sieben Drive Lift Station Forcemain (* ***Figure 6-2*** *).*	LF	1,835	$48.00	$48.00	$88,080.00
5	8" PVC PIPE SEWER *Located west of sub-district SE-24, and west of sub-district NW-20 (* ***Figure 6-2*** *).*	LF	4,314	$30.00	$0.00	$0.00
6	15" PVC PIPE SEWER *Located southeast of sub-district SE-24 (* ***Figure 6-2*** *).*	LF	1,643	$76.00	$46.00	$75,578.00
7	18" RC PIPE SEWER *Located south of sub-district S-29, and west of sub-districts WC-31, WC-35, and WC-36 (* ***Figure 6-2*** *).*	LF	7,182	$46.00	$16.00	$114,912.00
8	27" RC PIPE SEWER *Located west of sub-district SW-30 (* ***Figure 6-2*** *).*	LF	3,416	$58.00	$28.00	$95,648.00
9	30" RC PIPE SEWER *Located upsream of General Sieben Drive Lift Station (* ***Figure 6-2*** *).*	LF	448	$65.00	$35.00	$15,680.00
10	36" RC PIPE SEWER *Located downstream of General Sieben Drive Lift Station (* ***Figure 6-2*** *).*	LF	3,123	$79.00	$49.00	$153,027.00
11	42" RC PIPE SEWER *Located downstream of the intersection of the trunks described in Items No. 8 and 10 (* ***Figure 6-2*** *).*	LF	680	$114.00	$84.00	$57,120.00
12	PIPE REAMING 12" TO 36" *Located along Vermillion Rd and immediately dowsntream of the 42" trunk described in Item No. 11 (* ***Figure 6-2*** *).*	LF	1,811	$505.00	$505.00	$914,555.00
					Sub-Total	*$1,831,600.00*
					Construction Contingency (10%)	$183,160.00
					Sub-Total	*$2,014,760.00*
					Indirect Costs (20%)	$402,952.00
					TOTAL	***$2,417,712.00***

*Costs obtained from the City's 2017 Utility Rate Study.

1. Costs are for budgeting purposes only and are subject to change as projects are studied, designed, and constructed.
2. Costs are estimated based on 2017 construction costs.
3. Land acquisition costs are not included.

Comprehensive Sanitary Sewer System Plan

City of Hastings, MN

2030-2035 Proposed Sanitary Sewer Improvements

No.	Description	Unit	Quantity	Unit Cost	Incremental Unit Cost	Total Cost
1	S-ULT LIFT STATION 1 (80 gpm capacity)* *Located in the ultimate south district (**Figure 6-2**).*	LS	1	$335,000.00	$335,000.00	$335,000.00
2	TREATMENT PLANT LIFT STATION (600 gpm capacity)** *Located at the existing wastewater treatment plant (**Figure 6-2**).*	LS	1	$401,360.00	$401,360.00	$401,360.00
3	4" PVC FORCEMAIN* *S-Ult Lift Station 1 Forcemain (**Figure 6-2**).*	LF	2,471	$29.00	$29.00	$71,659.00
4	8" PVC FORCEMAIN** *Treatment Plant Lift Station Forcemain (**Figure 6-2**).*	LF	3,399	$45.00	$45.00	$152,955.00
5	12" PVC PIPE SEWER *Located in the ultimate west central district (**Figure 6-2**).*	LF	1,275	$71.00	$41.00	$52,275.00
6	15" PVC PIPE SEWER *Located in the ultimate west central district (**Figure 6-2**).*	LF	4,639	$76.00	$46.00	$213,394.00
7	18" RC PIPE SEWER *Located in the ultimate west central district (**Figure 6-2**).*	LF	3,225	$46.00	$16.00	$51,592.00
8	27" RC PIPE SEWER *Located in the ultimate west central district (**Figure 6-2**).*	LF	2,976	$58.00	$28.00	$83,328.00
9	48" RC PIPE SEWER** *Located along Ravenna Tr (**Figure 6-2**).*	LF	2,499	$148.00	$148.00	$369,852.00
10	54" RC PIPE SEWER** *Located downstream of the 48" pipe described in Item No. 9 (**Figure 6-2**).*	LF	4,480	$154.00	$154.00	$689,920.00
11	TELEVISE SANITARY SEWER** *Televise newly installed sanitary sewer along Ravenna Tr.*	LF	6,979	$1.50	$1.50	$10,468.50
12	48" DIA SAN SEWER MANHOLE** *Installation of new manholes along Ravenna Tr.*	EACH	14	$3,000.00	$3,000.00	$42,000.00
13	CASTING ASSEMBLY** *Castings for new manholes along Ravenna Tr.*	EACH	14	$700.00	$700.00	$9,800.00
14	CHIMNEY SEAL** *Seals for new manholes along Ravenna Tr.*	EACH	14	$250.00	$250.00	$3,500.00
					Sub-Total	*$2,487,103.50*
					Construction Contingency (10%)	$248,710.35
					Sub-Total	*$2,735,813.85*
					Indirect Costs (20%)	$547,162.77
					TOTAL	***$3,282,977.00***

*Developers will be responsible for the majority of these costs.

**These costs are associated with the re-routing of wastewater from the existing wastewater treatment plant to the new plant location. The City expects the Metropolitan Council to cover these costs.

1. Costs are for budgeting purposes only and are subject to change as projects are studied, designed, and constructed.
2. Costs are estimated based on 2017 construction costs.
3. Land acquisition costs are not included.

Comprehensive Sanitary Sewer System Plan

City of Hastings, MN

2035-2040 Proposed Sanitary Sewer Improvements

No.	Description	Unit	Quantity	Unit Cost	Incremental Unit Cost		Total Cost
1	WC-ULT LIFT STATION 1 (300 gpm Ultimate capacity)* *Located in the ultimate west central district (**Figure 6-2**).*	LS	1	$364,000.00	$364,000.00	$	364,000.00
2	WC-ULT LIFT STATION 2 (625 gpm Ultimate capacity)* *Located in the ultimate west central district (**Figure 6-2**).*	LS	1	$402,000.00	$402,000.00	$	402,000.00
3	6" PVC FORCEMAIN* *WC-Ult Lift Station 1 Forcemain (**Figure 6-2**).*	LF	1,985	$35.00	$35.00	$	69,475.00
4	8" PVC FORCEMAIN* *WC-Ult Lift Station 2 Forcemain (**Figure 6-2**).*	LF	2,544	$45.00	$45.00	$	114,480.00
5	10" PVC PIPE SEWER *Located in the ultimate west central district (**Figure 6-2**).*	LF	2,045	$57.00	$27.00	$	116,565.00
6	12" PVC PIPE SEWER *Located in the ultimate west central district (**Figure 6-2**).*	LF	1946	$71.00	$41.00	$	138,166.00
7	27" RC PIPE SEWER *Located in the ultimate south west district, west of sub-district SW-30 (**Figure 6-2**).*	LF	3,416	$58.00	$28.00	$	198,128.00
8	30" RC PIPE SEWER *Located parallel to the existing 24" main interceptor (**Figure 6-2**).*	LF	1,388	$65.00	$65.00	$	90,220.00
9	36" RC PIPE SEWER *Located parallel to the existing 27" main interceptor (**Figure 6-2**).*	LF	1,618	$79.00	$79.00	$	127,822.00
10	PIPE REAMING 24" TO 36" *Existing 24" main interceptor located in Vermillion Rd (**Figure 6-2**).*	LF	3,546	$350.00	$350.00	$	1,241,100.00
11	TELEVISE SANITARY SEWER *Televise newly installed parallel sanitary sewer interceptors described in Items No. 8 and 9.*	LF	6,552	$1.50	$1.50	$	9,828.00
12	48" DIA SAN SEWER MANHOLE *New manholes for parallel sanitary sewer interceptor.*	EACH	7	$3,000.00	$3,000.00	$	21,000.00
13	CASTING ASSEMBLY *Castings for parallel sanitary sewer interceptor.*	EACH	7	$700.00	$700.00	$	4,900.00
14	CHIMNEY SEAL *Seals for parallel sanitary sewer interceptor.*	EACH	7	$250.00	$250.00	$	1,750.00
					Sub-Total	*$*	*2,899,434.00*
					Construction Contingency (10%)	$	289,943.40
					Sub-Total	*$*	*3,189,377.40*
					Indirect Costs (20%)	$	637,875.48
					TOTAL	***$***	***3,827,253.00***

*Developers will be responsible for the majority of these costs.

1. Costs are for budgeting purposes only and are subject to change as projects are studied, designed, and constructed.
2. Costs are estimated based on 2017 construction costs.
3. Land acquisition costs are not included.

APPENDIX 4

Technical Memorandum – East 10th St. Sanitary Sewer Lift Station Capacity and Sub-sewershed Analysis

DRAFT

477 Temperance Street | St. Paul, MN 55101 | (651) 286-8450

June 9, 2017

Nick Egger, P.E.
Public Works Director
City of Hastings
1225 Progress Drive
Hastings, MN 55033

Re: Technical Memorandum
East 10th St. Sanitary Sewer Lift Station Capacity and Sub-sewershed Analysis

Dear Nick:

We have determined the current wastewater volumes that are generated from the sanitary sewershed that is served by the East 10th St. Lift Station. We have also estimated the remaining capacity of this lift station to serve future development. On May 18, 2017, we installed flow monitoring equipment inside two manholes and assisted City staff to conduct a pump drawdown capacity test inside the lift station to determine the actual pumping capacity for each of the two existing submersible pumps.

Flow Monitoring
We set-up electronic flow monitors inside the 10-inch and 8-inch gravity sanitary sewer lines that flow to this lift station to measure and determine the maximum peak flow rates from the sewershed over a one week period. One flow monitor was installed inside Manhole No. 8 on East 10th St. and the second flow monitor was installed inside a manhole that receives wastewater from the Hastings Veteran's Home. The attached graphs illustrate the flow data that was recorded from the monitors over the 7-day monitoring period. The combined maximum peak hourly flow that was measured from the two flow monitors was approximately 95 gallons per minute (gpm).

Lift Station Capacity Test
The lift station wetwell was filled with 13.8-inches of potable water from an upstream hydrant for testing Pump No. 1. The wetwell was filled with 17.4-inches of potable water for testing Pump No. 2. Each of the two pumps were operated separately for each test while the drawdown was measured and timed to calculate the displacement rate (pumping flow rate) for each pump. By subtracting the measured maximum peak flow rate (flow monitor data) of the sewershed from the pumping capacity of the lift station, we were able to calculate the remaining residual pumping capacity of the lift station to serve future development as follows:

Pump No. 1 Test

A	Pump No. 1 Capacity	179 gpm	Pump Test
B	Peak Hour Sewershed Flow Rate Over 7 Day Period	95 gpm	Flow Monitor
C	Remaining Residual Pumping Capacity	84 gpm	C = A – B
D	Remaining Residual Pumping Capacity Assuming 80% Maximum Use of Residual Pumping Capacity	67 gpm	D = C X 0.80
E	Pumping Capacity Over 24 hours	96,480 gallons per day	E = D X 1,440 minutes per day
F	Remaining Capacity for Future Development	24,120 gallons per day	F = E/4 Peak Hour Factor

Pump No. 2 Test

A	Pump No. 1 Capacity	185 gpm	Pump Test
B	Peak Hour Sewershed Flow Rate Over 7 Day Period	95 gpm	Flow Monitor
C	Remaining Residual Pumping Capacity	90 gpm	C = A – B
D	Remaining Residual Pumping Capacity Assuming 80% Maximum Use of Residual Pumping Capacity	72 gpm	D = C X 0.80
E	Pumping Capacity Over 24 hours	103,680 gallons per day	E = D X 1,440 minutes per day
F	Remaining Capacity for Future Development	25,920 gallons per day	F = E/4 Peak Hour Factor

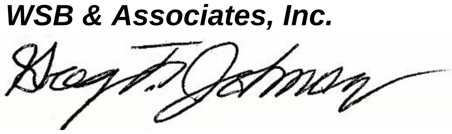
Analysis of Results

The remaining capacity of the East 10th St. Lift Station is limited to the pump that provided the lowest discharge rate during the lift station capacity test which was Pump No. 1 in this case. If Pump No. 2 is out of service, the remaining residual pumping capacity of the East 10th St. Lift Station is 96,480 gallons per day. However, this is the average remaining residual capacity over a 24-hour period, and lift station pumps must be capable of pumping the peak hourly flow rates that occur at certain times of the day. Smaller sanitary sewersheds typically have a peak hourly factor of 4 times the average daily flow rate. Therefore, the East 10th St. Lift Station should be capable of pumping a maximum additional wastewater volume of 24,000 gallons per day from future development. If the projected wastewater flows from future development exceed this daily volume, the City should consider upsizing the existing pumps and installing new VFDs at the lift station depending on the additional pumping capacity required and the maximum hydraulic capacity of the existing 6” forcemain.

If you have any questions or would like to discuss this technical memorandum, please contact me at 651-286-8466.

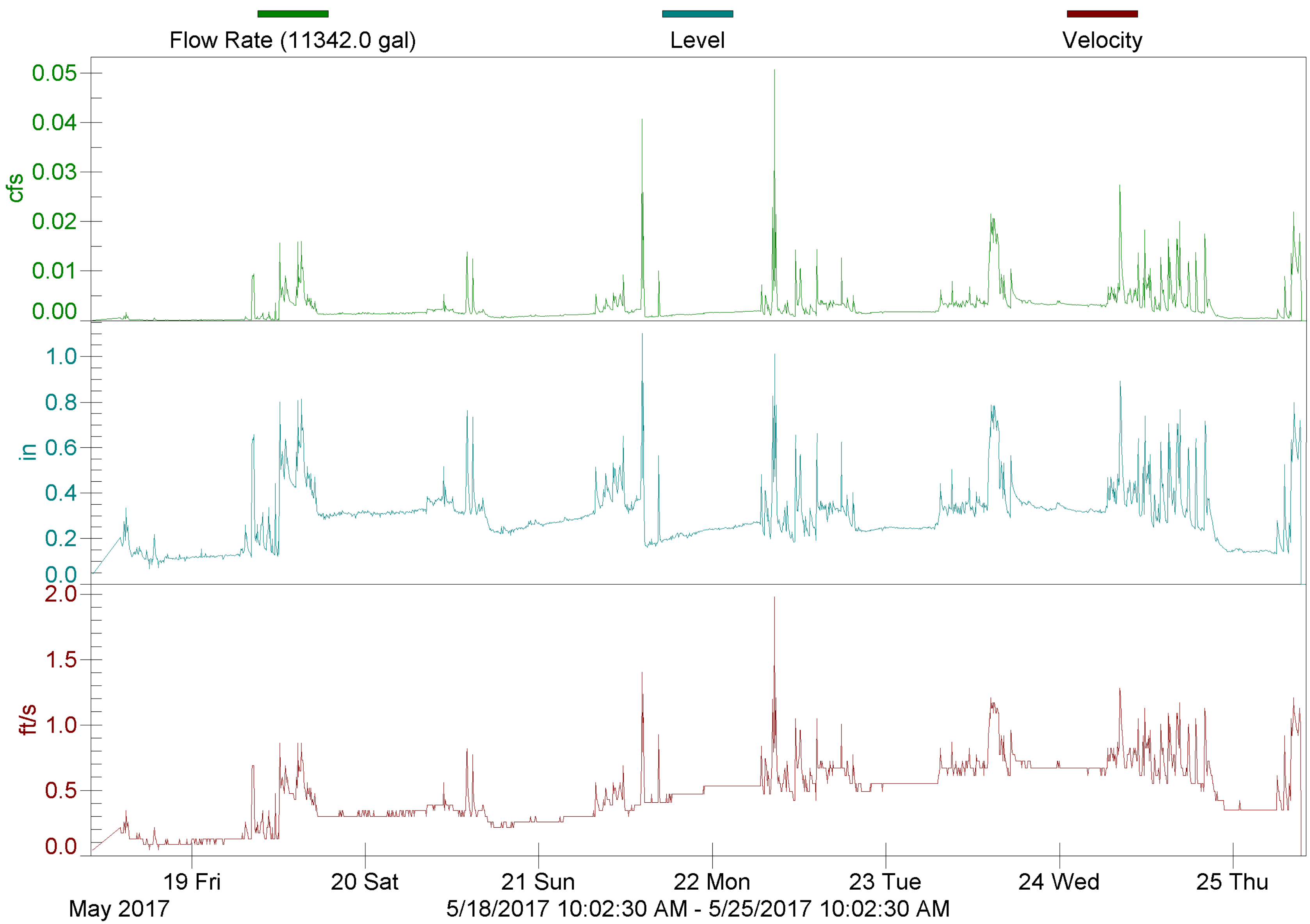
Sincerely,

WSB & Associates, Inc.



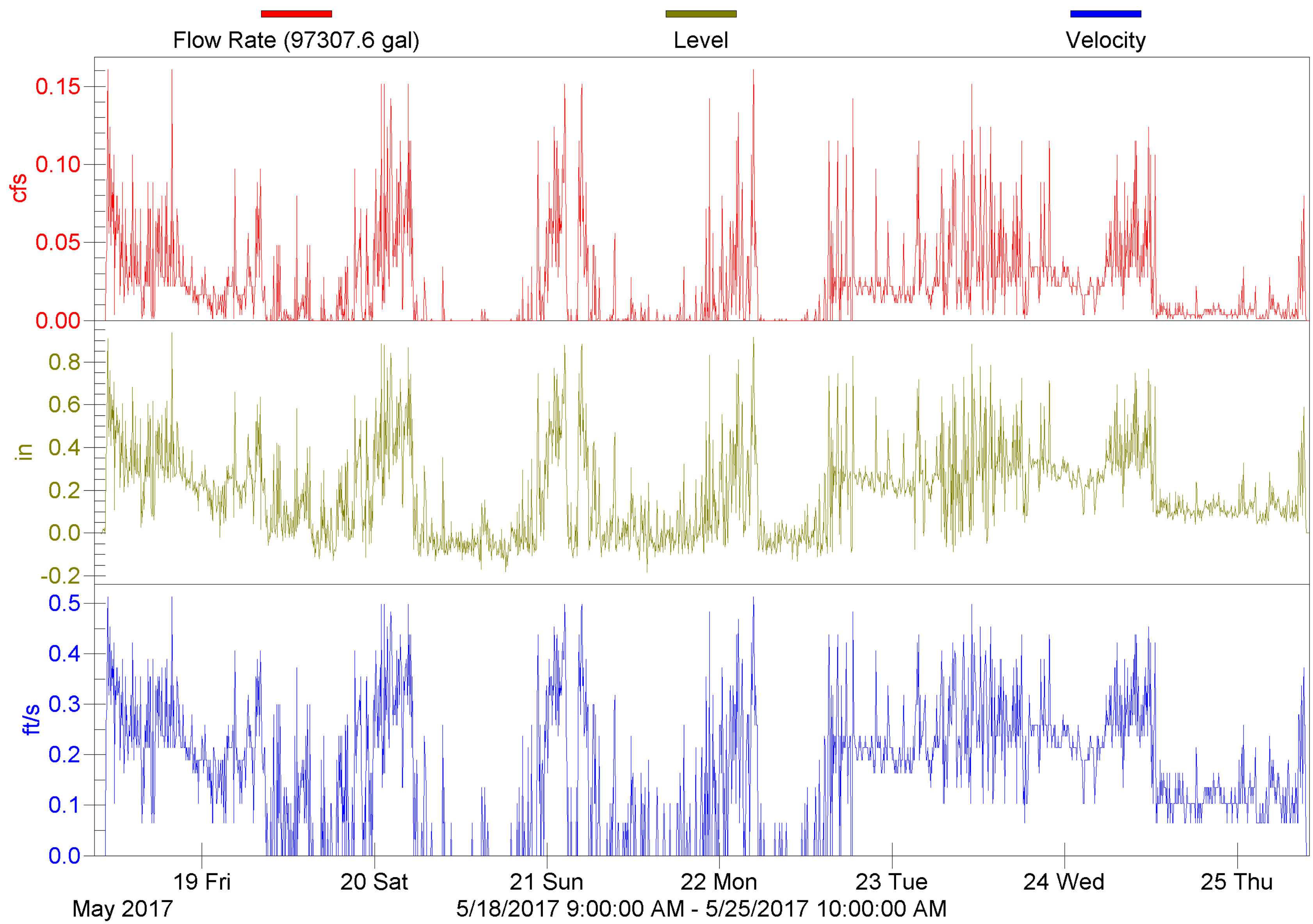
Greg Johnson, PE
Water/Wastewater Group Manager

Hastings 8



Flow Rate (11342.0 gal)
Level
Velocity
cfs
0.05
0.04
0.03
0.02
0.01
0.00
in
1.0
0.8
0.6
0.4
0.2
0.0
ft/s
2.0
1.5
1.0
0.5
0.0
19 Fri
20 Sat
21 Sun
22 Mon
23 Tue
24 Wed
25 Thu
May 2017
5/18/2017 10:02:30 AM - 5/25/2017 10:02:30 AM

Hastings 10



Flow Rate (97307.6 gal)
Level
Velocity
cfs
0.15
0.10
0.05
0.00
in
0.8
0.6
0.4
0.2
0.0
-0.2
ft/s
0.5
0.4
0.3
0.2
0.1
0.0
19 Fri
20 Sat
21 Sun
22 Mon
23 Tue
24 Wed
25 Thu
May 2017
5/18/2017 9:00:00 AM - 5/25/2017 10:00:00 AM