Introduction

The City's sanitary sewer system collects and conveys residential, commercial, and industrial wastewater flows from the Cedar Rapids Metropolitan Area to the City's Water Pollution Control Facility. The system serves the Cities of Marion, Hiawatha, and Palo, and a small part of Linn County in addition to the City of Cedar Rapids.

In recent years, the City's sanitary sewer system and Water Pollution Control Facility have been challenged by peak flows approaching and exceeding existing capacity. The peaks are attributed to extraneous wet weather flows commonly referred to as infiltration and inflow (I&I) that are produced by local precipitation and/or high river levels. The challenge with peak flows has become more pronounced since catastrophic flooding in 2008.

This Executive Summary provides an overview of the results of a nine-month effort to develop a hydraulic model of the City's sanitary sewer system and provide an initial update to the City's 1998 Sanitary Sewer System Master Plan. The City's intent is to move forward with capital improvements to address high priority sanitary sewer system needs while taking initial steps to produce a living Master Plan that will become more comprehensive through additional effort in coming years.

The initial Master Planning effort reflects the collaborative effort of City and HDR staff to bring a fresh perspective and innovative thought to accomplish the following:

- Proceed with initial development of a living Sanitary Sewer Master Plan that will become more comprehensive and expansive with time.
- Understand and incorporate the City’s vision as reflected in EnvisionCR.
- Develop a Capital Improvements Plan that clearly communicates the priorities, rationale, and timeline to address known sanitary sewer issues.
- Identify funding needs and develop a financial plan that closes the gap between current revenues and capital needs.
- Obtain available GIS and other available information to proceed with higher-level hydraulic modeling Citywide to begin to assess capacity needs.
- Engage and work collaboratively with Public Works staff to identify policy and other considerations relative to sanitary sewer master planning.
- Establish the framework for annual updates to expand and improve upon the initial plan.
Existing Sanitary Sewer System

With portions dating back to the late 1800’s, the Cedar Rapids sanitary sewer system includes over 660 miles of public sewer and seven public lift stations delivering wastewater to the Cedar Rapids Water Pollution Control Facility (CRWPCF). There are approximately 50 miles of private sewer, multiple private lift stations, and approximately 500 miles of private service laterals connected to the public system as well. As shown in the figure below, wastewater from four major interceptor sewers and three smaller sewers are captured and conveyed by the Main Interceptor. A portion of the industrial wastewater from the C Street SW area is conveyed separately through the Anaerobic Conveyance Sewer to the anaerobic treatment facility at the Water Pollution Control Facility.

The I&I that challenges the capacity of the existing system is extraneous, relatively clear surface and ground water entering through defects. These extraneous flows can overwhelm sanitary sewer and treatment capacity causing basement backups and sanitary sewer overflows.

In spite of significant I&I, the City has achieved notable reductions in the number of sanitary sewer overflows over the last 15 years.

The average number of reported overflows now equates to less than three overflows per year per 100 miles of sanitary sewer. This categorizes the Cedar Rapids sanitary sewer system as high performing in comparison to national data accumulated by HDR.

Over the past 16 years, the City has lined or replaced an average of 0.7 percent of the system annually. This is consistent with EPA audit recommendations back in 2006, but below the City’s one to two percent target. Prior to the June 2008 flood, flows to the CRWPCF were trending downward, believed to be reflective of those efforts. However, that trend has reversed since the June 2008 flood, presumably due to damage in those portions of the sanitary sewer system impacted by flood waters.

Forecast future average daily flows are manageable. Even with continued or enhanced efforts at I&I reduction, extraneous flows will be problematic. Forecast future maximum day and peak flows exceed current downstream capacity and will require large capital expenditures for additional capacity if not reduced through I&I reduction. As a result, priority should be placed on reducing peak flows moving forward.
Integration with EnvisionCR

EnvisionCR provides a vision for the future of Cedar Rapids to focus priorities for City policies and public investments in the next 20 years. It forecasts a future annual growth rate of 0.64 percent, identifies growth areas to the North, Northwest, West, Southwest, and South, assesses sanitary sewer serviceability, and provides anticipated future land use maps.

EnvisionCR also includes a number of key implications for sanitary sewer master planning:

- Recommendations for detailed studies for extending services to growth areas.
- Consideration that sanitary sewer improvements could incorporate trail considerations.
- Recognition that the southeast portion of the South growth area and the northwest growth areas will require lift stations.
- Acknowledgement that development in the West growth area should be limited to south of the ridgeline to avoid the need for a lift station.

Hydraulic Modeling

Sanitary sewers 18-inch diameter and larger were incorporated into a Citywide sanitary sewer system model. The associated lift stations were also added. The model was used to simulate system performance for 5-year 24-hour storm events for both existing and forecast future conditions. The model was validated with actual flow metering data at five primary meter locations. Initial results identify the potential for significant deficiencies throughout the sanitary sewer system based on a continuance of current levels of I&I. The associated deficiencies have the potential to result in backups and/or overflows.

Improvements to address deficiencies include $67.2 million of previously identified Indian Creek Interceptor and Prairie Creek Interceptor Improvements, but also $102.3 million of potential East Interceptor, West Interceptor, and Main Interceptor improvements not previously identified.

The intent is to refine and validate the model to additional flow meters over the coming years to more accurately reflect current and future conditions throughout the existing system. At that point, the model will be used more confidently to assess and affirm initial results, evaluate alternative improvements for deficiencies, and identify actual capital needs for capital improvements planning and improvements design. To date, the model affirms the adverse implications of extraneous I&I on the sanitary sewer system.
Capital Improvements Needs

Prior studies provide the foundation for the current capital improvements plan. These include:

- 1984 Sewer System Evaluation
- 1998 Sanitary Sewer Master Plan
- 2011 Collection System I&I Analysis
- 2015 Collection System Infiltration and Inflow Analysis/Pilot Program and WPC Main Lift Station Capacity Assessment

The studies define improvements that have already been completed, as well as multiple ongoing and planned improvements.

The current 5-year CIP:

- Anticipates total capital expenditures of $38.6 million over the next five fiscal years, as shown to the right. Sanitary sewer rates are the primary funding source ($17.5 million, or $3.2 to $3.7 million per year). Other funding sources include TIF funds, revenue bonds, developer contributions, and cash reserves.
- Ramps up to $3.4 million of ongoing annual capital expenditures for rehabilitation or replacement and I&I reduction. This need will extend well beyond the five years. In fact, an additional $1.2 million of annual capital expenditures would be required to achieve the City’s goal of annually rehabilitating or replacing one to two percent of the existing sanitary sewer system.
- Does not include up to $224 million of identified or potential sanitary sewer capital needs, the magnitude of which will largely be determined by the effectiveness of I&I reduction efforts.
- Anticipates that growth related needs will be paid for through growth related connection and extension fees.

Historically, sanitary sewer capital needs have been prioritized using benefit, relationship to other projects, project type, and funding availability as the prioritization criteria. As the Sanitary Sewer Master Plan gets refined in subsequent phases, the associated CIP prioritization criteria should be as well. The intent will be to more closely match the template and criteria developed for stormwater CIP prioritization.
Financial Needs

Historically, Sanitary Sewer Operations is funded by 60 percent of sanitary sewer rate revenue from all except major industrial customers. The remaining 40 percent and all of the revenue from major industrial customers funds Water Pollution Control.

**TYPICAL CEDAR RAPIDS MONTHLY RESIDENTIAL SEWER BILL.** Metered water use provides the basis for sanitary sewer bills. Typical residential customer sewer bills for 7,500 gallons per month are shown below.

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Price per month for 7,500 Gallons</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>$25.92</td>
<td>7.5%</td>
</tr>
<tr>
<td>2016</td>
<td>$25.24</td>
<td>2.7%</td>
</tr>
<tr>
<td>2015</td>
<td>$24.68</td>
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<tr>
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<td>2010</td>
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<tr>
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<td>$15.95</td>
<td>8.5%</td>
</tr>
<tr>
<td>2007</td>
<td>$16.27</td>
<td>7.0%</td>
</tr>
</tbody>
</table>

Average of 2.6% rate increase per year

Average of 7.5% rate increase per year

Given the wet industrial nature, Cedar Rapids also strives to be rate competitive with other cities throughout the Midwest (Madison, Rochester, and Fort Wayne) with economies driven by major wet industries. A recent comparison made by Cedar Rapids Utility Department staff demonstrates that competitiveness as well, as shown in the graph to the right.

Finally, national survey data from the American Water Works Association also demonstrates the competitiveness of the City’s current rates. That data indicates 2013 national medians of $40.05 and $40.55 for customers served by wastewater only and combined water and wastewater utilities, respectively.

**TYPICAL MONTHLY RESIDENTIAL SANITARY SEWER BILL.** At $25.92 per month, the City of Cedar Rapids is well below the median rate in the 2015 Sewer Rate Report for Iowa Cities 10,000 Population or Higher published by the City of Ames. For the 40 cities in the survey, the typical monthly residential sanitary sewer bill ranges from $15.13 to $89.60 per month with a median of $44.60 per month.
The City’s current sanitary sewer system financial plan forecasts a 7.5 percent sanitary sewer rate increase in fiscal year 2017, 10 percent increases in fiscal years 2018 and 2019, and 5 percent increases in fiscal years 2020 and 2021. It also includes a cap on Water Pollution Control’s portion of the non-industrial revenues at $5 million to generate additional revenue for sanitary sewer operations. The 5-year plan increases the typical monthly residential sewer bill to $37.17 in 2021, still well below the current survey median rates noted previously.

The current 5-year financial plan includes approximately $15.5 million sanitary sewer revenue bonds, $1.7 million TIF bonds, and $2.4 million developer contributions. It increases annual debt service obligations from approximately $2.6 million in fiscal year 2016 to a forecast $3.2 million in fiscal year 2021.

The current 5-year plan produces a forecast $34 million for capital improvements without any federal grants or other outside funding. This generally matches the current 5-year Capital Improvements Plan. Without the proposed sanitary sewer rate increases, the plan would produce an estimated $8.0 million less revenue, requiring a corresponding reduction in capital improvements.

Shorter term, major projects to increase Prairie Creek and Indian Creek trunk sewer capacity, coupled with other ongoing improvements, stretch the City’s ability to pay for sanitary sewer capital needs. Longer term, significant I&I in the sanitary sewer system could stretch the City’s ability to pay for capital needs even further; potentially requiring additional, even more significant, future investment in capacity for other trunk sewers and significant future investment in pumping and treatment capacity at the Water Pollution Control Facility.

Sanitary sewer rate revenue is the main funding source for both operations and capital improvements. As such, sanitary sewer rates and other user charges will need to increase significantly over time. Other recommendations follow.

- Sustain and accelerate efforts to target and reduce I&I to reduce future capital needs.
- Monitor and aggressively seek grant or other special funding to more quickly address significant needs.
- Proceed with basin-scale modeling to better define long-term needs.
- Prepare individual basin plans to better define needs in targeted growth areas.
- Review and refine connection and extension fees to assure that growth pays for the associated sanitary sewer needs.
- Continue efforts to work collaboratively with others to cost share on multi-purpose projects.
- Incorporate the sanitary sewer system into the Water Pollution Control cost of service model to consider both sanitary sewer and treatment capital needs to more accurately forecast required future rate increases.
Policy and Other Considerations

The following considerations have a direct impact on current or future sanitary sewer master planning:

- Transfer of ownership from private to public for multiple lift stations. Capital expenditures to begin this transfer are included in the current CIP.
- Coordination and funding of sanitary sewer rehabilitation or replacement in conjunction with street reconstruction. Use of street reconstruction funding for associated sanitary sewer needs increases the ability to address other sanitary sewer capital needs. On the other hand, use of sanitary sewer funding to address street reconstruction related sanitary sewer needs reduces the ability to address other, potentially higher prior, sanitary sewer needs.
- Addressing I&I from the following sources. Capital expenditures to begin to address I&I from private sources are phased into the current CIP utilizing a Private Service Lateral program.
  - from private foundation drains and sump pumps
  - from private service laterals and service connections
  - from neighboring cities
- Rate revenue allocation between treatment and collection. Both collection and treatment have significant capital needs. The current CIP reflects some shift of rate revenue from treatment to collection.
- The appropriate sanitary sewer design storm event. The current CIP is based on a 5-year design storm event. To date, the Iowa Department of Natural Resources has not officially recognized this criteria. The more extreme the design storm event, the more sanitary sewer system capacity required, and the higher the potential expenditures to provide that capacity.
- The serviceability of future growth areas. The current CIP assumes that current sanitary sewer related connection and extension fees are sufficient to pay for growth.

Acknowledgments

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