City of Reedsburg
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Public Works Committee Agenda
October 20, 2021
Reedsburg City Hall Council Chambers
5:30 PM

DUE TO THE RESTRICTIONS CAUSED BY THE COVID-19 PANDEMIC, SOME VOTING MEMBERS MAY BE PRESENT VIA TELECONFERENCE OR VIDEO CONFERENCE, AS PROVIDED BY THE RECOMMENDATIONS OF THE WISCONSIN DEPARTMENT OF JUSTICE. HTTPS://WWW.DOJ.STATE.WI.US/NEWS-RELEASES/OFFICE-OPEN-GOVERNMENT-ADVISORY-CORONAVIRUS-DISEASE-2019-COVID-19-AND-OPEN-MEETINGS

NOTICE IS HEREBY GIVEN THAT A MAJORITY OF THE MEMBERS OF THE COMMON COUNCIL MAY ATTEND THIS MEETING TO GATHER INFORMATION ABOUT A SUBJECT OVER WHICH THE COMMON COUNCIL HAS DECISION-MAKING AUTHORITY. IF A QUORUM OF THE COMMON COUNCIL ATTENDS THIS MEETING, NO ACTION WILL BE TAKEN BY THE COMMON COUNCIL AT THIS MEETING.

CALL TO ORDER

APPROVAL OF MINUTES

I. APPROVE MINUTES FOR THE MEETING HELD ON SEPTEMBER 15, 2021:

THE COMMITTEE WILL RECEIVE INFORMATION ON NON-AGENDA TOPICS BROUGHT BEFORE THE COMMITTEE BY MEMBERS OF THE PUBLIC. THE COMMITTEE WILL NOT DISCUSS THESE TOPICS, AND WILL NOT TAKE ACTION ON ANY OF THEM AT THIS MEETING

I. GENERAL BUSINESS:

A. Review WWTP Facilities Plan and set Public Hearing date for November 17, 2021

B. Approve Town & Country contract for preliminary WWTP design work

C. Consideration of parking hours on North Walnut Street between East Main Street and Second Street

D. Update on current projects

II. ADJOURN:

Reedsburg, WI
September 15, 2021

The Public Works Committee for the City of Reedsburg convened for a regular meeting, on September 15, 2021 at 5:30 p.m. at the Reedsburg Center Conference Room with the following members present:

Members Present: Craig Braunschweig, Dave Knudsen, Charlie Backeberg and Phil Peterson

Also Present: Steven Zibell, Tim Becker, Chris Kleinschmidt, Casey and Ben from Town and Country Engineering

Motion by Peterson seconded by Braunschweig to approve the minutes from August 18, 2021 meeting.

Ben discussed wastewater plant options 3A, 3B, 3C and 3B in detail stating the plusses and minuses for all options along with detailed cost analysis. After taking tours of various plants and looking at the options presented staff thought the best overall option for the City would be 3C since it's the lowest operating cost and would produce the least amount of sludge. Ben stated all options would be a Class a sludge product and two options would be with a dryer including 3C. There was a considerable amount of discussion with the members and staff. Motion by Braunschweig seconded by Backeberg to go with option 3C.

Motion Carried

Ben discussed a possible wastewater rate structure. Ben stated it may be best to start next year with an increase and spread the increase out over a few years if possible. The members agreed that we should implement a rate increase sometime next year. Zibell state the last increase for residential users was in 2013. Ben discussed what the new rates for residential may be and also for industrial users. Staff and Ben thought it would be best to discuss the proposed rates with our heavy users first and get the agreements executed before we start the process with the residential rates. Planning wise staff will setup meetings with heavy users this fall.

No Action

Zibell gave an update on current projects. Knudsen asked if the meeting could be moved to 6:00 pm, everyone was fine with 6:00 pm.

No Action

Motion by Backeberg seconded by Braunschweig to adjourn.

Motion Carried

Adjourned at 6:45 p.m.
Respectively Submitted,

Steven T. Zibell, Public Works Director/City Engineer
City of Reedsburg

ATTACHMENT A
MEMORANDUM

Date: October 15, 2021

To: Steve Zibell, P.E., Public Works Director/City Engineer – City of Reedsburg

From: Ben Heidemann, P.E., Vice President – Town and Country Engineering

Subject: Scope of Services – WWTF Preliminary Design

The City of Reedsburg is in the process of completing a Facilities Plan, which provides a 20-year outline for their wastewater services. The conclusion of the plan proposed construction of a new wastewater treatment facility to be located on the southeast side of the City, adjacent to the Public Works Garage. The City has discussed proceeding with design of the proposed facility improvements with the intent of having bidding documents prepared by the fall of 2023 for the 2023/2024 bidding season. The schedule could be adjusted based upon the result of industrial negotiations, funding, and routing to/from the new facility.

The scope of services for the WWTF preliminary design contract is as follows:

1. Site Survey: Complete site topographic and inventory survey to obtain all data necessary for preparation of plans and specifications for the interceptor, force main, lift station, WWTF, and outfall sites/routes.

2. Process Design: Develop preliminary sizing and layout for each unit treatment process.

3. Hydraulic Profile: Prepare a hydraulic profile that will establish requirements for structure elevations, pumping equipment design, and site grading plan

4. Preliminary Interceptor, Force Main, and Outfall Sewer Design: Prepare preliminary alignments and profiles of proposed pipeline routes.

5. Preliminary WWTF Site and Building Layouts: Prepare preliminary conceptual site plan, building, and structure layouts for all proposed modifications. This will include preliminary site building and piping layouts for the new site.

6. Sub-Surface Design Conditions: Based on the site plan layout and other preliminary design parameters, a request for geotechnical services will be prepared and sent out to prospective companies. These sub-surface geotechnical services will include soil borings and reporting which will give recommendations for below grade structures and construction methods. The cost for these geotechnical services will be established through the proposal process and as such are not included in the preliminary design contract cost, but will rather be contracted directly by the City.

7. Environmental and Historical Investigations: As necessary to accommodate improvements being done to existing structures and the site, we will coordinate investigations into wetlands, endangered species, asbestos, and historical sites. These investigations will provide the eventual contractors with information related to special consideration that may be required. The cost for these investigations will be established from third party firms as a part of the preliminary design and as such are not included in the preliminary design contract costs, but will rather be contracted directly by the City.

The estimated engineering cost for the above scope will be billed on an hourly basis and **will not exceed $275,000.**

Several items may be desired as a follow up to the preliminary design, however are not included in this scope. Town & Country Engineering will assist City staff or assist in contracting for these services from outside consultants, if needed.

- Pilot testing of treatment systems including tertiary filtration, thickening/dewatering equipment, side stream treatment systems, etc.
- Soil borings and soil engineering report (request for proposals and coordination included above).
- Wetland, endangered species, asbestos and historical investigations and report (request for proposals and coordination included above).
- Property and/or easement acquisition, if necessary.
- Industrial negotiations
- Rural Development funding application
- Right-of-way mapping required by the Rural Development agency.
- Coordination with Rural Development on completion of Docket items after obligation of funds.
- Clean Water Fund Program loan application and related documents.
- Final design and preparation of plans and specifications for Rural Development, DNR, and DSPS submittal and bidding.
- Construction administration and resident engineering services.
- Sewer use ordinance and user charge system preparation.
- Cost for permit fees.

We at Town & Country Engineering, Inc. wish to thank you for the opportunity to present this scope of services to the City of Reedsburg and look forward to continuing to serve you. If you have any questions regarding the above scope, please feel free to call.

BJH
J:\JOB#S\Reedsburg\RD-00-00\O&E Contracts\2021 Preliminary Design (RD Contract)\Attachment A - Scope of Services.docx

FACILITIES PLANNING DOCUMENT

City of Reedsburg, Wisconsin
Wastewater Treatment Plant

October 2021

TOWN & COUNTRY ENGINEERING, INC.
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FACILITIES PLANNING DOCUMENT

City of Reedsburg, Wisconsin
Wastewater Treatment Plant

October 2021

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EXECUTIVE SUMMARY

General Overview

The City of Reedsburg is undertaking facilities planning to develop and evaluate viable alternatives for upgrade of its existing wastewater treatment facility (WWTF). The WWTF was originally constructed in 1939 with a trickling filter and anaerobic digester, and has undergone major upgrades in 1969, 1983, 1990, 1996, 2000, 2002, 2006, and 2014. The WWTF is located within the floodway of the Baraboo River and experienced historic flooding in 2008, after which flood recovery and mitigation measures were undertaken. A subsequent flood in 2018 was higher than 2008, but the flood mitigation measures protected the WWTF from total flooding. However, there is no dry land access to the WWTF during a flood and staff must resort to access via boat or a large utility vehicle such as an end loader.

The City of Reedsburg has grown steadily over the past several years, resulting in increasing influent loads to the WWTF. The plant is currently overloaded based on average flows and loads, and severely overloaded during periods of peak loads and high flows. Additional capacity is required to meet the City's needs for the next 20 years and a major upgrade will be needed to meet future phosphorus limits expected with the next Wisconsin Pollutant Discharge Elimination System (WPDES) permit term. In addition, some processes and equipment are reaching the end of their useful life and need replacement or upgrading. The purpose of this Facilities Planning Document is to evaluate alternatives for meeting future loading conditions and complying with current and future permit requirements.

Historical records have been evaluated and projections have been made to establish long term needs. The rationale for development and selection of the recommended alternative is summarized in the following paragraphs; however, for a more detailed look at all alternatives evaluated, refer to the remaining chapters and appendices.

The planning process necessarily depends on input from various sectors of the community including City staff, private citizens, industries, and the commercial sector to become a successful planning tool. A public hearing will be held and public comments will be incorporated in the final Facilities Planning Document.

Planning Area and Regionalization

The Planning Area for this Facilities Planning Document includes the planning area from the City's 2012 Comprehensive Plan and covers all land within the City's boundaries, which encompasses approximately 5 square miles, and the Extraterritorial Jurisdiction Area, which extends 1.5 miles beyond the City limits.

Regionalization with neighboring communities was considered as part of the facilities planning process. The City sent out two rounds of letters to seven neighboring communities located within 5 to 10 miles away to gauge interest in regionalization of wastewater treatment. These communities, namely Loganville, Rock Springs, LaValle, Lime Ridge, Cazenovia, Hill Point, and North Freedom, are considerably smaller than the City of Reedsburg and would be potential dischargers to the Reedsburg WWTF. As of October 2021, only two of the communities have formally responded, and only the Village of LaValle has expressed preliminary interest and asked to be kept informed as planning efforts progress and cost impacts are defined. Additional follow-up will be performed with each of these communities subsequent to completion of this Facilities Planning Document.

Major Industries

The City of Reedsburg has agreements for wastewater treatment services with the three major industries that process dairy products. As part of the facilities planning process, the City has had discussions with these industries to look at past loadings, address issues with reporting of slug loads and routine sampling/monitoring, and develop future loading projections. The City formally requested capacity needs from each industry in July 2018 and has had subsequent meetings and discussions to finalize capacity projections and needs. It is the City's intent to accommodate these capacity requests and provide for continued operation and growth of its major industries. The existing agreements with the industries will be renegotiated following completion of this Facilities Planning Document.

Evaluation of Needs and Alternatives

Chapter 3 of this Facilities Planning Document focuses on the condition of the existing WWTF and the current flows and loads. The current flows and loadings to the plant are often exceeding the design capacity and the plant is overloaded. While the plant has been marginally able to process the increased loads and continue meeting its effluent limits, slug or peak loads have caused operational hardships. In addition to the need for increased capacity, several issues and improvements have been identified for further consideration, particularly the replacement of aging structures and equipment.

Chapter 4 presents the future design conditions based on the projected growth for the planning area. Future population growth for the City was estimated using the Wisconsin Department of Administration's (DOA) population projections. A 2040 population of 12,800 was selected for planning purposes and represents a growth of a 3,161 people over the next 20 years, using 9,639 as the current base population. Based on current knowledge of possible growth areas, the City feels this is a reasonable projection and is consistent with past growth.

One of the biggest factors impacting future design conditions are peak flows. Reedsburg has experienced periods of flooding when portions of the City and its collection system became inundated with floodwater and flows to the WWTF were greater than the plant can handle. True peak flows to the WWTF are unknown because the influent gate influent has been lowered to limit the flow through the plant during flood events, and the capacity of the influent flow meter has been exceeded on several occasions. In planning for future plant capacity, it is not practical or cost-effective for the City to pump and provide treatment for all of the flow during periods when the river and portions of the City are flooded, and backups and basement flooding will still occur during extreme events regardless of what flow is processed by the WWTF. Therefore, the daily and peak instantaneous flows that can reasonably be handled by the plant were estimated by excluded days that the Baraboo River stage was higher than 17 feet. This river stage represents a major flood event when a good portion of City is underwater, with and basements and historic City facilities being flooded. The peak flows without the flood data have been used for the 2040 projected flows.

Chapter 5 present the alternatives that were considered for the Reedsburg WWTF. Significant upgrades are needed to ensure compliance with current and future WPDES limits, replace aging equipment and infrastructure, provide treatment of the future flows and loads, allow for reasonable growth, and address flooding risks. The City has two main courses of action it could take, maintain its existing WWTF with necessary improvements, or construct a new WWTF outside of the floodplain. Both of these options were evaluated through detailed cost and non-economic analyses. Alternatives were also developed to evaluate the possibility of providing pre-treatment for the major industries rather than treating the full design load at the WWTF.

Three different alternatives were evaluated for upgrading facilities at the existing WWTF site. Alternatives 1A and 1B would provide for treatment of the full projected flows and loads at the existing site. Alternative 2 would have the same average and peak flows as Alternatives 1A and 1B, but would have a reduced organic and solids loadings with industrial pre-treatment at on off-site location. For construction of new WWTF, alternatives were considered without industrial pretreatment (Alternative 3) and with industrial pretreatment (Alternative 4).

Chapter 6 provides a comparison of the four main Alternatives and their sub-options in terms of capital costs, present worth, and other factors. A cost-effectiveness evaluation was performed by comparing the 20-year net present worth (NPW) of capital costs, operation and maintenance costs, replacement costs, and salvage values. According to WDNR guidance, alternative present worth costs within 10 percent of each other are considered essentially equal due to normal cost estimating variability.

Chapter 6 also considers several other factors beyond the capital and present worth costs for selection of a recommended alternative, and selection of sub-options within that alternative. The non-economic analysis includes factors such as ease of operation, future growth potential, environmental impacts, and other considerations.

Conclusions and Recommendations

The present worth analysis that shows that the options with pre-treatment, Alternatives 2 and 4, are more costly than the respective options without pretreatment, Alternatives 1 and 3. The present worth analysis also shows that Alternative 1, upgrading the City's existing WWTF, is less costly than constructing a new treatment facility with Alternative 3. However, the NPW costs support moving the WWTF out of the floodway to a new site in accordance with Wisconsin. Administrative Code NR 110 for dry land access. The Reedsburg City Council has considered the economic and non-economic factors associated with this decision and approved Alternative 3 and the moving the WWTF to a new site at their July 2021 meeting.

The current City Dog Park Site was selected as the site for the new WWTF because it is already owned by the City, it is adjacent to the City's new public works facilities, and it provides favorable site conditions for gravity flow between processes and similar effluent limits to the existing WWTF site. The environmental impacts for this site and the proposed interceptor and force main route are discussed in Chapter 7.

Four suboptions were considered for Alternative 3, differing mainly in the type of sludge processing but with all options producing Class A biosolids. Alternative 3A uses lime stabilization, similar to the existing plant. Alternative 3B uses temperature phased anaerobic digestion, with both thermophilic and mesophilic digestion, while Alternative 3C uses just mesophilic digestion followed by drying. Alternative 3D uses just drying to produce Class A biosolids. The Base NPW values for these alternatives range from approximately $112.5M for Alternative 3A to approximately $118.4M for Alternative 3D. The difference between the present worth values for these options is less than 10 percent and they are considered essentially equal according to WDNR facility planning guidance.

Of the Alternative 3 suboptions, Alternative 3C and 3D have the highest scores in the non-economic factors analysis, primarily due to the reduced sludge volume with the drying option. Producing the lowest volume of sludge possible protects the City in the event that future regulations for per- and polyfluoroalkyl substances (PFAS) and other emerging contaminants limit disposal options. The City collected two rounds of samples and tested for PFAS in WWTF effluent and biosolids as a follow-up to testing performed by the DNR in February 2021. These results indicate no immediate concerns as compared to currently-proposed standards for PFAS, but reducing liability and limitations for sludge disposal are still important factors for the City as they face tightening regulations. For this reason, Alternatives 3C and 3D were preferred over the other alternatives.

The City has selected Alternative 3C as the preferred alternative based on consideration non-economic factors as well as the capital, O&M, and NPW costs. The ultimate deciding factor in this selection is the annual operating cost, which is almost $500,000 lower for Alternative 3C than 3D. Since the City is planning to construct a new WWTF, they gave consideration to operating costs and potential inflation beyond the 20-year planning period and selected Alternative 3C as the most cost effective option for long-term operation of the new facility.

Cost Summary of Selected Alternative

The total estimated capital cost for the recommended alternative, Alternative 3C, is approximately $85,909,000, which includes a 10% contingency, 13% engineering, administration and legal work to plan, design, finance and manage the project, and 4% for resident project representative services during construction.

The Alternative 3C capital costs includes construction of the following:

- New WWTF at a City-owned site, with a new outfall to the Baraboo River
- New Main Lift Station at a location near the existing WWTF
- New interceptor from the existing WWTF to the new Main Lift Station
- New force main from the Main Lift Station to the new WWTF site

This cost also includes cogeneration and sidestream phosphorus treatment that are not required for treatment but are included as potential enhancements to improve treatment efficiency and reduce operating costs. These enhancements could be included in the initial construction or could be added as a later phase, if desired.

The overall project budget will include the capital costs for these facilities and may include additional costs for legal services, interim financing, and administrative costs for grants and loans, depending on the funding scenario. The overall project budget will be developed as project funding is secured.

User Charge Impacts

Chapter 8 provides information on potential funding and revenue sources and estimates the user charge impacts of implementing the recommended alternative. User charges for an average residential customer are expected to increase from the current average equivalent meter charge of $29 per month to between $50 and $53 per month in the next five years.

User rates were conservatively calculated with no increase in users or usage assumed, and an average equivalent meter usage of approximately 3,500 gallons per month, which would be a typical residential water use rate. These user rate impacts were also conservatively calculated using 2020 industrial flows and loadings with no future flow and loading increase or surcharges, and with the industries paying only based on flows and loads rather than a capital contribution. It should be noted that other revenue-generating sources can be utilized such as impact fees, grants, energy grants/incentives and other funding mechanisms. If these methodologies are implemented, the rates presented would be reduced accordingly.

Implementation Schedule

The City intends to apply for funding through the U.S. Department of Agriculture (USDA) Rural Development (RD) water and wastewater program and the Wisconsin Clean Water Fund Program (CWFP) to finance construction. The following implementation schedule is based on the timelines for these loan programs, as well as requirements for agency review, approval, and permitting. The actual schedule will depend on the availability of financing, possible interim financing costs, and City decisions on the ultimate timeline and phasing of construction.

Action	Completion Date
Submit CWFP Intent to Apply	October 2021
Begin Industrial Contract Negotiations	October 2021
Proceed with Preliminary Design	October 2021
Public Hearing on Facilities Plan	November 2021
Incorporate Public Hearing comments into the Final Facilities Plan.	December 2021
Submit Facilities Plan to WDNR	December 2021
DNR Approval of Facilities Plan	March 2022
Submit Rural Development Funding Application	Summer 2022
Finalize Industrial Contract Negotiations	Summer 2022
Proceed with Final Design	Summer/Fall 2022
Obtain Preliminary RD Funding Commitment	Fall/Winter 2022
Submit Plans and Specifications to DNR	September 30, 2023
Submit CWF Loan Application	September 30, 2023
Apply for Required Construction Permits	September 2023
Obtain USDA OGC Closing Instructions	September 2023
Approval of Plans and Specifications	December 2023
Advertise for Bids	December 2023
Open Bids	January 2024
Award Bids	February 2024
Submit User Charge Rates/Ordinances	March 2024
Submit Executed Contracts to DNR and USDA	March 2024
Start Construction	March 2024
Clean Water Fund Loan Closing	June 2024
Complete Construction	June 2026
Complete O&M Manual and Loan Closeout	August 2026

1. INTRODUCTION

1.1 Planning Objectives

The intent of this facilities plan is to develop and evaluate viable alternatives for upgrade of the existing wastewater treatment plant (WWTF) for the City of Reedsburg. The WWTF was originally constructed in 1939 with a trickling filter and anaerobic digester, and has undergone major upgrades in 1969, 1983, 1990, 1996, 2000, 2002, 2006, and 2014. The WWTF is located within the floodway of the Baraboo River and experienced historic flooding in 2008, after which flood recovery and mitigation measures were undertaken. A subsequent flood in 2018 was higher than 2008, but the flood mitigation measures protected the WWTF from total flooding.

The City of Reedsburg has grown steadily over the past several years, resulting in increasing influent loads to the WWTF. The plant is currently overloaded based on average flows and loads, and severely overloaded during periods of peak loads and high flows. While the plant has been marginally able to process the increased loads of biochemical oxygen demand (BOD) and total suspended solids (TSS) and continue meeting its effluent limits, the slug or peak loads have caused operational hardships. Additional capacity is required to meet the City's needs for the next 20 years. In addition, some processes and equipment are reaching the end of their useful life and need replacement or upgrading.

The Wisconsin Pollutant Discharge Elimination System (WPDES) permit that was issued to the City and became effective on July 1, 2018, and was subsequently modified on January 1, 2019 and November 1, 2019 (Appendix A). Reedsburg is a part of the Wisconsin River Basin Total Maximum Daily Load (TMDL), which was approved by the US Environmental Protection Agency (EPA) on April 26, 2019. The TMDL gives the Reedsburg WWTF a monthly wasteload allocation (WLA) for total phosphorus, which is reflected in its current permit.

The treatment of phosphorus has been very difficult when the plant is overloaded, resulting in occasions when the daily effluent concentrations was over 1 mg/L. Under normal loading conditions the plant should be capable of meeting the current phosphorus limits, but more stringent TMDL limits are expected in future permits with the recent adoption of site-specific criteria for portions of the Wisconsin River basin. Once these are implemented, the City will not be able to meet these limits without a major upgrade or a variance.

1.2 Planning Area

The City of Reedsburg is located in Sauk County in the southwest portion of Wisconsin. The City is located approximately 50 miles northwest of Madison, and 63 miles southeast of LaCrosse. The City is approximately ten miles west-southwest of Interstate 90 at its closest point. Surrounding municipalities include the Village of LaValle to the northwest, the Village of Loganville to the south, and the Village of Rock Springs to the southeast.

The City of Reedsburg developed a comprehensive plan in 2003 and updated it in 2012.[1] The planning area for this facilities plan includes the planning area from the City's comprehensive plan

[1] Accessible via the City's website at: https://www.reedsburgwi.gov/index.asp?SEC=E675FDA9-0594-49B6-9283-2E450A4CE182&DE=5764015F-8679-4AA1-BE1E-1508A0B2AE93

and covers all land within the City boundaries which encompasses approximately five square miles as well as the unincorporated areas located within a 1.5 mile extraterritorial jurisdiction.

The current sanitary sewer service area is within the City's urban area, shown in Figure 1-1. The future sanitary sewer service area may include growth into the current rural area with future development and will require further amendment to the City's service area. A map of City's current sanitary sewer system, as well as land use and public facility maps from the comprehensive plan, are provided in Appendix B.

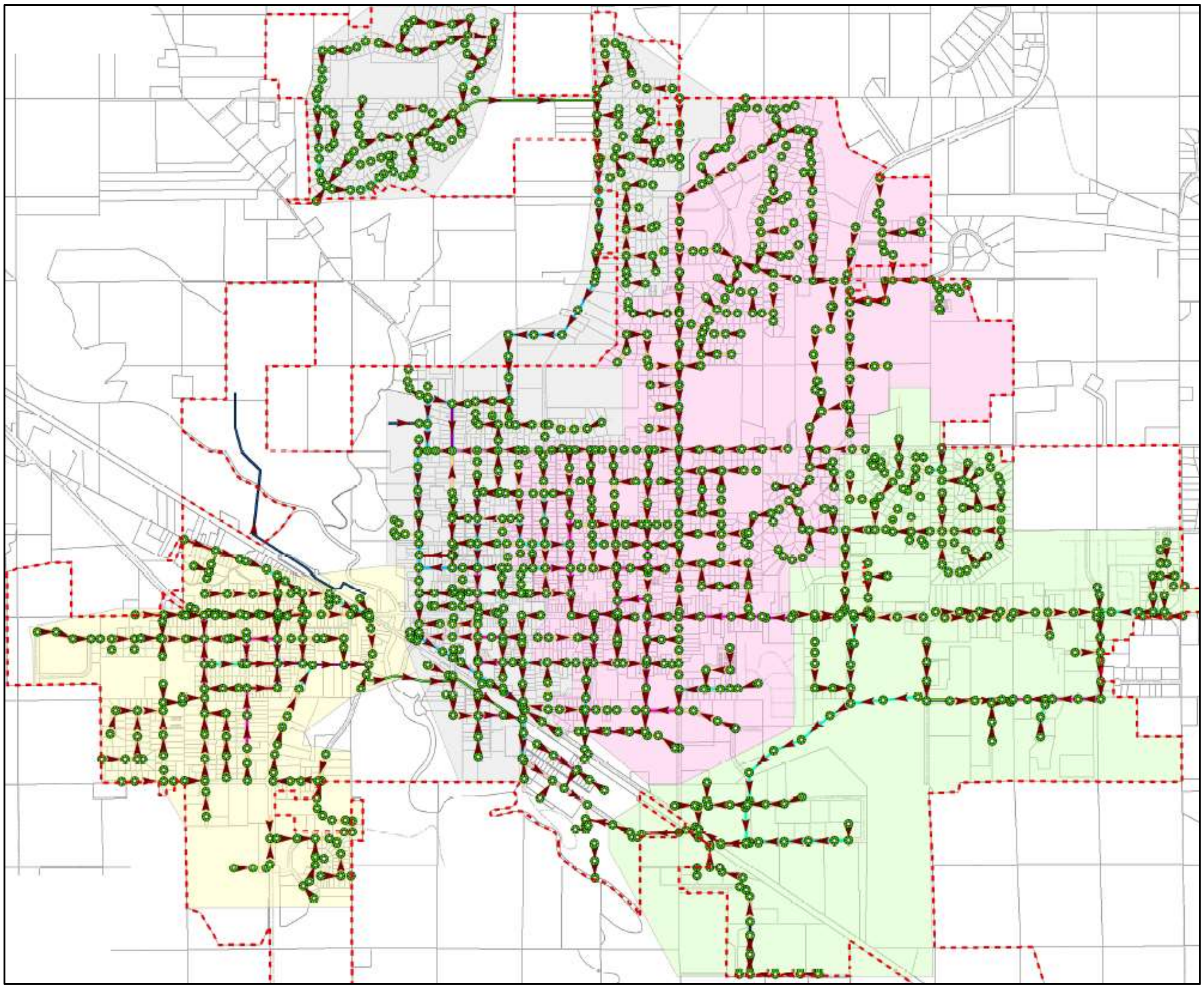

Figure 1-1 City of Reedsburg Sanitary Sewer Service Area

In early 2019 the City also sent letters to neighboring communities that may be interested in regionalization of wastewater treatment, with follow-up letters sent in May 2020. There are seven neighboring WWTF discharges (approximate distances listed) with the nearest being Loganville (5 miles), followed by Rock Springs (6 miles), LaValle (7 miles), Lime Ridge (8.5 miles), Cazenovia (8.5 miles), Hill Point (9 miles), and North Freedom (10 miles). As of October 2021, only two communities have formally responded to these letters. The Village of Loganville has responded that they are not interested in regionalization. The Village of LaValle has expressed preliminary interest and asked to be kept informed as planning efforts progress and cost impacts are defined. Additional follow-up will be performed with each of these communities subsequent to completion of this Facilities Planning Document.

According to current WPDES permitting information, the LaValle WWTF serves a population of approximately 367 residents with no industrial contributors and the facility is designed to treat an average daily flow of 57,000 gallons per day. Regionalization with LaValle would involve pumping wastewater from LaValle to the Reedsburg WWTF and the LaValle flows and loads would be a small percentage of the flows and loads to the plant. Potential regionalization options are explored in the alternatives development and analysis in Chapters 5 and 6.

1.3 Facilities Plan Approach

The facilities planning process begins with an evaluation of the existing facilities in terms of both condition and pollutant loadings, followed by development of future design parameters using historical data and appropriate demographic projections. Alternatives are developed and compared to arrive at a viable and cost effective option that will meet the community's needs for the next 20 years. Although a 20-year time frame is used for planning, alternative development, and evaluation, consideration may be given to growth and capacity needs beyond 20 years.

Chapter 3 presents a detailed evaluation of existing equipment and building conditions, as well as an accounting of the existing loading data to the WWTF. The baseline loading parameters for the plant include values for flow, BOD, TSS, ammonia, and phosphorus, all of which have limits included in the facility's current discharge permit. The loading rates and design for the existing facilities are compared to Chapter NR 110, Sewerage System, of the Wisconsin Administrative Code (NR 110) and other industry-standard guidelines for WWTF design.

Chapter 4 presents the projected loads for the WWTF. Future loading increases are based on population projections, future land use, and consideration of the needs of any current or future major dischargers to the City's plant. Projections are based on information from the City of Reedsburg's current comprehensive plan as well as U.S. Census Bureau and Wisconsin Department of Administration (DOA) population projections. Review and approval by the City and regional planning entities is a crucial step since these projections potentially have far-reaching impacts for the design of future facilities.

The design loads presented in Chapter 4 are used to develop preliminary design alternatives for meeting future needs. These alternatives are presented in Chapter 5 and compared in Chapter 6. Alternatives considered will include both modifications of the existing plant as well as construction of a new plant at an alternate site.

Alternatives must have the capacity to meet the anticipated water quality limits of future discharge permits. If an increase in the design capacity or change in outfall location is required or considered, then a request for planning effluent limits is made to the Wisconsin DNR based on the projected loading parameters.

The selection of the recommended alternative is based on both economic and non-economic evaluations in Chapter 6. The economic analyses include capital, operation and maintenance and 20-year present worth cost evaluations for each alternative. Non-economic evaluations consider such factors as ease of operation, future growth potential, and an environmental assessment.

Chapter 7 presents the potential environmental impacts and mitigative measures for the recommended alternative. Potential funding sources and impacts to user rates are described in Chapter 8. This chapter also presents an estimated schedule for implementation based on the anticipated timelines for design and construction as well as adequate time for the community to secure project funding and undertake the associated debt load.

2. DESCRIPTION OF PLANNING AREA

The following sections describe the features and setting for the City of Reedsburg's planning area, as defined in Section 1.2, and its existing WWTF. The WWTF site is located on Division Street on the southern side of the City, and discharges to the Baraboo River within the Reedsburg/Baraboo River Watershed of the Lower Wisconsin River Basin.

2.1 Climate

Typical of the Great Lakes region, the City of Reedsburg experiences cold and snowy winters, hot summers, and moderate springs and autumns. The temperature ranges from an average of 22°F in January to 76°F in July. The annual average precipitation is 32 inches, the majority of rain falls in April through September. Typically, the month of June is the wettest and January is the driest.

2.2 Physical Setting

For the most part, the landscape of the Reedsburg varies from flat to gently rolling. At the Baraboo River's edge, the elevation is on average approximately 860 feet, and rises to 1,180 elevation in the City proper. Some of the outlying areas north and northeast of the City have adverse slopes that do not lend themselves to gravity flow to the main collection grid. These areas require the construction of pump stations to deliver wastewater to the main collection system.

The City does not have any state natural areas or wildlife areas within its boundaries. However, the eastern terminus of the 400 State Trail is located in the City.[2] In addition, Cady's Marsh State Natural Area is located southeast of the City, and is a 13.8 acre property that contains prairie, sedge meadow and aquatic marsh.[3]

2.3 Soils

The Natural Resources Conservation Service (NRCS) soil resource report for the existing WWTF site and the vicinity is included in Appendix C. Generally, soils in this area can be classified as silty or sandy loams on slopes ranging from 0% to 3%. The majority of the site is characterized as Northbend-Ettrick silt loam with 0 to 3% slopes and frequently flooded.

2.4 Water Resources

Surface water resources within the City of Reedsburg's planning area are within the Baraboo River Sub-Basin (8-digit Hydrologic Unit Code (HUC-8) 0707000) and the Narrows Creek and Baraboo River Watershed (HUC-10 = 0707000403)[4]. Watershed maps are provided in Appendix D. The existing WWTF discharges to the Baraboo River, which flows east/southeast through the City to its confluence with the Wisconsin River. Tributaries to the Baraboo River, including Twin, Hay, Babb and Copper Creeks, are also found in the City's planning area. The land surrounding is designated as floodplains and/or wetland. Large areas of wetlands are found in the southeast portion of the City's planning area, with another found in the western portion. Another hydrological feature is a manmade lake (Lake Virginia) east of the City of Reedsburg on STH 33.

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[2] Additional information is available at https://dnr.wi.gov/topic/parks/name/400/
[3] Additional information is available at https://dnr.wi.gov/topic/Lands/naturalareas/index.asp?SNA=72
[4] https://dnr.wi.gov/water/watershedDetail.aspx?code=LW22&Name=Narrows%20Creek%20and%20Baraboo%20River

The Baraboo River use designation is as a warmwater sport fish community, non-public water supply. The water is impaired for total phosphorus. In April 2019, the Wisconsin River TMDL was approved by the EPA for total phosphorus.[5]

According to the DNR PRESTO-Lite model results, the watershed in which the Reedsburg WWTF outfall discharges is approximately 389.94 square miles. This watershed, named the Coper Creek-Baraboo River watershed, is primarily agricultural (60.5%), forested area (30.3%), and urban (6.1%), with the remainder wetland (1.6%), barren (0.6%), grassland (0.5%), and open water (0.4%). The PRESTO-Lite Watershed Delineation Report is provided in Appendix D.

2.5 Floodplain Surveys

Flood hazard area boundary maps produced by the Federal Emergency Management Agency (FEMA) were reviewed for the existing WWTF site. Based on available information, the developed portion of the existing WWTF site lies in an area designated as a regulatory floodway, and within the 100-year flood plain delineation indicating at least 1% annual chance of a flood hazard. Maps are from the National Flood Hazard Layer are provided in Appendix D.

The existing WWTF flooded extensively in June 2008, as can be seen in the before/after photographs below. The river crest for the 2008 flood was 21.0 feet. A subsequent project raised the levels of the flood protection system surrounding the exiting site. Another major flood event occurred in August 2018 that crested at 21.85 feet, higher than the 2008 flood, but the berm and flood protection measures successfully prevented flooding of the WWTF. Additional protective measures were added following the 2018 flood, but the WWTF remains at a relatively high level of flood risk given its proximity to the Baraboo River and uncertainty regarding future flood risks. During a flood, the City does not have dry land access to the WWTF and must resort to access via boat or a large utility vehicle such as an end loader.

Normal Conditions (Summer 2007)

Flooding in Summer 2008

Given the susceptibility of the existing WWTF to flooding, the City is considering alternate sites for a new WWTF. These alternatives are described in Chapter 5 and the potential environmental impacts are covered in Chapter 7.

2.6 Wetlands

The DNR's Surface Water Data Viewer indicates that the existing WWTF site contains wetland indicators and is surrounded by mapped wetlands. Appendix D contains maps of both the wetland indicators and mapped wetlands at or near the existing WWTF site. The wetland indicators

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[5] Additional information is available at https://dnr.wi.gov/topic/tmdls/wisconsinriver/

include Fw (Fluvaquents, wet) and Az (Arenzville silt loam, 0 to 3% slopes, occasionally flooded). The mapped wetlands include the designators T3Kw and T3H, which signify broad-leaved deciduous forested wetlands with either wet soil or standing water.

2.7 Groundwater

According to the Reedsburg Utility 2018 Consumer Confidence Report, groundwater supplies all of the water for domestic, commercial, and industrial uses in the City of Reedsburg. The wells serve a demand of about 2,000,000 gallons per day (gpd), with a maximum of 3,000,000 gpd during the summer canning months. Most water demand is from commercial and industrial uses.

The City is currently served by five active wells – #s 3, 4, 6, 7, and 8. Well #s 1 and 2 were for emergency use and were later abandoned once well #8 came online in 2010. Well #5 was abandoned in 2002. The five existing wells in use are approximately 300 to 500 ft deep. Water supplies are drawn from sandstone (Dresbach/Elk Mound). Groundwater for the area is considered moderately hard, with raw water sampling from 2018 at each well indicating hardness levels averaging 160 mg/L as $CaCO_3$.

Reedsburg Utility's Wellhead Protection Plan, adopted in June 2010, addresses wellhead protection strategies such as well abandonment, cross-connection and wellhead protection ordinances, public education, water conservation, and contingency planning.

2.8 Agriculture

There is no active agriculture at the existing WWTF site but land near the WWTF and within the current City limits is actively being farmed. Contact will be made with the State of Wisconsin Department of Agriculture, Trade and Consumer Protection with regards to the potential impacts to agriculture land should a decision be made to use active agriculture land. This will be covered in more detail in Chapter 7.

2.9 Historic and Cultural Assets

The extent of historic and cultural assets at the proposed work sites are covered in detail in Chapter 7 of this planning document.

2.10 Population and Land Use

According to the census data presented in the City of Reedsburg's 2012 Comprehensive Plan Update, the population with the City has increased steadily from 1980 through 2010 by 82.6% or a 2.0% annualized growth rate. The growth from 7,827 residents in 2000 to 9,634 residents in 2010 represents a 23.0% increase. Excerpts from the Comprehensive Plan are provided in Appendix B. The Wisconsin Department of Administration (DOA) estimated population was 9,639 for 2019. Table 2-1 summarizes the census data and recent population estimates for the City.

Table 2-1 Population Summary

Year	Census[6]						Estimate[7]
	1960	1970	1980	1990	2000	2010	2019
City of Reedsburg Population	4,371	4,585	5,038	5,834	7,827	9,200	9,639

According to the City's 2019 Billing Cycle for the water utility, the City serves 3,154 residential customers, 386 commercial properties, 35 industries, 49 public authority sources, and 48 multifamily residences within the municipality. For this Facilities Planning Document, the current base population was assumed to be 9,639, the 2019 estimated population from the DOA. Projected population increases from this baseline figure will be used to estimate future flows and loadings in Chapter 4.

Maps of the City of Reedsburg WWTF service area and land use are provided in Appendix B. Information on existing land use within this area were taken from the City of Reedsburg's 2012 Comprehensive Plan Update. Existing land use is summarized in Table 2-2 below. Land use within the City is primarily agriculture (39.0%), single-family residential (19.8%), and woodlands (16.3%).

Table 2-2 Existing Land Use Summary

	City of Reedsburg	
Land Use	**Acres**	**Percent**
Single Family in Extraterritorial Area.	493.67	6.90%
Single Family in City	923.65	12.90%
Downtown Commercial	16	0.20%
General Commercial	269.64	3.80%
Industrial	454.68	6.40%
Manufactured Home	83.91	1.20%
Multifamily	174.04	2.40%
Parks	100.17	1.40%
Private Parks	240.68	3.40%
Public	435.34	6.10%
Woodland	1163.3	16.30%
Agriculture	2778.73	39.00%
TOTAL	**7133.81**	**100.00%**

Source: City of Reedsburg 2012 Comprehensive Plan Update

[6] U.S. Census Bureau Data

[7] Wisconsin Department of Administration, Municipal Final Population Estimates, January 2019

3. EXISTING CONDITIONS

As stated in Section 1.1, the City of Reedsburg WWTF has equipment and processes that are near the end of their useful lives and additional capacity will be needed to meet the City's needs for the next 20. This chapter covers the conditions of the collection system and the wastewater treatment facility and presents the wastewater treatment facility capacity evaluation, existing WPDES permit summary, and current flows and loads.

3.1 Description of Existing Facilities - Sanitary Sewer Collection System

The City's sanitary sewer collection system includes approximately 16 miles of sanitary sewer pipes ranging in size from 8 to 36 inches in diameter, approximately 1,163 manholes, and six pumping stations with associated force mains totaling approximately 54 miles in length. The sanitary sewer map is provided in Appendix E and Table 3-1 lists the various pipe sizes and lengths included in the sewerage system. Additional collection system information can be found in Appendix E. Pipe materials include vitrified clay pipe, slip lined clay pipe, and PVC pipe.

Table 3-1 Existing Sanitary Sewer Inventory

Gravity Sewers Diameter (inches)	Length (ft)
4-inch	324
6-inch	373
8-inch	192,295
10-inch	29,614
12-inch	23,424
15-inch	11,636
18-inch	5,086
21-inch	15,432
24-inch	3,434
30-inch	226
36-inch	1,087
Force Main Length (ft)	
9,816	

Wastewater flows to the WWTF through four main gravity interceptors. The main interceptor is 30-inch diameter at the WWTF site and extends from the wet well starting at an invert elevation of approximately 852-ft (USGS datum). Tributary to the main interceptor are three primary gravity interceptors which service the entire City, referred to as the east, west, and central interceptors.

- The east interceptor is 15-inch diameter, is the newest construction of the three interceptors, and tees into the 24-inch main interceptor prior to its entry to the WWTF. The east interceptor services the eastern extents of the City, which includes an industrial park.
- The west interceptor is 21-inch diameter and services collection basins on the eastern side of Baraboo River, including the downtown area, and the northwest portion of the City, which consists of residential areas. The western side of the City, west of the Baraboo River, is served by the Webb LS, which pumps to end of the west interceptor.
- The central interceptor is 15-inch diameter where it connects to the main interceptor, and increases to 21-inches and 24-inches diameter further upstream. The central interceptor services the heart of the City and portions of the downtown area. Several of the City's high-volume dischargers, including Foremost Farms and Saputo Cheese, flow through the central interceptor.

The City of Reedsburg currently operates eight lift stations that pump wastewater to the WWTF.

- Lift Station #1: Zinga Drive
- Lift Station #2: Industrial Park
- Lift Station #3: Riverview (County Highway V)
- Lift Station #4: Bank
- Lift Station #5: Granite & County Highway K
- Lift Station #6: Webb Ave & Granite
- Lift Station #8: Preston
- Lift Station #9: Thomas Road

Lift Station #7 at James & Main was retired due to construction of a gravity sewer which eliminated the need for the lift station.

All of the lift stations, except Riverview and Preston, are equipped with two submersible pumps, one of which has sufficient capacity to handle the incoming flow if the other is out of service. Riverview and Preston each have one submersible pumps. The Webb Ave LS has its own generator, the other LS are operated with portable generators during power outages. Based on run times for the pumps, the Zinga lift station is nearing capacity and should be considered for an upgrade in the near future.

There are some known problems with infiltration and inflow in parts of the collection system. The City has undertaken an Infiltration and Inflow Study concurrently with this Facility Plan, in an effort to identify ways to reduce clearwater entering the collection system. The City has been replacing and upgrading portions of the collection system as opportunities arise with street reconstruction and other projects.

3.2 Description of Existing Facilities - Wastewater Treatment

The City of Reedsburg's WWTF treats the municipal wastewater collected by the sanitary sewerage system within the City limits. The WWTF is located on the south side of the City near the banks of the Baraboo River. Liquid treatment is accomplished through combined activated sludge and fixed growth processes with biological nutrient removal (BNR) while sludge is stabilized utilizing lime pasteurization to produce Class A exceptional quality biosolids. Treated effluent from the facility is discharged to the river.

The original secondary treatment plant was based around a trickling filter and anaerobic digester designed and built in 1939. The plant was subsequently modified in 1969 with the addition of activated sludge basins after the trickling filter, and again in 1983 when an intermediate clarifier, an additional final clarifier, and a new anaerobic digester were added. Additional modifications were made in 1990 when the chlorine disinfection process was changed to ultraviolet disinfection. In 1996 sludge dewatering and lime stabilization equipment was installed that replaced the liquid sludge hauling previously employed at the facility. In 2000 the dewatering unit was replaced with a dewatering centrifuge producing higher solids content. In 2002 the anaerobic digesters were converted to sludge holding tanks to provide storage for the feed to the lime stabilization system.

A major upgrade to liquid treatment at the facility occurred in 2005 to 2006 when a new headworks building was constructed including a mechanical step screen and grit washing equipment; a circular fermenter and selector basins were constructed for biological phosphorus removal; aeration basin capacity was expanded; two new 75-foot final clarifiers were constructed; new UV disinfection equipment was installed in channels between the new clarifiers; and a comprehensive

SCADA system was established. The facility upgrade also included upgrading the RAS/WAS pumping systems, additional blowers, modifications to sludge holding tanks, expanding the dewatered sludge building and adding garage facilities. An upgrade to the sludge processing system was completed in 2014, which added a second centrifuge, provided increased capacity, and allowed for better management of recycle streams. In 2016-2017, a project was completed involving a number of plant improvements, including replacement of aeration blowers and modification of associated air piping/controls.

The forward flow is pumped at two or three separate locations within the WWTF before the treated effluent is discharged by gravity to the river. The 100-year flood elevation of the Baraboo River near the treatment facility effluent outfall was established at 878 feet at the time of the 2006 upgrade. The facility has been designed and constructed so that all of the treatment processes will function properly in the event the Baraboo River reaches this flood stage. The river flood stage elevation is approximately 26 feet higher than the invert of the influent interceptor pipeline which necessitates pumping within the facility.

In the exterior channel following the grit removal chamber at Structure 10, the wastewater can be diverted to two separate treatment trains – the trickling filter train or the selector basin train – depending on the loading conditions and the needs of the operator. Typically flow is split in both directions, with more flow directed to the trickling filter train when BOD loadings are high, and more flow directed to the selector basin trains when it is desired to maximize biological phosphorus removal.

For the trickling filter train, some or all of the flow is diverted from the headworks (Structure 10) to the rectangular primary clarifiers (Structure 20), to the intermediate wet well (Structure 50), pumped up to the trickling filter (Structure 25), and then to the aeration basins (Structure 35). For the selector basin train, the flow is diverted to the circular primary clarifier (Structure 15), on to the selector basins (Structure 32) and then to the aeration basins. The separate flows from each train are combined at the inlet box to the aeration basins. Flow continues through the aeration basins, by gravity to the mixed liquor wet well (Structure 40), pumped up to the final clarifiers (Structure 40), where the effluent flows by gravity through the UV disinfection system (Structure 40) and then out to the Baraboo River.

Refer to Appendix F for site plans of the existing WWTF. Existing facilities, equipment, and processes are described in more detail below.

3.2.1 Buildings and Grounds

The following structures are present on the Reedsburg WWTF site:

- 10 – Headworks Building
- 14 – Chemical Feed Building
- 15 – Original Primary Clarifiers
- 20 – Primary Clarifiers
- 25 – Trickling Filter
- 30 – Centrate Holding Tank (Former Intermediate Clarifier)
- 32 – Selector Basins
- 35 – Aeration Basins
- 38 – Blower Building
- 40 – Final Clarifiers
- 50 – Control Building
- 55 – Waste Receiving Station

60 – Sludge Holding Tanks
65 – Centrate Pump Station
70 – Sludge Processing Building
80 – Administration Building/Garage

In general, the Reedsburg WWTF is operating well and the major structures are in good condition. However, space on the WWTF site is very limited for any expansion and is subject to flooding by the adjacent Baraboo River. The following sections provide more detailed information about each of the structures and the major process equipment.

3.2.2 Headworks (Structure 10)

Structure 10 is the headworks, which has influent flow measurement, an influent wet well, a step screen, and a grit removal system.

3.2.2.1 Influent Pumping, Flow Monitoring and Sampling

Raw wastewater flows by gravity to the influent wet well through a 30-inch diameter interceptor that runs along the west side of the WWTF site. After bar screening to remove large objects, the raw wastewater enters the influent wet well and is pumped to channels inside the headworks building. During extreme flooding events, such as the August 2018 flood, the influent gate to the wet well has been lowered to limit the flow through the plant.

The influent flume and wet well are located deep in a concrete structure to the west of the headworks building proper, and are accessible by a series of aluminum staircases/landings.

Influent wastewater samples for laboratory analysis are collected just upstream of the flume with an ISCO Model 3700FR automatic wastewater sampler located in the basement of the headworks building. The sampler collects composited, flow-proportioned influent wastewater quality samples and storing the samples in a refrigerated compartment. The influent flow is measured by a 12" Parshall flume and flow meter/recording system and then passes through one of five openings into the raw wastewater wet well. The influent flow meter has a maximum capacity of 6,000 gpm, which has been exceeded on several occasions, so true peak flows to the plant are unknown.

Influent Auto-Sampler

Raw sewage is typically at an elevation of roughly 850 feet above mean sea level before it passes through the flume, and is raised approximately 30 feet by four submersible raw sewage pumps. The pumps currently installed consist of one Flygt pump, two Wemco pumps, and one ABS pump. The pump capacities are such that three pumps can convey the design peak flow (7.914 MGD) plus recycle flows while one pump is out of service, with a firm capacity of 8.0 MGD. During peak flows the WWTF has had periods when all four pumps are running.

The pumps are rated for Class I, Division 1 service, and each pump has a separate, dedicated discharge pipe extending up to the inlet mechanical screen channel. The submersible pumps are mounted on rails and can be removed by hoist for maintenance or replacement. The wet well contains space to add one additional pump.

Pumps #2 to #4 each have a variable frequency drive (VFD) to automatically ramp the pump discharge rate up or down in an attempt to match the incoming flow rate. Pump #1 is constant speed and is equipped with a pre-rotation basin that allows a variable flow rate while operating at constant motor speed. This provides variable flow based on the influent flow rate, while allowing the pump to lower water levels sufficient low to keep the wet well clean of grease and scum build up. Due to this use of the pre-rotation basin, the wet well is not equipped with submersible mixer.

All four existing pumps are still in good, working condition. However, the hydraulic capacity of the existing pumps will need to be increased to handle peak flow events:

- Influent Pumping Firm Capacity: 8.0 MGD (5,550 gpm)
- WWTF Observed Flow (Peak): 8.64 MGD (6,000 gpm), while influent gate was partially closed down to prevent flooding.
    - The WWTF has 15 historical instances of 6,000 gpm readings, the maximum capacity of the existing influent flow meter.

Above Influent Flume

Submersible Raw Sewage Pumps

3.2.2.2 Screening

After being pumping from the wet well, flow proceeds by gravity through the step screen and to the exterior chamber for grit removal.

Raw wastewater pumped from the wet well enters a common discharge box in the headworks building, and flows by gravity through screening to remove large solids and trash from the wastewater. Screening of wastewater is provided by a mechanical step screen, Vulcan Industries

Model ESR 23-798-3. The screen removes debris from the incoming wastewater by means of fixed and moveable lamellas set with 1/8" filtration openings. A slide gate can be installed into the channel upstream of the mechanical screen to bypass the screen channel.

A Vulcan Industries Model EWP-250-800 washer/compactor cleans screened debris to remove organic and dissolvable materials from the material captured by the screen, and return these organic materials back to the raw wastewater stream. The washer/compactor cleans, dewaters, compresses, and transports the washed and screened material to an enclosed plastic disposable bag located within a dumpster for collection and ultimate disposal.

A manually-cleaned bar rack is installed in the channel adjacent to and west of the step screen channel. A slide gate can be installed into the channel upstream of the bar rack to shut off flow to the bar rack channel. Flow can be bypassed to this channel from the mechanical screen channel through a notched opening in the common wall between the two channels. This will occur at abnormally high water elevation upstream of the mechanical screen. The bar rack provides a means to remove larger size trash from the wastewater stream in the event that the mechanical screen is out of service or is unable to accommodate the flow.

A third channel located to the east of the mechanical screen channel provides a second bypass route if flow cannot be accommodated by the first two channels. A slide gate can be installed into the channel on the upstream end of this channel to shut off flow. This channel can also be used for future screening equipment installation. Flow can also be bypassed to this channel from the mechanical screen channel through a notched opening in the common wall between the two channels. This notched opening is at a higher elevation than the opening to the bar rack channel so it will receive water only in extreme emergencies.

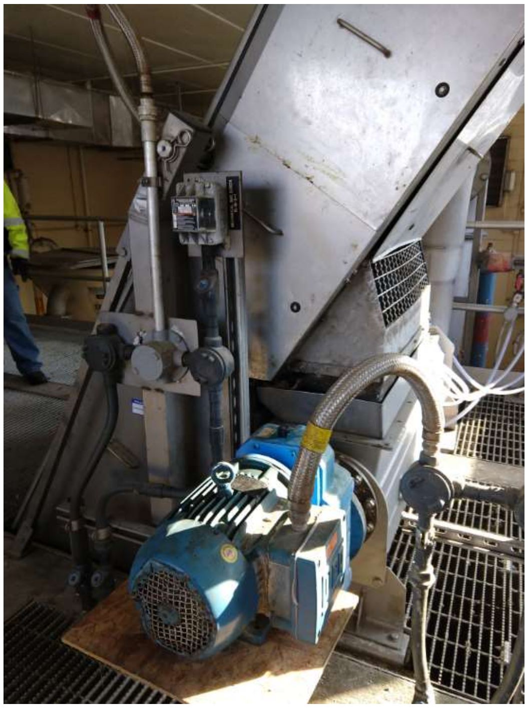
A short gate section is also used downstream of the mechanical screen to minimize the water velocities through the screen. This is necessary to minimize the amount of solids and debris from being forced through the screen openings thus increasing the screen efficiency.

Front of Vulcan Step Screen

Back of Vulcan Step Screen & Washer/Compactor

The step screen and washer/compactor were installed in 2007, have been operated and maintained satisfactorily, and are in serviceable condition, with the following hydraulic capacity:

- Influent Screen Design Flow (Peak): 7.914 MGD
- WWTF Observed Flow (Peak): 8.64 MGD (6,000 gpm)
    - The WWTF has 15 historical instances of 6,000 gpm readings, the maximum capacity of the existing influent flow meter.



Side of Vulcan Step Screen

Screenings Dumpster

3.2.2.3 Grit Removal

The grit removal system includes settling of the material in a grit chamber, pumping the settled grit to a grit washer, cleaning and drying of the grit, and disposal in a portable dumpster. Wastewater exiting from the screening process flows out of the building and enters the grit chamber on the south side exterior of the headworks building. Grit settling occurs in a circular concrete chamber with an Eimco Jeta Model 300 mechanical drive and paddle installed which keeps the lighter organic material in suspension. Flow to the grit chamber can be bypassed around the process through the use of gates. Flow exiting the grit chamber is split to the trickling filter train and the fermenter train through the use of weir gates.

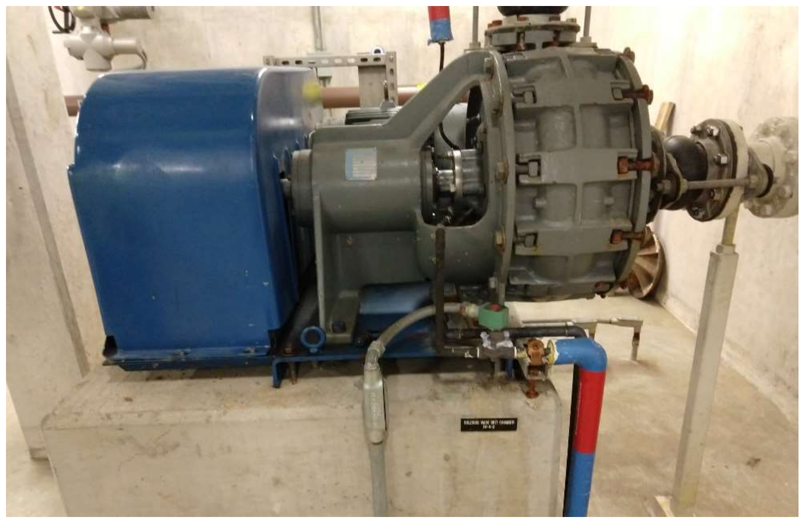
A Wemco Model C grit pump is used to pump the grit to a Vulcan Model ESW-S16 grit washer in the basement. A 4-inch suction pipe from the bottom of the grit chamber is connected to the pump, and a plug valve is used to isolate the pump for inspection and repair. A separate 1-inch fluidizing line with solenoid valve installed adjacent to the suction line and extending into the bottom of the grit chamber injects a burst of non-potable water into the settled grit before the pump is started to loosen the grit to allow for easy pumping. The grit washer includes a washing hopper, grit removal auger, and manufacturer-supplied control panel used to control non-potable water and air supply to the hopper. The grit washer utilizes water and compressed air injected into the grit slurry to wash organic material from the grit.

Washed grit is deposited into a roll-on dumpster that is regularly transported to a landfill for final disposal system. The grit washing system has a rated capacity of 250 gpm, minimum grit capture rate of 95%, and a maximum of 3% organics in the washed grit.

The grit removal system was installed in 2007, has been operated and maintained satisfactorily, and is in serviceable condition. The design hydraulic capacity of the grit system is less than current peak flows, but it may be able to handle more flow at reduced settling efficiency or with baffle modifications:

- Grit Chamber Design Flow (Peak): 7.91 MGD
- WWTF Observed Flow (Peak): 8.64 MGD (6,000 gpm)
  - The WWTF has 15 historical instances of 6,000 gpm readings, the maximum capacity of the existing influent flow meter.

Grit Removal System



Grit Pump

Side of Vulcan Grit Washing System

Top of Vulcan Grit Washing System

3.2.2.4 Primary Sludge Pumping

The basement of Structure 10 contains two Dorr-Oliver Model ODS air-operated diaphragm pumps used to pump settled solids from the floor of the circular primary clarifier/fermentation tank (Structure 15). The settled sludge can be pumped to one of three different locations: recycled back to the influent of the fermentation tank; pumped to the anaerobic basins of the selector basins (Structure 32); or sent to the sludge/centrate storage tanks (Structure 60). Typical operation is to recycle the sludge during off-peak hours when volatile fatty acids are not required at the selector basins, and to pump the sludge to the selector basins during peak hours when biological phosphorus removal needs to be enhanced due to higher phosphorus loadings. These solids are not typically pumped directly to the sludge/centrate storage tanks because, while doing so would reduce the loadings to downstream processes, it would also decrease the biological phosphorus capability of the facility.

Air-Operated Diaphragm Pumps

In addition to settled solids removal, the air-operated diaphragm pumps also convey scum and floating solids removed from the surface of the fermentation tank from the chamber on the north side of the tank to the sludge/centrate storage tanks (Structure 60). Operators must adjust valves before switching from pumping settled solids to pumping scum/floating solids.

The Structure 10 basement also contains one Hydrovane and one Curtis Model SE 10 compressor, each powered by a 10 hp motor to provide compressed air to a 200-gallon compressed air receiver. The compressors start and stop depending on the downstream pressure levels, and operators can designate lead-lag operation of the compressors at the controller to equalize run times. Compressed air passes through a Zeks 75HSG refrigeration air dryer unit prior to distribution to remove undesirable moisture. The compressed air is used to operate air-operated diaphragm sludge pumps and pinch valves.

Air Compressors **Air Receiving Tank and Drier**

3.2.3 Chemical Feed Building (Structure 14)

Structure 14 is a small chemical feed building located west of the new blower building (Structure 36). Within the chemical feed building are two cylindrical polyethylene chemical storage tanks, one 7-foot diameter by 10 feet high and one 6-foot diameter by 10 feet high as well as two ProMinent chemical feed pumps. The chemical storage tanks currently contain ferric chloride which is used for chemical removal of phosphorus as needed. Ferric chloride can be dosed to the centrate returned to the head of the WWTF or the aeration basin effluent.

Potential future needs include flow pacing controls, SCADA integration, and additional dosing points. The tanks are too small to contain a full tanker for chemical delivery unless they are fully empty.

Inside Chemical Feed Building **Chemical Feed Pumps**

3.2.4 Circular Primary Clarifier/Fermenter (Structure 15)

Structure 15 is a circular primary clarifier, which receives roughly half of the forward flow after screening and grit removal and acts as a fermenter for the biological phosphorus system as described below. The fermenter has a 45-ft inside diameter, a side water depth of 13-feet, and a cone-shaped bottom. Flow from the fermenter goes to the selector basins (Structure 32).

The circular primary clarifier generates VFAs via fermentation that aid in biological phosphorus removal in subsequent processes. To achieve this, solids are settled out in the tank, allowed to ferment on the tank floor, and then recycled to the influent of the tank or pumped downstream to the selector basins (Structure 32). Primary solids can also be removed in the circular primary clarifier whereby they settle to the floor of the tank and are pumped to a sludge holding tank (Structure 60) to be processed in sludge processing (Structure 70). The main factor in determining how the circular primary clarifier is operated is whether biological phosphorus removal or primary BOD reduction is of the most importance.

Influent flow enters the circular primary clarifier via the center dispersion well. Effluent from the tank flows over a perimeter weir, into the effluent trough before flowing to the discharge box, from which it can be directed to the selector basins (Structure 32) or to the intermediate wet well (Structure 50). A diaphragm valve with actuator and flow meter controls diversion to Structure 50.

Settled solids from the circular primary clarifier are removed by sludge pumps in the basement of the control building (Structure 10). These solids can be returned to the west chamber of the rectangular primary clarifiers' splitter box or pumped to the selector basins. Scum and floating materials removed from the water surface by an Eimco Water Technologies skimming/sludge scraping mechanism, and is directed to the scum box outside the tank perimeter and removed by the sludge pumps.

The circular primary clarifier was installed in 2007, and is operating satisfactorily. The drive motor has significant exterior rust and will likely need replacement within the next 5 years. Painting of clarifier equipment will be needed in the near future.

Observed peak flows to the clarifier/fermenter exceed the design overflow rates, measured in gallons per day per square foot (gpd/sf):

- Average Design Flow Surface Overflow Rate: 1,000 gpd/sf
- Maximum Month Observed Surface Overflow Rate: 935 gpd/sf

- Peak Hour Design Flow Surface Overflow Rate: 1,500 gpd/sf
- Maximum Observed Peak Hour Surface Overflow Rate: 2,716 gpd/sf * (max flow of 8.64 MGD, with 50% going to the fermenter)

Exterior of Circular Primary Clarifier

Interior of Cicular Primary Clarifier

3.2.5 Rectangular Primary Clarifiers (Structure 20)

Structure 20 is three rectangular primary clarifiers which receive roughly half of the forward flow after screening and grit removal. Flow from the headworks branches into three separate 14-inch pipes that enter the influent trough of the west side of the rectangular primary clarifiers. There are no gates located within this influent trough so to restrict flow to any one clarifier a temporary barrier will have to be placed in the trough to control the direction of flow.

Each rectangular primary clarifier is 14-ft wide by 50-ft long, with a side water depth of 8-ft, and is constructed of reinforced concrete. Each tank is provided with a mechanical chain mechanism for removing scum from the water surface and settled sludge from the tank floor. Flow through the clarifiers is from west to east and scum is removed by a manually operated, pivoting scum trough on the west end of the structure. The scum trough is piped to a concrete basin which is connected to the sludge pumping system.

Settled sludge on the clarifier floor is pushed to the east end of the tanks into a sludge pit running the width of the tank and is removed by pumps in the basement of the control building (Structure 50). There are two sludge suction pipes connected to each sludge pit (total of six suction pipes), and the flow through these pipes is controlled by electrically-actuated plug valves. The valves are located within the clarifier tanks and valve stems extend up through the concrete top platform to stand-mounted actuators. Operation of the valves is tied to operation of the designated sludge pump by the SCADA system.

Effluent from the clarifiers exits the tanks over an effluent weir and into the effluent trough from where it is piped to the intermediate wet well (Structure 50).

While the rectangular primary clarifiers remain operable, they have a limited operating range given their modest size, are an outdated design, and are operating well past their design lives. Observed peak flows to the clarifiers exceed the design overflow rates:

- Average Design Flow Surface Overflow Rate: 1,000 gpd/sf
- Maximum Month Observed Surface Overflow Rate: 708 gpd/sf

- Peak Hour Design Flow Surface Overflow Rate: 1,500 gpd/sf
- Maximum Observed Peak Hour Surface Overflow Rate: 2,057 gpd/sf (max flow of 8.64 MGD, with 50% going to the primaries)

Rectangular Primary Clarifiers

Scum Tray & Overflow Launders

Electric Gate Actuators

3.2.6 Trickling Filter (Structure 25)

The trickling filter is part of the original plant constructed in 1939. It is now used to help buffer peak loads to the aeration basins. The trickling filter is uncovered, with a 90-ft diameter and a rock depth of 8-ft. Total rock volume is 50,900 cu ft.

Wastewater from intermediate wet well (Structure 50) is pumped to the rotating distributor arm of the trickling filter (Structure 25), and filters down through the rock media. The treated effluent is collected in discharge box and flows from the trickling filter directly to the aeration basin (Structure 35). A pipe recirculates a portion of the wastewater that has passed through the trickling filter back to the secondary wet well to ensure continuous flow to the top of the trickling filter.

The trickling filter's distributor arms and nozzles are were replaced most recently during the 2016-2017 upgrades. Rehabilitation of the drive unit will likely be needed within the next five years.

The trickling filter is well past its design life, uses an outmoded technology, and the adjacent pipe/valve gallery is severely rusted. However, the filter is still operable, and the treatment provided by the filter has allowed the plant to provide treatment of influent loads that are well beyond the rated capacity of the plant.

Top of Trickling Filter

Deteriorated Conditions

3.2.7 Centrate Holding Tank (Structure 30)

The centrate holding tank was formerly an intermediate clarifier that was modified to receive centrate pumped from the centrate pumping station (Structure 65). The tank is 55-ft diameter with a side water depth of 7-ft, resulting in a volume of approximately 125,000 gallons. Centrate in the tank can be metered back to head of plant with a small rotary pump in the basement of Structure 50. The tank is not currently used because due to issues with solids build-up and centrate is currently stored in one of the Structure 60 holding tanks. Since it is unused, this structure should be considered for demolition to provide additional space on the plant site.

Top of Centrate Holding Tank

3.2.8 Selector Basins (Structure 32)

The four selector basins were built as part of the 2005-2006 upgrade, and receive forward flow from the circular primary clarifier as well as return activated sludge (RAS) flow. The selector basins consist of anoxic and anaerobic environments used to denitrify the RAS and to promote biological phosphorus removal by producing VFAs and achieving the primary release of phosphorus from entrained microorganisms.

The selector basins are numbered 1 to 4, from west to east. The west basins (basins 1 and 2) are typically operated as anoxic basins where the RAS is denitrified, and the east basins (basins 3 and 4) are typically operated as anaerobic basins where additional fermentation and soluble phosphorus release takes place. Each basin measures 25-ft x 25-ft with a 12.5-ft side water depth. There are three flow streams directed to the selector basins, as follows:

(1) Effluent flow from the circular primary clarifier can be directed to selector basin 3 or 4;
(2) RAS from the final clarifiers is pumped to selector basin 1, 2, or 3; and
(3) Settled sludge from the circular primary clarifier is pumped to either selector basin 3 or 4, or to the final discharge chamber at the northeast corner of the structure.

Flow between basins is by gravity through openings in the common walls of adjacent tanks. The flow is controlled by overflow weirs installed at these openings. If a basin is taken down for maintenance, the bypass piping system routes flow to a downstream basin. Effluent from the selector basins flows to the discharge chamber and is piped to influent box of the aeration basins.

A Flygt Model 4640 submersible mixer with 4 hp motor is in each tank to keep the solids in suspension. In addition, a Flygt Model NP3085 with 3 hp motor submersible pump has been installed in the discharge chamber to pump forward flow back to the anoxic basins to provide a carbon source for denitrification of the RAS.

The selector basins are operating satisfactorily and have no known issues. Typically only one or two basins are used during normal plant operations.

Selector Basin 1

Selector Basin 2


Selector Basin 3 **Selector Basin 4**

3.2.9 Aeration Basins (Structure 35)

Structure 35 is three aeration basins originally constructed in 1969, numbered 1 to 3 from east to west. Aeration basins 1 and 2 are each 24-ft x 84-ft with a 14-ft effluent weir elevation, and each have an effective volume of approximately 215,000 gallons. Aeration basin 3, originally an aerobic digester, has dimensions of 24-ft x 100-ft with a 14-ft effluent weir elevation, and effective volume of 255,000 gallons.

Flow from the selector basins and the trickling filter is combined at the influent chamber to the aeration basins at their northwest corner. The piping from the selector basins extends through aeration basin 3 to arrive at this point. At this influent chamber, a portion of the total flow is directed to aeration basins 1 and 2 through one gate and the remaining flow to aeration basin 3 though another gate. Aeration basins 1 and 2 share an influent box with fixed weirs that split the total flow roughly evenly between the two basins.

Flow through the basins is in a north-to-south direction and discharges over effluent fixed weirs at the south end of each basin. Air is delivered to the aeration basins from the blowers in the new blower building (Structure 36), with the blowers in the original blower building (Structure 38) as backup. Each aeration basin has a dedicated 10-inch main air header that normally supplies air from the blowers in the new blower building, but can be supplied by the original aeration blowers in Structure 38.

Air drop pipes connect to the main headers and provide air to the diffuser grids at the bottom of each aeration basin. There are two drop pipes per basin, and individual butterfly valves on the drop pipes are used to modulate air flow to any one drop. These valves are opened periodically to blow off condensate that collects within the piping grid. The drops supply manifolds for the ceramic, 9-inch diameter, fine bubble diffusers in each basin. Aeration basins 1 and 2 each contain 644 diffusers, and aeration basin 3 contains 672 diffusers, for a total of 1,960 diffusers in the three basins. The diffusers are in good condition but will require continued maintenance / chemical cleaning to remain operational. Replacement of diffuser o-rings and grit removal is periodically required to maintain the highest possible aeration volume and prevent future maintenance problems.

There are dissolved oxygen (DO) probes installed in each aeration basin at about the halfway point on each tank, and a spare DO probe is available. A local display of DO values is available at the transmitter enclosure on the walkways between the tanks, and the DO signals are sent back to the main SCADA network for monitoring and control of the air blowers.

At a maximum conventional BOD loading rate of 40 pounds of BOD per 1,000 cubic feet per day, basins 1& 2 each have treatment capacity for 1,129 pounds of BOD per day, while basin 3 has treatment capacity for 1.344 pounds of BOD per day:

- Aeration Basin BOD Loading Capacity: 3,602 lbs/day
- Maximum Month Loading Observed: 3,861 lbs/day (estimated load to the aeration basins accounting for removal in the primaries, trickling filter, and selector basins for an influent load of 8,463 lbs/day)

Based on the available capacity of the basins, additional aeration volume is required to handle the current maximum month BOD loading. Other minor improvements to the existing basins and piping configuration will be needed if additional aeration basins are added.

View of Aeration Basins From SE

View of Aeration Basins from SW

Air Distribution Piping & Walkway

Air Distribution Piping & Valves

3.2.10 New Blower Building (Structure 36)

Structure 36 is the new blower building that was constructed in 2016. The new blower building contains a large blower room and a smaller electrical room. The electrical room contains MCCs and VFDs for the blowers. The large blower room contains four Aerzen model D52S blowers with 75 HP motors, rated for 1,483 standard cubic feet per minute (scfm) each to supply air to the aeration basins (Structure 35). Each of the four blowers feed into a 12-inch main air header in the new blower building, where three individual 10-inch lines feed each basin with control by modulating air valves. A fourth 10-inch aeration line was stubbed out for a future fourth aeration basin and the blower building was designed to hold two additional blowers for future aeration capacity expansion.

The new blowers provide approximately 5,900 scfm of air with all four blowers running. This air flow is capable of maintaining an oxygen concentration of 2 mg/L with a load of approximately 6,100 pounds of BOD per day of to the aeration basins, which correlates to an influent BOD loading 11,346 pounds per day.

New Blower Building

Aerzen Blower

Air Piping Within New Blower Building

Motor Control Center in Electrical Room

3.2.11 Original Blower Building (Structure 38)

Structure 38 contains the original aeration blowers, return activated sludge (RAS) and waste activated sludge (WAS) pumps, and an electrical room.

3.2.11.1 Blowers

Prior to the 2016-2017 improvements, air to the aeration basins was supplied by six blowers, Sutorbilt Model 7MVP with 40 hp motors. Four of these blowers (Blowers 2, 3, 4 and 6) were retained after the aeration upgrade to serve as a backup to the new aeration blowers in Structure 36. Blowers 2 and 4 can supply air to Aeration Basin 1 and Blowers 3 and 6 can supply air to Aeration Basins 2 and 3. Each of the blowers are equipped with VFDs in the MCC to ramp the blower motors and thus the air flow being delivered to the basins.

The blowers in Structure 38 can only serve for backup since they are in poor condition, are beyond their useful life, and not able to provide enough air to meet current peak and sustained loads.

Original Blower Building

Blowers in Structure 36

3.2.11.2 RAS/WAS Pumping

RAS and WAS pumps are located in the basement of Structure 38.

Three Flygt Model NT3153 pumps, with 12 hp motors and VFDs for speed/flowrate adjustment, are used to convey RAS from the final clarifiers. Flowmeters and actuated pinch valves are on each of the pumps' suction pipes. The common pump discharge header exits the basement as 10-inch out the south side of the structure and extends to the selector basins. When the selector basins are being utilized the RAS can be conveyed to one of the anoxic selector basins (Structure 32) or directly to the aeration basins by making adjustments to the valves in the Structure 38 basement.

Because the final clarifiers are constructed at a higher elevation than the selector basins it is possible for the RAS to flow by gravity to these basins. However, this will be possible only up to a certain flow rate due to friction losses in the RAS pipeline. There is a bypass pipe with actuated valve which connects the suction side of the RAS pumps' piping to their discharge piping, thereby allowing for gravity flow if the pumps are not needed.

Sludge wasting is done from the RAS suction lines from the final clarifiers by a WAS pump located adjacent to the RAS pumps. The WAS pump is a Fairbanks Morse Model 5442 with 5 hp motor.

The RAS pumps are in good condition and have adequate hydraulic capacity and while the WAS pump also has adequate capacity, it is reaching the end of its life:

- RAS Pump Capacity: 3.026 MGD
- WWTF Maximum Day RAS Pumping Observed: 1.770 MGD

- WAS Pump Capacity: 0.115 MGD
- WWTF Maximum Day WAS Pumping Observed: 0.060 MGD

RAS Pumps/Piping/Valves **WAS Pump/Piping** **Electronic Flowmeter**

3.2.12 Final Clarifiers (Structure 40)

Structure 40 consists of a mixed liquor pumping station, two final clarifiers, an ultraviolet light disinfection system, and an auto-sampler to take water quality samples of the final effluent prior to discharge.

3.2.12.1 Mixed Liquor Pumping

Effluent from the aeration basins flows to the mixed liquor wet well which is located between the two final clarifiers. There are four submersible pumps installed in the mixed liquor wet well, one ABS, one Flygt, and two Wemco pumps. Three of the pumps, Mixed Liquor Pumps 2 through 4, are provided with variable frequency drives in the MCC and are speed adjusted depending on the wet well liquid level. Mixed Liquor Pump No. 1 is a constant speed pump with a pre-rotation basin which can draw down the liquid level to greater depths to aid in keeping grease and scum accumulations to a minimum.

Mixed liquor is then pumped up to the final clarifiers' splitter box where the operator will have the opportunity to direct flow to either or both of the north or south clarifiers. From the splitter box the mixed liquor flows through a 24" pipe that enters the clarifiers up the center columns of the tanks. Clarified effluent from the tanks is over a perimeter fixed weir and then into a channel which leads to the disinfection process.

Design parameters for the mixed liquor pumps were based on the peak influent flow, recycle flow, and maximum RAS during peak flow conditions. Each pump was has a capacity of 2,500 gpm, with a firm capacity of 10.807 MGD:

- MLSS Pump Capacity: 10.807 MGD
- WWTF Maximum Day MLSS Pumping Observed: 7.298 MGD

3.2.12.2 Final Clarifiers

The two final clarifiers are circular tanks, 75’ in diameter with a 14’ side water depth. A surface skimming and sludge scraping mechanism directs floating material on the water surface to a full surface trough, and pushes settled solids along the floor of the structure to the center sludge hopper. Each mechanism, as manufactured by Eimco Water Technologies, is powered by a drive including a 1 HP motor. From the sludge hopper, solids are removed by the RAS pumps in the basement of Structure 38.

The final clarifiers were installed in 2005, and are working satisfactorily, but will need repainting of the clarifier equipment and rebuild of the clarifier drives in the near future. Additionally, the clarifiers are nearing the design surface overflow rates with current peak flows:

- Average Design Flow Surface Overflow Rate: 300 gpd/sf
- Maximum Month Observed Surface Overflow Rate: 263 gpd/sf

- Peak Hour Design Flow Surface Overflow Rate: 1,000 gpd/sf
- Maximum Observed Peak Hour Surface Overflow Rate: 978 gpd/sf (*max flow of 8.64 MGD)*

View from SW of Final Clarifiers

Flow Control Gates

Final Clarifier Scum Rake, Launder, Walkway

Final Clarifier Drive

3.2.12.3 UV Disinfection

Disinfection is provided by an ultraviolet system incorporating a Trojan 3000+ two-bank, 160 lamp system with a rated capacity of approximately 3.0 MGD. The system is operating effectively but there are observed hydraulic issues and expansion of the system is constrained by the channel dimensions and configuration. Additionally, peak flows have exceeded the design flow rate for the UV system:

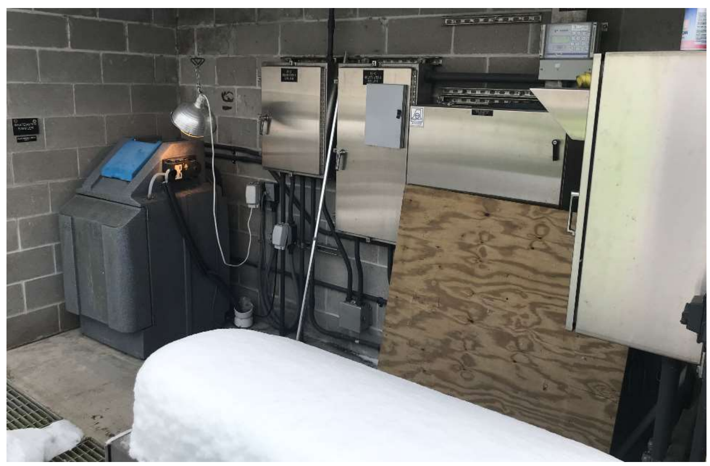
- UV Equipment Design Peak Flow Rate: 7.91 MGD (hydraulic)
- Treatment capacity = 3.0 MGD
- Observed Peak Flow Rate: 8.6 MGD

3.2.12.4 Effluent Sampling and Metering

Effluent wastewater samples for laboratory analysis are collected by an ISCO Model 3700FR automatic wastewater sampler located on the platform above the channel. The auto-sampler collects composite, flow-proportioned influent wastewater quality samples and store the samples in a refrigerated compartment.

Prior to discharge, effluent flowrate is measured by a 12-inch Parshall flume with a maximum metering capacity of approximately 10.4 MGD.

UV Disinfection System



Effluent Auto-Sampler, Electrical Panels

3.2.13 Control Building / Intermediate Wet Well (Structure 50)

Structure 50 is a control building and intermediate wet well. The control building contains a small bathroom, a storage area, electrical switchgear, control panels, as well as a number of pumps located in the basement. The pumps include a centrate pump, sludge pump, intermediate pump, and primary sludge pump.

Sludge pumping includes removing solids from the primary rectangular clarifiers (Structure 20) and pumping sludge to the sludge processing building (Structure 70), and centrate from the Structure 60 storage tank to the head of the WWTF. A Dorr Oliver Model ODS air-operated diaphragm pump is used for pumping solids from the rectangular primary clarifiers to the sludge/centrate storage tanks (Structure 60). A Vogelsang Model VX186-130Q rotary lobe pump pumps sludge from Structure 60 to the Centrisys centrifuge in the sludge processing building (Structure 70), and can pump sludge to the Andritz centrifuge (at reduced speeds to provide the required capacity) if the Centrisys centrifuge is out of service. A Borger Model PL 300 rotary lobe pump meters centrate from the centrate storage tank (Structure 60) to a manhole for return to the head end of the WWTP. The interconnected piping among these pumps allows each of them to function as a backup in the event that one or more of the pumps is out of service.

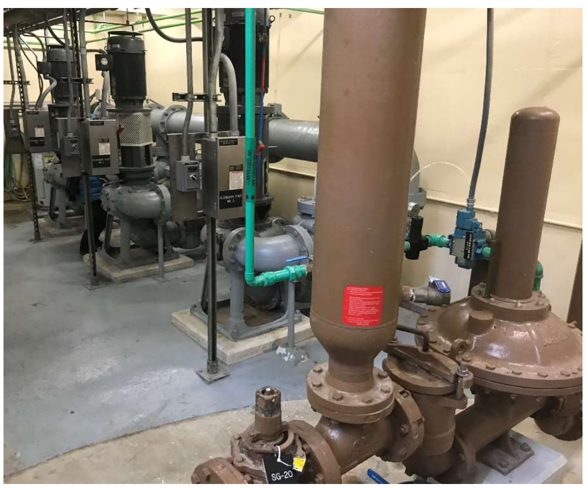
The intermediate wet well receives flow from the rectangular primary clarifiers (Structure 20) and has internal dimensions of 16-ft x 10-ft x 8-ft/9-in deep, providing nominal storage volume of about 8,400 gallons assuming 2-ft freeboard. Three Fairbanks Morse Model 5443-T30 E8K dry-pit pumps in the basement of the control building convey wastewater from the intermediate wet well through a common header to the trickling filter (Structure 25). Each 25 hp pump has an operating point of 1,488 gpm at 43 feet total head. The total pumping capacity of the intermediate wet well with one pump out of service is 2,976 gpm, slightly more than half the total peak flow to the influent wet well. The pumps are equipped with VFDs to adjust the pumping rate based on the wet well level sensing instrumentation or alternatively with manually activated controls.

Structure 50 is functional but should be considered for replacement given its age and condition.

View of Control Building from South

Storage Area

Electrical Switchgear **Electrical Panels**



Pumps in Basement **Additional Pumps in Basement**

3.2.14 Waste Receiving Station (Structure 55)

Structure 55 is the waste receiving station, used to accept septage and holding tank waste from outside sources. The structure is located at the northeast corner of the WWTP and is designed with three compartments, two of which can be filled from trucks using hoses extending from the holding tanks. One compartment has a capacity of about 25,000 gallons and has coarse-bubble aeration diffusers installed on the floor to provide mixing and aeration of the waste. A second compartment has a capacity of about 8,500 gallons and also is supplied with an aeration diffuser grid. The center compartment is designed to accept flow from either of the other two adjacent compartments and includes a drain and an ABS submersible pump with a 2.7 hp motor for transferring the liquid waste to the east sanitary interceptor extending to the main interceptor leading to the influent wet well. A Bora Model SAP-180 regenerative air blower has been installed on the roof of the receiving station to supply air to the aeration grids in each of the receiving compartments.

The receiving station is in good condition and has adequate capacity for current needs. The City would like to add screening facilities at the station with future upgrades.

3.2.15 Sludge / Centrate Holding Tanks (Structure 60)

Structure 60 consists of two covered above ground circular holding tanks used to hold sludge and centrate, as well as a small blower shed in between. The tanks were originally used as anaerobic digesters, but in 2002 were converted to sludge holding tanks to provide storage for the feed to the lime stabilization system. The northern holding tank is currently used to hold sludge, and the southern holding tank is used to hold centrate.

Submersible mixing and diffused aeration with EDPM membrane diffusers is used to keep solids adequately mixed and in suspension to prevent solids from accumulating at the bottom of the tanks. To maximize the solids content of the sludge before pumping to subsequent sludge processes, the operator can return clear liquid from the sludge tank to the influent wet well. This is done by allowing the solids to settle out in the tanks; draining clear liquid from the surface of the tank from where solids have settled out; and then re-suspending the solids with the mixing or aeration equipment before pumping to downstream processes. This process is automated to mix and settle the tanks at specific times each day as determined by the operator.

On the west side of each holding tank is a small structure containing piping and valves, and supports an aluminum staircase to reach the tank cover and Davit crane.

The concrete of the holding tanks are generally in good condition, but the tank covers are showing signs of age such as cracking and frayed edging. The concrete at the top of the south holding tank was rehabilitated during the 2016-2017 improvements to extend the life of this structure. The small structures adjacent to each holding tank are in in poor condition, particularly structurally and concerning interior rust. The blower shed is in fair condition and the blowers are undersized for the current conditions, with insufficient capacity to maintain DO in tanks to prevent septic conditions. WWTF staff have also observed issues with fouling/calcium scale buildup on the diffusers in the south tank, which is used primarily for centrate.

North Holding Tank & Blower Shed

South Holding Tank & Blower Shed

Aluminum Access Ladder **Blowers Inside Blower Shed**

3.2.16 Centrate Pump Station (Structure 65)

Centrate from the dewatering centrifuges flows to a small lift station manhole (Structure 65) outside of the sludge processing building (Structure 70). The centrate pump station wet well is a 6-foot diameter manhole, 7-feet deep, providing nominal storage volume of about 1,480 gallons. The lift station is equipped with a Sulzer Model XFP80C CB1 submersible pump with 3.8 hp motor rated to convey 288 gpm at 26.8 feet total head, and has room for a second pump to be added. Centrate is pumped to the southern sludge holding tank (Structure 60) for storage and is then pumped to the head of the plant at a controlled rate. The pump can also pump to the centrate/sludge holding tanks (Structure 60). The pump can be automatically controlled by the wet well float switches or, alternatively, with manually activated controls.

A bypass pipe is provided from Structure 65 back to head of the plant. If the centrate pump cannot keep up then centrate is bypassed back to the head of the plant unmetered rather than being sent to storage. The pump is able to handle centrate from current centrifuge operations but may need to be upsized or a second pump added if centrifuge operation or capacity is increased.

Side View of Centrate Pump Station **Front View of Centrate Pump Station**

3.2.17 Sludge Processing (Structure 70)

Structure 70 consists of sludge process building, which includes two sludge dewatering centrifuges, lime stabilization equipment, an exterior lime storage silo, and covered sludge storage area to produce a Class A biosolids product.

3.2.17.1 Sludge Dewatering

The sludge dewatering centrifuges are from Centrysis and Andritz. The Centrisys centrifuge, Model CA21-4Hc2P, is the primary unit used to dewater sludge and the Andritz centrifuge is a backup unit. Typical feed rates to the Centrysis centrifuge are from 150 to 250 gpm of liquid sludge depending on the sludge characteristics for any given day, while the Andritz centrifuge can be fed at 40 to 75 gpm.

Sludge is pumped from the sludge holding tanks (Storage 60) by pumps in the basement of the control building (Structure 50) to the dewatering centrifuges where the solids concentration is increased from around 2% to 20% by removing excess water. Polymer is added upstream from the sludge inlet to the centrifuge by a ProMinent model MO1500X2 polymer feed system. The excess water or centrate is returned to the influent wet well by the centrate pump station (Structure 65).

The Andritz centrifuge is at the end of its useful life, and is in need of replacement. The Centrysis centrifuge is still in good working condition.

- Andritz Centrifuge Loading Capacity: 75 gpm and 600 lbs of solids per hour
- Centrysis Centrifuge Loading Capacity: 250 gpm and 1,250 lbs of solids per hour
- WWTF Maximum Month Loading Observed: 144 gpm, assuming 7.5 operating hours per day, and 5 operating days per week.

Sludge Dewatering Centrifuges

Lime Stabilization Equipment

3.2.17.2 Lime Stabilization

After the sludge is dewatered, the sludge cake is conveyed to a Schwing-Bioset lime stabilization process where pathogen reduction and vector attraction requirements are met to produce a Class A biosolids product. The exceptional quality biosolids end product has less monitoring requirements and end use restrictions when compared to typical Class B sludge produced at most municipal WWTFs. To meet Class A requirements, the following conditions for the Bioset process from the WPDES permit must be met:

- Dewatered sludge must be mechanically mixed with calcium oxide (quicklime) to achieve a pH of equal to or greater than 12 standard units.

- Sulphamic acid must be mixed with the sludge/quicklime mixture to maintain the temperature of the mix at equal to or greater than 55ºC (131ºF).
- The process must be operated in a plug flow regime with a minimum operating pressure of 27kPa (4psi) and a minimum solids retention time of 40 minutes at a minimum temperature of 55ºC (131ºF).

Dewatered sludge from the centrifuge is transported to the twin screw mixer which is used for blending the cake sludge with crushed quicklime and sulfamic acid. The blended product from the mixing augers drops into the piston feed pump where the limed biosolids are pumped to the reactor vessel to provide the required retention time and temperature to comply with the permit requirements for Class A biosolids.

The lime stabilization process has been operating successfully and has adequate capacity for the current conditions, but WWTF staff indicate that the lime silo auger may need to be replaced and the capacity of the silo increased.
- Bioset Solids loading capacity: 9,500 wet lbs per hour (20% solids), total throughput of 11,500 wet lbs per hour
- Lime Silo Storage: 30 tons
- WWTF Maximum Weekly Lime Usage Observed: 30 tons per week, with a lime dosage rate of 80%.

Lime Stabilization Equipment

Lime Storage Silo

3.2.17.3 Sludge Storage

Cake sludge produced by the Class A lime stabilization process are stored in a covered storage area at Structure 70. The existing storage pad has a maximum capacity of 76,800 cubic feet assuming an average pile height of 8 feet and allowing for a 20 foot driving lane. Current sludge production exceeds the design capacity of the storage pad, but operators have been able to manage sludge removal to maintain adequate storage:
- Sludge Storage Capacity: 354 cf/day
- WWTF Maximum Observed: 511 cf/day

The City currently has an agreement with an off-site sludge hauling and disposal company to meet the DNR's requirements to provide 180 days of storage. This agreement was signed in 2019 for 3 years, with two additional years as an option.

Inside Covered Sludge Storage Area

3.2.17.4 Air Treatment

Structure 70 includes a wet scrubber to remove moisture and ammonia from the air stream at the discharge end of the lime stabilization reactor vessel. The scrubber includes a fan, scrubbing tower and sump, and is installed near the reactor vessel with the necessary water and drain pipe connections. Treated air is released to the sludge storage pad area. Water collected at the base of the ammonia scrubber is discharged to a hub drain and flows to the centrate pump station.

3.2.18 Administration Building / Garage (Structure 80)

Structure 80 is the administration building/garage which consists of garage bays, a pump maintenance shop, general administration building rooms, and a laboratory.

Front of Administration Building

View of Administration Building / Garage from NE

The building is in good condition and has no identified needs for upgrades.

3.2.19 Site Piping and Utilities

3.2.19.1 Site Piping

Any piping that is over 40 years old should be evaluated for replacement and considered as part of any plant improvement. WWTF staff have also idenified some non-functional valves for replacement. The hydraulics of future peak flows are discussed in Chapter 5 and potential bottlenecks are identified for replacement.

3.2.19.2 Stormwater Pumping Station

The WWTF site has a stormwater pumping station located near Structures 32 and 38 that pumps stormwater collected from the site to the exterior of the site berm. The pump station manhole and piping were installed in the 2006-2007 upgrade and an existing Fairbanks Morse, 5 hp single stage propeller pump rated for 1,250 gpm was relocated to the new manhole. The discharge of the pumping station is at invert elevation of 876, below the 100-year flood elevation, so check valves in the discharge piping prevent inflow of floodwater. The stormwater pump and check valves are a critical component of flood-protection measures for the plant and should be replaced to ensure continued operation.

3.2.19.3 Electrical Service

Electrical service to the facility is supplied by the Reedsburg Utility Commission with incoming service extending from the main trunk line on Division Street. Power from the utility flows through a pad-mounted transformer located to the north of Structure 10, which converts 26,400 volt utility service to 480/277 volt, 3-phase power for facility use. From the transformer the electrical service passes through a CT/PT (current and voltage transformers) cabinet with attached meter socket which are used to monitor incoming power and measure power consumption that is used WWTF for billing purposes. From the CT/PT cabinet there are power and ground conductors which extend to a pad-lockable air-break isolating switch cabinet on the outside wall of Structure 10. The isolating switch is rated for 2,000 amps and is used by the Utility to verify that power produced by the WWTF's standby generator cannot back feed into the Utility's grid should the Utility wish to isolate the grid from the facility for maintenance or repair of the supply grid. From the isolating switch cabinet the power and ground conductors extend inside the building to the service entrance rated paralleling switch gear which provides protective relaying and controls for the standby generator. This paralleling gear houses a 2,000 amp utility breaker and emergency power breaker to provide downstream protection from over-current conditions.

3.2.19.4 Standby Generator

The WWTF has a diesel-powered Kohler Power Systems Model 600 REOZM generator in Structure 10, which is rated to provide up to 610 kW of power at 480/277V. The generator comes complete with a control system and sub-base 660-gallon fuel tank equipped with a secondary rupture basin with alarm contacts, low fuel level alarm contacts, water separator, fuel gauge, and 5 gallon spill/fill box with remote alarm panel. Both the normal utility power supply and the generator interface to Kohler Power Systems Model PD-100 parallel switchgear rated to 2,000 amps and located in the generator room of the headworks building (Structure 10). The parallel switchgear contains an operator interface, controls, protective relays, and draw-out circuit breakers required to operate the backup generator in parallel with the utility-supplied electricity.


Standby Diesel Generator **Sound Attenuation**

3.2.19.5 Water Service

Potable water is supplied to the WWTF from the Reedsburg Water Utility via a 6-inch ductile iron pipe running from Division Street down the east side of the WWTF's access road and into the basement of the control building (Structure 50), where it reduces to 4-inch diameter and is metered before branching out to service the WWTF. There is a main shut-off valve located on Division Street for this main service to the WWTF. A branch pipe extends off the main water service to supply water to the fire hydrant northwest of the control building. A Sensus Model SRH compound flowmeter measures flow for billing purposes.

3.2.19.6 Natural Gas

Natural gas is used at the Reedsburg WWTF for building heat, hot water heating, and clothes dryers. Natural gas is supplied from the local utility to the WWTF from the main gas line running along Division Street. There is a 4-inch pipeline that extends from Division Street to the basement of the control building (Structure 50) where the main gas meter is located. There is also a separate 2-inch pipeline which branches off the 4-inch pipe and connects directly to the sludge processing building (Structure 70) where a second gas meter measures the natural gas used at that structure.

3.2.19.7 Telephone Service

The local telephone utility provides hard-line telephone service to the WWTF at the administration building/garage (Structure 80), although phones can be installed at other buildings by transmitting voice signals over the WWTF's fiberoptic system.

3.2.20 Controls/SCADA

The WWTF has a supervisory control and data acquisition (SCADA) system which allows for indication, observation, and operation of the WWTF and remote collection system lift stations. Control is provided by programmable logic controllers (PLCs) that are installed in area control panels located in the major structures throughout the WWTF and at individual lift stations. Operations staff is able to change settings and monitor operations from an Operator Interface Terminal (OIT) provided at each PLC control panel with a keypad or touchscreen for inputting data and observation of critical processes controlled by any given PLC. Operations staff rarely, if ever, interacts directly with the programming of the PLC as this is the responsibility of the systems integrator who is trained in the use of the programming language. Each of the PLCs is linked together by fiberoptic cable so that all data and process information is sent back to the main control panel (MCP) PLC where it is collected, monitored, processed and stored as required. Each PLC communicates directly with process equipment, sensors, and controls and more or less acts as the gateway between the operator and the equipment. There are also PLCs located at the main lift stations of the collection system.

The SCADA system has been integrated with an alarm system and dialer which function to alert operators when an abnormal condition has been detected by the PLC, or by a remote controller at the collection system lift stations. An alarm condition can be indicated by a change at a sensor, by data outside of limits programmed by the operator, or by loss of electrical power. The alarm system and dialer operation are controlled via the master computer station at the sludge processing building (Structure 70). The existing SCADA system is fully functional and has been updated with as plant upgrades have taken place. Any future upgrades to the plant must include associated updates to the SCADA system and alarm dialer functions.

3.3 Existing Facility Evaluation

The design capacity of the existing WWTF is summarized in Table 3-2 below.

Table 3-2 Existing Facility Capacity

Parameter	Units	Current Design	Average (2015-June 2020)	Maximum Annual Average (2015-2019)
Annual Average Flow	MGD	2.646	2.355	2.774 (2019)
Max Day Flow	MGD	5.010	5.026	5.658 (2016)
Peak Hourly Flow	MGD	7.914		
BOD	lbs/day	6,331	7,414	8,443 (2019)
TSS	lbs/day	5,048	4,891	5,488 (2019)
TKN	lbs/day	815		
Phosphorus	lbs/day	205	176.8	201.3 (2019)

As described further in Section 3.5, the flows and loadings to the facility are often exceeding the rated design capacity.

The current WWTF also has several issues and improvements that have been identified for further consideration in this facilities plan, as follows:

- Collection System Lift Stations
  - Upgrade Zinga LS as it is nearing capacity.
- Headworks (Structure 10)
  - Replace corroded exterior doors
  - Replace obsolete controls on standby generator
  - Integrate compressed air system with SCADA
  - Increase hydraulic capacity of raw wastewater pumps, flow monitoring, screening, and grit removal as observed peak flows to the plant exceed the existing hydraulic capacity.
- Chemical Feed Building (Structure 14)
  - Replace chemical feed storage tanks with larger size to accommodate full truckload
- Primary Clarifiers (Structures 15 and 20)
  - Replace Structure 15 drive motor and paint clarifier equipment
  - Replace Structure 20 rectangular clarifiers, which have reached the end of their useful
  - Increase hydraulic capacity of primary treatment to meet current peak flows.

- Trickling Filter (Structure 25)
    - Replace corroded piping and valves
    - Rehabilitate distribution drive unit
- Centrate Holding Tank (Structure 30)
    - Demolish unused structure
- Selector Basins (Structure 32)
    - No major issues identified
- Aeration Basins (Structure 35)
    - Increase aeration volume to meet current loads
- New Blower Building (Structure 36)
    - No major issues identified
- Original Blower Building (Structure 38)
    - Retire old backup blowers due to difficulty of continued operation and maintenance.
    - Replace WAS pump, which is at end of its useful life, and consider redundant pumping.
- Final Clarifiers/MLSS Pumping/UV Disinfection (Structure 40)
    - Increase hydraulic capacity to meet current peak flows
    - Replace clarifier drive motors and paint clarifier equipment
- Control Building (Structure 50)
    - Consider retiring/replacing structure given its age and condition
- Waste Receiving Station (Structure 55)
    - Add screening facilities to address pump plugging
- Sludge / Centrate Holding Tanks (Structure 60)
    - Replace holding tank covers
    - Increase capacity for holding sludge
    - Replace blowers and blower enclosure due to issues with capacity and condition
    - Rehabilitate corroded piping and valves in structures adjacent to holding tanks.
    - Address calcium scale fouling of diffusers in centrate holding tank (south tank).
- Centrate Pump Station (Structure 65)
    - No current issues, will need capacity upgrade with additional centrifuge operation.
- Sludge Processing (Structure 70)
    - Replace aging Andritz centrifuge
    - Replace lime silo auger and consider additional lime storage
    - Provide additional sludge storage capacity
- Administration Building/Garage (Structure 80)
    - No major issues identified
- General Needs
    - Replace stormwater pump and check valves in stormwater pumping station to ensure continued operation during flood events.
    - Replace any piping over 40 years old as part of any plant improvement and evaluate hydraulics of future peak flows to identify potential bottlenecks and site piping to be upsized.
    - Replace non-functional yard piping valves.
    - Replace aging MCCs/electrical components and upgrades to SCADA, instrumentation and controls as needed for new processes.
    - General buildings improvements as needed

3.4 Existing WPDES Summary

WPDES permit No. WI-0020371-09-2, with an effective date of July 1, 2018, was issued for the City of Reedsburg WWTF. The City of Reedsburg requested a permit modification on May 29, 2019 following the approval of the Wisconsin River Basin TMDL by EPA April 26, 2019. This request was made because the WWTF was capable of meeting the TMDL mass-based phosphorus limit of 33 lbs/day as a monthly average, based on the statewide phosphorus criteria applicable at the time. The modified permit was issued in November 1, 2019 to remove the Multi-Discharger Variance for phosphorus and include the Phosphorus TMDL limits. The permit also includes a 1.0 mg/L monthly average limit for phosphorus as a technology-based limit, which was retained to prevent backsliding.

On July 9, 2020 the U.S. EPA approved site-specific phosphorus criteria for Petenwell Lake, Castle Rock Lake and Lake Wisconsin. When EPA approved the Wisconsin River Basin TMDL in 2019, they approved allocations based both on the statewide phosphorus criteria and these newly approved site-specific criteria. With the approval of the site-specific criteria, the allocations presented in Appendix K of the TMDL will now be used for future wastewater permitting decisions and the WLA for Reedsburg WWTF will be significantly reduced for future permit terms, with a WLA of 2,954 pounds of total phosphorus per year, or 8 pounds per day, compared to a WLA of 8,073 pounds/year or 22 pounds/day with that was used for the current permit. Upgrade of the treatment plant would be required to meet effluent limits based on the site-specific criteria and WLA.

The discharge limits in the current permit are summarized in Table 3-3. See Appendix A for a copy of the complete permit.

Table 3-3 Existing WPDES Permit Limits

Parameter	2020 Limits
BOD_5 (monthly average)	30 mg/L
BOD_5 (weekly average)	45 mg/L (October through May) 37 mg/L (June) 32 mg/L (July, August) 39 mg/L (September)
BOD_5 (weekly average)	810 lbs/day (June) 720 lbs/day (July, August) 850 lbs/day (September)
TSS (monthly average)	30 mg/L
TSS (weekly average)	45 mg/L (October through May) 37 mg/L (June) 32 mg/L (July, August) 39 mg/L (September)
TSS (weekly average)	810 lbs/day (June) 720 lbs/day (July, August) 850 lbs/day (September)
Nitrogen, Ammonia (NH_3-N) (daily maximum)	34 mg/L
Nitrogen, Ammonia (NH_3-N) (monthly average)	17 mg/L (January, February, October, December) 22 mg/L (March, November) 28 mg/L (April) 18 mg/L (June) 14 mg/L (July, August) 23 mg/L (September)
Nitrogen, Ammonia (NH_3-N) (weekly average)	34 mg/L (November through April) 37 mg/L (June) 28 mg/L (July) 29 mg/L (August) 48 mg/L (September) 35 mg/L (September)
Fecal Coliform (mean- monthly)	400 # / 100 mL (May through September)
Fecal Coliform (mean- weekly)	656 # / 100 mL (May through September)
pH Field (daily maximum)	9.0 su
pH Field (daily minimum)	6.0 su
Phosphorus (monthly average)	1.0 mg/L
Phosphorus (monthly average)	33 lbs/day
Mercury	5.5 ng/L
Chronic Whole Effluent Toxicity	4.0 TU_a

3.5 Wastewater Flows and Loadings

Wastewater treated by the Reedsburg WWTF includes flow from residential, commercial, industrial, and public authority users within the City of Reedsburg. Influent flow and loading data are provided in Appendix G and are summarized in the following sections. Significant industrial contributors include Saputo, Foremost, and Bioriginal (formerly known as Wisconsin Specialty

Protein and Nutegrity), summarized as “Major Industries” in the following sections and tables. Other additional contributors include hauled waste brought to the WWTF by truck.

3.5.1 Major Industries

The City of Reedsburg has agreements for wastewater treatment services with the three major industries that process dairy products. The agreements define agreed discharge limitations (ADLs), including average daily values for any consecutive 5-day period and maximum day values for any 24-hour period. The City may assess surcharges against the industries for exceedances of the ADLs. Table 3-4 summarizes the ADLs for the three major industries. Each of the industries has had excursions above these ADLs and negotiation of new agreements will be a necessary part of future WWTF modifications/expansion.

Table 3-4 Major Industry Agreed Discharge Limitations

	Flow (MGD)	BOD (lbs/d)	TSS (lbs/d)	Total P (lbs/d)
5-Day Average ADL				
Foremost	0.180	1,000	500	50
Saputo	0.110	1,500	700	50
Bioriginal	0.150	1,700	750	51
Maximum Daily ADL				
Foremost	0.216	1,200	600	60
Saputo	0.150	1,800	840	60
Bioriginal	0.180	2,000	1,000	60

As part of the facilities planning process the City has had discussions with the industries to look at past loadings, address issues with reporting of slug loads and routine sampling/monitoring, and develop future loading projections. The industries were encouraged to look at ways to reduce phosphorus discharges and phosphorus surcharges were enacted by the City in 2018. The City inspected existing flow monitoring and sampling facilities at each of the industries and made requests for improvements. The Saputo flow monitoring and sampling system was found to be substantially under-reporting flows and loads to the WWTF and was modified in 2019 to provide more accurate data. Data from the period following the modifications was used to apply correction factors to data from 2016-2019, and corrected data was reviewed and agreed upon with Saputo as the basis for future loading projections. Data from 2020 are considered accurate without correction, as the improvements to Saputo’s system were completed in December 2019. Summaries of data from each of the three major industries are provide in Appendix H.

3.5.2 Influent Wastewater Flow

In order to differentiate between actual wastewater flow and infiltration and inflow (I/I), historical water use and facility influent records were evaluated. After separating I/I as a quantified component in the overall influent flow value, future flow increases can be better determined for actual wastewater flows from the residential, commercial, industrial, and municipal sectors of the community.

The Reedsburg Utilities water and sewer utility billing reports for 2015-2019 were referenced for sewer usage information and are summarized below in Table 3-5. The billed sewer flow for the various categories is based on metered water usage including customers that have sewer/deduct meters to adjust for water purchased but not discharged to the City's collection system. Water and sewer use records for the period of evaluation are provided in Appendix G.

Table 3-5 Summary of Annual Metered Sewer Use

Year	Metered Water Use (MGD)					
	Residential	Commercial	General Industrial	Major Industries	Municipal	Annual Average
2015	0.359	0.209	0.169	0.318	0.041	1.096
2016	0.351	0.206	0.227	0.335	0.048	1.168
2017	0.343	0.196	0.163	0.335	0.060	1.097
2018	0.347	0.208	0.133	0.394	0.049	1.131
2019	0.342	0.216	0.126	0.419	0.045	1.149
Average	0.348	0.207	0.164	0.360	0.049	1.128
Percent of Total	31%	18%	15%	32%	4%	100%

The metered sewer use for each sector was analyzed to develop per capita and per customer usage rates for the annual average, summarized in Table 3-6.

Table 3-6 Metered Sewer Use as Gallons Per Capita or Customer per Day (GPCD)

	Residential Flow (GPCD)*	Commercial Flow (GPCD)	General Industrial Flow (GPCD)	Major Industries Flow (GPCD)	Municipal Flow (GPCD)
Year	Annual Ave	Annual Ave	Annual Ave	Annual Ave	Annual Ave
2015	38	556	4,691	105,927	958
2016	37	556	6,317	111,716	1,045
2017	36	520	4,517	111,670	1,276
2018	36	553	3,682	131,355	1,042
2019	36	576	3,493	139,808	964
Average	37	552	4,540	120,095	1,057

*Residential sewer use was calculated using the DOA population estimate.

Recorded wastewater flows at the City WWTF are provided by year in Appendix G and summarized in Table 3-7. 2020 flows and loads through June 30, 2020 have been include in this and subsequent tables because 2020 data is considered the most accurate representation of the major industrial loads following corrections to Saputo's monitoring and sampling system.

Table 3-7 Influent Wastewater Flows

Year	WWTF Influent Flows (MGD)			
	Annual Average	Max Month	Max Week	Max Day
2015	1.704	1.945	2.279	3.102
2016	2.209	3.128	3.940	5.658
2017	2.354	2.856	3.568	4.282
2018	2.547	3.580	5.682	8.454
2019	2.774	3.374	3.841	4.880
2020*	2.541	2.813	3.016	3.780
Average	2.355	2.949	3.721	5.026

*2020 Includes data through June 30, 2020

Influent flows to the WWTF included in Table 3-6 are annual averages, maximum monthly, maximum weekly, and maximum daily flows. The 2019 annual average exceeded the plant design capacity flow of 2.646 MGD. The average max month and max week flows over the period of 2015-2020 exceed the plant design capacity flow of 2.646 MGD. The true peak instantaneous flows to the plant are unknown because the influent gate has been closed down during flooding events and flows have exceeded the 6,000 gpm maximum capacity of the existing influent flow meter.

The City Base flow was calculated for annual averages and maximum months by subtracting the major industries and hauled waste flows from the WWTF influent. Table 3-8 provides a summary of the city base flow calculations.

Table 3-8 City Base Flows

Year	Annual Average Flows (MGD)				Maximum Month Flows (MGD)			
	WWTP Influent	Major Industrial	Hauled Waste	City Base	WWTP Influent	Major Industrial	Hauled Waste	City Base
2015	1.704	0.318	0.009	1.377	1.945	0.343	0.261	1.340
2016	2.209	0.335	0.011	1.863	3.128	0.384	0.465	2.279
2017	2.354	0.335	0.018	2.001	2.856	0.358	0.562	1.936
2018	2.547	0.394	0.044	2.109	3.580	0.421	0.591	2.568
2019	2.774	0.419	0.024	2.330	3.374	0.480	0.562	2.332
2020*	2.541	0.444	0.032	2.065	2.813	0.503	0.899	1.411
Average	2.355	0.374	0.023	1.958	2.949	0.415	0.557	1.978
Maximum	2.774	0.444	0.044	2.330	3.580	0.503	0.899	2.568

*2020 includes data through June 30, 2020.

3.5.3 Infiltration and Inflow

Infiltration and Inflow (I/I) are two sources of clear water that can enter the collection system and greatly impact influent wastewater flows. After separating I/I as a quantified component in the overall influent flow value, future flow increases can be better determined for actual wastewater flows from the residential, commercial, industrial, and municipal sectors of a community.

Infiltration is groundwater that infiltrates a sewer system through defective pipes, pipe joints, connections, or manholes. Infiltration does not include and, is distinguished from, inflow. Infiltration is generally measured during seasonally high ground water conditions, during a dry period.

Inflow is water other than sanitary flow that enters a sewer system from sources which include, but are not limited to, roof leaders, cellar drains, yard drains, area drains, drains from wet areas, cross connections between storm sewers and sanitary sewers, catch basins, cooling towers, stormwater, surface runoff (including leaking manhole covers), street wash-water, or drainage. Inflow does not include, and is distinguished from, infiltration. Inflow is generally measured during wet weather.

WWTF influent records were evaluated to differentiate between actual wastewater flow and I/I. The dry weather, annual average, sustained wet weather and maximum daily I/I was calculated by subtracting the City billed sewer flow from the various WWTF flows in Table 3-6. In the calculation of wet weather maximum day, maximum week and maximum monthly I/I, the average of the three highest values from 2015 to 2020 (through June 30, 2020) was used. For peak instantaneous flows, the three highest recorded flows for each year were averaged and then the three highest of these values were averaged to arrive at the value. The calculations are provided in Appendix I and the results are summarized below in Table 3-9:

Table 3-9 Existing I/I Values 2015-2020

	I/I Flow (MGD)
Dry Weather Infiltration (Sustained Minimum)	0.870
Wet Weather Infiltration and Inflow	
Annual Average	1.229
Maximum Monthly	2.163
Maximum Weekly	3.815
Maximum Daily	4.792
Peak Instantaneous	7.090

The EPA defines excessive infiltration as average dry weather flow greater than 120 gallons per capita per day. Using the average minimum 2-week sustained flow of 0.870 MGD to represent dry weather flows and the current estimated residential population of 9,639 (Section 2.10), the dry weather flows are approximately 90 gallons per capita per day. While this number does not exceed the EPA guideline for excessive infiltration, it indicates that infiltration may be a significant contributor to flows in the City.

The EPA further defines excessive inflow as average wet weather flows that exceed 275 gallons per capita per day, excluding significant commercial and industrial flow. This is calculated by adding the average city base daily flow (1.958 MGD) to the maximum daily I/I (4.792MGD), which results in a flow of 6.75 MGD and 700 gallons per capita per day. This value exceeds the guideline for excessive inflow, indicating that inflow is a significant contributor to flows in the City.

When compared to the EPA guidelines, the City appears to have significant infiltration and excessive inflow in its collection system. An I/I study was undertaken in 2019 to identify and evaluate sources of clearwater. The study consisted of preliminary flow monitoring to identify the main areas of focus for nighttime flow monitoring, evaluation of plant and lift station data, and three nighttime flow monitoring events during periods of wet weather/high groundwater. The results of the study are summarized in Appendix I. The I/I study identified some areas for televising and repairs, which the City has been implementing, but did not identify any major leaks. As part of the I/I study, the manholes that were flooded during the 2018 flood were inspected and assessed for sources of I/I, resulting in a prioritized list of repairs. The City has been actively addressing these manholes with an annual rehabilitation program.

A previous 2003 I/I study identified many possible sources of I/I including many inflow sources and significant infiltration sources in the interceptor across the wetland in Webb Street area. This resulted in the new Webb Street lift station and new sewers across the wetland to James Street, which eliminated the James Street lift station. The city completed many of the recommended improvement, which have resulted in reduced clear water flows but also minimized house backups in the James Street area.

While the I/I studies have identified improvements for reducing clearwater in the collection system, the peak flows to the WWTF are driven by flooding rather than explicit issues in collection system, and these impacts have increase in the past five years compared to previous planning periods.

3.5.4 Organic and Suspended Solids Loading

Annual average BOD and total suspended solids loadings to the WWTF are provided in Tables 3-10 and 3-11 below, along with the maximum months for each year. The City base load has been calculated by subtracting out the loads from the major industries and hauled waste. The existing base loading is determined by averaging the maximum months because the facility will have to handle the impact of sustained loads. Appendix G, WWTF Flow and Loading Data, contains historical loading tables for each year listed.

Table 3-10 Organic Loading to WWTF

Year	Annual Average BOD (lbs/day)				Maximum Month BOD (lbs/day)			
	WWTP Influent	Major Industrial	Hauled Waste	City Base	WWTP Influent	Major Industrial	Hauled Waste	City Base
2015	6,493	3,367	53	3,072	7,635	4,496	100.7	3,038
2016	6,653	3,463	61	3,129	7,737	4,553	123.3	3,060
2017	6,300	3,358	97	2,845	7,493	3,896	147.2	3,450
2018	7,924	5,487	67	2,370	9,186	6,666	259.6	2,260
2019	8,443	5,665	136	2,642	10,266	6,420	132.8	3,713
2020*	8,670	5,718	174	2,778	9,747	7,239	203.9	2,304
Average	7,414	4,510	98	2,806	8,677	5,545	161	3,104
Maximum	8,670	5,718	174	3,129	10,266	7,239	260	3,713

*2020 includes data through June 30, 2020.

Table 3-11 Solids Loading to WWTF

Year	Annual Average TSS (lbs/day)				Maximum Month TSS (lbs/day)			
	WWTP Influent	Major Industrial	Hauled Waste	City Base	WWTP Influent	Major Industrial	Hauled Waste	City Base
2015	3,804	1,120	127	2,558	4,677	1,633	293.4	2,751
2016	4,619	1,173	138	3,308	6,073	1,612	324.6	4,136
2017	4,952	1,218	199	3,535	5,796	1,437	337.1	4,022
2018	5,460	1,911	170	3,378	6,931	2,362	979.4	3,589
2019	5,488	2,224	291	2,973	6,783	3,112	275.6	3,395
2020*	5,024	1,925	367	2,732	6,085	2,206	463.1	3,416
Average	4,891	1,595	215	3,081	6,058	2,060	446	3,579
Maximum	5,488	2,224	367	3,535	6,931	3,112	979	4,136

*2020 includes data through June 30, 2020.

Using a current population of 9,639, the calculated BOD and TSS per capita loading rates for the City Base are approximately 0.20 lbs of BOD/per capita per day and 0.23 lbs of TSS per capita per day when the commercial, general industrial, and public flows in Table 3-5 are assumed to contribute 250 mg/L of BOD and TSS.

3.5.5 Ammonia/Nitrogen and Phosphorus Loadings

Annual average and highest month influent ammonia/nitrogen loadings to the WWTF are provided in Table 3-12 below. Appendix G, WWTF Flow and Loading Data, contains historical loading tables for each year listed. Ammonia data has not been collected regularly for the major industries, so it is not possible to determine what portion of this load is the City base load. City base loadings for TKN in Chapter 4 are approximated by using a typical value of 40 mg/L.

Table 3-12 Ammonia/Nitrogen Loadings to WWTF

Year	Influent NH_3-N (lbs/day)	
	Annual Average	Highest Month
2015	273	300
2016	282	329
2017	279	318
2018	279	307
2019	323	505
Average	287	352

Annual average and highest month influent phosphorus loadings to the WWTF are provided in Table 3-Table 3-13 below. The City base load has been calculated by subtracting out the loads from the major industries and hauled waste, to be used in the projections in Chapter 4. Appendix G, WWTF Flow and Loading Data, contains historical loading tables for each year listed.

Table 3-13 Phosphorus Loadings to WWTF

Year	**Annual Average Total P (lbs/day)**				**Maximum Month Total P (lbs/day)**			
	WWTP Influent	Industrial	Hauled Waste	City Base	WWTP Influent	Industrial	Hauled Waste	City Base
2015	157.1	92.9	2.2	62.0	180.4	113.1	4.3	63.0
2016	161.3	86.7	2.5	72.0	186.4	102.8	5.2	78.4
2017	180.0	105.1	4.0	70.9	194.2	117.3	6.1	70.7
2018	185.6	140.6	2.8	42.1	223.7	169.9	11.8	42.0
2019	201.3	144.2	5.6	51.5	250.4	170.4	5.4	74.6
2020*	175.7	127.1	7.2	41.4	195.9	139.8	8.5	47.7
Average	176.8	116.1	4.1	56.6	205.2	135.5	6.9	65.7
Maximum	201.3	144.2	7.2	72.0	250.4	170.4	11.8	78.4

*2020 includes data through June 30, 2020.

4. FUTURE DESIGN CONDITIONS

4.1 Community Growth

Future population growth for the City of Reedsburg was projected using past census data, Wisconsin Department of Administration (DOA) population projections and estimates, and the 2012 City of Reedsburg Comprehensive Plan Update. A graph of the population projections for the City of Reedsburg is provided in Appendix B and Table 4-1 summarizes the projections.

Table 4-1 Population Projections

	Census[8]		Estimate[9]	Projection[10]				
	2000	2010	2019	2020	2025	2030	2035	2040
DOA Projection	7,827	9,200	9,639	10,500	11,330	12,080	12,530	12,800
Linear Growth Projection				10,573	11,260	11,946	12,633	13,319

In the City's Comprehensive Plan Update, two population projections out to 2030 were presented, one using DOA projections and one using linear growth based on the average annual population The linear growth projection in Table 4-1 is based on change from 1990-2010 of approximately 137 people per year, extrapolated out to 2040 for an estimated population of 13,319. The DOA projected the 2040 population to be 12,800. The linear growth estimate was determined to be an aggressive projection and, based on current knowledge of the City's developments, the City feels that the DOA projection is the most reasonable and should be used for future planning.

Growth in the commercial, industrial, and public authority sectors was projected based on the City's Comprehensive Plan Update and input from the City, with an estimated 20% growth in the number of customers for each of these sectors. The industrial growth projections do not include future capacity requests by the major industries, which are summarized in the following section.

The projections are summarized in Table 4-2 below and the projection calculations are provided in Appendix J.

Table 4-2 Year 2040 Growth Projections

Sector	Increase
Residential	3,161 capita
Commercial	76 customers
Public Sector	10 customers
General Industrial	8 customers

4.2 Major Industry Requests

Growth for the three major industries, Saputo, Foremost, and Bioriginal, was determined through discussions and correspondence with company representatives. The City formally requested capacity needs in a letter to each industry in July 2018 and had initial discussions with each industry in September and October 2018. The meetings with industries also included an

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[8] U.S. Census Bureau Data
[9] Wisconsin Department of Administration, Municipal Final Population Estimates, January 2019
[10] Wisconsin Department of Administration, Municipal Population Projections, 2010-2040

inspection of sampling and flow monitoring facilities with follow-up investigations and corrections to ensure accurate data from the industries. A second letter was sent to the industries in May 2020, followed by meetings to finalize capacity projections and needs. The future capacity needs for each industry are summarized as follows:

- Saputo has no immediate/known plans for growth or expansion. Their annual average and maximum month flows and loads from 2018-2020 were used for capacity projections for facilities planning.
- Foremost has had one recent increase in production in 2018 and plans to have two additional similar increases in the future. These production increases were estimated by using the increase between their 2015-2017 data and their 2018-2020 data. Two increases of this magnitude were added to the annual average and maximum months from 2018-2020 for future capacity needs.
- Bioriginal does not plan to expand its facility but intends to maximize the use of its existing production capacity. June 2020 was used as an example of the maximum flow to be expected from their facility when they are running at full capacity. For future capacity needs, annual average flow and loadings are based on their 2018-2020 averages, the maximum month flow is the 4-week average from June 2020, and the maximum loads are based on 2018-2020 maximum month concentrations multiplied by the June 2020 maximum flow.

The projections based on these requests are provided in Appendix J and are included in the subsequent sections. Since the future requests and current discharges exceed the ADLs described in Section 3.5.1 and Table 3-4, the existing agreements with the three major industries will need to be re-negotiated as part of the WWTF planning process.

4.3 Wastewater Flows

The design flow rates for the Reedsburg WWTF will include the main components listed below:

- Existing City Base
- Future City Base Increases
- Additional Contributors
- Major Industry Requests
- Unallocated Industrial
- Clear Water Infiltration and Inflow

The existing City base flow is the sum of the residential, commercial, general industrial, and public authority billed sewer flow, as presented in Section 3.5.2, and excludes major industries, additional contributors, and I/I.

Future City base increases, including residential, commercial, general industrial, and public authority are based on the expected growth shown in Table 4-2. The future residential increase is based on the population growth shown in Table 4-2 multiplied by the calculated gallons per capita for existing flows. The future commercial, industrial, and public authority expansion is based on the customer growth projections shown in Table 4-2 multiplied by the calculated flow per customer by current customers in each sector.

Additional contributions come from acceptance of septage and/or holding tank wastewater from outside sources wastes. An additional contribution of 8,000 gallons per day of septage hauling (high-strength), 500 gallons of medium-strength septage hauling, and 18,000 gallons per day of holding tank waste are included in the projected contributions. The City currently accepts approximately 6 to 7 Million gallons per year of hauled wastes and these volumes are consistent with current volumes accepted.

The major industry requests presented in Section 4.2 are included in the future design flows along with an allocation for a future unidentified major industry to allow for some unforeseeable industrial growth. In accordance with NR 110, this additional allowance may not normally exceed 5%, or 10% for municipalities with less than 10,000 population, of the total average design flow exclusive of the allowance, or 25% of the total industrial flow, existing plus documented future, whichever is greater. For Reedsburg, 25% of the total industrial flow and load was used for unallocated industrial sources.

Current infiltration and inflow quantities were established in Table 3-9; however these values include periods of flooding when portions of the City and its collection system became inundated with floodwater and flows to the WWTF were greater than the plant can handle. During flood events, the gate on the influent interceptor to the wet well must be almost all the way closed to limit flow to the plant and prevent plant flooding. In planning for future plant capacity, it is not practical or cost-effective for the City to pump and provide treatment for all of the flow during periods when the river and portions of the City are flooded, and backups and basement flooding will still occur during extreme events regardless of what flow is processed by the WWTF. Therefore, the daily and peak instantaneous flows I/I flows that can reasonably be handled by the plant were estimated by excluded days that the Baraboo River stage was higher than 17 feet. This river stage represents a major flood event when a good portion of City is underwater, with and basements and historic City facilities being flooded. Based on past data, the 17-foot river stage is also correlated with a substantial increase in influent flows to the WWTF. Table 4-3 presents the I/I flows with and without the data on days when the river state exceeded 17 feet, which was 6 days from 2015 – June 2020. The I/I flows without the flood data have been used for the 2040 projected flows.

Table 4-3 Existing I/I Values 2015-2020

	I/I Flow (MGD) All Data	I/I Flow (MGD) Without Flood Data
Dry Weather Infiltration (Sustained Minimum)	0.870	0.845
Wet Weather Infiltration and Inflow		
Annual Average	1.229	1.216
Maximum Monthly	2.163	2.087
Maximum Weekly	3.815	2.932
Maximum Daily	4.792	3.772
Peak Instantaneous*	7.090	7.090

*Flow measurement could not be recorded above 6,000 gpm

The design flows are calculated by summing the current city base flow, future city increases, additional contributor loading, requested major industrial projections, and the existing and future additional I/I values. Both annual average and maximum month flows are calculated, but it is intended that maximum month values will be used for design

The maximum daily flow value is determined by summing the annual average values for current base flow, future base increases and major industrial, multiplying this sum by a peaking factor of 2.05; and adding this value to the maximum daily I/I, future additional sustained I/I, and additional contributions. The peaking factor was determined by taking the City Base plus Major Industrial Max Day values divided by the City Base plus Major Industrial annual averages for 2015-2020 data. The peak hourly flow value is calculated similarly to the maximum daily flow with the exception that the peak instantaneous I/I number is used rather than the maximum daily I/I.
The future flow projection calculations are provided in Appendix J and summarized in Table 4-4.

Table 4-4 Future Flow Projections – Year 2040

Contributor	Quantity	Rate	Design Flow MGD	Subtotals
1a. City Base - Annual Average				
Residential	9,639 capita	37 gpcd	0.352	
Commercial	376 customers	552 gpcd	0.208	
Public	47 customers	1,057 gpcd	0.050	
General Industrial	36 customers	4,540 gpcd	0.163	0.773
1b. City Base – Max Month				
Residential	9,639 capita	41 gpcd	0.396	
Commercial	376 customers	609 gpcd	0.229	
Public	47 customers	1,740 gpcd	0.082	
General Industrial	36 customers	5,966 gpcd	0.215	0.921
2a. Future City Increases - Annual Average				
Residential	3,161 capita	37 gpcd	0.116	
Commercial	76 customers	552 gpcd	0.042	
Public	10 customers	1,057 gpcd	0.011	
General Industrial	8 customers	4,540 gpcd	0.036	0.204
2b. Future City Increases – Max Month				
Residential	3,161 capita	41 gpcd	0.130	
Commercial	76 customers	609 gpcd	0.046	
Public	10 customers	1,740 gpcd	0.017	
General Industrial	8 customers	5,965 gpcd	0.048	0.241
3. Additional Contributors				
Septage Hauling			0.008	
Medium Septage Hauling			0.0005	
Holding Tank Waste			0.018	0.026
4A. Future Major Industry Requests - Annual				
Foremost			0.128	
Saputo			0.117	
Bioriginal			0.204	
Unallocated Industrial			0.112	0.561
4B. Future Major Industry Requests – Max Month				
Foremost			0.188	
Saputo			0.131	
Bioriginal			0.314	
Unallocated Industrial			0.158	0.791
5. Clear Water Infiltration/Inflow				
Existing Max Month			2.087	
Future Max Month	3,161 capita x 40 gpcd		0.126	
Future Reduction	No reductions assumed		0	
Daily Wet Weather Inflow			3.772	
Instantaneous Inflow			7.090	
Annual Average Flow (MGD)				2.907
Design Sustained Flow (MGD)				**4.192**
Maximum Daily Flow (MGD)				7.098
Peak Hourly Flow (MGD)				10.416

4.4 Organic and Suspended Solids Loadings

Historical loading data from 2014 through 2019, as summarized in Table 3-10 were used to establish the current annual average and maximum month loadings for BOD and TSS being processed at the WWTF.

The future residential increase is based on the population growth shown in Table 4-2 multiplied by the calculated per capita load from current residential customers for both BOD and TSS. Typical concentrations of 250 mg/l for both BOD and TSS were used to determine the commercial expansion, public sector growth, and general industrial expansion. The requested loadings of the main industries are included separately.

The additional contributions from septage waste was multiplied by concentrations of 3,640 mg/L BOD and 20,000 mg/L TSS, and 2,000 mg/L BOD and 10,000 mg/L TSS for medium-strength septage hauling. The additional contributions from holding tank waste was multiplied by concentrations of 600 mg/L BOD and 1,000 mg/L TSS. The concentrations were based on typical values and sampling data from past hauled wastes.

A summary of these projected design future loadings is given in Table 4-5 and detailed calculations are provided in Appendix J.

Table 4-5 BOD and SS Loading Projections – Year 2040

	BOD (lbs/day)	TSS (lbs/day)
1. City Base Loading		
Annual Average	2,806	3,081
Design Sustained	3,104	3,579
2a. Future City Increases - Annual Average		
Residential	632	727
Commercial	88	88
Public	22	22
General Industrial	76	76
2b. Future City Increases – Max Month		
Residential	632	790
Commercial	96	96
Public	36	36
General Industrial	100	100
3. Additional Contributors		
Septage Hauling	243	1,334
Medium Septage Hauling	8	42
Holding Tank Waste	88	146
4A. Future Major Industry Requests - Annual		
Foremost	1,745	1,528
Saputo	3,581	1,033
Bioriginal	1,217	315
Unallocated Industrial	1,636	719
4B. Future Major Industry Requests - Max Month		
Foremost	2,403	2,868
Saputo	4,350	1,357
Bioriginal	2,393	833
Unallocated Industrial	2,287	1,264
Annual Average Loading (lbs/day)	12,141	9,110
Design Max Month Loading (lbs/day)	**15,741**	**12,444**
Current Rated Capacity	**6,331**	**5,048**

4.5 Nutrient Loadings

Influent phosphorus sampling has been collected at the WWTF and major industries since 2016. Ammonia data is available for the WWTF influent but has not been collected for the major industries. Historically, no influent TKN testing has occurred. A combination of WWTF influent data and typical values was thus used to project nutrient loadings for TKN and phosphorus. For City base TKN loading, a typical value of 40 mg/L was used. The City base phosphorus loading was calculated using the annual average of 2015-2019 for annual conditions, and an average of the maximum months of 2015-2019 was used to calculate sustained conditions. Future City increases used typical concentration values of 40 mg/L TKN and 7 mg/L total phosphorus. For the additional contributors, concentrations of 400 mg/L TKN and 180 mg/L phosphorus are assumed for septage hauling, 200 mg/L TKN and 100 mg/L phosphorus are assumed for medium-strength septage hauling, and 200 mg/L TKN and 24 mg/L phosphorus are assumed for holding tank waste.

These concentrations were multiplied by the flow rates established in Table 4-2 to determine the projected nutrient loadings. The requested loadings of the main industries are included separately. A summary of these calculations is given below in Table 4-6.

Table 4-6 Future Nutrient Loadings – Year 2040

	TKN (lbs/day)	P (lbs/day)
1. City Base Loading		
Annual Average	258	57
Sustained	307	66
2a. Future City Increases - Annual Average		
Residential	39	7
Commercial	14	2
Public	4	1
General Industrial	12	2
2b. Future City Increases - Max Month		
Residential	43	8
Commercial	15	3
Public	6	1
General Industrial	16	3
3. Additional Contributors		
Septage Hauling	27	12
Medium Septage Hauling	1	0
Holding Tank Waste	29	4
4a. Future Major Industry Requests – Annual Average		
Foremost	135	39
Saputo	47	56
Bioriginal	50	60
Unallocated Industrial	58	39
4b. Future Major Industry Requests - Max Month		
Foremost	186	53
Saputo	57	65
Bioriginal	98	148
Unallocated Industrial	85	67
Annual Average Loading (lbs/day)	673	279
Design Max Month Loading (lbs/day)	**871**	**429**
Current Rated Capacity	**815**	**205**

4.6 Future Effluent Limitations

As part of the facilities planning process, an effluent limit request was made to the Water Resources Section of the WDNR for the current outfall location. Copies of correspondence regarding this request are included in Appendix K and a summary of the preliminary effluent limits as calculated by the WDNR is given below in

Table 4-7. The proposed limits are very similar to the existing limits, with the addition of an E. coli limit and the phosphorus mass limit based on the Wisconsin River TMDL.

Table 4-7 Projected WPDES Permit Limits at Existing Outfall

Parameter	Proposed Limits
BOD_5 (monthly average)	30 mg/L
BOD_5 (weekly average)	45 mg/L (October through May) 37 mg/L (June) 32 mg/L (July, August) 39 mg/L (September)
BOD_5 (weekly average)	810 lbs/day (June) 720 lbs/day (July, August) 850 lbs/day (September)
TSS (monthly average)	30 mg/L
TSS (weekly average)	45 mg/L (October through May) 37 mg/L (June) 32 mg/L (July, August) 39 mg/L (September)
TSS (weekly average)	810 lbs/day (June) 720 lbs/day (July, August) 850 lbs/day (September)
Nitrogen, Ammonia (NH_3-N) (daily maximum)	34 mg/L (November through April)
Nitrogen, Ammonia (NH_3-N) (monthly average)	17 mg/L (January, February, October, December) 22 mg/L (March, November) 28 mg/L (April) 18 mg/L (June) 14 mg/L (July, August) 23 mg/L (September)
Nitrogen, Ammonia (NH_3-N) (weekly average)	34 mg/L (November through April) 37 mg/L (June) 28 mg/L (July) 29 mg/L (August) 48 mg/L (September) 35 mg/L (September)
Fecal Coliform Interim Limit (monthly average)	400 # / 100 mL (May through September)
E.coli Final Limit (monthly average)	126 # / 100 mL (May through September)
pH Field (daily maximum)	9.0 su
pH Field (daily minimum)	6.0 su
Phosphorus Interim Limit (monthly average)	1.0 mg/L
Phosphorus Final Limit (monthly average)	12 lbs/day
Mercury	5.5 ng/L
Chronic Whole Effluent Toxicity	3.8 TU_c

With a phosphorus mass limit of 12 lbs/day based on the Wisconsin River TMDL, this equates to an effluent phosphorus concentration of approximately 0.5 mg/L at the projected annual average design flow (2.907 MGD) and approximately 0.35 mg/L at the projected maximum month design flow (4.192 MGD). At the current maximum month flow from Table 3-7 (2.949 MGD), an effluent phosphorus concentration of approximately 0.49 mg/L would be need to meet the mass limit.

4.7 Design Summary

A summary of the projected design parameters established in the preceding sections are given in Table 4-8.

Table 4-8 Design Loading Summary

Design Parameter	2040 Design Year
Projected Population	12,800
Flow Rates (MGD)	
Annual Average	2.907
Maximum Month	4.192
Maximum Daily	7.098
Peak Hourly	10.416 (7,229 gpm)
Sustained Pollutant Loadings (lbs/day)	
BOD	15,741
Suspended Solids	12,444
TKN	871
Phosphorus	429

5. PROJECT ALTERNATIVES

5.1 Overview and Need for the Project

As noted in Section 1.1, the purpose of this Facilities Planning Document is to evaluate alternatives for upgrading the City of Reedsburg's existing WWTF to maintain compliance with current and future permit requirements and provide additional capacity to meet the City's needs for the next 20 years. The following sections summarize the need for the upgrade.

5.1.1 Growth

The City of Reedsburg and its industries have grown steadily over the past several years, resulting in increasing influent loads to the WWTF. The plant is currently overloaded based on average flows and loads, and severely overloaded during periods of peak loads and high flows. While the plant has been marginally able to process the increased loads and continue meeting its effluent limits, slug or peak loads have caused operational hardships. Additional capacity will be needed to meet the City's needs for the next 20 years, with the 20-year design loads defined in Chapter 4.

5.1.2 Aging Infrastructure

Some processes and equipment at the Reedsburg WWTF are reaching the end of their useful life and need replacement or upgrading. The following needs were identified in Chapter 3:

- Replace aging grit chamber drive and add grit chamber baffles to improve capacity
- Repair/replace aging clarifier drive units and paint clarifier equipment
- Replace Structure 20 rectangular clarifiers, which have reached the end of their useful life
- Repair/replace aging trickling filter piping, valves and equipment
- Retire old backup blowers due to difficulty of continued operation and maintenance.
- Replace aging aeration diffusers
- Replace WAS pump, which is at end of its useful life, and add redundant WAS pump
- Replace aging RAS pumps
- Retire/replace Control Building (Structure 50) given its age and condition
- Replace aging trickling filter pump and primary clarifier pumps
- Replace aging holding tank covers, blowers, enclosures, piping, and valves and address diffuser fouling
- Demolish unused intermediate clarifier
- Replace aging Andritz centrifuge and lime silo auger, new polymer system
- Replace aging stormwater pump and check valves in stormwater pumping station to ensure continued operation during flood events
- Replace any piping over 40 years and any non-functional yard piping valves
- Replace aging air compressors in Headworks building
- Replace aging MCCs/electrical components including obsolete controls on standby generator
- Provide general buildings improvements as needed, including architectural and HVAC improvements and painting

Additional details are provided in Sections 3.2 and 3.3

5.1.3 Health, Sanitation, and Security

The most significant issue related to health, sanitation, and security for the Reedsburg WWTF is the potential for flooding. The existing WWTF lies within the floodway of the Baraboo River and is susceptible to flooding, with major flooding of the plant occurring in 2008 and near flooding in

2018. The WWTF site is protected by a berm, which was raised after the 2008 flooding, but the 2018 flood elevation was higher than the 2008 flood and demonstrated the ongoing susceptibility of the WWTF to extreme weather events. When the river stage is higher than 17 feet, the WWTF experiences a substantial increase in influent flows due to basements and portions of the City being flooded. During these events, WWTF staff must take measures to limit the influent flow to the plant to prevent flooding/washout. Also, there is no dry land access to the WWTF during a flood and staff must resort to access via boat or a large utility vehicle such as an end loader.

In addition to the flooding concerns, there is a need to address health, sanitation, and security concerns at the existing facility due to aging infrastructure and equipment. As equipment and processes reach and surpass the end of their useful lives, there is a greater chance of decreased treatment efficiency and biological upsets are more likely to occur. A decrease in treatment reliability poses a sanitation health risk to recreational users in the receiving stream and operations staff. Permit requirements related to effluent discharge are covered in the following section.

5.1.4 Permit Requirements

The plant is generally meeting current permit requirements, as documented in the Compliance Maintenance Annual Reports (CMARs) in Appendix L, however there are numerous incidents when influent flow or loading has exceeded the rated design capacity of the WWTF. Additionally, phosphorus treatment has been challenging when the plant is overloaded or receives slug loads. Upgrades will be needed to ensure compliance with plant's WPDES permit limits.

With the approval of the site-specific criteria for the Wisconsin River TMDL, the phosphorus WLA for Reedsburg WWTF will be significantly reduced for future permit terms. As shown in Table 4-7, a mass limit of 12 lbs/day as a monthly average is expected for the current outfall location, in addition to the existing limit of 1 mg/L, monthly average. To meet the mass limit an effluent concentration of less than 1 mg/L would be required for both current and future flows, as described in Section 4.6. During times when the plant is overloaded it is difficult to meet the current 1 mg/L limit, and upgrade of the treatment plant would be required to meet the monthly mass limit that is expected with the next permit term.

5.1.5 Hydraulic and Loading Capacity

Some components of the WWTF require upgrade, replacement, or modification to provide treatment of the future flows and loads described in Chapter 4. The specific issues that have been identified for existing flows and loads are described in Section 3.2 and are summarized in Section 3.3. The following list summarizes hydraulic and capacity-related issues for the WWTF for both current and future flows and loads:

- Raw Wastewater Lift Station – The raw wastewater pumps and piping are aging and are and inadequate for handling current and future peak flows. Replacement of the existing four pumps with five new pumps and additional conveyance piping for the 5th pump are required to accommodate current and future sustained and peak flows.
- Preliminary Treatment – The existing screening and grit removal facilities cannot hydraulically handle current and future peak flows. An additional screen and associated channel modifications and equipment would be needed to handle the projected flows. Baffles could be added to the existing grit chamber to improve capacity for peak flows.
- Significant primary treatment upgrades are required due to aging equipment/structures and the need for additional hydraulic capacity, including repairs to the existing fermenter, replacement of the rectangular clarifiers. In order for the existing plant to handle the increased flow and BOD loadings with limited available space, a mechanical primary

filtration system is recommended to augment primary treatment during peak flows. This would involve addition a splitter box following grit removal and installation of filtration equipment. A Salsnes Filter system with rotating filtermesh has been assumed for this process. Chemically enhanced primary treatment would provide additional BOD and TSS removal upstream of the biological treatment processes.

- The existing aeration basin volume is not sufficient for future flows and loads. Addition of a fourth aeration basin is needed, with additional blowers to supply the aeration system. The existing blower building has space for two additional blowers. Integrated fixed-film activated sludge (IFAS) could be used to extend the capacity of existing and future tankage. IFAS systems use attached-growth media to increase the activated sludge treatment capacity by increasing the amount of biomass available to do the work.
- WAS Thickening is recommended to extend the capacity of the existing sludge handling systems. Dissolved air floatation (DAF) has been assumed for all WAS thickening options, but other technologies could be evaluated during design.
- The existing plant has both chemical phosphorus removal (ferric addition) and biological phosphorus removal with selector basins but additional treatment would be need to meet future limits. Disc filtration has been assumed as the tertiary phosphorus treatment for all options, but other technologies could be evaluated during design. It has been assumed that chemical feed storage would be moved to the new disk filter structure and the storage capacity would be increased to allow for full truckload deliveries and to meet future needs. The addition of disk filtration will also require additional pumping facilities because the hydraulic profile with the existing clarifiers does not have sufficient head available to accommodate a new process without effluent pumping.
- The final clarifiers are marginal for existing and future peak flows. NR 110 code requires an overflow rate of 1,200 gpd/sf for peak hourly flows and 1,000 gpd/sf is desirable according to Ten States Standards. The existing clarifiers can handle 8.8 MGD at 1,000 gpd/sf but additional capacity would be needed to provide reliable treatment at the future peak hourly flow rate of 10.4 MGD.
- The existing MLSS Pumping and UV disinfection facilities do not have the hydraulic capacity to meet peak flows and must be upgraded.
- Sludge processing capacity must be upgraded to meet future loads, including the additional capacity for dewatering (centrifuge), stabilization, and centrate pumping.
- Additional sludge storage capacity is needed as the existing facilities are not adequate for current or future loads. Off-site sludge storage is assumed because the current site does not have room for additional storage.
- The Waste Receiving Station (Structure 55) has adequate capacity but screening facilities are needed to address pump plugging.
- The pumps in the Zinga lift station must be replaced to increase capacity.
- The majority of the site piping must be upsized to convey the projected peak flows without backups or overtopping of structures.
- An additional standby generator is needed to accommodate the increased electrical loads for upgraded and new process equipment.

5.1.6 Summary of Upgrade Requirements

Significant upgrades are needed at the Reedsburg WWTF to ensure compliance with current and future WPDES limits, replace aging equipment and infrastructure, provide treatment of the future flows and loads, allow for reasonable growth, and address flooding risks. As noted in the preceding sections, almost every major structure and process will require replacement, modification, or expansion to meet these needs. Available space at the facility is limited by the berm that separates the facility from the surrounding floodplain.

5.2 General Summary of Alternatives

5.2.1 Alternate Treatment Plant Sites

Two types of alternatives were considered in this facilities plan, those using the existing treatment plant site with upgrades to existing equipment and structures, and those with construction of a new WWTF at a different site. The City wanted to consider a new WWTF site as part of this planning effort because the existing WWTF site is susceptible to flooding and has limited room for expansion within the existing bermed area.

NR 110 code requires that treatment facilities be located such that they are not subject to flooding and have dry land access, defined as a service road which has a minimum elevation of at least one foot above the regional flood elevation. These requirements cannot be waived for any existing treatment facility that is located in a floodway unless the construction costs of expansion or upgrading of the facility is less than 50% of the value of the facility. The NR 110 code states that "The value of the existing facility shall be calculated by subtracting the 20-year total present worth of expanding or upgrading the existing facility from the 20-year total present worth of the most cost-effective treatment alternative located at another site which is not in a floodplain." The capital and net present worth costs developed in Chapter 6 will be used to evaluate the need to relocate the Reedsburg WWTF out of the floodway.

The City has identified potential locations for a new plant site and effluent planning limits were requested from the DNR for the following sites and outfall locations:

New WWTF Site #1 – East of the airport and new public works garage (existing dog park site), north of the Baraboo River, with two proposed outfall locations:

- Outfall Option A – to adjacent ditch in SW ¼ of the SW ¼ Section 12, T12N, R4E, Town of Reedsburg (43.52533° N and 89.97343° W).
- Outfall Option B – to Baraboo River in SE ¼ of the NW ¼ Section 24 T12N, R4E, Town of Reedsburg (43.50600° N and 89.96426° W).

New WWTF Site #2 – West of the existing WWTF, south of the Baraboo River, with one proposed outfall location:

- Outfall Option C - to Baraboo River in NW ¼ of the NW ¼ Section 15, T12N, R4E, Town of Reedsburg (43.52404° N and 90.00974° W).

Regulatory correspondence regarding the planning effluent limits is provided in Appendix K. According to the DNR February 10, 2021 planning limit memorandum, the following impacts to limits and permit requirements would result from building a new treatment plant and relocating the discharge to one of the proposed outfall sites:

- A mercury variance would not be approvable at Outfall Option A, because the relocated discharge is highly likely to cause a lowering of currently attained water quality (instream mercury concentrations are estimated to be well below effluent concentrations.) For this reason, Outfall Option A is not considered a feasible option and limits were not calculated for this location.
- In order to allow a continued mercury variance at Outfall Option C, instream mercury monitoring data must demonstrate that the relocated discharge will not cause a lowering of currently attained water quality (effluent mercury concentrations must be lower than instream concentrations).
- The relocated discharge would be able to retain the TMDL WLA of 2,954 lbs/year for total phosphorus at Outfall Options B and C. If the permittee requests additional wasteload

allocation to cover the increase in design flow rate at the facility, the facility will need to demonstrate that the antidegradation and antibacksliding requirements in ch. NR 207, Wis. Adm. Code, are met.

- The discharge must comply with the final TMDL phosphorus limits immediately after construction of the new plant and the allowed start-up period.
- At Outfall Options B and C, ammonia and BOD5 limits would be more stringent than the existing outfall location, with a slight lowering of limits at Outfall B and a more significant lowering of limits for Outfall C. For both Outfall B and C, the limits could be set equal to the current permit limits if the City makes the necessary demonstrations to receive limits based on the full assimilative capacity of the receiving water body.

Specific details for the planning limits are provided in Appendix K. Of the two potential plant sites that were considered, Site #1 is preferred by the City because it uses land already owned by the City, is close to the City's new public works facility, and has slightly more favorable effluent limits than Site #2. For the purposes of this facilities plan, Site #1, the City's current dog park site, has been used for developing cost estimates and comparing alternatives.

5.2.2 Pretreatment Alternatives

Alternatives were also developed to evaluate the possibility of providing pre-treatment for the major industries rather than treating the full design load at the WWTF. There are many options for providing pre-treatment, either at each industrial site individually or at a combined pre-treatment facility that is either operated by the industries or by the City. For the purposes of this facilities plan it has been assumed that a municipally-operated pre-treatment facility would be constructed at a new site near the City's new public works facilities on the east side of the City (WWTF Site #1, Dog Park Site).

This pre-treatment facility was assumed to treat Saputo and Bioriginal wastewater to domestic strength waste. Pretreatment was not assumed for Foremost because they do not have room to install their own pretreatment system on-site and their location would be the most difficult to convey raw wastewater to the assumed pretreatment site. However, the assumed pre-treatment system is modular and could be expanded to accommodate Foremost if desired. With the assumed treatment arrangement, industrial waste would undergo pre-treatment at the Dog Park Site and the effluent would be discharged to the existing WWTF via the existing gravity sanitary sewer. A similar pre-treatment arrangement was also considered for the new plant alternatives, with a separate pre-treatment facility at the new plant site and discharge to the headworks of the new WWTF.

Loading projections were developed for the pretreatment options using the same methodology described in Chapter 4. For the pretreatment facility, the flows and loads are assumed to be the full strength wastewater from Bioriginal and Saputo. The flows and loads for the municipal WWTF are the same as those developed in Tables 4-4, 4-5, 4-6 with the exception that domestic strength waste was assumed for Saputo and Bioriginal. Table 5-1 summarizes the flows and loads for the municipal WWTF with and without pre-treatment.

Table 5-1 Design Loading Summary with and without Pretreatment

Design Parameter	2040 Design Year (No Pretreatment)	2040 Design Year with Pretreatment
Flow Rates (MGD)		
Annual Average	2.907	2.907
Maximum Month	4.192	4.192
Maximum Daily	7.098	7.098
Peak Hourly	10.416 (7,229 gpm)	10.416 (7,229 gpm)
Sustained Pollutant Loadings (lbs/day)		
BOD	15,741	8,471
Suspended Solids	12,444	10,635
TKN	871	839
Phosphorus	429	198

As shown in Table 5-1, pretreatment reduces the organic, solids, and nutrient loading to the City's WWTF, with an estimated influent BOD load of approximately 8,500 lbs/day, but does not reduce the quantity of wastewater that must be treated. The existing WWTF would have sufficient sludge processing and aeration capacity for this loading, but substantial upgrades would still be required to accommodate the design hydraulic loads and replace existing equipment. However, pretreatment would free up capacity at the existing facility and extend the amount of time that the City can continue to use this site.

5.3 Existing Treatment Plant Upgrade Alternatives

Three different alternatives were evaluated for upgrading facilities at the existing WWTF site. Alternatives 1A and 1B were designed with an average flow of 4.2 MGD, a peak flow of 10 MGD, and an average BOD loading of 15,750 lbs/day, which represents the projected growth of the City and the industries in the next 20 years. Under these alternatives, all flows and loadings are discharged directly to the treatment plant, with the difference being in the secondary treatment processes. Alternative 2 has the same average and peak flows as Alternatives 1A and 1B, but would have a reduced BOD loading rate of approximately 8,500 lbs/day due to the addition of industrial pre-treatment.

5.3.1 Alternative 1 – Upgrade Existing Facility

Design WWTF Capacity: 4.2 MGD, 15,750 lbs/day BOD

Alternatives 1A and 1B would utilize the existing facility. The existing facility needs additional capacity to be able to treat the projected loadings that it will be experiencing. Alternative 1A would upgrade/replace the majority of the existing equipment/processes and add several new processes to achieve the required flow and BOD capacity. The sludge produced during the treatment process would remain being treated to a Class A biosolid via lime stabilization and an off-site sludge storage building would be built near the new public works building.

<u>1A: Existing Site Upgrade</u>

In addition to the upgrades needed for the existing site facilities, the following will be added:

- Primary filters
- Chemically enhanced primary treatment
- Upgrade activated sludge to IFAS in conjunction with addition of a fourth aeration basin.
- Tertiary disc filtration for phosphorus removal

- UV treatment – replace existing, downstream of tertiary filtration.
- Effluent pumping after tertiary filtration
- WAS thickening (DAF)
- Additional centrifuge and polymer for sludge dewatering
- Additional lime silo and Bioset sludge stabilization system at existing Sludge Processing Building
- Off-site sludge storage
- Additional standby generator

1B: Existing Site plus Class A TPAD

Alternative 1B would require similar WWTF improvements to Alternative 1A, however sludge would be treated to Class A biosolids via temperature phased anaerobic digestion (TPAD) rather than lime stabilization.

The upgrades would be same as those listed for Alternative 1A, with the exception of the lime/Bioset system and the addition of the following:

- Repurpose sludge and centrate storage to thermophilic digesters, add mesophilic digester
- New sludge processing building with sludge batch tanks, sludge pumping, digester heating, and biogas utilization
- New centrate storage

With the addition of anaerobic digestion to the treatment system, there is the potential to beneficially reuse biogas that is produced to generate electricity. A cogeneration facility has been included in this alternative as a potential enhancement that could part of the plant upgrade or added at a later time.

5.3.2 Alternative 2 – Upgrade Existing Facility and Industrial Pre-treatment

Design WWTF Capacity: 4.2 MGD, 8,500 lbs/day BOD

Design Pretreatment Capacity: 0.6 MGD, 8,000 lbs/day BOD

Alternative 2 would be similar to Alternative 1A, requiring upgrades to the existing facility to achieve an increased flow and BOD capacity, however the BOD capacity improvements would be limited as industrial pre-treatment would also be constructed to treat Saputo and Bioriginal to a domestic strength waste. For the purposes of this plan it has been assumed that the pre-treatment facilities would be built near the new public works facilities. Industrial waste would undergo pre-treatment and the effluent would be discharged to the existing treatment via the existing gravity sanitary sewer. Sludge would be produced at the industrial pre-treatment site, but because there would be no human waste being treated; the sludge would not need treatment. Improvements to the existing WWTP would be limited as compared with Alternative 1. A sludge storage building would also be built at the pretreatment site to provide additional storage for the municipal biosolids.

The modifications to the sludge processing would be similar to alternative 1A, with the replacement of the Andrtiz centrifuge and the lime silo auger and the addition of a second lime silo, but an additional Bioset system would not be needed.

In additional to the existing site facilities, the following will be added:

- Primary filters
- Chemically enhanced primary treatment
- Additional aeration basin (no IFAS)
- Tertiary disc filtration for phosphorus removal
- UV treatment

- Effluent pumping
- WAS thickening (DAF)
- Off-site sludge storage
- Additional standby generator

Industrial Pretreatment would include the following:

- Saputo & Bioriginal pump station to new site
- Industrial equalization tank
- DAF primary treatment
- MBBR biological treatment
- Clarification (final clarifier)
- Anaerobic treatment of biosolids
- Centrifuge dewatering of industrial waste
- Sludge storage for municipal and industrial waste
- Standby generator

5.4 New Treatment Plant Alternatives

For construction of new treatment plant, alternatives were considered without industrial pretreatment (Alternative 3) and with industrial pretreatment (Alternative 4).

For the purposes of this evaluation, the Dog Park Site, located adjacent to the new public works garage, has been assumed as the new site for Alternative 3 and 4. If the City decides to move forward with a new facility, a more formal siting investigation could be pursued.

All of the new treatment plant alternatives include the following:

- Demolition at existing WWTF site
- A new main lift station built near the existing plant with a dual force main (18" assumed) extending to the location of the new WWTF
- Upgrades to the Zinga lift station
- A new administration building and service garage at the new plant site
- Effluent discharge to the Baraboo River, with the currently assumed routing following S Golf Course Road. A 48" gravity outfall was assumed.

For all new site alternatives, Class A sludge treatment is assumed. The City wants to continue producing Class A biosolids to provide the most flexibility for beneficial reuse and disposal.

5.4.1 Alternative 3 – New WWTF

Design WWTF Capacity: 4.2 MGD, 15,750 lbs/day BOD

Alternatives 3A, 3B, 3C, and 3D involve construction of a new wastewater treatment facility to treat 100% of the wastewater generated within the City. The treatment processes at the new site are outlined for each of four options below.

3A: New Site: Conventional Treatment plus Class A Lime Stabilization

Alternative 3A would utilize conventional activated sludge treatment and Class A lime stabilization, similar to the existing WWTF.

The facilities at the new site will consist of:

- Headworks (screening and grit removal)
- Selector basins
- Aeration basins

- Blower building
- Final clarifiers
- Tertiary disc filtration for phosphorus removal
- UV Treatment
- WAS thickening (DAF)
- Sludge Holding
- Centrifuge sludge dewatering
- Centrate and sludge holding tanks
- Bioset/lime sludge stabilization
- Sludge storage
- Waste receiving
- Standby generators
- On-site lift station

3B: New Site: Conventional Treatment plus Class A TPAD

Alternative 3B would utilize conventional activated sludge treatment and Class A temperature phased anaerobic digestion (TPAD).

The treatment facilities will be similar to Alternative 3A, with the exception of the Bioset/lime stabilization equipment and the addition of the following:

- Primary clarifiers
- Solids Treatment Building with batch tank, heat exchangers, thermophilic and mesophilic digesters, and centrifuge

Alternative 3B includes two potential enhancements for the digestion system that would reduce operating costs and improve treatment efficiency. The following enhancements could be included as part of the initial plant construction or added at a later time:

- Cogeneration for beneficial biogas utilization
- Sidestream treatment of digester supernatant for phosphorus/nutrient removal.

3C: New Site: Conventional Treatment plus Class B Digestion plus Class A Drying

Alternative 3C would utilize conventional activated sludge treatment, class B mesophilic digestion, and Class A sludge drying.

The treatment facilities and potential enhancements will be the same as Alt 3B, with the exception of the thermophilic digesters and the addition of the following:

- Class A sludge drying
- Biosolids storage silos

3D: New Site: Conventional Treatment plus Class A Drying

Alternative 3D would utilize conventional activated sludge treatment, no digestion, and Class A sludge drying. The facilities at the new site would be the same as Alt 3C except that there will be no heat exchangers/digesters, just an aerated sludge holding tank prior to drying.

The cogeneration and sidestream treatment enhancements would not be applicable for this alternative because it does not include digestion.

5.4.2 Alternative 4– New WWTF with Industrial Pre-treatment

Design WWTF Capacity: 4.2 MGD, 8,500 lbs/day BOD

Design Pretreatment Capacity: 0.6 MGD, 8,000 lbs/day BOD

Alternatives 4A, 4B, and 4C would be similar to their Alternative 3 counterparts, however; the new treatment plant would be designed for a hydraulic capacity of 4.2 MGD and a BOD capacity of 8,000 lbs/day and a pretreatment facility (similar to Alternative 2) would be constructed for Saputo and Bioriginal waste. One exception to the similarity to Alternative 3 would be Alternative 4A, which would not utilize conventional activated sludge treatment, and instead uses an oxidation ditch.

Each of the Alternative 4 options includes Industrial Pretreatment at the new site, the same as Alternative 2:

- Saputo & Bioriginal pump station to new site
- Industrial equalization tank
- DAF primary treatment
- MBBR biological treatment
- Clarification
- Anaerobic treatment of biosolids
- Centrifuge dewatering of industrial waste
- Sludge storage for municipal and industrial waste

4A: New Site: Ditch plus Lime with Industrial Pretreatment

For Alternative 4A, secondary treatment is provided with an oxidation ditch and Class A sludge treatment is provided by a lime stabilization system similar to that at the existing WWTF.

The municipal facilities at the new site will consist of the following:

- Headworks (screening and grit removal)
- Selector Basins
- Oxidation ditch activated sludge
- Final clarifiers
- Tertiary disc filtration for phosphorus removal
- UV Treatment
- DAF WAS thickening
- Sludge holding
- Centrifuge sludge dewatering
- Centrate holding
- Bioset/lime sludge stabilization
- Sludge storage for municipal and industrial waste

4B: New Site: Conventional plus TPAD with Industrial Pretreatment

Alternative 4B would utilize conventional activated sludge treatment and Class A temperature phased anaerobic digestion.

The municipal facilities at the new site will be similar to Alternative 4A, with the exception of the oxidation ditch and Bioset/lime stabilization equipment and the addition of the following:

- Primary clarifiers
- Selector basins
- Aeration basins
- Blower building
- Solids treatment building with batch tank, heat exchangers, thermophilic and mesophilic digesters, and centrifuge

The digestion facilities will produce biogas that could be beneficially reused generate electricity. A cogeneration facility has been included in this alternative as a potential enhancement that could part of the initial plant construction or added at a later time. Sidestream treatment of digester supernatant was not considered for this alternative because it would not be cost effective at the planned loading rates.

4C: New Site: Conventional plus Class B Meso plus Drying with Industrial Pretreatment
Alternative 4C would utilize conventional activated sludge treatment, class B mesophilic digestion, and Class A sludge drying.

The municipal facilities and potential enhancements at the new site will be the same as Alt 4B with the exception of the thermophilic digesters and the addition of the following:

- Class A sludge drying
- Silo biosolids storage

5.5 Summary of Alternatives

Table 5-2 summarizes the ten alternatives that were developed and evaluated for this Facilities Planning Document. A detailed comparison of costs and non-economic factors for these Alternatives is provided in Chapter 6.

Table 5-2 Alternatives Summary

Number	Description
1A:	Upgrade Existing Site with Lime Stabilization
1B:	Upgrade Existing Site plus TPAD
2:	Upgrade Existing Site plus Industrial Pre-treatment at New Site
3A:	New Site: Conventional Treatment plus Lime Stabilization
3B:	New Site: Conventional Treatment plus TPAD
3C:	New Site: Conventional Treatment plus Class B Meso Digestion plus Drying
3D:	New Site: Conventional Treatment plus Aerated Sludge plus Drying
4A:	New Site: Oxidation Ditch plus Lime Stabilization with Industrial Pretreatment
4B:	New Site: Conventional plus TPAD with Industrial Pretreatment
4C:	New Site: Conventional plus Class B Meso Digestion plus Drying with Industrial Pretreatment

6. ALTERNATIVES COMPARISON

The chapter presents an analysis of financial and non-economic factors for the alternatives and sub-options described in Chapter 5. The financial analyses include capital, operation and maintenance, replacement, salvage, and present worth cost evaluations for each alternative. Operation and maintenance costs are based on the current utility budget for the City, with changes made as appropriate to account for differences in energy requirements, materials, and staffing for each proposed alternative. The present worth cost analysis is intended to provide an evaluation of the cost-effectiveness of the alternatives, and is used in conjunction with consideration of other factors to select a recommended alternative. The non-economic analysis includes factors such as ease of operation, future growth potential, environmental impacts, and other considerations.

Inflation has not been factored into the monetary analysis in this chapter and it should be noted that construction and operations costs could change between the date of this facility planning document and the time when the eventual project is bid out.

6.1 Capital Cost

This section presents capital costs for facilities that would be constructed to correct current deficiencies and meet treatment and capacity needs for the current conditions and the projected flows and loads in Table 4-8.

Tables 6-1 presents the summarized capital costs for Alternatives 1 through 4, respectively, with costs broken out for each of the options described in Chapter 5. The capital costs include costs for the eventual general contractor’s scope of services; as well as contingency costs and costs for the engineering, construction observation, administration and legal work that will be necessary to plan, design, finance and manage the project. The contractor’s scope of services includes construction of the upgrades or new facilities with a contractor’s mark up to accommodate overhead and profit, and contract administration. The contingency is based on a percentage of the projected contractor’s cost, with a 10% contingency for construction at a new plant site and a higher 15% contingency for upgrades at the existing WWTF site due to space constraints and inherent unknowns with construction at a site that has housed a treatment facility since 1939. Engineering, construction observation, administration and legal work estimates are also based on percentages of the construction cost, with lower percentages used for construction at a new plant site.

Table 6-1 Capital Cost Summary

Alternatives	Construction	Contingency	Engineering, Administration, & Legal	Resident Observation	Total
Existing Site Alternatives					
1A	$32,633,500	$4,895,000	$4,242,400	$1,305,300	$43,076,000
1B	$40,073,900	$6,011,100	$5,209,600	$1,603,000	$52,898,000
2	$40,576,300	$6,086,400	$5,274,900	$1,623,100	$53,561,000
New Site Alternatives					
3A	$57,686,900	$5,768,700	$5,768,700	$1,586,400	$70,811,000
3B	$66,756,200	$6,675,600	$6,675,600	$1,668,900	$81,776,000
3C	$70,129,800	$7,013,000	$7,013,000	$1,753,200	$85,909,000
3D	$61,343,100	$6,134,300	$6,134,300	$1,533,600	$75,145,000
4A	$66,352,200	$6,635,200	$6,635,200	$1,990,600	$81,613,000
4B	$73,547,400	$7,354,700	$7,354,700	$2,206,400	$90,463,000
4C	$76,885,400	$7,688,500	$7,688,500	$2,306,600	$94,569,000

A more detailed cost breakout for each of these alternatives is provided in Appendix M. The process models that were used to develop the sizes for structures and equipment are provided in Appendix N.

It should be noted that the capital costs for the alternatives with anaerobic digestion include for costs for cogeneration (Alternatives 1B, 3B, 3C, 4B, and 4C) and sidestream phosphorus treatment (Alternatives 3B and 3C) that are not required for treatment but are included as potential enhancements to improve treatment efficiency and reduce operating costs. These enhancements could be included in the initial construction or could be added as a later phase, if desired. The following sections for O&M costs, replacement costs, and salvage costs include these potential enhancements for these alternatives, but the net present worth analysis in Section 6.5 considers only the base cost, without enhancements.

6.2 Operations and Maintenance Cost

Annual O&M costs for Alternatives 1 through 4 are summarized in Table 6-2. For Alternatives 1 and 2, these costs are related to operation of the existing WWTF and existing collection system. For Alternatives 3 and 4, the O&M costs are for conveying wastewater to a new site, operation of the new WWTF, and maintaining the existing collection system. Alternatives 2 and 4 also include operation and maintenance costs for an industrial pretreatment facility. As described in Chapter 5, there are many ways that pre-treatment could be achieved, but for the purposes of this Facilities Planning Document it was assumed that the pre-treatment facility would be operated by the City. The costs provided in Table 6-2 include the costs for industrial pretreatment.

The tables includes two costs for each option: one for start-up conditions and the second is for design year (2040) conditions. Actual O&M costs for startup and design are expected to fall within these ranges. The City’s current O&M cost of approximately $1,483,000 was used as baseline for developing alternative O&M costs, with the City’s budgeted line item format as the starting point.

Table 6-2 Annual O&M Cost Summary at Start-Up and Design Conditions

Alternatives	Startup O&M Annual Cost	Design O&M Annual Cost
Existing Site Alternatives		
1A	$1,666,500	$2,366,100
1B	$1,509,600	$1,973,100
2	$1,742,100	$2,120,700
New Site Alternatives		
3A	$1,860,200	$2,450,900
3B	$1,577,400	$1,971,000
3C	$1,676,200	$2,040,300
3D	$1,895,000	$2,503,100
4A	$1,739,700	$2,150,800
4B	$1,699,900	$2,018,100
4C	$1,776,100	$2,155,500

A detailed breakout of the O&M costs for each of the alternatives is provided Appendix M. Operating costs that differ among the alternatives include the following:

- Electrical and natural gas usage for both liquid treatment and sludge processing based on the estimated horsepower or energy inputs for the assumed process equipment and operating time. These estimates include power for pumping to a new WWTF site for Alternatives 3 and 4.
- Natural gas and electrical usage for building heating and lighting based on existing building sizes and assumed sizing for new buildings/additions.
- Chemical usage for liquid treatment, including ferric chloride and polymer for phosphorus removal, based on the flows and loading.
- Chemical usage for sludge processing, including polymer, sulfamic acid, and lime, based on the volume of sludge that will be dewatered.
- Sludge contract hauling costs based on estimated sludge production for Class A cake or dried solids.
- Additional staffing requirements based on the site and process needs. The O&M costs include one additional full-time operator at startup and two additional at design for Alternative 1, one additional full-time, operator for Alternative 3, and two additional full-time operators for pretreatment with Alternatives 2 and 4.
- Pretreatment costs for polymer and electrical usage with Alternatives 2 and 4.

All other costs for general maintenance, operations, and administration were assumed to be the same for all alternatives and are based on current costs. No inflation was assumed on current costs or unit prices, the difference between startup and design values are based only increases in quantities of liquid and biosolids to be treated. As shown in Table 3-1, Alternative 1B has the lowest O&M cost while Alternative 3D has the highest.

6.3 Replacement Cost

Annual replacement costs for the four alternatives and sub-alternatives are summarized in Table 6-3. Individual replacement costs are calculated by considering the present day installed cost of the equipment and determining the annual contribution necessary to replace the item after an assumed equipment life. The annual cost is calculated assuming the same interest rate as that assumed for the present worth analysis provided later in this chapter. Projected inflation values have not been factored into the equipment costs which would increase the higher replacement costs at a greater net amount than the lower replacement costs. Detailed spreadsheets showing the replacement cost values for each of the equipment items for each alternative are presented along with the other cost information in Appendix M of this report.

Table 6-3 Annual Replacement Cost Summary

Alternative	WWTF	Industrial Pretreatment	Total
Existing Site Alternatives			
1A	$390,500		$390,500
1B	$436,300		$436,300
2	$355,700	$150,900	$506,600
New Site Alternatives			
3A	$388,800		$388,800
3B	$437,100		$437,100
3C	$523,300		$523,300
3D	$520,600		$520,600
4A	$351,100	$150,900	$502,000
4B	$421,400	$150,900	$572,300
4C	$511,300	$150,900	$662,200

The replacement costs range between $388,800 per year for Alternative 3A and $662,200 per year for Alternative 4C. Existing replacement costs are estimated to be $192,900. The main difference between the lowest and highest replacement costs is the sludge handling equipment, including centrifuges, lime stabilization, digestion, and drying equipment, which all have relatively high capital costs.

6.4 Salvage Costs

The total salvage value for each of the alternatives has been estimated and a summary is provided in Table 6-4. Those options with newer construction have more inherent salvage value at the end of the evaluation period since the residual value of the newer infrastructure will be greater for newer construction and equipment. In addition, greater emphasis is placed on clarifier, anaerobic digester, and sludge processing equipment since this equipment can typically be re-painted to extend the life of the equipment as opposed to other equipment which is just replaced. The salvage values of the existing equipment and structures are significantly lower than new construction or are considered to be zero. Details on the salvage value calculations are provided in Appendix M.

Table 6-4 Salvage Values

Alternatives	Total
Existing Site Alternatives	
1A	$4,352,000
1B	$5,894,000
2	$6,552,000
New Site Alternatives	
3A	$16,316,000
3B	$17,392,800
3C	$16,857,000
3D	$14,585,000
4A	$18,567,000
4B	$19,250,000
4C	$18,940,000

6.5 Present Worth Analysis

A present worth analysis was performed for each alternative by determining the net present worth (NPW) value of capital costs and annual costs over the evaluation period of twenty years. The capital costs from Table 6-1 were assumed to occur in year 0 of the analysis, although the possibility of phasing could be considered during the design phase. The annual costs of O&M, replacement and salvage costs were outlined in the previous sections of this chapter and presented in Tables 6-2, 6-3, and 6-3. The discount rate used for this analysis is 3.125%, which was the WDNR's published discount rate for Federal Fiscal Year 2021 in accordance with NR 110.09(1)(a), Wisconsin. Administrative Code.

A summary of the present worth analysis is presented in Tables 6-5. The NPW does not include the costs of enhancements for cogeneration (Alternatives 1B, 3B, 3C, 4B, and 4C) and sidestream phosphorus treatment (Alternatives 3B and 3C) since the enhancements are not necessary for treatment. Tables in Appendix M provide additional details of how the NPW costs were calculated.

The purpose of the present worth analysis is to provide a direct monetary comparison of the alternatives and ensure that the recommended alternative is cost-effective. According to WDNR guidance, alternative present worth costs within 10 percent of each other are considered essentially equal due to normal cost estimating variability. The NPW costs in Table 6-5 have been used to evaluate cost effectiveness and differences in costs.

Table 6-5 Present Worth Values of Alternatives

Alt	Capital Cost Estimate	Startup O&M Estimate	Design O&M Estimate	Replace-ment Fund Costs	Salvage Costs	Total Present Worth
Existing Site Alternatives						
1A	$43,076,000	$1,666,500	$2,366,100	$390,500	$4,352,000	$77,271,000
1B	$50,449,000	$1,509,600	$1,973,100	$436,300	$5,589,700	$82,294,000
2	$53,561,000	$1,742,100	$2,120,700	$506,600	$6,552,000	$89,465,000
New Site Alternatives						
3A	$70,811,000	$1,860,200	$2,450,900	$388,800	$16,316,000	$112,511,000
3B	$74,522,000	$1,577,400	$1,971,000	$437,100	$16,699,200	$116,924,000
3C	$78,655,000	$1,676,200	$2,040,300	$523,300	$16,163,400	$118,256,000
3D	$75,145,000	$1,895,000	$2,503,100	$520,600	$14,585,000	$118,415,000
4A	$81,613,000	$1,739,700	$2,150,800	$502,000	$18,567,000	$123,183,000
4B	$88,014,000	$1,699,900	$2,018,100	$572,300	$18,945,700	$129,619,000
4C	$92,120,000	$1,776,100	$2,155,500	$662,200	$18,635,700	$136,208,000

The present worth values for the existing site alternatives range from approximately $77.3M for Alternative 1A and $89.5M for Alternative 2. The present worth values for new plant alternatives range from $112.5M for Alternative 3A to $136.2M for Alternative 4C

A comparison between Alternatives 1 and 2 and between Alternatives 3 and 4 shows that the alternatives that include industrial pretreatment, Alternatives 2 and 4, have a higher NPW that the corresponding alternatives without pretreatment, Alternatives 1 and 3. The difference between Alt 2 and the lowest cost Alt 1A is approximately16%. The difference between the lowest cost Alt 4A and Alt 3A is approximately 10%. Therefore, the pre-treatment alternatives are considered less cost effective than the alternatives without pretreatment.

NR 110 code requires that treatment facilities be located such that they are not subject to flooding and have dry land access, unless the construction costs of expansion or upgrading of the facility is less than 50% of the value of the facility. The difference in cost between Alternative 1A and Alternative 3A is $35.2M, which is the “value of the existing facility” according to the NR 110 code. When the value of the existing facility is compared to the lowest cost option to upgrade the existing facility ($77.3M) and the lowest cost to move to a new site ($112.5M), the NPW costs support relocating the Reedsburg WWTF out of the floodway.

Based on the NPW analysis, a new WWTF site without pre-treatment, Alternative 3, is the preferred alternative. The NPW costs for the Alternative 3 options range from $112.5M for Alternative 3A to $118.4M for Alternative 3D, a difference of approximately 5.2%. Therefore, the Alternative 3 options are considered essentially equal from a cost-effectiveness standpoint.

6.6 Non-Economic Considerations

As stated previously, there are several other factors beyond the capital and present worth costs that need to be taken into consideration in the selection of a recommended alternative, and selection of sub-options within that alternative. The non-economic analysis includes factors such as ease of operation, future growth potential, environmental impacts, and other considerations. Qualitative factors that have been identified as being important by City staff and board members are the following:

- Utilization of existing structures
- Ease of construction and potential construction issues
- Reduction of flooding risk
- Future facility expansion capability, related to the ability to add structures and technology for future upgrades
- Operational concerns including flexibility, ease of operation and safety for City staff
- Energy efficiency
- Sludge production, disposal options, and value to farmers for land application
- Noise, air quality, and other environmental factors
- Ability to comply with existing and future effluent limits

Tables 6-6 and 6-7 provide summaries of the subjective rating on these qualitative factors for the existing and new site alternatives, respectively. The maximum value possible for each category is shown and each alternative is scored against this value, with the highest value being the best score and the lowest being the worst. The benefit of performing a qualitative evaluation such as this should be to identify the strengths of certain alternatives that may not necessarily impact a quantitative cost analysis. Additional environmental impacts related to the facility construction are not included in this section are evaluated in Chapter 7 for the recommended alternative.

Table 6-6 Non-Economic Analysis of Alternatives – Existing Site

Factor	**Max Value**	**Existing Site Alternatives**		
		1A	**1B**	**2**
Site				
Utilization of Existing Structure	5	5	5	5
Future Expansion Capabilities	10	0	0	5
Ease of Construction	5	0	0	2
Reduced Flooding Risk	15	0	0	2
Liquid Treatment Operations				
Flexibility	5	2	2	3
Ease of Operation (includes Pretreatment)	10	7	7	5
Safety	5	3	3	2
Energy Efficiency	5	3	3	4
Biosolids Treatment				
Ease of Operation	10	10	5	8
Sludge Production/Volume	10	3	5	4
Disposal Options/Flexibility	10	6	7	7
Value to Farmers	5	5	5	5
Biogas Production/Energy Efficiency	5	3	5	2
Safety	5	5	3	3
Environmental Factors				
Noise	5	5	5	4
Air Quality	5	2	4	3
Stormwater	5	0	0	2
Effluent Limitations				
Phosphorus	10	2	2	4
Future Nitrogen	10	2	2	4
Total	**140**	**61**	**61**	**70**

For the existing site alternatives, Alternative 2 scores higher than Alternative 1 because it has fewer improvements to site compared with Alternative 1, but both have significant construction challenges due an already crowded site and requirements for phasing while keeping the plant operational, and neither of these alternatives reduces the risk of flooding. Alterative 2 has greater staffing needs with a separate industrial pretreatment and sludge facility, but has greater flexibility for operations and meeting future permit requirements than Alternative 1.

Table 6-7 Non-Economic Analysis of Alternatives – New Site

Factor	Max Value	New Site Alternatives						
		3A	3B	3C	3D	4A	4B	4C
Site								
Utilization of Existing Structure	5	0	0	0	0	0	0	0
Future Expansion Capabilities	10	10	10	10	10	8	8	8
Ease of Construction	5	5	5	5	5	5	5	5
Reduced Flooding Risk	15	15	15	15	15	15	15	15
Liquid Treatment Operations								
Flexibility	5	4	5	5	5	4	5	5
Ease of Operation (includes Pretreatment)	10	10	9	9	9	6	5	5
Safety	5	5	4	4	4	4	3	3
Energy Efficiency	5	2	5	5	5	3	4	4
Biosolids Treatment								
Ease of Operation	10	10	5	7	9	9	5	7
Sludge Production/Volume	10	3	5	10	7	4	5	9
Disposal Options/Flexibility	10	6	7	10	8	7	10	9
Value to Farmers	5	5	3	3	3	5	3	3
Biogas Production/Energy Efficiency	5	3	5	4	1	3	5	4
Safety	5	5	3	3	4	4	2	1
Environmental Factors								
Noise	5	5	5	5	5	4	4	4
Air Quality	5	2	4	4	5	3	4	4
Stormwater	5	5	5	5	5	4	4	4
Effluent Limitations								
Phosphorus	10	10	7	7	10	8	6	5
Future Nitrogen	10	10	10	10	10	8	8	8
Total	**140**	**105**	**102**	**111**	**110**	**96**	**93**	**95**

The new site alternatives, Alternatives 3 and 4, score significantly higher than the existing site alternatives, mainly due ease of construction at a new site, reduction of flooding risk, and future expansion capabilities. The main lift station for Alternatives 3 and 4 would require property acquisition by the City and may still be located in the flood plain, but would be constructed well above the flood elevation. Alterative 4 has more operational complexity and greater staffing needs than Alternative 3 because it includes a separate industrial pretreatment facility.

Alternative 3 is the most favorable alternative based on the non-economic analysis. The sub-options of Alternative 3 differ primarily in the sludge treatment processes and equipment. While the operational costs associated with sludge processing and disposal are included in the O&M costs, these costs do not take into consideration the potential inflation associated with natural gas, electricity, and commodities such as lime, or potential future restrictions on sludge disposal options due to stricter regulations or emerging contaminants. The non-economic analysis accounts for these factors and helps differentiate between these alternatives that are similar in NPW cost. The following summary explains the main differences between the Alternative 3 sub-options:

- Alternative 3A - Class A Lime Stabilization
    - Simple treatment process
    - High O&M cost associated with lime and sludge production that may be subject to future inflation (not included in NPW analysis)
    - No reduction in sludge volume compared to current process
    - Larger quantity of sludge to dispose of if there are future limitations.
    - High value to farmers for lime content
- Alterative 3B - Class A Temperature Phased Anaerobic Digestion
    - More involved treatment process with potential for biological upset
    - Potential for beneficial re-use of biogas
    - 50+% reduction in biosolids volume
    - Potential concentration of sludge contaminants, which may limit future disposal options
- Alternative 3C - Class A Sludge Drying with Anaerobic Digestion
    - Moderately involved treatment process with involved mechanical equipment
    - Energy intensive, though utilizes biogas for heat requirements
    - Moderate potential for beneficial re-use of biogas (may be limited as both digestion and drying require biogas)
    - 90% reduction of sludge volume
    - Higher potential for concentration of sludge contaminants, which may limit future disposal options
    - Explosion potential of dust must be address in the design
- Alternative 3D - Class A Sludge Drying without Digestion
    - Mechanically involved treatment process
    - Energy intensive with high O&M costs associated with natural gas and electricity
    - 90% reduction of sludge volume
    - Higher potential for concentration of sludge contaminants, which may limit future disposal options
    - Explosion potential of dust must be address in the design

6.7 Recommendations and Selected Alternative

The present worth analysis that shows that the options with pre-treatment, Alternatives 2 and 4, are more costly than the respective options without pretreatment, Alternatives 1 and 3. The present worth analysis also shows that Alternative 1, upgrading the City's existing WWTF, is less costly than constructing a new treatment facility with Alternative 3. However, as explained in 5.2.1 and 6.5, the NPW costs support moving the WWTF out of the floodway to a new site. The Reedsburg City Council has considered the economic and non-economic factors associated with this decision and approved Alternative 3 and the moving the WWTF to a new site at their July 2021 meeting.

The Dog Park Site (Site #1) was selected as the site for the new WWTF because it is already owned by the City, it is adjacent to the City's new public works facilities, and it provides favorable site conditions for gravity flow between processes and similar effluent limits to the existing WWTF site. The environmental impacts discussed in Chapter 7 are for this site and the proposed interceptor and force main route from the existing WWTF.

Four suboptions were considered for Alternative 3, differing mainly in the type of sludge processing but with all options producing Class A biosolids. Alternative 3A uses lime stabilization, similar to the existing plant. Alternative 3B uses TPAD, with both thermophilic and mesophilic digestion, while Alternative 3C uses just mesophilic digestion followed by drying. Alternative 3D uses just drying to produce Class A biosolids. The Base NPW values for these alternatives range from approximately $112.5M for Alternative 3A to approximately $118.4M for Alternative 3D. The difference between the present worth values for these options is less than 10 percent and they are considered essentially equal according to WDNR facility planning guidance.

Of the Alternative 3 suboptions, Alternative 3C and 3D have the highest scores in the non-economic factors analysis, primarily due to the reduced sludge volume with the drying option. Producing the lowest volume of sludge possible protects the City in the event that future regulations for per- and polyfluoroalkyl substances (PFAS) and other emerging contaminants limit disposal options. The City collected two rounds of samples and tested for PFAS in WWTF effluent and biosolids as a follow-up to testing performed by the DNR in February 2021. The results from all three rounds of testing are provided in Appendix O. These results indicate no immediate concerns as compared to currently-proposed standards for PFAS, but reducing liability and limitations for sludge disposal are still important factors for the City as they face tightening regulations. For this reason, Alternatives 3C and 3D were preferred over the other alternatives.

The City has selected Alternative 3C as the preferred alternative based on consideration non-economic factors as well as the capital, O&M, and NPW costs. The ultimate deciding factor in this selection is the annual operating cost, which is almost $500,000 lower for Alternative 3C than 3D. Since the City is planning to construct a new WWTF, they gave consideration to operating costs and potential inflation beyond the 20-year planning period and selected Alternative 3C as the most cost effective option for long-term operation of the new facility.

The estimated capital cost for Alternative 3C is $85,909,000. This cost includes cogeneration and sidestream phosphorus treatment that are not required for treatment but are included as potential enhancements to improve treatment efficiency and reduce operating costs. These enhancements could be included in the initial construction or could be added as a later phase, if desired. The City will be considering including sidestream treatment immediately and cogeneration may be added with a future project after startup.

7. ENVIRONMENTAL IMPACTS

7.1 Project Identification

This chapter provides an analysis of the environmental impacts for the recommended upgrades to the City of Reedsburg WWTF. As described in Section 6.7, the City has decided to relocate the WWTF to new site to alleviate concerns with flooding and provide room for future expansion. The recommended alternative for the new WWTF is Alternative 3C, conventional activated sludge treatment with mesophilic digestion followed by sludge drying. This Chapter covers the environmental impacts for the new WWTF site and the interceptor and force main route from the existing WWTF to the new site. A map showing these locations is provided in Appendix O.

The new WWTF site is located in the SE1/4 of the SW1/4 of Section 12, T12N-R4E, with an address of 600 S Golf Course Road. An interceptor will be constructed from the existing WWTF to a new main lift station east of the WWTF, and a dual forcemain will convey wastewater from the main lift station to the new WWTF. The proposed force main would follow a route running in the right-of-way (ROW) of Division Street, South Dewey Avenue, and Zinga Drive with portions crossing the City of Reedsburg Airport and other private properties, primarily following an existing stormwater channel. The actual force main route will be determined during the preliminary design phase and may be adjusted based on constructability and availability of access/easements.

7.2 Affected Environment

7.2.1 Land Use

The land proposed for the new WWTF is an approximately 27 acre parcel owned by the City and within the municipal limits. A portion of the parcel is currently used as municipal dog park while the remaining acreage is wooded or leased for agricultural uses/row crops. The land immediately adjacent to the new WWTF site is used for the City's public works garage/facilities to the west, residential to the north, WDNR land (Cady's Marsh State Natural Area) to the south, and agricultural to the east, across Golf Course Road. The closest residences will be along Labansky Road to the north and a few farmsteads/residences along Golf Course Road to the east. The new WWTF facilities will be sited to comply with the separation distances required by NR 110.15(3)(d) to minimize any potential odor, noise, and nuisances. A map of the closest residential properties and the required 500-foot separate distances is provided in Appendix O

Following completion of the new WWTF it is anticipated that the structures at the existing WWTF site will be removed and the site will be re-landscaped, with the existing berm to remain in place. Abandonment plans for the existing WWTF site will developed as part of the design phase for the project.

7.2.2 Soils

The soils at the new WWTF site were examined by consulting the United States Department of Agriculture Natural Resources Conservation Service (NRCS) soil maps. An NRCS Soils report for the new WWTF site is provided in Appendix B. The custom NRCS soils report indicates that the soils at the new WWTF site are primarily Eleva sandy loam with small portions of Boone sand, with slopes ranging from 2% to 12%. Soil borings will be performed at new site as part of the design process.

7.2.3 Important Farmland, Prime Forest Land, and Prime Rangeland

The Farmland Protection Policy Act (FPPA), the USDA regulation implementing the FPPA (7 CFR Part 658), and USDA Departmental Regulation No. 9500-3, "Land Use Policy", provide protection for important farmland and prime rangeland and forest land.

The new WWTF will be constructed on a parcel currently owned by the City of Reedsburg and within the City's municipal limits. While a portion of this parcel is currently leased for agricultural uses, the project will not result in the conversion of prime farmland areas because it is located in an area that is planned and zoned for industrial uses. The current zoning for the parcel is I-4, Business Center. The forcemain will be constructed mainly in the City ROW, with portions crossing the City of Reedsburg Airport and other private properties, which may require easements but not property acquisition. It is likely that the City will need to acquire a small parcel for a Main Lift Station near the existing WWTF, which will be within the City limits and will not affect agricultural property.

The Department of Agriculture, Trade and Consumer Protection (DATCP) must be notified of any project which may involve the acquisition of an interest in land from a farm operation through the use of eminent domain procedures (condemnation). The DATCP should be notified of such a project regardless of whether the proposing agency actually intends to use these powers in the acquisition of rights to proposed project lands. If a proposed project involves the actual or potential exercise of the powers of eminent domain in the acquisition of an interest in more than five acres of land from anyone farm operation, the DATCP is required to prepare an agricultural impact statement (AIS) which describes and analyzes the potential effects of the project on farm operations and agricultural resources. If a proposed project involves five acres or less from any one farm operation, an AIS may be prepared at the DATCP's discretion. According to these guidelines from DATCP, an AIS will not be required for this project since no land will be acquired for the new WWTF site. The WWTF parcel is currently owned by the City and the acquisition did not occur through condemnation procedures.

7.2.4 Formally Classified Lands

There are certain properties that are either administered by Federal, State, or local agencies or have been accorded special protection through formal legislative designations. For the purposes of this report, these properties have been designated "formally classified lands." Examples include wild and scenic rivers, forestlands, scenic trails, national and state parks, and wildlife refuges. Visual impacts to formally classified land from proposed projects need to be considered as appropriate.

There are no known formally classified lands that will be directly affected by this project, but the new WWTF is located adjacent to the Cady's Marsh State Natural Area (SNA), which is owned by the DNR and was designated a SNA in 1998. According to the DNR's information on Cady's Marsh SNA, this 80-acre area contains dry sandy prairie grading into loamy mesic and wet-mesic prairie with sedge meadow and shallow emergent aquatic marsh also present. The SNA is available for public recreational uses such as hiking, fishing, cross country skiing, hunting, trapping, scientific research, wild edibles collection, and wildlife viewing. Portions of the WWTF may be visible to users of the SNA, with the presence of the buildings/structures potential impacting the aesthetic appearance of the area and potential for odors to be generated at the facility. The proposed structures at the new treatment facility site will be constructed of high-quality materials and will primarily consist of either concrete tanks or buildings with block exterior. These structures should be aesthetically pleasing to the typical passerby. Odor mitigation measures will be regarded as a primary concern in the design of the facility, and odor control provisions will be incorporated into the construction of the new facility, and should not be a factor due to the odor control provisions and separation distance.

According to the DNR's management plan for Cady's Marsh SNA, there are no listed species or habitats are known to occur here and/or in the general area, so impacts to threatened or endangered species in not a concern.

7.2.5 Floodplains

The existing WWTF site lies within an area of significant flood hazard and within the 100-year flood plain delineation. The WWTF most recently flooded in 2008 and had a near-flooding event in 2018. The City has decided to relocate its WWTF to avoid future flooding risks. The new WWTF will be located outside of the floodplain in an area of minimal flood hazard. In order to convey wastewater from the existing WWTF site, portions of the new interceptor and force main will be constructed within the floodplain.

Flood Hazard Boundary Maps for the proposed new WWTF site and the interceptor/force main route are provided in Appendix O. While construction must take place in the floodplain, the interceptor/forcemain piping will be buried and following construction there will be no impacts to the floodplain. A new Main Lift Station will be constructed near the existing WWTF and may be within the floodplain, but the top of the wet well wall will be constructed above the 500-year flood elevation and at least 2 feet above the 100-year flood elevation.

7.2.6 Wetlands

Based on a review of available resources, including the WDNR Surface Water Data Viewer and wetland inventory, there are no wetlands present at the proposed new WWTF and main lift station sites. The interceptor and forcemain to the new WWTF site will cross small areas of wetlands based on the currently-proposed route. Refer to the wetland inventory figure in Appendix O.

Wetland delineation will be performed for the interceptor and forcemain route during the preliminary design. If wetlands are determined to be present during the design phase, appropriate permits will be applied for and obtained from the relevant regulating agencies, and strict adherence to the conditions of any permit will be required during construction. Any disturbed wetlands will be restored to pre-existing conditions, and therefore the long-term impacts to any wetlands are expected to be minimal.

7.2.7 Cultural Resources

The National Historic Preservation Act (NHPA) of 1966, as amended, and the Advisory Council on Historic Preservation's (ACHP) implementing regulations, 36 CFR Part 800 (Section 106 regulations), requires Federal agencies to take into account the effect their actions may have on historic properties that are within the proposed project's area of potential effect. To avoid harm to both known historic properties and archeological sites, and to undiscovered sites present in a project area, historic and archaeological sites within or near the project area must be identified, and the effects of the project on these sites must be assessed.

A listing of all Wisconsin properties on the National and State Registers of Historic Places contains no entry within the immediate vicinity of the new WWTF site or interceptor/force main route. An archaeological review of the proposed construction sites will be performed during the preliminary design phase, including a review of the Wisconsin Historic Preservation Database (WHPD) for the WWTF and interceptor/force main route.

7.2.8 Biological Resources

Throughout the United States there are many plant and animal species that are threatened with extinction or exist in greatly reduced numbers partly as a result of human activities. The Endangered Species Act (ESA) of 1973 establishes a national program for the conservation and protection of threatened and endangered species of plants and animals and the preservation of habitats upon which they depend. Under Section 7 of the ESA, Federal agencies are required to consult with the United States Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Service for all threatened and endangered species. The consultation is to ensure that the proposed project does not jeopardize the continued existence of any federally-listed threatened or endangered species or result in the destruction or adverse modification of a critical habitat.

State agencies should also be contacted for information on State-listed species and concerns. In some instances, the State may have more detailed information on federally-listed or proposed species and/or critical habitat than the USFWS. Other biological resources which may be impacted by the project include fish and wildlife and vegetation.

Pursuant to these requirements, an Endangered Resources Preliminary Assessment was performed for the WWTF site using the WDNR Natural Heritage Inventory (NHI) Public Portal. According to this assessment, endangered resources have been recorded for this area and further action would be required or recommended for construction. The Preliminary Assessment is provided in Appendix N. A full Endangered Resources Review will be requested from the DNR as part of the preliminary design phase for the new WWTF site, the Main Lift Station, and the Interceptor/Force Main route

A review was conducted using the US Fish and Wildlife Service IPaC tool. It was determined that there are potentially three Federally-listed threatened species, one endangered species, one candidate species, and one “non-essential experimental population” species listed for the project areas. The endangered species is the Rusty Patched Bumble Bee and the threatened species are the Norther Long-eared Bat, Northern Wild Monkshood, and Prairie Bush-clover. A review of these species has been conducted in accordance with USFWS guidelines and is provided in Appendix D. No critical habitat was identified at the new WWTF site or in the proposed forcemain and outfall ROW corridor; therefore no impact to these species is anticipated for the proposed project. According to USFWS guidelines, agency concurrence is not required for no effect determinations

7.2.9 Miscellaneous Impacts

7.2.9.1 Operational Impacts

Operational impacts associated with the new WWTF are expected to be similar to the existing WWTF but will be in new location. It is expected that there will be initial concerns from the existing neighbors regarding the potential for noise, dust, odors, and aesthetic impacts. A minimum 500-foot separation distance, as required by NR 110.15(3)(d), will be maintained between the treatment facilities and nearby residences to minimize any potential odor, noise, and nuisances. A map showing adjacent residences and the 500-ft setback distances is provided in Appendix P.

During operation of the WWTF, the overall impact to traffic will be minimal, except when disposing of sludge in the spring and fall. Also, the new site will greatly reduce the risk of flooding and will improve the quality of effluent discharged to the receiving stream. Any improvement in effluent quality will have a positive influence on fishery resources.

Section 6.6 addresses other health and environmental impacts related to operation of the proposed new WWTF.

7.2.9.2 Construction Impacts

Construction of the treatment facility, lift station, and force main will have temporary impacts due to construction. These temporary impacts will include the increase of traffic and noise around the construction site and disturbance of dust and dirt during construction. Traffic along routes to the site will increase during construction.

Construction of the new WWTF will take place on land currently owned by the City and will not have significant negative impacts on land use in the area. Because the location of the site is outside of the main residential and commercial areas, this will minimize the impacts of construction. Construction impacts will be mitigated as described in Section 7.3.

The effluent outfall location for the new treatment facility will be determined during the design phase. The location will be placed in conjunction with coordination with Wisconsin DNR chapter 30 requirements.

If high groundwater conditions necessitate the use of high capacity wells (in excess of 70 gpm) for the dewatering, then the environmental impact will be evaluated by the WDNR's Bureau of Water Supply prior to installation of the wells.

7.2.9.3 Secondary Impacts

The construction or upgrade of any WWTF may potentially encourage urbanization by making increased wastewater collection and treatment capacity available. By using foresight and careful planning, the City can successfully defend against unwanted urbanization.

7.3 Mitigative Measures

Primary impacts regarding operational and agricultural concerns will be minimal and do not require mitigative measures; likewise, secondary impacts regarding urbanization concerns will be minimal as well. Mitigative measures for temporary impacts during construction are described in the following sections.

7.3.1 Temporary Construction Impacts and Controls

Temporary impacts during construction will be mitigated. Temporary traffic control barricades, signs, flagmen and detours will be implemented as necessary and in accordance with WisDOT standards. If conditions warrant control of dust then a combination of water, calcium chloride suppressant and other dust control measures in compliance with industry standards will be applied.

Erosion control and shoreline stabilization during and following construction are other important considerations during construction. The WDNR has stressed the importance of implementing and maintaining proper erosion control measures. If necessary, any disturbed riverbanks will be rip-rapped, seeded and mulched within 24 hours of completion. Any steep areas that will be disturbed and that would affect downstream riverbanks or wetlands will be stabilized with erosion control matting in accordance with WDNR guidelines. Erosion control requirements will be defined during design and in coordination with WDNR Chapter 30, Notice of Intent and Corp of Engineers CFR 404 permitting.

7.3.2 Archaeological

If any undiscovered archeological sites or human remains are encountered in the course of investigations at the project area or during construction, the work will have to stop immediately, and the Historic Preservations Division consulted.

7.3.3 Endangered Species

No impacts to endangered species are expected as described in 7.2.8.

In the protection of flora, reasonable avoidance of impact areas will be made with the pipeline routes during design of the interceptor, force main, and the effluent outfall piping. Areas with lush vegetation will be surveyed and identified prior to routing the pipelines and during design reasonable efforts will be made to avoid such areas.

The netting of erosion control matting can easily entrap snakes which are anticipated to be prevalent on the site. To mitigate this impact erosion mat with biodegradable netting and with independently moveable strands meeting WDNR guidelines will be used.

7.3.4 Wetlands

There are no known wetlands at the new WWTF site and no impacts to existing wetlands are expected.

Wetlands may be crossed in order to install the interceptor and force main to convey the wastewater to the new WWTF Site, and possibly to convey the treated wastewater to the ultimate discharge location (Baraboo River). A wetland delineation will be performed during the design phase and if wetlands are identified, appropriate permits will be applied for and obtained from the relevant regulating agencies (in particular Corps of Engineers CFR 404 permit and WDNR Chapter 30 permit), and strict adherence to the conditions of any permit will be required. Whenever possible, the underground pipelines which must cross wetlands will be installed using a directional drilling technique in order to minimize the disturbance to any wetlands. Any disturbed wetlands will be restored to pre-existing conditions, and therefore the long-term impacts to any wetlands are expected to be minimal.

7.4 Alternatives to the Proposed Action

The alternatives that were considered are presented in Chapter 5 and cost comparisons of the alternatives are provided in Chapter 6 and in Appendix M. The deciding factors in selection of the preferred alternative were cost effectiveness as well as the desire to reduce flooding risk by moving the WWTF out of the floodplain.

8. FINANCES AND FUNDING

8.1 Total Project Cost Estimate

The total estimated capital cost for the recommended alternative, Alternative 3C, is approximately $85.9M as described in Chapter 6, which includes a 10% contingency, 13% engineering, administration and legal work to plan, design, finance and manage the project, and 4% for resident project representative services during construction. The Alternative 3C capital costs includes construction of the following:

- New WWTF at a City-owned site, with a new outfall to the Baraboo river
- New Main Lift Station at a location near the existing WWTF
- New interceptor from the existing WWTF to the new Main Lift Station
- New force main from the Main Lift Station to the new WWTF site

The overall project budget will include the capital costs for these facilities and may include additional costs for legal services, interim financing, and administrative costs for grants and loans, depending on the funding scenario. The overall project budget will be developed as project funding is secured.

8.2 Financing Methods

There are six possible methods of financing the proposed improvements. These include general obligation bonds, revenue bonds, special assessment bonds, direct loans from private institutions, financing through government programs, and immediate payment. Given the size and scope of the proposed project, immediate payment is not possible due to lack of available funds. Assessment bonds are eliminated because of the financial impact to the customers. That leaves four major financing methods for the City, as described in the following sections.

8.2.1 General Obligation Bonds

General obligation bonds are readily saleable, and the interest rate is relatively low. These bonds are not necessarily dependent on service charges, although service charges can be used to provide the needed revenue. The total amount of general obligation bonds which can be issued by a municipality is limited by Wisconsin Statutes to 5% of the equalized valuation of the municipality. There are many serious disadvantages to this method of financing for projects such as this. First, it is possible that not all users of the new facilities would contribute financially to the repayment of the general obligation bonds. This would depend upon the method used to recover funds used to may payments on the bonds. Secondly, the use made of the wastewater treatment facilities will not necessarily be directly related to the value of a property utilizing the facilities. Third, the issuance of general obligation bonds for utility purposes can affect the credit rating issued to the municipality at the time of the sale of future bonds issues covering other general expenditures.

8.2.2 Revenue Bonds

The advantages of revenue bonds are that their issuance does not affect the credit rating or bonding power of the municipality, and they are equitable in that the users of the system pay the capital cost of the facilities. Revenue bonds can be readily issued in Wisconsin if the service charge is such that the net revenues of the utility, after expenses and depreciation, are approximately 1.25 times the debt retirement and operation and maintenance costs. The interest rate for revenue bonds generally is 1 to 2 percent greater than for general obligation bonds.

8.2.3 Direct Loans

The estimated cost of the proposed project is quite large, lessening the chance of direct loans from financial institutions or government agencies. If direct loans are available, their interest rates may well be less than for either general obligation or revenue bonds. In addition, there are fewer restrictions on the use of direct loans as a method of revenue generation, and there is less effect on the bonding powers and credit rating of the community than with general obligation bonds.

8.2.4 Financing Through Government Programs

Past demand for improved wastewater treatment resulted in the establishment of federal and state government programs for financial assistance to communities undertaking the construction of wastewater treatment facilities improvements. The following sections summarize the government funding programs which may be available.

8.3 Governmental Funding Sources

8.3.1 Rural Development (RD)

The Rural Development (RD) branch of the U.S. Department of Agriculture (USDA) provides financial assistance to small rural communities, those with populations of 10,000 or less. RD has a program in which it provides financial assistance in the form of grants and low-interest loans for construction of wastewater collection and treatment systems. The loans have a 40 year payback period and are classified as revenue bond type loans secured only by sewer and water use charges. The current interest rates range from 1.250% to 1.750% (for a Market Rate of 2.125% as of October 1, 2021) and are based on income levels and identified health and sanitary conditions that will be addressed by the project.

If funds are available, an RD grant may be combined with a loan to keep user rates reasonable for residential users. To receive a grant, the user charge rates for the average residential customer are compared to a percentage of the median household income and the rates for other comparable communities and grant funds may be offered to reduce the rate impacts. Grants may be available for up to 45% of eligible project costs and are intended to benefit residential users and small commercial users. Grants may exceed 45% for communities that qualify for the lowest (poverty) interest rate based on the median household income (MHI).

The City intends to apply for grant and loan funding for this project from RD. For the user charge impacts described in subsequent paragraphs it will be assumed that the project may be funded by RD as one alternative for financial considerations.

8.3.2 Wisconsin Environmental Improvement Fund (CWFP)

The State of Wisconsin's Environmental Improvement Fund (EIF) is managed and administered jointly by DNR Environmental Loans (EL) and Department of Administration (DOA). EIF encompasses two environmental financing programs for local governments: the Clean Water Fund Program (CWFP), for wastewater and storm water infrastructure projects; and the Safe Drinking Water Loan Program (SDWLP), for drinking water infrastructure projects. The CWFP and SDWLP are revolving loan programs that combine federal grants and state funding to provide financial assistance to municipalities in the form of subsidized loans. Some municipalities may also be eligible for funding in the form of principal forgiveness, which reduces their overall loan amount.

For eligible projects of municipalities with population of less than 10,000 population; and MHI less than or equal to 80% of the Wisconsin MHI, the interest rate is 33% of the market rate, 0.891% based on the current market rate of 2.700% as of October 1, 2021. For eligible projects of municipalities not meeting the financial need criteria, the interest rate is 55% of the market rate, or 1.485% currently. Only those communities whose treatment facilities are in basic compliance with effluent standards are eligible. For treatment plants in violation of effluent standards full financing is available, but at the full market rate. Additionally, the portion of projects for receiving and storing septage and capacity for treating septage can be financed at 0% interest through the CWFP. The standard loan term is 20 years, but terms up to 30 years are possible for pipeline projects and assets that have a demonstrated useful life greater than 20 years.

Based on the current MHI estimates, it is expected that the City would receive an interest rate that is 55% of market rate. The City intends to apply for funding from the CWF program and it is likely that they would qualify for principal forgiveness. For the user charge impacts described in subsequent paragraphs it will be assumed that the project may be funded by CWF as one alternative for financial considerations.

8.3.3 Community Development Block Grant (CGBG)

The Community Development Block Grant (CDBG) program is a federal formula-allocated grant program under the U.S. Department of Housing and Urban Development (HUD). The State of Wisconsin's Department of Administration administers the state Community Development Block Grant program for public facilities (CDBG-PF), which provides grant money to expand and improve public infrastructure and facility projects critical to community vitality and sustainability. A municipality can qualify for this grant under several conditions, i.e., low and moderate income, urgent need, or economic development. These grants are highly competitive, and may require multiple attempts before successful award. The City of Reedsburg may qualify for a CDBG grant, but this possible funding source has not been included in the projected user charge impacts. In general, the receipt of such a grant would reduce the amount of RD grant, unless it can be used for project costs that are not funded by RD. The City does not currently meet the qualifying threshold for low to moderate income, but CDGB opportunities will be explored further during the design process.

8.3.4 Other Programs

Focus on Energy incentive programs are available to municipal customers of participating Wisconsin utilities to implement energy efficiency projects. Prescriptive incentives are offered for standard energy efficient technologies that have predictable and predetermined savings, including lighting, many HVAC measures, motors and drives, and others. Custom incentives are available for technologies such as energy efficient aeration and heat recovery and are calculated on a case-by-case basis based on the estimated first year energy savings associated with a project/technology. Custom incentives may pay up to 50 percent of a project's cost, for a maximum of $300,000 and are available for projects that have a payback between 1.5 and 10 years. There may be opportunities to apply for Focus on Energy incentives for the proposed construction project.

8.4 Summary of Probable Financing

Any of the four practical financing methods may be used; namely, general obligations bonds, revenue bonds, direct loans from private sources, or government program financing. It is likely that the best interest rates will be achieved through a Wisconsin CWFP Loan for a 20 year loan, and USDA Rural Development rates are comparable but offer 40-year repayment terms. Also, principal forgiveness or grant funding could be available through these programs. USDA Grant funding has not been factored into the user rate impacts, but CWFP principal forgiveness has been assumed in some of the funding scenarios because it is likely that the City would qualify for it. For the purposes of this Facilities Plan, it was assumed that the project would be funding by either Rural Development or CWFP, or a combination of both. The City will continue to pursue both Rural Development and CWFP funding. The following sections describe the parallel cost percentage, septage percentage, and phosphorus percentage that must be calculated for CWFP loans.

8.5 Parallel Cost Percentage

The parallel cost (PC) percentage is calculated to determine that portion of the proposed total project cost eligible for below-market rate financing through the CWF. Reference is made to NR 162 of the Wisconsin Administrative Code and the WDNR web page guidance for the basis of calculating parallel cost percentages.

In order to calculate the value for PC, revised loading conditions are determined which reduce the total design loadings by those amounts associated with unsewered areas that are not currently connected to the sanitary system; the reserve capacity for loadings which will be realized beyond ten years from the project completion date; and for current and future flows from industrial wastewater users.

An estimate has been made of those projected contributions from residential, commercial, and additional contributions (including septage treatment capacity) that will not be realized until beyond ten years after the completion of the project. The future loadings described in Chapter 4 have been assumed to be added in a straight-line projection over the course of the design period of twenty years. One-half of these future loads will not be included in the revised loading conditions. Loadings from the current industrial customers, and their respective projected growth, have also been removed.

A summary of the revised loadings for WWTF flows and loads is presented in Table 8-1. The column heading “DC” is used by the WDNR to indicate total design capacity, and “RC” is used for reduced capacity. The Design Capacity (DC) used for the PC calculations is the projected design load presented in Table 4-8. The DC was the basis for the project costs developed in Chapter 6.

The RC loading for the City represents a reduction in loading as described above. The reduced loading conditions are then used to determine what changes would result in terms of structure sizing and equipment selection. The selected alternative is evaluated for areas where a cost difference would be realized if reduced capacity flow and loading were to impact the design of the project. Similar effects would be realized if other alternatives were evaluated. For more detailed information on the calculations, refer to Appendix O.

Table 8-1 Reduced Loading Conditions for PC Calculation

Parameter	Units	DC	RC
Design Flow	MGD	4.192	3.335
Max Day Flow	MGD	7.059	6.967
Peak Hourly Flow	MGD	10.377	9.265
BOD	lbs./day	15,741	4,142
TS	lbs./day	12,444	5,957
TKN	lbs./day	871	418
Phosphorus	lbs./day	429	91

Although the RC flow and loadings are less than the DC conditions, there are few components of the proposed upgrades that are dependent on the increased loadings, as many processes and piping and sized based on hydraulic loads. The peak hourly flow value (the basis for design of the forward flow hydraulics) is not significantly lower for the reduced condition.

As the City is planning on a blended funding scenario, it is expected that portions of the project may be funded by CWFP and other portions may be funded by USDA-RD. Therefore, parallel cost percentages have been calculated for the following four main components that may be funded independently or constructed under separate contracts:

- Main Lift Station
- Force Main and Outfall
- Tertiary Treatment for Phosphorus Removal
- Remaining WWTF Processes

A cost estimate for the RC was developed for each of these components based on the original cost estimate. For the new lift station, interceptor, and force main, and outfall there is no difference in cost between the DC and RC because these facilities will be designed to handle the peak hour flow, and the reduced flow difference is negligible. A summary of the original and revised costs and the calculated PC percentage are given below in Table 8-2, with additional details in Appendix R.

Table 8-2 Project Costs for PC Calculation – New WWTF

Item	DC Cost	RC Cost
Main Lift Station	$8,547,545	$8,547,545
Parallel Cost Percentage		**100%**
Force Main and Outfall	$6,177,199	$6,177,199
Parallel Cost Percentage		**100%**
Tertiary Treatment for Phosphorus Removal	$4,856,524	$4,298,746
Parallel Cost Percentage		**88.5%**
Remaining WWTF Processes	$68,497,557	$50,793,068
Parallel Cost Percentage		**74.2%**

8.6 Septage Percentage

If the project includes costs for septage receiving facilities and/or septage treatment capacity, those costs may be eligible for a 0% loan rate from the CWFP. The septage percentage (SP) is calculated to determine what portion of the below market rate financing through the CWFP will be eligible for zero rate financing. Reference is made to the resource paper entitled “Wisconsin DNR Program for Septage Considerations in Municipal Wastewater Facility Planning and for Application of Zero Percent Clean Water Fund Loans” dated June 7, 2006 and revised August 2012.

The reduced capacity conditions without market rate items and without septage capacity is denoted as RC2 in Table 8-3 below. The RC2 condition, in addition to the DC and RC, are used to determine the septage percentage and project costs eligible for a 0% interest loan.

Separate revised loading conditions are determined which reduce the previously revised design loadings developed for the PCP known as RC. This second revised loading condition, labeled

RC2, will be that loading associated without unsewered areas, reserve capacity expected beyond 10 years from the project completion date, industrial contributions, and without any septage loadings. A summary of the revised loadings (RC2) with comparison to the total design capacity (DC) and revised loadings (RC) is given below for the City is in Table 8-3.

Table 8-3 Reduced Loading Conditions for SP Calculation

Parameter	Units	DC	RC	RC2
Design Flow	MGD	4.192	3.335	3.309
Max Day Flow	MGD	7.059	6.967	6.941
Peak Hourly Flow	MGD	10.377	9.265	9.239
BOD	lbs/day	15,741	4,142	3,803
TS	lbs/day	12,444	5,957	4,435
TKN	lbs/day	871	418	361
Phosphorus	lbs/day	429	91	75

The facility upgrade includes provisions for septage receiving facilities and septage treatment capacity. Table 8-4 summarizes the project costs for reduced capacity conditions used for the septage percentage calculation.

Table 8-4 Project Costs for Septage Percentage Calculation

Item	RC2 Cost
Septage Cost	$1,064,701
Total Project Cost	$85,909,000
Septage Percentage	**1.2%**

8.7 Phosphorus Percentage

The CWFP program also offers priority principal forgiveness (PF) for phosphorus reduction costs. Eligible municipalities must meet the eligibility requirements for Regular PF, discharge less than 150 pounds of phosphorus per month, have an alternate phosphorus limit, or serve a population of less than 10,000. The WWTF must discharge to surface water and have a final water quality-based effluent limit for phosphorus less than or equal to 0.3 mg/L as a monthly average limit (or 0.1 mg/L as a 6-month average limit) or be located in an implemented TMDL area for phosphorus.

The Phosphorus Reduction PF is only calculated on the phosphorus reduction-related WWTF upgrade costs and the phosphorus cost percentage should be calculated as PP = PC/DC where PP is the phosphorus percentage expressed as a decimal; PC is the construction costs associated with the phosphorus components of the project; and DC is the construction costs associated with the total design capacity.

Construction a new WWTF for Reedsburg includes costs that are specific to phosphorus treatment capacity and achieving compliance with limits established as a part of the Wisconsin River TMDL. The costs in the selected Alternative 3C associated with construction of phosphorus components include the selector basins and appurtenances for biological phosphorus removal and all work associated with chemical flocculation and tertiary filtration of phosphorus. Table 8-5 summarizes the costs associated with the phosphorus components and the total design capacity. The phosphorus percentage is calculated by dividing the phosphorus costs by the total design costs.

Table 8-5 Project Costs for PP Calculation

Item	RC2 Cost
Phosphorus Cost	$12,117,000
Total Project Cost	$85,909,000
Phosphorus Percentage	**14.1%**

Additional information and detailed cost estimates for the phosphorus percentage are included in Appendix O.

8.8 Revenue Sources

Wisconsin Statutes empowers a municipality to construct, maintain, and expand a wastewater system, and further, to collect the revenues to support such a system. There are five potential sources of revenue available to municipalities for support of wastewater treatment facilities. They are as follows: (1) special assessments, (2) general fund revenues, (3) impact fees, (4) TIF fees and (5) service charges; and are described in the subsequent sections.

8.8.1 Special Assessments

The levy of special assessments is provided for by Section 66.07 of the Wisconsin Statutes. Generally, the special assessment principle is used primarily to recover the costs of services and facilities provided immediately adjacent to the property assessed. One additional use of the special assessment provision employed elsewhere from time to time is that of directly assessing the cost of major capital improvements. This is generally utilized in cases where no service charges are made but the governing body wishes to recover the cost of the improvements. It is more applicable to the financing of a collection system than to the treatment plant itself.

If a municipality were to provide the proposed wastewater treatment facilities as a general service, it would be possible to assess the costs of the improvement to the benefited parties. However, the municipality would not be able to do so unless the proper legal procedures were followed and the assessment did not exceed the benefit received by the property assessed. Because of the difficulty in determining the differences in benefits between users and user classes and because of the magnitude of this assessment to present property owners only, special assessments are not recommended for this project.

8.8.2 General Fund Allocations

General fund monies from general taxation sources and other routine sources of municipal income can be used to pay for the subject project. A direct tax levy to recover the project costs project which are not funded by grants-in-aids is possible. The use of general fund monies on a debt service basis is a potential method of financing. This would be accomplished through issuance of general obligation bonds as described in Section 8.2.1. Generally, this method of financing is reserved for street improvements and administration improvements, not for wastewater treatment facilities. This method of financing will not be used for the proposed project.

8.8.3 Impact Fees

Wisconsin Statute 66.0617 allows cities, villages, and towns and counties to assess impact fees on developers to offset the capital costs for public facilities needed as a result of the new development. The law requires municipalities that wish to utilize the connection fee or connection charge concepts to base these fees on sound concepts. A municipality has the option to implement an impact fee to assist in paying for improvements that are a result of development.

These fees cannot be used to finance deficiencies of any system but for replacement of systems that will not have adequate capacity to meet new user demands. Any implementation of impact fees will require a needs report (this document will meet that requirement), breakout of costs to present and future users, an ordinance regulating the fees, development of an accounting system to segregate the fees, and a public hearing on the ordinance.

The City can utilize this system and may want to consider impact or connection fees for future users. This method will not be used at this time for calculating the user charge impacts. It should be noted that the same bond types can be used in conjunction with this system.

8.8.4 Tax Increment Finance District (TIF)

Municipalities can develop tax increment finance districts to assist in financing this wastewater improvements. To utilize this approach, the municipality would have to identify some specific boundaries of land that is mostly undeveloped but is anticipated to be developed in the near future. The percentage of cost of the proposed project that is related to the potential development of this area included in the TIF district can be paid by the increment of the TIF district. The tax increment is the amount of tax money collected between the value of the district at the time of formation to value of the property after development. This tax increment can be used to pay off projects that have been included in the TIF Plan.

This method of financing is a viable alternative and can be considered in the future, but will not be used for calculating user charge impacts.

8.8.5 Service Charges

Wisconsin Statute 66.0821(3) empowers a municipality to establish service charges in such amount as to meet all the financial requirements for the construction, reconstruction, improvement, extension, operation, maintenance, repair, and depreciation of a wastewater system. Further, such service charges may be adjusted to cover the payment of all principal and interest of any indebtedness incurred thereof, including the replacement of funds advanced by or paid for the general fund of the municipality. These charges may include a reasonable excess and the actual basis of the charges is at the discretion of the appointed/elected governing members. To date, the City has used service charges to generate revenue for construction, maintenance and operation of wastewater treatment facilities and this is the anticipated revenue source for future improvements.

8.9 Financial Status and Considerations

8.9.1 Revenue Sources and Current User Rates

The City collects revenues through user service charges and currently serves approximately 3,666 users with its collection and wastewater treatment system. Table 8-6 presents a summary of the total number of customers and equivalent meters, based on the City's 2020 sewer billing summary. The recent sewer usage information, customer counts, and equivalent meter calculations are provided in Appendix P.

Table 8-6 Customer Accounts and Equivalent Meters

Customer Class	Customer Count	Equivalent Meters
Residential	3,201	3,259
Commercial	402	1,208
Industrial	23	161
Major Industrial	3	125
Public Authority	37	228
Totals	3,666	4,980.5

The City bills sewer users based on their municipal water usage bills as well as a fixed rate that is based on the meter size. The existing user charge system has a fixed charge of $11.50 per month for the smallest meter size and a flow charge of $3.64 per 100 cubic feet, which equals about $29 per month for approximately 3,500 gallons per month for the average residential user. The current rates have been in effect since June 2013.

User charges will need to be increased further to cover the cost of the proposed project, as described in Section 8.9. As noted previously, the City has three major industrial users with agreements for wastewater treatment services. These agreements will also need to be modified to reflect additional costs for treatment.

8.9.2 Operating Expenses

The City's current sewer fund annual operating budget and financial information for 2020 is provided in Appendix P. The total current annual operating budget is approximately $3 Million for the sewer fund. After removing depreciation, debt payments, and other misc. expenses not factored into the estimated O&M costs, the budget for operating and maintaining the WWTF is approximately $1,483,000. This is the base value used in projecting future O&M costs for this analysis. The projected operating costs for the first full year of operations for the new WWTF (Alternative 3C) are approximately $1,676,000 per year and are expected to increase annually. The design year projected operating costs are approximately $2,040,000 per year. Detailed estimates of these future costs are provided in Appendix M.

8.9.3 Short Lived Assets / Replacement Fund

A municipality receiving a loan from the CWFP is required to establish an equipment replacement fund to be used only for expenses incurred for equipment related to the municipality's wastewater treatment works. The City had replacement fund balance of approximately $2,360,150 at the end of 2020 and deposits to this fund are made annually. As detailed in Section 6.3, the replacement fund deposit for the planned improvements could increase up to approximately $$523,300 annually.

USDA RD also looks at funding replacement for items deemed to be short-lived assets and not covered under normal operations and maintenances. Short lived assets are those which have a useful life significantly less than the repayment period for the loan and the design life of the facility. The annual cost for funding short-lived assets is factored into USDA RD loan and grant determinations. The short-lived asset calculations will be provided as part of the USDA funding application.

8.9.4 Debt Repayments and Debt Reserves

The City has six existing loans being paid by the sewer utility, with a total principal amount of approximately $9.2M at the end of 2020. Two CWFP loans for previous WWTF and interceptor projects will be paid off in 2025. The other sewer loans will be paid off between 2029 and 2037. Details on existing debts are provide in Appendix P. Future debt and impacts to user charges for the proposed project are addressed in Section 8.10. .

8.9.5 Other Capital Improvements

It is anticipated that the City will continue to perform sewer improvements and other projects as described in Section 3.1. Annual collection system improvements at $250,000 per year, plus inflation, have been include in the user rate analysis. Revenue to cover the costs of these improvements will be collected through the user charge system.

8.10 Projected Annual Operating Budget and User Charge Rates

The projected annual operating budget and user charge rates for the City need to take several components into consideration and can be best analyzed using a cash flow schedule. The expense components of the cash flow include future debt of the wastewater facility improvements, debt or costs for future capital/improvements public works projects, collection system depreciation, equipment replacement funds, and total annual operation costs as described in the previous sections. The revenue components of the cash flow are revenue from current rates and major industrial users as described in Section 8.9.1 and projected revenue from rate increases, connection fees, and interest income. Improvements can also be financed through use of cash on hand or replacement fund reserves.

The estimated capital cost for the selected alternative (Alternative 3C) was used to determine potential loan payments using either CWFP or USDA RD loans, and resulting impacts to user charges. As stated in Section 8.4, it is expected that either USDA RD or CWFP funding, or a combination of both, could be used for the project and the rate impacts will be refined as the funding package is developed. User rates were calculated for various scenarios ranging from a scenario of 20-year financing for CWFP with 30% Principal Forgiveness and a 2.0% interest rate to a scenario with funding from USDA RD using a 2.0% interest rate for 40-year financing but with payback in 25 years. The scenarios also included paying off existing CWFP loans and capital contributions from the City. Cash flow projections for the two most likely scenarios with CWFP and USDA RD funding are provided in Appendix Q.

Based on these cash flow projections, user charges for an average residential customer are expected to increase from the current average residential charge of approximately $29 per month to between $50 and $53 per month in the next 5 years depending on the methodology of the user charge system and the funding package.

User rates were conservatively calculated with no increase in users or usage assumed, and an average equivalent meter usage of approximately 3,500 gallons per month, which would be a typical residential water use rate. These user rate impacts were also conservatively calculated using 2020 industrial flows and loadings with no future flow and loading increase or surcharges, and with the industries paying only based on flows and loads rather than a capital contribution. The existing agreements with the industries will be renegotiated following completion of this facilities plan. Since conservative assumptions were used for these major industries in the user charge calculations, any changes to these agreements are expected to beneficially impact user rates for residential and other users.

The cash flow projections in Appendix Q are examples of possible methodology and rate implementation schedule, but the actual rates and schedule for rate increases will depend on the funding method, schedule, and required debt reserve and debt coverage. If possible, stepped rate increases are recommended to lessen the immediate impacts to users. It should be noted that other revenue generating sources can be utilized such as impact fees, grants, energy grants and other funding mechanisms. If these methodologies are implemented, the rates presented would be reduced accordingly.

8.11 Implementation Steps and Schedule

The City intends to apply for funding through USDA RD's water and wastewater program and the Wisconsin CWFP to finance construction. The following implementation schedule is based on the timelines for these loan programs, as well as requirements for agency review, approval, and permitting. Plan review will be performed by the WDNR and USDA RD. The State of Wisconsin's Division of Safety and Professional Services (DSPS) plan review is required for public buildings 25,000 cubic feet or larger. Permits that may be required include WDNR Chapter 30 permits, Water Resources Application for Project Permits (WRAPP), and the U.S. Army Corps of Engineers' Clean Water Act Section 404 permitting.

A preliminary project scheduled is presented in Table 8-7. It includes preliminary design beginning in the summer or fall of 2021 and continuing through 2022/2023 with a September 2023 submittal to WDNR for plan and specification approval. Final construction documents are to be complete for an early 2024 bid date. The actual schedule will depend on the availability of financing, possible interim financing costs, and City decisions on the ultimate timeline and phasing of construction projects.

Table 8-7 Proposed Implementation Schedule

Action	Completion Date
Submit CWFP Intent to Apply	October 2021
Begin Industrial Contract Negotiations	October 2021
Proceed with Preliminary Design	October 2021
Public Hearing on Facilities Plan	November 2021
Incorporate Public Hearing comments into the Final Facilities Plan.	December 2021
Submit Facilities Plan to WDNR	December 2021
DNR Approval of Facilities Plan	March 2022
Submit Rural Development Funding Application	Summer 2022
Finalize Industrial Contract Negotiations	Summer 2022
Proceed with Final Design	Summer/Fall 2022
Obtain Preliminary RD Funding Commitment	Fall/Winter 2022
Submit Plans and Specifications to DNR	September 30, 2023
Submit CWF Loan Application	September 30, 2023
Apply for Required Construction Permits	September 2023
Obtain USDA OGC Closing Instructions	September 2023
Approval of Plans and Specifications	December 2023
Advertise for Bids	December 2023
Open Bids	January 2024
Award Bids	February 2024
Submit User Charge Rates/Ordinances	March 2024
Submit Executed Contracts to DNR and USDA	March 2024
Start Construction	March 2024
Clean Water Fund Loan Closing	June 2024
Complete Construction	June 2026
Complete O&M Manual and Loan Closeout	August 2026