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Memo

TO: Dave Gutchess, Director of Public Works – City of Grand Ledge

FROM: Josh Redner, PE

DATE: January 19, 2024 PROJECT NO.: 201424

SUBJECT: Grand Ledge Wastewater Treatment and Sanitary Sewer Improvements

Purpose

This memorandum provides background and rational for design decisions related to the City of Grand Ledge (City) Wastewater Treatment Plant and Sanitary Sewer System Improvements project along with information on the impacts of potential design changes.

Project Background

Collection System History

Combined Sewer Separation and Inflow/Infiltration

The collection system was originally constructed as a combined sewer system, but the City completed construction of a sewer separation project in 1991. Despite these improvement efforts, wet weather events continued to cause sanitary sewer overflows (SSO) in the collection system and discharges of partially treated wastewater from the retention treatment basin at the WWTP. These continued SSO events have resulted in enforcement action from the Michigan Department of Environment, Great Lakes, and Energy (EGLE).

Collection System Modeling

The Phase II Combined Sewer Overflow report dated May 1998 showed the results of flow monitoring and hydraulic modeling of the Grand Ledge collection system. The monitoring showed significant infiltration remained in all areas of the collection system, with 53% from the North End District. In 2005, Fishbeck performed a capacity analysis of the system that confirmed there was still significant infiltration resulting in high peak flows for the size of the collection system. A model was created and calibrated during that analysis to determine what future improvements would be needed.

Flow monitoring of the collection system has continued in 2013-2015, 2017-2018, and 2022. With this information the hydraulic model of the collection system was updated to understand how seasonal conditions affect the peak wet weather flows. This model was used to size the current collection system improvements and the flow equalization basin that would be needed to reduce the likelihood of future SSOs. The modeled peak instantaneous flow from the collection system, assuming no additional I/I removal, was 14.3 million gallons per day (MGD). This flow rate is well above the peak flow capacity of the existing WWTP.

Past Inflow/Infiltration Removal

The City completed roof drain and downspout disconnections between 2006 and 2007, but footing drain connections and other groundwater infiltration still produce a significant amount of I/I.

In 2010, upgrades were performed to both the West River Street Lift Station and the River Interceptor to further reduce the occurrence of SSOs. However, the City received a Violation Notice on March 11, 2021, which outlined SSOs that EGLE determined to be violations of the City's existing National Pollutant Discharge Elimination System (NPDES) permit.

Funding for I/I Removal

Fishbeck continues to recommend eliminating I/I from the collection system, specifically by means of eliminating footing drain connections to the sanitary sewer system to reduce the occurrence of SSO events. An effective means of reducing I/I, a footing drain disconnect program can come at a significant capital cost and require modifications to the collection system on private property. Additionally, significant storm sewer system improvements would be required to complete a footing drain disconnect program.

Funding for collection system I/I removal improvements is available through the Clean Water Safety Revolving Fund (CWSRF) program in the form of low interest loans and potential grants in the same manner as the current CWSRF funding request. Adding I/I removal to the current project scope would likely not increase the scoring for the current project as the current project seeks to eliminate SSO events by means of conveyance improvements, and influent equalization improvements.

WWTP History

The WWTP was originally constructed in the 1930s. Many of the current treatment processes were constructed in 1975. The most recent upgrade, completed in 2012, included a retention treatment basin, a new headworks building, and disinfection expansion. The City has continued to maintain the existing equipment, but the majority of the WWTP process equipment is from 1975 and largely approaching the end of its useful life.

Fishbeck conducted an evaluation of the wastewater treatment system capacity in 2017. This study determined the WWTP was at 73% of its current 1.5 MGD hydraulic capacity and was at, or exceeding the WWTP design biological treatment capacity, and therefore has limited capacity for additional flow or biological loading. The WWTP capacity is recognized as the limiting factor to development within the service area. The City has been unable to accept new industrial users interested in building in the area due to a lack of treatment plant capacity.

Basis of Design Development

The current project scope is intended to provide additional treatment capacity and eliminate SSOs. City staff provided input while identifying areas of potential growth including areas to the southeast, west, and north of the City. Table 1 presents the projected Residential Equivalent Units (REU) by area. The values presented in Table 1 do not include projected industrial demand.

Table 1 – Projected Residential Equivalent Units to be Served

Area	REUs
1 – South/East	2,400
2 – West	2,000
3 – North	700
Existing Service*	3,300
Total to be served	8,400

* From 2020 City billing information

Beyond the additional residential and commercial flows, the basis of design included a separate allocation based on representative flow and loads from up to two Significant Industrial Users (SIU). Total projected average flow and loading is summarized in Table 2.

Table 2 – Projected Annual Average Flows and Loads

Flow Source	Flow (MGD)	$CBOD_5$ (mg/L)	$CBOD_5$ (lbs/day)	TSS (mg/L)	TSS (lbs/day)	NH_3-N (mg/L)	NH_3-N (lbs/day)	Total-P (mg/L)	Total-P (lbs/day)
Existing Average	1.06	291	2,395	228	2,258	25	221	4.9	39
Additional Residential & Commercial Average	1.40	190	2,211	210	2,453	25	292	4.9	57
Additional Industrial Average	1.20	183	1,834	234	2,282	36	351	5	49
Water Treatment Plant Average	0.28	0	0	144	340	0	0	0	0
Total Projected Average	3.9	198	6,449	225	7,332	26	864	4.4	145

Previous Alternatives Analysis and Selection

The following treatment alternatives were developed considering the design criteria in the December 2021 Alternatives Analysis Report:

- No Action
- Regional Alternative
- Expansion of Conventional Activated Sludge
- Conversion to Extended Aeration
- Conversion to Membrane Bioreactors (MBR)
- Maintain Existing Facility and Construct a Remote Facility

The “No Action” and “Regional Alternative ” options were not considered principal alternatives. An additional remote treatment facility located near the industrial park would require significant collection system improvements. These improvements would be difficult to operate, have highly restrictive discharge limits, be cost prohibitive, and were not considered as a principal alternative.

The remaining alternatives were considered based on capital cost, operation, and maintenance (O&M) costs, land requirements in Fitzgerald Park, and environmental impacts. Of the three options, the MBR option was selected due to the competitive capital cost, smallest footprint achievable, and the high-quality effluent the system would produce.

Alternatives Considered

I/I Removal

Summary

For the City, a majority of the I/I issue rises from the footing drains that are connected to the sanitary sewer system. Disconnecting footing drains would require identifying which properties are connected to the sanitary sewer, excavating, disconnecting the footing drain from the sanitary connection, and redirecting the footing drain to the storm sewer. The typical cost for this work is estimated to range from $7,000 to $12,000 per residence,

however, this cost can increase with finished basements. Additionally, significant improvements would likely be required to increase the capacity of the storm sewer system.

WWTP Expansion at Alternate Site

Summary

Expanding the WWTP at an alternate site near the existing WWTP would allow for alternative treatment technologies including a conventional activated sludge treatment system similar to the current WWTP or an MBR treatment system similar to the currently planned improvements. A conventional activated sludge treatment system would require additional treatment tanks and a larger overall footprint, while an MBR treatment system would have a smaller footprint but would require additional mechanical equipment.

Building a treatment plant at an alternate site would reduce construction impacts on the existing WWTP and could mitigate floodplain and wetlands concerns associated with the current design. Key benefits of constructing improvements at an alternate site include:

- Reduced encroachment on existing structures which could help reduce construction cost.
- Improved building geometry for more efficient construction, equipment layout, and long-term operation.
- Improved construction schedule by limiting phasing associated with reuse of the existing site.

General Design Considerations

The following assumptions were made during the development of alternative treatment options:

- Opinions of probable cost were escalated to 2025 construction.
- The new WWTP will have a rated capacity of 3.9 MGD.
- No additional I/I removal is undertaken. The West River Pump Station (WRPS) associated force main, and Influent Wastewater Storage Tank size will remain in the design with minor modifications. The WWTP design flow and loads match the basis of design of the current design, and as described above.
- The Influent Wastewater Storage Tank would be located at the alternative site. This would allow the tank to be built completely above-grade. Alternatives to the pre-stressed concrete tank could be incorporated into the design and be more cost-effective.
- The existing headworks building would remain in operation, a new screen designed for the peak flow would be installed.
- A portion of the existing retention treatment basin would be retrofitted to accommodate a new pump station. A new discharge force main would be installed from the lift station to the new WWTP site.
- The existing primary clarifier and aeration tank structures would be abandoned.
- The existing chlorine disinfection system would be reused.
- Half of the gravel parking lot would be available for contractor trailers and vehicles, as was done with the Headworks project in 2009-2010.
- New electrical gear and generator would be located in the new treatment building.

MBR Treatment at an Alternative Site

EGLE has indicated that expansion of the WWTP capacity will require effluent to meet Advanced Waste Treatment (AWT) limits. This can be accomplished in multiple ways including MBR treatment. Construction at an alternate site allows for some modifications from the current design. The current estimate incorporates the following assumptions:

- Preliminary treatment including screening and grit removal would be completed at the current site.
- Screened and degritted wastewater would be pumped to the new site.

- Drum screens would be used to provide fine screening of wastewater entering the MBR treatment process. Drum screens would require a larger footprint than the Salsness Filters in the current design but would be less expensive.
- Diffused Aeration combined with MBRs would be used as the secondary treatment process, like the current design.
- MBR permeate would flow by gravity back to the existing site for disinfection in the existing chlorine contact tank.
- Waste activated sludge would be lime stabilized and directed to the existing storage tanks.
- To meet the firm capacity requirements, a biosolids dewatering system similar to the current design is included.

Opinion of Probable Cost

The American Association of Cost Engineers has established a Class 5 estimate as appropriate for concept screening purposes. The expected accuracy range for a Class 5 estimate is stated as -50% to +100%. The engineer's preliminary opinion of probable construction cost presented here should be viewed as a Class 5 estimate for the assumptions stated. If the alternative moves forward, the estimate would be refined as the design progresses and the expected accuracy range of the estimate would be narrowed. Actual costs will depend on the bidding climate at the time bids are received, and can be impacted by contractor availability, supply chain issues, inflation, and cost escalation. Changes to the scope of improvements could further impact the range of potential differences in cost from those projected here.

Table 3 – Opinion of Probable Construction Cost for MBR Treatment at an Alternate Site (3.9 MGD Rated Capacity)

Items	Estimated Cost
West River Pump Station, Force Main, and Influent Wastewater Storage Tank	$9,100,000
Site Civil Work	$8,100,000
Fine Screening	$1,800,000
MBR System	$12,900,000
Solids Handling	$2,400,000
Existing WWTP Work	$3,400,000
Site Electrical	$500,000
Contingency (30%)	$11,400,000
Mobilization (10%)	$3,800,000
Construction Subtotal	**$53,400,000**
Contractor's OH&P (15%)	$8,100,000
Total	**$61,500,000**

Design engineering fees for the MBR treatment facility are estimated to be between $1,200,000 and $1,500,000. This estimated fee range assumes that the West River Drive Pump Station, force main and sanitary sewer collection system improvements design can be reused. The project scope and delivery method will need to be confirmed before a proposal for engineering services can be provided.

Conventional Activated Sludge Treatment at an Alternative Site

AWT limits can be met with conventional activated sludge treatment and tertiary filtration. This treatment technology is similar to the existing WWTP in that it includes primary clarifiers, aeration tanks and secondary clarifiers. Tertiary filtration would be added after the secondary clarifiers and prior to disinfection to meet more stringent effluent requirements.

The current estimate incorporates the following assumptions:

- Preliminary treatment including screening and grit removal would be completed at the current site.
- Screened and degritted wastewater would be pumped to the new site.
- Wastewater would flow by gravity through primary clarifiers, aeration tanks, secondary clarifiers and tertiary filters at the new site.
- Tertiary filter effluent would flow by gravity back to the existing site for disinfection in the existing chlorine contact tank prior to discharge to the Grand River through the existing outfall.
- Primary and waste activated sludge would be lime stabilized and directed to the existing storage tanks.
- To meet the firm capacity requirements, a biosolids dewatering system similar to the current design is included.

Opinion of Probable Cost

An opinion of probable cost for Conventional Activated Sludge Treatment at an Alternative Site is presented in Table 4. This represents a Class 5 estimate as previously described.

Table 4 – Opinion of Probable Cost for Conventional Activated Sludge Treatment at an Alternative Site (3.9 MGD Rated Capacity)

Items	Estimated Cost
West River Pump Station, Force Main, and Influent Wastewater Storage Tank	$9,100,000
Site Civil Work	$7,200,000
Fine Screening	$1,800,000
Aeration System	$5,700,000
Secondary Clarifiers	$5,300,000
Tertiary Filters	$3,700,000
Solids Handling	$2,400,000
Existing WWTP Work	$3,400,000
Site Electrical	$500,000
Contingency (30%)	$11,800,000
Mobilization (10%)	$5,100,000
Construction Subtotal	**$56,000,000**
Contractor's OH&P (15%)	$8,400,000
Total	**$64,400,000**

Design engineering fees for the conventional activated sludge treatment facility are estimated to be between $1,200,000 and $1,500,000. This estimated fee range assumes that the West River Drive Pump Station, force main and sanitary sewer collection system improvements design can be reused. The project scope and delivery method will need to be confirmed before a proposal for engineering services can be provided.

Current Design Considerations

West River Drive Pump Station Force Main

Method of Installation

Fishbeck evaluated open cut installation methods and horizontal directional drilling (HDD) installation methods for the 18-inch sanitary force main from the West River Pump Station on Jefferson Street. It was ultimately decided to proceed with designing the sanitary force main to be installed using open cut installation methods for the following reasons:

- Depth: Existing gravity sanitary sewer is present on Jefferson Street at a depth between 11 feet and 13 feet. Existing water main is present on Jefferson Street at an assumed depth between 5 feet and 6 feet. Municipal sanitary and water services are assumed to be present at the approximate depths listed for each utility at each property along Jefferson Street. The depth of the existing sanitary sewer and existing water main provides a "depth window" between 6 feet and 11 feet where the sanitary force main could be installed with minimal presumed conflicts or interruptions to residential municipal services. The identified depth window allows for standard manholes to be utilized at pressure relief valve locations and ease of maintenance which includes single lane traffic impacts should the force main need to be excavated and repaired in the future.
    - Depth of directional drilling would likely need to be 18 inches to 24 inches below the deepest existing utility, to reduce the potential impact to residential services. This would mean between 13 feet and 15 feet of cover would be the likely design depth if the sanitary force main was to be installed using HDD.
- Resident Impact: During preliminary discussions, the City expressed a desire to reduce the impact the construction will have on residents. HDD requires long lengths of high density polyethylene (HDPE) pipe to be staged prior to installation. There does not appear to be a good staging area along Jefferson Street near the project limits, so pipe would likely need to be staged near the site, and driveway access would likely be restricted for several days during this operation. Additionally, during the installation of the HDD, driveway access would be restricted in the immediate area where the work is occurring. There is also a concern of soil displacement, which can cause pipe separation, damage, and result in multiple emergency excavations and repairs. If a sanitary service break goes unnoticed, it could cause backups through floor drains in basements.
    - Open cut installation is also impactful to the residents; however, it is limited to shorter durations and shorter longitudinal lengths along Jefferson Street as the force main installation progresses.

Changing from open cut installation to an HDD installation would require a new design to be developed for contractor pricing. Fishbeck has discussed this approach with contractors and based on that feedback and the bids from the Well 2 Raw Water Transmission Main project. Based on this information it is estimated that allowing HDD may save approximately $500,000 in total project cost.

Materials of Construction

During the current bidding, both HDPE and ceramic lined ductile iron pipe were allowed for the West River Drive Pump Station force main. The current design is based on open cut construction. Bidding documents indicate that ceramic lined ductile iron pipe is currently more cost effective than HDPE pipe, although with material cost variability, this could change in the future. Both options should be allowed for this application.

Influent Wastewater Storage Tank

Relocating the influent wastewater storage tank to a new site would allow an alternate method of construction to be used and would avoid costly rock excavation and earth retention. The current prestressed concrete tank is estimated to cost $3,000,000. This includes a tank flushing system but does not include the associated site work including the required rock excavation and temporary earth retention system. Fishbeck received a budgetary cost estimate from a steel tank manufacturer of $2,700,000. This cost did not include a flushing system. The primary cost savings associated with relocating the tank to a new site will be associated with the reduction of the required site work.

Lime Storage and Feed System

Initial bid results and post bid interview information indicates that the elimination of lime storage and feed system improvements may result in approximately $5,000,000 in cost savings.

Conclusion

Project details will need to be confirmed to provide a more accurate opinion of probable construction cost. Initial estimates indicate that constructing a new WWTP at an alternate site near the existing WWTP could provide a cost savings over the current project design. The City has expressed interest in alternate project delivery methods to further identify potential cost saving opportunities. Changes in the project scope or in the delivery method would require updates to the existing project plan if CWSRF funding is to be used for the project.

By email
Copy: Adam Smith, City Manager – City of Grand Ledge
Josh Redner, PE – Fishbeck
John Willemin, PE – Fishbeck

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January 19, 2024
Project No. 201424

Adam Smith
City Manager
City of Grand Ledge
310 Greenwood Street
Grand Ledge, MI 48837

Grand Ledge Wastewater Treatment Plant and Sanitary Sewer System Improvements – Bid Evaluation

Fishbeck has reviewed the bids for the Wastewater Treatment Plant and Sanitary Sewer System project received by the City of Grand Ledge on January 9, 2024, at 11:00 a.m. Two bids were received. The apparent low bid was received from Commercial Contracting Corporation (CCC).

The Engineers Preliminary Opinion of Probable Construction Cost of $86,100,000.00 was provided to the SRF program in the Part II funding application on December 12, 2023. This cost was based on the June 27, 2023, bid results. CCC provided a bid price of $77,292,000.00 and Walsh Construction provided a bid price of $84,223,500.00. Both bids are within the available funding allocated for this project through the Clean Water State Revolving Fund (CWSRF) program. A tabulation of the bid results is attached.

CCC attended the prebid conference on October 23, 2023, provided Fishbeck with detailed questions during the bidding process, and demonstrated a good understanding of the project requirements as presented in their Bid Documents. They have also provided information about their project team, many of whom have experience with large scale wastewater improvement projects.

CCC is currently under contract for a number of wastewater treatment improvement projects including improvements to the Delta Township Wastewater Treatment Plan (WWTP). They have completed projects of similar or larger scale for the Great Lakes Water Authority, the Detroit Water and Sewerage Department, and the Oakland County Water Resources Commission. CCC has indicated that they intend to self-perform the concrete, steel, and interiors work, along with identifying reputable subcontractors for the major trades.

Based on our evaluation we find that CCC is qualified and prepared to complete the work.

If you have any questions or require additional information, please contact me at 616.464.3848 or jredner@fishbeck.com.

Sincerely,

Josh W Redner

Joshua W. Redner, PE
Senior Water and Wastewater Engineer

Attachments
Email

Bid Opening Form

fishbeck

PROJECT NAME	City of Grand Ledge Wastewater Treatment Plant and Sanitary Sewer System Improvements	PROJECT NO.	201424
BID DATE	January 9, 2024	TIME OF BID	11:00 a.m.

BIDDERS	BID BOND/ SECURITY	ADDENDA					BID AMOUNT
		1	2	3			
Walsh	X	X	X	X			$84,223,500
CCC	X	X	X	X			$77,292,000