Preliminary Engineering Report

Water System Study - Storage
City of Storm Lake, Iowa

June, 2021

Project No. 20-24717

ISG
Architecture
Engineering
Environmental
Planning
ISGInc.com

REPORT FOR:
City of Storm Lake
P.O. Box 1086
620 Erie Street
Storm Lake, IA 50588
712-732-8000

FROM:
ISG
Kelly Evans, PE
508 East Locust Street
Des Moines, IA 50309
515-243-9143
Kelly.Evans@ISGInc.com

SIGNATURE SHEET

I HEREBY CERTIFY THAT THIS ENGINEERING DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT PERSONAL SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF IOWA.

06/02/2021

Kelly Evans, **PE**
Senior Water/Wastewater Engineer
License No. 23465
Renewal Date: December 31, 2021

ISG
508 East Locust Street
Des Moines, IA 50309

Water System Study - Storage
Storm Lake, Iowa

Engineer's Project Number: 20-24717

Dated this 2nd day of June, 2021

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EXECUTIVE SUMMARY

ISG was retained by the City of Storm Lake, Iowa to complete a water system preliminary engineering report (PER). This PER presents recommendations and complies with current Iowa Department of Natural Resources (Iowa DNR), 2012 Recommended Standards for Water Works (Ten State Standards), and Statewide Urban Design and Specification (SUDAS) requirements. This study primarily addresses storage needs as separate PERs are being prepared for source, treatment, & distribution needs.

The City of Storm Lake, Iowa is in Buena Vista County and has a population of 10,600 per the 2010 census. It supplies water to the surrounding entities of Lakeside, Lake Creek Homeowners Association (Lake Creek HOA), Truesdale, and the unincorporated area on the south side of the lake. The City currently retains 3.425 million gallons (MG) of storage capacity via two clearwells and three elevated water towers. The clearwells at the water treatment plant (WTP) provide 1.675 MG of storage; an onsite generator to power the high service pumps allows them to count towards the total storage volume. The three towers comprise the remaining storage volume. Tower 1 (Downtown Tower) is located on Ontario Street and has 0.75 MG capacity. Tower 2 (Rothmoor Road) is located on the east side of the City on Rothmoor Road with 0.5 MG capacity. Tower 4 (West Lake Estates) is located on the west side of the City in the West Lake Estates area and has 0.5 MG of capacity.

Evaluation of demand revealed the total system storage is undersized for the current average daily demand. Projected increases in demand over the next twenty years indicate an additional million gallons of storage is needed, highlighting the need for capacity expansion. Evaluation of the existing system revealed opportunities for improving operations. Complications from Tower 4 have rendered it hydraulically insufficient to the system. Correcting Tower 4 can reclaim the City's investment and improve water quality. Addressing water stagnation found in all three towers can provide further benefits to water quality.

This PER explores various options for optimizing the existing storage network and expanding its capacity. Options to expand capacity include replacing Tower 1 with a 2.0 MG elevated tower, construction of a new 1 MG elevated tower, and construction of a new 1 MG ground storage reservoir. Optimization of the existing system includes hydraulically isolating Tower 4, refurbishing the existing towers, installing water tower mixers, and adjusting the water tower operating levels.

ISG recommends the City of Storm Lake act upon hydraulically isolating Tower 4, a new 2.0 MG Composite Tank to replace Tower 1, addition of water tower mixers, and water tower rehabilitation. Adjustment of on/off tower levels from the high service pump should be instigated once source capacity and treatment are increased but there should be no associated costs. This series of actions will meet the City's projected storage demands with a long-range vision, protect the City's existing storage infrastructure investments, and ensure improved water quality for years to come while potentially reducing operation & maintenance (O&M) costs. Recommended schedule is as follows:

Improvement Recommendation (In Prioritized Order)	Engineer's Opinion of Probable Project Cost
Tower 4 Hydraulic Isolation Begin Immediately	$332,000
New 2.0 MG Composite Tank Begin immediately for construction in 2022 before new coating requirements increase cost	$4,936,000
Water Tower Mixers – Towers 2 & 4 (Total Cost) Complete when economically feasible – within next 5 years	$100,000
Water Tower Rehabilitation – Towers 2 & 4 (Total Cost) Complete when economically feasible but preferably before 2023 – otherwise place in maintenance plan for economic feasibility	$2,191,000

INTRODUCTION

The City of Storm Lake, Iowa is currently facing challenges related to its water system storage capacity. The City has retained ISG (I&S Group, Inc.) to complete this Preliminary Engineering Report (PER) to explore current storage capacity and options for storage expansion. This PER presents recommendations and properly complies with current Iowa DNR, 2012 Recommended Standards for Water Works (Ten State Standards), and Statewide Urban Design and Specification (SUDAS) requirements.

Background

The City of Storm Lake, IA is located in Buena Vista County. In the 2010 census, the City had a population of 10,600. The City supplies water to several consecutive systems including Lakeside, Lake Creek HOA, Truesdale, and homes outside of municipal boundaries (Figure 1). The collective population served as informed by the 2010 census and estimates of the unincorporated population is 12,038 as seen in *Table 1*.

Table 1. Summary of populations served.

Entity	Population	Data Source
Storm Lake	10,600	Census
Lakeside	917	Census
Outside Storm Lake Boundaries	265	2019 Sanitary Survey
Lake Creek HOA	175	2019 Sanitary Survey
Truesdale	81	Census
TOTAL	12,038	

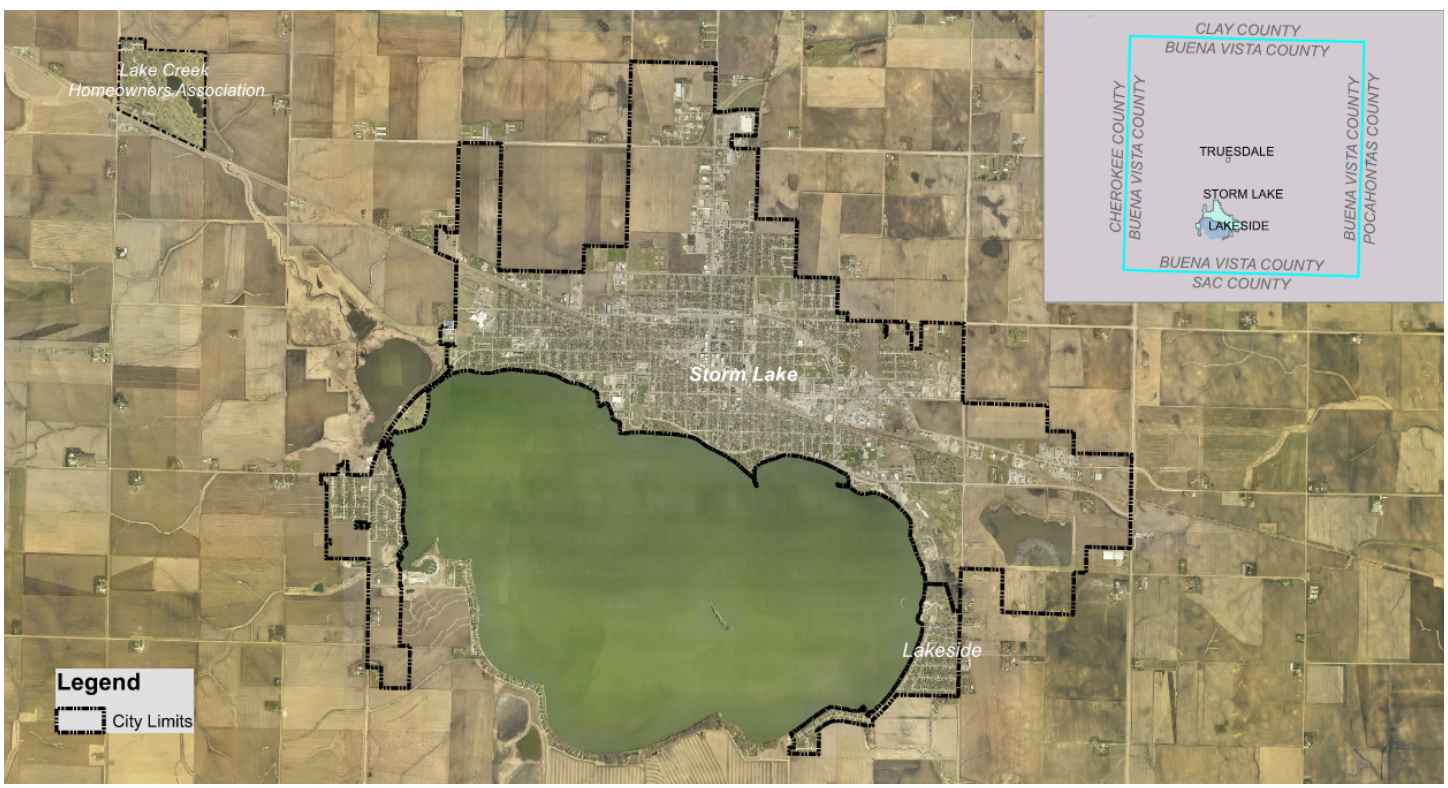


Figure 1. Location of Storm Lake and surrounding entities.

WATER USAGE

One of the first steps in the analysis of a water system includes determining the demand for water. This water demand is often quantified in terms of average and maximum daily usage. The average day demand is calculated as the average water usage per day over the given data set. The maximum day demand is the highest water usage the system experiences in one, 24-hour period. The maximum day demand is typically experienced in the summer months, due to irrigation practices. Part of the water demand analysis includes projections for future water demand.

Theoretical Water Demand

Using SUDAS design standards, theoretical water demands are based on population and the following factors:

- Average daily demand: A consumptive rate of 100 gpcd was assumed over a 20-hour time period
- Peak day demand: A 20-hour operation period times twice the average daily demand
- Peak rate demand: The instantaneous peak rate factor was calculated as follows:

$$Average\ day\ demand\ (gpm) \times 7/P^{0.167}$$

Where *P* is the design year population in thousands.

Table 2. Theoretical Water Demand.

Water Demand	Calculation	Gallons per day (gpd)	Gallons per minute (gpm)
Average day demand	=12,038*100	1,203,800	1,003
Peak day demand	=1,203,800 MGD*2	2,407,600	2,006
Peak hourly demand	=1,000*7/($12.038^{0.167}$)	--	4,620

The results of this theoretical analysis are deficient. The City's top two water users include a pork processing plant and a turkey processing plant. These two entities use approximately 70%-80% of the total water produced each year by the water system. Due to the large industrial presence, the population cannot accurately predict the water demand.

Historical Water Demand

Historical operating data is the most accurate way to analyze existing water demand. Storm Lake monthly operating reports (MORs) were analyzed from January 2016 to December 2020. MORs report the amount of water leaving the water treatment plant (WTP) and entering the distribution system. The plant currently experiences significant variation in water demand from 1 MGD to 4.5 MGD as seen in *Figure 2.*

Billing data for the top ten water users was also provided by the City from January 2016 to January 2021. The City's top two water users include a pork processing plant and a turkey processing plant. These two entities use approximately 70%-80% of the total water produced each year by the WTP. It is no surprise that the operation of these industries therefore has a significant impact on usage trends. *Figure 3* shows the last three months of 2020. Lower water usage is correlated with weekends whereas higher demand occurs during the weekdays. The lowest water demand in this data range can be observed on Thanksgiving 11/26/20 and Christmas 12/25/20 when the industries were not in operation.

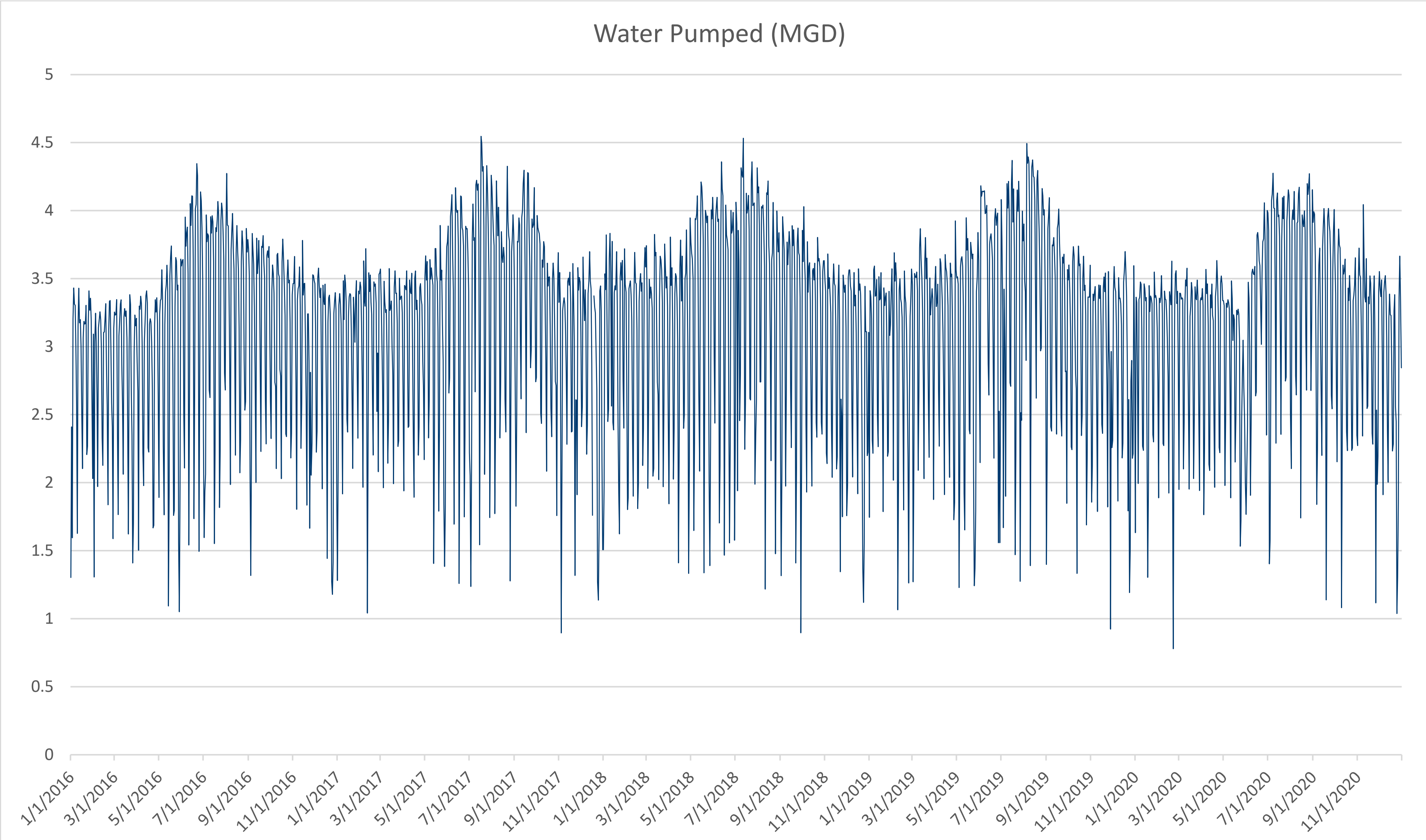


Figure 2. Existing water usage for the City of Storm Lake.

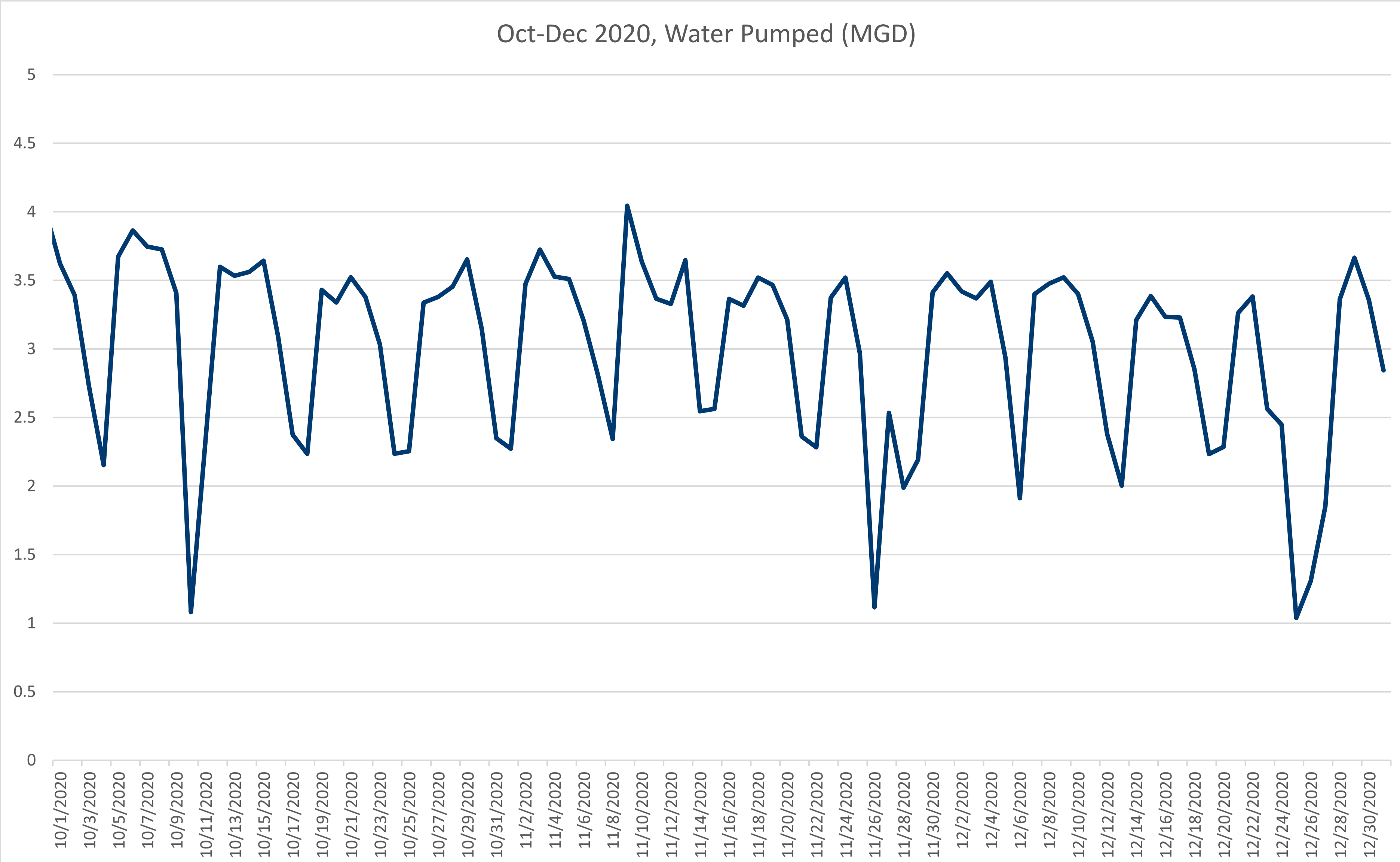


Figure 3. Snapshot of water demand data from 10/1/2020 to 12/30/2020 for Storm Lake, IA.

Table 3 shows the system's yearly total and average daily water production. The average yearly water pumpage was found to be 1,143 MGY with a standard deviation of 18 MGY. The system's water pumpage has remained relatively steady for the past 5 years. As discussed later in this section, history of water conservation implementation may deem these values inaccurate.

Table 3. Sum and average per year of water demand.

Year	Sum of Water Pumped (MG/YR)	Average of Water Pumped (MGD)
2016	1,112	3.04
2017	1,153	3.17
2018	1,156	3.17
2019	1,152	3.15
2020	1,145	3.13
Average	**1,143**	**3.13**

The statistical average day demand was found to be 3.13 MGD across the data set. The peak day was found to be 4.55 MGD and occurred on July 12th of 2018. Similar peaks around 4.5 MGD are seen each year occurring in the summer months. A peaking factor of 1.45 was calculated by dividing the peak day demand by the average day demand. The minimum water usage recorded over the data set is 0.78 MGD. The cause for this low water usage is unknown and appears to be an anomaly. The statistical 0.01 percentile of the data range is 1.05 MGD. 1.05 MGD will be used for the historical minimum day demand.

As previously mentioned, the City's demand varies directly with the local industries operational schedule. *Table 4* provides a summary of the analysis completed per day of the week. The average weekday demand was found to be 3.47 MGD and the average weekend demand was found to be 2.28 MGD over the data set. On average, there is a 52% increase in demand from the weekend to the weekday.

Table 4. Summary of the day of the week demand.

Day	Average of Water Pumped (MGD)	Maximum of Water Pumped (MGD)
Sunday	2.21	4.01
Monday	3.43	4.55
Tuesday	3.57	4.50
Wednesday	3.57	4.39
Thursday	3.52	4.53
Friday	3.26	4.14
Saturday	2.35	4.15
	Daily Average = 3.13	Daily Maximum = 4.55

The City occasionally enforces water conservation, most recently in the summer and fall of 2020, which could cap the maximum historical water pumpage. As a result, the available historical average and peak day demand could skew artificially low. As mentioned in the theoretical demand section, 2.0 is typically the assumed peaking factor for residential communities. The City's historical peaking factor is 1.45. This is a potential indicator of the maximum demand being suppressed. However, the local industries that account for 70-80% of the total demand may not follow typical residential peaking factors.

To address this uncertainty, conservative approaches for projecting the design demand will be utilized. Existing water demands are summarized below:

	Demand (MGD)
Overall Average Day Demand	3.13
Weekday Average Day Demand	3.47
Weekend Average Day Demand	2.28
Observed Peak Day Demand	4.55
Observed Peaking Factor Peak Day	1.45
Minimum Day Demand	1.05

Projected Water Demands

RESIDENTIAL

The 2017 Storm Lake housing study projected a growth of 400 people from 2017-2025 or 50 people per year. Conversations with the City have suggested a faster growth scenario of 600 units from 2017-2025. Assuming 2.5 persons per housing unit, this represents 1,500 people over 8 years or 187.5 people per year.

Table 5 shows the envelope of the projected water demands by the design year of 2041 following these growth patterns. Iowa DNR and Ten State Standards usage rates of 100 gpcd were used.

Table 5: Storm Lake population projections by 2041.

Persons per Year	2041 Projected Additional Population	Additional Residential Water Demand (GPD)
50	1,000	100,000
187.5	3,750	375,000

INDUSTRIAL

Exact industrial growth projections are unavailable at this time. Future conversations with the City and industries are planned. For the purpose of this report, an additional 10% contingency will be added to account for future growth of the industrial users.

Industries account for 70-80% of the total water demand in the City. With an average weekday demand of 3.47 MGD, industries account for approximately 2.43-2.75 MGD during the week. A 10% increase in demand would result in an additional 0.24-0.28 MGD.

Fire Flow Demand

Fire flow can only be provided if residual pressure remains at or above 20 psi. *Table 6* includes the fire flows that are recommended by SUDAS.

Table 6. Fire flow demands.

Water Demand	Distance between Buildings (feet)	Total Gallons per Minute (gpm)
Fire Flow Demand	Over 100’	500.0
Fire Flow Demand	31’ to 100’	750.0
Fire Flow Demand	11’ to 30’	1,000.0
Fire Flow Demand	10’ or less	1,500.0

Design Water Demand

The City's design water demand was conservatively selected from the analysis above and is summarized in *Table 7*.

Table 7. Summary of design average day water demand.

Average Water Demand	MGD
Existing Average Total Demand	3.47
Projected Increase Average Residential Demand	0.375
Projected Increase Average Industrial Demand	0.280
Total Projected Average Design Demand	4.13

Table 8 shows a summary of the design water demand that this report will be based on. A peaking factor of 2.0 has been assumed for peak day demand. This is consistent with typical design standards. Design standards require that the peak day demand calculated for a system must be met within 20 hours of production time. It has been assumed that the average day will be met in 20 hours as well to prevent on/off cycling of the lime softening plant.

Table 8. Design Water Demands.

Water Demand	Total Gallons per Day (MGD)	Total Gallons per Minute (GPM)
Average Day Demand	4.13	3,441
Peak Day Demand	8.26	6,883
Fire Flow Demand	-	1,000

EXISTING WATER STORAGE SYSTEM

The City of Storm Lake has two clearwells and three water towers which together provide 3.425 million gallons (MG). Both clearwells are on the southern half of the WTP site. All tower locations and elevations are shown in *Figure 4* and *Figure 5,* respectively. Tower 1 (Downtown Tower) is located on Ontario Street and has 0.75 MG capacity. Tower 2 (Rothmoor Road) is located on the east side of the City on Rothmoor Road with 0.5 MG capacity. Tower 4 (West Lake Estates) is located on the west side of the City in the West Lake Estates area and has 0.5 MG of capacity.

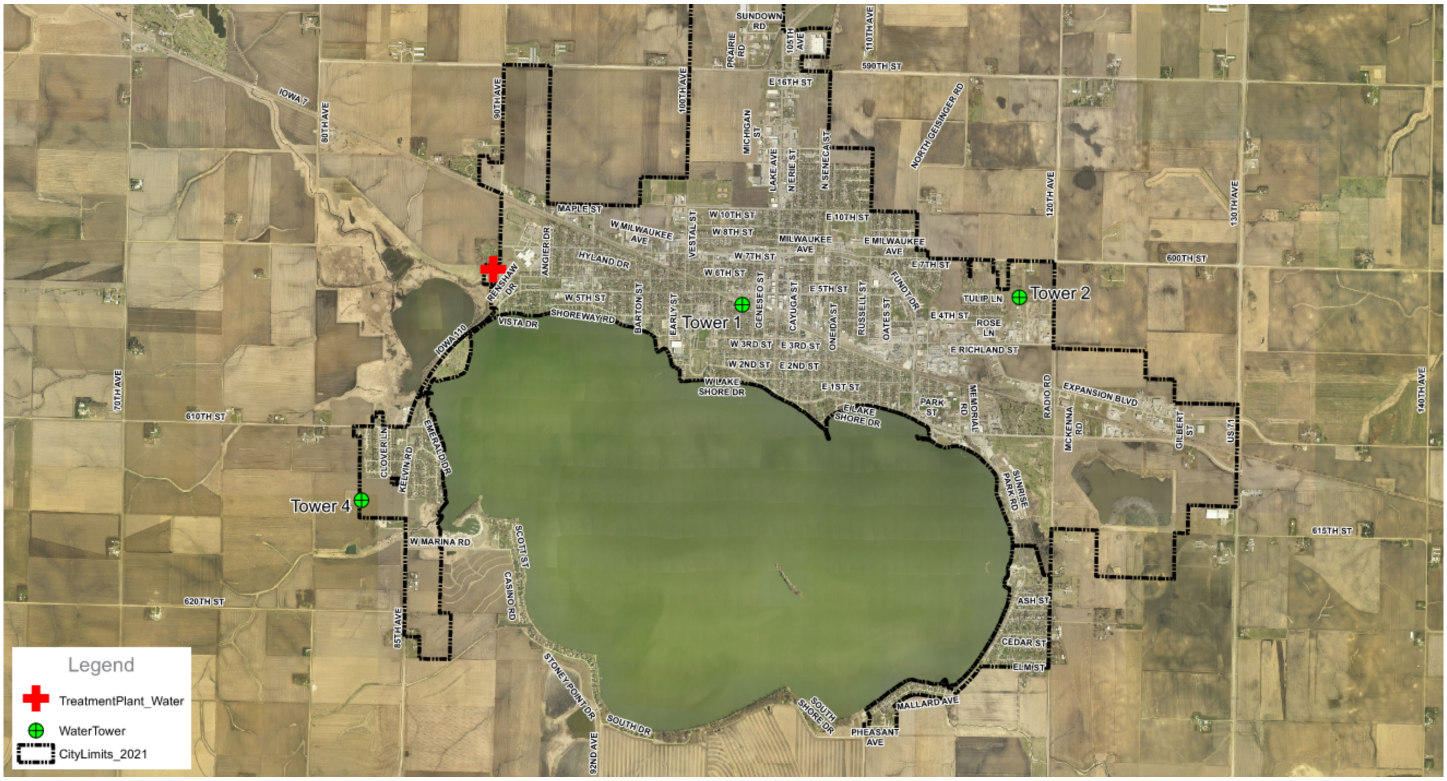


Figure 4: Storm Lake elevated storage locations.

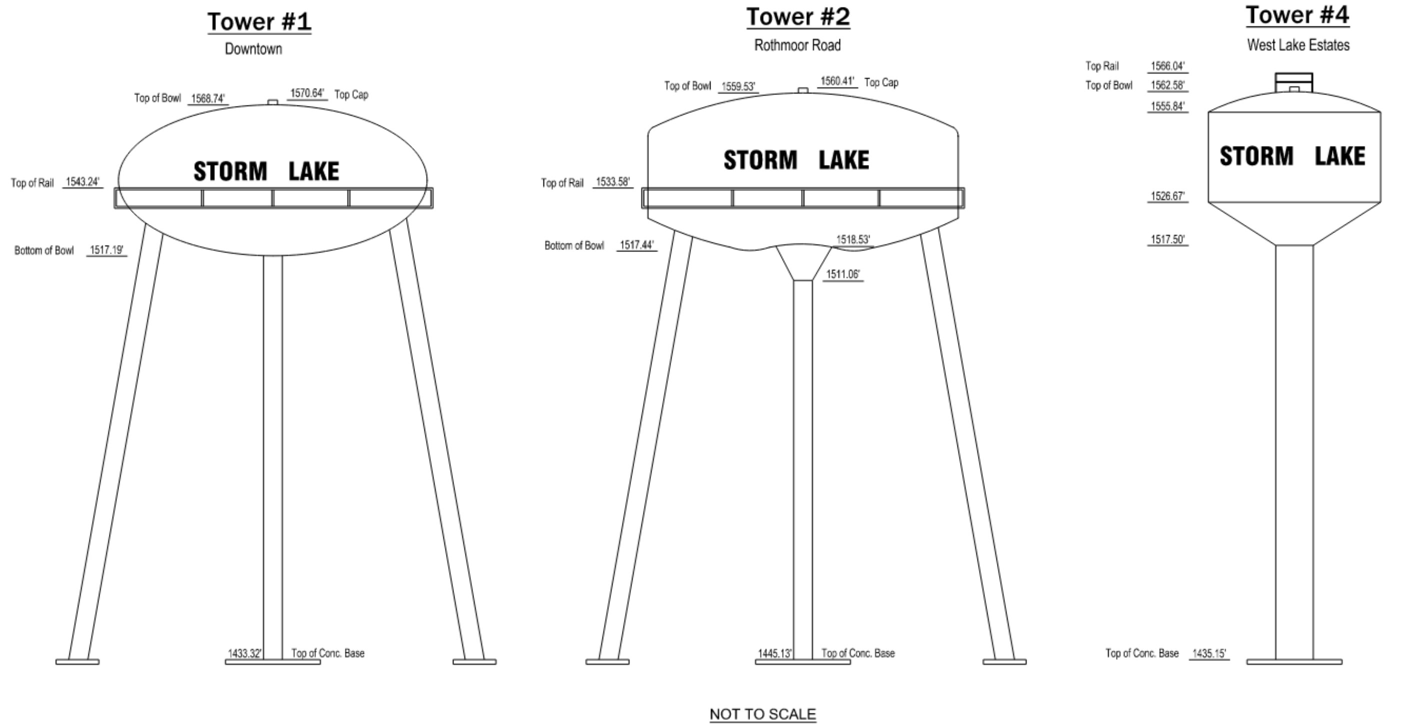


Figure 5. Existing water tower elevations.

Clearwells

Clearwell 1 was constructed in 1978 and Clearwell 2 was constructed in 1990. The pair run in series to provide 1.675 MG of ground storage. The treatment plant's five high service pumps pull out of the clearwells and pump to distribution. The plant's on-site generator is appropriately sized to run the high service pumps which makes water stored in the clearwells accessible during an emergency. Therefore, the clearwells' capacity counts towards Storm Lake's required total system storage.

The last inspection date of the clearwells is unknown. The City has plans to begin inspections of the clearwells as soon as summer of 2021. As noted in the 2019 sanitary survey, Clearwell 2 has insufficient grading which allows standing water within 50 feet of the structure in violation of Ten State Standards 7.0.2.

An aerial view of the clearwells can be seen in *Figure 6*.

Figure 6. Aerial imagery of the Storm Lake Water Treatment Plant.

Tower 1

Tower 1 is a 750,000 gal legged elevated tower constructed in 1956. It undergoes annual maintenance and alternates biennially between visual and ROV assisted inspections. As of the 2019 sanitary survey, the tower had several openings including the overflow pipe which were not properly fitted with a screen. Due to notable mildew accumulation and rust formation, the tower is scheduled for new interior and exterior paint in 2021.

Figure 7. Exterior and interior of Tower 1.

Tower 2

Tower 2 is a 500,000 gal toro ellipsoidal tower constructed in 1974. It undergoes annual maintenance and alternates biennially between visual and ROV assisted inspections. As of the last inspection in 2020, the tower was in compliance with all sanitary, structural, and safety regulations. The City was provided a video inspection report. Considerable staining on the interior and underbelly of the exterior were noted. Due to mildew accumulation and staining, the tower is scheduled for new interior and exterior paint in 2022.

Figure 8. Exterior and interior of Tower 2.

Tower 4

Tower 4 is a 500,000 gal fluted column tower constructed in 1991. It undergoes annual maintenance and alternates biennially between visual and ROV assisted inspections. As of the 2019 sanitary survey, the tower was in compliance with all sanitary regulations. Due to mildew accumulation and rust formation, the tower is scheduled for new interior and exterior paint in 2022.

The City notes that under typical operation, Tower 4 fills considerably faster than the other two. Tower 4 is believed to have been constructed at too low of an elevation, causing the system's hydraulic operating elevations to be higher than the overflow level. To resolve this issue, the City has closed a valve to reroute water clockwise around Storm Lake. The longer route forces head loss before the tower and limits its fill level. As a result, there is no loop to the system, and water age and storage accessibility could be an issue. In addition, a solenoid operated control valve is located at the base of the tower to prevent overflow and to aid in water turnover. Further discussion is provided below to assess Tower 4's hydraulic behavior and the implications on the City's system.

Figure 9. Exterior and interior of Tower 4.

ALTERNATIVE ANALYSIS

ISG explored several options for optimizing and expanding the existing storage in Storm Lake. The following are presented in order of alternative prioritization.

Alternative 1 – Water Tower 4 Utilization

As mentioned in the Existing Water Storage System section, Tower 4 does not operate correctly as it seems to not circulate/utilize the stored water causing water age issues. The tower utilizes a single pipe as an inlet and outlet. The base is fitted with a solenoid operated control valve (solenoid valve) meant to shut off at high fill levels to prevent overflow (measured by pressure differential). Once the tower is filled, the solenoid valve is closed until a preset pressure on the distribution side of the valve is low enough to reopen the valve, thus allowing the tower to feed the distribution system. Although a distribution valve has been closed to reroute water clockwise around Storm Lake, Towers 1 and 2 still maintain a significant pressure on the distribution side of the solenoid valve and rarely allow the valve to reopen from a low pressure in the distribution system. Even when the valve is opened due to Towers 1 and 2's low water levels, causing a lower pressure on the distribution side of the solenoid valve, the zone of influence of Tower 4 is small and only allows minor water volumes to leave and be consumed before the high service pumps turn back on. Once the high service pumps turn back on, the pressure differential is quickly overcome, causing the tower to fill back up and reclosing the solenoid valve. The short on/off cycling of the high service pumps is due to the large demand in the system and the bottle-neck of the supply and treatment systems. This causes the City to ensure the storage is kept at a relatively peak capacity in case of high demands where the supply/treatment could not keep up.

In the past, a Cla-Val automatic control valve (old tower valve) was installed near Frank Starr Park, prior to the looping of the distribution system around the lake and solenoid valve installation at the base of the tower. This did not solve the issue of Tower 4's utilization. The cause is unknown as that valve no longer exists and neither do many of the operations staff to consult with, but the following assumption is provided:

- The old tower valve operated on a 5-psi differential to open (could be adjusted but it is uncertain if it was). This is approximately 11.5' of head in the tower of a 38' head range (or 150,000 gallons of the total 500,000). Once the old tower valve was opened, the water already in the distribution system nearest the tower was pushed back into the tower. Any new water from the high service pumps supplied demand during that time and was added to the tower last. With one fill/draw pipe, that new water that was added last is then taken to the distribution system first once the old tower valve is closed again, leaving the old water still at the top of the tower allowing it to age. This continued over and over.
    - A larger pressure differential would have been recommended at that time along with a mixer to ensure old water was pulled from the tower rather than just new at the bottom. A 50% turnover (250,000 gallons) rather than a 30% turnover (150,000 gallons) would achieve better water age. A water pressure at 50% turnover would still provide a minimum of 44 psi.

Because the current solenoid valve is now placed at the base of the tower rather than at the "beginning" of a system (similar to the old tower valve and pre-distribution looping around the lake), the solenoid valve only controls usage in the tower where no demand is consumed. If the valve was relocated back to the "beginning of a system," it could then remain closed but still allow for the tower to be consumed by demand by the rest of the separate system. This is preferred rather than the high service pumps and other towers providing the demand similar to current operations.

ISG is recommending the solenoid valve be relocated from the tower base to the west shore along Frank Starr Park as indicated in *Figure 10*. On the east shore near Lakeside, a pressure relief valve (PRV) will be inserted as a redundant fill option in case of failure of the solenoid valve. In addition, tower mixers are recommended to help circulate the water with a one fill/draw pipe design.

Figure 10. Proposed locations for solenoid valve and pressure relief valve to utilize Tower 4.

The relocation essentially isolates the southern half of the system to draw demand from Tower 4, creating a separate pressure system. Once local demand draws the tower water level in the tower down sufficiently, roughly an 8-9 psi differential or 50% Tower 4 turnover, the solenoid valve will open, and the tower will fill using existing pressure in the northern half of the distribution system until reaching a predetermined level. In case of solenoid valve failure, the PRV will respond to the pressure drop and open to resupply the area until repairs commence. This hydraulically separates the tower from the other two, resolving the head differential and water stagnation problems.

With this recommendation, water can only flow into the southern half but cannot flow north, the tower cannot provide water to customers upstream of the valves. This prevents Tower 4 from being counted towards the system's total storage required to meet the average day demand. *Table 9* shows the calculations for the current demand compared to the storage available removing Tower 4 and service area from the distribution system. Tower 4 utilization creates a storage deficiency of 0.195 MG upstream.

Tower 4 can sufficiently provide the average day water demand for the area downstream of the recommended solenoid valve relocation. The average day demand of this area is approximated to be 350,000 gpd. Tower 4 provides 500,000 gals of capacity.

Table 9. Summary of storage and demands as related to Tower 4.

Storage	MG
Existing Total Storage	3.425
Tower 4 Capacity	0.5
Storage Available to the Distribution System without Tower 4	2.925
Demand	**MGD**
Existing Total Design Average Day Demand	3.47
Existing Residential Average Day Demand around Tower 4	0.35
Existing Average Day Demand without Tower 4 Area	3.12
Existing Storage Deficit	**0.195**

Alternative 2 – New Water Tower

A summary of the projected average daily demands required for storage is provided in *Table 10.* A minimum of an additional 850,000 gals is projected for the City of Storm Lake. While this number considers projections for the next twenty years, the overall life of a tower with proper maintenance can easily be longer. To ensure this is a long-term solution for the City, a million gallons of additional storage is recommended.

Table 10. Summary of projected storage demands.

Average Water Demand	MGD
Existing Storage Deficit	0.195
Projected Increase Average Residential Demand	0.375
Projected Increase Average Industrial Demand	0.280
Total	**0.850**

Because the new tower will be subjected to the same head conditions as Towers 1 and 2, their operating elevations need to be matched. All towers have the same low water elevation and an operating range between 0 and 37 feet. To avoid dead storage volume or consistent overflow, new storage will need to operate within this elevation range. Given these constraints, replacing an existing tower with a larger one, construction of a fourth tower, and a ground storage reservoir are explored below.

Tower Locations

Regardless of the solution, additional storage volume needs to be constructed at a new location due to the small existing water tower parcels. Should the City decommission an existing tower and build a larger tower, it is not an option to demolish and reuse the place of an existing tower. The existing tower would need to remain active until a replacement is online. Should the City build a fourth tower or ground storage reservoir, there is insufficient space for adjacent storage on existing parcels with some contingencies of increased costs due to site constraints.

The proposed new or replacement tower locations shown in *Figure 11* are situated on high elevation parcels owned by the City. Due to the surface elevation, the column can be shorter while achieving the aforementioned head conditions. The east location is close in proximity to the large industrial user and future industrial developments. The north location is nearby future residential developments.

In addition to elevation and proximity to future developments, parcels were evaluated for interference with leaking underground storage tank (LUST) plumes. The east location has possible plume interference. Precautions in accordance with Iowa DNR requirements would be applied to protect watermains constructed at this site. The north location has no plume interference and is the recommended location due to the reduced amount of water main infrastructure needed.

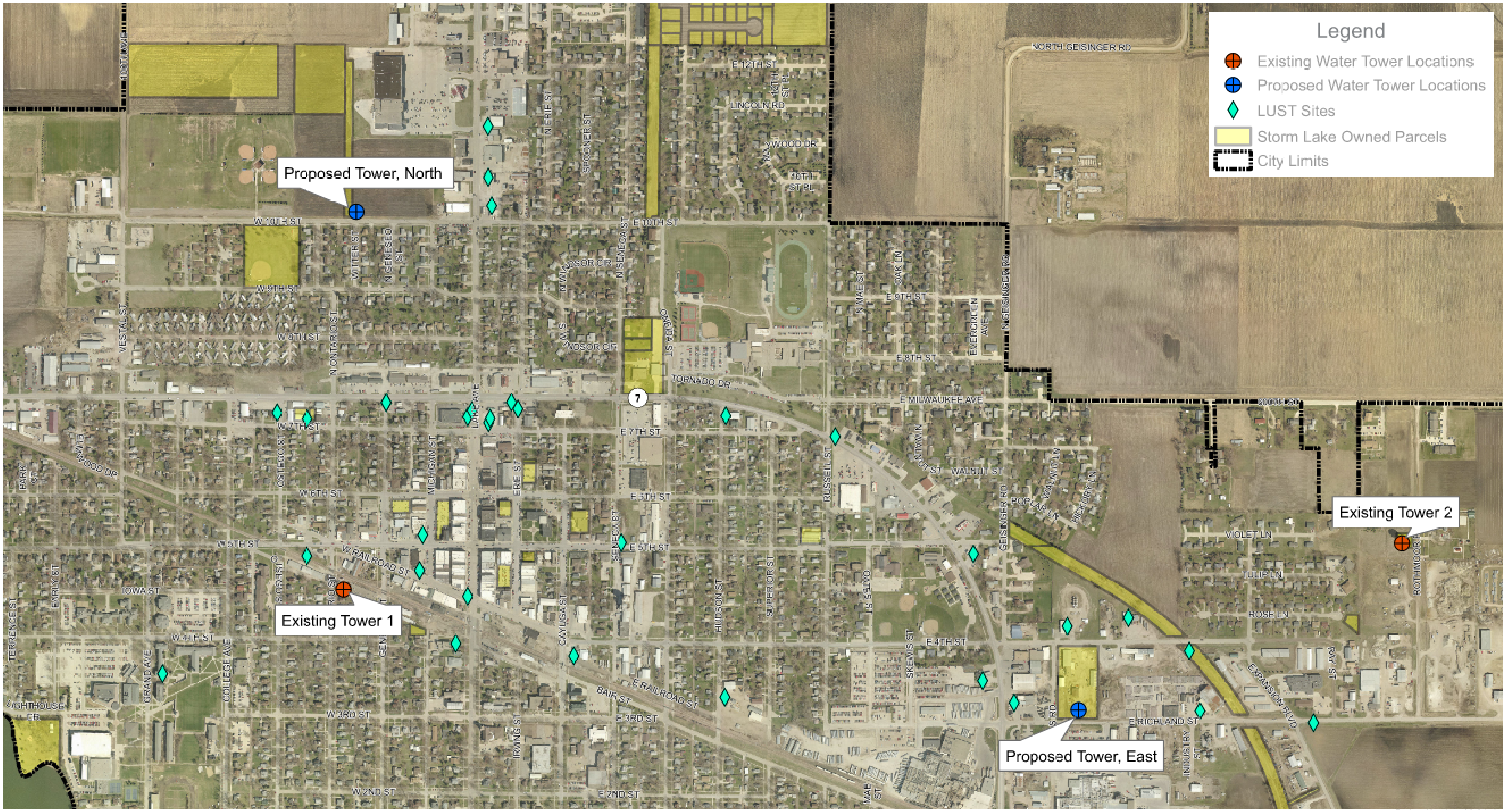


Figure 11. Proposed water tower locations and LUST sites.

REPLACEMENT OF EXISTING WATER TOWER

Replacing an existing tower addresses the storage deficit while avoiding maintenance of additional infrastructure. This option decommissions an existing tower and constructs a new tower with the volume of the old plus the projected 1.0 MG. Decommissioning Tower 1 requires a 1.75 MG replacement and decommissioning Tower 2 requires a 1.5 MG replacement.

Tower 2 is located next to the highest industrial users yet only provides 0.5 MG of storage. Tower 1 is centrally located and the oldest tower. As part of this study, ISG developed a water model specific to Storm Lake. Based on the calibrated water model, increasing storage near high demand has little impact on the recovery of the nearby tower or stress in the system. Given there is minimal hydraulic difference between the decommissioning of Tower 1 versus Tower 2, it is recommended that any replacement tower be in place of Tower 1 to remove aged infrastructure.

The water model was then used to evaluate the hydraulic implications of constructing a water tower at both proposed locations assuming a replacement of Tower 1. The theoretical tank levels for the existing Tower 2 and proposed 1.75 MG Tower 5 when constructed at either the east or north location were assessed over a 24-hour period of maximum usage. Results are shown in *Figure 12*. No appreciable difference in recharge ability or draw down is noted. Either location is hydraulically viable. Final location selection is dependent on cost, water age, and conversations with the City.

Exact behaviors are subject to change based on pump sequencing. Pump settings for purposes of this model were selected based on SCADA data from February of 2020 which utilized HSPs 1 and 5.

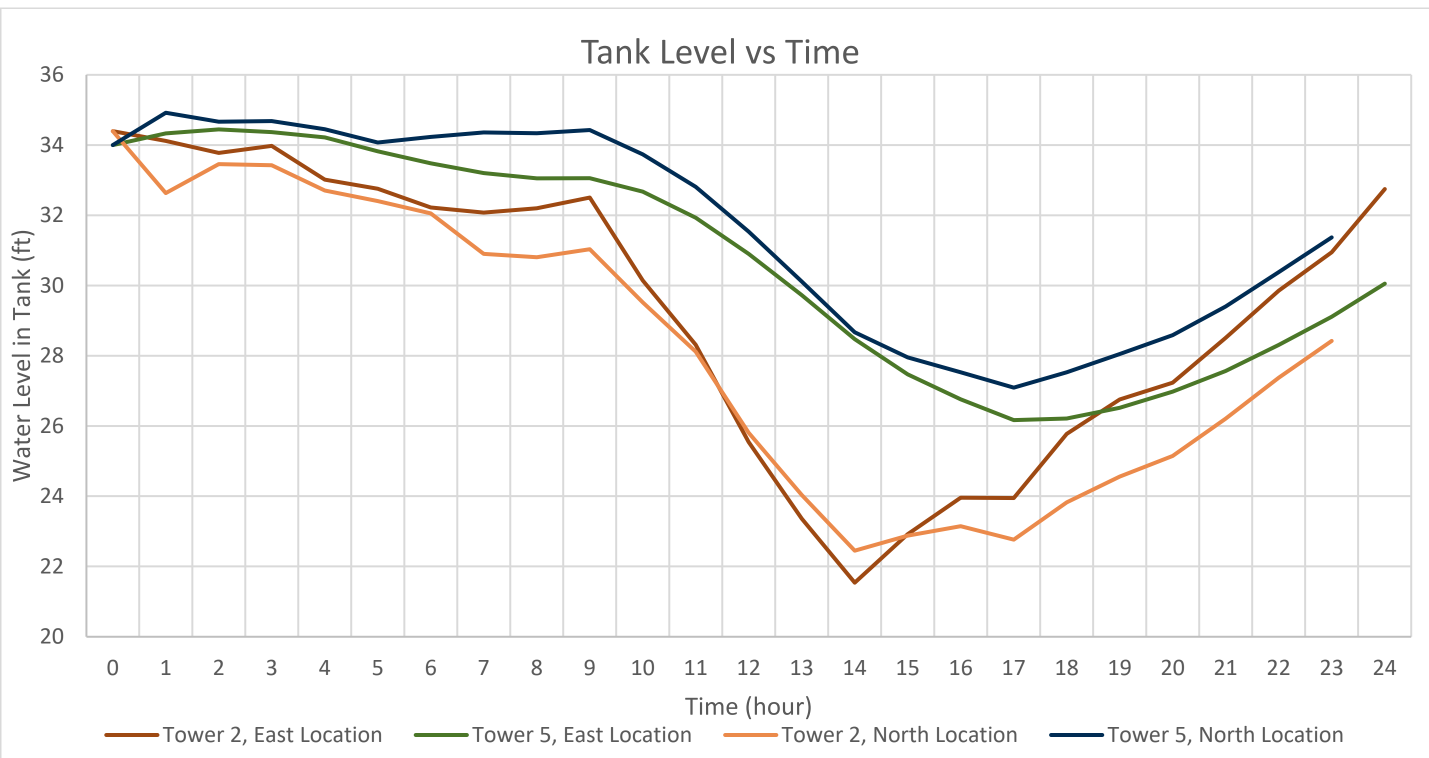


Figure 12. Water tower levels over 24-hour period of Tower 2 and a new 2.0 MG Tower 5 construction at either the east or north location.

Given the large volume needed within the constraints of operating elevations, only a few options are available. At 1.5 MG +, only a toro spherical tank, fluted column, and composite tank are available. Example configurations of each are shown in *Figures 13*, *14*, and *15*. The capacities and head ranges for these available tanks are provided in *Table 11* below.

Table 11. Summary of 1.5 + MG Tank Options.

Tank Type	Capacity	Tank Diameter	Head Range
Toro Spherical Legged Tank	1,500,000	91'-0"	35'-4"
	2,000,000	105'-0"	34'-9"
Fluted Column Tank	2,000,000	100'-0"	40'-0"
Composite Tank	1,500,000	83'-0"	40'-0"
	2,000,000	92'-6"	45'-0"

Since the existing head range is capped at 37', all proposed head ranges should meet this requirement. If the new tank matches low water levels (LWLs) of the existing tanks; then anything over 37' will not be utilized. If the new tank matches high water levels (HWLs), recommended to match overflows, of the existing tanks; then anything below the LWLs of the other tanks will be dead storage. Based on *Table 11* above, only a toro spherical legged tank meets the existing head ranges but a legged tank is more costly to construct and more costly to maintain (recoating more surface area & more difficult to apply). In addition, at this capacity, there are only two (2) contractors in the Midwest capable of constructing these tanks; ultimately increasing bid costs due to lack of competition and busier schedules. Due to these reasons, toro spherical tanks are not recommended.

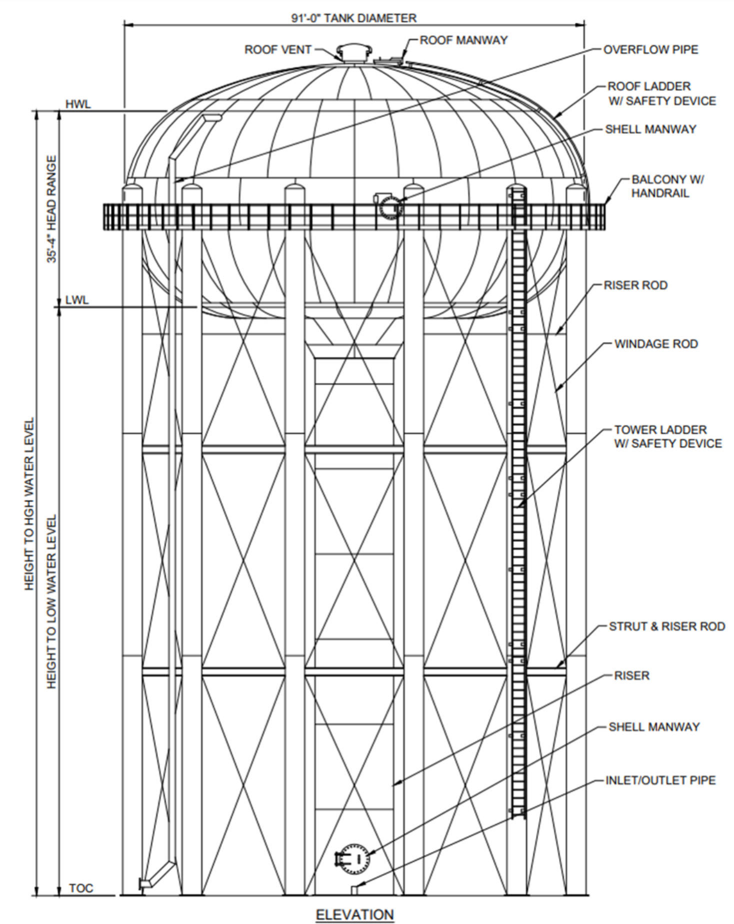


Figure 13. Example of a 1.5 million gallon Toro Spherical Legged storage tank.

Alternatively, the composite tank and fluted column tank operate outside of the head range. To combat this, evaluation of what capacities remain usable within the head range is provided below in Table 12.

Table 12. Summary of 1.5 + MG Tank Options.

Tank Type	Capacity	Tank Diameter	Head Range	Usable Capacity
Fluted Column Tank	2,000,000	100'-0"	40'-0"	1.90 MG
Composite Tank	1,500,000	83'-0"	40'-0"	1.42 MG
	2,000,000	92'-6"	45'-0"	1.79 MG

A fluted column tank is a single, steel, fluted pedestal supporting a welded-steel container; similar to Tower 4. Fluted columns offer similar design characteristics and internal storage capabilities as composite tanks. The primary distinction of fluted columns is they are constructed entirely of carbon steel. Fluted column tanks offer an aesthetic alternative to composite tanks, with a pedestal structure that can be painted to compliment the container. They also offer more rigidity and stability than composite systems. This difference can be beneficial in areas with greater risk of seismic activity.

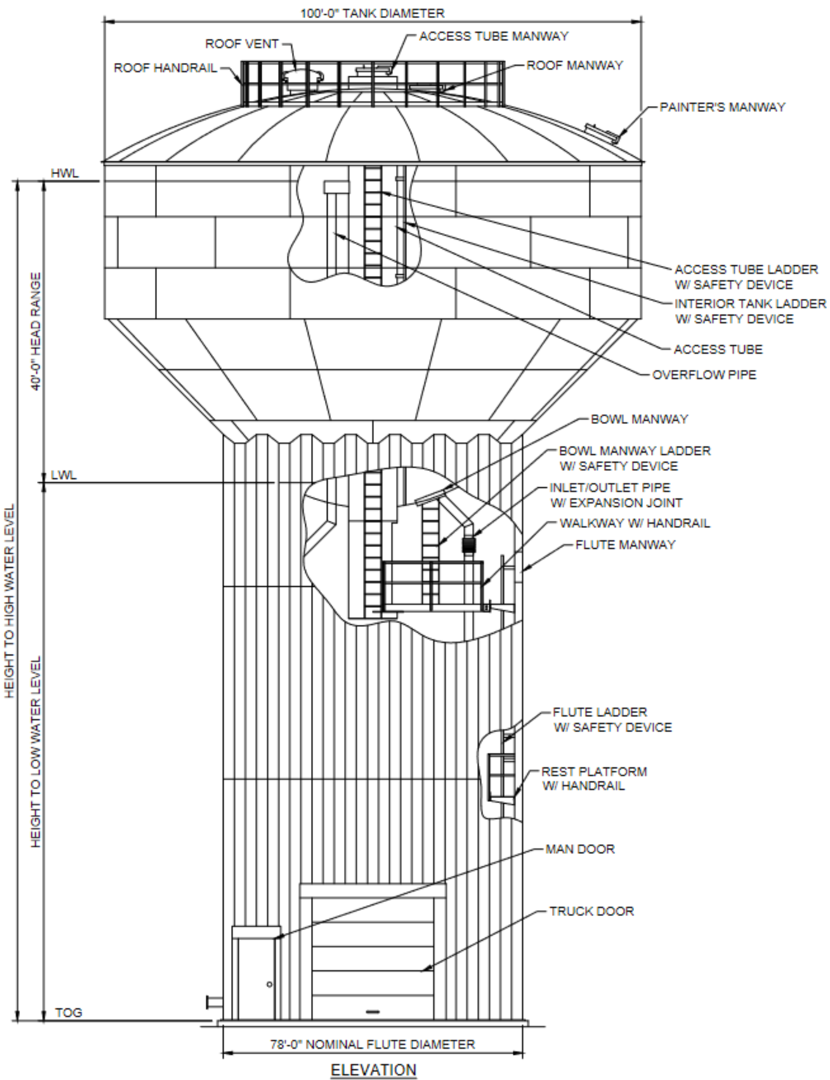


Figure 14. Example of a 2.0 million gallon Fluted Column storage tank.

A composite elevated tank is a single concrete pedestal supporting a welded steel container. Composite tanks offer some similar benefits to spherical tanks by requiring a smaller construction footprint, having interior ladder systems, and having less painted surface area to maintain. Composite tanks have become an increasingly popular option for larger tanks (500,000 gallons and larger) due to their pleasing aesthetic appearance, long-term maintenance costs, and storage areas available in the base of the tank pedestal. The only maintenance required on these tanks is the recoating of the bowl itself rather than the entire tank when compared to fluted column; saving upwards of 50% of the cost of each recoating.

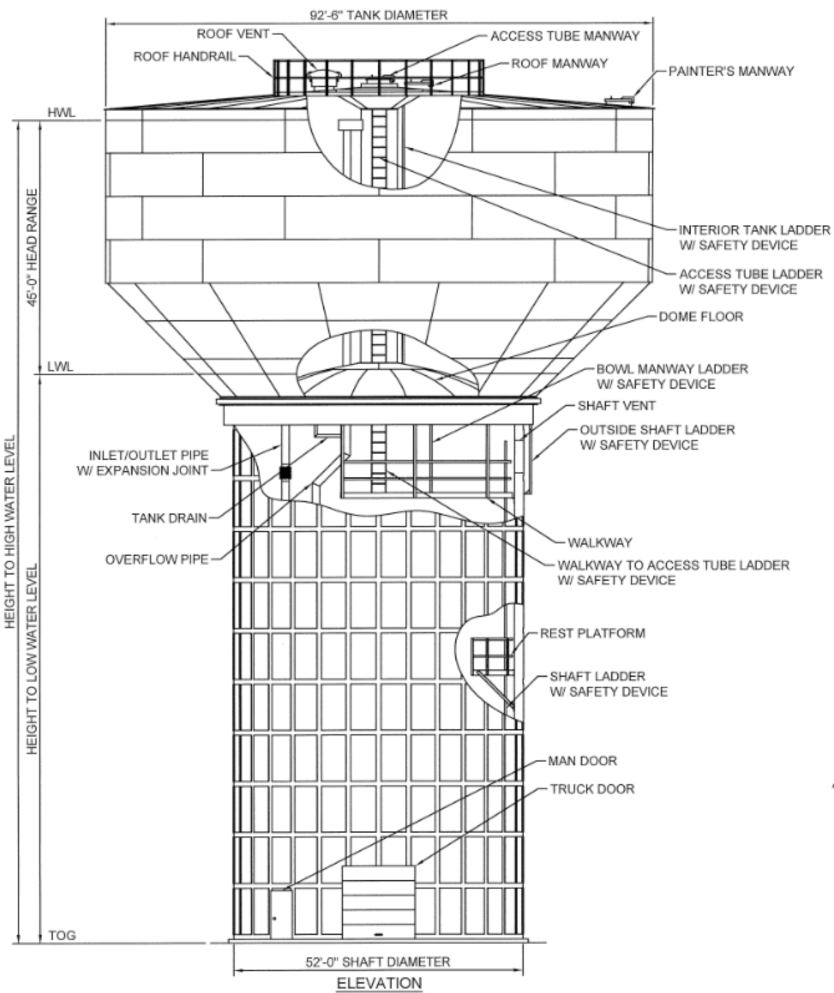


Figure 15. Example of a 2.0 million gallon Composite storage tank.

For long-term planning reasons, and due to similar costs between the fluted column and composite tanks, a 2.0 MG composite tank is recommended for replacement of Tower 1 to capitalize on 1.79 MG of replacement storage. This will be complimented with lower O&M costs during the design life of the tank.

NEW 1 MG WATER TOWER

A new, fourth water tower addresses the storage deficit without demolishing existing infrastructure and providing a cheaper capital cost. At 1.0 MG, only a spheroidal tank, fluted column, toro spherical legged tank, and composite tank are available. The head ranges for these tanks are provided in *Table 13* below with usable capacities as reviewed above. The toro spherical tank is not recommended per prior reasoning and will not be evaluated further.

Table 13. Summary of 1.0 MG Tank Options.

Tank Type	Tank Diameter	Head Range	Usable Capacity
Spheroidal Tank	74'-1"	40'-0"	0.89 MG
Fluted Column Tank	74'-0"	40'-0"	0.97 MG
Composite Tank	74'-0"	35'-0"	1.00 MG

The water model was used to determine hydraulic implications of constructing a 1.0 MG water tower at both proposed locations assuming Towers 1, 2, and 4 remain. The theoretical water level in Towers 1, 2, and Tower 5 at either the east or north location were assessed over a 24-hour period of maximum usage. Results are shown in *Figure 16*. Again, no appreciable difference in recharge ability or draw down is noted.

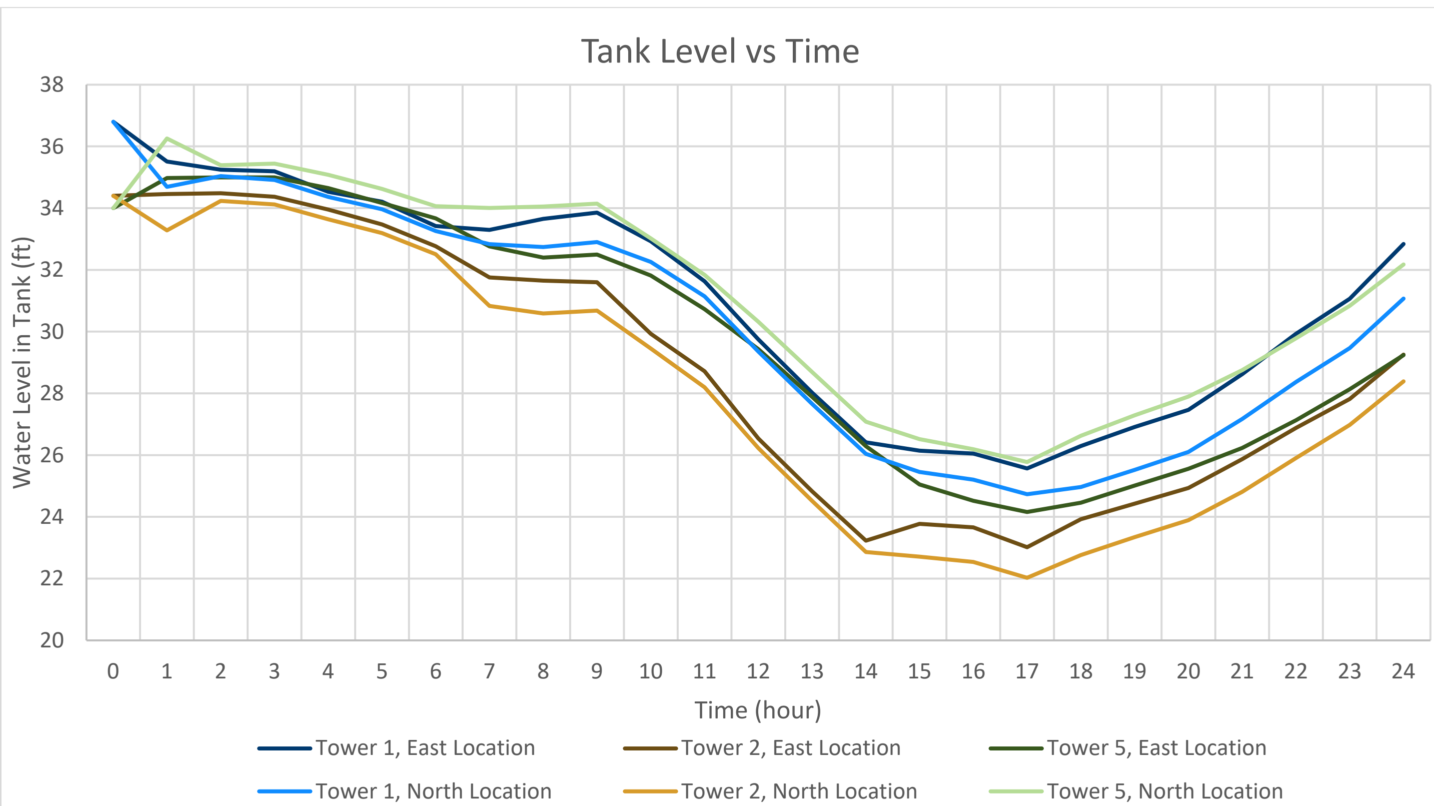


Figure 16. Water tower levels over 24-hour period of Towers 1, 2, and a new 1.0 MG Tower 5 at either the east or north location.

A new 1.0 MG tower incurs additional long-term expenses associated with additional infrastructure and therefore is not recommended. If the City elects to construct a new, 4th tower, it is similarly recommended to construct a 1.0 MG composite tank to capitalize on the full design volume while adding to the benefits as reviewed above.

The question between a new water tower and replacement as well as composite vs. fluted column towers is addressed below.

The most expensive replacement water tower option evaluated was a 2.0 MG composite tank. This cost estimate is $4.936 million. The least expensive new 4th water tower was a 1.0 MG spheroidal tank which only capitalizes on 0.89 MG. This is estimated at $3.366 million. The cost difference is $1.57 million. This figure is mitigated by the annual maintenance costs of three towers versus four. The cost difference would be realized in as little as 20 years when either Tower 1 is past its design life and a new 0.75 MG replacement tank is needed or alternatively through approximately 2 cycles of recoating and structural repairs.

Composite tower cost has been shown to be approximately 3-5% higher than a fluted column tank at larger sizes (1.5 MG +). This minimal cost difference can be realized within 1 cycle of recoating and structural repairs as recoating will be approximately 50% cheaper on a composite than a fluted column due to reduced steel surface area.

A new, 2.0 MG composite water tower is recommended for its reduced total life cycle cost.

GROUND STORAGE RESERVOIRS

A one-million-gallon ground storage reservoir (GSR) could provide the necessary storage volume, but the current WTP lacks space onsite and other locations will be hard to locate due to the large footprint. The GSR would be filled through system pressure by the existing HSPs and require independent HSPs for distribution. For the GSR to count towards the City's storage requirement, the HSPs drawing from the GSR need a generator. An electronically actuated altitude valve would maintain the level within the GSR to prevent overflow from the existing hydrostatic system pressure.

Due to complexities of operation and O&M costs, a GSR is not recommended. The pumps and generator would need continual maintenance and operations would need to ensure the volume is circulated by turning these on during high demands and ensuring these pumps override the high service pumps at the plant.

Figure 17. Example of a one-million-gallon GSR.

Alternative 3 – Water Tower Mixers

Ten State Standards recommends designing to facilitate water tower turnover. SCADA data indicates all three towers are consistently near full and rarely see turnover. Maintaining full towers ensures ample storage in case the large industrial user calls on the system but leads to water stagnation. In single-pipe towers, newer water remains at the bottom and is the first to be drawn. Mechanical mixing disperses old and new water throughout the water column. Eliminating water stratification limits water age as well as tank condensation and ice formation. A mechanical mixer should be added to each tower to see these benefits.

Alternative 4 – Water Tower Rehabilitation

Small rehabilitation efforts can prolong the longevity of the existing towers. Corrosion and mildew accumulation as seen on all three towers threatens the integrity and sanitation of the tower. The City should proceed on schedule to repaint the tower interior and exteriors as outlined in the Existing Conditions. Should Tower 1 be replaced, rehabilitation would not be unnecessary.

There are also some upcoming changes to the allowable extractables in coatings starting January 1, 2023. NSF has finalized and adopted a new reference standard, NSF/ANSI/CAN Standard 600, for NSF/ANSI Standards 60 and 61 Drinking Water Health Effects Standards. Standard 600 has a lower allowable concentration for three commonly used solvents in epoxies widely used in tank interiors. This will eliminate the use of commonly used potable water epoxy technologies; Tnemec Series N140, V140, 141, 20HS, FC20HS, 20, & FC20. This will be a new mandatory requirement for all coatings inside water towers. These new coating changes are going to increase costs substantially (estimated anywhere between 25-50% of wet coatings on the internals of water towers). Full cost impact is unknown yet as this has not been bid out in municipal projects.

Due to this change and the impending deadline, it is recommended to recoat any and all towers, as economically feasible, before the January 1, 2023 date. In addition, prior quotes from manufacturers for recoating should also be reviewed for two reasons:

1. Ensuring the quote includes updates for the allowable extractable coatings if the work is to be done after Jan. 1, 2023.
2. Ensuring the quote includes coatings of proper thickness and quality so that the new coat will last 15-20 years rather than the typical quoted coating of 5-10.

Due to the above reasons, recoating cost estimates to meet these requirements are provided in Appendix B of this report.

Alternative 5 – Water Tower Levels

In accordance with Ten State Standards 7.3.3, the HSPs are controlled by the water level in Tower 2. The tolerance of draw down before activating a pump is discretionary. The City's SCADA set points at the time of this report are summarized in *Table 14*. The system can only rest while the demand draws down between start and stop levels. The result is tower levels oscillating at a high fill level with constant pump activation. Widening the pump tolerance settings would see the benefits of tower turnover and reduced stress on the HSPs.

Table 14. Steps of pump activation in response to Tower 2 fill levels.

Step No.	HSP Operation	Start Level, ft.	Stop Level, ft.
Step 1	HSP #2	35.0	36.2
Step 2	HSP #3	30.0	33.0
Step 3	HSP #1	28.0	32.0

During tank drawdowns, stored volume is reduced. If peak demand occurs while the towers are not at full capacity, the system is unable to keep up. While the HSPs can throughput the design flow of 6,883 gpm, they are drawing from the clearwells. Water cannot be treated at the design flow to recharge the clearwells. The clearwells will slowly deplete. Because of this, the viability of adjusting pump tolerances is contingent upon either increased production capacity or scheduling of drawdowns in contravention to peak times or seasons.

FINAL SUMMARY AND RECOMMENDATION

ISG recommends a combination of alternatives to optimize the existing system and account for future growth. ISG recommends the City of Storm Lake act upon hydraulically isolating Tower 4 and the south side of the lake, either a new 2.0 MG Composite Tank to replace Tower 1 or a 4th 1.0 MG tower (dependent on capital cost & O&M considerations – refer to Table 15), addition of water tower mixers, & water tower rehabilitation. Adjustment of on/off tower levels from the high service pump should be instigated once source capacity and treatment are increased but there should be no associated costs. This series of actions will meet the City's projected storage demands with a long-range vision, protect the City's existing storage infrastructure investments, and ensure improved water quality for years to come while potentially reducing operation & maintenance (O&M) costs. Recommended schedule is as follows:

Table 15. Comparison of New 1.0 MG Tower & Replacement 2.0 MG Tower over 40 Years

	New 1.0 MG Spheroidal Tower (0.89 MG Usable Capacity)	Replacement 2.0 MG Composite Tower (1.79 MG Usable Capacity)
Capital Cost:	$3,366,000	$4,936,000
Tower 1 Replacement within 40 Years:	$4,000,000	$0
Tower 1 Recoating (Year 0):	$1,181,000	$0
Tower 1 Recoating (Year 20):	$1,500,000	$0
New Tower Recoating (Year 20):	$1,500,000 (Estimated)	$1,000,000 (Estimated)
New Tower Recoating (Year 40):	$1,700,000 (Estimated)	$1,300,000 (Estimated)
TOTAL:	$13,247,000	$7,236,000

Table 16. Improvement Recommendations in Prioritized Order.

Improvement Recommendation (In Prioritized Order)	Engineer's Opinion of Probable Project Cost
Tower 4 Hydraulic Isolation Begin Immediately	$332,000
New 2.0 MG Composite Tank Begin immediately for construction in 2022 before new coating requirements increase cost	$4,936,000
Water Tower Mixers – Towers 2 & 4 (Total Cost) Complete when economically feasible – within next 5 years	$100,000
Water Tower Rehabilitation – Towers 2 & 4 (Total Cost) Complete when economically feasible but preferably before 2023 – otherwise place in maintenance plan for economic feasibility	$2,191,000

Permit Requirements

All drinking water projects in Iowa are required to obtain construction permits through the Iowa DNR. Necessary permit applications will be submitted to the Iowa DNR upon completion of plans and specifications.

Preliminary Schedule

A project timeline can be seen in *Table 17*.

Table 17. Proposed preliminary schedule.

Task	Length of Time	Total Time
Water Tower 4 Utilization	Design – 3 Months	9 Months
	Permitting – 3 Months	
	Construction – 3 Months	
New Water Tower	Design – 5 Months	20 Months
	Permitting – 3 Months	
	Construction – 12 Months	
Water Tower Mixers	Design – 1 Month	4 Months
	Permitting – 2 Months	
	Construction – 1 Month	
Water Tower Rehabilitation	Design – 3 Months	7 Months
	Permitting – 0 Months	
	Construction – 4 Months	

*All dates are tentative and dependent on review/funding authorities.

Appendix A: Maguire Maintenance Plan – Full Service

Jake Dugger
17318 Spencer St
Omaha, NE 68116
(402) 651-6450
duggerj@maguireiron.com

MAGUIRE MAINTENANCE PLAN – FULL SERVICE

City of Storm Lake, Iowa

12/15/20

MAGUIREIRON.COM

OUR STORY

At Maguire Iron, Inc. we believe in building a better tomorrow by providing unmatched services to deliver life-sustaining water. We do this by creating products, delivering services and partnering with communities to build and maintain the infrastructure that delivers the most important resource to live…water!

Maguire Iron is a family-owned and operated company based in Sioux Falls, South Dakota that has been in the water storage tank industry since 1915.

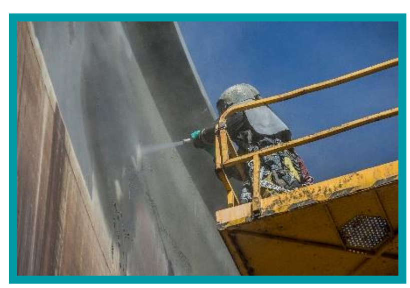
We offer a full spectrum of water storage tank services including building new tanks, relocation of existing tanks, steel repairs and replacement parts, lead abatement services, exterior painting, interior linings, service agreements, full-service maintenance programs, year around emergency services, and tank inspections by NACE certified inspectors. We Currently service over 900 maintenance agreements throughout the Midwest with 8 paint crews, 3 repair/washout crews, and 2 on call emergency crews all in house company run crews.
We also operate a 60,000-square foot facility that includes an ASME Certified fabrication shop.

Our range of operational capability consists primarily of 23 states from the Rocky Mountains to Ohio, and North Dakota to the Gulf Coast, with occasional work in outlying states.

We employ approximately 130 full-time professional employees consisting of office staff, fabricators, welders, erectors, steelworkers, painters, inspectors and repair specialists. This includes 16 field crews performing field and site operations. We also have the expertise of an in-house engineering department, 4 SSPC C3/C5 Lead Abatement certified personnel, and National AWWA D100 Steel Tank, D101 Tank Inspection, and M42 committee members.

CORE VALUES

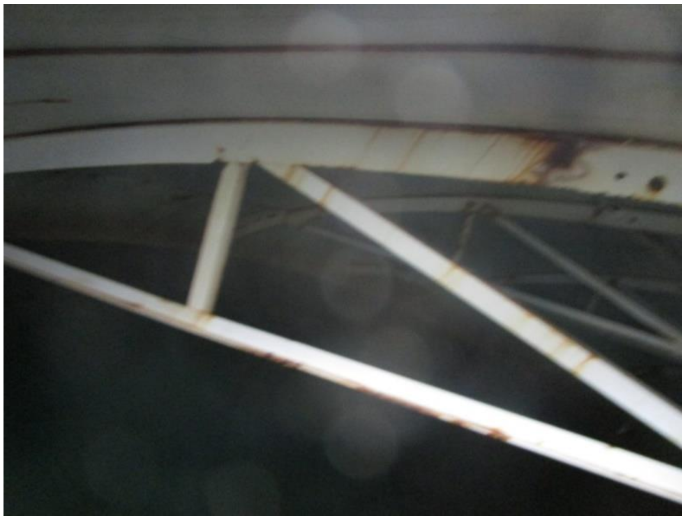
1. Strive for Excellence
2. Commit to Safety
3. Build on Integrity
4. Serve with Passion
5. Grow the Family

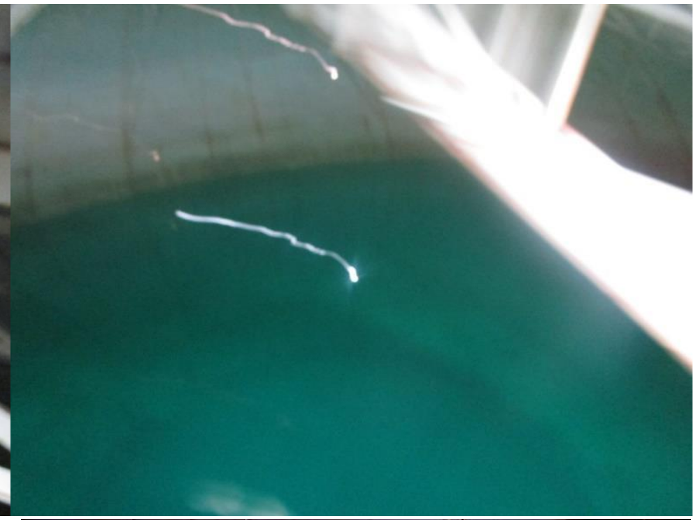


MAGUIRE MAINTENANCE PLAN BENEFITS – FULL SERVICE

- **Maguire Iron assumes all risk and liability of maintaining your water tank**
- **Renovation costs can be spread several years with NO Interest**
- **Lifetime perpetual warranty under a Maguire Maintenance Plan**
- **Set annual budget figure**
- **"Maintenance expense" figures are consistent**
- **Future Exterior Renovations included**
- **Future Interior Renovations included**
- **Annual inspections with detailed reports**
- **Cleanout and disinfection inspections with detailed reports**
- **Emergency Repairs (Repairs, Graffiti, Etc.)**
- **Yearly Renewable Contract**
- **Hassle free tank maintenance**

Storm Lake 750,000 Gallon Elevated Legged Tower



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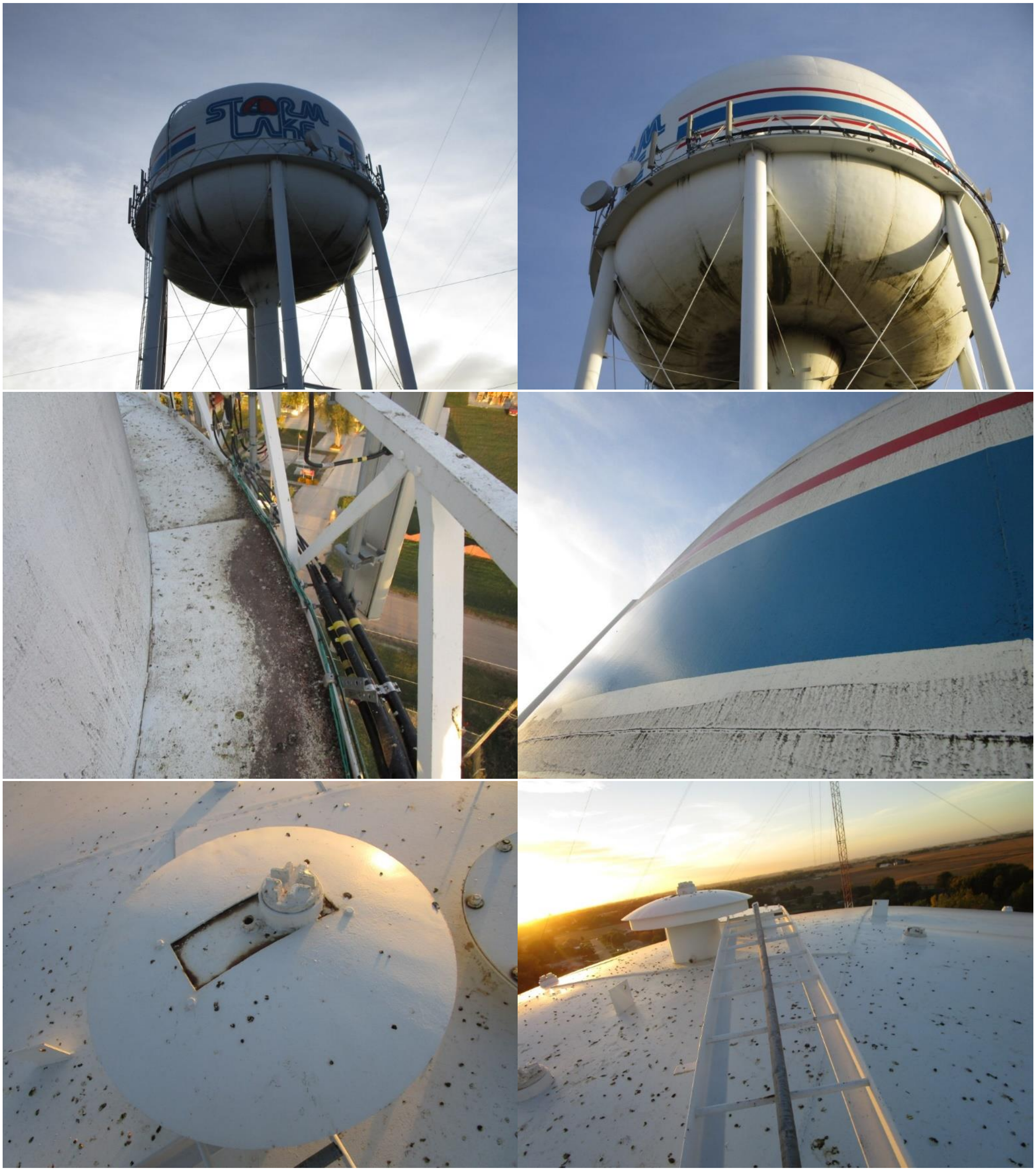
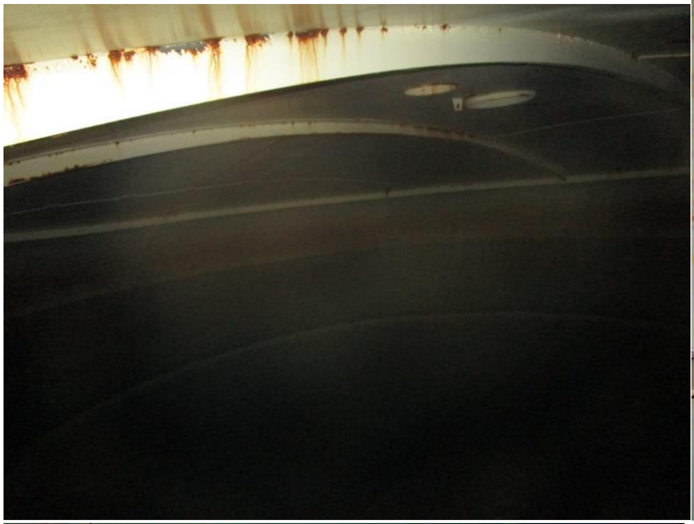
Storm Lake 500,000 Gallon Elevated Legged Tower





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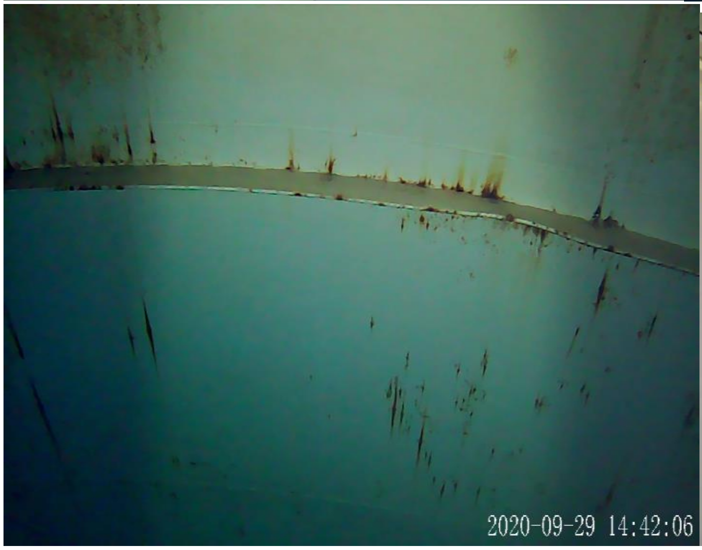
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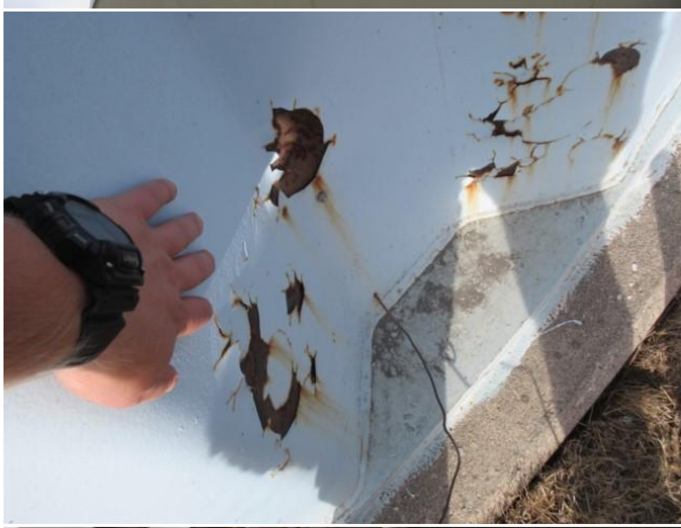
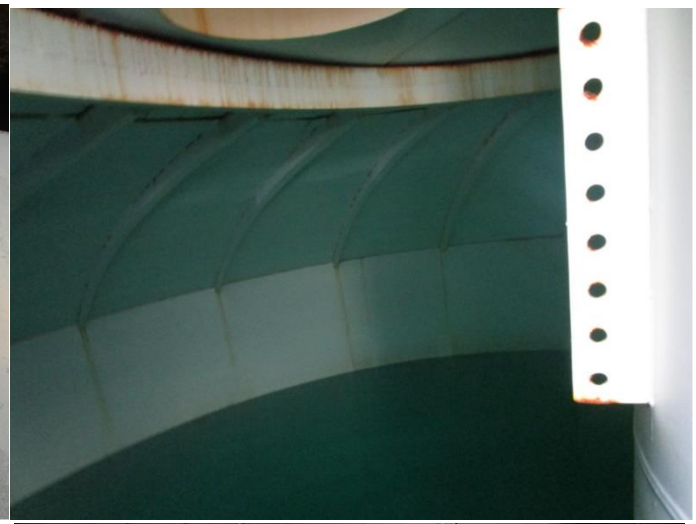
Storm Lake 500,000 Gallon Hydropillar West Tower



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PROJECTED SCHEDULE OF WORK AND FEES
750MG Elevated Tower Only

Year	2021	2022	2023	2024	2025	2026
Storm Lake 750MG Elevated Tower	*Exterior Paint *Interior Paint & Repairs	Visual Inspection	Clean-out or ROV and Inspection with Report	Visual Inspection	Clean-out or ROV and Inspection with Report	Visual Inspection
Annual Spend	$161,228.00	$161,228.00	$161,228.00	$161,228.00	$161,228.00	$41,059.00

<u>Maintenance Plan Spread with No Interest:</u>

Upfront Renovation Total: $657,100

Maintenance Fees: $37,260 x (4) = $149,040

$657,100 + $149,040 = $806,140

Spread Total: $806,140 / 5 years= $161,228/year

Year 6 annual maintenance fee: $41,059 includes any maintenance moving forward including inspections, cleaning, welding repairs, and future repainting. Therefore, you won't ever have to come up with large lump sums for tank renovations again.

PROJECTED SCHEDULE OF WORK AND FEES
All 3 Towers

Year	2021	2022	2023	2024	2025	2026
Storm Lake 750MG Elevated Tower	*Exterior Paint *Interior Paint & Repairs	Visual Inspection	Clean-out or ROV and Inspection with Report	Visual Inspection	Clean-out or ROV and Inspection with Report	Visual Inspection
Annual Spend	$161,228.00	$161,228.00	$161,228.00	$161,228.00	$161,228.00	$41,059.00
Storm Lake 500MG Hydro	Visual Inspection	*Exterior Paint *Interior Paint & Repairs	Visual Inspection	Clean-out or ROV and Inspection with Report	Visual Inspection	Clean-out or ROV and Inspection with Report
Annual Spend	$5,000.00	$100,192.00	$100,192.00	$100,192.00	$100,192.00	$32,150.00
Storm Lake 500MG Legged	Visual Inspection	*Exterior Paint *Interior Paint & Repairs	Visual Inspection	Clean-out or ROV and Inspection with Report	Visual Inspection	Clean-out or ROV and Inspection with Report
Annual Spend	$5,000.00	$81,957.00	$81,957.00	$81,957.00	$81,957.00	$26,747.00
Annual Total	$173,249.00	$343,377.00	$343,377.00	$343,377.00	$343,377.00	$99,956.00

JAKE DUGGER
WATER TOWER EXPERT
NACE Level 1

c: (402) 651-6450
w: (605) 334-9749

duggerj@maguireiron.com

Appendix B: Potential Funding Sources

Memorandum

No. 20-24717 Potential Funding Sources

To:	City of Storm Lake
Date:	June 2, 2021
Subject:	No. 20-24717 Potential Funding Sources, Storage

STATE REVOLVING LOAN FUND (SRF) PLANNING AND DESIGN LOAN

This loan provides a 0% interest loan for up to three years with no initiation or servicing fees. The loan can be utilized to pay for engineering assessments and reports, legal/administrative fees as necessary, and for engineering design of the selected option. At the end of the three-year period (or before), the loan can be rolled into an SRF Construction Loan or is repaid when permanent financing is secured; for example, a loan through the SRF Drinking Water Program or financing through USDA Rural Development.

SRF DRINKING WATER FUND

The SRF Drinking Water Fund is a revolving loan fund through the State of Iowa Finance Authority. Currently, the SRF interest rate is 2.0% for a 20-year loan. In some cases, the term can be extended to 30 years at an interest rate of 3.0% if the project being funded has a lifespan greater than 30 years. The City may also be eligible and can apply for the Disadvantaged Community status, which finances the loan at a 2.0% interest rate over a 30-year term. Funding through the SRF Drinking Water Fund is subject to Federal Davis Bacon Prevailing Wages. The SRF program will also require and reimburse the City for the services of a Municipal Advisor (MA) to be eligible for funding. The MA will assist the City in determining utility rate adjustments that will be adequate to finance the identified improvements, maintain a required debt coverage ratio, and ensure a healthy fund balance for the utility fund.

REVENUE BONDS

Revenue bonds are a common way to finance a public improvement. The revenues collected from utility rates repay the revenue bond. Traditional revenue bonds typically have a higher interest rate than General Obligation Bonds and are typically not recommended as a financing mechanism for this project. Given that interest rates on bonds are currently at historical lows, the City may want to investigate this financing option further. Interest rates and loan terms vary depending on the lender.

COMMUNITY DEVELOPMENT BLOCK GRANT (CDBG) WATER AND SEWER FUND

The CDBG program is administered by the Iowa Economic Development Authority (IEDA) and allows municipalities to apply for grant funding on a competitive basis each year for water and wastewater improvements. The main criteria used in determining a community's grant eligibility revolves around the City's Low to Moderate Income (LMI) household percentage. To be eligible for funding, the community's LMI percentage needs to be greater than or equal to 51%. Storm Lake's recent community wide CDBG LMI survey had a result of 52.0%. The City of Storm Lake would be eligible for up to $600,000 in grant funding if they applied for and secured funding through the CDBG Water and Sewer Fund program.

USDA RURAL DEVELOPMENT WATER & WASTE DISPOSAL LOAN & GRANT PROGRAM

USDA Rural Development offers loans and potential grant funding packaged together for utility improvements. The USDA RD grant formula considers several factors when determining eligibility amounts including the number of households, Median Household Income (MHI), current utility rates, existing debt, current operations and maintenance costs, and short-lived assets. To determine grant funding, the loan amount is applied first until the predetermined affordability utility rate is reached. The approximate maximum grant amount that can be awarded for system improvements for Storm Lake is approximately 40% of project costs, although actual grant amounts would most likely be much lower. The City will need to coordinate Rural Development staff to apply for funding and determine maximum grant eligibility amounts. RD loans are serviced over a 40-year term at a fixed rate. Current interest rates range from 1.375% to 2.25%. To apply for funding the City must submit a loan application accompanied by a Preliminary Engineering Report/Facility Plan. This existing Facility Plan will need to be updated to meet USDA Rural Development requirements.

AMERICAN RESCUE PLAN

President Biden signed the American Rescue Plan (ARP) Act into law in 2021. The ARP includes $365.9 billion in direct funding for state, local, tribal, and territory infrastructure systems. Eligible uses for these funds include capital investments in infrastructure systems and operation expenses. Storm Lake is eligible for $1,431 million and the listed improvements in this report are eligible to funded by the ARP.

Appendix C: Engineer's Opinion of Probable Project Costs

Cost Estimate

ISG

Client Name: CITY OF STORM LAKE
Location: STORM LAKE, IA
ISG Project Number: 20-24717
Date: JUNE 2, 2021

Engineer's Opinion of Probable Cost - Water Tower 4 Utilization

No.	ITEM DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL AMOUNT
1	MOBILIZATION / DEMOBILIZATION	LS	1	$12,150.00	$12,150.00
2	TRAFFIC CONTROL	LS	1	$25,000.00	$25,000.00
3	PRESSURE RELIEF VALVE PIT	EA	2	$38,000.00	$76,000.00
4	FILL VALVE PIT	EA	1	$45,000.00	$45,000.00
5	ALTITUDE VALVE PIT DEMOLITION	LS	1	$15,000.00	$15,000.00
6	ELECTRICAL SERVICE & CONTROLS	LS	1	$55,000.00	$55,000.00
7	SEEDING, FERTILIZING, AND MULCHING (HYDRAULIC SEEDING)	LS	1	$12,000.00	$12,000.00
8	TESTING	LS	1	$15,000.00	$15,000.00
				Construction Costs	**$255,150.00**
				10% Contingency	$25,515.00
				20% Non-Construction Cost	$51,335.00
				TOTAL PROJECT COST	$332,000.00

Client Name: CITY OF STORM LAKE
Location: STORM LAKE, IA
ISG Project Number: 20-24717
Date: JUNE 2, 2021

Engineer's Opinion of Probable Cost - 2.0 MG Fluted Column Tank (Tower Replacement)

40' Realized Head - 37' Utilized - 1.90 MG Captured

No.	ITEM DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL AMOUNT
1	MOBILIZATION / DEMOBILIZATION	LS	1	$199,540.00	$199,540.00
2	TRAFFIC CONTROL	LS	1	$15,000.00	$15,000.00
3	WATER MAIN, C900 PVC, OPEN CUT	LF	400	$70.00	$28,000.00
4	HYDRANT ASSEMBLY	EA	1	$6,500.00	$6,500.00
5	GATE VALVE AND VALVE BOX	EA	3	$6,000.00	$18,000.00
6	TAPPING VALVE ASSEMBLY	EA	1	$10,000.00	$10,000.00
7	WATER MAIN, CONNECT TO EXISTING	EA	1	$1,200.00	$1,200.00
8	2,000,000 GALLON WATER TOWER	LS	1	$3,725,000.00	$3,725,000.00
9	CITY LOGO	LS	1	$15,000.00	$15,000.00
10	MIXING AND RECIRCULATION SYSTEM	LS	1	$55,000.00	$55,000.00
11	750,000 GALLON WATER TOWER DEMOLITION	LS	1	$100,000.00	$100,000.00
12	SILT FENCE	LF	300	$3.00	$900.00
13	SILT FENCE, CLEANOUT	LF	300	$3.00	$900.00
14	SILT FENCE, REMOVAL	LF	300	$1.00	$300.00
15	SEEDING, FERTILIZING, AND MULCHING (HYDRAULIC SEEDING)	LS	1	$5,000.00	$5,000.00
16	TESTING	LS	1	$10,000.00	$10,000.00
				Construction Costs	$4,190,340.00
				10% Contingency/Land	$419,034.00
				20% Non-Construction Cost	$837,626.00
				TOTAL PROJECT COST	$5,447,000.00

Client Name: CITY OF STORM LAKE
Location: STORM LAKE, IA
ISG Project Number: 20-24717
Date: JUNE 2, 2021

Engineer's Opinion of Probable Cost - 1.5 MG Composite Tank (Tower Replacement)
40' Realized Head - 37' Utilized - 1.42 MG Captured

No.	ITEM DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL AMOUNT
1	MOBILIZATION / DEMOBILIZATION	LS	1	$163,290.00	$163,290.00
2	TRAFFIC CONTROL	LS	1	$15,000.00	$15,000.00
3	WATER MAIN, C900 PVC, OPEN CUT	LF	400	$70.00	$28,000.00
4	HYDRANT ASSEMBLY	EA	1	$6,500.00	$6,500.00
5	GATE VALVE AND VALVE BOX	EA	3	$6,000.00	$18,000.00
6	TAPPING VALVE ASSEMBLY	EA	1	$10,000.00	$10,000.00
7	WATER MAIN, CONNECT TO EXISTING	EA	1	$1,200.00	$1,200.00
8	1,500,000 GALLON WATER TOWER	LS	1	$3,000,000.00	$3,000,000.00
9	CITY LOGO	LS	1	$15,000.00	$15,000.00
10	MIXING AND RECIRCULATION SYSTEM	LS	1	$55,000.00	$55,000.00
11	750,000 GALLON WATER TOWER DEMOLITION	LS	1	$100,000.00	$100,000.00
12	SILT FENCE	LF	300	$3.00	$900.00
13	SILT FENCE, CLEANOUT	LF	300	$3.00	$900.00
14	SILT FENCE, REMOVAL	LF	300	$1.00	$300.00
15	SEEDING, FERTILIZING, AND MULCHING (HYDRAULIC SEEDING)	LS	1	$5,000.00	$5,000.00
16	TESTING	LS	1	$10,000.00	$10,000.00
				Construction Costs	$3,429,090.00
				10% Contingency/Land	$342,909.00
				20% Non-Construction Cost	$686,001.00
				TOTAL PROJECT COST	$4,458,000.00

Client Name: CITY OF STORM LAKE
Location: STORM LAKE, IA
ISG Project Number: 20-24717
Date: JUNE 2, 2021

Engineer's Opinion of Probable Cost - 2.0 MG Composite Tank (Tower Replacement)

45' Realized Head - 37' Utilized - 1.79 MG Captured

No.	ITEM DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL AMOUNT
1	MOBILIZATION / DEMOBILIZATION	LS	1	$180,790.00	$180,790.00
2	TRAFFIC CONTROL	LS	1	$15,000.00	$15,000.00
3	WATER MAIN, C900 PVC, OPEN CUT	LF	400	$70.00	$28,000.00
4	HYDRANT ASSEMBLY	EA	1	$6,500.00	$6,500.00
5	GATE VALVE AND VALVE BOX	EA	3	$6,000.00	$18,000.00
6	TAPPING VALVE ASSEMBLY	EA	1	$10,000.00	$10,000.00
7	WATER MAIN, CONNECT TO EXISTING	EA	1	$1,200.00	$1,200.00
8	2,000,000 GALLON WATER TOWER	LS	1	$3,350,000.00	$3,350,000.00
9	CITY LOGO	LS	1	$15,000.00	$15,000.00
10	MIXING AND RECIRCULATION SYSTEM	LS	1	$55,000.00	$55,000.00
11	750,000 GALLON WATER TOWER DEMOLITION	LS	1	$100,000.00	$100,000.00
12	SILT FENCE	LF	300	$3.00	$900.00
13	SILT FENCE, CLEANOUT	LF	300	$3.00	$900.00
14	SILT FENCE, REMOVAL	LF	300	$1.00	$300.00
15	SEEDING, FERTILIZING, AND MULCHING (HYDRAULIC SEEDING)	LS	1	$5,000.00	$5,000.00
16	TESTING	LS	1	$10,000.00	$10,000.00
				Construction Costs	$3,796,590.00
				10% Contingency/Land	$379,659.00
				20% Non-Construction Cost	$759,751.00
				TOTAL PROJECT COST	$4,936,000.00

Client Name: CITY OF STORM LAKE
Location: STORM LAKE, IA
ISG Project Number: 20-24717
Date: JUNE 2, 2021

Engineer's Opinion of Probable Cost - 1.0 MG Composite Tank (4th Tower)

35' Realized Head - 35' Utilized - 1.0 MG Captured

No.	ITEM DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL AMOUNT
1	MOBILIZATION / DEMOBILIZATION	LS	1	$123,290.00	$123,290.00
2	TRAFFIC CONTROL	LS	1	$15,000.00	$15,000.00
3	WATER MAIN, C900 PVC, OPEN CUT	LF	400	$70.00	$28,000.00
4	HYDRANT ASSEMBLY	EA	1	$6,500.00	$6,500.00
5	GATE VALVE AND VALVE BOX	EA	3	$6,000.00	$18,000.00
6	TAPPING VALVE ASSEMBLY	EA	1	$10,000.00	$10,000.00
7	WATER MAIN, CONNECT TO EXISTING	EA	1	$1,200.00	$1,200.00
8	1,000,000 GALLON WATER TOWER	LS	1	$2,300,000.00	$2,300,000.00
9	CITY LOGO	LS	1	$15,000.00	$15,000.00
10	MIXING AND RECIRCULATION SYSTEM	LS	1	$55,000.00	$55,000.00
11	SILT FENCE	LF	300	$3.00	$900.00
12	SILT FENCE, CLEANOUT	LF	300	$3.00	$900.00
13	SILT FENCE, REMOVAL	LF	300	$1.00	$300.00
14	SEEDING, FERTILIZING, AND MULCHING (HYDRAULIC SEEDING)	LS	1	$5,000.00	$5,000.00
15	TESTING	LS	1	$10,000.00	$10,000.00
				Construction Costs	$2,589,090.00
				10% Contingency/Land	$258,909.00
				20% Non-Construction Cost	$518,001.00
				TOTAL PROJECT COST	$3,366,000.00

Client Name: CITY OF STORM LAKE
Location: STORM LAKE, IA
ISG Project Number: 20-24717
Date: JUNE 2, 2021

Engineer's Opinion of Probable Cost - 1.0 MG Fluted Column Tank (4th Tower)

40' Realized Head - 37' Utilized - 0.97 MG Captured

No.	ITEM DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL AMOUNT
1	MOBILIZATION / DEMOBILIZATION	LS	1	$147,040.00	$147,040.00
2	TRAFFIC CONTROL	LS	1	$15,000.00	$15,000.00
3	WATER MAIN, C900 PVC, OPEN CUT	LF	400	$70.00	$28,000.00
4	HYDRANT ASSEMBLY	EA	1	$6,500.00	$6,500.00
5	GATE VALVE AND VALVE BOX	EA	3	$6,000.00	$18,000.00
6	TAPPING VALVE ASSEMBLY	EA	1	$10,000.00	$10,000.00
7	WATER MAIN, CONNECT TO EXISTING	EA	1	$1,200.00	$1,200.00
8	1,000,000 GALLON WATER TOWER	LS	1	$2,775,000.00	$2,775,000.00
9	CITY LOGO	LS	1	$15,000.00	$15,000.00
10	MIXING AND RECIRCULATION SYSTEM	LS	1	$55,000.00	$55,000.00
11	SILT FENCE	LF	300	$3.00	$900.00
12	SILT FENCE, CLEANOUT	LF	300	$3.00	$900.00
13	SILT FENCE, REMOVAL	LF	300	$1.00	$300.00
14	SEEDING, FERTILIZING, AND MULCHING (HYDRAULIC SEEDING)	LS	1	$5,000.00	$5,000.00
15	TESTING	LS	1	$10,000.00	$10,000.00
				Construction Costs	$3,087,840.00
				10% Contingency/Land	$308,784.00
				20% Non-Construction Cost	$617,376.00
				TOTAL PROJECT COST	$4,014,000.00

Client Name: CITY OF STORM LAKE
Location: STORM LAKE, IA
ISG Project Number: 20-24717
Date: JUNE 2, 2021

Engineer's Opinion of Probable Cost - 1.0 MG Spheroidal Tank (4th Tower)
40' Realized Head - 37' Utilized - 0.89 MG Captured

No.	ITEM DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL AMOUNT
1	MOBILIZATION / DEMOBILIZATION	LS	1	$123,290.00	$123,290.00
2	TRAFFIC CONTROL	LS	1	$15,000.00	$15,000.00
3	WATER MAIN, C900 PVC, OPEN CUT	LF	400	$70.00	$28,000.00
4	HYDRANT ASSEMBLY	EA	1	$6,500.00	$6,500.00
5	GATE VALVE AND VALVE BOX	EA	3	$6,000.00	$18,000.00
6	TAPPING VALVE ASSEMBLY	EA	1	$10,000.00	$10,000.00
7	WATER MAIN, CONNECT TO EXISTING	EA	1	$1,200.00	$1,200.00
8	1,000,000 GALLON WATER TOWER	LS	1	$2,300,000.00	$2,300,000.00
9	CITY LOGO	LS	1	$15,000.00	$15,000.00
10	MIXING AND RECIRCULATION SYSTEM	LS	1	$55,000.00	$55,000.00
11	SILT FENCE	LF	300	$3.00	$900.00
12	SILT FENCE, CLEANOUT	LF	300	$3.00	$900.00
13	SILT FENCE, REMOVAL	LF	300	$1.00	$300.00
14	SEEDING, FERTILIZING, AND MULCHING (HYDRAULIC SEEDING)	LS	1	$5,000.00	$5,000.00
15	TESTING	LS	1	$10,000.00	$10,000.00
				Construction Costs	$2,589,090.00
				10% Contingency/Land	$258,909.00
				20% Non-Construction Cost	$518,001.00
				TOTAL PROJECT COST	$3,366,000.00

Client Name: CITY OF STORM LAKE
Location: STORM LAKE, IA
ISG Project Number: 20-24717
Date: JUNE 2, 2021

Engineer's Opinion of Probable Cost - Water Tower 1 Rehabilitation

No.	ITEM DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL AMOUNT
1	MOBILIZATION / DEMOBILIZATION	LS	1	$43,250.00	$43,250.00
2	TRAFFIC CONTROL	LS	1	$15,000.00	$15,000.00
3	INTERIOR / EXTERIOR RECOATING	LS	1	$715,000.00	$715,000.00
4	STRUCTURAL REPAIRS	LS	1	$125,000.00	$125,000.00
5	TESTING	LS	1	$10,000.00	$10,000.00
				Construction Costs	**$908,250.00**
				10% Contingency	$90,825.00
				20% Non-Construction Cost	$181,925.00
				TOTAL PROJECT COST	$1,181,000.00

Client Name: CITY OF STORM LAKE
Location: STORM LAKE, IA
ISG Project Number: 20-24717
Date: JUNE 2, 2021

Engineer's Opinion of Probable Cost - Water Tower 2 Rehabilitation

No.	ITEM DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL AMOUNT
1	MOBILIZATION / DEMOBILIZATION	LS	1	$32,750.00	$32,750.00
2	TRAFFIC CONTROL	LS	1	$15,000.00	$15,000.00
3	INTERIOR / EXTERIOR RECOATING	LS	1	$550,000.00	$550,000.00
4	STRUCTURAL REPAIRS	LS	1	$80,000.00	$80,000.00
5	TESTING	LS	1	$10,000.00	$10,000.00
				Construction Costs	$687,750.00
				10% Contingency	$68,775.00
				20% Non-Construction Cost	$137,475.00
				TOTAL PROJECT COST	$894,000.00

Client Name: CITY OF STORM LAKE
Location: STORM LAKE, IA
ISG Project Number: 20-24717
Date: JUNE 2, 2021

Engineer's Opinion of Probable Cost - Water Tower 4 Rehabilitation

No.	ITEM DESCRIPTION	UNIT	QTY	UNIT PRICE	TOTAL AMOUNT
1	MOBILIZATION / DEMOBILIZATION	LS	1	$47,500.00	$47,500.00
2	TRAFFIC CONTROL	LS	1	$15,000.00	$15,000.00
3	INTERIOR / EXTERIOR RECOATING	LS	1	$825,000.00	$825,000.00
4	STRUCTURAL REPAIRS	LS	1	$100,000.00	$100,000.00
5	TESTING	LS	1	$10,000.00	$10,000.00
				Construction Costs	$997,500.00
				10% Contingency	$99,750.00
				20% Non-Construction Cost	$199,750.00
				TOTAL PROJECT COST	$1,297,000.00

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On January 12, 2017, ISG formally announced its transition of firm ownership to a 100% employee stock ownership plan (ESOP). As a multi-disciplinary firm that started 47+ years ago, ISG has since grown to be a Top 500 Design Firm as recognized by Engineering News-Record (ENR), a Zweig Group Hot Firm, and PSMJ Circle of Excellence recipient, illustrating the progressive increase in talent, expertise, and market share.