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Water Supply Engineering

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RANDOLPH WATER WORKS

Project #: W2024-0119

Permit #:

DWSRF #: FS-36-24-DWSRF-044

Preliminary Engineering Report (PER) - Revision 2

Water Source, Treatment, Storage and Distribution System

Randolph, Iowa

172534 | April, 2024

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Engineers | Architects | Planners | Scientists

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Building a Better World for All of Us®

April 8, 2024

RE: Preliminary Engineering Report
Water Source, Treatment, Storage and Distribution System
Randolph, Iowa
SEH No. #172534 10.00

Honorable Mayor and City Council Members
City of Randolph
107 S Main Street
Randolph, IA 51649

Dear Mayor and Council Members:

This report evaluates the existing conditions and 20-year design needs of the City's water source, treatment, storage and distribution systems in the City of Randolph, Iowa. It includes an inventory of existing water system components and reviews the ability of each major component to serve both the current and projected future needs of the City of Randolph. Finally, this report provides recommendations for improvements, opinions of probable construction costs, and opinions of added operational and maintenance (O&M) costs, if any, for the improvements to assist the City in planning, budgeting and applying for project funding if desired.

We would like to thank you for the opportunity to work in cooperation with you and your city staff to provide this evaluation and recommendation for improvements to your community water system.

Sincerely,

Benjamin J. Klaus

Benjamin J. Klaus, PE (MN, IA)
Project Engineer

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Preliminary Engineering Report (PER) - Revision 2

Water Source, Treatment, Storage and Distribution System

Randolph, Iowa

SEH No. 172534

April, 2024

LICENSED PROFESSIONAL ENGINEER BENJAMIN J. KLAUS P24903 IOWA	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. Benjamin J. Klaus 4/8/2023
	BENJAMIN J. KLAUS, P.E Iowa Reg. No. P24903 Date My license renewal date is 12/31/2025 Pages covered by this seal: All

W2024-0119_31573

APPROVED

Timothy M Duda
Digitally signed by Timothy M Duda
DN: C=US, E=timothy.duda@dnr.iowa.gov, O=Iowa Department of Natural Resources, OU=Water Supply Engineering Section, CN=Timothy M Duda
Reason: I am approving this document
Date: 2024.04.12 15:30:00-05'00'

DATE 04/12/2024

IDNR ENVIRONMENTAL SERVICES DIVISION

Short Elliott Hendrickson Inc.
5414 NW 88th Street, Suite 140
Johnston, IA 50131-1701
515.608.6000

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Executive Summary

The City of Randolph owns and operates a public water system (PWS), a system that provides treated water for its customers of 100 active service connections and serves approximately 189 individuals within and outside the city's corporate limits.

This study was commissioned by the City to provide an evaluation of the existing water supply, treatment, storage facilities, and distribution system to determine if improvements should be made to provide continued safe drinking water in adequate quantity and pressures for the period of the next 20 years and beyond.

The following alternatives are recommended for the City to implement based upon our evaluation of the water system, and are discussed in greater detail in the report.

- Alternative 1 – New Well to Replace Failing Well #4
    - Geotechnical Investigation to Determine Siting and Aquifer
    - Test Well(s) and Drilling of New Well
    - Controls, Piping, and Appurtenances
    - Abandonment of Well #4
- Alternative 2 – Water Plant Rehabilitation
    - New High Service Pumps
    - VFD for Well #3
    - Well Failure Alarm for Well #3
    - Replacement of Sand Media in Pressure Filters
    - Exterior and Interior Masonry Tuckpointing
    - Flow Meter Calibration
    - Installation of Emergency Backup Generator
- Alternative 3a – New Elevated Water Storage Tank
    - Mobilization, Design, and Tank Foundation
    - New Elevated Storage Tank, Fabrication, Erection, and Other Site Work
    - Surface Preparation and Coating
    - Connection to Existing Water System
- Alternative 4 – Replace Existing Water Main on Randolph Street
    - Removal and replacement of 6" cast iron with 6" PVC on Randolph Street
    - New Hydrants and Valves
    - Surface restoration
- Alternative 5 – Replace Remaining Cast Iron With 6" PVC
    - Removal and replacement of remaining 6" cast iron with 6" PVC
    - New Hydrants and Valves
    - Surface restoration
- Alternative 6 – Replace Old Individual Flow Meters
    - Installation of Sensus IPERL water meters

The Total Opinion of Probable Project Costs for these proposed improvements is $3,915,600. The table below presents a summary of the Engineer's Opinion of Probable Project Costs.

SUMMARY OF TOTAL OPINION OF PROBABLE PROJECT COSTS

Alt #	Alternative	Construction Costs	Non-Construction Costs	Total Project Cost
1	New Well to Replace Well #4	$286,000	$62,000	$348,000
2	Water Plant Rehabilitation	$251,000	$51,000	$302,000
3a	New Elevated Water Storage Tank	$702,500	$142,500	$883,000
4	Replace Existing Water Main on Randolph Street	$571,400	$108,000	$679,400
5	Replace Remaining Cast Iron with 6" PVC	$1,364,000	$266,000	$1,630,000
6	Replace Old Individual Flow Meters	$61,200	$12,000	$73,200
	Total Project Costs	**$3,254,100**	**$641,500**	**$3,915,600**

The proposed schedule for implementation of the recommended improvements is as follows:

ANTICIPATED IMPLEMENTATION SCHEDULE

Implementation Milestones	Anticipated Completion Date/Period
Submit PER to IDNR and USDA for Review/Approval	August, 2023
IDNR/USDA Approval of PER	September, 2023
Determine Funding Sources and Apply	August, 2023 to September, 2023
Begin Improvements Design Phase	November, 2023
Complete Design	April, 2024
IDNR Review and Approval	April, 2024 – May, 2024
CBDG Funding Application	July 1, 2024
CDBG Funding Approved	October, 2024
Start Geologic Investigation	October, 2024
Project Bidding Phase / Finish Geologic Investigation and Start Well Design	December, 2024
Award Contract	February, 2025
Start Construction	April, 2025
Complete Well Design	April, 2025
Well #5 Project Bidding Phase	May, 2025
Well #5 Award Contract	June, 2025
Complete Construction	November, 2025

The proposed Improvements are eligible for various types of grant and loan funding programs. It is recommended that the City move forward with funding implementation considerations including applying for USDA Grant/Loan funding or other funding such as a Clean Water State Revolving Funds (CWSRF) Loan and Community Development Block Grant (CDBG) funding.

Contents

List of Appendices

1 INTRODUCTION

This Preliminary Engineering Report (PER) is prepared for the City of Randolph, Iowa, by Short Elliott Hendrickson, Inc. (SEH) in accordance with guidelines provided by the United States Department of Agriculture (USDA) Rural Utilities Services (RUS) and the Iowa Department of Natural Resources. These guidelines require the description of an existing facilities and a description of the issues being addressed by the proposed project. It also requires the analysis of alternatives, an opinion of probable project costs of the recommended alternative, life cycle cost analysis of technically feasible alternatives and to propose a specific course of action.

The following report provides an evaluation of the City's public water system, taking into consideration its existing conditions and viability for the future. This report includes an inventory of existing water system components and reviews the ability of each major component to serve both the current and projected future needs of the City's water system. Finally, this report provides recommendations for improvements, opinions of probable project costs, and opinions of added operational and maintenance (O&M) costs, if any, for the improvements to assist the City in planning, budgeting and applying for project funding if desired

1.1 Elements of a Public Water System

A public water system (PWS) is defined as a system that provides piped water for human consumption to at least 15 service connections or regularly serves at least 25 individuals. All public water supplies are required, by the Safe Drinking Water Act and Iowa law, to be tested on a scheduled basis for potentially harmful contamination. There are specific requirements for which contaminants must be checked and the frequency of testing.

A public or municipal water system consists of numerous components that are combined to provide a community with water at the pressure, quantity, and quality necessary to meet the user's needs and the standards established by the Iowa Department of Natural Resources (IDNR). The primary components consist of a water source, treatment system, storage facilities, and a distribution system.

A municipal water system provides two essential services to the community. The service that is most commonly associated with the municipal water system is providing domestic, commercial, and industrial water for everyday use by the consumers. This function requires that water be chemically and bacteriologically safe for consumption. Also, the supply, pumping, distribution, and storage facilities must be capable of delivering sufficient quantities of water to meet the user's demands at an acceptable pressure.

The focus of this report will be to evaluate the City's existing water system and components with an emphasis on typical domestic usage recorded in the community.

1.2 Background & Need for Study

The City of Randolph owns and operates its drinking water system, including two water supply wells, a water treatment system, transmission pipelines, an elevated storage tank, distribution pipelines and service connections that serves the community within and outside the corporate limits of the city.

1.2.1 Need for Improvements to Facilities

This section outlines components that are currently posing a threat to the on-going ability of the City of Randolph to provide a safe and reliable drinking water to its community. The intent of this report is to identify improvements needed to maintain compliance with the IDNR regulations. The overall goal of the proposed improvements is to help provide safe and reliable drinking water while helping to minimize risks related to the health and safety of the environment and the community.

1.2.2 Health, Sanitation and Security

The City has recent health, sanitation, or security concerns reported to them by the IDNR in their letter to City dated March 13, 2020, which cited specific issues found in their water supply sanitary survey on February 17, 2020. A copy of the letter is included in Appendix A of this report. The issues noted included:

- The wells for the City of Randolph do not have alarm systems to alert the Operator in the event of a pump failure.
- It is recommended that a contingency plan for the provision of potable water during emergencies be developed and updated on an annual basis. It is also recommended that well house, at all times, be kept clean, in good repair, and free of any toxic or hazardous material storage.
- During inspection, Well #4's concrete riser appeared badly cracked and pieces of cement were broken off complete. The City of Randolph must seal Well #4's cement riser.
- An auxiliary source of power is recommended in the event of normal power failure.
- It is recommended that a cleaning and inspection schedule be developed for the aerator.
- The detention tank was cleaned and inspected in 2017 and was again in 2020. It is recommended to maintain a regular inspection and cleaning schedule.
- The water distribution system includes water mains with fire hydrants that are not of adequate diameter to meet the 6" minimum diameter for use for firefighting purposes. The City should not use fire hydrants for firefighting purposes on those mains of less than 6" diameter.
- It is recommended that the City of Randolph perform a water loss analysis to determine if there is greater than 10% loss of water to recover lost revenue and prevent contaminants from entering the system.
- City of Randolph is required to test coliform after painting, maintenance, inspection and/or cleaning of the storage tank. Two or more successive sets of bacterial samples must be taken at 24-hour intervals and must be bacterially safe before facility is placed into operation.

In addition to the IDNR's sanitary survey report findings, there is concern from the City of Randolph that the two wells may be nearing the end of their production capabilities.

1.2.3 System Operation and Maintenance

The water system is owned and operated by the City of Randolph as a utility supported by rates paid by the customers of the system. The City currently utilizes US Water to provide operators for the normal daily operation and maintenance of the system.

1.2.4 Aging Infrastructure

The City has several portions of the water treatment system that are at or nearing their useful life. Specifically, the well risers need reinforcing and the well casings and screen need inspection and cleaning. The City also has concerns about a lack of water being produced in the wells, possibly requiring rehabilitation of the well or the installation of a third well.

The water distribution mains which were built in the 1930's are aging as well, and are in fair condition and are primarily constructed of cast iron. Projects that include water main replacement should focus on replacement with larger diameter mains (6" or larger) and provide some looping for greater system reliability and reduction of dead-end mains that contribute to stagnant water in some areas of the community.

Additionally, the old cast iron water main piping is prone to a reduction in available diameter over time from deposition of minerals and other materials carried by the water. This reduction in diameter then results in a decrease in carrying capacity of the piping as well as increased friction that ultimately reduces system pressures

Our evaluation will consider alternatives to help address these issues listed above as well as the following:

- Long dead-end and small diameter mains that lead to insufficient chorine residuals and stagnant water should be upgraded to sufficient size and looped into the system.
- Improvements to the aging treatment system.

1.3 Scope

The scope of this Preliminary Engineering Report (Study) is to:

- Identify and evaluate water system improvement needs
- Assemble basic information
- Present criteria and assumptions
- Examine alternatives for improvements, layouts and opinions of probable costs
- Offer a recommendation of proposed improvements for consideration
- Describe possible project funding opportunities
- Outline official actions to implement the recommended improvements, with anticipated project schedule

1.4 Community Engagement

The City Council has openly discussed the need to plan for the water system's needs and deficiencies. The Council has hired SEH to explore options available to the community and present these to the Council for review, discussion and approval. Council meetings are open to the public and members of the community are given the opportunity to comment at these meetings.

2 EXISTING CONDITIONS AND PROJECTIONS

The purpose of this section of the report is to conduct an engineering evaluation of the number of users, water demands and the components of the existing water system facilities.

The design criteria, materials and equipment evaluated in this report and included in the final project design must meet the requirements of State and Federal laws and regulations, including:

- Iowa Administrative Code 567 (Environmental Protection) – Chapter 43: Water Supplies – Design and Operation.
- Great Lakes Upper Mississippi River Board of State Health and Environmental Managers Recommended Standards for Water Works (Ten State Standards).
- Iowa Statewide Urban Design and Specifications (SUDAS) design guidance for water systems.

2.1 Geographical Location

The City of Randolph is located in the eastern portion of Fremont County, which is located in southwestern portion of Iowa, approximately 12 miles northwest of the City of Shenandoah, Iowa. The City has primary access to County Highway-J18.

Figure 1 below shows an aerial photo of City of Randolph area. The City is located in a predominantly agricultural area.

Figure 1 - Aerial Photo of Randolph

The terrain within the vicinity of Randolph is gently rolling within the community, with USGS elevations ranging from the highest elevation of approximately 975 feet in the eastern portion of the community down to approximately 950 feet at the West Nishnabotna River to the west.

Figure 2 below, shows the Iowa Geographic Map that includes the City and the surrounding area. As can be seen, surface drainage generally flows to the west towards West Nishnabotna River.

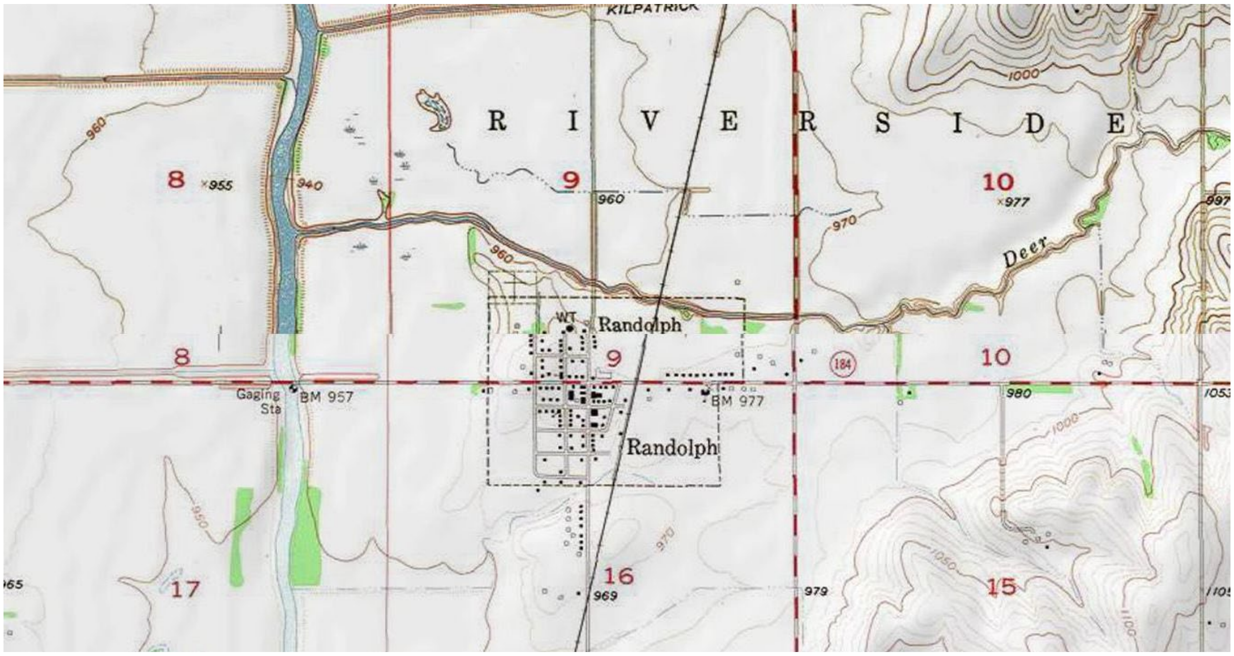

Figure 2 - USGS Topo Map of Randolph

2.2 Environmental Resources Present & Environmentally Sensitive Areas

While a formal environmental review has not been completed at the time of this report, it is believed that no significant environmental resources would be impacted by a wastewater project within, or adjacent to, the existing wastewater system site or within the sewer collection system routes.

2.2.1 Wetlands

According to the U.S. Fish and Wildlife Service National Wetlands Inventory, there are some emergent wetlands in areas around the City, but no significant wetlands are identified within the City. A National Wetland Inventory, as provided by the US Fish and Wildlife Service, is shown in Figure 3, below. In addition, there are no known significant historical or archaeological properties.

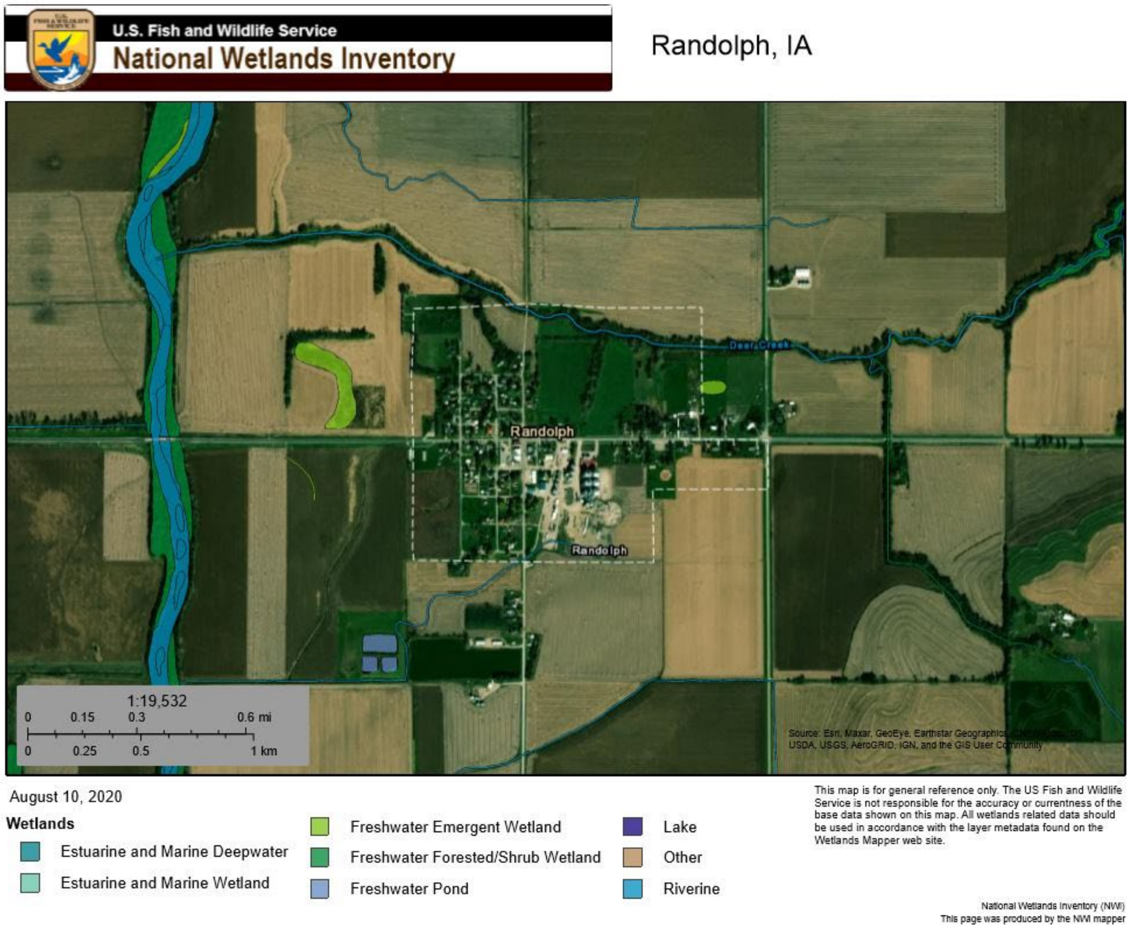

Figure 3 - Wetland Inventory Map of Randolph

2.2.2 Flood Plain Considerations

A FEMA designated floodplain map for the City of Randolph is included below in Figure 4 that indicates the extents of the floodplain along the West Nishnabotna River; however, there are no flood elevations listed in the FIRM document.

If any structures are developed in an existing floodplain or floodway, they shall meet the "Minimum Standards for Floodplain Management Programs" as prescribed by the Iowa Department of Natural Resources (DNR). If the construction of structures within the existing floodway is performed, it will not be permitted without showing that there will be no increase in water surface elevations along the floodway profile during the occurrence of a base flood.

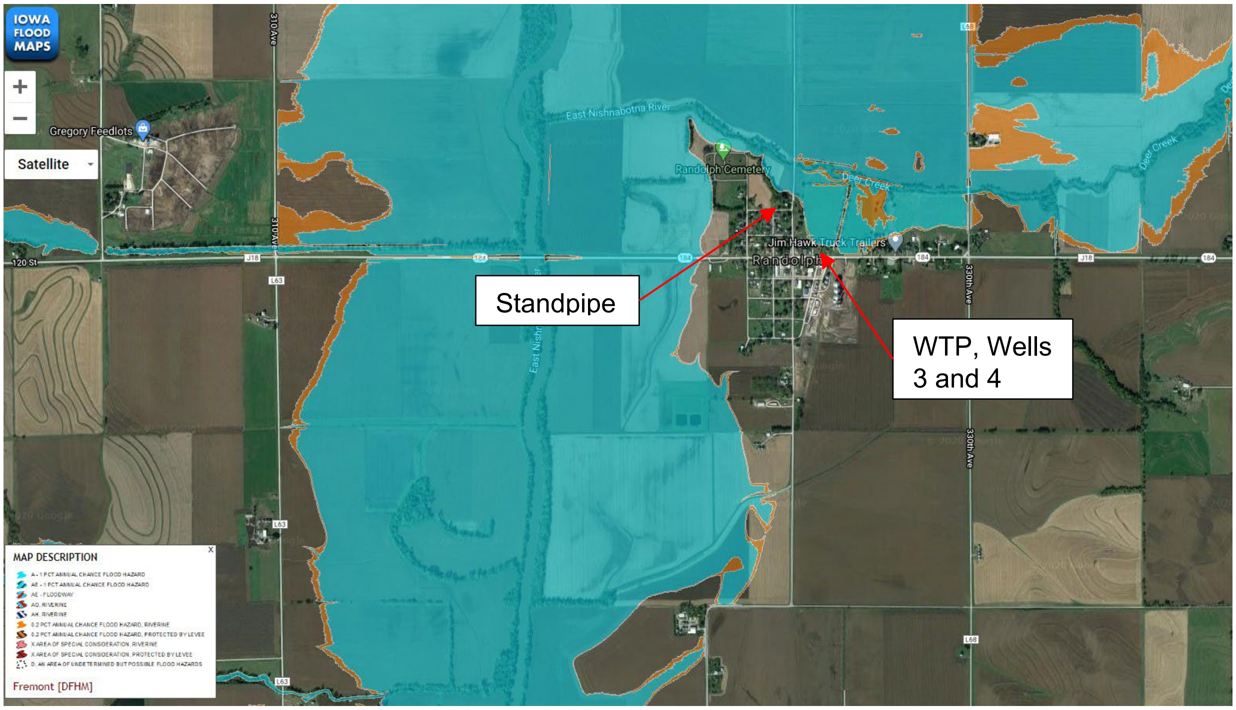

Figure 4 - City of Randolph Flood Plain Map

2.2.2.1 Existing Water Treatment Site Considerations

The location of the existing water treatment plant is on the northeast side of the City. In reviewing the FIRM map, the existing WTP is not located inside the 100-year floodplain. Any proposed improvements to the existing WTP or standpipe will also not be inside of the floodplain.

2.3 Service Area and Land Use

The entire community is currently served by the City owned water supply system that is being evaluated in this report. Any improvements deemed necessary will not change the service area.

The predominant land use in the community is residential, with some light commercial land use.

2.4 Population and System Users

2.4.1 Historical Population Trend

Reviewing historical populations for a community is completed to identify population trends and help aid in projecting future growth. For this report, projected populations are also used to estimate future water demand, which will then help to determine whether the City will be prepared to provide the necessary amount of water. This will be discussed more in depth in a later section. Gathered from the U.S. Census, the historical population for the City is shown in Table 1 below by the decade.

Table 1 – City of Randolph Population History

Year	Population	Percent Change (%)
1880	213	N/a
1890	276	29.58
1900	373	35.14%
1910	304	(-18.50%)
1920	404	32.89%
1930	344	(-14.85%)
1940	379	10.17%
1950	295	(-22.16%)
1960	257	(-12.88%)
1970	214	(-16.73%)
1980	223	4.21%
1990	243	8.97%
2000	209	(-13.99%)
2010	168	(-19.62%)
2020	189	12.50%
Table Notes: (X.XX) indicates negative percent growth		

The City's population for the year 2020 was reported to be 189 and will be used to determine per capita usage.

2.4.2 Water System Users

The system currently serves approximately 100 active water service connections (users), 98 of which are metered at the time of this study. Of the 98 metered water users in the system, there are 87 residential users, 8 commercial/industrial users, and 2 governmental users.

Of the un-metered users, two are governmental (the Fire Station/Community Center and Park) and one residential. The residential user is an agricultural user who is provided water at no cost as part of a leasing agreement for the ditch used by the wastewater treatment facility during discharges.

The City has individual water meters to measure water consumption for individual users. The Contract Operators read all individual water meters on the third week of each month. Approximately 9 of the 98 meters have been recently replaced with Sensus IPERL remote-read capable models.

Table 2, below, summarizes the types of users connected to the system.

Table 2 – Water System User Types

Type	Connections
Residential (Inside Corp. Limits)	80
Residential (Outside Corp. Limits)	7
Commercial/Industrial	8
Governmental	2
Un-Metered	3
Total Users (Connections)	**100**

Based upon discussions with the City staff and available records, the City of Randolph does not have any industrial users which consistently demand significant amounts of water use. Unless something unforeseen happens with the addition of new industrial businesses, this is not expected to change in the near future.

2.5 Regulatory Requirements

2.5.1 IDNR Inspections

The IDNR conducts periodic inspections of the water system facilities in Iowa. Following the inspection by IDNR personnel, a written report is presented to the City which includes observations, operational deficiencies, and recommendations for improvements that the City should consider.

A copy of the most recent IDNR letter dated March 13, 2020 for the inspection performed on February 17, 2020 is included in Appendix A. This report made certain requirements associated with operations of the existing facility. The requirements are outlined below:

- Repair the cement riser at Well #4 and submit documentation to Field Office 4 by April 1, 2020

In addition, the report made recommendations associated with operations of the existing facility. It is recommended that:

- An adequate alarm system should be provided in the event of a well pump failure.
- A contingency plan for the provision of potable water during emergencies be developed and updated on an annual basis.
- The well housing, at all times, be kept clean, in good repair, and free of any toxic or hazardous material storage.
- A cleaning and inspection schedule for the aerator is developed.
- The detention tank continues to be cleaned and inspected on a regular basis.
- A leak assessment be performed and that if a loss above 10% is observed, a leak detection. program be immediately instituted.
- All valves be exercised annually.
- The interior of the standpipe be inspected at least every two years.

2.6 Historical Water Demand

The rate of water use varies over a wide range during different periods of the year and during different hours of the day. Several characteristic demands are recognized as being critical in the design and operation of a water system. In this report, demand rates are expressed in gallons per day (GPD) or gallons per minute (GPM), which in the case of daily use, indicates the total amount of water used in a 24-hour period.

Maximum daily demand (MDD) is the maximum quantity used in any day during the year. MDD is the critical factor in the design of certain elements of the water system. The principal items affected by the maximum daily use are:

- Aquifer capacity
- Raw water supply facilities
- Treatment facility size
- Distribution and transmission main capacity
- Storage capacity requirements

2.6.1 Water Demand

The water demand was reviewed for the last calendar years, which was the period of July 2019 to June 2022. The data provided was the daily well pumping rates. The highest demand year was 2021, with average annual demand of approximately 0.92 million gallons or an average day demand of approximately 30,000 gpd. The overall average daily demand is 26,874 gpd for the period of July 2019 to June 2022.

Details of the past three years of water demand can be found in Appendix B.

It is observed that the water demand in the past three fiscal fluctuated slightly from year to year, but was generally consistent. From review of the daily data provided by the City, the maximum day demand was measured to be approximately 65,600 gpd which was experienced in November 2021.

Based on the data, the current water demands for the community are presented in Table 3 below:

Table 3 – Current Water Demands

	Gallons per Day (gpd)	Gallons per Minute (gpm)	Peak Factor
Average Daily Water Demand	26,874	18.7	1
Maximum Daily Water Demand	65,600	45.6	2.44

The existing water treatment facility is designed to treat up to 120 gpm, which is greater than the current MDD.

The charts in Appendix B present the monthly average daily water demand for the period of July 2019 to June 2022 (FY20 through FY22, as compared to the calculated daily average demand of 26,874 gpd,

The average demand per person is calculated to be 142 gallons per day per capita (gpcpd), based on the current 2020 census population of 189.

2.6.1.1 Large Water Consumers

In an agreement with a private landowner, in exchange for using a ditch for wastewater discharge, this property owner would be compensated with free water. During the spring and fall, this user consumes significant quantities of water for use in agricultural spraying. The user is unmetered, so it unknown exactly how much water is consumed, but anecdotally by the City, it is estimated that this user will consume up to three times the normal daily use. However, after reviewing the water demand data, it does not appear to show those spikes in usage during those times.

2.6.2 Distribution System Water Losses

An important measure of the condition of the water distribution system and piping is through analysis of the amount of water unaccounted-for (lost) from the time that it is pumped to the system to the time it enters the consumers' private systems. Due to inaccuracies in meter readings and leaks in the system, it is normal to see some water loss. Typically, an acceptable system loss would be less than 15% of the amount pumped to the system from the treatment facilities. If the percentage of loss is greater than 15%, the system could be experiencing excessive operating expense and lost revenue and may merit more extensive investigation. Sources of water loss can be numerous. Examples include leaking piping or valves, inaccurate private water meters, consumers that have leaks, inaccurate well pump meters, billing system errors, or other miscellaneous items.

Currently, the City uses meters to measure the water used by each customer, including the City operated facilities (with one exception as noted in the following Sections). With water meters, the water that is pumped from the wells can be compared to the water sold to the customers to determine if there is any water loss in the distribution system. Water loss in the distribution system is any water that is pumped from the wells and is not accounted for in water sales (metered) and water loss in the treatment system during backwashing, etc.

Table 4 below, shows the amount of water that is considered lost based upon the amount of water pumped to the system, less the water wasted during backwashing the treatment system, and less the amount of water billed (metered) to customers in Randolph. Note that all water use is metered, with the exception of the un-metered users discussed in a subsequent Section. The billing reviewed was from July 2019 to June 2022 as provided by the City.

Table 4 – Water Pumped to the System vs. Water Sold (Metered)

Fiscal Year	Water pumped from Wells (gal)	Water Loss in Treatment	Water Sold to Consumers (gal)	Water Loss in Distribution (gal)	Percent of Water Loss
20	8,370,800	208,000	4,313,100	3,849,700	45.99%
21	11,099,300	208,000	4,549,300	6,342,000	57.14%
22	10,080,500	208,000	4,119,360	5,753,140	57.07%

Comparing the billing data for the City of Randolph and the water pumped to the system over the same time period reveals that an average of approximately 53.4% of the water pumped from the wells is lost in the distribution system. Thus, the City's amount of water loss is well above what would be expected for a community of this size and therefore, the City should consider identifying the leaks in the distribution system and making improvements to reduce the water loss as soon as possible.

Typically, the discrepancy between water produced versus water sold could be due to one or more of the following:

2.6.2.1 Distribution System Leakage

City staff have indicated that that the distribution system is generally in fair to good condition with minor leaks reported recently. It is recommended to perform a leak detection survey to more accurately quantify the amount of and areas of water lost through distribution system leakage.

2.6.2.2 Water Meter Errors

Typically, as water meters age, less water is recorded than the actual amount used. The City currently reports that 9 of their existing meters have been replaced with new Sensus IPERL models to alleviate water meter error. Revenue loss due to water meter errors should be reduced once all water meters are replaced.

2.6.2.3 Water Plant Flow Meter Errors

There is no recent record of calibration of the flow meters used inside the water treatment plant. It is possible the apparent water loss is partially due to inaccurate readings of the amount of water being pumped from the wells.

2.6.2.4 Un-metered Water Users

Un-metered water users consist of any connections to the water system which are not metered. As previously mentioned, the Fire Station/Community Center, City Park, and agricultural user are all un-metered.

2.6.2.5 Other Water Losses

Other possible sources of water loss are the amount of water used during routine flushing of the water distribution mains. Based on discussions with City staff, the mains have been flushed periodically by the Fire Department, but records have not been kept on the exact flushing regimen.

2.6.3 Cost of Water Loss

Since the City of Randolph obtains water from two wells located in the city, any water pumped from the wells and is distributed to users after treatment that is lost can be considered lost revenue for the City. Table 5, below, presents the approximate revenue lost amounts (dollars) attributed to water loss in the distribution system.

Table 5 – Water Revenue Lost

Fiscal Year	Water Lost (gal)	Water Rate Based on FY23 Rate Ordinance	Water Revenue Lost[1]
20	3,849,700	$0.325/100 gal	$12,520
21	6,342,000		$20,620
22	5,753,140		$18,700

Implementation of a wholesale water distribution system improvement program to replace leaking mains and services and replacement of old water meters would result in a reduction of water loss and thus decrease the cost attributed to operating the water system. As a hypothetical analysis, assume that an improvement program reduces the percentage of water loss from the current average of 53.4% to a normal water loss percentage of approximately 15%. That equates to a reduction of water loss of approximately 1,247,160 gallons per year and a recovery (additional water revenue) of an average of $12,400 per year. The exact amount of water loss reduction to be realized by a water distribution system improvement project, however, cannot be reasonably approximated due to various factors, and therefore this analysis is for informational purposes only and likely represents a best-case scenario.

3 PROJECTED WATER DEMAND

3.1 Planning Period

The customary planning period for water system is 20 years, which is used for development of population projections and planning of improvements. This 20-year planning period is also a requirement of the IDNR in developing design parameters such as projected design-year demands for the various components of the system. The design year for planning purposes of this report is 2040. Though many facilities will last much longer than 20 years, the uncertainties in making projections increase greatly beyond this time period.

3.2 Design Population

The 2020 census existing population was 189. Accurately projecting the future population of a community can be difficult; however, using the basis of past population data along with input from City of Randolph officials, the future population can be reasonably projected. Figure 5 below, presents the population trends, including the projected population, in graphic format.

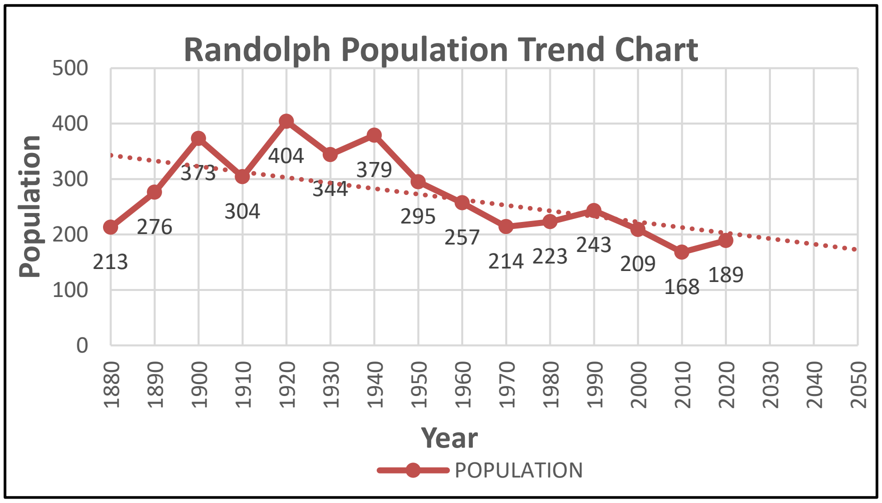

Figure 5 - City of Randolph Population Trend

Typically, when projecting future populations for a community of this size which has the potential for growth, a negative growth rate as depicted in Figure 5 will not be utilized. Rather, a nominal growth rate shall be used to ensure water is available for potential residents. For the purposes of this report, a projected year **2043 population of 200** will be utilized.

3.3 Design Year (2043) Water Demand

Various methods can be utilized to predict the future water demand. However, for this report, a standard population-based approach, which utilizes current and future population estimates and historical water demands, will be utilized to determine projected water demands.

As presented previously, based on historical data, the City of Randolph has an annual average daily water demand of approximately 26,874 gal/day, or approximately 142 gallons per capita per day (gpcpd), and a maximum day demand of 65,600 gpd, or approximately 347 gpcpd. The following calculations are for the projected water demand using the design population of 200:

- Projected Daily Average Demand = 142 gpcpd x 200 people = 28,400 gal/day
- Projected Maximum Day Demand = 347 gpcpd x 200 people = 69,400 gal/day, or 48.2 gpm

4 EXISTING FACILITIES EVALUATION

4.1 Existing Facilities Summary

The City of Randolph owns and operates a water treatment plant currently consisting of aeration, detention, pressure filtration, and chlorination. It also includes a 64,000 gallon elevated water storage tank and approximately 13,300 linear feet of water distribution mains. The majority of the water distribution mains were constructed with the original wells and water plant in the early 1900's and are made predominantly of 4" cast iron piping. The City has replaced certain segments of the distribution piping with new 6" PVC water main pipe during a systems improvement project in the early 2000's. The elevated water storage tank is a standpipe and was constructed with the original system in the early 1900's. The current water treatment plant was constructed in the 1960's. This section will detail the current conditions of the various components of the water system.

4.2 Drinking Water Regulations

In 1974, which later amended in the subsequent years, the United States Congress passed the Safe Drinking Water Act (SDWA) which established a corporative program between local, state and federal agencies to ensure safe drinking water. The United States Environmental Protection Agency (US EPA) identifies contaminants to regulate in drinking water to protect the public health. Hence, the US EPA sets regulatory limits for the amounts of certain contaminants in water provided by public water system, such as Randolph. These contaminant standards are required by the SDWA. Therefore, the US EPA collaborates and works with states and tribes to implement these SDWA provisions. Tables 6 and 7 below shows primary and secondary contaminants of interest as well as the corresponding Maximum Contaminant Level (MCL). Primary Standards protect the public health by limiting the level of contaminants in the drinking water. Secondary standards are guidelines regulating contaminants that may cause cosmetic, such as skin or tooth discoloration, or aesthetic effects, such as taste, color or odor.

Table 6 – US EPA Primary Contaminant MCL

Contaminants	Maximum Contaminant Level (mg/l)
Total Coliform	Maximum 5% of sample positive
Total Trihalomethanes	0.1
Chloramines	4.0
Chlorine	4.0
Arsenic	0.01
Barium	2.0
Beryllium	0.004
Cadmium	0.005
Chromium(Total)	0.1
Copper	1.3
Fluoride	4.0
Lead	0.015
Mercury	0.02
Nitrate	10
Nitrite	1
Selenium	0.05
Thallium	0.002
Alpha Particles	15 picocuries per Liter (pCi/L)
Beta Particles	4 millirems per year
Combined Radium	5 pCi/L
Uranium	30 micrograms/liter

Table 7 – US EPA Secondary Contaminant MCL

Contaminants	Maximum Contaminant Level (mg/l)
Aluminum	0.05 to 0.2
Chloride	250
Copper	1.0
Corrosivity	Non-Corrosive
Fluoride	2.0
Foaming Agents	0.5
Iron	0.3
Manganese	0.05
pH	6.5-8.5
Silver	0.1
Sulfate	250
Total Dissolved Solids (TDS)	500
Zinc	5.0

4.3 Existing Water Supply Evaluation

The City of Randolph owns, operates and maintains a raw water supply from two wells; Well #3 and Well #4, located at or near the water treatment plant with an address of 300 Randolph Street. The wells pump groundwater to the water treatment plant for subsequent pressure filtration and disinfection prior to storage in the standpipe and distribution to water customers in the community. A detailed description in accordance with GeoSam Database which is maintained by the University of Iowa for wells #3 and #4, and is summarized below in Table 8 below. The location of the two wells are shown in Figure 6 below.

Figure 6 - University of Iowa Well Inventory Map

Table 8 – Well Inventory

Description	Well #3	Well #4
Location Wells	Inside WTP	50' NE of WTP
Well Number	1040431	1040432
Year Drilled	1966	1968
Well Depth	53 ft	52 ft
Well Diameter	10 inch	10 inch
Top Elevation	980 ft	981 ft
Bed Rock Depth	Unknown	Unknown
Aquifers	Alluvium	Alluvium
Pumping Capacity	70 gpm	40 gpm
Rated Pump TDH	100	120
Pump Motor Hp.	5	5

The two wells are operated in an alternating mode with only one pumping at a time when called for by the water level in the detention tank.

4.3.1 Condition of Water Supply Wells

The City of Randolph has expressed concern over the long-term availability of water in their supply wells due to apparent lack of water available in the wells. The City has observed when Well #3 is running, the water table in Well #4 draws down below the pump intake level causing cavitation. Additionally, the new pump installed in Well #3 must be throttled from its capacity of 125 GPM to approximately 70 GPM to avoid drawing the water table below its intake, which would again result in cavitation causing damage to the pump.

Additionally, as reported by the City, during 2022 they experienced a failure in their primary Well #3 which required Well #4 to take over all pumping. Due to the beginnings of failure of that well, it was not able to keep up with demand which left the City without adequate water or pressure. As both of the existing wells are in the same aquifer and seem to influence each other, it is important for the City to have a third well, likely in a different aquifer, to ensure availability of water.

4.3.2 Source Water Quality

The City of Randolph regularly monitors the groundwater quality by taking samples at the treatment plant before it enters the treatment system. There are no contaminants of concern that the City must treat. Pre-chlorination with aeration precipitates out the low-level iron and manganese in the groundwater which are then removed by the pressure filters.

4.3.3 Annual Drinking Water Quality

The SDWA requires City of Randolph to annually issue a report describing the quality of the water supply. The purpose of this report is to raise the customers understanding of the drinking water and awareness of the need to protect the water supply sources. Included in the report are details about where the water comes from, its quality and how it compares to the water quality standards. The 2022 water quality report for the City of Randolph Water Supply is attached in Appendix C.

4.3.4 Source Water Protection

Source Water Protection (SWP) is the act of preventing contaminants from entering public drinking water source. In accordance with IDNR, an SWP has the following purposes:

- Define your source water area and susceptibility;
- Locate, inventory, and rank potential contaminant sources within the source water area;
- Provide the results to the public for improved protection of drinking water.

IDNR prepared SWP Phase I assessment report in 2012 for the City of Randolph to provide information and be used as a tool to help protect the quality and quantity of the City's water. In the report, it identified the inventory of wells, tables showing contamination sources within the source water area and maps showing the systems source water information. It also presents the rankings of contaminant sources and how to protect the City's drinking water. The SWP Phase I Assessment is attached in Appendix D for reference.

The SWP Phase I assessment only provides information on the source water area and contaminants. Hence, IDNR strongly recommends the City develop a SWP plan to fully protect the City's drinking water system. The steps to complete the SWP plan are outlined in the Phase I assessment plan, and are summarized below:

- Step 1: Organize a source water team
- Step:2: Identify the source water area
- Step3: Inventory well and contaminant sources
- Step 4: Assess and rank contaminant sources
- Step 5: Develop and action plan
- Step 6: Construct or update emergency response plan
- Step 7: Submit and implement SWP plan

4.3.5 Water Supply Conclusion

The City of Randolph appears to have sufficient water to operate at its current demand levels. However, from discussions with the City, there is some operational concern with the supply of water from the wells which leads to concerns about future availability of water being produced by the wells. The well supply capacity is 70 gpm because only one well can operate at a time. Under the current operations, the City's water supply is serving a daily average demand of 26,874 gpd or approximately 19 gpm. Additionally, the maximum day demand was measured to be approximately 65,600 gpd or approximately 46 gpm. While this value is below the 70 gpm supply capacity of the wells, there have been peak hours that have resulted in demands higher than the supply.

4.4 Existing Water Treatment System Evaluation

The City of Randolph water treatment facility was constructed in 1966 to eliminate the dissolved iron content of the source water from its raw water supply system. The existing treatment system consists of:

- Pre-Chlorination Injection to Facilitate Iron Oxidation
- Aerator for Iron Oxidation
- 31,000 Gallon Detention Tank
- Two (2) 5-feet Diameter Pressure Filter Vessels
- Miscellaneous piping, valves, meters, electrical, chemical feed systems and controls

Figure 7 below shows the water treatment building.

Figure 7 – City of Randolph Water Treatment Plant

Raw water is pumped from the two water supply wells to the detention tank through a 4-inch influent pipe where it receives an application of liquid chlorine prior to the aerator on top of the detention tank. This injection helps facilitation the oxidation of the natural iron as the water cascades through the aerator.

The water is stored in the detention tank before being pumped via two high service pumps through two pressure filters. Following this, disinfection of the water is provided by another application of liquid chlorine by utilizing a positive displacement solution pump as it is pumped into the water system and is measured by Sensus Turbine flow meters. The chlorine pump is controlled by the high service pumps. There is no dedicated force main from the water treatment plant to the standpipe. Rather, the water is pumped directly into the water system and fills the standpipe.

The pressure filters are backwashed once a week, and the backwash water is discharged to the wastewater treatment lagoon via gravity sanitary sewers and ultimately is discharged to the West Nishnabotna River after treatment in the lagoon system. Figure 8 below shows the aerator and Figure 9 below shows the two vessels at the Randolph Water Treatment Facility.

Figure 9 - City of Randolph Aerator and Detention Tank

Figure 8 - City of Randolph Pressure Filters

Based on information provided by the original equipment supplier, the design criteria for the treatment units are presented in Table 9 below.

Table 9 – Existing Treatment Description

Description	System Specification
Number of Vessels	Two (2) – 5 feet diameter X 5 feet straight side
Working Pressure, Psig	100
Normal Treatment Rate (ea)	60 gpm, 3 gpm/sq ft. of sand
Maximum Treatment Rate (ea)	80 gpm, 4 gpm/sq ft. of sand
Backwash Rate (ea), gpm	300 gpm, 15 gpm/sq ft
Support Gravels Depth, in	16
Filter Media Bed Depth, in	24

Table 12 above is a general description of the original design specification. There are no apparent issues with the filters which appear to be in good working conditions. It is believed that the media has never been replaced since its original installation.

4.4.1 Treated Water Quality

It is observed from the City's water quality report that the finished water supplied to the town is of very high quality. There are no violations or near violations of any contaminants.

4.4.2 Backup Power

The City does not have a back-up power source for operation of the wells during a power outage. The City only has 12 hours of water storage at average day demand between the high water level and low water level. Between the high water level and the 20-psi level (approximately 46' above ground level), this water storage increases to 33 hours.

4.4.3 Water Treatment System Conclusion

The treatment plant, while aging, is in good structural condition. The media in the pressure filters is likely due for replacement, though no breakthrough of iron or manganese has been observed.

The quality of water being produced by the City of Randolph meets the current regulatory requirements for drinking water. The City tests for chlorine residuals daily in the system and maintains an average residual of 0.84 mg/l of free chlorine. It can be concluded that the City is meeting the minimum free chlorine residual of 0.3 mg/l, set by IDNR, throughout the distribution system. Furthermore, it can be concluded that the City has not had any compliance issues with chlorine residual.

Replacement of the pressure filter media and installation of an emergency backup generator will be included as recommended improvements to the water treatment plant.

4.5 Existing Storage Evaluation

The City of Randolph currently utilizes one (1) elevated water storage tank, which is a standpipe type tower located on the north side of the City. The elevated storage tank was constructed in 1930 as part of the original water system for the City of Randolph and has a total storage capacity of approximately 64,000 gallons, and an effective storage capacity of approximately 13,700 gallons.

The overall height of the elevated storage tank is approximately 110 feet from the concrete foundation to the high water level (HWL) in the tank. The low water level (LWL) is approximately 86 feet from the concrete foundation. The tank provides water pressures at the ground elevation below the tank that ranges from 48 psi (HWL) to 38 psi (LWL), measured at the standpipe. Given the standpipe sits at a higher elevation, the water pressure reported around the City notes that pressures range from 60 to 50 psi. The designed standpipe elevations were taken from construction drawings provided by the City of Randolph. Figure 10 shows the existing storage facility currently serving the City of Randolph.

The main purposes of water storage facilities are to maintain pressure and provide a stored supply of water that can be called upon when needed. Storage also provides water that can be used if one of the wells is temporarily out of service.

Given that the projected (2043) average daily water consumption for the water system is approximately 28,438 gpd, the water storage facility would provide approximately 11.5 hours, or 0.48 days, of storage if operated at between the HWL and LWL. The Ten State Standards recommends a storage capacity equaling the average daily consumption. Using the HWL and LWL as designed, the water storage facility does not meet this standard.

Figure 10 - City of Randolph Standpipe

The City has reported pressure issues around town which could be due in part to the pressure at the low water level (38 psi) and/or tuberculation of the mains. Additionally, a small leak has been observed on one of the sets of rivets which will need to be corrected.

4.5.1 Storage Conclusions

The existing storage system, even if operating at its maximum capacity, does not have enough water storage capacity to supply water for 1 day at the design year average daily water consumption per the Ten State Standards.

The overall physical condition of the water storage tower is considered to be fair at this time. It was power washed and recoated approximately 10 years ago and should be power washed and recoated again (if necessary) in approximately another 10 years. Finally, the leak that has been observed should be repaired and any corrosion of the exterior or interior of the tank should also be removed and those areas recoated.

Due to the tower's age, current conditions, and not meeting the Ten State Standards for storage volume it is recommended that replacing the tower be considered rather than continuing to invest in maintenance and repairs.

4.6 Existing Water Distribution System Evaluation

The original water distribution system for the City consisted of 4" and 6" cast iron pipes and was installed in 1930. In 2002, a water system improvements project was constructed, which installed three sections of 6" PVC to create two loops and replace a section of 4" cast iron.

The current distribution system consists of approximately 13,300 linear feet of 4" and 6" mains. The size breakdown of water lines and mains in the City's distribution system is presented in Table 10, below. There are also approximately 22 fire hydrants and approximately 27 isolation valves in the distribution system.

Table 10 – Water Main Piping Inventory

Size (Dia)	Linear Feet	% of Total
4" Cast Iron	8,471	63.7%
6" Cast Iron	2,627	19.7%
6" PVC	2,202	16.6%
Total Mains	13,300	100.0%

Per City staff, a significant percentage of the distribution system piping is still the original cast iron pipe material. The remaining water main material consists of PVC installed during the 2002 project.

There are 4 dead end mains in the distribution mains in the community at the edges of the City.

The approximate layout of the city's water distribution system, which is based on existing mapping provided by the City, can be found in Appendix E. Field survey of the distribution system was not performed as part of the scope of this study.

4.6.1 Water Mains

Water distribution systems are normally designed to satisfy the water requirements for a combination of domestic, commercial, industrial, and fire-fighting purposes. The distribution system should be capable of meeting the demands placed on it at all times, with an acceptable residual pressure. Piping systems (distribution mains), pumping stations, house service connections, meters, fire hydrants, and other appurtenances are the main elements of the distribution system.

A large percentage of the City's water mains in the system are cast iron piping. Over time, cast iron pipe undergoes gradual degradation in the form of corrosion and tuberculation. Accordingly, as the water distribution system ages, the number of pipe failures can increase with time. However, the City has not reported prevalent cases of water main breaks, citing a frequency of such events at only three in the past several years.

A good quality cast iron pipe, installed under ideal conditions, has a life expectancy of 75-100 years, and possibly even more. Since the distribution system was constructed in 1930, the majority of the City's distribution system is likely nearing the end of its life expectancy, if it hasn't exceeded it already. The lifespan of a cast iron pipe is heavily influenced by the extent of its corrosion and/or tuberculation. Increasing interior tuberculation will increase the restriction on flow within the pipes and reduce residual pressure.

4.6.2 System Pressures

One way to measure the performance of a distribution system is on the basis of the pressures available in the system for a specified rate of flow. Pressures should be adequate to meet consumer demands (residential, commercial, and industrial); firefighting needs, and maintain a minimum of 20-psi residual pressure in all parts of the system. In addition, as pressures increase, leakage increases and money is then spent to process and transport a product that is wasted. Because the investment in a distribution system is large, it is important that the distribution system be optimized. The pressures will vary with the water demands in the system at any given time.

Normally, the desired static pressures (the pressure on the water system during no flow conditions) for a residential area usually range from 55 to 65 psi. For commercial and industrial areas, pressures in excess of 60 psi is desirable. A minimum pressure of 20 psi is required, and a 35 psi minimum is preferred.

The existing water storage tank appears to have been designed to provide a minimum static head of 37 psi (or an approximate LWL of 86' from the base of the standpipe) and a maximum of 48 psi (or a HWL of 110'). While this pressure range falls inside of the Ten State Standards there are complaints of low pressure around the City.

4.6.3 Head Losses

Distribution systems are generally classified as grid (looped) systems, branching systems (non-looped), or a combination of these. Primarily, the construction budgets, degree and types of development of the area, topography, street patterns, and location of supply and storage facilities dictate the configuration of the distribution system. A looped system is preferred to a branching system, since it can furnish a supply to any point from at least two directions. The branching system does not permit this type of circulation, since it has numerous dead-ends. A looped or combination system can also incorporate loop feeders, which act to distribute the flow to an area from several directions. The distribution system in Randolph is generally a grid/looped system with four dead-end mains as discussed previously.

Small diameter water mains result in a significantly large amount of friction loss (pressure loss) when a relatively large flow of water is needed at a particular location. The amount of friction loss will also vary depending on the type and age of the pipe involved. Table 11 below illustrates the significance of pipe size in the amount of friction loss that will be experienced at a flow of 500 gallons per minute. This table demonstrates that the amount of pressure loss due to friction of water flowing in a small pipeline may become very high in relatively short distances.

Table 11 – Pipe Friction Loss

	4" Dia. Pipe	6" Dia. Pipe	8" Dia. Pipe
Flow	500 gal/min	500 gal/min	500 gal/min
Velocity	11.22 fps	5.43 fps	3.16 fps
Friction Loss per 100 Feet	12.59 ft (5.46 psi)	2.15 ft. (0.9 psi)	0.58 ft. (0.25 psi)
Max Flow Capacity at Desired Max Velocity (7.5 fps)	294 gal/min	661 gal/min	1,175 gal/min

As stated in Table 11, under high flows, the four inch piping would experience almost 7 times the pressure drop as a larger 6" main. This illustrates that many regions of the City's water system can be expected to experience relatively high head loss (drops in pressures) during periods of high demands since over 60% of the water mains in the City are 4" diameter or smaller. Furthermore, Table 11 shows the six inch, IDNR minimum pipe size requirement, will have a capacity of passing 661 gal/min.

The City has portions of the distribution system with dead end mains. The City should consider installing additional mains to eliminate the dead end mains in certain areas of the community. Also, it may be necessary to install additional mains to eliminate dead end mains if there are repeated user complaints that indicate stagnant or "old" water or "dirty water" in the future.

4.6.4 Water Main Breaks

As a distribution system is a large financial investment for a community, any disruption in service or functionality can become costly. Water main breaks, especially in a system with few isolation valves, can be problematic. The expense for a water main break and resulting leak includes not only the materials and time to contain, fix, and disinfect the main, but also the amount of water lost. The City has not had a significant amount of breaks since their original construction. There are no records, but anecdotal evidence indicates three breaks in the past several years, all along Randolph Street.

4.6.5 Fire Hydrants

There are approximately 22 fire hydrants within the distribution system. The hydrants are located on the 4" & 6" water mains throughout the system.

4.6.6 Streets

Most of the existing streets are paved with asphalt seal coat. Many of the existing streets have been overlaid with additional asphalt pavement. A majority of the streets do not have curb and gutter but have adjacent ditches. Figure 11 is a photograph of a typical street within the City of Randolph. Existing water maps provided by the City indicate the existing water mains are generally located within the street right-of-way behind the asphalt edge. This is further confirmed by City staff as they have made some repairs to broken mains in the community, mostly along Randolph Street.

Figure 11 - Typical City Street in Randolph

4.6.7 Valves

There are approximately 27 gate "isolation" valves within the distribution system constructed to allow portions of the distribution system to be closed during periods of maintenance or repairs. When new water mains are constructed in a City distribution system, it is our recommendation that a sufficient number of valves be installed to allow for two block isolations, at a minimum. As a minimum, valves should be located at intersections, such that only one un-valved pipe exists at the intersection. Valves should be equally spaced, if possible, with spacing no more than 800 feet in residential areas and no more than 400 feet in high density residential, commercial, and industrial areas.

While the existing distribution system does not provide these capabilities at all locations, it appears that there is generally a sufficient number of valves installed in the system to allow for basic maintenance. It is our recommendation that non-operational valves are replaced, if any, as early as funding is available to the City, or as part of an improvement project. Any additional valves added would likely help isolate portions of the system to better shut down smaller areas of town when there are breaks or other problems in the distribution system.

4.6.8 Individual Water Meters

There are approximately 97 active individual water meters (for the 100 users) within the service area. Most of these water meters are approximately 20 years old and should be replaced. As discussed above, under the existing operation and maintenance cost, the City of Randolph has been losing revenue every year. A portion of this revenue loss can be attributed to inaccuracies of old water meters. The City has begun replacing older water meters and to date has replaced approximately 9 the total number of meters with the Sensus IPERL water meter.

4.6.9 Service Lines and User Connections

In a typical water system, individual users are supplied with water via a small service line (generally 2" in size or less) that connects to the public water supply main or line. The service line generally utilizes a curb stop or box located at the user's property line that allows the individual line to be shut off for maintenance or emergency. Randolph's water users are generally responsible for the maintenance of the water service line from the home to the curb stop, including the curb stop. The service line materials in the City of Randolph, as reported by the contract operators, are generally all copper.

4.6.10 Ability to Serve Expansion

The ability of the existing system to support further expansion of the City will greatly depend on the proposed development/user location and size. The looped portions of the water system where larger diameter water mains are present may be able to support growth. However, other portions that are branched and have smaller diameter pipe, will need additional water mains installed or replacement with larger mains to support the added demands. Each proposed development/user and any water system expansion should be evaluated carefully by the City on a case-by-case basis.

4.6.11 Distribution System Conclusions

The existing water distribution currently provides fair service to the community. It is possible that leaking piping, services, or valves, or poorly calibrated individual service meters could be contributing to the amount of water lost from the system.

The City's water system is primarily cast iron, and also has a large percentage (approximately 60%) of small diameter (4") water mains within the system. These mains can cause operational problems and symptoms that are noticeable to the water system users and cause complaints.

It is recommended that dead-end mains be connected and looped wherever possible and sections of small diameter water mains (less than 6" diameter) be replaced with 6" mains.

It is also recommended that the existing water service lines from the corp on the water main to the curb stop be replaced as a part of any water main replacement projects.

It is also recommended that the old water meters be replaced to ensure accurate readings are being recorded.

It is also recommended that many old hydrants and valves be replaced, and additional valves be installed to provide better operational and maintenance capabilities in the system and minimize negative impacts to the users. The City may consider implementation of a replacement plan within their current annual budget to replace old and non-functional valves and fire hydrants or replace them as part of an improvement project.

5 WATER UTILITY FINANCIAL STATUS

5.1 Water System User Rates

The current water use billing structure in the City of Randolph is based on actual water use on a 100-gallon increment. Billing for water use is done on a monthly basis. The following is an excerpt from the current FY23 water rate structure contained in City's Ordinance:

> *6-5-8 WATER RATES. Water shall be furnished at the following monthly rates per property serviced within the City limits:*
>
> *(Code of Iowa, Sec. 384.84(1))*
>
> *User Charge. That each and every owner and/or tenant of every building, tenement, or premises connected to the water system of the City of Randolph, Iowa, whether or not a meter has been installed, shall be charged the following rates:*
> *Effective January 1, 2023, the rates for both residential and business usage shall be charged:*
>
> 1. A minimum charge of $35.00 will include the first 3,000 gallons of water.
> 2. A rate of $3.25 per 1,000 gallons ($0.325 per 100 gallons) will be charged after the first 3,000 gallons.

The current average monthly rates based on 3,606 gallons of use (the approximate current average per service connection) will be as follows:

- Monthly Bill for 3,606 Gallons: $36.97/month

Depending on the type of improvements that are made, if any, the City may need to further adjust its water rates to cover the overall Operation and Maintenance (O&M) costs and pay debt service costs associated with any new capital projects. Typically, a community will base their water rates on the amount of water sold annually and the annual expenses incurred to maintain the water utility independently of other expenses in the City, with a neutral or positive income (i.e. water utility revenues = or > all water system expenses + reserves).

Because water demand can vary drastically from year to year, a community can either lose money or gain money in any given year. Therefore, the water rates for a community are often established to cover all expenses over a given year as well as fund a 10 to 20% reserve for emergencies; small, unfinanced capital improvements; equipment maintenance and repairs; and periods of unexpected low revenue. Small capital improvements in a water system are typically replacement of components or equipment, and repair of main leaks.

Based on historical billing records, the City of Randolph averages approximately 4,327,253 gallons per year (average of FY 20 – FY 22) or 360,604 gal/month sold to users (average of 3,606 gal per month per user (100 users)). The average monthly bill per user, based on 3,606 gallons per month and the most recent year's rates, is $36.97 per month.

5.2 Existing Water System Operations and Maintenance Cost

Table 12 below indicates the City's historical water system revenue and expenditures for each of the previous fiscal years.

Table 12 – Revenue and Expenditures

	FY 20	FY 21	FY 22
Total Annual Revenue	$16,442	$17,209	$15,812
Total Annual Expenses	$29,333	$31,071	$27,969
Difference (Reserve/Loss)	**($12,891)**	**($13,862)**	**($12,157)**

The water system averaged a net financial loss of approximately $12,970 per year over the past three fiscal years.

The largest contributing factor seems to be a lack of revenue, likely due to the excessive water loss. Annual expenses appear consistent year over year. The largest three categories of expenses, as provided by the City, are; Salaries, Other Professional Services (consisting mostly of Contract Operator costs), and Electric and Gas utility costs.

If the City's water system continues to follow the trend of the average expenses of approximately $29,458 per year and the average revenue of approximately $16,488 per year, it will continue to lose revenue and be unable to develop a reserve to pay for unforeseen expenses or any small capital improvement projects. Reduction of the amount of water loss in the system as well as increasing the monthly water rate charged to customers will help to offset the deficiencies in revenues.

5.3 Financial Status Conclusion

The information presented in Table 12 above, shows that the water rate structure is not generating adequate revenue to match the annual expenses for the utility. The revenue generated should cover the annual operating expenses and a reserve fund of at least 10% to 20% to meet a reserve target for future expenditures.

Also, the implementation of improvements to the water treatment system will be a significant capital improvement cost and will require additional annual revenue to service the debt.

It is recommended that the following be implemented by the community:

- Conduct a water rate evaluation to determine the necessary rate structure changes and increase needed to generate adequate revenue to cover the department's expenditures, plus 10 to 20% reserve, as well as adequate revenue to service the debt of upcoming capital improvements.

6 IMPROVEMENT ALTERNATIVES EVALUATION

6.1 General

Major improvement alternatives are outlined in this section as means to address the current system deficiencies and meet the future needs of the City's water system.

The following section will define the alternatives and provide opinions of probable costs for construction and installation. In general, the preliminary opinion of probable construction costs presented below include the cost for materials, installation, plus contractor's labor, overhead, and profit. It also includes non-construction costs such as engineering, legal, and administrative costs. Cost information is developed from equipment suppliers quotes, past experience on similar projects, Means Estimating Guide, and equipment catalogs. A 10% construction cost contingency has been included for unaccounted-for items and unforeseen items at this conceptual stage of the project. A summary of the immediate and long-term need improvement alternatives are presented below:

A detailed description of each improvement alternative considered, as well as a summary of the Opinion of Probable Project Cost, is presented below. Detailed Opinions of Probable Project Costs for each improvement alternative can be found in Appendix F.

6.2 No Action Alternative

This alternative includes leaving the existing water treatment facility, treatment system and distribution as it currently is, with necessary minor maintenance on the system including repairing any equipment breaks. However, there will be the concern of lack of water being available in the wells.

6.3 System Improvement Alternatives

These alternatives address the immediate needs the City has regarding water supply, treatment, and distribution as well as longer term projects. The following alternatives are considered:

- Alternative 1: New Well to Replace Well #4
- Alternative 2: Water Plant Rehabilitation
- Alternative 3a: New Elevated Water Storage Tank
- Alternative 3b: Water Tower Rehabilitation
- Alternative 4: Replace Existing Water Main on Randolph Street
- Alternative 5: Replace Remaining Cast Iron with 6" PVC
- Alternative 6: Replace Old Individual Flow Meters

6.3.1 Alternative 1: New Well to Replace Well #4

The Ten State Standards for Water Facilities recommends the ability to meet or exceed the maximum daily demand with the largest producing well out of service (known as firm capacity). The anticipated maximum daily demand is 69,417 gpd (or 48.2 gpm). Well #3 is able to meet this demand, but Well #4 cannot.

This alternative will include the complete construction of the new, replacement Well #5 to consist of; geologic investigation to determine a new aquifer, test wells, drilling of new well, installation of casing, installation of submersible pump, piping to the water treatment plant, controls, secured enclosure, and any associated appurtenances. After construction, Well #4 would also be abandoned. Note that the timeline on this alternative is longer than the other alternatives listed due to the nature of the investigation prior to construction.

Table 13, below provides a summary of the expected costs for this alternative. The complete breakdown of the opinion of probable cost can be found in the Appendix F.

Table 13 – New Well to Replace Well #4

Total Construction Cost	$286,000
Total Professional Services Cost	$62,000
Opinion of Total Project Cost	**$348,000**

6.3.2 Alternative 2: Water Plant Rehabilitation

This alternative includes rehabilitating or replacing the two existing high service pumps, installation of a VFD on the Well #3 pump, installation of well alarm failures for both Well #3 and Well #4, and replacement of the media in the pressure filters.

As mentioned previously, Well #3 was recently rehabilitated by Jensen Wells to include cleaning and jetting and a new submersible pump to replace the original. After the installation of the new pump, it was found the operator must throttle the pump back using an isolation valve, down from its rated capacity of 120 gpm to between 65 and 70 gpm to avoid drawing the water column below the pump intake resulting in cavitation. Rather than replace the pump, a VFD can be added to restrict the flow more safely as well as save energy.

Per the DNR sanitary survey, well failure alarms should be installed to alert the Operator in the event of a pump failure.

According to the City, the media in the pressure filters has not been replaced since their installation. No exceedances or breakthrough of iron or manganese has been observed, but media replacement would help ensure long term viability of the system.

As mentioned previously, an emergency backup generator is also included to allow the plant to operate in the event of a power failure.

Finally, the Sensus Turbine flow meters should be calibrated to ensure accurate well pumping readings.

Table 14, below, provides a summary of the expected costs for this alternative. The complete breakdown of the opinion of probable cost can be found in the Appendix F.

Table 14 – Water Plant Rehabilitation

Total Construction Cost	$251,000
Total Professional Services Cost	$51,000
Opinion of Total Project Cost	**$302,000**

6.3.3 Alternative 3a: New Elevated Water Storage Tank

Due to the age of the existing elevated water storage tank and observed pressure and maintenance issues, a new elevated water storage tank at a higher elevation to provide more pressure may be a better long term option for the City. Based on the projected average daily water demand of 28,438 gallons, a 30,000 gallon capacity may be appropriate.

This alternative includes the total cost for acquiring additional land for the tower, the contractor mobilization, design, tank foundation, the new tower (including fabrication, erection, surface preparation, and coating), and the connection to the existing water system.

Table 15, below, provides a summary of the expected costs for this alternative. The complete breakdown of the opinion of probable cost can be found in the Appendix F.

Table 15 – New Elevated Water Storage Tank

Total Construction Cost	$720,500
Total Professional Services Cost	$162,500
Opinion of Total Project Cost	**$883,000**

6.3.4 Alternative 3b: Water Tower Rehabilitation

Rather than construct a new tank, rehabilitating the existing tank to include a pressurized hydropneumatic tank to raise the pressure in town may also be a viable option.

As noted previously, the existing water tower is in fair condition but is observed to be leaking from a set of rivets. A tower inspection should be performed to determine fully the extent of this and any other damage. Depending on the results of this inspection, the total project cost is subject to change. It is assumed that the leaking rivets can be repaired from the outside of the tank and the only other rehabilitation that would need to be performed is the power washing of any staining or surface corrosion preset on the tank.

The hydropneumatic tank system consists of a pressurized tank inside of a building with pumps to draw water from the existing elevated storage tank into the hydropneumatic tank, allowing for higher pressures in the City without the need to construct a new elevated storage tank.

Table 16, below, provides a summary of the expected costs for this alternative. The complete breakdown of the opinion of probable cost can be found in the Appendix F.

Table 16 – Water Tower Rehabilitation

Total Construction Cost	$687,750
Total Professional Services Cost	$124,000
Opinion of Total Project Cost	**$814,250**

6.3.5 Alternative 4: Replace Existing Water Main on Randolph Street

This alternative includes the complete replacement of the existing 4" and 6" cast iron water mains along the entirety of Randolph Street. Despite the age of the system, few breaks have occurred over its life. What breaks have been observed have been along Randolph Street. By replacing the water main in this area with PVC, it will eliminate future breaks. Figure E-2 in Appendix E provides a map of the proposed improvements included in this alternative.

Table 17, below, provides a summary of the expected costs for this alternative. The complete breakdown of the opinion of probable cost can be found in the Appendix F.

Table 17 – Replace Existing Water Main on Randolph Street

Total Construction Cost	$571,400
Total Professional Services Cost	$108,000
Opinion of Total Project Cost	**$679,400**

6.3.6 Alternative No. 5: Replace Remaining Cast Iron with 6" PVC

As discussed, the City has a large portion of the existing water mains constructed of aging 4" cast iron (64% of the entire network). Figure E-3 in Appendix E provides a map of the proposed improvements included in this alternative. Note that this alternative does not include the replacement of the main along Randolph Street as described in Alternative 4.

Table 18, below, provides a summary of the expected costs for this alternative. The complete breakdown of the opinion of probable cost can be found in the Appendix F.

Table 18 – Replace Remaining Cast Iron with 6" PVC

Total Construction Cost	$1,364,000
Total Professional Services Cost	$266,000
Opinion of Total Project Cost	**$1,630,000**

6.3.7 Alternative No. 6: Replace Old Individual Flow Meters

Aging water meters can be the source of water loss due to poor calibration. By replacing the remaining old water meters with the City preferred Sensus IPERL units, the water loss should be reduced as well as time required for meter reading due to the automatic meter reading capability of the new meters.

Table 19**,** below, provides a breakdown of the expected costs for this alternative. The complete breakdown of the opinion of probable cost can be found in the Appendix F.

Table 19 – Replace Old Individual Flow Meters

Total Construction Cost	$61,200
Total Professional Services Cost	$12,000
Opinion of Total Project Cost	**$73,200**

6.4 Summary of Opinion of Project and O&M Costs

Preliminary Opinions of Cost have been prepared for the purpose of making a monetary comparison between the proposed alternatives. Material and equipment costs were determined by review of local construction projects of similar nature and consultation with various material and equipment manufacturers and suppliers. Material and labor costs have increased over the recent years resulting in increasing construction, operation, and maintenance costs. Market conditions indicate that this trend will likely continue in the future at varying rates. The cost opinions have been prepared based on present value construction costs for comparison purposes. These cost opinions also assume that the Build America, Buy America requirements of the USDA funding program will be reflected in construction costs.

Table 20 below provides a side by side comparison of the estimated opinion of probable cost and additional O&M Cost for each of the alternatives.

Table 20 – Summary of Engineer's Opinion of Cost

Alternative No.	Description	Opinion of Cost	Additional Annual O&M Cost
	No Action	$0	$ 0
1	New Well to Replace Well #4	$348,000	$5,000
2	Water Plant Rehabilitation	$302,000	$300
3a	New Elevated Water Storage Tank	$883,000	$200
4	Replace Existing Water Main on Randolph Street	$663,400	$ 0
5	Replace Remaining 4" Cast Iron with 6" PVC	$1,586,000	$ 0
6	Replace Old Individual Flow Meters	$71,200	$ 0

7 FEASIBILITY, IMPACTS AND PRIORITIZATION OF ALTERNATIVES

7.1 Technically Not Feasible

All alternatives are believed to be technically feasible and as such will be evaluated further in this document.

7.2 Financially Not Feasible

It is our opinion that all alternatives are financially feasible but have varying impacts to user rates.

7.3 Non-Monetary Factors and Environmental Impacts

For the previously presented alternatives, a preliminary look at the potential impacts upon social and environmental factors that are important when determining which alternative(s) should be pursued for the City. This evaluation will examine impacts to air, land, surface water and groundwater, as well as social and economic impacts. Beneficial water reuse or conservation are also important to consider when they are available.

The following is a preliminary list of likely known impacts from the potential improvement alternatives. As a part of that analysis, state and federal agencies will be consulted to review any potential concerns they may have.

7.3.1 Air Quality

The recommended improvement alternatives will not have significant impacts on air quality. However, the excavation and placement of earth for all alternatives may cause fugitive dust emissions, but the process will be conducted with water application to reduce the amount of dust created.

7.3.2 Land Use

All recommended improvements would be constructed within existing City of Randolph owned right-of-way and no additional land will be required.

7.3.3 Biological Resources

All alternatives considered are anticipated to have no adverse impacts to wildlife or endangered species. A thorough wildlife and endangered species review may be conducted in a separate report.

7.3.4 Archeological/Historical Resources

All alternatives considered are anticipated to have no adverse impacts to any archeological or historical sites. A thorough historical buildings and archeological review may be conducted in a separate report.

7.3.5 Surface Water & Wetlands

The alternatives are not anticipated to impact surface water and will not affect municipal, industrial or agricultural water users' availability of water. The potential impact to surface water from storm water runoff will be controlled via erosion control methods and best management construction practices.

The proposed construction for all alternatives is not planned to be within any wetland areas. Prior to design of any of these alternatives, it is recommended that wetland delineation be accomplished to appropriately locate and define wetlands and to confirm that no proposed construction occurs within the defined areas. If any wetlands are encountered and disturbed for a proposed project, the wetland will be restored or mitigated to preconstruction condition in compliance with applicable regulations.

7.3.6 Groundwater

No known wells are present in the proposed improvements site areas at this time and groundwater levels are not expected to be significantly impacted as a part of this alternative.

7.3.7 Economic and Social Impacts

The primary economic impact for this alternative is the cost to the sewer system users in the City. The project capital costs are projected to be significant and thus will have a financial impact on the sewer system users due to an increase to the monthly water rates anticipated for implementation of these alternatives. The City may be eligible for low-interest loans and/or grants that could reduce the financial burden of the rate payers.

There are not expected to be any social impacts of this project. No relocations or lengthy disruptions of traffic are expected from these alternatives.

8 LIFE CYCLE COST ANALYSIS

The purpose of the cost-effective evaluation is to determine the average annual equivalent cost of the alternatives identified over the design life of the project. This evaluation considers the initial cost, estimated annual operation and maintenance costs, and salvage value, if any,

Table 21, Alternatives Life Cycle Costs Summary, provides a breakdown of 20-year life cycle costs (LCC) for each alternative evaluated. The life cycle cost analysis is an engineering economics technique that is used to evaluate present and future costs for comparison of alternatives. The LCC analysis converts all costs to present day dollars using the federal discount rates for a 20-year period. The 20-year period LCC is calculated for each feasible alternative as the sum of the capital cost plus the present worth of the annual O&M costs minus the expected salvage value of the alternative (if applicable).

Life Cycle Costs were not calculated for the water distribution alternatives 4 and 5 or for the individual flow meter alternative 6.

Additional details of the Life Cycle Costs for each alternative are provided in Appendix F.

Table 21 – Alternatives Life Cycle Costs Summary

Alternative	1	2	3a	4	5	6
	New Well to Replace Well #4	Water Plant Rehabilitation	New Elevated Water Storage Tank	Replace Existing Water Main on Randolph Street	Replace Remaining Cast Iron with 6" PVC	Replace Old Individual Flow Meters
Total Capital Cost	$348,000	$302,000	$883,000	$536,902	$1,602,886	$50,094
20-yr O, M, & R PW[1]	$102,832	$12,698	$196,082	$0	$0	$0
20-yr Salvage Value PW[1]	($274,797)	($241,168)	($692,276)	$0	$0	$0
20-yr Life Cycle Cost	$176,035	$73,530	$386,806	**N/A**	**N/A**	**N/A**

[1] Estimated using the USDA provided formula.

9 PROPOSED PROJECT

9.1 Recommended Improvements

The study and evaluation of the municipal water system for the City of Randolph indicates that there are several areas where improvements are needed.

1. Water Supply: The supply of water does not appear to meet the needs of the City for the 20-year design criteria. A replacement well will provide firm capacity for the City and allow them the ability to ensure availability of water even under the highest demands.
2. Water Treatment: While still producing high quality water, some of the components in the water treatment facility are aging and reaching the end of their useful life. By rehabilitating the water plant it will continue to function for years to come.
3. Water Storage: With the existing water storage tank nearing 100 years old, its useful life is likely expired. Additionally, it does not meet the Ten State Standards for water storage. A new elevated water storage tank will provide decades of use as well as increasing water pressure to the homes and businesses of the City.
4. Water Distribution: Most of the water mains in the City are the original 4” and 6” cast iron that was originally installed in the 1930’s. Despite a good history with few main breaks, breaks that have been observed have happened along Randolph Street. With the original 6” cast iron main being nearly 100 years old, this replacement will eliminate breaks in this area and ensure long term viability as well as increasing pressure across the distribution system.
5. Water Meters: The City has replaced approximately 9 of the old meters with new Sensus IPERL water meters. To better quantify actual metered water use, the replacement of the remaining water meter is crucial. The remaining meters that need to be replaced are on an average over twenty years old and may have become unreliable in metering water use.

Hence, it is our recommendation that the City update and improve the water system to better meet current standards and provide a more reliable and efficient system by implementing the improvement alternatives which consist of:

- Alternative 1 – New Well to Replace Well #4
  - Geotechnical Investigation to Determine Siting and Aquifer
  - Test Well(s) and Drilling of New Well
  - Controls, Piping, and Appurtenances
  - Abandonment of Well #4
- Alternative 2 – Water Plant Rehabilitation
  - New High Service Pumps
  - VFD for Well #3
  - Well Failure Alarm for Well #3
  - Replacement of Sand Media in Pressure Filters
  - Exterior and Interior Masonry Tuckpointing
  - Flow Meter Calibration
  - Installation of Emergency Backup Generator
- Alternative 3a – New Elevated Water Storage Tank
  - Mobilization, Design, and Tank Foundation
  - New Elevated Storage Tank, Fabrication, Erection, and Other Site Work
  - Surface Preparation and Coating
  - Connection to Existing Water System
- Alternative 4 – Replace Existing Water Main on Randolph Street
  - Removal and replacement of 6” cast iron with 6” PVC on Randolph Street
  - New Hydrants and Valves
  - Surface restoration

- Alternative 5 – Replace Remaining Cast Iron With 6” PVC
    - Removal and replacement of remaining 6” cast iron with 6” PVC
    - New Hydrants and Valves
    - Surface restoration
- Alternative 6 – Replace Old Individual Flow Meters
    - Installation of Sensus IPERL water meters

9.2 Opinion of Total Project Cost of Recommended Improvements

The proposed initial capital project is to implement all improvements if funding can be obtained. Table 22 below lists the selected alternatives and the opinion of cost for each alternative. The opinion of cost includes total construction, land and right of ways, contingency, legal, and engineering costs.

Table 22 – Recommended Improvements Alternatives - Opinion of Probable Project Costs

Alternative No.	Description	Opinion of Total Project Cost
1	New Well to Provide Additional Water	$348,000
2	Water Plant Rehabilitation	$302,000
3a	New Elevated Water Storage Tank	$883,000
4	Replace Existing Water Main on Randolph Street	$679,400
5	Replace Remaining Cast Iron with 6” PVC	$1,630,000
6	Replace Old Individual Flow Meters	$73,200
	Total	**$3,915,600**

9.3 Anticipated O&M Upon Project Completion

The City is anticipated to have the annual expenditures depicted below in Table 23 upon the project completion. These values are based on the provided expenses as described earlier, plus annual costs of the proposed improvements.

Table 23 – Anticipated Expenditures Upon Project Completion

EXPENSES	
Salaries	$7,320
Other Professional Services	$7,112
Electric/Gas Utility	$4,427
Operational Equipment Repair	$2,693
Operating Supplies	$2,191
Sales Tax	$1,950
Other Contracting	$1,695
Insurance	$1,691
Grounds Maintenance and Repair	$982
Contract Operator	$982
Sentinel Cellular	$900
Association Dues	$817
Postage	$701
IPERS	$685
FICA	$584
Refunds	$287
Building Maintenance & Repair	$262
Permits	$105
Rents and Leases	$94
Supplies	$49
Operation/Capital Reserves Funding (10%)	$3,500
Total Expenses	**$38,525**

9.4 Project Implementation

9.4.1 Recommended Improvements

The City's current highest priority is to ensure the availability of water for the anticipated maximum daily demand and to update the individual water meters to prevent water loss. The of drilling a new well should prevent another instance of the City entirely losing water like what occurred in 2022, and the replacement of old individual water meters (and the installation of meters on the un-metered users) will give the City a better view of the actual water loss. The rehabilitation of the water plant will help ensure its long term viability. The construction of a new elevated water storage tank will provide decades of service to the town and increase the pressure for the residents. Finally, the replacement of the water mains along Randolph Street and the rest of the City will eliminate the potential for breaks and further water loss while also increasing water pressure.

9.4.2 Anticipated Project Schedule

The implementation of the recommended improvements can take a substantial length of time for the funding, design, review, and construction of the improvements. It is recommended that the City begin the implementation process immediately so that the deficiencies can be corrected as soon as possible.

If the City decides to pursue the construction of these recommended alternatives, Table 24 below lists the typical implementation milestones or steps and the anticipated date or period of each step to implement the alternative(s).

Table 24 – Anticipated Implementation Schedule

Implementation Milestones	Anticipated Completion Date/Period
Submit PER to IDNR and USDA for Review/Approval	August, 2023
IDNR/USDA Approval of PER	September, 2023
Determine Funding Sources and Apply	August, 2023 to September, 2023
Begin Improvements Design Phase	November, 2023
Complete Design	April, 2024
IDNR Review and Approval	April, 2024 – May, 2024
CBDG Funding Application	July 1, 2024
CDBG Funding Approved	October, 2024
Start Geologic Investigation	October, 2024
Project Bidding Phase / Finish Geologic Investigation and Start Well Design	December, 2024
Award Contract	February, 2025
Start Construction	April, 2025
Complete Well Design	April, 2025
Well #5 Project Bidding Phase	May, 2025
Well #5 Award Contract	June, 2025
Complete Construction	November, 2025

9.5 Permitting Requirements

Construction, installation or modification of any water source, treatment or distribution system, requires a construction permit issued by the IDNR. To obtain a construction permit, the following must be submitted to the IDNR Water Supply Engineering Section:

- Plans and specifications prepared by a Professional Engineer licensed in the State of Iowa.
- The applicable construction permit design schedules
- The appropriate permit fee

10 FUNDING OPPORTUNITIES

Depending upon the alternate selected, there are several methods of financing available; including:

- Water Utility Revenue Bonds
- The USDA Rural Development Water and Waste Disposal Loan and Grant Program
- The Iowa Department of Natural Resources State Revolving Loan Fund (SRF)
- The Iowa Economic Development Authority Community Development Block Grant Program

A combination of some or all of these funding sources is also possible. Considering the capital construction cost and ongoing O&M costs of the improvements, it may prove beneficial to the community to pursue funding assistance from one or more of the public programs listed above. A general description of each of these funding methods is provided below.

If the City of Randolph would like to proceed with this project, a representative from all these funding agencies will need to be contacted. SEH Inc. would be pleased to assist the City of Randolph with the preparation of the applications for financial assistance to be submitted to the various State and Federal Agencies along with copies of the completed report for their review.

10.1 Water Utility Revenue Bonds

Revenue bonds may be issued by utilities or jurisdictions that provide services for which revenues are collected. Debt service on the revenue bond issue is paid from the net revenues of the utility. One requirement of revenue bonds is that the total revenues of the utility must exceed the amount of the bond issue by an excess amount referred to as "coverage". This coverage is typically as much as 30% of the annual debt service payments to make the bonds attractive to buyers. In projects such as this with large expenditures and debt service requirements, the revenue bond requirement for 30% to 50% coverage often is a hardship to the owner, which makes other forms of financing more attractive. Revenue bonds are currently sold at interest rates of 2.5-4% for 15-20 year terms, depending on market conditions and credit worthiness of the issuer.

10.2 USDA Rural Development Program

USDA Rural Development uses the community's median household income (MHI) from the American Community Survey date for years 2011-2015 when considering funding eligibility for its loan/grant program. The state of Iowa's Non-Metro MHI is $54,188. A community at or above this figure is considered market rate. A community that falls under this is considered intermediate. A community with an MHI below $43,350 is eligible for USDA poverty rate assistance. Based upon the most recent Census, the MHI for the City of Randolph is $33,393 which likely qualifies the City for USDA loan and/or grant assistance. It is recommended that the City apply for funding with the USDA-RD.

10.3 Department of Natural Resources – Drinking Water State Revolving Fund (DWSRF)

One financing option is the IDNR State Revolving Fund (SRF). These loans are available for as low as 1.75% interest, plus a 0.25% loan servicing fee for both standard and disadvantaged communities. The term of the loan can be leveraged up to 20 years for the construction of a drinking water project. To be eligible for an SRF loan, the applicant must have an approved preliminary engineering report (PER) and must be on the Iowa Intended Use Plan. Table 25 below summarizes IDNR drinking water SRF program requirements.

Table 25 – IDNR Drinking Water SRF Program Requirements

IOWA DEPARTMENT OF NATURAL RESOURCES/IOWA FINANCE AUTHORITY IOWA STATE REVOLVING LOAN FUND – DRINKING WATER STATE OF IOWA	
Drinking Water State Revolving Fund	• Maximum financial assistance: None. • Term: Up to 20 years. Up to 30 years if the CWS satisfies the criteria of disadvantaged community. • Interest rate: 1.75% Loan (2.75% for 21-30 year term), plus a 0.25% loan servicing fee for both standard and disadvantaged communities. Since 2012, a 0.5% origination fee is charged on the full loan amount for all new DWSRF construction loans, with a maximum amount of $100,000. • Other eligibility requirements: Applicant must have an approved Preliminary Engineering Report Applicant must be on the Iowa Intended Use Plan

10.4 Iowa Economic Development Authority CDBG Program

The most recent low- and moderate-income (LMI) figures issued by the American Community Survey (5-Year Estimates 2011-2015) for the City of Randolph, IA was 55.3%. In order to qualify for funding under the Iowa Economic Development Authority's Community Development Block Grant (CDBG) – Water and Wastewater (CDBG – WW) Category, the community must have an LMI percentage of 51% or higher. Therefore, City of Randolph is eligible to qualify for funding under the Iowa Economic Development Authority's Community Development Block Grant (CDBG) – Water and Wastewater (CDBG – WW) Category of a grant of up to $500,000.

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Appendix A – IDNR Inspection Report

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March 13, 2020

CITY OF RANDOLPH
LORA DANKOF CITY CLERK
PO BOX 88
RANDOLPH IA 51649

SUBJECT: Randolph Municipal Water Supply Sanitary Survey
Public Water Supply ID # 3649072
Staff Action # 140756

Attention Honorable Mayor and Council:

On February 17, 2020, I visited the aforementioned public water supply on behalf of the Iowa Department of Natural Resources (DNR) for a sanitary survey inspection.

We believe you will find the report self-explanatory and strongly encourage you to take action on the requirements and recommendations as described. The City of Randolph must repair the cement riser at Well #4 and submit documentation to Field Office 4 by **April 1st, 2020.**

If you have any questions about the inspection or report, please contact me via e-mail at claire.asberry@dnr.iowa.gov or by telephone at 712-243-1934 / office or 712-340-3070 / cell.

The cooperation and assistance of Howard Petersen and Mike Lesher in completing this survey was appreciated.

Sincerely,

CA

Claire Asberry
Environmental Specialist
Field Services & Compliance Bureau

CMA:cma\ws\Randolph021720.ws.Sanitary Survey.Asberry.doc

Enclosures: Report
Iowa Main Break and Depressurization Guidance
Manganese Lab Results & FAQ Fact Sheet
Underwater Storage Tank Inspection & Cleaning Guidance

CC: Chris Spoelstra, DNR Water Supply Operations Section (w/encl.)
Howard Peterson, 504 Lincoln Avenue, Malvern, IA 51551 (w/encl.)
Mike Lesher, P.O. Box 482, Tabor, IA, 51653 (w/encl).
Facility File

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SUSPENSE: **April 1, 2020** - must repair the cement riser at Well #4 and submit documentation to Field Office 4 by **April 1st, 2020** (Recommended Standards for Water Works 3.2.5).

PUBLIC WATER SUPPLY INFORMATION

SYSTEM	NAME: RANDOLPH WATER WORKS		PWS CLASSIFICATION: COMMUNITY
	ADDRESS: PO BOX 88, RANDOLPH, IA 51649		PHONE: 712-625-2601
	RESPONSIBLE AUTHORITY/OWNER: LORA DANKOF, CITY CLERK/CITY OF RANDOLPH		
	ADDRESS: PO BOX 88, RANDOLPH, IA 51649		PHONE: 712-625-2601
	TREATMENT GRADE: WT1	DISTRIBUTION GRADE: WD1	WATER USE PERMIT #: N/A

SOURCE/ ENTRY POINT	SDWIS NAME: WELLS 3_4 AFTR TRTMT @ PLNT	DESCRIPTION/PHYSICAL LOCATION: SINK IN PLANT

RESPONSIBLE OPERATOR(S)	NAME: MICHAEL LESHER	GRADE: WT1/WD1	CERTIFICATION #: 8471

SURVEY INFORMATION

SURVEY	DATE THIS SURVEY: 02/17/2020	DATE LAST SURVEY: 02/21/2017		PURPOSE: SANITARY SURVEY
PERSONS INTERVIEWED	NAME: MIKE LESHER		TITLE: WATER OPERATOR	
CONSUMPTION	PERIOD REVIEWED: 02/2017-01/2020	AVERAGE GPD (MGD): .029	MAXIMUM GPD (MGD): .060	PE @ 100 GPCD: 288
POPULATION SERVED	TOTAL NUMBER OF SERVICE CONNECTIONS: 100		POPULATION OUTSIDE CORPORATE LIMITS: 0	
	CENSUS POPULATION: 168		TOTAL POPULATION SERVED*: 168	
	MILES OF PIPE: N/A			

*equals census pop. + population outside corp. limits (2.5 X # of service connections or actual pop.)

ASSESSMENTS	ORGANIC CHEMICAL PHYSICAL VULNERABILITY: NO
	SOURCE CLASSIFICATION: GROUND WATER

AUTHENTICATION

INSPECTOR	NAME/TITLE: CLAIRE ASBERRY, ENVIRONMENTAL SPECIALIST CA	DATE: 03/13/2020
REVIEWER	NAME/TITLE: KEITH WILKEN, ENVIRONMENTAL SPECIALIST SENIOR KW	DATE: 3/13/2020

GENERAL DESCRIPTION:

Water for the City of Randolph public water supply is derived from two shallow gravel-packed wells. Well #3 (1966) is located within the water treatment plant and Well #4 (1968) is located approximately 50 feet northeast of the plant. Treatment consists of pre-hypochlorination, aeration, detention in a 31,000-gallon detention tank, and pressure filtration. Two high service pumps precede filtration. Distribution pressure and storage are provided by a 64,000-gallon standpipe.

1. SOURCE:

- Well # 3 (1966) and Well # 4 (1968)
  - An adequate alarm system should be provided in the event of well pump failure.
  - It is recommended that a contingency plan for the provision of potable water during emergencies be developed and updated on an annual basis.
  - It is also recommended that well housing, at all times, be kept clean, in good repair, and free of any toxic or hazardous material storage.
  - During this inspection, Well #4's concrete riser appeared badly cracked and pieces of cement were broken off completely. Please refer to the photograph below. Concrete work and caulking is recommended to strengthen the integrity of the riser. Recommended Standards for Water Works 3.2.5 establishes construction specifications to assure that wells do not allow surface water and/or contaminants to enter the well. Please also refer to General Permit Condition #5 on your operational permit. The City of Randolph must seal Well #4's cement riser and submit documentation to this field office by April 1st, 2020.

2. TREATMENT:

- Treatment Plant
    - The Department recommends the supply have some means to provide auxiliary power in the event of loss of normal power.
- Aeration
    - As noted in previous sanitary surveys and during this inspection, there is no cleaning or inspection schedule for the aerator. It is highly recommended that the aerator be taken out of service periodically for cleaning and inspection and the appropriate maintenance work be completed.
- Detention
    - Mr. Lesher stated that in 2017 the detention tank was cleaned and inspected and found to be in excellent condition. In 2020, the detention tank is scheduled to be painted. It is recommended that the detention tank continues to be cleaned and inspected on a regular basis.
- Filtration
    - The filter beds should be regularly inspected for cementing, mud balls, and uniform depth of media.
    - Mr. Lesher noted that in 2013 the filters were sandblasted and painted. It was reported that the filters are backwashed once a week.

3. DISTRIBUTION SYSTEM:

- Pressure
  - This department's construction standards require that the minimum size of water mains for providing fire protection and serving fire hydrants shall be six-inch diameter. This system should not use fire hydrants connected to four-inch mains for fire flow purposes. Water for firefighting purposes should be limited to segments of the distribution system that are served with adequate piping between the point of use and the treatment plant. (Recommended Standards for Water Works 8.2.2)
  - The DNR has updated its main break and pressure loss guidance. A copy of the Iowa Main Break and Depressurization Guidance (DNR Form 542-0535) and three appendices are attached to this report for your reference and were discussed during the inspection. It is recommended that responsible officials become familiar with the attached guidance. It is recommended that responsible officials contact this office with any questions or concerns regarding main breaks and/or pressure loss situations.
- Maintenance
  - As mentioned in previous reports, it is highly recommended that this system conduct an assessment to determine what percent of water produced by this system is reaching consumers. If it is determined that there is a 10% or greater loss of water, a leak detection program should be immediately instituted. The elimination of leaks not only reduces the cost of producing water, but also eliminates pathways for contaminants to enter the distribution system.
  - It is recommended that all valves be exercised annually to ensure that they are in working condition.

4. FINISHED WATER STORAGE:

- 64,000-gallon standpipe
  - It is recommended that the interior of the storage structure be inspected at least every two years.
  - This system is reminded that coliform testing must be performed after painting, maintenance, inspection, or cleaning. Two or more successive sets of bacterial samples must be taken at 24-hour intervals and must be bacterially safe before the facility is placed back into operation. [Recommended Standards for Water Works 7.0.18]

- The DNR recently created the Iowa Underwater Storage Tank Inspection and Cleaning Guidance document. A copy of the guidance document is attached to this report. It is the responsibility of the public water supply to ensure that the water being served to its customers is safe and meets the requirements of the rules contained in 567 IAC Chapters 40-43. This document serves as guidance for maintaining drinking water standards during an underwater tank inspection or cleaning event outlined in Section 4.4 of AWWA Standard C652-11. It is recommended that responsible officials contact this office with any questions or concerns.

5. PUMP, PUMP FACILITIES, AND CONTROLS:

- There are no deficiencies or recommendations to report based on observations made at the time of this survey.

6. MONITORING/REPORTING/DATA VERIFICATION:

- Manganese
    - The United States Environmental Protection Agency (US EPA) has developed a health advisory (HA) for manganese in drinking water of 0.3 mg/L and 1 mg/L. These are not enforceable standards. However, infants under 6 months of age should immediately stop consuming the water and formula that was prepared with the water and public notice of such is required when manganese levels in drinking water exceed 0.3 mg/L. Children and adults should use bottled water or an alternative source of water for drinking and food preparation and public notice of such is required when manganese levels in drinking water exceed 1 mg/L. A copy of DNR's Manganese in Drinking Water Fact Sheet and Frequently Asked Questions document is attached for your reference.
    - During this inspection, DNR staff collected a water sample from the source entry point (SEP) and submitted it to the State Hygienic Laboratory to be analyzed for manganese. As observed on the attached laboratory analytical report, the sample yielded **<0.02** mg/L of manganese.
    - The DNR recently developed protocols to identify those systems which have a potential to exceed the manganese HA. The DNR followed the protocols during this inspection and discussed them with Mr. Lesher. The City of Randolph will be assigned the following monitoring requirements in this system's Operation Permit.
        - **Certified laboratory annual manganese sample at the SEP**
        - **Daily self-monitoring for manganese at the SEP**

- Please be advised that if the daily self-monitoring manganese results exceed 0.3 mg/L, the system must notify the Field Office within 24 hours and collect and submit a SEP sample to your certified laboratory as soon as possible. These results will be used to determine if Public Notice will be required and if additional monitoring is warranted.

- Disinfection Monitoring/Reporting

    - DNR staff reviewed this system's Monthly Operation Reports (MORs) and historic sampling results prior to the inspection. It was observed that reported free chlorine residuals are typically within 80% of this system's total chlorine residuals at the source entry point (SEP) and within the distribution system. During the inspection, chlorine residuals were measured at the SEP. Free chlorine residuals yielded 1.01 mg/L with no drift. Total chlorine residuals yielded 1.27 mg/L. Steady free chlorine residuals within 80% of total chlorine residuals are indicative of a true free chlorine. For reference, a minimum free chlorine residual of 0.3 mg/L or a minimum total chlorine of 1.5 mg/L must be continuously maintained throughout the distribution system except for those points that terminate in dead ends or are very low use areas. Chlorine residuals measured on the day of this inspection were acceptable.

- Records

    - The system is reminded that all bacteriological analyses records must be retained for a period of not less than five years. [567 IAC 42.5(1)]

    - The system is reminded that all records of chemical analyses shall be retained for a period not less than ten years. [567 IAC 42.5(1)]

    - The system is reminded that all records of actions taken to correct violations must be retained for a period not less than three years. [567 IAC 42.5(1)]

    - The system is reminded that all Sanitary Surveys and copies of all reports, summaries or communication related to Sanitary Surveys shall be retained for a period not less than ten years. [567 IAC 42.5(1)]

    - The system is reminded that copies of reports, summaries or communication related to reports concerning variances or exemptions must be retained for a period not less than five years. [567 IAC 42.5(1)]

    - The system is reminded that all monthly records of operation completed as described in 567 IAC 42.4(3), Appendix B and 43.5(4) & (5) shall be maintained at the facility for inspection by the department for a period of five years. [567 IAC 42.5(1)]

- The system is reminded that all copies of reports, summaries or communication related to copies of public notices issued must be retained for a period of not less than three years. [567 IAC 42.5(1)]

7. WATER SYSTEM MANAGEMENT AND OPERATIONS:

- Financial
    - Water system management should review the user fee, user charge, or rate system at least annually to ensure the financial viability of the system.
- Management
    - Water system management should develop a formal planning process to schedule capital improvements and ensure adequate funding for improvements.

8. OPERATOR CERTIFICATION COMPLIANCE:

- There are no deficiencies or recommendations to report based on observations made at the time of this survey.

SUMMARY OF SIGNIFICANT DEFICIENCIES

No significant deficiencies observed.

SUMMARY OF MINOR DEFICIENCIES

1. The City of Randolph must seal Well #4's cement riser and submit documentation to Field Office 4 by **April 1st, 2020.**

SUMMARY OF REQUIREMENTS

No requirements observed.

SUMMARY OF RECOMMENDATIONS

Please refer to sections 1, 2, 3, 4 and 7.

Iowa Main Break and Depressurization Guidance

Any disruption in a water system that results in a loss of positive pressure may allow contaminants to enter the system. This document is intended to provide guidance to public water supply owners and operators in evaluating and responding to pressure loss situations from distribution system issues such as main breaks, valve repairs, or extreme fire flows, and operational disruptions such as a pump failure, power outage, telemetry failure, source failure, or storage depletion.

During a main break or other work that opens the system, the loss of positive pressure within the water system may allow disease-causing microorganisms from surrounding soil or groundwater to enter a distribution system pipe. The loss of pressure may also allow disease-causing microorganisms and chemical contaminants to be drawn into the pipe through backsiphonage due to the pressure differences. In addition, during the process of repair, contamination of the system may occur if the pipe has been opened to the environment and has come into direct contact with groundwater, runoff, soil, or contaminants in the area of the repair.

During any pressure loss situation, protection of public health and safety are the priority and primary concern. At the same time, it is important to minimize the disruption of water service to the customers. For this reason, boil water or bottled water advisories may be recommended or required while bacteriological sampling is completed so the repaired water main may be returned to service. It is critical that sanitary procedures are followed throughout the process of response, repair, and returning the line or system to service.

AWWA Standard C651

For water main breaks, AWWA Standard C651-14 must be followed. The standard includes the following preventive and corrective measures to accomplish the repair in a sanitary manner:

- Keep the new pipe, fittings, valves, etc. clean and dry (protected from contamination)
- Prevent contaminants from entering the existing pipe by maintaining positive pressure as long as possible - until the pipe is fully exposed and the trench is dewatered to below the existing pipe
- Inspect, clean, and disinfect (by spraying or swabbing with a 1% chlorine solution) all exposed portion of the existing pipe, all materials used in the repair, and all tools used to make the repair
- After repairs are complete, flush, measure chlorine residuals, and collect bacteria samples if required

AWWA Standard C651-14 is available for review at the DNR Field Offices and at the DNR Water Supply Engineering Office in Des Moines. It may also be purchased from the AWWA Store online.

This standard includes specific practices for the repair of water main breaks and classifies breaks into four (4) categories listed below. Each category includes actions, recommendations, and requirements based on the contamination risk.

Controlled pipe repair without depressurization: The repair activities are well controlled and positive pressure is maintained to the area of the break and at the site at all times. The repair site is exposed and the trench is adequately dewatered so that the repair site can be cleaned and disinfected. These are main breaks that are repaired with clamping devices while the main remains under pressure. See the flushing recommendations below. No bacteria sampling is recommended or required. A boil water or bottled water advisory is not recommended or required.

Controlled pipe repair with depressurization after shutdown without opening the pipe: After the repair site has been exposed and secured from trench soil and water contamination (the trench is adequately dewatered so that the repair site can be cleaned and disinfected), the water main is depressurized by a shutdown to complete the repair. The repair site should be cleaned and disinfected. See the flushing recommendations below. A boil water advisory and bacteria sampling are typically not warranted. In the case of potential contamination from a high hazard business in the affected area, consult with the DNR Field Office to determine if a boil water, bottled water, or alternative source advisory and bacteria or other sampling may be recommended or required.

- Situations including high risk or vulnerable populations, such as a school, day care, hospital, nursing home, dialysis center, other medical facilities
- An inexperienced operator or individual from the water system dealing with the situation

Consult with the DNR Field Office to determine if sampling and a boil water, bottled water or alternative source advisory is necessary.

During normal business hours call the appropriate DNR Field Office to consult about sampling, boil water, bottled water and alternative advisories, and public notice. After hours, call the 24 hour emergency response hotline. If a boil water, bottled water, or alternative source advisory is required or recommended, determine:
- The extent and method of distribution (door hanger, hand delivery, phone, press release, Code Red or other method)
- The notification must include critical users (nursing homes, hospitals, schools, wet industries, etc.)
- The content of the notice

There is no federally mandated language for boil water, bottled water and alternative source advisories. Advisory templates are included in Appendix 2. Consider the following when issuing an advisory:
- Systems with Nitrate above 7 mg/L or Nitrite above 0.7 mg/L at the SEP or in the distribution, must include language that infants must use an alternative source, such as bottled water, due to the potential to increase the nitrate or nitrite levels above the MCL with boiling.
- Systems with manganese levels above 0.22 mg/L at the SEP or in the distribution system, must include language that infants must use an alternative source, such as bottled water, due to the potential increase in manganese levels above the acute Health Advisory Level with boiling.
- Systems with manganese levels above 0.7 mg/L at the SEP or in the distribution system, must include language that all persons use an alternative source, such as bottled water, due to the potential increase in manganese levels above the acute Health Advisory Level with boiling.
- Systems with colored water must use the alternative source language as manganese levels are elevated.
- Systems that do not know their manganese levels, must use the alternative source language. Systems test nitrate once per year at a minimum and test nitrite if they have a risk of nitrification. These levels should be available to the operator.
- If a backflow or backsiphonage event has occurred, do not issue a boil water advisory as this will concentrate the chemical contamination. Instead, issue a "No Use" advisory.
- Determine if a water conservation advisory should be issued

The advisory must remain in place until absent (clean) bacteria sample results are received.

Bacteria Sampling

The minimum number of samples to be collected and analyzed for total coliform and chlorine residual is based on the number of service connections and the type of services in the area. See the information above for the explanation of high hazard service connections and high risk/vulnerable populations. The presence of high hazard service connections or high risk/vulnerable populations may increase the number of bacteria samples that are needed.

The number of samples is specified in the chart below for all water systems including consecutive systems (those that purchase water). For rural water systems, a minimum of 1 sample per every 5 miles of pipe depressurized is recommended. If this is not practical, consult with the DNR Field Office.

Number of Service Connections Impacted by the Depressurization	Controlled Repair with Depressurization Minimum Number of Samples Recommended*	Uncontrolled Pipe Break Minimum Number of Samples Required**
1 – 25	1	1 + 1 or 1 + 2***
26 – 50	2	2 + 2
51 – 100	3	3 + 3

Appendix 2

PRESSURE LOSS COMMUNICATION PLAN

____,

Iowa

05/2019 cmc

DNR Form 542-0535a2

CRITICAL CUSTOMERS

Name	Title	Phone	Cell Phone	Email
	Schools			
	Hospital			
	Doctors/Dentist Offices			
	Nursing Homes			
	Food/Beverage Plants			
	Restaurants			
	Power Plants			
	Prisons			

MEDIA CONTACTS

Name	Title	Phone	Cell Phone	Email
	Radio			
	Television			
	Newspaper			

Other

Name	Title	Phone	Cell Phone	Email
	Iowa Department of Public Health	515-281-7689		
	State Hygienic Lab	515-725-1600		
John Lins	IOWARN	515-323-6234	515-208-1993	lins@dmww.com
	Iowa Homeland Security & Emergency Management	515-725-3231		

DRINKING WATER ADVISORY

The {NAME} Water Supply is recommending to use an alternative source for drinking or to boil the water before using and the water may have high levels of *nitrate, nitrite or manganese (select appropriate contaminant)*.

DO NOT GIVE THE WATER TO INFANTS UNDER 6 MONTHS OLD OR USE IT TO MAKE INFANT FORMULA

The {NAME} Water Supply had a problem in the distribution system and the system lost pressure on {DATE}. Due to the potential for bacterial contamination, it is being recommended that the water be boiled before using for drinking or cooking or that an alternative source be used. *The nitrate or nitrite (select appropriate one) levels may be above the Maximum Contaminant Level (MCL). The manganese levels may be above the Health Advisory (HA) Level. Nitrate, nitrite, manganese (select appropriate contaminant) in drinking water is a serious health concern for infants less than six months old. Add information or change to specific area if impacts are limited.*

- **DO NOT GIVE THE WATER TO INFANTS.** ***Infants below the age of six months who drink water or formula made with the water containing nitrate or nitrite in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue baby syndrome.*** Blue baby syndrome is indicated by blueness of the skin. Symptoms in infants can develop rapidly, with health deteriorating over a period of days. If symptoms occur, seek medical attention immediately. *(Delete if manganese).*

- **DO NOT GIVE THE WATER TO INFANTS Infants below the age of six months who drink water or formula made with the water containing manganese in excess of the Health Advisory (HA) Level may have impacts to their learning and behavior.** *(Delete if nitrate or nitrite).*

- Water, juice, and formula for children <u>under six months of age</u> should not be prepared with tap water. Bottled water or other water low in *nitrates, nitrite, manganese (select appropriate contaminant)* should be used for infants until further notice.

- **DO NOT BOIL THE WATER for use for infants.** Boiling, freezing, filtering, or letting water stand does not reduce the *nitrate, nitrite, manganese (select appropriate contaminant)* level. Excessive boiling can make the *nitrates, nitrite, manganese (select appropriate contaminant)* more concentrated, because *nitrates, nitrite, manganese (select appropriate contaminant)* remain behind when the water evaporates.

- **For adults and children over six months of age: IT IS RECOMMENDED NOT TO DRINK THE WATER WITHOUT BOILING IT FIRST.** Bring all water to a boil, let it boil for one minute, and let it cool before using, or use bottled water. Boiled or bottled water should be used for drinking, making ice, brushing teeth, and food preparation until further notice. Boiling kills bacteria and other organisms in the water. The water may be used for bathing and other similar purposes. If the water is colored, use an alternative source such as bottled water. If you are pregnant or have specific health concerns, you may wish to consult your doctor

DRINKING WATER ADVISORY

The {NAME} Water Supply is recommending to use bottled water or an alternative source for drinking

DO NOT USE THE WATER FOR DRINKING OR COOKING

The {NAME} Water Supply had a problem in the distribution system and the system lost pressure on {DATE}. Due to the potential for bacterial contamination, it is being recommended that bottled water or an alternative source be used. The manganese levels may be above the Health Advisory (HA) Level. Manganese in drinking water is a serious health concern. *Add information or change to specific area if impacts are limited.*

DO NOT GIVE THE WATER TO INFANTS Infants below the age of six months who drink water or formula made with the water containing manganese in excess of the Health Advisory (HA) Level may have impacts to their learning and behavior.

DO NOT GIVE THE WATER TO ADULTS AND CHILDREN OVER SIX MONTHS OF AGE. Adults and children over six months of age who drink water containing manganese in excess of the Health Advisory (HA) Level may have neurological health issues.

Bottled water or an alternative source should be used for drinking, making ice, brushing teeth, and food preparation until further notice.

The water may be used for bathing and other similar purposes.

- Water, juice, and formula for children under six months of age should not be prepared with tap water. Bottled water or other water low in manganese should be used for infants until further notice.
- **DO NOT BOIL THE WATER.** Boiling, freezing, filtering, or letting water stand does not reduce the manganese level. Excessive boiling can make the manganese more concentrated, because manganese remain behind when the water evaporates.

For more information, please contact {NAME}, *Water Superintendent or appropriate title* at {CONTACT INFO}. General guidelines on ways to lessen the risk of infection by microbes are available from the EPA Safe Drinking Water Hotline at 1(800) 426-4791.

When water service is restored, there may be air in your water piping and the water may be discolored. It is recommended to run the first water from a faucet that does not have an aerator screen, such as a bathtub or hose bib. Open the faucet slowly to allow the air to escape. Once the water is flowing, allow the faucet to run until it is clear. The water may be cloudy at first due to air in the water or particles that dislodged as the pipes filled with water. This should clear fairly quickly. If water is cloudy throughout the house and it does not clear after allowing the water to run for several minutes, contact the person listed above.

The system has been repaired, repressurized, and bacteria samples will be collected. This advisory is a precaution until bacterial sample results are available. You will be notified when the results are available and the advisory is lifted. *Add or change to explain situation and what is being done.*

The system is working with the Iowa Department of Natural Resources to resolve the situation.

{NAME} Water Supply Boil Water Advisory Lifted

Customers of the {NAME} Water Supply were notified on {DATE}, of a pressure loss in our system and were advised to boil their water before using for drinking. We are pleased to report that the work has been completed and the bacteria samples were satisfactory (contained no bacteria). **It is no longer necessary to boil your water before use.** We apologize for any inconvenience and thank you for your patience.

You may contact *water operator/city clerk/ office*, (NAME) at (CONTACT INFO), with any comments or questions.

This notice is being sent to you by the ______________________ Water Supply.

PWSID#: ___________

Date distributed: __________________

Appendix 3: Main Break Types and Responses

Controlled Pipe Repair Without Depressurization	Controlled Pipe Repair With Depressurization After Shutdown Without Opening the Pipe	Controlled Pipe Repair with Depressurization After Shutdown With Opening of the Pipe	Uncontrolled Pipe Break with a Likelihood of Water Contamination or Loss of Sanitary Conditions During Repair
Positive pressure maintained during the break	Positive pressure maintained during the break	Positive pressure maintained during the break	Loss of pressure at the break site
Positive pressure maintained during the repair	Positive pressure maintained until controlled shut down – pressure maintained until repair site is exposed and secured, Pipe is not opened	Positive pressure maintained until controlled shut down – pressure maintained until repair site is exposed and secured, Pipe is opened	Loss of pressure during repair, uncontrolled shutdown, may be catastrophic event or failure
No signs of contamination or intrusion	No signs of contamination or intrusion	No signs of contamination or intrusion	Possible or actual contamination or intrusion
Procedures	Procedures	Procedures	Procedures
Excavate to below break	Excavate to below break	Excavate to below break	Document possible contamination
Maintain trench water level below break	Maintain trench water level below break	Maintain trench water level below break	Excavate to below break
Clean and disinfect repair site and parts	Clean and disinfect repair site and parts	Clean and disinfect repair site and parts – flush into trench to clean	Clean and disinfect repair site and parts – flush into trench to remove any contamination
Repair under pressure (clamp or sleeve)	Control shutdown – depressurize area to make the repair	Control shutdown – depressurize area to make the repair	Disinfect line if possible
Flush until water is visually clear	Flush to scour pipe with 3 pipe turnover if possible. Flush until water is visually clear	Flush to scour pipe with 3 pipe turnover if possible. Flush until water is visually clear	Flush to scour pipe with 3 pipe turnover if possible. Flush until water is visually clear
Check chlorine residuals upstream and downstream from break	Check chlorine residuals upstream and downstream from break	Check chlorine residuals upstream and downstream from break	Check chlorine residuals upstream and downstream from break
Return the line to service	Return the line to service	Return the line to service	Return the line to service
If colored water occurs, advise customers to flush their plumbing until clear. If the water is not clear, use an alternative source.	Advise customers to flush their plumbing until clear. If the water is not clear, use an alternative source.	Advise customers to flush their plumbing until clear. If the water is not clear, use an alternative source.	Advise customers to flush their plumbing until clear. If the water is not clear, use an alternative source.
No boil water advisory	No boil or bottled water advisory unless potential contamination identified	A boil water advisory is recommended; use a bottled water advisory if elevated levels of nitrate, nitrite, or manganese	A boil water advisory is required; use a bottled water advisory if elevated levels of nitrate, nitrite, or manganese
No bacteria sampling	No bacteria sampling unless potential contamination identified	Bacteria sampling is recommended	Bacteria sampling is required
		Lift boil or bottled water advisory after absent bacteria results	Lift boil or bottled water advisory after two consecutive sets of absent bacteria results

Notes: Consult with your DNR Field Office with any questions.
The DNR Field Office must be notified when an advisory is issued or lifted.

THE UNIVERSITY OF IOWA | STATE HYGIENIC LABORATORY

ANALYTICAL REPORT

1-800-421-IOWA (4692)

Collection Location	Collector	Client Reference	Accession #	
wells 3 & 4 after treatment plant	asberry claire	randolph	930076	
PWS ID/PWS Name	**Collected**	**Received**	**Project**	
IA3649072 RANDOLPH WATER WORKS	2020-02-17 10:00	2020-02-18 10:17	idnr manganese	
Report To			**Facility ID** 01	**Sampling Pt ID** 01
ANNE LYNAM IDNR MANGANESE MONITORING 502 E 9TH ST DES MOINES, IA 50319			**SDWA Sample Type** SP - Special	**Sample Category** Chemical
			Sample Type Drinking Water	
			Sample Note(s) 1	

RESULTS OF ANALYSIS - FINAL REPORT

TEST	RESULT (mg/L)	QUANT LIMIT	ACTION LEVEL	ANALYSIS NOTE(S)
Metals, EPA 200.8				2
Manganese	**<0.02**	**0.02**	**0.3**	

SAMPLE AND ANALYSIS NOTES

1. Upon arrival, sample met container and preservation requirements for the analysis requested. Please review carefully your sample results for additional analyte comments or method exceptions.
2. The MCL (maximum contaminant level) is only applicable to compliance monitoring samples under the Safe Drinking Water Act (SDWA).

ANALYSIS INFORMATION

TEST	ANALYZED	SITE	RELEASED	ANALYSIS PREP
1. Metals, EPA 200.8	2020-02-18 10:31 SGB	3201	2020-02-19 13:27 MRC	

DESCRIPTION OF UNITS

mg/L = Milligrams per Liter

SITE(S) PERFORMING TESTING

3201 STATE HYGIENIC LABORATORY ANKENY, IOWA LABORATORIES COMPLEX, 2220 S ANKENY BLVD, ANKENY, IA 50023; Phone 515/725-1600; Fax 515/725-1642; Michael D. Schueller, M.S., Interim Associate Director; Wade K. Aldous, Ph.D. (D)ABMM, Associate Director; IOWA ENVIRONMENTAL LAB ID #397

Manganese in Drinking Water
Fact Sheet and Frequently Asked Questions

This document is intended to answer common questions about manganese and health and using water with higher levels of manganese.

What is manganese and where does it come from?

Manganese is a common, naturally-occurring mineral found in rocks, soil, groundwater, and surface water. Manganese is a natural component of most foods. Manganese is an essential nutrient, and eating a small amount of it each day is important to stay healthy.

How are people exposed to manganese?

The majority of manganese exposure in the general population comes from the food we eat. Grains, beans, nuts and teas are rich in manganese and it is also found in infant formula. A normal diet typically provides adequate manganese intake. The principal source of exposure to manganese is from food, but in situations where manganese levels in drinking water are elevated, the contribution from drinking water can increase the overall intake of manganese.

Manganese is found naturally in groundwater and surface waters in Iowa. Manganese may become noticeable in water at levels greater than 0.05 milligrams per liter (mg/L). At this level, the water will have a brown color and may leave black deposits on sinks and bathroom fixtures.

Manganese Levels of Concern in Drinking Water

The United States Environmental Protection Agency (US EPA) has developed a health advisory level (HAL) for manganese in drinking water of 0.3 mg/L which is intended to be protective of life-time exposure for the general population.

The US EPA recommends that infants up to 6 months of age should not be given water with manganese concentrations greater than 0.3 mg/L for more than a total of 10 days per year, nor should the water be used to make formula for more than 10 days per year.

The US EPA recommends that the general population should not ingest water with manganese concentrations greater than 1 mg/L for more than a total of 10 days per year.

Much lower manganese levels in water can result in noticeable staining and taste complaints. It is for this reason that the US EPA has a "secondary" drinking water guideline of 0.05 mg/L.

The US EPA health advisory levels of 0.3 mg/L and 1 mg/L were set based upon typical daily dietary manganese intake levels not known to be associated with adverse health effects. This does not imply that intakes above these levels will necessarily cause health problems. As a precaution, the general population should consider limiting their consumption of drinking water when levels of manganese are above the US EPA health advisory to decrease their exposures and to decrease the possibility of adverse neurological effects.

Currently, there is no regulatory limit set by the US EPA or the Iowa Department of Natural Resources (DNR).

Frequently Asked Questions

What levels of manganese are of concern in drinking water? The United States Environmental Protection Agency (US EPA) has developed a health advisory level for manganese in drinking water of 0.3 mg/L (milligrams per liter) and a secondary drinking water guideline of 0.05 mg/L for aesthetic issues. These are not enforceable standards. It is recommended to not drink water that has manganese above the 0.3 mg/L.

Can I drink this water? Elevated levels of manganese in the water can cause discoloration. If the water contains elevated levels of manganese or is discolored, it is recommended that you use an alternate water source for drinking.

Should I use this water to make formula for my baby? The most important thing to do is to switch to bottled water or water that is low in manganese to make formula. If you have concerns about your child, you should speak to your health care provider.

Should I stop drinking the water if I am breastfeeding my child? No. There is no correlation between manganese levels in water and manganese levels in breast milk. If you are healthy and breastfeeding you should continue to do so.

Should I be concerned if I am pregnant? If you are concerned, you should talk to your health care provider.

Can I cook with the water? No. As a precaution, do not use the water for cooking.

<u>Do not boil the water</u>. Boiling will concentrate the levels of manganese.

Can I use the water to make ice and drinks? No. As a precaution, do not use the water for making ice or drinks.

Can I use the water to wash dishes? Yes.

Can I bathe, shower, or wash my hands with the water? Yes. Manganese is poorly absorbed through the skin.

Can I brush my teeth with the water? Yes.

Can I give the water to my pets and livestock? Information is not available on the effect of elevated manganese in drinking water on pets and livestock. Please contact your veterinarian.

Iowa Department of Public Health Contact Information:
For additional health related inquiries regarding manganese in drinking water, contact Stuart Schmitz at 515-281-8707.

Iowa DNR Contact Information:
For additional questions or information, please contact the appropriate DNR Field Office:

Field Office 1, Manchester	563-927-2640	Field Office 4, Atlantic	712-243-1934
Field Office 2, Mason City	641-424-4073	Field Office 5, Des Moines	515-725-0268
Field Office 3, Spencer	712-262-4177	Field Office 6, Washington	319-653-2135

Underwater Storage Tank Inspection & Cleaning Guidance for Maintaining Public Water Supply Storage Quality[1]

Iowa Department of Natural Resources

Numerous companies offer the services of inspecting finished water storage tanks using underwater methods such as divers or remote operated vehicles (ROV). The department does not have specific rules governing the methods for cleaning or inspecting water storage tanks but does have rules for disinfection and sampling following cleaning, inspection, and maintenance of storage tanks (AWWA Standard C652-11 and Ten States Standards 2012 Edition adopted by reference at 567 IAC 43.3 (2)*"a"* in 2018). It is the responsibility of the public water supply to ensure that that the water being served to its customers is safe and meets the requirements of the rules contained in 567 IAC Chapters 40-43. This document serves as guidance for maintaining drinking water standards during an underwater tank inspection or cleaning event as outlined in section 4.4 of AWWA Standard C652-11. These guidelines do not apply to newly constructed tanks, or tanks which are removed from service and drained for cleaning or inspection. AWWA Standard C652-11 should be referenced for these situations.

Only experienced qualified contractors should be used. Contractors must follow all applicable federal, state, and local regulations and be willing to explain their diver safety and disinfection procedures. Improperly disinfected divers, inspectors, and equipment can contaminate the water and pose a risk to public health and safety. Additionally, tank sediment may contain microorganisms which, if re-suspended during the inspection or cleaning, has the potential to cause contamination of the water. Observing and measuring water quality and taking the appropriate actions if drinking water standards are not maintained, including the notification of customers is the responsibility of the water utility.

I. Notifications

A. As a courtesy, the utility is encouraged but not required to provide advance notification of the proposed tank entry to customers served by the affected tank in a manner appropriate for the area and the utility.

B. Notice to the DNR is not required unless a Precautionary Boil Advisory is issued per section III.A or IV of this guidance document. To report a boil advisory or for general questions contact the appropriate DNR Field Office:

FO1 (Manchester): 563-927-2640
FO2 (Mason City): 641-424-4073
FO3 (Spencer): 712-262-4177
FO4 (Atlantic): 712-243-1934
FO5 (Des Moines): 515-725-0268
FO6 (Washington): 319-653-2135
After Hours Emergency Response Hotline: 515-725-8694

II. Tank Isolation

A. Isolation of the storage tank during underwater inspection or cleaning is strongly recommended and may be required for safety reasons. Also, by removing the storage tank from service, it may reduce the potential for any contamination entering the system, and allows for decontamination, if it should become necessary. If operational conditions necessitate an underwater inspection or cleaning without isolation, then the work should be done during periods when positive flow into the storage tank is maintained, or flow rates into or out of the tank are minimal, if possible. If a storage facility is

[1] *The Iowa Department of Natural Resources (DNR) has prepared this guidance to assist facilities in complying with public water supply regulations. This document is intended solely as guidance, cannot be used to bind the DNR and is not a substitute for reading applicable statutes and regulations. This guidance was based on AWWA C652-11 Disinfection of Water Storage Facilities and Ten States Standards for Water Supplies 2012 Edition. This guidance is only meant to address the sanitary quality of the water before and after tank entry and is not meant to provide guidance on safety issues for confined space entry and diving operations. Because of the hazardous nature of this work, contractors must comply with all federal, state, and local regulations and safety requirements.*

to the *Iowa Main Break and Depressurization Guidance* (IDNR Form 542-0535). This guidance is available at www.iowadnr.gov/ws-publicnotice. The situation should be evaluated by qualified personal and appropriate action taken. The Precautionary Boil Advisory is to remain in effect until bacteriological samples from the tank and the distribution system are negative (coliform absent

C. When surface water plant clearwells or ground storage tanks are inspected and cleaned, turbidity analysis must be done in addition to disinfectant residual analysis. Water exceeding 1.0 NTU must not be released to the system. Please note that inspection of tanks that are used to meet contact time requirements (CT), may require additional measurement and surveillance to ensure the system meets CT requirements. Systems are encouraged to consult with their respective DNR Field Office prior to inspection of a CT tank.

V. Equipment and Personnel Requirements

A. All equipment to be used shall be available for inspection.
B. All equipment exposed to water shall be dedicated for potable water storage facilities only and shall be stored in a manner that prevents both chemical and bacteriological contamination.
C. All equipment shall be constructed and maintained so that water quality is not affected.
D. Divers shall be completely encapsulated with no bare skin exposed. There shall be no contact of the mouth or head with the water.
E. Diving clothing shall be of the dry-suit type, in good condition, and free from tears or other imperfections that may impair the integrity of the suit.
F. Float down inspectors must wear a dry suit that can be properly disinfected.
G. Unless explicitly approved by the utility to do so, divers or ROV's shall not disturb tank sediment.
H. All personnel entering a storage tank shall be free of communicable disease and shall not have been under a physician's care within the previous 7 day period. No person who knowingly has an abnormal temperature or symptoms of illness shall work in a storage tank.

VI. Disinfection of Equipment

A. All equipment exposed to water shall be suitable for disinfection.
B. Before opening, the access hatch and its immediate area shall be cleaned of all loose dirt and debris.
C. A diver and clothing shall be disinfected after the diver is suited up and on top of the tank.
D. A solution of 200 mg/L available chlorine shall be applied to all surfaces and immediately prior to entry to the water. Application can be by submersion, spray, sponge, or brush and shall remain in contact with the solution for at least 30 minutes. Any excess, runoff, or spillage is to be controlled so that it does not enter the storage tank.
E. Any equipment that makes contact with the exterior roof shall be re-disinfected prior to entering the tank.

VII. Certifications

A. The contractor shall have a comprehensive safety manual on site which addresses all potential hazards for the particular storage tank. The manual shall include certifications for onsite employees for diving, OSHA confined space entry, first aid, and CPR.
B. The contractor shall have a method and equipment readily available for extraction and lowering of an injured diver.

VIII. Logistics

A pre-job meeting involving the contractor and water utility representatives shall be held to ensure that the personnel understand the inspection or cleaning procedures, the configuration of the reservoir, disinfection procedures, maintenance of water quality, and the consequences if such quality is not maintained.

Appendix B – Water Demand

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Average Water Demand

Month	Pumpage to system (gallons)	Avg. Day Demand (GPD)	Avg. Day Demand (GPM)	Max. Day Demand (GPD)	Max. Day Demand (GPM)	Average Demand (GPD/Capita[1])
Jul-19	841,300	27,139	19	40,100	28	144
Aug-19	709,400	22,884	16	30,400	21	121
Sep-19	689,900	22,997	16	30,500	21	122
Oct-19	569,800	18,381	13	27,300	19	97
Nov-19	541,300	18,043	13	27,900	19	95
Dec-19	566,300	18,268	13	28,400	20	97
Jan-20	684,200	22,071	15	35,100	24	117
Feb-20	617,700	21,300	15	29,000	20	113
Mar-20	606,200	19,555	14	28,400	20	103
Apr-20	806,200	26,873	19	39,000	27	142
May-20	836,600	26,987	19	50,900	35	143
Jun-20	901,900	30,063	21	63,700	44	159
Jul-20	676,900	21,835	15	35,500	25	116
Aug-20	703,800	22,703	16	44,900	31	120
Sep-20	649,000	21,633	15	33,300	23	114
Oct-20	737,300	23,784	17	31,300	22	126
Nov-20	793,900	26,463	18	34,100	24	140
Dec-20	924,300	29,816	21	56,500	39	158
Jan-21	979,300	31,590	22	49,400	34	167
Feb-21	1,148,000	41,000	28	57,800	40	217
Mar-21	1,534,533	49,501	34	65,300	45	262
Apr-21	977,300	32,577	23	44,900	31	172
May-21	917,600	29,600	21	43,100	30	157
Jun-21	932,300	31,077	22	55,700	39	164
Jul-21	918,900	29,642	21	46,100	32	157
Aug-21	896,900	28,932	20	47,800	33	153
Sep-21	802,900	26,763	19	45,300	31	142
Oct-21	820,200	26,458	18	48,100	33	140
Nov-21	836,000	27,867	19	65,600	46	147
Dec-21	841,100	27,132	19	42,600	30	144
Jan-22	912,300	29,429	20	43,700	30	156
Feb-22	794,000	28,357	20	39,600	28	150
Mar-22	854,800	27,574	19	40,600	28	146
Apr-22	833,400	27,780	19	52,900	37	147
May-22	886,600	28,600	20	40,800	28	151
Jun-22	683,400	22,780	16	37,000	26	121
FY20 Monthly Average	**697,567**	**22,880**	**16**	**35,892**	**44**	**121**
FY21 Monthly Average	**914,519**	**30,132**	**21**	**45,983**	**45**	**159**
FY22 Monthly Average	**840,042**	**27,610**	**19**	**45,842**	**46**	**146**
Overall Average	**817,376**	**26,874**	**19**	**42,572**	**45**	**142**
2043 Projected	**864,948**	**28,438**	**20**	**45,050**	**48**	**150**

Denotes the maximum daily demand found in the referenced year (shaded cells)

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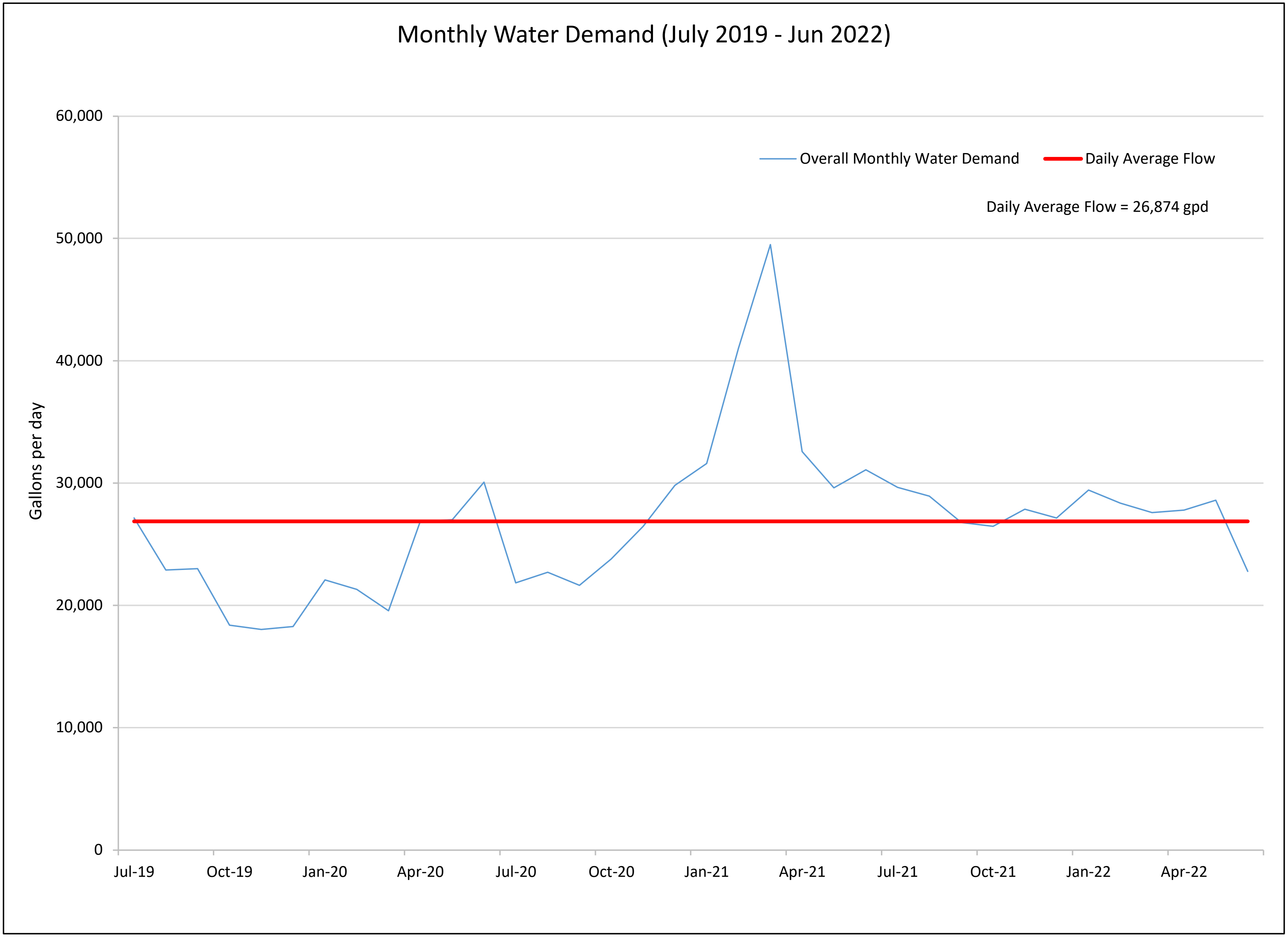
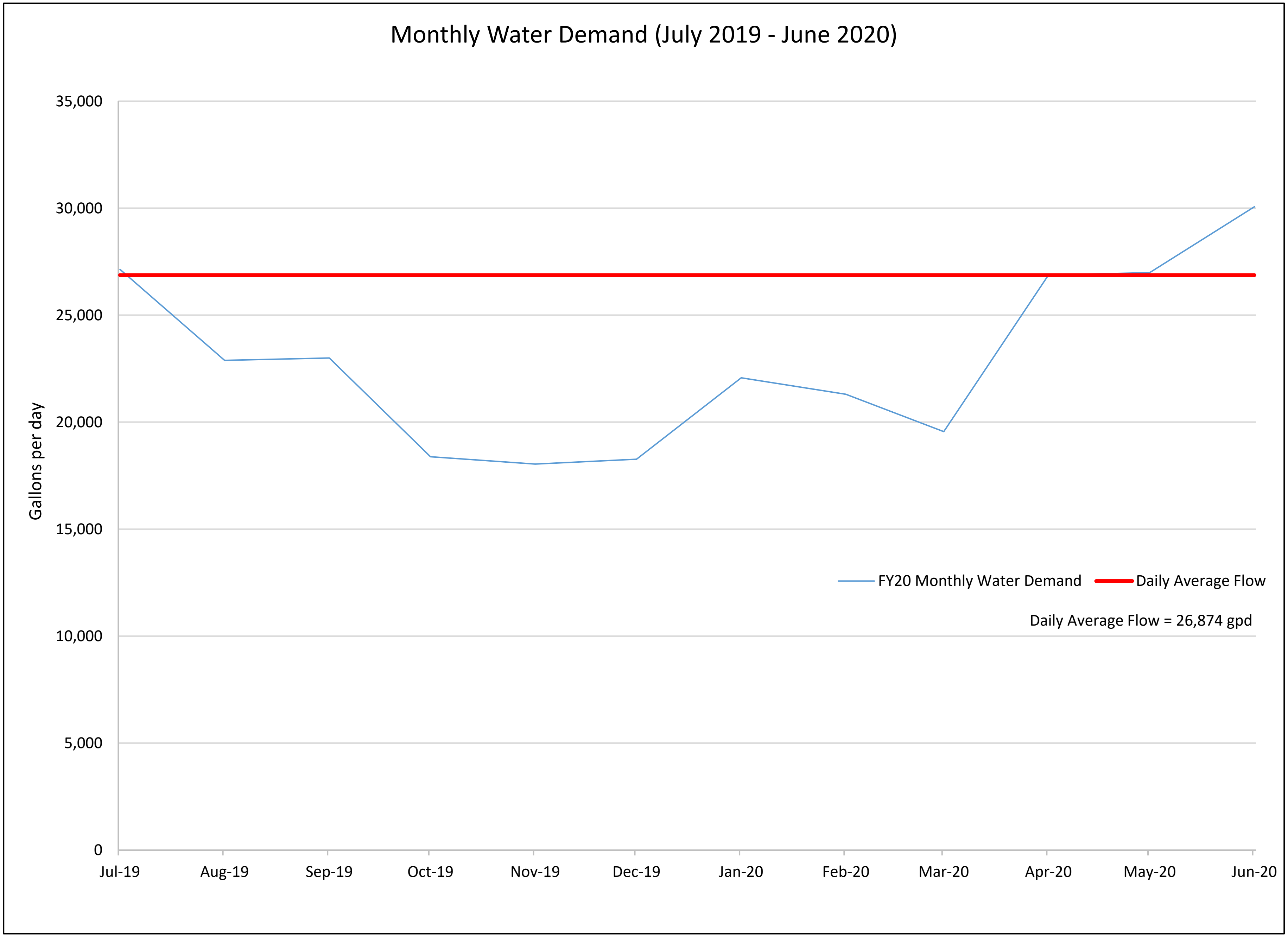
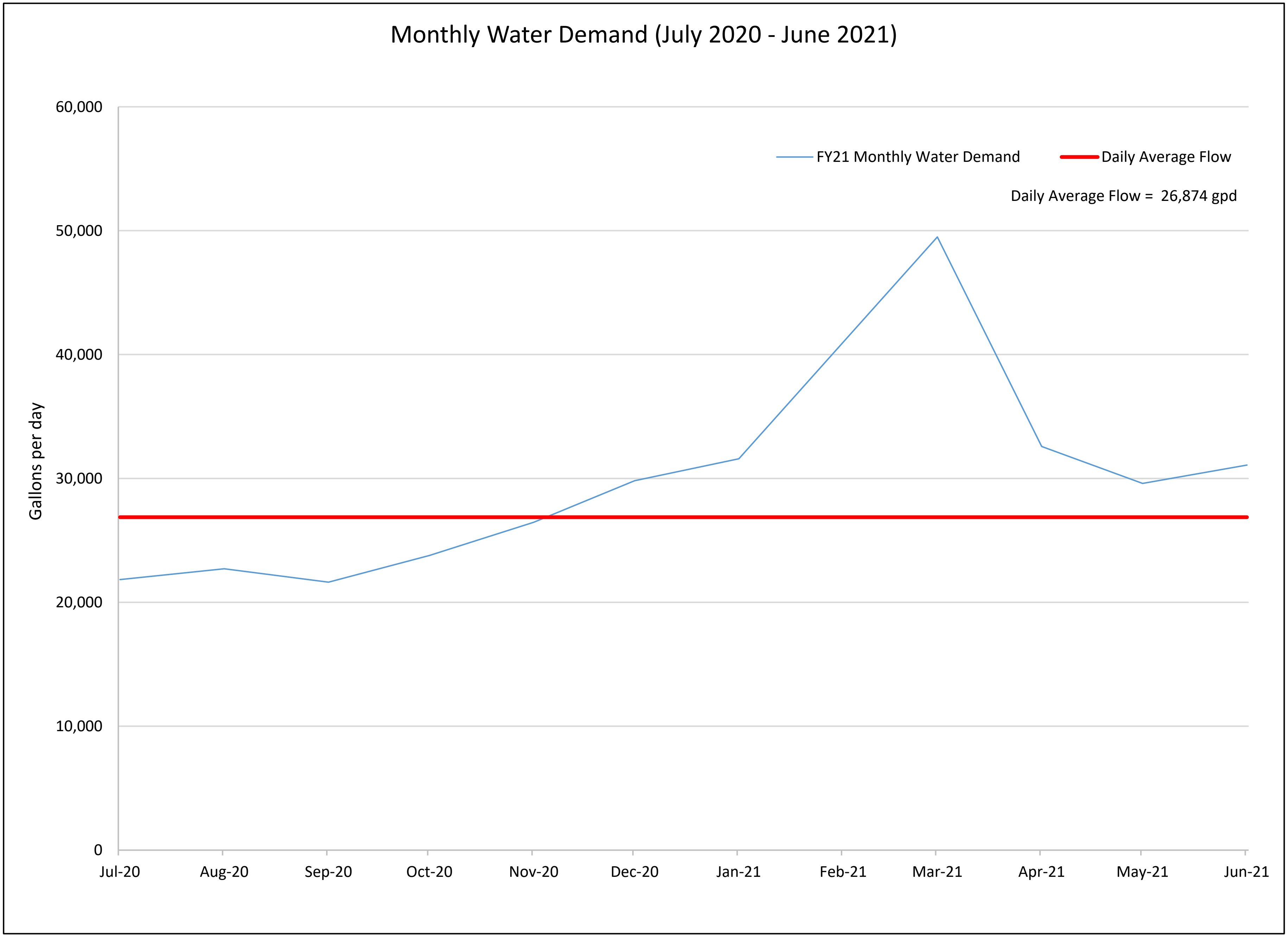
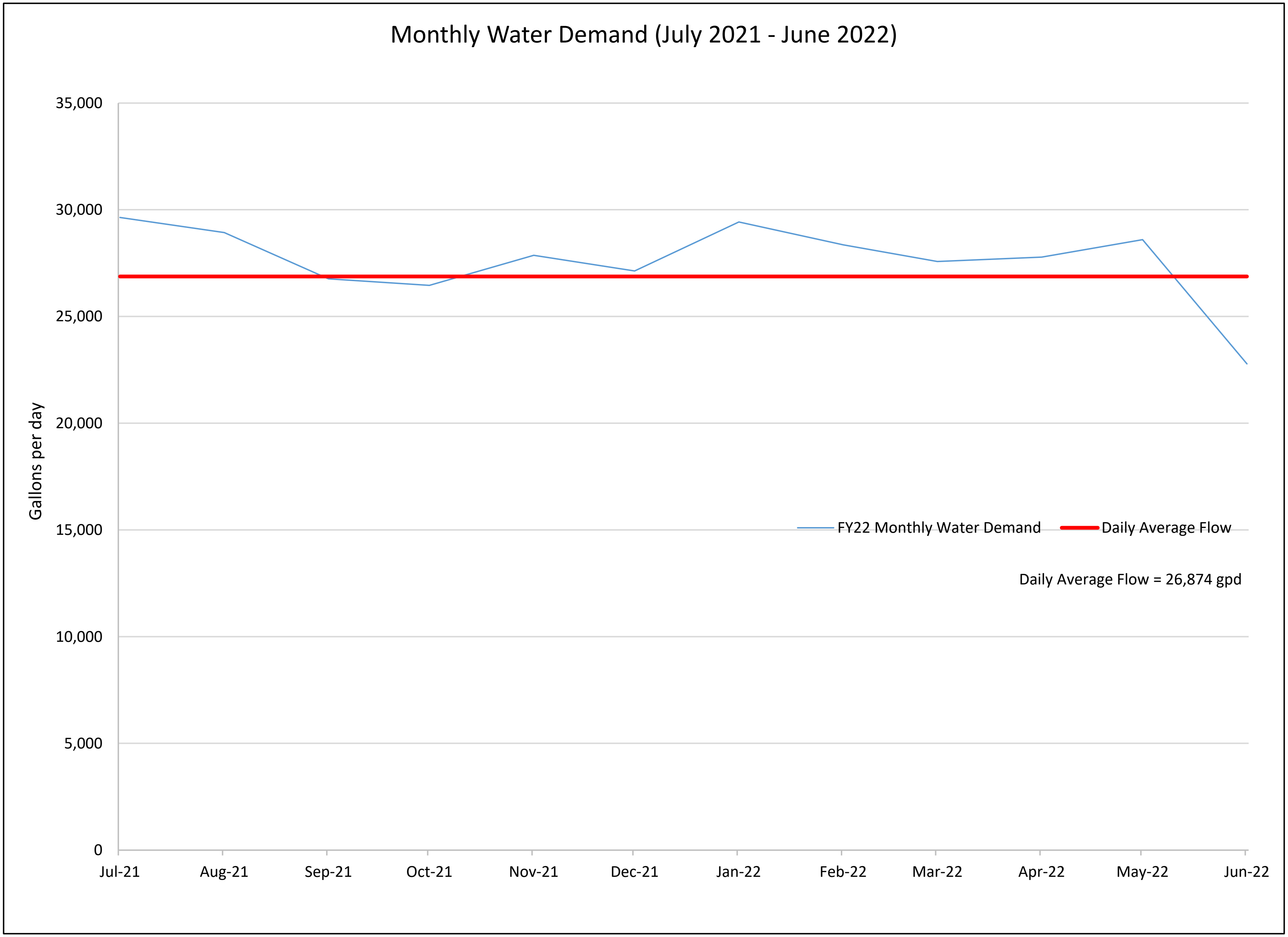


Monthly Water Demand (July 2019 - Jun 2022)
Overall Monthly Water Demand
Daily Average Flow
Daily Average Flow = 26,874 gpd
Gallons per day
60,000
50,000
40,000
30,000
20,000
10,000
0
Jul-19
Oct-19
Jan-20
Apr-20
Jul-20
Oct-20
Jan-21
Apr-21
Jul-21
Oct-21
Jan-22
Apr-22

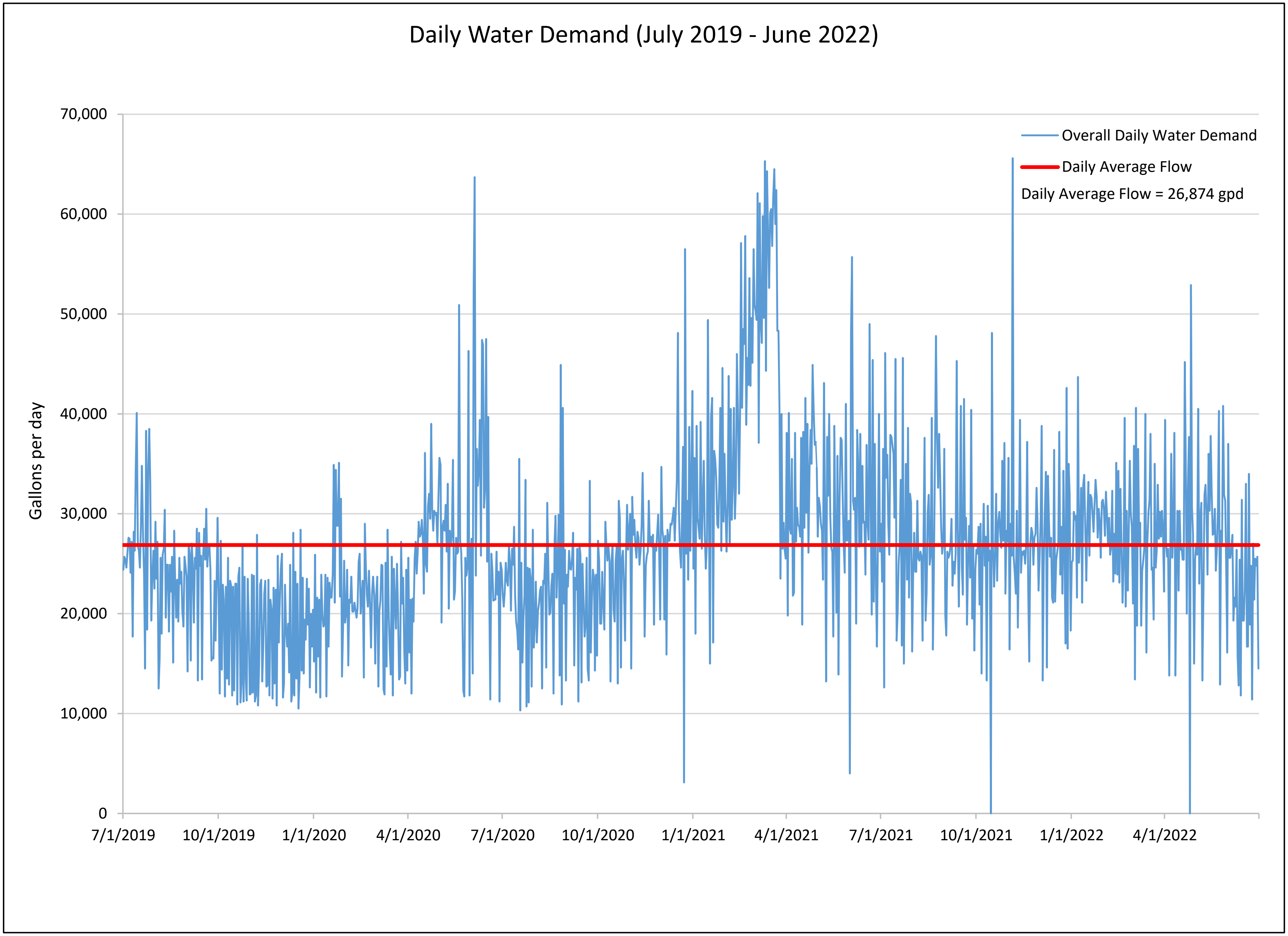

Monthly Water Demand (July 2019 - June 2020)
Gallons per day
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Jul-19
Aug-19
Sep-19
Oct-19
Nov-19
Dec-19
Jan-20
Feb-20
Mar-20
Apr-20
May-20
Jun-20
FY20 Monthly Water Demand
Daily Average Flow
Daily Average Flow = 26,874 gpd



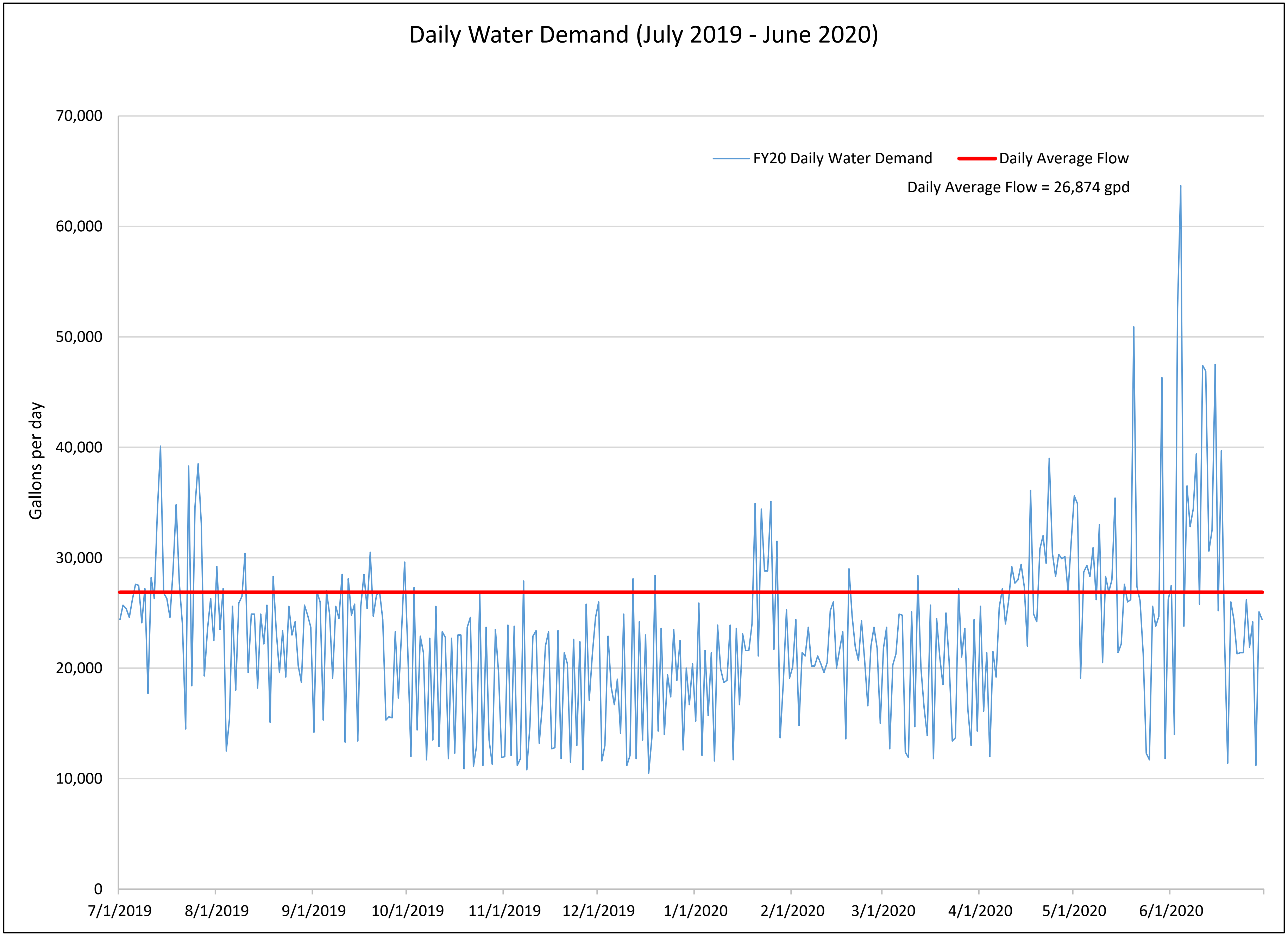
Monthly Water Demand (July 2020 - June 2021)
FY21 Monthly Water Demand
Daily Average Flow
Daily Average Flow = 26,874 gpd
Gallons per day
60,000
50,000
40,000
30,000
20,000
10,000
0
Jul-20
Aug-20
Sep-20
Oct-20
Nov-20
Dec-20
Jan-21
Feb-21
Mar-21
Apr-21
May-21
Jun-21



Monthly Water Demand (July 2021 - June 2022)
Gallons per day
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Jul-21
Aug-21
Sep-21
Oct-21
Nov-21
Dec-21
Jan-22
Feb-22
Mar-22
Apr-22
May-22
Jun-22
FY22 Monthly Water Demand
Daily Average Flow
Daily Average Flow = 26,874 gpd



Daily Water Demand (July 2019 - June 2022)
Gallons per day
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
7/1/2019
10/1/2019
1/1/2020
4/1/2020
7/1/2020
10/1/2020
1/1/2021
4/1/2021
7/1/2021
10/1/2021
1/1/2022
4/1/2022
Overall Daily Water Demand
Daily Average Flow
Daily Average Flow = 26,874 gpd



Daily Water Demand (July 2019 - June 2020)
FY20 Daily Water Demand
Daily Average Flow
Daily Average Flow = 26,874 gpd
Gallons per day
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
7/1/2019
8/1/2019
9/1/2019
10/1/2019
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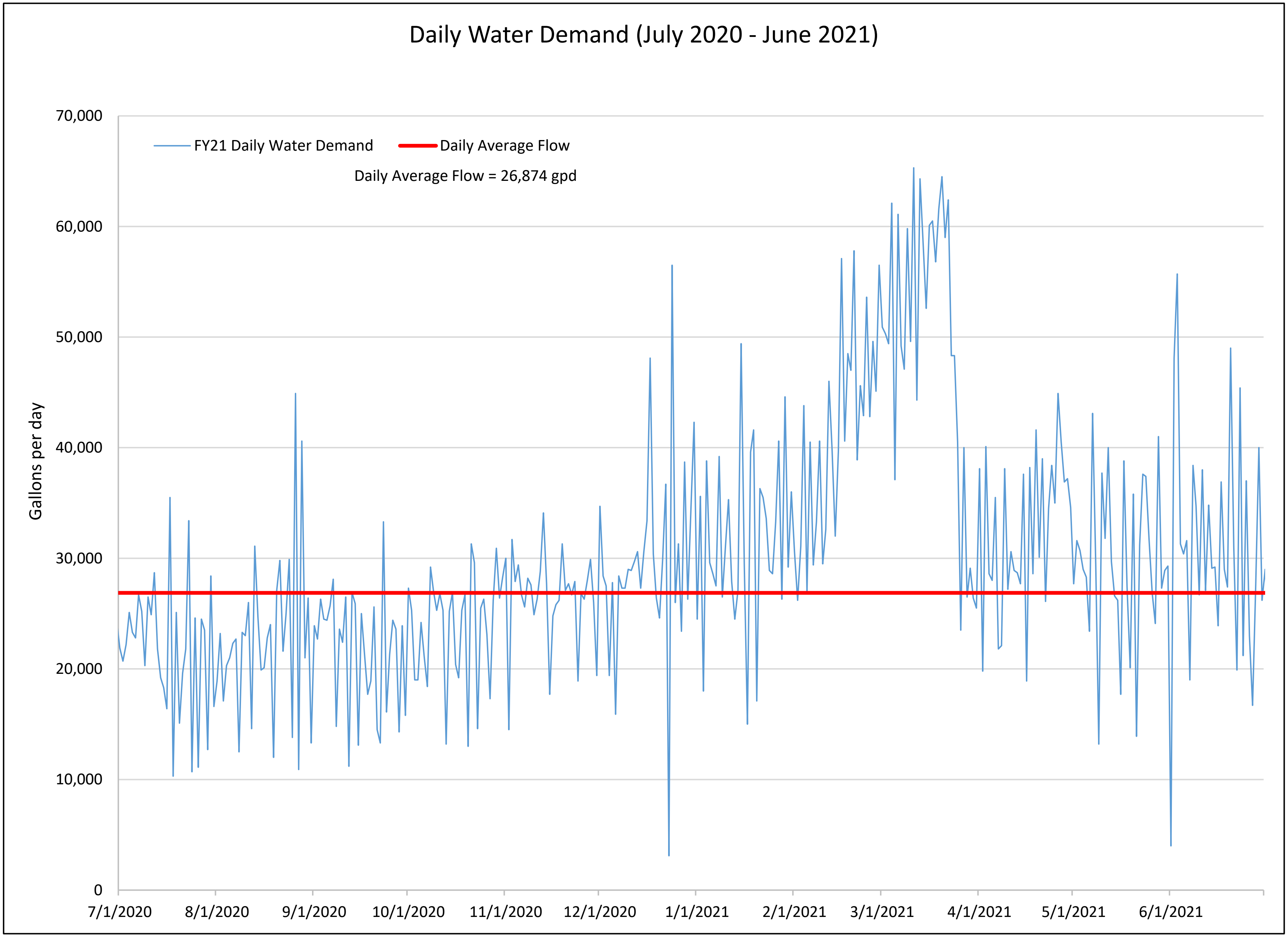
4/1/2020
5/1/2020
6/1/2020


Daily Water Demand (July 2020 - June 2021)
FY21 Daily Water Demand
Daily Average Flow
Daily Average Flow = 26,874 gpd
Gallons per day
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
7/1/2020
8/1/2020
9/1/2020
10/1/2020
11/1/2020
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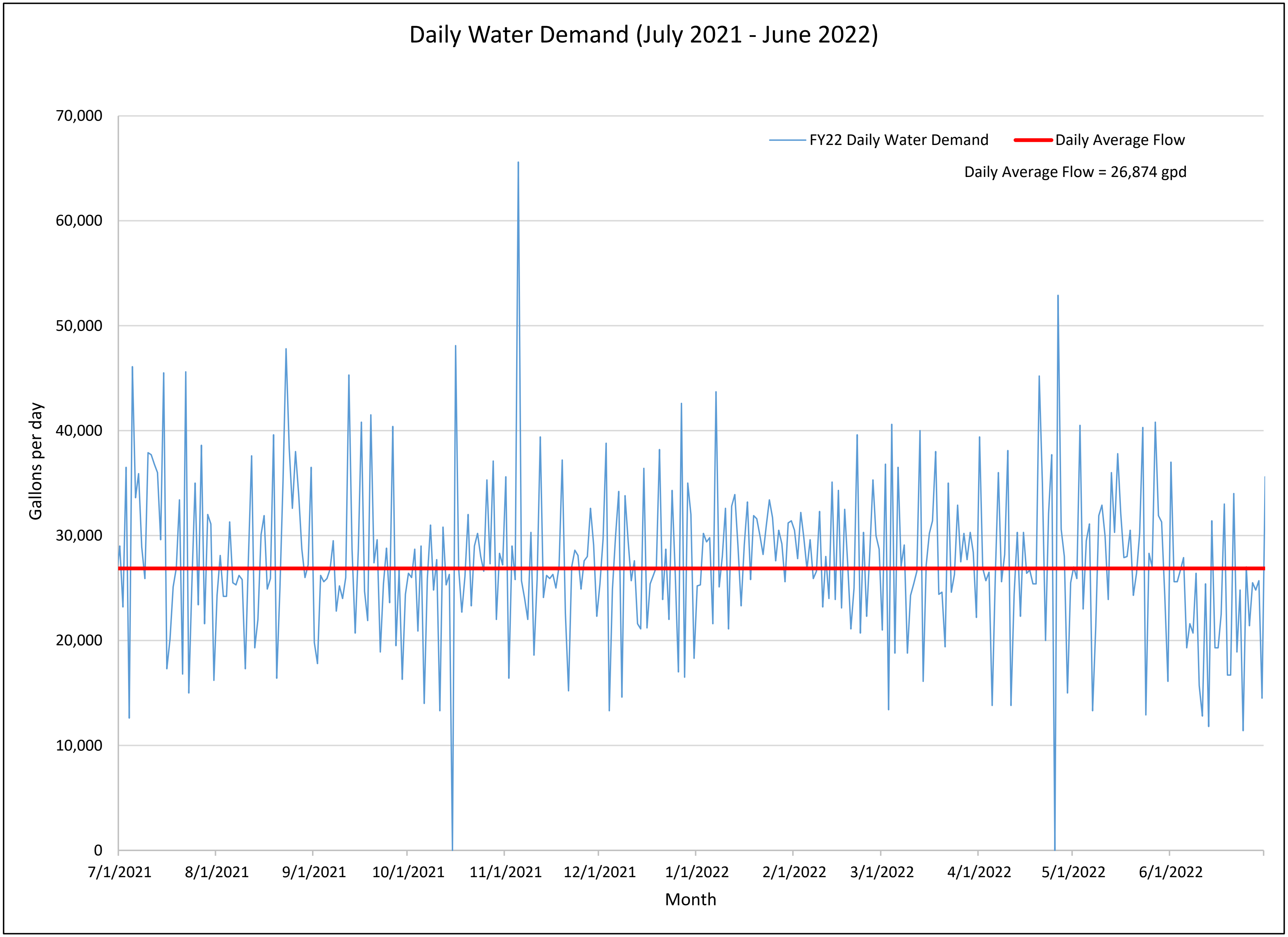
5/1/2021
6/1/2021


Daily Water Demand (July 2021 - June 2022)
FY22 Daily Water Demand
Daily Average Flow
Daily Average Flow = 26,874 gpd
Gallons per day
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
7/1/2021
8/1/2021
9/1/2021
10/1/2021
11/1/2021
12/1/2021
1/1/2022
2/1/2022
3/1/2022
4/1/2022
5/1/2022
6/1/2022
Month

Appendix C – Water Quality Report

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2022 WATER QUALITY REPORT
FOR
RANDOLPH WATER WORKS

This report contains important information regarding the water quality in our water system. The source of our water is groundwater. Our water quality testing shows the following results:

CONTAMINANT	MCL - (MCLG)	Compliance		Date	Violation	Source
		Type	Value & (Range)		Yes/No	
Copper (ppm)	AL=1.3 (1.3)	90th	0.0602 (0.0268 - 0.0656)	2021	No	Corrosion of household plumbing systems; Erosion of natural deposits; Leaching from wood preservatives
Lead (ppb)	AL=15 (0)	90th	5.70 (ND - 7)	2021	No	Corrosion of household plumbing systems; erosion of natural deposits
950 - DISTRIBUTION SYSTEM						
Chlorine (ppm)	MRDL=4.0 (MRDLG=4.0)	RAA	1.1 (0.81 - 1.21)	09/30/2022	No	Water additive used to control microbes
Total Trihalomethanes (ppb) [TTHM]	80 (N/A)	SGL	57.50	07/07/2020	No	By-products of drinking water chlorination
Total Haloacetic Acids (ppb) [HAA5]	60 (N/A)	SGL	16.60	07/07/2020	No	By-products of drinking water disinfection
01 - WELLS 3_4 AFTR TRTMT @ PLNT						
Gross Alpha, inc (pCi/L)	15 (0)	SGL	5.34	08/24/2021	No	Erosion of natural deposits
Barium (ppm)	2 (2)	SGL	0.274	09/08/2020	No	Discharge of drilling wastes; Discharge from metal refineries; Erosion of natural deposits
Selenium (ppb)	50 (50)	SGL	4.00	09/08/2020	No	Discharge from petroleum and metal refineries; Erosion of natural deposits; Discharge from mines
Fluoride (ppm)	4 (4)	SGL	0.3	09/08/2020	No	Water additive which promotes strong teeth; Erosion of natural deposits; Discharge from fertilizer and aluminum factories
Arsenic (ppb)	10 (0)	SGL	1.80	09/08/2020	No	Erosion of natural deposits: Runoff from orchards; Runoff from glass and electronic production wastes
Sodium (ppm)	N/A (N/A)	SGL	17.3	09/08/2020	No	Erosion of natural deposits; Added to water during treatment process
Nitrate [as N] (ppm)	10 (10)	SGL	0.700	2022	No	Runoff from fertilizer use; Leaching from septic tanks, sewage; Erosion of natural deposits

Note: Contaminants with dates indicate results from the most recent testing done in accordance with regulations.

DEFINITIONS

- Maximum Contaminant Level (MCL) – The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.
- Maximum Contaminant Level Goal (MCLG) -- The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.
- ppb -- parts per billion.
- ppm -- parts per million.
- pCi/L – picocuries per liter

- N/A – Not applicable
- ND -- Not detected
- RAA – Running Annual Average
- Treatment Technique (TT) – A required process intended to reduce the level of a contaminant in drinking water.
- Action Level (AL) – The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.
- Maximum Residual Disinfectant Level Goal (MRDLG) - The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.
- Maximum Residual Disinfectant Level (MRDL) - The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.
- SGL – Single Sample Result
- RTCR – Revised Total Coliform Rule
- NTU – Nephelometric Turbidity Units

GENERAL INFORMATION

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water posed a health risk. More information about contaminants or potential health effects can be obtained by calling the Environmental Protection Agency's Safe Drinking Water Hotline (800-426-4791).

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by *Cryptosporidium* and other microbial contaminants are available from the Safe Drinking Water Hotline (800-426-4791).

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. RANDOLPH WATER WORKS is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at http://www.epa.gov/safewater/lead.

SOURCE WATER ASSESSMENT INFORMATION

This water supply obtains its water from the sand and gravel of the Alluvial aquifer. The Alluvial aquifer was determined to be highly susceptible to contamination because the characteristics of the aquifer and overlying materials provide little protection from contamination at the land surface. The Alluvial wells will be highly susceptible to surface contaminants such as leaking underground storage tanks, contaminant spills, and excess fertilizer application. A detailed evaluation of your source water was completed by the Iowa Department of Natural Resources, and is available from the Water Operator at 402-660-3793 .

CONTACT INFORMATION

For questions regarding this information or how you can get involved in decisions regarding the water system, please contact RANDOLPH WATER WORKS at 402-660-3793.

Appendix D – Source Water Protection

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Source Water Assessment for Randolph (PWS#3649072) Alluvial Aquifer

Source Water Protection

The purpose this Source Water Protection (SWP) "Phase I" assessment is to:

- Define your source water area and susceptibility;
- locate, inventory, and rank potential contaminant sources within your source water area;
- provide the results to the public for improved protection of your drinking water.

Introduction

This Source Water Protection (SWP) "Phase I" assessment is meant to provide information and be used as a tool to help protect the quality and quantity of your drinking water. Within it you will find an inventory of your wells, tables showing potential contamination sources within your source water area, and maps showing your system's source water information.

The source water area defined in this report is the region directly linked to your water supply, and where land use changes have the greatest influence on your drinking water quality. Your source water area was defined based on scientific information available to the Iowa Department of Natural Resources - Iowa Geological and Water Survey (IDNR-IGWS).

This "Phase 1" source water assessment by no means protects your drinking water. To protect your drinking water your system should develop and implement a source water protection plan. Protection measures are different for each system, but commonly include reserving areas for future wells, cleaning up contaminants, and converting portions of your source water area to native vegetation. Further information on how to protect your drinking water, including guidebooks and online resources, can be found at www.iowasourcewater.org.

This SWP assessment includes the following sections:

1. Defining Your Source Water Area
2. Susceptibility of Your Source Water Area
3. Contaminant Sources within Your Source Water Area
4. Ranking Contaminant Sources
5. How to Protect Your Drinking Water
6. Consumer Confidence Report

Section 1: Defining Your Source Water Area

Accurate well, aquifer, and pumping information is critical to providing the best estimate of your source water area. According to our records Randolph has two active wells in the sand and gravel of the West Nishnabotna River alluvial aquifer. The table below shows your well and aquifer information. If you believe the table is wrong please contact the Source Water Protection program at www.iowasourcewater.org or 319-335-1575.

W#	Local Name	Depth (ft.)	Const. date	Status	Aquifer	Aquifer thick. (ft.)	SWL (ft.)	PWL (ft.)	Rate (gpm)
41624	#3	53	1/1/1966	Active	Alluvial	0	14	30	226
41625	#4	52	1/1/1968	Active	Alluvial	0	11	20	163
41627	#2	58	10/24/1955	Not Used	Alluvial	0	0	0	0
41626	#1	60	8/1/1930	Not Used	Alluvial	0	0	0	0

Source Water Glossary

Aquifer: An underground water-bearing layer that provides a usable quantity of water.

Source Water Area: An estimation of the area contributing water to your public wells.

Capture zone: A computer modeled source water area, typically using 2-5-and 10 year time of travel periods.

Time of travel: A duration of time specified to determine the distance and area that water will travel.

Susceptibility: A measure of an aquifer's potential to become contaminated. Does not imply either good or poor water quality.

Confining layer: A layer of material which slows the movement of water.

Sufficient information was available concerning your wells, aquifer and pumping conditions to use a computer model to estimate your source water area. For your water supply, the source area was divided and prioritized to show the areas we estimate groundwater to flow during "time of travel" periods, typically 2, 5, and 10-years. These source areas for your facility were estimated using an analytical element model for the purpose of delineating source water protection areas. The model requires certain input data for your aquifer, wells, and pumping rate, listed below:

•Gradient: 0.001 ft./ft. •Flow Direction: 180 •Porosity: 0.25 •Transmissivity: 8300 ft.2/day •Aquifer Thickness: 30 ft. •Average Gallons per Day: 23000.

Section 2: Susceptibility of Your Source Water Area

Research by IDNR-IGWS has determined that thickness of confining layers such as till, clay, and shale between the aquifer and the land surface provide a good measure of aquifer susceptibility. Aquifers overlain by thicker confining beds are less susceptible to contamination than aquifers overlain by thin confining beds. The table below summarizes susceptibility by confining layer thickness.

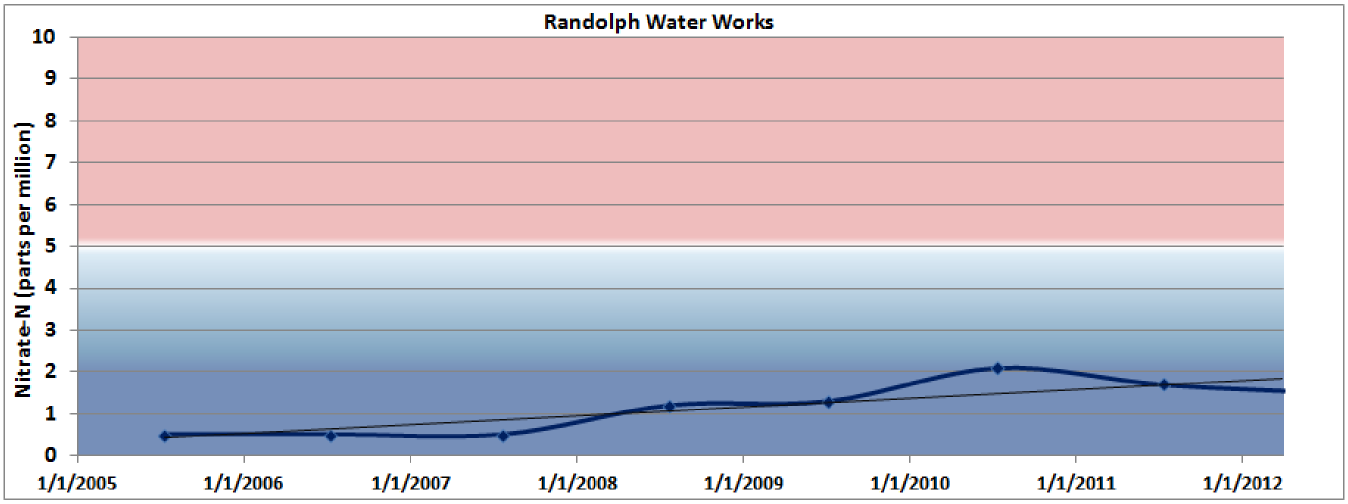
Confining layer thickness	Susceptibility designation
<25 feet	Highly susceptible
25 to 50 feet	Susceptible
50 to 100 feet	Slightly susceptible
>100 feet	Low susceptibility

Based on our data, your wells have a cumulative confining layer thickness of less than 25 feet. Your aquifer was therefore determined to be highly susceptible to surface contamination.

Another method for determining the susceptibility of your aquifer is by using nitrate concentrations to evaluate the risk of surface contamination. Wells with higher nitrates typically have less protection from contamination at the land surface and are more at risk than wells with low nitrates. Based on our records, finished water at Randolph has a six-year average nitrate-N concentration of 1.46 parts per million (ppm), based on five total samples.

Nitrate concentrations in your public water supply are generally low. The concentrations measured much lower than the EPA maximum contamination level (MCL) of 10 ppm, indicating little contamination from nonpoint, fertilizer, or septic sources. Elevated nitrate concentrations can disrupt the electron transport system and cause methemoglobinemia, or blue baby syndrome, in infants.

The chart on the next page shows historic nitrate trends in Randolph through time. Your public water supply's nitrate-N concentrations show a relatively increasing trend of 0.22 ppm per year during the past six years (2005-2011). You may wish to investigate whether this increase may be related to pumping, land use, treatment, analysis, or facility changes these past few years.



Section 3: Contaminant Sources within Your Source Water Area

To identify potential contaminant sources we searched electronic databases for facilities and land uses that fell inside your source water area. The databases used for the inventory are described in Table 1 of the *Iowa Source Water Protection plan*. The contaminant source inventory includes facilities and land uses that have been known to contaminate groundwater.

Table 1 lists the potential contaminant sources we found in your source water area. The map numbers correspond to the contaminant source list in Table 1. The potential contaminant sources are derived from databases that have varying degrees of locational accuracy, and therefore could be mapped in the wrong area or omitted from the map entirely. For this reason, locational accuracy is noted at the end of the table. You or other residents may be aware of additional contaminant sources that should be included, feel free to modify this report to reflect your knowledge.

For many aquifers, particularly those overlain by thick confining layers, the greatest threat of contamination to the aquifer is through existing wells that penetrate the confining layers. For this reason, Table 2 lists all known wells, owners, and locations identified in your source water area. A numbered symbol shown on the map at the end of this report identifies well locations. Well locations are derived from databases that have varying degrees of accuracy, and therefore could be mapped in the wrong area or omitted from the map entirely. For this reason, locational accuracy is noted at the end of the table 2.

In addition to the specific "point" sources listed in Table 1, nonpoint sources of contamination also exist in your source water area. In Iowa, a potentially significant nonpoint source of contamination is row crop agriculture. Your source water area was determined to have over 50% of its area in row crop agriculture in 2011. Common potential contaminants from row crop agriculture include nitrate, pesticides, and phosphorus. If your water chemistry indicates elevated nitrate-N levels, we suggest your community pursue non-point management practices such as conservation reserve program or permanent easements within your source water area. Land use percentages and acreages are presented in Table 3.

Section 4: Ranking Contaminant Sources

We have attempted to prioritize the relative risk based on a three component ranking system; 1) the location of the potential contaminant source in the source water area, 2) the susceptibility ranking of the aquifer to contamination, and 3) the type of contaminant source. Points are assigned for each category and a cumulative score calculated for each potential contaminant source using the scores for each of the three components. Higher numbers always correspond to higher risk in this report.

1) Location of potential contaminant sources

Your potential contaminant sources are ranked from 1-3 based on the capture zone they are located in, with greater weight given based on proximity to the well. Fixed radius capture zones also received greater risk as they represent unknown or poorly known hydrogeologic conditions. The table below shows the risk score assigned to each source water area.

Source Water Area	Risk score
2-year time of travel, hydrologic boundary, fixed radius, 1-mile, modified karst - high	3
5-year time of travel, modified karst – medium	2
10-year time of travel, aquifer retrieval area, surface runoff area	1

2) Aquifer susceptibility to contamination

Susceptibility rankings were given scores to give more priority to aquifers with less confining layers. Aquifer susceptibilities were given ranks of 1-4, from low susceptibility to highly susceptible. If your well depth or confining layer thickness is unknown, the source water area was automatically designated “highly susceptible” and ranked 4.

3) Land-use type

The land-use type combines the potential for different facility classes or land uses to release contaminants with an estimate of the toxicity of the contaminants that may be released. Land-use risks are assigned values from 1 to 5 (least to greatest risk).

The final “Risk Score” for the source water area is the result of summing the three components of relative risk. For a list of land-use types and additional information regarding the ranking classification, please refer to the *Iowa Source Water Protection* plan.

The goal for ranking potential contaminants is to provide your system with a list to help prioritize potential risks. These risks can only be addressed through local initiatives and strategies started by your community. To begin a SWP plan, it is up to your local community to decide which potential contaminant sources carry the most risk, and to proactively engage problems you might find to your drinking water. The risk rankings provided in this report are only a guide; the final decision on the priority of potential contaminant sources rests with your local source water protection team.

Section 5: How to Protect Your Drinking Water

This Source Water Phase I assessment only provides information on your source water area and contaminants. Your community is responsible for taking the necessary action to ensure you have clean drinking water for future generations. To do this the Iowa Source Water Program strongly encourages you to start a Source Water Protection Plan. A SWP plan is different for each community, but the steps needed to complete one are the same for every system. Most steps have already been outlined and partially completed in the SWP “Phase 1” assessment:

Steps for completing a Source Water Protection plan

Step 1: Organize a source water team
Step 2: Identify your source water areas
Step 3: Inventory well and contaminant sources
Step 4: Assess and rank contaminant sources

Step 5: Develop an action plan
Step 6: Construct or update your emergency response plan
Step 7: Submit and Implement your SWP Plan

If your community is interested in protecting your drinking water, there are plenty of free resources available to help guide you through this process, www.iowasourcewater.org has many online resources available, including a detailed Guidebook and Workbook catered for Iowa community water supplies. Please contact Chad Fields (319-335-2083) of the Source Water Program for further information.

Section 6: Consumer Confidence Report

As the agency responsible for conducting drinking water programs in the state of Iowa, IDNR must provide each public water supply with language to be included in their Consumer Confidence Report regarding source water protection. The following language, at a minimum, must be included in each Consumer Confidence Report you produce from now on:

> "The city of Randolph obtains its water from the sand and gravel of the West Nishnabotna River alluvial aquifer. The alluvial aquifer was determined to be highly susceptible to contamination because the characteristics of the aquifer and overlying materials provide little protection from contamination at the land surface. Randolph's alluvial wells will be highly susceptible to surface contaminants such as leaking underground storage tanks, contaminant spills, and excess fertilizer application. A detailed evaluation of your source water was completed by the Iowa Department of Natural Resources, and is available from the Water Operator at 712-374-2613."

You may modify this language or include additional information if you so desire, but you must identify the source of your system's drinking water and identify known sources of potential contamination.

Table 1. Inventory and ranking of potential contaminant sources.

Randolph Public Water Supply (3649072)

Phase I - Contaminant Source Inventory and Assessment

Aquifer: Alluvial Highly Susceptible *(risk factor = 4)*

Map No.	Site Name	Site Type	Site Link[1]	Program ID	Site Address	Loc'n Acc[2]	Land Use Risk[3]	Risk Score[4]
Capture zone: 2-year time of travel *(risk factor = 3)*								
1	D & D Service	Leaking USTs	310506324	7LTQ95	101 E Randolph St, Randolph, IA 51649	good	5	**12**
2	Farm Service Company - Randolph	Air Permit - Group 1 Grain Elevators	311402023	36-08-001	109 Depot St, Randolph, IA 51652	poor	3	**10**
3	Farm Service Company	Risk management plan	310786999	110002439451	109 Depot Street, Randolph, IA 51649	good	5	**12**
4	Farm Service Company, Randolph Facility	Tier II Chemical Storage	310786999	FAIDSIT2A000040	109 Depot Street, Randolph, IA 51649	poor	3	**10**
5	Randolph Fertilizer And Grain	Contaminated sites	311756688	865	109 Depor Street, Randolph, IA 68771	good	5	**12**
6	Tom Rumery	Underground storage tank	310512735	198912261	202 S Main, Randolph, IA 51649	poor	5	**12**

[1]ID's are hyperlinked to detailed contaminant source information where available. Click once to open the spreadsheet, then click again to follow the link.

[2]Estimated horizontal accuracy: < 25m. = good; 25m. to 50m. = fair; >50m. = poor

[3]Score range: 1 to 5, see Table 3 of the Iowa Source Water Protection and Assessment plan

[4]Sum of land use, capture zone, and aquifer susceptibility risk factors

Table 2. Inventory of water wells not used in source water area.

Randolph Public Water Supply (3649072)

Phase I - Inventory of Wells

Aquifer: Alluvial Highly Susceptible *(risk factor =)*

Map No.	Well ID[1]	Well Owner	Well ID Source	Depth (ft.)	Date Drilled/ permitted	Well Location	Locational Accuracy[2]
Capture zone: 2-year time of travel *(risk factor = 3)*							
1	3235	Randolph Water Works	Water Use Permit Wells	53	<Null>	T70N, R41W, Sec. 9, SE, SW, SW	good
2	3236	Randolph Water Works	Water Use Permit Wells	53	<Null>	T70N, R41W, Sec. 9, SE, SW, SW	good

[1]Well id's are hyperlinked to detailed well information where available.
Click once to open the spreadsheet, then click again to follow the link.

[2]Estimated horizontal accuracy: < 25m. = good; 25m. to 50m. = fair; >50m. = poor

Table 3. Land cover within your source water area.

Randolph - Alluvial aquifer Highly Susceptible

Summary of land cover types (2010) by percentage of total

Capture zone	Row Crop	Alfalfa	Grassland	Wetlands	Developed Areas	Forested Areas	Total Acres
2-year	9.6	17.2	16.5	1.7	53.6	1.4	65
5-year	53.0	4.1	24.5	4.1	13.0	1.4	98
10-year	75.9	0.0	4.3	0.8	17.4	1.6	170

Randolph Water Works 3649072
Alluvial Aquifer - Source Water Protection Area

Public Wells
- Active
- Not Used
- Standby

Source Water Areas
- 2-Year Capture Zone
- 5-Year Capture Zone
- 10-Year Capture Zone

Contaminant Sources
- Air Permit - Group 1 Grain Elevators
- Contaminated sites
- Tier II Chemical Storage
- Risk management plan
- Underground storage tank
- Leaking USTs

Other Wells
- Water Use Permit Wells

0 0.24 Miles

N W E S

Iowa SOURCE WATER Protection

Report Created: 8/6/2012

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Appendix E – Maps, Drawings, & Figures

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Short Elliott Hendrickson Inc.
5414 NW 88th Street, Suite 140
Johnston, IA 50131-1701

651.490.2000 **main** | 888.908.8166 **fax**
800.325.2055 **toll free** | **www.sehinc.com**

CITY OF RANDOLPH

MARK	DATE	DESCRIPTION

PRELIMINARY ENGINEERING REPORT

SEH FILE NO.	RANDO 172534
ISSUE DATE	8/22/2023
DESIGNED BY	BJK
CHECKED BY	KLK
DRAWN BY	CPS

SHEET CONTENTS
EXISTING WATER SYSTEM

E-1

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SHEET CONTENTS
WATER MAIN REPLACEMENT - RANDOLPH STREET

E-2

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CITY OF RANDOLPH

MARK	DATE	DESCRIPTION

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SEH FILE NO.	RANDO 172534
ISSUE DATE	8/22/2023
DESIGNED BY	BJK
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DRAWN BY	CPS

SHEET CONTENTS
WATER MAIN REPLACEMENT - REMAINING CAST IRON

E-3

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Appendix F – Detailed Opinions of Probable Costs and Life-Cycle Cost Analysis

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Alternative 1: New Well to Provide Additional Water

ENGINEER'S BUDGETARY OPINION OF PROBABLE COST
Randolph Water System Study
Randolph, Iowa
SEH Project No. RANDO 172534

Date Prepared:
September, 2023

SEH

ESTIMATE OF QUANTITIES

Item #	Description	Unit	Quantity	Unit Price	Total
Construction					
1.	Mobilization/Bonds/Insurance (7%)	LS	1	$16,000	$16,000
2.	Well Installation - Drilling, Casing Pipe, Grout	LF	200	$600	$120,000
3.	Raw Water Main, 6"	LF	300	$60	$18,000
4.	Submersible Pump, VFD, Well Failure Alarm - Well #5	LS	1	$50,000	$50,000
5.	Controls	LS	1	$10,000	$10,000
6.	Security Enclosure	LS	1	$20,000	$20,000
7.	Surface Restoration	AC	0.1	$50,000	$5,000
8.	Construction Survey	LS	1	$5,000	$5,000
9.	Unidentified Miscellaneous Construction Items (10%)	LS	1	$16,000	$16,000
				Construction Subtotal	$260,000
			Construction Contingencies	10%	$26,000
				Total Opinion of Construction Cost	**$286,000**
Professional Services					
1.			Hydro-geologic Investigation Report	LS	$25,000
2.			Engineering Design/Bidding/Construction Services/Observation	LS	$52,000
3.			Legal, Fiscal and Administration	LS	$10,000
				Professional Services Subtotal	**$62,000**
				Total Opinion of Project Cost	**$348,000**

Opinions of Probable Cost provided for herein are to be made on the basis of SEH's experience and qualifications and represent SEH's best judgment. However, since SEH has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, SEH cannot and does not guarantee that proposals, bids, or actual construction cost will not vary from Opinions of Probable Cost prepared by SEH.

PRESENT WORTH CALCULATION

Project name: **Randolph Water System Study**

Alternative 1: **New Well to Provide Additional Water** **Federal Discount Rate =** **0.2%**

Annual Operation & Maintenance Costs	
Labor	$2,000
Utilities	$800
Maintenance	$900
Testing	$500
Other	$800
Total	**$5,000**

Salvage Value Calculation	
Construction Cost	$286,000
Useful Life (years)	50
Years Remaining	50
Total Salvage Value	**$286,000**

PRESENT VALUE OF OPERATION, MAINTENANCE & REPLACEMENT (O, M & R) COSTS

Year of repair replacement	O, M & R Item	discount rate conversion factor [2]	Cost of O, M & R Item in Today's Dollars	Present value
1	Annual O&M costs [1]	19.586	$5,000	$97,930
1		0.998		$0
2		0.996		$0
3		0.994		$0
4		0.992		$0
5		0.990		$0
6		0.988		$0
7		0.986		$0
8		0.984		$0
9		0.982		$0
10	Submersible Pump and VFD Servicing	0.980	$5,000	$4,901
11		0.978		$0
12		0.976		$0
13		0.974		$0
14		0.972		$0
15		0.970		$0
16		0.969		$0
17		0.967		$0
18		0.965		$0
19		0.963		$0
20		0.961		$0
20	Salvage Value [4]	(0.961)	$286,000	($274,797)
			Total Present Value of O, M, R & Salvage Value =	**-$171,965**
			plus Total Project Capital Cost [5] =	**$348,000**
			TOTAL PRESENT WORTH [6] =	**$176,035**

NOTES

1 The O&M costs are the annual recuring cost for 20 years

2 Uniform present value (UPV) =

$$UPV = Cost \times \frac{(1+i)^n - 1}{i(1+i)^n}$$ n = 20, i= interest rate

3 The conversion factor for present value of a cost that occurs in a specific year (SPV) =

$$SPV = Cost \times \frac{1}{(1+i)^n}$$ n = year, i= interest rate

4 Salvage Value is the value of the improvement(s) at end of study period (20 yrs) using straight line depreciation

5 Total Project Capital Cost is the total cost including construction, contingencies and non-construction costs

6 Total Present Worth is sum of Total Present Value of O, M, R and Salvage Value plus Total Project Capital Cost

Alternative 2: Water Plant Rehabilitation

ENGINEER'S BUDGETARY OPINION OF PROBABLE COST
Randolph Water System Study
Randolph, Iowa
SEH Project No. RANDO 172534

Date Prepared:
September, 2023

ESTIMATE OF QUANTITIES

Item #	Description	Unit	Quantity	Unit Price	Total
Construction					
1.	Mobilization/Bonds/Insurance (7%)	LS	1	$15,000	$15,000
2.	High Service Pumps	EA	2	$30,000	$60,000
3.	Well #3 Pump VFD	LS	1	$6,000	$6,000
4.	Well Failure Alarm - Well #3	LS	1	$3,000	$3,000
5.	Replacement of Sand Media in Pressure Filters	EA	2	$15,000	$30,000
6.	Masonry Tuckpointing	LS	1	$20,000	$20,000
7.	Flow Meter Calibration	EA	2	$5,000	$10,000
8.	Emergency Backup Generator	LS	1	$70,000	$70,000
9.	Unidentified Miscellaneous Construction Items (10%)	LS	1	$14,000	$14,000
				Construction Subtotal	$228,000
			Construction Contingencies	10%	$23,000
				Total Opinion of Construction Cost	$251,000
Professional Services					
1.	Engineering Design/Bidding/Construction Services/Observation			LS	$46,000
2.	Legal, Fiscal and Administration			LS	$5,000
				Professional Services Subtotal	**$51,000**
				Total Opinion of Project Cost	**$302,000**

Opinions of Probable Cost provided for herein are to be made on the basis of SEH’s experience and qualifications and represent SEH’s best judgment. However, since SEH has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor’s methods of determining prices, or over competitive bidding or market conditions, SEH cannot and does not guarantee that proposals, bids, or actual construction cost will not vary from Opinions of Probable Cost prepared by SEH.

PRESENT WORTH CALCULATION

Project name: Randolph Water System Study

Alternative 2: Water Plant Rehabilitation

Federal Discount Rate = 0.2%

Annual Operation & Maintenance Costs		
Labor		$0
Utilities		$0
Maintenance		$0
Testing		$0
Other		$300
Total		**$300**

Salvage Value Calculation	
Construction Cost	$251,000
Useful Life (years)	50
Years Remaining	50
Total Salvage Value	**$251,000**

PRESENT VALUE OF OPERATION, MAINTENANCE & REPLACEMENT (O, M & R) COSTS

Year of repair replacement	O, M & R Item	discount rate conversion factor [2]	Cost of O, M & R Item in Today's Dollars	Present value
1	Annual O&M costs [1]	19.586	$300	$5,876
1		0.998		$0
2		0.996		$0
3		0.994		$0
4		0.992		$0
5		0.990		$0
6		0.988		$0
7		0.986		$0
8		0.984		$0
9		0.982		$0
10	Submersible Pump and VFD Servicing	0.980	$5,000	$4,901
11		0.978		$0
12		0.976		$0
13		0.974		$0
14		0.972		$0
15		0.970		$0
16		0.969		$0
17		0.967		$0
18		0.965		$0
19		0.963		$0
20	Ion Exchange Resin Replacement	0.961	$2,000	$1,922
20	Salvage Value [4]	(0.961)	$251,000	($241,168)
			Total Present Value of O, M, R & Salvage Value =	**-$228,469**
			plus Total Project Capital Cost [5] =	**$302,000**
			TOTAL PRESENT WORTH [6] =	**$73,531**

NOTES

1 The O&M costs are the annual recuring cost for 20 years

2 Uniform present value (UPV) =

$$UPV = Cost \times \frac{(1+i)^n - 1}{i(1+i)^n}$$ n = 20, i= interest rate

3 The conversion factor for present value of a cost that occurs in a specific year (SPV) =

$$SPV = Cost \times \frac{1}{(1+i)^n}$$ n = year, i= interest rate

4 Salvage Value is the value of the improvement(s) at end of study period (20 yrs) using straight line depreciation

5 Total Project Capital Cost is the total cost including construction, contingencies and non-construction costs

6 Total Present Worth is sum of Total Present Value of O, M, R and Salvage Value plus Total Project Capital Cost

Alternative 3a: New Elevated Water Storage Tank

ENGINEER'S BUDGETARY OPINION OF PROBABLE COST
Randolph Water System Study
Randolph, Iowa
SEH Project No. RANDO 172534

Date Prepared:
September, 2023

SEH

ESTIMATE OF QUANTITIES

Item #	Description	Unit	Quantity	Unit Price	Total
Construction					
1.	Mobilization, Design, and Tank Foundation	LS	1	$200,000	$200,000
2.	New Elevated Storage Tank, Fabrication, Erection, and Other Site Work	LS	1	$300,000	$300,000
3.	Surface Preparation and Coating	LS	1	$90,000	$90,000
4.	Connection to Existing Water System	LS	1	$22,500	$22,500
5.	Unidentified Miscellaneous Construction Items (10%)	LS	1	$42,000	$42,000
				Construction Subtotal	$654,500
			Construction Contingencies	10%	$66,000
				Total Opinion of Construction Cost	**$720,500**
Professional Services					
1.	Geotechnical Investigation and Report	LS			$20,000
2.	Engineering Design/Bidding/Construction Services/Observation	LS			$130,000
3.	Legal, Fiscal and Administration	LS			$2,500
4.	Land Acquisition	LS			$10,000
				Professional Services Subtotal	**$162,500**
				Total Opinion of Project Cost	**$883,000**

Opinions of Probable Cost provided for herein are to be made on the basis of SEH's experience and qualifications and represent SEH's best judgment. However, since SEH has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, SEH cannot and does not guarantee that proposals, bids, or actual construction cost will not vary from Opinions of Probable Cost prepared by SEH.

PRESENT WORTH CALCULATION

Project name: Randolph Water System Study

Alternative 3a: New Elevated Water Storage Tank

Federal Discount Rate = 0.2%

Annual Operation & Maintenance Costs	
Labor	$0
Utilities	$200
Maintenance	$0
Testing	$0
Other	$0
Total	**$200**

Salvage Value Calculation	
Construction Cost	$720,500
Useful Life (years)	50
Years Remaining	50
Total Salvage Value	**$720,500**

PRESENT VALUE OF OPERATION, MAINTENANCE & REPLACEMENT (O, M & R) COSTS

Year of repair replacement	O, M & R Item	discount rate conversion factor [2]	Cost of O, M & R Item in Today's Dollars	Present value
1	Annual O&M costs [1]	19.586	$200	$3,917
1		0.998		$0
2		0.996		$0
3		0.994		$0
4		0.992		$0
5		0.990		$0
6		0.988		$0
7		0.986		$0
8		0.984		$0
9		0.982		$0
10		0.980		$0
11		0.978		$0
12		0.976		$0
13		0.974		$0
14		0.972		$0
15		0.970		$0
16		0.969		$0
17		0.967		$0
18		0.965		$0
19		0.963		$0
20	Sandblasting and Recoating	0.961	$200,000	$192,166
20	Salvage Value [4]	(0.961)	$720,500	($692,276)
			Total Present Value of O, M, R & Salvage Value =	**-$496,194**
			plus Total Project Capital Cost [5] =	**$883,000**
			TOTAL PRESENT WORTH [6] =	**$386,806**

NOTES

1 The O&M costs are the annual recuring cost for 20 years

2 Uniform present value (UPV) =

$$UPV = Cost \times \frac{(1+i)^n - 1}{i(1+i)^n}$$

n = 20, i= interest rate

3 The conversion factor for present value of a cost that occurs in a specific year (SPV) =

$$SPV = Cost \times \frac{1}{(1+i)^n}$$

n = year, i= interest rate

4 Salvage Value is the value of the improvement(s) at end of study period (20 yrs) using straight line depreciation

5 Total Project Capital Cost is the total cost including construction, contingencies and non-construction costs

6 Total Present Worth is sum of Total Present Value of O, M, R and Salvage Value plus Total Project Capital Cost

Alternative 3b: Water Tower Rehabilitation

ENGINEER'S BUDGETARY OPINION OF PROBABLE COST
Randolph Water System Study
Randolph, Iowa
SEH Project No. RANDO 172534

Date Prepared:
September, 2023

ESTIMATE OF QUANTITIES

Item #	Description	Unit	Quantity	Unit Price	Total
Construction					
1.	Mobilization/Bonds/Insurance (7%)	LS	1	$43,000	$43,000
2.	Tower Inspection with Report	LS	1	$7,500	$7,500
3.	Tower Rehabilitation	LS	1	$50,000	$50,000
4.	Hydropneumatic Tank	LS	1	$225,000	$225,000
5.	Building for Hydropneumatic Tank and Pumps	LS	1	$225,000	$225,000
6.	Miscellaneous Piping and Fittings	LS	1	$21,250	$21,250
7.	Unidentified Miscellaneous Construction Items (10%)	LS	1	$53,000	$53,000
				Construction Subtotal	$624,750
			Construction Contingencies	10%	$63,000
				Total Opinion of Construction Cost	**$687,750**
Professional Services					
1.	Engineering Design/Bidding/Construction Services/Observation			LS	$124,000
2.	Legal, Fiscal and Administration			LS	$2,500
				Professional Services Subtotal	**$126,500**
				Total Opinion of Project Cost	**$814,250**

Opinions of Probable Cost provided for herein are to be made on the basis of SEH's experience and qualifications and represent SEH's best judgment. However, since SEH has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, SEH cannot and does not guarantee that proposals, bids, or actual construction cost will not vary from Opinions of Probable Cost prepared by SEH.

PRESENT WORTH CALCULATION

Project name: Randolph Water System Study

Alternative 3b: Water Tower Rehabilitation

Federal Discount Rate = 0.2%

Annual Operation & Maintenance Costs	
Labor	$500
Utilities	$765
Maintenance	$200
Testing	$100
Other	$0
Total	**$1,565**

Salvage Value Calculation	
Construction Cost	$687,750
Useful Life (years)	50
Years Remaining	10
Total Salvage Value	**$137,550**

PRESENT VALUE OF OPERATION, MAINTENANCE & REPLACEMENT (O, M & R) COSTS

Year of repair replacement	O, M & R Item	discount rate conversion factor [2]	Cost of O, M & R Item in Today's Dollars	Present value
1	Annual O&M costs [1]	19.586	$1,565	$30,652
1		0.998		$0
2		0.996		$0
3		0.994		$0
4		0.992		$0
5		0.990		$0
6		0.988		$0
7		0.986		$0
8		0.984		$0
9		0.982		$0
10	Sandblasting and Recoating	0.980	$200,000	$196,044
11		0.978		$0
12		0.976		$0
13		0.974		$0
14		0.972		$0
15		0.970		$0
16		0.969		$0
17		0.967		$0
18		0.965		$0
19		0.963		$0
20	Ion Exchange Resin Replacement	0.961	$2,000	$1,922
10	Salvage Value [4]	(0.980)	$137,550	($134,829)
			Total Present Value of O, M, R & Salvage Value =	**$93,789**
			plus Total Project Capital Cost [5] =	**$814,250**
			TOTAL PRESENT WORTH [6] =	**$908,039**

NOTES

1 The O&M costs are the annual recuring cost for 20 years

2 Uniform present value (UPV) =

$$UPV = Cost \times \frac{(1+i)^n - 1}{i(1+i)^n}$$ n = 20, i= interest rate

3 The conversion factor for present value of a cost that occurs in a specific year (SPV) =

$$SPV = Cost \times \frac{1}{(1+i)^n}$$ n = year, i= interest rate

4 Salvage Value is the value of the improvement(s) at end of study period (20 yrs) using straight line depreciation

5 Total Project Capital Cost is the total cost including construction, contingencies and non-construction costs

6 Total Present Worth is sum of Total Present Value of O, M, R and Salvage Value plus Total Project Capital Cost

Alternative 4: Replace Existing Water Main on Randolph Street

ENGINEER'S BUDGETARY OPINION OF PROBABLE COST
Randolph Water System Study
Randolph, Iowa
SEH Project No. RANDO 172534

Date Prepared:
September, 2023

SEH

ESTIMATE OF QUANTITIES

Item #	Description	Unit	Quantity	Unit Price	Total
Construction					
1.	Mobilization/Bonds/Insurance (7%)	LS	1	$34,000	$34,000
2.	Removals	LS	1	$15,000	$15,000
3.	6" PVC Water Main, DR 18	LF	3,600	$60	$216,000
4.	Hydrant Assembly	EA	7	$7,000	$49,000
5.	6" Gate Valve and Box, MJ	EA	6	$3,000	$18,000
6.	Reconnect Existing Water Service with 3/4" PE	EA	27	$2,500	$67,500
7.	Miscellaneous System Connection/Fittings	LS	1	$13,500	$13,500
8.	Sealcoat Pavement Restoration	SY	3,600	$10.00	$36,000
9.	Subbase Stabilization	TONS	135	$40	$5,400
10.	Turf Surface Restoration/Erosion Control	LS	1	$10,000	$10,000
11.	Temporary Traffic Control	LS	1	$6,000	$6,000
12.	Construction Survey (1%)	LS	1	$5,000	$5,000
13.	Unidentified Miscellaneous Construction Items (10%)	LS	1	$44,000	$44,000
				Construction Subtotal	$519,400
			Construction Contingencies	10%	$52,000
				Total Opinion of Construction Cost	**$571,400**
Professional Services					
1.	Engineering Design/Bidding/Construction Services/Observation			LS	$103,000
2.	Legal, Fiscal and Administration			LS	$5,000
				Professional Services Subtotal	**$108,000**
				Total Opinion of Project Cost	**$679,400**

Opinions of Probable Cost provided for herein are to be made on the basis of SEH's experience and qualifications and represent SEH's best judgment. However, since SEH has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, SEH cannot and does not guarantee that proposals, bids, or actual construction cost will not vary from Opinions of Probable Cost prepared by SEH.

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Alternative 5: Replace Remaining Cast Iron with 6" PVC

ENGINEER'S BUDGETARY OPINION OF PROBABLE COST
Randolph Water System Study
Randolph, Iowa
SEH Project No. RANDO 172534

Date Prepared:
September, 2023

SEH

ESTIMATE OF QUANTITIES

Item #	Description	Unit	Quantity	Unit Price	Total
Construction					
1.	Mobilization/Bonds/Insurance (7%)	LS	1	$82,000	$82,000
2.	Removals	LS	1	$15,000	$15,000
3.	8" PVC Water Main, DR 18	LF	100	$80	$8,000
4.	6" PVC Water Main, DR 18	LF	7,900	$60	$474,000
5.	Hydrant Assembly	EA	24	$7,000	$168,000
6.	6" Gate Valve and Box, MJ	EA	24	$3,000	$72,000
7.	Reconnect Existing Water Service with 3/4" PE	EA	58	$2,500	$145,000
8.	Miscellaneous System Connection/Fittings	LS	1	$15,000	$15,000
9.	Sealcoat Pavement Restoration	SY	12,000	$10	$120,000
10.	Subbase Stabilization	TONS	150	$40	$6,000
11.	Turf Surface Restoration/Erosion Control	LS	1	$10,000	$10,000
12.	Temporary Traffic Control	LS	1	$6,000	$6,000
13.	Construction Survey (1%)	LS	1	$15,000	$15,000
14.	Unidentified Miscellaneous Construction Items (10%)	LS	1	$104,000	$104,000
				Construction Subtotal	**$1,240,000**
			Construction Contingencies	10%	$124,000
				Total Opinion of Construction Cost	**$1,364,000**
Professional Services					
1.	Engineering Design/Bidding/Construction Services/Observation	LS			$246,000
2.	Legal, Fiscal and Administration	LS			$20,000
				Professional Services Subtotal	**$266,000**
				Total Opinion of Project Cost	**$1,630,000**

Opinions of Probable Cost provided for herein are to be made on the basis of SEH's experience and qualifications and represent SEH's best judgment. However, since SEH has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, SEH cannot and does not guarantee that proposals, bids, or actual construction cost will not vary from Opinions of Probable Cost prepared by SEH.

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Alternative 6: Replace Old Water Meters

ENGINEER'S BUDGETARY OPINION OF PROBABLE COST					
Randolph Water System Study					
Randolph, Iowa			Date Prepared:		
SEH Project No. RANDO 172534			September, 2023		
ESTIMATE OF QUANTITIES					
Item #	**Description**	**Unit**	**Quantity**	**Unit Price**	**Total**
Construction					
1.	New Sensus IPERL Water Meter, Installed	EA	92	$500	$46,000
2.	Miscellaneous System Connections/Fittings	EA	92	$100	$9,200
				Construction Subtotal	$55,200
			Construction Contingencies	10%	$6,000
				Total Opinion of Construction Cost	**$61,200**
Professional Services					
1.	Engineering Design/Bidding/Construction Services/Observation	LS			$12,000
				Professional Services Subtotal	**$12,000**
				Total Opinion of Project Cost	**$73,200**

Opinions of Probable Cost provided for herein are to be made on the basis of SEH's experience and qualifications and represent SEH's best judgment. However, since SEH has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, SEH cannot and does not guarantee that proposals, bids, or actual construction cost will not vary from Opinions of Probable Cost prepared by SEH.

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