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June 8, 2022

Water System Study

City of Montrose, MN

0W1.123744

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Certification

Water System Study

For

City of Montrose, MN

0W1.125362

June 2022

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

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Date: 6-8-2022

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I. INTRODUCTION

A. Background

The water supply and treatment system in Montrose consists of two elevated storage tanks and three municipal wells, No. 4, No. 5, and No. 6. The raw water is currently treated by chlorine disinfection, fluoridation, and polyphosphate. Raw water from all three wells exceeds the Minnesota Department of Health (MDH) health-based recommended value of 0.1 mg/L of manganese or less.

B. Purpose and Scope

The City of Montrose has engaged Bolton & Menk to evaluate the existing water supply and explore treatment options for the high level of manganese present in the water.

The purpose of this Drinking Water Study is to provide the City of Montrose with necessary information regarding existing water supply, storage, and treatment. The City of Montrose can utilize the information gathered here to establish priorities, plan, fund, and implement future water system improvements. This report will look at the current and projected future water supply, demand, treatment, and distribution. This report will review the current and potential future drinking water standards and evaluate the options which the city can utilize to continue to meet those standards. This report will provide a roadmap of how the city has provided safe drinking water to its customers, and how it can continue to do so in the future.

C. Water Demand Projection

Drinking water demand projections are based on historical population and historical water data. An estimate of average day and maximum day water demand will be 276,000 gpd and 607,000 gpd respectively in 2045.

D. Source, Supply, and Capacity Evaluation

The existing water supply and treatment system in Montrose consists municipal wells No. 4, No. 5, and No. 6. Wells No. 4 and No. 5 are located in well house No. 2, while well No. 6 in well house No. 3.

All the wells draw from the Quaternary Buried Artesian aquifer to provide the city with drinking water. The total well capacity is 1,560,000 gpd. Firm well capacity is 960,000 gpd. Firm well capacity is considered as the total available delivery rate with the largest well out of service. Capacity is expected to be sufficient through 2045.

Section III provides an evaluation of the existing system capacity.

E. Existing Water Quality

The raw water drawn from the existing wells is of poor quality but does not violate EPA primary drinking water standards. High concentrations of manganese are the main concern, with measured values averaging over 0.8 mg/L. Manganese occurs naturally in rocks and soils across Minnesota and is commonly found in Minnesota ground and surface water. Manganese can stain plumbing black and may pose a health risk to sensitive populations.

Section IV evaluates the existing water quality.

F. Water Treatment Options

Manganese removal is the priority contaminant for removal in this analysis due to MDH 2020 health-based guidance. The new guidance sets a secondary maximum concentration level of 0.05 mg/L. This guidance was implemented because of the potential adverse health effects due to chronic exposure of Manganese from drinking water.

Further discussion on the current treatment of drinking water can be found in Section V.

G. Water Storage

The city has 300,000 gallons of storage which is split between the two elevated storage tanks, tank No. 1 is 50,000 gallons and tank No. 2 is 250,000 gallons. Tank No 1. was built in 1930 and maintenance is expected to be expensive since the tower coating is suspected to be lead based. Therefore, replacement of Tower No.1 with a new 250,000-gallon storage tank should be considered to compensate for future demands. Tank No. 2 was constructed in 1967.

H. Water Distribution

Water mains in the City of Montrose range in size from 4” to 12” diameter. The current distribution system provides adequate pressure for everyday demand but would have a difficult time moving the large amounts of water required for a fire emergency. All future constructed mains should be at least 8 inches in diameter to account for fire emergencies.

I. Water Treatment Plant and Water Source Wells

Montrose does not currently have a water treatment facility. The city performs chemical addition to the raw well water before it is pumped to the distribution system. To adequately remove manganese from the raw water, the City of Montrose will need to construct a water treatment facility. The treatment plant would allow for manganese removal and the ability to improve other secondary standards such as iron and hardness.

J. Staffing Review and Analysis

Staffing for the current water system includes three employees. Each employee works part time on the water system. Total time allocated from the employees for the water system is equivalent to one full time employee.

II. WATER DEMAND PROJECTION

A reliable estimate of the quantity of water required for residential, commercial, and industrial uses within the city water system service area must be made before the system can be designed to transport, treat, and distribute these flows. The development of future water requirements is based on several factors including past population trends, future population projections, water use trends, water quality, and water system capacity. These factors are reviewed to develop and estimate future water requirements. City documents and records provided the primary data for the evaluation.

A. Population Review

There is a close relationship between the population of a community and total water consumption volumes. Future water sales can be expected to generally reflect future changes in the service area population. Similarly, commercial, public, and industrial water consumption will also tend to vary proportionately with the observed population growth of the city.

1. Service Area

The City of Montrose is located 35 miles west of Minneapolis along US highway 12 in Wright County. The city has an area of 3.2 square miles (2054 acres) and a 2020 population of 3,775 people.

The existing water system is shown in Figure 2.1.

2. Planning Period

It is generally not feasible to make frequent changes to the capacity of supply, storage, treatment, or distribution of water for a municipality. Typically, infrastructure and facilities are designed for a 20-year period. The planning period used in this study ends the year 2045. Population is the primary basis of determining future municipal flows.

3. Population Trends and Projections

The population of Montrose has grown over the last 10 years. The Minnesota State Demographer provides population estimates for counties, cities, and townships between the decennial census years. Although the State Demographer does not provide projections for cities or townships, projections can be extrapolated to the city level using the U.S. Census State Demographer data. Using the Wright County population projections and the historical percentage represented by Montrose, a linear regression was used to estimate the future population of Montrose through the design year. This method aligns with the Montrose Comprehensive Plan's conservatively low population estimate.

Population projections for the City of Montrose are summarized in Table 2.1 and presented graphically in Figure 2.2.

Watermain System Map

City of Montrose, Minnesota

Figure 2.1

January 2022

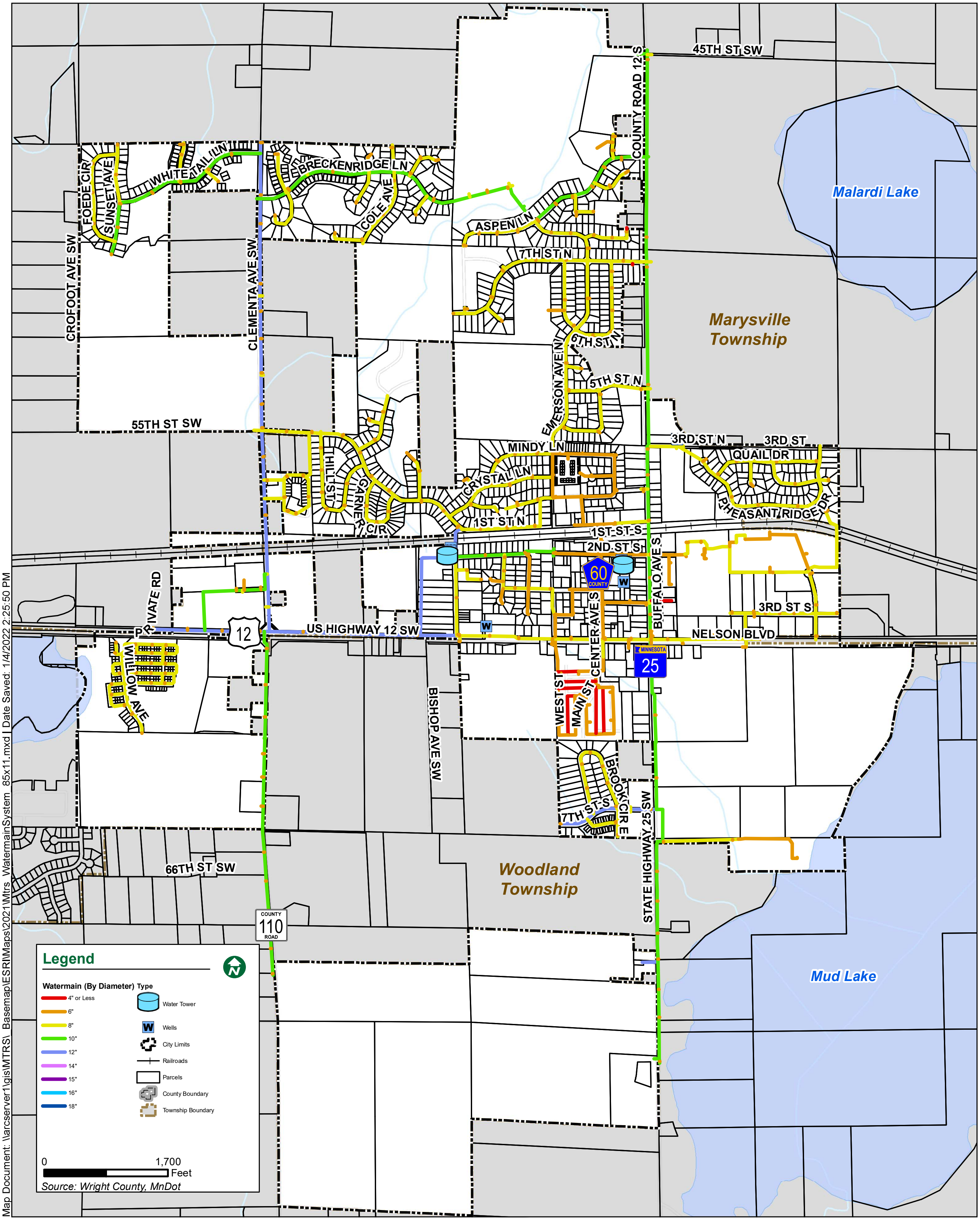


Table 2.1: Population Projections	
Year	City of Montrose
2010	2,847
2015	3,110
2020	3,775
2025	3,963*
2030	4,148*
2035	4,320*
2040	4,479*
2045	4,626*
***Population projected as % of County**	

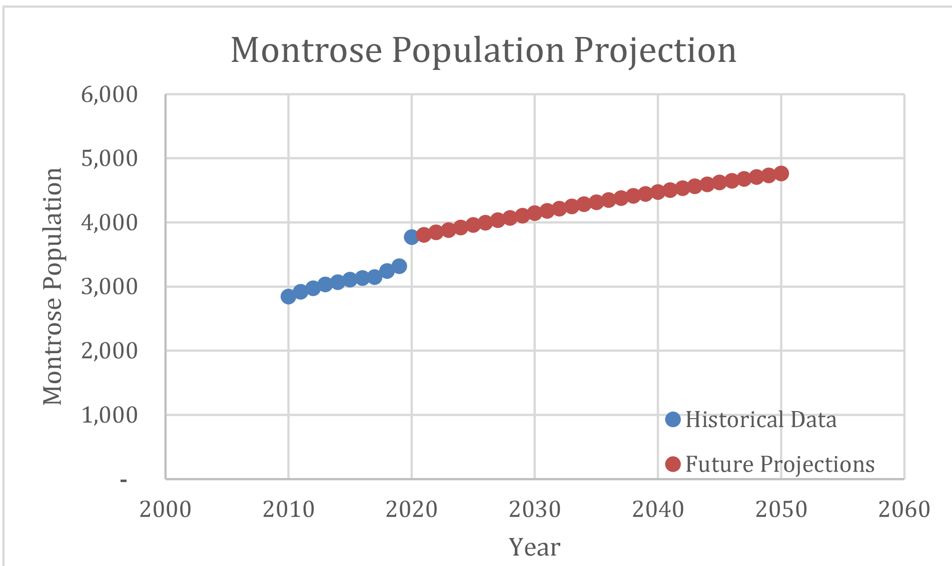


Figure 2.2: City of Montrose Population Trend and Projections

B. Water Supplied

A water pumpage and consumption review can provide insight into the past development of a water system and water utilization trends. Pumpage represents the quantity of water which is appropriated from the supply source and delivered into the production and distribution facilities. Consumption represents the quantity of water utilized by utility customers. In the following subsection, the material, pumpage, and consumption information is reviewed and evaluated to aid in estimating future water requirements.

1. Water Pumped History

Pumping data was obtained from Montrose Monthly Operating Reports (MORs) and the DNR Permit and Reporting System (MPARS) for the public water supply Appropriations Permit Number 1984-3186.

Table 2.2 and 2.3 summarize historical raw water pumpage for Montrose on a total yearly and maximum daily basis. Table 2.4 summarizes average historical raw water pumpage for the city on a monthly and yearly basis. An average of 72.3 million gallons (MG) per year or about 0.40 million gallons per day (MGD) was pumped by the city. The maximum raw water pumped in one day was 0.46 MGD on July 5, 2020.

Table 2.2: Historical Total Yearly Pumpage

Year	Total Water Pumped to the City (gallons per year)					
	Well 2	Well 3	Well 4	Well 5	Well 6	Total
2016	24,725,000	-	22,206,000	21,883,000	N/a	68,814,000
2017	27,111,000	-	22,035,000	23,136,000	N/a	72,282,000
2018	23,653,000	-	21,379,000	27,255,000	N/a	72,287,000
2019	24,565,000	-	19,935,000	23,856,000	N/a	68,356,000
2020	5,427,000	-	34,698,000	33,495,000	5,950,130	79,570,130
Average	**21,096,200**	**-**	**24,050,600**	**25,925,000**	**5,950,130**	**72,261,826**

Table 2.3: Historical Maximum Daily Well Pumpage

Year	Max Day (Gallons per day)				
	Well House 1 (Wells 2 and 3)	Well House 2 (Wells 4 and 5)	Well House 3 (Well 6)	Total	Peak Day Date
2016	232,000	143,000	0*	375,000	**July 3rd**
2017	211,000	198,000	0*	409,000	**June 4th**
2018	269,000	171,000	0*	440,000	**June 7th**
2019	143,000	166,000	0*	309,000	**June 16th**
2020	0*	455,000	172,720	455,000	**July 5th**
5-yr Max Day				**455,000**	

* Well house 1 demolished in October 2020. Well house 3 began operation in October 2020.

Table 2.4: Average Daily Water Pumpage (gallons per day)					
Month	**2016**	**2017**	**2018**	**2019**	**2020**
January	166,355	166,355	174,258	164,226	167,323
February	161,000	161,679	160,429	164,893	165,724
March	160,806	160,806	169,355	162,387	171,161
April	173,100	174,900	173,000	167,733	198,333
May	209,613	215,226	247,387	219,581	244,323
June	221,467	267,400	223,933	226,933	312,767
July	261,161	300,903	259,129	217,452	309,161
August	219,548	221,097	267,387	218,516	280,935
September	180,733	211,633	208,567	193,433	225,433
October	169,355	169,839	166,097	174,613	188,644
November	162,867	156,833	160,233	168,400	171,720
December	168,000	166,806	162,290	167,226	171,245
Annual Average	**188,016**	**198,033**	**198,047**	**187,277**	**217,405**
5-yr Average	**197,756**				

2. Historical Peaking Factor

A maximum day peaking factor for a water system is the ratio of the peak-day water demand to the average-day water demand. Peaking factors are a useful way to help determine an actual temporal change in water demand. If water usage increases during a specific time of year, for example because of summer irrigation, then peaking factors will be similarly large each year. However, if there are watermain breaks or other distribution issues, peaking factors may vary significantly from year to year and may not occur during the same season. Typical maximum day peaking factors range from 1.5 to 3.0. Smaller cities tend to have higher peaking factors due to summer peaks when irrigation and recreational activities increase water usage and there are no large industrial users to balance the summer peaks.

Table 2.5 presents the historical peaking factor for Montrose between the years 2016-2020. The peak days occurred in June and July which is a good indication the peaking factors are seasonal due to summer irrigation and recreation.

Table 2.5: Historical Annual Peak Water Pumpage			
Year	**Average Day Pumpage (gpd)**	**Peak Day (gpd)**	**Peaking Factor**
2016	188,016	375,000	1.99
2017	198,033	409,000	2.07
2018	198,047	440,000	2.22
2019	187,277	309,000	1.65
2020	217,405	455,000	2.09
Average	**197,756**	**---**	**2.22**
Maximum	**---**	**455,000**	

3. Per Capita Water Usage

The historical per capita water usage can be derived from previous information about population and water usage. The historical per capita water usage for Montrose has ranged from 56.4 to 135.5 gallons per capita per day (gpcd), with a five-year average of 59.6 gpcd, as can be seen in Table 2.6 and 2.7. Per capita values will be used to project future water usage.

Table 2.6: Average Per Capita Water Consumption

Year	Montrose Population	Average Raw Water Demand (gpd)	Average Gallons per Capita per Day
2016	3,136	188,016	60.0
2017	3,151	198,033	62.8
2018	3,247	198,047	61.0
2019	3,320	187,277	56.4
2020	3,775	217,405	57.6
	Average	**197,756**	**59.6**

Table 2.7: Max Per Capita Water Consumption

Year	Montrose Population	Peak Raw Water Demand (gpd)	Gallons per Capita per Day
2016	3,136	375,000	119.6
2017	3,151	409,000	129.8
2018	3,247	440,000	135.5
2019	3,320	309,000	93.1
2020	3,775	455,000	120.5
	Average	**397,000**	**119.7**

4. Waverly Water Usage

Waverly is a neighboring community with similar water quality concerns as Montrose. The population of Waverly was 1,609 people in 2019 and is expected to pump 30 million gallons in 2021. The two cities may benefit from regionalization.

C. Future Water Requirements

Average day demand and peak day demand are important to the design of water treatment facilities. Maximum hour demand seldom lasts longer than a few hours, and the impact is primarily felt in the distribution and storage systems. Using the 2045 population projections and the current per capita usage, the predicted average demand in 2045 would be 276,000 gpd. Using the 2.2 peaking factor gives an estimated maximum demand of 607,000 gpd for 2045.

1. Demand Distribution

Water demands at any potable water facility are variable. Demands vary throughout the day and throughout the year. Annually in Minnesota and other midwestern states, heaviest water demand occurs during the summer months when irrigation increases and recreational activities like swimming increase water usage.

Water demand varies by season and fluctuates throughout the day. Commercial and industrial users are typically more consistent and predictable regarding daily uses since industries follow strict operating hours. Residential demands are less predictable and do not naturally follow strict schedules. Typical residential demands increase after daybreak, often peaks by late afternoon when lawn watering, meal preparation, and laundering occurs, then decreases during the evening hours.

Due to the variability in demand, a minimum firm capacity of water supply should be equal to the peak day demand. This is a recommendation of the Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers in the Recommended Standards for Water Works (commonly referred to as Ten States Standards). The Minnesota Department of Natural Resources (DNR) requires water supply design meet these standards. The City of Montrose has a current firm well capacity greater than the predicated maximum demand in 2045, so the city currently meets the recommendations.

Storage tanks are used to help supplement the water supply during peak demand. Potable water storage is also useful to supply water during a fire. When water demand is low, typically early morning, excess water is produced and stored. If demand exceeds the production rate, the stored water can make up the supply deficit. The storage tank will again fill once demand lowers, and the storage cycle continues.

2. Average Day Demand

Average day demand is the total quantity of water required annually divided by 365 days. The average day demand for the City of Montrose was computed by the design year population and the historic per capita water usage.

$$\text{Montrose 2045 } Average\ Day\ Demand = Design\ Year\ Population \cdot Design\ Year\ Usage$$

$$= 4{,}626\ persons \cdot 59.6\ gallons/person$$

$$= 275{,}750\ gallons\ per\ day\ (gpd)$$

3. Maximum Day Demand

Seasonal fluctuations in water usage are important factors in designing and sizing water supply and storage facilities. Maximum (peak) daily water demands usually occur during the summer months during hot days and when additional water is used for lawn irrigation, gardening, bathing, and industrial cooling. The maximum day demand is the amount of water pumped during a single day of the year with the highest water usage and is often expressed as a ratio of the annual average day pumpage. This ratio is known as a peaking factor. The maximum day pumpage is of particular importance to water system planning because water supply facilities are sized to meet this demand.

Yearly peaking factors for Montrose are presented in Table 2.5. From 2016-2020, the maximum peaking factor (ratio of maximum day to average day pumpage) was 2.2 (220%). This study projected future demand variations would resemble the variations observed over the historical analysis period. To evaluate future water supply and storage needs, a peaking factor of 2.2 was used for this study.

$$\begin{aligned} Montrose\ 2045\ Maximum\ Day\ Demand &= Design\ Year\ Population\ \cdot Design\ Year\ Usage \cdot PF \\ &= 4{,}626\ persons \cdot 59.6\ gallons/person * 2.2 \\ &= 607{,}000\ gallons\ per\ day\ (gpd) \end{aligned}$$

III. WATER SOURCE, TREATMENT, AND CAPACITY EVALUATION

A. Water Supply

The City of Montrose currently obtains raw water from three active wells. Water sources, supply capacity, quality, distribution, treatment, and storage will be evaluated in this section. In Section II the average day and maximum day demand for the city water supply system is projected to be 275,750 gpd and 607,000 gpd by the year 2045, which is capable of being met with the existing wells.

B. Raw Water Sources

The well depths range from 150-200 feet, drawing from the Quaternary Buried Artesian aquifer of the North Fork Crow River watershed. The raw water sources are summarized in Table 3.1.

Table 3.1: Raw Water

Well Name	Unique Well #	Year Installed	Aquifer	Pumping Capacity (gpm)	Depth (ft)
Well 2	235853	1975/sealed 2020	Quaternary Buried Artesian Aquifer	290	184
Well 3	149692	1978/converted to environmental well in 2020	Quaternary Buried Artesian Aquifer	300	181
Well 4	700302	2003	Quaternary Buried Artesian Aquifer	400	175
Well 5	700301	2003	Quaternary Buried Artesian Aquifer	400	175
Well 6	843402	2019	Quaternary Buried Artesian Aquifer	500	165
		Rated Total Capacity (wells 4, 5, and 6)		1,560,000 gpd	
		Rated Firm Capacity (wells 4, 5, and 6)		960,000 gpd	

1. Summary of Existing Supply Capacity

The design water supply capacity of the potable water system is about 1,300 gpm (1,560,000 gpd). The average historical pumping rate is about 198,000 gpd with a historical peak pumping rate of approximately 455,000 gpd. Total cumulative runtimes for the well pumps to achieve the average day demand is estimated to be 7.6 hours, and the total runtime for the well pumps to supply for peak day demand is an estimated 17.5 hours. It is occasionally necessary to take a pump out of service for periods of several days to several weeks for maintenance. Firm capacity is considered as the total available delivery rate with the largest pumping unit out of service. Thus, firm pumping capacity of the system is 800 gpm (960,000 gpd).

- Estimated Total Well Capacity: 1,200 gpm (1,440,000 gpd)
- Estimated Firm Capacity: 800 gpm (960,000 gpd)

The existing pumping capacity is expected to be sufficient through 2045 as both, the design year average day demand and maximum day demand, are below the firm capacity at 275,750 gpd and 607,000 gpd, respectively.

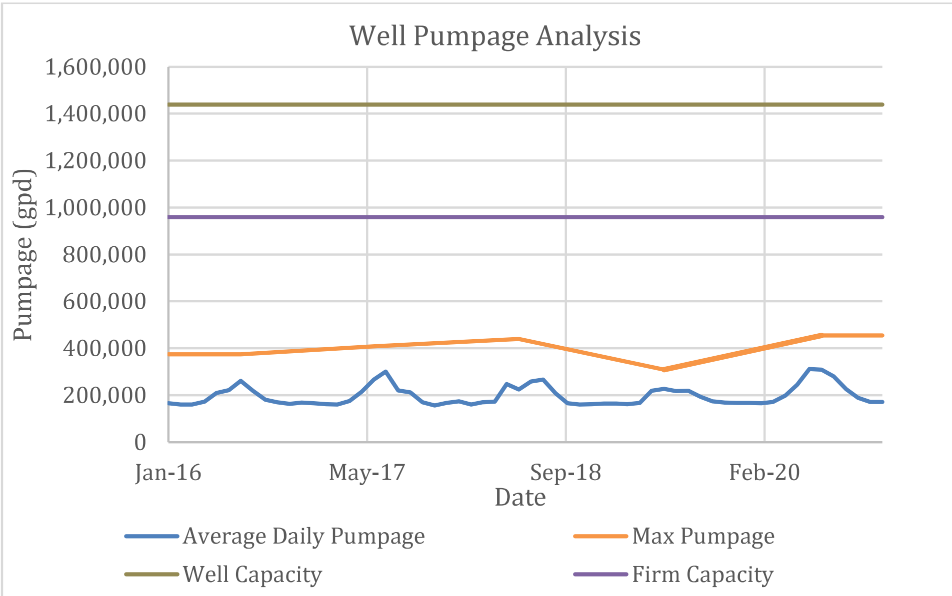


Figure 3.1: Well Pumpage Analysis

C. Water Quality

The raw water quality meets all EPA primary water standards but exceeds the MDH health-based value for concentration of manganese. Manganese is the main water quality concern; concentrations of manganese are listed in Table 3.2.

Table 3.2: Raw Water Well Manganese Concentrations

Well Name	Unique Well #	Aquifer	Average Manganese Concentration, mg/L
Well 4	700302	Quaternary Buried Artesian Aquifer	1.070
Well 5	700301	Quaternary Buried Artesian Aquifer	0.810
Well 6	843402	Quaternary Buried Artesian Aquifer	0.423

*Data from historical water testing for City of Montrose 2-5-2021

The manganese concentrations present in wells No. 4, 5, and 6 are high. The EPA has a secondary maximum contaminant level (SMCL) guideline for Manganese of 0.050 mg/L. The average concentration of manganese in all the city supply wells exceed the EPA SMCL.

D. Distribution System

Water mains in the City of Montrose range in size from 4 to 12 in diameter. The current distribution system provides adequate pressure for everyday demand but would have a difficult time moving the large amounts of water required for a fire emergency. As the system is improved, the city should upgrade water mains to a minimum of 8” to provide better fire protection.

The trunk watermains in the City of Montrose are in good locations, such as the 10” line on Buffalo Ave. As growth in the city occurs, it is recommended to loop the trunk watermain. This practice will minimize pressure loss during extreme events, such as fires and watermain breaks and provide excellent service to the citizens of Montrose.

E. Existing Treatment Evaluation

1. Capacity

Based on experience and historical demand, Montrose can pump sufficient water to residents through the design year 2045. The chemical feed system and well house facilities provide sufficient capacity to produce enough finished water.

2. Chemical Feed

Although the city can maintain current treatment, manganese concentrations are a problem for the existing treatment system. Manganese concentrations in each well exceed the EPA recommended standard of 0.05 mg/L. A centralized water treatment facility would allow the city to remove manganese prior to distribution, see Section IV for further details.

The chemical feed systems are maintained by the city and are repaired as needed. Chlorine, polyphosphate, and fluoride are added at the well houses before storage and distribution. Parts of the chemical systems should be replaced as necessary, including feed tubing, metering pumps or pump wear parts, and accessories. The city conducts pump inspections on a rotating basis. Chemical feed inspections should be conduct in conjunction pump inspections.

3. Well Houses

The City of Montrose has two operational well houses. Well house No. 3 was constructed in 2020 followed by the demolition of well house 1. Both, well house No. 2 and 3, are currently in good condition.

4. Electrical and Controls

The electrical SCADA system is anticipated to remain operating for the design period. The existing SCADA system would be fully integrated and updated as part of the new water treatment facility.

F. Finished Water Storage Evaluation

Water storage is used to provide a constant supply of water and pressure during variable demand conditions. During high demand periods, part of the demand can be met by storage reserves. During low demand conditions the high service pumps continue to operate, pumping the excess supply to the storage tanks for future demands. Storage is also used as an emergency water source in the case of supply failure such as power outage, intake repair, or raw water transmission main breaks or during a fire.

The total storage capacity for the City of Montrose is 300,000 gallons and is split between a 50,000-gallon elevated storage tank and a 250,000-gallon elevated storage tank. Additional storage may be needed to compensate for future demand and account for periods of high demand such as a fire emergency.

1. Condition

Tank No. 1 is in poor condition and is coated with lead based paint. The tank was constructed in 1930 and is rusting. This tank should be taken out of service and replaced with a higher capacity storage tank. Despite being built in 1967, tank No. 2 is in good condition and will continue to serve the community. The city should maintain inspections of water towers every 5 years and budget for a repaint every 20 years.

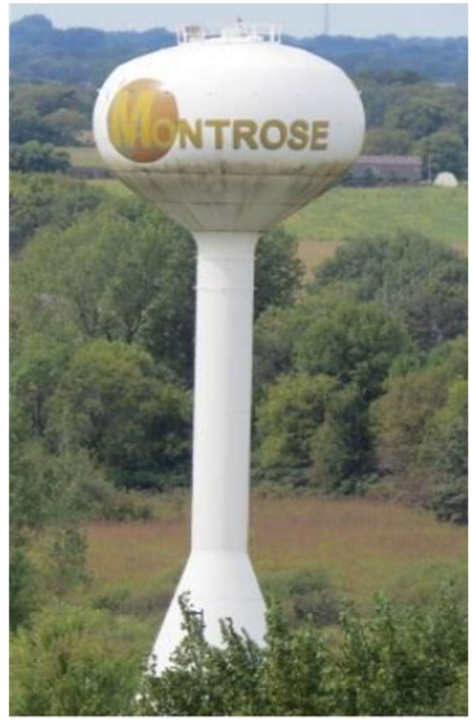


Figure 3.2 Photo of tower No. 1 on the left.
Figure 3.3 Photo of tower No. 2 on the right.

2. Capacity

The existing towers supply Montrose with 300,000 gallons of storage. Several criteria are used to determine the storage requirements for the system. The Ten States Standards has the following recommendations:

"Storage facilities should have sufficient capacity, as determined from engineering studies, to meet domestic demands, and where fire protection is provided, fire flow demands.

a) The minimum storage capacity (or equivalent capacity) for systems not providing fire protection shall be equal to the average daily consumption. This requirement may be reduced when the source and treatment facilities have sufficient capacity with standby power to supplement peak demands of the system.

b) Excess storage capacity should be avoided to prevent potential water quality deterioration problems.

c) Fire flow requirements established by the appropriate state Insurance Services Office should be satisfied where fire protection is provided."

Table 3.3: Water Storage Tanks			
Tank	**Constructed**	**Capacity (gallons)**	**Material**
Elevated Storage 1	1930	50,000	Steel
Elevated Storage 2	1967	250,000	Steel
Total Storage Capacity		**300,000**	

The Ten States Standards recommends having a minimum storage capacity of the average day demand. The current storage of 300,000 gallons is greater than current and projected average day demand. However, with the recommendation to decommission the 1930 tank, the city would only have 250,000 gallons. Average day demand is expected to exceed this by 2032. In this situation the water supply would be supplemented by drawing from additional wells or utilizing emergency connections. It is also recommended to have sufficient storage for fire needs. Fighting a fire at 3,000 gpm for 3 hours would require an additional 540,000 gallons of storage for a total of approximately 800,000 gallons of storage. A larger storage structure is needed for future growth and fire flow demands

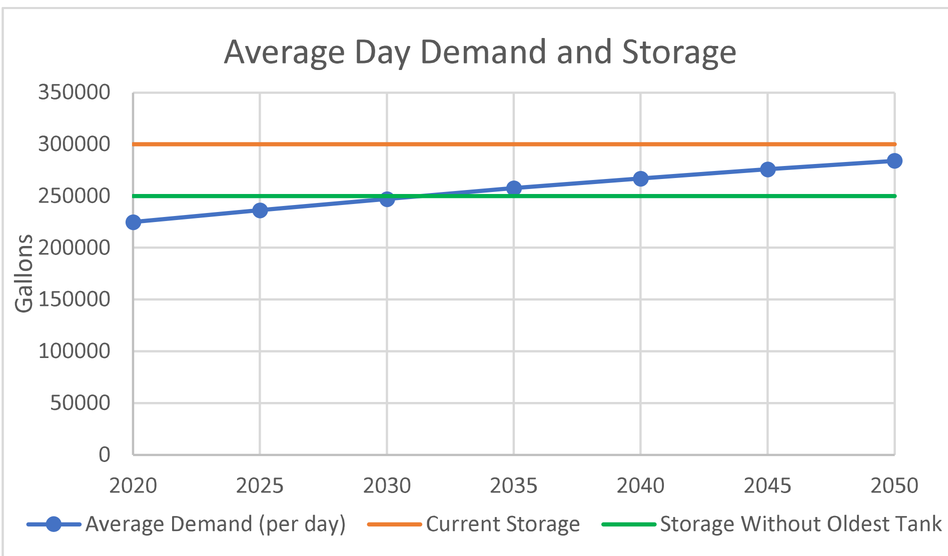


Figure 3.4 Average Day Demand versus Storage

3. Emergency Power

The new treatment plant will need emergency power from an appropriately sized generator.

IV. EVALUATION OF WATER QUALITY

A. Introduction

Due to the concern for safe drinking water, many federal and state agencies have instituted statutes which regulate drinking water quality. Finished water must be acceptable to the local community regarding taste, odor, hardness, and color. The Environmental Protection Agency (EPA) has recently been restricting the concentrations of contaminant such as nitrogen and phosphorus. The United States EPA provides guidelines for producing and supplying safe drinking water.

Included in this section are discussions related to raw water quality as well as water treatment rules and regulations. These treatment regulations assist in identifying water treatment objectives which are used in evaluating water treatment. Discussions are presented to evaluate the existing raw water quality and the state and federal regulations impacting the Montrose Water Treatment Facility.

B. Existing Raw Water Quality

The raw water of City of Montrose is supplied by three wells. The water quality from these wells meets all primary EPA drinking water standards but does have high levels of Manganese. Manganese can cause adverse health effects, especially in infants.

Table 4.1: Raw Water Well Manganese Concentrations

Well Name	Unique Well #	Aquifer	Average Manganese Concentration, mg/L
Well 4	700302	Quaternary Buried Artesian Aquifer	1.070
Well 5	700301	Quaternary Buried Artesian Aquifer	0.810
Well 6	843402	Quaternary Buried Artesian Aquifer	0.423

C. Federal and State Rules Summary

The United States Environmental Protection Agency (EPA) has established basic water quality rules to protect public health. The Minnesota Department of Health is used to enforce the water quality rules.

Relevant rules and regulations include:

- Safe Drinking Water Act (SDWA)
- National Primary Drinking Water Regulations (NPDWRs)
- Stage 1 and Stage 2 Disinfectants and Disinfection By-Products Rules (DBPRs)
- Revised Total Coliform Rule (RTCR)
- Radionuclide Rule
- Drinking Water Contaminant Candidate List (CCL)
- Secondary Drinking Water Standards

This report focuses on evaluating the water quality as it pertains to the primary and secondary drinking water standards.

1. Safe Drinking Water Act (SDWA)

   Through the passage of the Safe Drinking Water Act (SDWA) in 1974, the U.S. Congress authorized the United States Environmental Protection Agency (EPA) to establish drinking water regulations which apply to all public water systems in the United States. State governments are responsible for implementing and enforcing the Act's provisions through the health departments and environmental agencies.

   Under the SDWA, the EPA initially proposed the National Interim Primary Drinking Water Regulations (NIPDWR). The regulations were referred to as "interim" because the regulations were to be revised upon further research and special studies. The interim regulations were adopted as the National Primary Drinking Water Regulations (NPDWRs) upon the passage of the 1986 Amendments to the SDWA. There were 83 contaminants to be regulated at that time.

   Changes were made to the SDWA by the 1996 amendments. These amendments retained most of what the NPDWRs previously enacted. The 1996 amendments did change the process for selecting contaminants to be regulated and did mandate new rules regarding arsenic, uranium, radon, and groundwater disinfection. The 1996 amendments placed an increasing emphasis on ensuring all new and existing water systems have the technical, managerial, and financial capacity to comply with NPDWRs. Systems which do not commit the resources required to comply with these rules may not be eligible for Drinking Water State Revolving Fund (DWSRF) loans and may be vulnerable to enforcement actions. There are currently over 90 parameters regulated by the SDWA.

   The regulations discussed below fall under the Safe Drinking Water Act, as the SDWA provides the process the EPA must follow to create drinking water regulations.

2. National Primary Drinking Water Regulations (NPDWRs)

   National Primary Drinking Water Regulations (NPDWRs) are the enforceable standards (maximum contaminant levels and treatment techniques) with which water suppliers must comply. Currently, there are standards for more than 90 contaminants, including turbidity, 6 other microorganism indicators, 4 disinfection byproducts, 3 disinfectants, 4 radionuclides, 16 inorganic contaminants, and 53 organic contaminants. The EPA is required to review and revise, as appropriate, each NPDWR every six years. The most recent review was completed in December 2016. Another review is currently in progress and is expected to be completed in 2023. Based upon the 2016 review, the EPA has identified Chlorite, Cryptosporidium, Giardia lamblia, and Haloacetic Acids (HAA5) rules as candidates for revision. Appendix B includes a summary of all standards for regulated contaminants.

3. Stage 1 and Stage 2 Disinfectants and Disinfection By-products Rules (DBPRs)

   In December 1998, the EPA established maximum residual disinfectant levels for water systems which use a chemical disinfectant under the Stage 1 Disinfectants and Disinfection Byproducts Rule (DBPR). The Stage 2 DBPR added to the Stage 1 Rule by increasing compliance monitoring requirements for Trihalomethanes (TTHM) and Haloacetic acids (HAA5). The maximum residual disinfectant level is 4.0 mg/L of chlorine as free chlorine. The compliance date for groundwater systems was November 2003. Maximum limits have been established to limit the health effects of disinfectant byproducts.

   Table 4.2 shows EPA Exhibit II-I, which identifies the Maximum Contaminant Limits (MCL) and Maximum Contaminant Limit Goals (MCLG) for disinfection byproducts.

Table 4.2 - MCLGs and MCLs for Disinfection Byproducts		
Disinfection Byproduct	**MCLG (mg/L)**	**MCL (mg/L)**
Total Trihalomethanes (TTHM), consisting of:	**ND**	**0.080**
Chloroform	ND	ND
Bromodichloromethane	0	ND
Bromoform	0	ND
Dibromochloromethane	0.06	ND
Five Halo Acetic Acids (HAA5), consisting of:	**ND**	**0.060**
Monochloroacetic Acid	ND	ND
Dichloroacetic Acid	0	ND
Trichloroacetic Acid	0.3	ND
Monobromoacetic Acid	ND	ND
Dibromoacetic Acid	ND	ND
Chlorite	**0.8**	**1.0**
Bromate	**0**	**0.010**

ND – not determined

These limits should not be an issue for the City of Montrose provided disinfection control systems are adequately maintained and operated.

4. Revised Total Coliform Rule (RTCR)

EPA promulgated a Total Coliform Rule on June 29, 1989, and revised the Rule on February 13, 2013. This Rule applies to both surface water supplies and groundwater supplies. The Revised Total Coliform Rule became effective on April 1, 2016. The revised Rule establishes a maximum containment level for E. coli and uses E. coli and total coliforms to initiate a "find and fix" approach to address fecal contamination which could enter the distribution system. It requires public waste systems (PWSs) to perform assessments to identify sanitary defects and subsequently take action to correct any defects.

Recommended guidelines for total coliform control are:

- Maintenance of detectable disinfectant residual throughout the distribution system.
- Proper repair/replacement/maintenance of the distribution system

5. Radionuclide Rule

The EPA Radionuclide Rule went into effect in 1977 and was revised in 2000. This regulation requires monitoring and sets maximum contaminant levels for combined Radium 226 and Radium 228, Uranium, gross Alpha particles, and Beta/photon emitters. The overall goal of the rule is to protect customers from radionuclides.

6. Drinking Water Contaminant Candidate List (CCL)

The EPA has drinking water regulations for more than 90 contaminants, and the complete list is presented in Appendix B. The SDWA includes a process which the agency follows to identify new contaminants which may require regulation in the future. The EPA periodically releases a Contaminant Candidate List (CCL) with contaminants which need to be evaluated to determine if future regulation is necessary.

The first list was published in March 1998 and had 60 unregulated contaminants. The fourth version of the list was published on November 17,2016 and contains 97 chemicals or chemical groups and 12 microbial contaminants. This list includes, among others, chemicals used in commerce, pesticides, biological toxins, disinfection byproducts, pharmaceuticals, and waterborne pathogens.

7. Secondary Drinking Water Standards

In addition to the National Primary Drinking Water Regulations, which cover the contaminants that affect public health, EPA recommends Secondary Drinking Water Standards with recommended limits on contaminants that affect the aesthetic qualities of drinking water. The secondary regulations are intended to serve as guidelines and are not federally enforceable. Although water utilities are not required to treat to Secondary Drinking Water Standards, keeping the quality of drinking water within these guidelines makes it more acceptable to consumers, thereby decreasing customer complaints. EPA Secondary Drinking Water Standards can be found in Appendix B.

D. Recommended Treatment Objectives

The raw water quality for the City of Montrose can be treated through conventional means. It is recommended the city reduce manganese levels below the Secondary Drinking Water Standards. Treatment of manganese can be accomplished in the following ways:

- Gravity filtration
- Pressure filtration
- Lime softening with filtration
- Gravity filtration followed by reverse osmosis

It is recommended the city construct a new water treatment facility for the removal of manganese. All four options can achieve the objective of removing arsenic, manganese, and iron. The city may also choose to soften the water and remove hardness.

Treatment alternatives are discussed in Section V.

V. WATER TREATMENT OPTIONS

A. Treatment Process Screening

The water treatment objectives for the City of Montrose are to provide residents with safe and palatable water fit for domestic and commercial uses, while wasting minimal water in the process. This section summarizes alternative treatment processes and the benefits of each process. From this analysis, treatment trains were developed for detailed comparison. A summary of the ability of each treatment process to meet or aid in meeting the water quality objectives is given in Table 5.1.

Centralized water softening limits the treatment options for the city to reverse osmosis or lime softening. Home water softeners can remove hardness if residents choose to operate one. The issue with home water softeners is the cost to consumers and the increase in chloride load to the wastewater system, which can negatively impact the environment and is costly to remove.

Table 5.1 - Alternative Treatment Technology Summary

Contaminant	Primary Treatment (Removal)			
	Gravity Filtration	Pressure Filtration	Lime and Soda Ash Softening with Filtration	Gravity Filtration and Reverse Osmosis (RO)
Iron and Manganese Removal	X	X	X	X
Hardness Removal			X	X
Chloride Production to WWTF	Residential Waste	Residential Waste	Some Waste (mostly removed as sludge to offsite)	Blended Concentrate Waste
Note: X = Process will achieve or aid in achieving the treatment goal for the indicated parameter				

1. Gravity Filtration

Filtration is a proven water treatment technology which has been used since the early 19th century and is commonly used to remove iron and manganese. Since water from underground aquifers is in direct contact with rock and ground layers, the water has higher concentrations of iron, manganese, and hardness. Gravity filtration is one of the primary treatment techniques used to remove iron and manganese from ground water. Hardness is not removed using gravity filtration, so further treatment would be necessary to reduce hardness. Filters can be constructed out of concrete or steel.

Steel filters are less expensive and are a competitive option for small facilities, while concrete filters are more economical for larger facilities. Steel filters will need maintenance and recoating in 15-20 years, whereas concrete filters would service the community for the next 40 to 60 years. The life cycle analysis makes concrete filters more economical than steel filters for plants designed for a maximum day demand of approximately one million gallons.

2. Pressure Filtration

Pressure filters are another common way to remove iron and manganese. Pressure filters are enclosed vessels which force pressurized water through the filter media, usually sand. Like gravity filters, pressure filters do not soften water so additional treatment would be needed to reduce hardness. While pressure filters have a low initial cost, there are many disadvantages which come with pressure filters. The inability to observe the pressure filters while in operation and possible premature breakthrough of contaminants. Due to these concerns pressure filters are not recommended and were not investigated further.

3. Lime and Soda Ash Softening with Filtration

Hard water is defined as water containing the sum of calcium, magnesium, and other divalent cations. The raw water for Montrose has a hardness of approximately 420 mg/L $CaCO_3$. The raw water falls in the "very hard" classification based on the American Water Works Association (AWWA) definition. Centralized softening eliminates the need for home water softening units. Without the use of individual water softeners, the amount of chloride discharged into the wastewater system is greatly reduced. This can also help the City of Montrose stay ahead of any potential future chloride discharge limits.

Lime softening can also remove iron and manganese from drinking water. In the presence of oxygen, the oxygen will react with these compounds to create ferric and manganic hydroxide. Lime reacts with iron and manganese to precipitate as ferric hydroxide and manganic oxide which are then captured using filtration. The oxidation reaction rates for iron and manganese are accelerated by the high pH levels present in lime softening.

Lime softening is a process which requires an understanding of the chemical reactions occurring, additional testing, monitoring, and a significant amount of equipment, resources, and time. The lime softening process involves creating a lime slurry using water and a powdered lime source, feeding the slurry into a clarifier, allowing the chemical reactions to occur, and allowing the solids to settle out. The lime clarifier effluent water has a high pH which will need to be lowered through re-carbonation to stabilize the water and prevent scale deposits on the subsequent filter media. Lime softening will require additional staffing to operate the treatment system, treat the lime sludge, and will require additional staffing compared to typical gravity filtration facilities without softening.

4. Reverse Osmosis Membrane Filtration

Reverse Osmosis (RO) is another type of treatment process which offers the finest level of filtration available. The membrane acts as a barrier to all dissolved salts and inorganic molecules as well as most organic molecules with a molecular weight greater than 100. Water molecules can pass freely through the membrane which creates a purified effluent stream. The dissolved salts and molecules which remain on the opposite side of the membrane barrier flow out of the system as a concentrate or reject stream of water. The amount of water used for the concentrate stream varies from 5 to 30 percent of the total water supplied to the RO system but is generally in the 20 to 25 percent range.

5. Chlorine Disinfection

Primary disinfection by the City of Montrose is currently accomplished by free chlorination. Free chlorine is applied using chlorine gas injection. The inactivation of microorganisms such as *Giardia lamblia*, *Cryptosporidium*, and viruses is based on contact time multiplied by the chlorine residual (CT). The required CT is a function of other water treatment parameters, such as the organism being inactivated, water temperature, and pH. Chlorine is applied not only to perform disinfection as part of the treatment process but also to provide residual disinfection in the distribution system. The free chlorine method of disinfection is relatively simple to use but can lead to the formation of disinfection by-products such as TTHMs or HAAs.

Chlorine could also be used for disinfection by chloramination. Chlorine is added to the water along with small amounts of ammonia, which react together to form chloramines. Chloramine is a long-lasting disinfectant and is relatively stable.

Chlorimation requires a specific balance between chlorine and ammonia in the water supply. Sufficient chlorine must be added to react with the ammonia in the water supply and form chloramines for disinfection. However, if too much chlorine is added, monochloramines begin to breakdown dichloramines resulting in taste and odor issues. If chlorine levels are even higher, breakpoint chlorination can be reached, when all of the ammonia in the water is broken down and a free chlorine residual is left, which can lead to the formation of DBP. Chloramination also has a greater space and storage requirement than chlorination.

B. Improvement Items Common to All Alternatives

1. Additional Water Storage

As previously discussed, the 50,000-gallon storage tank built in 1930 should be decommissioned due to the age and condition. The Ten States Standards recommend having a minimum storage capacity of the average day demand. While 250,000 gallons of storage is sufficient for the current demand, the project demand is expected to exceed the finished water storage capacity around 2032. It is recommended the city install an additional 250,000-gallon elevated storage tower with a clearwell at the proposed WTP to meet necessary usage and fire flow demands.

A new elevated tank would serve as an additional pressure equalizer in the distribution system. However, if the projected growth of the city will not develop areas of low service pressure, ground storage may be sufficient. The economics of ground storage make it the most practical if it is built in conjunction with a new treatment plant.

2. New Water and Wastewater Piping

The source water wells, water storage structures, and the distribution system will need to be connected to the new WTF. The existing wastewater collection system should be adequate for any future WTF. However, sanitary sewer system improvements may be needed for the reverse osmosis option due to the amount and concentration of reject water.

3. Plate Settlers for Water Reclaim

The City of Montrose should consider installing a package plate settling system in addition to the backwash tanks. Plate settlers are used to increase the amount of water reused and can be sent back to the treatment process instead of wasting it to the sewer. The plate settling system would have a smaller area footprint than a standard sedimentation basin due to the layers of plates which create additional surface area for settling within the unit. The plate settler is able to return about 98 percent of water, whereas about 85-90 percent is returned without the use of plate settling. See Figure 5.1.

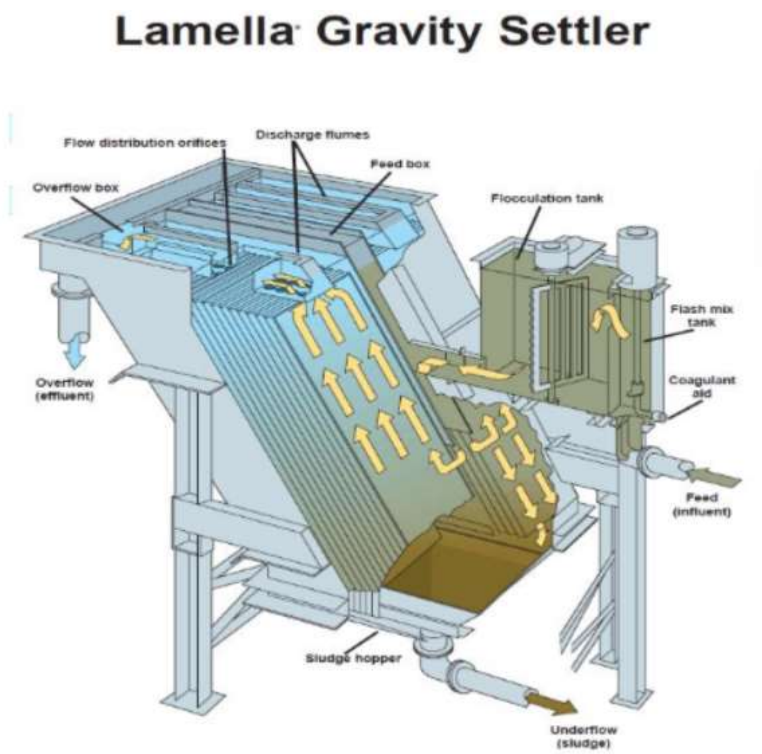


Figure 5.1 Inclined Lamella Plate Gravity Settler

C. Treatment Alternatives

After considering the treatment goals and process alternatives, three specific treatment alternatives were developed. Pressure filter systems were not considered due to the previously mentioned disadvantages. These alternatives are as follows:

1. Construct a new treatment facility using the gravity filtration
2. Construct new treatment facility using filtration and lime softening
3. Construct new treatment facility using filtration and reverse osmosis

The treatment process recommended for each alternative begins similarly – aeration and detention for iron oxidation, use of potassium permanganate for manganese oxidation, filtration for iron and manganese removal, followed by softening technology, chlorine for disinfection, the addition of fluoride, and addition of a corrosion inhibitor. The average and peak facility flows in 2045 are predicted to be 276,000 gpd (192 gpm) and 607,000 gpd (422 gpm) respectively.

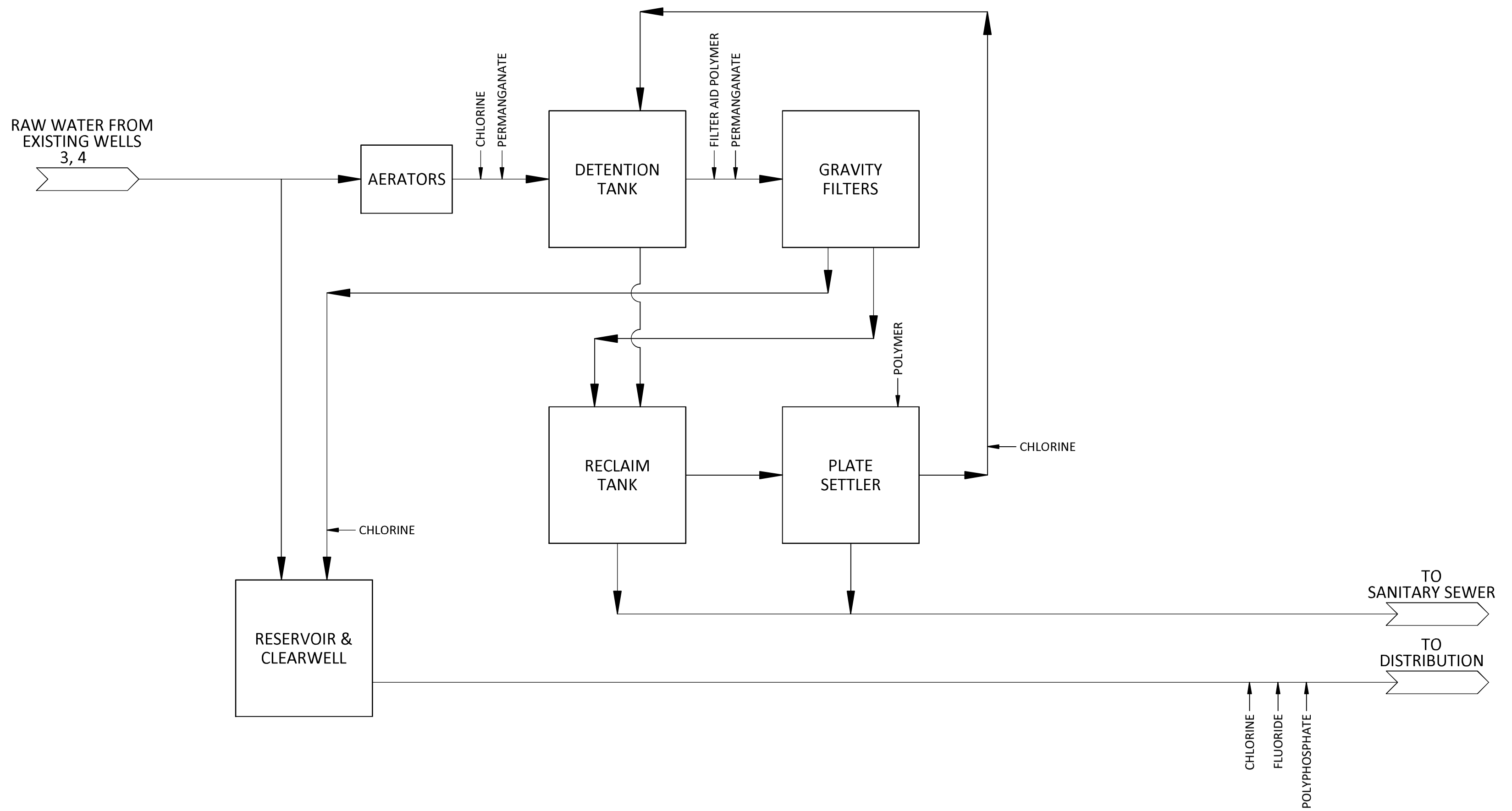
All alternatives will include new water treatment buildings to house the treatment equipment and materials. Potential locations will be analyzed during a future water model study. Building and structure layout and sizing would be finalized during the design process.

1. Construct a New Gravity Filtration Process

This method includes the construction of a new gravity filtration process designed to remove iron and manganese as well as provide disinfection. The process flow for a gravity filtration process is shown in Figure 5.2.

The existing wells are expected to provide sufficient water for current and future demands. A water treatment facility would be constructed to enclose the treatment processes and associated equipment and provide room for expansion.

FIGURE 5.2 - GRAVITY FILTRATION



The process begins with the aerator. The aerator would be an induced draft aerator constructed of aluminum with PVC internal components and designed for the maximum flow rate. Water cascades downward through the aerator, releasing gases in the water, while oxygen is provided from the upward flowing of air which is drawn through the aerator by fans located on top of the structure. This type of aeration provides the most efficient oxidation and gas stripping, providing the greatest treatment flexibility. The water flows from the aerator to the detention basin.

The detention basin allows complete oxidation of the iron and would be sized for 40-minutes of detention time. Detention time provides iron additional time to form floc, resulting in more thorough and efficient filtration.

Water flows to newly constructed filter cells located in the treatment building. The filter cells would consist of filter backwash troughs, gravel underdrains, support media, a Greensand Plus (or silica sand) layer, and an anthracite layer on top. The water treatment facility would be constructed to enclose the filters and associated equipment and provide room for expansion.

The filters would be designed in multiple units to allow taking a unit off-line for maintenance. The optimal design filtration rate is 2.0 gpm/sq. ft. The filter system would consist of four rectangular filters, each with approximate dimensions of up to 10-feet by 10-feet. This design would be able to process 600 gpm with three of the filters operating.

The underdrain system would be designed to prevent scaling on the surface due to the extreme hard water. The backwash system would incorporate both air and water wash. The use of air in the backwashing system reduces the time and water volume required for backwashing. It also improves the cleaning of the media, reducing mud balls and extending media life. A dedicated backwash pump would be used to provide water for backwashing and a dedicated blower would be used to provide air.

To minimize the amount of backwash water wasted and discharged, a backwash water plate settler reclamation system would be installed. The system would consist of a steel tank with inclined lamella settling plates, as previously described, to receive backwash water as it is discharged from the filters. After settling, the clarified water would be recycled and blended with the raw water. Solids from the bottom of the tank would be discharged to the sanitary sewer. Polymer can be used increase the amount of solids removed by the plate settler.

Water flows to the newly constructed filter cells located in the treatment building. The concrete filter cells would consist of filter backwash troughs, underdrains, support media, and a Greensand Plus (or silica sand) layer and an anthracite layer on top.

A new two-chamber baffled clearwell could be constructed to provide the appropriate contact time per chamber and to provide finished water storage. High service pumps would be used to pump water from the clearwell to the distribution system and elevated storage tanks. Each will be provided with a variable frequency drive for flow adjustment. The clearwell will provide storage for finished water and for backwashing.

Chemical feed systems will be installed. Potassium or sodium permanganate will be used for oxidation of metal ions present in the raw water. Chlorine will provide disinfection and residual disinfection in the distribution system. Fluoride will be added for dental health. Polyphosphate can be added to the effluent so residual iron and manganese might be sequestered after treatment or during bypasses.

A new SCADA system will be installed as part of the new facility and integrated with the existing SCADA system to provide for one fully functional system. Emergency power will be added at the facility for backup use.

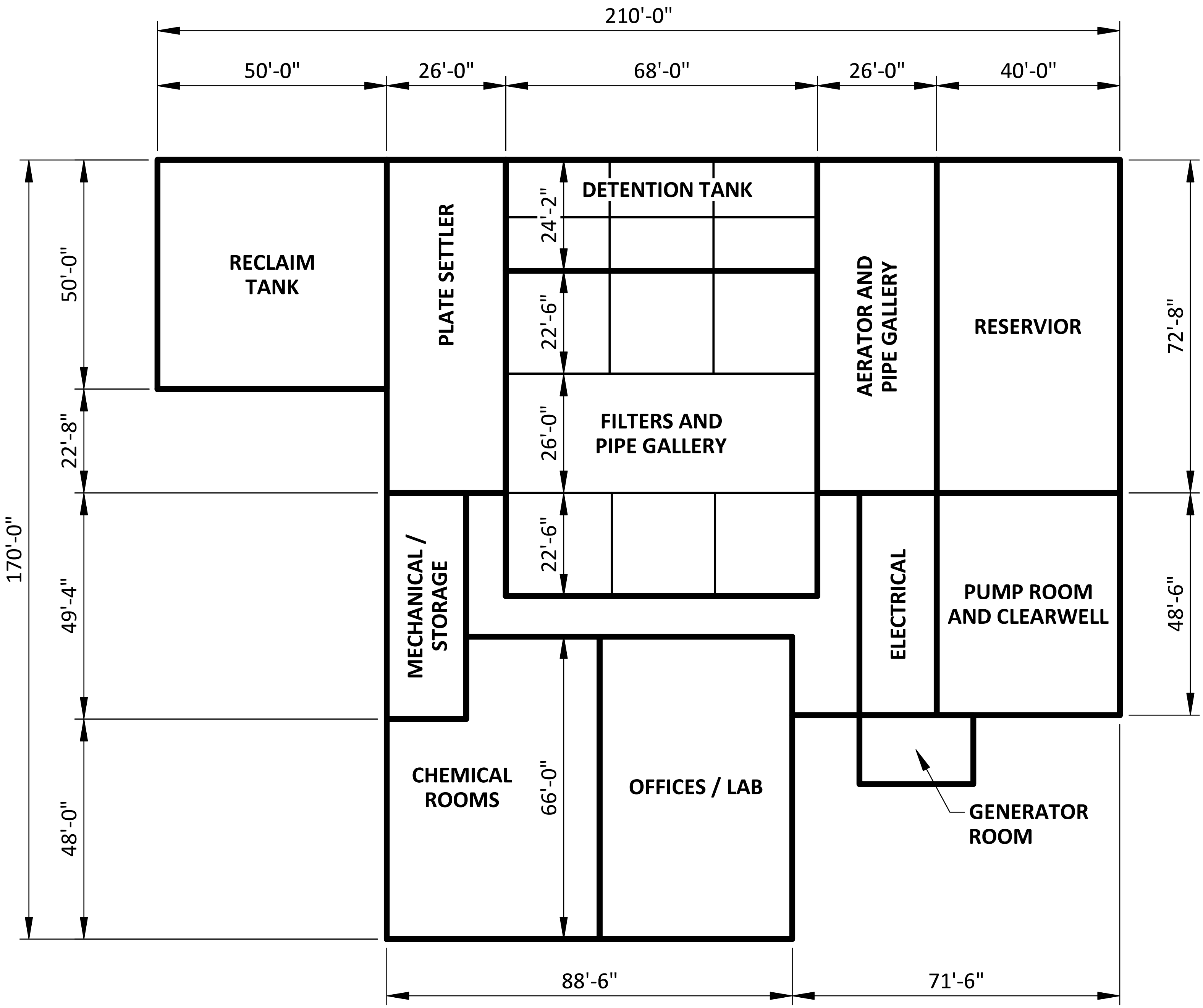
The facility will be designed with a common office/lab area to allow water sample analysis and record keeping. There will also be an operations control room and a restroom. A garage and work area could be constructed as part of the treatment building to allow the operators a place to park trucks and work on equipment.

Figures 5.3 and 5.4 shows potential layout for the new treatment facility; the exact sizing of the layout would change once the design is determined. There are multiple layouts to consider, and the building and structure layout and sizing would be finalized during the design process and in consultation with the city.

WATER TREATMENT FACILITY LAYOUT

CITY OF MONTROSE, MINNESOTA

FIGURE No. 5.3 - GRAVITY FILTRATION

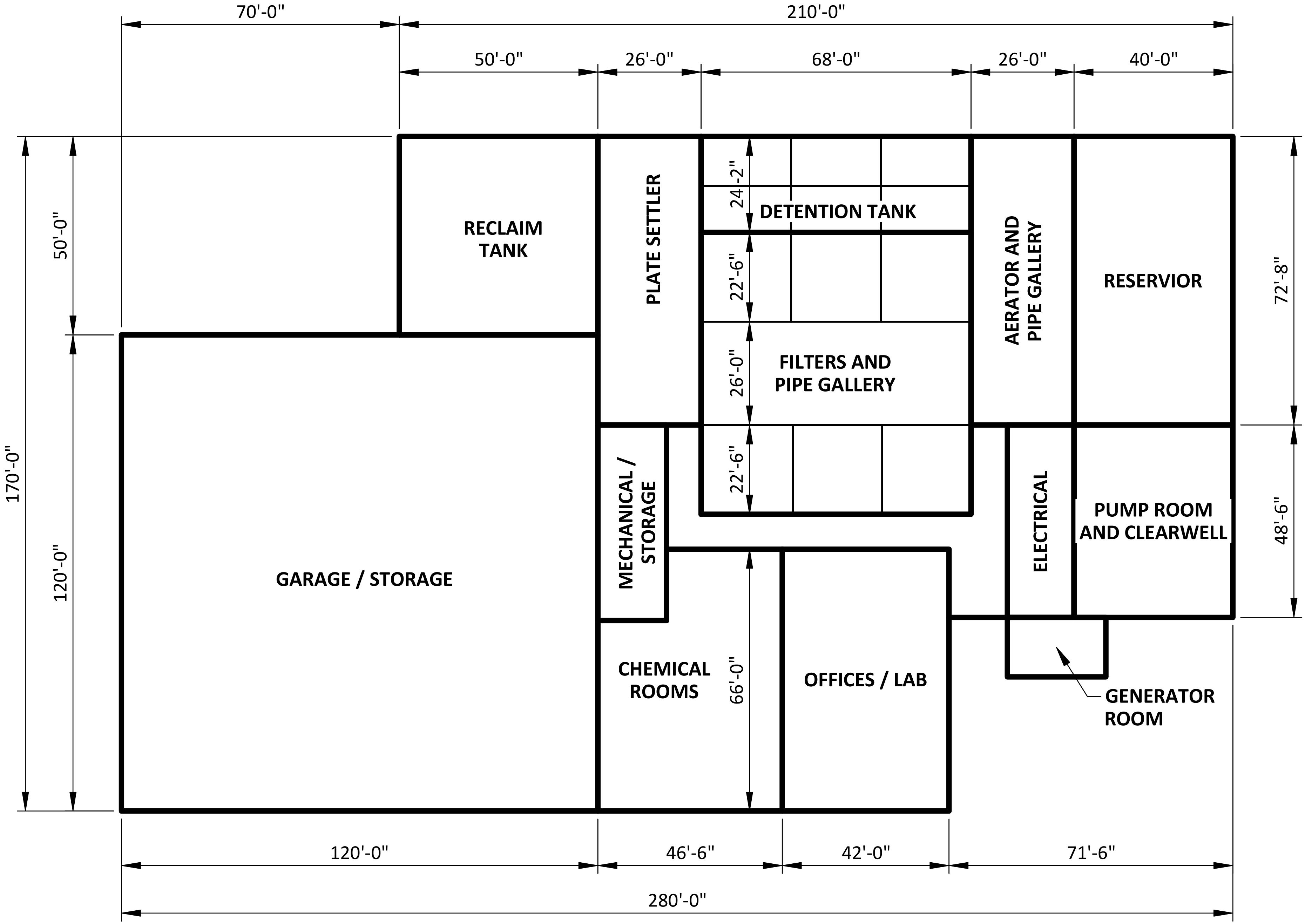


WATER TREATMENT FACILITY LAYOUT

CITY OF MONTROSE, MINNESOTA

FIGURE No. 5.4 - GRAVITY FILTRATION

WITH STORAGE GARAGE



2. Construct a New Lime Softening and Gravity Filtration Treatment process

Alternative 2 consists of constructing a new treatment facility with a lime softening treatment with two solids contact clarifiers. The two solids contact clarifiers provide operational flexibility and allow for maintenance on one clarifier while maintaining treatment.

The process flow diagram is shown in Figure 5.5, and the potential plant layouts are shown in Figures 5.6 and 5.7. The building structure, layout, and sizing would be finalized during the design process and in consultation with the city.

The existing wells are expected to provide sufficient water for current and future demands. A water treatment facility would be constructed to enclose the treatment processes and associated equipment and provide room for expansion.

The aerator would be an induced draft aerator constructed of aluminum with PVC internal components and designed for the maximum flow rate. Water cascades downward through the aerator, releasing gases in the water, while oxygen is provided from the upward flowing of air which is drawn through the aerator by fans located on top of the structure. This type of aeration provides the most efficient oxidation and gas stripping, providing the greatest treatment flexibility.

Lime soda ash softening is a system which causes chemical precipitation of hardness ions to soften the water. Lime (calcium hydroxide) is used to remove chemicals which cause carbonate hardness and soda ash (sodium carbonate) is used to remove chemicals which cause non-carbonate hardness. Many municipal water systems use lime softening only and remove primarily carbonate hardness. However, the raw water contains both calcium and magnesium hardness, which indicates a combined system will be the most effective.

The softening system would be provided with hydrated lime and soda ash storage, feeding equipment, upflow clarifiers for water softening, carbonic acid feed system, a basin for recarbonization, and lime sludge storage and disposal. Water is pumped into the lime clarifiers where it is mixed with hydrated lime and soda ash. The softened water then flows to a recarbonation basin where it receives a pH adjustment by liquid carbonic acid and is then pumped into the filtration system. This system requires a large building footprint and the storage of both raw lime and lime sludge on-site. This

FIGURE 5.5 - GRAVITY FILTRATION AND LIME SOFTENING

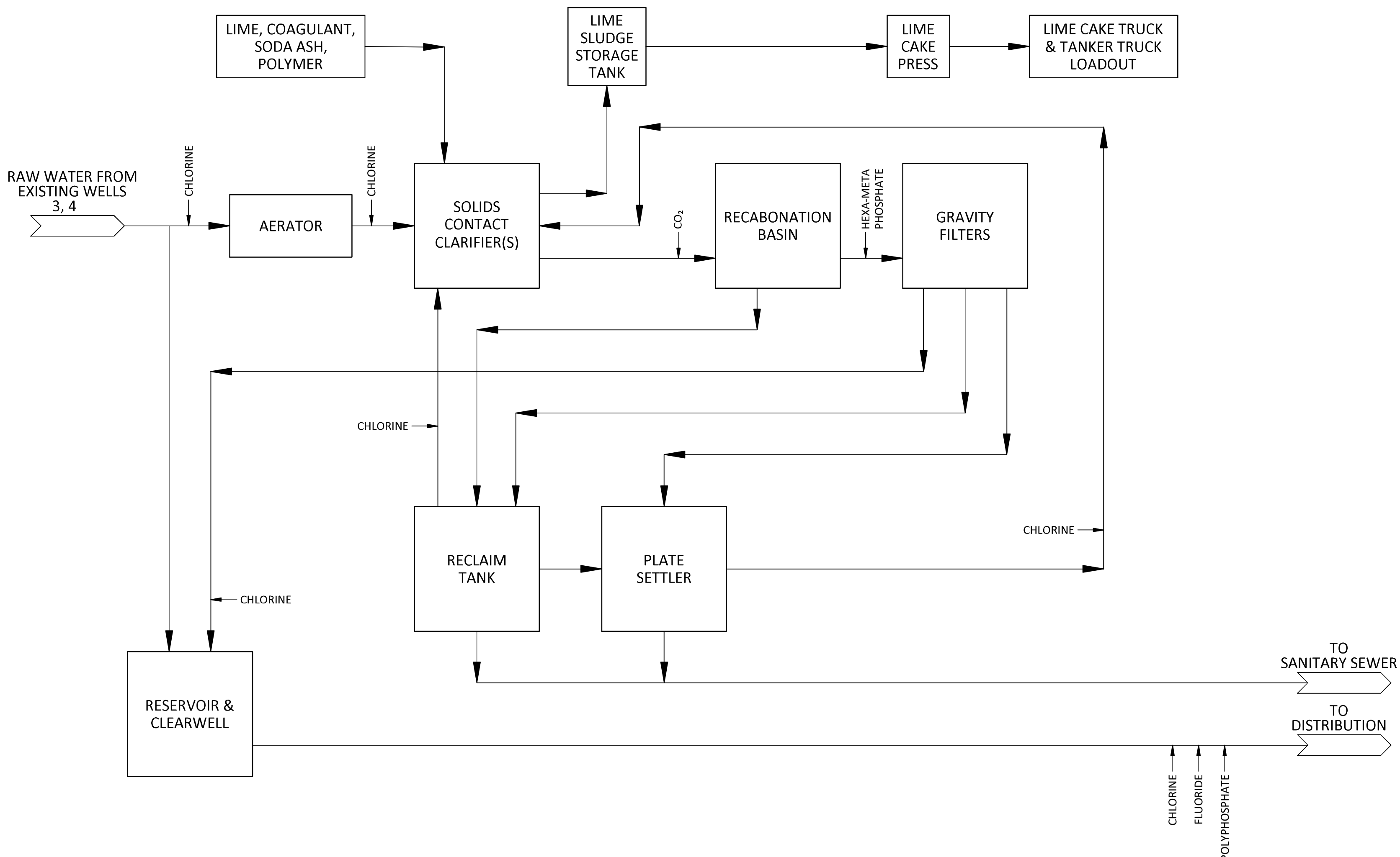
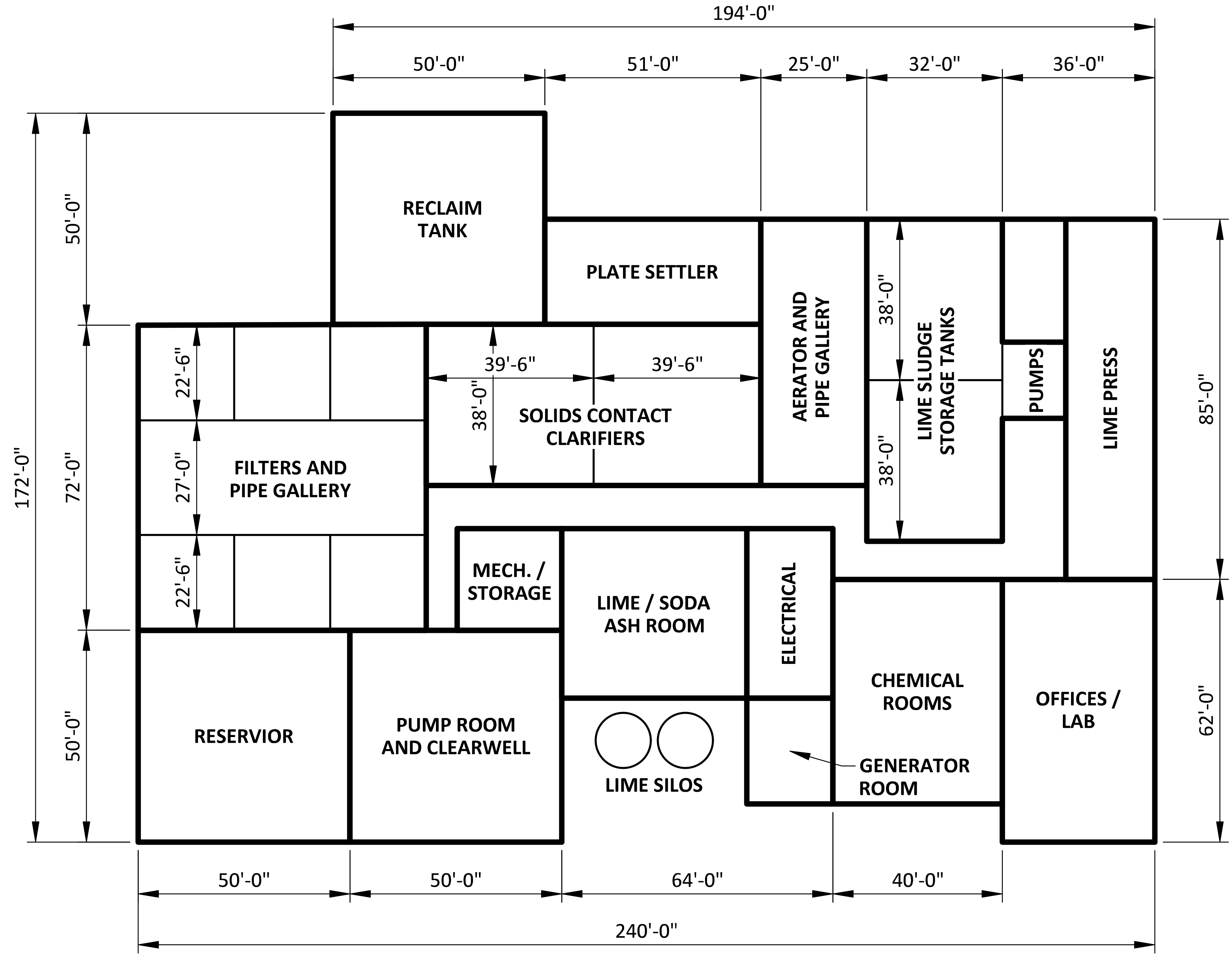


FIGURE 5.6 - GRAVITY FILTRATION AND LIME SOFTENING

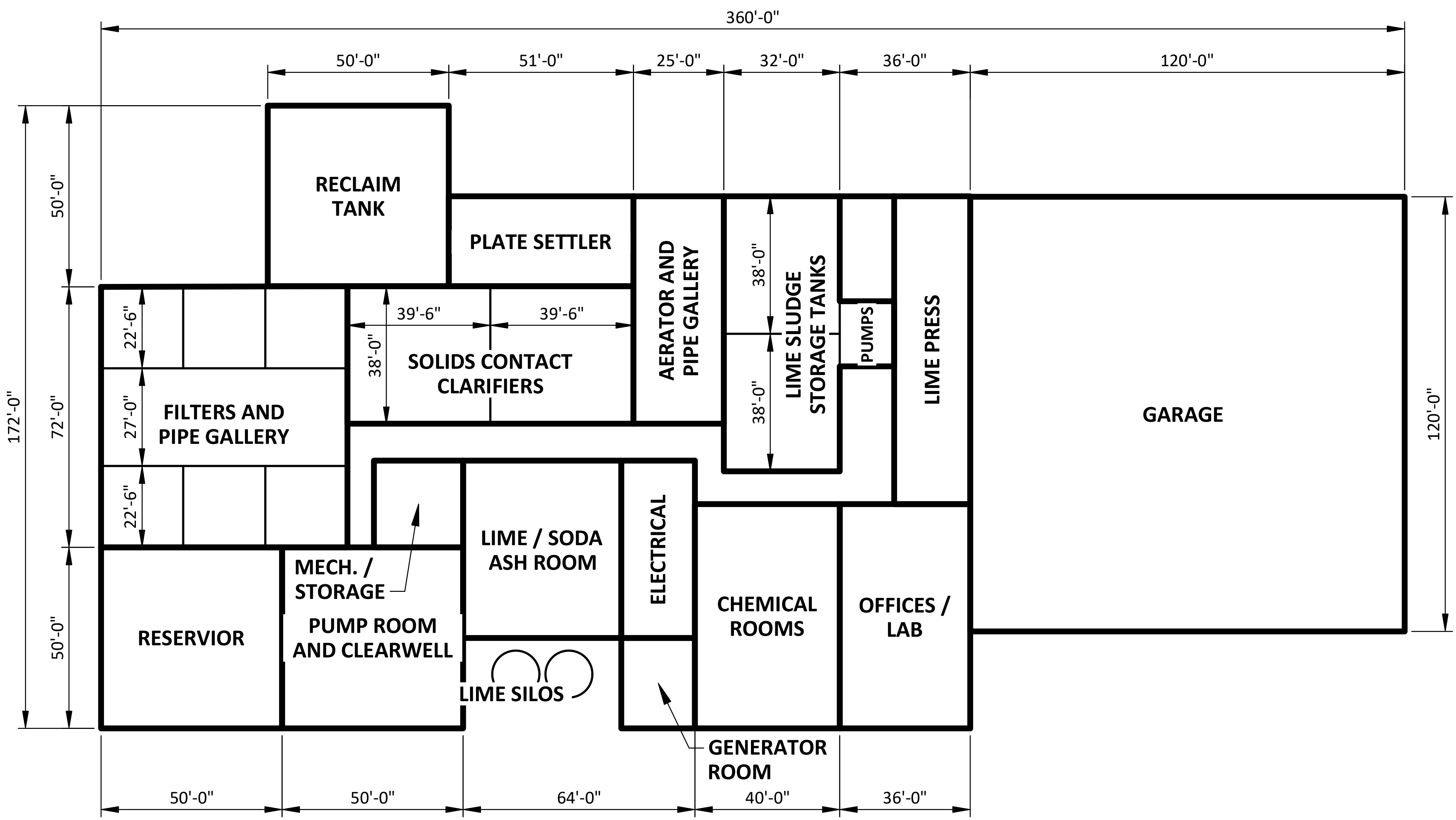


WATER TREATMENT FACILITY LAYOUT

CITY OF MONTROSE, MINNESOTA

FIGURE No. 5.7 - GRAVITY FILTRATION AND LIME SOFTENING

WITH STORAGE GARAGE



system could reasonably reduce hardness to less than 100 mg/L of hardness as $CaCO_3$.

The filters would be designed in multiple units to allow taking a unit off-line for maintenance. The design filtration rate is 2.0 gpm/sq. ft. The filter system would consist of four rectangular filters, each with approximate dimensions of up to 10-feet by 10-feet. Filter media is proposed to be a combination of anthracite and greensand, with a gravel underdrain system. The use of air in the backwashing system reduces the time and water volume required for backwashing. It also improves the cleaning of the media, reducing mud balls and extending media life. A dedicated backwash pump would be used to provide water for backwashing and a dedicated blower would be used to provide air.

To minimize the amount of backwash water wasted and discharged, a backwash water plate settler reclamation system would be installed. This would allow for multiple filters to be backwashed immediately in series. The system would consist of a reclaim tank and a steel tank with inclined lamella settling plates to receive backwash water from the filters. Plate settlers increase the amount of water reused from about 85-90 percent, to about 98 percent. After settling, the clarified water would be recycled back to the detention tank to be blended with the raw water. Solids from the bottom of the tank would be discharged to the sanitary sewer. Polymer can be used increase the amount of solids removed by the plate settler.

A new chemical feed area would be incorporated into this alternative. A chemical room would be provided for the potassium permanganate and corrosion inhibitor with room for future chemicals. The softening chemicals would be located in dedicated rooms. The fluoride would also be located in a dedicated room, as the fluoride vapors are very corrosive and are isolated to reduce corrosion damage. The chlorination would be stored as required by current building codes. Chlorine will provide disinfection and a residual in the distribution system.

Lime soda ash softening generates a significant amount of sludge. There are two options for disposal: lagoons, or storage and contracting a disposal agency. Lime sludge can be stored in a lagoon and the water allowed to evaporate or infiltrate until a thickened sludge remains. This sludge would need to be dredged from the lagoon every 3 to 5 years and then either land applied or landfilled. Alternately, lime sludge can be stored in a minimum of two dedicated storage tanks and then dewatered to approximately 60 percent solids and then land applied. A minimum of two presses are proposed for this system to allow for operational flexibility and the ability to press sludge while maintenance is performed on the other press. The dewatered sludge would be discharged into a truck and then land applied. The city would need to source appropriate sites for land application.

A new SCADA control system would be added with the new facility. The remaining control features will be replaced, and all systems will be integrated to provide for one fully functional system. The system would allow control of the facility from multiple sites and would provide secure communications.

Emergency power will be provided by a new generator onsite.

The facility will be designed with a common office/lab area to allow water sample analysis and record keeping. There will be an operations control room and a restroom. A garage and work area would be constructed as part of the treatment building to allow the operators a place to park trucks and work on equipment.

3. Construct a New Treatment Facility with Gravity Filtration and Reverse Osmosis

The improvements for this alternative include gravity filtration, plate settling, and reverse osmosis membrane filtration with recovery. With Reverse Osmosis (RO), 20 to 25 percent of the raw water pumped is discharged as reject water. The average influent flow to an RO facility would need to be 327,000 gpd for a finished water demand of 261,000 gpd and the maximum flow would need to be approximately 759,000 gpd rather than 607,000 gpd. This reject water would be roughly 66,000 gallons for average day use in 2045. The reject water would then be wasted to the sanitary sewer. Depending on location of the new treatment facility, a larger diameter sewer line may be required to handle the additional flow from the RO process. It is also important to consider whether the current wastewater system can handle this larger incoming flow.

The process flow for this alternative is shown in Figure 5.8. Figures 5.9 and 5.10 shows potential layouts for the new treatment facility. There are multiple layouts to consider, and the building and structure layout and sizing would be finalized during the design process.

The existing wells are expected to provide sufficient water for current and future demands and would continue to be used to supply raw water for treatment even with the increased raw water demand from an RO system. A water treatment facility would be constructed to enclose the treatment processes and associated equipment and provide room for expansion.

The aerator would be an induced draft aerator constructed of aluminum with PVC internal components and designed for a maximum flow rate of 759,000 gpd. Water cascades downward through the aerator, releasing gases in the water, while oxygen is provided from the upward air flow drawn through the aerator by fans located on top of the structure. This type of aeration provides the most efficient oxidation and gas stripping, providing the greatest treatment flexibility.

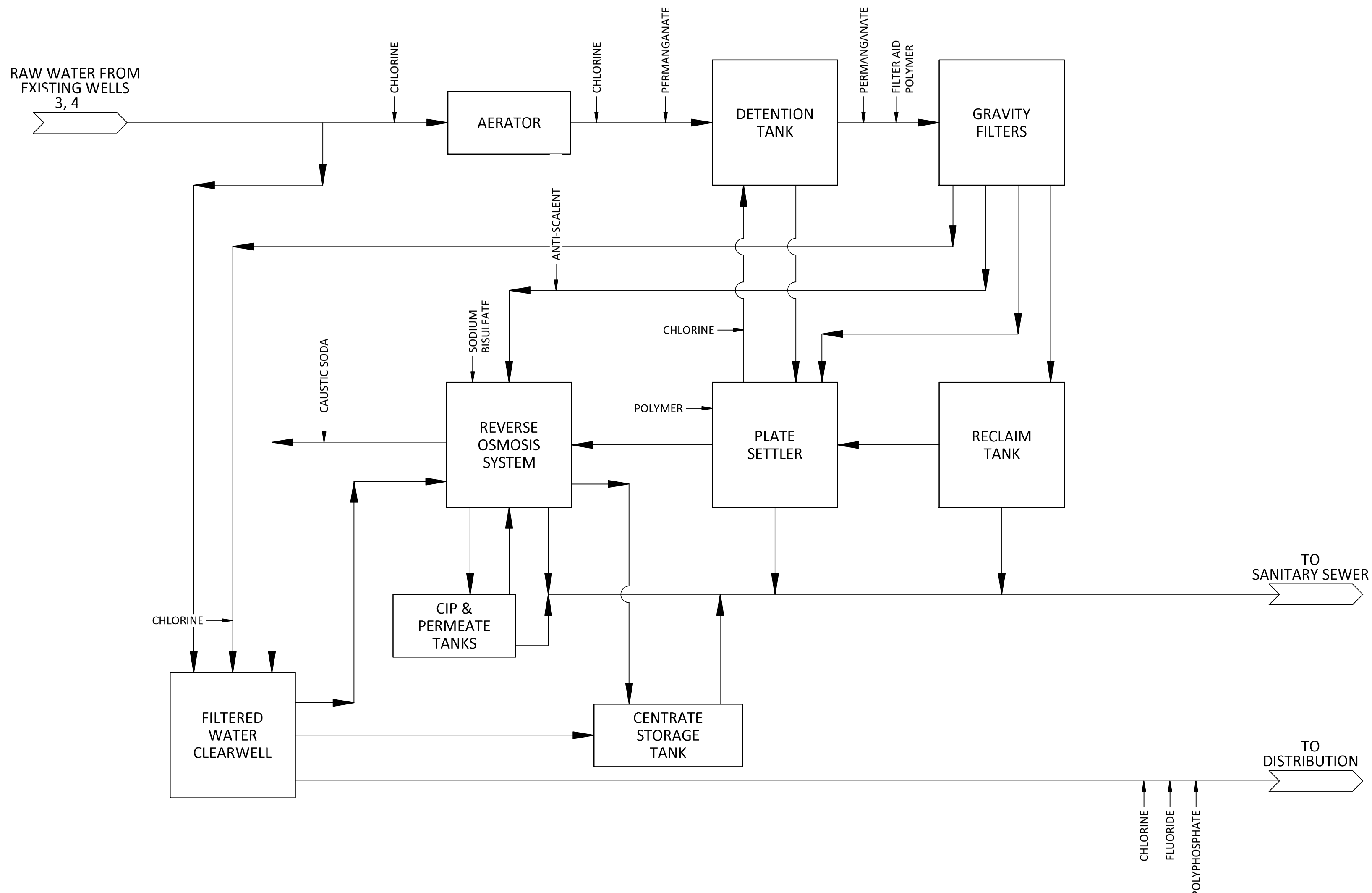
The detention basin would be provided to allow complete oxidation of the iron. The tank would be sized to allow 40-minutes of detention time. This detention time allows the iron additional time to form floc, allowing more thorough and efficient filtration.

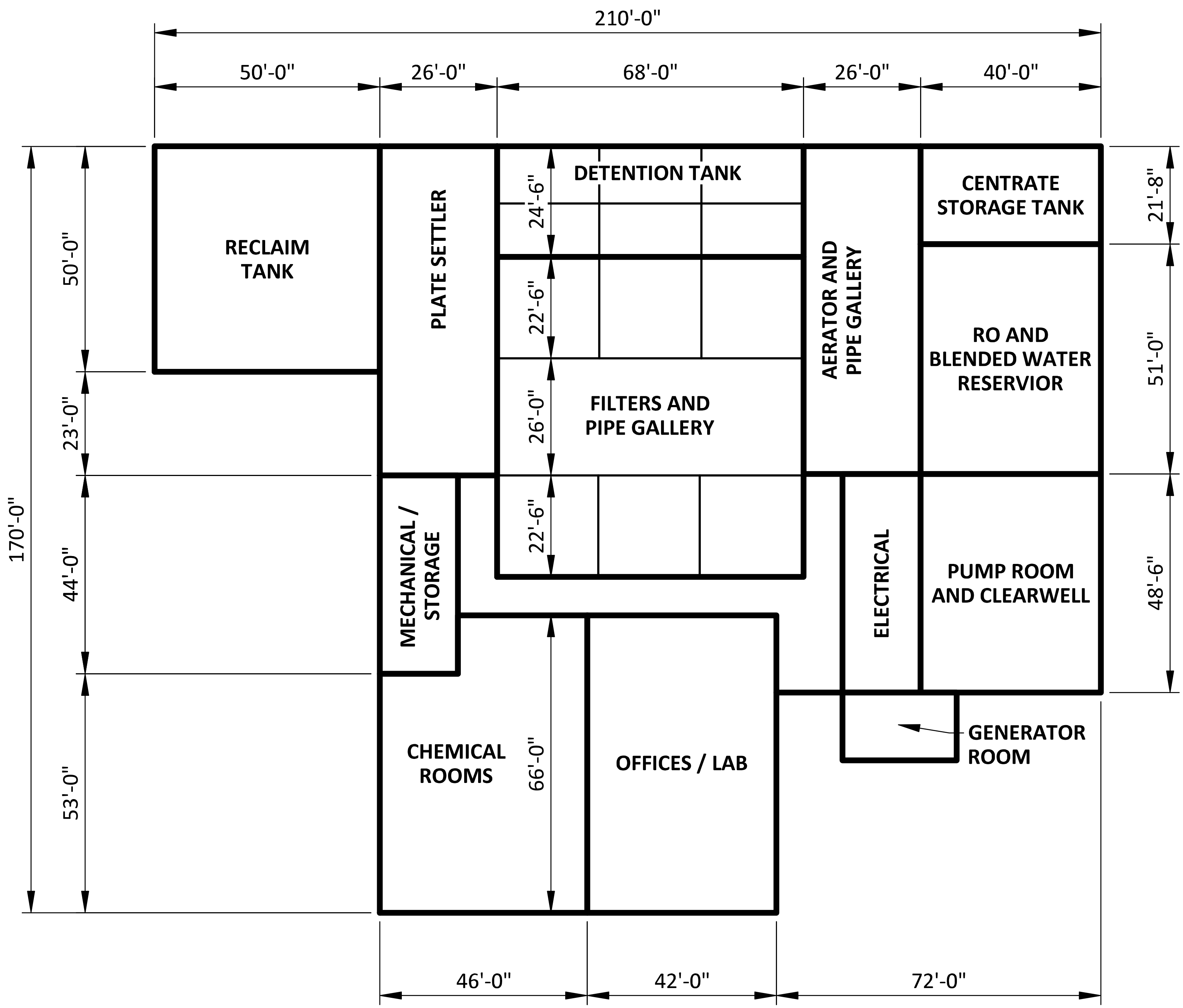
The filters would be sized to treat 759,000 gpd of water, total. The filters would be designed in multiple units to allow taking a unit off-line for maintenance. The design filtration rate is 2.0 gpm/sq. ft. The filter system would consist of four rectangular filters, each with an approximate dimension of up to 10.5-feet by 10.5-feet. Filter media is proposed to be a combination of anthracite and greensand, with a gravel underdrain system. The underdrain system would be designed to prevent scaling on the surface due to the extreme hard water. The backwash system would incorporate both air and water wash. The use of air in the backwashing system reduces the time and water volume required for backwashing. It also improves the cleaning of the media, reducing mud balls and extending media life. A dedicated backwash pump would be used to provide water for backwashing and a dedicated blower would be used to provide air.

To minimize the amount of backwash water wasted and discharged, a backwash water plate settler reclamation system would be installed. The system would consist of a steel tank with inclined lamella settling plates, as previously described, to receive backwash water as it is discharged from the filters. After settling, the clarified water would be recycled to the filters to be blended with the raw water. Solids from the bottom of the tank would be discharged to the sanitary sewer.

It is estimated lamella plate settling process will recover about 98 percent, and

FIGURE 5.8 - GRAVITY FILTRATION AND REVERSE OSMOSIS




210'-0"
50'-0"
26'-0"
68'-0"
26'-0"
40'-0"
RECLAIM TANK
PLATE SETTLER
DETENTION TANK
24'-6"
22'-6"
26'-0"
22'-6"
FILTERS AND PIPE GALLERY
AERATOR AND PIPE GALLERY
CENTRATE STORAGE TANK
RO AND BLENDED WATER RESERVIOR
PUMP ROOM AND CLEARWELL
ELECTRICAL
GENERATOR ROOM
MECHANICAL / STORAGE
CHEMICAL ROOMS
66'-0"
OFFICES / LAB
21'-8"
51'-0"
48'-6"
170'-0"
50'-0"
23'-0"
44'-0"
53'-0"
46'-0"
42'-0"
72'-0"

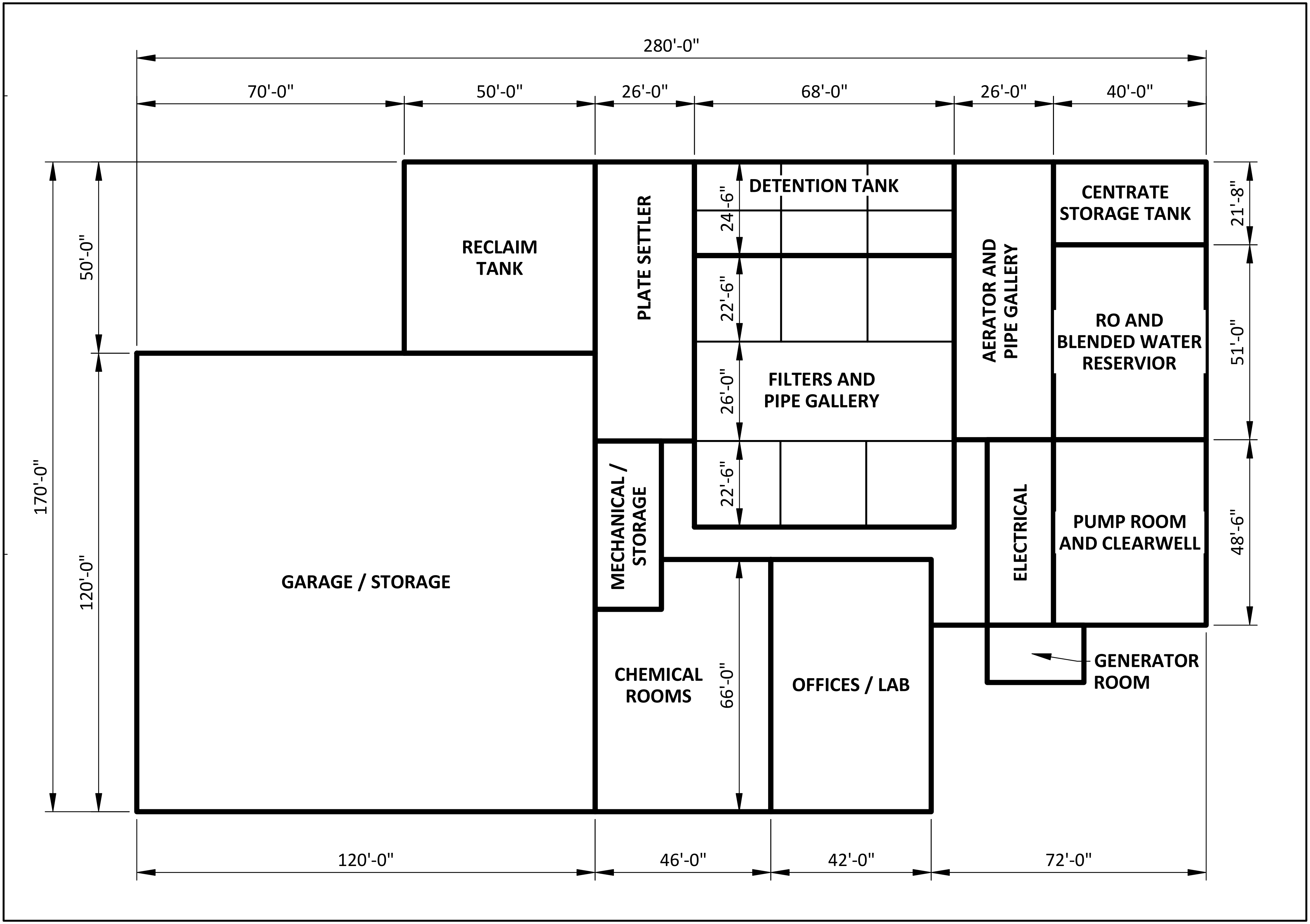
WATER TREATMENT FACILITY LAYOUT

CITY OF MONTROSE, MINNESOTA

FIGURE No. 5.10 - GRAVITY FILTRATION AND REVERSE OSMOSIS

WITH STORAGE GARAGE

BOLTON & MENK



the RO process is estimated to have an 80 percent recovery rate of water from the settler. The plate filters and plate settler will provide excellent pre-treatment for the RO system and will likely result in greater membrane longevity. Polymer can be used to increase the amount of solids removed by the plate settler.

After gravity filtration and plate settling, the water would flow into the reverse osmosis membrane system. This system would reduce the hardness of the water by approximately 70-75 percent.

Reverse osmosis treatment uses pressure to drive water through an artificial membrane and effectively remove nearly all contaminants in the water. The membrane divides the water into two parts: the concentrate stream or reject water, and the permeate or product water. The concentrate stream is water and other constituents rejected by the membrane. The permeate stream is the water which has passed through the membrane and is nearly 100 percent pure water. This pure water is extremely soft and corrosive which may cause problems in the distribution system. Corrosion is combated in two ways: the permeate stream is blended with the filter effluent and the final product is treated to a pH adjustment to make it less corrosive. The blending process mixes the permeate stream with 15 to 30 percent of the filter effluent not passed through the RO system. Blending filtered water with the permeate adds a portion of the hardness-causing minerals back into the water, reducing the corrosivity and helping to reduce taste concerns for customers.

The reject stream typically consists of 20 to 25 percent of the water directed through the RO system, or 15 to 25 percent of the total water flow, and is discharged into the sanitary sewer system. The reject stream is highly concentrated; however, most of the water originally pumped is ultimately discharged to the sanitary sewer system, meaning the final waste stream does not have significantly higher concentration of contaminants than the raw water. Additionally, reverse osmosis removes many impurities and provides added protection for any potential future drinking water standards or well contamination. Reverse osmosis is a time-tested membrane technology which has been used in various communities in Minnesota for these purposes.

The volume of water filtered through the RO process can be chosen based on desired finished water quality and capacity. The RO process would soften the water, remove manganese, and allow the city to treat many additional contaminants.

It is possible the sewer mains may have to be replaced with larger diameter mains, or the facility would need to install its own sewer line. The Montrose wastewater treatment facility should also evaluate the impact of additional flow to the facility from the additional water used for RO treatment.

Filtered water would gravity flow to a baffled concrete clearwell (size to be determined). After the filtered water and RO permeate are blended in the blended clearwell, the water will be chlorinated, and high service pumps would be used to pump water from the clearwell to the distribution system and elevated storage tank. Each pump will be provided with a variable frequency drive for flow adjustment. The clearwell will provide storage for pumping and backwashing.

A chemical feed area would be incorporated into this alternative. Chemical feed systems will include permanganate, sodium bisulfate, antiscalant, liquid hypochlorite, fluoride, and potentially polymer. Sodium bisulfate will be provided for cleaning RO membranes and antiscalant for preventing scale build-up on the membranes during and between treatment. Chlorine will provide disinfection and a residual in the distribution system.

A new SCADA control system will be added with the new treatment facility. The remaining control features will be replaced, and all systems will be integrated to provide for one fully functional system. The system would allow control of the facility from multiple sites and would provide secure communications.

Emergency power will be provided by a new generator onsite.

The facility will be designed with a common office/lab area to allow water sample analysis and record keeping. There will also be an operations control room and a restroom. A garage and work area could be constructed as part of the treatment building to allow the operators a place to park trucks and work on equipment.

D. Future Capital Improvement Items

In addition to the recommended treatment improvements described in the various alternatives, there are some recommended capital improvement projects the City of Montrose should consider keeping or adding to the capital improvement plan during the design period.

1. Construct new water storage structure(s) to ensure demand and fire flow requirements are less than or equal to finished water storage capacity. As mentioned previously, the city should replace the 50,000-gallon elevated storage tower with a new 250,000-gallon elevated storage tower. Tower No. 1 is past its design life and the additional storage would help the city meet increasing demand and provide adequate water pressure.

   A clearwell is another storage option for the city to consider. Clearwells are very economical and are very easy to maintain. This can be accomplished by adding a concrete clearwell to any of the options outlined earlier in this report.

2. As the City continues to expand and grow, additional distribution system improvements are needed such as trunk watermains and the addition of new booster stations. The timing for the watermain extensions and booster stations all depend on timing for growth and expansion of the city. These improvements will be dictated by growth.

VI. STAFFING REVIEW AND ANALYSIS

This section will look at the existing staffing and evaluate needs for future staffing based on whether a treatment facility is constructed.

The current staffing for the water system is led by a few staff members, totaling one full time employee. If a new water treatment facility is added (Alternative No. 1 – Iron and Manganese removal), it is suggested that two utilities operators are staffed to allow for additional time required to operate and maintain the facility. If Alternative No. 3, Reverse Osmosis, is selected, one additional staff operator is recommended in conjunction with the two needed for Alternative 1. This is due to the additional operation and maintenance for the reverse osmosis membranes, chemical feed, and associated equipment. For Alternative No. 2, the lime softening plant, two additional staff members are recommended in conjunction with the two needed for Alternative No. 1, thereby requiring a total four staff. A lime softening plant will require additional labor to handle the lime feed and equipment and disposal of the solids waste product.

A summary of the staffing requirements for each option are noted below:

- Gravity Filtration – 

- Lime Softening with Gravity Filtration – 

- Gravity Filtration with Reverse Osmosis – 

When a treatment facility is constructed, it is suggested to move the Utilities staff to the new facility to centralize operations. This requires adequate office space to be included at the new facility.

VII. RECOMMENDATIONS AND CONCLUSIONS

A. Treatment Alternatives Evaluation Discussion

All three alternatives described in Section VI will provide quality water for the City of Montrose.

Alternatives No. 2 and No. 3 will provide the most improved water quality over the existing process and reduce the high levels of manganese and hardness in the raw groundwater. Residents and businesses which currently use point-of-use water softening systems will be able to reduce or eliminate softener usage. This can result in reduced chloride discharge in wastewater.

Table 7.1 - Decision Matrix

Item	Primary Treatment (Removal)		
	Gravity Filtration	Lime and Soda Ash Softening with Filtration	Gravity Filtration and Reverse Osmosis (RO)
Ability to Meet Water Quality Goals	Good	Excellent	Excellent
Expandability Potential	Excellent	Excellent	Excellent
Ability to Meet Future Average and Peak Demand	Excellent	Excellent	Excellent
Ease of Operation	Excellent	Moderate	Moderate

Table 7.2 - Estimated Project Cost

Item	Option 1 Gravity Filtration	Option 2 Lime and Soda Ash and Filtration	Option 3 Filtration and RO
WTF Cost New Water Tower Added Site Work, Land Costs, etc.	\$8,000,000 \$2,000,000 \$200,000	\$11,000,000 \$2,000,000 \$200,000	\$9,500,000 \$2,000,000 \$200,000
Total Construction Cost	**\$10,200,000**	**\$13,200,000**	**\$11,700,000**
Contingencies (20%) Engineering/Legal/Admin (20%)	\$2,050,000 \$2,050,000	\$2,650,000 \$2,650,000	\$2,350,000 \$2,350,000
Total Project Cost **Project Range (+/-15%)**	**\$14,300,000** **\$11.4M - \$17.2M**	**\$18,500,000** **\$14.8M - \$22.2M**	**\$16,400,000** **\$13.1M - \$19.7M**
Estimated Annual OM&R Cost	\$250,000	\$325,000	\$300,000

B. Alternative Recommendation

Each of the three options will achieve lower manganese concentrations and comply with the current health recommendations. Alternatives No. 2 and No. 3 have the added benefit of softening the water. Alternative No. 2 wastes the least amount of water, however, solids from the lime treatment system must be disposed of via land application or landfill. Alternative 3 does utilize the most water, however, reverse osmosis does remove many impurities and provides added protection for any potential future drinking water standards or well contamination.

A gravity filter plant can be designed to allow for future addition of lime softening or RO treatment. However, to do this, the city would need to select a softening option before construction to allow for the most efficient initial design of the facility for future expansions.

C. User Rate Analysis

One way to structure user water utility rates is to include a monthly service charge on top of usage rate. The monthly service charge does not include any water use and is intended to pay for the portions of the system costs which are required no matter how much water is produced. These costs include the distribution system, overhead and administration expenses, loan payments, some maintenance and repair costs, and some utilities. The usage rate is charged to the customer for any amount of water usage and is intended to pay for the system costs which vary depending on demand. These variable costs include chemical costs, some maintenance and repair costs, and some utilities. Often times, municipalities will have different rates for residential customers, commercial customers, and industrial customers.

The existing rate system for Montrose is structured with variable rates and a monthly service charge. Residential rates get a monthly flat base charge of $5.10, and additional charges based on quantity of water used. Increasing the base charge or usage rates is one way Montrose could raise additional funds for its water treatment facility.

D. Financing Options

There are several funding options the City of Montrose can explore to help finance these improvements. A brief review of these options is included in this section.

1. Bonding

The City of Montrose could sell general obligation bonds, local improvement, or revenue bonds to raise the capital costs to fund the proposed project. The proceeds of the bonds would need to be repaid through property taxes, assessments, or user charges to the system.

2. Drinking Water Revolving Fund (DWRF) Loans

The Clean Water Revolving Fund (CWRF) is a loan program operated by the State of Minnesota that was created under the Clean Water Act. This fund is intended to help communities build or upgrade water infrastructure. The program is not meant to fund new development and will only fund the part of the treatment facility for existing users.

The Drinking Water State Revolving Fund (DWSRF) is a loan program operated by the State of Minnesota that was created under the Clean Water Act. The Minnesota revolving loan program provides below market rate loans to public water system improvements. The Minnesota MN Department of Health (MDH) administers the environmental and permitting aspects of a project to prepare it for financing, while the MN Public Funding Authority (PFA) provides and administers the financial aspects of the loan review and disbursements. Funds are provided from sources including US

EPA, state matching funds, loan repayments, and the PFA revenue bond proceeds. To be eligible for funding, the City of Montrose must submit a proposal to be put on the Project Priority List (PPL). The project funding priority is ranked based on different categories including public health, adequate water supply, and financial need. A project must be listed on the PPL to be eligible for a loan through the DWSRF. A city must then submit a Preliminary Engineering Report (PER) to the MDH for approval, complete an Intended Use Plan (IUP) application to request inclusion on the quarterly IUP list, and also submit an Environmental Review Checklist for environmental review. Once an application is on the list, the city is eligible to apply for an DWSRF construction loan.

The standard loan term for all applicants is a 20-year loan period at a low-interest rate. Interest rates have historically been around 1.08 percent but vary based on the current market. The DWSRF also offers extended loan terms of 30 years, with different interest rates based on the financial need of the community. A loan secured through the DWSRF program may be repaid through local property tax rates, user fees, or assessments.

3. USDA Rural Development Loan or Grant

The City of Montrose may be eligible to secure a loan or grant through the USDA Office of Rural Development to help finance water and wastewater system improvements. Repayment could be through an increase in local property tax rates, user fees, or assessments. A portion of the project costs may be eligible for grant funding as part of this program, depending on the city customers' economic status. Based on the initial analysis, the recommended alternative would likely cause user rates that are considered affordable by USDA RD and are not likely to allow the project to be eligible for some grant funding.

To be considered for Rural Development monies, a Preliminary Engineering Report (PER) and Environmental Report (ER) must be completed and submitted to RD for their review and approval. Upon approval, RD would allocate a low-interest, fixed-rate loan and/or grant to be used to help finance the project. Loan rates are typically a low fixed-rate interest for up to 40-year terms. Depending on economic status, grants may be available for up to 49 percent of the project cost.

Rural Development uses an Equivalent Dwelling Unit (EDU) calculation determining the amount and type of funding for which a community is eligible. Although a 40-year loan term is favorable from an annual cost basis, water treatment facilities typically require a significant upgrade after 20 years. Since the facility is designed for shorter than the loan term, it is generally not advisable to consider paying for water treatment facilities with this method (i.e., The City might be in perpetual debt for the WTF).

The construction phasing of the project will depend on what the city decides to do. All the alternatives will have similar construction staging where the new buildings and equipment are installed. Some phasing will be needed as wells are converted to pump to the new treatment facility instead of directly to the system. However, this phasing should result in minimal impact to existing users and allow the system to still meet all water demands.

This section will be finalized after the city chooses how to proceed.

E. Implementation

The implementation schedule for a WTF construction project will depend on how the city chooses to proceed. A sample implementation schedule is shown in Table 7.3, and this shows the quickest schedule to move forward with water treatment improvements. This schedule will be updated as the city moves through this process. Next steps would include meeting with the City Council, conducting a public engagement process, a meeting with City Council, and then final adoption of the report.

Table 7.3 - Sample Implementation Schedule	
Task	**Month #**
Initiate Preliminary Design	0
Initiate Final Design	6
Submit Plans/Specs to MDH	10
Council Approval of Plans and Specs for Bidding	14
Advertisement for Bids	15
Bid Project	16
Award Contract	17
Start Construction	18
Project Completion	36
Note: Month each activity is shown to occur is approximate	

Appendix A: Raw Water Quality

Montrose

2017 DRINKING WATER REPORT

Making Safe Drinking Water

Your drinking water comes from a groundwater source: three wells ranging from 175 to 184 feet deep, that draw water from the Quaternary Buried Artesian aquifer.

Montrose works hard to provide you with safe and reliable drinking water that meets federal and state water quality requirements. The purpose of this report is to provide you with information on your drinking water and how to protect our precious water resources.

Contact Daniel Remer, Water Operator, at 763-238-2389 or wwtp@montrose-mn.com if you have questions about Montrose's drinking water. You can also ask for information about how you can take part in decisions that may affect water quality.

The U.S. Environmental Protection Agency sets safe drinking water standards. These standards limit the amounts of specific contaminants allowed in drinking water. This ensures that tap water is safe to drink for most people. The U.S. Food and Drug Administration regulates the amount of certain contaminants in bottled water. Bottled water must provide the same public health protection as public tap water.

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 poses a health risk. More information about contaminants and potential health effects can be obtained by calling the Environmental Protection Agency's Safe Drinking Water Hotline at 1-800-426-4791.

Montrose Monitoring Results

This report contains our monitoring results from January 1 to December 31, 2017.

We work with the Minnesota Department of Health to test drinking water for more than 100 contaminants. It is not unusual to detect contaminants in small amounts. No water supply is ever completely free of contaminants. Drinking water standards protect Minnesotans from substances that may be harmful to their health.

Learn more by visiting the Minnesota Department of Health's webpage Basics of Monitoring and Testing of Drinking Water in Minnesota (http://www.health.state.mn.us/divs/eh/water/factsheet/com/sampling.html).

How to Read the Water Quality Data Tables

The tables below show the contaminants we found last year or the most recent time we sampled for that contaminant. They also show the levels of those contaminants and the Environmental Protection Agency's limits. Substances that we tested for but did not find are not included in the tables.

We sample for some contaminants less than once a year because their levels in water are not expected to change from year to year. If we found any of these contaminants the last time we sampled for them, we included them in the tables below with the detection date.

We may have done additional monitoring for contaminants that are not included in the Safe Drinking Water Act. To request a copy of these results, call the Minnesota Department of Health at 651-201-4700 or 1-800-818-9318 between 8:00 a.m. and 4:30 p.m., Monday through Friday.

Definitions

- **AL (Action Level)**: The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.
- **EPA:** Environmental Protection Agency

- **MCL (Maximum contaminant level)**: 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.
- **MCLG (Maximum contaminant level goal)**: 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.
- **Level 1 Assessment**: A Level 1 assessment is a study of the water system to identify potential problems and determine (if possible) why total coliform bacteria have been found in our water system.
- **Level 2 Assessment**: A Level 2 assessment is a very detailed study of the water system to identify potential problems and determine (if possible) why an E. coli MCL violation has occurred and/or why total coliform bacteria have been found in our water system on multiple occasions.
- **MRDL (Maximum residual disinfectant level):** 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.
- **MRDLG (Maximum residual disinfectant level goal)**: 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.
- **NA (Not applicable)**: Does not apply.
- **NTU (Nephelometric Turbidity Units)**: A measure of the cloudiness of the water (turbidity).
- **pCi/l (picocuries per liter)**: A measure of radioactivity.
- **ppb (parts per billion)**: One part per billion in water is like one drop in one billion drops of water, or about one drop in a swimming pool. ppb is the same as micrograms per liter (μg/l).
- **ppm (parts per million)**: One part per million is like one drop in one million drops of water, or about one cup in a swimming pool. ppm is the same as milligrams per liter (mg/l).
- **PWSID**: Public water system identification.
- **TT (Treatment Technique):** A required process intended to reduce the level of a contaminant in drinking water.
- **Variances and Exemptions**: State or EPA permission not to meet an MCL or a treatment technique under certain conditions.

Water Quality Data Tables

LEAD AND COPPER – Tested at customer taps.

Contaminant (Date, if sampled in previous year)	**EPA's Action Level**	**EPA's Ideal Goal** (MCLG)	**90% of Results Were Less Than**	**Number of Homes with High Levels**	**Violation**	**Typical Sources**
Copper (06/21/17)	90% of homes less than 1.3 ppm	0 ppm	1.01 ppm	1 out of 10	NO	Corrosion of household plumbing.
Lead (06/21/17)	90% of homes less than 15 ppb	0 ppb	1.5 ppb	0 out of 10	NO	Corrosion of household plumbing.

INORGANIC & ORGANIC CONTAMINANTS – Tested in drinking water.

Contaminant (Date, if sampled in previous year)	**EPA's Limit** (MCL)	**EPA's Ideal Goal** (MCLG)	**Highest Average or Highest Single Test Result**	**Range of Detected Test Results**	**Violation**	**Typical Sources**
Barium (06/27/13)	2 ppm	2 ppm	0.09 ppm	N/A	NO	Discharge of drilling wastes; Discharge from metal refineries; Erosion of natural deposit.

CONTAMINANTS RELATED TO DISINFECTION – Tested in drinking water.

Substance (Date, if sampled in previous year)	**EPA's Limit** (MCL or MRDL)	**EPA's Ideal Goal** (MCLG or MRDLG)	**Highest Average or Highest Single Test Result**	**Range of Detected Test Results**	**Violation**	**Typical Sources**
Total Trihalomethanes (TTHMs)	80 ppb	N/A	1.6 ppb	N/A	NO	By-product of drinking water disinfection.
Total Haloacetic Acids (HAA)	60 ppb	N/A	1.6 ppb	N/A	NO	By-product of drinking water disinfection.
Total Chlorine	4.0 ppm	4.0 ppm	1.53 ppm	0.84 - 2.08 ppm	NO	Water additive used to control microbes.

Total HAA refers to HAA5

OTHER SUBSTANCES – Tested in drinking water.						
Substance (Date, if sampled in previous year)	**EPA's Limit** (MCL)	**EPA's Ideal Goal** (MCLG)	**Highest Average or Highest Single Test Result**	**Range of Detected Test Results**	**Violation**	**Typical Sources**
Fluoride	4.0 ppm	4.0 ppm	0.77 ppm	0.73 - 0.78 ppm	NO	Erosion of natural deposits; Water additive to promote strong teeth.

Potential Health Effects and Corrective Actions (If Applicable)

Fluoride: Fluoride is nature's cavity fighter, with small amounts present naturally in many drinking water sources. There is an overwhelming weight of credible, peer-reviewed, scientific evidence that fluoridation reduces tooth decay and cavities in children and adults, even when there is availability of fluoride from other sources, such as fluoride toothpaste and mouth rinses. Since studies show that optimal fluoride levels in drinking water benefit public health, municipal community water systems adjust the level of fluoride in the water to a concentration between 0.5 to 1.5 parts per million (ppm), with an optimal fluoridation goal between 0.7 and 1.2 ppm to protect your teeth. Fluoride levels below 2.0 ppm are not expected to increase the risk of a cosmetic condition known as enamel fluorosis.

Some People Are More Vulnerable to Contaminants in Drinking Water

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. The developing fetus and therefore pregnant women may also be more vulnerable to contaminants in drinking water. These people or their caregivers should seek advice about drinking water from their health care providers. EPA/Centers for Disease Control (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 at 1-800-426-4791.

Learn More about Your Drinking Water

Drinking Water Sources

Minnesota's primary drinking water sources are groundwater and surface water. Groundwater is the water found in aquifers beneath the surface of the land. Groundwater supplies 75 percent of Minnesota's drinking water. Surface water is the water in lakes, rivers, and streams above the surface of the land. Surface water supplies 25 percent of Minnesota's drinking water.

Contaminants can get in drinking water sources from the natural environment and from people's daily activities. There are five main types of contaminants in drinking water sources.

- **Microbial contaminants,** such as viruses, bacteria, and parasites. Sources include sewage treatment plants, septic systems, agricultural livestock operations, pets, and wildlife.
- **Inorganic contaminants** include salts and metals from natural sources (e.g. rock and soil), oil and gas production, mining and farming operations, urban stormwater runoff, and wastewater discharges.

- **Pesticides and herbicides** are chemicals used to reduce or kill unwanted plants and pests. Sources include agriculture, urban stormwater runoff, and commercial and residential properties.
- **Organic chemical contaminants** include synthetic and volatile organic compounds. Sources include industrial processes and petroleum production, gas stations, urban stormwater runoff, and septic systems.
- **Radioactive contaminants** such as radium, thorium, and uranium isotopes come from natural sources (e.g. radon gas from soils and rock), mining operations, and oil and gas production.

The Minnesota Department of Health provides information about your drinking water source(s) in a source water assessment, including:

- How Montrose is protecting your drinking water source(s);
- Nearby threats to your drinking water sources;
- How easily water and pollution can move from the surface of the land into drinking water sources, based on natural geology and the way wells are constructed.

Find your source water assessment at Source Water Assessments (www.health.state.mn.us/divs/eh/water/swp/swa/) or call 651-201-4700 or 1-800-818-9318 between 8:00 a.m. and 4:30 p.m., Monday through Friday.

Lead in Drinking Water

You may be in contact with lead through paint, water, dust, soil, food, hobbies, or your job. Coming in contact with lead can cause serious health problems for everyone. There is no safe level of lead. Babies, children under six years, and pregnant women are at the highest risk.

Lead is rarely in a drinking water source, but it can get in your drinking water as it passes through lead service lines and your household plumbing system. Montrose provides high quality drinking water, but it cannot control the plumbing materials used in private buildings.

Read below to learn how you can protect yourself from lead in drinking water.

1. **Let the water run** for 30-60 seconds before using it for drinking or cooking if the water has not been turned on in over six hours. If you have a lead service line, you may need to let the water run longer. A service line is the underground pipe that brings water from the main water pipe under the street to your home.
    - You can find out if you have a lead service line by contacting your public water system, or you can check by following the steps at: Are your pipes made of lead? Here's a quick way to find out (https://www.mprnews.org/story/2016/06/24/npr-find-lead-pipes-in-your-home).
    - The only way to know if lead has been reduced by letting it run is to check with a test. If letting the water run does not reduce lead, consider other options to reduce your exposure.
2. **Use cold water** for drinking, making food, and making baby formula. Hot water releases more lead from pipes than cold water.
3. **Test your water.** In most cases, letting the water run and using cold water for drinking and cooking should keep lead levels low in your drinking water. If you are still concerned about lead, arrange with a laboratory to test your tap water. Testing your water is important if young children or pregnant women drink your tap water.
    - Contact a Minnesota Department of Health accredited laboratory to get a sample container and instructions on how to submit a sample:
      Environmental Laboratory Accreditation Program
      (https://apps.health.state.mn.us/eldo/public/accreditedlabs/labsearch.seam)
      The Minnesota Department of Health can help you understand your test results.
4. **Treat your water** if a test shows your water has high levels of lead after you let the water run.
    - Read about water treatment units:
      Point-of-Use Water Treatment Units for Lead Reduction
      (http://www.health.state.mn.us/divs/eh/water/factsheet/com/poulead.html)

Learn more:

- Visit Lead in Drinking Water (http://www.health.state.mn.us/divs/eh/water/contaminants/lead.html#Protect)
- Visit Basic Information about Lead in Drinking Water (http://www.epa.gov/safewater/lead)
- Call the EPA Safe Drinking Water Hotline at 1-800-426-4791.To learn about how to reduce your contact with lead from sources other than your drinking water, visit Lead Poisoning Prevention: Common Sources (http://www.health.state.mn.us/divs/eh/lead/sources.html).
- This report is not being mailed to all customers but is available upon request. Please contact this City of Montrose at 763-575-7422.

Appendix B: National Primary and Secondary Drinking Water Regulations Summary

Appendix B: National Primary and Secondary Drinking Water Regulations Summary

National Primary Drinking Water Regulations

Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from long-term[3] exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal (mg/L)[2]
Acrylamide	TT[4]	Nervous system or blood problems; increased risk of cancer	Added to water during sewage/ wastewater treatment	**zero**
Alachlor	0.002	Eye, liver, kidney, or spleen problems; anemia; increased risk of cancer	Runoff from herbicide used on row crops	**zero**
Alpha/photon emitters	15 picocuries per Liter (pCi/L)	Increased risk of cancer	Erosion of natural deposits of certain minerals that are radioactive and may emit a form of radiation known as alpha radiation	**zero**
Antimony	0.006	Increase in blood cholesterol; decrease in blood sugar	Discharge from petroleum refineries; fire retardants; ceramics; electronics; solder	**0.006**
Arsenic	0.010	Skin damage or problems with circulatory systems, and may have increased risk of getting cancer	Erosion of natural deposits; runoff from orchards; runoff from glass & electronics production wastes	**0**
Asbestos (fibers >10 micrometers)	7 million fibers per Liter (MFL)	Increased risk of developing benign intestinal polyps	Decay of asbestos cement in water mains; erosion of natural deposits	**7 MFL**
Atrazine	0.003	Cardiovascular system or reproductive problems	Runoff from herbicide used on row crops	**0.003**
Barium	2	Increase in blood pressure	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits	**2**
Benzene	0.005	Anemia; decrease in blood platelets; increased risk of cancer	Discharge from factories; leaching from gas storage tanks and landfills	**zero**
Benzo(a)pyrene (PAHs)	0.0002	Reproductive difficulties; increased risk of cancer	Leaching from linings of water storage tanks and distribution lines	**zero**
Beryllium	0.004	Intestinal lesions	Discharge from metal refineries and coal-burning factories; discharge from electrical, aerospace, and defense industries	**0.004**
Beta photon emitters	4 millirems per year	Increased risk of cancer	Decay of natural and man-made deposits of certain minerals that are radioactive and may emit forms of radiation known as photons and beta radiation	**zero**
Bromate	0.010	Increased risk of cancer	Byproduct of drinking water disinfection	**zero**
Cadmium	0.005	Kidney damage	Corrosion of galvanized pipes; erosion of natural deposits; discharge from metal refineries; runoff from waste batteries and paints	**0.005**
Carbofuran	0.04	Problems with blood, nervous system, or reproductive system	Leaching of soil fumigant used on rice and alfalfa	**0.04**

LEGEND

DISINFECTANT | DISINFECTION BYPRODUCT | INORGANIC CHEMICAL | MICROORGANISM | ORGANIC CHEMICAL | RADIONUCLIDES

Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from long-term[3] exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal (mg/L)[2]
Carbon tetrachloride	0.005	Liver problems; increased risk of cancer	Discharge from chemical plants and other industrial activities	**zero**
Chloramines (as Cl_2)	MRDL=4.0[1]	Eye/nose irritation; stomach discomfort; anemia	Water additive used to control microbes	**MRDLG=4[1]**
Chlordane	0.002	Liver or nervous system problems; increased risk of cancer	Residue of banned termiticide	**zero**
Chlorine (as Cl_2)	MRDL=4.0[1]	Eye/nose irritation; stomach discomfort	Water additive used to control microbes	**MRDLG=4[1]**
Chlorine dioxide (as ClO_2)	MRDL=0.8[1]	Anemia; infants, young children, and fetuses of pregnant women: nervous system effects	Water additive used to control microbes	**MRDLG=0.8[1]**
Chlorite	1.0	Anemia; infants, young children, and fetuses of pregnant women: nervous system effects	Byproduct of drinking water disinfection	**0.8**
Chlorobenzene	0.1	Liver or kidney problems	Discharge from chemical and agricultural chemical factories	**0.1**
Chromium (total)	0.1	Allergic dermatitis	Discharge from steel and pulp mills; erosion of natural deposits	**0.1**
Copper	TT[5]; Action Level=1.3	Short-term exposure: Gastrointestinal distress. Long-term exposure: Liver or kidney damage. People with Wilson's Disease should consult their personal doctor if the amount of copper in their water exceeds the action level	Corrosion of household plumbing systems; erosion of natural deposits	**1.3**
Cryptosporidium	TT[7]	Short-term exposure: Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste	**zero**
Cyanide (as free cyanide)	0.2	Nerve damage or thyroid problems	Discharge from steel/metal factories; discharge from plastic and fertilizer factories	**0.2**
2,4-D	0.07	Kidney, liver, or adrenal gland problems	Runoff from herbicide used on row crops	**0.07**
Dalapon	0.2	Minor kidney changes	Runoff from herbicide used on rights of way	**0.2**
1,2-Dibromo-3-chloropropane (DBCP)	0.0002	Reproductive difficulties; increased risk of cancer	Runoff/leaching from soil fumigant used on soybeans, cotton, pineapples, and orchards	**zero**
o-Dichlorobenzene	0.6	Liver, kidney, or circulatory system problems	Discharge from industrial chemical factories	**0.6**
p-Dichlorobenzene	0.075	Anemia; liver, kidney, or spleen damage; changes in blood	Discharge from industrial chemical factories	**0.075**
1,2-Dichloroethane	0.005	Increased risk of cancer	Discharge from industrial chemical factories	**zero**

LEGEND

DISINFECTANT

DISINFECTION BYPRODUCT

INORGANIC CHEMICAL

MICROORGANISM

ORGANIC CHEMICAL

RADIONUCLIDES

Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from long-term[3] exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal (mg/L)[2]
1,1-Dichloroethylene	0.007	Liver problems	Discharge from industrial chemical factories	**0.007**
cis-1,2-Dichloroethylene	0.07	Liver problems	Discharge from industrial chemical factories	**0.07**
trans-1,2, Dichloroethylene	0.1	Liver problems	Discharge from industrial chemical factories	**0.1**
Dichloromethane	0.005	Liver problems; increased risk of cancer	Discharge from industrial chemical factories	**zero**
1,2-Dichloropropane	0.005	Increased risk of cancer	Discharge from industrial chemical factories	**zero**
Di(2-ethylhexyl) adipate	0.4	Weight loss, liver problems, or possible reproductive difficulties	Discharge from chemical factories	**0.4**
Di(2-ethylhexyl) phthalate	0.006	Reproductive difficulties; liver problems; increased risk of cancer	Discharge from rubber and chemical factories	**zero**
Dinoseb	0.007	Reproductive difficulties	Runoff from herbicide used on soybeans and vegetables	**0.007**
Dioxin (2,3,7,8-TCDD)	0.00000003	Reproductive difficulties; increased risk of cancer	Emissions from waste incineration and other combustion; discharge from chemical factories	**zero**
Diquat	0.02	Cataracts	Runoff from herbicide use	**0.02**
Endothall	0.1	Stomach and intestinal problems	Runoff from herbicide use	**0.1**
Endrin	0.002	Liver problems	Residue of banned insecticide	**0.002**
Epichlorohydrin	TT[4]	Increased cancer risk; stomach problems	Discharge from industrial chemical factories; an impurity of some water treatment chemicals	**zero**
Ethylbenzene	0.7	Liver or kidney problems	Discharge from petroleum refineries	**0.7**
Ethylene dibromide	0.00005	Problems with liver, stomach, reproductive system, or kidneys; increased risk of cancer	Discharge from petroleum refineries	**zero**
Fecal coliform and *E. coli*	MCL[6]	Fecal coliforms and *E. coli* are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Microbes in these wastes may cause short term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a special health risk for infants, young children, and people with severely compromised immune systems.	Human and animal fecal waste	**zero[6]**

LEGEND

DISINFECTANT | DISINFECTION BYPRODUCT | INORGANIC CHEMICAL | MICROORGANISM | ORGANIC CHEMICAL | RADIONUCLIDES

Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from long-term[3] exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal (mg/L)[2]
Fluoride	4.0	Bone disease (pain and tenderness of the bones); children may get mottled teeth	Water additive which promotes strong teeth; erosion of natural deposits; discharge from fertilizer and aluminum factories	**4.0**
Giardia lamblia	TT[7]	Short-term exposure: Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste	**zero**
Glyphosate	0.7	Kidney problems; reproductive difficulties	Runoff from herbicide use	**0.7**
Haloacetic acids (HAA5)	0.060	Increased risk of cancer	Byproduct of drinking water disinfection	**n/a[9]**
Heptachlor	0.0004	Liver damage; increased risk of cancer	Residue of banned termiticide	**zero**
Heptachlor epoxide	0.0002	Liver damage; increased risk of cancer	Breakdown of heptachlor	**zero**
Heterotrophic plate count (HPC)	TT[7]	HPC has no health effects; it is an analytic method used to measure the variety of bacteria that are common in water. The lower the concentration of bacteria in drinking water, the better maintained the water system is.	HPC measures a range of bacteria that are naturally present in the environment	**n/a**
Hexachlorobenzene	0.001	Liver or kidney problems; reproductive difficulties; increased risk of cancer	Discharge from metal refineries and agricultural chemical factories	**zero**
Hexachloro-cyclopentadiene	0.05	Kidney or stomach problems	Discharge from chemical factories	**0.05**
Lead	TT[5]; Action Level=0.015	Infants and children: Delays in physical or mental development; children could show slight deficits in attention span and learning abilities; Adults: Kidney problems; high blood pressure	Corrosion of household plumbing systems; erosion of natural deposits	**zero**
Legionella	TT[7]	Legionnaire's Disease, a type of pneumonia	Found naturally in water; multiplies in heating systems	**zero**
Lindane	0.0002	Liver or kidney problems	Runoff/leaching from insecticide used on cattle, lumber, and gardens	**0.0002**
Mercury (inorganic)	0.002	Kidney damage	Erosion of natural deposits; discharge from refineries and factories; runoff from landfills and croplands	**0.002**
Methoxychlor	0.04	Reproductive difficulties	Runoff/leaching from insecticide used on fruits, vegetables, alfalfa, and livestock	**0.04**
Nitrate (measured as Nitrogen)	10	Infants below the age of six months who drink water containing nitrate in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits	**10**

LEGEND

DISINFECTANT | DISINFECTION BYPRODUCT | INORGANIC CHEMICAL | MICROORGANISM | ORGANIC CHEMICAL | RADIONUCLIDES

Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from long-term[3] exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal (mg/L)[2]
Nitrite (measured as Nitrogen)	1	Infants below the age of six months who drink water containing nitrite in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits	**1**
Oxamyl (Vydate)	0.2	Slight nervous system effects	Runoff/leaching from insecticide used on apples, potatoes, and tomatoes	**0.2**
Pentachlorophenol	0.001	Liver or kidney problems; increased cancer risk	Discharge from wood-preserving factories	**zero**
Picloram	0.5	Liver problems	Herbicide runoff	**0.5**
Polychlorinated biphenyls (PCBs)	0.0005	Skin changes; thymus gland problems; immune deficiencies; reproductive or nervous system difficulties; increased risk of cancer	Runoff from landfills; discharge of waste chemicals	**zero**
Radium 226 and Radium 228 (combined)	5 pCi/L	Increased risk of cancer	Erosion of natural deposits	**zero**
Selenium	0.05	Hair or fingernail loss; numbness in fingers or toes; circulatory problems	Discharge from petroleum and metal refineries; erosion of natural deposits; discharge from mines	**0.05**
Simazine	0.004	Problems with blood	Herbicide runoff	**0.004**
Styrene	0.1	Liver, kidney, or circulatory system problems	Discharge from rubber and plastic factories; leaching from landfills	**0.1**
Tetrachloroethylene	0.005	Liver problems; increased risk of cancer	Discharge from factories and dry cleaners	**zero**
Thallium	0.002	Hair loss; changes in blood; kidney, intestine, or liver problems	Leaching from ore-processing sites; discharge from electronics, glass, and drug factories	**0.0005**
Toluene	1	Nervous system, kidney, or liver problems	Discharge from petroleum factories	**1**
Total Coliforms	5.0 percent[8]	Coliforms are bacteria that indicate that other, potentially harmful bacteria may be present. See fecal coliforms and *E. coli*	Naturally present in the environment	**zero**
Total Trihalomethanes (TTHMs)	0.080	Liver, kidney, or central nervous system problems; increased risk of cancer	Byproduct of drinking water disinfection	**n/a[9]**
Toxaphene	0.003	Kidney, liver, or thyroid problems; increased risk of cancer	Runoff/leaching from insecticide used on cotton and cattle	**zero**
2,4,5-TP (Silvex)	0.05	Liver problems	Residue of banned herbicide	**0.05**
1,2,4-Trichlorobenzene	0.07	Changes in adrenal glands	Discharge from textile finishing factories	**0.07**

LEGEND

DISINFECTANT

DISINFECTION BYPRODUCT

INORGANIC CHEMICAL

MICROORGANISM

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RADIONUCLIDES

Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from long-term[3] exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal (mg/L)[2]
1,1,1-Trichloroethane	0.2	Liver, nervous system, or circulatory problems	Discharge from metal degreasing sites and other factories	0.2
1,1,2-Trichloroethane	0.005	Liver, kidney, or immune system problems	Discharge from industrial chemical factories	0.003
Trichloroethylene	0.005	Liver problems; increased risk of cancer	Discharge from metal degreasing sites and other factories	zero
Turbidity	TT[7]	Turbidity is a measure of the cloudiness of water. It is used to indicate water quality and filtration effectiveness (e.g., whether disease-causing organisms are present). Higher turbidity levels are often associated with higher levels of disease-causing microorganisms such as viruses, parasites, and some bacteria. These organisms can cause short term symptoms such as nausea, cramps, diarrhea, and associated headaches.	Soil runoff	n/a
Uranium	30μg/L	Increased risk of cancer, kidney toxicity	Erosion of natural deposits	zero
Vinyl chloride	0.002	Increased risk of cancer	Leaching from PVC pipes; discharge from plastic factories	zero
Viruses (enteric)	TT[7]	Short-term exposure: Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste	zero
Xylenes (total)	10	Nervous system damage	Discharge from petroleum factories; discharge from chemical factories	10

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DISINFECTANT | DISINFECTION BYPRODUCT | INORGANIC CHEMICAL | MICROORGANISM | ORGANIC CHEMICAL | RADIONUCLIDES

NOTES

1 Definitions

- **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 and are non-enforceable public health goals.
- **Maximum Contaminant Level (MCL):** The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLGs as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards.
- **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.
- **Treatment Technique (TT):** A required process intended to reduce the level of a contaminant in drinking water.

2 Units are in milligrams per liter (mg/L) unless otherwise noted. Milligrams per liter are equivalent to parts per million (ppm).

3 Health effects are from long-term exposure unless specified as short-term exposure.

4 Each water system must certify annually, in writing, to the state (using third-party or manufacturers certification) that when it uses acrylamide and/or epichlorohydrin to treat water, the combination (or product) of dose and monomer level does not exceed the levels specified, as follows: Acrylamide = 0.05 percent dosed at 1 mg/L (or equivalent); Epichlorohydrin = 0.01 percent dosed at 20 mg/L (or equivalent).

5 Lead and copper are regulated by a Treatment Technique that requires systems to control the corrosiveness of their water. If more than 10 percent of tap water samples exceed the action level, water systems must take additional steps. For copper, the action level is 1.3 mg/L, and for lead is 0.015 mg/L.

6 A routine sample that is fecal coliform-positive or E. coli-positive triggers repeat samples--if any repeat sample is total coliform-positive, the system has an acute MCL violation. A routine sample that is total coliform-positive and fecal coliform-negative or E. coli-negative triggers repeat samples--if any repeat sample is fecal coliform-positive or E. coli-positive, the system has an acute MCL violation. See also Total Coliforms.

7 EPA's surface water treatment rules require systems using surface water or ground water under the direct influence of surface water to (1) disinfect their water, and (2) filter their water or meet criteria for avoiding filtration so that the following contaminants are controlled at the following levels:

- ***Cryptosporidium*:** 99 percent removal for systems that filter. Unfiltered systems are required to include Cryptosporidium in their existing watershed control provisions.
- **Giardia lamblia:** 99.9 percent removal/inactivation
- **Viruses:** 99.9 percent removal/inactivation
- ***Legionella*:** No limit, but EPA believes that if *Giardia* and viruses are removed/inactivated, according to the treatment techniques in the surface water treatment rule, *Legionella* will also be controlled.
- **Turbidity:** For systems that use conventional or direct filtration, at no time can turbidity (cloudiness of water) go higher than 1 nephelometric turbidity unit (NTU), and samples for turbidity must be less than or equal to 0.3 NTU in at least 95 percent of the samples in any month. Systems that use filtration other than the conventional or direct filtration must follow state limits, which must include turbidity at no time exceeding 5 NTU.
- **HPC:** No more than 500 bacterial colonies per milliliter
- **Long Term 1 Enhanced Surface Water Treatment:** Surface water systems or ground water systems under the direct influence of surface water serving fewer than 10,000 people must comply with the applicable Long Term 1 Enhanced Surface Water Treatment Rule provisions (e.g. turbidity standards, individual filter monitoring, *Cryptosporidium* removal requirements, updated watershed control requirements for unfiltered systems).
- **Long Term 2 Enhanced Surface Water Treatment:** This rule applies to all surface water systems or ground water systems under the direct influence of surface water. The rule targets additional *Cryptosporidium* treatment requirements for higher risk systems and includes provisions to reduce risks from uncovered finished water storages facilities and to ensure that the systems maintain microbial protection as they take steps to reduce the formation of disinfection byproducts. (Monitoring start dates are staggered by system size. The largest systems (serving at least 100,000 people) will begin monitoring in October 2006 and the smallest systems (serving fewer than 10,000 people) will not begin monitoring until October 2008. After completing monitoring and determining their treatment bin, systems generally have three years to comply with any additional treatment requirements.)
- **Filter Backwash Recycling:** The Filter Backwash Recycling Rule requires systems that recycle to return specific recycle flows through all processes of the system's existing conventional or direct filtration system or at an alternate location approved by the state.

8 No more than 5.0 percent samples total coliform-positive in a month. (For water systems that collect fewer than 40 routine samples per month, no more than one sample can be total coliform-positive per month.) Every sample that has total coliform must be analyzed for either fecal coliforms or E. coli. If two consecutive TC-positive samples, and one is also positive for E. coli or fecal coliforms, system has an acute MCL violation.

9 Although there is no collective MCLG for this contaminant group, there are individual MCLGs for some of the individual contaminants:

- **Haloacetic acids:** dichloroacetic acid (zero); trichloroacetic acid (0.3 mg/L)
- **Trihalomethanes:** bromodichloromethane (zero); bromoform (zero); dibromochloromethane (0.06 mg/L)

NATIONAL SECONDARY DRINKING WATER REGULATION

National Secondary Drinking Water Regulations are non-enforceable guidelines regarding contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. EPA recommends secondary standards to water systems but does not require systems to comply. However, some states may choose to adopt them as enforceable standards.

Contaminant	Secondary Maximum Contaminant Level
Aluminum	0.05 to 0.2 mg/L
Chloride	250 mg/L
Color	15 (color units)
Copper	1.0 mg/L
Corrosivity	Noncorrosive
Fluoride	2.0 mg/L
Foaming Agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 threshold odor number
pH	6.5-8.5
Silver	0.10 mg/L
Sulfate	250 mg/L
Total Dissolved Solids	500 mg/L
Zinc	5 mg/L

FOR MORE INFORMATION ON EPA'S SAFE DRINKING WATER:

visit: **epa.gov/safewater**

call: **(800) 426-4791**

ADDITIONAL INFORMATION:

To order additional posters or other ground water and drinking water publications, please contact the National Service Center for Environmental Publications at: **(800) 490-9198**, or email: **nscep@bps-lmit.com**.