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March 14, 2022

Mr. Joseph E. Batis, MAI, R/W-AC
Edward J. Batis & Associates
313 N. Chicago Street
Joliet, IL 60432

Re: Engineering Report
Water and Wastewater Systems
Ironton, Missouri

Dear Mr. Batis:

Flinn Engineering, LLC is pleased to present the following information regarding the water and wastewater systems owned by the City of Ironton, Missouri (City) as part of the appraisal process you are completing for Missouri American Water. The purpose of this Engineering Report is to provide an inventory of assets, estimate the 2022 installation cost, and estimate the depreciated value of the assets based on 2022 installation costs and the age of the assets. This report also includes a high-level review of the overall condition of the systems. The source water for the water treatment plant is Shepherd Mountain Lake. **The cost and condition of the lake and dam are not included in this report.**

Information provided and/or found through internet research includes:

- US Department of Labor – Bureau of Labor Statistics Average Annual Inflation Rate - **Appendix A**
- MDNR Census of Missouri Public Water Systems 2021 - excerpt in **Appendix B**
- MDNR Inspection of water system dated March 10, 2021 (MDNR Water Inspection Report) - **Appendix C**
- Water Distribution System Map – not attached
- City of Ironton Water Department Emergency Operation Plan – not attached
- Construction plans for sewer system improvements prepared by Crawford, Murphy & Tilly, Inc. dated February 1990 (1990 Construction Plans) – not attached
- “Ironton Wastewater Improvements Facility Plan” prepared by Smith & Co. dated September 2017 (Facility Plan) – not attached
- MDNR Operating Permit for WWTP – excerpt in **Appendix D**

The high-level condition assessment includes five (5) designations for the overall systems – Excellent, Very Good, Good, Fair, and Poor. Each individual piece of equipment is not assessed separately and underground assets are not observed. The overall condition assessment is based on visual observation of the physical condition of the above-ground assets, known or estimated age of the assets, judgment based on my experience observing water and wastewater assets, and reports by others if applicable. The high-level overall condition assessment considers that individual assets and/or facilities within the system may range from Excellent to Poor. Therefore, even though a system, for example, might appear to be in good overall condition, it is reasonable to expect some of the assets and/or facilities that comprise the system could be in excellent condition while others could be in poor condition. The overall condition for the system is not intended to suggest that every individual component of the system is in the same condition. A site visit was conducted on December 20, 2021. The site visit included an interview with City staff followed by a site visit to each facility location. No additional testing was conducted beyond the visual observation of physical condition of above-ground assets. The following reports (also listed above) that include an indication of the condition of the assets were also used in the high-level condition assessment:

- MDNR Water Inspection Report - **Appendix C**
- Facility Plan – not attached

The original installation costs and installation dates were not documented by the City. The 2022 estimated cost of installation was calculated using a combination of an engineering opinion of cost to install the assets based on knowledge of other systems, as well as correspondence from the City, vendors, and contractors. When original costs are provided or estimated, they are inflated to 2022 using the average annual inflation rate downloaded from the US Department of Labor – Bureau of Labor Statistics (**Appendix A**). The 2022 estimated installation cost was depreciated based on the estimated age of each asset.

Water System

Based on the MDNR Census of Missouri Public Water Systems 2021 (excerpt in **Appendix B**), the Ironton original water system was placed in service in 1928. The 2021 MDNR Water Inspection Report (**Appendix C**) also states that Shepherd Mountain Lake and the original water plant were construction in 1928. The water system also includes three (3) storage tanks, a pressure reducing valve (PRV) vault, and the water distribution system.

Water Treatment Plant

The water treatment plant is a conventional treatment plant including flocculation, sedimentation, greensand filtration, and microfiltration. The plant was originally constructed in 1928 with a significant improvement project in 2007. The City received $2,500,000 through the state revolving loan fund program for water system improvements. Based on conversations with City staff the improvements at the plant included replacing the sand in the original filters with greensand, adding microfiltration units, and replacing the emergency generator. We assumed the tanks and other improvements described below that were installed in 2007, were also part of the $2,500,000 loan. We used historic inflation (**Appendix A**) to inflate the loan value to 2022. We subtracted other assets that were installed in 2007 to determine a 2022 estimate for the water treatment plant. Since all original assets at the water treatment plant would be fully depreciated, we did not attempt to estimate the original plant assets. Based on the visual observation during the site visit and the age of the original plant, the water treatment plant appears to be in fair condition.

Water Storage Tank

The water system includes three (3) ground storage tanks. The tanks are constructed at high ground elevations so pump stations are not required to pump out of the tanks. The oldest tank is the Dent Street Tank. It is a 200,000 gallon welded steel tank. The nameplate on the tank shows that it was installed in 1965. The other two (2) tanks are the Westwood Tank and the North Tank. Both are 106,000 gallons and glass-lined steel tanks. Based on correspondence with Cady Aquastore®, Inc. the tanks were purchased in 2007 and the cost was approximately $121,000 for each tank, not including foundation, site piping, etc. Based on conversations with tank manufacturers, the estimated cost for supplying and constructing the welded steel tank in 2022 would be in the range of $2.00 to $2.50 per gallon depending on the height of the tank. We estimated the cost of the Dent Street Tank to be $2.00 per gallon because of the height. We used historic inflation (**Appendix A**) to inflate the cost of the Westwood and North tanks to 2022. We estimated the cost of the foundation to be 10% of the tank cost, the site piping to be 5% of the tank cost, and the site work (grading, fencing, etc.) to be $5,000. The engineering is estimated at 10% of the subtotal for the tank, foundation, etc. **Tables 1 and 2** summarize the estimated cost to install the tanks in 2022.

Table 1 – Dent Street Tank Estimated Installation Cost in 2022

Description of Work	Tank (200,000 gallons)
Tank ($2.00 per gallon)	$ 400,000.00
Foundation (10% of Tank)	$ 40,000.00
Site Piping (5% of Tank)	$ 20,000.00
Site Work (Lump sum $5,000)	$ 5,000.00
Subtotal	$ 465,000.00
Engineering (10% of Subtotal)	$ 46,500.00
Total	**$ 511,500.00**

Table 2 – Westwood Tank and North Tank Estimated Installation Cost in 2022

Description of Work	Tanks (106,000 gallons)
Tank ($121,000 in 2007)	$ 172,869.31
Foundation (10% of Tank)	$ 17,286.93
Site Piping (5% of Tank)	$ 8,643.47
Site Work (Lump sum $5,000)	$ 5,000.00
Subtotal	$ 203,799.70
Engineering (10% of Subtotal)	$ 20,379.97
Total	**$ 224,179.67**

The MDNR Water Inspection Report (**Appendix C**) indicates that the tanks are in "generally good" condition. No tank inspection reports were provided. Based on the visual observation during the site visit, the age of the tanks, and the MDNR Water Inspection Report (**Appendix C**) the tanks appear to be in good condition.

<u>Water Distribution System</u>

A distribution system map was provided by the City. The map is not dated and is not printed to scale. The map includes the location and size of water mains, location of hydrants, and street names. The water distribution layout was recreated and measured in *Google Earth™ mapping service* to obtain an estimate of the length of main by size for this report. **Table 3** summarizes the water main inventory.

Table 3 – Water Main Inventory

Pipe Diameter	Length (feet)
2-inch Water Main	10,400
4-inch Water Main	53,200
6-inch Water Main	13,200
8-inch Water Main	12,600
Total	89,400

The MDNR Water Inspection Report (**Appendix C**) indicates that the distribution system is approximately 90% cast iron and approximately 10% PVC. The length of 8-inch main is approximately 14% of the total length of main. Based on the location of the 8-inch main, we assumed it was installed in 2007 with the Westwood Tank and the North Tank. All other water main is assumed to be part of the original system. **Table 4** summarizes the estimated 2022 cost of the water distribution system. The estimated cost assumes the average depth of the water main is approximately 3 feet. The estimate includes design, excavation, materials, installation, backfill, and restoration. The number of fire hydrants is based on the City of Ironton Water Department Emergency Operation Plan. The number of services and meters is based on the information provided by the City. The hydrants and the services/meters are assumed to be part of the original system.

Table 4 – Distribution System Estimated Installation Cost in 2022

Asset Description	Quantity	Unit	Estimated Unit Cost 2022	2022 Estimated Installation Cost
2-inch Water Main	10,400	feet	$ 35	$ 364,000
4-inch Water Main	53,200	feet	$ 55	$ 2,926,000
6-inch Water Main	13,200	feet	$ 55	$ 726,000
8-inch Water Main	12,600	feet	$ 60	$ 756,000
PRV Vault	1	each	$ 20,000	$ 20,000
Fire Hydrants	91	each	$ 4,500	$ 409,500
Services and Meters	726	each	$ 2,000	$ 1,452,000
			Total	**$ 6,653,500**

The water distribution system was not observed for condition. The MDNR Water Inspection Report (**Appendix C**) indicates the non-revenue water (NRW) based on 2017 production and sales was 8%, which is considered an acceptable level by MDNR. High levels of NRW can be caused by a variety of issues and is not always an indication of the condition of the water distribution system. Common causes of NRW include water main leaks, inaccurate meters, unmetered connections, theft, and inaccurate estimates of water used for flushing hydrants and fire protection. Based on the age of the water distribution assets and the acceptable level of NRW, the water distribution system appears to be in good condition.

Wastewater System

The original wastewater system is assumed to date back to the original water system in 1928. The wastewater system includes a wastewater treatment plant (WWTP), one (1) lift station, and the sewer collection system. The City provided three (3) sets of construction plans dated February

1990 prepared by Crawford, Murphy & Tilly, Inc. The construction plans are titled "Division 1: Wastewater Treatment Plant Improvements", "Division 2: Land Application System", and "Division 3: Sewer System Improvements", collectively referred to as 1990 Construction Plans in this report. Although the construction plans are dated 1990, we assumed the construction was completed in 1991. The City also provided report titled "Ironton Wastewater Improvements Facility Plan" prepared by Smith & Co. dated September 2017.

Wastewater Treatment Plant

According to the MDNR Operating Permit (excerpt in **Appendix D**), the WWTP is a three cell lagoon (one aerated cell and two holding cells), partial irrigation, and sludge is retained in the lagoons. The WWTP has a design flow of 400,000 gallons per day. Based on the 1990 Construction Plans the wastewater treatment plant upgrades included a new excess flow pump station, a new holding cell, level control structures, irrigation pump station, chlorination building, and discharge structure. During the site visit the City staff indicated that a new bar screen was installed within the last few years. Since all original assets at the WWTP would be fully depreciated, we did not attempt to estimate the original plant assets. We assumed a unit cost of $5 per gallon for the WWTP improvements in 2022. The new influent bar screen is estimated at $250,000 in 2022 based on discussions with vendors and contractors. The Facility Plan indicates that the WWTP is not able to meet ammonia and nitrogen requirements and does not meet the disinfection requirements for discharge. This is not necessarily an indication of the asset condition, but could be attributed to more stringent regulations. Based on the visual observation during the site visit and the age of the original plant, the WWTP appears to be in fair condition.

Sewer Lift Station

The wastewater system include a lift station on Fair Lane. The lift station is included in the 1990 Construction Plans. The station is constructed of concrete and the wet well is approximately 15 feet deep with two (2) submersible 7.5 hp pumps. During the site visit the City staff indicated that both pumps were replaced six (6) years ago. Based on discussions with contractors, the 2022 cost of the lift station is estimated at $150,000 and the pump replacement is estimated at $20,000. Most of the structure and equipment at the lift station is below ground and could not be observed. Based on the age and the recent pump replacement, the lift station is assumed to be in good condition.

Sewer Collection System

The sewer collection system inventory (sewers and manholes) was found on the City's GIS portal (https://semorpc.maps.arcgis.com/apps/webappviewer/index.html?id=f78cea313eb54df685fe5553da559f8b). The collection system includes vitrified clay pipe (VCP) and polyvinyl chloride (PVC) ranging in size from 4-inch to 24-inch. **Table 5** summarizes the sewer inventory.

Table 5 – Sewer Collection System Inventory

Pipe Diameter and Material	Length (feet)
4-inch Forcemain (PVC)	2,944
6-inch Gravity (VCP)	1,834
6-inch Gravity (PVC)	2,745
8-inch Gravity (VCP)	55,259
8-inch Gravity (PVC)	11,153
8-inch Forcemain (PVC)	4,680
10-inch Gravity (VCP)	10,757
12-inch Gravity (PVC)	648
15-inch Gravity (PVC)	3,226
18-inch Gravity (PVC)	6,228
24-inch Gravity (PVC)	120
Total	**99,594**

The VCP is assumed to be part of the original system dating back to 1928 and the PVC is assumed to be part of the 1991 project. The 1990 Construction Plans included new PVC sewer and the length is comparable to the PVC sewer listed above. The number of manholes is based on the GIS data and the 1990 Construction Plans. The number of service laterals was provided by the City and assumed to be part of the original system. The 2022 estimated cost to install the sewer collection system is based on an average depth of 6 feet for the gravity sewer and 3 feet for the forcemain. This is consistent with the 1990 Construction Plans. The estimate includes design, excavation, materials, installation, backfill, and restoration. **Table 6** summarizes the inventory of the sewer collection system and the estimated installation cost in 2022.

Table 6 - Sewer Collection System Estimated Installation Cost in 2022

Asset Description	Quantity	Unit	Estimated Unit Cost 2022	2022 Estimated Installation Cost
4-inch PVC Forcemain	2,944	feet	$ 55.00	$ 161,920
8-inch PVC Forcemain	4,680	feet	$ 60.00	$ 280,800
6-inch Clay Gravity	1,834	feet	$ 55.00	$ 100,870
6-inch PVC Gravity	2,745	feet	$ 55.00	$ 150,975
8-inch Clay Gravity	55,259	feet	$ 65.00	$ 3,591,835
8-inch PVC Gravity	11,153	feet	$ 65.00	$ 724,945
10-inch Clay Gravity	10,757	feet	$ 70.00	$ 752,990
12-inch PVC Gravity	648	feet	$ 75.00	$ 48,600
15-inch PVC Gravity	3,226	feet	$ 80.00	$ 258,080
18-inch PVC Gravity	6,228	feet	$ 90.00	$ 560,520
24-inch PVC Gravity	120	feet	$ 100.00	$ 12,000
Manholes-Original System	247	each	$ 4,000.00	$ 988,000
Manholes-1991 Improvements	72	each	$ 4,000.00	$ 288,000
Service Laterals	643	each	$ 400.00	$ 257,200
			Total	$ 8,176,735

The sewer collection system was not observed for condition. The Facility Plan indicates that the collection system experiences significant Infiltration/Inflow (I/I) issues. The Facility Plan summarized the I/I issues based on a video inspection that was conducted in 2011 and 2012. They identified approximately 300 points spread across the entire collection system for potential infiltration sources. Approximately 2/3 of the collection system is clay pipe that is assumed to date back to the original system. Based on the age and material of the majority of the collection system and the significant I/I issues, the collection system is assumed to be in poor condition.

Estimated Depreciated Value

Table 7 shows a summary of the estimated cost for installation in 2022 and the depreciated value based on the age of the assets. The depreciation calculation is included in **Appendix E**. The depreciation periods are based on depreciation periods used by the Missouri Public Service Commission (PSC) during recent rate cases. The depreciation schedules from six (6) recent rate cases are included in **Appendix F**. Three (3) are from water systems and three (3) are from wastewater systems. The depreciation periods used are summarized in **Table 8**.

Table 7 - Summary of Estimated Depreciated Value

	Estimated 2022 Installation Cost	Depreciated from 2022 Estimate
Ironton Water System	$ 9,980,700.00	$ 2,184,197.09
Ironton Wastewater System	$ 10,596,735.00	$ 1,616,528.29
Total	$ 20,577,435.00	$ 3,800,725.38

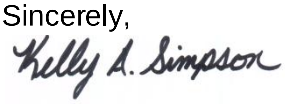
Table 8 – Depreciation Periods

Asset	Depreciation Period (years)
Tanks	42
Water Treatment Equipment	35
Water Main	50
Services and Meters	35
Hydrants	50
WWTP - Equipment	22
WWTP - Lagoon	40
Sanitary Sewer, Manholes, Laterals	50
Lift Station	10

Overall the water and wastewater systems appear to be in fair condition. Although many of the assets are fully or nearly depreciated, they are still in operation and could continue to stay in operation well beyond the depreciation period.

Thank you for the opportunity to assist you on this project. Please let me know if you have any questions.

Sincerely,



Kelly A. Simpson, PE, LEED® AP
Owner

Enclosures:
Appendix A – US Department of Labor – Bureau of Labor Statistics Average Annual Inflation Rate
Appendix B – MDNR Census of Missouri Public Water Systems 2021
Appendix C – MDNR Water Inspection Report
Appendix D – MDNR Operating Permit for WWTP
Appendix E – Depreciation Calculation
Appendix F – Missouri PSC Depreciation Schedules

CPI-All Urban Consumers (Current Series)
12-Month Percent Change
US Department of Labor - Bureau of Labor Statistics
Series Id: CUUR0000SA0L1E
Not Seasonally Adjusted
Series Title: All items less food and energy in U.S. city
Area: U.S. city average
Item: All items less food and energy
Base Period: 1982-84=100
Years: 1958 to 2020

https://data.bls.gov/pdq/SurveyOutputServlet
Search for CUUR0000SA0L1E
More Formatting Options
12-month percent change

Added Columns to Calculate Inflation Factor

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	HALF1	HALF2	Annual Factor	Factor to 2021
1958	3.2	3.2	2.8	2.4	2.4	2.1	2.4	2.1	1.7	1.7	1.7	1.7	2.4			1.024	10.171
1959	1.7	1.7	1.7	1.7	2.0	2.0	2.0	2.0	2.4	2.7	2.0	2.0	2.0			1.020	9.932
1960	2.0	2.3	2.0	2.0	1.7	1.7	1.3	1.3	1.0	1.0	1.0	1.0	1.3			1.013	9.737
1961	1.0	0.7	0.7	1.0	1.0	1.0	1.3	1.3	1.6	1.3	1.3	1.3	1.3			1.013	9.612
1962	1.3	1.3	1.6	1.3	1.6	1.6	1.3	1.3	1.3	1.3	1.3	1.3	1.3			1.013	9.489
1963	1.0	1.0	1.0	1.3	1.0	1.3	1.3	1.6	1.3	1.3	1.6	1.6	1.3			1.013	9.367
1964	1.9	1.9	1.9	1.6	1.6	1.6	1.6	0.9	1.3	1.3	1.2	1.2	1.6			1.016	9.247
1965	1.6	1.6	1.2	1.6	1.6	1.2	1.2	1.6	1.5	1.5	1.2	1.5	1.2			1.012	9.101
1966	0.9	1.2	1.5	1.8	2.1	2.4	2.8	3.1	3.0	3.3	3.6	3.3	2.4			1.024	8.994
1967	3.6	3.6	3.6	3.3	3.3	3.3	3.3	3.3	3.6	3.5	3.5	3.8	3.6			1.036	8.783
1968	4.1	4.1	4.4	4.4	4.3	4.6	4.9	4.9	4.9	4.8	5.1	5.1	4.6			1.046	8.478
1969	5.1	5.3	5.6	6.1	6.1	5.8	5.8	5.8	6.0	6.0	5.9	6.2	5.8			1.058	8.105
1970	6.2	6.1	6.1	5.8	6.0	6.5	6.2	6.2	6.2	6.4	6.6	6.6	6.3			1.063	7.660
1971	6.3	5.8	5.2	5.0	5.2	4.9	4.9	4.6	4.4	3.8	3.3	3.1	4.7			1.047	7.206
1972	3.1	3.3	3.3	3.3	3.1	2.8	2.8	3.3	2.8	3.0	3.0	3.0	3.0			1.030	6.883
1973	2.8	2.8	3.0	3.2	3.2	3.2	3.2	3.2	3.8	4.3	4.5	4.7	3.6			1.036	6.682
1974	4.9	5.4	5.8	6.2	6.8	7.9	8.8	9.6	10.2	10.6	11.2	11.1	8.3			1.083	6.450
1975	11.5	11.7	11.4	11.3	10.5	9.6	9.1	8.2	7.7	7.0	6.8	6.7	9.1			1.091	5.956
1976	6.7	6.5	6.6	6.4	6.5	6.5	6.7	6.8	6.8	6.7	6.5	6.1	6.5			1.065	5.459
1977	6.3	6.3	6.2	6.3	6.3	6.6	6.3	6.2	6.2	6.0	5.9	6.5	6.3			1.063	5.126
1978	6.4	6.2	6.3	6.5	6.8	7.0	7.4	7.5	7.9	8.4	8.7	8.5	7.4			1.074	4.822
1979	8.6	9.2	9.3	9.3	9.4	9.3	9.6	10.0	9.9	10.1	10.6	11.3	9.8			1.098	4.490
1980	12.0	12.0	12.5	13.0	13.3	13.6	12.4	11.8	12.0	12.3	12.1	12.2	12.4			1.124	4.089
1981	11.4	10.9	10.0	9.5	9.5	9.4	11.1	11.6	11.8	10.9	10.2	9.5	10.4			1.104	3.638
1982	9.3	9.1	8.8	8.9	8.7	8.6	7.6	7.1	5.9	5.9	5.3	4.5	7.4			1.074	3.295
1983	4.7	4.7	4.7	4.3	3.6	2.9	3.0	3.0	3.5	3.7	4.3	4.8	4.0			1.040	3.068
1984	4.8	4.8	5.0	5.0	5.2	5.1	5.0	5.1	5.1	4.9	4.6	4.7	5.0			1.050	2.950
1985	4.5	4.7	4.8	4.5	4.5	4.4	4.2	4.1	4.0	4.1	4.4	4.3	4.3	4.7	4.3	1.043	2.810
1986	4.4	4.2	4.1	4.2	4.0	4.0	4.1	4.0	4.1	4.0	3.8	3.8	4.0	4.1	4.0	1.040	2.694
1987	3.8	3.8	4.0	4.2	4.2	4.1	4.0	4.2	4.3	4.3	4.4	4.2	4.1	4.0	4.2	1.041	2.590
1988	4.3	4.3	4.4	4.3	4.3	4.5	4.5	4.4	4.4	4.5	4.4	4.7	4.4	4.4	4.5	1.044	2.488
1989	4.6	4.8	4.7	4.6	4.6	4.5	4.6	4.4	4.3	4.3	4.4	4.4	4.5	4.6	4.3	1.045	2.383
1990	4.4	4.6	4.9	4.8	4.8	4.9	5.0	5.5	5.5	5.3	5.3	5.2	5.0	4.8	5.3	1.050	2.281
1991	5.6	5.6	5.2	5.1	5.1	5.0	4.8	4.6	4.5	4.4	4.5	4.4	4.9	5.3	4.6	1.049	2.172
1992	3.9	3.8	3.9	3.9	3.8	3.8	3.7	3.5	3.3	3.5	3.4	3.3	3.7	3.8	3.4	1.037	2.071

CPI-All Urban Consumers (Current Series)
12-Month Percent Change
US Department of Labor - Bureau of Labor Statistics

https://data.bls.gov/pdq/SurveyOutputServlet
Search for CUUR0000SA0L1E
More Formatting Options
12-month percent change

Series Id:	CUUR0000SA0L1E
Not Seasonally Adjusted	
Series Title:	All items less food and energy in U.S. city
Area:	U.S. city average
Item:	All items less food and energy
Base Period:	1982-84=100
Years:	1958 to 2020

Added Columns to Calculate Inflation Factor

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	HALF1	HALF2	Annual Factor	Factor to 2021
1993	3.5	3.6	3.4	3.5	3.4	3.3	3.2	3.3	3.2	3.0	3.1	3.2	3.3	3.4	3.2	1.033	1.997
1994	2.9	2.8	2.9	2.8	2.8	2.9	2.9	2.9	3.0	2.9	2.8	2.6	2.8	2.8	2.9	1.028	1.933
1995	2.9	3.0	3.0	3.1	3.1	3.0	3.0	2.9	2.9	3.0	3.0	3.0	3.0	3.0	3.0	1.030	1.880
1996	3.0	2.9	2.8	2.7	2.7	2.7	2.7	2.6	2.7	2.6	2.6	2.6	2.7	2.7	2.7	1.027	1.826
1997	2.5	2.5	2.5	2.7	2.5	2.4	2.4	2.3	2.2	2.3	2.2	2.2	2.4	2.6	2.2	1.024	1.778
1998	2.2	2.3	2.1	2.1	2.2	2.2	2.2	2.5	2.5	2.3	2.3	2.4	2.3	2.2	2.4	1.023	1.736
1999	2.4	2.1	2.1	2.2	2.0	2.1	2.1	1.9	2.0	2.1	2.1	1.9	2.1	2.1	2.0	1.021	1.697
2000	2.0	2.2	2.4	2.3	2.4	2.5	2.5	2.6	2.6	2.5	2.6	2.6	2.4	2.3	2.5	1.024	1.662
2001	2.6	2.7	2.7	2.6	2.5	2.7	2.7	2.7	2.6	2.6	2.8	2.7	2.6	2.6	2.7	1.026	1.623
2002	2.6	2.6	2.4	2.5	2.5	2.3	2.2	2.4	2.2	2.2	2.0	1.9	2.4	2.5	2.2	1.024	1.582
2003	1.9	1.7	1.7	1.5	1.6	1.5	1.5	1.3	1.2	1.3	1.1	1.1	1.4	1.7	1.3	1.014	1.545
2004	1.1	1.2	1.6	1.8	1.7	1.9	1.8	1.7	2.0	2.0	2.2	2.2	1.8	1.6	2.0	1.018	1.524
2005	2.3	2.4	2.3	2.2	2.2	2.0	2.1	2.1	2.0	2.1	2.1	2.2	2.2	2.2	2.1	1.022	1.497
2006	2.1	2.1	2.1	2.3	2.4	2.6	2.7	2.8	2.9	2.7	2.6	2.6	2.5	2.2	2.7	1.025	1.464
2007	2.7	2.7	2.5	2.3	2.2	2.2	2.2	2.1	2.1	2.2	2.3	2.4	2.3	2.4	2.3	1.023	1.429
2008	2.5	2.3	2.4	2.3	2.3	2.4	2.5	2.5	2.5	2.2	2.0	1.8	2.3	2.3	2.3	1.023	1.397
2009	1.7	1.8	1.8	1.9	1.8	1.7	1.5	1.4	1.5	1.7	1.7	1.8	1.7	1.8	1.6	1.017	1.365
2010	1.6	1.3	1.1	0.9	0.9	0.9	0.9	0.9	0.8	0.6	0.8	0.8	1.0	1.1	0.8	1.010	1.342
2011	1.0	1.1	1.2	1.3	1.5	1.6	1.8	2.0	2.0	2.1	2.2	2.2	1.7	1.3	2.0	1.017	1.329
2012	2.3	2.2	2.3	2.3	2.3	2.2	2.1	1.9	2.0	2.0	1.9	1.9	2.1	2.2	2.0	1.021	1.307
2013	1.9	2.0	1.9	1.7	1.7	1.6	1.7	1.8	1.7	1.7	1.7	1.7	1.8	1.8	1.7	1.018	1.280
2014	1.6	1.6	1.7	1.8	2.0	1.9	1.9	1.7	1.7	1.8	1.7	1.6	1.7	1.8	1.7	1.017	1.257
2015	1.6	1.7	1.8	1.8	1.7	1.8	1.8	1.8	1.9	1.9	2.0	2.1	1.8	1.7	1.9	1.018	1.236
2016	2.2	2.3	2.2	2.1	2.2	2.2	2.2	2.3	2.2	2.1	2.1	2.2	2.2	2.2	2.2	1.022	1.214
2017	2.3	2.2	2.0	1.9	1.7	1.7	1.7	1.7	1.7	1.8	1.7	1.8	1.8	2.0	1.7	1.018	1.188
2018	1.8	1.8	2.1	2.1	2.2	2.3	2.4	2.2	2.2	2.1	2.2	2.2	2.1	2.1	2.2	1.021	1.167
2019	2.2	2.1	2.0	2.1	2.0	2.1	2.2	2.4	2.4	2.3	2.3	2.3	2.2	2.1	2.3	1.022	1.143
2020	2.3	2.4	2.1	1.4	1.2	1.2	1.6	1.7	1.7	1.6	1.6	1.6	1.7	1.8	1.6	1.017	1.119
2021	1.4	1.3	1.6	3	3.8	4.5	4.3	4	4	4.6	4.9	5.5	3.6	2.6	4.55	1.036	1.100
2022	6	6.4											6.2			1.062	1

CENSUS OF MISSOURI PUBLIC WATER SYSTEMS 2021

Missouri Department of Natural Resources
Division of Environmental Quality
Water Protection Program
Public Drinking Water Branch

City Water Systems

Community Water System Name		Year Began	Operator Level	Owner Code	Population Served	Service Connections	Pct Sur Water	Pct Grd Water	Pct GW Under Infl	Pct Pur Sur Water	Pct Pur Grd Water	Pct Pur GW Und Infl	Supply Capacity MGD	Avg Daily Consumption MGD	Finished Water Storage
HUNNEWELL PWS															
System ID Number	County Location														
MO2010390	SHELBY	1969	1	L	184	79	0	0	0	100	0	0	0.0430	0.0090	0.0400
HUNTSVILLE PWS															
System ID Number	County Location														
MO2010393	RANDOLPH	1950	1	L	1,563	667	0	0	0	100	0	0		0.1080	0.3000
HURLEY PWS															
System ID Number	County Location														
MO5010423	STONE	1993	2	L	178	84	0	100	0	0	0	0	0.0190		0.0210
IBERIA PWS															
System ID Number	County Location														
MO3010396	MILLER	1952	D2	L	736	360	0	100	0	0	0	0	0.9170	0.0680	0.3280
INDEPENDENCE PWS															
System ID Number	County Location														
MO1010399	JACKSON	1925	B3	L	117,240	49,898	0	100	0	0	0	0	48.0000	27.1000	13.1140
IONIA PWS															
System ID Number	County Location														
MO3010400	BENTON	1960	1	L	105	47	0	100	0	0	0	0	0.0850	0.0080	0.0500
IRONDALE PWS															
System ID Number	County Location														
MO6010401	WASHINGTON	1988	1	L	480	181	0	100	0	0	0	0	0.1200	0.0250	0.1050
IRONTON PWS															
System ID Number	County Location														
MO4010402	IRON	1928	B2	L	1,398	695	100	0	0	0	0	0	0.2880	0.1240	0.4440
JACKSON PWS															
System ID Number	County Location														
MO4010404	CAPE GIRARDEAU	1907	C3	L	14,932	3,995	0	100	0	0	0	0	2.9520	1.5550	2.1570
JAMESPORT PWS															
System ID Number	County Location														
MO1010406	DAVIESS	1956	1	L	826	331	0	0	0	0	100	0	0.1440	0.0440	0.0000

Missouri Department of NATURAL RESOURCES dnr.mo.gov
Michael L. Parson, Governor Carol S. Comer, Director

March 10, 2021

The Honorable Robert Lourwood
City of Ironton
123 North Main
Ironton, MO 63650

FINDING OF COMPLIANCE

Dear Mayor Lourwood:

An engineering sanitary survey was conducted at Ironton public water system by Missouri Department of Natural Resources (Department) staff pursuant to Safe Drinking Water Law on March 1, 2021, as described in the enclosed report.

The site was found to be **in compliance** with the Safe Drinking Water Law based upon the observations made at the time of the inspection. The Report of Engineering Sanitary Survey outlines the findings of the inspection and may list important recommendations that should be considered to ensure continued compliance. Your cooperation implementing those recommendations will be appreciated.

Unless otherwise requested within the report, all correspondence and questions should be directed to Mr. Zachary Miller of this office by calling 573-840-9023 or via mail at the Southeast Regional office, 2155 North Westwood Boulevard, Poplar Bluff, MO 63901.

Sincerely,

SOUTHEAST REGIONAL OFFICE

Toby A. Gilham, PE
Engineering Section Chief

Enclosure

c: Public Drinking Water Branch (electronically)
Public Drinking Water Branch Monitoring Section (electronically)
Mr. Tony Prior, fax: 573-546-6555
Permits and Engineering Section (electronically)

Missouri Department of Natural Resources
Southeast Regional Office/Public Drinking Water Branch
Report of Engineering Sanitary Survey
Ironton PWS
Iron County, Missouri
Public Water System ID Number MO MO4010402
March 10, 2021

Introduction

An engineering sanitary survey was made by the Missouri Department of Natural Resources (Department) of the community public water system serving Ironton on March 1, 2021.

Missouri Public Drinking Water Regulation 10 CSR 60-2.010(2)(S)(2) defines a sanitary survey as an on-site engineering inspection and review of a public water system, its supply source(s), treatment of supply source(s), treatment facilities, and distribution system(s), for the purpose of evaluating their adequacy, reliability, and safety for producing and distributing drinking water. 10 CSR 60-4.010(7)(A) further defines a sanitary survey for surface water systems and systems using groundwater under the direct influence of surface water as an on-site review, under the supervision of an engineer, of the water source, facilities, equipment, operation, maintenance, and monitoring compliance, in order to evaluate the adequacy of the system, its sources and operations and the distribution of safe drinking water. Like a compliance and operation type of inspection, this survey reviews all eight critical components applicable to the public water system which are; 1.Source; 2.Treatment; 3.Distribution System; 4.Finished Water Storage; 5.Pumps, Pump Facilities and Controls; 6.Monitoring, Reporting and Data Verification; 7.System Management and Operation; and 8.Operator Compliance with Department Requirements.

The following people were present at the time of the inspection:

Ironton PWS
Mr. Tony Prior, Water Plant Chief Operator, (573) 546-2122
Mr. John Marshall, Operator, jmarsh@irontonmo.gov

Missouri Department of Natural Resources
Mr. Zachary Miller, Environmental Engineer Assistant

Facility Description and History

Ironton's water system is classified as a community public water system that is in operation throughout the year. This is a primary system which is 100% surface water. The system has three (3) active water storage tanks for a combined storage capacity of 412,000 gallons. The supply also has a 32,000 gallon concrete clearwell tank in operation. The system serves 1,460 people in the community through 719 connections. The system requires an operator properly certified at the B treatment, DS-II distribution level. The operator in charge of treatment is Mr. Tony Pryor, Certification #5886. Mr. Prior holds a B level drinking water treatment certification. The operator in charge of the distribution system is Mr. Joseph Groggin, Certification #9936. Mr. Groggin holds a DS-II certification.

Sources

The system is located in the Upper St. Francis Watershed (08020202), drawing water from Shepherd Mountain Lake. Shepherd Mountain Lake is a 21 acre reservoir formed by a constructed dam. A 2013 USGS bathymetric map of Shepherd Mountain Lake shows a volume

of 186 acre-feet, see http://pubs.usgs.gov/of/2013/1101/ for additional details.
The system is bin 1 under the Long Term 2 Surface Water Treatment Rule. The system has emergency connections with Arcadia (MO4010023) and Pilot Knob (MO4010643).

Treatment

The water treatment includes two trains of flocculation and sedimentation, green sand plus filtration and microfiltration. Mixing is accomplished in a stationary mixer. Alum ($Al_2(SO_4)_3$) is used as the coagulant. Potassium permanganate is fed at the primary flocculator. 12.5% liquid chlorine is fed after sedimentation. pH is adjusted after filtration using NaOH. The filters are piped to allow bypass of either the membrane filters or greensand filters; usual operation is to pass the settled water through the greensand filters and then the microfiltration membrane filters.

Storage

The system's finished water storage is provided by three ground water storage tanks. The tanks are located on hills to provide pressure. The North Tank has been taken offline and drained.

Pumping Facilities, Pumps and Control System

All finished water pumping is accomplished by the system's high service pumps. The high service pumps are controlled by the level in the 106,000 gallon South Tank, located in the higher of the two pressure zones. Water flows to the lower pressure zone through a 6-inch pressure reducing valve between the zones.

Distribution System

Connections are provided within the City of Ironton. No significant expansion is anticipated. Approximately 90% of piping is cast iron with the remainder being PVC.

History of Notice of Violations (NOV)/Concerns

A Notice of Violation, (NOV) and other regarding regulatory matters have been issued by the Department to the Ironton Public Water System in the past fifteen years. They include;

Violation Number	Date Issued	Type of Violation
2016-813113	August 29, 2016	MCL, LRAA TTHM

This violation triggered public notice actions which the City did post. The Ironton PWS was considered to be in compliance at the time of the inspection.

Other Historical Events

Shepherd Mountain Lake and the original water plant were constructed in 1928, and underwent significant modification around 1955 and again in 2006. The 2006 modifications included new membrane filters. Because of reliability issues with the membrane filters, the water system made modifications to the system's greensand filters to allow the system to produce safe drinking water with or without the membrane filters.

Discussion of Inspection and Observation

I contacted John Marshall on February 19, 2021 to schedule a sanitary survey of Ironton's public water system on March 1, 2021. The inspection was conducted during normal business hours. Upon arrival I met with Mr. Prior and Mr. Marshall and discussed the scope and the purpose of the inspection.

I reviewed the records for the system, and they were adequate. The system had an Emergency Operation Plan (EOP) that had been updated recently. The operators described their flushing procedures. For a whole system flush, they start near the plant or tanks and work their way out, but do not isolate flow paths using system valves as would be done in unidirectional flushing. Because the system valves haven't been routinely exercised for many years, the operators have a legitimate concern that some valves would fail when turned. I suggested that they could have repair parts and equipment on hand before making the attempt. The main objective for flushing has been to control elevated TTHMs. The system has some dead end lines that don't have adequate flushing devices.

We discussed the recent snow storm and how they dealt with the increased water consumption and leaks. Mr. Prior and Mr. Marshall operated the plant for approximately 48 hours straight with Mr. Groggin also working overtime to repair issues in the distribution system. I expressed concern that when Mr. Prior retires in the next three years, it will be difficult to find a single person willing and capable of appropriately operating the system with Mr. Marshall during such incidents, and during October when the lake overturns. Refilling the basins takes approximately 4 hours per basin, during which an operator needs to be on site – this has proven to be taxing with just Mr. Prior and Mr. Marshall operating the plant.

We toured the treatment facilities and intake structure. The intake depth is adjustable, it is usually set near the level of the thermocline. The intake pumps directly to flocculation and sedimentation. Alum, powdered activated carbon, and potassium permanganate are fed just before flocculation. Alum is always fed. The operator mentioned that they are limiting production to about 200 gpm for better sedimentation and filtration. In cold weather they may further reduce pumping rates.

We discussed filter backwash and the lifetime of the greensand filters. Backwash is initiated based on factors including turbidity breakthrough and time in service. The backwash procedure did not include filter to waste, but the filters are sometimes allowed to settle before returning to service. The individual filter turbidimeters were indicating less than 0.1 NTU. The piping and other equipment around the filters appeared to be in reasonably good condition. The greensand has been used without being replaced since 2009, with some new sand added to the system a few years ago.

The membrane filters were in service at the time of the inspection. The operator said that the only time they have failed a pressure decay test was when a seal had failed and they have only had to pin a few tubes. The filters are routinely taken out of service when the water temperature drops.

The system has installed bulk tanks for hypochlorite, alum, and sodium hydroxide in the filter room. The bulk tanks feature double wall construction. The operator mentioned that the hypochlorite decays noticeably between shipments. The bulk containers have floating level indicators.

We traveled to the three ground storage tanks, PRV vault, and automatic air release valve. The storage tanks appeared to be in generally fair condition. None of the tanks had footings that extended a foot above grade. I pointed out debris on top of the footing along the grout line, which can contribute to paint failure and corrosion. The overflows are equipped with tight fitting flaps but all three tanks had ripped screens

The PRV is in a shallow vault along Lake Drive. The vault holds water and will likely flood if not pumped out occasionally. The pressure gauges indicated about 80 psi upstream and 59 psi downstream.

Disinfection Profiling

All surface water systems are required to provide 3-log (99.9%) *Giardia* inactivation and 4-Log (99.99%) virus inactivation. The conventional filtration process in use at Ironton, when operated in full compliance with regulations and meeting turbidity requirements, is credited with 2.5-log (99.68%) *Giardia* inactivation and 2-Log (99%) virus inactivation. An additional 0.5-log (68.4%) *Giardia* inactivation, and 2-Log (99%) virus inactivation must be provided by chemical means. The required CT for 0.5-log *Giardia* inactivation disinfection by free chlorine at 5°C, pH=7.5, and 1-2 mg/L free chlorine is 30-33 Min*mg/L. The required CT for 2-log virus inactivation by free chlorine at 5°C and pH=7.5 is 4 Min*mg/L. Detention time, adjusted to account for short circuiting in the clearwell and filters by use of baffling factors (0.7 for the filters and 0.3 for the clearwell), comes to 26.2 minutes and the minimum free chlorine residual required to meet the giardia inactivation requirement is 1.2 mg/L. These calculations assume plant production is limited to 200 gpm, 250 gpm high service pumping rate, and any possible removal credit for two stage filtration is ignored.

As a BIN 1 system practicing conventional or alternative filtration, Ironton PWS is not required to provide additional *Cryptosporidium* inactivation. Under the conditions observed at the time of the inspection, the system is meeting or exceeding required inactivation or removal of *Cryptosporidium, Giardia,* and Viruses.

Sampling and Monitoring

The appropriate sampling materials were taken on the inspection. The manufacturer's standard methods and sampling procedures for each instrument were followed. The instruments taken for field monitoring were the Hach DR900, Missouri State Health Department-approved bacteriological sample bottles, and the necessary testing reagents.

All instruments were properly calibrated according to manufacturer's recommendations and all reagents were used prior to the stated expiration date. QA/QC data for all field equipment is maintained at the regional office. Two (2) bacteriological water samples were collected from the distribution system and analyzed as absent for coliform bacteria (safe).

The following analytical field data was collected at the time of inspection:

Analytical Field Data			
Parameter	**Sample Location**	**Results**	**Units**
Chlorine (Free)	Clear well	2.6	mg/L
Chlorine (Total)	Clear well	2.4	mg/L
Turbidity	Clear well	0.14	NTU
Turbidity	Raw Water	5.31	NTU
Hardness	Clear well	56	mg/L as $CaCO_3$
Iron	Clear well	ND	mg/L

Iron	Raw Water	0.03	mg/L
Manganese	Clear well	ND	mg/L
Manganese	Raw Water	0.172	mg/L
pH	Clear well	7.9	-

Engineering Assessment

The U.S. Census Bureau, Population Division estimates Ironton's population was 1,528 as of 2019, up 4.6% from the 2010 census. Over the same period, the population of Iron County is estimated to have decreased by 4.0%.

The plant produced 38,785,000 gallons in the past year, of which 35,989,150 gallons were sold or otherwise accounted for. Average production is about 106,777 gallons, peak is estimated as 125,000 gallons during the summer. But with the inclement weather two weeks ago, causing pipes to burst, 240,000 gallons was produced in a day with the plant operating for approximately 48 hours straight. The plant is currently operated at 180 gpm and would meet maximum day production in 11.5 hours of run time.

The treatment includes 2 stages of rapid mix, flocculation, and sedimentation. Rapid mix allows the treatment chemicals to be evenly distributed in the raw water before flocculation. Coagulants and flocculants are most effective when mixed with the whole volume of influent water quickly enough that the mixing is complete before significant coagulation or flocculation occurs. Ironton's process relies on the turbulence at the flocculation inlet for mixing. It appears that some mixing is occurring in flocculation, which reduces the effective flocculation time. Inadequate mixing can impair process performance.

The system is using Alum as a flocculant and to adjust water pH to the optimal range for alum flocculation. Alum reacts with bicarbonate in the water to produce aluminum hydroxide, an insoluble precipitate. If there is not enough bicarbonate available to react with the alum, floc formation is reduced and aluminum can remain dissolved in the water. Aluminum has occasionally been detected in the treated water well above the SMCL, which can result in discolored water at the tap. Depending on the source water alkalinity and pH, the system may need to use more or less alum for pH control than needed for optimal coagulation/flocculation. Changes to chemicals or feed locations are significant modifications and require written approval from the Department. Approval could be easier to obtain for a pilot study, which is generally recommended for treatment chemical changes.

Flocculation uses a variable speed vertical shaft paddle. Ideally, the paddle will mix the water so that suspended partials and colloids will bump and adhere together forming floc, but not so vigorously as to break up floc as it forms. The flocculation chamber provides about 22 minutes hydraulic detention at 200 gpm. Recommended detention time in flocculation is 30 minutes.

In sedimentation, floc settles out of the water. Sedimentation reduces the particulate loading on the filters, but effective sedimentation also removes a significant fraction of pathogens and organic disinfection byproduct precursors. For small or light floc to settle, the water velocity needs to be low. The Minimum Design Standards for Missouri Community Water Systems limits water velocity to 0.5 feet/minute and requires at least 4 hours of settling time. At 200 gpm, water velocity varies from 0.66 ft/min in the narrow portion of the flow path, to 0.46 ft/min in the wider portion. Detention time is 110 minutes in each sedimentation basin. Tube settlers have been installed at the end of each sedimentation basin. At 200 gpm, the tube settlers are close to the 2 gpm/ft^2 maximum recommended loading rate. The sedimentation basins are shallower than recommended in the design standards, which contributes to high water velocity and short detention time.

Short detention time in flocculation and sedimentation can impair the effectiveness of the process. The operators should be alert to process performance indicators, especially when water temperatures are low.

The treatment plant has the option of filtering the settled water with greensand gravity filters, membrane filters, or both. Routine operation is to pass the water through the greensand filters and then the membrane filters. When the membrane filters are not working or water temperatures are low, the greensand filters are used to produce finished water.

The greensand filters have approximately 30 inches of greensand-plus media with an anthracite cap. The greensand-plus media is slightly smaller with a narrower size distribution than standard filter media. Turbidity records suggest that the media is capable of particulate removal as well as manganese removal. 12.5 % chlorine is fed at the top of the filters for disinfection and to recharge the greensand-plus media.

The raw water occasionally has high levels of manganese, particularly when the lake turns over which generally takes place in October. Manganese is oxidized using potassium permanganate and chlorine with greensand-plus. The potassium permanganate feed is increased when manganese is detected in the raw water. Oxidized manganese is filtered out in the greensand filter. Any manganese reaching the greensand while still in solution will tend to precipitate on the greensand. The oxidation and greensand filtration appears effective for removing manganese.

The system uses a high-range manganese test that is unreliable at the Secondary Maximum Contaminant Level (SMCL) for manganese of 0.05 mg/L. Using a high-range test could allow water with manganese content above the SMCL to leave the plant undetected. The SMCL is not a regulatory or health related requirement. Systems operating near or above the Mn SMCL may experience nuisance issues such as discolored water or stained fixtures.

The two Memcore XS submerged microfiltration membrane filters are a packaged treatment manufactured by Siemens and rated for 250,000 GPD each. The filters struggle to maintain even reduced flow in cold water conditions. The filters have had some reliability issues and are not always used. When the membrane filters are used, they are capable of substantially removing *cryptosporidium* and *giardia lamblia* cysts.

The system has taken the 106,000 gallon North Tank out of service. The remaining tanks hold almost 3 days' water at average usage. North Tank is believed to have water age issues that contributed to TTHM exceedances. The tank was also observed to exhibit thermal stratification. When the tank was installed, there was significant water demand from a hotel that has since closed. No new water demand developed in the area. It isn't clear if the anticipated 3 foot operating range would have been sufficient to produce adequate circulation or how much the tank level was actually fluctuating. Before permanently taking the tank out of service, the water system should obtain written authorization from the Department by submitting a construction permit application with appropriate engineering plans, supporting documents, and specifications.

For many systems, TTHM formation corresponds with loss of chlorine residual. Mapping chlorine residuals across the system helps identify areas with high water age for targeted flushing. Compliance assistance may be available.

The system is producing water that can vary from slightly scale forming to slightly aggressive. The system submits 10 routine samples every 3 years for lead and copper under the reduced sampling schedule. Pb/Cu levels have been well below action levels.

Compliance Determination and Required Actions

The system was found to be in **compliance** with the Missouri Safe Drinking Water Regulations based on the observations made at the time of the inspection.

Recommendations

1. The system might not have a properly certified standby replacement operator as required by Missouri Safe Drinking Water Regulation 10 CSR 60 14.010(4)(A)6.

Mr. Tony Prior, the chief operator, plans to retire in the next three years. John Marshall is not currently certified. Getting John Marshall certified and figuring out additional hiring to replace Tony Prior is of paramount importance. Hiring a certified standby replacement operator now that would be willing to stay on long term would be very beneficial to the water system. Encouraging all qualified operators to pursue certification at least equal to the system classification reduces the probability of not being able to replace a chief operator with a properly certified operator.

The Department recommends that the city make formal arrangements for a standby operator to replace the treatment or distribution chief operators if they become unavailable or incapacitated.

2. The plant's sand filters do not have filter to waste capacity.

After a backwash or filter startup, filtered water might not meet turbidity requirements. It is a best practice to waste filtered water when starting a filter to avoid passing turbid water to the clearwell. Allowing the filter to settle for a few minutes after backwash, assuring that the backwash is adequate, and starting the filter at a reduced rate can reduce volume of turbid water produced when starting a filter. When the membrane filters are operating as a second stage filtration, they can reasonably be expected to capture much of the turbidity from the sand filter startup.

The Department recommends that the system operate the sand filters to minimize turbidity spikes at startup and investigate the possibility of adding some filter to waste capability.

3. Accumulation of silt may be reducing the depth and capacity in Shepherd Mountain Lake.

Because water velocity is typically much lower in lakes than the steams that feed them, some silt deposition should be expected. The loss of reservoir capacity could become a concern in an extended drought. The reduced depth of the lake causes temperature to change more quickly and contributes to higher organics loading. The City should consider some effort to monitor or track the extent of the potential problem. A USGS Bathymetric map of Shepherd Mountain Lake, based on survey data collected in July 2007, is attached to this report. Changes in measured depth of the lake would give the city an indication of the rate at which sediment has been accumulating in the lake. Dredging operations typically require an operating permit for return water, storm water runoff from material deposition sites, and other disturbances resulting from dredging operations.

The Department recommends that the system monitor and track the depth of the lake.

4. The clear well has not been inspected for 10 years.

All finished water storage, including the clear well and ground storage tanks, should be professionally inspected every 3-5 years. The inspection should check for structural, safety, and sanitary defects. Additionally, the system should routinely check the tanks for sanitary concerns at least annually.

At the time of the inspection, the tanks appeared to be in generally good condition. The footings do not extend the recommended 12" above grade, which makes keeping debris and plant growth away from the top of the footing more challenging. Plant growth was observed in the grout line of all the tanks. The screens on the overflow of all three ground storage tanks had been torn, which the operators said they would promptly repair. The overflow was also protected by a tight fitting flap.

South Tank had a number of dents and dings. When a glass lined tank is dented, the coating on the inside can crack and flake off. Some of the dents may have been from rocks thrown out of a mower. The system should consider measures to protect the tank as these small dents will likely contribute to corrosion inside the tank.

The Department recommends that the system have their water storage tanks professionally inspected every 3-5 years and give due consideration to the inspector's recommendations.

5. The downstream side of the Shepherd Mountain Lake Dam is spalling and vegetation appeared overgrown in the spillway.

The dam appears to have been surfaced with a relatively fine grained masonry topcoat, but much of the surface has de-bonded, exposing the underlying concrete. The surface layer protects the structural concrete from weathering and erosion. Heavy vegetation in the spillway reduces the spillway's capacity. Plant roots can damage the dam and form paths which water can percolate through.

The Department recommends that the system prevent trees and shrubs from growing near the dam or getting overgrown in the spillway. The system may want to investigate technologies and associated costs for resurfacing the dam.

6. An NOV was issued to Ironton PWS on 08-29-2016 for exceeding the Locational Running Annual Average (LRRA) MCL for Total Trihalomethanes (TTHM).

Trihalomethanes (chloroform, bromodichloromethane, dibromochloromethane, and bromoform) form in the water system when chlorine reacts with natural organic matter. Because chlorine and organic precursors react somewhat slowly under typical conditions in the water system, TTHM tends to increase with water age. Strategies for limiting the formation Trihalomethanes that have been implemented at Ironton include delaying chlorination until organics have been removed by sedimentation, managing distribution storage to limit water age, and distribution flushing. Since the 2016 violation, Ironton has not exceeded the TTHM LRAA MCL. Some systems have had success using tank mixing or tank aeration to reduce TTHMs.

The Department recommends that the city continue efforts to minimize TTHM formation.

7. The system does not have written procedures for routine operation and maintenance.

Written procedures helps assure consistent operations with different operators and are potentially useful in emergency situations. Written procedures are also useful in training. Procedures for the treatment plant should include start up, shut down, operational control testing, plant controls/adjustments, filter backwash/pressure decay testing, and any other procedures an operator would need to know to operate the plant in full compliance with regulations. Distribution system procedures could include the main repair program, flushing, meter reading, service connects/disconnects, line locating, sampling, and valve maintenance. Some grant/loan programs will expect the system to have an operations and maintenance manual as an indication of technical or managerial capacity.

The Department recommends that the system develop written procedures for routine operations and maintenance.

8. The system does not practice unidirectional flushing or exercising distribution valves.

Unidirectional flushing means that water flows to the flush hydrant by a single path. Usually, flushing will start near a tank or other water source and work outwards. Unidirectional flushing achieves higher flushing velocities in each pipe and uses less water. Higher flush velocities are desirable to remove sediments from the system. Isolating the flow paths for unidirectional flushing will result in exercising many system valves. When valves are exercised, deposits and corrosion are scraped from the moving parts. Regularly exercised valves can also be easier to locate and operate when they are needed to isolate a leak. When a valve that has not been exercised for many years is used it might break or not close tight. When starting a valve exercise program, it is a good idea to have appropriate replacement valves and repair parts on hand.
An effective unidirectional flushing program requires accurate system maps and reliable valves.

The Department recommends that the system practice unidirectional flushing and exercise each valve in the distribution system annually.

9. The system has some dead end lines that don’t have adequate flush hydrants.

A water velocity of 2.5 ft/s or more in the pipes being flushed is needed to remove sediment and scour the pipe walls of deposits or slime. More than 5 ft/s is recommended with unidirectional flushing. Inadequate flushing velocity can contribute to chronic taste and odor complaints. Flushing a 2 inch pipe at 2.5 ft/s requires a flow of more than 25 gal/min.; typical residential service connections can’t provide enough flow to flush small mains.

The Department recommends that the system install flush hydrants on all dead end lines.

10. The system does not have leak detection equipment.

Often, leaks are not detected until water saturates the soil and appears at the surface. However, water can travel some distance from the leak before reaching the surface. Leak detection equipment helps locate leaks more precisely than surface indications, reducing repair time and cost. Additionally, leak detection equipment can be used to find small leaks that don’t present at the surface or to locate water mains.

The Department recommends that the system consider obtaining leak detection equipment.

11. The system has not displayed pump curves at the pump controls.

Pump curves graphically display a pump's expected performance in terms of pressure and flow. Most manufactures also indicate pump efficiency or a preferred operating range. Operators can refer to the pump curve to assure that it is being operated in the appropriate range. Operating pumps outside of their preferred range can damage the pump or result in excessive pumping costs. Significant departure of the actual pump performance from the pump curve may indicate developing problems with the pump. Pump curves are available from the pump manufacturer and can usually be found online. Pump affinity laws may be needed to relate pumps performance for pumps on VFDs.

The Department recommends that the system obtain pump curves for the intake, high service, and backwash pumps and routinely compare each pumps operating conditions to the curves.

Additional Comments and Conclusions

The Revised Total Coliform Rule was effective on April 1, 2016. The most significant change was that unsafe routine samples will result in an assessment with the goal of finding and eliminating the cause of contamination instead of the issuance of a microbiological maximum contaminant level violation. Please refer to http://dnr.mo.gov/env/wpp/pdwb/rtcr.htm for more information.

The process of planning for necessary maintenance and upgrades should be a continuous process with constant re-evaluation, establishing both short term and long term goals. It is strongly recommended that an annual review of water rates be evaluated and compared to revenues and available finances. As appropriate, the Public Water System should increase water rates as needed to meet the needs of their operations budget and capital improvement programs. When maintaining, upgrading or replacing systems, much care and consideration must be taken, as the processes are generally very expensive and can take years to complete.

The financial burden of these upgrades and replacements can be eased by seeking funding through the State Revolving Fund (SRF) and other funding agencies in the State. Most monies available are low interest rate loans. However, there are some grants offered.

In the future should it become necessary to obtain additional funding for upgrades and replacements, the department invites the City of Ironton to apply to the Missouri Water and Wastewater Review Committee to better assess the City's needs and to make recommendations for obtaining funding through the appropriate funding agencies. A copy of the Intended Use Plan/Loan Application Packet may be reviewed and downloaded from the following department web site http://www.dnr.mo.gov/env/wpp/srf/index.html.

Signatures

SUBMITTED BY:

Zachary S. Miller
Environmental Engineer Assistant
Southeast Regional Office

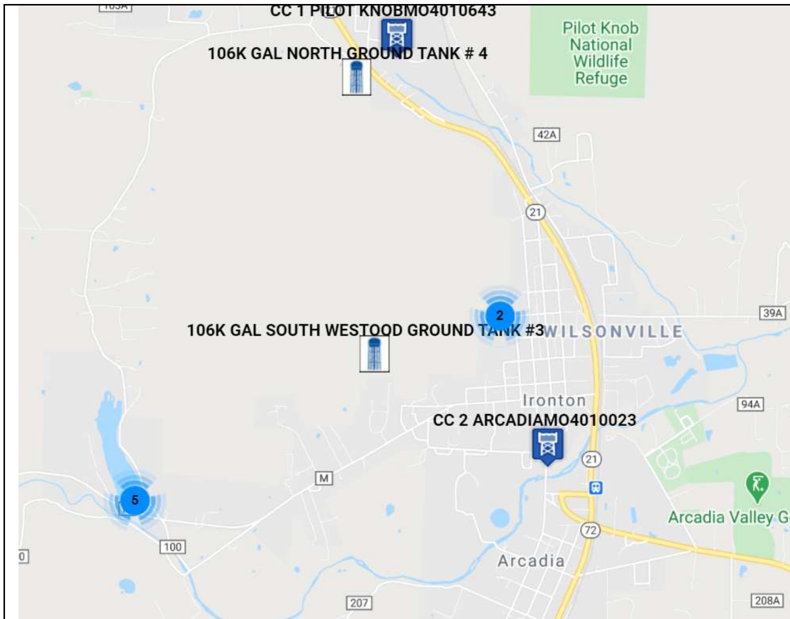
REVIEWED BY:

Toby A. Gilham, PE
Engineering Section Chief
Southeast Regional Office

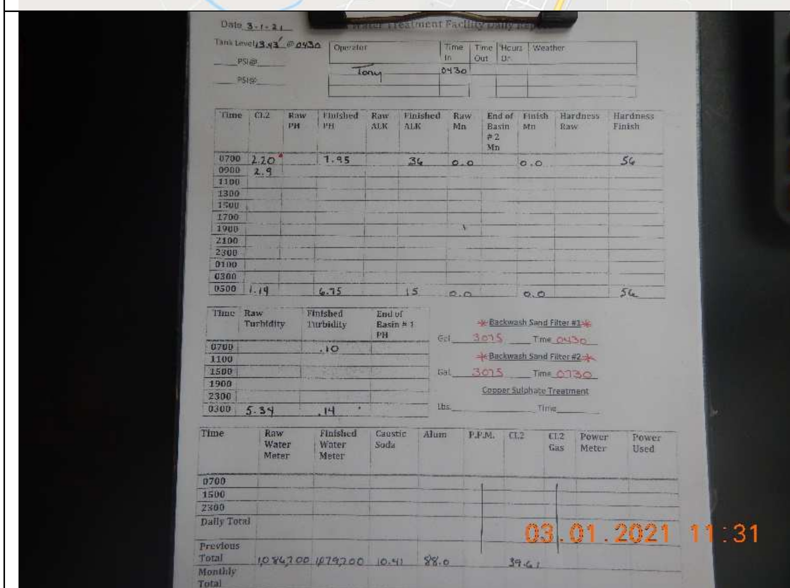
Attachments

Attachment #1 – Photos 1 through 10

Attachment #1 – Photos (1-3)



Photograph #: 001
Taken By: Zachary Miller
Entity: Ironton PWS
PWS ID: MO4010402
Location: Water Treatment Plant
Description: Approximate position of Ironton PWS major components.
Date Taken: 3/1/2021
Program: PDWB



Photograph #: 002
Taken By: Zachary Miller
Entity: Ironton PWS
PWS ID: MO4010402
Location: Water Treatment Plant
Description: Log Sheet
Date Taken: 3/1/2021
Program: PDWB

Photograph #: 003
Taken By: Zachary Miller
Entity: Ironton PWS
PWS ID: MO4010402
Location: Water Treatment Plant
Description: Distribution map
Date Taken: 3/1/2021
Program: PDWB

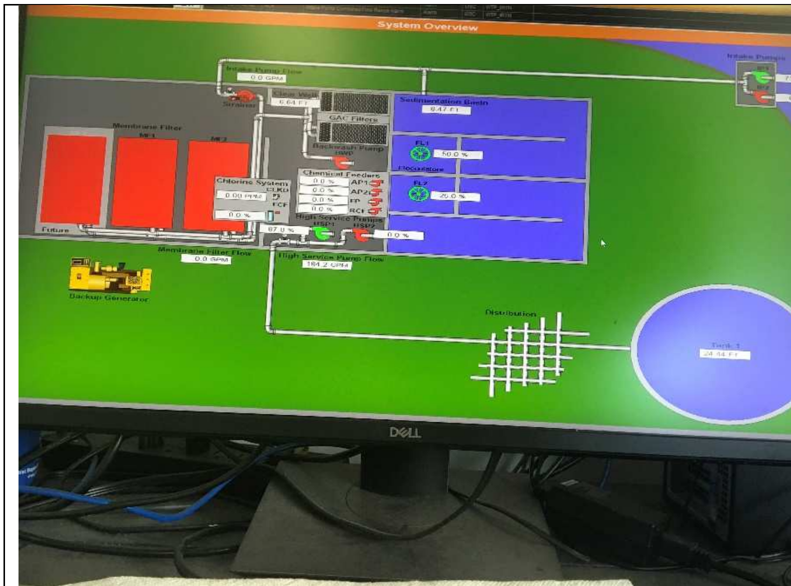
Attachment #1 – Photos (4-6)

Photograph #: 004
Taken By: Zachary Miller
Entity: Ironton PWS
PWS ID: MO4010402
Location: Water Treatment Plant
Description: Rapid Mix #2, redundant Rapid Mix #1 not pictured but looked to be in the condition.
Date Taken: 3/1/2021
Program: PDWB

Photograph #: 005
Taken By: Zachary Miller
Entity: Ironton PWS
PWS ID: MO4010402
Location: Water Treatment Plant
Description: Greensand Plus Media basin, not in picture but includes a 12.5% chlorine drip
Date Taken: 3/1/2021
Program: PDWB

Photograph #: 006
Taken By: Zachary Miller
Entity: Ironton PWS
PWS ID: MO4010402
Location: Water Treatment Plant
Description: High Service Pumps
Date Taken: 3/1/2021
Program: PDWB

Attachment #1 – Photos (7-9)

	Photograph #: 007 Taken By: Zachary Miller Entity: Ironton PWS PWS ID: MO4010402 Location: Water Treatment Plant Description: SCADA Date Taken: 3/1/2021 Program: PDWB
	Photograph #: 008 Taken By: Zachary Miller Entity: Ironton PWS PWS ID: MO4010402 Location: South tank Description: Overflow screen with tears Date Taken: 3/1/2021 Program: PDWB
	Photograph #: 009 Taken By: Zachary Miller Entity: Ironton PWS PWS ID: MO4010402 Location: North tank Description: Overflow screen with tears Date Taken: 3/1/2021 Program: PDWB

Ironton, MO
Asset Report
Depreciated Value of 2021 Cost

Asset Description	Year Installed	Estimated Installation Cost 2022	Age (2022)	Depreciation Period [1]	Depreciation [2]	Depreciated Value [3]
Westwood Tank 106,000 gallons	2007	$ 224,179.67	15	42	$ 80,064.17	$ 144,115.50
Dent Street Tank 200,000 gallons	1965	$ 511,500.00	57	42	$ 694,178.57	$ -
North Tank 106,000 gallons	2007	$ 224,179.67	15	42	$ 80,064.17	$ 144,115.50
2-inch Water Main	1928	$ 364,000.00	94	50	$ 684,320.00	$ -
4-inch Water Main	1928	$ 2,926,000.00	94	50	$ 5,500,880.00	$ -
6-inch Water Main	1928	$ 726,000.00	94	50	$ 1,364,880.00	$ -
8-inch Water Main	2007	$ 756,000.00	15	50	$ 226,800.00	$ 529,200.00
8-inch Water Main	2007	$ 20,000.00	15	50	$ 6,000.00	$ 14,000.00
Fire Hydrants	1928	$ 409,500.00	94	50	$ 769,860.00	$ -
Services and Meters	1928	$ 1,452,000.00	94	35	$ 3,899,657.14	$ -
Water Treatment Plant Improvements	2007	$ 2,367,340.66	15	35	$ 1,014,574.57	$ 1,352,766.09
Total Water Assets		$ 9,980,700.00				$ 2,184,197.09
Wastewater Treatment Plant Improvements	1991	$ 2,000,000.00	31	40	$ 1,550,000.00	$ 450,000.00
Influent Bar Screen	2019	$ 250,000.00	3	22	$ 34,090.91	$ 215,909.09
Fair Lane Lift Station	1991	$ 150,000.00	31	10	$ 465,000.00	$ -
Lift Station Pump Replacement	2015	$ 20,000.00	7	10	$ 14,000.00	$ 6,000.00
4-inch PVC Forcemain	1991	$ 161,920.00	31	50	$ 100,390.40	$ 61,529.60
8-inch PVC Forcemain	1991	$ 280,800.00	31	50	$ 174,096.00	$ 106,704.00
6-inch Clay Gravity	1928	$ 100,870.00	94	50	$ 189,635.60	$ -
6-inch PVC Gravity	1991	$ 150,975.00	31	50	$ 93,604.50	$ 57,370.50
8-inch Clay Gravity	1928	$ 3,591,835.00	94	50	$ 6,752,649.80	$ -
8-inch PVC Gravity	1991	$ 724,945.00	31	50	$ 449,465.90	$ 275,479.10
10-inch Clay Gravity	1928	$ 752,990.00	94	50	$ 1,415,621.20	$ -
12-inch PVC Gravity	1991	$ 48,600.00	31	50	$ 30,132.00	$ 18,468.00
15-inch PVC Gravity	1991	$ 258,080.00	31	50	$ 160,009.60	$ 98,070.40
18-inch PVC Gravity	1991	$ 560,520.00	31	50	$ 347,522.40	$ 212,997.60
24-inch PVC Gravity	1991	$ 12,000.00	31	50	$ 7,440.00	$ 4,560.00
Manholes-Original System	1928	$ 988,000.00	94	50	$ 1,857,440.00	$ -
Manholes-1991 Improvements	1991	$ 288,000.00	31	50	$ 178,560.00	$ 109,440.00
Service Laterals	1928	$ 257,200.00	94	50	$ 483,536.00	$ -
Total Wastewater Assets		$ 10,596,735.00				$ 1,616,528.29

Note 1 - Based on Missouri PSC Rate Case Dockets WR-2015-0138 Village Greens Water Company; WR-2016-0169 Woodland Manor Water Company; WR-2015-0104 Spokane Highlands Water Company; SR-2014-0105 Terre Du Lac Utility Company; SR-2014-0068 P.C.B., Inc.; and SR-2013-0435 Rogue Creek Sewer.

Note 2 - Depreciation = Age/Depreciation Period X Estimated Installation Cost

Note 3 - Depreciated Value = Estimated Installation Cost - Depreciation

APPENDIX F in Asset Report Prepared by Flinn Engineering, LLC dated 3/14/2022

VILLAGE GREENS WATER COMPANY

SCHEDULE of DEPRECIATION RATES

(WATER Class D)

WR-2015-0138 Attachment D

NARUC USOA ACCOUNT NUMBER	ACCOUNT DESCRIPTION	DEPRECIATION RATE	AVERAGE SERVICE LIFE (YEARS)	NET SALVAGE
	Source of Supply			
311	Structures & Improvements	2.5%	44	-10%
314	Wells & Springs	2.0%	55	-8%
	Pumping Plant			
321	Structures & Improvements	2.5%	44	-10%
325.1	Submersible Pumping Equipment	10.0%	12	-20%
	Water Treatment Plant			
331	Structures & Improvements	2.5%	44	-10%
332	Water Treatment Equipment	2.9%	35	0%
	Transmission and Distribution			
342	Distribution Reservoirs & Standpipes	2.5%	42	-5%
343	Transmission & Distribution Mains	2.0%	50	0%
345	Customer Services	2.5%	40	0%
346.1	Customer Meters, Plastic (Throw Aways)	10.0%	10	0%
347	Customer Meter Pits & Installation	2.5%	40	0%
348	Hydrants	2.0%	50	0%
	General Plant CLASS D			
371	Structures & Improvements	2.5%	40	0%
372	Office Furniture & Equipment	5.0%	20	0%
372.1	Office Electronic & Computer Equip.	14.3%	7	0%
373	Transportation Equipment	13.0%	7	9%
379	Other General Equipment (tools, shop equip., backhoes, trenchers, etc.)	10.0%	8.7	13%

https://www.efis.psc.mo.gov/mpsc/commoncomponents/view_itemno_details.asp?caseno=WR-2015-0138&attach_id=2015030930

*Revised 1/23/2015

APPENDIX F in Asset Report Prepared by Flinn Engineering, LLC dated 3/14/2022

For Staff Proposed Adoption by Missouri-American Water Company
WM-2016-0169

Woodland Manor Water Company
SCHEDULE of DEPRECIATION RATES dated 4/1/2013
(WATER Class D)
WR-2013-0326

USOA ACCOUNT NUMBER	ACCOUNT DESCRIPTION	DEPRECIATION RATE	AVERAGE SERVICE LIFE (YEARS)	NET SALVAGE
	Source of Supply			
311	Structures & Improvements	2.5%	44	-10%
314	Wells & Springs	2.0%	55	-8%
	Pumping Plant			
321	Structures & Improvements	2.5%	44	-10%
325	Electric Pumping Equip. (Plus Generator)	6.7%	15	0%
328	Other Pumping Equipment	5.0%	20	0%
	WaterTreatment Plant			
332	Water Treatment Equipment	2.9%	35	$0
	Transmission and Distribution			
342	Distribution Reservoirs & Standpipes	2.5%	42	-5%
343	Transmission & Distribution Mains	2.0%	50	0%
345	Customer Services	2.9%	35	0%
346.1	Customer Meters (Installed after 2012)*	10.0%	10	0%
346.2	Bronze Meters and Installs prior 2013	3.3%	30	0%
347	Meter Installations (Meter Pits after 2012)	2.5%	40	0%
348	Hydrants	2.5%	40	0%
349	Other Transmission & Distribution Plant	3.3%	30	0%
	General Plant			
372	Office Equipment & Furniture	5.0%	20	0%
372.1	Office Electronic Equipment	14.3%	7	0%
373	Transportation Equipment	13.0%	7	9%
379	Other General Equipment	6.7%	13	13%

Customer Meters (Installed after 2012)* Plus 18 plastic meters installed in 2007

The above recommended depreciation rates are based on Staff's review of the Company's operation and records.

https://www.efis.psc.mo.gov/mpsc/commoncomponents/view_itemno_details.asp?caseno=WM-2016-0169&attach_id=2016015052

APPENDIX F in Asset Report Prepared by Flinn Engineering, LLC dated 3/14/2022

SPOKANE HIGHLANDS WATER COMPANY
DEPRECIATION RATES
(WATER)
CASE NO. WR-2015-0104

ACCOUNT NUMBER	ACCOUNT	DEPRECIATION RATE %	AVERAGE SERVICE LIFE (YEARS)	SALVAGE %
311	Structures & Improvements	2.5%	44	-10%
314	Wells & Springs	2.0%	55	-8%
325	Electric Pumping Equipment			
325.1	Submersible (Well Pump) Equipment	10.0%	12	-20%
325.2	High Service or Booster Pumps	2.0%	7	0%
342	Distribution Reservoirs & Standpipes	2.5%	42	-5%
343	Transmission & Distribution Mains	2.0%	50	0%
345	Services	2.9%	35	0%
346	Meters	2.0%	10	0%
347	Meter Installations	1.0%	50	0%
348	Hydrants	2.5%	40	0%
372	Office Furniture & Equipment	5.0%	20	0%
379	Other General Equipment	6.7%	13	13%

https://www.efis.psc.mo.gov/mpsc/commoncomponents/view_itemno_details.asp?caseno=WR-2015-0104&attach_id=2015020974

APPENDIX F in Asset Report Prepared by Flinn Engineering, LLC dated 3/14/2022

Terre Du Lac Utility Company

DEPRECIATION RATES
(SEWER)
SR-2014-0105

ACCOUNT NUMBER	ACCOUNT DESCRIPTION	DEPRECIATION RATE	AVERAGE SERVICE LIFE (YEARS)	NET SALVAGE
300	Stipulated Plant	2.5%	40	0%
311	Structures and Improvements	2.5%	44	-10%
352.1	Collection Sewers (Force)	2.0%	50	0%
352.2	Collection Sewers (Gravity)	2.0%	50	0%
353	Services	2.0%	50	0%
354	Flow Measurement Devices	3.3%	30	0%
362	Receiving Wells	5.0%	26	-5%
363	Electric Pumping Equipment	10.0%	10	0%
371	Treatment Plant Shed	2.5%	44	-10%
372	Treatment & Disposal Equipment	5.0%	22	-10%
390	Structures & Improvements Office/Shop	2.5%	44	-10%
391	Office Furniture & Equipment	5.0%	20	0%
391.1	Electronic Office Equipment	0.0%	Excessively Accrued	
392	Transportation Equipment	13.0%	7	9%
393	Stores Equipment	4.0%	25	0%
394	Tools, Shop, and Garage Equipment	5.0%	18	10%
395	Laboratory Equipment	8.3%	12	0%
396	Power Operated Equipment	6.7%	13	13%
397	Communication Equipment	3.3%	Over Accrued	

Reviewed, 1/7/2014. The above are standard small company depreciation rates modified as a result of Staff's investigation of the Company's operation, records, and physical plant, and are dependent on the Company's implementation of the end of test year adjustments to the Company's plant in service and accumulated reserves as shown in the Staff accounting schedules.

https://www.efis.psc.mo.gov/mpsc/commoncomponents/view_itemno_details.asp?caseno=SR-2014-0105&attach_id=2014014505

APPENDIX F in Asset Report Prepared by Flinn Engineering, LLC dated 3/14/2022

P.C.B., Inc.

SCHEDULE of DEPRECIATION RATES
(SEWER Class C & D)

SR-2014-0068 Attachment D

ACCOUNT NUMBER	ACCOUNT DESCRIPTION	DEPRECIATION RATE	AVERAGE SERVICE LIFE (YEARS)
	COLLECTION PLANT		
311	Structures & Improvements	3.3%	33
352.2	Collection Sewers (Gravity)	2.0%	50
355	Flow Measurement Devices	3.3%	30
	PUMPING PLANT		
362	Receiving Wells	4.0%	26
363	Electric Pumping Equipment	10.0%	10
	TREATMENT & DISPOSAL PLANT		
372	Oxidation Lagoons	4.0%	40
373	Treatment & Disposal Facilities	5.0%	22
375	Outfall Sewer Lines	2.0%	50
	GENERAL PLANT		
391	Office Furniture & Equipment	5.0%	20

Reviewed, 1/07/2014. The above are standard small company depreciation rates modified as a result of Staff's investigation of the Company’s operation, records, and physical plant, and are dependent on the Company's implementation of the end of test year adjustments to the Company's plant in service and accumulated reserves as shown in the Staff accounting schedules.

https://www.efis.psc.mo.gov/mpsc/commoncomponents/view_itemno_details.asp?caseno=SR-2014-0068&attach_id=2014016258

APPENDIX F in Asset Report Prepared by Flinn Engineering, LLC dated 3/14/2022

Rogue Creek Sewer
Interim Rate Case
SR-2013-0435
Test Year Ending 12-31-2012
Depreciation Expense - Sewer

Line Number	A Account Number	B Plant Account Description	C Adjusted Jurisdictional	D Depreciation Rate	E Depreciation Expense
1		INTANGIBLE PLANT			
2	301.000	Organization	$135	0.00%	$0
3	302.000	Franchises	$1,127	0.00%	$0
4	303.000	Miscellaneous Intangible Plant	$0	0.00%	$0
5		TOTAL INTANGIBLE PLANT	$1,262		$0
6		SOURCE OF SUPPLY PLANT			
7	310.000	Land & Land Rights	$0	0.00%	$0
8	311.000	Structures & Improvements	$2,532	3.00%	$76
9		TOTAL SOURCE OF SUPPLY PLANT	$2,532		$76
10		COLLECTION PLANT			
11	352.100	Collection Sewers - Force	$12,827	2.00%	$257
12	352.200	Collection Sewers - Gravity	$105,094	2.00%	$2,102
13	353.000	Other Collection Plant Facilities	$0	0.00%	$0
14	354.000	Services to Customers	$18,120	2.00%	$362
15	355.000	Flow Measuring Devices	$0	0.00%	$0
16		TOTAL COLLECTION PLANT	$136,041		$2,721
17		PUMPING PLANT			
18	362.000	Receiving Wells and Pump Pits	$1,804	5.00%	$90
19	363.000	Pumping Equipment (Elec.,Diesel, other)	$24,068	10.00%	$2,407
20		TOTAL PUMPING PLANT	$25,872		$2,497
21		TREATMENT & DISPOSAL PLANT			
22	372.000	Oxidation Lagoon	$0	0.00%	$0
23	373.000	Treatment and Disposal Equipment	$31,190	4.50%	$1,404
24	374.000	Plant Sewers	$0	0.00%	$0
25	375.000	Outfall Sewer Lines	$0	0.00%	$0
26	376.000	Other Treatment & Disposal Plant Equip.	$0	0.00%	$0
27		TOTAL TREATEMENT & DISPOSAL PLANT	$31,190		$1,404
28		GENERAL PLANT			
29	391.000	Office Furniture & Equipment	$467	5.00%	$23
30	391.100	Office Computer Equipment	$371	20.00%	$74
31	392.000	Transportation Equipment	$228	13.00%	$30
32	394.000	Tools Shop & Garage Equipment.	$15	5.00%	$1
33		TOTAL GENERAL PLANT	$1,081		$128
34		Total Depreciation	$197,978		$6,826

https://www.efis.psc.mo.gov/mpsc/commoncomponents/view_itemno_details.asp?caseno=SR-2013-0435&attach_id=2013018070

Appendix I-C has been marked CONFIDENTIAL in its entirety.

Appendix J-C has been marked CONFIDENTIAL in its entirety.