CITY OF SPOKANE

Fluoridation Implementation Study

June 2023

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Fluoridation Implementation Study

City of Spokane

June 2023

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CERTIFICATION

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.

6/7/2023

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Section 3.4.2

6/7/2023

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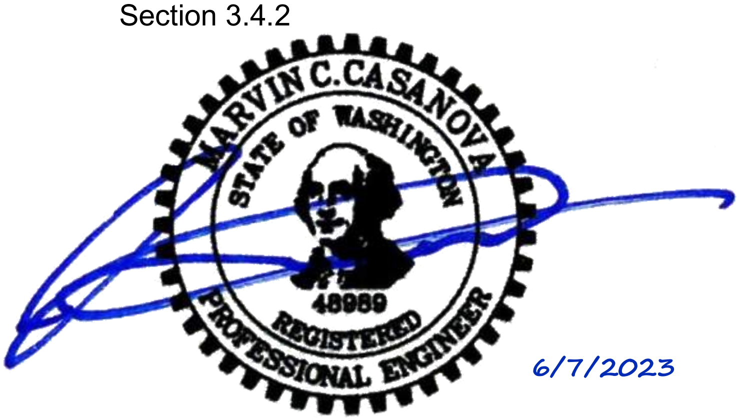

6/7/2023

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Sections 3.5.1, 3.5.2, 3.5.4, and 3.5.5

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Executive Summary

In January 2022, the City of Spokane (City) began work on a Preliminary Engineering Study for Fluoridation to better understand the costs and implementation steps associated with providing fluoridated water to the community. The City's Mayor and Council agreed to a public and transparent process to decide next steps upon completion of the three-phase Preliminary Engineering Study for Fluoridation.

Background

The City places great importance on supplying high-quality drinking water to its customers in an efficient manner that maintains affordability for the community. The City's water system includes seven existing well station facilities and an eighth facility that is currently being built. These well stations draw from the Spokane Valley Rathdrum Prairie Aquifer to provide clean, safe drinking water to more than 230,000 community members. This aquifer has small amounts of naturally occurring fluoride (less than 0.1 milligrams of fluoride per liter of water).

To help inform future decisions, the Preliminary Engineering Study for Fluoridation provides information about the costs and implementation steps to build and operate a fluoridation system that would meet current standards for fluoridated drinking water.

THE PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION WAS COMPLETED IN THREE PHASES:

- **PHASE 1** — Collect data and develop alternatives
- **PHASE 2** — Evaluate alternatives and select preferred alternative
- **PHASE 3** — Prepare conceptual design of selected alternative

PHASE 1

Spokane's Existing Water System and Condition Assessment

The Phase 1 work is reported in the *Preliminary Engineering Study for Fluoridation: Well Facility Condition Assessment* (Murraysmith, September 2022) which documents existing infrastructure at each well station to determine what retrofits would be necessary should fluoridation be implemented.

Installing a fluoridation system would require some construction at each well station. Depending on the specific well and site characteristics, this may include expanding building footprints, improving driveways and access, updating electrical panels, and improving other aspects of the well station sites.

PHASE 2

Fluoridation Alternatives Evaluation and Preferred Alternative

The Phase 2 work is reported in the *Preliminary Engineering Study for Fluoridation: Fluoridation System Alternatives* (Murraysmith, December 2022) which documents the evaluation of three chemical fluoridation alternatives using a multi-objective decision analysis (MODA) process with input from operations, engineering, and finance staff.

The three alternatives were:

- Sodium fluoride (dry chemical)
- Sodium fluorosilicate (dry chemical)
- Fluorosilicic acid (FSA) (liquid chemical form)

Because the two dry chemicals have similar facility and operation and maintenance requirements, the integrated analysis focused on comparing dry and liquid fluoride chemicals to arrive at a preferred alternative. This analysis considered both the financial components (capital and annual operating costs) and non-financial components of each alternative.

Non-financial components included:

- Environmental and sustainability impact
- Neighborhood impacts
- Worker safety
- Public safety
- Service reliability
- Ease of maintenance and operations

After consideration of these factors, FSA (liquid chemical) was identified as the preferred alternative.

WHY LIQUID FEED ALTERNATIVE?

- *Industry-standard option*
- *Requires comparably smaller facilities*
- *Maintenance and reliability*
- *Supply chain considerations*

PHASE 3

Implementation & Cost

The Phase 3 work is reported in this *Preliminary Engineering Study for Fluoridation: Fluoridation Implementation Study* (Study) to help inform future decisions by Spokane's elected leaders. Drawing on the findings from Phase 1 and Phase 2, this Study provides a preferred fluoridation alternative, preliminary designs to retrofit the City's well stations for fluoridation, and other information used to develop preliminary capital and lifecycle costs and a proposed implementation approach.

Included in this Study:

1 Section 1: Introduction

provides background information about the goal of the Study, which provides sufficient preliminary engineering to evaluate the capital and lifecycle cost implications of fluoridation.

2 Section 2: Existing Facilities

describes the City's seven well station facilities as well as the eighth well facility currently under construction and provides a summary of pumps, capacity, and pressure zones. This information was used to inform sizing and preliminary design.

3 Section 3: Fluoridation Implementation Preliminary Design

provides information about the selected fluoridation alternative and the preliminary process, site and building, and instrumentation and controls design. This information was used to inform development of preliminary capital cost estimates.

4 Section 4: Operation and Maintenance Plan

outlines anticipated operations and maintenance activities required for fluoridation, including monitoring, staffing, safety, and certification requirements. This information was used to inform development of preliminary operations and maintenance costs.

5 Section 5: Project Implementation

describes the project assumptions used to prepare preliminary capital and lifecycle cost estimates for fluoridation. This includes a Class 3 Opinion of Probable Construction Costs and a 50-year Life Cycle Cost Analysis for each well station.

A Appendices A-K

are referenced throughout the Study and include background reports, State Environmental Policy Act (SEPA) permitting materials, draft preliminary drawings, Washington State Department of Health (DOH) Fluoridation Forms and Worksheets, and detailed cost workups and background cost reference information.

Preliminary Design

Each fluoridation system includes a bulk tank, a transfer pump, a day tank, individual dosing pumps for each well, an injection quill and static mixer, and sampling equipment. The FSA is delivered in bulk by a tractor trailer which connects to and fills the bulk tank via a dedicated fill port. The bulk tanks are sized to provide at least 60 days of storage volume based on maximum demand day (MDD) usage predicted for the 2043 system demands. A magnetic-drive transfer pump is used to fill the day tank from the bulk tank and is manually operated as a safeguard against accidental over-dosing of the system or overflow of the day tank. The day tanks are sized to provide at least 30 hours of storage volume based on the 2043 MDD. Injection pumps for each well inject the FSA at precisely the required dosage into each well pump discharge through an injection quill. The pumps are mounted on a skid for easy installation and the skid includes a spare pump for backup. Plate-style static mixers help mix the FSA with the well water to ensure the concentration of fluoride is consistent. Sampling equipment is installed downstream of the injection point to provide continuous, online monitoring of actual fluoride concentration and alerts operators if the concentration diverges from the target concentration. Additional instrumentation and controls allow remote monitoring of the system and prevent accidental overfeed of the fluoride.

Operations and Maintenance

Per DOH requirements, adding fluoridation to the City's water system would reclassify the City's well stations as water treatment facilities, which would require the City to hire an operator with a Water Treatment Plant Classification 2. It is estimated that an additional 2.7 full-time equivalent positions would be needed to support the proposed fluoridation system, including both operations and some maintenance and admin support. **Section 4** of this Study provides additional detail on recommended operations and maintenance tasks/schedules, including distribution system monitoring, and reporting requirements.

OPERATOR TOUR OF PEER UTILITY

Implementation

In the event Spokane's elected officials decide to move forward with fluoridation of the City's water system, several steps would be needed for permitting, final design, and construction. These steps are detailed in **Section 5** of this Study and highlighted below.

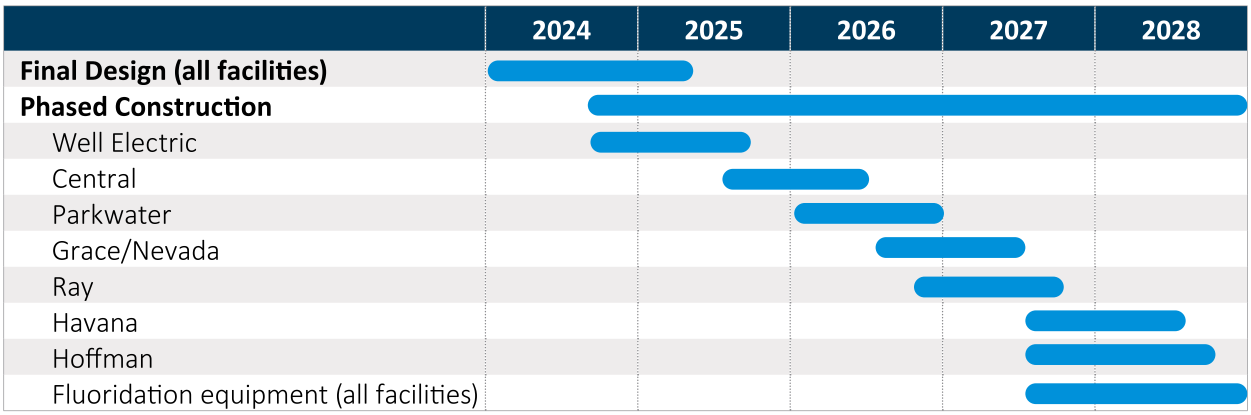
- With the recent passage of House Bill 1251, public notification requirements would need to be followed in advance of a decision to comment fluoridation.
- Since the City's current Comprehensive Water System Plan does not include the capital improvements needed to proceed with fluoridation, the City would need to coordinate with DOH to amend the plan.
- A project-level SEPA would need to be completed during design to meet DOH requirements for approval of project engineering reports. The project-level SEPA would have its own determination based on design details and public comment process.

Phased Schedule

At this time, Spokane's elected officials have not yet made a decision to proceed with fluoridation implementation. The proposed potential implementation schedule in Figure ES-1 uses an example start date of 2024 to show how work could be phased. Construction of the site and building improvements at each of the well station facilities is proposed over a five-year period, with installation of the fluoridation chemical storage and injection system occurring at all well station facilities in the final construction year. This would allow for startup of the fluoridation system at all facilities on same timeline meeting the DOH requirements for consistent fluoridation of all sources.

The City is currently assessing onsite sodium hypochlorite generation systems for its water system disinfection. If timing and funding align, the City may combine construction of the proposed fluoridation facilities with the onsite generation facilities to reduce potential costs and interruption of operations.

Figure ES-1 Proposed Potential Implementation Schedule



Cost Summary

An implementation cost summary showing initial capital costs and an anticipated range for the first year of operating and maintenance costs is presented in Table ES-1. Further detail about how capital costs could be spread across the proposed five-year implementation period is included in **Section 5**.

Table ES-1 Cost Summary

	2023 Capital Cost	Year 1 Cost to Operate: High Range[1] (2028 Dollars)[2,4]	Year 1 Cost to Operate: Low Range[3] (2028 Dollars)[2,4]	Year 1 Cost to Maintain: High Range[1] (2028 Dollars)[4]	Year 1 Cost to Maintain: Low Range[3] (2028 Dollars)[4]
Well Electric	$1,548,000	$416,400	$320,400	$46,100	$35,500
Parkwater	$1,759,000	$488,800	$376,100	$49,100	$37,800
Ray	$1,501,000	$205,200	$157,900	$45,300	$34,800
Central	$1,545,000	$193,100	$148,600	$46,100	$35,500
Grace/Nevada	$1,519,000	$302,700	$232,900	$45,700	$35,200
Hoffman	$1,434,000	$151,500	$116,500	$44,500	$34,200
Havana	$1,695,000	$259,300	$199,500	$48,100	$37,000
All Facilities	**$ 11,001,000**	**$2,017,000**	**$1,551,900**	**$324,900**	**$250,000**

[1] *High range costs include a 30 percent contingency.*
[2] *Includes power, chemical costs, and tax.*
[3] *Low range costs exclude the 30 percent contingency.*
[4] *Includes year one ramp-up on labor costs.*

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SECTION 1

Introduction

1.1 Project Authorization

The City of Spokane (City) authorized Consor North America, Inc., formerly Murraysmith Inc., (Consor), in January 2022 to provide professional engineering services to complete a Preliminary Engineering Study for Fluoridation (Study) to evaluate the cost implications in the event the City decides to provide fluoridated drinking water to its customers. This Study will outline a proposed approach that includes, at a minimum, as the basis of the assessment, preliminary design, and steps to implement fluoridation in order to more accurately evaluate the costs associated with providing fluoridated water to the customer.

The primary purpose of this Study was to better understand costs to add fluoride to the water system as stated above, the information and calculations contained in this study also meet the Washington State Department of Health (DOH) requirements for a Project Engineering Report (Project Report) outlined in WAC-246-290-110, and preliminary design study for the Spokane Fluoridation under WAC 246-290-250. The *DOH General Report Checklist* is included in Appendix A.

1.2 Project Description and Purpose

The City entered an agreement with Arcora Foundation in September 2020, by which Arcora would provide funding for the fluoridation of the City's water system. In August 2021, the Agreement was amended to allow the City to conduct a preliminary engineering study to implement fluoridation of the City's water system, using a portion of the provided funds. In support of conducting a preliminary engineering study, the City's Mayor and Council have agreed to have a public and transparent process to decide next steps once this study has been completed.

The City places great importance on supplying safe, high-quality drinking water to its customers in a manner that is efficient and maintains affordability for the community. This Study was conducted with the objective of providing information for future decisions regarding the associated costs of adding fluoride to the drinking water system.

This Study builds upon previous fluoridation feasibility studies, which were conducted in 2004 and updated in 2016. These studies reviewed the permitting and operational/maintenance requirements, as well as capital improvements that would be necessary to fluoridate the City's water system.

1.3 Background

The City water system is currently supplied by seven well station facilities with an eighth well facility currently under construction. Each well station facility has between two and eight well pumps ranging in capacity from 5.4 to 19.4 million gallons per day (MGD). The well stations total capacities vary between 15 MGD and 90 MGD. The City's water demand changes significantly throughout the year, from a winter average of approximately 35 MGD, to a summer peak of over 147 MGD. This wide range of water demand requires careful considerations for operational effectiveness of the proposed fluoride chemical feed systems which would need to be added.

Retrofitting of the existing well station facilities with the equipment necessary for fluoridation would be required if fluoridation of the system were to be implemented. The *Preliminary Engineering Study for Fluoridation: Well Facility Condition Assessment* (Murraysmith, September 2022) was conducted to gain an understanding of the existing conditions of each well station and determine any potential retrofits that would be required which are defined further in Section 3 of this Study and included in Appendix B.

Additionally, in Appendix C, the *Preliminary Engineering Study for Fluoridation: Fluoridation Systems Alternatives* (Murraysmith, December 2022) was conducted to provide an objective and transparent selection process for determining a preferred fluoridation alternative for the purposes of understanding cost implications. The process of determining a preferred alternative was based on the City's long-term goals of balancing sustainability, social responsibility, and affordability. This analysis evaluated the implementation of three fluoridation alternatives through a multi-objective decision analysis considering design/facility requirements, O&M considerations, and costs. The proposed implementation of the preferred liquid fluoridation injection is defined in Section 3 of this Study.

1.4 Planning Information

The City is required by WAC 246-290-100 to have a Comprehensive Water System Plan (WSP) which identifies capital improvement projects prior to receiving approval of a project engineering report. The City has an approved WSP. However, since fluoridation is not a required treatment process, the WSP does not include the capital improvements needed if the City were to proceed with fluoridation of its water. Therefore, if the City undertakes fluoridation of its water system, the City will need to coordinate with DOH to amend the WSP to include this project or projects.

Additionally, the Washington State Environmental Policy Act (SEPA) provides for SEPA review to be conducted as early in the process as possible. A non-project SEPA was completed for this Study. The Study itself, is to determine potential costs if fluoridation of the City water system were to occur does not in itself create an environmental impact. A determination of non-significance was issued for the non-project SEPA covering the Study. In the event City officials decide to move forward with fluoridation of the City's water system, a project level SEPA will be completed during the project design process. A project level SEPA, which includes public process, is required for approval of the project engineering report. Any comments received during the comment period for the non-project SEPA process for this Study was included in the Study along with a copy of the non-project SEPA checklist and is in Appendix D (*Draft SEPA Checklist and Comments*).

The Study assumed that no new sources of water would be developed, and it would not involve interties. However, any instillation of fluoride would require some construction at the existing wells. The City maintains a sanitary control area (SCA) around each well, has a wellhead protection program, and has established Critical Aquifer Recharge Areas (CARA). The proposed project would meet any applicable requirements for development within these areas. Fluoridation of the water is not expected to impact water demand, system capacity, water source, disinfection requirements, or booster pump station and reservoir operation.

SECTION 2

Existing Facilities

2.1 General

The City of Spokane (City) owns and operates eight well station facilities, which supply water to the entire water distribution system. The *Preliminary Engineering Study for Fluoridation: Well Facility Condition Assessment* (Murraysmith, September 2022), was developed to document the existing infrastructure at each of the well station facilities in preparation for determining required retrofits that would be required if the implementation of fluoridation were to occur for the purpose of understanding cost implications, and is included in **Appendix B**.

The *Preliminary Engineering Study for Fluoridation: Well Facility Condition Assessment* provides the following information for each well station:

- Parcel and Information Access
- Site Security
- Pressure Zones Served
- Pump /Transmission Summaries
- Existing Structural/Electrical Facilities Summaries
- Existing Mechanical Plan

Basic information about each well station is summarized in this section, however, if more detailed information is needed on the existing well facilities refer to the *Preliminary Engineering Study for Fluoridation: Well Facility Condition Assessment*.

2.2 Existing Site Description

The following provides a brief description of each of the City's well facilities. Error! Reference source not found. on the following page provides summary of pumps, capacity, and pressures zones served by each well facility. This information is used as the basis for sizing and designing the fluoridation system defined in **Section 3** of this Fluoridation Implementation Study.

Table 2-1 | Well Station Facilities Summary

Pump No.	Well No.	Capacity, gpm	Pressure Zone	Pump No.	Well No.	Capacity, gpm	Pressure Zone
Well Electric				Central			
1	5	7,550	Intermediate	1	1	8,000	North Hill
2	5	8,330	North Hill	2	2	8,000	North Hill
3	5	13,500	Low	Grace			
4	4	8,300	North Hill	1	1	8,000	North Hill
5,6	4,4	Out of service indefinitely		2	1	8,000	North Hill
Parkwater				Nevada			
1	1	7,500	Intermediate	1	1	5,700	Low
2	1	7,500	Intermediate	2	1	9,800	Low
3	2	8,000	Low	3	1	9,800	Low
4	2	8,000	Low	4	1	5,700	Low
5	3	8,000	Low	Hoffman			
6	3	8,000	Low	1	1	5,500	North Hill
7	4	8,000	Low	2	2	5,500	North Hill
8	4	8,000	Low	Havana			
Ray				1,2,3	1,2,3	TBD	Low
1	1	7,000	Intermediate	4	4	3,750	Intermediate
2	2	7,200	Intermediate	5	5	3,750	Intermediate
3	2	4,350	Intermediate	6	6	3,750	Intermediate

2.2.1 Well Electric Well Station

The Well Electric Well Station was constructed in 1925. Located southwest of the City's hydroelectric Upriver Dam, the facility address is 2701 N Waterworks Street, Spokane, WA 99212. This well station houses two large-diameter wells, Well No. 4 and Well No. 5, and serves three pressure zones from four operating well pumps. Pumps 1, 2, and 3 draw from Well 5 and Pump 4 draws from Well 4 Pumps 1, and 3 serve the Intermediate and Low Zones, respectively. Pumps 2 and 4 both serve the North Hill Zone. Pumps 5 and 6 at this location previously pumped from Well No. 4 but are currently abandoned. The well station building is equipped with system control, pump control, chlorine, and maintenance rooms.

2.2.2 Parkwater Well Station

Constructed in 1947, the Parkwater Well Station serves two pressure zones from eight pumps and four wells. Pumps 1 and 2 serve the Intermediate Zone, while pumps 3 through 8 serve the Low Zone. Pumps 1 and 2 draw from Well No. 1, pumps 3 and 4 draw from Well No. 2, pumps 5 and 6 draw from Well No. 3, and pumps 7 and 8 draw from Well No. 4. Located southwest of the Felts Field Airport, the Parkwater facility address is 5317 E Rutter Avenue, Spokane, WA, 99212. A chlorine room in the middle of the building segments the wells into two pairs. Motor controls are located between each pair of wells.

2.2.3 Ray Street Well Station

Constructed in 1937, the Ray Street Well Station serves the Intermediate Zone via two wells and three pumps. Pumps 1 and 2 draw from Well No. 1, and pump 3 draws from Well No. 2. This well station facility is located in the City’s East Central residential neighborhood at 607 S Ray Street, Spokane, WA. This well station is equipped with a decommissioned restroom and a chlorine room. Space for a future pump exists within Well No. 1 pump caisson.

2.2.4 Central Avenue Well Station

The original Central Well Station was constructed in 1960 and consisted of two individual vaults for each of the wells and one chlorine and controls building. New well buildings were constructed in 2016 and 2019. This well station serves the North Hill pressure Zone via two wells and two pumps. Pumps 1 and 2 draw from Well No. 1 and Well No. 2, respectively. A chlorine room, control room, restroom, and signals and lighting room exist within the Central Avenue well control building. The Central Well Station is located within the City's North Hill residential neighborhood at 5903 N Normandie Street, Spokane, WA.

2.2.5 Grace Well Station

The Grace Well Station was constructed in 1949. Located east of the City's Water Department building at 1024 E North Foothills Drive, Spokane, WA. The Grace Well Station serves the North Hill Zone via one well and two pumps. A motor control center, a chlorine room, and a temporary storage area exist within the Grace well station building.

2.2.6 Nevada Well Station

Constructed in 1956, the Nevada Well Station serves the Low Zone with one well and four pumps. Like the Grace Well Station, the Nevada Well Station is located east of the City's Water Department building and within the Water Department yards at 914 E North Foothills Drive, Spokane, WA. This well station is equipped with a chlorine room, control room, and an adjacent flow meter tunnel.

2.2.7 Hoffman Well Station

The Hoffman Well Station is located in the City's Bemiss residential neighborhood and was constructed in 1936. This well station is currently undergoing necessary retrofits to install a second pump into the facility's second well. Once the installation of the second pump is complete the Hoffman Well Station will serve the North Hill Zone via two pumps and two wells. Pump 1 draws from the west well and pump 2 draws from the east well. The address of this well station is 2109 E Hoffman Avenue, Spokane, WA. This well station has a chlorine room, two storage rooms, and a controls area.

2.2.8 Havana Well Station

The Havana Well Station is currently being constructed and will serve two pressure zones via six wells and six pumps. The future Havana Well Station site is located at 4302 E 6th Avenue, Spokane Valley, WA and will consist of two well station buildings: "Well Station A" and "Well Station B". Well Station A will house pumps 4 through 6 and serve the Intermediate Zone. Well Station B will house pumps 1 through 3 and serve the Low Zone. After construction, this well station building will have a chlorine room, a restroom, and a communications room.

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SECTION 3

Fluoridation Implementation Preliminary Design

3.1 Fluoridation Alternatives Evaluation

As defined in Section 1, the City of Spokane (City) is completing a grant-funded Preliminary Engineering Study for Fluoridation (Study) to evaluate the cost implications in the event the City decides to provide fluoridated drinking water to its customers. evaluating three different chemical fluoridation alternatives for the proposed fluoridation of the City of Spokane's water system. The chemical fluoridation alternatives were evaluated using a multi-objective decision analysis (MODA) focused on facilitating an objective and transparent selection process regarding the City's long-term goals of providing affordable, safe, and sustainably fluoridated drinking water. The chemical fluoride alternative selection process was documented in the *Preliminary Engineering Study for Fluoridation: Fluoridation System Alternatives* (Murraysmith, December 2022) found in **Appendix C** and the *Fluoridation Implementation Multi-Objective Decision Analysis* (Parametrix, January 2023) found in **Appendix E**.

The three fluoridation chemical alternatives that were evaluated were: sodium fluoride, sodium fluorosilicate, and fluorosilicic acid (FSA). Sodium fluoride and sodium fluorosilicate both exist as dry chemicals, while FSA exists in liquid chemical form. Due to the two dry chemicals possessing similar facility and operation and maintenance requirements, and manufacturer limitations of sodium fluorosilicate, the focus of the report shifts to comparing differences between dry and liquid fluoride chemicals.

The following were evaluated for the dry and liquid chemical alternatives:

- Preliminary equipment sizing
- Listing of required key equipment
- General process flow diagrams
- General site and mechanical plan layouts based on system operations, maintenance, and safety considerations
- Class 5 opinion of probable construction costs (OPCC)
- Concept-level 50-year life cycle cost analysis (LCCA)

The results of the alternatives evaluation are briefly summarized in this section; however, the reader should refer to the *Preliminary Engineering Study for Fluoridation: Fluoridation System Alternatives* **(Appendix C)** and the *Fluoridation Implementation Multi-Objective Decision Analysis* **(Appendix E)** for more detailed information about the alternative selection.

Table I-1 of the *Preliminary Engineering Study for Fluoridation: Well Facility Condition Assessment* (Murraysmith, September 2022), in **Appendix B**, includes a Condition Assessment Matrix summarizing key condition assessment elements that were used for the development of the fluoridation system alternatives. The assessment determined that the proposed future fluoridation facilities require a dedicated building due to the existing well station buildings not possessing enough space to house new fluoridation systems. The exception is the Well Electric building, though extensive retrofits would likely be required to facilitate the proposed new system, so the addition of a new fluoride feed facility at the Well Electric Well Station was proposed. Additionally, for the Central Well Station, rather than constructing a new building from scratch, due to space limitations an existing control building must be demolished down to the foundation and a new building constructed to accommodate the fluoridation equipment.

3.1.1 Sodium Fluoride

Sodium fluoride is sold as a colorless, low-dust, granular solid. In this form, personnel exposure and risk of inhalation is minimized. Although delivered in a solid form, the use of a dry feeder to deliver sodium fluoride is uncommon. Sodium fluoride readily dissolves to relatively uniform saturation levels at temperature ranges common in water treatment facilities with minimal operator input. A saturation tank is often used as an intermediate step to deliver sodium fluoride. Sodium fluoride is the most expensive of the fluoridation chemical alternatives and is less effective in areas where feed water possesses high hardness.

3.1.2 Sodium Fluorosilicate

Sodium fluorosilicate is sold as a white, odorless crystalline salt. Similar to sodium fluoride, sodium fluorosilicate comes in a low-dust granular form. Sodium fluorosilicate does not dissolve as readily as sodium fluoride, requiring significant mixing to reach saturation. Additionally, the concentration of dissolved chemical is significantly more temperature dependent and thus the formation of an unsaturated solution via metering with a dry feeder into a solution tank is commonly required. Sodium fluorosilicate, being a weak acid, is better suited for use in locations where water hardness is high. The use of sodium fluorosilicate has been declining since the 1970s and it is the least used form of fluoride in municipal systems, currently.

3.1.3 Fluorosilicic Acid

Fluorosilicic Acid (FSA) is distributed as an acidic aqueous solution with a pH of 1.2, typically delivered in concentrations of 23-25 percent. FSA is the most widely used fluoridation product and may be directly injected in the state in which it is delivered, minimizing the amount of operator involvement. Due to the presence of trace amounts of hydrogen fluoride and silicon tetrafluouride in solution, FSA is volatile as these gases evaporate from the surface of the liquid. Due to its high-water content, shipping costs of FSA are high. At a specific gravity of approximately 1.22 a single gallon of FSA weighs over 20 percent more than an equivalent volume of water.

3.2 Selected Alternative

An integrated analysis approach was utilized to evaluate both the financial and non-financial components of each chemical alternative. A summary of this integrated analysis evaluation may be seen in Table 5-1 of the *Preliminary Engineering Study for Fluoridation: Fluoridation System Alternatives* report included in **Appendix C**. Capital and annual operational costs for each alternative were calculated. Non-financial chemical alternative considerations included:

- Environmental and Sustainability Impact
- Neighborhood Impacts
- Worker Safety

- Public Safety
- Service Reliability
- Ease of Maintenance and Operations

A primary reason bulk storage/feed systems for the dry chemical options were eliminated for consideration as chemical alternatives was due to limitations of regional supply from vendors for bulk delivery. The liquid chemical alternative evaluation determined a lower capital and annual operations cost than the dry chemical alternatives.

Fluorosilicic acid was determined to be the preferred alternative. The carbon footprint of FSA is lower than the dry chemical alternatives due to this alternative requiring less frequent chemical delivery trips. However, due to the time it takes to fill the large bulk chemical storage tanks, delivery times for this alternative are longer than the dry chemical alternative. Additionally, the fluoridation building footprint requirements for each well facility are larger to accommodate for the large bulk chemical storage tanks. Although more personal protective equipment (PPE) is required when handling FSA due to an exposure event being more hazardous than the dry chemical alternatives, less handling is required. Compared to the dry chemical alternatives the risk of a chemical spill is lower, but the implications if one does occur are higher. Furthermore, less full-time equivalent (FTE) operational and maintenance staffing is required for the FSA chemical alternative.

3.3 Overall Fluoridation Process Design

3.3.1 Water System Demands

A 20-year planning horizon will be used for sizing the proposed fluoridation system based on an anticipated useful life of the FSA injection equipment. The City of Spokane projected future water system demand through 2045 in the *Spokane Future Flows – Baseline Water Demand Forecast* (HDR, August 2022). The technical memorandum reports a 19 percent increase in maximum day demand (MDD) compared to current values in 2042 and a 23 percent increase in 2045. Similarly, for the average demand day (ADD), increases in demand of 18 percent and 21 percent are predicted for 2042 and 2045, respectively. For the 2043 planning horizon, it is assumed based on these projections that both ADD and MDD will increase approximately 20 percent from current values.

The actual observed ADD and MDD from the City's well pump data for 2019, 2020, and 2021 was determined and the 2043 ADD and MDD were estimated using the 20 percent increase in demand. The City operates several of the well sites seasonally, so at these sites the ADD is adjusted for only the days when the site is in use. Thus, it is an average when operating, but should not be extrapolated to an annual average. A summary of the design ADD and MDD is shown in **Table 3-1**, below.

A few site-specific assumptions were made to account for unique circumstances at some of the well stations, as detailed below:

- Ray Street Well Station: The 2043 MDD resulting from the assumed 20 percent increase in demand is higher than the capacity of the existing well pumps, but there is room to install an additional pump. It is assumed that an additional pump will be added when needed to supply the MDD, so the 20 percent increase in demand can be provided.

- Grace Well Station: The 2043 MDD resulting from the assumed 20 percent increase in demand is higher than the capacity of the well pumps. It is assumed that the existing well pumps will remain in place, so the maximum capacity of the well pumps was used instead.

- Hoffman Well Station: The 2043 MDD resulting from the assumed 20 percent increase in demand is higher than the capacity of the existing well pump, but the installation of a second well pump at the facility is in progress. It is assumed that the installation of the second pump would be complete so that the 20 percent increase in demand can be provided.

- Havana Well Station: The Havana Well Station is currently being constructed, so the ADD and MDD were estimated based on the total buildout capacity scaled to the ratio of Demand/Total Capacity for the City's other well sites (0.40 for ADD and 0.68 for MDD). This assumes that the Havana Pumps will be used similarly to the other well sites, operating about 16.3 hours total on the MDD. Pump capacity is assumed to be 4,200 GPM for pumps 1, 2, and 3, and 3,750 GPM for pumps 4, 5, and 6.

Table 3-1 | Water System Demand Summary

	Well Electric	Parkwater	Ray	Grace	Nevada	Central	Hoffman	Havana
Total Station Capacity (GPM)	37,380	62,500	22,850	16,000	31,000	16,000	11,000	23,850
Current Operating ADD (MGD)[1]	23.3	29.3	12.6	11.0	13.8	11.1	5.8	13.6
Current Operating MDD (MGD)[1]	41.3	44.8	22.3	22.7	23.8	18.8	7.4	23.3
2043 Operating ADD (MGD)	28.0	35.2	15.1	13.3	16.5	13.3	7.0	16.3
2043 MDD (MGD)	49.6	53.8	26.8	27.2	28.6	22.6	8.9	27.9

3.3.2 FSA Storage and Dosing

Each well station is proposed to have a new fluoride building that houses the bulk FSA storage tanks, transfer pump, day tank, metering pumps, and related appurtenances.

An exterior fill port is provided on the fluoride building to allow easy and well controlled delivery of bulk FSA from chemical suppliers. This fill port is covered, includes chemical containment around the port, clearly labeled, and locked so that it cannot be used without a qualified operator present, as recommended by the Washington Department of Health (DOH).

Tank material for the bulk tanks and day tanks must be resistant to degradation when storing the FSA; two appropriate options are fiberglass-reinforced plastic (FRP) and high-density polyethylene (HDPE). FRP tanks are fabricated using a hand layup process that allows for users to specify the exact volume, diameter, and height desired, which is advantageous when installing tanks in existing spaces with fixed dimensional constraints. In contrast, HDPE tanks are only available in manufacturer selected volumes and dimensions. If FRP tanks are regularly inspected and if the interior surface is recoated before the corrosion-resistant barrier is compromised, the service life of these tanks are generally two to three times longer than HDPE tanks. Unlike FRP tanks, HDPE tanks cannot be repaired in place if they develop a leak and must be replaced. Capital costs of HDPE tanks are typically about half to a third of the cost of FRP tanks. For this preliminary design phase FRP tank material was selected as the basis of design. This can be further evaluated during final design.

The target concentration for fluoridation is 0.7 mg/L, with an allowable minimum of 0.5 mg/L and maximum of 0.9 mg/L per the *Water System Design Manual* (DOH, 2020) Section 10.2.3. Each of the bulk tanks was sized to provide a minimum of 60 days of FSA storage based on a target dose of 0.7 mg/L of fluoride for the

2043 MDD. A summary of bulk tank sizing is shown in **Table 3-2.** The number of deliveries per year for each site is based on the total annual water production at each facility. Due to seasonal variability in water demand and the seasonal operation of several of the wells, more FSA will be consumed in the summer months, so deliveries will be timed closer together in the spring and summer and will be more spaced out in the winter.

Table 3-2 | Bulk Tank Summary

	Well Electric	Parkwater	Ray	Central	Grace / Nevada	Hoffman	Havana
Minimum Tank Volume (gal)	8,989	9,751	4,843	4,094	9,364	1,618	5,067
Design Tank Volume (gal)	10,000	10,000	5,000	4,250	10,000	1,800	5,250
Days of Storage at 2043 MDD	67	62	62	62	64	67	62
Days of Storage at Current MDD	80	74	74	75	71	80	74
Average Number of Deliveries Per Year	3	4	2	2	1	1	2

Day tanks are sized to provide 30 hours of storage volume for the 2043 MDD as recommended in the *Water System Design Manual*, Section 10.6.1. This design criteria was established to reduce the severity of potential chemical overfeed incidents. **Table 3-3** shows a summary of the design day tank volume for each well station.

Table 3-3 | Day Tank Summary

	Well Electric	Parkwater	Ray	Central	Grace / Nevada	Hoffman	Havana
Tank Volume at 2043 MDD (gal)	188	204	101	86	195	34	106
Design Tank Volume (gal)	200	225	100	100	200	50	125
Days of Storage at 2043 MDD	1.34	1.38	1.24	1.47	1.28	1.85	1.48
Days of Storage at Current MDD	1.60	1.66	1.48	1.76	1.42	2.23	1.78

FSA is transferred from the bulk tanks to the day tanks manually by operators as recommended in the *Water System Design Manual*. Magnetic-drive centrifugal pumps are a cost effective and robust option for chemical transfer pumps. The liquid handling end of the pump is driven by magnets rather than a shaft, which eliminates the need for a mechanical seal and reduces the wear caused by harsh chemicals such as FSA. The casing and impeller material is polypropylene to eliminate the risk of corrosion. Transfer pumps are sized at approximately 50 GPM so that bulk tanks at all sites can be filled in one to five minutes.

One injection pump for each well pump is proposed to inject the FSA into the water as it is pumped into the distribution system and an additional backup pump is included. All of the well pumps in the City's system are constant speed pumps, so injection pumps can be calibrated and set to provide consistent FSA injection without flow pacing. The pressure in the pipe varies for each pump based on the site elevation and pressure zone being served. A summary of the pump flowrate and discharge pressures is shown in **Table 3-4.**

Table 3-4 | Injection Point Summary

Pump No.	Well Pump Flowrate (GPM)	Injection Pump Flowrate (GPD)	Injection Point Pressure (PSI)	Pump No.	Well Pump Flowrate (GPM)	Injection Pump Flowrate (GPD)	Injection Point Pressure (PSI)
Well Electric				Central			
1	7,550	32.9	165.4	1	8,000	34.8	50.9
2	8,330	36.3	126.4	2	8,000	34.8	50.9
3	13,500	58.8	87.9	Grace			
4	8,300	34.8	126.4	1	8,000	98.3	34.8
5,6	Out of Service Indefinitely			2	8,000	98.3	34.8
Parkwater				Nevada			
1	7,000	30.5	137.0	1	5,700	24.80	63.6
2	7,500	32.6	137.0	2	9,800	42.65	63.6
3	8,000	34.8	59.5	3	9,800	42.65	63.6
4	8,000	34.8	59.5	4	5,700	24.80	63.6
5	8,000	34.8	59.5	Hoffman			
6	8,000	34.8	59.5	1	5,500	23.93	58.1
7	8,000	34.8	59.5	2	5,500	23.93	58.1
8	8,000	34.8	59.5	Havana			
Ray				1[1]	4,200	18.3	71
1	7,000	30.5	154.7	2[1]	4,200	18.3	71
2	7,200	31.3	154.7	3[1]	4,200	18.3	71
3	4,350	18.9	154.7	4	3,750	16.3	148.3
4[1]	4,350	18.9	154.7	5	3,750	16.3	148.3
				6	3,750	16.3	148.3

Note:

1. Pump has not been constructed yet, future flows may vary.

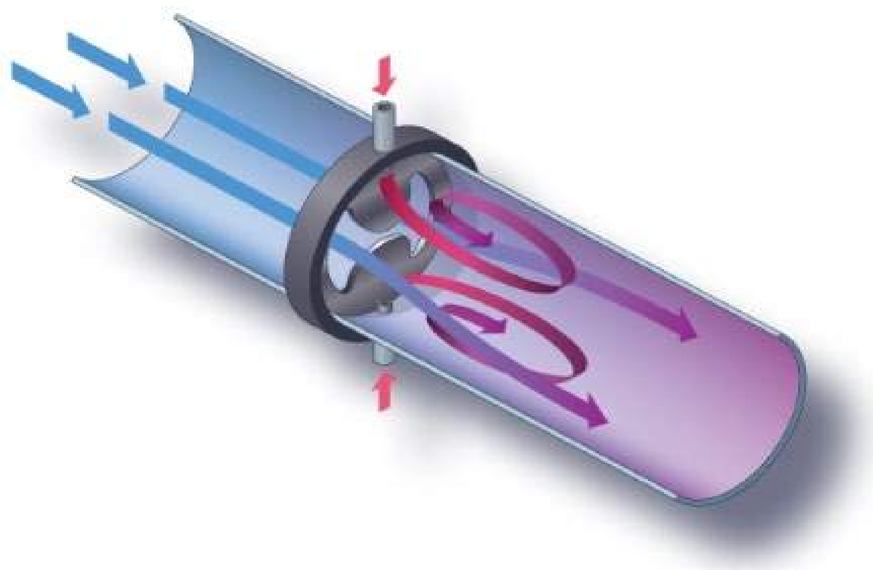
Peristaltic and diaphragm pumps are the most common types used for chemical dosing because they each allow for precise flowrate selection over a much wider range of flows and have good compatibility with harsh chemicals. Peristaltic pumps generally have lower maximum pressure ratings than diaphragm pumps. The City would prefer to standardize dosing pumps across the system and has some wells that discharge into moderately high pressure zones, so diaphragm pumps are recommended.

3.3.3 Fluoride Injection, Mixing, and Sampling

Static mixers are proposed to increase mixing of the well water with the FSA so that a consistent and well mixed fluoride concentration can be achieved. Fluoridation injection points can be paired with a static mixer for convenience and to minimize footprint. Injection points are recommended to be positioned downstream of the well pump discharge head check valve to ensure that fluoride is injected into the distribution system and does not inadvertently go into the aquifer.

Many of the well stations have limited distances of exposed piping after check valves where injection and mixing equipment can be added. Static mix plate style mixers are recommended because they have limited space requirements and lower cost compared to other styles of static mixer. Plate style static mixers create a turbulent environment within a pipe as water passes through the mixer orifice, as shown in **Figure 3-1**. A mixing distance of 7 pipe diameters is generally recommended to achieve sufficient mixing along the main at the required fluoride concentration before sampling, but actual minimum mixing length varies based on the type of mixer, chemical, water, and other factors. Additionally, a minimum of three straight pipe diameters is recommended after mixing before any elbows are encountered along the flow path.

Figure 3-1 | Plate Style Static Mixer Rendering



Many of the well stations possess exposed piping or existing metering vaults and/or flow meter vaults that make easy sampling points. The locations of the static mixers and sampling location, therefore, must vary by site to ensure reliable fluoride concentration monitoring. These elements are shown in the drawings in **Appendix F**, *Preliminary Design Drawings Submittal.* Injection location, sampling location, and mixing length is summarized in **Table 3-5** below.

Table 3-5 | Static Mixer and Sampling Point Summary

Pump No.	Injection Location (FT)	Sample Location (FT)	Mixing Length (FT)	Pump No. (FT)	Injection Location (FT)	Sample Location (FT)	Mixing Length (FT)
Well Electric				Central			
1	11.5	25.5	14.0	1	12.4	29.33	16.9
2	0.83	16.3	15.47	2	12.4	29.33	16.9
3	11.2	25.2	14.0	Grace			
4	2.3	18.63	16.33	1	14.0	>43.5	29.5
Parkwater				2	14.0	>43.5	29.5
1	22.7	>56	>33.3	Nevada			
2	22.7	>56	>33.3	1	2.2	69.1	66.9
3	22.7	>56	>33.3	2	2.2	62.2	60
4	22.7	>56	>33.3	3	2.2	71.6	69.4
5	22.7	>56	>33.3	4	2.2	67.9	65.7
6	22.7	>56	>33.3	Hoffman			
7	22.7	>56	>33.3	1	3.7	>118.8	115.1
8	22.7	>56	>33.3	2	3.7	>69.2	65.5
Ray				Havana			
1	24.7	113.7	89	1	14.8	76.7	61.9
2	24.7	113.7	89	2	14.8	102.8	88
3	24.7	113.7	89	3	14.8	128.7	113.9
4	24.7	113.7	89	4	14.8	76.7	61.9
				5	14.8	102.8	88
				6	14.8	128.7	113.9

3.3.4 Fluoride Overfeed Prevention

The FSA transfer pumps require manual operation and supervision to eliminate the risk of overfeeding FSA from a bulk storage tank, per section 10.6.1 of the *Water Systems Design Manual*. The fluoride feed pumps are interconnected electrically with the well pump and also with a flow sensing switch or meter in the water main. Additionally, fluoride injection lines have two anti-siphon valves, one at the injection pump discharge and the other at the injection point, to prevent inadvertent siphoning of the day tank, as recommended in Appendix F.2 of *the Water Systems Design Manual*.

The DOH recommends that the fluoride injection pumps have a maximum chemical feed rate no more than twice the recommended dose. Injection pumps have a very wide range of flows but tend to lose accuracy when operating close to the maximum. That makes this recommendation difficult to achieve hydraulically, but the pump controls will be set with an upper limit to prevent operators from inadvertently exceeding this limit. Additionally, DOH recommends two interlocks on all fluoride feed equipment. This would be included using the well pump run signals and flow meters.

The Washington Administrative Code (WAC) 246-290-460 requires for daily sampling after the fluoride injection point, but the *Water Systems Design Manual* recommends continuous online monitoring to prevent overfeed so this project will include continuous online measurement. There are several fluoride sampling units available, including a reagantless analyzer that eliminates the need for operators to monitor reagent usage. Monitoring results are reported to DOH monthly. The report form, reporting guidance, fluoride overfeed actions, and information on the fluoridation treatment quality award program are included in Appendix G, *DOH Fluoridation Forms*.

3.4 Other Project Design Elements

3.4.1 Fluoride Buildings

The proposed fluoride buildings house the FSA bulk and day tanks, transfer pumps, and metering pumps. Each well site has a new fluoride building because of constraints with the existing buildings. Preliminary mechanical layouts for the fluoride buildings are included in the drawings in Appendix F, *Preliminary Design Drawings Submittal*. Well Electric and the Nevada/Grace well stations will have identical building layouts, as will Ray Street and Hoffman well stations. The Parkwater and Havana well stations have their own fluoride building layouts. Central Well Station has limited space, so instead of a dedicated fluoride building the fluoride equipment would be incorporated into a new building built in place of the existing building.

As mentioned in Section 3.3.1, design capacity criteria were developed based on a 20-year estimate. To accommodate for potential future water demand increases beyond this timeframe, fluoride building door openings and bulk tank pad dimensions must be sufficiently large to allow for the replacement of larger bulk tanks in the future if necessary.

Both tanks are required to have secondary containment, which can be incorporated into the concrete building foundation by constructing the chemical room partially below grade so that the entire floor area below the door openings functions as a containment area. This would require landings and stairways within the building to get from grade level down to the chemical room floor. Chemical fumes are vented upwards since the chemical rises and may create an unpleasant odor. The FSA storage and handling equipment is located in a separate room from any electrical or controls equipment due to the corrosivity of the chemical fumes.

Architecturally, the buildings would be constructed of similar material and style to existing building on each site to maintain a common visual theme. Building size varies by site and ranges from approximately 600 to 1,000 square feet.

3.4.2 Site Access

The bulk FSA would be delivered to each of the well sites by a delivery truck, which could be a semi-truck with a 53-foot tanker trailer. Most well sites currently do not have provisions for access by a large truck, so driveway and access improvements will be needed except for the Grace and Nevada well site and the Havana well station site. Driveway and access improvement are not required at the Grace and Nevada well site since there already is adequate room for delivery trucks at the existing Water Department yard where the Grace well station and Nevada well station is located. The *Preliminary Design Drawings Submittal* in Appendix F shows the extent of driveway improvements needed to allow truck access for bulk deliveries. The drawings include approximate material quantities for the driveway improvements.

The limits of the driveway and access improvements were developed from performing truck turning movement analysis utilizing Transoft Solutions, Inc. Vehicle turn simulations used a delivery truck with a 53-feet long trailer that has an overall wheelbase length of 67 feet. This type of delivery truck is identified as a WB-67, which is the most common large truck size.

Access to the well buildings is already restricted with locking doors. The fluoride buildings would also be locked to prevent public access.

3.4.3 Finished Water Quality Impacts (Corrosivity)

Finished water quality with the addition of FSA was reviewed and summarized in the *Fluoridation Ancillary Elements Technical Review Technical Memorandum*, February 6, 2023, included in **Appendix K**. Noting that FSA will change the pH and alkalinity of the water and therefore change the City's final water corrosion indices. As indicated in practice, water with a Langelier Saturation Index (LSI) between −0.5 and +0.5 will not display enhanced mineral dissolving or scale forming properties. Water with an LSI below −0.5 tends to exhibit noticeably increased dissolving abilities while water with an LSI above +0.5 tends to exhibit noticeably increased scale forming properties.

As defined in Table 1 of the *Fluoridation Ancillary Elements Technical Review Technical Memorandum*, the LSI values range from -0.07 to -0.47 following the additional of FSA to achieve a concentration of 0.7 mg/L. Based on chemical analysis theoretical equilibriums the potential for dissolution of lead will not be impacted with a slight but insignificant impact on the dissolution of copper. Based on this it is recommended that the City still monitor the water system to see if there are any signs that corrosion has increased or that scale deposits previously formed in the system have destabilized.

3.5 Instrumentation and Control

3.5.1 Alarm Conditions

The fluoridation system introduces some components that can notify staff via SCADA when an anomaly of a component exists. Below are some examples of alarm conditions:

- High or Low Fluoride Value
- Fluoride Analyzer Error/Trouble/Failure
- Fluoridation PLC Loss of Communication or Power
- Fluoride Metering Pump(s) Failure
- Fluoride Transfer Pump Trouble/Failure
- Day Tank High/Low Alarm
- High Rate of Tank Drawdown Alarm
- Containment Area Flood Switch Alarm
- Operator in Trouble (Optional)
- Fluoridation Building High or Low Room Temperature

Staff will need to be trained to recognize and address the alarms as they are received. Time delays may be added and adjusted for alarms that may be a nuisance.

3.5.2 Calibration, Verification and Testing

It is recommended that calibration, verification, and testing of the fluoride analyzer be performed as recommended by the analyzer's manufacturer, both at startup and for routine maintenance. The City should obtain a benchtop fluoride analyzer to routinely verify that the on-line analyzers are performing as expected.

3.5.3 Flow and Pressure Control

Monitoring and control of any water treatment process is important, but it is especially critical to fluoridation due to the precise dosing concentrations required. Flow from the well pumps is already monitored and recorded with flow meters. Flow from the FSA injection pumps would be measured and recorded with flow meters also. Pressure in the injection system would be regulated with two anti-siphon backpressure valves on each injection line. In addition to preventing accidental overfeed from siphoning, the valves provide a consistent pressure for the pump which improves accuracy. Both flow and pressure would be monitored continuously and set to send alarms if either parameter deviates from a predetermined range.

3.5.4 Power Supply

All well sites have a new electrical panel dedicated to supply power to the fluoridation system's components. The fluoridation system's panel is generally rated for 120/208 volt three-phase at 125 amps, but slight adjustments to these ratings are needed at some well sites to be compatible with existing infrastructure (e.g. Central uses 120/240 volt single-phase for station service power).

Most of the well sites have the fluoride system's panel fed from the existing station service panel, provided the existing panel has been determined to have the electrical capacity to support the new fluoridation system's electrical loads. Central has a new building with a new panel to support building loads in addition to the fluoridation system, and Grace/Nevada would need to convert its station service disconnect to a panelboard to supply power to its fluoridation system panel.

3.5.5 Instrumentation and SCADA

At each of the well sites there is an existing programmable logic controller (PLC) that receives and transmits well information from and to the main control room at Well Electric. Most of the PLCs are at capacity in terms of accommodating additional input/output (I/O), therefore it is recommended that the fluoridation system have a new, dedicated PLC at each site. The new Fluoridation System PLC communicates to supervisory control and data acquisition (SCADA) through the well site's existing radio via serial or Ethernet.

Fluoride sampling instrumentation is physically located as close to the sampling points as practical (discussed further in Section 3.5.7). An analyzer from a reputable manufacturer assembles the necessary components on a wall-mountable board that occupies approximately 17"x25" of wall space. Once mounted, tubing, power, and control signal wiring is field routed to the analyzer board to complete the sampling system. It is recommended that for control signal wiring, an analog signal for fluoride measurements and a discrete signal for analyzer trouble alarm be relayed to the SCADA system at a minimum.

3.5.6 Sample Piping

All fluoride sampling lines are 3/8-inch tubing contained in a 2-inch PVC conduit sleeve to provide containment and allow tubing to be replaced if needed. Wherever possible, sampling lines are tapped into existing flow meter vaults or pulled from existing chlorine sampling ports. The distance between the sample point and the fluoride analyzers is minimized to provide as rapid a response time as possible while still ensuring sufficient mixing of the FSA after the injection point. Non-translucent tubes are used as recommended by DOH.

The sampling locations are shown in the *Preliminary Design Drawings Submittal* in **Appendix F**. Each of the waterlines at the Parkwater, Ray Street, Central, Grace, Well Stations sample from existing flow meter vaults with a single sample line for each well pump waterline. At the Hoffman Well Station, both waterlines connect to a single pipe with an existing flow meter where fluoride samples will be taken. At the Well Electric Well Station, samples from well pumps one, three, and four are proposed to sample from existing chlorine sample ports, but pump two does not have sufficient mixing distance at the existing chlorine sample port so a new sample port would be installed in the pipe tunnel. At the Nevada Well Station each of the four pump discharges connect to an existing north-south 36" water main, so two sample lines are located each side of the pump connections to provide a composite sample of water entering the distribution system in either direction.

3.6 Final Design Considerations

This Fluoridation Implementation Study has developed the key design criteria required for implementation of fluoridation at each of the City's well sites, but the scope is limited to include analysis of only the largest and most critical design elements. In order for the City to implement a fluoridation system the following elements need to be further considered during final design:

- General contracting requirements and processes.
- Administrative and Technical Specifications.
- Additional site surveys to capture any data gaps.
- Detailed civil design elements including temporary erosion and sediment control, site drainage and grading, driveway material, utility conflict analysis, and landscaping.
- Detailed mechanical design elements for FSA chemical feed system, including final equipment layout, final equipment and ancillary elements material selection, injection points design, final selection of transfer and metering pumps, and confirmation on containment approach.
- Complete architectural design of new buildings and review of any architectural impacts to existing buildings.
- Complete structural design of new buildings and review of any structural impacts to existing buildings.
- Complete heating and ventilation design and control.
- Complete electrical and supervisory control and data acquisition (SCADA) system design.
- Assess coordination with other planned City projects such as the onsite sodium hypochlorite (chlorine) generation project.
- The storage tanks, containment, and facilities for FSA will need to be in accordance with Spokane Municipal Code, Chapter 17E.010 Critical Aquifer Recharge Areas – Aquifer Protection.
- The City will need to review and update its Emergency Response Plan (ERP) to include any new chemical response requirements for FSA.
- Permitting requirements, see **Section 5**.
- Schedule, see **Section 5**.

SECTION 4

Operation and Maintenance Plan

4.1 General

This section covers the anticipated operations and maintenance activities that would be required through the implementation of fluoridation of the City of Spokane's (City's) water system. Operation and maintenance elements include routine activities, monitoring, staffing, safety, and certification requirements.

4.2 Routine Operation and Maintenance Activities

A typical bulk fluorosilicic acid (FSA) system for fluoridation of public water systems includes a chemical room or building that houses a bulk storage tank, day tank, and chemical transfer and feed pumps. An exterior fill port on the building for filling the bulk tank from a chemical delivery tank truck. The bulk tank as defined in Section 3, Fluoridation Implementation Preliminary Design, is sized for 60 days of the anticipated future maximum day demand of the well facility. A manual transfer pump is used to convey FSA from the bulk storage tank to the day tank. Gravity feeding of day tanks from bulk tank is not recommended. Tanks should never be filled automatically, and transfer of FSA should always be monitored, which is recommended based on industry standards defined by the Great Lakes - Upper Mississippi River Board (GLUMRB)10 States Standards for Water Works and the Centers for Disease Control and Prevention (CDC). The day tank is sized for one day of the anticipated future maximum day demand of the well facility to prevent the potential for overfeeding fluoride into the water system from the bulk tank. The chemical feed pumps inject FSA into the well pump station discharge at locations defined in Section 3, Fluoridation Implementation Preliminary Design.

Table 4-1 provides a summary of typical operations and maintenance activities for FSA chemical injection systems.

Table 4-1 | Recommended Operations and Maintenance Schedule

O&M Task	Daily	Monthly	Quarterly	Annually
Inspect the chemical feed system	X			
Look for leaks or differences	X			
Check additive solution levels	X			
Check hoses for air locks	X			
Check the pump for prime	X			
Fill the day tank (daily)	X			
Check daily continuous automated fluoride monitoring equipment	X			
Calibrate fluoride analyzer per manufacturer recommendation (typical one-point calibration daily, two-point calibration weekly)	X			
Fluoridation Chemical Loading		X (or less)		
Collect split monitoring samples once per month at each site and provide DOH report on results		X		
Check all piping for leaks			X	
Check gas venting for integrity			X	
Check pipes and hoses for encrustations			X	
Inspect tank level measurements (floats, gauges, etc.)			X	
Calibrate the pump's delivery rate			X	
Check the lubrication and adjustments of motor driven pumps				Bi-annual
Check for crystalline deposits in foot valves, lines, hoses, and injectors				Bi-annual
Disassemble and clean foot valves, lines, hoses, and injectors				Bi-annual
Test the operation of vacuum breakers and anti-siphon valves				Bi-annual
Disassemble and replace worn parts of vacuum breakers and anti-siphon valves				Bi-annual
Disassemble and replace worn parts of metering pumps				Annual

4.3 Monitoring Requirements

The Washington Administrative Code (WAC) 246-290-460 requires the following monitoring and reporting activities to ensure concentrations remain as close as possible to the optimal fluoride concentration of 0.7 milligrams per liter (mg/L) throughout the entire distribution system. As defined in **Section 3, Fluoridation Implementation Preliminary Design**, the operating range of the fluoridation system is maintained through continuous monitoring to keep fluoride concentrations within a range of 0.6 to 0.8 mg/L. To confirm that fluoridation facilities and monitoring equipment are operating properly, the City is planning to take the following actions:

- Monitoring
  - Maintain continuous monitoring downstream from each fluoride injection point at the first sample tap where adequate mixing has occurred.
  - Once per month, collect a split sample at the same location as continuous monitoring samples are collected and process as follows:
    - Analyze half the sample (in-house) and record the results on the chain of custody document; and
    - Submit the other half of the sample for analysis to a drinking water certified laboratory with the chain of custody document.
  - Analyze samples in accordance with procedures identified in the 22nd edition of Standard Methods for the Examination of Water and Wastewater, January 2012, or other department-approved procedures.
- Reporting
  - Record routine analysis results on a monthly report form provided by the Washington State Department of Health (DOH). See Appendix G for the *DOH Fluoridation Forms*.
  - Maintain daily average of continuous monitoring samples and record the average fluoride concentration.
  - Submit monthly monitoring reports to the DOH within the first ten days of the month following the month in which the samples were collected.

4.4 Staffing

The previously defined operations and maintenance activities are based on what was outlined in the *Preliminary Engineering Study for Fluoridation: Fluoridation Systems Alternatives* (Murraysmith, December 2022) report and input from the City of Spokane (City). Based on this the following level of effort has been developed to determine requirements for full-time equivalent (FTE) operational, maintenance, and administrative staff needs.

Table 4-2 provides a summary of hours per day, per month, and per year. The costs associated with these staffing requirements are included in the 50-year life cycle cost analysis in Section 5, Project Implementation. Note that the "Monthly" and "Yearly" columns are cumulative sums of hours for regular tasks (e.g. "Day Tank Fill" task is shown as daily hours, which are summed into monthly hours, which are then summed into yearly hours). For the four well stations operated seasonally, per-site tasks are assumed to only be performed eight months out of the year.

Table 4-2 | O&M Staffing Requirements
(Yearly hours include accumulation of daily/monthly tasks)

Task	Daily (Hours)	Monthly[1] (Hours)	Yearly (Hours)	Type of Staff Member
Daily Inspection	7	210	2,040[2]	Operations
Daily Distribution Monitoring	4	120	1,440	Operations
Preventative Maintenance		4	48	Maintenance
Materials Replacement Acquisition		4	48	Administration
Safety Coordination and Training		2	24	Administration
I&C Maintenance		2	24	Maintenance
Day Tank Fill	3.5	105	1,020[2]	Operations
Chemical Loading		7	68[2]	Operations
Equipment Maintenance			868	Maintenance
Staff Summary	**FTEs**		**Hours Per Year**	
Operations Staff	2.20		4,568	
Maintenance Staff	0.45		940	
Administration Staff	0.03		72	

Notes:
Includes "quarterly" tasks from Table 4-1.
For the four well stations operated seasonally, 8 months of hours per year is assumed.

4.5 Operator and Plant Safety Considerations

These general recommended practices are based on the CDC's understanding of the consensus of various safety data sheets (SDS) practices. The CDC recommends that personnel in potential contact with fluoride products always wear personal protective equipment (PPE). The equipment will vary based on the task being performed. Even with a full-face shield and goggles, eye irritation is possible, especially if PPE fails. In the event of a spill, a safety shower and eye wash station would be available for immediate use. The manufacturer's SDS is the primary source of information for PPE required to handle concentrated fluoride additive product.

- Use of PPE should be determined for each task based on a site-specific risk assessment. Risk assessments should consider the following.
- Using PPE.
- Long gloves, coveralls, boots, apron, safety goggles, and face shield.
- Not eating or smoking in an additive storage area.
- Cleaning up an additive storage area promptly after a spill.
- Washing clothes and body after exposure to concentrated additive product.
- Washing hands after exiting an additive product storage area.

- Having a backup “buddy” when entering any additive product storage area.
- Using a checklist when conducting safety and operating procedures.
- Documenting checklist use.
- Access to a first aid kit including a burn kit and acid neutralizer.
- Spill control response aids should be readily accessible wherever liquid additives are handled. Spill control absorbent pillows and dams should be used for initial containment. Follow-up action to neutralize the acid with lime or caustic soda is essential.

Exposure to single, large doses of concentrated fluoride additive product results in symptoms that vary by person. These include nonspecific symptoms: headache, sweating, excessive salivation, tearing, mucous discharges from nose and mouth, diarrhea, and generalized weakness. Potentially fatal symptoms include spasms, tetany and convulsions, weak pulse, low blood pressure, irregular heartbeats, and pulmonary edema.

In 2006, United States Environmental Protection Agency (EPA) reviewed current health effect information for the primary maximum contaminant level (MCL) of 4.0 milligrams per liter (mg/L) based on quantitative risk assessment for severe dental fluorosis, the risk for increased bone fractures as related to fluoride, and the less than crippling form of skeletal fluorosis (Stage II skeletal fluorosis). The review panel recommended updating the MCL. The EPA is conducting new research on the impacts of skeletal fluorosis, and skeletal fractures and has updated the source contributions for fluoride. The EPA may update the MCL or MCLG based on health effects in the future. The lethal dose of fluoride is currently thought to be from 2 to 8 milligrams per kilogram of body weight with lethal doses reported with levels of 16 milligrams per kilogram (mg/kg) in children and 32-64 mg/kg in adults.

Overfeeding above 4 mg/L would pose a City-wide hazard for all customers of the water system; however, numerous redundant design features would be incorporated to prevent overfeeding, including the following.

- Process control
- Equipment calibration
- Anti-siphon devices
- Backpressure
- Calibration columns
- Analyzer(s)
- Check valve(s)
- Flow switch(es)

4.6 Operator Certifications

The requirements for operator certification were reviewed based on the *DOH Purification Plant Criteria Worksheet* (see **Appendix H**). As noted in the worksheet, a water system with groundwater supply with only chlorination is considered a distribution system, not a water treatment facility. The addition of fluoride would result in a reclassification of water treatment certification. The City currently provides residual disinfection and at this level of treatment does not require a certified water treatment plant operator. The addition of the fluoride would result in a reclassification of the City’s water system per WAC 246-292-050 and requires a minimum operator certification of Water Treatment Plant Classification 2 (WTPO 2). The

City will need to designate at least one certified operator responsible and in charge of the fluoridation system at this certification and training level.

SECTION 5

Project Implementation

5.1 General Project Implementation Assumptions

The final implementation of fluoridation of the City of Spokane's (City's) water system will be determined by City elected officials. The purpose of this study was to understand costs IF the city were to implement fluoridation. To develop costs, many assumptions must be made in order to determine costs. If fluoridation were to be implemented, that will require the completion of final design, permitting, phasing of the construction, and startup. An approach is provided for each of these elements for cost estimating purposes, including an assumed start date for these activities, again to develop the basis of determining costs. Additionally, included in this section are the preliminary capital and lifecycle cost estimates to provide a complete understanding of costs the City would reasonably expect if fluoridation were implemented.

5.1.1 Final Design and Construction Phasing Assumptions

The final design and construction phasing is assumed to occur over a 5-year period. The initial phase of final design would be to progress the design to a 90% level for all fluoridation facilities at each of the City's well station facilities. This work would include a project level SEPA to be completed. Further the facility construction would be separated into two sub phases. The first would complete construction of the site and building improvements at each of the well station facilities over multiple years. The second sub phase would be installation of the fluoridation chemical storage and injection system at the well station facilities in the final construction year. This would allow for startup of the fluoridation system at all facilities on the same timeline meeting the Washington State Department of Health (DOH) requirements for consistent fluoridation of all sources.

Figure 5-1 presents the anticipated design, permitting, construction implementation, and startup schedule. Since a decision by the City has not been made to proceed with fluoridation implementation, the proposed potential implementation schedule has an example start date 2024 to show the progression of the project and dates are only shown as an example. Future budgetary costs following the sub phases and preliminary proposed construction phasing schedule shown in **Figure 5-1** are presented in **Section 5.2, Table 5-5.**

The City is also currently assessing onsite sodium hypochlorite generation systems for its water system disinfection. If timing and funding align, the City may combine construction of the proposed fluoridation facilities with the onsite generation facilities to reduce costs and interruption of operations.

5.1.2 Permitting and Regulation Assumptions

The following is a broad overview of the regulations, application procedures, and permit requirements for the seven fluoridation facility sites.

5.1.2.1 Regulations

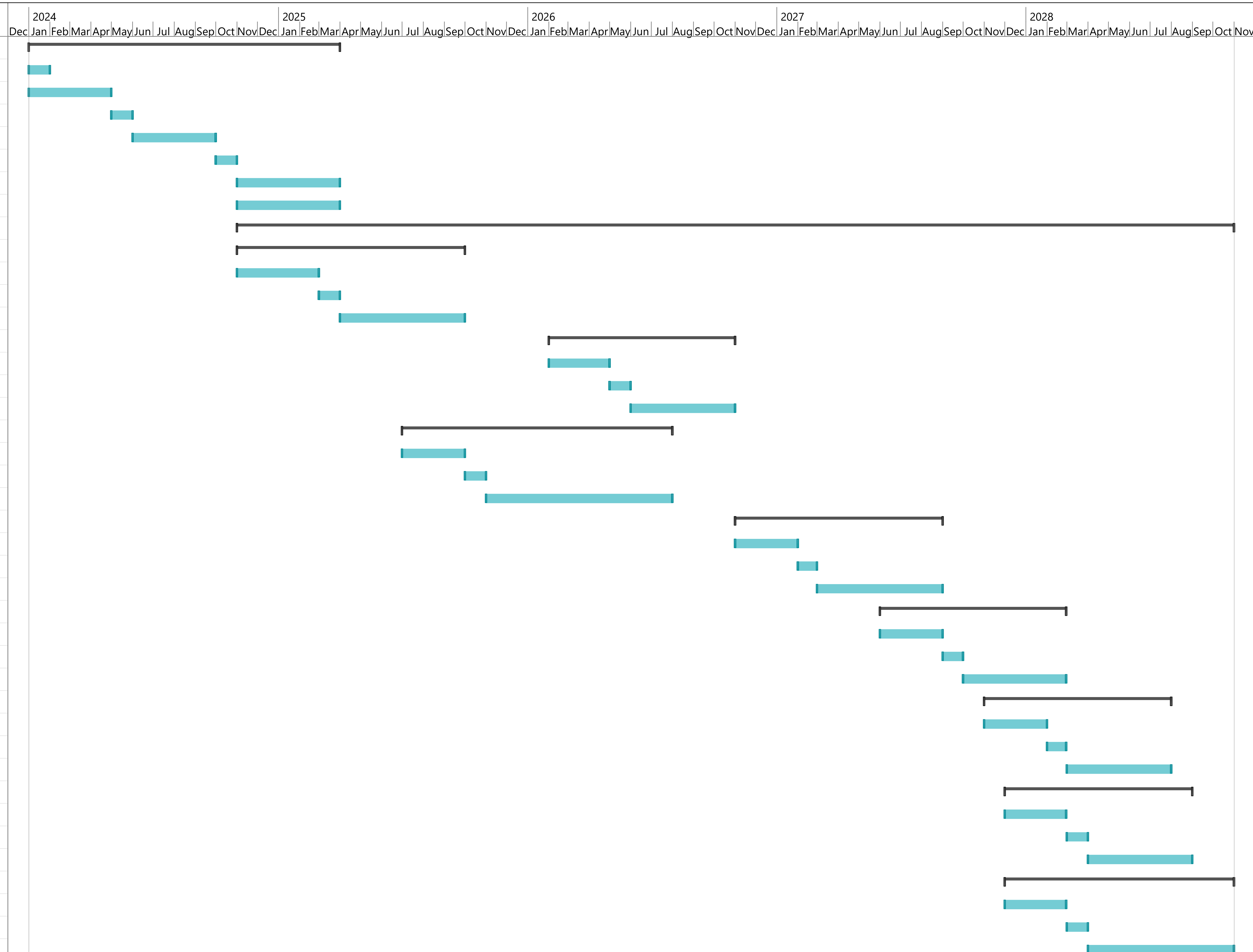
Engrossed Substitute House Bill 1251, an act relating to water systems' notice to customers of public health considerations, is a piece of legislation that was passed in the Washington State Legislature on February 9, 2023. The bill relates to the fluoridation of municipal water supplies in the state of Washington and will add a new section to chapter 70A.125 of the RCW. Specifically, the bill requires that a public water system that is considering commencing or discontinuing fluoridation of its water supply shall notify its customers and the department of its intentions at least 90 days prior to a vote or decision on the issue. This notification can be made by any method that effectively notifies its customers i.e., radio, television, newspaper, mail, or electronically. Any public water system that violates the notification requirements shall return the fluoridation of its water supply to its previous level until the required notification has been provided.

A comprehensive review of local, state, and national regulatory and planning requirements for fluoridated water systems was conducted and summarized in the *Fluoride Regulatory and Planning Review Technical Memorandum,* **Appendix I**. More information and resources regarding the Engrossed House Bill are located in **Appendix I**.

Figure 5-1 Example Fluoridation Implementation Schedule

City of Spokane
Fluoridation Implementation Study

ID	Task Mode	Task Name
1		**Final Design- All Well Facilities**
2		Pre-Application Meetings
3		60% Design Submittal
4		City Review
5		90% Design Submittal
6		City Review
7		Permitting
8		DOH Project Report Review
9		**Contract Documents & Construction Phasing**
10		**Well Electric**
11		100% Bid Submittal
12		Bid
13		Construction
14		**Parkwater**
15		100% Submittal
16		Bid
17		Construction
18		**Central**
19		100% Submittal
20		Bid
21		Construction
22		**Grace & Nevada**
23		100% Submittal
24		Bid
25		Construction
26		**Ray**
27		100% Submittal
28		Bid
29		Construction
30		**Havana**
31		100% Submittal
32		Bid
33		Construction
34		**Hoffman**
35		100% Submittal
36		Bid
37		Construction
38		**Fluoridation Equipment- All Facilities**
39		100% Submittal
40		Bid
41		Construction



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5.1.2.2 Permitting

The initial permitting information that Consor and Parametrix have compiled is provided in **Table 5-1.** Each well station facility will have a distinct set of requirements for the implementation of fluoridation and building improvements depending on its location.

A non-project State Environmental Policy Act (SEPA) checklist was completed for this Fluoridation Implementation Study and is anticipated to be published May 22, 2023, and included in **Appendix D** *(Draft SEPA Checklist and Comments)*. Along with the publication of the non-project SEPA checklist, the City issued a DNS SEPA threshold determination. This determination reflects the purpose of this study which is to solely understand costs. A study to understand costs does not in itself have an impact on the environment. The public will have 14 days to review and comment on the checklist and SEPA determination. All comments received will be included in **Appendix D** of the final Fluoridation Implementation Study report to provide decision makers with all information collected during the study process. If the City chooses to move forward with fluoridation, a project level SEPA would be completed, and a determination based on project level details would be made and circulated for public comment.

The permitting process would start during final design, IF the city choses to move forward, and would include scheduling a pre-application meeting with the City's Development Services Center prior to beginning the application process for each site to confirm the required permits and permit application process. Depending on the time frame anticipated to obtain each permit, the pre-application meeting may need to be scheduled several months prior to the final design completion for each respective site. Once it is determined which permits are needed, the time frame to obtain each permit would be reflected in the project schedule along with any predecessors (often one permit can be a predecessor for other permits). This would allow the project team to determine the critical path. The project schedule would allow adequate time for permits to be obtained and permit requirements to be incorporated into the Plans, Specifications, and Estimate (PS&E).

General Permit Process

The general permit process includes the following:

- Submit the applications: An application will need to be submitted to the appropriate agency for each permit for each site. The applications would typically include detailed plans and specifications for the proposed design and upgrades. It's anticipated that a project-level SEPA checklist will be required for each site as part of the permit application process.

- Review and approval: The agency responsible for reviewing the application would typically conduct a thorough review to ensure that the proposed design meets all applicable local and state regulations. This may involve a review of the plans and specifications, as well as a site visit to the project location.

- Permit issuance: If the application is approved, the agency would issue the necessary permits and approvals.

- Construction: Once the necessary permits have been obtained, construction can begin. It is important to ensure that all work is done in compliance with the approved plans and specifications, permit conditions, and any applicable local and state regulations.

- Inspection and final approval: After construction is complete, the agency responsible for issuing the permits would typically conduct a final inspection to ensure the project meets all applicable regulations and permit conditions.

Due to its proximity to the Spokane River and Felts Field Airport, the Well Electric Well Station Facility will require a Shoreline Substantial Development Permit and also be subject to Federal Aviation Administration (FAA) requirements for building heights. In addition, five well station facilities are eligible for inclusion in the National Register of Historic Places and would require further review under Section 106 of the National Historic Preservation Act (NHPA) for a final determination.

It is important to note that the specific requirements for the permitting process will vary depending on the well station facility location and the type of upgrades being made. It will be important to work closely with the City's Development Services Center throughout the process to ensure that all necessary permits and approvals are obtained and that the upgrades are completed in compliance with all applicable regulations.

Table 5-1 | Permitting Requirement Summary by Well Station Facility

City Well Station Facility	Required Permits	Zoning, Land Use
Well Electric	Shoreline Permit Confirm height requirements with FAA Existing site partially within FEMA 100-year flood zone SEPA review Historic/architectural review Building Permit (mechanical and energy code requirements) Electrical Permit	LI, LI
Parkwater	SEPA Review Historic/architectural review Building Permit (mechanical and energy code requirements) Electrical Permit	LI, LI
Ray	Conditional Use (Residential Zone) SEPA review Historic/architectural review Building Permit (mechanical and energy code requirements) Electrical Permit	RTF, R 10-20
Central	Conditional Use (Residential Zone) SEPA review Building Permit (mechanical and energy code requirements) Electrical Permit	RSF, R 4-10
Grace	No special permitting requirements SEPA review Historic/architectural review Building Permit (mechanical and energy code requirements) Electrical Permit	CC1-EC, CC Core
Nevada	No special permitting requirements SEPA review Building Permit (mechanical and energy code requirements) Electrical Permit	CC1-EC, CC Core
Hoffman	Conditional Use (Residential Zone) SEPA review Historic/architectural review Building Permit (mechanical and energy code requirements) Electrical Permit	RSF, R 4-10
Havana	Permitting within City of Spokane Valley Conditional Use (Residential Zone) SEPA review Building Permit (mechanical and energy code requirements) Electrical Permit	MFR, MFR (City of Spokane Valley)

Notes:
LI – Light Industrial
RTF - Residential Two-family
RSF - Residential Single-family
CC - Center and Corridor
MFR - Multifamily Residential

Further, the City will need to submit a project engineering report (Project Report) outlined in WAC-246-290-110, meeting the treatment design requirement under WAC 246-290-250 to DOH. The *DOH General Report Checklist* is included in **Appendix A** for reference.

5.1.3 Startup and Testing Assumptions

The final step in the fluoridation implementation is the final inspection and startup of the fluoridation facilities. The major elements that would need to be inspected to confirm installation per the design are as follows:

- Site improvements (access and landscaping).
- Structure (meeting building code special inspection, containment areas, and ancillary building elements, such as electrical).
- Safety and heating, ventilation, and air conditioning (HVAC) including safety showers, eyewashes, and ventilation equipment.
- Process equipment (storage and day tanks, metering pumps, and instruments).
- Instrumentation and controls (Integration of the process control instruments, such as fluoride analyzer, flow meters, and pressure gauges).

The Manual of Water Supply Practices, M4, Water Fluoridation Principles & Practices Sixth Edition, AWWA outlines the following major system component categories that are typically tested:

- Pressure testing of pipes and tanks: All pipes and tanks are filled with the appropriate fluid and pressurized for a duration specified in the contract documents. Clean water is typically used for functionality testing.
- Containment area leak test: The containment area or structure within which the fluoridation equipment is located is leak tested.
- Chemical feed equipment: Metering pumps are calibrated, and a calibration curve is developed for each metering pump.
- Other equipment: Valves, HVAC equipment, and other ancillary equipment (e.g., sump pumps) are tested to ensure that they operate properly and reliably. Instrumentation and process control equipment is tested and calibrated.
- Safety systems: Emergency showers and eyewashes are tested to ensure the necessary flow rate is delivered. The fire protection system, if required, is tested for functionality and capacity.
- Electrical equipment: Electrical conductors, equipment, protective devices, grounding, and other components are tested as specified in the contract documents. Motors are jogged to verify the direction of rotation.
- Instrumentation and controls: An operational readiness test and a functional acceptance test are performed to ensure that the control of the fluoridation system by supervisory control and data acquisition (SCADA) has been properly programmed.

Other considerations during startup are to maintain proper records of calibration and testing. Calibrate devices used for testing and have required chemical reagents needed. Start fluoride target feed at a low dose to allow for fine tuning without overdosing as the fluoridation facilities are brought online.

5.2 Capital, O&M, and Lifecycle Cost Estimates

Based on the assumed steps and processes discussed above, capital costs were developed for each well station facility to a Class 3 Estimate Level, as defined by AACE International. Enough preliminary engineering design work was completed to determine the Opinion of Probable Construction Cost (OPCC). The OPCC can be classified with accuracy ranges of -20 percent on the low side and +30 percent on the high side. According to AACE International, Class 3 estimates are useful for budgetary costs such as developed via the preliminary design detailed in this Study. A preliminary life cycle cost analysis (LCCA), based on a 50-year life cycle, was also developed. It was based on the preliminary design and long-term system operational and maintenance requirements detailed in **Section 4.** All costs are in January 2023 US Dollars based on information available at the time the costs were developed, except where otherwise noted.

Final costs will depend on the following.

- actual field conditions
- actual material and labor costs
- market conditions for construction
- regulatory factors
- final project scope
- method of implementation
- schedule

Detailed workups of the costs are included in the *Fluoridation Cost Calculations,* **Appendix J.** The capital OPCC unit costs were based on the Consor North America, Inc. (Consor) estimating database.

The Consor estimating database is stored within HCSS Heavybid© Software. The estimating database was developed from data across multiple industries and disciplines. The database includes but is not limited to the costs from projects related to heavy civil, buildings, roads, railways, bridges, airports, dams, sewer systems, trenchless projects, tunnels, demolition, drilling and blasting operations, water systems, wastewater treatment facilities, landfills, concrete structures, under water construction projects, water filtration systems, dewatering systems, aquifer storage and recovery well construction, electrical generation facilities, electrical distribution systems, environmental protection projects, storm water management projects, and emergency response projects.

The Consor database includes complete integration with RSMeans, most of the United States Department of Transportation (DOT) unit cost databases, and other national and regional costs data sources. The actual bid tab results from DOT websites are also integrated into the Heavybid system for easy comparison. These databases together with the data from current and past projects allow Consor to provide the most current cost available. Because of uncertainty with supply chains and market conditions Consor does not recommend or use average unit costs, or unit cost averages that are older than 3 years.

Database inputs include labor, equipment, materials, subcontractor quotes, specialty equipment, and local contractor quotes as required. This input is updated on a quarterly basis or as required by project specific requirements. The inputs are organized by state and region within each state. This provides the most current and accurate cost data for a project within a specific region. For this OPCC, the Consor data is measured against the Washington DOT information, the Spokane Washington RS Means information, and supplemented with current specialty equipment cost, or other regional data.

5.2.1 Capital Facility Costs

The OPCC costs presented in **Table 5-2** are based on the following additional assumptions.

- Equipment costs were based on planning-level estimates from manufacturer vendors.
- Site improvements were based on Consor's database of capital cost information. Lower site improvements costs were used for sites with industrial or commercial zoning such as Parkwater or the Grace/Nevada site.
- Building costs were based on Consor's database of capital cost information.
    - Larger building costs were used for sites located in residential zones where the architectural style would need to match the existing well station facility.
    - Unit building costs include HVAC and safety equipment.
    - HVAC and gas venting/scrubbing costs were estimated at $10 per building square foot based on Consor's database of capital cost information.
- Due to available space constraints, it was assumed that the existing control building located at the Central Well Station Facility would be demolished to the foundation and replaced with a new facility housing existing well controls, existing chlorination equipment, and the proposed fluoridation system.
- Land or right-of-way acquisition is not expected to be required.
- Fluoride injection or water service yard piping were included for sites where the building is not located next to the well station facility per the preliminary design.
- A 30 percent contingency was applied to the capital costs.

Table 5-2 | 2023 Class 3 Facility Capital Costs (OPCC)

Well Station Facility	Capital Cost
Well Electric	$1,548,000
Parkwater	$ 1,759,000
Ray	$ 1,501,000
Central	$ 1,545,000
Grace/Nevada	$ 1,519,000
Hoffman	$ 1,434,000
Havana	$ 1,695,000
TOTAL	**$11,001,000**

Section 5.1.1 describes the sub-phasing and presents a preliminary construction phasing schedule for all fluoridation systems. **Table 5-3** | Preliminary Capital Expenditure Schedule (Future Dollars) shows future costs for each well station facility and sub phase based on the approach described in **Section 5.1.1.** These costs include Spokane sales tax (nine percent) and contingency.

Table 5-3 | Preliminary Capital Expenditure Schedule (Future Dollars)

Well Station Facility	Building Costs				Equipment Costs
Year	2025	2026	2027	2028	2028
Well Electric	$810,000				$1,068,000
Parkwater		$747,000			$1,465,000
Ray			$1,074,000		$831,000
Central Ave	$1,089,000				$736,000
Grace/Nevada			$653,000		$1,296,000
Hoffman				$1,242,000	$635,000
Havana				$1,014,000	$1,205,000
All Facilities	**$1,899,00**	**$747,000**	**$1,727,000**	**$2,256,000**	**$7,236,000**

Note: These costs are in future dollars, by column label year; therefore they will not sum up to the capital costs noted elsewhere in this Section.

5.2.2 Operations and Maintenance Costs

Operations and maintenance (O&M) costs were developed based on the following assumptions, see **Table 5-4** for a summary of the anticipated O&M costs for the first three years of operation.

- Total annual equipment maintenance and repair costs were assumed to be one percent of the total capital cost, per Section E.4 of the *Work Breakdown Structure-Based Cost Model for Biological Drinking Water Treatment*. These costs do not include long-term equipment replacement but do include a 30% contingency unless otherwise noted.
- Chemical cost budgetary quotes were obtained for two different chemical grade types (low grade 2023 quote: $0.39/pound, high grade 2023 quote: $0.50/pound). The highest cost was used for the LCCA. The chemical demand estimate for each well station facility was based on average production in 2021 for the portion of the year a well station facility is typically operated (e.g., the smaller well station facilities are typically not used in the winter). Chemical costs include Spokane sales tax (nine percent) and a 30% contingency, unless otherwise noted.
- Labor costs were based on the Full-Time Equivalent (FTE) assumptions noted in Section 4 and 2023 labor costs provided by the City and include a 30 percent contingency, unless otherwise noted.
- Power costs were based on $0.10 per kWh for the sum of anticipated energy usage of all equipment at each well station, and include a 30 percent contingency, unless otherwise noted.
- Operating and maintenance costs were escalated to 2028 dollars based on the projected inflation rates in **Table 5-5** | Assumed LCCA Inflation Rate Projections**.**

Table 5-4 | Three-Year Operations and Maintenance Costs, 2028-2030 Dollars

Well Station Facility	No. Operating Months/Yr		Year 1[1]	Year 2[1]	Year 3
Well Electric	12	Equipment Operation	$135,800	$136,100	$136,100
		Equipment Maintenance	$46,100	$46,200	$46,200
		Power	$2,200	$2,300	$2,500
		Chemical[2]	$278,400	$292,300	$306,900
Parkwater	12	Equipment Operation	$135,800	$136,100	$136,100
		Equipment Maintenance	$49,100	$49,200	$49,200
		Power	$2,800	$2,900	$3,100
		Chemical	$350,200	$367,700	$386,100
Ray	8	Equipment Operation	$103,600	$103,800	$103,800
		Equipment Maintenance	$45,300	$45,400	$45,400
		Power	$1,500	$1,600	$1,700
		Chemical	$100,100	$105,100	$110,300
Central	8	Equipment Operation	$103,600	$103,800	$103,800
		Equipment Maintenance	$46,100	$46,200	$46,200
		Power	$1,500	$1,600	$1,700
		Chemical	$88,000	$92,400	$97,000
Grace/Nevada	8	Equipment Operation	$103,600	$103,800	$103,800
		Equipment Maintenance	$45,700	$45,800	$45,800
		Power	$1,500	$1,600	$1,700
		Chemical	$197,600	$207,500	$217,900
Hoffman	8	Equipment Operation	$103,600	$103,800	$103,800
		Equipment Maintenance	$44,500	$44,600	$44,600
		Power	$1,300	$1,400	$1,500
		Chemical	$46,600	$48,900	$51,300
Havana	12	Equipment Operation	$135,800	$136,100	$136,100
		Equipment Maintenance	$48,100	$48,200	$48,200
		Power	$2,600	$2,700	$2,900
		Chemical	$120,900	$127,000	$133,300
All Facilities: High Range with 30% Contingency		*TOTAL*	**$2,341,900**	**$2,404,100**	**$2,467,000**
All Facilities: Low Range, No Contingency		*TOTAL*	**$1,801,500[3]**	**$1,849,300**	**$1,897,700**

Notes:

1. Costs do not include long-term equipment replacement. Labor costs were increased by 10% and 5% for the first and second years of operations, respectively, as staff become acquainted equipment operation and maintenance tasks.
2. Chemical costs include Spokane sales tax (9%).
3. Based on low-range year 1 calculations in **Table 5-7.**

5.2.3 Life Cycle Cost Analysis

The LCCA is presented in **Table 5-6** and is based on incorporating the previously developed capital and O&M costs along with the following assumptions and inflation projections.

- A 50-year life cycle.

- 10 percent of capital site improvements costs was included in the LCCA for every 20 years to allow for updates or retrofits to each site.
- The LCCA includes estimated energy costs.
- Electrical and controls equipment were assumed to require replacement every 10 years. All other equipment were assumed to require replacement every 20 years.
- The 50-year discount rate was assumed to be equal to the variable inflation rates described below.
- A 30 percent contingency was applied to the LCCA costs.
- Spokane sales tax (nine percent) was applied to chemical and equipment replacement costs. A 30% contingency was applied to all costs.

Inflation was projected at a variable rate for the next 50 years based on current and anticipated future market conditions, as shown in **Table 5-5.**

Table 5-5 | Assumed LCCA Inflation Rate Projections

Year Range	Assumed LCCA Inflation Projection
2023-2024	12.0%
2024-2025	8.0%
2025-2050	5.0%
2050-2080	3.0%

The 50-year costs shown in **Table 5-6** represent the combined capital, operations, maintenance, and equipment replacement costs summed up over 50 years, but in 2023 dollars. The 50-year LCCA helps create an overall picture of how long-term facility costs compare to up-front capital costs. Non-capital costs are spread out over the 50-year period in the “Average 50-Yr Annual Operating” column, which represents an average yearly cost of operating and maintaining each facility. This value could be used for budgeting, though it should be escalated using the inflation rates in **Table 5-5** to obtain future dollars for each budgetary year.

Table 5-6 | Class 3 LCCA, 2023 Dollars

Well Station Facility	50-Year LCCA[1]	Average 50-Yr Annual Operating[2]
Well Electric	$18,893,000	$347,000
Parkwater	$22,111,000	$407,000
Ray	$11,121,000	$193,000
Central	$10,465,000	$179,000
Grace/Nevada	$14,896,000	$268,000
Hoffman	$8,987,000	$152,000
Havana	$13,314,000	$233,000
Total	$99,787,000	$1,779,000

Notes:

1. Includes capital costs.
2. Does not include capital costs.

5.2.4 Implementation Cost Summary

An implementation cost summary, which includes initial capital and a range of anticipated yearly operating and maintenance costs for the first year of operation is presented in **Table 5-7**. Capital costs are shown in 2023 dollars, but operations and maintenance costs have been escalated to 2028 dollars and include a year-one labor ramp-up factor of 10%. First year operations and maintenance costs are also shown with and without a 30% contingency to capture the uncertainty of the long-term costs.

Table 5-7 | Cost Summary

Well Station Facility	2023 Capital Cost	Year 1 Cost to Operate: High Range[1] (2028 Dollars)[2,4]	Year 1 Cost to Operate: Low Range[3] (2028 Dollars)[2,4]	Year 1 Cost to Maintain: High Range[1] (2028 Dollars)[4]	Year 1 Cost to Maintain: Low Range[3] (2028 Dollars)[4]
Well Electric	$1,548,000	$416,400	$320,400	$46,100	$35,500
Parkwater	$1,759,000	$488,800	$376,100	$49,100	$37,800
Ray	$1,501,000	$205,200	$157,900	$45,300	$34,800
Central	$1,545,000	$193,100	$148,600	$46,100	$35,500
Grace/Nevada	$1,519,000	$302,700	$232,900	$45,700	$35,200
Hoffman	$1,434,000	$151,500	$116,500	$44,500	$34,200
Havana	$1,695,000	$259,300	$199,500	$48,100	$37,000
All Facilities	*$ 11,001,000*	*$2,017,000*	*$1,551,900*	*$324,900*	*$250,000*

Notes:

1. High range costs include a 30% contingency.
2. Includes power, chemical costs, and tax.
3. Low range costs exclude the 30% contingency.
4. Includes year 1 ramp-up on labor costs.

APPENDIX A
DOH GENERAL REPORT CHECKLIST

Appendix A.3.1 General Project Report Checklist

Include the following information in the project report, as applicable to the project and water system's planning status. See Chapter 2, including the project development flowcharts therein, and WAC 246-290-110 and -120 for further design guidance and requirements.

- ☑ The signed and dated stamp of a Washington state-licensed professional engineer. Federal facilities can have a PE from any state, but still must have a PE stamp.
- ☑ Narrative discussion that establishes the need for the project. It should include a construction schedule for the recommended alternative, project cost, and method of financing. Also, indicate the relationship of the project to the currently approved water system plan or one in the process of being prepared or updated.
- ☑ Alternatives analysis and rationale for selecting the proposed project. It should include an evaluation of life cycle costs, including initial capital costs and on-going operations and maintenance costs.
- ☑ Appropriate planning elements: Cite appropriate reference in an approved water system plan, prepare an amended water system plan, or include as part of the project report.
- N/A Capacity analysis if seeking a change in the number of approved service connections. Include rationale and calculations to justify total number of service connections and equivalent residential units (ERUs). The analysis should identify the number of residential, industrial, commercial, and municipal connections the water system now serves. If the water system seeks to increase its approved number of connections through construction of new facilities, document water system plan approval status.
- N/A *Water Right Self-Assessment Form* must be completed for new sources and all projects that increase the approved number of connections.
- N/A Hydraulic analysis that demonstrates the ability of the project to supply minimum pressure requirements during peak flows and fire events. The analysis should include a narrative discussion that describes the hydraulic analysis method, explains critical assumptions, and summarizes the effect of the proposed expansion on the existing water system.
- ☑ Measures to protect against vandalism.
- N/A Disinfection procedures according to AWWA or APWA/WSDOT standards and a narrative discussion on how the project will be disinfected and tested prior to use.
- ☑ Provisions to discharge water to waste including description of how wastewater is disposed, and documentation that procedures are acceptable to the Department of Ecology and local authorities.
- ☑ Routine and preventive operations and maintenance tasks and their frequency, and the role of a certified operator in completing them.

APPENDIX B
PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION: WELL FACILITY CONDITION ASSESSMENT

consor

murraysmith

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CITY OF SPOKANE

THE CITY OF SPOKANE

Preliminary Engineering Study for Fluoridation: Well Facility Condition Assessment

September 2022

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Preliminary Engineering Study for Fluoridation Well Facility Condition Assessment

City of Spokane

September 2022

The Report or Report Section(s) listed below were prepared under the direction of (a) Registered Professional Engineer(s).

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CERTIFICATION

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.

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Introduction

The City of Spokane's (City's) priority is continuing to deliver safe, high-quality drinking water to its residents with efficient operations, while keeping rates affordable for the community. To inform future decisions, the City is completing a feasibility study to better understand the costs and implementation steps associated with providing fluoridated water to the community. The study is fully paid for by grant funds and builds off previous feasibility studies conducted in 2004 and an update in 2016 which were high-level reviews of the permitting requirements, long-term operational/maintenance requirements, and capital improvements needed to fluoridate the water system. This report is a condition assessment of the City's well stations which is intended to establish a foundation for the upcoming fluoridation alternatives analysis and preliminary design.

The City owns eight well station facilities that provide water supply for the entire water system. This condition assessment includes information on each facility's site, facilities, equipment, and electrical and controls infrastructure as they are related to supporting a fluoridation system. The purpose of the assessment is to document the existing infrastructure at each facility in preparation for defining required retrofits for implementing fluoridation.

A summary of the condition assessment report by site is shown in Table I-1.

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Table I-1 | Condition Assessment Summary Matrix

Assessment Category	Well Electric	Parkwater	Ray	Central Ave	Grace	Nevada	Hoffman	Havana
Access: Adequate for Chemical Delivery?	Yes, via Waterworks St. No through access for large vehicles. Turnarounds needed for large vehicles.	Yes, via E Rutter Ave. There is adequate turnaround at the nearby end of Rutter Ave.	Passes through Residential Zones.	Passes through Residential Zones for one block. Pull through driveway provides turnaround for smaller delivery vehicles.	Yes, via North Foothills Drive. Delivery vehicle turnaround is needed since only one driveway off North Foothills Drive.	Yes, via the Water Department yard. Vehicle turnaround is provided within the Water Department yard.	Passes through Residential Zones. No through access for large vehicles. A turnaround is needed for delivery vehicles.	Passes through Residential Zones. Two site entrances provide turnarounds for large delivery vehicles.
Security	Site perimeter fencing exists up to Spokane Riverbank. Consider security cameras.	Site perimeter fencing exists except along Rutter Avenue. North fence line is Felts Field perimeter security fencing. Consider security cameras.	Consider fence upgrades. The electrical switch gear yard is fenced. Site perimeter fencing is only 3 ft. tall.	No site perimeter fencing. Electrical switchgear yard is fenced. Consider fence upgrades and security cameras.	Only the back (southside) of the well station and electrical switch gear yard contain fencing. Consider fence upgrades and security cameras.	Water Department yard fencing provides security. Unknown if Water Department yard contains security cameras.	Only the back (northside) of the well station and electrical switch gear yard contain fencing. Consider fence upgrades and security cameras.	Site perimeter fencing contains privacy slats. Electrical switchgear yard has separate fencing within site perimeter fencing. Consider security cameras.
Space in Existing Facility for Fluoridation System?	Potentially: Loading area adjacent to Cl room, tool room adjacent to well building, or existing Sodium Hypochlorite storage area.	No	No, unless future pump site can be used.	No	No	No	No	With some changes to design
Space onsite for new building?	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Building Code Notes	Investigate soil conditions. Large penetrations may trigger lateral retrofit of building. Ensure proposed work does not affect load capacity of building.	N/A; no space inside building.	Investigate concrete beams under slab.	N/A; no space inside building.	N/A; no space inside building.	N/A; no space inside building.	N/A; no space inside building.	N/A; building not constructed
Adequate Power for Proposed System?	Potentially; further evaluation required later in design. Onsite power available at this site.	Potentially; further evaluation required later in design.	Lighting panel is full. Main panelboard has capacity.	Potentially; further evaluation required later in design.	Most likely no; additional capacity required.	Potentially; further evaluation required later in design.	Potentially; further evaluation required later in design.	Not evaluated
Emergency Backup Power?	Yes, but cannot be used for new electrical loads.	No	No	No	No	No	No	Yes
PLC Capacity and Expansion	Existing spare I/O cannot accommodate, but spare slots may.	Existing spare I/O cannot accommodate, but spare slots may.	No capacity available. Additional PLC likely required.	No capacity available. Additional PLC likely required.	Existing spare I/O cannot accommodate, but spare slots may.	Existing spare I/O cannot accommodate, but spare slots may.	No capacity available. Additional PLC likely required.	Not evaluated
Station Service Voltage	120/240	120/208	120/208	120/240	120/208	120/208	120/208	120/240

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Site Overview

Each of the City's well facilities have unique sites with varying building size and layout due to them being constructed over at different eras with different water production requirements. Zoning, security, and access vary between well stations. Details are provided in the Existing Facilities section

Mechanical Overview

Most of the City's wells are caisson-style with one or more vertical turbine pumps in each well (see Existing Facilities section for details and exceptions). The City currently utilizes gaseous chlorine for treatment, which is stored in 150-pound bottles (though the Parkwater Well Station uses a 1-ton cylinder) and injected as a chlorine solution at the bottom of each pump. Flow metering typically occurs via magnetic flow meter in an underground vault downstream of each well.

The City's pressure zones are divided into three major groups named by the lowest parent zone connected to the City's wells: the "Low System," the "Intermediate System," and the "North Hill System". The Existing Facilities section documents which system is served by each well.

Structural Overview

Most of the City's well stations were constructed between 1895 and 1960, though the Central Avenue facilities were upgraded between 2016 and 2019 and the future Havana station was under construction during the time of this assessment. The primary construction types for the well station buildings include unreinforced brick masonry (URM), concrete masonry unit (CMU), and concrete. Most of the sites did not appear to have enough space for a fluoridation system inside the buildings, so it is likely that new enclosures will be constructed on each site for the retrofit. The Well Electric and Ray Well Stations appeared to have potential to fit a new fluoridation system within the existing buildings on site; however, further investigation is still required at those sites to verify the existing infrastructure can accommodate the proposed fluoridation systems.

Electrical, Instrumentation & Controls, and Telemetry Overview

A new fluoride system would require additional Input/Output (I/O) channels to monitor the system and communicate with the control center, similar to the existing equipment. The I/O quantity will be dependent on the number of well pumps at a site. It is anticipated that fluoride I/O requirements will be similar to the requirements for the chlorination system at each site, and will include pump run status, chemical weight and/or volume, chemical concentration in the header to each pressure zone, and alarms related to equipment failure or chemical spills or leakage. Ability to control the system remotely (in addition to monitoring) would result in additional requirements.

Preliminary estimated I/O requirements are listed in Table I-2.

Table I-2 | I/O Quantity Estimate

Fluoridation System I/O	Digital Inputs	Digital Outputs	Analog Inputs
Dosing pump run		1 per pump	
Dosing pump running	1 per pump		
Dosing pump fail/trouble	1 per pump		
Fluoride Tank A level/weight	2 per site		1 per site
Fluoride Tank B level/weight	2 per site		1 per site
Fluoride concentration at header			1 per pressure zone
Fluoride system leak		2 per site	1 per site
Other controls		2 per site	

Based on the projected additional I/O requirements of a fluoridation system, most of the existing Programmable Logic Controllers (PLCs) do not have enough additional I/O spares and would require modification to support additional equipment.

A site summary spreadsheet comparing the amount of spare I/O at each site with the anticipated amount of I/O for a fluoridation system at each site is attached in **Appendix A.**

With the exception of Nevada Well's PLC which is hardwired to Grace Well Station's PLC, and the Remote Terminal Units (RTUs) at Well Electric Well Station, All RTU sites communicate to the Master Terminal Unit (MTU) at Well Electric Well Station through 900 megahertz (MHz) ethernet radios manufactured by Microwave Data Systems Inc. (a GE company).

Section 1

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Section 1

Well Electric Well Station

The Well Electric Well Station, located at the City's Upriver Dam facility, which is north of the Felts Field Airport, serves three different pressure zones from four operating pumps and two wells (Wells 4 and 5). For parts of the year, the wells experience the influence of the Spokane River, which is extremely close to the site, so the wells are operated seasonally. The Well 4 and 5 building was constructed in 1925 and the pumps are partially powered by the facility's hydroelectric generators. The City's system MTU and central control room are located at the same site.

1.1 Existing Site – Summary

1.1.1 Parcel Information and Access

The Well Electric Well Station is located southwest of the City's hydroelectric Upriver Dam (south of the Spokane River), and on the same site as the City's central control room for all water facilities and the Upriver hydroelectric facility. The facility address is 2701 N Waterworks Street, Spokane, WA 99212.

The figure in Appendix B highlights the building and well location, as well as existing yard piping. The parcel (number 35111) is zoned for Light Industrial use (LI zoning). The site is also used for City vehicle storage and equipment maintenance.

The parcel is 56.3 acres (which includes the dam and associated river area) and slopes up away from the riverbank to the south edge of the parcel. Access is intended to accommodate trucks for chemical and equipment delivery. The well station site can only be accessed from N Waterworks Street, since this street dead ends at the adjacent Spokane Police Academy training facility, which is northeast of the Well Electric Well Station site.

The main access into the Well Electric Well Station site is at the southeast side of the parcel at a gated driveway that leads to the Upriver Hydroelectric and Waterworks Project Interpretive Center office with adjacent visitor parking. The other access into the Well Electric Well Station site is at the southwest side of the parcel at a gated driveway that leads to and is adjacent to the southwest side of the "L" shaped well station building. which houses Well 4 and 5. This site access road connects to the main entrance driveway near the small parking lot at the interpretive center's office. There is an upper (i.e., in elevation) gravel roadway running through the City's planned future wellfield that connects these two site entrance roadways and provides access to the site's electrical transformers. These roads provide adequate vehicular access to the Well Electric Well Station site.

The southwest access road wraps around the east side of the Well 4 and Well 5 building addition with a tight turning radius that likely limits vehicular through access to Class 4 (14, 001 to 16,000 pound) vehicles which have two axels. Larger classes of vehicles would likely not be able to use this through access. Areas for larger classes of product delivery types of trucks is limited since there are no designated turnaround areas along this southwest access route. However, turnarounds could be completed by smaller classes of delivery trucks if City staff vehicles are moved from two parking areas adjacent to this through route. See Well Electric Well Station Site Plan in **Appendix B.**

1.1.2 Site Security

The Well Electric Well Station site is surrounded by a 6-foot-tall chain link perimeter fence that is in good condition. There is no barb wire along the top of the perimeter fence, nor are there any privacy slats within the chain link fence fabric. The perimeter fence south of the L-shaped building has a gap that is spanned by a hedge row. The perimeter fencing is parallel to and is on the northwest side of N Waterworks Street and then angles towards the Spokane River at the northeast and southwest corners of the site. There is no perimeter fencing along the Spokane River.

The main entrance at the northeast corner of the Well Electric Well Station site has an electric slide gate with an entrance card reader for gate operation. This gate typically remains open during business hours. The secondary entrance at the southwest corner of the Well Electric Well Station site has a 16-foot-wide swing gate that remains locked during all hours for site security. The Well Electric Well Station site fencing and gates provide fair security for the facility.

1.1.3 Pressure Zones Served

The City's 21 pressure zones are divided into three major groups named by the lowest parent zone connected to the City's wells: the "Low System," the "Intermediate System," and the "North Hill System". The Well Electric Well Station facility serves all three major parent zones. Detailed information on how each well pump serves the distribution system is shown in **Table 1-1.** The North Hill transmission main and one of the Low transmission branches run northwest across the Spokane River.

Table 1-1 | Well Electric Well Station Pump Transmission Summary

Pump No.	Well No.	Zone Served	Transmission Main Size
1	5	Intermediate	30-inch (see **Appendix B**)
2	5	North Hill	36-inch (same outgoing main as pump 4)
3	5	Low	36-inch, 30-inch, and 42-inch (see **Appendix B**)
4	4	North Hill	36-inch (same outgoing main as pump 2)
5	Out of service indefinitely		
6	Out of service indefinitely		

1.2 Existing Facility Summary – Structural

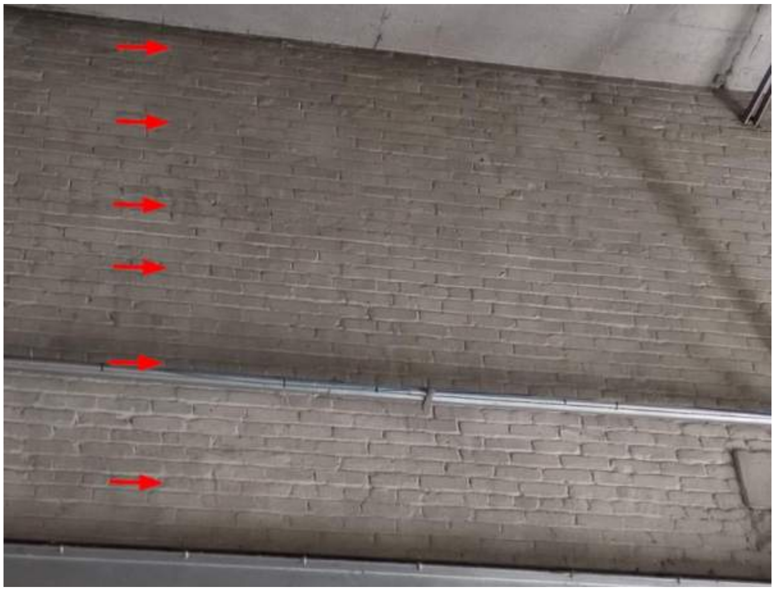
1.2.1 Description of Structures

The original building constructed at the Well Electric Well Station site was constructed in 1895 using unreinforced brick masonry. The addition to the original building that encompasses Wells 4 and 5 was constructed in 1925 using unreinforced brick masonry for the walls, but also used concrete columns to support the steel roof framing (see **Figure 1-1**).

Figure 1-1 | Well Electric Well Station – Wells 4 and 5 Building Addition

All the construction at the site appears to use unreinforced masonry. Unreinforced masonry is the use of masonry without any steel reinforcing needed to provide tension capacity in a structure. For URM, typically two courses of brick are laid side by side with a 'header' course every six to eight layers of brick, which is oriented perpendicular to the layers in-between. This 'header' course is the simplest way to visually determine if brick masonry is unreinforced (see **Figure 1-2** below). This type of construction has very low capacity for lateral loads caused by wind or earthquakes.

Figure 1-2 | Well Electric Well Station – Unreinforced Masonry 'Header' Course



The structures on-site appeared to be in fair condition. Due to the age of the building, settlement over time, and concrete shrinkage, several minor cracks have propagated throughout the facility.

Structural steel in the buildings appeared to be in fair condition, but closer inspection was difficult as it was typically high and far away for visual observation.

1.2.2 Building Code Requirements

Well Electric Well Station was one of the few sites that appears to have enough available square footage to add a fluoridation system inside the existing buildings. Multiple locations in the building were deemed as feasible, but further investigation is required structurally in those locations, mainly to determine soil conditions underneath where the system would be placed. When performing work on existing structures, a general guideline is a "do no harm" policy to make sure that work performed on an existing structure does not affect the load capacity of the building. Several of the proposed locations could impact the structure if penetrations are required in the walls. Per the International Existing Building Code (IEBC) Section 807 (assuming a Level 2 alteration), it is likely that creating large penetrations in the walls to get equipment in place could trigger a full building lateral retrofit.

1.3 Existing Mechanical Plan

Two caisson-style wells (Wells 4 and 5) are housed in the southeastern building at the Well Electric/Upriver Dam site. A summary of the 6 pumps is shown in **Table 1-2.** Magnetic Flow Meters installed on discharge mains for Pumps 1 and 3 are located inside the building. Because Pumps 2 and 4 both serve the North Hill System, flow metering is combined for these two pumps and is located in an underground vault northeast of the building after the two discharge mains meet. Flow metering is shown in the figures in **Appendix B.** The appendix also includes photos of the facility.

Table 1-2 | Well Electric Well Station Pump Summary

Pump No.	Well No.	Pump Type	Horsepower	Design Flow (gpm)	Design Head (ft)	Notes
1	5	Byron Jackson Vertical Turbine	900	7,550	415	
2	5	De Laval Split Case	900	8,330	320	
3	5	Goulds Vertical Turbine	1,000	13,500	240	
4	4	Flowserve Split Case	900	8,000	319	New pump to be installed 2022
5	4	Out of service indefinitely				
6	4					

The Well Electric Well Station Chlorine room is located northwest of the well building as shown in **Appendix B**. The gaseous chlorine is mixed with water from the distribution system and injected at each pump suction bell in the well caisson, except for Well Pump 2, where chlorine injection occurs in the pump suction line aboveground as shown in **Appendix B**.

Free chlorine residual is continuously monitored by one Hach CL17 analyzer for each pressure zone. Samples are taken from the pump discharge pipes inside the building prior to the pipes entering the pipe tunnel. The locations of the chlorine analyzers are on the upper level as shown in the building layout plan in **Appendix B.** One of the four CL17 analyzers does not appear to be operational, and the three operational analyzers monitor the Low, Intermediate, and North Hill pressure zones. Each Hach CL17 chlorine analyzer requires 1-3 gallons per minute (gpm) of continuous sample flow. The CL17 is a colorimetric analyzer which adds a small amount of reagent to the sample; thus, the sample is drained to sanitary sewer.

1.4 Existing Facility Summary – Electrical

1.4.1 Power Feed and Supply Capacity

Well Electric Well Station can generate its own power from its onsite hydroelectric generators, but power is supplemented by the local utility, Avista. A one-line diagram of the medium voltage distribution system is shown below.

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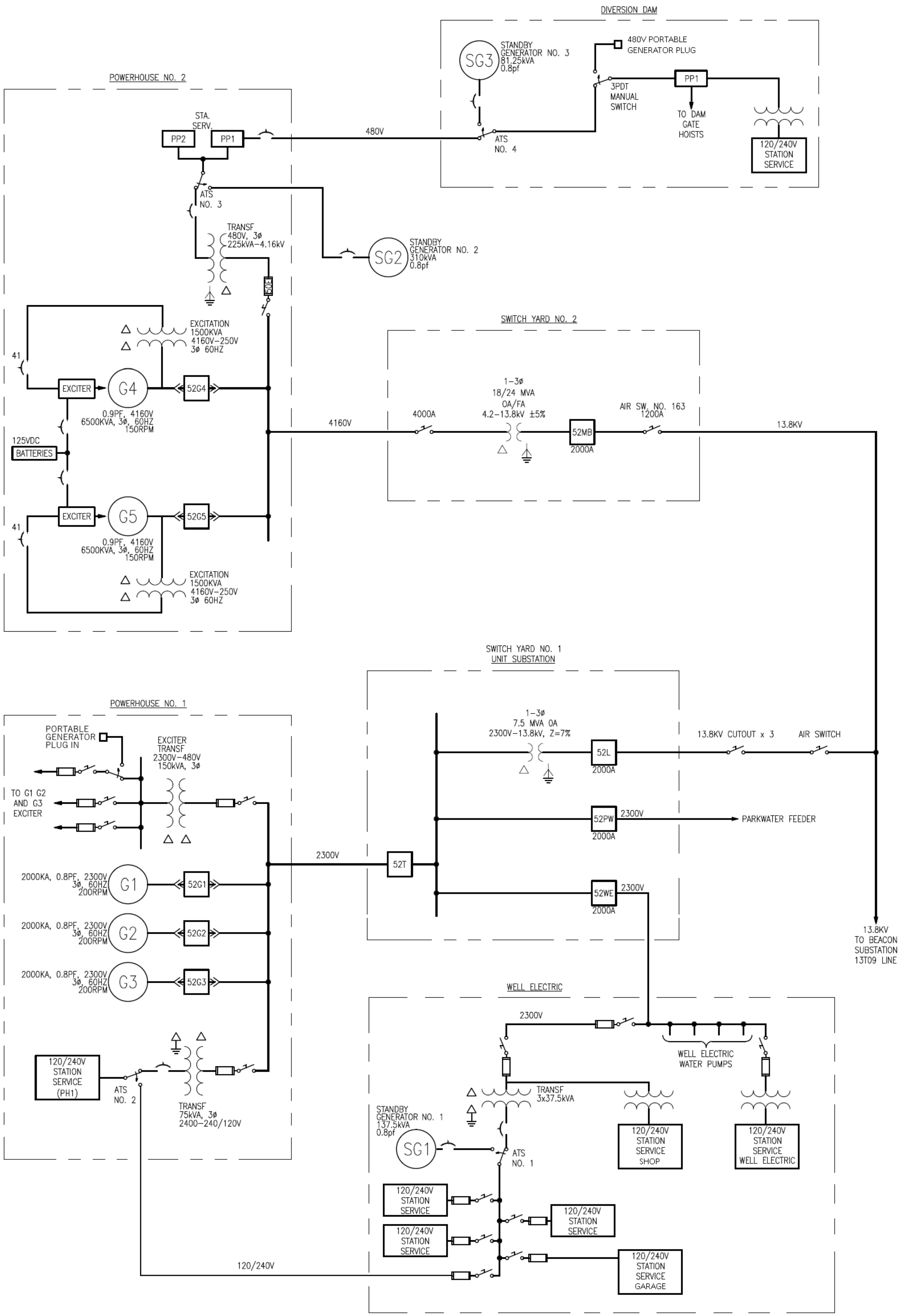
DIVERSION DAM
SG3
STANDBY GENERATOR NO. 3 81.25kVA 0.8pf
480V PORTABLE GENERATOR PLUG
3PDT MANUAL SWITCH
PP1
TO DAM GATE HOISTS
120/240V STATION SERVICE
ATS NO. 4
480V
POWERHOUSE NO. 2
STA. SERV.
PP2
PP1
ATS NO. 3
TRANSF 480V, 3ø 225kVA-4.16kV
SG2
STANDBY GENERATOR NO. 2 310kVA 0.8pf
EXCITATION 1500KVA 4160V-250V 3ø 60HZ
41
EXCITER
G4
52G4
0.9PF, 4160V 6500KVA, 3ø, 60HZ 150RPM
125VDC
BATTERIES
EXCITER
G5
52G5
0.9PF, 4160V 6500KVA, 3ø, 60HZ 150RPM
EXCITATION 1500KVA 4160V-250V 3ø 60HZ
4160V
SWITCH YARD NO. 2
4000A
1-3ø 18/24 MVA OA/FA 4.2-13.8kV ±5%
52MB
2000A
AIR SW. NO. 163 1200A
13.8KV
SWITCH YARD NO. 1 UNIT SUBSTATION
1-3ø 7.5 MVA OA 2300V-13.8kV, Z=7%
52L
2000A
13.8KV CUTOUT x 3
AIR SWITCH
52PW
2300V
2000A
PARKWATER FEEDER
52T
2300V
52WE
2300V
2000A
13.8KV TO BEACON SUBSTATION 13T09 LINE
POWERHOUSE NO. 1
PORTABLE GENERATOR PLUG IN
EXCITER TRANSF 2300V-480V 150kVA, 3ø
TO G1 G2 AND G3 EXCITER
2000KA, 0.8PF, 2300V 3ø, 60HZ 200RPM
G1
52G1
2000KA, 0.8PF, 2300V 3ø, 60HZ 200RPM
G2
52G2
2000KA, 0.8PF, 2300V 3ø, 60HZ 200RPM
G3
52G3
120/240V STATION SERVICE (PH1)
ATS NO. 2
TRANSF 75kVA, 3ø 2400-240/120V
120/240V
WELL ELECTRIC
2300V
WELL ELECTRIC WATER PUMPS
TRANSF 3x37.5kVA
STANDBY GENERATOR NO. 1 137.5kVA 0.8pf
SG1
ATS NO. 1
120/240V STATION SERVICE SHOP
120/240V STATION SERVICE WELL ELECTRIC
120/240V STATION SERVICE
120/240V STATION SERVICE
120/240V STATION SERVICE
120/240V STATION SERVICE GARAGE

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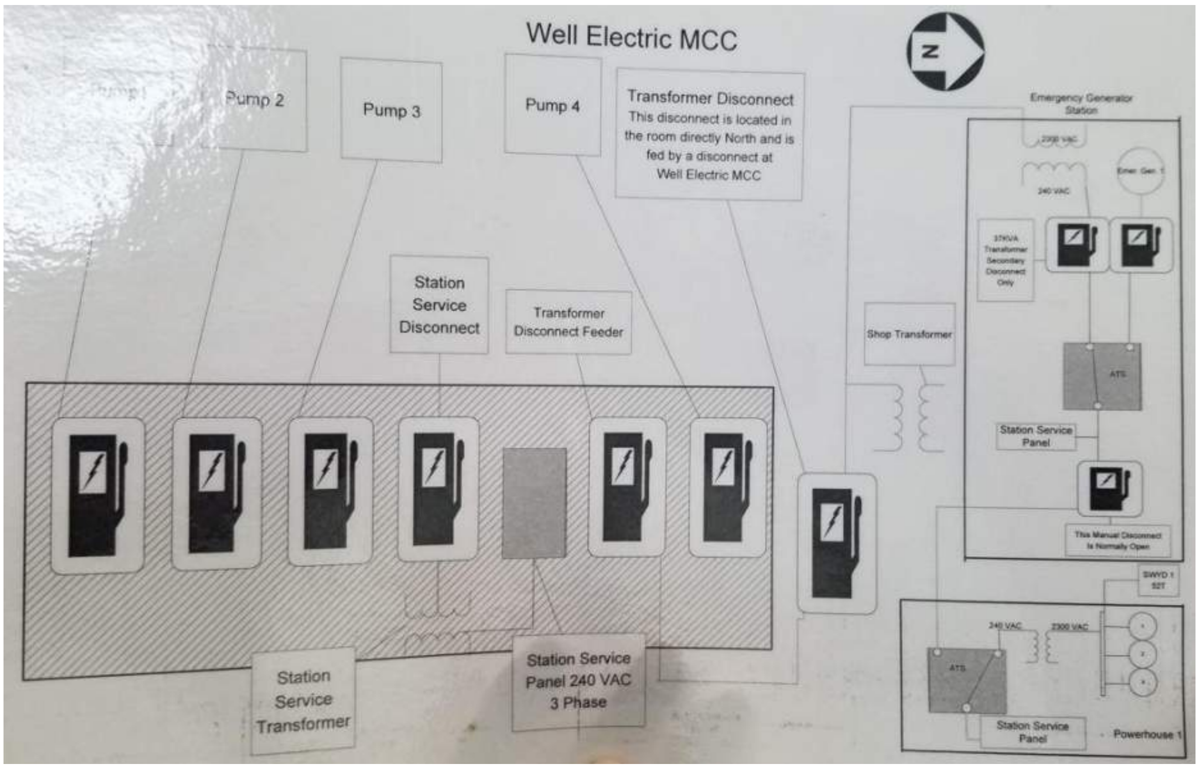
1.4.2 Motor Control Centers and Panelboards

The 2400-volt (V) Motor Control Centers (MCC) currently serves four well pumps on a 1200-amp bus. Each pump operates on a soft starter. There is an MCC section containing a station service transformer and a 225 amp, 120/240V panelboard, labeled Panel A.

A one-line diagram of the motor control center and its surrounding distribution equipment is shown in **Figure 1-4**.

Figure 1-4 | Well Electric Well Station MCC One-Line Diagram



Well Electric Well Station has eight low voltage (120/240V) panelboards:

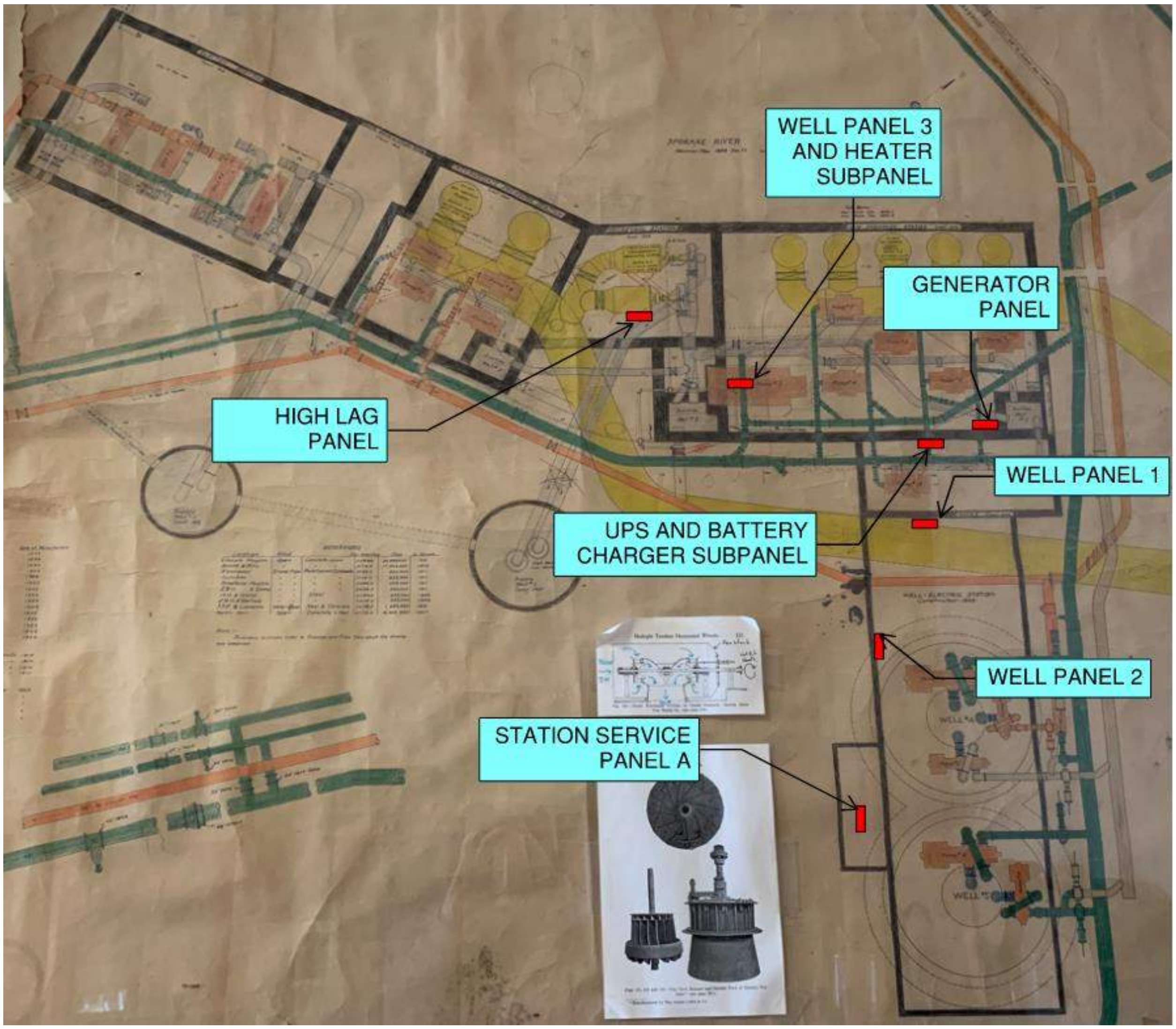
1. Panel 1 – Located in the Well 4/5 room by the door closest to the main entrance.
2. Panel 2 – Located in the Well 4/5 room at the base of the mezzanine stairs.
3. Panel 3 – Located in the garage bay adjacent to the chlorine room.
4. Heater subpanel – Located next to Panel 3.
5. UPS and Battery Charger subpanel – Located in the storage room between the Well 4/5 room and offices.
6. Generator Panel – Located near the 100-kilowatt (kW) emergency generator.

7. High Lag Panel – Located outside the offices, under the stairs leading up to the second-floor storage room.

8. Station Service Panel A – Located in the Pump MCC.

A site plan showing the locations of the eight panels is shown in **Figure 1-5**.

Figure 1-5 | Well Electric Well Station Electrical Panel Locations



Electrical capacity information for each panelboard is shown in **Table 1-3**.

Table 1-3 | Well Electric Well Station Panelboard Information

Well Electric	Main breaker?	Spare breakers available?	Space available for new breakers?	Notes
Panel 1	Unknown size, looks like 100 amp	Yes (3)	No	Spares are in subpanel.
Panel 2	100 amp	Maybe circuits 13 and 14	No	
Panel 3	Unknown size, looks like 100 amp	Maybe circuit 14	No	
Heater Subpanel	No	No	Yes (3 spaces)	
UPS and Batt. Charger Subpanel	No	No	Yes (6 spaces)	
Generator Panel	60 amp	No	No (see notes)	Panel is at capacity.
High Lag Panel	No	Yes (2)	Yes (25 spaces)	
Station Service Panel A	No	Yes	No	240V only. 120V not available.

Based on the availability of spare breakers and spaces for additional breakers, Panel 1 and the High Lag Panel are the best candidates for accommodating the fluoridation system should the new equipment require 120V or 240V loads.

Once enough information on the fluoridation equipment's location and electrical load are determined, prospective sources of power from existing panelboards may be finalized. A 30-day load measurement should be performed at any prospective panelboards to verify the panelboards can support the anticipated electrical load of the fluoridation system.

1.4.3 Emergency Backup Generators Capacity

Well Electric Well Station is the only operational well site with an emergency backup generator. The backup generator is rated at 100 kW and supplies power to a 60 amp, 120/140V panelboard which primarily powers the server room equipment and the generator's battery charger. The generator and its panel do not have the capacity to support additional loads.

1.5 Existing Facility Summary – I&C

1.5.1 Existing Hardware and Software Platforms

The City water supervisory control and data acquisition (SCADA) system's MTU resides at Well Electric Well Station. It comprises an Allen Bradley ControlLogix L72 processor and two Ethernet/IP modules on a 4-slot rack. Located physically next to the MTU are a redundant pair of servers running Wonderware/AVEVA Human Machine Interface (HMI) software in a server cabinet.

There are two RTU PLCs at Well Electric Well Station:

1. The Well Pump PLC, located at the Well 4/5 room's mezzanine, is an Allen-Bradley MicroLogix 1100 with 10 discrete inputs and 6 discrete outputs on board, and two 8-channel analog input modules leaving room for two additional modules. This PLC monitors the four well pumps around Wells 4 and 5, discharge pressures at certain areas of the system, a flood detection system, and an intrusion system. Flow meter signals (instantaneous and totalized) at each of the four pumps are transmitted through a HART-to-Ethernet/IP gateway (Prosoft part number 5228-DFNT-HART). No controls are performed at this PLC. This PLC control panel has a Schneider Electric Magelis local HMI.

2. The Chlorination System PLC, located outside of the Chlorine Room, manages monitoring, alarming, and control for the chlorination system. The PLC is an Allen-Bradley MicroLogix 1100 with 10 discrete inputs and 6 discrete outputs on board, and one 4-channel analog input modules leaving room for three additional modules. No controls are performed at this PLC. This PLC control panel does not have a local HMI.

1.5.2 Telemetry

The MTU and central control room is located at Well Electric Well Station, so wireless telemetry is likely not required for expansion at this site. Any fluoridation equipment installed at this site with a PLC can be connected directly to the MTU over copper-based Ethernet cable.

1.5.3 Expansion Options for Additional Monitoring and Controls

At the time this report was written, the existing PLCs have the following quantities of spare I/O (see **Table 1-4**):

Table 1-4 | Existing PLC Spare I/O

	Digital Inputs	Digital Outputs	Analog Inputs	Analog Outputs
Well Pump	4	6	2	0
Chlorination	5	6	3	0

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Section 2

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Section 2

Parkwater Well Station

2.1 Existing Site – Summary

The Parkwater Well Station was constructed in 1947 out of concrete and serves two pressure zones via eight pumps and four wells. It is located southwest of the Felts Field Airport and its transmission mains connect directly to several of the Well Electric Well Station transmission mains to the north.

2.1.1 Parcel Information and Access

The Parkwater Well Station is located at 5317 E Rutter Avenue, Spokane, WA, 99212. The well station site can be accessed from westbound E Rutter Avenue, or from eastbound E Rutter Avenue which is the arterial that provides access to Felts Field airport.

The site plan in **Appendix C** highlights the building and well location, as well as existing yard piping. The parcel (number 35114.2501) is zoned for Light Industrial use (LI zoning). The parcel is 0.68 acres.

The Parkwater Well Station building structure sits approximately 10 feet from E Rutter Avenue's westbound lanes concrete curb and gutter. Unmarked streetside parking is available along the westbound lane of the E Rutter Avenue curb. There is an adjacent sidewalk along E Rutter Avenue with concrete walkways that lead to two sets of large double doors that provide access into the well station for large equipment to pass through. A single door with hazardous materials warning signs provides City staff adequate access into the well station building. There are concrete driveways (i.e., curb drops) at each of these access doorways. Bollards in front of the double doors prevent vehicles from blocking the double doors and unlawful entrance into the Parkwater Well Station.

Vehicle access around to the backside, or north side of the Parkwater Well Station is through double swing gates that are 8 feet in width each. This singular vehicle access is at the northeast corner of the parcel and provides paved access from the back of sidewalk to the gate which remains locked, until access is required to the backside of the building where chlorine gas canisters are delivered. Therefore, vehicle access to the front and back sides of the Parkwater Well Station site is good. See Parkwater Well Station site plan in **Appendix C.**

A likely delivery route to the Parkwater Well Station is shown in **Appendix C.** The route is along Rutter Avenue from Fancher Road via Trent Avenue (SR 920). This delivery route passes only three residential parcels. The haul route is mostly along industrial zoned and commercial zoned parcels.

2.1.2 Site Security

The Parkwater Well Station's east and south sides of the parcel are surrounded by a 6-foot-tall chain link perimeter fence that does not contain a top rail. There is no barb wire along the top of these sections of perimeter fencing, nor are there any privacy slats within the chain link fence fabric. At the southwest corner of the parcel, the perimeter fencing terminates at the Felts Field airport perimeter security fence and extends to the southwest corner of the Parkwater Well Station building. The well station sites perimeter fencing on the east side of the parcel terminates at the northeast corner of the Parkwater Well Station building and extends to the east parcel line at a corner fence post. This perimeter fencing then extends northward along the parcel's east boundary line.

There is airfield security fencing on the west side and north sides of the Parkwater Well Station parcel. This airfield fencing consists of a 6-foot-tall chain link fencing with a top rail, but no barb wire nor privacy slats. There are no access gates in the airfield security fencing that is adjacent to the Parkwater Well Station parcel's north and west boundary lines. The Parkwater Well Station site fencing along with the airfield fencing provide good security for the facility.

2.1.3 Pressure Zones Served

The Parkwater Well Station serves the Intermediate Pressure Zone and the Low-Pressure Zone. Detailed information on how each well pump serves the distribution system is shown in **Table 2-1.** The transmission mains running north cross the Felts Field Airfield to connect to the Well Electric Well Station transmission mains.

Table 2-1 | Parkwater Pump Transmission Summary

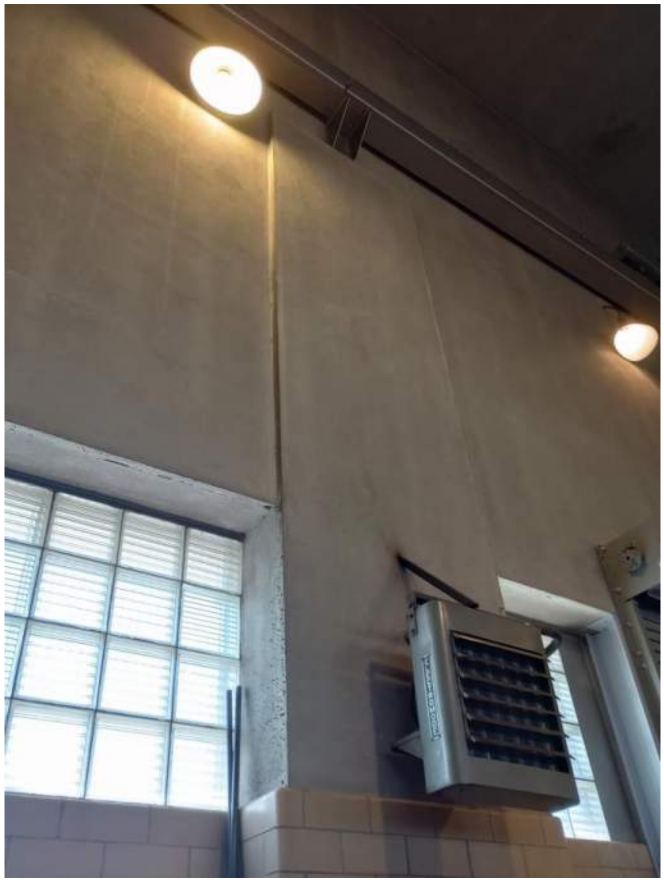
Well No.	Pumps	Zone Served	Transmission Main Size (in)
1	1&2	Intermediate	20" upsizes to 24"
2	3&4	Low	20" which splits to 42", 30" and 18"
3	5&6	Low	20" which splits to 42", 30" and 18"
4	7&8	Low	20" which splits to 42", 30" and 18"

2.2 Existing Facility Summary – Structural

2.2.1 Description of Structures

The original building constructed at the Parkwater site was constructed in 1947 per available existing drawings. The building was constructed with concrete from floor to ceiling (see **Figure 2-1**).

Figure 2-1 | Parkwater – Concrete Walls, Columns, and Ceiling



The structure on-site appeared to be in satisfactory condition. Due to the age of the building, settlement over time, and concrete shrinkage, a few minor cracks have propagated throughout the facility.

2.2.2 Building Code Requirements

While on-site, it was determined that there was not enough space inside the existing facility to incorporate a new fluoridation system. This site would require a new fluoridation system to be placed nearby outside the building with a new enclosure around it. This new enclosure would need to meet all requirements under the current International Building Code (IBC).

2.3 Existing Mechanical Plan

The Parkwater Well Station houses four caisson-style wells and eight vertical turbine pumps (see **Table 2-2**). Each pump has its own flow meter installed in underground vaults northwest of the building, as shown in **Appendix C**.

Table 2-2 | Parkwater Pump Summary

Pump No.	Well No.	Pump Manufacturer	Horsepower	Design Flow (gpm)	Design Head (ft)
1	1	Fairbanks-Morse	900	7,000	415
2	1	Flowserve	1,000	7,500	450
3	2	Fairbanks-Morse	900	8,000	247
4	2	Goulds	900	8,000	249
5	3	Fairbanks-Morse	600	8,000	247
6	3	Trillium/Floway	600	8,000	243
7	4	Fairbanks-Morse	600	8,000	247
8	4	Trillium	600	8,000	243

The Parkwater chlorine room is located on the northwest side of the building as shown in the figures in **Appendix C.** The gaseous chlorine is mixed with water from the distribution system and injected at each pump suction bell in the well caisson.

Free chlorine residual is continuously monitored by one Hach CL17 analyzer for each pressure zone, for a total of two analyzers. Representative samples are taken from the low and intermediate pressure zones. Samples are taken from below grade vaults in the yard and run back to chlorine residual monitors in the building. The location of the sample taps is shown in the building layout plan in **Appendix C** and the locations of the Chlorine monitors are shown in the site plan in **Appendix C**. Each Hach CL17 chlorine analyzer requires 1-3 gpm of continuous sample flow. The CL17 is a colorimetric analyzer which adds a small amount of reagent to the sample; thus, the sample is drained to sanitary sewer.

2.4 Existing Facility Summary – Electrical

2.4.1 Power Feed and Supply Capacity

Parkwater's electrical supply comes from a 2.3 kilovolt (kV) 2000 A feeder within the Switch Yard No. 1 Unit Substation. A one-line diagram of the medium voltage distribution system is shown in **Section 1.4.1**.

2.4.2 Motor Control Centers (MCC) and Panelboards

Parkwater has two MCCs that both operate on a 1200-amp bus at 2400V. Each MCC has a station service disconnect switch. One MCC powers Pumps 1 through 4 and the other powers Pumps 5 through 8. There is a tie breaker between the MCCs that is normally open.

Parkwater has three station service panelboards:

1. Panel A – Located on the exterior east wall of the chlorination room to the right of the MCC powering Pumps 5-8.

2. Panel B – Located adjacent to Panel A.

3. Lighting Panel – Located next to the main entrance.

Electrical capacity information for each panelboard is shown in **Table 2-3**.

Table 2-3 | Parkwater Panelboard Information

Parkwater	Main breaker?	Spare breakers available?	Space available for new breakers?	Notes
Panel A	No (200A bus)	Yes (2)	No	120/208V
Panel B	200A	No	No	
Lighting Panel	No (100A bus)	Yes (1)	No	

Between Panel A and the Lighting Panel there may be enough circuits to provide power to a new fluoridation system, but further information on the fluoridation system's electrical load requirements, as well as measured load data at these panels, are needed to make a determination.

2.5 Existing Facility Summary – I&C

2.5.1 Existing Hardware and Software Platforms

The Parkwater PLC is an Allen-Bradley 1747-L552C SLC 5/05 in a 10-slot rack with two slots available. This PLC control panel has a Schneider Electric Magelis local HMI. Flow meter signals (instantaneous and totalized) at each of the eight pumps are transmitted through a HART-to-Ethernet/IP gateway (Prosoft part number 5228-DFNT-HART).

2.5.2 Telemetry

Parkwater communicates to the MTU at Well Electric Well Station with a 900 MHz radio.

2.5.3 Expansion Options for Additional Monitoring and Controls

The Parkwater PLC has the following quantities of spare I/O and has space for two more I/O modules (see **Table 2-4**):

Table 2-4 | Existing PLC Spare I/O

	Digital Inputs	Digital Outputs	Analog Inputs	Analog Outputs
Parkwater	2	0	18	0

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Section **3**

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Section 3

Ray Street Well Station

The Ray Street Well Station, located in the City's East Central residential neighborhood, was constructed in 1937. It serves one pressure zone via two wells and three pumps.

3.1 Existing Site – Summary

3.1.1 Parcel Information and Access

The Ray Street Well Station is located at 607 S Ray Street, Spokane, WA. The well station site is located northeast of the intersection of W Hartson Avenue and S Ray Street are local residential access streets. This street intersection where the Ray Street Well Station is located is within the City's East Central residential neighborhood.

Vehicle access into the Ray Street Well Station site is rated fair since there is only one 10-foot-wide concrete driveway from S Ray Street. The concrete driveway (i.e., curb drop) through the adjacent concrete sidewalk provides access to a one-way concrete pathway 10-foot in width to the front coil roll-up door with man door that leads into the Ray Street Well Station building. There is no vehicular turn around at the end of the concrete pathway. Also, there are no other driveways or roads providing access through the Ray Street Well Station site. The site plan in Appendix D highlights the building and well location, as well as existing yard piping. The parcel (number 35222.0001) is zoned for Residential Two-Family use (RTF zoning). The parcel is 1.90 acres.

A likely delivery route to the Ray Street Well Station is shown in Appendix D. The route is along Thor Street from 3rd Avenue via Interstate 90. This delivery route passes many residential zoned parcels along 3rd Avenue and Thor Street with commercial zoned at the intersection of 3rd Avenue and Thor Street. The portion of the haul route on Hartson Avenue and Ray Street is along residential zoned parcels.

3.1.2 Site Security

The Ray Street Well Station site security is fair since there is a site perimeter fence around the site. However, the perimeter fence is only 40 inches tall and does not cross the concrete pathway to the building structure's main access door. A taller site perimeter fence would likely prevent unauthorized access and vandalism. However, since the Ray Street Well Station site is in the City's East Central neighborhood, site security perimeter fencing would likely exclude the property from the rest of the neighborhood. Also, a site perimeter security fence would result in an undesired visual presence for the East Central neighborhood who use the southeast corner of the Ray Street Well Station parcel as a community garden space.

There are two removable steel pipe bollards in front of the roll-up coiling garage style of door at the front of the Ray Street Well Station. These bollards provide a protective barrier that limits vehicle access through the door protecting the Ray Street Well Station and City staff inside the building structure.

The high voltage switchyard that contains electrical service assets and transformers for the Ray Street Well Station has an 8-foot-tall perimeter fence with no barb wire along its top rail. There are no privacy slats in the chain link fence fabric. There are double swing gates on the north side of the high voltage switchyard's perimeter fence which is in fair condition. There are high voltage warning signs posted on the north, east and south sides of the switchyard's perimeter fence. The Ray Street Well Station site's building structure frames the west side of the switchyard's boundary.

3.1.3 Pressure Zones Served

The Ray Street Well Station serves the Intermediate Pressure Zone via 20-inch discharge mains that tee into the 36-inch transmission main on Ray Street.

3.2 Existing Facility Summary – Structural

3.2.1 Description of Structures

The original building constructed at the Ray site was constructed in 1937 per available existing drawings. The building was constructed with unreinforced brick masonry walls above grade and a concrete foundation below grade. (see **Figure 3-1**).

Figure 3-1 | Ray – Unreinforced Masonry Walls and Concrete Foundation (Painted Yellow)

The structure on-site appeared to be in fair condition. Due to the age of the building, settlement over time, and concrete shrinkage, several minor cracks have propagated throughout the facility.

3.2.2 Building Code Requirements

Ray was one of the few sites that appeared to have enough available square footage to add a fluoridation system inside the existing buildings. A portion of this available space would no longer be available if a future pump was installed next to pump No. 1. Some existing piping is in place that suggests a future pump has been planned for at this location. The currently available space was located in the southwest corner of the building. Large concrete beams are underneath the slab that appear to be capable of supporting the new system, but further investigation is required structurally to fully verify the capacity of the beams and what load they currently support. This location appears to require no major work to be performed at the site and would seemingly not trigger any IEBC full building retrofit criteria. The capacity of the beams would need to be verified per the IEBC. Additionally, the site has plenty of space to construct a nearby enclosure for the new fluoridation system.

3.3 Existing Mechanical Plan

The Ray Well Station houses two caisson-style wells and three vertical turbine pumps (see **Table 3-1**). Each pump has its own flow meter installed in underground vaults west of the building, as shown in **Appendix D**.

Table 3-1 | Ray Street Pump Summary

Pump No.	Well No.	Pump Manufacturer	Horsepower	Design Flow (gpm)	Design Head (ft)
1	1	Fairbanks-Morse	900	7,000	406
2	2	Fairbanks-Morse	900	7,200	400
3	2	Goulds	500	4,350	372

The Ray Street chlorine room is located inside the well building on the upper level as shown in the figures in **Appendix D.** The gaseous chlorine is mixed with water from the distribution system and injected at each pump suction bell in the well caisson.

Free chlorine residual is continuously monitored by one Hach CL17 analyzer because Ray Street feeds one pressure zone (Intermediate). The sample is taken from an unknown location in the yard and run back to chlorine residual monitor in the building via a 1-inch service line entering the northwest corner of the building. The location of the Chlorine monitor is shown in the building layout plan in **Appendix D**. Each Hach CL17 chlorine analyzer requires 1-3 gpm of continuous sample flow. The CL17 is a colorimetric analyzer which adds a small amount of reagent to the sample thus, the sample is drained to sanitary sewer.

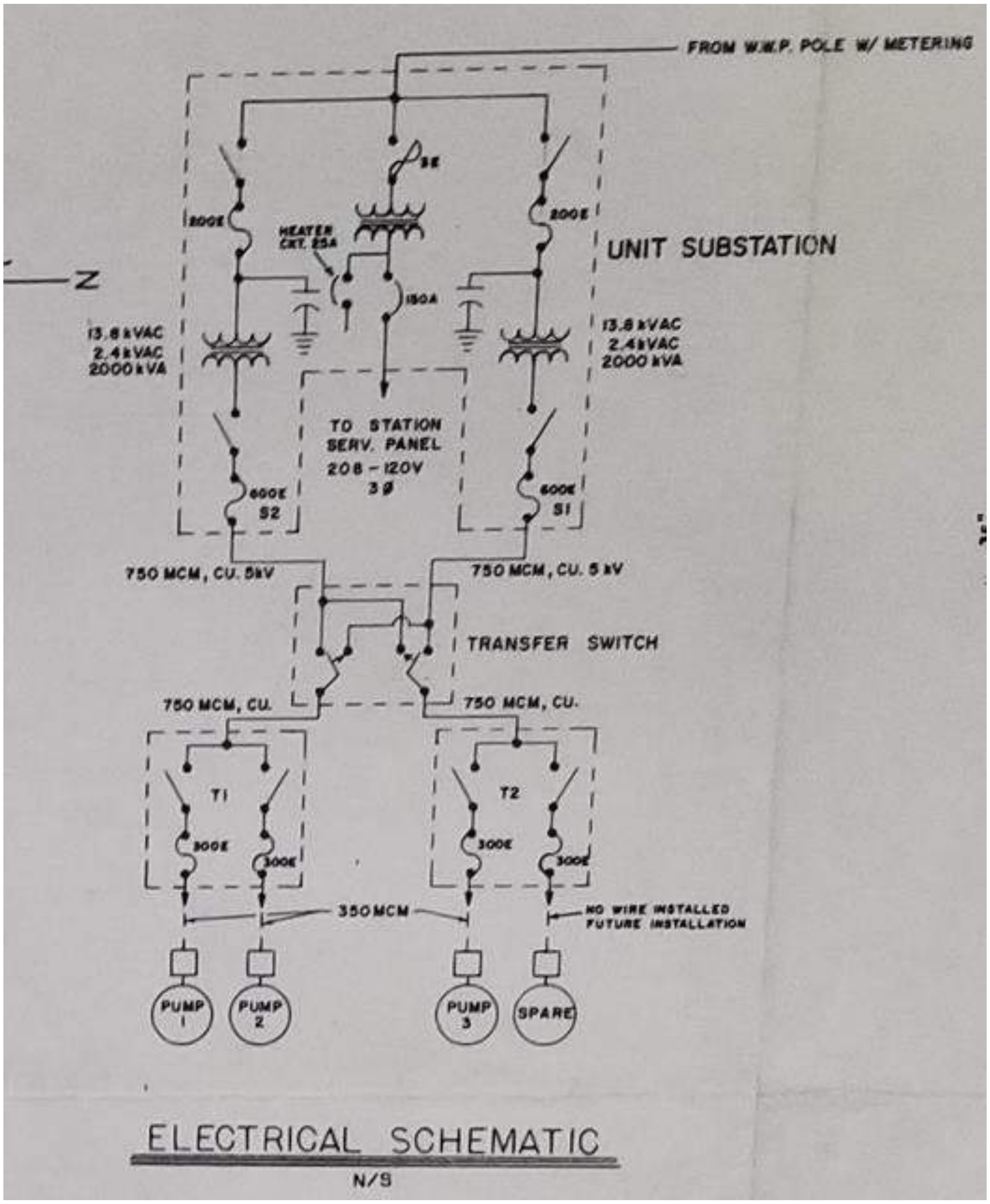
3.4 Existing Facility Summary – Electrical

3.4.1 Power Feed and Supply Capacity

The Ray Street Well Station is fed by a single utility feeder supplying power to a unit substation outside the rear side of the well building. The unit substation contains three feeders: two feeders each supply a 2000 kilovolt-Ampere (kVA) transformer and the third feeder supplies 120/208V station service power through a 30 kVA transformer.

A one-line diagram of Ray Street Facility is shown in **Figure 3-2**.

Figure 3-2 | Ray Street One-Line Diagram



3.4.2 Motor Control Centers (MCC) and Panelboards

Dedicated MCCs for each pump are fed by disconnect switches in the switchyard. There is a spare 2400V feeder if voltages larger than 208V are needed for the fluoridation system.

Ray Well has two panelboards under station service:

1. Main panelboard – Located at the lower level between Pumps 2 and 3.
2. Lighting panel – Located above the stairs leading down to Pumps 1 and 2.

Electrical capacity information for each panelboard is shown in **Table 3-2**.

Table 3-2 | Ray Street Panelboard Information

Ray	Main breaker?	Spare breakers available?	Space available for new breakers?	Notes
Main Panelboard	175A	Yes (1)	Yes (11)	120/208V 3-ph
Lighting Panel	100A	No	No	

There may be enough circuits at the Main Panelboard to provide power to a new fluoridation system, but further information on the fluoridation system's electrical load requirements, as well as measured load data at the Main Panelboard, are needed to make a determination.

3.5 Existing Facility Summary – I&C

3.5.1 Existing Hardware and Software Platforms

The Ray PLC is an Allen-Bradley MicroLogix 1100 with three 4-channel analog input modules and one 16-channel discrete direct current (DC) input module. Module expansion is at capacity for this PLC. This PLC control panel has a Schneider Electric Magelis local HMI. Flow meter signals (instantaneous and totalized) at each of the three pumps are transmitted through a HART-to-Ethernet/IP gateway (Prosoft part number 5228-DFNT-HART).

3.5.2 Telemetry

The Ray Street Well Station communicates to the MTU at Well Electric Well Station with a 900 MHz radio.

3.5.3 Expansion Options for Additional Monitoring and Controls

The Ray PLC has the following quantities of spare I/O and has no space for more I/O modules, but the 4-channel analog input modules can be replaced with 8-channel analog input modules if needed (see **Table 3-3**).

Table 3-3 | Existing PLC Spare I/O

	Digital Inputs	Digital Outputs	Analog Inputs	Analog Outputs
Ray	14	0	1	0

Section 4

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Section 4

Central Avenue Well Station

The original Central Avenue Well Station was constructed in 1960 and consisted of three buildings: one for each well, and one control and chlorine building. New buildings for each well were constructed between 2016 and 2019. The well station serves one pressure zone via two wells and two pumps and is located in the City's North Hill residential neighborhood.

4.1 Existing Site – Summary

4.1.1 Parcel Information and Access

The Central Avenue Well Station is located at 5903 N Normandie Street, Spokane, WA. The well station site is located northwest of the intersection of W Central Avenue and N Normandie Street, which are urban minor collector and local access streets, respectively. This street intersection where the Central Avenue Well Station is located is within the City's North Hill residential neighborhood. The site plan in **Appendix E** highlights the buildings and well locations, as well as existing yard piping. The parcel (number 36311.1406) is zoned for Residential Single-Family use (RSF zoning). The parcel is 0.35 acres.

Vehicle access into the Central Avenue site is good since there is a 16-foot-wide circular drive from W Central Avenue to N Normandie Street. This quarter circle drive-through provides front door access to the older control building with chlorine room. There are also concrete driveways (i.e., curb drops) at each of the two well pump stations; one at the southwest corner of the site that provides vehicle access to well station #1 from W Central Avenue and the other at the northeast corner of the site that provides vehicle access to well station #2 from N Normandie Street. These 16-foot-wide driveways provide access to the double doors on the east side of well station #1 and to the double doors on the south side of well station #2.

Also, there is an alley that is accessible from W Central Avenue that provides access to the fenced high voltage yard that is in the northwest corner of the Central Avenue Well Station site. The alley way provides good access to the electrical service assets and transformers for the well station site. The utility pole with transformer is also located within the fenced high voltage yard. Vehicle access the yard by driving on the lawn to the gates in the high voltage yard's perimeter fence.

A likely delivery route to the Central Avenue Well Station is shown in **Appendix E.** The route is along Central Avenue from Division Street (Hwy 395) Drive. This delivery route passes one block of residential parcels. The haul route is along commercial zoned parcels that line Division Street.

4.1.2 Site Security

The Central Avenue Well Station site security is poor since there is not a site perimeter fence to enclose the sites three building structures which are well station #1, well station #2, and the controls building with chlorine room. The site perimeter fence would prevent unauthorized access and vandalism. However, since the Central Avenue Well Station site is in the City's North Hill neighborhood, site security perimeter fencing would likely exclude the property from the rest of the neighborhood. Also, a site perimeter security fence would result in an undesired visual presence for the North Hill neighborhood.

The high voltage switchyard that contains electrical service disconnects and transformers for the Central Avenue Well Station has a 6-foot-tall perimeter fence with three strands of barb wire along its top rail. There are no privacy slats in the chain link fence fabric. There are double swing gates on the south side of the high voltage switchyard's perimeter fence which is in fair condition. There are high voltage warning signs posted on the south and east sides of the switchyard's perimeter fence. Arborvitae hedges line the west and north sides of the high voltage switchyard's perimeter fence. The hedges provide privacy and visual appeal for the adjacent residences to the west and north of the Central Avenue Well Station site.

4.1.3 Pressure Zones Served

The Central Avenue Well Station serves the North Hill Pressure Zone via 24-inch discharge mains which both tee into two different 24-inch and 30-inch transmission mains.

4.2 Existing Facility Summary – Structural

4.2.1 Description of Structures

The well buildings at the Central Ave site were constructed between 2016 and 2019 to replace the existing vaults over the wells and pumps. The original chlorine and control building was still in operation, which was constructed in 1960. The two new well buildings were constructed using CMU walls and a timber framed roof. CMUs, sometimes called cinder blocks, are much more standard for modern masonry construction. The CMUs are staggered, similar to typical brick construction, so the holes overlap with CMU layers above and below. Reinforcing can be ran through all the layers of CMU to tie the wall together and provide tension capacity in the wall. However, not all CMU construction uses reinforcing. There is no visual way to tell with this type of construction, but noninvasive tools are available if further investigation is required. Due to the age of these buildings as well as available information in the plans, the well buildings on site are reinforced and designed to meet today's code requirements. The figure below shows the CMU walls.

Figure 4-1 | Central Ave – CMU construction

The structures on-site appeared to be in good condition. Minimal damage was observed at these relatively newer facilities.

4.2.2 Building Code Requirements

While on-site, it was determined that there was not enough space inside the existing facility to incorporate a new fluoridation system. This site would require a new fluoridation system to be placed nearby outside the buildings with a new enclosure around it. This new enclosure would need to meet all requirements under the current IBC.

4.3 Existing Mechanical Plan

Two caisson wells, each with one vertical turbine pump (see **Table 4-1**), are housed in two different buildings on the Central Avenue site. Each pump has its own flow meter installed in underground vaults as shown in the site plan in **Appendix E**.

Table 4-1 | Central Avenue Pump Summary

Pump No.	Well No.	Pump Manufacturer	Horsepower	Design Flow (gpm)	Design Head (ft)
1	1	Goulds	900	8,000	355
2	2	National Pump Company	900	8,000	355

A separate building on the Central site, has a chemical room for the chlorine system as shown in the figures in **Appendix E.** The gaseous chlorine is mixed with water from the distribution system and injected at each pump suction bell in the well caisson.

Free chlorine residual is continuously monitored by one Hach CL17 analyzer for each pump, for a total of two analyzers. Both pumps serve the same zone but have separate headers. Samples are taken from unknown locations from pump discharge header pipes in the road and run back to chlorine residual monitors in their respective buildings. The locations of the chlorine monitors are shown in the building layout plan in **Appendix E**. Each Hach CL17 chlorine analyzer requires 1-3 gpm of continuous sample flow. The CL17 is a colorimetric analyzer which adds a small amount of reagent to the sample; thus, the sample is drained to sanitary sewer.

4.4 Existing Facility Summary – Electrical

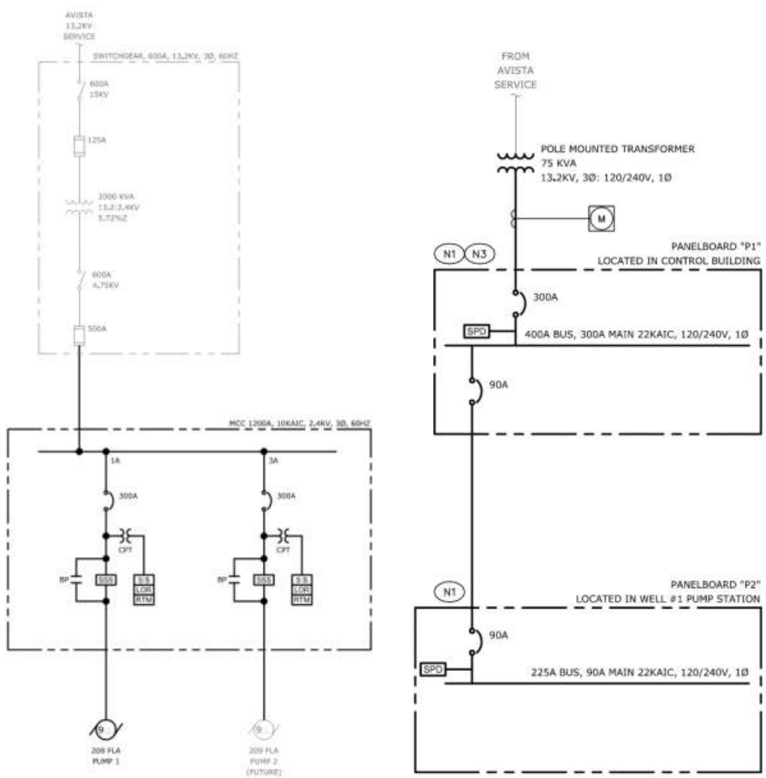
4.4.1 Power Feed and Supply Capacity

Well pump power is supplied by a 2000 kVA pad mount dry transformer and disconnect switch in the switchyard. The disconnect feeds a 1200-amp MCC operating at 2400V.

Station service power is supplied by a 75 kVA pole mounted transformer feeding a panelboard with a 300-amp bus and 400-amp main breaker.

One-line diagrams of the well pumps and station service power are shown in **Figure 4-2**.

Figure 4-2 | Central Avenue One-Line Diagram



4.4.2 Motor Control Centers (MCC) and Panelboards

The MCC is a three section MCC located in the building between the two well pump buildings. The two well pump soft starters reside in this MCC. The MCC can potentially be expanded to the left if voltages larger than 240V are required for the fluoridation system.

Central has three station service panelboards:

1. Panel P1– Located in the main building between the two well pump buildings.
2. Panel P2 – Located in the west pump building where Pump 1 resides.
3. Panel P3 – Located in the east pump building where Pump 2 resides.
4. Panels P2 and P3 are fed by Panel P1 with 90 amp 2-pole breakers.

Electrical capacity information for each panelboard is shown in **Table 4-2**.

Table 4-2 | Central Avenue Panelboard Information

Central	Main breaker?	Spare breakers available?	Space available for new breakers?
Panel P1	400A adjustable (300A bus)	Yes (1)	Yes (10)
Panel P2	90A	Yes (2)	Yes (9)
Panel P3	90A (125A bus)	Yes (5)	Yes (28)

Based on the number of spare breakers and space for new breakers, Central Avenue Well Station has relatively abundant capacity to support a fluoridation system, but further information on the fluoridation system's electrical load requirements, as well as measured load data at these panelboards, are needed to make a determination.

4.5 Existing Facility Summary – I&C

4.5.1 Existing Hardware and Software Platforms

Central's RTU PLC is an Allen-Bradley MicroLogix 1100 with two 4-channel analog input modules, one 16-channel discrete DC input module, and a 4-channel RTD module. Module expansion is at capacity for this PLC. This PLC control panel has a Schneider Electric Magelis local HMI. Flow meter signals (instantaneous and totalized) at each of the two pumps are transmitted through a HART-to-Ethernet/IP gateway (Prosoft part number 5228-DFNT-HART).

4.5.2 Telemetry

The Central Avenue Well Station communicates to the MTU at Well Electric Well Station with a 900 MHz radio.

4.5.3 Expansion Options for Additional Monitoring and Controls

The Central Avenue Well Station PLC has the following quantities of spare I/O and has no space for more I/O modules, but the 4-channel analog input modules can be replaced with 8-channel analog input modules if needed (see **Table 4-3**):

Table 4-3 | Existing PLC Spare I/O

	Digital Inputs	Digital Outputs	Analog Inputs	Analog Outputs
Central	12	2	0	0

Section 5

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Section 5

Grace Well Station

The Grace Well Station serves one pressure zone via two wells and two pumps and is located east of the City's Water Department building. The Nevada Well Station is also located at this site. The Grace Well Station was constructed in 1949.

5.1 Existing Site – Summary

5.1.1 Parcel Information and Access

The Grace Well Station is located at 1024 E North Foothills Drive, Spokane, WA. The Grace Well Station is located within the City's water department yard that is southeast of the intersection of E North Foothills Drive and N Hamilton Street. The Grace Well Station site can be accessed only from E North Foothills Drive because water department yard perimeter fencing terminates at the northwest and southeast corners of the Grace Well Station building structure. This fencing blocks access into the Grace Well Station from the water department yard since there are doors only on the north side of the well station building. The man door and roll-up garage door face E North Foothills Drive. Site access is only fair since the water department yard perimeter fencing limits vehicle access to each the Grace Well Station. The site plan in Appendix F highlights the building and well location, as well as existing yard piping. The Grace Well Station is on the same parcel as the Nevada Well Station and the City Water Department (parcel number 35081.2802). The parcel is zoned as a Center and Corridor Type 1 Zone- Employment Center (CC1-EC). The parcel is 6.68 acres.

A likely delivery route to the Grace Well Station is shown in Appendix F. The route is along North Foothills Drive from the Ruby Street/Division Street couplet (Hwy 395). This delivery route passes only three residential parcels. The haul route is along industrial zoned and commercial zoned parcels.

5.1.2 Site Security

The Grace Well Station building does not have perimeter security fencing and its assessment rating is poor. Only the west and south sides of the well station building are within City water department yard fencing. Existing fencing on the west side of the Grace Well Station is 6 feet tall with three strands of wire with no barbs strung above the top fence rail. There are red vinyl privacy slats in the chain link fencing along E North Foothill Drive and in the chain link fencing that surrounds the transformer yard that is located northwest and adjacent to the Grace Well Station site. The water department fence on the south side of the Grace Well Station building is new fencing that is in excellent condition. This fencing is 6 feet tall with three strands of barb wire along its top rail.

There is also a locked man gate in the fencing where it terminates at the southeast corner of the well station building. This new fencing was installed as part of the Spokane Public Schools' (SPS) new Yasuhara Middle School located east of the Grace Well Station.

There is one fisheye security camera mounted on the southeast corner of the Grace Well Station building. The security camera is mounted approximately 12 feet above the ground surface. This (SPS) security camera provides a southeast view of the middle school parking lot that is along E North Foothills Drive. The security camera likely provides a limited view along the east boarder of the City's water department yard south of the Grace Well Station building.

5.1.3 Pressure Zones Served

The Grace Well Station serves the North Hill Pressure Zone via 24-inch discharge mains that turn east into the 36-inch transmission main on Foothills Avenue.

5.2 Existing Facility Summary – Structural

5.2.1 Description of Structures

The building at the Grace Well Station site was constructed in 1949 per available drawings. The building was constructed using CMU walls. It is unknown whether the walls contain reinforcing. The ceilings were very tall in this building and the framing appeared to be covered by plywood. It was difficult to confirm what was used for the roof framing, but the plywood may suggest that it was formwork for concrete that was never removed (see **Figure 5-1**). The building has a brick veneer on the outside, which only serves aesthetic purposes.

Figure 5-1 | Grace – CMU Walls and Unknown Ceiling

The structure on-site appeared to be in fair condition. Due to the age of the building, settlement over time, and concrete shrinkage, several minor cracks have propagated throughout the facility. Under the main floor of the building, several beams span transversely across the floor. There was some spalling observed on one of the beams which has exposed bars and has allowed for corrosion of the reinforcing bars to take place (see **Figure 5-2**).

Figure 5-2 | Grace – CMU Walls and Unknown Ceiling

5.2.2 Building Code Requirements

This site has enough floor space to include a new fluoridation system, however there are concerns about the logistics of operating the overhead crane inside the building. Picks made by the crane would need to go up and over the new fluoridation equipment or over the existing pump equipment. The floor would also need to be evaluated for the required structural capacity to support the new fluoridation equipment. The floor spans over the wells below and is not supported by soil underneath. There may be potential to shore up the existing floor to support the new equipment. Without needing any penetrations in the walls, this site would not trigger any IEBC upgrades for the building. Additionally, the fluoridation equipment could be located in a new structure outside the building that is current with the IBC requirements.

5.3 Existing Mechanical Plan

The Grace Well Station houses one caisson-style well and two vertical turbine pumps (see **Table 5-1**). Each pump has its own flow meter installed in an underground vault north of the building, as shown in **Appendix F**.

Table 5-1 | Grace Pump Summary

Pump No.	Pump Manufacturer	Horsepower	Design Flow (gpm)	Design Head (ft)
1	Goulds	900	8,000	340
2	Goulds	900	8,000	340

The Grace chlorine room is located inside the well building on the upper level as shown in the figures in **Appendix F.** The gaseous chlorine is mixed with water from the distribution system and injected at each pump suction bell in the well caisson.

Free chlorine residual is continuously monitored by one Hach CL17 analyzer. The sample is taken from an unknown location in the pump discharge header pipe in the road and run back to chlorine residual monitor in the pump building via a 2-inch water service line. The location of the chlorine monitor is shown in the building layout plan in **Appendix F**. Each Hach CL17 chlorine analyzer requires 1-3 gpm of continuous sample flow. The CL17 is a colorimetric analyzer which adds a small amount of reagent to the sample; thus, the sample is drained to sanitary sewer.

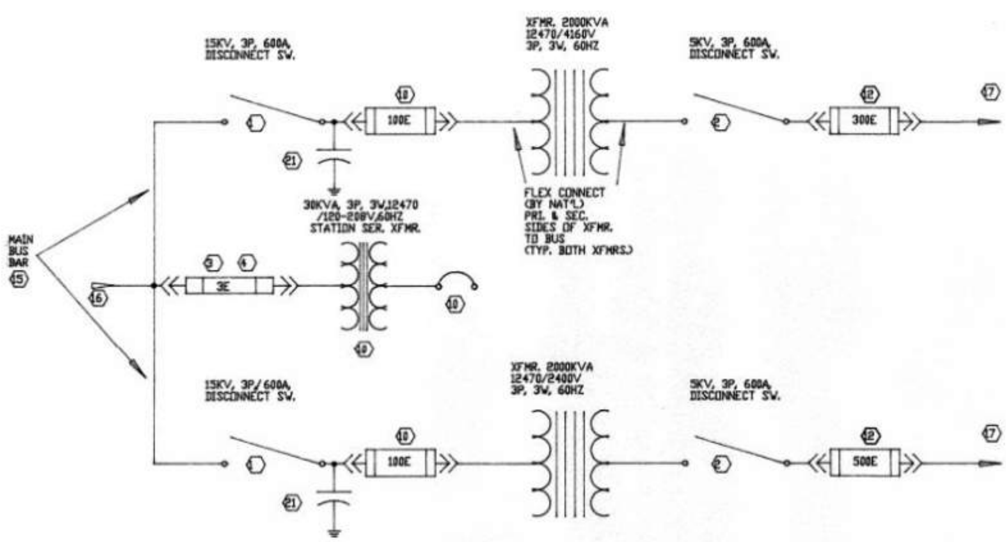
5.4 Existing Facility Summary – Electrical

5.4.1 Power Feed and Supply Capacity

The Grace Well Station MCC is powered through a 2000 kVA transformer and operates at 4160V. A 600 amp disconnect switch is installed at the transformer secondary.

Station service power is supplied by a 30 kVA transformer and operates at 120-208V 3-phase. This transformer also feeds one of two station power feeders to the Nevada Well facility. A one-line diagram of the Grace facility is shown in **Figure 5-3**.

Figure 5-3 | Grace One-Line Diagram



5.4.2 Motor Control Centers (MCC) and Panelboards

Grace Well Station has two well pumps installed and use soft starters in an MCC with a bus rating of 1200 amps.

Grace Well Station has one panelboard for station service power, located on the south wall adjacent to the pump MCC (see **Table 5-2**).

Table 5-2 | Grace Panelboard Information

Grace	Main breaker?	Spare breakers available?	Space available for new breakers?
Station Service Panel	100A (200A bus)	Yes (1 20A)	No

With one spare breaker and no space for additional breakers, the existing panel likely does not have the capacity to support a fluoridation system, so a subpanel or further evaluation on an additional power source may be required.

5.5 Existing Facility Summary – I&C

5.5.1 Existing Hardware and Software Platforms

Grace Well Station's PLC is an Allen-Bradley MicroLogix 1100 with three 4-channel analog input modules leaving room for one additional module. This PLC control panel has a Schneider Electric Magelis local HMI. Flow meter signals (instantaneous and totalized) at each of the two pumps are transmitted through a HART-to-Ethernet/IP gateway (Prosoft part number 5228-DFNT-HART).

5.5.2 Telemetry

Grace Well Station communicates to the MTU at Well Electric Well Station with a 900 MHz radio. This radio also transmits data from Nevada Well Station.

5.5.3 Expansion Options for Additional Monitoring and Controls

The Grace Well Station PLC has the following quantities of spare I/O and has space for one more I/O module. The 4-channel analog input modules can be replaced with 8-channel analog input modules if needed (see **Table 5-3**):

Table 5-3 | Existing PLC Spare I/O

	Digital Inputs	Digital Outputs	Analog Inputs	Analog Outputs
Grace	1	2	7	0

Section **6**

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Section 6

Nevada Well Station

The Nevada Well station serves one pressure zone via four pumps in one well. It was constructed in 1956 and is located at the City Water Department site, west of the Grace Well Station.

6.1 Existing Site – Summary

6.1.1 Parcel Information and Access

The Nevada Well Station is located at 914 E North Foothills Drive, Spokane, WA. The Nevada Well Station is located within the City's water department yard that is southeast of the intersection of E North Foothills Drive and N Hamilton Street. The Nevada Well Station site can only be accessed from within the City's water department yard that has a driveway entrance from E North Foothills Drive. Vehicular and City staff access to the Nevada Well Station site good since there is more than 44 feet of asphalt pavement on the west and south sides of the Nevada pump house and chlorine building that comprise the Nevada Well Station. The site plan in **Appendix G** highlights the building and well location, as well as existing yard piping. The Nevada Well Station is on the same parcel as the Grace Well Station and the City Water Department (parcel number 35081.2802). The parcel is zoned as a Center and Corridor Type 1 Zone- Employment Center (CC1-EC). The parcel is 6.68 acres.

A likely delivery route to the Nevada Well Station is shown in **Appendix G.** The route is along North Foothills Drive from the Ruby Street/Division Street couplet (Hwy 395). This delivery route passes only three residential parcels. The haul route is along industrial zoned and commercial zoned parcels.

6.1.2 Site Security

The Nevada Well Station lies within the water department's yard. The water department yard has 6 feet tall perimeter fencing with three strands of barb wire above the top rail and red vinyl privacy slats in the chain link fence fabric which provides good site security. The north side of the chlorine building is not within City water department yard site fencing. This north side of the chlorine building structure is adjacent to E North Foothill Drive.

The Nevada Well Station is adjacent to and east of the main driveway entrance into the City's water department yard off E North Foothills Drive. The gate at the main entrance is 30 feet wide minimum, with two slide gates that are manually operated.

6.1.3 Pressure Zones Served

The Nevada Well Station serves the Low-Pressure Zone via 16-inch discharge mains that turn north into a 36-inch, and south into a 30-inch transmission main.

6.2 Existing Facility Summary – Structural

6.2.1 Description of Structures

The building was constructed at the Nevada Ave site was constructed in 1956 per available drawings. The building was constructed using concrete for the walls and timber framing for the ceiling (see figure below). Several alterations have taken place over the years, including a pump house roof and hoist frame replacement in 2002.

Figure 6-1 | Nevada – Concrete Walls and Timber Ceiling

The structure on-site appeared to be in fair condition. Due to the age of the building, settlement over time, and concrete shrinkage, several minor cracks have propagated throughout the facility.

6.2.2 Building Code Requirements

While on-site, it was determined that there was not enough space inside the existing facility to incorporate a new fluoridation system. This site would require a new fluoridation system to be placed nearby outside the buildings with a new enclosure around it. This new enclosure would need to meet all requirements under the current IBC.

6.3 Existing Mechanical Plan

The Nevada Well Station houses one caisson-style well and four pumps (see **Table 6-1**). Each pump has its own flow meter installed in an underground tunnel connected to the west side of the building, as shown in **Appendix G**.

Table 6-1 | Nevada Pump Summary

Pump No.	Pump Manufacturer	Horsepower	Design Flow (gpm)	Design Head (ft)
1	Byron-Jackson-Submersibles	400	5,700	234
2	Flowserve Vertical Turbine	800	9,800	250
3	Flowserve Vertical Turbine	800	9,800	250
4	Byron-Jackson-Submersibles	400	5,700	234

The Nevada chlorine room is the northern, main level portion of the well building as shown in the figures in **Appendix G.** The gaseous chlorine is mixed with water from the distribution system and injected at each pump suction bell in the well caisson.

Free chlorine residual is continuously monitored by one Hach CL17sc analyzer (a newer model than the CL17). The sample is taken from an unknown location from the pump discharge header pipe in the road and run back to the chlorine residual monitor in the control room, whose location is shown in the building layout plan in **Appendix G**. Each Hach CL17sc chlorine analyzer requires 1-3 gpm of continuous sample flow. The CL17sc is a colorimetric analyzer which adds a small amount of reagent to the sample; thus, the sample is drained to sanitary sewer.

6.4 Existing Facility Summary – Electrical

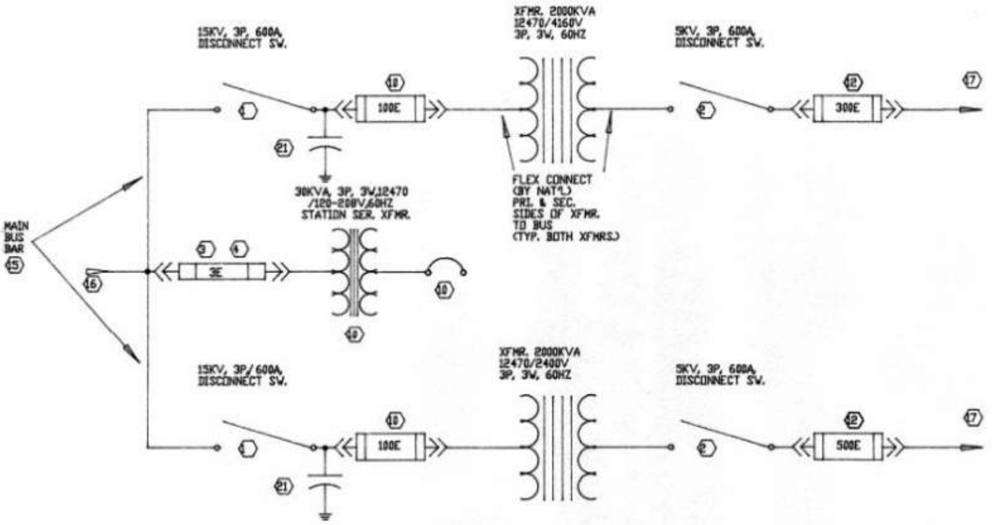
6.4.1 Power Feed and Supply Capacity

The Nevada Well Station has four pumps. Pumps 1 and 2 are fed by a 2000 kVA transformer and operate at 2400 volts. The 2000 kVA transformer also services one of two station service panels that is located outside the Nevada Well building on the east exterior wall, which primarily serves the two HVAC units for the pump room. The exterior station service panel is fed by a 75 kVA transformer and operates at 120-208V 3-phase. A 200-amp fused disconnect switch protects the primary side of the 75 kVA transformer.

Pumps 3 and 4 are fed by a 1500 kVA transformer and operate at 2400V.

The second station service panel, located inside the Nevada Well Station next to the main entrance, shares the same 30 kVA transformer that feeds the Grace Well Station service as mentioned in **Section 5.4.1**. A one-line diagram of the facility is shown in **Figure 6-2**.

Figure 6-2 | Nevada One-Line Diagram



6.4.2 Motor Control Centers (MCC) and Panelboards

The MCC lineup is located at the northeast corner of the pump building and is dual sourced as discussed in **Section 6.4.1**. Nameplate information such as bus rating was not clearly visible on the face of the MCC lineup.

The Nevada Well Station has two station service panelboards:

1. Interior Station Service Panel – Located inside the building next to the main entrance. Fed by the 50 kVA, 120/208V transformer.

2. Exterior Station Service Panel – Located outside the building on the east exterior wall. Fed by the 2000 kVA, 2400V transformer and the 75 kVA, 120/208V transformer.

Electrical capacity information for each panelboard is shown below. (see **Table 6-2**).

Table 6-2 | Nevada Street Panelboard Information

Nevada	Main breaker?	Spare breakers available?	Space available for new breakers?
Interior Panel	100A	Yes (2)	Yes (4)
Exterior Panel	200A	Yes (2)	Yes (27)

There appears to be adequate space and capacity to provide breakers for a fluoridation system at this site, but a load study should be performed to ensure the additional load will not exceed the bus rating of the panelboard(s) being used.

6.5 Existing Facility Summary – I&C

6.5.1 Existing Hardware and Software Platforms

The Nevada Well Station PLC is an Allen-Bradley MicroLogix 1100 with one 16-channel discrete DC input module and two 8-channel analog input modules leaving room for one additional module. This PLC control panel has a Schneider Electric Magelis local HMI. Flow meter signals (instantaneous and totalized) at each of the four pumps are transmitted through a HART-to-Ethernet/IP gateway (Prosoft part number 5228-DFNT-HART).

6.5.2 Telemetry

Nevada Well Station does not have a radio. Its data is sent to the Grace PLC through a MODBUS serial connection, then is relayed to the MTU at Well Electric Well Station to the 900 MHz radio at Grace Well Station.

6.5.3 Expansion Options for Additional Monitoring and Controls

The Nevada Well Station PLC has the following quantities of spare I/O and has space for one more I/O module (see **Table 6-3**):

Table 6-3 | Existing PLC Spare I/O

	Digital Inputs	Digital Outputs	Analog Inputs	Analog Outputs
Nevada	13	0	3	0

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Section 7

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Section 7

Hoffman Well Station

The Hoffman Well Station is located in the City's Bemiss residential neighborhood and was constructed in 1936. It serves one pressure zone via one pump and well but is currently undergoing retrofits so that a second pump can be installed in the facility's second well (which is currently out of commission).

7.1 Existing Site – Summary

7.1.1 Parcel Information and Access

The Hoffman Well Station is located at 2109 E Hoffman Avenue, Spokane, WA. The well station site is located northeast of the intersection of N Crestline Street and E Hoffman Avenue which are urban minor arterial and local access streets, respectively. This street intersection where the Hoffman Well Station is located is within the City's Bemiss residential neighborhood.

Vehicle access into the Hoffman Well Station site is rated fair since there is only one 12-foot-wide concrete driveway from E Hoffman Avenue. The concrete driveway (i.e., curb drop) through the adjacent concrete sidewalk provides access to a one-way concrete pathway 12 feet in width to the tall front double doors that lead into the Hoffman Well Station building. There is no vehicular turn around at the end of the concrete pathway. Also, there are no other driveways or roads providing access through the Hoffman Well Station site. The site plan in **Appendix H** highlights the building and well location, as well as existing yard piping. The Hoffman Well Station parcel (parcel number 35041.0419 is zoned for Residential Single Family (RSF) use. The parcel is 0.64 acres.

A likely delivery route to the Hoffman Well Station is shown in **Appendix H**. The route is along Wellesley Avenue from Division Street (Hwy 395). This delivery route passes many residential zoned parcels along Wellesley Avenue with commercial zoned parcels at the intersection of Wellesley Avenue and Crestline Street. The portion of the haul route on Division Street is along commercial zoned parcels.

7.1.2 Site Security

The Hoffman Well Station site security is poor since there is not a site perimeter fence to enclose the well station building structure. A site perimeter fence would likely prevent unauthorized access and vandalism. However, since the Hoffman Well Station site is in the City's Bemiss neighborhood, site security perimeter fencing would likely exclude the property from the rest of the neighborhood. Also, a site perimeter security fence would result in an undesired visual presence for the Bemiss neighborhood.

There are two removable steel pipe bollards in front of the double swing doors that provide the only access into the Hoffman Well Station. These bollards provide a barrier that limits vehicle access through the doors protecting the Hoffman Well Station and City staff inside the building structure.

The high voltage switchyard that contains electrical service assets and transformers for the Hoffman Well Station has a 6-foot-tall perimeter fence with three strands of barb wire along its top rail. There are no privacy slats in the chain link fence fabric. There are double swing gates on the north side of the high voltage switchyard's perimeter fence which is in fair condition. There are high voltage warning signs posted on the north, west, and east sides of the switchyard's perimeter fence. The Hoffman Well Station site's building structure frames the south side of the switchyard's boundary.

7.1.3 Pressure Zones Served

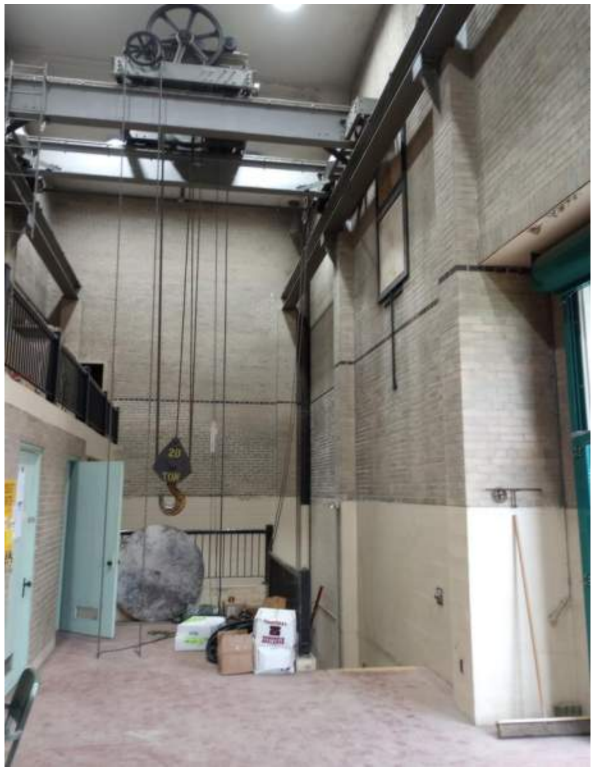
The Hoffman Well Station serves the North Hill Pressure Zone. The facility retrofit will replace the existing 18-inch discharge mains with 24-inch mains that will feed into an existing 30-inch transmission main running north.

7.2 Existing Facility Summary – Structural

7.2.1 Description of Structures

The building at the Hoffman site was constructed in 1936 per available drawings. The building was constructed using URM brick walls on top of concrete foundation walls (see figure below). The roof framing was covered and not able to be observed from the main floor. The Well 2 caisson is currently undergoing structural retrofits to accommodate a new pump in 2022.

Figure 7-1 | Hoffman – URM Walls on Concrete Foundation and Unknown Ceiling



The structure on-site appeared to be in fair condition. Due to the age of the building, settlement over time, and concrete shrinkage, several minor cracks have propagated throughout the facility.

7.2.2 Building Code Requirements

While on-site, it was determined that there was not enough space inside the existing facility to incorporate a new fluoridation system. This site would require a new fluoridation system to be placed nearby outside the buildings with a new enclosure around it. This new enclosure would need to meet all requirements under the current IBC Building Code Requirements.

7.3 Existing Mechanical Plan

Once retrofits are complete (scheduled for 2022 or 2023), the Hoffman Well Station will house two caisson-style wells and two pumps, one in each well (see **Table 7-1**). The combined flow will be metered in the underground vault on the north side of the site, as shown in **Appendix H**.

Table 7-1 | Future Hoffman Pump Summary

Pump No.	Pump Manufacturer	Horsepower	Design Flow (gpm)	Design Head (ft)
1	Flowserve	600	5,500	340
2	Flowserve	600	5,500	340

The Hoffman chlorine room is located on the ground level of the well building as shown in the figures in **Appendix H.** The gaseous chlorine is mixed with water from the distribution system and injected at each pump suction bell in the well caisson.

Free chlorine residual is continuously monitored by one Hach CL17 analyzer. The sample is taken from an unknown location in the yard and run back to chlorine residual monitor in the pump building. The location of the chlorine monitor is shown in the building layout in **Appendix H**. Each Hach CL17 chlorine analyzer requires 1-3 gpm of continuous sample flow. The CL17 is a colorimetric analyzer which adds a small amount of reagent to the sample; thus, the sample is drained to sanitary sewer. Future planned changes to the yard piping may modify the sampling at monitoring protocol at this station.

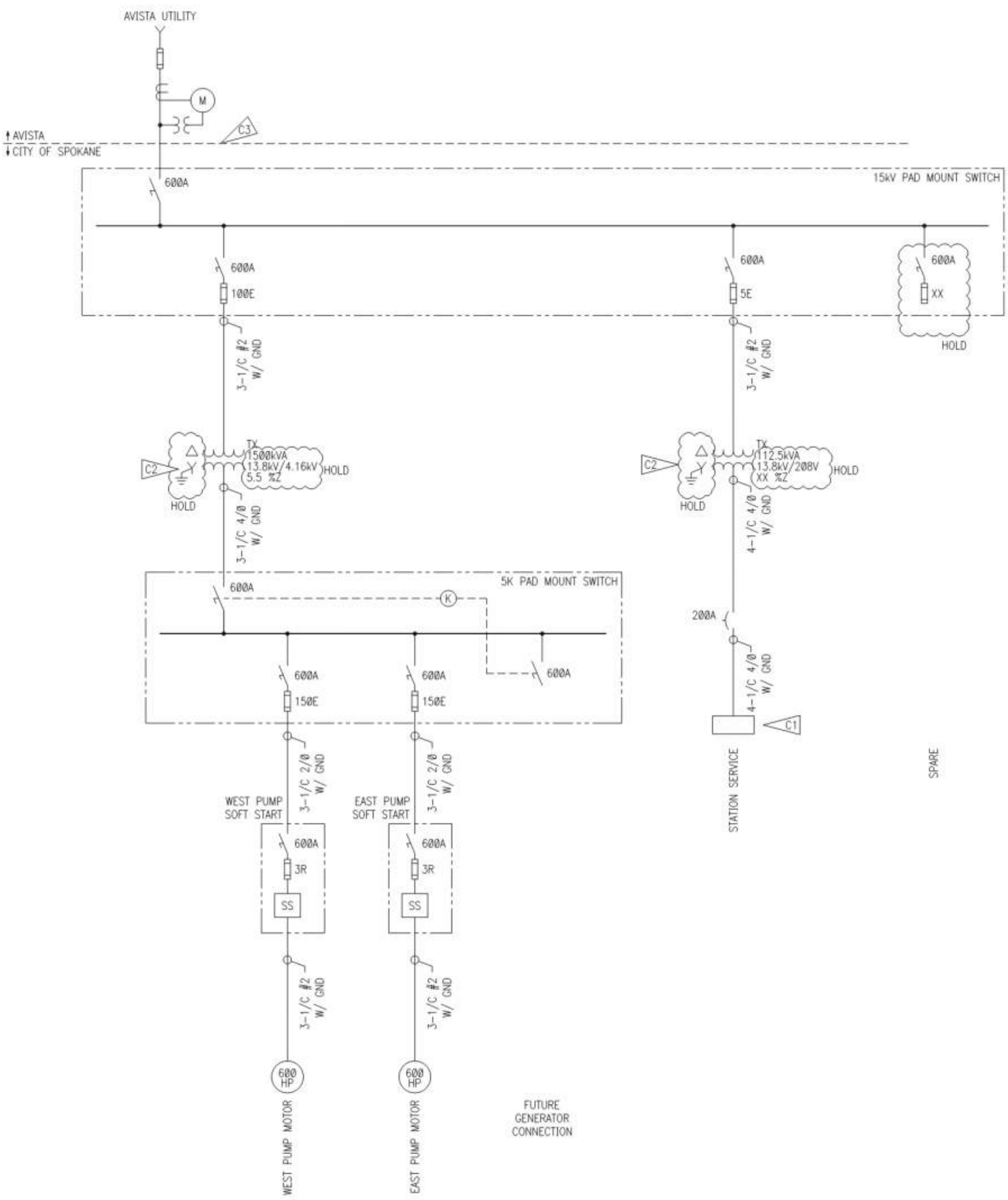
7.4 Existing Facility Summary – Electrical

7.4.1 Power Feed and Supply Capacity

The Hoffman Well Station facility is in the process of having its electrical switchyard equipment upgraded. After the upgrade, a 1500 kVA transformer will be installed to power two well pumps that operate at 2400V. A second, 112.5 kVA transformer will be installed for station service power that operates on 120/208 volts three-phase.

A one-line diagram of Hoffman Well Station's power distribution (after retrofits) is shown in **Figure 7-2**.

Figure 7-2 | Hoffman One-Line Diagram



7.4.2 Motor Control Centers (MCC) and Panelboards

At the time this report was written, only one of the two pumps was in service, but retrofits were underway to install a second pump in the facility. Pump 1's motor control enclosure is located on the west side of the building near the chlorine room entrance and is comprised of a soft starter and a control relay panel. Pump 2 was in the process of getting rehabilitated with a new motor and starter. The starter is planned to be installed at the east side of the mezzanine near the small storage room.

Hoffman Well Station has two station service panelboards that operate under 120/208 3-phase:

1. Main Panelboard – Located on the north wall in front of the main entrance.
2. Lighting Panel – Located next to the main entrance to the west.

Electrical capacity information for each panelboard is shown below (see **Table 7-2**).

Table 7-2 | Hoffman Panelboard Information

	Main breaker?	Spare breakers available?	Space available for new breakers?
Main Panelboard	200A	Yes (6)	Yes (4)
Lighting Panel	No	Yes (3)	No

There may be enough circuits at the Main Panelboard to provide power to a new fluoridation system, but further information on the fluoridation system's electrical load requirements, as well as measured load data at the Main Panelboard, are needed to make a determination.

7.5 Existing Facility Summary – I&C

7.5.1 Existing Hardware and Software Platforms

Hoffman Well Station's PLC is an Allen-Bradley MicroLogix 1100 with two 4-channel analog input modules leaving room for two additional modules. This PLC control panel has a Schneider Electric Magelis local HMI. Flow meter signals (instantaneous and totalized) at Pump 1 is transmitted through a HART-to-Ethernet/IP gateway (Prosoft part number 5228-DFNT-HART).

7.5.2 Telemetry

The Hoffman Well Station communicates to the MTU at Well Electric Well Station with a 900 MHz radio.

7.5.3 Expansion Options for Additional Monitoring and Controls

The Hoffman Well Station PLC has the following quantities of spare I/O* and has space for two more I/O modules, but the 4-channel analog input modules can be replaced with 8-channel analog input modules if needed (see **Table 7-3**):

Table 7-3 | Existing PLC Spare I/O

	Digital Inputs	Digital Outputs	Analog Inputs	Analog Outputs
Hoffman	0	2	0	0

*These quantities are based on the assumption that Pump 2’s I/O will be identical to Pump 1’s I/O when it is installed.

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Section 8

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Section 8

Havana Well Station

8.1 Existing Site – Summary

The Havana Well Station was under construction at the time of this assessment but will serve two different pressure zones via six wells and six pumps. A limited assessment was conducted for this site due to its status.

8.1.1 Parcel Information and Access

The future Havana Well Station site is located at 4302 E 6th Avenue, Spokane Valley, WA, southeast of the intersection of S Havana Street and E 6th Avenue, which are urban minor arterial and local access streets, respectively. At the Havana Well Station site, Havana Street is the east City of Spokane boundary limit and Havana is also the west City of Spokane Valley boundary limit. At this S Havana Street intersection, E 6th Avenue in the City of Spokane Valley changes to E 5th Avenue on the west side of Havana Street, within the city limits of Spokane. The parcel (number 35232.4114) and does not have a zoning designation. The parcel is 1.24 acres.

A likely delivery route to the Havana Well Station is shown in **Appendix I.** The route is along Havana Street from 3rd Avenue via Interstate 90. This delivery route passes many residential zoned parcels along 3rd Avenue and Havana Street. The portion of the haul route on 6th Avenue is also along residential zoned parcels.

8.1.2 Site Security

The Havana Well Station security infrastructure is under construction.

8.1.3 Pressure Zones Served

The Havana Well Station "A" will serve the Intermediate Pressure Zone, and Station "B" will serve the Low-Pressure Zone.

8.2 Facility Summary – Structural

8.2.1 Description of Structures

Havana was under construction during the time of observation. The building was being constructed with reinforced CMUs. Steel joists were planned to be used for the roof framing.

8.2.2 Building Code Requirements

The building was designed per current codes at the time of observation. The building did not appear to have enough extra space per the plans to include a fluoridation system. This site would require a new fluoridation system to be placed nearby outside the buildings with a new enclosure around it. This new enclosure would need to meet all requirements under the current IBC.

8.3 Future Mechanical Plan

The Havana Well Station is under construction; however, the six borehole-style wells had already been drilled at the time of the assessment visit. Each well will house a vertical turbine pump. Chlorine injection will occur at each pump suction bell similar to the other well stations. The three well pumps that have already been selected as part of the facility construction and will be installed in 2022 or 2023 are shown in **Table 8-1.**

Table 8-1 | Future Havana Pump Summary

Pump No.	Pump Manufacturer	Horsepower	Design Flow (gpm)	Design Head (ft)
1, 2, and 3	TBD			
4, 5, and 6	Floway/Trillium	600	3,750	426

8.4 Future Facility Summary – Electrical

8.4.1 Power Feed and Supply Capacity

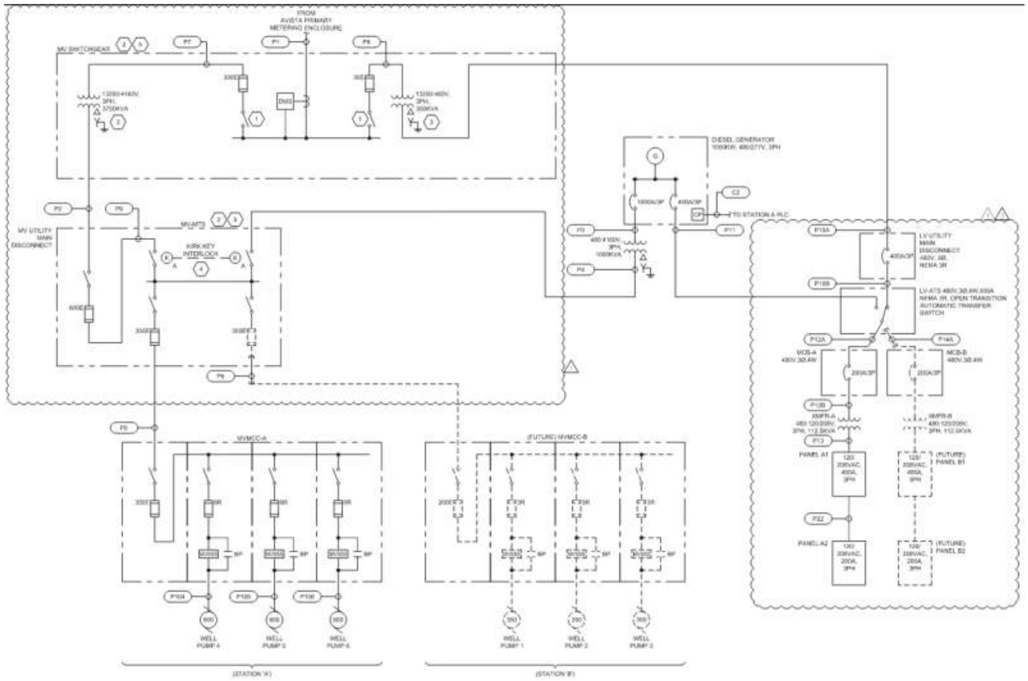
The Havana Well Station is a new facility that was under construction at the time this report was written. It will be comprised of two well buildings named Station A and Station B.

A utility feeder will enter medium voltage switchgear with two feeders. One feeder will be dedicated to pump power and the second feeder will be dedicated to station service. A 3750 kVA transformer will supply power to the pump power feeder at 4160V, and a 300 kVA transformer will supply power to station service at 120/208V 3-phase.

A 1000 kW diesel generator will back up station service as well as up to 1000 kVA to the pump feeder in the event of a power outage.

A one-line diagram of Havana's power distribution is below.

Figure 8-1 | Havana One-Line Diagram



8.4.2 Motor Control Centers (MCC) and Panelboards

Two motor control centers are planned to power six well pumps at Havana. One motor control center will reside in Station A building and will power three 600 horsepower (HP) pumps, and the other motor control station will reside in Station B building and power three 350 HP pumps. All pumps will operate on 4160V.

Five station service panelboards are planned for the Havana Well Station facility. All panels will operate on 120/208V:

1. Panel A1 – Located next to the south entrance of Station A
2. Panel A2 – Located in Station A's Communications Room
3. Panel B1 – Located next to the north entrance of Station B
4. Panel B2 – Location to be determined

Electrical capacity information for each panelboard is shown in **Table 8-2**.

Table 8-2 | Havana Panelboard Information

Havana Panel	Main breaker?	Spare breakers available?	Space available for new breakers?
Panel A1	400A	Yes (10)	No
Panel A2	200A	Yes (7)	No
Panel B1	400A	Yes (11)	No
Panel B2	TBD	TBD	TBD

Based on the design load calcs, Station A has about 200 amps of capacity remaining between Panels A1 and A2, and 150 amps of capacity remaining at Station B.

There appears to be adequate space and capacity to provide breakers for a fluoridation system at this site, but a load study should be performed to ensure the additional load will not exceed the bus rating of the panelboard(s) being used.

8.5 Future Facility Summary – I&C

8.5.1 Existing Hardware and Software Platforms

The design drawings to not specify the hardware platform for Havana's RTU, but if it is going to match most of the other well sites it will have an Allen-Bradley MicroLogix 1100 PLC with a Schneider Electric Magelis HMI, model HMIS5T. Two PLCs are planned for the Havana site: one in Station A and one in Station B.

8.5.2 Telemetry

The design drawings do not specify the method of telemetry Havana Well Station will be using, but if it is going to match the other well sites it will communicate to the MTU at Well Electric Well Station with a 900 MHz radio.

8.5.3 Expansion Options for Additional Monitoring and Controls

The Havana Well Station PLC has the following quantities of spare I/O in its design (see **Table 8-3**):

Table 8-3 | Existing PLC Spare I/O

	Digital Inputs	Digital Outputs	Analog Inputs	Analog Outputs
Havana	15	5	7	0

Appendix

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APPENDIX A

Electrical Assessment Matrix

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Spokane Fluoridation Study Electrical Site Assessment Matrix

	Voltage	Main Breaker	Spare Breakers?	Breaker Spaces?	Arc Flash Sticker?	Notes
Well Electric						
Pump Voltage	2400					
Station Service Transformer						2400/4160Y:120/208
On-Site Generator	240					
Heater (sub)Panel	120/240	no	no	space available for three breakers	no	
W.E. Panel 3	120/240	size unknown, looks like 100 amp	maybe circuit 14	no space available	no	
UPS and Batt. Charger Subpanel	120/240	none	no	6	no	
Well Elect. Panel 2	120/240	100 amp	maybe circuits 13, 14	no space available	no	
Pump MCC Panel A	240 only	no	yes	no (but lots of spares)	no	
Well Elect. Panel 1	120/240	size unknown, looks like 100 amp	yes	yes, in subpanel above	no	
Generator Panel	120/240	60 amp	no	yes, but can't be used	no	Feeds server room equipment, do not use
"208V High Lag"	120/240, but panel says 208 V	no	yes	plenty	no	Feeds 220V heaters, offices
Parkwater						
Pump Voltage	2400					
Fed from Well Electric Substation						Transformers mounted on roof of chlorine room
3 Phase 208 Volt Panel A	120/208	no, bus is 200a rated	yes	no	no	3-ph 4-wire
Panel B	240	yes, 200a, bus is 200a rated	no	no	no	feeds unit heaters
Lighting Panel	120/208	no, bus is 100a rated	yes	no	no	
Grace						
Pump Voltage	4160					
Station Panel	120/208	yes, 100a, bus is 200a rated	one spare 20a	no	yes	Two gray 2000 kva for grace and nevada each, green 1500 kva for nevada
Nevada						
Pump Voltage	2400					
Station Panel	120/208	yes, bus is 100a rated	yes, 15a and 20a	yes, 4	yes	
Station AC Panel Nevada	120/208	yes, 200a, bus rating not shown	maybe (two turned off)	plenty	yes	Feeds ac units and outlet
Central						
Pump Voltage	2400					
Main Building Panelboard P1	120/240	yes, 400a, bus is 300a rated (?)	20a 208	10	no	Station service appears to be fed from overhead transformer
East Building Panel "P3"	120/240	yes, 90a, 125a bus rating	plenty	28	no	
West Building Panel "P2"	120/240	yes, 90a, 90a bus rating	two spares	9	no	
Hoffman						
Pump Voltage	2400					
Station Service Panel	120/208	yes, 200a	plenty	4	yes	Transformer in fenced yard, to be replaced with new transformer
Station Lighting Panel	120/208		(1) 15A, (2) 20A	no	yes	
Ray						
Pump Voltage	2400					Transformer in fenced backyard, plenty of yard
Lighting Panel	120/208	yes, 100a	no	no	yes	RTU fed from here
Main Panelboard	120/208	yes, 175a	yes	plenty	yes	RTU circuits here too

Spokane Fluoridation Study Electrical Site Assessment Matrix

	PLC Type	Empty I/O slots available	Spare DI Available	Spare DO Available	Spare AI available	Notes
Well Electric						
Well Pump PLC	MicroLogix 1100	2	4	6	2	
Chlorination PLC	MicroLogix 1100	3	5	6	3	
Anticipated quantity of fluoridation I/O			**12**	**8**	**4**	
Parkwater						
Parkwater PLC	SLC 5/05	2	2	0	18	
Anticipated quantity of fluoridation I/O			**20**	**12**	**4**	
Grace						
Grace PLC	Micrologix 1100	1	1	2	7	
Anticipated quantity of fluoridation I/O			**8**	**12**	**4**	
Nevada						
Nevada PLC	Micrologix 1100	1	13	0	3	
Anticipated quantity of fluoridation I/O			**12**	**8**	**4**	
Central						
Central PLC	Micrologix 1100	0	12	2	0	
Anticipated quantity of fluoridation I/O			**8**	**6**	**4**	
Hoffman						
Hoffman PLC	Micrologix 1100	2	0	2	0	
Anticipated quantity of fluoridation I/O			**8**	**6**	**4**	
Ray						
Ray PLC	Micrologix 1100	0	14	0	1	
Anticipated quantity of fluoridation I/O			**10**	**7**	**4**	

LEGEND:

2400/4160	Existing spare I/O cannot accommodate, but spare slots may.
	No capacity available. Second PLC likely required.
	Capacity available.

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APPENDIX B

Well Electric Well Station Figures

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Well Electric Well Station Photos

Chlorine Room Entrance

East Exterior of Well Building

Gaseous Chlorine Tanks

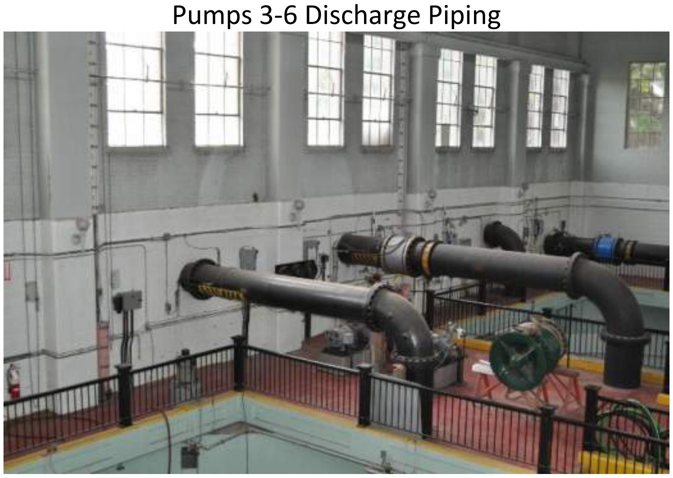
Monitoring Sample Point, Pump 1

Well Electric Well Station Photos

North Hill Pressure Zone Flow Meter Vault

Well 4

Pumps 3-6 Discharge Piping



West Exterior of Well Building

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SCALE IN FEET

PLAN
SCALE: 1"=20'

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NOTICE
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DESIGNED
EJJ/DKH
DRAWN
KLW
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CITY OF SPOKANE

SPOKANE FLUORIDATION STUDY

WELL ELECTRIC WELL WELL STATION SITE PLAN

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: JULY 2022

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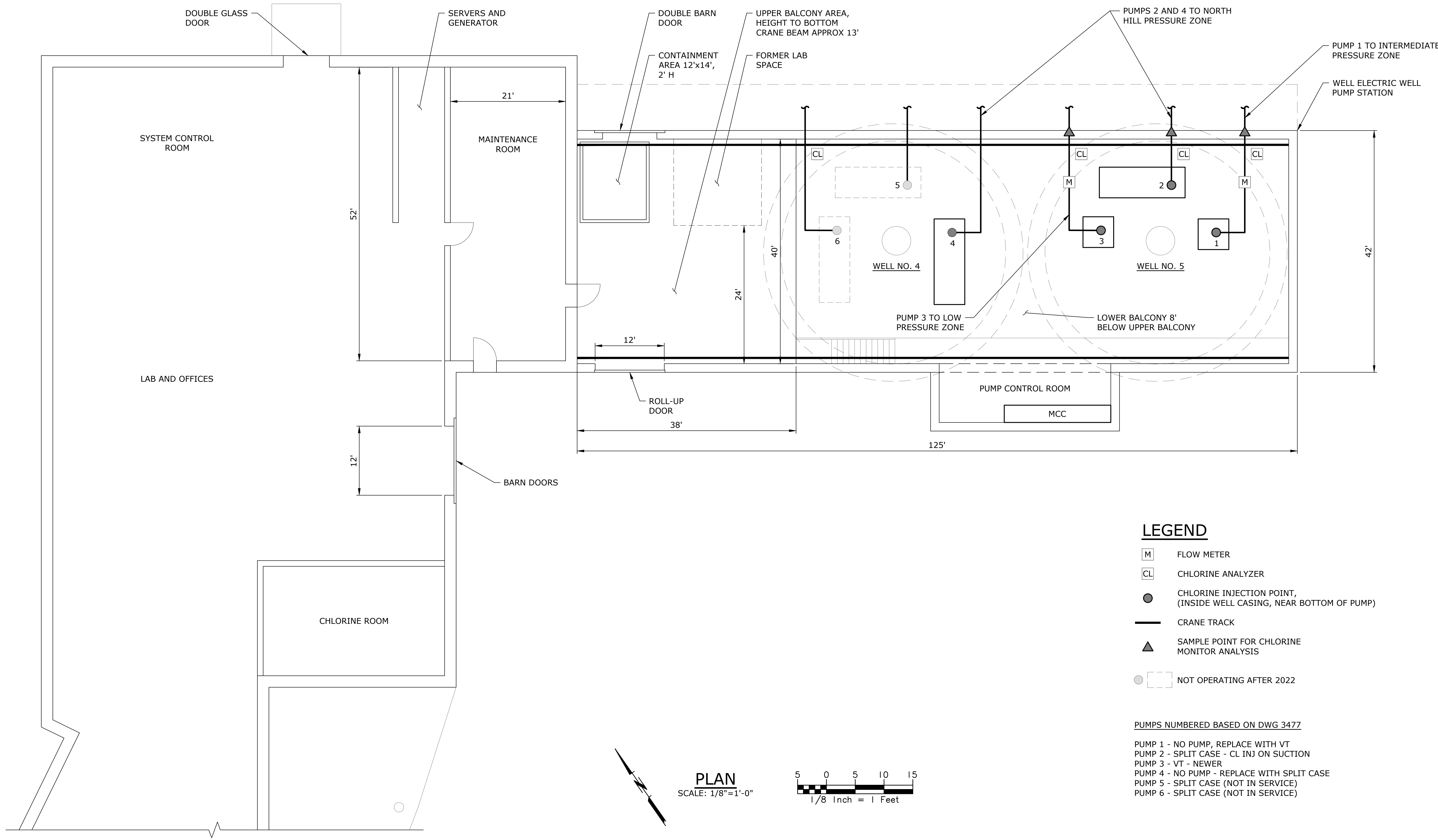

LEGEND

- M FLOW METER
- CL CHLORINE ANALYZER
- CHLORINE INJECTION POINT, (INSIDE WELL CASING, NEAR BOTTOM OF PUMP)
- CRANE TRACK
- SAMPLE POINT FOR CHLORINE MONITOR ANALYSIS
- NOT OPERATING AFTER 2022

PUMPS NUMBERED BASED ON DWG 3477

PUMP 1 - NO PUMP, REPLACE WITH VT
PUMP 2 - SPLIT CASE - CL INJ ON SUCTION
PUMP 3 - VT - NEWER
PUMP 4 - NO PUMP - REPLACE WITH SPLIT CASE
PUMP 5 - SPLIT CASE (NOT IN SERVICE)
PUMP 6 - SPLIT CASE (NOT IN SERVICE)

PLAN

SCALE: 1/8"=1'-0"

5 0 5 10 15
1/8 Inch = 1 Feet

NO.	DATE	BY	REVISION

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SPOKANE FLUORIDATION STUDY

WELL ELECTRIC WELL
WELL STATION BUILDING PLAN LAYOUT

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: JULY 2022

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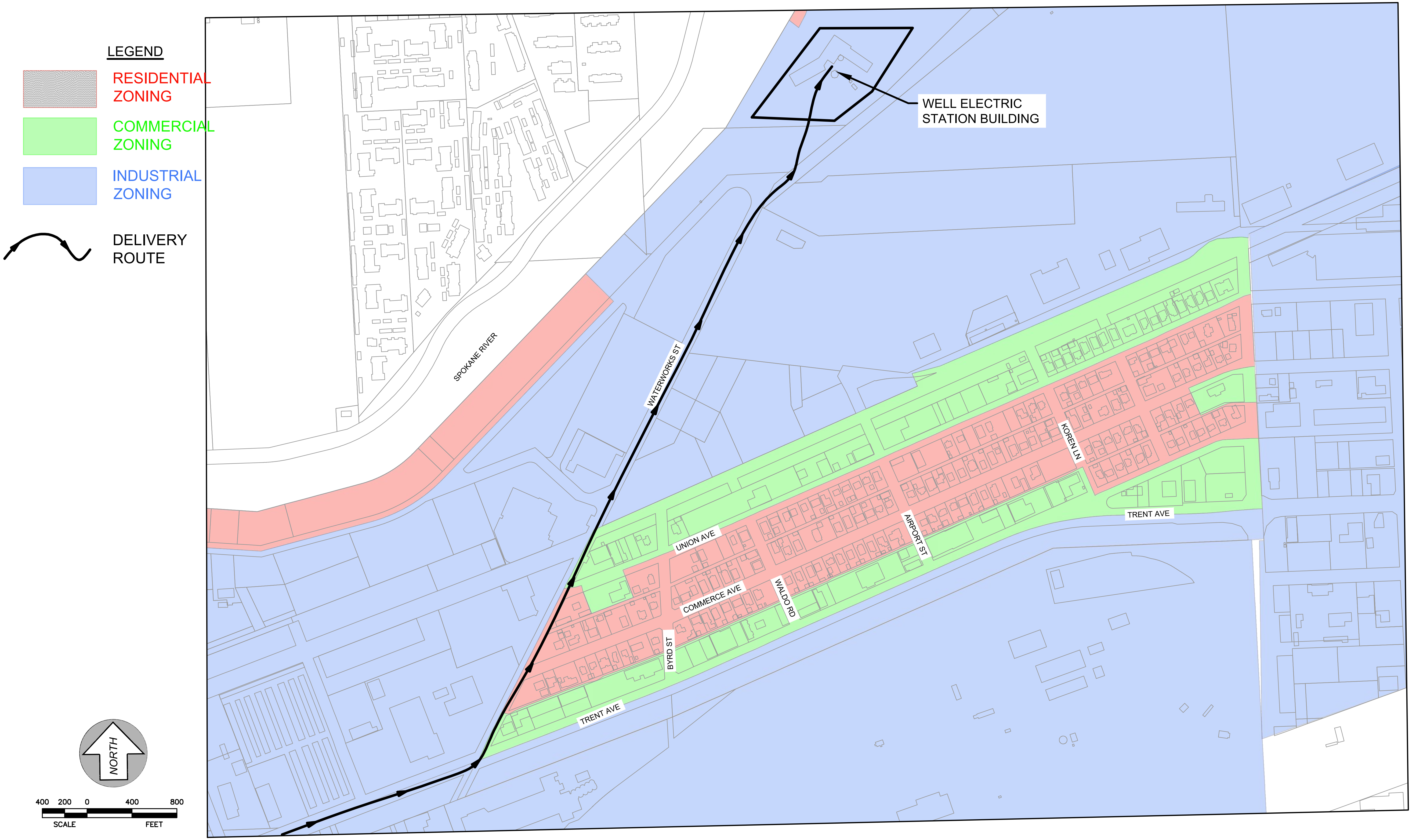

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SPOKANE FLUORIDATION STUDY

WELL ELECTRIC SITE DELIVERY ROUTE

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APPENDIX C

Parkwater Well Station Figures

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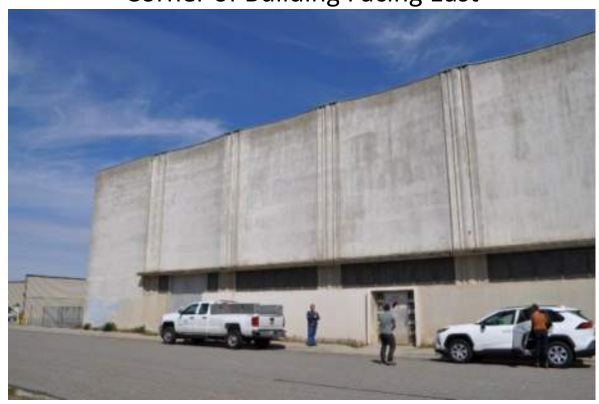
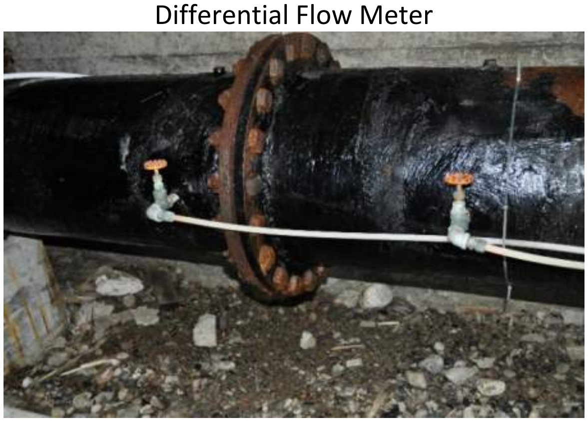
Parkwater Well Station Photos

1 Ton Chlorine Cylinder

Corner of Building Facing East



Differential Flow Meter



Exterior West

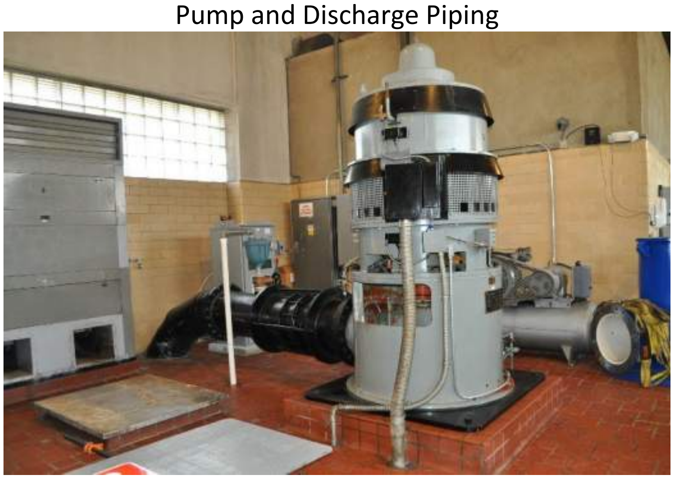
Parkwater Well Station Photos

Parkwater Chlorine Monitor

Front Gate

Corner of Building

Pump and Discharge Piping



LEGEND

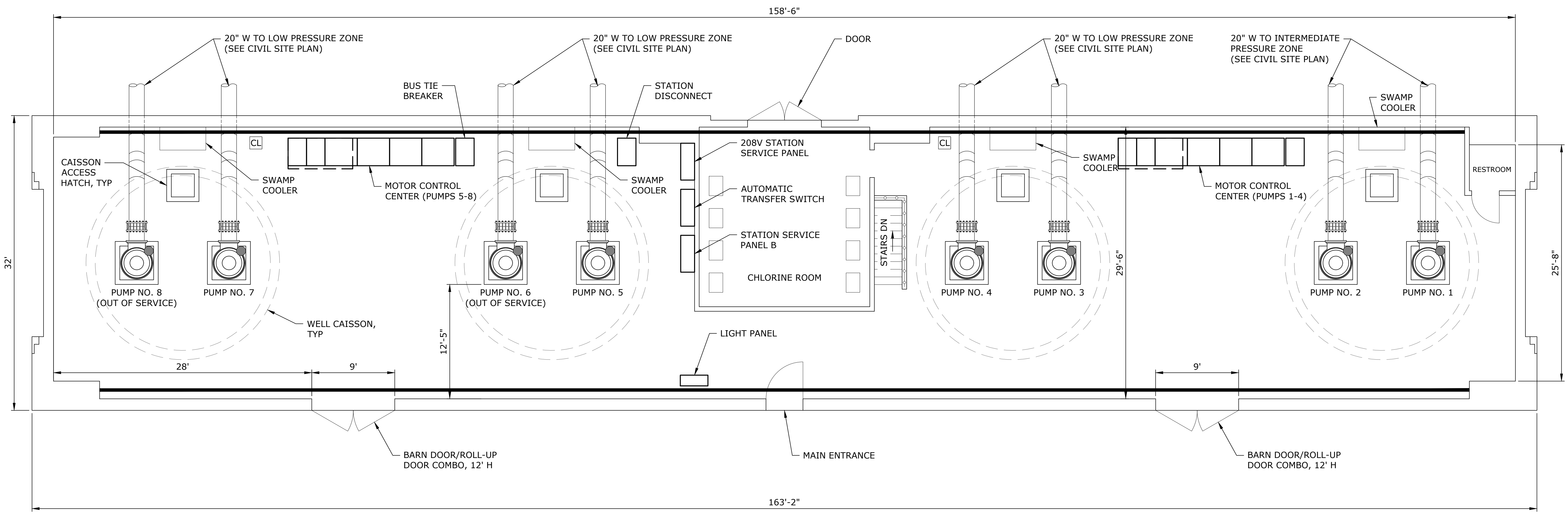
CL CHLORINE ANALYZER

● CHLORINE INJECTION POINT, (INSIDE WELL CASING, NEAR BOTTOM OF PUMP)

▬ CRANE TRACK

NOTE:

1. DISTANCE BETWEEN FINISHED FLOOR OF PUMP LEVEL AND BOTTOM OF CRANE BEAM APPROXIMATELY 24'.



PLAN

SCALE: 3/16"=1'-0"

1 0 5 10 15

3/16 Inch = 1 Feet

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CITY OF SPOKANE

SPOKANE FLUORIDATION STUDY

PARKWATER WELL

WELL STATION BUILDING LAYOUT PLAN

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: JULY 2022

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LEGEND

- M — FLOW METER
- CL — CHLORINE ANALYZER, (SEE BUILDING PLAN)
- ● — CHLORINE INJECTION POINT, (SEE BUILDING PLAN)
- ▲ — SAMPLE POINT FOR CHLORINE MONITOR ANALYSIS
- ○ — APPROX LOCATION OF WELL PUMP

20 10 0 20 40

SCALE IN FEET

PLAN

SCALE: 1"=20'

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CITY OF SPOKANE

SPOKANE FLUORIDATION STUDY

PARKWATER WELL
WELL STATION SITE PLAN

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: JULY 2022

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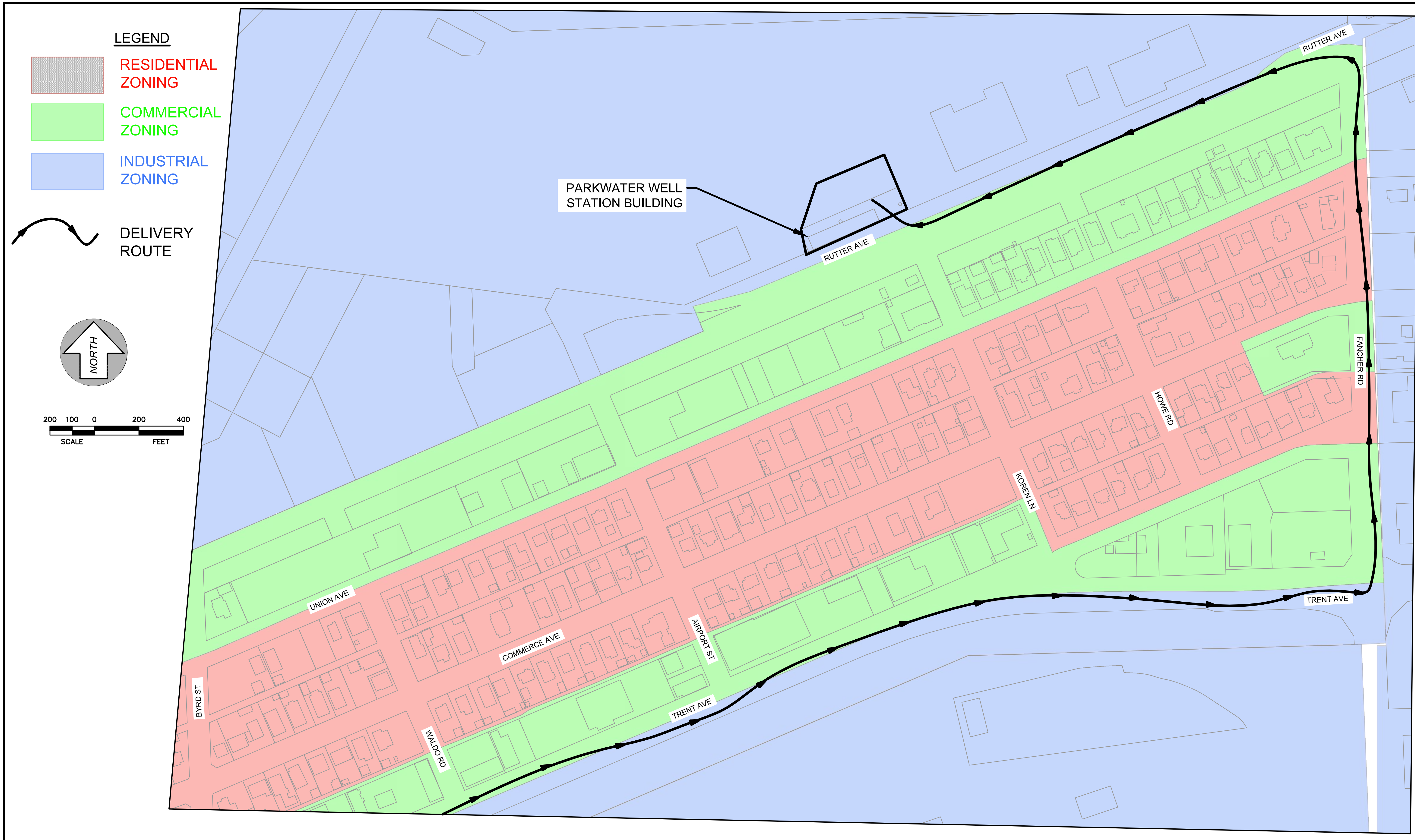

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SPOKANE FLUORIDATION STUDY

PARKWATER WELL SITE DELIVERY ROUTE

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APPENDIX D

Ray Street Well Station Figures

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Ray Street Well Station Photos

Chlorine Analyzer

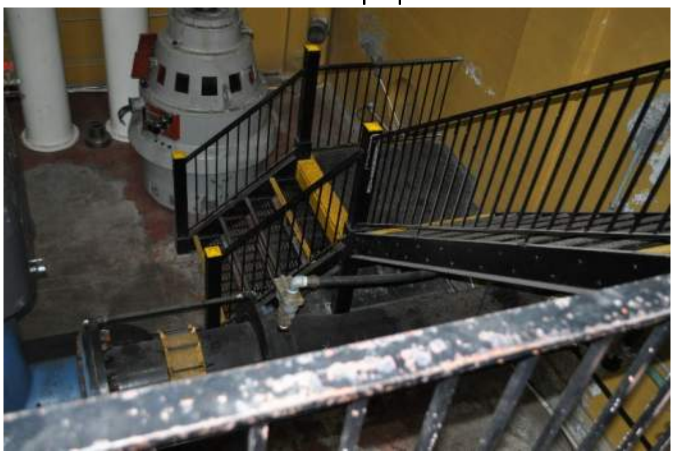
Chlorine Room

Flow Meter

Roll Up Door

Ray Street Well Station Photos

Future Pump Space



Pump 1

Pump Discharge

20 10 0 20 40
SCALE IN FEET

PLAN
SCALE: 1"=20'

LEGEND

- M — FLOW METER
- CL — CHLORINE ANALYZER, (SEE BUILDING PLAN)
- ● — CHLORINE INJECTION POINT, (SEE BUILDING PLAN)
- ▲ — SAMPLE POINT FOR CHLORINE MONITOR ANALYSIS
- ○ — APPROX LOCATION OF WELL PUMP

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SPOKANE FLUORIDATION STUDY

RAY STREET WELL
WELL STATION SITE PLAN

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: JULY 2022

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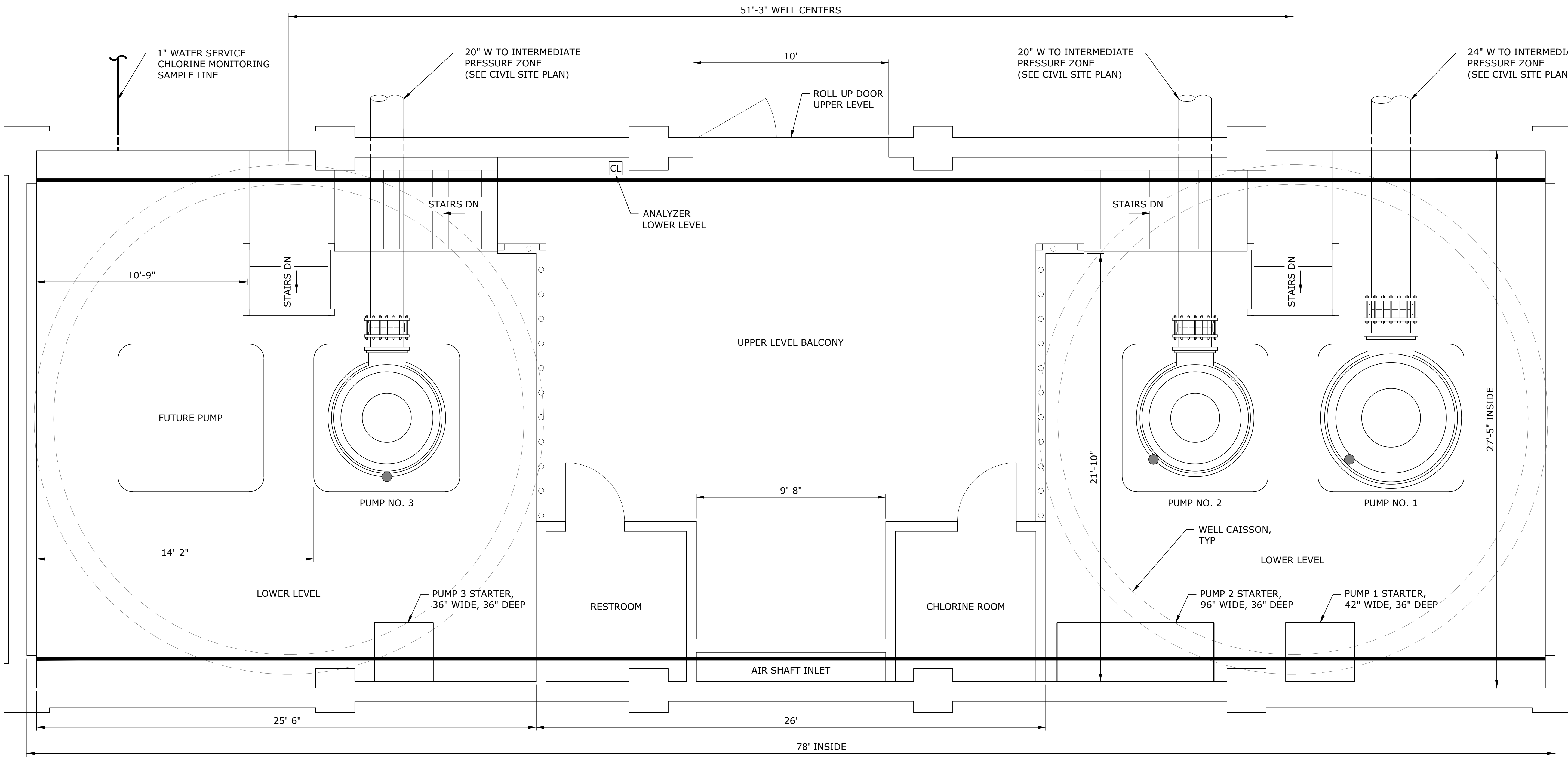

LEGEND

- M FLOW METER
- CL CHLORINE ANALYZER
- ● CHLORINE INJECTION POINT, (INSIDE WELL CASING, NEAR BOTTOM OF PUMP)
- ▬ CRANE TRACK

NOTE:

DISTANCE BETWEEN FINISHED FLOOR OF PUMP LEVEL AND BOTTOM OF CRANE BEAM IS 30'. DISTANCE FROM FINISHED FLOW OF GROUND LEVEL TO BOTTOM OF CRANE BEAM IS 20'.

N

PLAN

SCALE: 3/8"=1'-0"

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3/8 Inch = 1 Feet

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SPOKANE FLUORIDATION STUDY

RAY STREET WELL
WELL STATION BUILDING LAYOUT PLAN

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: JULY 2022

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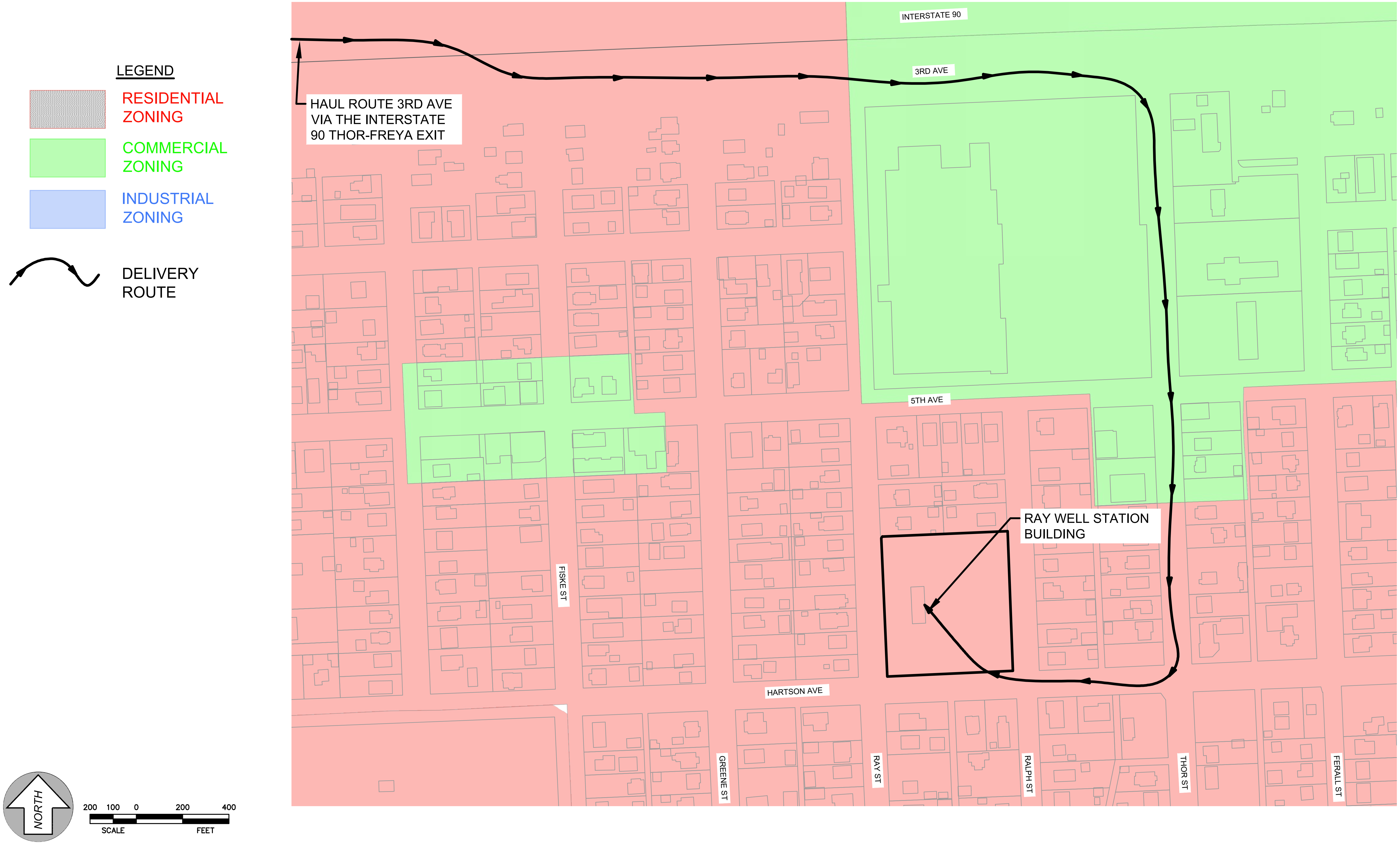

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SPOKANE FLUORIDATION STUDY

RAY WELL SITE DELIVERY ROUTE

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APPENDIX E

Central Avenue Well Station Figures

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Central Avenue Well Station Photos

Control Building and Well 2 Building Exterior

Fenced Power Area

Well 1 Exterior

Well 1 Piping in Building

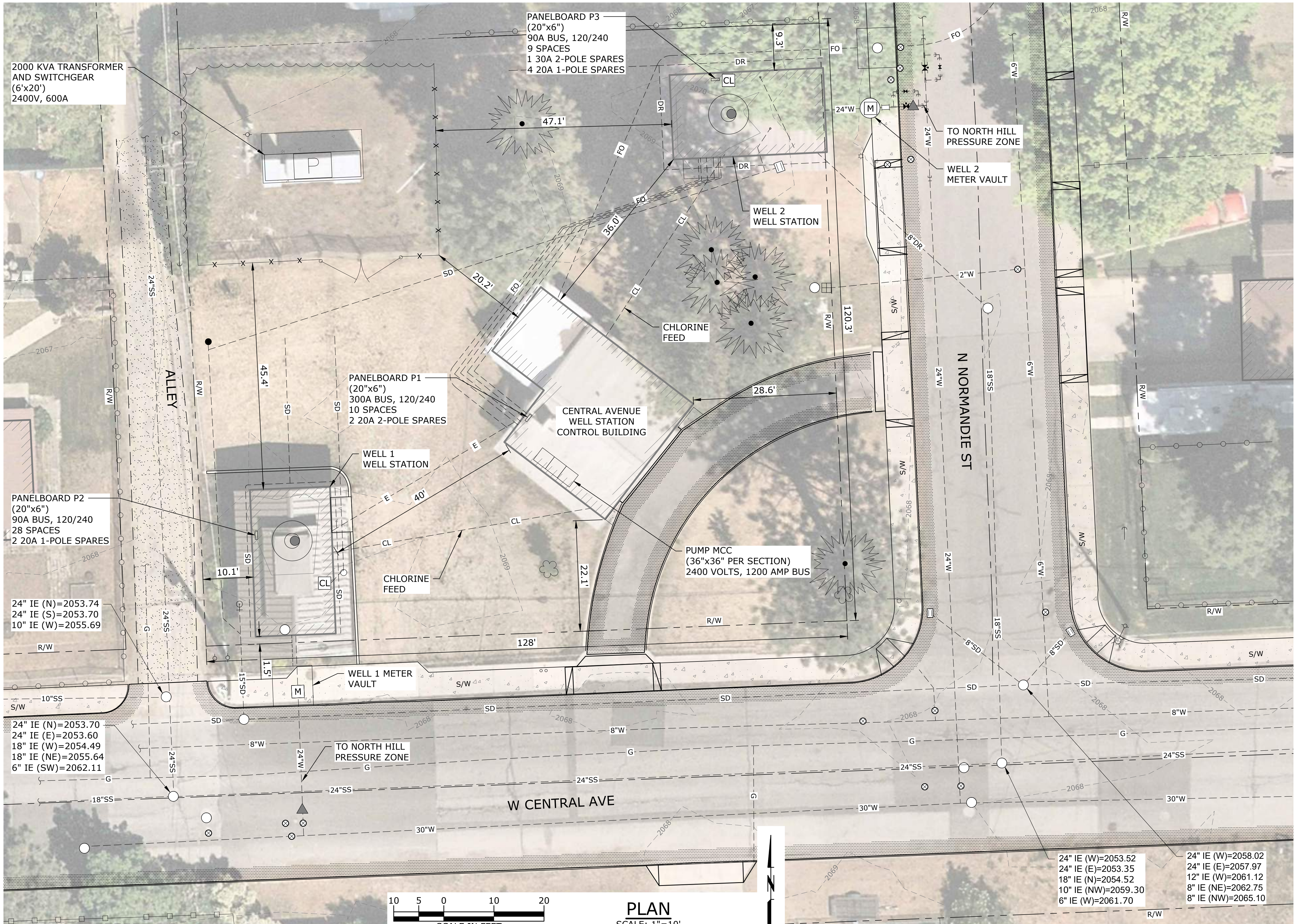
Central Avenue Well Station Photos

Well 1 Chlorine Analyzer

Well 1 Meter Vault

Well 1 Pump Motor

Well 1 Sample Tap



PLAN
SCALE: 1"=10'

LEGEND

- M FLOW METER
- CL CHLORINE ANALYZER, (SEE BUILDING PLAN)
- ● CHLORINE INJECTION POINT, (SEE BUILDING PLAN)
- ▲ SAMPLE POINT FOR CHLORINE MONITOR ANALYSIS
- ○ APPROX LOCATION OF WELL PUMP

NO.	DATE	BY	REVISION

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SPOKANE FLUORIDATION STUDY

CENTRAL AVE WELL
WELL STATION SITE PLAN

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: JULY 2022

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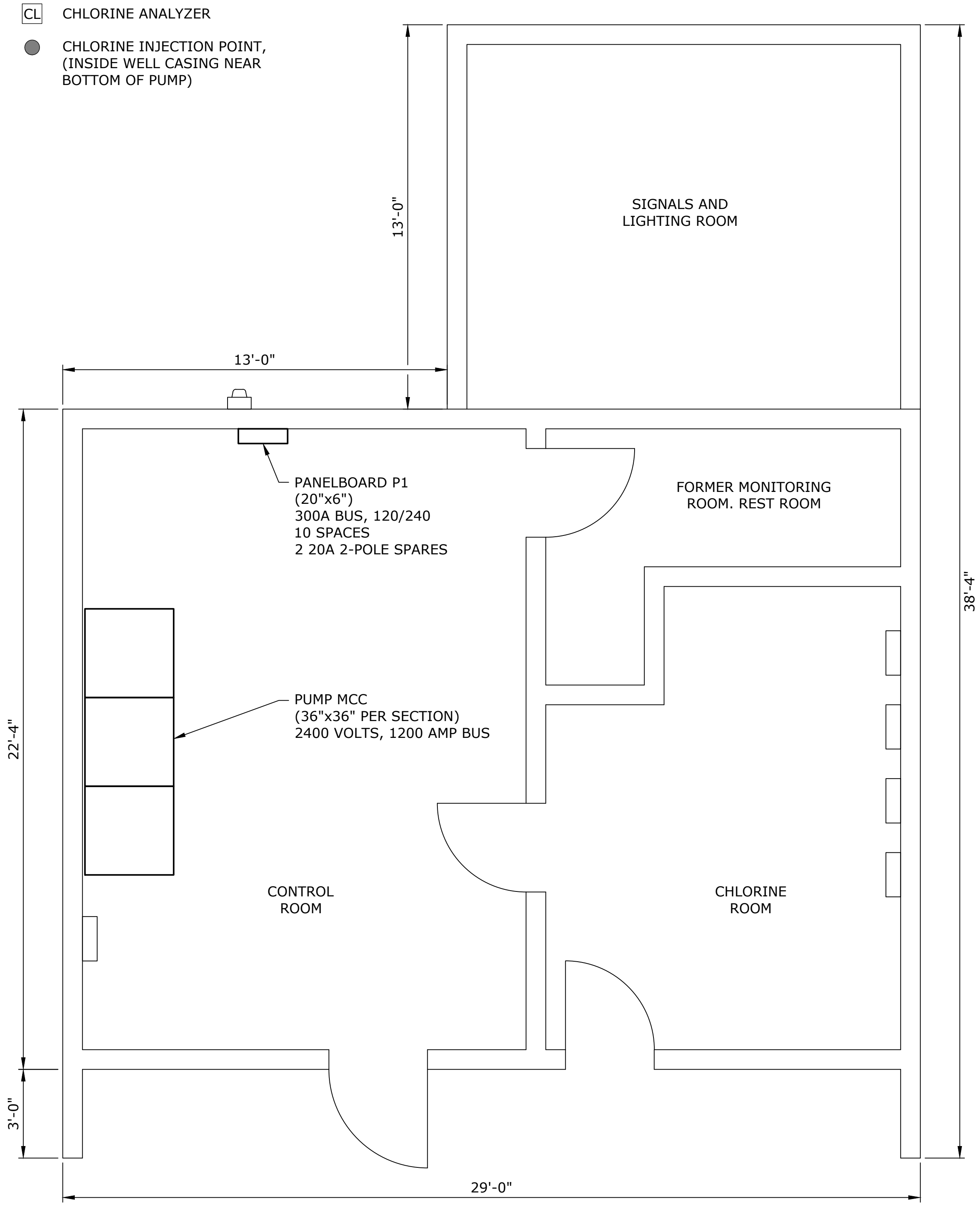
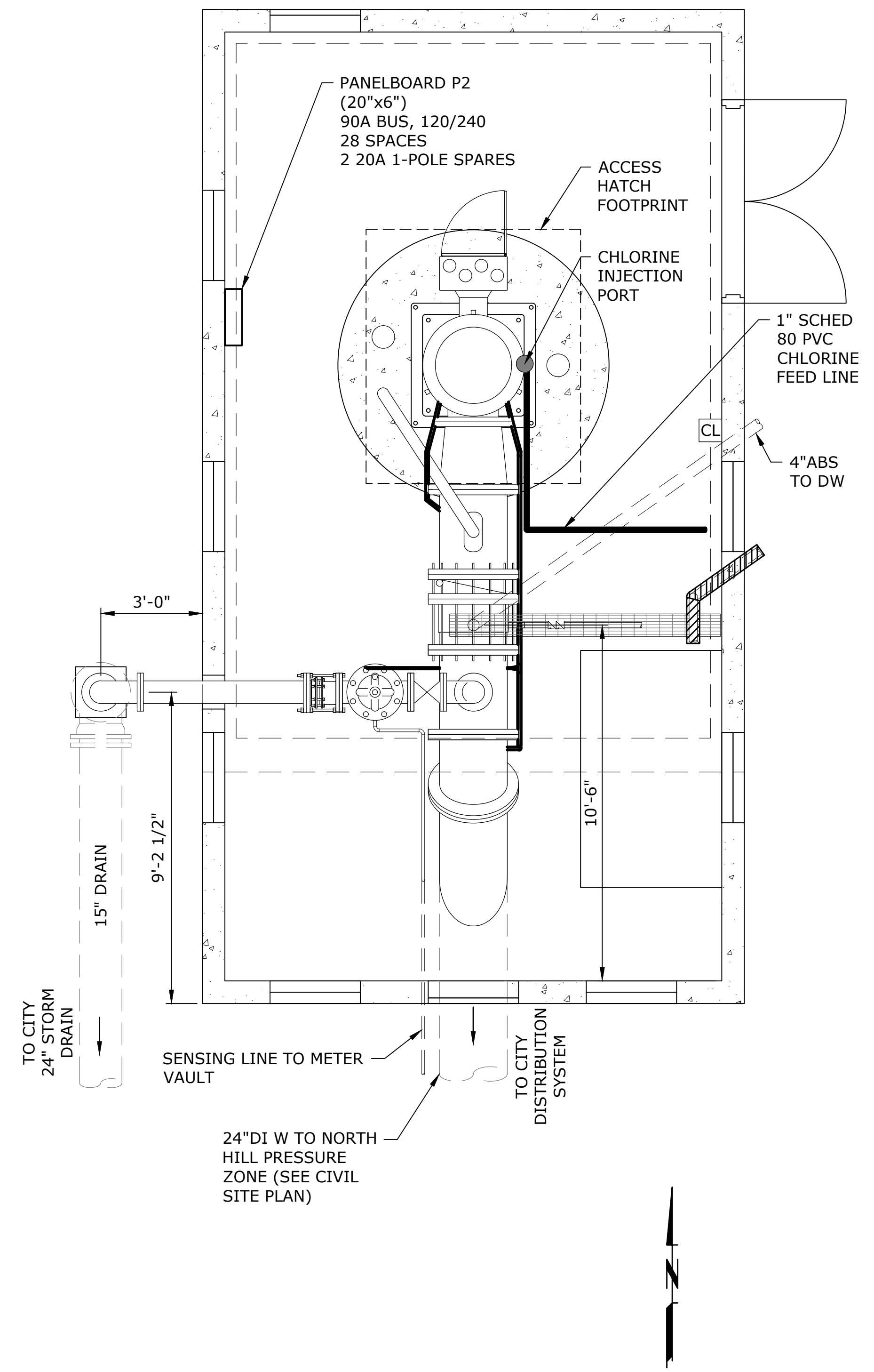
LEGEND

- CL — CHLORINE ANALYZER
- ● — CHLORINE INJECTION POINT, (INSIDE WELL CASING NEAR BOTTOM OF PUMP)



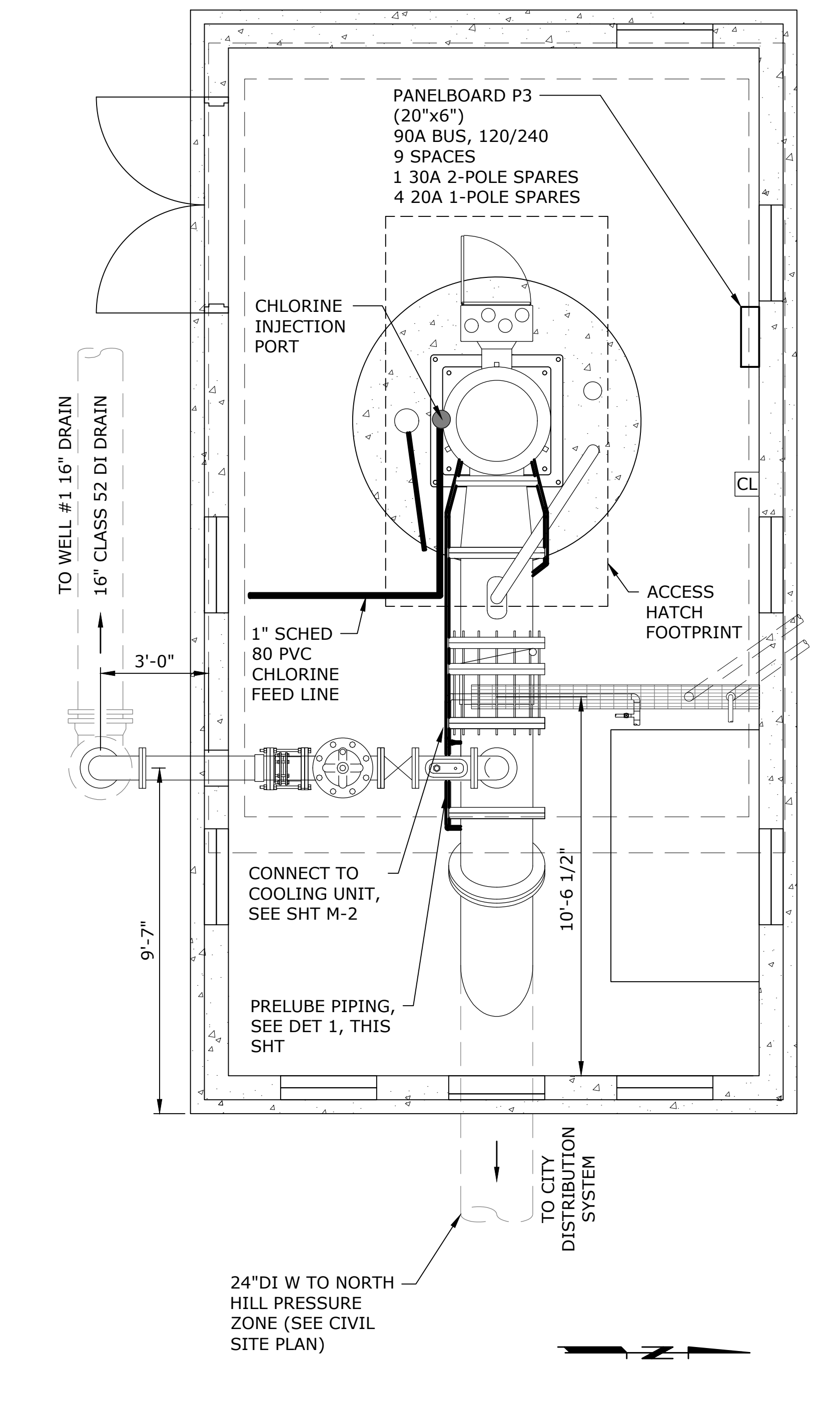
CENTRAL AVENUE WELL CONTROL BUILDING

SCALE: 3/8"=1'



CENTRAL AVENUE WELL 1 - WELL HOUSE PLAN

SCALE: 3/8"=1'



CENTRAL AVENUE WELL 2 - WELL HOUSE PLAN

SCALE: 3/8"=1'

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CITY OF SPOKANE

SPOKANE FLUORIDATION STUDY

CENTRAL AVE WELL
WELL STATION AND CONTROL
BUILDING LAYOUT PLANS

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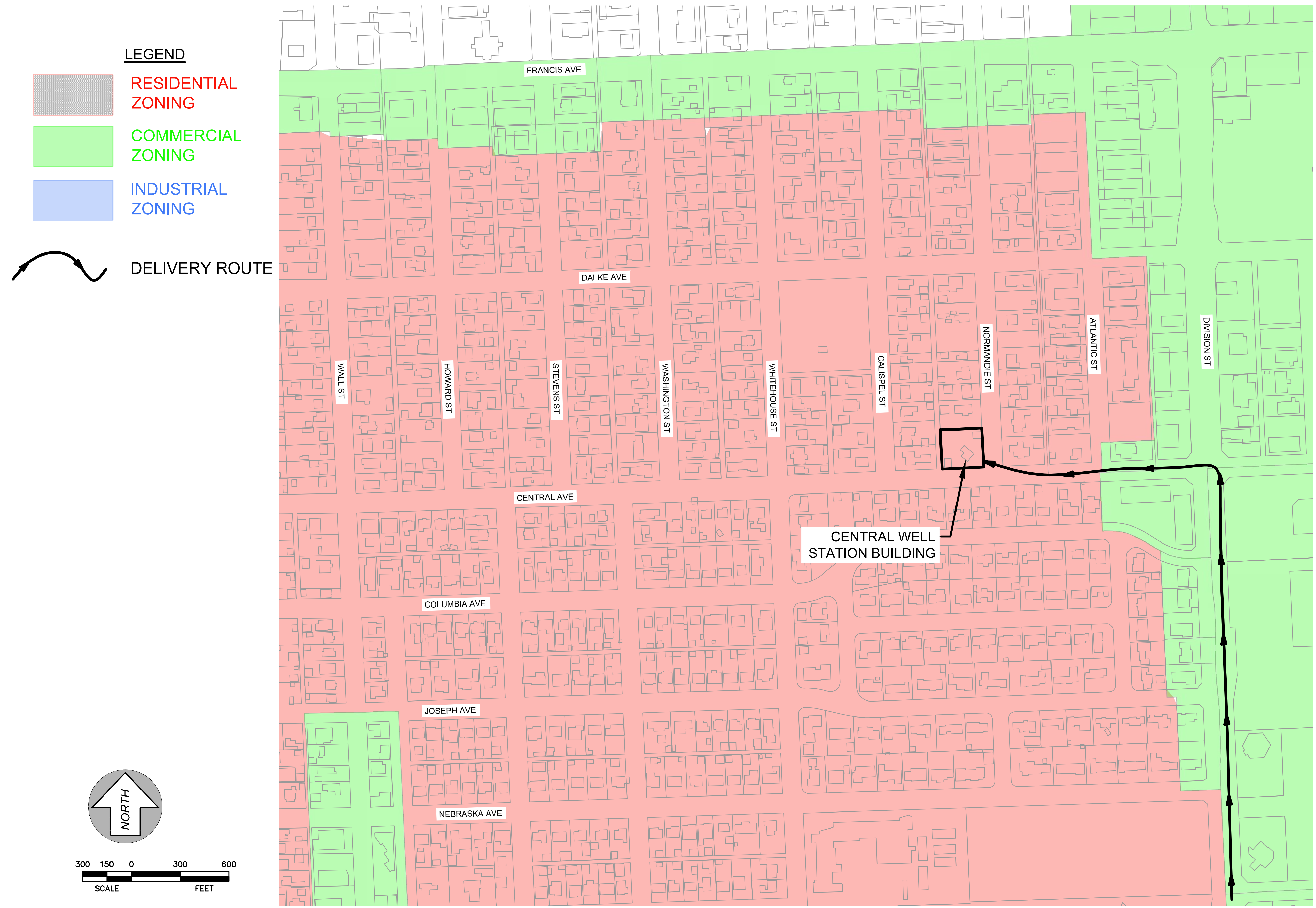

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SPOKANE FLUORIDATION STUDY

CENTRAL WELL SITE DELIVERY ROUTE

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APPENDIX F

Grace Well Station Figures

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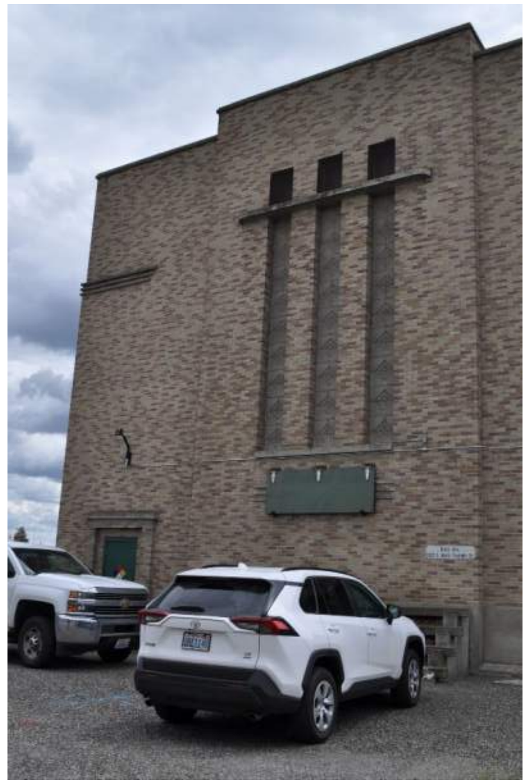
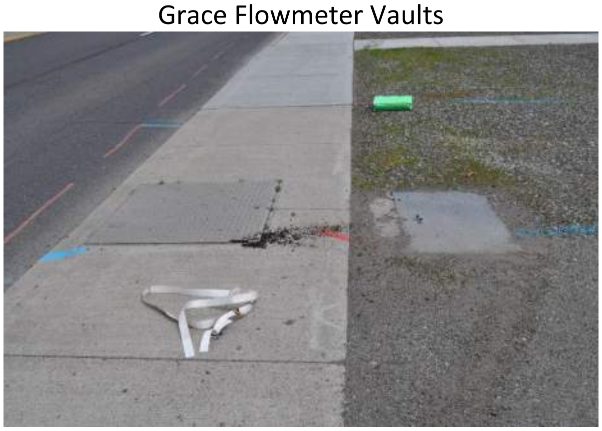
Grace Well Station Photos

Grace Exterior



Grace Chlorine Analyzer

Grace Flowmeter Vaults

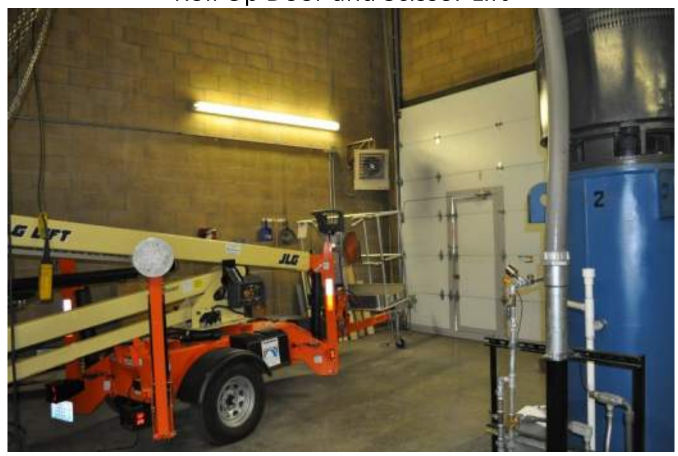


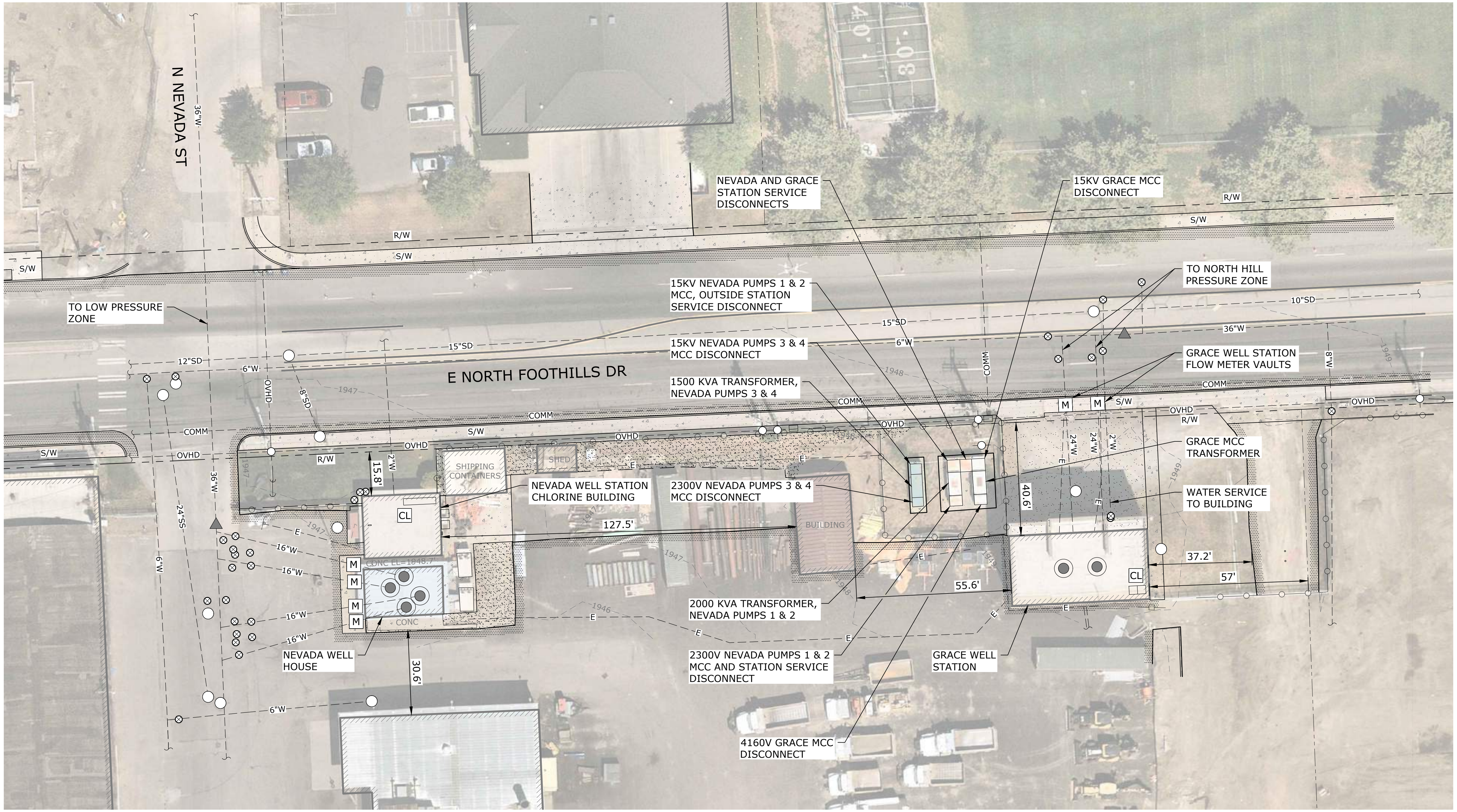
Grace Flowmeter

Grace Well Station Photos

Pump and Pipe Discharge

Roll Up Door and Scissor Lift





LEGEND

- M FLOW METER
- CL CHLORINE ANALYZER, (SEE BUILDING PLAN)
- CHLORINE INJECTION POINT, (SEE BUILDING PLAN)
- SAMPLE POINT FOR CHLORINE MONITOR ANALYSIS
- APPROX LOCATION OF WELL PUMP

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SCALE IN FEET

PLAN
SCALE: 1"=20'

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CITY OF SPOKANE

SPOKANE FLUORIDATION STUDY

GRACE AND NEVADA WELLS
WELL STATION SITE PLAN

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: JULY 2022

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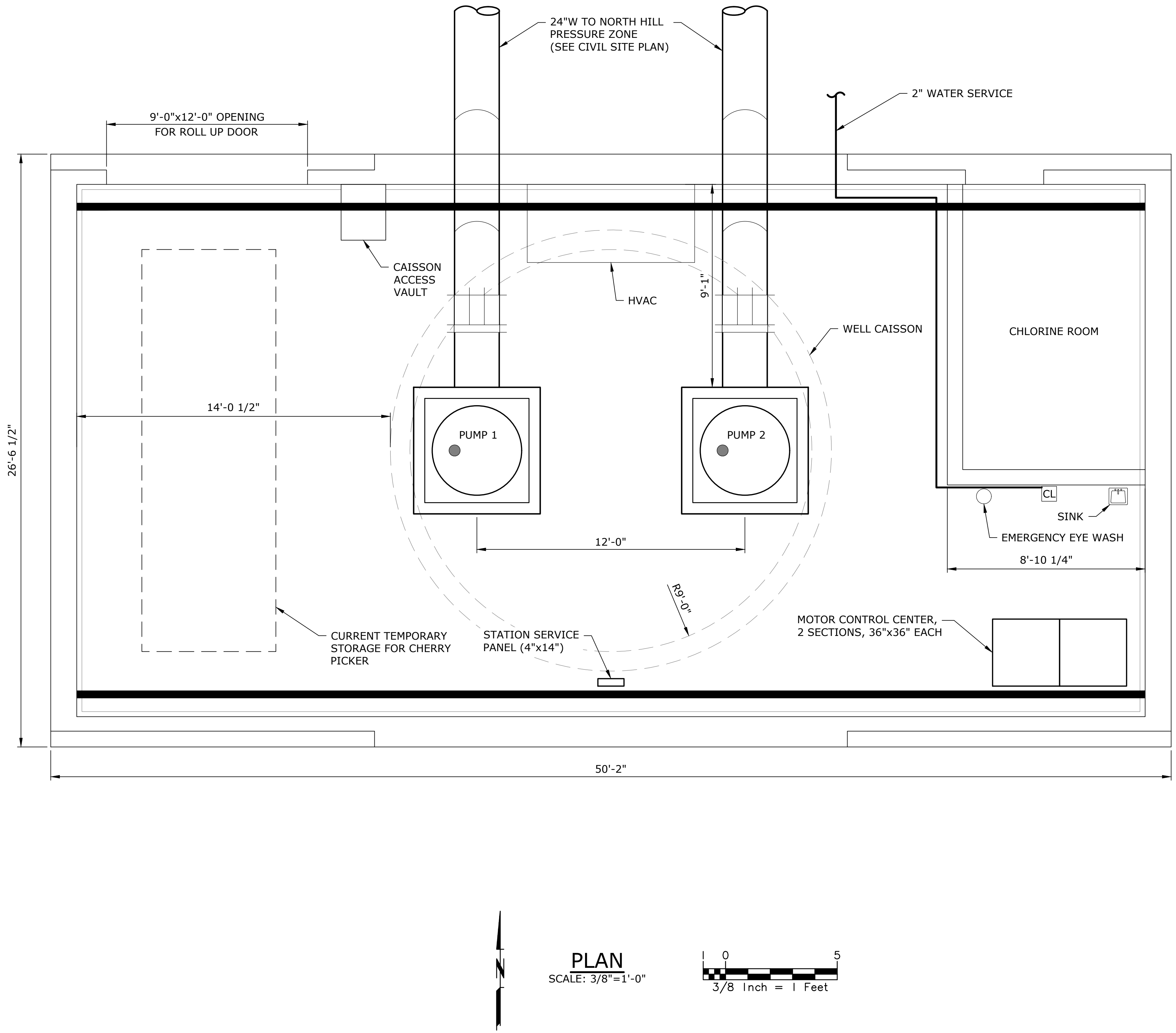

LEGEND

- CL — CHLORINE ANALYZER
- ● — CHLORINE INJECTION POINT, (INSIDE WELL CASING, NEAR BOTTOM OF PUMP)
- ▬ — CRANE TRACK

NOTE:

DISTANCE BETWEEN FINISHED FLOOR AND BOTTOM OF CRANE BEAM IS 25'-6"

PLAN

SCALE: 3/8"=1'-0"

0 5

3/8 Inch = 1 Feet

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CITY OF SPOKANE

SPOKANE FLUORIDATION STUDY

GRACE WELL
WELL STATION BUILDING LAYOUT PLAN

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: JULY 2022

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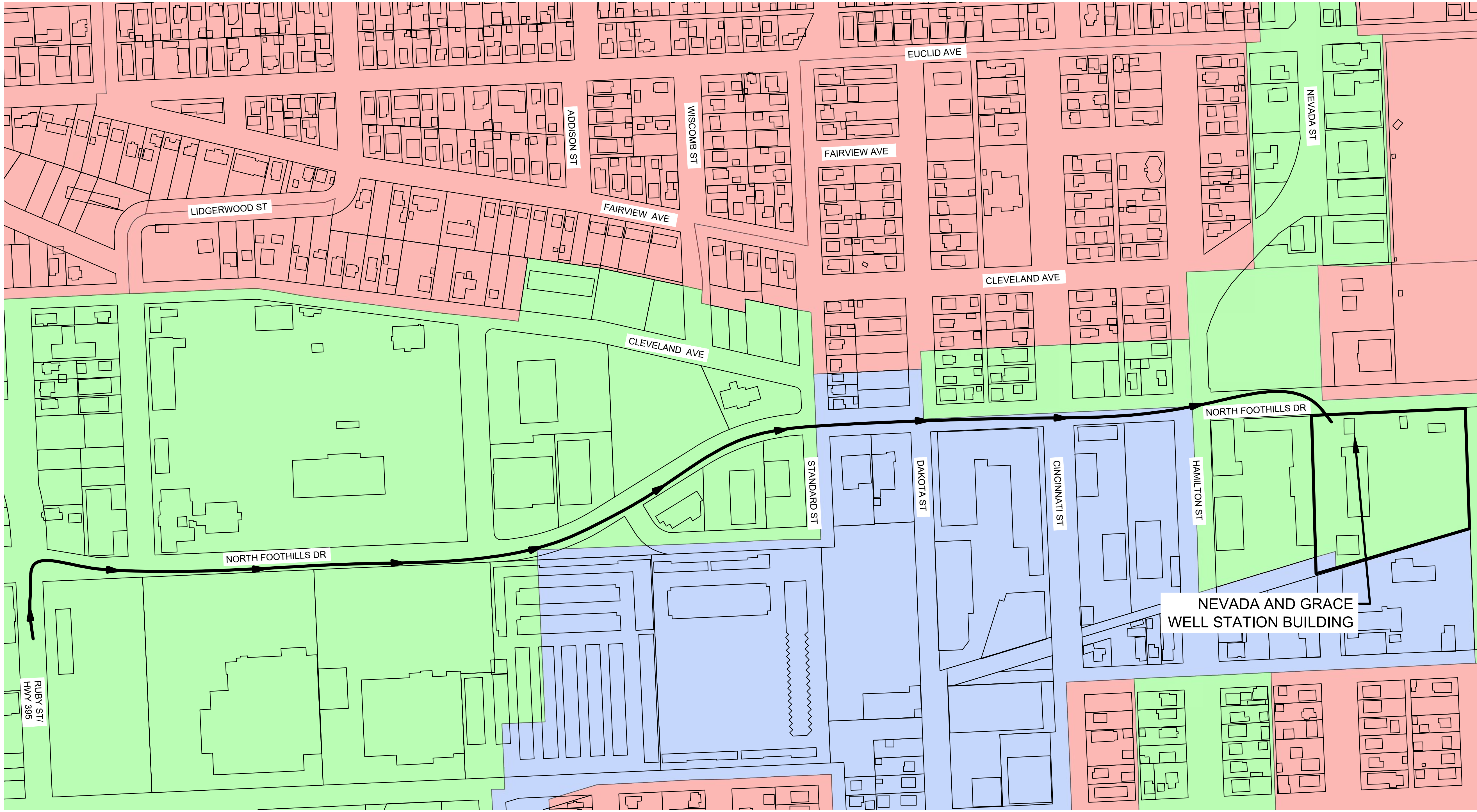

NORTH

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SCALE FEET

LEGEND

RESIDENTIAL ZONING

INDUSTRIAL ZONING

COMMERCIAL ZONING

DELIVERY ROUTE

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SPOKANE FLUORIDATION STUDY

NEVADA AND GRACE WELL SITE DELIVERY ROUTE

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APPENDIX G

Nevada Well Station Figures

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Nevada Well Station Photos

Between Sites Facing East

Nevada Flow Meter Tunnel

Nevada Pump Station and Chlorine Building Exterior

Nevada Pumps and Piping

Nevada Well Station Photos

Nevada Turbidity and Chlorine Analyzer

Piping Storage Area

Submersible Piping

LEGEND

- M FLOW METER
- CL CHLORINE ANALYZER, (SEE BUILDING PLAN)
- ● CHLORINE INJECTION POINT, (SEE BUILDING PLAN)
- ▲ SAMPLE POINT FOR CHLORINE MONITOR ANALYSIS
- ○ APPROX LOCATION OF WELL PUMP

20 10 0 20 40
SCALE IN FEET

PLAN
SCALE: 1"=20'

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

EKW
DESIGNED
EJJ/DKH
DRAWN
KLW
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CITY OF SPOKANE

SPOKANE FLUORIDATION STUDY

PARKWATER WELL
WELL STATION SITE PLAN

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: JULY 2022

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LEGEND

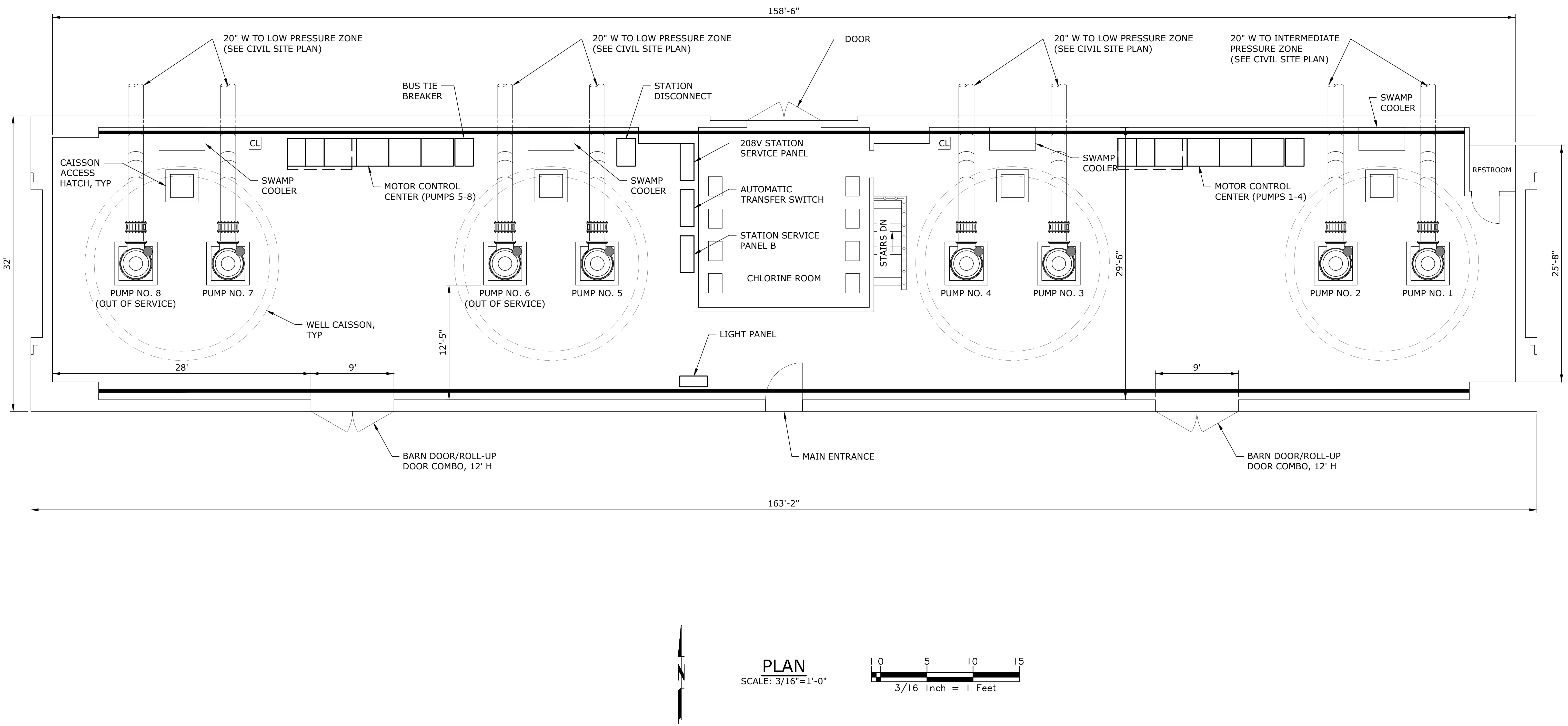
CL CHLORINE ANALYZER

CHLORINE INJECTION POINT, (INSIDE WELL CASING, NEAR BOTTOM OF PUMP)

CRANE TRACK

NOTE:

1. DISTANCE BETWEEN FINISHED FLOOR OF PUMP LEVEL AND BOTTOM OF CRANE BEAM APPROXIMATELY 24'.



PLAN

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3/16 Inch = 1 Feet

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DKH DRAWN

KLW CHECKED

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CITY OF SPOKANE

SPOKANE FLUORIDATION STUDY

PARKWATER WELL

WELL STATION BUILDING LAYOUT PLAN

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: JULY 2022

SHEET

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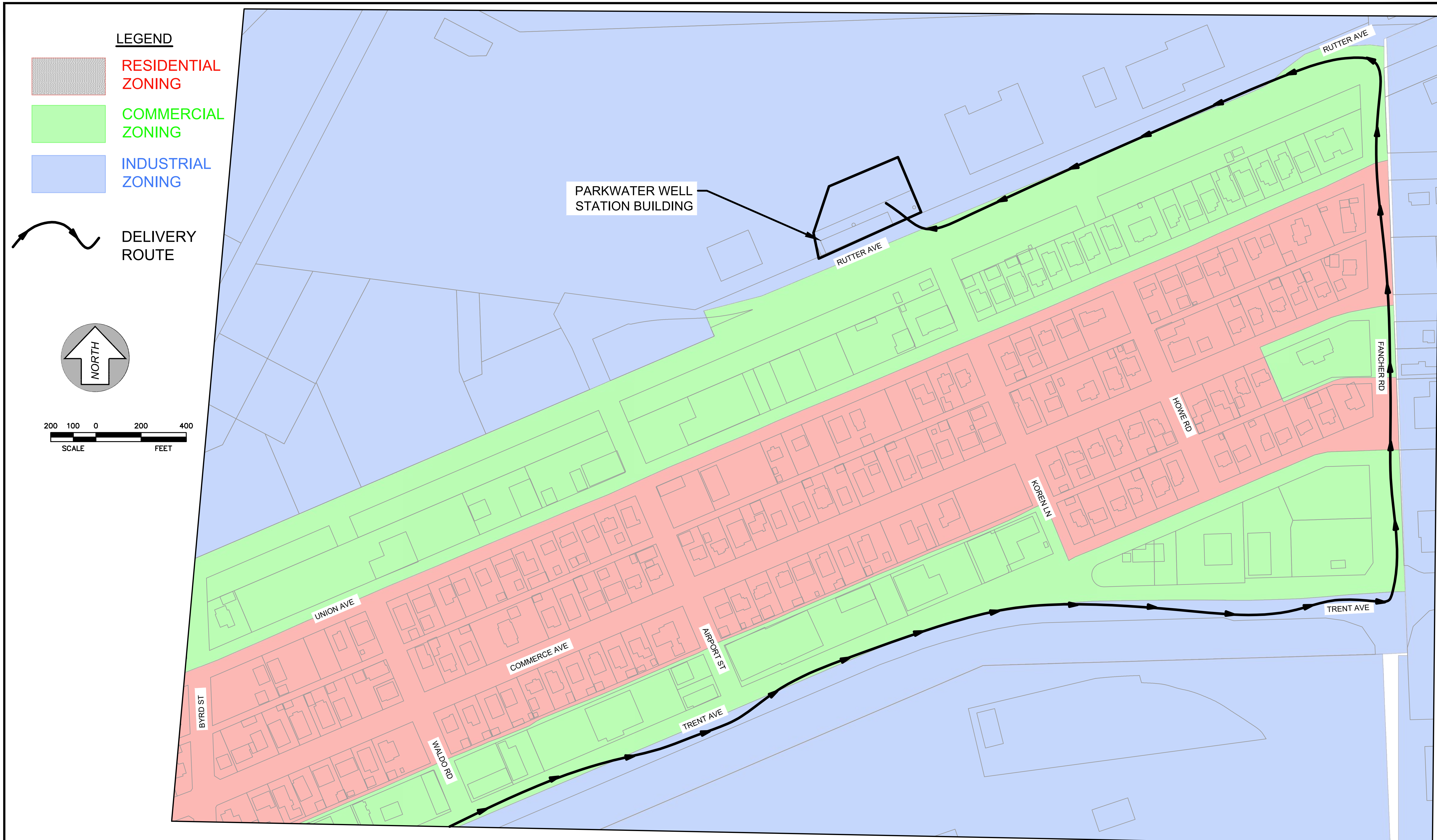

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SPOKANE FLUORIDATION STUDY

PARKWATER WELL SITE DELIVERY ROUTE

PROJECT NO.: 00-0000.000 | SCALE: AS SHOWN | DATE: JULY 2022

ATTACHMENT

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APPENDIX H

Hoffman Well Station Figures

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Hoffman Well Station Photos

Chlorine Analyzer Area

Chlorine Room and HVAC

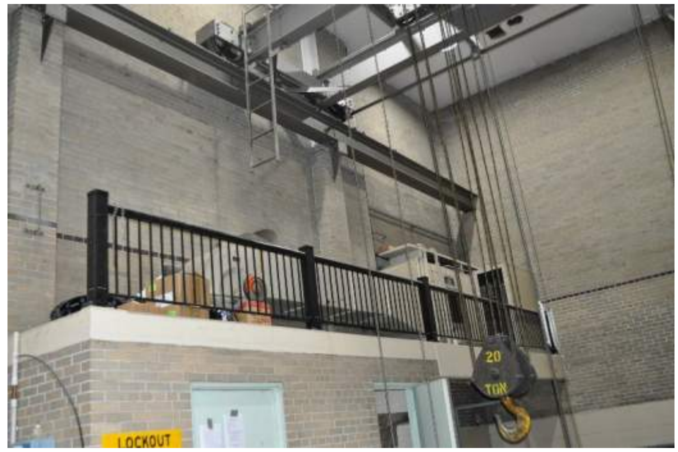
Hoffman Chlorine Analyzer

Hoffman Front Exterior

Hoffman Well Station Photos

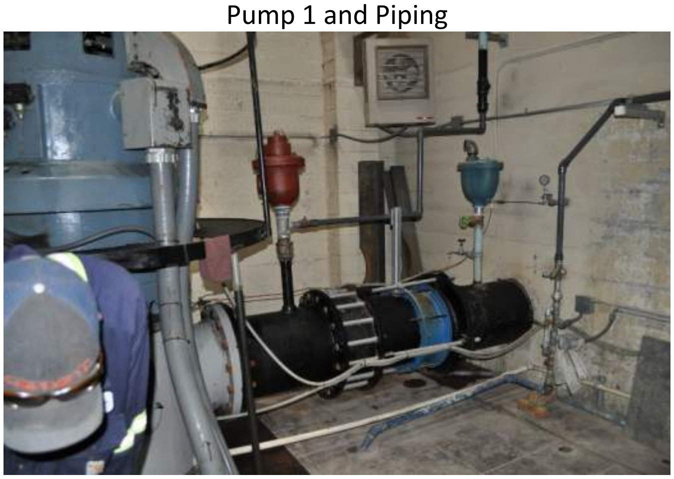
Hoffman Site View Facing Southeast

HVAC Area



Pump 2 Casing

Pump 1 and Piping



Hoffman Well Station Photos

Storage Area and Crane

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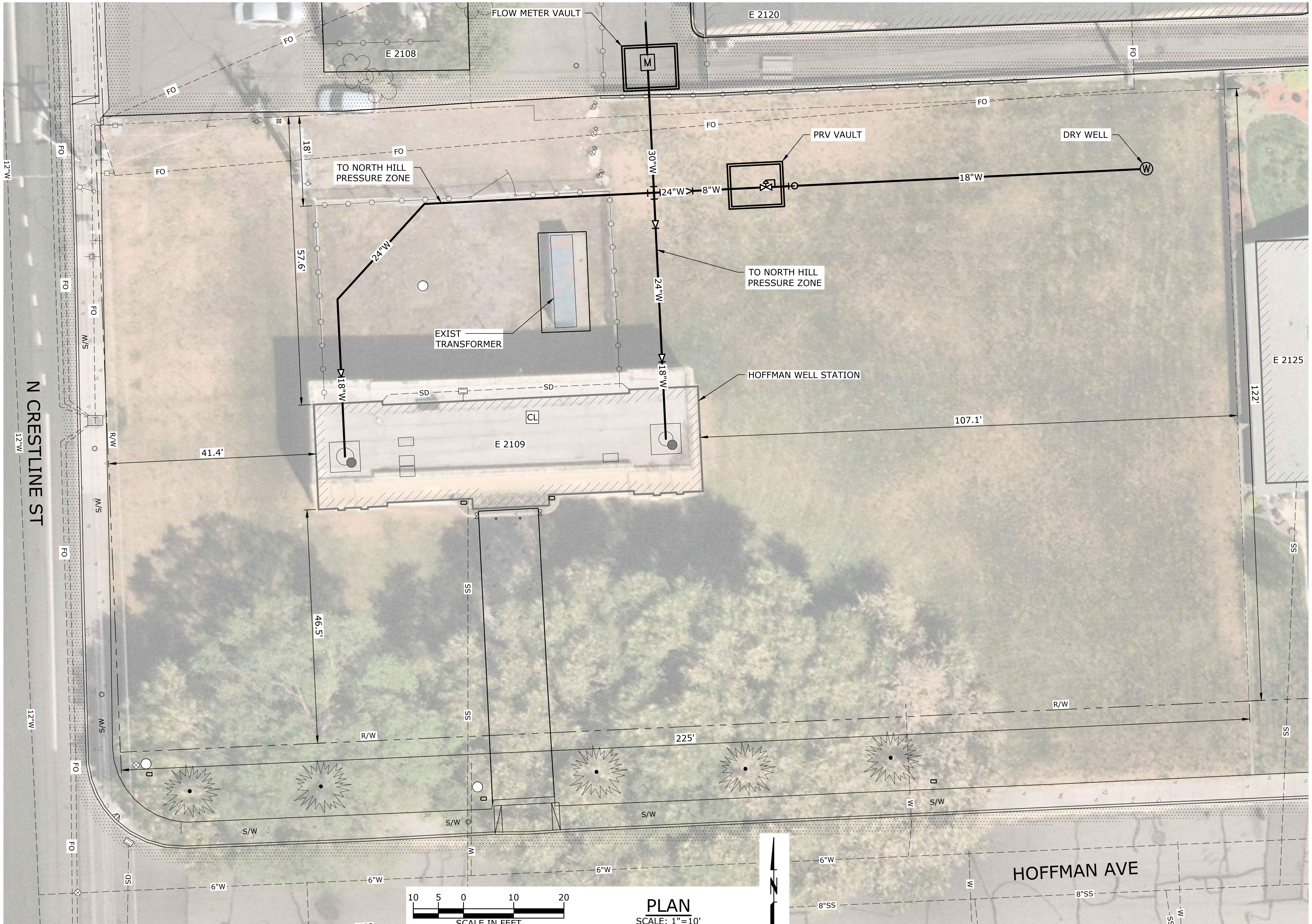

LEGEND

- M FLOW METER
- CL CHLORINE ANALYZER, (SEE BUILDING PLAN)
- ● CHLORINE INJECTION POINT, (SEE BUILDING PLAN)
- ▲ SAMPLE POINT FOR CHLORINE MONITOR ANALYSIS
- ○ APPROX LOCATION OF WELL PUMP

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CITY OF SPOKANE

SPOKANE FLUORIDATION STUDY

HOFFMAN WELL
WELL STATION SITE PLAN

PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: JULY 2022

SHEET
C-1
X of X

LEGEND

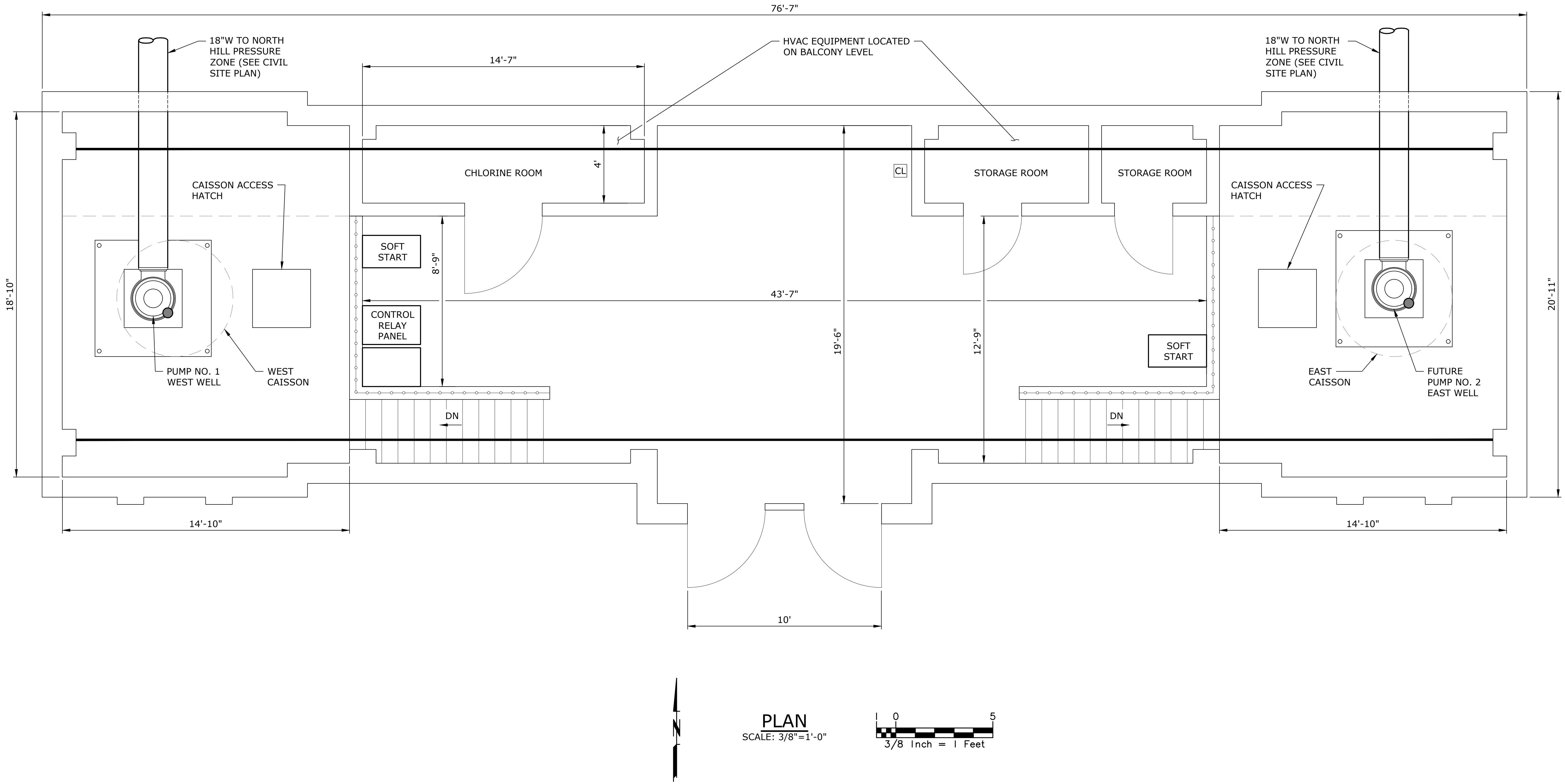
CL CHLORINE ANALYZER

CHLORINE INJECTION POINT, (INSIDE WELL CASING, NEAR BOTTOM OF PUMP)

CRANE TRACK

NOTE:

DISTANCE BETWEEN FINISHED FLOOR OF GROUND LEVEL AND BOTTOM OF CRANE BEAM APPROXIMATELY 18'. PUMP LEVEL IS APPROXIMATELY 12' LOWER THAN GROUND LEVEL.



PLAN

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HOFFMAN WELL

WELL STATION BUILDING LAYOUT PLAN

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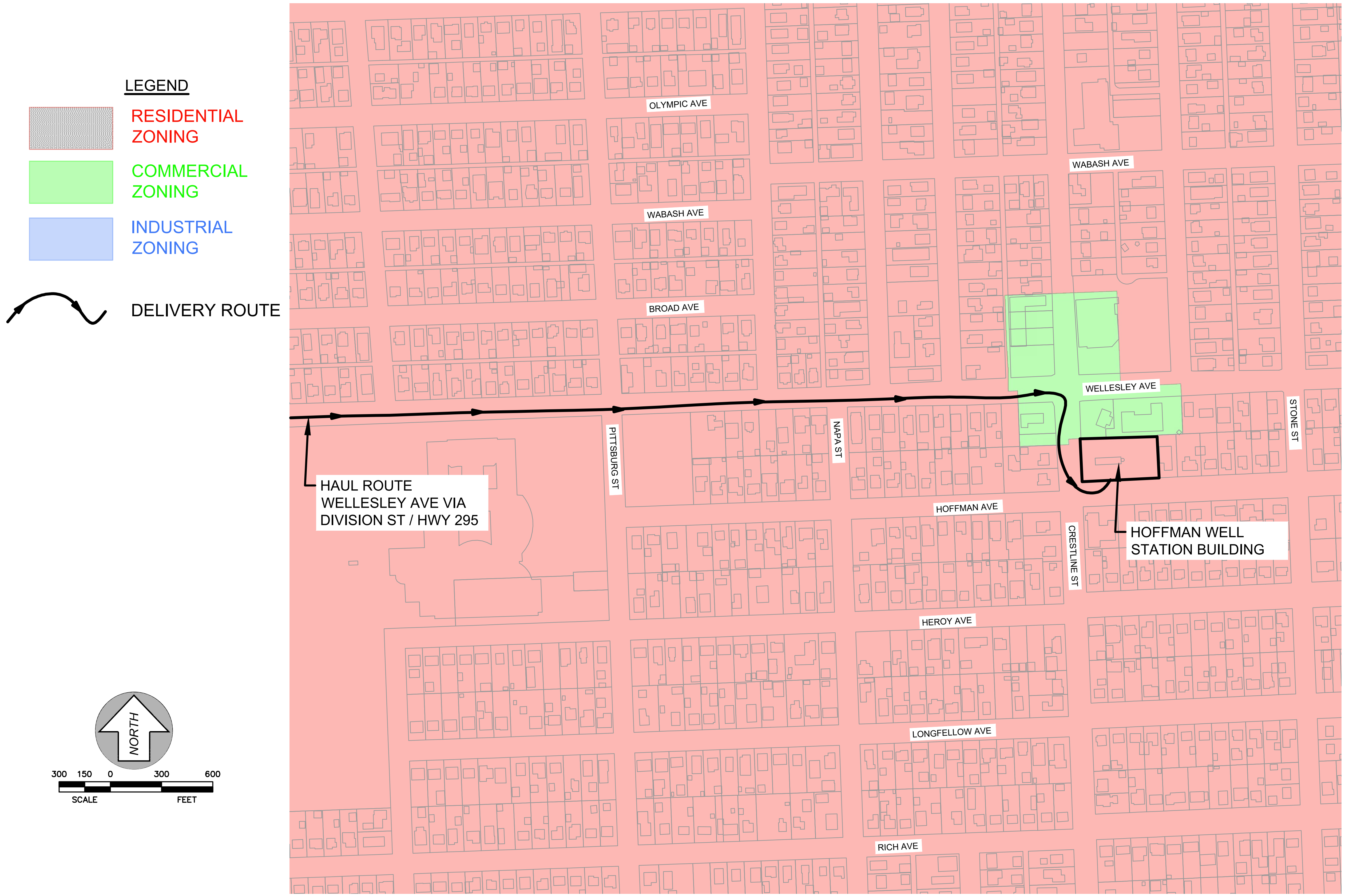

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SPOKANE FLUORIDATION STUDY

HOFFMAN WELL SITE DELIVERY ROUTE

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APPENDIX I

Havana Well Station Figures

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Havana Well Station Photos

Example Well Casing

Well Station A

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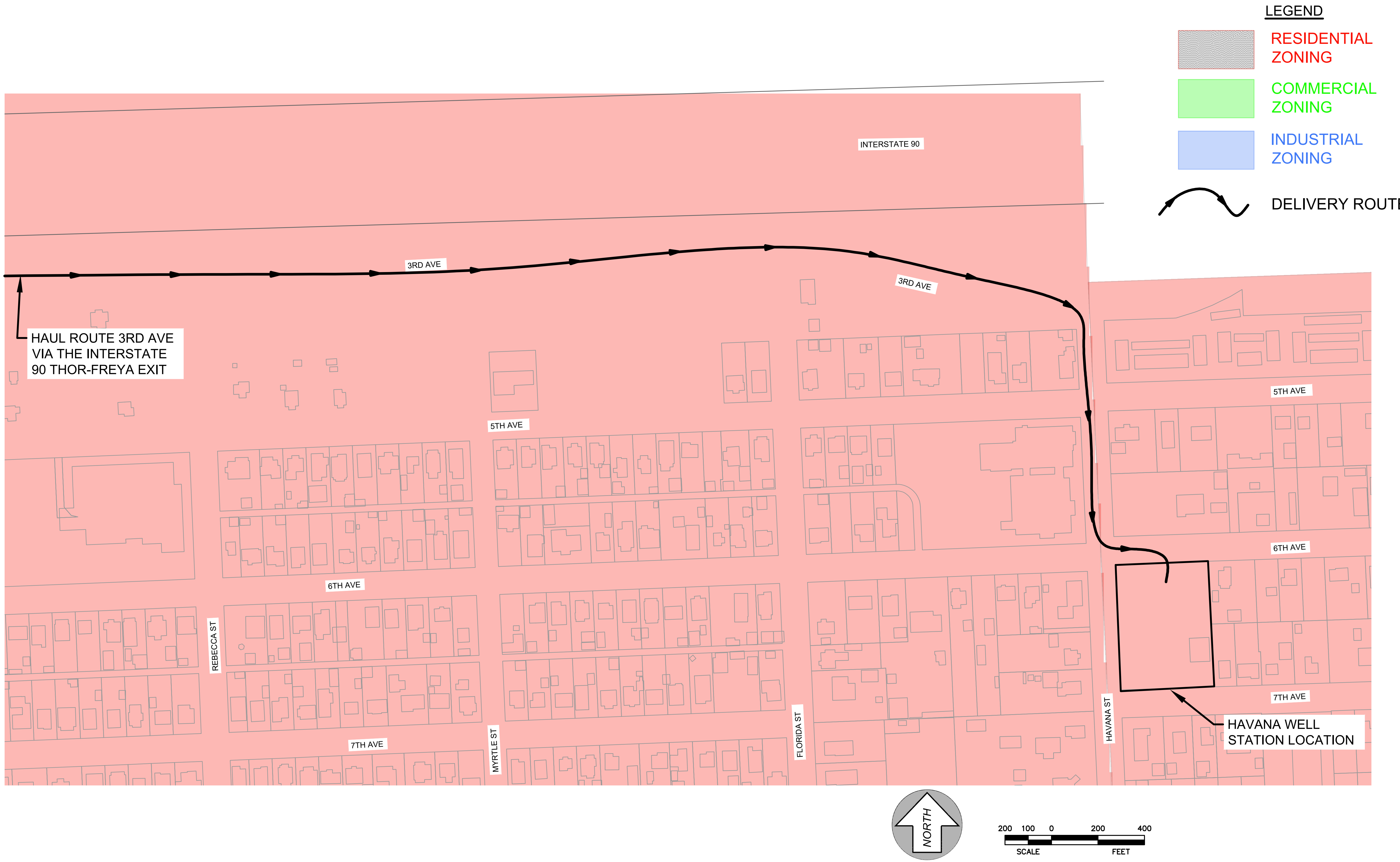

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SPOKANE FLUORIDATION STUDY

HAVANA WELL SITE DELIVERY ROUTE

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APPENDIX C
PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION: FLUORIDATION SYSTEM ALTERNATIVES

consor

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CITY OF SPOKANE

THE CITY OF SPOKANE

Preliminary Engineering Study for Fluoridation: Fluoridation System Alternatives

December 2022

Fluoridation System Alternatives

City of Spokane

December 2022

Murraysmith

421 West Riverside Avenue
Suite 762
Spokane, WA 99201

Parametrix

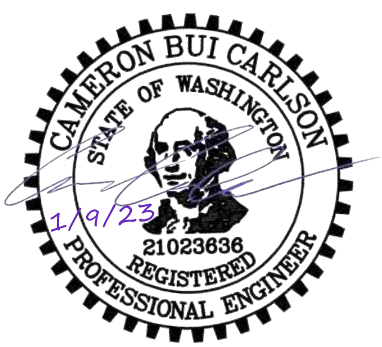
835 N Post St
Suite 201
Spokane, WA 99201

CERTIFICATION

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.

Prepared by Mike Morse, PE, Parametrix
Section 3.1.2.2

Prepared by Jacob Linke, PE, Parametrix
Sections 3.1.2.2 and 3.1.2.3



Prepared by Cameron Bui Carlson, PE, Parametrix
Sections 3.1.2.2 and 3.1.2.4

Acronyms & Abbreviations

A	
AWWA	American Water Works Assoscication
C	
CDC	Centers for Disease Control
City	City of Spokane
D	
DOT	United States Department of Transportation
E	
EPA	United States Environmental Protection Agency
F	
FAA	Federal Aviation Administration
FSA	fluorosilicic acid
FTE	full-time equivalent
G	
GLUMRB	Great Lakes - Upper Mississippi River Board
H	
HVAC	heating, air conditioning, and ventilation
L	
LCCA	life cycle cost analysis
M	
MCL	Maximum Contaminant Level
mg/L	milligrams per liter
MGD	million gallons per day
MODA	multi-objective decision analysis
O	
OPCC	opinion of probable construction costs
P	
pH	Hydrogen Potiental
PLC	programable logic control
PPE	personal protective equipment
S	
SDS	safety data sheets
W	
WFI	Water Facilities Inventory
WA DOH	Washington State Department of Health

Table of Contents

Tables

Appendices

SECTION 1

Section 1

Introduction

1.1 Purpose and Goals of this Alternatives Analysis

The City of Spokane (City) is conducting a preliminary engineering study of fluoridation implementation in the City's water system. The study is grant-funded. This Fluoridation System Alternatives Report provides an intermediate step in the development and assessment of the fluoridation implementation alternatives for the City's consideration. This Report provides input for the City to assess up to three different chemical alternatives in Task 6 of the engineering study scope, Alternatives Evaluation, and for the selection of a preferred alternative for the City to consider moving forward.

The evaluation of alternatives will be assessed through a multi-objective decision analysis (MODA) that will facilitate an objective and transparent process to select the preferred alternative based on the City's long-term goals of balancing sustainability, social responsibility, and affordability (City's Triple Bottom Line).

This Report evaluates the implementation of three fluoridation chemical alternatives: sodium fluoride, sodium fluorosilicate, and fluorosilicic acid (FSA). The defined alternatives include preliminary equipment sizing, a list of key equipment required, general process flow diagrams, general site and mechanical plan layouts based on anticipated sizes of each of the fluoridation systems and operations, maintenance, and safety considerations. A Class 5 opinion of probable construction costs (OPCC) and a concept-level 50-year life cycle cost analysis (LCCA) was developed based on equipment sizing along with operations and maintenance considerations.

1.2 Water System Overview

Fluoridation of the City's water system requires the retrofit of each of its seven existing well pump stations and a new well pump station currently under construction to add necessary fluoridation chemical feed systems. The nameplate capacities of each well station range from 15 million gallons per day (MGD) to 90 MGD. The demand on the City's water system changes greatly throughout the year, from a winter average of about 35 MGD to a summer peak of over 147 MGD, requiring careful consideration for operational effectiveness of the implemented fluoride chemical feed systems.

A detailed condition assessment of each of the well pump stations was completed in Spring 2022 and summarized in Well Facility Condition Assessment Report, September 2022. Table I-1 of the Well Facility Condition Assessment Report includes a Condition Assessment Matrix summarizing key condition assessment elements that were used for the development of the fluoridation system alternatives. The assessment determined that the future fluoridation facilities will likely need to be housed in a dedicated building. The existing well station buildings do not appear to have enough space to house a new fluoridation system. The exception is the Well Electric building, though extensive retrofits would likely be required to facilitate the new system, so the addition of a new fluoride feed facility at the Well Electric Well Station was assumed for this study.

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SECTION 2

Section 2

Fluoridation System Overview

2.1 Overview of Chemical Options

Fluoridation injection systems in potable drinking water incorporate chemical addition processes that form fluoride ions in the finished water. The three common chemical injection alternatives are sodium fluoride, sodium fluorosilicate, and FSA. Sodium fluoride and sodium fluorosilicate are distributed as dry powder chemicals while FSA is distributed in liquid form. Because the facility requirements and operation and maintenance requirements are similar for both dry chemicals, and due to the severe supply chain and manufacturer limitations of sodium fluorosilicate, this Report focuses on comparing the differences between the liquid chemical and the dry chemicals. All three are further described below.

2.1.1 Sodium Fluoride

Sodium fluoride is sold as a colorless or white, odorless, low-dust granular chemical product. American Water Works Association (AWWA) Standard B701 covers its use in potable drinking water systems. Sodium fluoride has a favorable solubility characteristic: it dissolves within minutes to a near constant solubility (4 percent) at water temperatures normally experienced in potable water systems. At water temperatures typically encountered in chemical treatment equipment located in a building or from a well, a sodium fluoride solution will reach full saturation in about 5 minutes. Therefore, a saturator tank can be used to dissolve the chemical into water to create a solution for injection into the water system, meaning the chemical can be added directly to the saturator tank without precise chemical metering.

2.1.2 Sodium Fluorosilicate

Sodium fluorosilicate, also a dry fluoride product, is a white, odorless crystalline salt. American Water Works Association Standard B702 covers the use in potable drinking water systems. Like the sodium fluoride additive product, sodium fluorosilicate comes in a low-dust granular form that minimizes personnel exposure and risk of inhalation. Because sodium fluorosilicate is produced by partially neutralizing FSA, the hydrogen potential (pH) of a sodium fluorosilicate solution will range between 3.0 and 4.0.

Sodium fluorosilicate is normally fed as a dry salt to a tank sized for active mixing with a 5- to 10-minute detention. Unlike sodium fluoride, sodium fluorosilicate can take a long time to achieve full saturation, and its solubility varies with water temperature. Because sodium fluorosilicate does not become fully saturated and requires active mixing, it is unsuitable for use in saturator feed equipment (which is typically used for sodium fluoride). Hard water, lower water temperatures, and the product's crystalline character each can increase the time needed to dissolve the sodium fluorosilicate additive product to an acceptable concentration. Sodium fluorosilicate has a very slow dissolution rate as the solution approaches saturation. Up to several hours of firm mixing can be required to achieve saturation. Consequently, the preferred operating strategy is to prepare a dilute solution of less than one-half saturation.

Fluoridating with the sodium fluorosilicate additive product requires slightly larger quantities than are used with sodium fluoride. A larger dissolving tank is also required to create a chemical solution compared to the saturators that can be used for sodium fluoride.

Sodium fluorosilicate use has been declining since the 1970s and is the least used form of fluoride in municipal systems, currently.

2.1.3 Fluorosilicic Acid

An aqueous acidic solution with a pH of 1.2, FSA can range from colorless ("water-white") to a straw color. American Water Works Association Standard B703 covers the use in a potable drinking water system. Fluorosilicic acid's color comes from other substances in the solution, especially iodine and phosphoric acid. Fluorosilicic acid is a volatile acidic solution because trace amounts of hydrogen fluoride and silicon tetrafluoride gases evaporate from the liquid's surface.

The FSA additive solution is made up of about 74 percent water, with an FSA concentration ranging from 23 percent to 25 percent. The remaining one percent to three percent of the solution is made up of trace amounts of free acids: hydrogen fluoride, sulfuric acid, hydrochloric acid, phosphoric acid, and others. Shipping is a major component of FSA additive cost because three-quarters of the product volume is water. At a 25 percent concentration, FSA weighs 10.1 pounds per gallon, heavier than an equal amount of water.

2.2 Fluoridation Implementation Standards

The following industry technical standards define guidelines and recommendations for fluoridation implementation and align with Washington State Department of Health guidance. The industry technical standards that were referenced in the development of the design criteria for developing the alternatives include:

- Washington State Department of Health – Water Design Manual, June 2020 (WA DOH)
- AWWA Manual of Practice M4 – Water Fluoridation Principles and Practices (AWWA M4)
- Centers for Disease Control (CDC) and Prevention Guidelines (CDC)
- Great Lakes - Upper Mississippi River Board (GLUMRB) - often referred to as 10 States Standards

2.3 Design Criteria and Assumptions

Table 2-1 lists design criteria and assumptions which are the basis for the alternative concept-level design development used to establish a comparison between the chemical alternatives. Each assumption needs to be further evaluated and confirmed before design begins with the selected chemical alternative.

Table 2-1 | Design Criteria and Assumptions

Design Element	Assumption for Alternatives Analysis	Alternate Assumption Options	What does this assumption affect?
Chemical Storage Duration	Approximately 60 days (10 States Standards)	▪ 3 months (CDC) ▪ Match volume of delivery (AWWA M4)	Storage size/building size, chemical delivery frequency, operator chemical handling frequency
Chemical Storage Duration Demand Basis	Average daily demand when facility is operational	▪ No industry standard. ▪ Average month (Low storage) up to max month demand (High storage)	Storage size/building size, chemical delivery frequency, operator chemical handling frequency
Day Tank (liquid chemical only) Storage Duration	2 days of MDD	▪ Day tank recommended ▪ 30 hours (10 States Standards) ▪ 2 days (CDC) ▪ 3 days (AWWA M4) ▪ Note: industry standards do not specify a demand basis assumption- base day tank sizing on City preference	Day tank size, transfer pump size, operator day tank transfer frequency
Saturator (dry chemical only) Detention Time	Approx 6-ft diameter, 3.5-ft height	▪ Minimum depth of chemical 12 inches (CDC, AWWA M4) ▪ Saturator could be sized larger so that two super sacks could be dumped during one site visit	Saturator size, bulk bag unloader hopper size
Dry Chemical Storage	▪ Full hopper and one standby super sack ▪ Central storage facility	▪ Could store additional sacks onsite ▪ Saturator could be sized larger so that two super sacks could be dumped during one site visit	Building size, frequency to transport sacks
Metering Pumps	Assume two metering pumps for each well pump	▪ Depends on chemical injection point locations- to be refined during design. ▪ AWWA M4 recommends not injecting chlorine and fluoride in the same location.	Number and size of metering pumps, size of building, electrical requirements

2.4 Alternative Evaluation Criteria

Evaluation of the potential fluoridation system alternatives defined later in this Report will be done through both financial and non-financial analyses. The life-cycle cost estimates will be combined with the non-monetary analyses for an integrated alternatives analysis to support decision-making. **Table 2-2** defines non-financial criteria that were developed during the May 10, 2022 MODA Criteria Workshop. This workshop was attended by Katherine Miller (City), Loren Searl (City), Lee Odell (Murraysmith), Joe Foote (Murraysmith), Kristy Warren (Murraysmith), Aubrie Koenig (Murraysmith), Liz Kelly (Parametrix), Mark Mazzola (Parametrix), and Dana Rivera (Parametrix). The Summary of Alternatives section in this Report (**Table 4-1**) will include a summary of considerations for the City to use for scoring of the criteria during the Alternatives Workshop. Also, the Facility Summary in **Table 3-3** includes comments on criteria that are affected by the well station site.

Table 2-2 | Fluoridation Alternatives Analysis Non-Financial Criteria

Criteria No.	Criterion	Description	Weight
1	Environmental and Sustainability Impacts	Environmental impacts to the natural environment, such as those to critical areas or the aquifer, including those attributed to the supply chain, in the immediate vicinity of the facilities or the broader region. Includes impact on the city's sustainability goals.	12%
2	Neighborhood Impacts	Impacts to the built environment in the immediate neighborhood including cultural, aesthetic, historical preservation, and livability impacts such as those related to increased traffic, noise, air quality, and odors. Includes impacts during construction.	8%
3	Safety – Public	Potential public safety hazards in the immediate neighborhood as well as the broader region, including those related to increased truck traffic. Not including health impacts associated with consumption of fluoridated water. Includes hazards during construction.	25%
4	Safety – Worker	Potential worker safety hazards including chemical loading/unloading, exposure to chemicals, and other safety hazards such as slips, trips, falls, and confined space entry during facility operations and maintenance. Includes hazards during construction.	25%
5	Service Reliability	Ability to achieve desired reliability of the fluoridation system, including resiliency in extreme conditions. Consider overfeeding (which may require public notice due to termination of fluoridation) and the ability of the system to consistently achieve regulatory requirements, both near and long term. Consider outcomes at the customer tap.	15%
6	Ease of Maintenance and Operations	Relative ease of maintenance and operational activities, including training, certifications, and equipment needed, regular visits to the sites, renewal and rehabilitation needs. This criterion does not include cost, which will be included in the life cycle cost estimate, and not including worker safety, which should be considered the Safety – Worker criterion.	15%
			100%

SECTION 3

Section 3

Summary of Alternatives

3.1 Alternative Definition

For the potential fluoridation of the City's water system, three chemical alternatives as well as three chemical feed systems were reviewed. Based on initial research of the chemical availability and delivery limitations, two alternatives have been defined for evaluation.

The following is a brief description of the alternatives.

- Dry (Sodium fluoride)

  Incorporates a new structure at each of the existing well station sites, except for the Central Well Station, for a super sack bulk bag unloader and saturator tank, metering pumps, analyzers, electrical/control elements, and heating, air conditioning, and ventilation (HVAC). The Central Well Station site requires replacement of the existing electrical/chemical building to house the fluoridation equipment.

- Liquid (FSA)

  Incorporates a new structure at each of the existing well station sites, except for the Central Well Station, for bulk and day storage tanks with transfer/metering pumps, analyzers, electrical/control elements, and HVAC. The Central Well Station site requires replacement of the existing electrical/chemical building to house the fluoridation equipment.

Sodium fluorosilicate is not included as an alternative chemical for consideration, based on limitations of regional supply from vendors for bulk delivery. Additionally, bulk storage tanks/feed systems for the dry chemical option were not considered further, since chemical suppliers are not equipped to deliver sodium fluoride in bulk in the Pacific Northwest.

3.1.1 Major Equipment and Design Features – Requirements

Key equipment and design considerations for each chemical are summarized in **Table 3-1**. A concept-level equipment matrix for each well station fluoridation facility is shown in **Table 3-2**.

Table 3-1 | Key Equipment Considerations

Chemical	Dry Chemical	Liquid Chemical
Reserve Storage	30-day minimum. 1-ton super sacks or 50-lb bags. Super sacks can be stored at central location.	30-day minimum. HDPE tanks meeting ASTM 1998 standards.
Day Storage	Bags are dumped via a bulk bag unloader into a storage hopper with a vibrator to eliminate clumping or buildup	Day tank (1 to 3 days of storage) filled manually via transfer pump
Chemical Handling	Super sacks require a bulk bag unloader system with a crane and trolley. Forklift required to move super sacks. 50-lb bags can be transported on a palette and dumped into the hopper manually.	Truck pumps chemical to bulk storage.
Feed Hoppers	Volumetric and gravimetric feeder	N/A
Saturator	Saturator with radial distributor and gravel support bed. Saturator minimum bed depth > 12 inches. Preferred bed depth = 16-18 inches. 6-foot diameter, 3.5-foot depth assumed for alternatives definition.	N/A
Transference	PVC or cross-linked HDPE piping	PVC or cross-linked HDPE piping
Spill Protection	Containment required for saturator.	Entire FSA tank volume (day and bulk storage) plus an additional 10%. Containment at delivery hose building connection to catch transfer spills. Epoxy undercoat and a urethane top coat or spray-on manhole rehabilitation polyurethane to protect concrete.
Dust Control	Dust control unit and powder seal on bulk bag unloader unit	Not required, though ventilation required for acid fumes.
Building Notes	Storage should be secured in a dedicated room. Include roll-up door for forklift access.	Storage should be secured in a dedicated room. Include roll-up door for tank access.
Safety Equipment	Eyewash and shower station	Eyewash and shower station
Metering and Injection	Positive displacement metering pumps, injection quill with orifice-style mixer or pumped carrier water injection.	Positive displacement metering pumps, injection quill with orifice-style mixer or pumped carrier water injection.

Table 3-2 | Equipment by Well Station

Major Equipment	Well Electric	Parkwater	Ray	Central	Nevada/ Grace	Hoffman	Havana
Dry Chemical							
Super Sack Storage Onsite	1 in feed, 1 stored onsite						
Saturator Size	Approximately 6-ft diameter, 3.5-ft depth for all well stations. Assume tank is installed in a basement level adjacent to the bulk bag unloader						
Liquid Chemical							
Bulk Storage Onsite (gal)	4,400	4,400	2,500	2,500	5,400	750	4,400
Day Tank (gal)	250	410	160	160	410	55	250
Additional Chemical Equipment for Either Option							
Number of Metering Pumps	8	16	6	4	12	4	12
Number of Injection Points	4	8	3	2	6	2	6

3.1.2 Facility Requirements

Table 3-3 summarizes the requirements for constructing a new fluoridation facility to serve each well station including access, site impacts, building information, and electrical and controls requirements.

3.1.2.1 Permitting

As shown in **Table 3-3**, permits may include the following.

- Shoreline for Well Electric Well Station (City of Spokane)
- Conditional Use (City of Spokane, City of Spokane Valley for Havana Well Station)
- SEPA
- Historic/Architectural review for sites located in residential zones

Federal Aviation Administration (FAA) requirements for building heights will need to be considered for the Well Electric Well Station, which is near the Felts Field Airport.

The WA DOH will require a project report and description of improvements and final design documents for approval, including an updated Water Facilities Inventory (WFI). The City will also have to meet the water treatment certification requirements established by WA DOH.

3.1.2.2 General Site Requirements

As shown in **Table 3-3**, delivery truck access was evaluated for each site and incorporated into the site plans included in **Appendix A.** Driveways were sized for a 54-foot delivery truck, which would accommodate a large delivery of super sacks to multiple well stations in one trip. The proposed driveway footprints could be reduced depending on the City's desired dry chemical delivery schedule. A new driveway hardscape would likely require stormwater management facilities.

Table 3-3 | Facility Requirements Matrix

Facility Requirements Category	Well Electric	Parkwater	Ray	Central	Grace	Nevada	Hoffman	Havana
Permits	▪ Shoreline Permit. ▪ Confirm height requirements with FAA. ▪ Existing site partially within FEMA 100-year flood zone. ▪ SEPA review.	SEPA review.	▪ Conditional Use (Residential Zone). ▪ SEPA review. ▪ Historic/architectural review.	▪ Conditional Use (Residential Zone). ▪ SEPA review.	▪ No special permitting requirements. ▪ SEPA review.	▪ No special permitting requirements. ▪ SEPA review.	▪ Conditional Use (Residential Zone). ▪ SEPA review. ▪ Historic/architectural review.	▪ Permitting within City of Spokane Valley. ▪ Conditional Use (Residential Zone). ▪ SEPA review.
Access	▪ Via Waterworks St. No through access for large vehicles. Delivery route passes by several residential homes.	▪ Via E Rutter Ave. ▪ Delivery route passes by several residential homes (increased large vehicle traffic).	Passes through Residential Zones (increased large vehicle traffic).	Passes through Residential Zones for one block (increased large vehicle traffic).	Via North Foothills Drive or via the Water Department yard if added building has door(s) on its south side.	Via North Foothills Drive or via the Water Department yard if added building has door(s) on its south side.	▪ Via Hoffman Ave. ▪ Passes through Residential Zones (increased large vehicle traffic).	Passes through Residential Zones (increased large vehicle traffic).
Truck Turnaround	▪ Liquid media delivery truck (~22-ft. wheelbase) turning movement at the closed entrance gate feasible assuming delivery truck parks on westbound N Waterworks Street. ▪ Larger delivery truck (~54-ft. wheelbase) turning movement is feasible inside the site's perimeter fence within the area east of the site entrance road, south of the existing gravel road, and north of N Waterworks Street. ▪ Proposed gravel turnaround requires realignment to accommodate the turning movement and retaining wall to preserve existing police department access road.	▪ Liquid media delivery truck (~ 22-ft. wheelbase) turning movement at the west end of E Rutter Avenue is feasible within the existing 90-ft. diameter cul-de-sac. ▪ Larger delivery truck (~54-ft. wheelbase) turning movement at the west end of E Rutter Avenue is not feasible within the existing 90-ft. diameter cul-de-sac. ▪ The asphalt paved cul-de-sac with concrete curb and gutter is approximately 700 ft. west of the Parkwater well station site on E Rutter Avenue.	▪ Liquid media delivery truck (~22 ft. wheelbase) and solid media delivery truck (~54-ft. wheelbase) turning movements from southbound on S Ray Street to eastbound on E Hartson Avenue work with new pull through 30 ft. concrete driveways and new 24-ft. paved pull through with gravel shoulders. ▪ Larger vehicle turning movement is only feasible if there are no parked vehicles on the west side of S Ray Street and the south side of E Hartson Avenue. ▪ Pull through driveway to go around existing on-site tree at the NE corner of S Ray Street and E Hartson Avenue.	▪ Liquid media delivery truck (~22-ft. wheelbase) turning movement from eastbound on W Central Avenue to southbound on N Normandie Street works with wheel path tracking over the existing driveway concrete curb onto adjacent lawn, and with no parked cars on the east side of N Normandie Street. ▪ Larger delivery truck (~54-ft. wheelbase) turning movement is not feasible since wheel paths travel over W Central Avenue and N Normandie Street sidewalks, existing driveway south curb, and large swaths of on-site lawn areas.	▪ Delivery truck turn around is on site. ▪ City receives multiple deliveries at this site and sees no concern with liquid or dry bulk fluoride deliveries.	▪ Delivery truck turn around is on site. ▪ City receives multiple deliveries at this site and sees no concern with liquid or dry bulk fluoride deliveries.	Proposed driveway through site off Hoffman Ave with hammerhead truck turnaround.	▪ Liquid media delivery truck (~22 ft. wheel base) and solid media delivery truck (~54-ft. wheel base) turning movements are feasible at 30-ft. wide driveways off 6th Avenue and 7th Avenue with no site improvements required. ▪ Larger delivery truck wheel paths may track off street pavement onto gravel street shoulders adjacent to site during turning movements.

Facility Requirements Category	Well Electric	Parkwater	Ray	Central	Grace	Nevada	Hoffman	Havana
Impact to Neighborhood	Industrial zoning, little impact to neighborhood.	Industrial zoning, little impact to neighborhood.	▪ Residential neighborhood with on-street parking. ▪ Potential for delivery truck to double park to unload. ▪ Residential streets do not accommodate delivery trucks very well which results in congestion. ▪ Noise during delivery, visual impact of new building.	▪ Residential neighborhood with on-street parking. ▪ Potential for delivery truck to double park to unload. ▪ Residential streets do not accommodate delivery trucks very well which results in congestion. ▪ Noise during delivery, visual impact of new building.	Located on Water Department Site, little impact.	Located on Water Department Site, little impact.	▪ Residential neighborhood with on-street parking. ▪ Potential for delivery truck to double park to unload. ▪ Residential streets do not accommodate delivery trucks very well which results in congestion. ▪ Noise during delivery, visual impact of new building.	▪ Residential neighborhood with on-street parking. ▪ Potential for delivery truck to double park to unload. ▪ Residential streets do not accommodate delivery trucks very well which results in congestion. ▪ Noise during delivery, visual impact of new building.
Dry Chemical Building Footprint: Super Sack Option	21.5 ft x 29.5 ft =634 sf	21.5 ft x 29.5 ft =634 sf	21.5 ft x 29.5 ft = 634 sf	29.5 ft x 38.25 ft = 1,102 sf Includes space for lighting/signals infrastructure and chlorine room	31.7 ft x15 ft = 475 sf	31.7 ft x15 ft = 475 sf	21.5 ft x 29.5 ft = 634 sf	21.5 ft x 29.5 ft = 634 sf
Dry Chemical Building Height: Super Sack Option	26 ft	26 ft	26 ft	28 ft	25 ft	25 ft	26 ft	26 ft
Liquid Chemical Building Footprint	647 sf	647 sf	647 sf	1,102 sf. Includes space for lighting/signals infrastructure and chlorine room	647 sf	647 sf	729 sf	729 sf
Liquid Chemical Building Height	21 ft	21 ft	20 ft	21 ft	19 ft	19 ft	20 ft	20 ft
Architectural Style	Basic/Industrial CMU.	Basic/Industrial CMU.	Align with neighborhood/existing style (CMU with brick).	Align with neighborhood/existing style (CMU).	Basic/Industrial CMU.	Building will be located near Grace facility.	Align with neighborhood/existing style (CMU with brick).	Match proposed well facility buildings (CMU).
Tree Removal?	Yes, several small trees.	Yes, east of building.	Plan to avoid tree.	Likely No.	No.	No.	Likely No.	No.
Structural Considerations	▪ Geotech evaluation required for final design. ▪ Foundation will act as a retaining wall on steep slope.	▪ Geotech evaluation required for final design. ▪ Understand effects of new structure adjacent to existing structure.	▪ Geotech evaluation required for final design. ▪ Understand effects of new structure adjacent to existing structure.	▪ Geotech evaluation required for final design. ▪ Demo existing control building.	▪ Geotech evaluation required for final design. ▪ Understand effects of new structure adjacent to existing structure.	Building will be located near Grace facility.	Geotech evaluation required for final design. Understand effects of new structure adjacent to existing structure.	Geotech report likely available for new site.
Space Onsite for New Building?	Yes, north of Waterworks St. between access gates.	Yes, east of building.	▪ Yes, add on to existing building to the south. ▪ Do not impact community garden.	No. Demo/retrofit existing control building.	Yes, add onto Grace building.	Building will be located near Grace facility.	Yes, add on to existing building to the east.	Yes, SE of Building B.

Facility Requirements Category	Well Electric	Parkwater	Ray	Central	Grace	Nevada	Hoffman	Havana
Electrical Service Notes	▪ 120/240 1-phase power available on generator. Spare breakers on 300 A Panel P1. ▪ 2400/4160Y available on Substation Primary. ▪ As-Built load calcs not available.	▪ 120/208 3-phase power available with spare breakers on 200 A Panel A. ▪ 2400 3-phase available on Substation Primary. ▪ As-Built load calcs not available.	▪ 120/208 3-phase power available with spare breakers on 175 A Main Panelboard. ▪ 2400 3-phase available on Substation Primary. ▪ As-Built load calcs not available.	▪ 120/240 1-phase power available on 90 A Panel P3 with spare breakers and 11A demand availability. Main breaker could be increased to 125 A for 46A availability. ▪ 2400 3-phase available on Substation Primary.	▪ 120/208 3-phase power available on 100 A Station Panel (only 1 spare 20 A breaker). ▪ 4160 3-phase available on Substation Primary. ▪ As-Built load calcs not available.	▪ 120/208 3-phase power available on 200 A Station AC Panel. ▪ 2400 3-phase available on Substation Primary. ▪ As-built load calcs not available.	▪ 120/208 3-phase power available on 200 A Station Service Panel. ▪ 2400 3-phase available on Substation Primary. ▪ As-built load calcs not available.	▪ 120/208 3-phase power available on 400 A Panel A1 with spare breakers and 76 A demand availability. ▪ 4160 3-phase available on Substation Primary.
Water Service Notes	Supply from existing 12-inch distribution main that already serves the facility.	Supply from existing 6-inch service line onsite	Extend existing 1-inch service line onsite to building.	Connect into existing service to electrical/chemical building, or new service from main in the street.	Supply from existing Grace service line.	Supply from existing Grace service line.	New service line from Hoffman distribution main.	Supply from existing 6-inch service line onsite.
Fluoride Injection Yard Piping Notes	Utilidor across site to well room.	Connect directly through wall to well room.	Connect directly through wall to well room.	Parallel to Cl feed line in new utilidor.	Connect directly through wall to well room.	Utilidor through site between Nevada and fluoridation building.	Connect directly through wall to well room.	Utilidor through site Further consideration required crossing 24" transmission main and other utilities.
Estimated Electrical Load	15 kVA (65 A at 240 V 1-phase).	14 kVA (40 A at 208 V 3-phase).	30 kVA (82 A at 208 V 3-phase).	▪ 32 kVA (131 A at 240 V 1-phase). ▪ Demand exceeds existing panel capacity, according to as-built load calcs.	▪ 14 kVA (40 A at 208 V 3-phase). ▪ Demand exceeds existing panel breaker capacity.	14 kVA (40 A at 208 V 3-phase).	30 kVA (82 A at 208 V 3-phase).	▪ 30 kVA (82 A at 208 V 3-phase). ▪ Demand exceeds existing panel capacity, according to latest plan load calcs.
Control Requirements	Either connect directly to the ControlLogix MTU via Ethernet, one of the MicroLogix RTUs via hardwire, or install a new MicroLogix 1400 locally.	Either connect directly to the SLC 505 PLC (either Ethernet or hardwire), or install a new MicroLogix 1400 locally.	Either connect directly to the MicroLogix PLC via hardwire, or install a new MicroLogix 1400 locally.	Either connect directly to the MicroLogix PLC via hardwire, or install a new MicroLogix 1400 locally.	Either connect directly to the MicroLogix PLC via hardwire, or install a new MicroLogix 1400 locally.	Either connect directly to the MicroLogix PLC via hardwire, or install a new MicroLogix 1400 locally.	Either connect directly to the MicroLogix PLC via hardwire, or install a new MicroLogix 1400 locally.	Either connect directly to the MicroLogix PLC via hardwire (assuming the new PLCs are identical to most sites), or install a new MicroLogix 1400 locally.
Telemetry Requirements	MTU on site. Remote monitoring with local controls.	RTU available. Remote monitoring with local controls.	RTU available. Remote monitoring with local controls.	RTU available. Remote monitoring with local controls.	RTU available. Remote monitoring with local controls.	RTU available. Remote monitoring with local controls.	RTU available. Remote monitoring with local controls.	RTU likely available. Remote monitoring with local controls.
Station Service Voltage	120/208	120/208	120/208	120/240	120/208	120/208	120/208	120/240

Site and right-of-way improvements will be required to incorporate truck turnarounds for the Parkwater, Ray, and Central Well Stations.

Tree removal will be avoided where possible. Landscaping will likely be required for sites in residential zones such as Central, Ray, and Hoffman. Water service and electrical service will be provided to the new building and the fluoride solution injection line between the fluoride building and the well station will be installed in an accessible utilidor for future maintenance and replacement.

Most of the well station sites have plenty of space for additional yard piping. However, the Nevada and Grace Well Stations are located at the Water Department site where there are numerous fiber optic communication lines installed under the site that were not marked for the condition assessment phase of this project. These will need to be coordinated with any new yard piping on the site. Also, the Havana Well Station site will require numerous utility crossings with the proposed fluoride solution injection line which will need to be evaluated during design.

3.1.2.3 General Building Requirements

Proposed building sizes for both chemical alternatives are summarized in **Table 3-3** and are illustrated on the site plans in **Appendix A** and in the building, layout concepts in **Appendix B.** Each building construction type will align with the architectural style of the existing well station in residential zones to limit visual impact to the neighborhood. A geotechnical evaluation for each site will be required during final design, as well as design of HVAC systems. For facilities where the new fluoridation building will be attached to the existing well station building, the new building will need to be evaluated to determine if it can tie into the existing building footing or if the new structure needs a stand-alone foundation.

Due to space limitations on the Central Well Station site, the existing control building must be demolished down to the foundation and a new building constructed to accommodate the fluoridation equipment. Concept-level building layouts (liquid chemical and dry chemical) for the sites are included in **Appendix B**.

3.1.2.4 Electrical and Controls Requirements

The specific estimated electrical requirements for each well station are shown in **Table 3-3**. More electrical circuits would likely be required for the dry chemical option compared to the liquid chemical option.

The programable logic control (PLC) monitoring controls strategy between the liquid and dry options would likely differ, but this would not affect equipment cost. Further, the existing MicroLogix 1100 PLCs at the well pump stations are no longer manufactured, so replacement parts are limited. The existing City-owned MicroLogix 1100 PLCs will continue to operate, and programming can still be modified, but the 1100 hardware is not supported by the manufacturers. Replacement of the PLCs with a MicroLogix 1400 model at each station needs to be assessed further during pre-design of the preferred alternative.

3.1.2.5 Dry Chemical Facility Requirements

The new chemical building required to accommodate the dry chemical equipment would have a smaller footprint, but a larger height compared to the liquid chemical option to accommodate the bulk bag unloader equipment used to handle the chemical super sacks. It is recommended that due to the corrosive nature of the chemicals, the chemical handling equipment be located in a separate room from any electrical or controls equipment. The sodium fluoride saturator would most likely be installed below grade to avoid an excessive building height and to keep it below the bulk bag unloader so that chemical is added to the saturator via gravity. The saturator height must be sufficient to accommodate the following.

- an underdrain
- a gravel bed
- at least 12 inches of chemical, at all times
- additional chemical height after a super sack is unloaded
- saturated solution above the sodium fluoride layer
- freeboard space

The building layout sizes in **Appendix B** assume that the City's reserve chemical storage would be located offsite allowing the City to better manage stored chemicals and increase storage during peak summer demand seasons. Only one super sack would need to be stored in the building at one time. The saturator could be sized larger so that more than one super sack could be dumped into the saturator during a visit, decreasing deliveries to the sites. For well stations that are offline during the winter months, operations would plan to use all dry chemical within the bulk bag unloader before shutdown. To provide further flexibility a 50-pound bag unloading hood could be added directly to the saturator to allow operators to load small volumes of dry chemical as needed during the spring and fall operational transition periods.

3.1.2.6 Liquid Chemical Facility Requirements

The proposed building for the liquid chemical (see **Appendix B**) would likely have a larger footprint compared to the dry chemical building due to the size of the storage tanks. Both tanks (bulk and day tank) are required to have secondary containment. Some manufacturers offer double-walled tanks that have built-in containment; if these are not used containment would likely be installed below-grade. The liquid facility layouts include a day tank and a transfer pump to move the chemical from the bulk tank to the day tank. It is important that chemical fumes are vented upwards since the chemical rises and can create an unpleasant odor. It is also recommended that chemical storage and handling equipment be located in a separate room from any electrical or controls equipment due to the corrosivity of the chemical fumes.

3.2 Operations and Maintenance Considerations

This portion is a general overview of operation, maintenance, and safety considerations. This section lists common factors and/or basic procedures for each chemical.

3.2.1 Sodium Fluoride System Operation and Maintenance

A saturator or saturator-style tank would be used to create the four percent sodium fluoride solution. The saturator would be fed using a super sack loaded into the bulk bag unloader which reduces product dusting and operator exposure. To minimize dust, additive bags should be secured in the bulk bag unloader before it is opened. Operation activities includes loading super sacks and checking the sodium fluoride bed to verify a sufficient supply of product. When the bed is depleted, the operator would add another super sack of product to the bed.

The concept-level alternatives assume that each saturator is sized to hold one super sack volume of chemical above the minimum bed depth. However, the frequency of chemical deliveries to each site could be reduced with a larger saturator so that more than one super sack would be discharged into the saturator during a delivery site visit.

Maintenance should be performed regularly to ensure that all equipment is working correctly. **Table 3-4** provides a summary of typical operations and maintenance activities for sodium fluoride dry chemical injection systems.

Table 3-4 | Sodium Fluoride Recommended Operations and Maintenance Schedule

Daily/Weekly
Inspect the system
Look for leaks
Check additive solution levels
Check the solution level switch
Check hoses for air leaks
Check the pump for prime
Super sack delivery and refill feed hopper unloader
Quarterly
Remove cinders or encrustations in the saturator, pipes, and hoses
Verify a uniform flow through the additive bed
Verify water softener is in working order
Verify water strainer
Check all piping for leaks
Inspect tank level measurements (floats, gauges, etc.)
Calibrate the pump delivery rate
Rotate the additive inventory
Bi-Annually
Check the lubrication and adjustments of motor driven pumps
Check for crystalline deposits in valves, lines, hoses, and injectors
Disassemble and clean foot valves, lines, hoses, and injectors
Test the operation of vacuum breakers and anti-siphon valves
Disassemble and replace worn parts of vacuum breakers and anti-siphon valves

Annually
Thoroughly clean the saturator/tank
Disassemble and replace worn parts of metering pumps
Replace hoses, diaphragms, seals, etc. of metering pumps
Flush feed lines
Clean foot valves, suction/discharge valves, anti-siphon valves, vacuum breakers, and injection check valves

3.2.2 Liquid (FSA) Operation and Maintenance

A typical bulk FSA system includes an exterior fill port on the building for the bulk tank and then a manual transfer pump is used to convey FSA from the bulk storage tank to the day tank. Gravity feeding of day tanks from bulk tank should be avoided. Tanks should never be filled automatically, and transfer of FSA should always be monitored (10 States Standards and CDC requirements).

Table 3-5 provides a summary of typical operations and maintenance activities for FSA chemical injection systems.

Table 3-5 | FSA Recommended Operations and Maintenance Schedule

Daily
Inspect the system
Look for leaks or differences
Check additive solution levels
Check hoses for air locks
Check the pump for prime
Fill the day tank
Quarterly
Check all piping for leaks
Check gas venting for integrity
Check pipes and hoses for encrustations
Inspect tank level measurements (floats, gauges, etc.)
Calibrate the pump's delivery rate
Bi-Annually
Check the lubrication and adjustments of motor driven pumps
Check for crystalline deposits in foot valves, lines, hoses, and injectors
Disassemble and clean foot valves, lines, hoses, and injectors
Test the operation of vacuum breakers and anti-siphon valves
Disassemble and replace worn parts of vacuum breakers and anti-siphon valves
Annually
Disassemble and replace worn parts of metering pumps
Replace hoses, diaphragms, seals, etc. of metering pumps
Flush feed lines
Clean foot valves, suction/discharge valves, anti-siphon valves, vacuum breakers, and injection check valves

3.2.3 Staffing Levels

Based on the previous recommended operations and maintenance activities the following level of effort has been developed to determine requirements for full-time equivalent (FTE) operational staff needs.

Table 3-6 provides a summary of hours per day, per month, and per year. The costs associated with these staffing requirements are included in the 50-year life cycle cost analysis in **Section 3-3.**

Table 3-6 | O&M Staffing Requirements

Task	Daily	Monthly	Yearly
Both Systems			
Daily Inspection	7	210	2,520
Daily Distribution Monitoring	4	120	1,440
Preventative Maintenance		4	48
Materials Replacement Costs		4	48
Safety Costs		2	24
I&C Maintenance		2	24
Dry Chemical System Only			
Super sack Replacement	3.5*	105	1,260
Chemical Delivery		2	24
Equipment Maintenance			1,232
Total Staff Hours Per Year: Dry Chemical System			**6,620**
Staff FTE: Dry Chemical System			**3.2**
Liquid Chemical System Only			
Day Tank Fill	3.5	105	1,260
Chemical Loading		7	84
Equipment Maintenance			868
Staff Hours Per Year: Liquid Chemical System			**6,316**
Staff FTE: Liquid Chemical System			**3.0**

*Averaged over the week; super sack replacement would not need to occur every day.

3.2.4 Safety

These general recommended practices are based on the CDC's understanding of the consensus of various safety data sheets (SDS) practices. The CDC recommends that personnel in potential contact with fluoride products always wear personal protective equipment (PPE). The equipment will vary based on the task being performed. Even with a full-face shield and goggles, eye irritation is possible, especially if PPE fails. In the event of a spill, a safety shower and eye wash station should be available for immediate use. The manufacturer's SDS is the primary source of information for PPE required to handle concentrated fluoride additive product.

Exposure to single, large doses of concentrated fluoride additive product results in symptoms that vary by person. These include nonspecific symptoms: headache, sweating, excessive salivation, tearing, mucous discharges from nose and mouth, diarrhea, and generalized weakness. Potentially fatal symptoms include spasms, tetany and convulsions, weak pulse, low blood pressure, irregular heartbeats, and pulmonary edema.

In 2006, United States Environmental Protection Agency (EPA) reviewed current health effect information for the primary maximum contaminant level (MCL) of 4.0 milligrams per liter (mg/L) based on quantitative risk assessment for severe dental fluorosis, the risk for increased bone fractures as related to fluoride, and the less than crippling form of skeletal fluorosis (Stage II skeletal fluorosis). The review panel recommended updating the MCL. The EPA is conducting new research on the impacts of skeletal fluorosis, and skeletal fractures and has updated the source contributions for fluoride. The EPA may update the MCL or MCLG based on health effects in the future. The lethal dose of fluoride is currently thought to be from 2 to 8 milligrams per kilogram of body weight with lethal doses reported with levels of 16 milligrams per kilogram (mg/kg) in children and 32-64mg/kg in adults.

Use of PPE should be determined for each task based on a site-specific risk assessment. Risk assessments should consider the following.

- Using PPE
- Long gloves, coveralls, boots, apron, safety goggles, and face shield1
- Not eating or smoking in an additive storage area
- Cleaning up an additive storage area promptly after a spill
- Washing clothes and body after exposure to concentrated additive product
- Washing hands after exiting an additive product storage area
- Having a backup “buddy” when entering any additive product storage area
- Using a checklist when conducting safety and operating procedures
- Documenting checklist use
- Access to a first aid kit including a burn kit and acid neutralizer

[1] Note: Based on developed standard operating procedures (SOPs), may allow for handling of sodium fluoride that limits operators’ exposure and reduce need for PPE.

- Spill control response aids should be readily accessible wherever liquid additives are handled. Spill control absorbent pillows and dams should be used for initial containment. Follow-up action to neutralize the acid with lime or caustic soda is essential.

Overfeeding of either chemical above 4 mg/L would pose a City-wide hazard for all customers of the water system; however, numerous redundant design features would be incorporated to prevent overfeed, including the following.

- Process control
- Equipment calibration
- Anti-siphon devices
- Backpressure
- Calibration columns
- Analyzer(s)
- Check valve(s)
- Flow switch(es)

3.2.5 Operator Certification

The requirements for operator certification were reviewed based on the Washington State Department of Health Purification Plant Criteria Worksheet. As noted in the worksheet, a water system with groundwater supply with only chlorination is considered a distribution system, not a water treatment facility. The addition of fluoride would result in a reclassification of water treatment certification. The City currently provides residual disinfection and at this level of treatment does not require a certified water treatment plant operator. The addition of fluoride would result in a reclassification per WAC 246-292-050 that requires a minimum operator certification of Water Treatment Plant Classification 2, WTPO 2. The City will need to designate at least one certified operator in responsible charge of the fluoridation system at this certification level.

3.3 Cost

Concept-level Class 5 capital costs (as defined by AACE International) were developed for each of the chemical alternatives and each well station. Because some elements of the alternatives design were created at a concept-level for this OPCC, the OPCC can be classified with accuracy ranges of -30 percent on the low side and +50 percent on the high side. According to AACE International, Class 5 estimates are useful for high-level screening studies such as the alternatives analysis in this Report. A concept-level 50-year LCCA was developed based on the concept alternatives defined in Section 3.1. All costs (see Table 3-9) are in August 2022 US Dollars based on information available at the time the costs were developed. Because the construction date(s) of the fluoridation systems is (are) unknown, capital costs were not escalated to a future construction year.

Final costs will depend on the following.

- actual field conditions
- actual material and labor costs
- market conditions for construction
- regulatory factors
- final project scope
- method of implementation
- schedule

Detailed workups of the costs are included in **Appendix D.** The capital OPCC unit costs were based on the Murraysmith estimating database.

The Murraysmith estimating database is stored within HCSS Heavybid Software. The estimating data based was developed from data across multiple industries and disciplines. The data base includes but is not limited to the costs from projects related to heavy civil, buildings, roads, railways, bridges, airports, dams, sewer systems**,** trenchless projects, tunnels, demolition, drilling and blasting operations, water systems, wastewater treatment facilities, landfills, concrete structures, under water construction projects, water filtration systems, dewatering systems, aquifer storage and recovery well construction, electrical generation facilities, electrical distribution systems, environmental protection projects, storm water management projects, and emergency response projects.

The Murraysmith database includes complete integration with RS Means, most of the United States Department of Transportation (DOT) unit cost data bases, and other national and regional costs data sources. The actual bid tab results from DOT websites are also integrated into the Heavybid system for easy comparison. These data bases together with the data form current and past projects allow Murraysmith to provide the most current cost available. Because of uncertainty with supply chains and market conditions Murraysmith does not recommend or use average unit costs, or unit cost averages that are older than 3 years.

Database inputs include labor, equipment, materials, subcontractor quotes, specialty equipment, and local contractor quotes as required. The estimates may also include costs that are derived **from first principles.** This input is updated on a quarterly basis or as required by project specific requirements. The inputs are organized by state and region within each state. This provides the most current and accurate cost data for a project within a specific region. For this OPCC, the Murraysmith data is measured against the Washington DOT information, the Spokane Washington RS Means information, and supplemented with current specialty equipment cost, or other regional data.

The OPCC costs were based on the following additional assumptions.

- Budgetary manufacturer quotes were used for the dry chemical bulk bag unloader (which includes the bag powder seal) and the liquid bulk and day storage tanks.

- Other equipment costs were based on Murraysmith's estimating data base of capital cost information.

- Site improvements were based on Murraysmith's database of capital cost information. Larger site improvements costs were used for sites with industrial or commercial zoning such as Parkwater or the Grace-Nevada site.

- Building costs were based on Murraysmith's database of capital cost information.

  - Larger building costs were used for sites located in residential zones where the architectural style would need to match the existing well station.

  - Various building sizes were developed to scale with the capacity of the well stations, see **Appendix B**.

  - Optimization of the larger building layouts may help with cost savings during preliminary design. While a square-shaped building may work best with some sites, a longer-shaped building is a more efficient use of indoor equipment space.

  - Unit building costs include HVAC, dust and gas venting/scrubbing, and safety equipment.

  - Replacement of HVAC systems due to corrosion was not evaluated and is within the contingency of a Class 5 estimate.

  - Dry chemical costs include three standalone dry chemical storage facilities. The well stations would share storage between the three facilities.

- It was assumed that the existing control building located at the Central Well Station site would be demolished to the foundation and replaced with a new facility housing existing well controls, existing chlorination equipment, and the proposed fluoridation system.

- Land or right-of-way acquisition is not expected to be required.

- Fluoride injection or water service yard piping were not included for sites where the building is not located next to the well station, since fluoride injection design will not begin until preliminary design.

- A 30 percent contingency was applied to the capital costs.

The life cycle cost analysis was based on the following assumptions and inflation projections.

- A 50-year life cycle.

- A five percent net present value discount rate was applied to the first 20 years of the LCCA; a discount rate of three percent was used for the last 30 years.

- Equipment maintenance and repairs were assumed to be two percent of capital costs each year.
- The LCCA includes estimated energy costs.
- Chemical cost budgetary quotes were obtained from two different suppliers. The highest supplier cost was used for the LCCA. See **Table 3-7**. The chemical demand estimate for each well station was based on average production in 2021 for the portion of the year a well station is typically operated (e.g., the smaller wells are typically not used in the winter).
- Labor costs were based on the FTE assumptions noted in **Table 3-2** and a labor cost of $70 per hour.
- Electrical and controls equipment were assumed to require replacement every 10 years. All other equipment, including site driveways were assumed to require replacement every 20 years.
- A 30 percent contingency was applied to the LCCA costs.
- Inflation was projected at a variable rate for the next 50 years based on current and anticipated future market conditions, as shown in **Table 3-8.**

Table 3-7 | Annual Chemical Costs

Well Station	Monthly Liquid Demand (lbs)	Monthly Dry Demand (lbs)	Number of Operating Months Per Year	Dry Cost Per Year	Liquid Cost Per Year
Well Electric	23,827	9,305	12	$ 256,900	$ 143,000
Parkwater	29,970	11,704	12	$ 323,100	$ 179,900
Nevada	14,064	5,492	8	$ 101,100	$ 56,300
Grace	11,293	4,410	8	$ 81,200	$ 45,200
Hoffman	5,950	2,324	8	$ 42,800	$ 23,900
Central	11,295	4,411	8	$ 81,200	$ 45,200
Ray	12,833	5,011	8	$ 92,300	$ 51,400
Havana	10,348	4,041	12	$ 111,600	$ 62,100
TOTAL	**119,581**	**46,699**		**$ 1,090,200**	**$ 607,000**

Table 3-8 | Assumed LCCA Inflation Rate Projections

Year Range	Annual Inflation Rate Projection
2022-2023	12.5%
2023-2024	12.0%
2024-2025	8.0%
2025-2050	5.0%
2050-2080	3.0%

Table 3-9 | Class 5 OPCC and LCCA

2022 Dollars	Dry Chemical			Liquid Chemical			% Difference Capital Cost	% Difference Operating Cost
Well Station	**Capital**	**50-Year LCCA**	**Average 50-Yr Annual Operating**	**Capital**	**50-Year LCCA**	**Average 50-Yr Annual Operating**	**Dry minus Liquid**	**Dry minus Liquid**
Well Electric	$ 1,616,000	$11,199,000	$224,000	$ 1,423,000	$ 8,772,000	$ 176,000	12%	22%
Parkwater	$ 1,865,000	$12,266,000	$246,000	$ 1,683,000	$ 9,189,000	$ 184,000	10%	25%
Ray	$ 1,332,000	$6,656,000	$134,000	$ 1,108,000	$ 5,419,000	$ 109,000	17%	19%
Central	$ 1,622,000	$6,722,000	$135,000	$ 1,328,000	$ 5,379,000	$ 108,000	18%	20%
Grace/Nevada	$ 1,616,000	$10,139,000	$203,000	$ 1,423,000	$ 8,182,000	$ 164,000	12%	19%
Hoffman	$ 1,332,000	$6,656,000	$134,000	$ 1,108,000	$ 5,419,000	$ 109,000	17%	19%
Havana	$ 1,618,000	$8,396,000	$168,000	$ 1,436,000	$ 7,100,000	$ 142,000	11%	15%
Total	$ 11,001,000	$62,034,000	$1,244,000	$ 9,509,000	$ 49,460,000	$ 992,000	14%	20%

The cost analysis shows that the two chemical alternatives are comparable in terms of capital costs. Because the liquid chemical bulk storage is located onsite, the larger well stations have more expensive liquid chemical buildings and almost match capital costs for the dry chemical option. However, the liquid chemical capital costs are lower for the smaller well stations since the building is smaller and equipment is cheaper compared to the dry system.

For all sites, the dry chemical alternative was estimated to cost about 15-25 percent more in operational costs primarily due to the cost of the chemicals.

SECTION 4

Section 4

Alternatives Assessment

4.1 Alternatives Screening

This section details a review of the evaluation criteria defined in Section 2.3 for the dry and liquid chemical options. Table 4-1 summarizes this evaluation for quick reference.

Sodium fluorosilicate was eliminated from consideration due to the limited long-term supply availability.

Table 4-1 | Alternatives MODA Screening Data

MODA Criterion	Dry Chemical	Liquid Chemical
ENVIRONMENTAL AND SUSTAINABILITY		
Impact to Aquifer	A leak would be limited to saturator smaller volume. Higher chance of chemical spill in dry form, but lower impact to aquifer (easier to clean up).	Higher potential impact with liquid spill or leak with delivery and bulk storage. Lower chance of spill.
Energy Use	Similar, additional electrical components and dust control.	Similar, additional fume ventilation required.
Impact to Critical Areas	Same, site dependent.	Same, site dependent.
Impact to City's Sustainability Goals	Higher carbon footprint due to more frequent delivery trips.	Lower carbon footprint due to fewer delivery trips.
NEIGHBORHOOD IMPACTS		
Impacts During Construction	Same, site dependent.	Same, site dependent.
Cultural Impacts	Same, site dependent.	Same, site dependent.
Aesthetic Impacts	Higher with additional building height requirements for hopper system.	Larger building, shorter height.
Historical Preservation Impacts	Same, site dependent.	Same, site dependent.
Traffic Impacts	▪ Smaller delivery vehicle. ▪ During peak demand: 2 trips per week for Parkwater, 1 trip per month for Hoffman ▪ During winter demand: 1-2 trips per week for Parkwater, 2 trips per month for Havana (smaller wells not operating) ▪ Construction traffic same.	▪ Monthly or bi-monthly chemical deliveries. ▪ Larger delivery vehicle. ▪ Construction traffic same.
Noise, Air Quality, and Odor Impacts	▪ No noticeable odor. ▪ Construction noise same.	▪ More odor potential but can be mitigated by ventilation design. ▪ Construction noise same.
SAFETY--PUBLIC		
Local Neighborhood Hazards	More delivery traffic; see above.	Less delivery traffic; see above. Potential for spills.
Hazards to Broader Region	Less with dry chemical.	Higher potential impact from spills.
SAFETY--WORKER		
Chemical Unloading/Loading	Forklift safety considerations and addressing dust filling hopper.	Truck loading containment needed for spills.
Chemical Handling/Exposure	More chemical handling with super sack delivery. Higher exposure potential with dry chemical. Chemical exposure is less hazardous to worker.	Lower chemical handling. Lower exposure potential with liquid chemical. Chemical exposure is more hazardous to worker.
Process Safety Management	Not subject to OSHA Process Safety Management	Not subject to OSHA Process Safety Management
PPE Required	Respiratory and skin exposure protection. Leather gloves, coveralls, respirator, and goggles.	Splash protection. Long gloves, coveralls, apron, boots, googles, and face shield.
Safety Equipment Required	Same.	Same.
SERVICE RELIABILITY		
Extreme Conditions Resiliency	Same.	Same.
Overfeeding Impacts	Same.	Same.
System Ability to Meet Regulatory Requirements	Same.	Same.
Outcomes at Customer Tap	Same.	Same.
Chemical Purity Consistency	Same.	Same.
Chemical Availability	Multiple manufacturers.	Multiple manufacturers.
Chemical Damage to Equipment/Facilities	Lower corrosivity. Higher potential for clogging/caking in equipment.	Higher potential with corrosive nature. Lower potential for clogging in equipment.

MODA Criterion	Dry Chemical	Liquid Chemical
EASE OF MAINTENANCE AND OPERATIONS		
Training and Certifications	Same – WTPO 2	Same – WTPO 2
FTEs needed	Based on Table 3.6, estimated 3.2 FTEs.	Based on Table 3.6, estimated 3.0 FTEs.
Ancillary Equipment Needed	Need for delivery truck and forklift, and bulk bag unloader. Requires ventilation systems with dust collection filter.	Less with just liquid chemical storage tanks. Requires ventilation system.
Number of Visits to Site Per Week	▪ Daily for equipment inspection. ▪ Super sack delivery during peak demand: 2 trips per week for Parkwater, 1 trip per month for Hoffman ▪ Super sack delivery during winter demand: 1-2 trips per week for Parkwater, 2 trips per month for Havana (smaller wells not operating)	▪ Daily for equipment inspection. ▪ Daily to fill day tank ▪ Monthly or bi-monthly chemical delivery to site
Equipment Replacement	Higher for mechanical equipment.	Lower, with higher tank life.
Equipment Cleaning	Higher with dry chemical to address chemical caking and cleaning of sa	Lower with liquid.
Other Equipment Maintenance	Additional for bulk bag unloader, ventilation filter cleaning, and water softener, beyond regular storage tanks and metering pumps maintenance.	Less with just liquid chemical storage tanks and metering pumps maintenance.
Chemical Shelf Life	Same.	Same.
Time Spent at Each Site Per Visit	▪ 30 minutes per visit for daily inspection. ▪ For super sack deliveries: Approx 1.5 hours/visit per site.	▪ 30 minutes per visit for daily inspection. ▪ 30 minutes to fill day tank ▪ 2 hours for chemical delivery

4.2 Alternatives Evaluation

4.2.1 Environmental and Sustainability Impacts

The short-term and long-term impacts of each chemical alternative include potential for contamination of the aquifer, facility energy use, impact to critical areas, and overall impact on the City's Sustainability Goals.

4.2.1.1 Chemical Considerations

Both chemicals use a similar amount of power for equipment and building operation. However, fewer delivery trips would be required for transport of the liquid chemical. A spill of the dry chemical would be easier to clean up and has less potential to infiltrate into the aquifer. A spill of the saturator tank would be more likely to reach the aquifer compared to the dry chemical as delivered. However, the saturator volume is much smaller compared to the liquid chemical bulk tanks. The liquid chemical has a higher potential for a large spill which could contaminate the aquifer; this risk would be mitigated via liquid double containment as discussed in the Alternatives Summary section.

4.2.1.2 Site Considerations

The Well Electric Well Station is located along the Spokane River, so this site has the highest potential to impact critical areas in the event of a spill.

Removal of large trees can most likely be avoided for most sites; see **Table 3-3**.

4.2.2 Neighborhood Impacts

Cultural impact, aesthetics, historical preservation, impacts during construction, and traffic were evaluated as potential impacts to the neighborhood of each well station. Noise, air quality, and odor were also considered.

4.2.2.1 Chemical Considerations

Traffic impacts depend primarily on chemical type. Because the liquid chemical is delivered in bulk it requires a larger delivery truck, though deliveries are less frequent compared to the dry chemicals. Aesthetically, the dry chemical may have more of an impact on the neighborhood due to the height requirements for the chemical hopper system, though the liquid building would likely have a larger footprint. Noise and air quality impacts would be minimal for either chemical since the equipment would be enclosed.

Sodium fluoride carries no noticeable odor, but FSA causes an unpleasant acidic odor. Proper ventilation design of the facility can direct the odor upwards. Since the fumes are lighter than air, they will rise and have a negligible effect on the local neighborhood.

4.2.2.2 Site Considerations

For historical preservation and aesthetic purposes, the architectural style of the existing well stations located in residential zones will be used for the proposed fluoridation facilities. These include the Hoffman, Ray, Central, and Havana Well Stations. These well stations would also experience a higher impact during construction compared to well stations located in commercial or industrial areas.

Due to its location on the Spokane River, the Well Electric Well Station likely has the highest potential for cultural impacts if artifacts are found or impacted during construction.

4.2.3 Safety—Public

Both local neighborhood and regional safety impacts were considered for each chemical alternative.

4.2.3.1 Chemical Considerations

The higher level of delivery traffic required for the dry chemical would pose a higher safety risk to the local neighborhood. A spill of the dry chemical is unlikely to leak into the aquifer and would not impact public safety. The liquid chemical would have a higher impact on the broader region in the event of aquifer contamination, though a small spill could be mitigated before aquifer contamination. Secondary containment is required for the liquid chemical buildings (both storage and loading area), so a large spill is unlikely. Neither chemical poses a high fire risk compared to a normal commercial building; however, if a fire should occur, fluoride additive products can release hydrogen and hydrogen fluoride gas, which requires special PPE for first responders. Under normal operating conditions, this gas is not a hazard for system operators. Further fluoride and chlorine needs to be located in separate areas with separate containment to address any potential chemical interactions.

4.2.3.2 Site Considerations

The Hoffman, Ray, Central, and Havana Well Stations are located in residential neighborhoods, so delivery, construction, and maintenance traffic would have a higher safety impact for these sites.

4.2.4 Safety—Worker

Safety impacts to the operators were considered in terms of chemical loading and unloading and chemical handling and exposure. Specific safety processes and required PPE are described in Section 3.2.4.

4.2.4.1 Chemical Considerations

Skin exposure to sodium fluoride is less hazardous than respiratory exposure, but the chemical can cause burns. Recommended PPE includes leather gloves, coveralls, a respirator, and goggles.

The chemical is delivered in a granular form which limits dust. The bulk bag unloader equipment for the dry chemical includes dust collection equipment and dust sealing features which are designed to limit worker dust exposure. Forklift and bulk bag unloader crane safety procedures may be needed to protect workers during use of chemical loading equipment.

Splash protection is the most concerning hazard for FSA; recommended PPE includes long gloves, coveralls, apron, boots, goggles, and face shield. Even with a full face shield and goggles, eye irritation is possible in proximity to FSA, especially if PPE fails. In the event of a spill, a safety shower and eye wash station should be available for immediate use. Spill containment for the liquid chemical will be required both at the chemical loading connection to the fluoridation building and around the bulk storage tank.

4.2.4.2 Site Considerations

Worker safety considerations are likely to be similar for all well stations.

4.2.5 Service Reliability

The reliability of the fluoridation system was evaluated in terms of resiliency during extreme conditions, the impact of fluoride overfeeding, the system’s ability to meet regulatory requirements, outcomes at the customer’s tap, consistency in chemical purity, chemical availability, and potential chemical damage to equipment or facilities.

4.2.5.1 Chemical Considerations

Sodium fluoride and FSA are both produced by multiple manufacturers; however, there are a limited number of manufacturers who produce sodium fluorosilicate and supply is limited and unreliable. Because a long gap in chemical availability would result in an extended outage of the fluoridation system, sodium fluorosilicate was eliminated from the chemical alternatives evaluation. The liquid chemical has a higher potential to damage equipment and facilities due to its corrosive nature but is unlikely to cause an outage of the system if equipment is maintained properly.

Overfeeding impacts, resiliency under extreme conditions, ability to meet regulatory requirements, the outcomes at customer taps, and the consistency of chemical purity are unlikely to vary between chemical types.

4.2.5.2 Site Considerations

Service reliability is unlikely to vary between sites.

4.2.6 Ease of Maintenance and Operations

4.2.6.1 Chemical Considerations

The liquid chemical equipment will likely require less maintenance compared to the dry chemical, though the daily filling of the day tank and inspection of the feed equipment is required. For the dry chemical, multiple deliveries of the chemical super sack are required every week or month, depending on the time of year, whereas the liquid chemical would be delivered less frequently. For each operator to visit the site, more time would need to be spent at the site unloading the dry chemical. Chemical shelf life does not vary between chemicals. The dry chemical would require the largest and most expensive ancillary equipment including a City delivery truck and forklift.

Additionally, for either chemical, an operator with a WTPO 2 certification is required, which is not currently held by any of the City's staff.

4.2.6.2 Site Considerations

The Parkwater Well Station is the highest producing well station in the system, so it would require the most frequent operator visits and delivery of the dry chemical (multiple times per week). Since the dry chemical super sacks would likely be stored in bulk at the Water Department warehouse on E North Foothills Drive, dry chemical loading for the Nevada and Grace Well Stations would be simpler and would likely not require a delivery truck. For the facilities that are typically not operated during the low-use season, chemical deliveries, day tank operation, and daily inspection would not be needed between October and March unless the off-season wells are turned on. These well stations are Grace, Nevada, Central, Hoffman, and Ray.

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SECTION 5

Section 5

Assessment Summary

Table 5-1 summarizes key considerations for each chemical alternative (dry chemical: sodium fluoride; liquid chemical: FSA) as discussed in this Report.

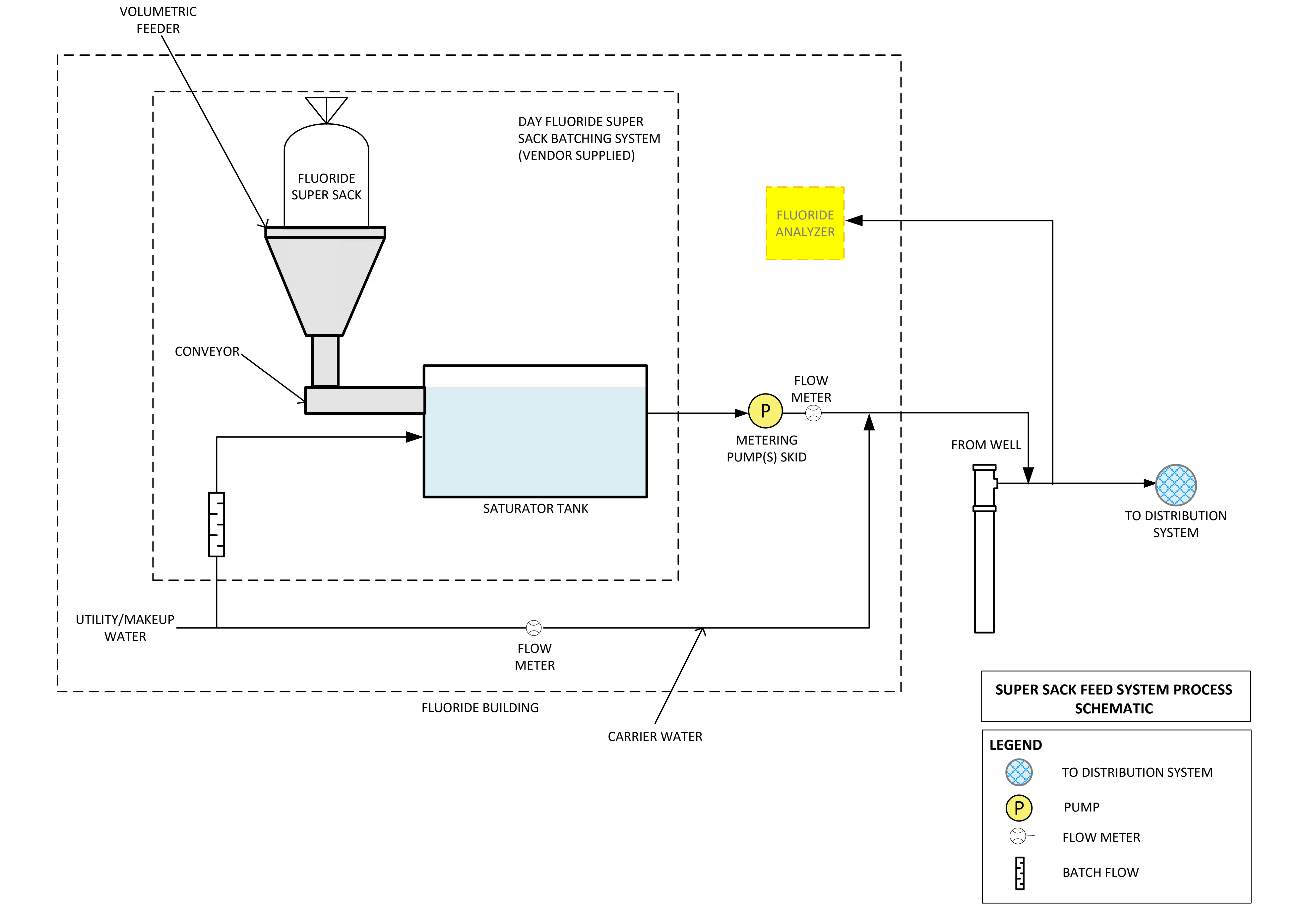
Table 5-1 | Key Alternatives Considerations

Alternative Criterion	Dry Chemical	Liquid Chemical
Cost: Capital (2022 Dollars)	$11.00M	$9.51M
Cost: Annual Operational (2022 Dollars)	$1.24M	$0.99M
ENVIRONMENTAL AND SUSTAINABILITY	▪ Higher carbon footprint ▪ Lower impact of spill ▪ Higher risk of spill	▪ Lower carbon footprint ▪ Higher impact of spill ▪ Lower risk of spill
NEIGHBORHOOD IMPACTS	▪ Higher building with smaller footprint. ▪ More frequent traffic (1-4 trips per month per site), but smaller delivery vehicle. ▪ No noticeable odor.	▪ Larger building, but shorter height. ▪ Less frequent traffic (monthly or bi-monthly) but larger delivery vehicle. ▪ Odor can be mitigated.
SAFETY--PUBLIC	▪ More delivery traffic. ▪ Less potential for chemical spills.	▪ Less delivery traffic. ▪ Higher potential for spills.
SAFETY--WORKER	▪ Respiratory exposure, respirator required. ▪ Some skin protection required but less compared to liquid chemical. ▪ More chemical handling; higher risk of exposure. ▪ Exposure is less hazardous to worker. ▪ Smaller containment required. ▪ Forklift safety considerations.	▪ Splash protection required. ▪ More PPE required. ▪ Less chemical handling; lower risk of exposure. ▪ Exposure is more hazardous to worker. ▪ Larger containment required.
SERVICE RELIABILITY	▪ Less potential to damage facilities. ▪ More chance of clogging/caking in equipment.	▪ Corrosivity may damage facilities. ▪ Lower change of clogging in equipment.
EASE OF MAINTENANCE AND OPERATIONS	▪ Deliveries are more frequent but require less time per delivery. ▪ No daily operation of facilities other than inspection. ▪ More equipment maintenance required. ▪ Forklift required. ▪ Estimate 3.2 FTEs.	▪ Less frequent deliveries, but more time required per delivery. ▪ Daily transfer pump operation required. ▪ Less equipment maintenance required. ▪ Estimate 3.0 FTEs.

The information in this section will be used to “score” the liquid and dry chemical options against the City’s MODA criteria as part of Task 6 of this engineering study on fluoridation of the City’s system. Task 6 includes City selection of a chemical alternative, and a preliminary design will be completed for the selected alternative in early 2023.

APPENDICES

APPENDIX A
PROCESS FLOW DIAGRAMS



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SPOKANE FLUORIDATION STUDY

DRY CHEMICAL PROCESS FLOW DIAGRAM

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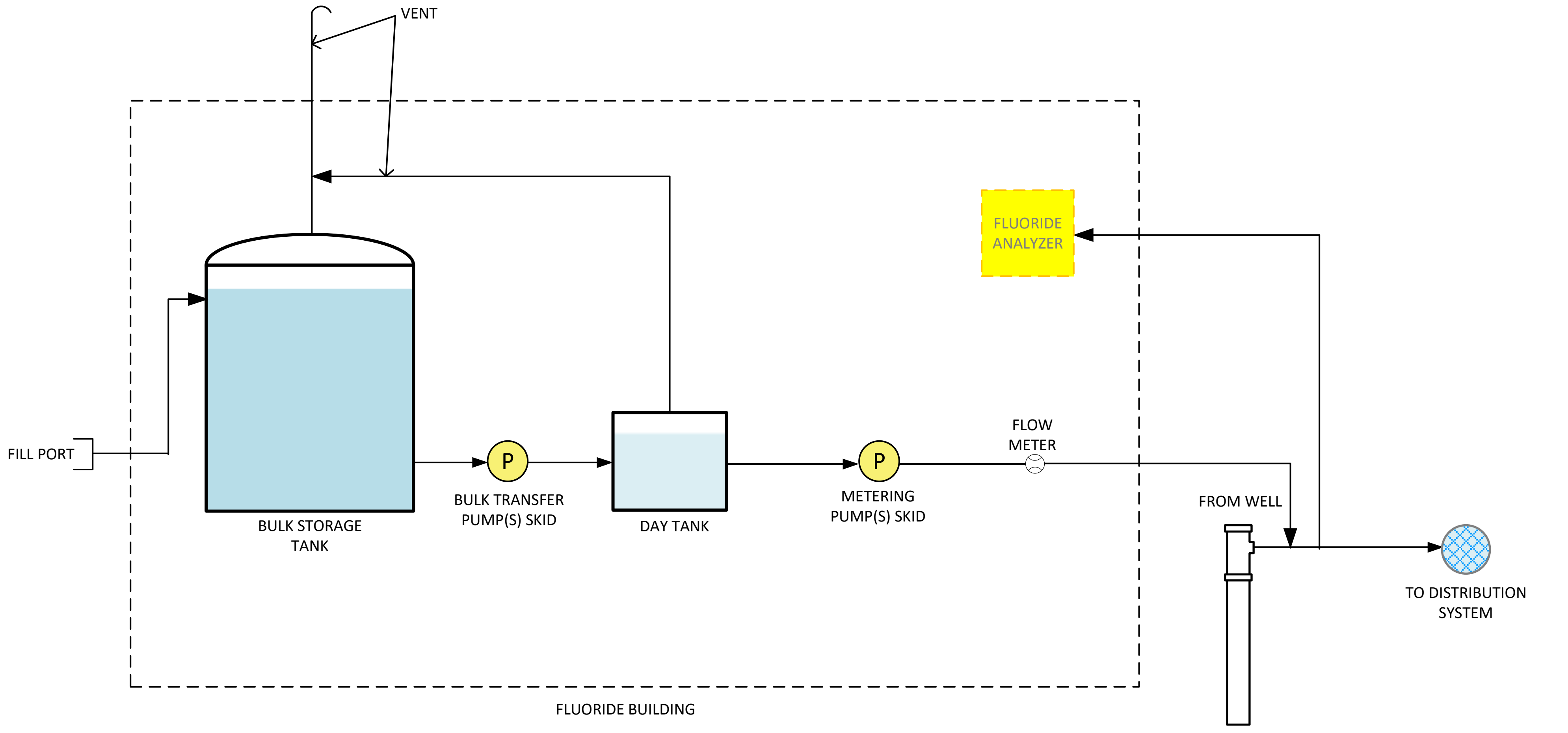
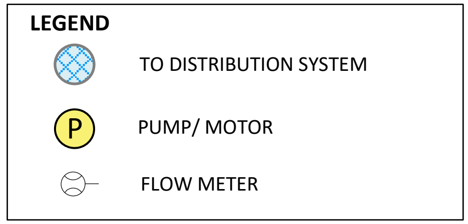


BUILK LIQUID FEED SYSTEM PROCESS SCHEMATIC



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SPOKANE FLUORIDATION STUDY

LIQUID CHEMICAL
PROCESS FLOW DIAGRAM

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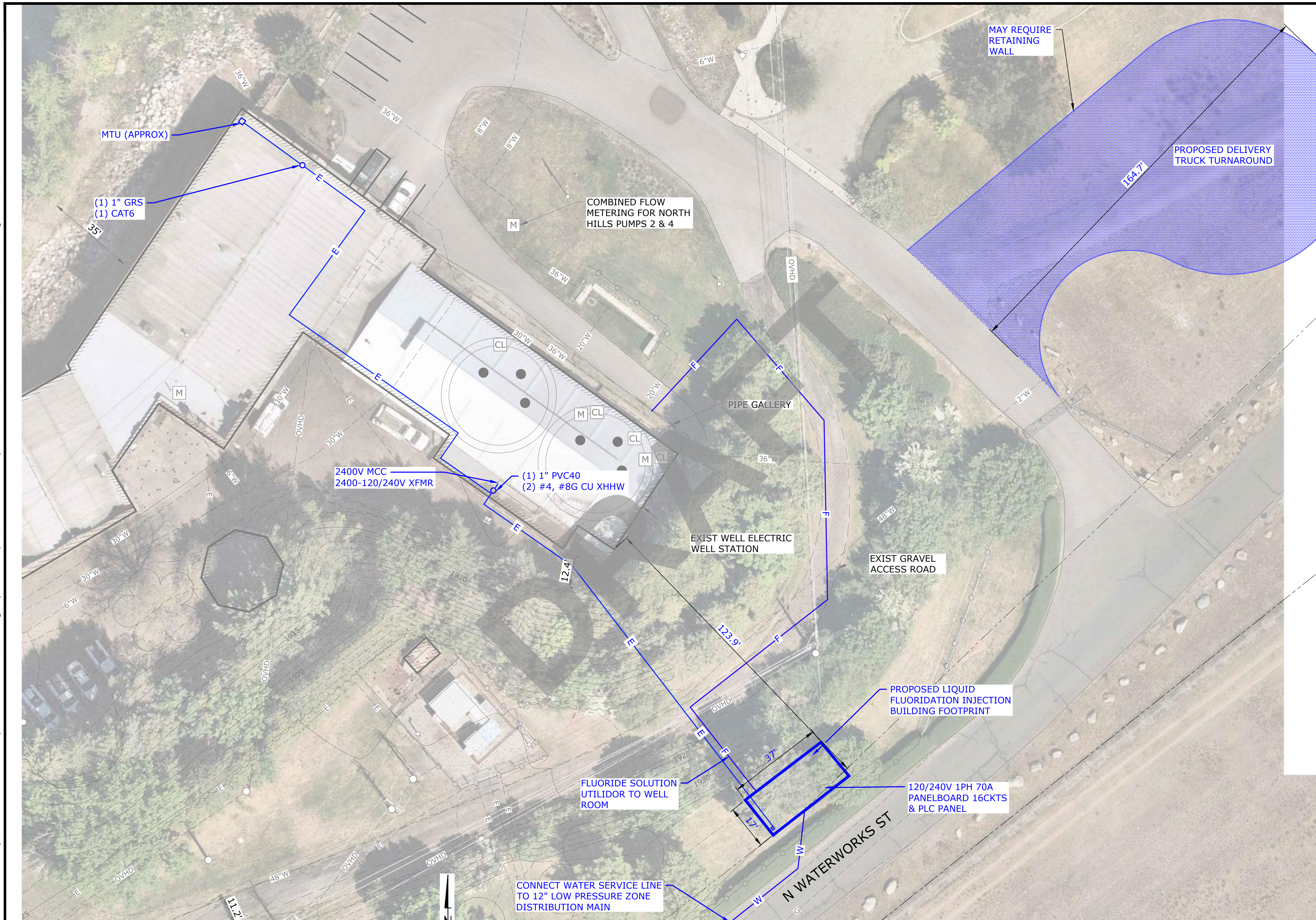
APPENDIX B
PRELIMINARY SITE PLANS



LEGEND

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CL	CHLORINE ANALYZER
●	CHLORINE INJECTION POINT
▲	SAMPLE POINT FOR CHLORINE MONITOR ANALYSIS
○	APPROX LOCATION OF WELL PUMP
—F—	CHEMICAL SOLUTION LINE
—W—	PROPOSED WATER SERVICE LINE
—E—	PROPOSED ELECTRICAL SERVICE LINE

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SPOKANE FLUORIDATION STUDY

WELL ELECTRIC
WELL STATION SITE PLAN

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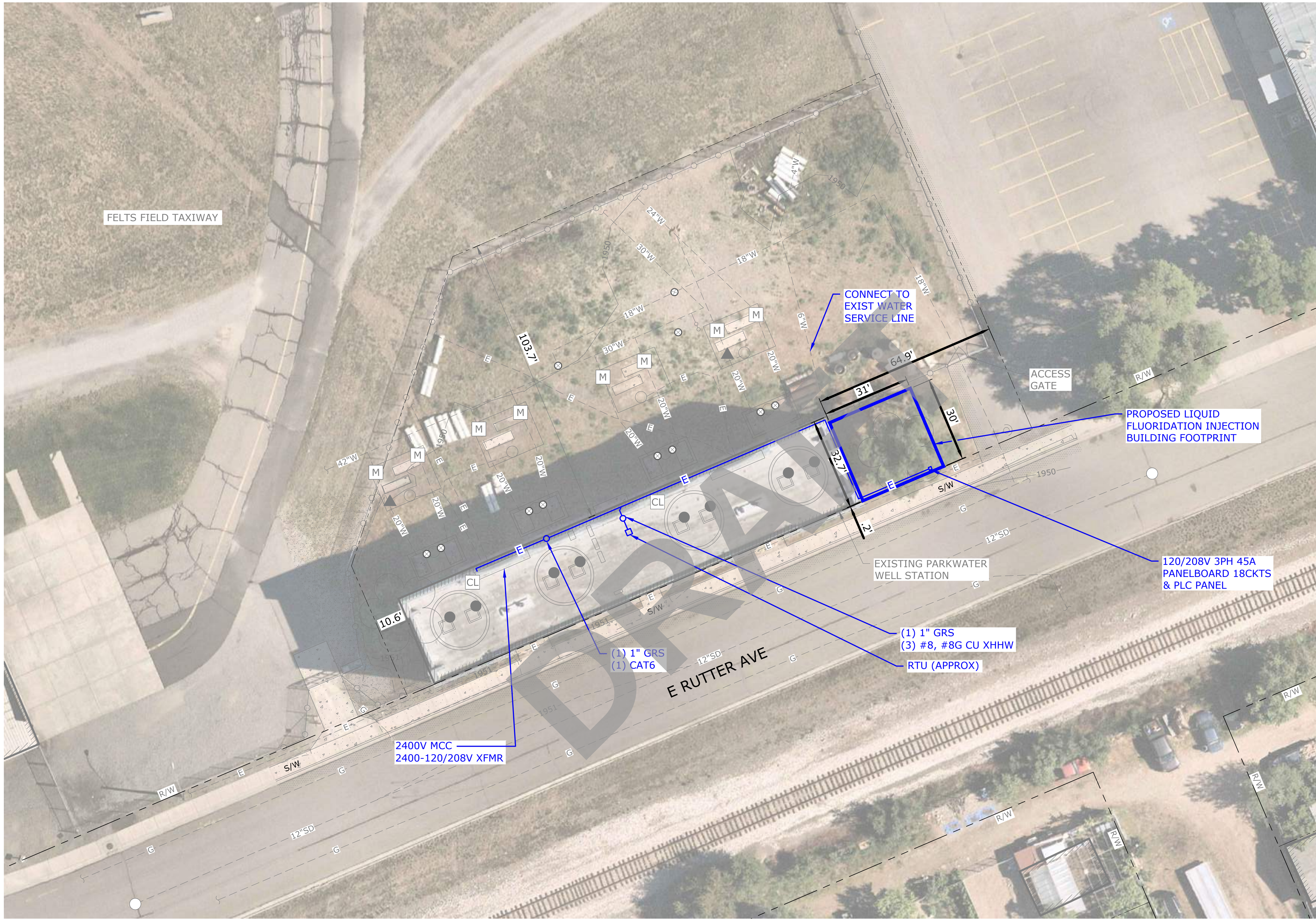

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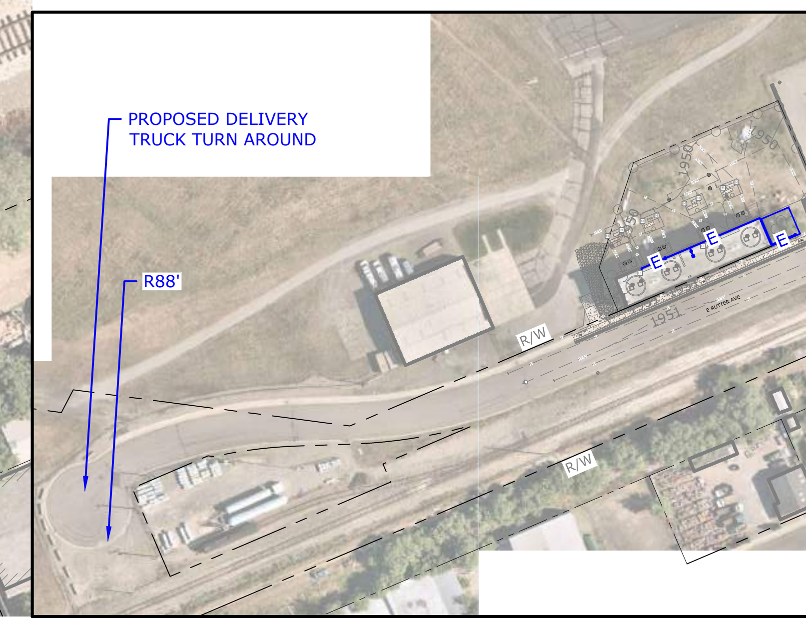
○	APPROX LOCATION OF WELL PUMP
—E—	PROPOSED ELECTRICAL SERVICE LINE



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VICINITY MAP
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SPOKANE FLUORIDATION STUDY

PARKWATER WELL STATION SITE PLAN

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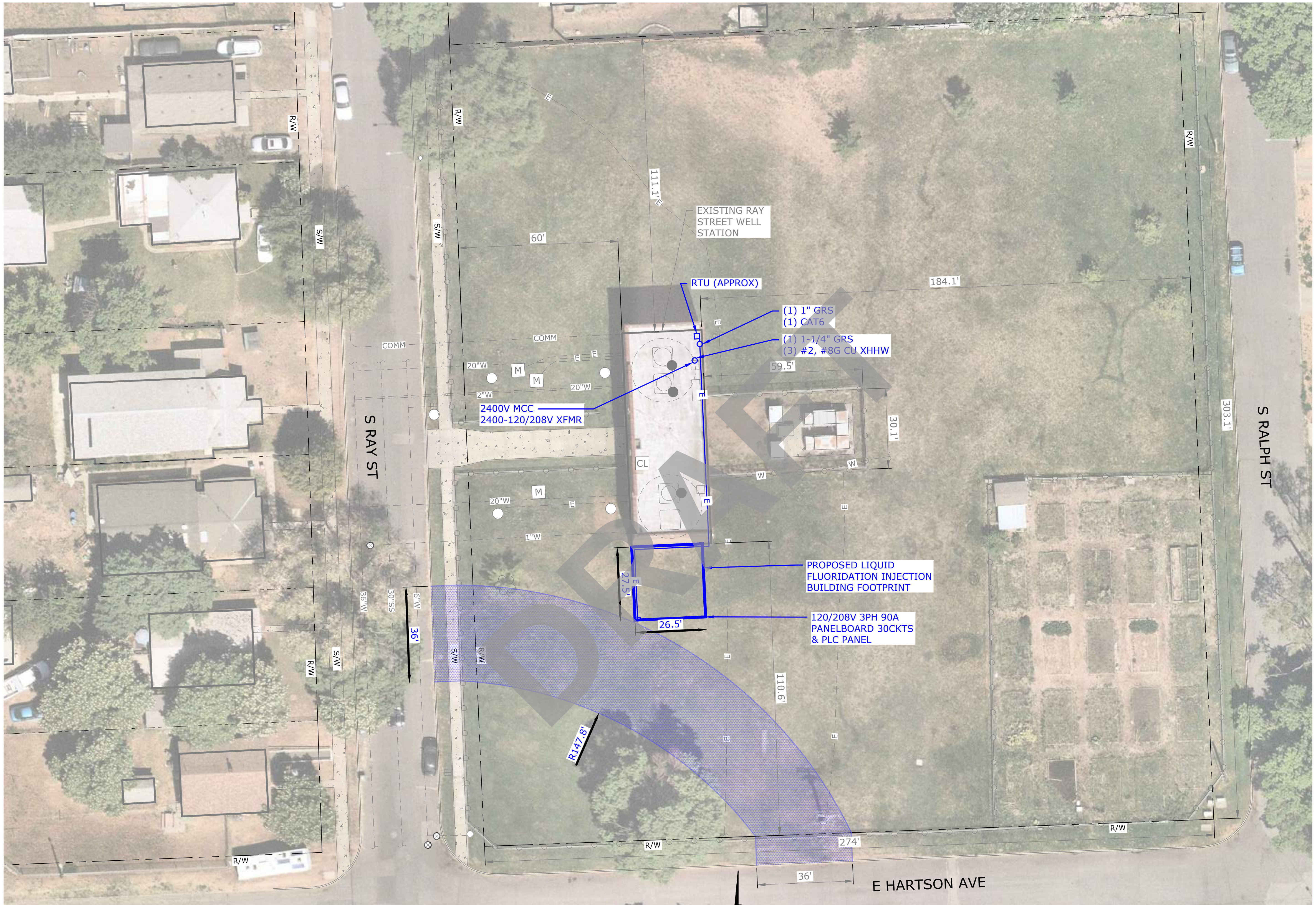

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RAY STREET WELL STATION SITE PLAN

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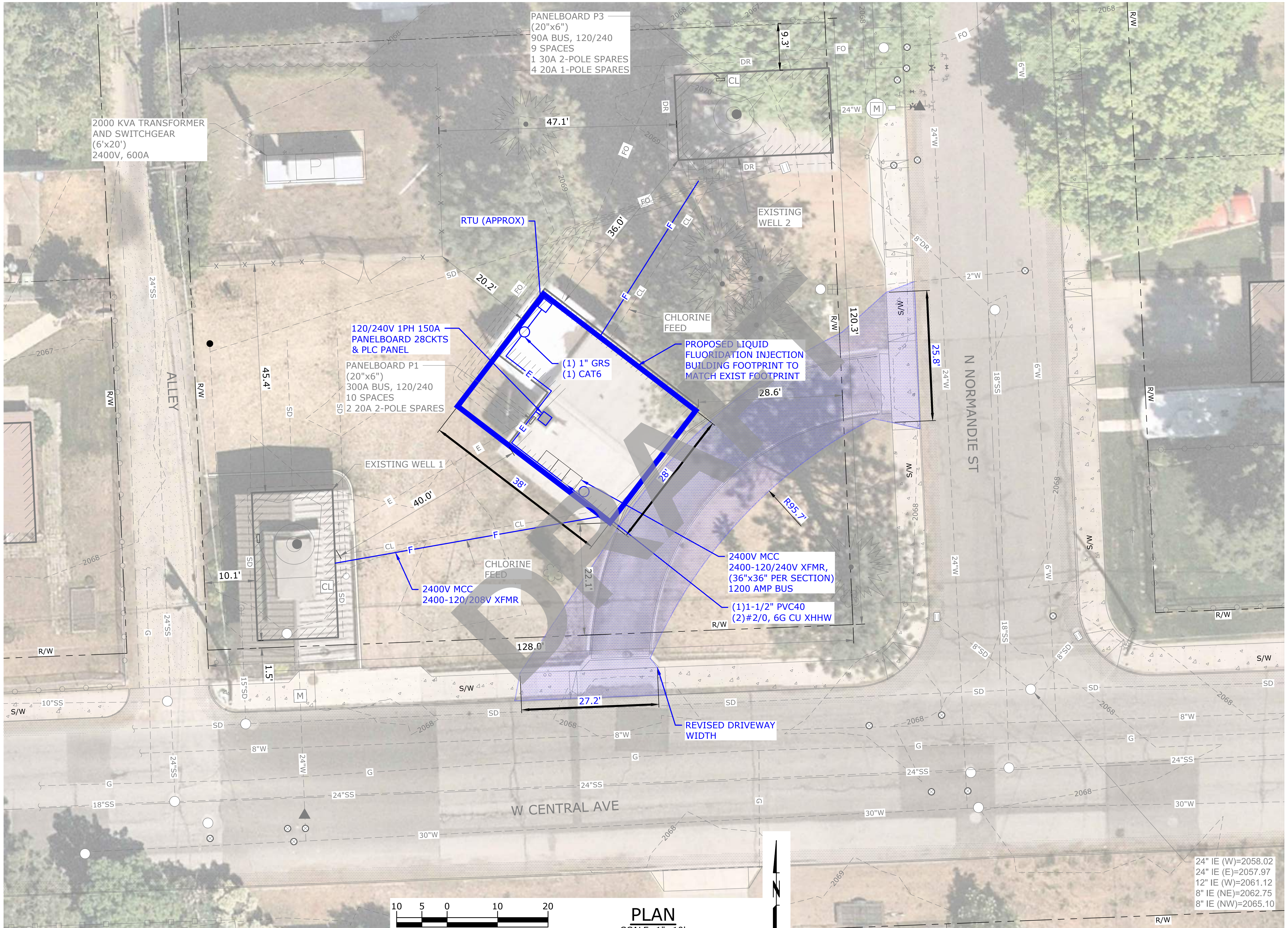

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CENTRAL AVE WELL STATION SITE PLAN

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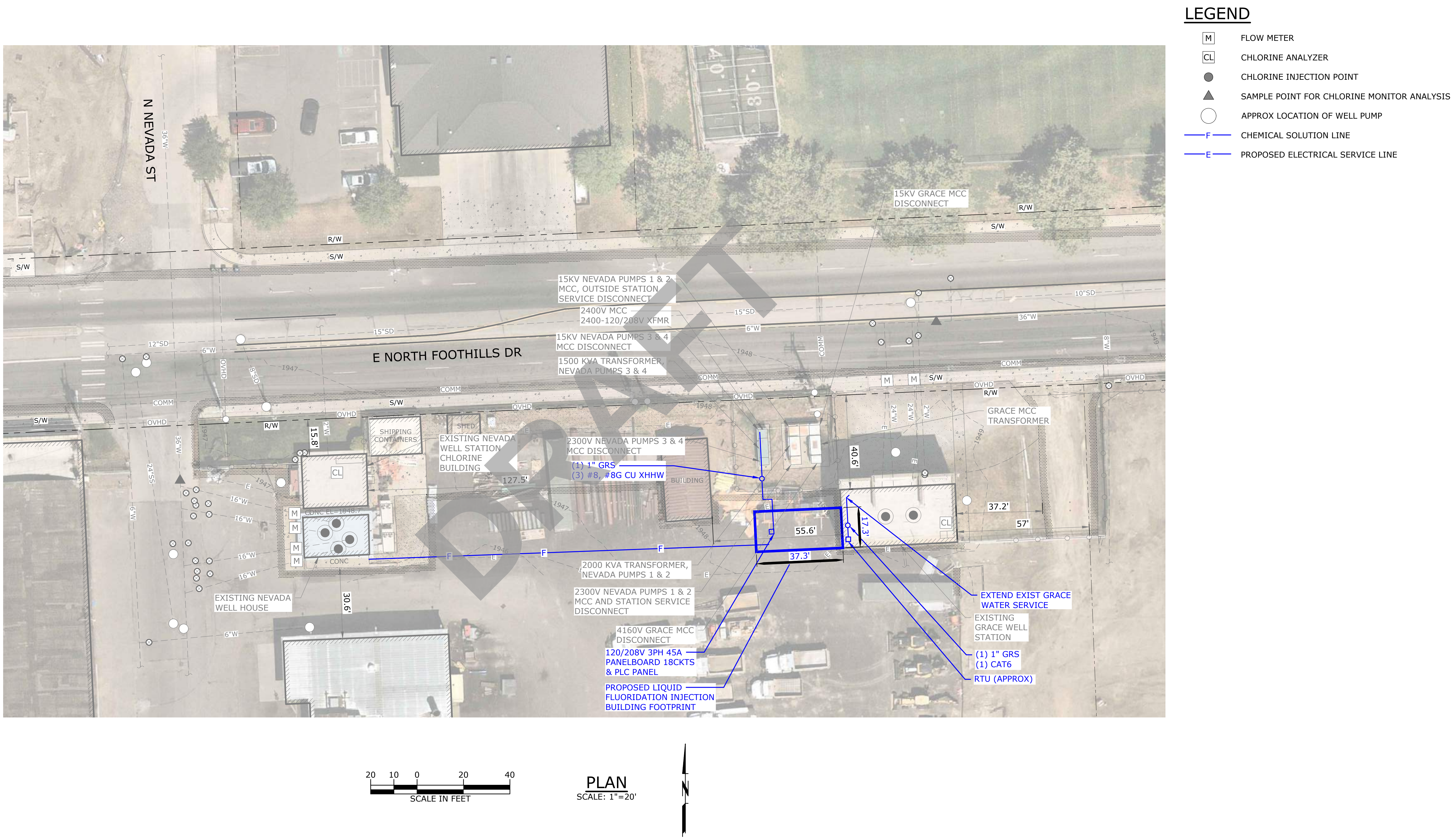

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SPOKANE FLUORIDATION STUDY

GRACE AND NEVADA WELL STATION SITE PLAN

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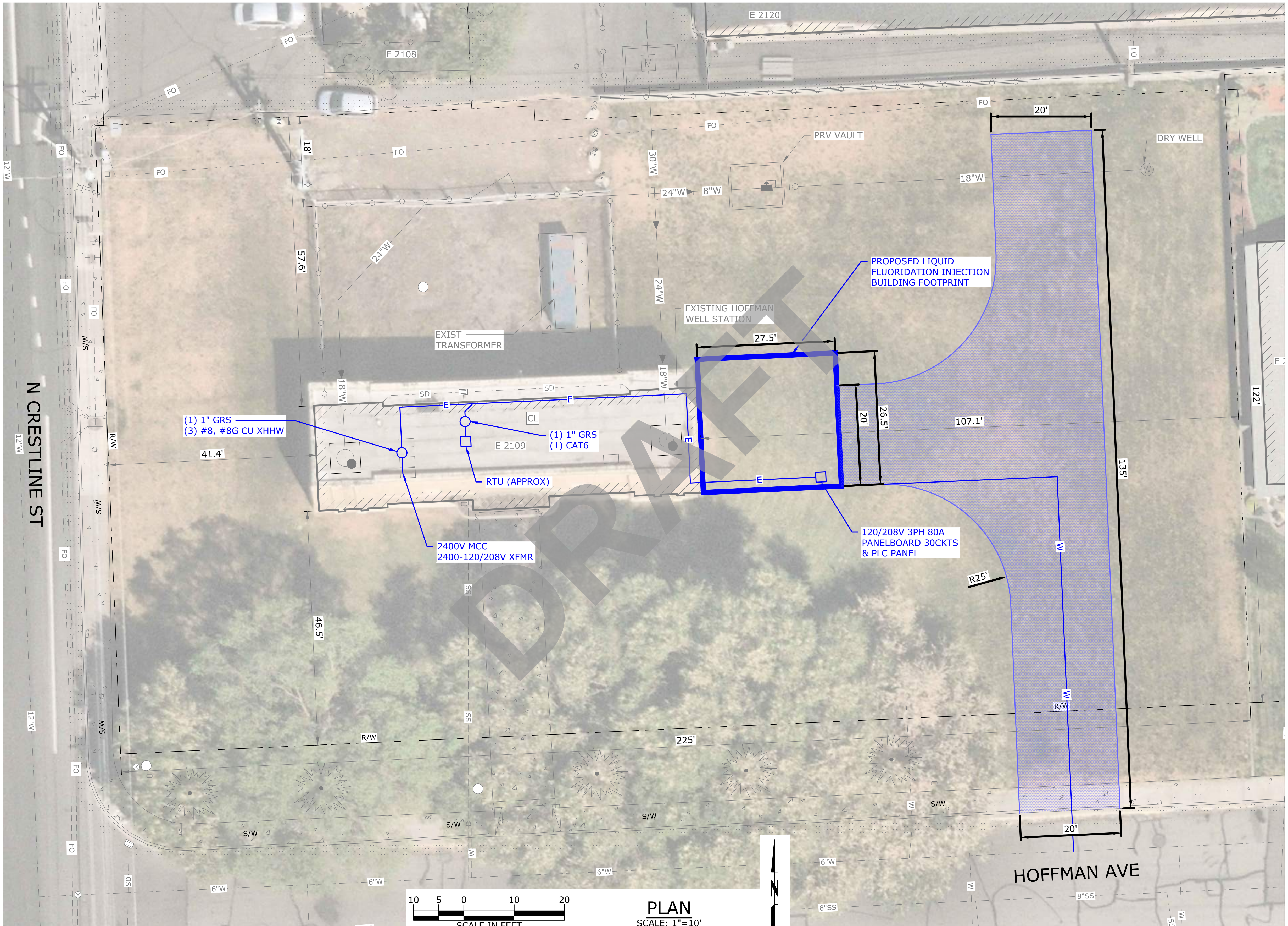

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SPOKANE FLUORIDATION STUDY

HOFFMAN
WELL STATION SITE PLAN

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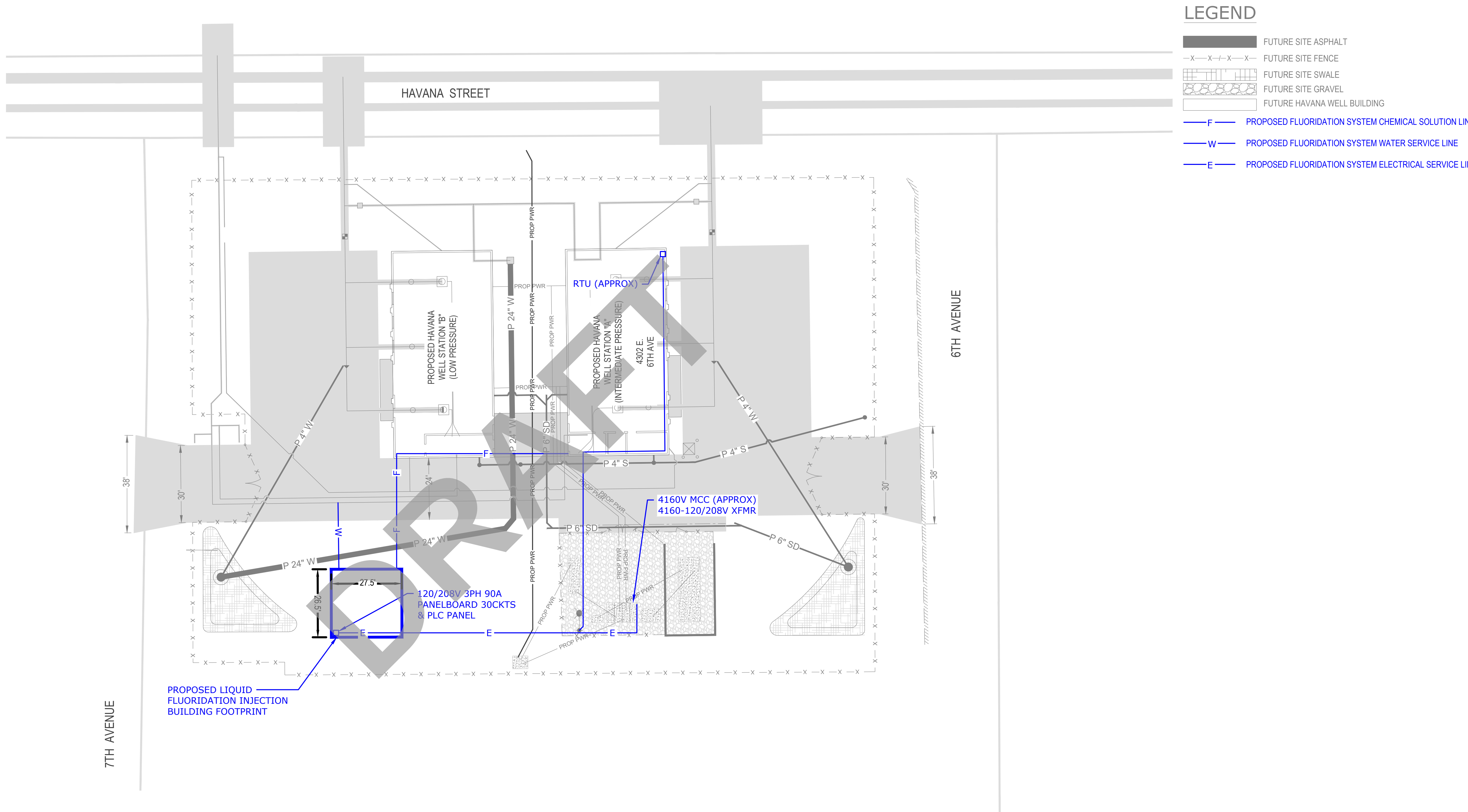

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SPOKANE FLUORIDATION STUDY

HAVANA WELL STATION SITE PLAN

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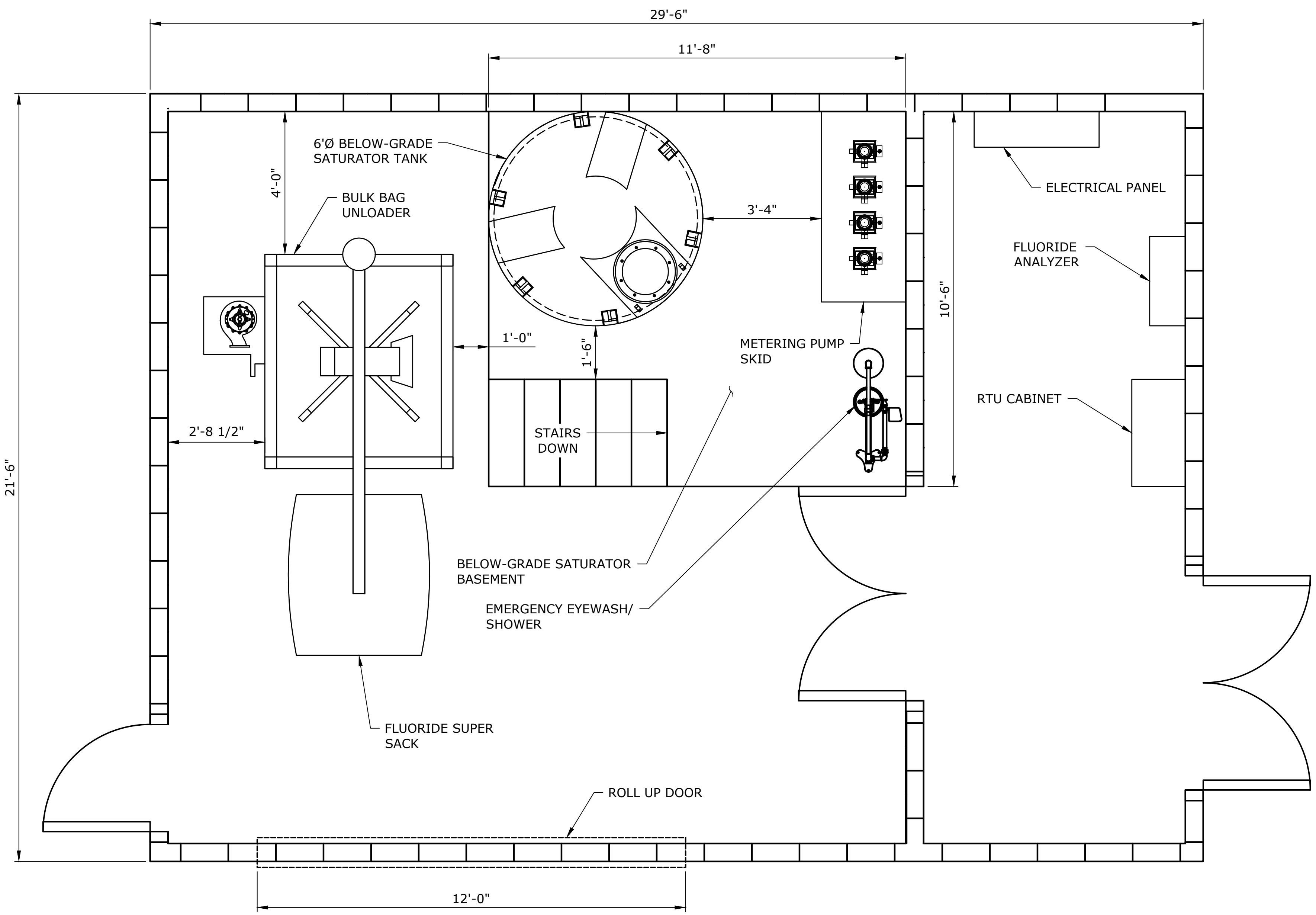
APPENDIX C
PRELIMINARY BUILDING LAYOUTS

NOTES:

1. ALL ROOMS TO HAVE HVAC EQUIPMENT TO BE INSTALLED.

2. ESTIMATED BUILDING HEIGHT: 26'



PLAN
SCALE: 1/2"=1'-0"

I:\BOI_Projects\22\3386 - Spokane Fluoridation Study\CAD\Sheets\22-3386-WA-PARKWATER-M.dwg M-2.1 9/26/2022 1:45 PM ELI.JEFFERSON 23.0s (LMS Tech)

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

EKW DESIGNED
EJJ DRAWN
KLW CHECKED

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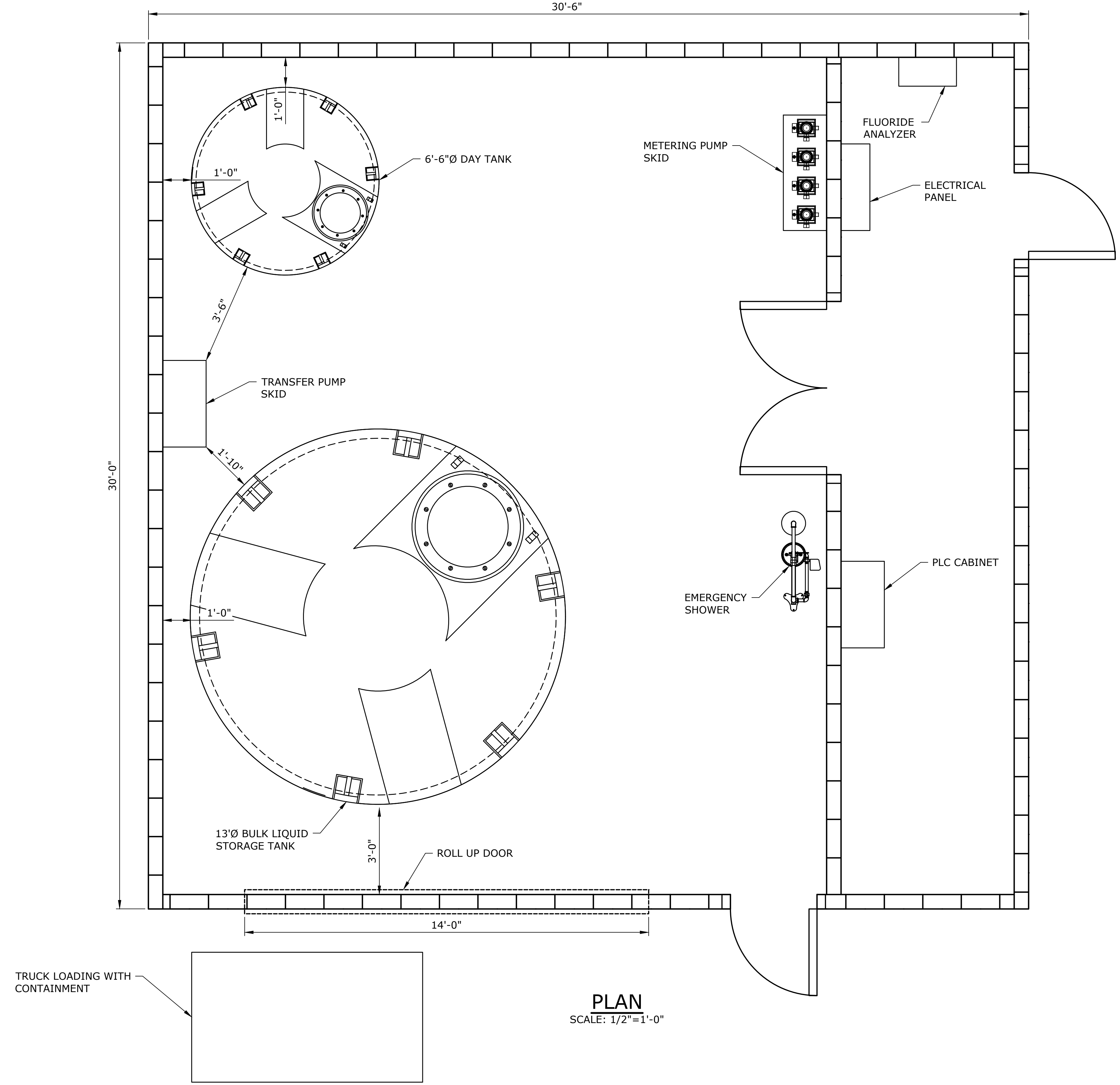
CITY OF SPOKANE

SPOKANE FLUORIDATION STUDY

PARKWATER/RAY/HOFFMAN/HAVANA
SUPER SACK FEED SYSTEM
MECHANICAL LAYOUT

DRAFT

PROJECT NO.: 22-3386	SCALE: AS SHOWN	DATE: JULY 2022



PLAN
SCALE: 1/2"=1'-0"

NOTES:

1. ALL ROOMS TO HAVE HVAC EQUIPMENT TO BE INSTALLED.
2. ESTIMATED BUILDING HEIGHT: 21'

I:\BOI_Projects\22\3386 - Spokane Fluoridation Study\CAD\Sheets\22-3386-WA-PARKWATER-M.dwg M-2.1 (2) 9/26/2022 1:45 PM ELI.JEFFERSON 23.0s (LMS Tech)

NO.	DATE	BY	REVISION

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CITY OF SPOKANE

SPOKANE FLUORIDATION STUDY

WELL ELECTRIC/PARKWATER/HAVANA
LIQUID FEED SYSTEM
MECHANICAL LAYOUT

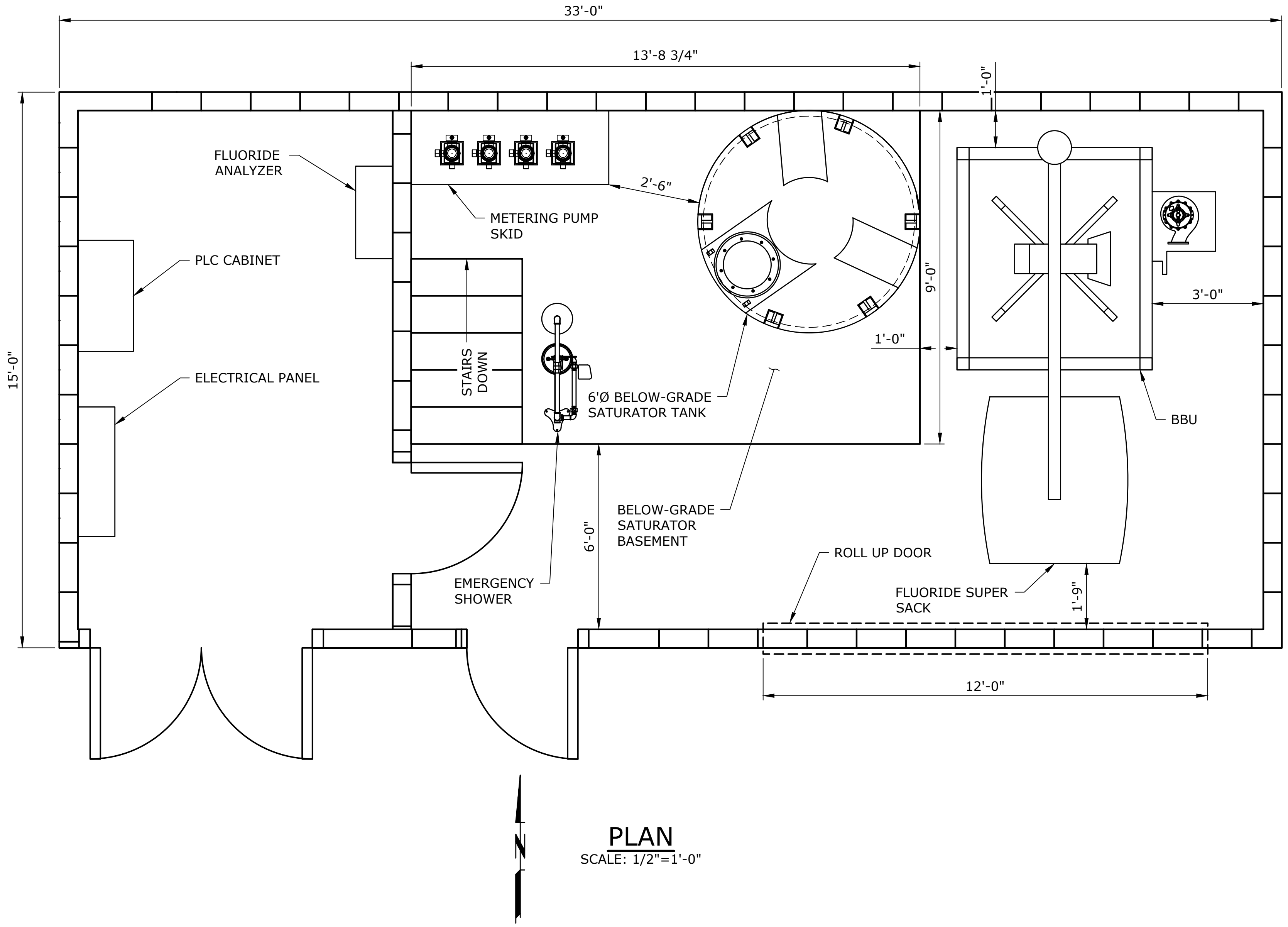
DRAFT

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: JULY 2022

NOTES:

1. ALL ROOMS TO HAVE HVAC EQUIPMENT TO BE INSTALLED.

2. ESTIMATED BUILDING HEIGHT: 25'



PLAN
SCALE: 1/2"=1'-0"

I:\BOI_Projects\22\3386 - Spokane Fluoridation Study\CAD\Sheets\22-3386-WA-GRACE-NEVADA-M.dwg M-2.3 9/26/2022 1:44 PM ELI.JEFFERSON 23.0s (LMS Tech)

NO.	DATE	BY	REVISION

NOTICE
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SPOKANE FLUORIDATION STUDY

DRAFT

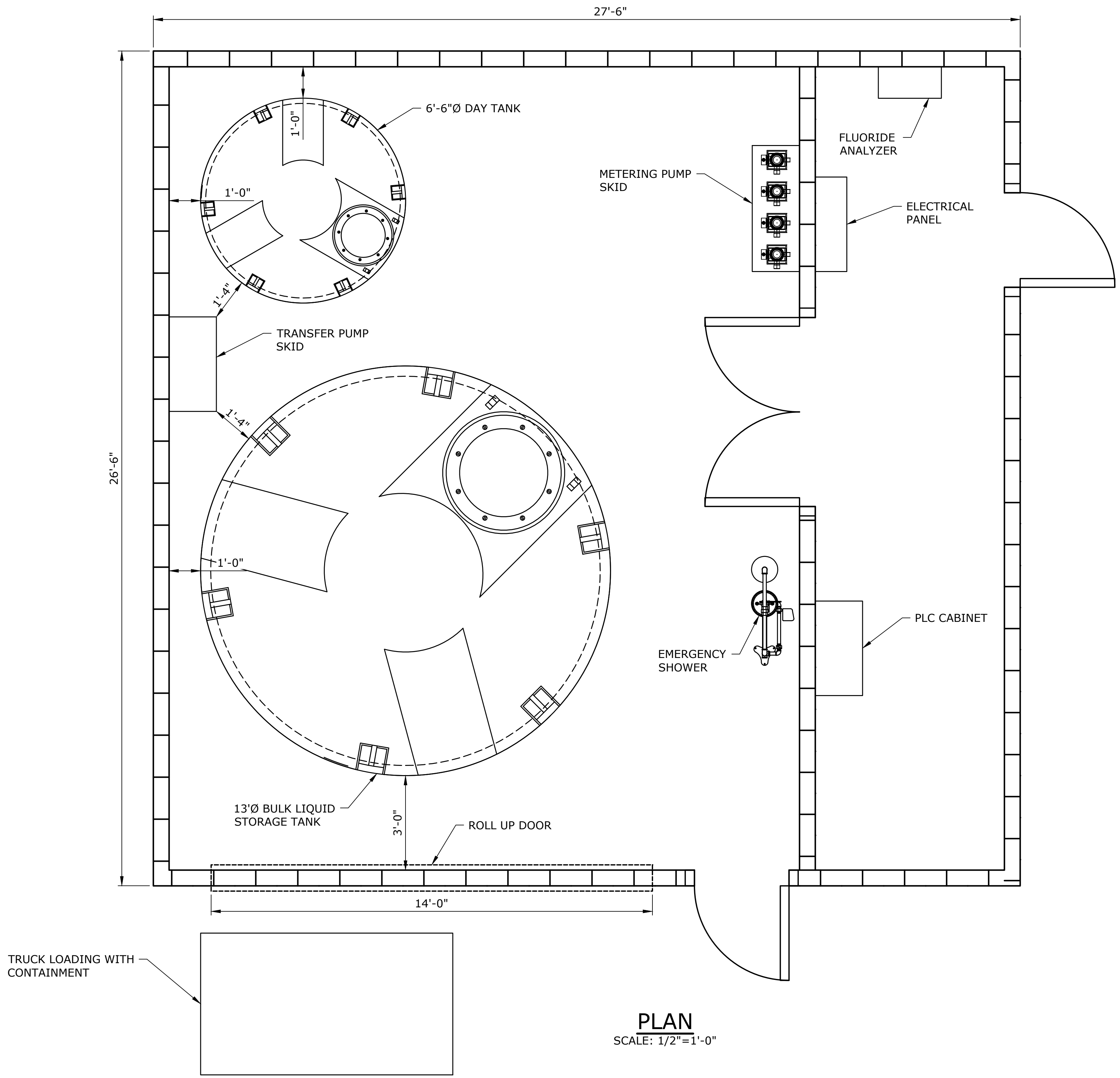
NEVADA/GRACE/WELL ELECTRIC
SUPER SACK FEED SYSTEM
MECHANICAL LAYOUT

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: JULY 2022

NOTES:

1. ALL ROOMS TO HAVE HVAC EQUIPMENT TO BE INSTALLED.

2. ESTIMATED BUILDING HEIGHT: 20'



PLAN

SCALE: 1/2"=1'-0"

I:\BOI_Projects\22\3386 - Spokane Fluoridation Study\CAD\Sheets\22-3386-WA-RAY-M.dwg M-2.1 (3) 9/26/2022 10:33 AM ELI.JEFFERSON 23.0s (LMS Tech)

NO.	DATE	BY	REVISION

NOTICE

0 ½ 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

EKW DESIGNED

EJJ DRAWN

KLW CHECKED

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CITY OF SPOKANE

SPOKANE FLUORIDATION STUDY

DRAFT

RAY/HOFFMAN STREET

LIQUID FEED SYSTEM

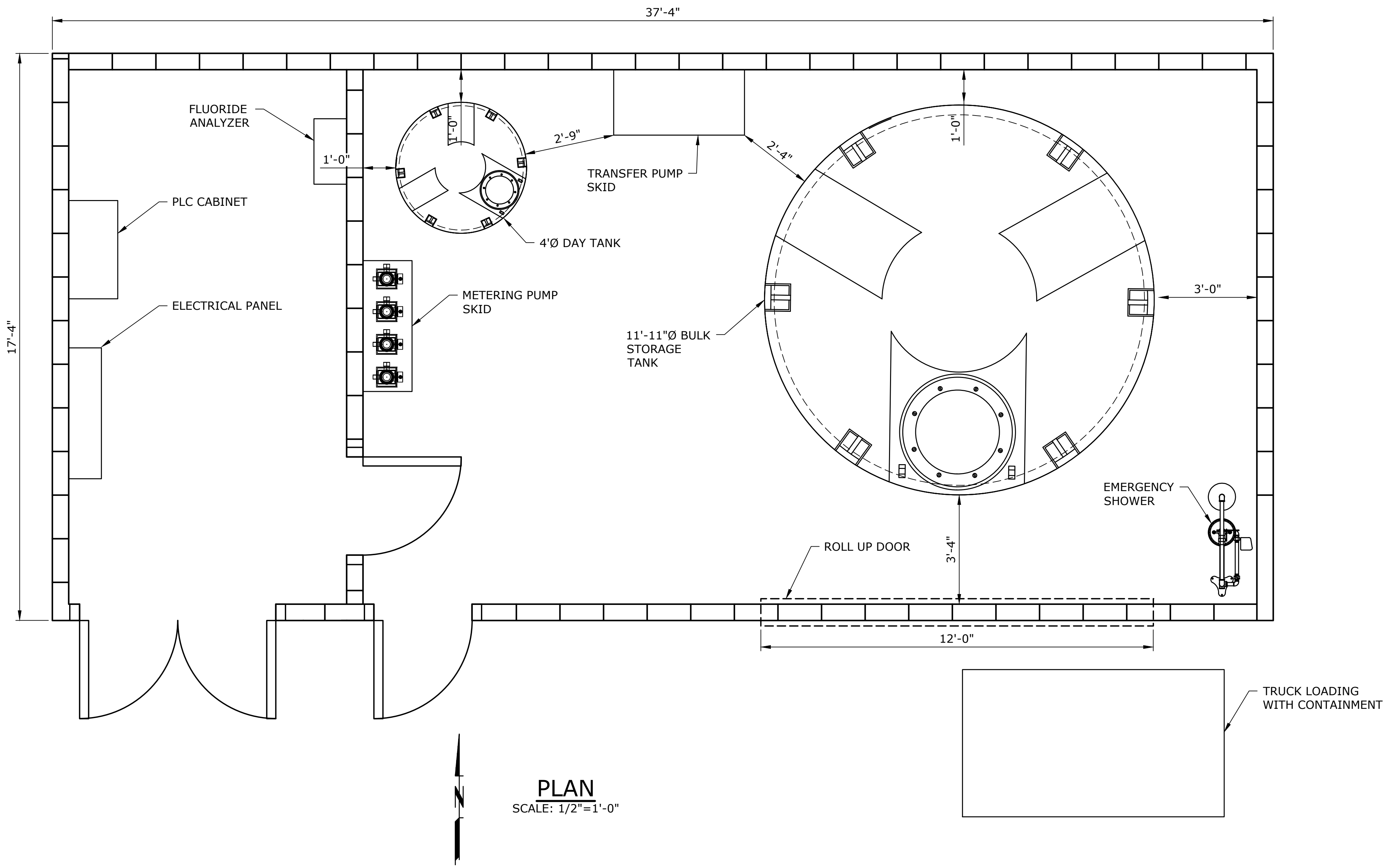
MECHANICAL LAYOUT

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: JULY 2022

NOTES:

1. ALL ROOMS TO HAVE HVAC EQUIPMENT TO BE INSTALLED.

2. ESTIMATED BUILDING HEIGHT: 19'



PLAN
SCALE: 1/2"=1'-0"

I:\BOI_Projects\22\3386 - Spokane Fluoridation Study\CAD\Sheets\22-3386-WA-GRACE-NEVADA-M.dwg M-2.3 (2) 9/26/2022 1:44 PM ELI.JEFFERSON 23.0s (LMS Tech)

NO.	DATE	BY	REVISION

NOTICE
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SPOKANE FLUORIDATION STUDY

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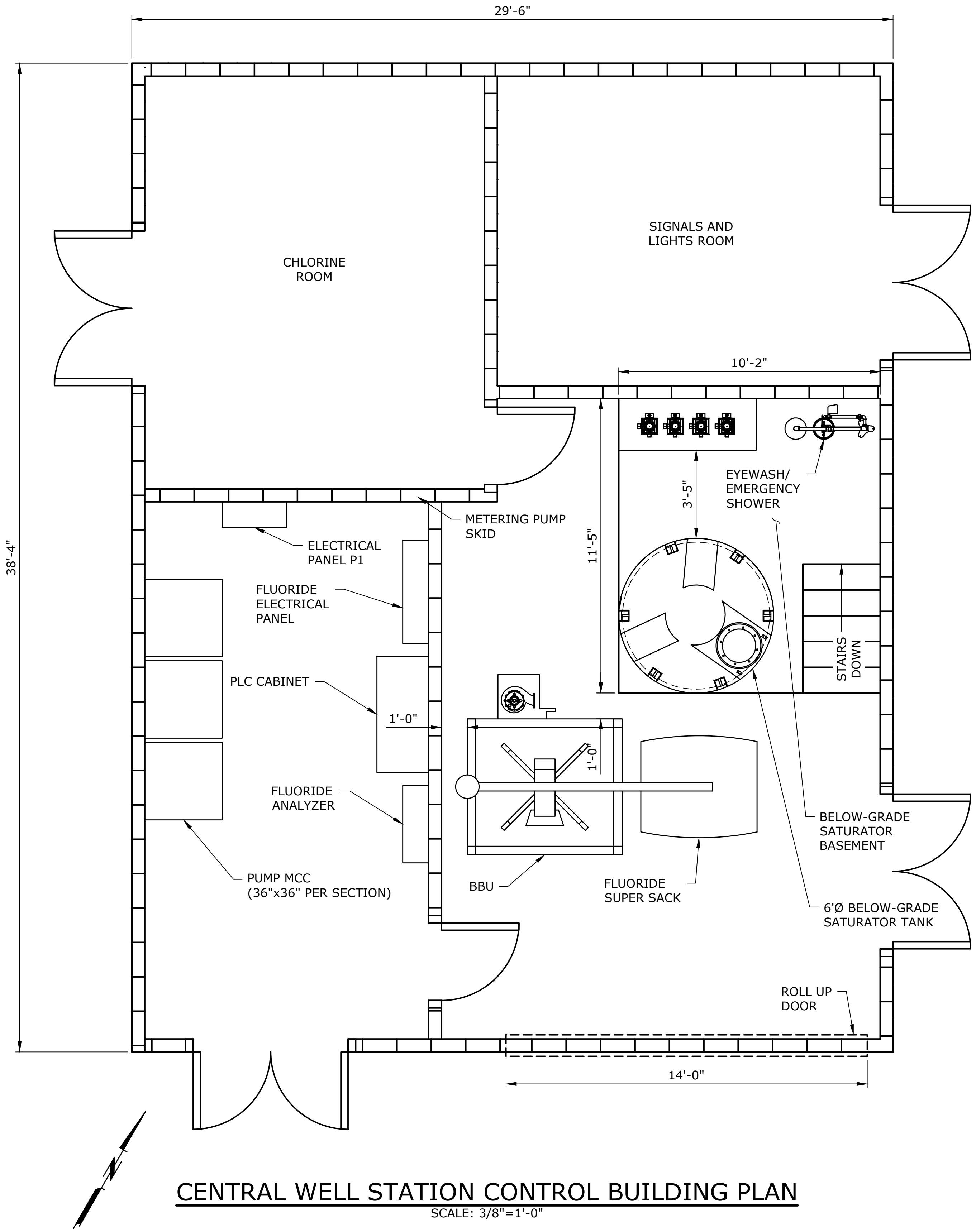
NEVADA/GRACE
LIQUID FEED SYSTEM
MECHANICAL LAYOUT

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: JULY 2022



NOTES:

1. ALL ROOMS TO HAVE HVAC EQUIPMENT TO BE INSTALLED.
2. ESTIMATED BUILDING HEIGHT: 28'

CENTRAL WELL STATION CONTROL BUILDING PLAN

SCALE: 3/8"=1'-0"

I:\BOI_Projects\22\3386 - Spokane Fluoridation Study\CAD\Sheets\22-3386-WA-CENTRAL-M.dwg M-2.2 9/26/2022 1:45 PM ELI.JEFFERSON 23.0s (LMS Tech)

NO.	DATE	BY	REVISION

NOTICE

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SPOKANE FLUORIDATION STUDY

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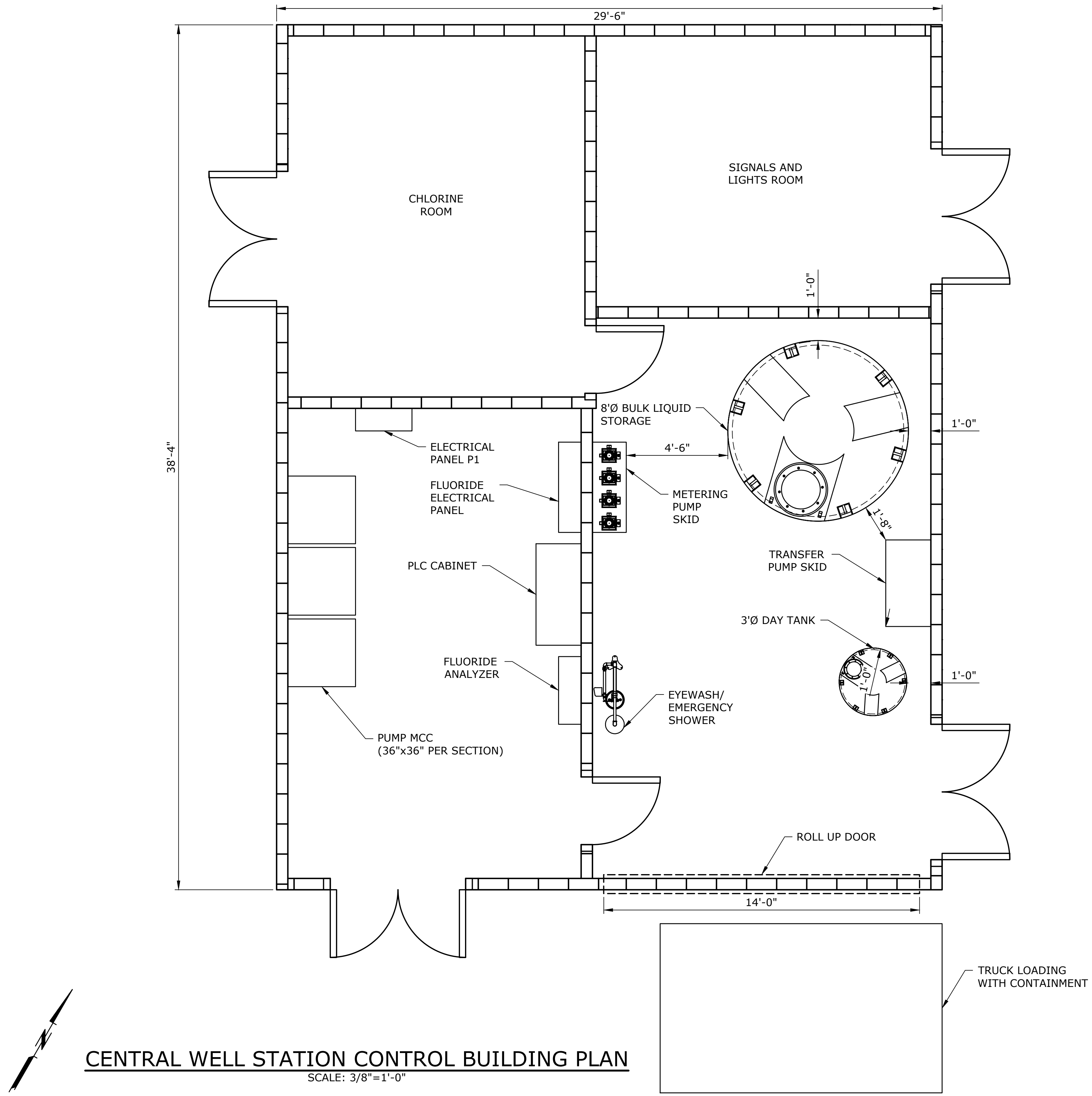
CENTRAL
SUPER SACK FEED SYSTEM
MECHANICAL LAYOUT

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: JULY 2022



CENTRAL WELL STATION CONTROL BUILDING PLAN

SCALE: 3/8"=1'-0"

NOTES:

1. ALL ROOMS TO HAVE HVAC EQUIPMENT TO BE INSTALLED.

2. ESTIMATED BUILDING HEIGHT: 21'

NO.	DATE	BY	REVISION

NOTICE

0 ½ 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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KLW — CHECKED

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SPOKANE FLUORIDATION STUDY

DRAFT

CENTRAL
LIQUID FEED SYSTEM
MECHANICAL LAYOUT

PROJECT NO.:	22-3386	SCALE:	AS SHOWN	DATE:	JULY 2022

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APPENDIX D
CLASS 5 OPCC AND 50-YEAR LCCA

Fluoridation Costs (2022 Dollars)

Well Station	Type of Building/Site	Size of Building	Dry Chemical Capital	Dry Chemical 50-Year LCCA	Dry Chemical Average 50-Yr Annual Operating	Liquid Chemical Capital	Liquid Chemical 50-Year LCCA	Liquid Chemical Average 50-Yr Annual Operating	% Difference Capital Dry minus Liquid	% Difference LCCA Dry minus Liquid
Well Electric	Industrial	Large	$ 1,616,000	$ 11,199,000	$ 224,000	$ 1,423,000	$ 8,772,000	$ 176,000	12%	22%
Parkwater	Industrial	Large	$ 1,865,000	$ 12,266,000	$ 246,000	$ 1,683,000	$ 9,189,000	$ 184,000	10%	25%
Ray	Match Existing Architectural Style	Small	$ 1,332,000	$ 6,656,000	$ 134,000	$ 1,108,000	$ 5,419,000	$ 109,000	17%	19%
Central Ave	Match Existing Architectural Style	Existing building size	$ 1,622,000	$ 6,722,000	$ 135,000	$ 1,328,000	$ 5,379,000	$ 108,000	18%	20%
Grace/Nevada	Industrial	Long and skinny	$ 1,616,000	$ 10,139,000	$ 203,000	$ 1,423,000	$ 8,182,000	$ 164,000	12%	19%
Hoffman	Match Existing Architectural Style	Small	$ 1,332,000	$ 6,656,000	$ 134,000	$ 1,108,000	$ 5,419,000	$ 109,000	17%	19%
Havana	Match Existing Architectural Style	Large	$ 1,618,000	$ 8,396,000	$ 168,000	$ 1,436,000	$ 7,100,000	$ 142,000	11%	15%
Total			$ 11,001,000	$ 62,034,000	$ 1,244,000	$ 9,509,000	$ 49,460,000	$ 992,000	14%	20%

MURRAYSMITH’s construction cost estimate (“estimate”) is in dollars valued as of the date of this estimate. This estimate is an opinion of probable cost based on information available at the time of its development. F

- actual field conditions.
- actual material and labor costs.
- market conditions for construction.
- regulatory factors.
- final project scope.
- method of implementation.
- schedule (time to completion? time of commencement? Speed of execution?), and
- other variables.
-

This estimate is based on our perception, which is based on experience and research, yet nevertheless, an assessment, of current conditions at the project location. This estimate reflects our professional opinion of current costs and is subject to change as the project design evolves. MURRAYSMITH has no control over, nor can it forecast variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means, and methods of executing the work, or of determining prices, of the impact of competitive bidding or market conditions, practices, or bidding strategies. MURRAYSMITH neither warrants nor guarantees that proposals, bids, or actual construction costs will reflect the costs presented, which are for illustrative purposes only.

*This is the master sheet-cells affect other sheets	**Parkwater**		Orange: 5% discount rate, Net Present value									
	Large Liquid Building	**Concept Level Cost, 2022 Dollars**	**LCCA Cost (2022 Dollars)**	**2023**	**2024**	**2025**	**2030**	**2040**	**2050**	**2060**	**2070**	**2080**
				12.5%	12.0%	8.0%	25.0%	50.0%	50.0%	30.0%	30.0%	30.0%
	Capital Cost			1 year	2 years	3 years	4 years	10 years	20 Years	30 Years	40 Years	50 Years
1	Electrical Equipment	$ 71,000.00	$ 510,573.05	$ 8,875.00	$ 8,520.00	$ 5,680.00	$ 17,750.00	$ 106,500.00	$ 106,500.00	$ 92,300.00	$ 92,300.00	$ 92,300.00
2	PLC MicroLogic 1400	$ 45,000.00	$ 323,602.64	$ 5,625.00	$ 5,400.00	$ 3,600.00	$ 11,250.00	$ 67,500.00	$ 67,500.00	$ 58,500.00	$ 58,500.00	$ 58,500.00
3	Metering Pump Skid	$ 480,000.00	$ 1,922,773.93	$ 60,000.00	$ 57,600.00	$ 38,400.00	$ 120,000.00	$ 240,000.00	$ 720,000.00	$ 144,000.00	$ 624,000.00	$ -
4	Bulk Storage Tank	$ 30,000.00	$ 120,173.37	$ 3,750.00	$ 3,600.00	$ 2,400.00	$ 7,500.00	$ 15,000.00	$ 45,000.00	$ 9,000.00	$ 39,000.00	$ -
5	Day Storage Tank	$ 20,000.00	$ 80,115.58	$ 2,500.00	$ 2,400.00	$ 1,600.00	$ 5,000.00	$ 10,000.00	$ 30,000.00	$ 6,000.00	$ 26,000.00	$ -
6	Roll up Door	$ 10,000.00	$ 40,057.79	$ 1,250.00	$ 1,200.00	$ 800.00	$ 2,500.00	$ 5,000.00	$ 15,000.00	$ 3,000.00	$ 13,000.00	$ -
7	Man Door	$ 8,000.00	$ 32,046.23	$ 1,000.00	$ 960.00	$ 640.00	$ 2,000.00	$ 4,000.00	$ 12,000.00	$ 2,400.00	$ 10,400.00	$ -
8	Fluoride Analyzer	$ 20,000.00	$ 143,823.39	$ 2,500.00	$ 2,400.00	$ 1,600.00	$ 5,000.00	$ 30,000.00	$ 30,000.00	$ 26,000.00	$ 26,000.00	$ 26,000.00
9	Backflow Preventer	$ 6,000.00	$ 24,034.67	$ 750.00	$ 720.00	$ 480.00	$ 1,500.00	$ 3,000.00	$ 9,000.00	$ 1,800.00	$ 7,800.00	$ -
10	Transfer Pump Skid	$ 30,000.00	$ 120,173.37	$ 3,750.00	$ 3,600.00	$ 2,400.00	$ 7,500.00	$ 15,000.00	$ 45,000.00	$ 9,000.00	$ 39,000.00	$ -
11	Secondary Containment	$ 50,000.00	$ -									
12	Building 915 sf @ $300	$ 274,500.00	$ -									
13	Site Improvements	$ 250,000.00	$ 1,001,444.75	$ 31,250.00	$ 30,000.00	$ 20,000.00	$ 62,500.00	$ 125,000.00	$ 375,000.00	$ 75,000.00	$ 325,000.00	$ -
	Subtotal Capital Cost	$ 1,294,500.00										
	Contingency 30%	$ 388,350.00										
	Total Capital Cost	**$ 1,682,850.00**										
	Operating Cost											
		Cost Per Year										
1	Maintenance	$ 25,890.00	$ 282,940.71	$ 29,126.25	$ 28,996.80	$ 27,961.20	$ 32,362.50	$ 38,835.00	$ 38,835.00	$ 33,657.00	$ 33,657.00	$ 33,657.00
2	Replace Equipment	See above	$ 4,318,818.77	See above	See above	See above	See above	See above	See above	See above	See above	See above
3	Operation of Equipment	$ 63,160.00	$ 690,248.57	$ 71,055.00	$ 70,739.20	$ 68,212.80	$ 78,950.00	$ 94,740.00	$ 94,740.00	$ 82,108.00	$ 82,108.00	$ 82,108.00
4	Power Cost	$ 1,126.46	$ 12,310.56	$ 1,267.26	$ 1,261.63	$ 1,216.57	$ 1,408.07	$ 1,689.68	$ 1,689.68	$ 1,464.39	$ 1,464.39	$ 1,464.39
5	Chemical Cost	$ 161,392.97	$ 1,763,794.61	$ 181,567.09	$ 180,760.13	$ 174,304.41	$ 201,741.21	$ 242,089.46	$ 242,089.46	$ 209,810.86	$ 209,810.86	$ 209,810.86
	Subtotal Operating Cost		$ 7,068,113.23									
	Operating Contingency 30%	$ -	$ 2,120,433.97									
	Total 50-year Operating Cost		**$ 9,188,547.20**									
	Total Capital and Operating	**$ 10,871,397.20**										
	Average Yearly Operating (2022 Dollars)		**$ 183,770.94**	$ 375,139.36	$ 369,160.96	$ 321,333.78	$ 104,919.86	$ 95,951.91	$ 179,351.91	$ 72,038.33	$ 155,438.33	$ 47,018.33

Hoffman, Ray

Orange: 5% discount rate, Net Present value

	Small Liquid Building	**Concept Level Cost**	**LCCA Cost**	**2023**	**2024**	**2025**	**2030**	**2040**	**2050**	**2060**	**2070**	**2080**
	Capital Cost			12.5%	12%	8%	4 years 25%	10 years 50%	20 Years 50%	30 Years 30.0%	40 Years 30.0%	50 Years 30.0%
1	Electrical Equipment	$ 71,000.00	$ 544,382.57	$ 8,875.00	$ 8,520.00	$ 5,680.00	$ 17,750.00	$ 106,500.00	$ 142,000.00	$ 92,300.00	$ 92,300.00	$ 92,300.00
2	PLC MicroLogic 1400	$ 45,000.00	$ 345,031.21	$ 5,625.00	$ 5,400.00	$ 3,600.00	$ 11,250.00	$ 67,500.00	$ 90,000.00	$ 58,500.00	$ 58,500.00	$ 58,500.00
3	Metering Pump Skid	$ 120,000.00	$ 537,836.34	$ 15,000.00	$ 14,400.00	$ 9,600.00	$ 30,000.00	$ 60,000.00	$ 240,000.00	$ 36,000.00	$ 156,000.00	$ -
4	Bulk Storage Tank	$ 30,000.00	$ 134,459.08	$ 3,750.00	$ 3,600.00	$ 2,400.00	$ 7,500.00	$ 15,000.00	$ 60,000.00	$ 9,000.00	$ 39,000.00	$ -
5	Day Storage Tank	$ 20,000.00	$ 89,639.39	$ 2,500.00	$ 2,400.00	$ 1,600.00	$ 5,000.00	$ 10,000.00	$ 40,000.00	$ 6,000.00	$ 26,000.00	$ -
6	Roll up Door	$ 10,000.00	$ 44,819.69	$ 1,250.00	$ 1,200.00	$ 800.00	$ 2,500.00	$ 5,000.00	$ 20,000.00	$ 3,000.00	$ 13,000.00	$ -
7	Man Door	$ 8,000.00	$ 35,855.76	$ 1,000.00	$ 960.00	$ 640.00	$ 2,000.00	$ 4,000.00	$ 16,000.00	$ 2,400.00	$ 10,400.00	$ -
8	Fluoride Analyzer	$ 20,000.00	$ 153,347.20	$ 2,500.00	$ 2,400.00	$ 1,600.00	$ 5,000.00	$ 30,000.00	$ 40,000.00	$ 26,000.00	$ 26,000.00	$ 26,000.00
9	Backflow Preventer	$ 6,000.00	$ 26,891.82	$ 750.00	$ 720.00	$ 480.00	$ 1,500.00	$ 3,000.00	$ 12,000.00	$ 1,800.00	$ 7,800.00	$ -
10	Transfer Pump Skid	$ 30,000.00	$ 134,459.08	$ 3,750.00	$ 3,600.00	$ 2,400.00	$ 7,500.00	$ 15,000.00	$ 60,000.00	$ 9,000.00	$ 39,000.00	$ -
11	Secondary Containment	$ 50,000.00	$ -									
12	Building 729 sf @ $400	$ 291,600.00	$ -									
13	Site Improvements	$ 150,000.00	$ 672,295.42	$ 18,750.00	$ 18,000.00	$ 12,000.00	$ 37,500.00	$ 75,000.00	$ 300,000.00	$ 45,000.00	$ 195,000.00	$ -
	Subtotal Capital Cost	$ 851,600.00										
	Contingency 30%	$ 255,480.00										
	Total Capital Cost	**$ 1,107,080.00**										
	Operating Cost											
		Cost Per Year										
1	Maintenance	$ 17,032.00	$ 186,135.43	$ 19,161.00	$ 19,075.84	$ 18,394.56	$ 21,290.00	$ 25,548.00	$ 25,548.00	$ 22,141.60	$ 22,141.60	$ 22,141.60
2	Replace Equipment	See above	$ 2,719,017.57	See above	See above	See above	See above	See above	See above	See above	See above	See above
3	Operation of Equipment	$ 63,160.00	$ 690,248.57	$ 71,055.00	$ 70,739.20	$ 68,212.80	$ 78,950.00	$ 94,740.00	$ 94,740.00	$ 82,108.00	$ 82,108.00	$ 82,108.00
4	Power Cost	$ 1,047.55	$ 11,448.23	$ 1,178.49	$ 1,173.26	$ 1,131.35	$ 1,309.44	$ 1,571.33	$ 1,571.33	$ 1,361.82	$ 1,361.82	$ 1,361.82
5	Chemical Cost	$ 51,331.55	$ 560,980.50	$ 57,747.99	$ 57,491.33	$ 55,438.07	$ 64,164.44	$ 76,997.32	$ 76,997.32	$ 66,731.01	$ 66,731.01	$ 66,731.01
	Subtotal Operating Cost		$ 4,167,830.30									
	Operating Contingency 30%		$ 1,250,349.09									
	Total 50-year Operating Cost		**$ 5,418,179.39**									
	Total Capital and Operating	**$ 6,525,259.39**										
	Average Yearly Operating (2022 Dollars)		**$ 108,363.59**									

*This is the master sheet- cells affect other sheets	Havana		Orange: 5% discount rate, Net Present value									
	Large Liquid Building- Havana (Residential)	**Concept Level Cost, 2022 Dollars**	**LCCA Cost (2022 Dollars)**	**2023**	**2024**	**2025**	**2030**	**2040**	**2050**	**2060**	**2070**	**2080**
	Capital Cost			12.5%	12%	8%	20% 4 years	50% 10 Years	100% 20 Years	30.0% 30 Years	30.0% 40 Years	30.0% 50 Years
1	Electrical Equipment	$ 71,000.00	$ 541,001.62	$ 8,875.00	$ 8,520.00	$ 5,680.00	$ 14,200.00	$ 106,500.00	$ 142,000.00	$ 92,300.00	$ 92,300.00	$ 92,300.00
2	PLC MicroLogic 1400	$ 45,000.00	$ 342,888.35	$ 5,625.00	$ 5,400.00	$ 3,600.00	$ 9,000.00	$ 67,500.00	$ 90,000.00	$ 58,500.00	$ 58,500.00	$ 58,500.00
3	Metering Pump Skid	$ 360,000.00	$ 1,596,366.16	$ 45,000.00	$ 43,200.00	$ 28,800.00	$ 72,000.00	$ 180,000.00	$ 720,000.00	$ 108,000.00	$ 468,000.00	$ -
4	Bulk Storage Tank	$ 30,000.00	$ 133,030.51	$ 3,750.00	$ 3,600.00	$ 2,400.00	$ 6,000.00	$ 15,000.00	$ 60,000.00	$ 9,000.00	$ 39,000.00	$ -
5	Day Storage Tank	$ 20,000.00	$ 88,687.01	$ 2,500.00	$ 2,400.00	$ 1,600.00	$ 4,000.00	$ 10,000.00	$ 40,000.00	$ 6,000.00	$ 26,000.00	$ -
6	Roll up Door	$ 10,000.00	$ 44,343.50	$ 1,250.00	$ 1,200.00	$ 800.00	$ 2,000.00	$ 5,000.00	$ 20,000.00	$ 3,000.00	$ 13,000.00	$ -
7	Man Door	$ 8,000.00	$ 35,474.80	$ 1,000.00	$ 960.00	$ 640.00	$ 1,600.00	$ 4,000.00	$ 16,000.00	$ 2,400.00	$ 10,400.00	$ -
8	Fluoride Analyzer	$ 20,000.00	$ 152,394.82	$ 2,500.00	$ 2,400.00	$ 1,600.00	$ 4,000.00	$ 30,000.00	$ 40,000.00	$ 26,000.00	$ 26,000.00	$ 26,000.00
9	Backflow Preventer	$ 6,000.00	$ 26,606.10	$ 750.00	$ 720.00	$ 480.00	$ 1,200.00	$ 3,000.00	$ 12,000.00	$ 1,800.00	$ 7,800.00	$ -
10	Transfer Pump Skid	$ 30,000.00	$ 133,030.51	$ 3,750.00	$ 3,600.00	$ 2,400.00	$ 6,000.00	$ 15,000.00	$ 60,000.00	$ 9,000.00	$ 39,000.00	$ -
11	Secondary Containment	$ 50,000.00	$ -									
12	Building 915 sf @ $400	$ 366,000.00	$ -									
13	Site Improvements	$ 150,000.00	$ 665,152.57	$ 18,750.00	$ 18,000.00	$ 12,000.00	$ 30,000.00	$ 75,000.00	$ 300,000.00	$ 45,000.00	$ 195,000.00	$ -
	Subtotal Capital Cost	$ 1,166,000.00										
	Contingency 30%	$ 349,800.00										
	Total Capital Cost	**$ 1,515,800.00**										
	Operating Cost											
		Cost Per Year										
1	Maintenance	$ 23,320.00	$ 264,848.57	$ 26,235.00	$ 26,118.40	$ 25,185.60	$ 27,984.00	$ 34,980.00	$ 46,640.00	$ 30,316.00	$ 30,316.00	$ 30,316.00
2	Replace Equipment	See above	$ 3,758,975.96	See above	See above	See above	See above	See above	See above	See above	See above	See above
3	Operation of Equipment	$ 63,160.00	$ 717,317.14	$ 71,055.00	$ 70,739.20	$ 68,212.80	$ 75,792.00	$ 94,740.00	$ 126,320.00	$ 82,108.00	$ 82,108.00	$ 82,108.00
4	Power Cost	$ 1,341.07	$ 15,230.75	$ 1,508.71	$ 1,502.00	$ 1,448.36	$ 1,609.29	$ 2,011.61	$ 2,682.14	$ 1,743.39	$ 1,743.39	$ 1,743.39
5	Chemical Cost	$ 62,088.71	$ 705,150.35	$ 69,849.80	$ 69,539.36	$ 67,055.81	$ 74,506.45	$ 93,133.07	$ 124,177.42	$ 80,715.32	$ 80,715.32	$ 80,715.32
	Subtotal Operating Cost		$ 5,461,522.78									
	Operating Contingency 30%	$ -	$ 1,638,456.83									
	Total 50-year Operating Cost		**$ 7,099,979.61**									
	Total Capital and Operating	**$ 8,615,779.61**										
	Average Yearly Operating (2022 Dollars)		**$ 141,999.59**									

Parkwater

Orange: 5% discount rate, Net Present Value

	Dry Building	Concept Level Cost	LCCA Cost	2023	2024	2025	2030	2040	2050	2060	2070	2080
	Capital Cost			12.5%	12%	8%	25% 4 years	50% 10 years	50% 20 Years	30.0% 30 Years	30.0% 40 Years	30.0% 50 Years
1	Electrical Equipment	$55,000.00	$ 421,704.81	$ 6,875.00	$ 6,600.00	$ 4,400.00	$ 13,750.00	$ 82,500.00	$ 110,000.00	$ 71,500.00	$ 71,500.00	$ 71,500.00
2	PLC MicroLogic 1400	$45,000.00	$ 345,031.21	$ 5,625.00	$ 5,400.00	$ 3,600.00	$ 11,250.00	$ 67,500.00	$ 90,000.00	$ 58,500.00	$ 58,500.00	$ 58,500.00
3	Metering Pump Skid (about 2-8 pumps per facility, will follow up with table showing number of pumps for each facility)	$ 480,000.00	$ 2,151,345.35	$ 60,000.00	$ 57,600.00	$ 38,400.00	$ 120,000.00	$ 240,000.00	$ 960,000.00	$ 144,000.00	$ 624,000.00	$ -
4	Backflow Preventer	$ 6,000.00	$ 26,891.82	$ 750.00	$ 720.00	$ 480.00	$ 1,500.00	$ 3,000.00	$ 12,000.00	$ 1,800.00	$ 7,800.00	$ -
5	Man Door	$ 8,000.00	$ 35,855.76	$ 1,000.00	$ 960.00	$ 640.00	$ 2,000.00	$ 4,000.00	$ 16,000.00	$ 2,400.00	$ 10,400.00	$ -
6	Roll up Door	$ 10,000.00	$ 44,819.69	$ 1,250.00	$ 1,200.00	$ 800.00	$ 2,500.00	$ 5,000.00	$ 20,000.00	$ 3,000.00	$ 13,000.00	$ -
7	Fluoride Analyzer	$ 20,000.00	$ 153,347.20	$ 2,500.00	$ 2,400.00	$ 1,600.00	$ 5,000.00	$ 30,000.00	$ 40,000.00	$ 26,000.00	$ 26,000.00	$ 26,000.00
8	Water Softener	$ 2,500.00	$ 19,168.40	$ 312.50	$ 300.00	$ 200.00	$ 625.00	$ 3,750.00	$ 5,000.00	$ 3,250.00	$ 3,250.00	$ 3,250.00
9	BBU (includes refill feeder, weigh feeder, model 810 BBU, saturator, volumetric feeder, control panel)	$ 200,000.00	$ 896,393.90	$ 25,000.00	$ 24,000.00	$ 16,000.00	$ 50,000.00	$ 100,000.00	$ 400,000.00	$ 60,000.00	$ 260,000.00	$ -
10	Saturator Basement	$ 50,000.00	$ -									
11	Building 635 sf @ $300	$ 190,500.00	$ -									
12	Storage Warehouse Space	$ 117,000.00	$ -									
13	Site Improvements	$ 250,000.00	$ 1,120,492.37	$ 31,250.00	$ 30,000.00	$ 20,000.00	$ 62,500.00	$ 125,000.00	$ 500,000.00	$ 75,000.00	$ 325,000.00	$ -
	Subtotal Capital Cost	$1,434,000.00										
	Contingency 30%	$ 430,200.00										
	Total Capital Cost	**$ 1,864,200.00**										
	Operating Cost	Cost Per Year										
1	Maintenance	$ 28,680.00	$ 313,431.43	$ 32,265.00	$ 32,121.60	$ 30,974.40	$ 35,850.00	$ 43,020.00	$ 43,020.00	$ 37,284.00	$ 37,284.00	$ 37,284.00
2	Replace Equipment	See above	$ 5,215,050.51	See above	See above	See above	See above	See above	See above	See above	See above	See above
3	Operation of Equipment	$ 66,200.00	$ 723,471.43	$ 74,475.00	$ 74,144.00	$ 71,496.00	$ 82,750.00	$ 99,300.00	$ 99,300.00	$ 86,060.00	$ 86,060.00	$ 86,060.00
4	Power Cost	$ 1,335.38	$ 14,593.78	$ 1,502.30	$ 1,495.62	$ 1,442.21	$ 1,669.22	$ 2,003.07	$ 2,003.07	$ 1,735.99	$ 1,735.99	$ 1,735.99
5	Chemical Cost	$ 289,924.82	$ 3,168,464.08	$ 326,165.42	$ 324,715.80	$ 313,118.80	$ 362,406.02	$ 434,887.23	$ 434,887.23	$ 376,902.26	$ 376,902.26	$ 376,902.26
	Subtotal Operating Cost		$ 9,435,011.23									
	Operating Contingency 30%		$ 2,830,503.37									
	Total 50-year Operating Cost		**$ 12,265,514.59**									
	Total Capital and Operating	**$ 14,129,714.59**										
	Average Yearly Operating (2022 Dollars)		**$ 245,310.29**									

Hoffman, Ray

Orange: 5% discount rate, Net Present Value

	Dry Building	Concept Level Cost	LCCA Cost	2023	2024	2025	2030	2040	2050	2060	2070	2080
	Capital Cost			12.5%	12%	8%	25% 4 years	50% 10 years	50% 20 Years	30.0% 30 Years	30.0% 40 Years	30.0% 50 Years
1	Electrical Equipment	$55,000.00	$ 421,704.81	$ 6,875.00	$ 6,600.00	$ 4,400.00	$ 13,750.00	$ 82,500.00	$ 110,000.00	$ 71,500.00	$ 71,500.00	$ 71,500.00
2	PLC MicroLogic 1400	$45,000.00	$ 345,031.21	$ 5,625.00	$ 5,400.00	$ 3,600.00	$ 11,250.00	$ 67,500.00	$ 90,000.00	$ 58,500.00	$ 58,500.00	$ 58,500.00
3	Metering Pump Skid (about 2-8 pumps per facility, will follow up with table showing number of pumps for each facility)	$ 120,000.00	$ 537,836.34	$ 15,000.00	$ 14,400.00	$ 9,600.00	$ 30,000.00	$ 60,000.00	$ 240,000.00	$ 36,000.00	$ 156,000.00	$ -
4	Backflow Preventer	$ 6,000.00	$ 26,891.82	$ 750.00	$ 720.00	$ 480.00	$ 1,500.00	$ 3,000.00	$ 12,000.00	$ 1,800.00	$ 7,800.00	$ -
5	Man Door	$ 8,000.00	$ 35,855.76	$ 1,000.00	$ 960.00	$ 640.00	$ 2,000.00	$ 4,000.00	$ 16,000.00	$ 2,400.00	$ 10,400.00	$ -
6	Roll up Door	$ 10,000.00	$ 44,819.69	$ 1,250.00	$ 1,200.00	$ 800.00	$ 2,500.00	$ 5,000.00	$ 20,000.00	$ 3,000.00	$ 13,000.00	$ -
7	Fluoride Analyzer	$ 20,000.00	$ 153,347.20	$ 2,500.00	$ 2,400.00	$ 1,600.00	$ 5,000.00	$ 30,000.00	$ 40,000.00	$ 26,000.00	$ 26,000.00	$ 26,000.00
8	Water Softener	$ 2,500.00	$ 19,168.40	$ 312.50	$ 300.00	$ 200.00	$ 625.00	$ 3,750.00	$ 5,000.00	$ 3,250.00	$ 3,250.00	$ 3,250.00
9	BBU (includes refill feeder, weigh feeder, model 810 BBU, saturator, volumetric feeder, control panel)	$ 200,000.00	$ 896,393.90	$ 25,000.00	$ 24,000.00	$ 16,000.00	$ 50,000.00	$ 100,000.00	$ 400,000.00	$ 60,000.00	$ 260,000.00	$ -
10	Saturator Basement	$ 50,000.00	$ -									
11	Building 635 sf @ $400	$ 254,000.00	$ -									
12	Storage Warehouse Space	$ 104,000.00	$ -									
13	Site Improvements	$ 150,000.00	$ 672,295.42	$ 18,750.00	$ 18,000.00	$ 12,000.00	$ 37,500.00	$ 75,000.00	$ 300,000.00	$ 45,000.00	$ 195,000.00	$ -
	Subtotal Capital Cost	$ 1,024,500.00										
	Contingency 30%	$ 307,350.00										
	Total Capital Cost	**$ 1,331,850.00**										
	Operating Cost	Cost Per Year										
1	Maintenance	$ 20,490.00	$ 223,926.43	$ 23,051.25	$ 22,948.80	$ 22,129.20	$ 25,612.50	$ 30,735.00	$ 30,735.00	$ 26,637.00	$ 26,637.00	$ 26,637.00
2	Replace Equipment	See above	$ 3,153,344.54	See above	See above	See above	See above	See above	See above	See above	See above	See above
3	Operation of Equipment	$ 66,200.00	$ 723,471.43	$ 74,475.00	$ 74,144.00	$ 71,496.00	$ 82,750.00	$ 99,300.00	$ 99,300.00	$ 86,060.00	$ 86,060.00	$ 86,060.00
4	Power Cost	$ 1,050.50	$ 11,480.41	$ 1,181.81	$ 1,176.55	$ 1,134.54	$ 1,313.12	$ 1,575.74	$ 1,575.74	$ 1,365.64	$ 1,365.64	$ 1,365.64
5	Chemical Cost	$ 92,211.51	$ 1,007,740.10	$ 103,737.95	$ 103,276.89	$ 99,588.43	$ 115,264.39	$ 138,317.27	$ 138,317.27	$ 119,874.97	$ 119,874.97	$ 119,874.97
	Subtotal Operating Cost		$ 5,119,962.91									
	Operating Contingency 30%		$ 1,535,988.87									
	Total 50-year Operating Cost		**$ 6,655,951.79**									
	Total Capital and Operating	**$ 7,987,801.79**										
	Average Yearly Operating (2022 Dollars)		**$ 133,119.04**									

Havana

Orange: 5% discount rate, Net Present Value

	Dry Building	Concept Level Cost	LCCA Cost	2023	2024	2025	2030	2040	2050	2060	2070	2080
	Capital Cost			12.5%	12%	8%	25% 4 years	50% 10 years	50% 20 Years	30.0% 30 Years	30.0% 40 Years	30.0% 50 Years
1	Electrical Equipment	$55,000.00	$ 421,704.81	$ 6,875.00	$ 6,600.00	$ 4,400.00	$ 13,750.00	$ 82,500.00	$ 110,000.00	$ 71,500.00	$ 71,500.00	$ 71,500.00
2	PLC MicroLogic 1400	$45,000.00	$ 345,031.21	$ 5,625.00	$ 5,400.00	$ 3,600.00	$ 11,250.00	$ 67,500.00	$ 90,000.00	$ 58,500.00	$ 58,500.00	$ 58,500.00
3	Metering Pump Skid (about 2-8 pumps per facility, will follow up with table showing number of pumps for each facility)	$ 360,000.00	$ 1,613,509.02	$ 45,000.00	$ 43,200.00	$ 28,800.00	$ 90,000.00	$ 180,000.00	$ 720,000.00	$ 108,000.00	$ 468,000.00	$ -
4	Backflow Preventer	$ 6,000.00	$ 26,891.82	$ 750.00	$ 720.00	$ 480.00	$ 1,500.00	$ 3,000.00	$ 12,000.00	$ 1,800.00	$ 7,800.00	$ -
5	Man Door	$ 8,000.00	$ 35,855.76	$ 1,000.00	$ 960.00	$ 640.00	$ 2,000.00	$ 4,000.00	$ 16,000.00	$ 2,400.00	$ 10,400.00	$ -
6	Roll up Door	$ 10,000.00	$ 44,819.69	$ 1,250.00	$ 1,200.00	$ 800.00	$ 2,500.00	$ 5,000.00	$ 20,000.00	$ 3,000.00	$ 13,000.00	$ -
7	Fluoride Analyzer	$ 20,000.00	$ 153,347.20	$ 2,500.00	$ 2,400.00	$ 1,600.00	$ 5,000.00	$ 30,000.00	$ 40,000.00	$ 26,000.00	$ 26,000.00	$ 26,000.00
8	Water Softener	$ 2,500.00	$ 19,168.40	$ 312.50	$ 300.00	$ 200.00	$ 625.00	$ 3,750.00	$ 5,000.00	$ 3,250.00	$ 3,250.00	$ 3,250.00
9	BBU (includes refill feeder, weigh feeder, model 810 BBU, saturator, volumetric feeder, control panel)	$ 200,000.00	$ 896,393.90	$ 25,000.00	$ 24,000.00	$ 16,000.00	$ 50,000.00	$ 100,000.00	$ 400,000.00	$ 60,000.00	$ 260,000.00	$ -
10	Saturator Basement	$ 50,000.00	$ -									
11	Building 635 sf @ $400	$ 254,000.00	$ -									
12	Storage Warehouse Space	$ 84,000.00	$ -									
13	Site Improvements	$ 150,000.00	$ 672,295.42	$ 18,750.00	$ 18,000.00	$ 12,000.00	$ 37,500.00	$ 75,000.00	$ 300,000.00	$ 45,000.00	$ 195,000.00	$ -
	Subtotal Capital Cost	$ 1,244,500.00										
	Contingency 30%	$ 373,350.00										
	Total Capital Cost	**$ 1,617,850.00**										
	Operating Cost	Cost Per Year										
1	Maintenance	$ 24,890.00	$ 272,012.14	$ 28,001.25	$ 27,876.80	$ 26,881.20	$ 31,112.50	$ 37,335.00	$ 37,335.00	$ 32,357.00	$ 32,357.00	$ 32,357.00
2	Replace Equipment	See above	$ 4,229,017.22	See above	See above	See above	See above	See above	See above	See above	See above	See above
3	Operation of Equipment	$ 66,200.00	$ 723,471.43	$ 74,475.00	$ 74,144.00	$ 71,496.00	$ 82,750.00	$ 99,300.00	$ 99,300.00	$ 86,060.00	$ 86,060.00	$ 86,060.00
4	Power Cost	$ 1,365.86	$ 14,926.84	$ 1,536.59	$ 1,529.76	$ 1,475.12	$ 1,707.32	$ 2,048.78	$ 2,048.78	$ 1,775.61	$ 1,775.61	$ 1,775.61
5	Chemical Cost	$ 111,535.58	$ 1,218,924.51	$ 125,477.52	$ 124,919.85	$ 120,458.42	$ 139,419.47	$ 167,303.36	$ 167,303.36	$ 144,996.25	$ 144,996.25	$ 144,996.25
	Subtotal Operating Cost		$ 6,458,352.15									
	Operating Contingency 30%		$ 1,937,505.64									
	Total 50-year Operating Cost		**$ 8,395,857.79**									
	Total Capital and Operating	**$ 10,013,707.79**										
	Average Yearly Operating (2022 Dollars)		**$ 167,917.16**									

Central

Orange: 5% discount rate, Net Present value

	Central Ave Liquid Building	Concept Level Cost	LCCA Cost	2023	2024	2025	2030	2040	2050	2060	2070	2080
	Capital Cost			12.5%	12%	8%	4 years 25%	10 years 50%	20 Years 50%	30 Years 30.0%	40 Years 30.0%	50 Years 30.0%
1	Electrical Equipment	$ 71,000.00	$ 544,382.57	$ 8,875.00	$ 8,520.00	$ 5,680.00	$ 17,750.00	$ 106,500.00	$ 142,000.00	$ 92,300.00	$ 92,300.00	$ 92,300.00
2	PLC MicroLogic 1400	$ 45,000.00	$ 345,031.21	$ 5,625.00	$ 5,400.00	$ 3,600.00	$ 11,250.00	$ 67,500.00	$ 90,000.00	$ 58,500.00	$ 58,500.00	$ 58,500.00
3	Metering Pump Skid	$ 120,000.00	$ 537,836.34	$ 15,000.00	$ 14,400.00	$ 9,600.00	$ 30,000.00	$ 60,000.00	$ 240,000.00	$ 36,000.00	$ 156,000.00	$ -
4	Bulk Storage Tank	$ 30,000.00	$ 134,459.08	$ 3,750.00	$ 3,600.00	$ 2,400.00	$ 7,500.00	$ 15,000.00	$ 60,000.00	$ 9,000.00	$ 39,000.00	$ -
5	Day Storage Tank	$ 20,000.00	$ 89,639.39	$ 2,500.00	$ 2,400.00	$ 1,600.00	$ 5,000.00	$ 10,000.00	$ 40,000.00	$ 6,000.00	$ 26,000.00	$ -
6	Roll up Door	$ 10,000.00	$ 44,819.69	$ 1,250.00	$ 1,200.00	$ 800.00	$ 2,500.00	$ 5,000.00	$ 20,000.00	$ 3,000.00	$ 13,000.00	$ -
7	Man Door	$ 8,000.00	$ 35,855.76	$ 1,000.00	$ 960.00	$ 640.00	$ 2,000.00	$ 4,000.00	$ 16,000.00	$ 2,400.00	$ 10,400.00	$ -
8	Fluoride Analyzer	$ 20,000.00	$ 153,347.20	$ 2,500.00	$ 2,400.00	$ 1,600.00	$ 5,000.00	$ 30,000.00	$ 40,000.00	$ 26,000.00	$ 26,000.00	$ 26,000.00
9	Backflow Preventer	$ 6,000.00	$ 26,891.82	$ 750.00	$ 720.00	$ 480.00	$ 1,500.00	$ 3,000.00	$ 12,000.00	$ 1,800.00	$ 7,800.00	$ -
10	Transfer Pump Skid	$ 30,000.00	$ 134,459.08	$ 3,750.00	$ 3,600.00	$ 2,400.00	$ 7,500.00	$ 15,000.00	$ 60,000.00	$ 9,000.00	$ 39,000.00	$ -
11	Secondary Containment	$ 50,000.00	$ -									
12	Building 1102 sf @ $400	$ 440,800.00	$ -									
13	Demo Existing Building	$ 20,000.00	$ -									
14	Site Improvements	$ 150,000.00	$ 672,295.42	$ 18,750.00	$ 18,000.00	$ 12,000.00	$ 37,500.00	$ 75,000.00	$ 300,000.00	$ 45,000.00	$ 195,000.00	$ -
	Subtotal Capital Cost	$ 1,020,800.00										
	Contingency 30%	$ 306,240.00										
	Total Capital Cost	**$ 1,327,040.00**										
	Operating Cost	Cost Per Year										
1	Maintenance	$ 20,416.00	$ 223,117.71	$ 22,968.00	$ 22,865.92	$ 22,049.28	$ 25,520.00	$ 30,624.00	$ 30,624.00	$ 26,540.80	$ 26,540.80	$ 26,540.80
2	Replace Equipment	See above	$ 2,719,017.57	See above	See above	See above	See above	See above	See above	See above	See above	See above
3	Operation of Equipment	$ 63,160.00	$ 690,248.57	$ 71,055.00	$ 70,739.20	$ 68,212.80	$ 78,950.00	$ 94,740.00	$ 94,740.00	$ 82,108.00	$ 82,108.00	$ 82,108.00
4	Power Cost	$ 1,059.06	$ 11,574.05	$ 1,191.45	$ 1,186.15	$ 1,143.79	$ 1,323.83	$ 1,588.60	$ 1,588.60	$ 1,376.78	$ 1,376.78	$ 1,376.78
5	Chemical Cost	$ 45,178.16	$ 493,732.79	$ 50,825.43	$ 50,599.54	$ 48,792.42	$ 56,472.71	$ 67,767.25	$ 67,767.25	$ 58,731.61	$ 58,731.61	$ 58,731.61
	Subtotal Operating Cost		$ 4,137,690.70									
	Operating Contingency 30%		$ 1,241,307.21									
	Total 50-year Operating Cost		**$ 5,378,997.91**									
	Total Capital and Operating	**$ 6,706,037.91**										
	Average Yearly Operating (2022 Dollars)		**$ 107,579.96**									

Central

Orange: 5% discount rate, Net Present Value

	Central Ave Dry Building	Concept Level Cost	LCCA Cost	2023	2024	2025	2030	2040	2050	2060	2070	2080
	Capital Cost			12.5%	12%	8%	25% 4 years	50% 10 years	50% 20 Years	30.0% 30 Years	30.0% 40 Years	30.0% 50 Years
1	Electrical Equipment	$ 71,000.00	$ 544,382.57	$ 8,875.00	$ 8,520.00	$ 5,680.00	$ 17,750.00	$ 106,500.00	$ 142,000.00	$ 92,300.00	$ 92,300.00	$ 92,300.00
2	PLC MicroLogic 1400	$45,000.00	$ 345,031.21	$ 5,625.00	$ 5,400.00	$ 3,600.00	$ 11,250.00	$ 67,500.00	$ 90,000.00	$ 58,500.00	$ 58,500.00	$ 58,500.00
3	Metering Pump Skid (about 2-8 pumps per facility, will follow up with table showing number of pumps for each facility)	$ 120,000.00	$ 537,836.34	$ 15,000.00	$ 14,400.00	$ 9,600.00	$ 30,000.00	$ 60,000.00	$ 240,000.00	$ 36,000.00	$ 156,000.00	$ -
4	Backflow Preventer	$ 6,000.00	$ 26,891.82	$ 750.00	$ 720.00	$ 480.00	$ 1,500.00	$ 3,000.00	$ 12,000.00	$ 1,800.00	$ 7,800.00	$ -
5	Man Door	$ 8,000.00	$ 35,855.76	$ 1,000.00	$ 960.00	$ 640.00	$ 2,000.00	$ 4,000.00	$ 16,000.00	$ 2,400.00	$ 10,400.00	$ -
6	Roll up Door	$ 10,000.00	$ 44,819.69	$ 1,250.00	$ 1,200.00	$ 800.00	$ 2,500.00	$ 5,000.00	$ 20,000.00	$ 3,000.00	$ 13,000.00	$ -
7	Fluoride Analyzer	$ 20,000.00	$ 153,347.20	$ 2,500.00	$ 2,400.00	$ 1,600.00	$ 5,000.00	$ 30,000.00	$ 40,000.00	$ 26,000.00	$ 26,000.00	$ 26,000.00
8	Water Softener	$ 2,500.00	$ 19,168.40	$ 312.50	$ 300.00	$ 200.00	$ 625.00	$ 3,750.00	$ 5,000.00	$ 3,250.00	$ 3,250.00	$ 3,250.00
9	BBU (includes refill feeder, weigh feeder, model 810 BBU, saturator, volumetric feeder, control panel)	$ 200,000.00	$ 896,393.90	$ 25,000.00	$ 24,000.00	$ 16,000.00	$ 50,000.00	$ 100,000.00	$ 400,000.00	$ 60,000.00	$ 260,000.00	$ -
10	Saturator Basement	$ 50,000.00	$ -									
11	Building 1102 sf @ $400	$ 440,800.00	$ -									
12	Demo Existing Building	$ 20,000.00	$ -									
13	Storage Warehouse Space	$ 104,000.00	$ -									
14	Site Improvements	$ 150,000.00	$ 672,295.42	$ 18,750.00	$ 18,000.00	$ 12,000.00	$ 37,500.00	$ 75,000.00	$ 300,000.00	$ 45,000.00	$ 195,000.00	$ -
	Subtotal Capital Cost	$ 1,247,300.00										
	Contingency 30%	$ 374,190.00										
	Total Capital Cost	**$ 1,621,490.00**										
	Operating Cost	Cost Per Year										
1	Maintenance	$ 24,946.00	$ 272,624.14	$ 28,064.25	$ 27,939.52	$ 26,941.68	$ 31,182.50	$ 37,419.00	$ 37,419.00	$ 32,429.80	$ 32,429.80	$ 32,429.80
2	Replace Equipment	See above	$ 3,276,022.31	See above	See above	See above	See above	See above	See above	See above	See above	See above
3	Operation of Equipment	$ 66,200.00	$ 723,471.43	$ 74,475.00	$ 74,144.00	$ 71,496.00	$ 82,750.00	$ 99,300.00	$ 99,300.00	$ 86,060.00	$ 86,060.00	$ 86,060.00
4	Power Cost	$ 1,067.74	$ 11,668.91	$ 1,201.21	$ 1,195.87	$ 1,153.16	$ 1,334.68	$ 1,601.62	$ 1,601.62	$ 1,388.07	$ 1,388.07	$ 1,388.07
5	Chemical Cost	$ 81,157.63	$ 886,936.95	$ 91,302.33	$ 90,896.55	$ 87,650.24	$ 101,447.04	$ 121,736.44	$ 121,736.44	$ 105,504.92	$ 105,504.92	$ 105,504.92
	Subtotal Operating Cost		$ 5,170,723.74									
	Operating Contingency 30%		$ 1,551,217.12									
	Total 50-year Operating Cost		**$ 6,721,940.87**									
	Total Capital and Operating	**$ 8,343,430.87**										
	Average Yearly Operating (2022 Dollars)		**$ 134,438.82**									

Nevada AND Grace (One Building)

Orange: 5% discount rate, Net Present value

	Nevada/Grace Liquid Buildling	Concept Level Cost	LCCA Cost	2023	2024	2025	2030	2040	2050	2060	2070	2080
	Capital Cost			12.5%	12%	8%	25% 4 years	50% 10 years	50% 20 Years	30.0% 30 Years	30.0% 40 Years	30.0% 50 Years
1	Electrical Equipment	$ 71,000.00	$ 544,382.57	$ 8,875.00	$ 8,520.00	$ 5,680.00	$ 17,750.00	$ 106,500.00	$ 142,000.00	$ 92,300.00	$ 92,300.00	$ 92,300.00
2	PLC MicroLogic 1400	$ 45,000.00	$ 345,031.21	$ 5,625.00	$ 5,400.00	$ 3,600.00	$ 11,250.00	$ 67,500.00	$ 90,000.00	$ 58,500.00	$ 58,500.00	$ 58,500.00
3	Metering Pump Skid	$ 360,000.00	$ 1,613,509.02	$ 45,000.00	$ 43,200.00	$ 28,800.00	$ 90,000.00	$ 180,000.00	$ 720,000.00	$ 108,000.00	$ 468,000.00	$ -
4	Bulk Storage Tank	$ 30,000.00	$ 134,459.08	$ 3,750.00	$ 3,600.00	$ 2,400.00	$ 7,500.00	$ 15,000.00	$ 60,000.00	$ 9,000.00	$ 39,000.00	$ -
5	Day Storage Tank	$ 20,000.00	$ 89,639.39	$ 2,500.00	$ 2,400.00	$ 1,600.00	$ 5,000.00	$ 10,000.00	$ 40,000.00	$ 6,000.00	$ 26,000.00	$ -
6	Roll up Door	$ 10,000.00	$ 44,819.69	$ 1,250.00	$ 1,200.00	$ 800.00	$ 2,500.00	$ 5,000.00	$ 20,000.00	$ 3,000.00	$ 13,000.00	$ -
7	Man Door	$ 8,000.00	$ 35,855.76	$ 1,000.00	$ 960.00	$ 640.00	$ 2,000.00	$ 4,000.00	$ 16,000.00	$ 2,400.00	$ 10,400.00	$ -
8	Fluoride Analyzer	$ 20,000.00	$ 153,347.20	$ 2,500.00	$ 2,400.00	$ 1,600.00	$ 5,000.00	$ 30,000.00	$ 40,000.00	$ 26,000.00	$ 26,000.00	$ 26,000.00
9	Backflow Preventer	$ 6,000.00	$ 26,891.82	$ 750.00	$ 720.00	$ 480.00	$ 1,500.00	$ 3,000.00	$ 12,000.00	$ 1,800.00	$ 7,800.00	$ -
10	Transfer Pump Skid	$ 30,000.00	$ 134,459.08	$ 3,750.00	$ 3,600.00	$ 2,400.00	$ 7,500.00	$ 15,000.00	$ 60,000.00	$ 9,000.00	$ 39,000.00	$ -
11	Secondary Containment	$ 50,000.00	$ -									
12	Building 647 sf @ $300	$ 194,100.00	$ -									
13	Site Improvements	$ 250,000.00	$ 1,120,492.37	$ 31,250.00	$ 30,000.00	$ 20,000.00	$ 62,500.00	$ 125,000.00	$ 500,000.00	$ 75,000.00	$ 325,000.00	$ -
	Subtotal Capital Cost	$ 1,094,100.00										
	Contingency 30%	$ 328,230.00										
	Total Capital Cost	**$ 1,422,330.00**										
	Operating Cost											
		Cost Per Year										
1	Maintenance	$ 21,882.00	$ 239,139.00	$ 24,617.25	$ 24,507.84	$ 23,632.56	$ 27,352.50	$ 32,823.00	$ 32,823.00	$ 28,446.60	$ 28,446.60	$ 28,446.60
2	Replace Equipment	See above	$ 4,242,887.19	See above	See above	See above	See above	See above	See above	See above	See above	See above
3	Operation of Equipment	$ 63,160.00	$ 690,248.57	$ 71,055.00	$ 70,739.20	$ 68,212.80	$ 78,950.00	$ 94,740.00	$ 94,740.00	$ 82,108.00	$ 82,108.00	$ 82,108.00
4	Power Cost	$ 1,153.04	$ 12,601.13	$ 1,297.18	$ 1,291.41	$ 1,245.29	$ 1,441.31	$ 1,729.57	$ 1,729.57	$ 1,498.96	$ 1,498.96	$ 1,498.96
5	Chemical Cost	$ 101,429.37	$ 1,108,478.16	$ 114,108.05	$ 113,600.90	$ 109,543.72	$ 126,786.72	$ 152,144.06	$ 152,144.06	$ 131,858.19	$ 131,858.19	$ 131,858.19
	Subtotal Operating Cost		$ 6,293,354.05									
	Operating Contingency 30%		$ 1,888,006.22									
	Total 50-year Operating Cost		**$ 8,181,360.27**									
	Total Capital and Operating	**$ 9,603,690.27**										
	Average Yearly Operating (2022 Dollars)		**$ 163,627.21**									

Well Electric

Orange: 5% discount rate, Net Present value

	Well Electric Liquid Buildling	Concept Level Cost	LCCA Cost	2023	2024	2025	2030	2040	2050	2060	2070	2080
	Capital Cost			12.5%	12%	8%	25% 4 years	50% 10 years	50% 20 Years	30.0% 30 Years	30.0% 40 Years	30.0% 50 Years
1	Electrical Equipment	$ 71,000.00	$ 544,382.57	$ 8,875.00	$ 8,520.00	$ 5,680.00	$ 17,750.00	$ 106,500.00	$ 142,000.00	$ 92,300.00	$ 92,300.00	$ 92,300.00
2	PLC MicroLogic 1400	$ 45,000.00	$ 345,031.21	$ 5,625.00	$ 5,400.00	$ 3,600.00	$ 11,250.00	$ 67,500.00	$ 90,000.00	$ 58,500.00	$ 58,500.00	$ 58,500.00
3	Metering Pump Skid	$ 360,000.00	$ 1,613,509.02	$ 45,000.00	$ 43,200.00	$ 28,800.00	$ 90,000.00	$ 180,000.00	$ 720,000.00	$ 108,000.00	$ 468,000.00	$ -
4	Bulk Storage Tank	$ 30,000.00	$ 134,459.08	$ 3,750.00	$ 3,600.00	$ 2,400.00	$ 7,500.00	$ 15,000.00	$ 60,000.00	$ 9,000.00	$ 39,000.00	$ -
5	Day Storage Tank	$ 20,000.00	$ 89,639.39	$ 2,500.00	$ 2,400.00	$ 1,600.00	$ 5,000.00	$ 10,000.00	$ 40,000.00	$ 6,000.00	$ 26,000.00	$ -
6	Roll up Door	$ 10,000.00	$ 44,819.69	$ 1,250.00	$ 1,200.00	$ 800.00	$ 2,500.00	$ 5,000.00	$ 20,000.00	$ 3,000.00	$ 13,000.00	$ -
7	Man Door	$ 8,000.00	$ 35,855.76	$ 1,000.00	$ 960.00	$ 640.00	$ 2,000.00	$ 4,000.00	$ 16,000.00	$ 2,400.00	$ 10,400.00	$ -
8	Fluoride Analyzer	$ 20,000.00	$ 153,347.20	$ 2,500.00	$ 2,400.00	$ 1,600.00	$ 5,000.00	$ 30,000.00	$ 40,000.00	$ 26,000.00	$ 26,000.00	$ 26,000.00
9	Backflow Preventer	$ 6,000.00	$ 26,891.82	$ 750.00	$ 720.00	$ 480.00	$ 1,500.00	$ 3,000.00	$ 12,000.00	$ 1,800.00	$ 7,800.00	$ -
10	Transfer Pump Skid	$ 30,000.00	$ 134,459.08	$ 3,750.00	$ 3,600.00	$ 2,400.00	$ 7,500.00	$ 15,000.00	$ 60,000.00	$ 9,000.00	$ 39,000.00	$ -
11	Secondary Containment	$ 50,000.00	$ -									
12	Building 647 sf @ $300	$ 194,100.00	$ -									
13	Site Improvements	$ 250,000.00	$ 1,120,492.37	$ 31,250.00	$ 30,000.00	$ 20,000.00	$ 62,500.00	$ 125,000.00	$ 500,000.00	$ 75,000.00	$ 325,000.00	$ -
	Subtotal Capital Cost	$ 1,094,100.00										
	Contingency 30%	$ 328,230.00										
	Total Capital Cost	**$ 1,422,330.00**										
	Operating Cost	Cost Per Year										
1	Maintenance	$ 21,882.00	$ 239,139.00	$ 24,617.25	$ 24,507.84	$ 23,632.56	$ 27,352.50	$ 32,823.00	$ 32,823.00	$ 28,446.60	$ 28,446.60	$ 28,446.60
2	Replace Equipment	See above	$ 4,242,887.19	See above	See above	See above	See above	See above	See above	See above	See above	See above
3	Operation of Equipment	$ 63,160.00	$ 690,248.57	$ 71,055.00	$ 70,739.20	$ 68,212.80	$ 78,950.00	$ 94,740.00	$ 94,740.00	$ 82,108.00	$ 82,108.00	$ 82,108.00
4	Power Cost	$ 1,126.46	$ 12,310.56	$ 1,267.26	$ 1,261.63	$ 1,216.57	$ 1,408.07	$ 1,689.68	$ 1,689.68	$ 1,464.39	$ 1,464.39	$ 1,464.39
5	Chemical Cost	$ 142,963.25	$ 1,562,384.08	$ 160,833.66	$ 160,118.84	$ 154,400.31	$ 178,704.06	$ 214,444.87	$ 214,444.87	$ 185,852.22	$ 185,852.22	$ 185,852.22
	Subtotal Operating Cost		$ 6,746,969.41									
	Operating Contingency 30%		$ 2,024,090.82									
	Total 50-year Operating Cost		**$ 8,771,060.23**									
	Total Capital and Operating	**$ 10,193,390.23**										
	Average Yearly Operating (2022 Dollars)		**$ 175,421.20**									

Nevada AND Grace (One Building)

Orange: 5% discount rate, Net Present Value

	Nevada/Grace Dry Building	Concept Level Cost	LCCA Cost	2023	2024	2025	2030	2040	2050	2060	2070	2080
	Capital Cost			12.5%	12%	8%	4 years 25%	10 years 50%	20 Years 50%	30 Years 30.0%	40 Years 30.0%	50 Years 30.0%
1	Electrical Equipment	$ 71,000.00	$ 544,382.57	$ 8,875.00	$ 8,520.00	$ 5,680.00	$ 17,750.00	$ 106,500.00	$ 142,000.00	$ 92,300.00	$ 92,300.00	$ 92,300.00
2	PLC MicroLogic 1400	$45,000.00	$ 345,031.21	$ 5,625.00	$ 5,400.00	$ 3,600.00	$ 11,250.00	$ 67,500.00	$ 90,000.00	$ 58,500.00	$ 58,500.00	$ 58,500.00
3	Metering Pump Skid (about 2-8 pumps per facility, will follow up with table showing number of pumps for each facility)	$ 360,000.00	$ 1,613,509.02	$ 45,000.00	$ 43,200.00	$ 28,800.00	$ 90,000.00	$ 180,000.00	$ 720,000.00	$ 108,000.00	$ 468,000.00	$ -
4	Backflow Preventer	$ 6,000.00	$ 26,891.82	$ 750.00	$ 720.00	$ 480.00	$ 1,500.00	$ 3,000.00	$ 12,000.00	$ 1,800.00	$ 7,800.00	$ -
5	Man Door	$ 8,000.00	$ 35,855.76	$ 1,000.00	$ 960.00	$ 640.00	$ 2,000.00	$ 4,000.00	$ 16,000.00	$ 2,400.00	$ 10,400.00	$ -
6	Roll up Door	$ 10,000.00	$ 44,819.69	$ 1,250.00	$ 1,200.00	$ 800.00	$ 2,500.00	$ 5,000.00	$ 20,000.00	$ 3,000.00	$ 13,000.00	$ -
7	Fluoride Analyzer	$ 20,000.00	$ 153,347.20	$ 2,500.00	$ 2,400.00	$ 1,600.00	$ 5,000.00	$ 30,000.00	$ 40,000.00	$ 26,000.00	$ 26,000.00	$ 26,000.00
8	Water Softener	$ 2,500.00	$ 19,168.40	$ 312.50	$ 300.00	$ 200.00	$ 625.00	$ 3,750.00	$ 5,000.00	$ 3,250.00	$ 3,250.00	$ 3,250.00
9	BBU (includes refill feeder, weigh feeder, model 810 BBU, saturator, volumetric feeder, control panel)	$ 200,000.00	$ 896,393.90	$ 25,000.00	$ 24,000.00	$ 16,000.00	$ 50,000.00	$ 100,000.00	$ 400,000.00	$ 60,000.00	$ 260,000.00	$ -
10	Saturator Basement	$ 50,000.00	$ -									
11	Building 475 SF @ $300	$ 142,500.00	$ -									
12	Storage Warehouse Space	$ 78,000.00	$ -									
13	Site Improvements	$ 250,000.00	$ 1,120,492.37	$ 31,250.00	$ 30,000.00	$ 20,000.00	$ 62,500.00	$ 125,000.00	$ 500,000.00	$ 75,000.00	$ 325,000.00	$ -
	Subtotal Capital Cost	$ 1,243,000.00										
	Contingency 30%	$ 372,900.00										
	Total Capital Cost	**$ 1,615,900.00**										
	Operating Cost	Cost Per Year										
1	Maintenance	$ 24,860.00	$ 271,684.29	$ 27,967.50	$ 27,843.20	$ 26,848.80	$ 31,075.00	$ 37,290.00	$ 37,290.00	$ 32,318.00	$ 32,318.00	$ 32,318.00
2	Replace Equipment	See above	$ 4,799,891.93	See above	See above	See above	See above	See above	See above	See above	See above	See above
3	Operation of Equipment	$ 66,200.00	$ 723,471.43	$ 74,475.00	$ 74,144.00	$ 71,496.00	$ 82,750.00	$ 99,300.00	$ 99,300.00	$ 86,060.00	$ 86,060.00	$ 86,060.00
4	Power Cost	$ 1,164.46	$ 12,725.83	$ 1,310.01	$ 1,304.19	$ 1,257.61	$ 1,455.57	$ 1,746.68	$ 1,746.68	$ 1,513.79	$ 1,513.79	$ 1,513.79
5	Chemical Cost	$ 182,206.77	$ 1,991,259.75	$ 204,982.62	$ 204,071.59	$ 196,783.32	$ 227,758.47	$ 273,310.16	$ 273,310.16	$ 236,868.81	$ 236,868.81	$ 236,868.81
	Subtotal Operating Cost		$ 7,799,033.23									
	Operating Contingency 30%		$ 2,339,709.97									
	Total 50-year Operating Cost		**$ 10,138,743.20**									
	Total Capital and Operating	**$ 11,754,643.20**										
	Average Yearly Operating (2022 Dollars)		**$ 202,774.86**									

Well Electric

Orange: 5% discount rate, Net Present Value

	Well Electric Dry Building	Concept Level Cost	LCCA Cost	2023	2024	2025	2030	2040	2050	2060	2070	2080
	Capital Cost			12.5%	12%	8%	4 years 25%	10 years 50%	20 Years 50%	30 Years 30.0%	40 Years 30.0%	50 Years 30.0%
1	Electrical Equipment	$ 71,000.00	$ 544,382.57	$ 8,875.00	$ 8,520.00	$ 5,680.00	$ 17,750.00	$ 106,500.00	$ 142,000.00	$ 92,300.00	$ 92,300.00	$ 92,300.00
2	PLC MicroLogic 1400	$45,000.00	$ 345,031.21	$ 5,625.00	$ 5,400.00	$ 3,600.00	$ 11,250.00	$ 67,500.00	$ 90,000.00	$ 58,500.00	$ 58,500.00	$ 58,500.00
3	Metering Pump Skid (about 2-8 pumps per facility, will follow up with table showing number of pumps for each facility)	$ 360,000.00	$ 1,613,509.02	$ 45,000.00	$ 43,200.00	$ 28,800.00	$ 90,000.00	$ 180,000.00	$ 720,000.00	$ 108,000.00	$ 468,000.00	$ -
4	Backflow Preventer	$ 6,000.00	$ 26,891.82	$ 750.00	$ 720.00	$ 480.00	$ 1,500.00	$ 3,000.00	$ 12,000.00	$ 1,800.00	$ 7,800.00	$ -
5	Man Door	$ 8,000.00	$ 35,855.76	$ 1,000.00	$ 960.00	$ 640.00	$ 2,000.00	$ 4,000.00	$ 16,000.00	$ 2,400.00	$ 10,400.00	$ -
6	Roll up Door	$ 10,000.00	$ 44,819.69	$ 1,250.00	$ 1,200.00	$ 800.00	$ 2,500.00	$ 5,000.00	$ 20,000.00	$ 3,000.00	$ 13,000.00	$ -
7	Fluoride Analyzer	$ 20,000.00	$ 153,347.20	$ 2,500.00	$ 2,400.00	$ 1,600.00	$ 5,000.00	$ 30,000.00	$ 40,000.00	$ 26,000.00	$ 26,000.00	$ 26,000.00
8	Water Softener	$ 2,500.00	$ 19,168.40	$ 312.50	$ 300.00	$ 200.00	$ 625.00	$ 3,750.00	$ 5,000.00	$ 3,250.00	$ 3,250.00	$ 3,250.00
9	BBU (includes refill feeder, weigh feeder, model 810 BBU, saturator, volumetric feeder, control panel)	$ 200,000.00	$ 896,393.90	$ 25,000.00	$ 24,000.00	$ 16,000.00	$ 50,000.00	$ 100,000.00	$ 400,000.00	$ 60,000.00	$ 260,000.00	$ -
10	Saturator Basement	$ 50,000.00	$ -									
11	Building 475 SF @ $300	$ 142,500.00	$ -									
12	Storage Warehouse Space	$ 78,000.00	$ -									
13	Site Improvements	$ 250,000.00	$ 1,120,492.37	$ 31,250.00	$ 30,000.00	$ 20,000.00	$ 62,500.00	$ 125,000.00	$ 500,000.00	$ 75,000.00	$ 325,000.00	$ -
	Subtotal Capital Cost	$ 1,243,000.00										
	Contingency 30%	$ 372,900.00										
	Total Capital Cost	**$ 1,615,900.00**										
	Operating Cost	Cost Per Year										
1	Maintenance	$ 24,860.00	$ 271,684.29	$ 27,967.50	$ 27,843.20	$ 26,848.80	$ 31,075.00	$ 37,290.00	$ 37,290.00	$ 32,318.00	$ 32,318.00	$ 32,318.00
2	Replace Equipment	See above	$ 4,799,891.93	See above	See above	See above	See above	See above	See above	See above	See above	See above
3	Operation of Equipment	$ 66,200.00	$ 723,471.43	$ 74,475.00	$ 74,144.00	$ 71,496.00	$ 82,750.00	$ 99,300.00	$ 99,300.00	$ 86,060.00	$ 86,060.00	$ 86,060.00
4	Power Cost	$ 1,168.74	$ 12,772.68	$ 1,314.83	$ 1,308.99	$ 1,262.24	$ 1,460.93	$ 1,753.11	$ 1,753.11	$ 1,519.36	$ 1,519.36	$ 1,519.36
5	Chemical Cost	$ 256,817.84	$ 2,806,652.09	$ 288,920.07	$ 287,635.98	$ 277,363.27	$ 321,022.30	$ 385,226.76	$ 385,226.76	$ 333,863.19	$ 333,863.19	$ 333,863.19
	Subtotal Operating Cost		$ 8,614,472.42									
	Operating Contingency 30%		$ 2,584,341.73									
	Total 50-year Operating Cost		**$ 11,198,814.14**									
	Total Capital and Operating	**$ 12,814,714.14**										
	Average Yearly Operating (2022 Dollars)		**$ 223,976.28**									

APPENDIX D
DRAFT SEPA CHECKLIST
AND COMMENTS

SPOKANE ENVIRONMENTAL ORDINANCE

(WAC 197-11-970) Section 11.10.230(3) File No. N/A
Determination of Non-Significance (DNS)

DETERMINATION OF NON-SIGNIFICANCE

Description of Proposal: This preliminary engineering study is to evaluate the financial commitments associated with fluoridation of the citywide water system which also extends outside the City limits within the City's designated Water Retail Service Area.

Proponent: City of Spokane, Public Works Division

Location of proposal, including street address, section, township and range if any: While the well pump stations are dispersed around the City, altogether the well pump stations areas cover approximately 2.2 acres and lie in Sections 04, 08, 11, 22, and 23 of Township 25 North, Range 43 East; and Section 31 of Township 26 North, Range 43 East, Willamette Meridian. Please refer to Attachment A for a site plan.

Lead agency: City of Spokane, Public Works

The lead agency for this proposal has determined that it does not have a probable significant adverse impact on the environment. An Environmental Impact Statement (EIS) is not required under RCW 43.21C.030(2)(c). This decision was made after review of a completed Environmental Checklist and other information on file with the lead agency. This information is available to the public on request.

[ ] There is no comment period for this DNS.

[ ] This DNS is issued after using the optional DNS process in Section 197-11-355 WAC. There is no further comment period on the DNS.

[X] This DNS is issued under WAC 197-11-340(2); the lead agency will not act on this proposal for 14 days from the date below. Comments must be submitted by June 5, 2023.

Responsible official: Katherine Miller, Public Works

Position/Title: Director, Strategic Initiatives & Development Phone: (509) 625-6700
Email Contact: fluoridesystemstudy@spokanecity.org
Website: https://my.spokanecity.org/publicworks/water/fluoride-system-study/

Address: 2nd Floor, City Hall, 808 W. Spokane Falls Blvd., Spokane, WA 99201-3343

Date: May 22, 2023 Signature: Katherine Miller

You may appeal this determination to Katherine Miller, Director of Strategic Initiatives & Development, Public Works

at 808 W. Spokane Falls Blvd: 2nd Floor, City Hall, Spokane, WA 99201-3343
no later than June 5, 2023
by (method): written

You should be prepared to make specific factual objections.

Contact Jillann Hansen at (509) 625-6700 to read or ask about the procedures for SEPA appeals.

DISTRIBUTION LIST

Updated as of January 24, 2023

PROJECT NAME: Preliminary Engineering Study for Fluoridation

via email:

Abrahamson, Randy	Spokane Tribe
Addressing	City of Spokane
Allenton, Scotty	City of Spokane, ICM
Anderson, Cindy	Ecology
Aushev, Eugene	Avista
Averyt, Chris	City of Spokane, Solid Waste
Barlow, Lori	City of Spokane Valley
Basinger, Mike	City of Spokane Valley
Becker, Zachary	City of Airway Heights
Black, Tirrell	City of Spokane, DSC
Brecto, Jason	Fairchild Air Force Base
Brown, Eldon	City of Spokane, DSC
Buller, Dan	City of Spokane, Engineering
Cannon, Mike	City of Spokane,
Carson, Barb	Spokane Schools
Chanse, Andrew	City of Spokane, Libraries
Chesney, Scott	Spokane County
Chouinard, Sonya	Spokane Schools
Corcoran, Lisa	Spokane Airports
Conklin, John	Spokane Clean Air
Davis, Marcia	City of Spokane, ICM
Deatrich, Kerry	City of Spokane
Archaeology and Historic Preservation	State of Washington
DNR Aquatics	State of Washington
Duvall, Megan	City of Spokane, Historic Preservation
Eliason, Joelie	City of Spokane, DSC
Engineering Admin	City of Spokane, Engineering
Eveland, Marcus	City of Spokane, Streets
Feist, Marlene	City of Spokane, Public Works
Figg, Greg	WSDOT
Fisher, Matt	Ecology
Forsyth, Greg	Spokane Schools
Fredrickson, Beryl	City of Spokane, ICM
Gardner, Spencer	City of Spokane, Planning
Gennett, Raylene	City of Spokane, Wastewater
Graff, Joel	City of Spokane, Engineering
Greene, Barry	Spokane County
Halbig, Bobby	City of Spokane, Streets
Hamad, Nicholas	City of Spokane, Parks
Hanson, Rich	City of Spokane, Wastewater
Hanson, Tonilee	Spokane Aquifer Joint Board
Harris, Clint E.	City of Spokane, Streets
Hayden, Adam	City of Spokane, DSC
Hughes, Rick	City of Spokane, Solid Waste Collection
Johnson, Erik D.	City of Spokane, DSC
Johnson, Jeffrey	Fairchild Air Force Base
Jones, Garrett	City of Spokane, Parks
Jones, Tammy	Spokane County
Jordan, Jess	Army Corps of Engineers
Kay, Char	WSDOT
Keller, Kevin	City of Spokane, Police
Kells, Patty	City of Spokane, DSC
Kinnick, Renee	DFW Government
Kincheloe, Melanie	Ecology
Kokot, Dave	City of Spokane, Fire
Limon, Tara	Spokane Transit Authority
Main, Steve	Spokane Regional Health District
Marsh, Denise	Avista
McClure, Jeff	Cheney School District
Meyer, Eric	Spokane Regional Health District
Miller, Katherine E	City of Spokane, ICM
Moore, David	Army Corps of Engineers
Moore, James	Spokane County
Moore, Michael	Williams Northwest Pipeline
Morris, Mike	City of Spokane, Wastewater
Murphy, Dermott G.	City of Spokane, DSC
Neighborhood Services	City of Spokane
Neiman, Saegen	Spokane County
Nelson, Connie	Inland Power and Light
Nilsson, Mike	City of Spokane, DSC
Note, Inga	City of Spokane, ICM
Nyberg, Gary	Spokane County
Okihara, Gerald	City of Spokane, Streets
Owen, Melissa	City of Spokane, DSC
Palmquist, Tami	City of Spokane, DSC
Perkins, Johnnie	City of Spokane, Mayor’s Office
Planning Review	City of Spokane, Planning
Pruitt, Larissa	Avista
Quinn-Hurst, Colin	City of Spokane, DSC
Raymond, Amanda	Bonneville Power Administration
Rehfeldt, Melissa	Spokane Transit Authority
Richman, James	City of Spokane, Legal
Robertson, Renee	City of Spokane, Accounting
Sheehan, Ryan	Spokane Airports
Sakamoto, James	City of Spokane, Water
Saywers, John	City of Spokane, Water
Searl, Loren	City of Spokane, Water
Spokane Regional Emergency Communications	City of Spokane, SREC
Steele, David	City of Spokane, Asset Management
Stewart, Ryan	Spokane Regional Transportation Center
Studer, Duane	City of Spokane, Water
Tagnani, Angela	City of Spokane, Wastewater
Taylor, Dannette	USPS
Taylor, Joel	City of Spokane, DSC
Trautman, Heather	City of Airway Heights
Treasury Accounting	City of Spokane, Accounting
Turner, Bob	Spokane Schools
Weinand, Kathleen	Spokane Transit Authority
Wendle, Ned	Mead School District
Westby, April	Spokane Clean Air
Westerman, Kile	Department of Fish and Wildlife
White, Jerry	Spokane River Keeper

REQUEST FOR COMMENTS

PROJECT NAME: Preliminary Engineering Study for Fluoridation

COMMENTS: (Use additional sheets if necessary)

____________________	____________________	________	____________
Authorized Signature	Department or Agency	Date	Concurrency Passed/Failed

Evaluation for
Agency Use Only

State Environmental Policy Act (SEPA)
ENVIRONMENTAL CHECKLIST
File No. N / A

PLEASE READ CAREFULLY BEFORE COMPLETING THE CHECKLIST!

Purpose of Checklist:

The State Environmental Policy Act (SEPA) chapter 43.21C RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. An Environmental Impact Statement (EIS) must be prepared for all proposals with probable significant adverse impacts on the quality of the environment. The purpose of this checklist is to provide information to help you and the agency identify impacts from your proposal (and to reduce or avoid impacts from the proposal, if it can be done) and to help the agency decide whether an EIS is required.

Instructions for Applicants:

This environmental checklist asks you to describe some basic information about your proposal. Governmental agencies use this checklist to determine whether the environmental impacts of your proposal are significant, requiring preparation of an EIS. Answer the questions briefly, with the most precise information known, or give the best description you can.

You must answer each question accurately and carefully, to the best of your knowledge. In most cases, you should be able to answer the questions from your own observations or project plans without the need to hire experts. If you really do not know the answer, or if a question does not apply to your proposal, write "do not know" or "does not apply." Complete answers to the questions now may avoid unnecessary delays later.

Some questions ask about governmental regulations, such as zoning, shoreline, and landmark designations. Answer these questions if you can. If you have problems, the governmental agencies can assist you.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Use of checklist for nonproject proposals:
Complete this checklist for nonproject proposals, even though questions may be answered "*does not apply*."

IN ADDITION, complete the SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (Part D).

For nonproject actions, the references in the checklist to the words "project," "applicant," and "property or site" should be read as "proposal," "proposer," and "affected geographic area," respectively.

A. BACKGROUND

1. Name of proposed project: City of Spokane Preliminary Engineering Study for Fluoridation
2. Applicant: City of Spokane Public Works
3. Address: 808 West Spokane Falls Boulevard

   City/State/Zip: Spokane, WA 99201 Phone: 509.755.2489

   Agent or Primary Contact: Katherine Miller

   Address: 808 West Spokane Falls Boulevard

   City/State/Zip: Spokane, WA 99201 Phone: 509.625.6338

   Location of Project: This preliminary engineering study is to evaluate the financial commitments associated with fluoridation of the citywide water system which also extends outside the City Limits within the City's designated Water Retail Service Area; Refer to the table below for specific locations of existing well pump stations where fluoridation could be added.

   ____ Address: ____

   Section: ____ Quarter: ____ Township: ____ Range: ____

   While the well pump stations are dispersed around the City, altogether, the well pump stations areas cover approximately 2.2 acres and lies in Sections 04, 08, 11, 22, and 23 of Township 25 North, Range 43 East; and Section 31 of Township 26 North, Range 43 East, Willamette Meridian. Please refer to Attachment A for a site plan.

   Tax Parcel Number(s) ____

Pump Station	Location Address	Tax Parcel Number
Well Electric	2810 North Waterworks Street, Spokane, WA 99212	35111.0001
Parkwater	5317 West Rutter Avenue, Spokane, WA 99212	35114.2501
Ray Well	533 South Ray Street, Spokane, WA 99202	35222.0001
Central	5903 North Normandie Street, Spokane, WA 99205	36311.1406
Grace	914 East North Foothills Drive, Spokane, WA 99207	35081.2802
Nevada	914 East North Foothills Drive, Spokane, WA 99207	35081.2802
Hoffman	2109 East Hoffman Avenue, Spokane, WA 99207	35041.0419
Havana	4302 East 6th Avenue, Spokane Valley, WA 99212	35232.4114

4. Date checklist prepared: February 21, 2023

5. Agency requesting checklist: City of Spokane (City)

6. Proposed timing or schedule (including phasing, if applicable):

   This is a Non-Project SEPA for a preliminary engineering study to evaluate the potential financial commitments of fluoridation to the City's water system. The purpose of the study is to understand the costs IF fluoridation were to be implemented. A proposed schedule for implementation has not been defined. Mayor and Council will utilize this study in their process to determine whether fluoridation will be implemented or not. If it is decided to implement fluoridation, a project level SEPA would then be conducted, as is typically done, during the design phase.

7. a. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

   This non-project study is being done to better understand costs/financial responsibilities. Upon completion the study will be presented to City Officials for their use in determining next steps.

   b. Do you own or have options on land nearby or adjacent to this proposal? If yes, explain.

   The City does own land nearby or adjacent to the existing well pump stations, although not a part of this non-project study.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

   The following preliminary environmental studies and reports were prepared for this non-project study to better understand costs that could be associated with implementing fluoridation. For the non-project study purposes, the following information was gathered:

   - Cultural Resource Survey was prepared by Plateau Archeological Investigations, LLC on December 8, 2022
   - Preliminary Engineering Study for Fluoridation: Fluoridation System Alternatives Report, prepared by Murraysmith for the City of Spokane in December of 2022 (the studies can be reviewed at: **https://my.spokanecity.org/publicworks/water/fluoride-system-study/**

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.

   There are no known pending applications or proposals related to properties covered by this non-project study.

10. List any government approvals or permits that will be needed for your proposal, if known.

    While these approvals would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed in the table below the anticipated required permits for each site if this study were to proceed to a project.

Well Station Location	Permits Required
Well Electric	Shoreline Permit Confirm height requirements with FAA Existing site partially within FEMA 100-year flood zone SEPA review Historic/architectural review
Parkwater	SEPA Review Historic/architectural review
Ray	Conditional Use (Residential Zone) SEPA review Historic/architectural review
Central	Conditional Use (Residential Zone) SEPA review
Grace	No special permitting requirements SEPA review Historic/architectural review
Nevada	No special permitting requirements SEPA review.
Hoffman	Conditional Use (Residential Zone) SEPA review Historic/architectural review
Havana	Permitting within City of Spokane Valley Conditional Use (Residential Zone) SEPA review

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later during this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page.________________

The City of Spokane is conducting a preliminary engineering study, a non-project study, to understand all the costs associated with implementing fluoridation of the City's municipal water system IF the city chooses to move forward. In other words, to understand what future cost impacts might arise from a decision to fluoridate, the reasonable details needed to be developed and the costs associated with those details intended to reasonably answer the question posed, "What would it cost the City if a fluoridation system was installed in the City's water system?" While the details developed during this non project study, such as which system to use for fluoridation are needed to help answer the question 'what would it cost', this non project study is not intended to limit any future decisions but is in response to IF fluoridation of the City's water system moves forward. IF fluoridation of the City's water system moves forward, a project level SEPA would be conducted separately for public review and comment and would reflect more robust design level information.

The Draft Study and the elements of the study that were used to help determine cost can be found at https://my.spokanecity.org/publicworks/water/fluoride-system-study/. Parametrix and Consor (formerly Murraysmith) are the consultants that were assisting the City of Spokane with the fluoridation study. If the City decides to implement fluoridation, each of its seven existing well pump stations, and a new well pump station currently under construction would require some level of construction to add necessary fluoridation chemical feed systems. After visiting the existing well pump stations, the following conclusions were used in the study. The future fluoridation facilities for each site would need to be housed in a new dedicated building. The exception is the Well Electric building, though extensive retrofits would be required to facilitate the new system. This study includes a 30% design level effort to better understand the financial commitment the City would need to address if a fluoridation system were to be installed and maintained. Any comments received under this Non-Project SEPA will be included during this study for future reference. The Study will be considered final after the Non-Project SEPA comments are included.

a. Location of the proposal: Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit application related to this checklist.

This preliminary engineering study considered the citywide system which also extends outside the City Limits within the Water Retail Service Area; Altogether, the well pump station areas would cover approximately 2.2 acres and lies in Sections 04, 08, 11, 22, and 23 of Township 25 North, Range 43 East; and Section 31 of Township 26 North, Range 43 East, Willamette Meridian. Please refer to Attachment A for a site plan of the locations where fluoridation would occur if this study were to proceed to a project.

Pump Station	Location
Well Electric	2810 North Waterworks Street, Spokane, WA 99212
Parkwater	5317 West Rutter Avenue, Spokane, WA 99212
Ray Well	533 South Ray Street, Spokane, WA 99202
Central	5903 North Normandie Street, Spokane, WA 99205
Grace	914 East North Foothills Drive, Spokane, WA 99207
Nevada	914 East North Foothills Drive, Spokane, WA 99207
Hoffman	2109 East Hoffman Avenue, Spokane, WA 99207
Havana	4302 East 6th Avenue, Spokane Valley, WA 99212

12. Does the proposed action lie within the Aquifer Sensitive Area (ASA)? The General Sewer Service Area? The Priority Sewer Service Area? The City of Spokane? (See: Spokane County's ASA Overlay Zone Atlas for boundaries.)

All of the existing well pump station sites lie within the ASA. All sites lie within the Spokane-Rathdrum

Aquifer. The sites lie within the general sewer service area. The sites do not lie within the Priority Sewer Service Area. All sites lie within the City of Spokane except for the Havana well site, which lies within the City of Spokane Valley on a City of Spokane owned property.

13. The following questions supplement Part A.

a. Critical Aquifer Recharge Area (CARA) / Aquifer Sensitive Area (ASA)

(1) Describe any systems, other than those designed for the disposal of sanitary waste installed for the purpose of discharging fluids below the ground surface (includes systems such as those for the disposal of stormwater or drainage from floor drains). Describe the type of system, the amount of material to be disposed of through the system and the types of material likely to be disposed of (including materials which may enter the system inadvertently through spills or as a result of firefighting activities). ______

While any systems would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed: At all potential sites, bio-infiltration swales with drywells would treat and dispose of stormwater runoff from the new access driveways for liquid deliveries. New building roof drain leaders would be piped directly into drywells for stormwater disposal. Approximate quantities (cubic feet per second – CFS) of stormwater from the access driveways and building is provided in the table below. The stormwater runoff would follow Spokane Regional Stormwater Guidelines.

Well Station Location	Drainage
Well Electric	Overall - 0.58 cfs, Driveway Only - 0.55 cfs, Bldg. Only - 0.03 cfs
Parkwater	Overall - 0.25 cfs, Driveway Only - 0.20 cfs, Bldg. Only - 0.05 cfs
Ray	Overall - 0.56 cfs, Driveway Only - 0.52 cfs, Bldg. Only - 0.04 cfs
Central	Overall - 0.18 cfs, Driveway Only - 0.07 cfs, Bldg. Only - 0.11 cfs
Hoffman	Overall - 0.28 cfs, Driveway Only - 0.24 cfs, Bldg. Only - 0.04 cfs
Havana	Bldg. Only - 0.04 cfs
Grace and Nevada	Bldg. Only - 0.03 cfs

(2) Will any chemicals (especially organic solvents or petroleum fuels) be stored in aboveground or underground storage tanks? If so, what types and quantities of material will be stored?

While chemicals would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed. Fluorosilicic acid (FSA) would be stored in above ground tanks at each site. The below table gives estimates on onsite above ground chemical storage. The amounts reflect 60 days of bulk storage.

	Site Location						
Major Equipment	**Well Electric**	**Parkwater**	**Ray**	**Central**	**Nevada/Grace**	**Hoffman**	**Havana**

	Liquid FSA						
Bulk Storage Onsite (gal)	10,000	10,000	5,000	5,000	10,000	2,000	5,000

(3) What protective measures will be taken to ensure that leaks or spills of any chemicals stored or used on site will not be allowed to percolate to groundwater. This includes measures to keep chemicals out of disposal systems.

While these measures would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; The liquid chemical has a potential for a spill, which could contaminate the groundwater. Protective measures would be to incorporate a new structure at each existing well-station site for bulk and day storage tanks with transfer/metering pumps, analyzers, electrical/control elements, and HVAC. Bulk chemical storage would be secured in a dedicated room. There would be a containment feature at the delivery hose building connection to catch potential transfer spills from the delivery truck to the storage tanks. Spill control absorbent pillows and dams would be used for initial containment, with follow-up action to neutralize the acid with lime or caustic soda. An epoxy undercoat and a urethane topcoat would be applied to manholes and polyurethane would be implemented to protect the concrete. The costs associated with the above-mentioned protective measures were incorporated into the study.

(4) Will any chemicals be stored, handled, or used on the site in a location where a spill or leak will drain to surface or groundwater or to a stormwater disposal system discharging to surface or groundwater?

While chemical storage would again be analyzed at project level SEPA review, it is included during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; Yes, chemicals would be stored, handled, and used on site in a location that may spill or leak to surface, groundwater, or stormwater disposal system discharging to surface or groundwater. Spill control response aids would be readily accessible wherever liquid additives are handled.

b. Stormwater

(1) What are the depths on the site to groundwater and to bedrock (if known)?

While the depths would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any costs implications. For the non-project study purposes, the following was assumed; approximate depths to groundwater and bedrock are shown in the following table.

	Site Location						
	Well Electric	Parkwater	Ray	Central	Nevada/Grace	Hoffman	Havana
Approx. Depth to Water (feet)	30	72	48	215	83	213	50
Approx. Depth to Bedrock	Not Known	Not Known	Not Known	Not Known	Not Known	Not Known	Not Known

(2) Will stormwater be discharged into the ground? If so, describe any potential impacts.

While stormwater would again be analyzed at project level SEPA review, was included during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; yes, stormwater would be discharged into the ground via drywells in compliance with Spokane Regional Stormwater Guidelines. Best management practices (BMPs) consistent with the City of Spokane's stormwater management regulations and construction standard specifications would be used to protect the existing stormwater drainage system, manage construction disturbance and stormwater runoff, and minimize erosion and sedimentation.

B. ENVIRONMENTAL ELEMENTS

1. Earth

a. General description of the site (check one):

X Flat ☐ Rolling ☐ Hilly X Steep slopes ☐ Mountainous

Other:

All proposed well pump station sites are generally flat except for the Well Electric site, which is located at the Upriver Dam. The site has a steep slope at the northwest side of the property that descends to the Spokane River.

b. What is the steepest slope on the site (approximate percent slope)?

The table below indicates the steepest slopes at each proposed site.

Well Station Location	Steepest Slope
Well Electric	30%
Parkwater	15%
Ray	3%
Central	3%
Grace	3%
Nevada	3%
Hoffman	3%
Havana	3%

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them, and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils.
While the soils would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; the table below indicates the types of soils found on each proposed site. None of the subject properties are agricultural land of long-term commercial significance. Soils Information retrieved from the USDA Web Soils Survey (https://websoilsurvey.sc.egov.usda.gov/).

Well Station Location	Soil Material
Well Electric	Sandy and gravelly glaciofluvial deposits with minor amounts of volcanic ash and loess in the upper part
Parkwater	Urban land, gravelly substratum
Ray	Sandy and gravelly glaciofluvial deposits with minor amounts of volcanic ash and loess in the upper part
Central	Sandy and gravelly glaciofluvial deposits
Grace	Sandy and gravelly glaciofluvial deposits with minor amounts of volcanic ash and loess in the upper part
Nevada	Sandy and gravelly glaciofluvial deposits with minor amounts of volcanic ash and loess in the upper part
Hoffman	Sandy and gravelly glaciofluvial deposits with minor amounts of volcanic ash and loess in the upper part
Havana	Sandy and gravelly glaciofluvial deposits with minor amounts of volcanic ash and loess in the upper part

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.
While the surface(s) would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; there are no surface indications or history of unstable soils in the immediate vicinity of the sites.

e. Describe the purpose, type, total area, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate source of fill:
While filling, excavation and grading would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand the cost implications. For the non-project study purposes the following was assumed; Minor excavations for foundations and driveway subgrades on the sites listed below Earthwork fills would consist of imported gravel and hot mix asphalt to construct access driveways.

Well Station Location	Purpose	Type	Total Area Affected	Earthwork Volume (CY)

Well Electric	Driveway Access & Building Foundation	Excavation & Grading	10,787 SF	436
Parkwater	Driveway Access & Building Foundation	Excavation & Grading	4,647 SF	213
Ray	Driveway Access & Building Foundation	Excavation & Grading	10,300 SF	417
Central	Driveway Access & Building Foundation	Excavation & Grading	3,340 SF	168
Hoffman	Driveway Access & Building Foundation	Excavation & Grading	5,213 SF	561
Havana	Building Foundation	Excavation & Grading	729 SF	63
Grace & Nevada	Building Foundation	Excavation & Grading	645 SF	57

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

While erosion would again be analyzed at project level SEPA review, it was included during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed. Minor wind erosion and/or stormwater runoff could occur during site grading and building construction. Best management practices was assumed be used to control wind and/or water erosion for each site. Additional assumptions included site specific and weather specific mitigation measures would be implemented during construction, as per an approved Erosion and Sedimentation Control Plan.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt, or buildings)?

While impervious surfaces would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand the cost implications. For the non-project study purposes, the following was assumed; Impervious surface coverage percentages below. These surfaces may include roadways, sidewalks, buildings, and driveways.

Well Station Location	Existing (Project Area) Impervious Surface Percentage	Post Construction Impervious Percentage Difference
Well Electric	30%	4%
Parkwater	20%	16%
Ray	4%	12%
Central	22%	12%
Hoffman	8%	18%
Havana	45%	1%
Grace & Nevada	87%	0%

h. Proposed measures to reduce or control erosion or other impacts to the earth, if any:

While these measures would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; BMPs would be used to control wind and/or water erosion on this site, such as silt fencing and straw bale barriers would be employed to minimize the potential for erosion during construction. Additional site specific and weather specific mitigation measures would be implemented during construction, as per an approved Erosion and Sedimentation Control Plan. Any vegetative areas disturbed during construction would be reseeded. The plan shall comply with the Spokane Region Stormwater Manual (2008).

2. Air

a. What type of emissions to the air would result from the proposal during construction, operation, and maintenance when the project is completed? If any, generally describe and give approximate quantities if known.

While emissions would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand the cost implications. For the non-project study purposes, the following was assumed; If this study were to proceed to design and ultimately construction, emissions would occur from vehicles and mobile and stationary equipment that combust gasoline and diesel fuels, such as crew vehicles, trucks, and construction equipment. The increase in emissions from construction would be temporary and mitigation measures would be used to control the generation of dust (e.g., spraying water over disturbed soil areas during dry weather). Although there are residential uses within the project vicinity, the temporary increase in emissions is not expected to adversely impact air quality. Upon project completion, the use of FSA may cause an unpleasant acidic odor. Proper ventilation design of the facility can direct the odor upwards. Since the fumes are lighter than air, they would rise and have a negligible effect on the local neighborhood.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

While off-site emissions would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; There are no known off-site sources of emissions or odors that would affect the project.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:
While these measures would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand the cost implications. For the non-project study purposes, the following was assumed; During construction, impacts to air quality would be reduced and controlled through implementation of standard federal, state, and local emission control criteria and City of Spokane construction practices. These would include requiring contractors to use best available control technologies, develop an odor control plan, ensure proper vehicle maintenance, and minimize vehicle and equipment idling. Proper ventilation design measures would be implemented to reduce impacts to air quality in and around the facility.

3. Water

a. SURFACE WATER:

(1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.
While surface waters would again be analyzed at project level SEPA review, it was included during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; The Spokane River is in the immediate vicinity of the Well Electric site. The Spokane River drains the northern part of Lake Coeur d'Alene, emptying into the Columbia River at Franklin D. Roosevelt Lake, approximately 110 miles downstream.

(2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.
While any work near water would again be analyzed at project level SEPA review, it was included during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; Well Electric site is within 200 feet of the Spokane River. Please refer to Attachment A for a site plan.

(3) Estimate the amount of fill and dredge material that would be placed in or removed from the surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.
While fill and dredge material would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; No material would be placed in or removed from surface water or wetlands.

(4) Will the proposal require surface water withdrawals or diversions? If yes, give general description, purpose, and approximate quantities if known.

While water withdrawals or diversions would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; the proposed work would not require surface water withdrawals or diversions.

(5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

While the 100 year floodplain would again be analyzed at project level SEPA review, it was included during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; The Well Electric project site is within the FEMA 100-year floodplain. Please refer to Attachment B, Well Electric Site Floodplain Map.

(6) Does the proposal involve any discharge of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

While any discharge of waste materials would again be analyzed at project level SEPA review, the topic was included during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; the project would not discharge waste materials to surface waters.

b. GROUNDWATER:

(1) Will groundwater be withdrawn from a well for drinking water or other purposes? If so, give a general description of the well, proposed uses and approximate quantities withdrawn from the well. Will water be discharged to groundwater? Give general description, purpose, and approximate quantities if known.

While groundwater withdrawals would again be analyzed at project level SEPA review, it was included during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; Groundwater is currently withdrawn from the below listed existing well sites for domestic water usage. There would be no change to the withdrawal quantities as a result of this project. Water would not be discharged to groundwater.

Well Station Location	Description	Approximate Existing Quantities Withdrawn Annually (Millions of gallons)
Well Electric	Existing Well/Domestic Drinking Water	7,520

Parkwater	Existing Well/Domestic Drinking Water	10,073
Ray	Existing Well/Domestic Drinking Water	1,942
Central	Existing Well/Domestic Drinking Water	2,145
Grace	Existing Well/Domestic Drinking Water	1,397
Nevada	Existing Well/Domestic Drinking Water	1,416
Hoffman	Existing Well/Domestic Drinking Water	597
Havana	Existing Well/Domestic Drinking Water	TBD, currently under construction

(2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals…; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

While discharge waste material would again be analyzed at project level SEPA review, it was included during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; this project would not discharge waste material from septic tanks or other sources into groundwater.

c. WATER RUNOFF (INCLUDING STORMWATER):

(1) Describe the source of runoff (including stormwater) and method of collection and disposal if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

While runoff would again be analyzed at project level SEPA review, it was included during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; Stormwater is expected to be the only source of water runoff from this site. Stormwater runoff from impervious surfaces would be collected and disposed in drywells or released into existing drainage ways, in accordance with adopted stormwater guidelines. The Project would not change existing stormwater drainage patterns. Stormwater runoff may need to be managed during construction to prevent sediment from entering and leaving the construction site. Barriers such as sandbags would be used to prevent runoff from entering the construction zone. Once construction is complete, temporary erosion control measures would be removed. The completed project would not create a need to manage additional stormwater runoff beyond current conditions. The current volume, timing, and duration of these stormwater flows are not known. With the exception of Well Electric, stormwater would not flow into existing waterways. Stormwater from the existing Well Electric site could drain into the Spokane River via sheet flow from the site.

(2) Could waste materials enter ground or surface waters? If so, generally describe.

While waste materials would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; No part of the work assumed in the study involves any discharges of waste materials to surface or ground waters. However, non-sediment pollutants that may be present during construction include petroleum products such as fuel, lubricants, hydraulic fluids, and oils from construction vehicles and equipment. These waste materials could enter surface waters from the Well Electric site in the event of a spill. Procedures to prevent a spill were assumed to include preparing a containment plan outlining procedures and responsibilities to identify, access, and handle materials of concern, spill prevention methods, spill control equipment, clean up procedures, spill reporting protocol, and emergency contact numbers. The associated costs were captured during this study.

(3) Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site? If so, describe.

While drainage patterns would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; the proposed project would not alter or otherwise affect drainage patterns.

d. PROPOSED MEASURES to reduce or control surface, ground, and runoff water, and drainage patter impacts, if any.

While these measures would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; to minimize stormwater impacts, the proposed project would be designed and constructed in accordance with Ecology's Stormwater Management Manual for Western Washington and the Spokane Regional Stormwater Manual (2008). Stormwater discharges would comply with Washington State and federal water quality standards. Additional permitting conditions would be determined during design if this study were to proceed and each proposed improvement would adhere to permit requirements during project construction. Following construction, all disturbed undeveloped areas would be restored with native and ornamental landscaping.

4. Plants

a. Check the type of vegetation found on the site:

Deciduous tree: ☐ alder ☐ maple **X** aspen

Other: ____________________

Evergreen tree: **X** fir ☐ cedar **X** pine

Other: ____________________

X Shrubs **X** Grass ☐ Pasture ☐ Crop or grain

☐ Orchards, vineyards, or other permanent crops

Wet soil plants: ☐ cattail ☐ buttercup ☐ bullrush ☐ skunk cabbage

Other: ____________________

Water plants: ☐ water lily ☐ eelgrass ☐ milfoil

Other: ____________________

Other types of vegetation: ____________________

While plant assessment would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the items marked above was assumed.

b. What kind and amount of vegetation will be removed or altered?

While impacts to vegetation would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; all existing vegetation within the proposed footprint of the new buildings for each site is planned may be removed. Most of the vegetation within the project area is grasses and shrubs. Disturbed vegetation outside of the planned building footprints would be restored to pre-project conditions. Existing trees would be protected.

c. List threatened and endangered species known to be on or near the site.

While species would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; there are no threatened or endangered plant species known to be on or near the sites.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:
While landscaping would again be analyzed at project level SEPA review, it was included during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; all areas temporarily impacted due to construction would be restored to preconstruction conditions.

e. List all noxious weeds and invasive species known to be on or near the site.
While noxious weeds and invasive species would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; there are no noxious weeds known to be on or near the sites; invasive species could include grasses and weeds typical of roadside vegetation.

5. Animals

a. Check *and* List any birds and other animals which have been observed on or near the site or are known to be on or near the site:

Birds: X hawk ☐ heron ☐ eagle X songbirds

Other: ______

Mammals: ☐ deer ☐ bear ☐ elk ☐ beaver

Other: ______

Fish: ☐ bass ☐ salmon X trout ☐ herring ☐ shellfish

Other: ______

Other (*not* listed in above categories): ______

While animals would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the items marked above was assumed.

b. List any threatened or endangered animal species known to be on or near the site.
While threatened and endangered species would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; Due to its proximity to the Spokane River, the Bull Trout is listed as a threatened animal species for the Well Electric site. Due to relatively high

development, there are no known threatened or endangered species know to be on or near the other project sites.

c. Is the site part of a migration route? If so, explain.

While migration routes would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; the sites are within the Pacific Flyway migratory path for birds. However, the proposed project is not anticipated to have any measurable effects to migratory birds.

d. Proposed measures to preserve or enhance wildlife, if any:

While wildlife would again be analyzed at project level SEPA review, measures were included during this non-project study to better understand cost implications. For the non-project study purposes, the following was assumed; all turf and shrubs impacted during construction would be restored as required. Project work would be performed in accordance with applicable City of Spokane water quality regulations and construction BMPs.

e. List any invasive animal species known to be on or near the site.

While invasive animal species would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; there are no invasive animal species known to be on or near the sites.

6. Energy and natural resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

While energy would again be analyzed at project level SEPA review, it were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; electricity would be used to power the pumps and provide heating and cooling to the building.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

While the solar energy potential would again be analyzed at project level SEPA review, it was included during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; the proposed project would not affect the potential use of solar energy by adjacent properties.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

While these features would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; energy usage for these projects would be small, as the dosing pumps are low horsepower. No conservation features beyond those required in the building code are included.

7. Environmental health

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste that could occur as a result of this proposal? If so, describe.
While health hazards would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; there is a risk for environmental health hazards due to a potential risk of a spill or overfeed to the system of liquid FSA, which could occur as a result of this proposal. However, numerous redundant design features would be incorporated to prevent overfeed, safety and personal protective measure would also be in place for personnel in potential contact with fluoride products.

(1) Describe any known or possible contamination at the site from present or past uses.
While possible contamination would again be analyzed at project level SEPA review, it was assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; The Grace and Nevada Well sites, located at 914 E North Foothills Drive, is the only project site identified to have past contamination. Ecology lists the status of the site as "cleanup started". The site is known as the City Operations Complex, owned by the City of Spokane. Soil contamination is being cleaned up as part of the site's redevelopment into the Denny Yasuhara Middle School. Site ownership is transferring from the city to the Spokane School District. The site was bisected by the Spokane Falls and Northern Railroad in the late 1880s. Other past uses include lumber storage and milling through the 1970s, masonry block manufacturing from the 1960s to the 1980s, automotive repair and fueling, and materials storage. Suspected and confirmed pollution sources include coal ash, releases from railcars, heavy oil from railroad use, emissions from the nearby foundry, asphalt debris, dry wells, underground storage tanks, and releases from vehicles or materials storage and handling. The site's potentially contaminated areas include the following:

- The Water Department materials storage area to the north of the site

- The railroad bed transecting the site from northeast to southwest
- The solid waste management area to the west
- The construction management area to the south
- The 200-foot-long former log pond area to the southwest
- The former underground storage tanks (two 1,000-gallon tanks were removed in 1986)
- The kiln building (wood drying and hazardous materials storage) to the west
- A third storage building (battery and oil waste recycling) to the north

(2) Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.

While existing hazardous chemicals/conditions would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; Non-sediment pollutants that may be present during construction include petroleum products including fuel, lubricants, hydraulic fluids, and form oils and chemicals associated with portable toilets. Currently, chlorine gas and natural gas is stored on each site.

(3) Describe any toxic or hazardous chemicals/conditions that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.

While toxic or hazardous chemicals/conditions would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; Liquid FSA would be stored on all sites and used during the operating life of the project. FSA is a very acidic solution with a National Fire Protection Association 704 classification of extreme danger for health and unstable if heated for reactivity. In addition, chlorine gas and natural gas, both toxic and hazardous chemicals, would be stored and used during the operating life of the constructed project. Appropriate ventilation would be included to prevent inhalation of fumes and personal protective equipment (PPE) would be utilized by operators to provide protection for eyes and skin.

(4) Describe special emergency services that might be required.

While the need for special services would again be analyzed at project level SEPA review, they were included during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; under normal operating conditions, no special emergency services would be required.

(5) Proposed measures to reduce or control environmental health hazards, if any:

While these measures would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; Protective measures would be to incorporate a new structure at each existing well station sites for bulk and day storage tanks with transfer/metering pumps, analyzers, electrical/control elements, and HVAC. Bulk storage would be secured in a dedicated room. There would be a containment feature at the delivery hose building connection to catch potential transfer spills from the delivery truck to the storage tanks. Spill control absorbent pillows and dams would be used for initial containment, with follow-up action to neutralize the acid with lime or caustic soda. An epoxy undercoat and a urethane topcoat would be applied to manholes and polyurethane would be implemented to protect the concrete. Overfeed of liquid FSA would pose a City-wide hazard for all customers of the water system; however, numerous redundant design features and safety measure would be incorporated to prevent overfeed, including the following:

- Process control
- Equipment calibration
- Anti-siphon devices
- Backpressure
- Calibration columns
- Analyzer(s)
- Check valve(s)
- Flow switch(es)

Proper remediation actions would be taken if there is an overfeed of fluoride to the municipal water system. The recommended actions information is provided in the following link: https://doh.wa.gov/sites/default/files/legacy/Documents/Pubs//331-609.pdf?uid=625ef4322a954.

A health and safety plan would be in place. In addition, a spill response kit would be maintained at each site during construction work at that site, and all project site workers would be trained in spill prevention and containment The addition of any chemical to a public water supply, other than a disinfectant requires a minimum operator certification of Water Treatment Plant Classification 2, WTPO 2 (WAC 246-292-050). There would be at least one designated certified operator in responsible charge of the fluoridation system at this certification level.

The CDC recommends that personnel in potential contact with fluoride products always wear PPE. The equipment would vary based on the task being performed at each site. Even with a full-face shield and goggles, eye irritation is possible, especially if PPE fails. In the event of a spill, a safety shower and eye wash station would be available for immediate use. The manufacturer's SDS is the primary source of information for PPE required to handle concentrated fluoride additive product. The costs for the measures described have been captured during this study.

NOISE:

(6) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

While noise would again be analyzed at project level SEPA review, it was included during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; Existing noise within the project vicinity is generated by vehicle traffic and residential activities, which would not affect the project sites.

(7) What types and levels of noise would be created by or associated with the project on a short- term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

While noise levels would again be analyzed at project level SEPA review, it was included during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; Short-term typical construction noise would be generated at each site. This noise would primarily occur during daylight hours (7 a.m. to 7 p.m.) and is expected to occur Monday through Friday. The completed project would generate noise typically associated with residential uses. The completed project would generate no additional noise from equipment used for operation or maintenance.

(8) Proposed measure to reduce or control noise impacts, if any:

While measures would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; Construction of the project would comply with requirements of applicable noise control laws and regulations addressing maximum noise levels and the days/hours during which noise-generating construction work is allowed, including the City of Spokane's noise ordinance.

8. Land and shoreline use

a. What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? If so, describe.

While current use would again be analyzed at project level SEPA review, it was assessed during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; the project would not affect current land uses on nearby or adjacent properties.

Well Station Location	Current Land Use
Well Electric	R 4-10, Light-Industrial, Conservation OS
Parkwater	Light-Industrial
Ray	R 10-20
Central	R 4-10
Grace	Light-Industrial
Nevada	Light-Industrial
Hoffman	R 4-10
Havana	Multifamily Residential

b. Has the project site been used as working farmlands or working forest lands? If so, describe. How much agricultural or forest land of long-term commercial significance will be converted to other uses as a result of the proposal, if any? If resource lands have not been designated, how many acres in farmland or forest land tax status will be converted to nonfarm or nonforest use?

While this assessment would again be analyzed at project level SEPA review, it was included during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; the project sites have not recently been used as working farmlands or forest lands.

1) Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling, and harvesting? If so, how:

While impacts would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; the project sites do not have surrounding farm or forest lands.

c. Describe any structures on the site.

While structures would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; there are existing well housing structures on all sites.

d. Will any structures be demolished? If so, which?

While structure demolition would again be analyzed at project level SEPA review, it was assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; the existing control building located at the Central Well Station site would be demolished to the foundation and replaced with a new facility housing existing well controls, existing chlorination equipment, and the proposed fluoridation system.

e. What is the current zoning classification of the site?
While current zoning would again be analyzed at project level SEPA review, it was included during this non-project study to better understand costs. For the non-project study purposes, the following was assumed:

Well Station Location	Current Zoning
Well Electric	Residential Single-Family, Light-Industrial
Parkwater	Light-Industrial
Ray	Residential Two-Family
Central	Residential Single-Family
Grace	Light-Industrial
Nevada	Light-Industrial
Hoffman	Residential Single-Family
Havana	Multifamily Residential

f. What is the current comprehensive plan designation of the site?
While designations would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand costs. For the non-project study purposes, the following was assumed;

Well Station Location	Current Comprehensive Plan Designation
Well Electric	Residential Single-Family, Light-Industrial
Parkwater	Light-Industrial
Ray	Residential Two-Family
Central	Residential Single-Family
Grace	Light-Industrial
Nevada	Light-Industrial
Hoffman	Residential Single-Family
Havana	Multifamily Residential

g. If applicable, what is the current shoreline master program designation of the site?

While this designation would again be analyzed at project level SEPA review, it was assessed during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; the Well Electric site has a shoreline designation of Urban Conservancy. It is within the shoreline buffer and shoreline jurisdiction.

h. Has any part of the site been classified as a critical area by the city or the county? If so, specify.

While critical areas would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; the Well Electric site is within the FEMA 100-year flood zone.

i. Approximately how many people would reside or work in the completed project?

While this would again be analyzed at project level SEPA review, it was included during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; No persons would reside in the completed project. Expected increase to staffing levels would be approximately three full-time employees for the entire fluoridation system (all sites). Those employees would spread their time over all the fluoridation sites described herein. That is, there would be no permanent employee presence at any of the well sites but there would be increased periodic visits to these well sites over the current frequency of site visits.

j. Approximately how many people would the completed project displace?

While displacement would again be analyzed at project level SEPA review, it was included during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; the project would not displace any people.

k. Proposed measures to avoid or reduce displacement impacts, if any:

While measures would again be analyzed at project level SEPA review, they were included during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; there would be no displacement impacts.

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

While measures would again be analyzed at project level SEPA review, they were included during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; the project is compatible with existing and projected land uses and plans.

m. Proposed measures to ensure the proposal is compatible with nearby agricultural and forest lands of long-term commercial significance, if any:

While measures would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; no measures are proposed because there are no agricultural or forest lands of long-term commercial significance on or near the project.

9. Housing

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

While these housing would again be analyzed at project level SEPA review, it was assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; the proposed project would not construct any housing units.

b. Approximately how many units, if any, would be eliminated? Indicate whether high-, middle- or low-income housing.

While housing would again be analyzed at project level SEPA review, it was included during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; the proposed project would not eliminate any housing units.

c. Proposed measures to reduce or control housing impacts, if any:

While impacts would again be analyzed at project level SEPA review, they were included during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; no measures are proposed because there would be no housing impacts.

10. Aesthetics

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

While these features would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; the height of proposed buildings is listed in the below table. Exterior building material would match existing architectural details which are primarily brick and Concrete Masonry Units (CMU).

Well Station Location	Height	Building Material
Well Electric	21 Feet	Basic/Industrial CMU
Parkwater	21 Feet	Basic/Industrial CMU
Ray	20 Feet	Align with neighborhood/existing style (CMU with brick)
Central	21 Feet	Align with neighborhood/existing style (CMU with brick)

Grace	19 Feet	Basic/Industrial CMU
Nevada	19 Feet	Building would be near Grace facility
Hoffman	20 Feet	Align with neighborhood/existing style (CMU with brick)
Havana	20 Feet	Match proposed well facility buildings (CMU)

b. What views in the immediate vicinity would be altered or obstructed?

While views would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; no views would be altered or obstructed.

c. Proposed measures to reduce or control aesthetic impacts, if any:

While measures would again be analyzed at project level SEPA review, they were included during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; if disturbed vegetation would be restored as required.

11. Light and Glare

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

While lighting and glare would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; the proposal would have no glare sources. Temporary lighting may be needed during early morning, late afternoon, and evening for construction activities that require lighting for safety purposes. No permanent increase to light or glare would occur.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

While safety hazard and interference would again be analyzed at project level SEPA review, they were included during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; the completed project would not create light or glare.

c. What existing off-site sources of light or glare may affect your proposal?

While off-site sources would again be analyzed at project level SEPA review, they were included during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; there are no existing off-site sources of light and glare that would affect the proposal.

d. Proposed measures to reduce or control light and glare impacts, if any:

While measures would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; no measures are needed to reduce or control light and glare impacts because no impacts would occur. If any work takes place after-dark, portable lighting would be adjusted as feasible to minimize glare.

12. Recreation

a. What designated and informal recreational opportunities are in the immediate vicinity?

While recreational opportunities would again be analyzed at project level SEPA review, they were included during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; the project encompasses various sites, and sidewalks and streets near the sites allow for informal recreation such as walking, jogging, and cycling.

b. Would the proposed project displace any existing recreational uses? If so, describe.

While this would again be analyzed at project level SEPA review, it was assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; the proposed work at all project sites would not permanently displace existing recreational uses. Project construction activities could result in short-term, temporary access restrictions or detours affecting vehicle, bike, and pedestrian routes/access.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

While measures would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; the project may have short-term, temporary impacts to vehicle access and recreational activity due to temporary travel lane and/or street closures or detours at various project sites. Project notifications through website updates, emails, and mailings would provide affected residents with advance notice regarding temporary closures and detours.

13. Historic and cultural preservation

a. Are there any buildings, structures, or sites, located on or near the sited that are over 45 years old listed in or eligible for listing in national, state, or local preservation registers located on or near the site? If so, specifically describe.

While preservation would again be analyzed at project level SEPA review, it was assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; a review of the Washington State Department of Archeology and Historic

Preservation (DAHP) secure electronic database known as the Washington Information System for Architectural and Archeological Data (WISAARD) was conducted by Plateau Archaeological Investigations. Based on the review, the Well Electric site, constructed between the years 1883 and 1886, is eligible under Criterion A due to its significance on a local/regional level. The Parkwater Well Station, constructed in 1950, meets the Criteria of both A and C. Constructed in 1938, the Ray Well Station meets Criterion C with respect to architecture. Grace Avenue Pumping Station, constructed in 1950, meets Criterion C with respect to architecture. Constructed in 1938, the Hoffman Well Station meets Criterion C with respect to architecture. Based on the review, there are a number of properties that are eligible for listing in national, state, or local preservation registers surrounding the sites.

b. Are there any landmarks, features, or other evidence of Indian or historic use or occupation? This may include human burials or old cemeteries. Are there any material evidence, artifacts, or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources.

While these features would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; A review of previously recorded cultural resources and archaeological surveys was completed through the WISAARD, which indicates that there are several previously conducted cultural resource surveys within 1.0 mile of the project sites. None of these surveys intersect with any of the proposed project areas. The DAHP's predictive model places the project sites in a variety of different risk levels. The Central area of potential impact is placed in an area of "Moderate Risk" for encountering cultural resources, stating that "survey is Recommended" for this location. The Grace, Nevada, Havana, and Ray Well areas of potential impact are placed in an area of "High Risk" for encountering cultural resources, stating that "survey is Highly Advised" for this location. The Hoffman, Parkwater, and Well Electric, areas of potential impact are placed in an area of "Very High Risk" for encountering cultural resources, stating that "survey is Highly Advised" for this location. There are no known Native American cultural materials observed on any of the sites. However, due to its location on the Spokane River, the Well Electric site has the highest potential for cultural impacts if artifacts are found or impacted during construction. No Native American or historic-era cultural materials or features were observed during this study. If fluoridation is implemented, a project level SEPA would be prepared, and further historic assessment would be conducted.

c. Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the department of archaeology and historic preservation, archaeological surveys, historic maps, GIS data, etc.

While these methods would again be analyzed at project level SEPA review, they were included during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; Pre-field research included the review of known archaeological resources within a 1.0 mile (mi) (1.6 kilometer [km]) radius of the project areas as inventoried at the DAHP in Olympia, Washington. This review was completed using DAHP's secure electronic database known as WISAARD. This database includes recorded archaeological resources, historic property inventories (HPIs), properties and districts on the National Register of Historic Places (NRHP) and the Washington Heritage Register (WHR), identified cemeteries, and previously conducted cultural resource surveys found throughout the state. Plateau also conducted cartographic analysis of landform, topography, proximity to water using topographic maps, and the United States Department of Agriculture (USDA) online soil survey. Secondary historic resources, on file at the DAHP and the Plateau office, were consulted to identify other potential historic resources. Plateau archaeologists conducted a pedestrian survey at two locations and provided an inventory for seven historic buildings. Plateau recommends that the proposed undertaking would result in no historic properties affected, and no further archaeological investigations are recommended prior to, or during, execution of this project.

d. Proposed measures to avoid, minimize, or compensate for loss, changes to, and disturbance to resources. Please include plans for the above and any permits that may be required.

While these measures would again be analyzed at project level SEPA review, they were assessed this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; should ground-disturbing activities reveal any cultural materials (e.g., structural remains, European American artifacts, or Native American artifacts), activity would cease, and the Washington State Historic Preservation Officer should be notified immediately. In addition, an Unanticipated Discovery Plan (UDP) has been prepared by Plateau Archaeological Investigations for use during all ground-disturbing work on the project.

14. Transportation

a. Identify public streets and highways serving the site or affected geographic area and describe proposed access to the existing street system. Show on site plans, if any.

While streets would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; the project sites are served by a variety of roadways, including non-arterial roadways, principal arterials, and transit routes. Temporary street closures and detours may need to occur on roadways as project work is being completed at each site.

b. Is site or affected geographic area currently served by public transit? If so, generally describe. If not, what is the approximate distance to the nearest transit stop

While transit would again be analyzed at project level SEPA review, it was assesses during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; the project sites have nearby stop locations that are served by Spokane Transit Authority bus service.

c. How many additional parking spaces would the completed project or non-project proposal have? How many would the project or proposal eliminate?

While parking would again be analyzed at project level SEPA review, it was assess during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; the completed project would neither create nor eliminate any parking spaces.

d. Will the proposal require any new or improvements to existing roads, streets, pedestrian, bicycle, or state transportation facilities, not including driveways? If so, generally describe (indicate whether public or private).

While these facilities would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; the only well station site that requires new or improvements to an existing street is Parkwater, where the existing cul-de-sac at the west end of East Rutter Avenue would be enlarged to the south for liquid delivery truck turn-around movements.

e. Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

While transportation would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; the Well Electric site is in the immediate vicinity of air transportation and located next to Felts Field Municipal Airport.

f. How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and non-passenger vehicles). What data or transportation models were used to make these estimates?

(*Note: to assist in review and if known, indicate vehicle trips during PM peak, AM Peak, and Weekday (24 hours).)*

While vehicular trips would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any cost implications. For the non-project study purposes, the following was assumed; when the wells are operational, operators make one trip per day with a light duty work vehicle to check on systems and adjust as needed. A chemical delivery truck comes once every six weeks to refill the bulk storage tanks. All visits are expected to take place between the hours of 7 a.m. and 5 p.m. Monday through Friday. It should be noted that many of the sites are only used seasonally, and no trips would be made when those sites are closed.

g. Will the proposal interfere with, affect, or be affected by the movement of agricultural and forest products on roads or streets in the area? If so, general describe.

While agricultural and forest products would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand any costs implications. For the non-project study purposes, the following was assumed; the proposal is not expected to interfere with, affect, or be affected by the movement of agricultural and forest products on roads or streets in the area.

h. Proposed measures to reduce or control transportation impacts, if any:

While measures would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand cost implications. For the non-project study purposes, the following was assumed; the project plans and specifications would require a Traffic Control Plan (TCP), which would include measures to address impacts related to any necessary project detours and lane restrictions. Advanced notice for construction delays would be provided with variable message signs and public notifications. The specifications would include Contractor provisions for advanced notifications of driveway impacts and impacts to public services in the immediate area. These potential impacts are expected to be short term in duration and transitory as construction moves along the project alignment.

15. Public services

a. Would the project result in an increased need for public services (for example: fire protection, police protection, public transit, health care, schools, other)? If so, generally describe.

While public services would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; the project would not result in an increased need for public services.

b. Proposed measures to reduce or control direct impacts on public services, if any:

While measures would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; not applicable.

16. Utilities

a. Check utilities currently available at the site:

- X electricity
- ☐ natural gas
- X water
- X refuse service
- X telephone
- X sanitary sewer
- ☐ septic system
- ☐ Other:

While utilities would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand costs. For the non-project study purposes, the items marked above was assumed.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed:

While utilities would again be analyzed at project level SEPA review, they were assessed during this non-project study to better understand costs. For the non-project study purposes, the following was assumed; The City of Spokane is the water service provider. The proposed project, if the city decides to implement, would provide fluoridated water to the community through the municipal water supply and would continue to be owned, operated, and maintained by the city. No additional utilities would be installed or altered.

C. SIGNATURE

I, the undersigned, swear under penalty of perjury that the above responses are made truthfully and to the best of my knowledge. I also understand that, should there be any willful misrepresentation or willful lack of full disclosure on my part, the *agency* must withdraw any determination of Nonsignificance that it might issue in reliance upon this checklist.

Date: 5/17/2023 Signature: Katherine Miller

Please Print or Type:

Proponent: Katherine Miller Address: 808 West Spokane Falls Boulevard

Phone: 509.755.2489 Spokane, WA 99201

Person completing form (if different from proponent): Dana Rivera, Parametrix

Phone: 509-759-1312 Address: 835 Post Street, Suite 201, Spokane, WA 99201

FOR STAFF USE ONLY

Staff member(s) reviewing checklist: Katherine Miller

Based on this staff review of the environmental checklist and other pertinent information, the staff concludes that:

☒ A. there are no probable significant adverse impacts and recommends a Determination of Nonsignificance.

☐ B. probable significant adverse environmental impacts do exist for the current proposal and recommends a Mitigated Determination of Nonsignificance with conditions.

☐ C. there are probable significant adverse environmental impacts and recommends a Determination of Significance.

D. SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS

(Do not use this sheet for project actions)

Because these questions are very general, it may be helpful to read them in conjunction with the list of elements of the environment.

When answering these questions, be aware of the extent the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?

   This study is a non-project action to focus on understanding the cost implications IF fluoridation of the City's water system were to be implemented. The study itself will not increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise. If the study moves forward and results in a fluoridation project, then that project has the potential for these impacts. For example, chemicals would need to be stored, handled, and used on site, which may lead to potential for spill or leak to surface, groundwater, or a stormwater disposal system discharging to surface or groundwater. There is also a possibility for an overfeed of fluoride to the municipal water system, which may pose a hazard to water system users. Project sites that require construction may result in exhaust emissions, dust, and noise from construction equipment. Upon project completion, the use of FSA may cause an unpleasant acidic odor. The proposed project would be evaluated for these potential impacts and corresponding mitigation measures would be put in place prior to implementation as appropriate.

   Proposed measures to avoid or reduce such increases are: This study is a non-project action to focus on understanding the cost implications IF fluoridation of the City's water system were to be implemented. This study with the purpose of understanding costs will not itself create the need to develop avoidance measures. However, if the study moves forward and becomes a project, proposed measures to avoid or reduce such incidences may include spill control response aids, readily accessible wherever liquid additives are handled. In addition, numerous redundant design features and safety measures would be incorporated to prevent overfeed to the system. Any increase in emissions from construction would be temporary and mitigation measures would be used to control the generation of dust (e.g., spraying water over disturbed soil areas during dry weather). Any temporary increase in emissions is not expected to adversely impact air quality. Proper ventilation design of the facility can direct any odor from the use of FSA upwards. Since the fumes are lighter than air, they would rise and have a negligible effect on any local neighborhoods. PPE would be utilized by operators to provide protection for eyes and skin.

How would the proposal be likely to affect plants, animals, fish, or marine life?
This proposal is a non-project action and will not itself result in direct impacts to plants, animals, fish, or marine life. For the purpose of understanding cost implications the following was assumed during this study; the Well Electric site, due to its proximity to the Spokane River, has the potential to impact fish or marine life from a potential spill of FSA into surface waters during operation or delivery.

Proposed measures to protect or conserve plants, animals, fish, or marine life are:
This study is a non-project action to focus on understanding the cost implications if fluoridation of the City's water system were to be implemented. The study, itself will not create the need to develop measures. If the study moves forward and becomes a project, bulk chemical storage would be secured in a dedicated room. There would be containment features at the delivery hose building connection to catch potential transfer spills from the delivery truck to the storage tanks. Spill control absorbent pillows and dams would be used for initial containment, with follow-up action to neutralize the acid with lime or caustic soda. An epoxy undercoat and a urethane topcoat would be applied to manholes and polyurethane would be implemented to protect the concrete. Each well site would be evaluated for potential impacts to vegetation and wildlife and corresponding mitigation measures would be put into place prior to project implementation.

2. How would the proposal be likely to deplete energy or natural resources?
As this is an analysis of costs, the proposal is unlikely to result in activities that would cause a greater depletion of energy or natural resources.

Proposed measures to protect or conserve energy and natural resources are:
This study is a non-project action focused on understanding the cost implications if fluoridation of the City's water system were to be implemented. The study itself will create the need to develop measures. If the study leads to a project, it is expected that energy usage would be small, as the dosing pumps are low horsepower. No conservation features beyond those required in the building code are included. Best management practices and procedures to protect or conserve energy and natural resources would be used in the design, construction, operations, and maintenance of the proposed project to the fullest extent possible.

3. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection, such as parks, wilderness, wild and scenic

rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, flood plains or prime farmlands?

As this is a non-project action to evaluate costs associated with fluoridation of the City's water system. The proposal itself will not result in direct effects to environmentally sensitive areas or areas designated for governmental protection. For the purpose of understanding potential costs the following was assumed during this study; there is the potential for the Well Electric site to impact the Bull Trout, which is listed as a threatened animal species. Additionally, there are a number of well sites that are eligible for inclusion in the National Register of Historic Places.

Proposed measures to protect such resources or to avoid or reduce impacts are:
This study is a non-project action focused on understanding the cost implications if fluoridation of the City's water system were implemented. The study itself will not create the need to develop measures. If the study moves forward and become a project, the proposal, for each well site, would be reviewed and addressed on an individual basis for impacts to environmentally sensitive areas and areas designated for government protection by permitting agencies prior to project implementation.

4. How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?

   As this is a non-project action to evaluate costs associated with potential fluoridation of the City's water system. The proposal, itself, will not affect land and shoreline use. If the proposal moves forward, the Well Electric site would require a shoreline permit as it is within the Urban Conservancy shoreline zone. The proposal would not encourage incompatible land uses.

   Proposed measures to avoid or reduce shoreline and land use impacts are:
   This study is a non-project action focused on understanding the cost implications if fluoridation of the City's water system were to be implemented. A study with the purpose of understanding costs will not itself create the need to develop measures, If the study moves forward and becomes a project, Well Electric site would be reviewed by the appropriate permitting agencies and would secure any necessary permits prior to project implementation.

5. How would the proposal be likely to increase demands on transportation or public services and utilities?

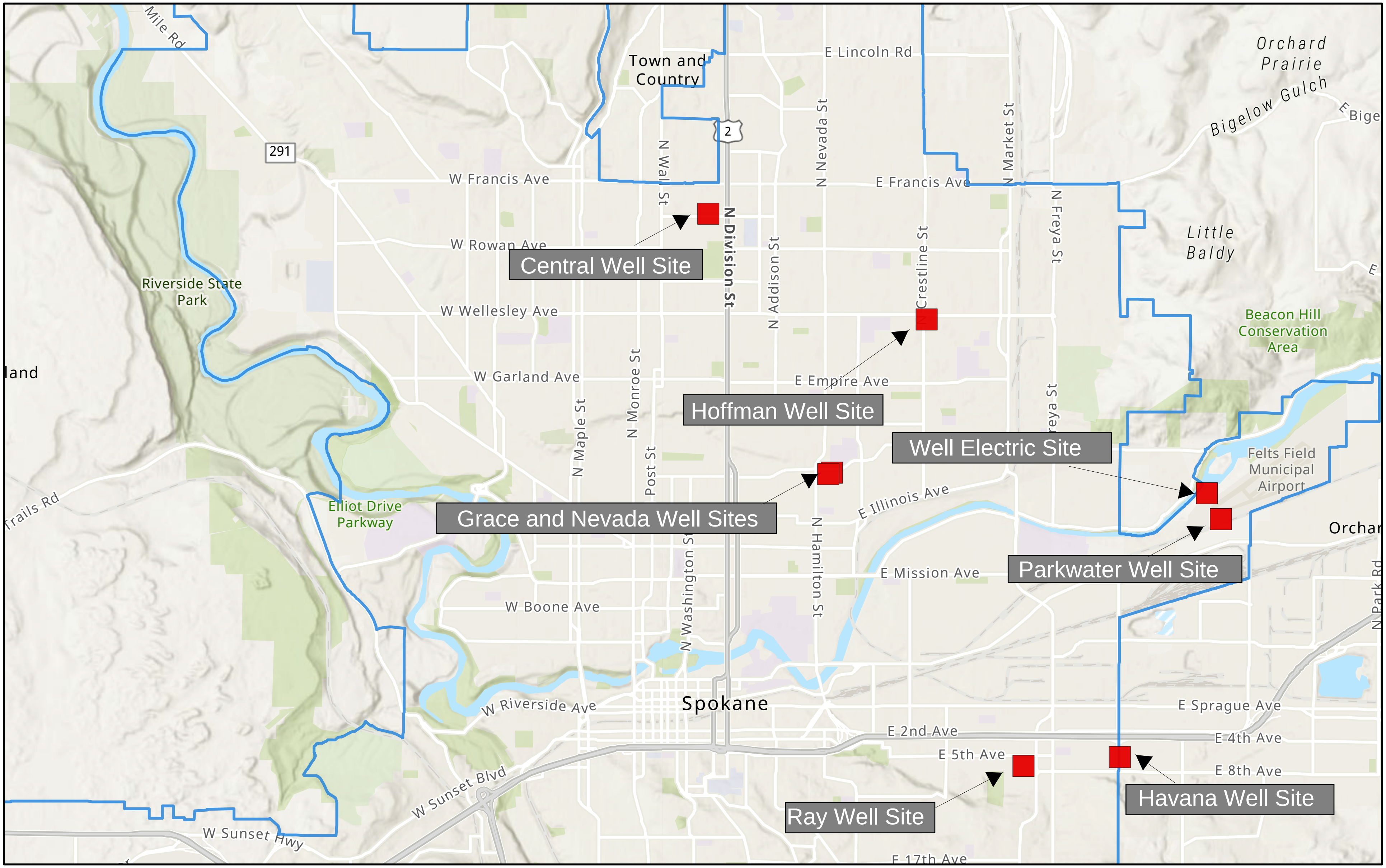
   This study is a non-project action focused on understanding the cost implications if fluoridation of the

City's water system were to happen. The study itself will not create an increase in demand for transportation, public services or utilities. If the study moves forward and become a project, a future project is not likely to increase demands on transportation, public services, or utilities. However, during construction, there is potential for a temporary increase of transportation. Temporary street closures and detours may need to occur on roadways as project work is being completed at each site. These potential impacts are expected to be short term in duration and transitory as construction progresses across sites.

Proposed measures to reduce or respond to such demand(s) are:
This study is a non-project action focused on understanding the cost implications if fluoridation of the City's water system were to be implemented. The study itself does not need measures. For the purposes of understanding cost implications, the following was assumed during this study; if the study leads to a project, the project plans and specifications would require a Traffic Control Plan (TCP), which would include measures to address impacts related to any necessary project detours and lane restrictions. Advanced notice for construction delays would be provided with variable message signs and public notifications. Each project site would be evaluated for impacts on transportation, public services, and utilities prior to implementation and proper mitigation measures would be employed as necessary.

6. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.
   This study is a non-project action focused on understanding the cost implications if fluoridation of the City's water system were to be implemented. The study itself, will not be in conflict with local, State or Federal Laws or requirements. Any specific project actions that may follow from this study would be subject to additional environmental reviews and would be evaluated for adherence to environmental laws or requirements prior to project implementation.

Attachment A: Spokane Well Sites Site Plan



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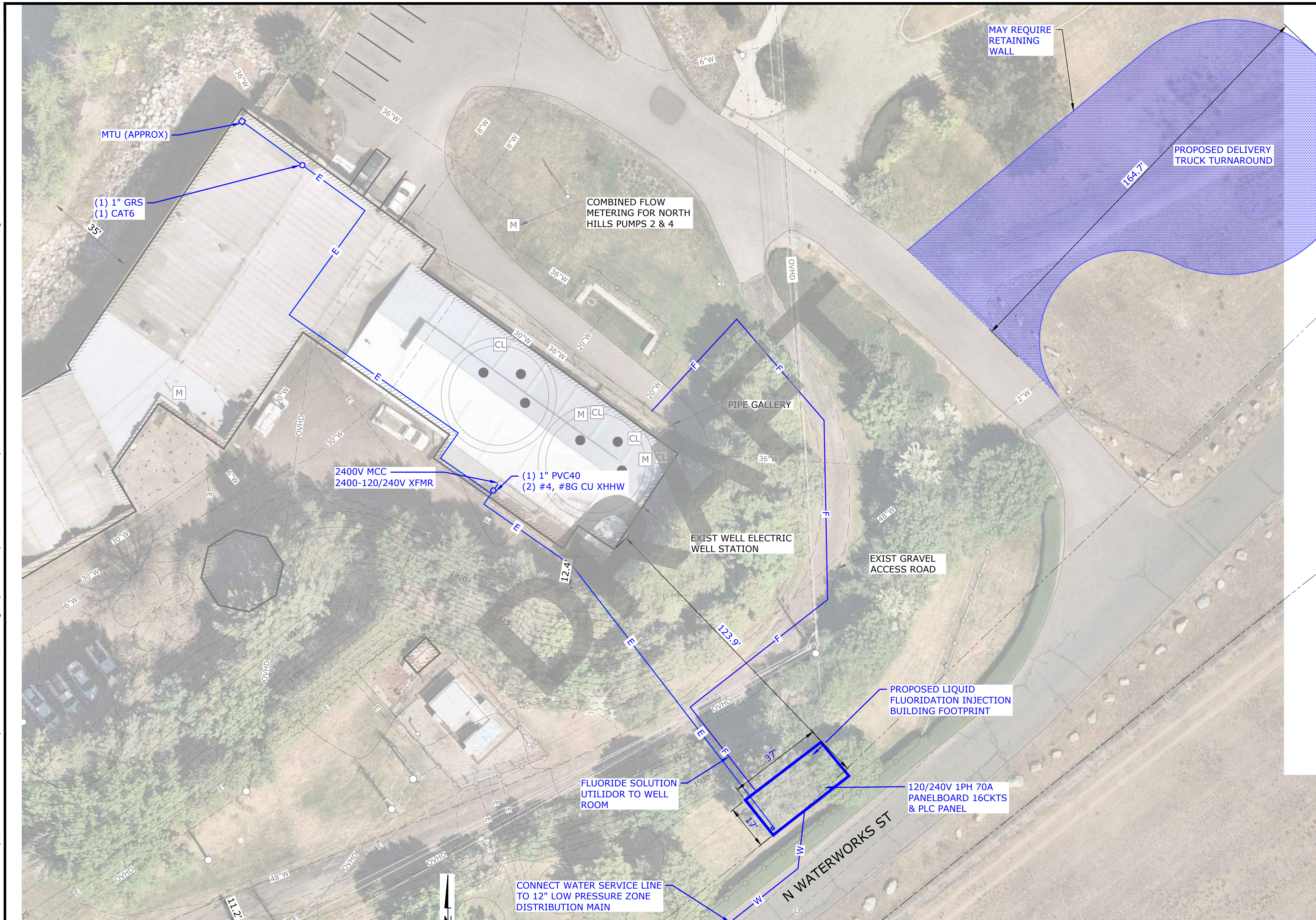
Esri, NASA, NGA, USGS, City of Spokane, Spokane County, WA State Parks GIS, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA,

Esri ArcGIS



LEGEND

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CL	CHLORINE ANALYZER
●	CHLORINE INJECTION POINT
▲	SAMPLE POINT FOR CHLORINE MONITOR ANALYSIS
○	APPROX LOCATION OF WELL PUMP
—F—	CHEMICAL SOLUTION LINE
—W—	PROPOSED WATER SERVICE LINE
—E—	PROPOSED ELECTRICAL SERVICE LINE

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KLW CHECKED

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CITY OF SPOKANE

SPOKANE FLUORIDATION STUDY

WELL ELECTRIC
WELL STATION SITE PLAN

DRAFT

PROJECT NO.:	22-3386	SCALE:	AS SHOWN	DATE:	SEPTEMBER 2022

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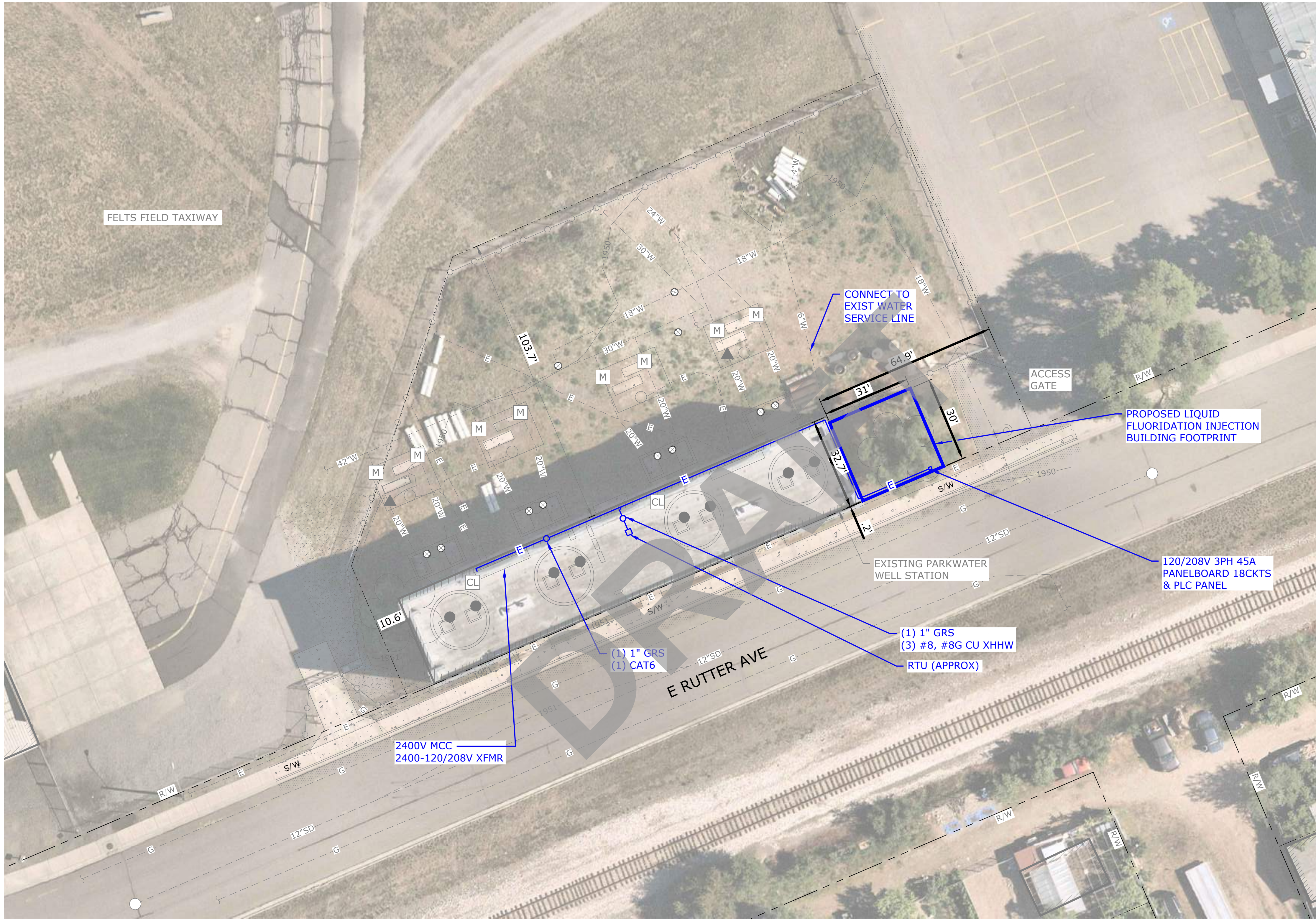

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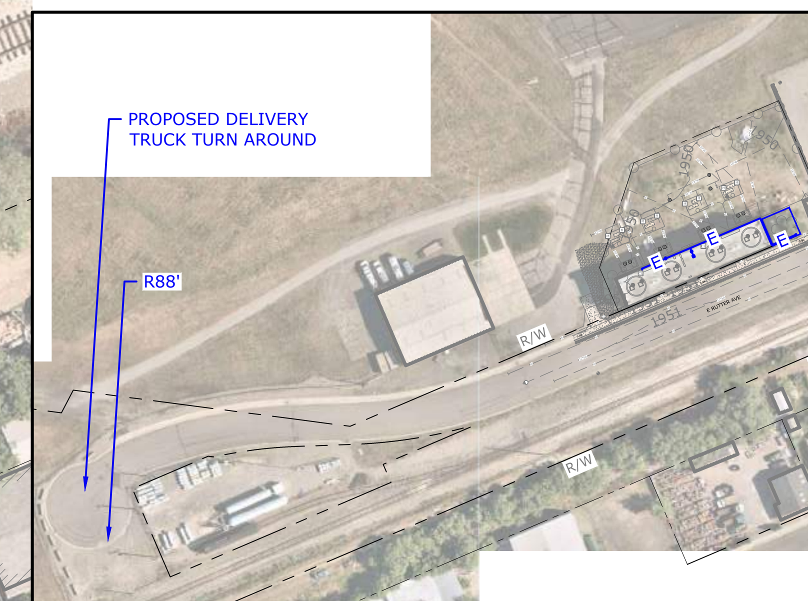
- ▲ — SAMPLE POINT FOR CHLORINE MONITOR ANALYSIS
- ○ — APPROX LOCATION OF WELL PUMP
- —E— — PROPOSED ELECTRICAL SERVICE LINE



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VICINITY MAP
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SPOKANE FLUORIDATION STUDY

PARKWATER WELL STATION SITE PLAN

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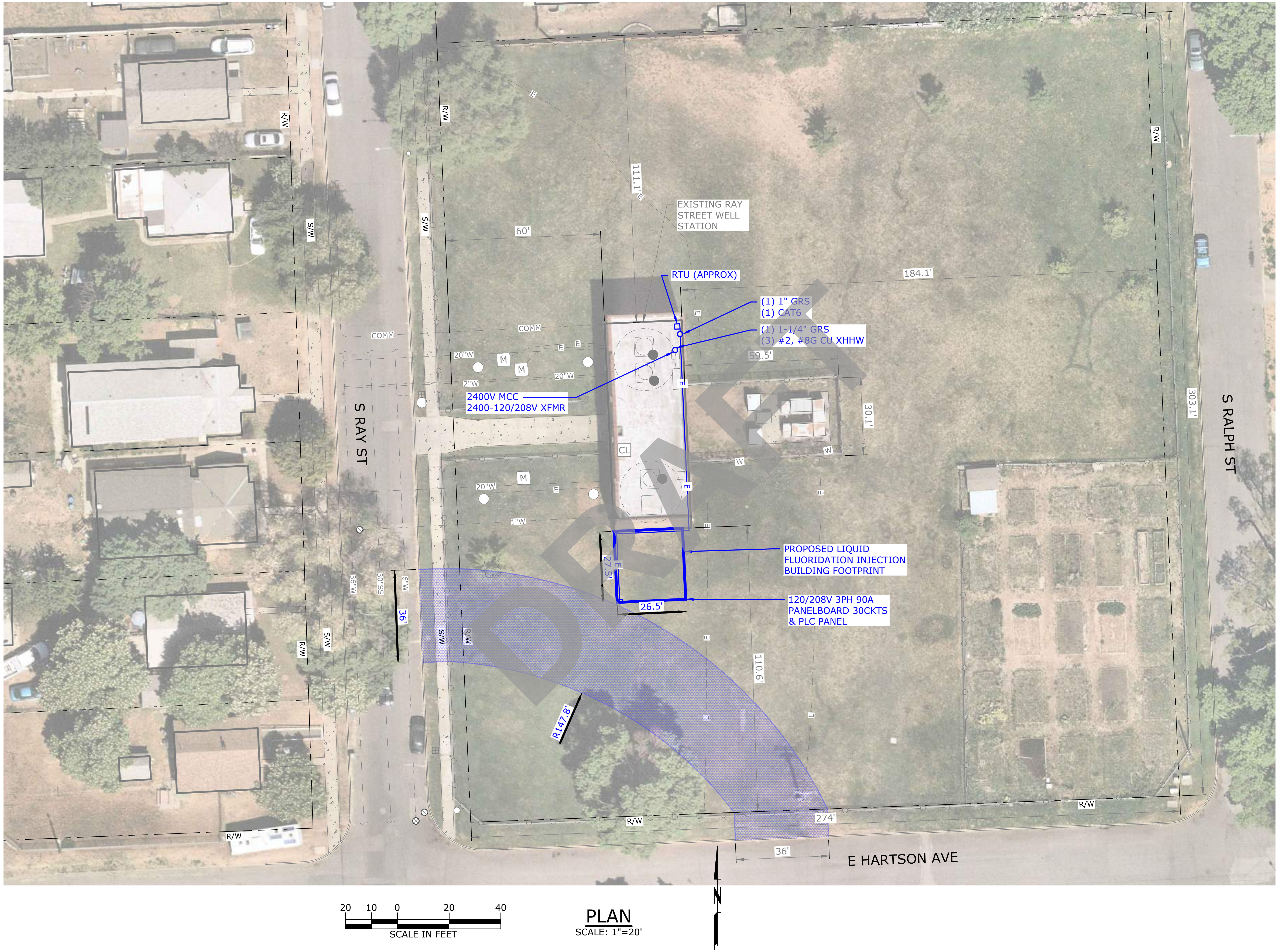
PROJECT NO.: 22-3386	SCALE: AS SHOWN	DATE: SEPTEMBER 2022



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SPOKANE FLUORIDATION STUDY

RAY STREET WELL STATION SITE PLAN

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PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: SEPTEMBER 2022

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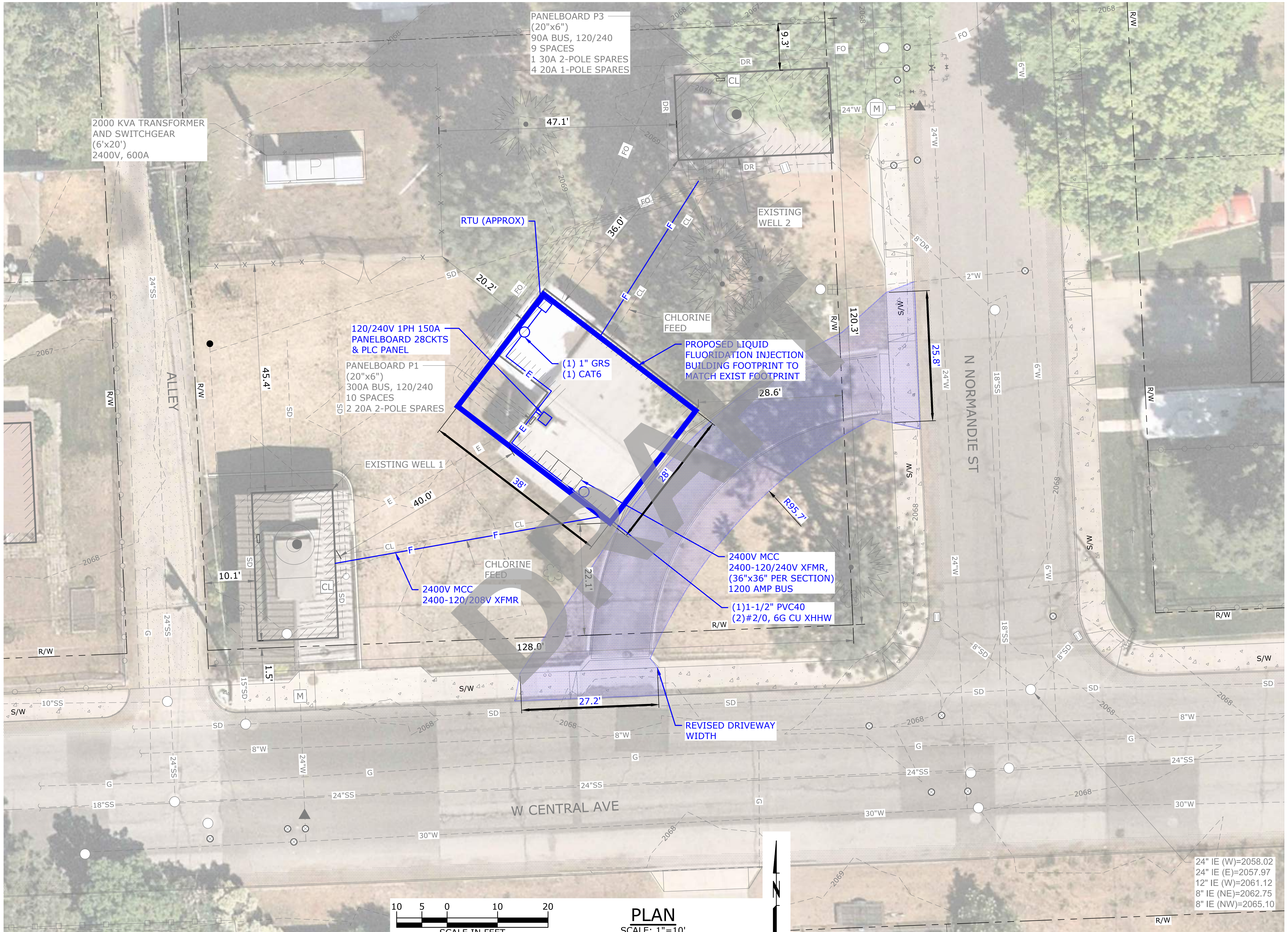

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—F—	CHEMICAL SOLUTION LINE
—E—	PROPOSED ELECTRICAL SERVICE LINE

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SPOKANE FLUORIDATION STUDY

CENTRAL AVE WELL STATION SITE PLAN

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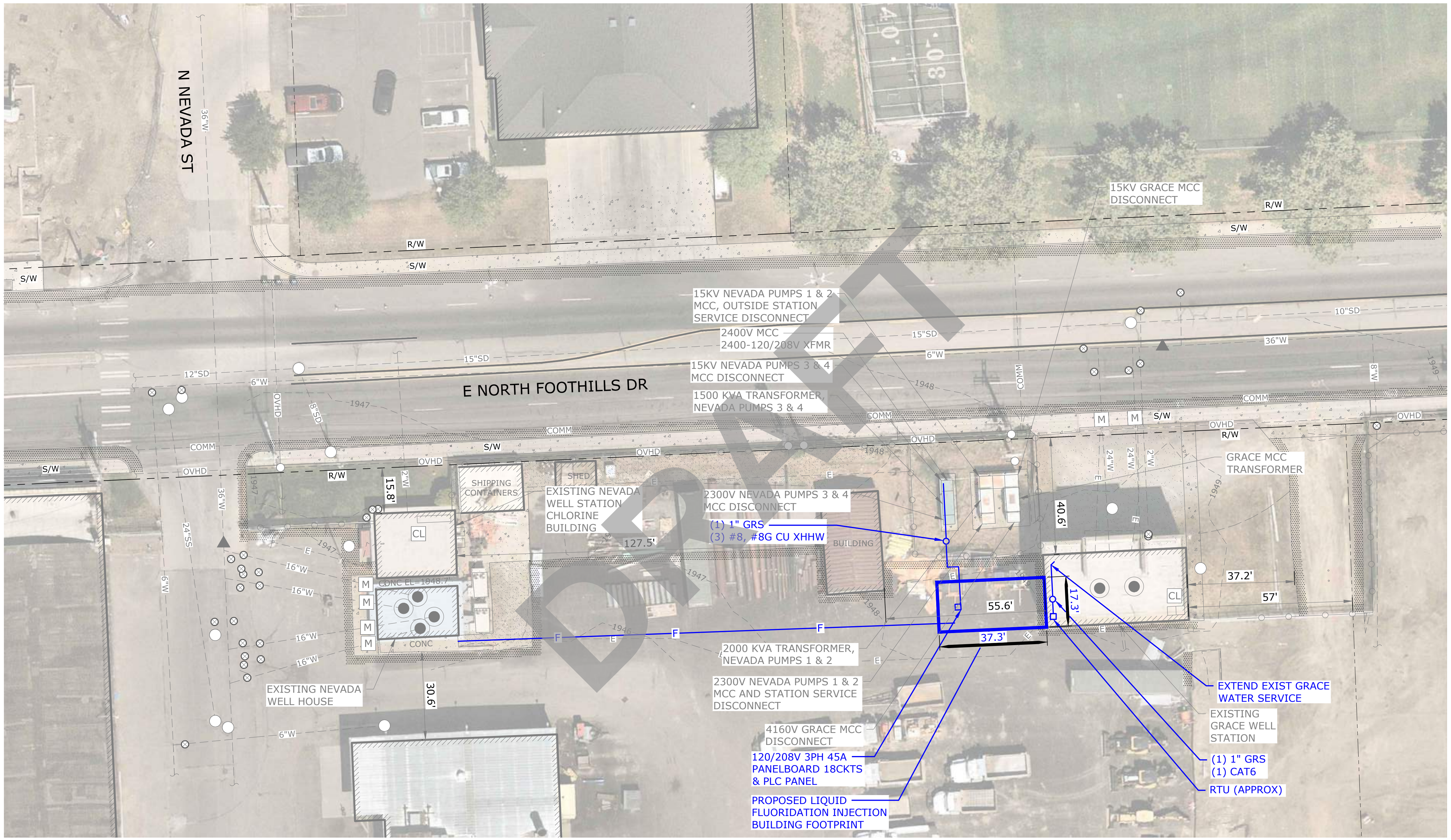
- —F— CHEMICAL SOLUTION LINE
- —E— PROPOSED ELECTRICAL SERVICE LINE



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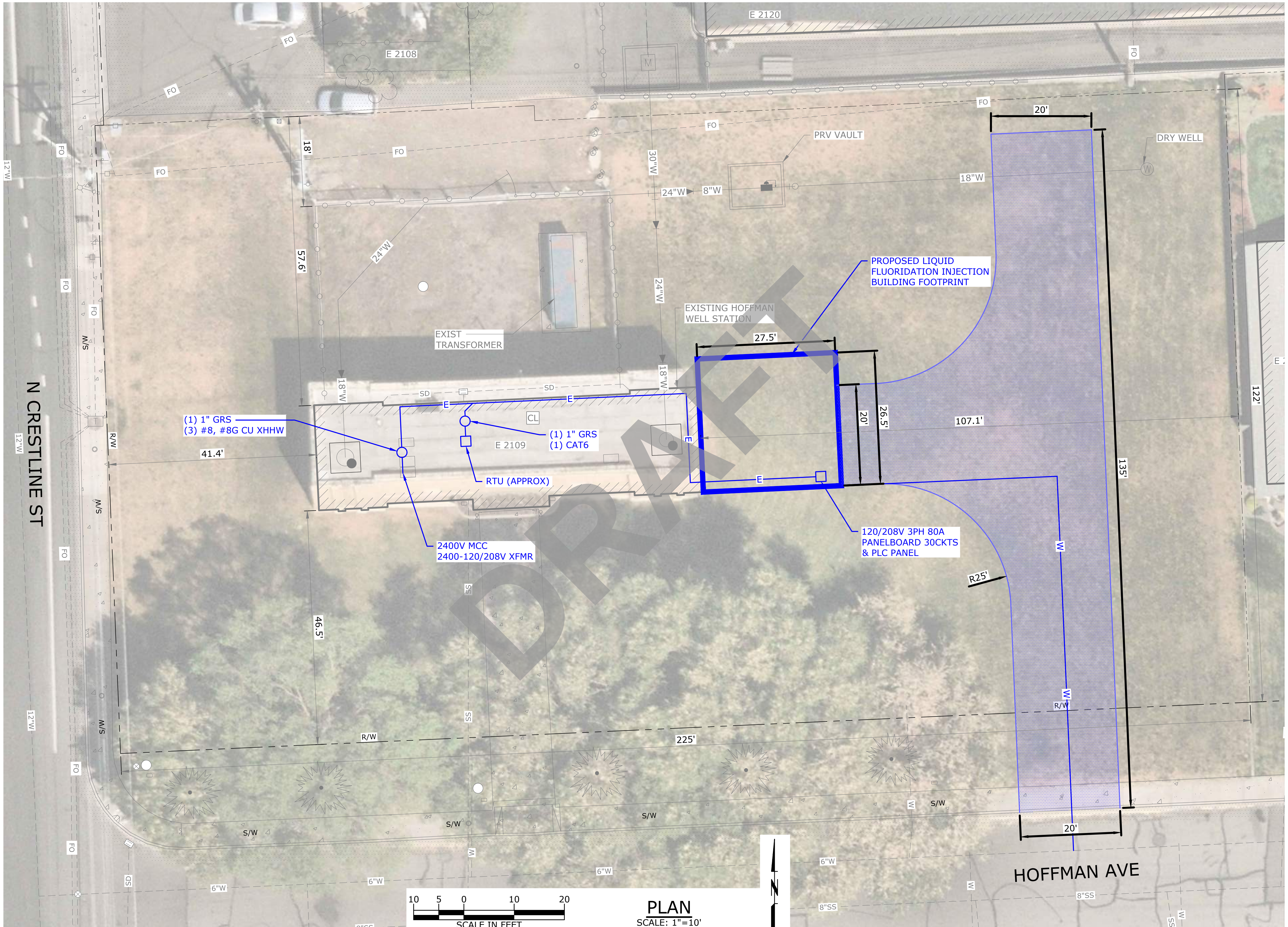
CITY OF SPOKANE

SPOKANE FLUORIDATION STUDY

GRACE AND NEVADA WELL STATION SITE PLAN

DRAFT

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: SEPTEMBER 2022



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- —E— PROPOSED ELECTRICAL SERVICE LINE

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CITY OF SPOKANE

SPOKANE FLUORIDATION STUDY

HOFFMAN WELL STATION SITE PLAN

DRAFT

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: SEPTEMBER 2022

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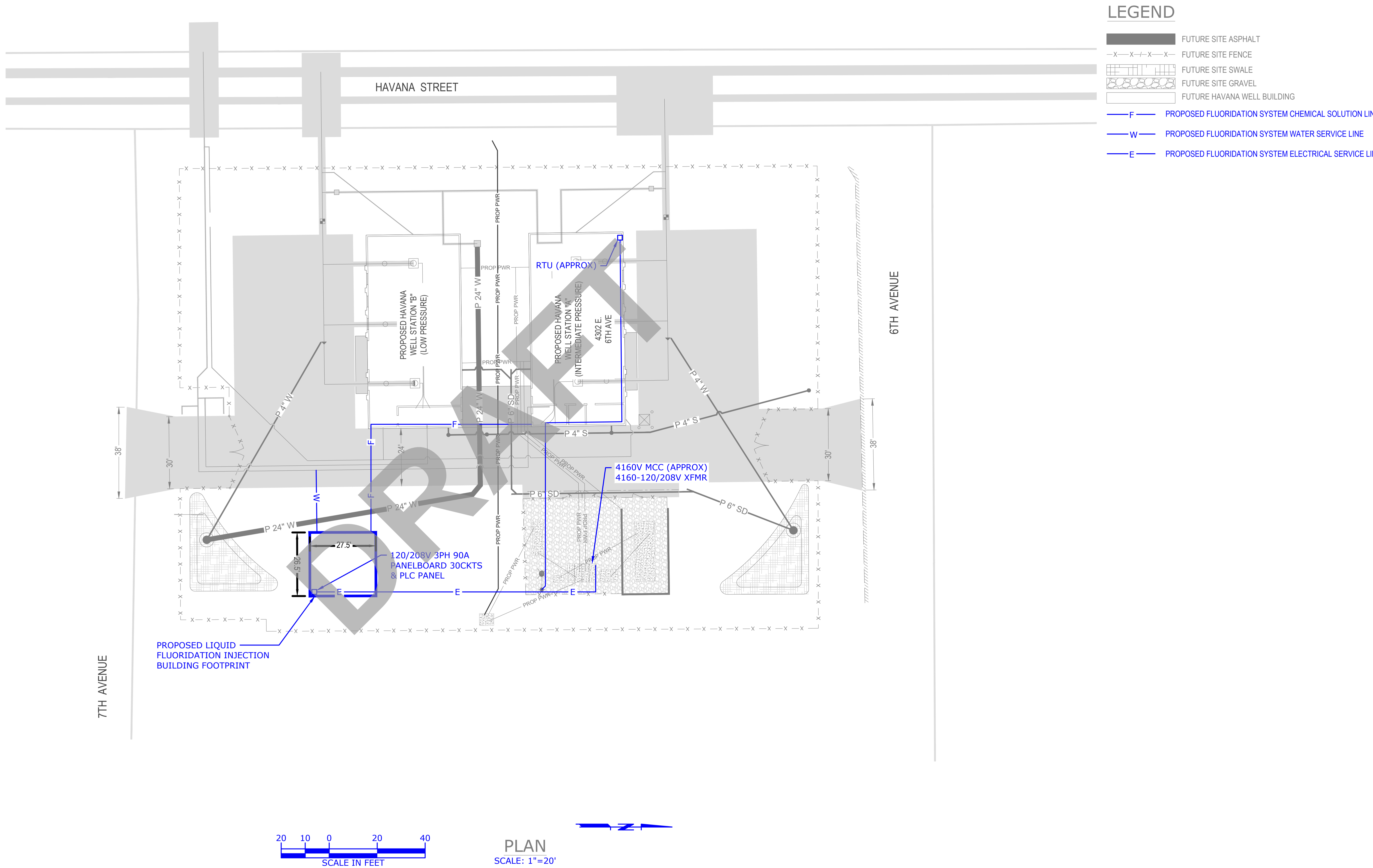

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CITY OF SPOKANE

SPOKANE FLUORIDATION STUDY

HAVANA WELL STATION SITE PLAN

DRAFT

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: SEPTEMBER 2022

I:\BOI_Projects\22\3386 - Spokane Fluoridation Study\CAD\Working\22-3386-WA-HAVANA-C.dwg C-2 SITE PLAN 9/26/2022 6:07 PM ELISHEVA.WALTERS 23.0s (LMS Tech)

Attachment B: Well Electric Flood Zone Map

2/9/2023

Environment - FEMA Flood Zone - FEMA Flood Zone

100 Year Flood Zone

500 Year Flood Zone

1:3,683

0 0.02 0.04 0.08 mi

0 0.03 0.07 0.13 km

Spokane Image Consortium, Maxar, Esri Community Maps Contributors, City of Spokane, Spokane County, WA State Parks GIS, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau,

Fluoride System Study Email Comments for non-project SEPA
May 22-June 5, 2023

No to fluoridation

DB Doug Burke <dburkespo@comcast.net>
To Fluoride System Study

Reply | Reply All | Forward

Mon 5/22/2023 2:35 PM

[CAUTION - EXTERNAL EMAIL - Verify Sender]

Our home would say no to fluoridating our drinking water.

Sent from my iPhone

Water System Fluoridation Implementation Study - City of Spokane, Washington

DR diane Riser <driser1996@gmail.com>
To Fluoride System Study

Reply | Reply All | Forward

Mon 5/22/2023 3:37 PM

[CAUTION - EXTERNAL EMAIL - Verify Sender]

Do resident home owners get a say in whether or not they want fluoride added to the city water or is this just an fyi?

Risers
Home owners

https://my.spokanecity.org/publicworks/water/fluoride-system-study/

Sent from my iPhone

NO FLUORIDE!

L lonny6 <lonny6@gmail.com>
To Fluoride System Study

Reply | Reply All | Forward

Mon 5/22/2023 3:48 PM

[CAUTION - EXTERNAL EMAIL - Verify Sender]

Multiple studies have linked fluoride in drinking water with neurological damage.

While some disagree, if there is ANY question whatever about the positive or negative value of ingesting a chemical (and there are), it would be STUPID to put it in the drinking water.

Don't be stupid. The evidence against fluoride is strong.

https://www.hsph.harvard.edu/news/features/fluoride-childrens-health-grandjean-choi/

Comment re fluoridation plan

PN Paul Nathan <paul@nathan.house>
To Fluoride System Study

Reply | Reply All | Forward

Mon 5/22/2023 5:35 PM

[CAUTION - EXTERNAL EMAIL - Verify Sender]

Hi,

I believe this is the right email address for providing feedback on the Fluoridation plan currently under review in Spokane.

If so, my feedback is as follows:

I expect and desire that the City add fluoride to its water, as this is a meaningful health improvement to all of its citizens. I certainly would vote for this measure if it was put on the ballot.

Thank you,
Paul Nathan
1015 W 14th Ave,
Spokane, WA 99204

Fluoridation of Spokane water

K khammann7@gmail.com
To Fluoride System Study

Reply | Reply All | Forward

Mon 5/22/2023 9:50 PM

[CAUTION - EXTERNAL EMAIL - Verify Sender]

Hello. If this is not the proper place to comment on the possible fluoridation of Spokane's tap water, I would greatly appreciate you directing me to the proper place. I found the directions online confusing. Thank you.

If this is the proper place, then I would like to say that I am opposed to fluoridation of Spokane's tap water. I think there are still questions about the safety of fluoridated water for people, such as myself, with thyroid problems, as well as other problems related to excess fluoride consumption.

Thank you very much for your time and attention.

Kenneth Hammann
707 E. Mission Ave. Apt. 331
Spokane, WA 99202
khammann7@gmail.com

Sent from Mail for Windows

Community input

LH Lisa Holmes <rwandalady@hotmail.com>
To Fluoride System Study

Reply | Reply All | Forward

Tue 5/23/2023 7:48 AM

[CAUTION - EXTERNAL EMAIL - Verify Sender]

Good Morning,
Is this where we, as community, are supposed to comment on fluoridation? It not clear.
Thank you for guidance.
Lisa Holmes

Sent from my iPhone

Public comment about fluoride in our water

CR chris roys <clr4miss@yahoo.com>
To Fluoride System Study

Reply | Reply All | Forward

Tue 5/23/2023 8:19 AM

[CAUTION - EXTERNAL EMAIL - Verify Sender]

As a citizen and voter in Spokane I want the chance to vote whether or not we put fluoride in our water supply. I don't think it should be left up to a few individuals to make that decision. It is the rights of Spokane citizens to make that decision.
Sincerely Christy Roys

Sent from Yahoo Mail for iPad

Fluoride is a neurotoxin

JS J S <johvan@gmail.com>
To Fluoride System Study

Reply | Reply All | Forward

Tue 5/23/2023 6:14 PM

You replied to this message on 5/24/2023 3:35 PM.

[CAUTION - EXTERNAL EMAIL - Verify Sender]

Fluoride was an old idea that should no longer be considered safe. Not a good idea to add poison to city water supply.

Johvan
--
Best Regards,

// Johvan //-
"There is nothing to take a man's freedom away from him, save other men"

Environmental Impact Study?

Wendy Powell <wendy@auroraherbs.com>
To Fluoride System Study

Reply | Reply All | Forward
Tue 5/23/2023 8:53 PM

You replied to this message on 5/24/2023 3:41 PM.
We removed extra line breaks from this message.

[CAUTION - EXTERNAL EMAIL - Verify Sender]

Dear Ms. Miller,

Why is no environmental impact study being required? It is well known that the fluoride that Spokane would be using is an industrial waste product, that there have been spills, that this chemical could get into the Spokane River system and cause damage, etc.

Could you explain this to me?

Thanks you, Wendy Powell

56 year Spokane Resident

Please stop fluoridation of our great tasting and mostly pure water

Elizabeth Herrin <elizlightshiner@hotmail.com>
To Fluoride System Study

Reply | Reply All | Forward
Thu 5/25/2023 5:24 PM

You replied to this message on 5/26/2023 8:41 AM.

[CAUTION - EXTERNAL EMAIL - Verify Sender]

Fluoride is a poison! Why would we want to add this toxin to our water which studies have shown causes lower IQ in children. Is it just because the federal or state government is giving Spokane money to do this? There is a documentary playing at BrightU.com about how bad this would be for our city. We really don't need it, despite what special interests say, like dentists.
Sent from Mail for Windows

SEPA review to implement fluoridation in Spokane

Ian Thompson <ian.thompson153@gmail.com>
To Fluoride System Study

Reply | Reply All | Forward
Thu 5/25/2023 9:22 PM

You replied to this message on 5/26/2023 8:43 AM.
[CAUTION - EXTERNAL EMAIL - Verify Sender]

Is there a significant negative impact from adding a neurotoxin to the city water supply? Absolutely.

Spokane's decision to even entertain this industry shrill-sponsored initiative is short sighted at best.

Fluoride in drinking water only harms people. Fluoride, even below 1 ppm, is NOT protective of human health, regardless of what our negligent EPA states is "acceptable", and I ask that Spokane consider dismissing this abhorrent practice.

Fluoride is a neurotoxin and degrades IQ by 1 point for EACH .2 ppm; you are effectively dumbing Spokane children/residents by irresponsibly administering a neurotoxin in the water supply. This is affirmed by numerous studies including highly credible NIH studies. The MCL provides a mere 3x protection from "severe skeletal fluorosis", i.e., it is not a protective standard in any way. National Research Council affirms the standards are non-protective. Meanwhile, EPA fumbles and delays in court to defend their losing position, and other generations are harmed by this immoral practice.

Contrast this with fluoridated octane chains that are regulated at parts per TRILLION levels based on sub-chronic impacts (e.g., "delayed eye opening in rat pups") and have 300+ protective factors. We are concerned over PFAS at 70 ppt, but not fluoride at 370,000 ppt? It is clear there is a hypocritical duality of standards. Whether organic or inorganic, the impact pathway of fluoride in our bodies is the same. Are you going to spend millions of taxpayer dollars to remove fluorinated PFAS at pptr levels, and then put the same harmful fluoride into the water post-treatment? This is wasteful and counterproductive.

Fluoride should be removed, not added, to drinking water. Unfortunately, it is fairly difficult to remove after addition, requiring reverse osmosis or distillation, creating a financial challenge for parents and kidney patients alike to REMOVE the toxin you have added after your water purification efforts.

Dental deception. Fluoride KILLS bacteria on teeth, and has the same inhibition inside human cells when fluoride is ingested, inhibiting Na-K-ATPase, an enzyme crucial to energy production in all cells. Fluoridation only benefits the fertilizer industry since they can unload a hazardous waste for profit, but it has negative impacts to people (far more harm than benefit). It is sugar that promotes the bacteria (streptococcus mutans) which causes cavities. No sugar-no cavities. ADA is a corporate shrill and should not be trusted for medical advice.

As a legal reminder, adding a medical additive to public drinking water is a violation of the Food, Drug, and Cosmetic Act. It provides irresponsible administration of a treatment without dosing control. Medical additives should NEVER be put into public drinking water supplies. That is what this initiative is proposing. That is completely irresponsible.

Please prevent the backwards and misinformed practice of adding fluoride, a neurotoxin and contaminant, to your public water supply. Please do your research, and you will come to a similar conclusion: fluoride has no place as an additive in drinking water, and its removal should be a high priority for our public drinking water systems. As to spending $11M taxpayer dollars to harm them, that course of action is a clear no.

Respectfully,
Ian Thompson

Do not add fluoride to our drinking water

JE Jaime E <jaijai9@msn.com>
To Fluoride System Study

Reply | Reply All | Forward | ...

Fri 5/26/2023 2:39 PM

You replied to this message on 5/30/2023 9:16 AM.

[CAUTION - EXTERNAL EMAIL - Verify Sender]

Hello,
I was born in Spokane and I am a current resident. Please listen to the people of Spokane, who continue to oppose the fluoridation of our drinking water. We do not want or need this added to our water.
Please do not add fluoride to our clean drinking water.
Best regards,
Jaime Koedding

Sent via the Samsung Galaxy S9+, an AT&T 5G Evolution capable smartphone
Get Outlook for Android

Fluoride in water

MH Margaret Herzog <margaretherzog76@gmail.com>
To Fluoride System Study

Reply | Reply All | Forward | ...

Fri 5/26/2023 3:17 PM

You replied to this message on 5/30/2023 9:21 AM.

[CAUTION - EXTERNAL EMAIL - Verify Sender]

I am unable to attend any of the meetings, but I have strong feelings about fluoride in the water.

*Why isn't it coming to a public vote? For the record, I know it has been on the ballot before and every time it was voted down by the public.

*If fluoride is so necessary for some individuals, they should purchase their toothpaste with fluoride.That is an easy fix and will not threaten those who are allergic to fluoride. In the water system no one can avoid it.

*Or is it that the city got some funds and wants to use it for fluoridation??? What about spending those funds on replacing the city's aging water mains?

I appreciate the chance to give my opinion.
Margaret Herzog
2694 E Marshall Ave
Spokane, WA 99207

Flouridation of Spokane water supply

MK Max Koedding <floorkoeddings@gmail.com>
To Fluoride System Study

Reply | Reply All | Forward | ...

Sat 5/27/2023 10:39 AM

[CAUTION - EXTERNAL EMAIL - Verify Sender]

To whom it may concern,

I am very against the flouridation of my water. There is evidence that consumption of flouride has negative side effects. There is no way that you can know how much water people are drinking, so dosage will differ between the population. Here is a little info on it, I have more if you need it.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7336600/#:~:text=Skeletal%20fluorosis%20is%20a%20metabolic,phenomenon%20endemic%20to%20developing%20countries.

I appreciate your time,
Max Koedding

(no subject)

BN Barbara Nicolai <bjbirder@gmail.com>
To Fluoride System Study

Reply | Reply All | Forward | ...

Tue 5/30/2023 9:23 AM

You replied to this message on 5/30/2023 9:36 AM.

[CAUTION - EXTERNAL EMAIL - Verify Sender]

I'm looking for the contact address or person so I can leave a public comment on the fluoridation of our water supply. Thank you.

Yes to fluoride

Sheila Benak <sbenak@gmail.com>
To Fluoride System Study
You replied to this message on 5/31/2023 9:12 AM.

Reply | Reply All | Forward
Wed 5/31/2023 7:18 AM

[CAUTION - EXTERNAL EMAIL - Verify Sender]

I am really excited at the prospect of having fluoride in the water in the city of Spokane. Studies have shown that children who live in cities with fluoridated water have less cavities. I feel this especially important for low-income children living within the city who may not have access to regular dental care. Thank you for considering adding fluoride to our water.

Sheila Benak

Water Fluoridation

evan white <evanwhite9@hotmail.com>
To Fluoride System Study; **City Council Members and Staff**
You replied to this message on 5/31/2023 1:31 PM.

Reply | Reply All | Forward
Wed 5/31/2023 1:11 PM

[CAUTION - EXTERNAL EMAIL - Verify Sender]
To Whom It May Concern:

I am writing you today to voice my support for water fluoridation in Spokane. I see day in and day out the effects of dental decay on children and adults. It is preventable and water fluoridation will be one huge step towards a greater health of our greater Spokane community. I support community water fluoridation. Community water fluoridation is important to our community's public health and to ensuring health equity. Spokane has significant oral health challenges, with a higher rate of oral health problems than many other communities across the state. Like many health issues, oral disease is higher among people with low incomes, populations of color, people with disabilities and older adults. Young children are especially vulnerable to tooth decay. Community water fluoridation is the most efficient and cost-effective way to get a good balance of fluoride to everyone in the community regardless of their age, education or income. By improving oral health in our community, we will improve overall health as well. Every other large community in the state fluoridates its water, but Spokane is the largest city in the state without fluoridated water. We are proud that we, too, will be a city that values health and equity, and that we have taken this important first step to implement this public health standard. By improving oral health in our community, we will improve overall health as well. Thank you for your work and progress towards water fluoridation, it is a great step in the right direction for the health of Spokane!

Evan White DMD

Spokane water fluoridation support

Amber Juliano <toothsaversofwa@gmail.com>
To Fluoride System Study

Reply | Reply All | Forward
Wed 5/31/2023 2:15 PM

Hello,
My name is Amber Juliano. I am the Clinical Director for ToothSavers Washington school oral health program, serving in Spokane schools since 2010. As a dental hygienist for the past 17 years and a public health advocate, I have seen firsthand the benefits of water fluoridation and the unfortunate health consequences to the children and adults in communities that lack it. This is why so many health providers support water fluoridation as a scientifically proven way to prevent tooth decay and support healthy communities. Every major health organization in the U.S. — including the Centers for Disease Control and Prevention, the American Academy of Pediatrics, the American Dental Association, the National Academy of Science — supports community water fluoridation. In Spokane, our supporters include health care providers MultiCare, Providence, CHAS, Unify; Spokane County Medical Society, Spokane District Dental Society; colleges of medicine; nonprofits; NAACP, Latinos en Spokane, and other communities of color leaders; over 120 medical and dental providers; including ToothSavers and more.
We have all come together to express our support for adjusting the level of fluoride in Spokane's water supply for the health of our community, as it is way overdue. We are so excited Spokane is finally stepping up to the plate so our families have an opportunity to reap the benefits of this safe and effective preventive measure.

Thank you so much for your time and consideration.

Sincerely,

Amber Juliano RDH, BSDH
Clinical Director
Toothsavers of Washington
(509) 676-6060
www.toothsaversofwashington.com

Fluoride

sandy_wilson57 <sandy_wilson57@comcast.net>
To Fluoride System Study
You replied to this message on 6/4/2023 11:29 AM.

Reply | Reply All | Forward
Thu 6/1/2023 7:41 AM

[CAUTION - EXTERNAL EMAIL - Verify Sender]

Hello,
My name is Sandy. I have hypothyroidism due to hashimotos. I can not have any fluoride. It makes my condition worse. There are lots of studies stating that fluoride is a neurotoxin and causes all kinds of health problems. We the people have voted no 3 times. Please do not contaminate our drinking water. Thank you.
Sandy

Fluoridation of Water is a Priority

BS Brian Seppi <brianseppi61@gmail.com>
To Fluoride System Study

Reply | Reply All | Forward | ...

Thu 6/1/2023 10:29 AM

[CAUTION - EXTERNAL EMAIL - Verify Sender]

I'm writing in support of water fluoridation in Spokane. Addition of fluoride to municipal water systems has been found to be a low cost way to improve oral health in communities. It is well known that low income , people of color, and disabled populations have challenges with oral health. The addition of fluoride to our water supply will have a larger benefit to these populations, improving their health and lowering overall health care costs.

As a physician I"m in favor of public health measures that improve the overall health of our community. Water fluoridation is a low cost way to improve the health of our community and the addition of water fluoridation is a no-brainer.

I'm fully in support of water fluoridation and hope that city leaders have the courage to place the health of the community first and adopt water fluoridation.

Brian Seppi MD .

Merri Jones CWF Support

JM Jones, Merri <merrij@ewu.edu>
To Fluoride System Study

Reply | Reply All | Forward | ...

Thu 6/1/2023 11:52 AM

You replied to this message on 6/4/2023 11:35 AM.

CWF Support_ June 2023.docx
15 KB

Hello,
I am attaching my support of CWF in Spokane, on behalf of the EWU Department of Dental Hygiene.
Thank you,

Merri Jones

Merri Jones, RDH, MSDH
Associate Professor
Eastern Washington University
Department of Dental Hygiene
she / her / hers
310 N. Riverpoint Blvd. Box E
Spokane, WA 99202
[f] 509-828-1283
Email merri.jones@ewu.edu

Fluoride

BS To Fluoride System Study

Reply | Reply All | Forward | ...

Thu 6/1/2023 12:49 PM

[CAUTION - EXTERNAL EMAIL - Verify Sender]

Hello,

I do not want Fluoride added to our water. People who don't want it should not be forced to drink fluoridated water!

Thank you.

Brenda Strange
204 W. 17th
Spokane, WA 99203

Fwd: Fluoride

Anthony Giardino <agiardino5208@outlook.com>
To Fluoride System Study

Reply | Reply All | Forward

Thu 6/1/2023 4:00 PM

Anthony Giardino
Subject: Fluoride

Please see the article written by Shawn Vestal and published in the Spokesman Review on 9/6/2020 in favor of adjusting the fluoride level in our area water supply. As we are all aware, there is a measurable and significant benefit to our children by reducing the incidence and prevalence of tooth decay. Dental caries is an infectious disease caused primarily by a bacteria called Streptococcus mutans. Once this infection is established on teeth it can progress to painful oral abscesses, cellulitis and more widespread systemic infection.
For a variety of reasons, children are more susceptible to tooth decay than most of the general population. As we enter our teens and twenties our oral microflora gradually changes and we "outgrow" tooth decay. But not completely. As we age, the bacteria in our mouth changes to a more complex makeup of potential pathogens that in some individuals leads to periodontal disease.
At the other end of the age spectrum, we again become more susceptible to dental decay. Several factors contribute, but the results are the same. We know that the bacteria and products of oral infection and inflammation enter our blood stream. This is not good for overall health, the heart and blood vessels and artificial joint replacements, etc. For people with cognitive decline, good dietary habits and effective oral home efforts often decline as well.
As teeth become mineralized while developing in our jaws, fluoride becomes part of the tooth structure through and through providing a lifetime of protection from dental decay. With professionally applied fluoride treatment as well as with tooth brushing with a fluoride toothpaste, only the outer layer is effected. These applications are beneficial but are not the same as systemic incorporation of fluoride during growth and development which would help our aging population.
As Vestal points out in his article, the dental community had a water fluoridation campaign in 2000. Dentists and other members of our dental and medical community wrote letters, dispersed educational materials, donated funding for advertisement and hired a consultant/lobbyist to help us with this effort. At the time, we thought we would be successful in passing this measure.
Hopefully the Spokane City Council and all those involved will continue to support and find success of this beneficial community health care action. Thank you on behalf of Spokane children and our aging population.

Anthony Giardino, DDS, MS
Past President (2000)
Spokane District Dental Society

Water fluoridation

Justin Racht <j_racht@yahoo.com>
To Fluoride System Study
Sun 4:57 PM
You replied to this message on 6/5/2023 9:49 AM.

[CAUTION - EXTERNAL EMAIL - Verify Sender]

As an emergency physician, I frequently care for patients with very poor dentition, which leads to complications in the short run (such as abscesses and other infections), and in the long run (chronic inflammation, which can lead to heart disease and other serious diseases). Water fluoridation is an important step towards not only preventing unnecessary emergency department visits, but also towards improving our citizens' dental health and overall health.

I and every colleague I've spoken with on this topic agrees that a citywide water fluoridation system would have a positive impact on the health of our community.

Justin Racht, MD, FACEP
Emergency Physician
Sacred Heart Medical Center
101 West 8th Ave.
Spokane, WA 99204

COMMENTS ON FLUORIDE

Scott Holbrook <earthsun51@gmail.com>
To Fluoride System Study
Reply Reply All Forward
Sun 6/4/2023 7:40 PM
You replied to this message on 6/5/2023 9:51 AM.

[CAUTION - EXTERNAL EMAIL - Verify Sender]

Kirstin Davis,

My comments on fluoride.
1-Fluoride is an industrial waste that looks similar under a microscope but is totally different.
2-Natural fluoride is living and the industrial waste is dead.
3-I have seen young kids whose teeth are totally rotten by the age of 15 because of fluoride.
4-The world has gotten along without fluoride for 6000 years we do not need it now.
5-Too much sugar is the main thing that destroys teeth and every part of the human body. Watch the video by Dr Robert Lustig The Truth About Sugar.
6-Soft drinks have too much sugar and in the natural ingredients list is Senomix. Look up the ingredients in Senomix.
7-Government has no right to decide what parents should be deciding.

Thank you
Scott Holbrook
earthsun51@gmail.com

I would like to appeal the decision to add fluoride to the city water

Arlene Badzik <funloverab@yahoo.com>
To Fluoride System Study

Reply | Reply All | Forward | ...
Sun 6/4/2023 9:32 PM

[CAUTION - EXTERNAL EMAIL - Verify Sender]

To Who it may concern:

I've known for at least 5 years that fluoride is toxic. We don't need or want more toxins in our environment! If people want fluoride in their water, they can add a fluoride tablet to their water. Is the fluoride lobby pushing this? I would like to know why it's even being considered? I wish I had learned about this sooner!
I just read an article about a study on fluoride and I am sending it to you! FLUORIDE LOWERS KIDS' IQS.

Sincerely,

Arlene Badzik

5/30/23

- BIG CHEMICAL
- › NEWS

Researchers Hid Data Showing Fluoride Lowers Kids' IQs, Emails Reveal

California's dental director and his team of researchers intentionally omitted data from a study seeking to undermine the forthcoming National Toxicology Program report linking fluoride exposure to neurodevelopmental damage in children, according to documents released last week.

By
Brenda Baletti, Ph.D.

Fluoride

Rachel Tamura <tamurachel@gmail.com>
To Fluoride System Study
You replied to this message on 6/5/2023 10:00 AM.

Reply | Reply All | Forward | ...
Mon 6/5/2023 6:38 AM

[CAUTION - EXTERNAL EMAIL - Verify Sender]

Hi there,

I am a concerned resident of Spokane that does not wish to see our public water fluoridated. I understand there is a period for public comment at this time but not sure how to participate. Will you please provide me with instruction?

In kindness,

Rachel

The above section of emails were replied to with the following response between May 23 and June 4, 2023:

At the direction of the City's elected officials, the City is finishing an engineering study that looks at how fluoride could be added to our water system and provide a good cost estimate to do that work. This comment period for SEPA is in regard to the engineering study only, effectively understanding the potential cost implications to distribute fluoride through the City of Spokane's water system if the City chooses to move forward with such a project.

Comments related to this SEPA need to be associated with the scope of the study only. The study does not address any potential environmental or public health impacts of doing so, so comments to this effect are outside the scope.

Once the study is complete, the information will be presented to the City's elected officials. These City Leaders will determine next steps and have committed to an open public discussion about this matter. Here are a few links that you may find helpful.

- Water System Fluoridation Implementation Study – Frequently Asked Questions
- **Instructions** for how **to submit comments** for this non-project **SEPA Comment Period** are contained in the **SEPA Document** on the City's **Fluoride System Study** webpage.
- General comments regarding fluoridation, i.e. that do not pertain to this non-project SEPA, can be sent to the Mayor's office at Mayor@SpokaneCity.org and the City Council office at CityCouncil@SpokaneCity.org.

Thank you for taking the time to engage and share your feedback.

What's Current Total Fluoride Intake of Spokane Residents?

CK Carol Kopf <ckopf2@optonline.net>
To Fluoride System Study

Reply | Reply All | Forward | ...

Mon 6/5/2023 4:32 PM

Before fluoridation is even considered, it must be ascertained how much fluoride residents, especially babies and children, are already ingesting and inhaling from all sources. There is no dispute that over-exposure to fluoride damages bones, children's teeth, and is neurotoxic to babies' developing brains.

Total fluoride intake should be determined before prescribing more, reported former New York State Department of Health Dental Director, J. Kumar, He wrote: "Because of the availability of fluoride from multiple sources, practitioners should prescribe other forms of fluoride therapy based on an understanding of patients' total exposure to fluoride and the need for it," (NYS Dental Journal, February 1998). Few dentists, if any including him, heed that advice.

But now, as the California state dental director and American Dental Association's National Fluoridation Advisory Committee, Kumar says "my job is to promote fluoridation."

Never is fluoride intake tallied when communities are pressured to continue or start fluoridation. Legislators should know much fluoride children already ingest before feeding them more via their water supply.

In fact, a 1999 study specific to non-fluoridated Connersville, Indiana, showed resident children got sufficient fluoride from foods, beverages and dental products. Dentists ignored that inconvenient fact pushed more fluoride into them in 2000 after a successful lobbying effort to start fluoridation.

Fluoride sources are many:

Absent from labels, fluoride is in virtually all foods and beverages, including, soda, baby foods and all infant formulas, It's high in tea (up to 6 mg/L) and ocean fish. Grape products (raisins, juice, wine, jellies, jams) because of fluoride-containing pesticide residues. EPA allows extremely high amounts of fluoride pesticide residues on foods See "Fluoride tolerances approved by US EPA as of July 15, 2005"

Fluoride is even in chocolate and french fries.

Foods made with mechanically separated (de-boned) chicken, such as canned meats, hot dogs, and infant foods, also add fluoride to the diet (J Agric Food Chem Sept 2001) "A single serving of chicken sticks alone would provide about half of a child's upper limit of safety for fluoride," the researchers report.

Fluoride ingested daily from toothpaste ranges from 1/4 to 1/3 milligram (National Institutes of Health) "Gels used by dentists are typically applied one to four times a year and can lead to ingestions of 1.3 to 31.2 mg fluoride each time."

Fluoride is in 20% of medicines, food packaging and inhaled from air pollution

Other sources come from feed regimens of animal products, animal products; food storage containers (Teflon-coated containers); and food packaging (migration of perfluorochemicals into food).

How much is too much?

According to the National Academy of Sciences, "without causing unwanted side effects including moderate dental fluorosis," (yellow splotched teeth), the adequate daily intake of fluoride, from all sources, should not exceed: (But does)

-- 0.01 mg/day for 0 – 6-month-olds (which is in every infant formula – concentrated or not)

-- 0.5 mg/day for 7 through 12 months

-- 0.7 mg/day for 1 – 3-year-olds

-- 1.1 mg/day for 4 – 8 year olds

This is what moderate dental fluorosis looks like, according to the US Centers for Disease Control

The US Department of Health and Human Services (1991) estimated that total fluoride exposure in fluoridated communities ranges from 1.6 to 6.6 mg/day

Fluoride is also an air pollutant from glassworks, steelworks, ceramic factories, phosphate fertilizer plants, brickworks, aluminum factories, uranium smelters and coal combustion.

No evidence proves anyone is or ever was fluoride-deficient. Fluoride isn't a nutrient or essential for decay-free teeth – meaning that fluoride-free diets do not cause cavities. Fluoride is a drug with side effects. In fact, 70% of US kids are fluoride overdosed and afflicted with dental fluorosis which created a lucrative market for cosmetic dentistry because fluoride is everywhere. But tooth decay is still epidemic

The EPA regulates water fluoride levels to only protect against fluoride-caused bone damage. So It's important to know that fluoride concentration in drinking water does not equate to an individual's daily dose. Fluoridation should never begin without fore knowledge of the community's fluoride intake from all sources.

Respectfully Submitted

Carol S. Kopf

Please say NO to fluoride in our water

JK Jerry Kiefel <jknfspokane@outlook.com>
To Fluoride System Study

Reply | Reply All | Forward | ...
Mon 6/5/2023 5:07 PM

You replied to this message on 6/6/2023 9:49 AM.

[CAUTION - EXTERNAL EMAIL - Verify Sender]

One of the crowning benefits to choosing Spokane for a great place reside is our amazing indigenous fresh water supply. Unlike few places on this precious earth, good water is right here and needs our focused vigilance right now. Why put anything in it beyond what we absolutely have to? Have respect for something so vital! Thank You,
Jerry Kiefel

Sent from Mail for Windows

Support of Community Water Fluoridation

NV Nick Velis <nick@velisdental.com>
To Fluoride System Study
Cc City Council Members and Staff

Reply | Reply All | Forward | ...
Mon 6/5/2023 10:40 PM

[CAUTION - EXTERNAL EMAIL - Verify Sender]

Dear Mayor Woodward, City Council, and Members of the Spokane Community,

I am writing to you today as the President of the Spokane District Dental Society to express my strong support for community water fluoridation. As you know, Spokane is the largest city in Washington State that does not have the protective amount of fluoride in our water. This is a major public health issue, as tooth decay is the most common chronic childhood disease in the United States. According to the Centers for Disease Control and Prevention, tooth decay affects more than 90% of people by the time they reach age 20. Fluoride is a naturally occurring mineral that helps to strengthen teeth and prevent tooth decay. When added to water at a safe level, fluoride can help reduce tooth decay by up to 50%. This is not only important for children, who are more likely to develop tooth decay, but also the elderly as their dexterity diminishes.

The study that was recently conducted by the City of Spokane found that it is feasible and cost-effective to fluoridate the city's water supply. Although these estimates may be more than previously thought, the cost not to implement community water fluoridation is higher. I urge you to move forward with the implementation of balancing the fluoride in the city's water supply in order for it to be protective against tooth decay. It may be wise to convert one well at a time and while a new well is built we should incorporate the infrastructure to implement this change. This is a sound public health decision that will benefit all of our citizens, especially our children and elderly.

Thank you for your time and consideration.

Sincerely,

Nicholas Velis DDS, FAGD
President, Spokane District Dental Society

The above section of emails were replied to with the following response on June 6, 2023:

At the direction of the City's elected officials, the City is finishing an engineering study that looks at how fluoride could be added to our water system and provide a good cost estimate to do that work. This comment period for SEPA is in regard to the engineering study only, effectively understanding the potential cost implications to distribute fluoride through the City of Spokane's water system if the City chooses to move forward with such a project.

Comments related to this SEPA need to be associated with the scope of the study only. The study does not address any potential environmental or public health impacts of doing so, so comments to this effect are outside the scope.

Once the study is complete, the information will be presented to the City's elected officials. These City Leaders will determine next steps and have committed to an open public discussion about this matter. Here are a few links that you may find helpful.

- Water System Fluoridation Implementation Study – Frequently Asked Questions
- **Instructions** for how **to submit comments** for this non-project **SEPA Comment Period** are contained in the **SEPA Document** on the City's **Fluoride System Study** webpage. The SEPA comment period deadline was midnight on June 5.
- General comments regarding fluoridation, i.e. that do not pertain to this non-project SEPA, can be sent to the Mayor's office at Mayor@SpokaneCity.org and the City Council office at CityCouncil@SpokaneCity.org.

Thank you for taking the time to engage and share your feedback.

community water fluoridation

IS info smilespokane.org <info@smilespokane.org>
To Fluoride System Study

Reply | Reply All | Forward

Mon 6/5/2023 3:19 PM

060523_Public Comment from Smile Spokane_final.docx
42 KB

[CAUTION - EXTERNAL EMAIL - Verify Sender]

Please see our attached letter of support for community water fluoridation including the extensive list of community partners.

Heather Wallace
(she, her, hers)

Attached document:

SmileSpokane
Healthier Teeth,
Healthier Lives

We are so grateful the City is listening to the community — and listening to science — and moving water fluoridation forward. This is an important step to ensuring our community's public health and to ensuring health equity.

Our network, Smile Spokane, formed in 2015 with the hopes of addressing Spokane's significant oral health challenges. We have worked hard to connect Medicaid patients to dentists and oral health care, integrate oral health screenings into doctor visits, provide sealants to kids in schools, and much more.

We especially want greater health equity in Spokane and fluoridation is the best way to do it. Fluoridation works regardless of race, zip code, stage in life, savings, income, job status, or who our parents happen to be. And it is the most cost-effective way to improve oral health when compared to everything else that we have tried or could try.

Fluoridation is improvement to our built environment, allowing each of us the opportunity to maximize our oral health potential.

We applaud our city for taking this important step to complete the feasibility process. However, we were dismayed to see that the City chose to do a SEPA on the study, even though the study had no environmental impacts. Arguably, WAC 197-11-845 makes the City's fluoridation proposal exempt from SEPA review.

Although we understand the SEPA process to be symbolic, we provide these comments in hopes of a clear, transparent, and efficient design and build process.

We recommend caution not to overstate the risk of fluoridation within the SEPA. Overall, we are happy to see standard protocols of environmental protection are outlined in the proposal. Here are a few specific places where risk assessment could be improved.

1) The approach to storage and protective measures will be like other drinking water treatment technologies the City currently uses, like chlorine. The risks are well known and manageable.

- Over 73% of US water systems currently operate fluoridation systems. Standards for safety in operating the systems have been well established and implemented over decades of practice at multiple levels of governmental jurisdiction. Accidental spills are exceedingly rare, and even in these cases, the environmental risks are limited. They can be contained locally without any inhalation risk, or when spilled into waterways, will quickly dilute to safe levels, likely within hours in the Spokane River even with a large spill, leading to no long-term effects.
- Fluoridation has been a feature of American water systems since the first one was installed over 75 years ago. The processes and procedures for maintaining and operating these systems have been proven over decades. The project would include redundant design features and safety measures to prevent overfeed.

2) Clearly highlight when a project site will be added to existing infrastructure locations, otherwise impacts will be exaggerated.

- Well sites that are pre-existing already see traffic from Operations and Maintenance Staff, including delivery traffic and monitoring. We do not anticipate traffic significantly increasing.
- Existing sites have already been reviewed for cultural and historical significance.

We'd like to restate that **community water fluoridation has no environmental impact other than making it easier for Spokane residents to be healthy.**

Improved dental health due to fluoride means reduced demand for dental treatments such as fillings, extractions, and other restorative procedures. Fluoridation contributes to the sustainability of oral health infrastructure, including dental clinics and hospitals, by reducing the need for extensive dental interventions and emergencies. Improving the general oral health in the population, in turn, can lead to overall better health and well-being, potentially reducing the burden on healthcare systems. These are considerations of the built environment.

Spokane physicians, dentists, and other health experts support community water fluoridation. In Spokane, our supporters include:

- MultiCare Health System
- Providence Health Care
- Providence Medical Group
- CHAS Health
- Unify Community Health (Yakima Valley Farm Workers Clinic)
- Kaiser Permanente
- Spokane County Medical Society
- Spokane District Dental Society
- Washington State University College of Medicine
- UW School of Medicine
- Eastern Washington University Department of Dental Hygiene
- Washington Association for Community Health
- Community Health Worker Coalition for Migrants and Refugees
- Spokane NAACP Branch #1137
- The Carl Maxey Center

- Latinos en Spokane
- I Did the Time
- Asian Pacific Islander Coalition, Spokane Chapter
- Latino Community Fund of Washington State
- Spokane Public Schools Board of Directors
- Spokane Public Schools Foundation
- Washington State Association of Head Start and ECEAP
- School Nurse Organization of Washington
- Children's Alliance
- Communities In Schools of Spokane County
- Toothsavers of Washington
- Spokane County United Way
- Spokane Housing Authority
- Spokane Low Income Housing Consortium
- Spokane Regional Labor Council
- Statewide Poverty Action Network
- Spokane Treatment and Recovery Services
- Smile Spokane
- Better Health Together
- Empire Health Foundation Community Advocacy Fund
- Health Sciences Student Advocacy Association
- Greater Spokane Progress
- Leadership Spokane
- League of Education Voters
- Priority Spokane
- Spectrum Center Spokane
- Volunteers of America
- More Equitable Democracy
- Arcora Foundation
- Washington Dental Hygienist Assocation
- Washington State Dental Association
- Amerigroup
- Community Health Plan of Washington
- Coordinated Care
- Delta Dental of Washington
- Molina Healthcare of Washington, Inc.
- Premera Blue Cross
- Over 120 medical and dental providers

We have all come together to express our support for adjusting the level of fluoride in Spokane's water supply for the health of our community. If we care about health equity, then water fluoridation is long overdue in Spokane.

Sincerely,
Smile Spokane

Duplicate comment from Smile Spokane was emailed by Heather Wallace on June 5, 2023:

Community Water Fluoridation

Heather Wallace <Heather@BetterHealthTogether.org>
To Fluoride System Study
Mon 6/5/2023 3:54 PM

If there are problems with how this message is displayed, click here to view it in a web browser.

[CAUTION - EXTERNAL EMAIL - Verify Sender]

We are so grateful the City is listening to the community — and listening to science — and moving water fluoridation forward. This is an important step to ensuring our community's public health and to ensuring health equity.

Our network, Smile Spokane, formed in 2015 with the hopes of addressing Spokane's significant oral health challenges. We have worked hard to connect Medicaid patients to dentists and oral health care, integrate oral health screenings into doctor visits, provide sealants to kids in schools, and much more.

We especially want greater health equity in Spokane and fluoridation is the best way to do it. Fluoridation works regardless of race, zip code, stage in life, savings, income, job status, or who our parents happen to be. And it is the most cost-effective way to improve oral health when compared to everything else that we have tried or could try.

Fluoridation is improvement to our built environment, allowing each of us the opportunity to maximize our oral health potential.

We applaud our city for taking this important step to complete the feasibility process. However, we were dismayed to see that the City chose to do a SEPA on the study, even though the study had no environmental impacts. Arguably, WAC 197-11-845 makes the City's fluoridation proposal exempt from SEPA review.

Although we understand the SEPA process to be symbolic, we provide these comments in hopes of a clear, transparent, and efficient design and build process.

We recommend caution not to overstate the risk of fluoridation within the SEPA. Overall, we are happy to see standard protocols of environmental protection are outlined in the proposal. Here are a few specific places where risk assessment could be improved.

Arcora Foundation comments on Non-Project SEPA DNS re: Water System Fluoridation Implementation Study

Alison Mondi <amondi@arcorafoundation.org>
To Fluoride System Study
Cc Vanetta Abdellatif; Eboné Anderson; Stacy Torrance
Mon 6/5/2023 4:40 PM

Arcora Comments on Spokane DNS.pdf
199 KB

[CAUTION - EXTERNAL EMAIL - Verify Sender]

Thank you for the opportunity to comment on the non-project SEPA Determination of Non-Significance (DNS). Comments from Arcora Foundation are attached. We appreciate the study getting the City closer to an understanding of what it will take to bring community water fluoridation to the residents of Spokane. We will continue to look to the City and local public health advocates on next steps.

Many thanks,

Alison Mondi (she/her)
Policy Director

(508) 380-9375
amondi@arcorafoundation.org

ARCORA Foundation
Bending the Arc of Oral Health Toward Equity

ArcoraFoundation.org

Attached document from Arcora:

ARCORA
Foundation
Bending the Arc of Oral Health Toward Equity

Public Comment from Arcora Foundation

Thank you for the opportunity to comment on the non-project SEPA Determination of Non-Significance (DNS). The City of Spokane is the recipient of grant funds from the Arcora Foundation to consider community fluoridation. The interest of Arcora and its other community partners is to cooperate fully with the City in this effort.

Though Arcora disagrees that the City of Spokane needs a SEPA analysis under WA State statute and regulation, careful review of environmental aspects of the project are worthwhile. Arcora is confident that the analysis will illustrate the lack of negative impacts related to a community water fluoridation program.

Here is a comprehensive study that researched and demonstrated the lack of impact of community water fluoridation on the environment:

> Water Fluoridation and the Environment: Current Perspectives in the United States (CDC).

As the City is aware, SEPA regulations at WAC 197-11-060 require consideration of impacts that are likely (probable), not merely speculative. And, under WAC 197-11-782:

> "Probable" means likely or reasonably likely to occur, as in "a reasonable probability of more than a moderate effect on the quality of the environment" (see WAC 197-11-794). Probable is used to distinguish likely impacts from those that merely have a possibility of occurring, but are remote or speculative. . . ."

The DNS speaks in various places about what is "possible." Spills are always possible. And in the Spokane community, native graves and historic sites are possible in many developed and developing areas. State and federal laws protect such sites, and any potential facility development would necessarily comply with such protections, including avoidance. While more disclosure is better than less, the DNS overstates issues relating to community fluoridation.

Additionally, the Court in *Clallam County Citizens for Safe Drinking Water v. City of Port Angeles*, 137 Wn. App. 214, 2020 (2007) specifically holds the City's proposal exempt from SEPA:

> WAC 197-11-845 categorically exempts from review "[a]ll actions under programs administered by the department of social and health services as of December 12, 1975," with specified exceptions. An "action" is defined as "(a) New and continuing activities (including projects and programs) entirely or partly financed, assisted, conducted, regulated, licensed, or approved by agencies; (b) New or revised agency rules,

> regulations, plans, policies, or procedures; and (c) Legislative proposals." WAC 197-11-704 (1). Thus, WAC 197-11-845 broadly exempts all new or continuing programs subject to official approval or oversight, as well as official changes in law or policy, provided that the activity occurs under a program the Department of Social and Health Services (DSHS) administers.

Based on these provisions, the City's proposal to fluoridate the public drinking water supply is an action under a program that DSHS administered on December 12, 1975. *See* former WAC 248-54-370 (1970) (fluoridation of public water supplies was formerly regulated by DSHS). That the Department of Health currently administers the same program does not affect this interpretation. The City's proposed fluoridation program could not occur without the Department of Health's approval and continuing oversight. *See* WAC 246-290-460. The proposal is an action "under" the Department of Health's fluoridation program because it is bound by its requirements and subject to its authority. **Accordingly, WAC 197-11-845 makes the City's fluoridation proposal exempt from SEPA review.** (Emphasis supplied.)

See also, City of Port Angeles v. Our Water-Our Choice, 170 Wn.2d 1 (2010) (citing the *Clallam County Citizens* holding that a decision to fluoridate is made pursuant to state Department of Health's program).

The completion of a draft feasibility study is a positive step for Spokane residents. Everyone deserves to have access to a modern health standard like community water fluoridation, regardless of where they live. The draft study allows Spokane to explore in earnest the benefits of joining the majority of U.S. residents (73%) who enjoy the advantages of community water fluoridation with improved oral health, fewer cavities, and greater health equity.

We appreciate the study getting the City closer to an understanding of what it will take to bring community water fluoridation to the residents of Spokane. We will continue to look to the City and local public health advocates on next steps.

Vanetta Abdellatif

Vanetta Abdellatif
President and CEO, Arcora Foundation

Fluoride System Study

KH Katie Hakes <drkhakes@icloud.com>
To Fluoride System Study

Reply | Reply All | Forward

Mon 6/5/2023 4:55 PM

[CAUTION - EXTERNAL EMAIL - Verify Sender]

Katherine Miller, Public Works
Director, Strategic Initiatives & Development
Phone: (509) 625-6700
Email Contact: fluoridesystemstudy@spokanecity.org

Thank you for the opportunity to comment on the non-project SEPA Determination of Non-Significance (DNS). I support the City of Spokane's determination of non-significance, as the study has no impact on the environment. While not the purpose of this SEPA, it should also be noted that community water fluoridation would have no impact on our environment.

As a dentist for more than 30 years who lives and cares for patients within our community, I'd like to go on record and share with you that I support water fluoridation because it is an extremely affordable way to provide a health benefit to all people regardless of income or age. Water fluoridation has a proven track record of protecting teeth against cavity-causing bacteria for more than 75 years.

Having grown up and trained in communities throughout Washington state, I have witnessed the marked difference among patients who have access to fluoridated drinking water and those who do not. Children and adults living in communities without fluoridation have higher rates of cavities, and the severity is exacerbated among lower income or uninsured families who experience barriers to yearly checkups and preventive care.

Water fluoridation for Spokane would provide added protection to help keep us healthy throughout our lives. The completion of the feasibility study is a positive step forward for Spokane Residents and I look forward to seeing the next steps from our city and local public health advocates.

Katie Hakes, DDS

Katherine M. Hakes, DDS, FAGD, FICD
Integrated Dental Arts, PLLC
5011 W. Lowell Avenue, Suite 130
Spokane, WA 99208
509-464-3100 (o) 509-464-3200 (f) kmh@identalarts.com

Comments on Spokane Fluoridation SEPA Documents

SW Safe Water Spokane <safewaterspokane@gmail.com>
To Fluoride System Study

Reply | Reply All | Forward

Mon 6/5/2023 6:06 PM

word -spokane sepa comments.docx
22 KB

[CAUTION - EXTERNAL EMAIL - Verify Sender]

Dear Ms. Katherine Miller:

Please find our community organization's comments to the Spokane Fluoridation SEPA Document attached below.

Thank you,

Jeff Irish
Chair, *Executive Committee*
Safe Water Spokane

Attached document from Safe Water Spokane:

To:
Katherine Miller
Director of Strategic Initiatives & Development
City of Spokane
2nd Floor, City Hall
808 W. Spokane Falls Blvd.,
Spokane, WA 99201-3342

**Submitted via email <fluoridesystemstudy@spokanecity.org on June 5, 2023.*

Comments on the Spokane Fluoridation Non-Project SEPA Document & Appeal of Determination

Submitted by the volunteer Executive Committee of Safe Water Spokane

Email: safewaterspokane@gmail.com

The SEPA document is incomplete, and therefore the full environmental impacts have not been adequately assessed.

Our review found that some of the most obvious and foreseeable environmental and health impacts have been overlooked and excluded from the report.

- **Negative Health Outcomes:** The potential for harm to residents and the environment resulting from exposure to fluoridation chemicals if fluoridation is implemented could be substantial. The SEPA assessment failed to consider the impact of substantially elevated chronic fluoride exposures for consumers, and didn't consider any mitigating measures, especially for those who are hypersensitive, pregnant, bottle-fed, or have impaired kidney, liver or thyroid function.

    - **Overexposure to fluoride**: there is no evidence that Spokane residents are in need of additional fluoride. No entity has assessed current resident exposures, blood serum levels, or urinary fluoride levels. Peer-reviewed literature has shown that many citizens are already overexposed to fluoride from toothpaste alone. EPA data also shows that the largest source of exposure to fluoride for residents living in fluoridated communities is the drinking water. Studies have also repeatedly shown that pregnant women living in fluoridated communities have significantly higher urinary fluoride levels than their counterparts living in non-fluoridated communities:

    - **Dental fluorosis**: CDC NHANES data shows that 70% of adolescents in the U.S. now have a visible biomarker of overexposure to fluoride called dental fluorosis. Increasing fluoride levels will absolutely increase fluorosis rates substantially in Spokane children, causing this permanent and unsightly enamel defect, and increasing decay:

      CDC Data on fluorosis:
      https://www.sciencedirect.com/science/article/pii/S0147651321005510?via=ihub

    - **Neurotoxicity for developing children (fetus & bottle-fed infants):** There is now a large body of government-funded research indicating that fluoride is neurotoxic, and is associated with lowered IQ in children and a significant increase in ADHD diagnosis and related behaviors in children at doses experienced in fluoridated communities. Experts in toxicology have likened the size of the effect to that from lead.

Examples include, but are not limited to:

1) Green 2019: published in the Journal of the American Medical Association's journal on *Pediatrics*. It reported substantial IQ loss in Canadian children from prenatal exposure to fluoride from water fluoridation.

2) Riddell 2019: published in *Environment International*. It found a shocking 284% increase in the prevalence of ADHD among children in fluoridated communities in Canada compared to non-fluoridated ones. Studies finding similar results were also published in 2018 and 2015.

3) Till 2020: published in *Environment International*. It reported that children who were bottle-fed in Canadian fluoridated communities lost up to 9 IQ points compared to those in non-fluoridated communities.

4) The first ever published benchmark dose analysis (Grandjean et al.) conducted on maternal fluoride exposure and fetal brain development was recently published in the journal *Risk Analysis*. The paper's authors ultimately concluded that a maternal urine fluoride concentration of 0.2mg/L was enough to lower IQ by 1 point, and that even this impact is likely underestimated.

5) See more studies: https://fluoridealert.org/wp-content/uploads/FAN-Neurotoxicity-One-pager-3-10-20.-pdf.pdf

The National Toxicology Program has conducted a 6-year systematic review of fluoride's neurotoxicity to the developing brain. It found that 52 of 55 human brain studies found lower IQ with higher fluoride exposures, demonstrating remarkable consistency. Of the 19 studies rated highest quality, 18 found lowering of IQ. The meta-analysis could not detect any safe exposure, including at levels common from drinking artificially fluoridated water. https://www.prnewswire.com/news-releases/government-report-finds-no-safe-level-of-fluoride-in-water-fluoridation-policy-threatened-301774635.htm

Clearly, hundreds of Spokane children will have brain development impaired every year if fluoridation levels in water are artificially increased through fluoridation.

- **Hypersensitivity:** allergic reactions to fluoride, which includes a variety of harmful conditions, affects about 1% of the population – putting over 2,000 Spokane residents at risk. https://belmont-dental.com/fluoride-allergy/

- **Thyroid impairment:** Numerous peer-reviewed studies have linked fluoridated drinking water to increased rates of hypothyroidism: https://fluoridealert.org/articles/new-study-links-fluoridation-to-hypothyroidism-in-pregnancy/

- **Kidney and liver impairment:** CDC data published in peer-reviewed literature indicates that fluoridated water impairs kidney and liver function in adolescents: https://www.sciencedirect.com/science/article/pii/S0160412019309274

- **Additional Concerns:** CDC data have been used in recent published peer-reviewed studies to link fluoridated water with a number of additional side effects, including earlier onset of menstruation for black teens, sleep disorders in adolescents, and increased uric acid levels in blood.

- **Inadequate Reporting Regulations:** No assessment was conducted on the environmental or health impacts of an overfeed, which are very common. The health and safety of Spokane residents could be greatly impacted by the current lack of state and local regulations on reporting requirements for overfeeds resulting in high fluoride levels for residents.

  Here is a list of some of the fluoridation related overfeeds that have occurred in the United States in recent years. Regardless of mitigation measures, overfeeds still manage to occur, and hundreds have been sickened with acute fluoride poisoning: https://fluoridealert.org/content/recent-fluoridation-related-accidents/

  Neither Washington State or the City of Spokane have regulations or guidelines in place to adequately report overfeeds to residents in a speed and manner that protects public safety. In fact, current state recommendations suggest that fluoride levels can increase up to a dangerous level of 30 PPM without the public being notified for up to 12 months after the incident occurred. This ensures that Spokane residents are at elevated risk for acute exposures if an overfeed occurs.

  See Washington's recommended, rather than required, actions following a fluoride overfeed: https://doh.wa.gov/sites/default/files/legacy/Documents/Pubs//331-609.pdf

- **Contaminants in the Fluoridation Additive:** Fluorosilicic acid is primarily derived from the wet scrubber systems that capture the toxic exhaust fumes of phosphate fertilizer factories. Because of this, it is heavily contaminated with environmental toxins, including aluminum, lead, barium, copper, manganese, iron, and significant levels of arsenic. This is well documented in certificates of analysis of fluoridation chemicals accompanying batches sold to other fluoridating communities, as well as in peer reviewed research (Mullenix, 2014).

The level of arsenic found in fluoridation chemicals is not trivial. According to a review in the American Water Works Association's publication Opflow, the amount of arsenic that fluoridation adds to finished water "is hardly a minimal amount."

The SEPA assessment fails to include any environmental assessment of these contaminants, and therefore doesn't identify any mitigation measures to avoid adverse impacts. These include impacts on water consumers, groundwater levels of these contaminants—especially arsenic-–or the impact these contaminants would have in higher concentrations found in the raw FSA if a spill or overfeed occurs.

Suggested mitigation measures may include 1) not adding fluorosilicic acid or fluoridation chemicals to the drinking water; or 2) procuring fluoridation additives that have been purified with contaminants removed. This second option would generate additional costs since these products are more expensive. An additional mitigation measure that was not included but is suggested would be to independently batch test each FSA shipment purchased by the City of Spokane. Currently, NSF regulations do not require wholesalers to test every batch, and contaminant levels vary from batch to batch.

- **Corrosion of Existing Water Infrastructure:** FSA is known to be highly corrosive, as noted in the SEPA document. While consideration was given to the maintenance of the fluoridation injection equipment, the maintenance, repair, and replacement costs on existing water system infrastructure caused by the corrosive nature of fluoridation chemicals were not adequately taken into consideration. There are countless examples of FSA shortening the lifespan of pipes and equipment the closer they are to the injection site.

Example: https://fluoridealert.org/news/attica-fluoridation-of-water-discontinued/

No assessment was done on corrosion to the water infrastructure in the event of an overfeed. Recently, in Sandy, Utah a power failure caused a large overfeed, which resulted in the water turning teal in households as it leached metals from the drinking water infrastructure and piping in homes. This event sickened 239 people: https://www.deseret.com/utah/2020/2/6/21127035/sandy-flouride-overfeed-investigation

No assessment was done on effects of the lower water PH that the highly acidic FSA will cause, which could potentially leach lead, iron, and aluminum from the water infrastructure and from fixtures in homes.

Here is an example: https://fluoridealert.org/news/patton-borough-water-department-to-end-fluoridation-on-or-after-oct-31-2016/

- **Corrosion Inhibitors:** FSA is very acidic and will lower the pH of the drinking water. A typical mitigation effort employed by water treatment facilities to reduce FSA corrosion is to add chemical inhibitors to stabilize the pH. There is no mention of or assessment of the effects these corrosion-inhibiting chemicals may have on the infrastructure, groundwater, employees, water consumers, or environment.

- **Hazmat Response:** In the event of an FSA spill, there will be an extra financial burden placed on existing city services, including fire, ambulance, and police. The spill mitigation response at area well sites or on city streets during transport and delivery of fluoridation chemicals could be substantial.

  On pages 20 and 33 of the SEPA document, the need for advanced and specialized hazmat training and equipment due to an FSA spill or accident is not included but ought to be. There will also be an increase in public service needs during a spill because the standard protocol for FSA is to evacuate the surrounding area. Since 5 of 8 pump houses are in residential areas, the need for additional services would be greater. There would also need to be an increase in public services to adequately and urgently communicate with the public in the case of a spill or overfeed.

- **Evacuation During Spills:** The SEPA document did not include the known need to evacuate surrounding areas in the case of a FSA spill or fire. FSA fumes are highly toxic. Since 5 of 8 pump houses are in residential areas, this ought to be included.

- **Deliveries of FSA:**

  - Regular Deliveries - The assessment failed to include the noise, emissions, and wear on roads from tractor trailers delivering FSA to the facilities every six weeks, year round. The assessment only looked at noise and emissions from vehicles during construction. These issues ought to be included on page 11 in sections (a) and (b). On page 22, additional noise from deliveries should also be included.

    - Weight Restrictions - Seasonal weight restrictions on many neighborhood roadways serve to preserve residential streets. Fluoridation chemical delivery vehicles will likely exceed these weight restrictions and cause significant wear and tear on area roadways.

- **Threat to Water Treatment Staff:** Fluoridation chemicals pose a significant health risk to city workers tasked with handling the chemicals and monitoring the equipment. The assessment doesn't include mention of this increased environmental health risk to staff. Skin exposure to FSA can quickly cause shock and be fatal. The fumes produced by FSA can also cause hospitalization or be fatal to staff.

  Accidental mixtures of FSA with other chemicals during delivery can quickly be fatal, as was experienced recently in Tennessee: https://www.tn.gov/content/dam/tn/workforce/documents/Employees/SafetyHealth/tosha/fatalityinvestigationarchive2020/10ChemicalExposureInspection1476489AmericanDevelopmentCorporation.pdf

  Example #2: https://fluoridealert.org/news/danville-water-treatment-plant-several-treated-at-hospital-after-chemical-accident/

  The SEPA document did not include mitigation efforts to reduce the chances of mistakenly mixing chemicals during delivery (see example from Tennessee referenced above).

  The assessment also did not include the health threat to people transporting the FSA to the Spokane facilities. Accidents during transportation occur with some regularity, and threaten the ecosystems, residents, and first responders near the spills.

  Here is an example of a recent FSA spill during transport that caused a fatality: https://fluoridealert.org/wp-content/uploads/fluorosilicic-fine-250000.ontario.pdf

  Example #2 – https://wlos.com/news/local/hazmat-spill-nc226-mitchell-county-road-closed-red-hill-emergency-management-hydrofluorosilicic-acid

- **Spokane River:** While the SEPA document admits that the Well Electric site is on the Spokane River and suggests mitigation efforts, it fails to assess the environmental impact of the 10,000 gallons of FSA stored at this site entering the river as a result of a spill. The document assumes that the mitigation efforts will be adequate, but recent examples of FSA spills indicate that assumption is incorrect.

  Example #1: https://fluoridefreefairbanks.org/fluoridation-chemical-incidents/

  Example #2: https://fluoridealert.org/news/martinsville-to-pay-for-spill-of-fluorosilicic-acid-from-water-department-fish-kill/

  This risk ought to be included, as well as an assessment of how it would impact water fluoride levels, residents downstream, plants, and animals.

- **Floods:** The document indicates that the Well Electric site is in a flood zone along the Spokane River. However, no assessment is made about the impact of 10,000 gallons of FSA stored at that site entering the Spokane River due to flood damage. No mitigation measures to prevent this are included either.

- **No Assessment of Impact on Fluoride Levels in Surrounding Groundwater:** This project will significantly increase fluoride levels in the Spokane water system and also in the wastewater and drainage (sprinklers, hoses, etc.). The SEPA document did not include an assessment of how fluoride levels in discharges from the water supply will increase fluoride levels in nearby groundwater and in the drinking water of surrounding communities, as well as in area watersheds, rivers, streams, and ecological habitats.

  Studies have shown that fluoride levels in groundwater increase as samples are taken from locations closer and closer to artificially fluoridated communities. By increasing the fluoride levels in Spokane water by 700%, you will also increase the fluoride levels in wastewater and surrounding ground and surface water.

- **Impact on Salmon:** No assessment was done on the impact fluoride will have on salmon. The Spokane River flows into the Columbia River, and the 1989 Damkaer/Dey study in the Columbia River found that fluoride at 0.5 parts per million (ppm) harms the migration of salmon. It concluded that it may be harmful at levels as low as 0.2 ppm. (http://images.bimedia.net/documents/John+Day+Dam+study.pdf)

  In 1994, based on numerous environmental studies, British Columbia recommended a fluoride level no higher than 0.2 ppm for salmon. (http://sonic.net/kryptox/environ/salmon.htm)

- **Impact on Caddisfly Larvae:** The SEPA document did not include an assessment of the impact on caddisfly larvae. This insect is identified as a species of greatest conservation need under the State Wildlife Action Plan. The 2002 Camargo study found that fluoride concentrations as low as 0.5 ppm could adversely affect caddisfly larvae. (https://fluorideresearch.files.wordpress.com/2014/01/fluoride-toxicity-to-aquatic-organisms-a-review-julio-a-camargo.pdf)

- **Bull Trout:** The assessment didn't provide enough information to adequately assess the impact on the bull trout. While the document mentions this endangered species, it does not indicate that any studies have been conducted confirming that FSA—whether in wastewater or in raw form from a spill-–is safe for bull trout. The absence of studies confirming safety means that an impact is unknown, rather than non-significant.

- **Home Values:** Home values could also be negatively affected as our neighborhood well houses are transformed from small buildings housing our fresh water sources into larger toxic chemical storage facilities. As noted in the report(s), new, larger buildings with larger footprints will be constructed at each well facility. Chemically hardened driveways and spill mitigation infrastructure will be installed to handle heavy chemical delivery vehicles and more frequent city employee traffic. The addition of six foot perimeter security fencing and lighting will change the look and feel of our neighborhoods, resulting in a negative impact on residential property values.

- **Overfeeds:** While the document admits that the public is at risk from overfeeds, no assessment is offered as to the negative health impact of an overfeed.

  Also, no mitigation measures are discussed in the case of a power failure that causes an overfeed, as was recently experienced in Sandy, Utah: https://fluoridealert.org/content/sandy-utah-february-2019-drinking-water-contamination-event/

The Determination of Significance is not supported by findings or conclusions.

Safe Water Spokane believes that the SEPA/financial cost analysis is inadequate and the conclusion is not supported as the report is at best incomplete and at worst incorrectly or inadequately assessing the environmental and health harm posed to residents and the environment.

Since the environmental and health burden on our community would be substantial, we urge the City Council to pursue more effective alternatives to combat dental decay that are actually safe for all residents, public works employees, and the environment.

Moreover, according to the state website describing SEPA, the Act is intended to "stimulate public health and welfare."

- Fluoride in water is classified and regulated by the US Environmental Protection Agency (EPA) as a contaminant. Therefore, the practice of fluoridation increases the level of a known contaminant in the public's drinking water.

- The additive Spokane intends to use to increase fluoride levels, fluorosilicic acid, is a highly corrosive hazardous waste product primarily derived from the wet scrubber systems of phosphate fertilizer factories. Batch analyses conducted by the National Sanitation Foundation and fluorosilicic acid producers show that this additive is also contaminated with other toxins, including heavy metals and significant levels of arsenic.

Therefore, adding fluorosilicic acid to the water supply and exposing Spokane residents to elevated levels of an environmental toxin directly contradicts the intent of SEPA. A determination of non-significance is indefensible in this case.

There are alternatives that address the proposal's purpose and need.

There is no need to add FSA to the public's drinking water, as 97% of the world has experienced the same decrease in dental decay as the U.S. while simultaneously rejecting the practice of artificial water fluoridation.

Alternative solutions to combat dental decay include fluoride toothpaste, which is widely available and easy to access for all Spokane residents. It's inexpensive-–a few dollars will buy a supply lasting several months for a family—it's more effective than fluoridation at preventing decay, and it isn't swallowed, so there is significantly less risk.

Other alternatives include the expansion of school-based dental programs, like annual dental screenings, sealant programs, and mid-level providers offering cleanings and referrals to treatment.

Also, for those who choose to ingest fluoride, supplements are available by prescription from doctors, dentists, and pharmacists in Washington State. They're inexpensive and widely available. Fluoridated bottled water is also available online and in some Spokane grocery stores. Alternatives to fluoridation abound.

Thank you,

Jeff Irish & Steve Busch
On behalf of the Safe Water Spokane Executive Committee
www.SafeWaterSpokane.Org

Email: safewaterspokane@gmail.com

The above section of comments received this response on June 6:

Thank you for taking the time to engage and share your feedback. Once the study is complete, the information will be presented to the City's elected officials. These City Leaders will determine next steps and have committed to an open public discussion about this matter.

Sincerely,

Kirstin

Other Comments/Responses:

Katherine Miller spoke to Stacey Stockton on Thursday via phone and indicated this email is the appropriate place to leave her comments. Kirstin Davis sent Stacey a modified version of the general response above.

Water System Fluoridation Implementation Study

Stacey Stockton <stacey.stockton99223@gmail.com>
To Fluoride System Study

Reply | Reply All | Forward

Thu 6/1/2023 12:17 PM

[CAUTION - EXTERNAL EMAIL - Verify Sender]

Hello!
I just left a VM as well.
I would like to comment on this as a concerned citizen but I'm not sure if I am doing this correctly.
When I click on the SEPA document (50 Pages) there is a place to comment on Page 3 and requires authorized signature and department or agency. I am a concerned citizen so not sure I am in the right place.
Also, are we to send it to everyone on the list (page 2) or to this email address or to Katherine Miller Directly?

I have a lot of concerns about this Fluoridation project.

1. It was already voted down 3 times by the people. Why is the City Council not honoring this? What is this evaluation costing us taxpayers?
2. Multiple references to Project Level SEPA review. What is the point of this preliminary review? How much are each of these costing the taxpayer?
3. The statement copy and pasted below, baffles me beyond belief. How can adding toxic chemicals to our water supply not have an adverse impact on the environment?

"The lead agency for this proposal has determined that it does not have a probable significant adverse impact on the environment. An Environmental Impact Statement (EIS) is not required under RCW 43.21C.030(2)(c). This decision was made after review of a completed Environmental Checklist and other information on file with the lead agency. This information is available to the public on request"

4. #3 - The liquid chemical has a potential for spill and contamination of groundwater. But we are OK pouring it into our water ? This makes zero sense to me.
5. We need to treat manhole covers to protect the concrete- But we are OK pouring it into our water?
6. Cost - As it relates to the environment I am not sure that all costs for implementing the addition of toxic chemicals to our water have been accounted for. (Handling of the chemicals, spills, exposure to those living near these stations etc)
7. I have other concerns but they are related to health and not environment per se.

Please advise on appropriate process for submitting comments.

Thank you
Stacey

Dale Arnold was not responded to, however his comments are included in the feedback through this process.

Just 1 Comment on the Study....Likely will be addressed in final approach

DALE ARNOLD <dalear6@aol.com>
To Fluoride System Study

Reply | Reply All | Forward

Fri 6/2/2023 8:57 AM

[CAUTION - EXTERNAL EMAIL - Verify Sender]

Request that a Citation be included "the Storage of the Source of Fluoride will be stored in accordance with Spokane's Critical Materials Ordinance" ; as I'm assuming storage will be within the Aquifer Area..

Remaining Document looks well done and thought out.

Thank you for allowing comments on such an important and valuable Project for the Citizen and Customers of Spokane's Water.

Dale E Arnold
457 W. 15th
Spokane, Wa.
99203

Kirstin responded to Sandy on June 5 at 9:54 am that she could submit her comments to the FluorideSystemStudy@spokanecity.org.

Comments

S sandy_wilson57 <sandy_wilson57@comcast.net>
To Fluoride System Study

Reply | Reply All | Forward

Sun 6/4/2023 8:24 PM

You replied to this message on 6/5/2023 9:53 AM.

[CAUTION - EXTERNAL EMAIL - Verify Sender]

Hello
The link to comment on the fluoride situation is a pdf to download. How do we actually comment?
Thank you
Sandy

Additional Follow-Up Emails:

Re: SEPA review to implement fluoridation in Spokane

IT Ian Thompson <ian.thompson153@gmail.com>
To Fluoride System Study

Reply | Reply All | Forward

Sun 5/28/2023 6:44 AM

You forwarded this message on 5/30/2023 9:13 AM.
We removed extra line breaks from this message.

[CAUTION - EXTERNAL EMAIL - Verify Sender]

SEPA is intended to evaluate the negative health and environmental factors. The negative health impacts from this action is completely within the scope of the action; you cannot evaluate the cost effectiveness of an action without weighing the negative impact on the population. If you are simply doing an engineering cost analysis, that is independent of SEPA/NEPA actions.

Respectfully,
Ian Thompson

APPENDIX E
FLUORIDATION IMPLEMENTATION MULTI-OBJECTIVE DECISION ANALYSIS

Fluoridation Implementation Multi-Objective Decision Analysis

Prepared for
City of Spokane

January 12, 2023

Prepared by
Parametrix
on behalf of
consor

Executive Summary

Parametrix
ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES
835 NORTH POST, SUITE 201 | SPOKANE, WA 99201 | P 509.328.3371

EXECUTIVE SUMMARY

Fluoridation Implementation Multi-Objective Decision Analysis

A Multi-Objective Decision Analysis (MODA), developed by Parametrix was conducted for the City of Spokane (City). The MODA is composed of an Alternatives Analysis (conducted by Consor), Total Cost of Ownership (TCO), performance evaluation, and alternative value assessment. Performance criteria were developed and weighted in a May 2022 MODA Criteria Workshop, the TCO analysis was prepared by Parametrix in October 2022, and lastly, a MODA Workshop facilitated by Parametrix and Consor occurred in November 2022. This Executive Summary provides an overview of the analysis and key findings as well as a brief description of the preferred fluoridation alternative.

PROJECT DESCRIPTION

The City is conducting a preliminary engineering study to understand all the elements needed to implement fluoridation if the City chooses to move forward. Previously, the design team at Consor and Parametrix provided a Fluoridation System Alternatives report that assessed three alternatives to fluoridate the water system and suggested two preferred chemical alternatives for further evaluation. The first alternative is a Liquid option using fluorosilicic acid (FSA), and the second is a Dry option using sodium fluoride (NaF).

The Parametrix and Consor teams co-facilitated an evaluation of the two final alternatives using the MODA process to select the technically preferred alternative. The preferred alternative was selected based on the City's long-term goals of balancing sustainability, social responsibility, and affordability (City's Triple Bottom Line).

ANALYSIS OBJECTIVES

The MODA is used to assist the City of Spokane in determining a preferred alternative between the Liquid and Dry options, considering several factors for each option, such as impacts to the environment, safety, service reliability, maintenance, and operations. A life cycle cost analysis was also completed, which was also used to inform an analysis of the TCO as presented later in this memorandum. Alternative costs include the initial capital costs and subsequent life cycle costs, including annual maintenance and operations costs, power and chemical costs, and subsequent replacement costs, across a 50-year life cycle. Salvage values were also taken into account. The data were calculated over the 50-year life cycle and discounted to 2022 dollars for evaluation. This type of cost analysis was not intended to understand exact costs but rather to provide information to the City in terms of the relative cost of each option and, more importantly, how they compare with each other.

The MODA takes into consideration a set of weighted performance criteria that were developed as a part of the initial phases of the study during a May 2022 workshop. The six criteria measure different impacts to the environment, neighborhoods, both public and worker safety, service reliability, and ease of maintenance and operations. City water operations personnel were brought together as a technical team to participate in the MODA process to conduct evaluations and score these criteria. The MODA model determines a calculated consensus score, which is performance-based in the application of the ratings from all participants, and an alternative value score, which is a function of performance relative to alternative cost. The alternative cost, performance, and value scores were used to develop and inform the selection of the preferred alternative.

Performance Criteria

The six performance criteria were weighted during the May 2022 workshop as follows:

- Environmental and Sustainability Impacts (*Weighting: 8%)*
- Neighborhood Impacts (*Weighting: 12%*)
- Safety – Public (*Weighting: 25%*)
- Safety – Worker (*Weighting: 25%*)
- Service Reliability (*Weighting: 15%*)
- Ease of Maintenance and Operations (*Weighting: 15%*)

Fluoridation Alternatives Analysis Results

The results from the MODA process identified the Liquid option, FSA, as the preferred alternative. It yielded the better scores for both performance and cost, scoring 5.2 and 5.7, respectively. This resulted in a value index score of 1.2, which is 39% higher when compared with the Dry alternative's score of 0.9. For a deeper explanation of the scoring system, methodology, and general formula used, refer to the Value of Alternatives section at the end of the Fluoridation Implementation Multi-Objective Decision Analysis Technical Memorandum.

Table ES-1 displays a summary of performance; TCO, which includes initial capital costs and subsequent operating costs over a 50-year life cycle; and value scores. Costs in Figure ES-1 below are adjusted to real 2022 dollars (i.e., they are adjusted for inflation and escalation and discounted over the 50-year period to represent 2022 dollars).

Table ES-1. Option Rankings

Option	TCO (USD) *50-Year Life Cycle*	Performance Score	Cost Score	Value Index	% Change
Fluorosilicic Acid – Liquid	$204,289,000	5.2	5.7	1.2	38.5%
Sodium Fluoride – Dry	$264,126,000	4.9	4.3	0.9	

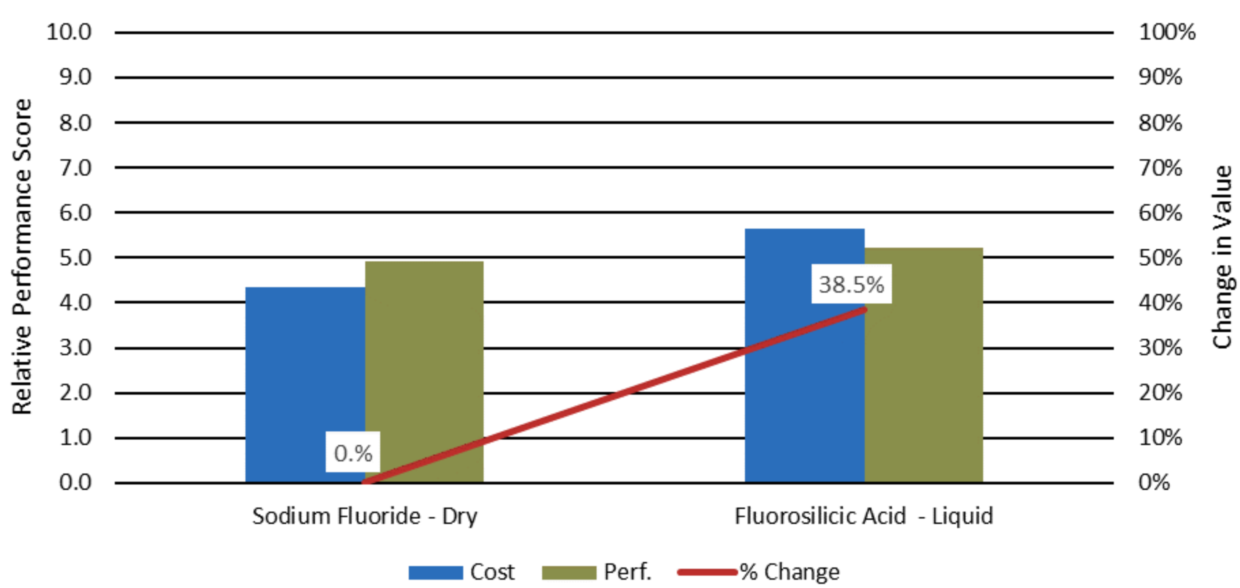


Figure ES-1. Option Ratings

The Liquid alternative is projected to be the lower cost option over a 50-year period, resulting in a better cost score. Annual operating costs were taken into consideration and include maintenance, operation of equipment, power, and chemical costs. Other one-time and periodic costs factored in were initial capital, engineering, capital and equipment replacement, and operating contingency. Salvage value of equipment was also considered.

The Dry alternative's initial capital costs are about $2 million higher. These initial capital costs also drive other costs throughout the life cycle, including engineering, maintenance, and equipment replacement. The price of the chemicals used in the fluoridation process is the most significant source of the life cycle cost differences, with the Dry alternative chemicals costing about $37 million more than Liquid over the 50-year period, which makes up 62% of the cost difference between each alternative. When considering the total cost of ownership of each fluoridation alternative, the Dry alternative costs $60 million more to own and operate over the 50-year life cycle (in real 2022 dollars).

The Liquid alternative also had a higher performance score. Both alternatives scored similarly except for two criteria: Service Reliability (6.4 compared with 5.2) and Ease of Maintenance and Operations (3.6 compared with 2.8). Given its better scores in both performance and cost, the Liquid alternative received a higher value index score, resulting in the recommendation that the Fluorosilicic Acid (Liquid) is the technically preferred alternative for fluoridation implementation if the City chooses to implement fluoridation.

Technical Memorandum

Parametrix
ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES

TECHNICAL MEMORANDUM

DATE:	January 12, 2023
TO:	City of Spokane
FROM:	Consor Mike Morse, PE, Project Manager, Parametrix Greg Brink, PMP, PMI-RMP, PMI-PBA, CCEA, CVS, Director of Strategic Advisory Services, Parametrix
SUBJECT:	Fluoridation Implementation Multi-Objective Decision Analysis
CC:	
PROJECT NUMBER:	376 4109 001
PROJECT NAME:	Fluoridation Alternatives Analysis

PROJECT BACKGROUND

The City of Spokane (City) is conducting a preliminary engineering study to understand all the elements needed to implement fluoridation if the City chooses to move forward. A technical team made up of water operators and other Water Department staff was created at the beginning of the study to help in the assessment. Initial work during this study by the design team at Consor and Parametrix, utilizing the technical team, provided a Fluoridation System Alternatives Technical Memorandum, which assessed three different alternatives to fluoridate the water system and suggested two preferred chemical alternatives for further evaluation. The purpose of this technical memorandum is to document the decision process that has resulted in a final recommendation between the two remaining options. The first alternative is a Liquid option using fluorosilicic acid (FSA), and the second is a Dry option using sodium fluoride (NaF). Detailed information and comparisons of the two alternatives can be found in the aforementioned Consor Fluoridation System Alternatives Technical Memorandum.

The Parametrix and Consor teams co-facilitated an evaluation of the two final alternatives using an objective and transparent Multi-Objective Decision Analysis (MODA) process to select the technically preferred alternative. The MODA process included a May 2022 workshop to select performance criteria for the alternatives, which were also weighted; an October 2022 Total Cost of Ownership (TCO) analysis prepared by Parametrix; and finally a November 2022 MODA Workshop with the technical team facilitated by Parametrix and Consor. The MODA Workshop was held to assign performance ratings to each alternative by applying the performance criteria to each of them and then to calculate alternative value scores based on performance ratings and alternative costs. The Parametrix team facilitated a collaborative discussion of each alternative’s overall value centered around the calculated scores, which helped select a technically preferred alternative for fluoridating the water system.

This technical memorandum provides an overview of the MODA process and details the steps and considerations taken to arrive at the technically preferred alternative, which include measuring performance using a set of performance criteria applied to both alternatives and then determining the relative value of each alternative compared with each other. The relative value of each alternative was determined using a TCO analysis and modeled over a 50-year life cycle period.

MULTI-OBJECTIVE DECISION ANALYSIS OVERVIEW

MODA is a process for making decisions involving multiple performance criteria and multidisciplinary stakeholders/decision makers. Participants in the process evaluated each proposed alternative of a project by weighting different performance criteria according to the needs and goals of the project and analyzing the tradeoffs each presents in relation to criteria selected. The process also facilitated a thorough discussion among all the technical team members. This allowed individuals to explain and justify their scoring of alternatives to the team based on their perspective, experience, and expertise. The MODA tool determines a calculated consensus that factors in ratings from all participants rather than forcing a group to reach negotiated consensus agreements. This approach allowed for many perspectives to be factored into a quantitative score.

The Parametrix team evaluated each alternative's cost and performance as well as value as a function of performance relative to cost. The Parametrix team evaluated the cost component by performing a TCO and Life Cycle Cost Analysis (LCCA) using data from the concept-level cost estimates provided by Consor. Performance was evaluated by applying weighted criteria to each alternative to calculate a performance score. Measuring performance was a multistep process that started with developing performance criteria and weighting those criteria relative to one another in a May 2022 MODA Criteria Workshop with the project team. In the November 2022 workshop, the project team and the technical team returned for a follow-up to score each alternative based on the criteria. Alternative value was determined during the November 2022 MODA Workshop by using a value formula that is a function of performance relative to cost. The value formula, which is shown below and described in more depth in the Value of Alternatives section of this technical memorandum, uses the performance score and the cost score derived from the TCO. After the value of each alternative was determined, group discussion was facilitated within the technical team regarding the conclusions.

In the following sections of this memorandum, each primary step of the MODA process will be described in further detail along with the process for determining the technically preferred alternative.

COST OF ALTERNATIVES

The cost of each alternative was measured using a TCO model that employs an LCCA. Parametrix prepared the TCO model based on the two remaining options for providing fluoridation of the City's water supply. The analysis of both the Liquid and Dry options included the initial construction costs, subsequent operations and maintenance, energy usage, chemical usage, replacement costs, and salvage benefits of the replaced equipment. The TCO considers costs across a 50-year life cycle and discounts these costs to 2022 dollars for ease of evaluation. All costs are preliminary (i.e., conceptual in nature) and developed for comparison of the alternatives and are reported in real dollars, meaning they are adjusted for inflation and escalation and discounted over the 50-year period to represent 2022 dollars. This means that future costs for both options were normalized to present value (PV) as a part of this process. The Parametrix team utilized the Association for the Advancement of Cost Engineering (AACE) International best practices, using Class 5 estimates with accuracy ranges of -30% on the low side and +50% on the high side.

The summary table and figure in the TCO Analysis Results section includes the initial and subsequent life cycle costs for the two options. These costs are based on P70 values from the uncertainty analysis for the initial and subsequent life cycle costs (i.e., a 30% chance of exceedance). P70 refers to there being a 70% probability that the costs are at or below the projected costs and a 30% probability of exceeding them based on the results of Monte Carlo analysis; it is an industry standard probability level for an LCCA.

Methodology

A TCO model or an LCCA is an economic method of project evaluation in which all costs arising from constructing, owning, operating, and maintaining, as well as subsequent replacement, of project elements are considered. LCCA is well suited to the economic evaluation of design options that satisfy the project requirements but may have differing investment, operating, maintenance, or repair costs, and possibly different life spans. It is particularly relevant to the evaluation of investments where high initial costs are traded for reduced future cost obligations (though that was not found to be the case it this analysis where the Liquid option has lower initial and subsequent costs). LCCA is one method alongside engineering, permitting, and performance criteria in the selection of a technically preferred alternative.

A probabilistic model is used to provide insight into the range of possible life cycle costs over a 50-year service life. The analysis is completed using a Monte Carlo simulation that allows for each uncertain element of the LCCA model to be observed probabilistically as opposed to deterministically. The model was simulated 10,000 times, and the statistics of each iteration were compiled to produce the range of anticipated outcomes. Each variable has been evaluated and the three-point range estimate identified for each variable, including the low, high, and most probable values. Each range identified was utilized to develop a probabilistic triangular distribution.

Basis of Life Cycle Cost Analysis

The TCO model was prepared for the project, with consideration of all initial capital costs, operations and maintenance costs, capital and equipment replacement costs, salvage value, and contingency costs. The model uses these factors to support the selection of a technically preferred alternative through economic evaluation. The TCO was prepared to reflect Parametrix's best understanding of the scope required, as provided by Consor.

Discount and Escalation Rates

The TCO normalizes costs of future periods to the PV to determine the PV of future cash flows. Therefore, the analysis applies a discounted cash flow methodology incorporating two discount rates, as provided by Consor. The base discount rates provided were then ranged based on historic data and forecasted economic analysis and applied in the PV calculations.

Periods	Base Discount Rate
1 through 20	5%
21 through 50	3%

Escalation rates were also provided and utilized in the analysis. These rates were applied on a compounding basis starting in Period 1. The most likely value of the rates varied depending on the period and are as outlined below:

Periods	Base Escalation Rate
1	12.5%
2	12%
3	8%
4 through 20	5%
21 through 50	3%

Basis of TCO Analysis

All conceptual cost estimates, including the initial capital costs, operations and maintenance costs, equipment replacement costs, contingency costs, and salvage value information, were obtained from the *Fluoridation System Alternatives – 2022.09.08* document and associated spreadsheet provided by Consor. This document contained both the data and project context that were utilized in the TCO's assumptions and overall development.

Assumptions

Key assumptions made in the analysis:

- Sites evaluated include Well Electric, Parkwater, Ray, Central Avenue, Grace/Nevada, Hoffman, and Havana.
- The Grace and Nevada sites are in one building.
- For the Dry option, Well Electric and Parkwater, the cheaper building cost of the two was applied. This capital cost is $191,000 (building 635 square feet @ $3,000/square feet).
- Consor's construction cost estimate is in dollars valued at the time of the estimate (September 19, 2022).
- Chemical costs are based on the average operating day from 2019 through 2021.
- Engineering occurs in the year 2023 (Period 1) and is 10% of the initial capital costs (sum of the capital costs in 2023 and 2024).
- Construction will begin in 2024/2025 (Periods 2 and 3). Therefore, initial capital costs are split, with 50% being allocated to 2024 and 50% to 2025. These costs are then escalated to the respective years.
- Annual operating costs begin in 2026 (Period 4).

TCO Analysis Results

Based on the summary analysis of the two options, the Liquid option has lower initial capital and engineering costs as well as lower subsequent life cycle costs than the Dry option over a 50-year life cycle based on the P70 values (see Table CA-1 and Figure 1).

Table CA-1. Total Cost of Ownership

Life Cycle Cost Estimate			
	Total Cost of Ownership (P70)	**Option 1**	**Option 2**
Life Cycle Period (Years)	50	Liquid (FSA)	Dry (NaF)
Note: Costs are in real 2022 dollars	Initial Capital	$ 13,050,000	$ 14,903,000
	Engineering	$ 1,412,000	$ 1,608,000
	Maintenance	$ 27,901,000	$ 31,853,000
	Operation of Equipment	$ 48,787,000	$ 50,878,000
	Power	$ 881,000	$ 893,000
	Chemical	$ 52,894,000	$ 89,835,000
	Capital and Equipment Replacement	$ 24,531,000	$ 28,170,000
	Operating Contingency	$ 38,719,000	$ 51,189,000
	Salvage	$ (742,000)	$ (850,000)
	Net Present Value in $2022 (NPV)	**$ 204,289,000**	**$ 264,126,000**

Note: Above costs are based on P70 values from Uncertainty Analysis

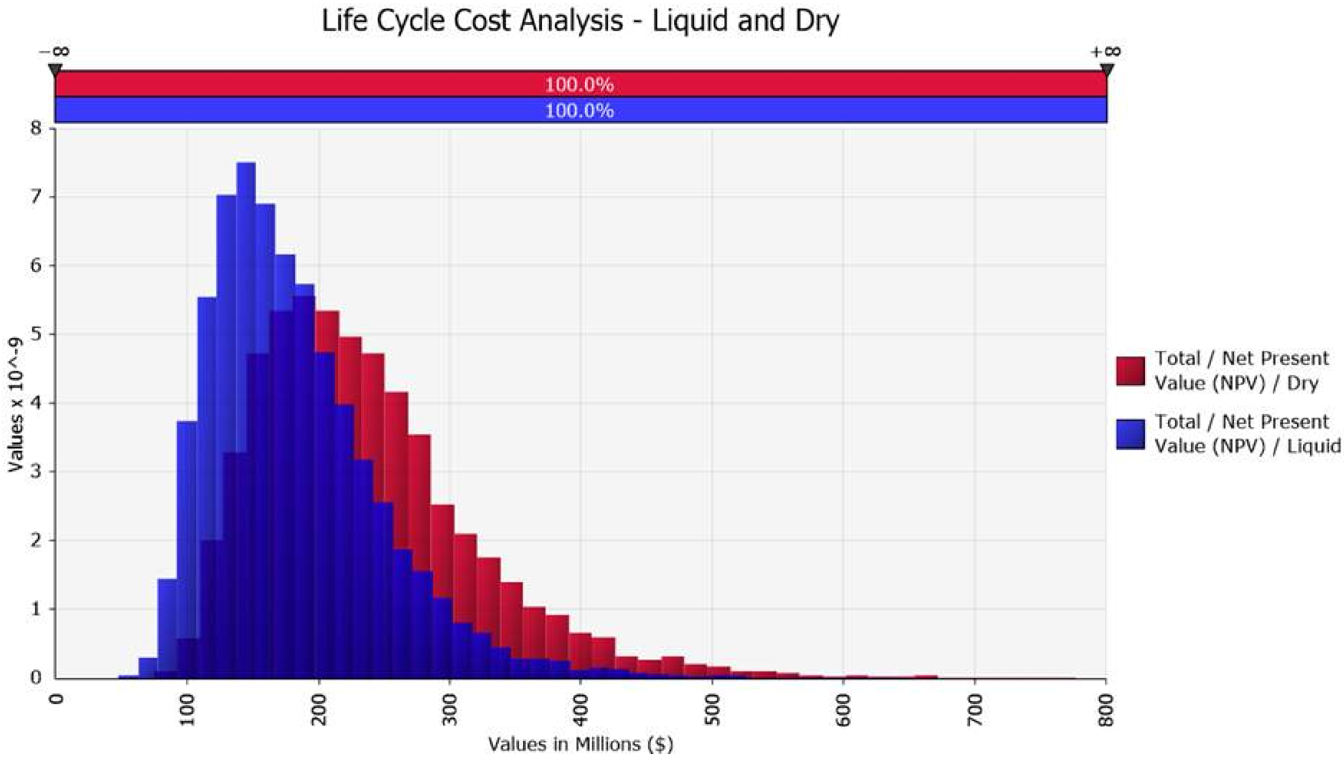


Figure 1. Example Lift Station Asset Type Criticality Formula

Key differences between the Liquid and Dry options are outlined below:

Initial Capital Costs – *Costs for construction of the fluoridation facilities and site improvements*: The Dry option requires additional infrastructure that the Liquid option does not, such as storage warehouse space for the chemicals and water softeners, which drives up the cost.

Liquid Option	Dry Option
$13.05 million	$14.90 million

Engineering Costs – *Costs for design and engineering of the project*: This is a percentage of initial capital costs, so the option with higher capital costs will have higher engineering costs as well. In this case, the Dry option has higher costs.

Liquid Option	Dry Option
$1.41 million	$1.61 million

Subsequent Costs (Total) – *Costs for subsequent operations (labor, utilities, and chemicals), maintenance, and periodic capital and equipment replacement*: The Dry option's chemical costs for NaF are significantly higher than the Liquid's FSA. Additionally, the capital replacement is naturally higher for the Dry option, as its capital and equipment that must be replaced are higher than the Liquid option.

Liquid Option	Dry Option
$192.97 million	$251.97 million

Net Present Value – *Total costs over the 50-year life cycle in 2022 dollars*: The Liquid option has the lowest net costs across all cost categories and thus has a lower net present value (NPV) over its entire life cycle.

Liquid Option	Dry Option
$204.29 million	$264.13 million

The NPV of initial and subsequent costs for the two options are using the 70% confidence interval from the Monte Carlo Analysis (described in the Methodology subsection). Both options share similar assumptions, and the largest sources of uncertainty in both estimates are the escalation and discount rates. The Dry option uniquely sees high levels of uncertainty in the chemical costs of NaF.

Equivalent Annual Cost Analysis Results

Equivalent annual cost (EAC) is the annual cost of owning, operating, and maintaining an asset over its entire life; it excludes the initial capital and engineering costs. EAC is often used by utilities for capital budgeting decisions, as it allows the agency to compare the cost-effectiveness of various assets over their usable lifespans. Essentially, the EAC is derived by taking the NPV of the TCO of the asset divided by the present value of an annuity factor, which takes into account the initial capital investment and associated operating/maintenance costs, the discount rate, and the usable life of the asset to normalize costs into an average annualized amount.

Table CA-2. Equivalent Annual Cost

Equivalent Annual Cost (EAC)			
EAC in $2022 (P70)		**Option 1**	**Option 2**
Life Cycle Period (Years)	50	Liquid (FSA)	Dry (NaF)
Note: Costs are inclusive of price escalation throughout life cycle, and does not include initial costs (Capital and Engineering)	Maintenance	$ 1,327,000	$ 1,515,000
	Operation of Equipment	$ 2,321,000	$ 2,420,000
	Power	$ 42,000	$ 42,000
	Chemical	$ 2,516,000	$ 4,273,000
	Capital and Equipment Replacement	$ 1,167,000	$ 1,340,000
	Operating Contingency	$ 1,842,000	$ 2,435,000
	Salvage	$ (35,000)	$ (40,000)
Net Equivalent Annual Cost in $2022		$ 9,180,000	$ 11,985,000

Note: Above costs are based on P70 values from Uncertainty Analysis

The EAC for the Liquid option is $9.18 million, and $11.99 million for the Dry option. These EACs are inclusive of inflation and expressed in 2022 dollars (see Table CA-2 above). That said, in standard years of operation, the annual operating costs are as low as approximately $3 million and $4 million, respectively. The average EAC is increased by years in which there are major rehabilitative cycles, when costs can be as high as $61 million and $74 million, respectively (in nominal dollars – i.e., not adjusted for inflation). Given these wide disparities in annual operating costs over the entire life of the project, the EAC gives an idea of how much money should be budgeted each year over the project and asset's usable life to account for this.

Key differences in the EAC between the Liquid and Dry options are outlined below:

Maintenance, Capital and Equipment Replacement, and Salvage – These costs represent the annual maintenance of the capital and equipment in each facility, the periodic replacement of capital and equipment as they age, and the salvage value that is recouped after equipment is replaced. These three cost inputs are derived as a percentage of the option's initial capital costs, so the option with the higher initial capital costs will have higher costs in these categories. In this case the Dry option has higher costs (note that salvage has a higher absolute value, as it is a negative cost).

	Liquid Option	Dry Option
Maintenance	$1.33 million	$1.52 million
Replacements	$1.17 million	$1.34 million
Salvage	$(35,000)	$(40,000)

Chemical – Costs for the chemicals used in the fluoridation process, FSA for Liquid and NaF for Dry. The Dry option's chemical costs for NaF are significantly higher than the Liquid's FSA, which accounts for the most significant annual cost difference between the two options.

Liquid Option	Dry Option
$2.52 million	$4.27 million

Operating Contingency – A reserve of extra funds to cover any unforeseen operating expenses or rise in operating cost inputs. The operating contingency at this stage in the project development is set to 30% of the total of regular annual operating costs, which includes maintenance, operation of equipment, power, and chemical costs. Generally, both options have similar costs for operation of equipment and power, but as described above, both the maintenance and chemical costs are higher for the Dry option. That difference drives the contingency higher for the Dry option as well, given that contingency is derived as a percentage of those costs.

Liquid Option	Dry Option
$1.84 million	$2.44 million

The primary limitations of EAC analysis are the fact that it relies on an estimated discount rate and averages costs over time. As pointed out, there can be wide variances in capital expenditures, considering normal operations relative to periods in which more substantial rehabilitative investments must be made to assets to keep them beneficially in use and operating. As such, it's always important to remember to combine EAC analysis with other capital budgeting tools, such as TCO and MODA, to make sure that the City decision makers understand the full picture regarding the investments being compared.

PERFORMANCE OF ALTERNATIVES

The performance of each alternative is measured by nonfinancial criteria representing the functional performance considerations that were developed during the May 2022 MODA Criteria Workshop. Six criteria were developed and included in the analysis, including Environmental and Sustainability Impacts, Neighborhood Impacts, Safety – Public, Safety – Worker, Service Reliability, and Ease of Maintenance and Operations. These criteria are measured on a 0 to 10 scale, from unacceptable performance to ideal performance, and weighted by relative importance to the project's needs and purpose.

During the November 2022 MODA Workshop, the criteria were applied to both fluoridation alternatives to provide average performance measurement scores. This process will be described further later in this section. Below are the detailed descriptions of each criterion and their measurements.

Environmental and Sustainability Impacts

A relative measure of the impacts to the natural environment, such as those to critical areas or the aquifer, including those attributed to the supply chain (such as carbon emissions from transporting chemicals), in the immediate vicinity of the facilities or the broader region (see Table PA-1). Includes impact on the City of Spokane's sustainability goals.

Weighting: 8%

Table PA-1. Environmental and Sustainability Impacts Scales

Rating	Label	Description
0	Unacceptable Impacts	The environmental impacts are extreme, and the project does not comply with state and/or federal environmental laws.
2	Irreversible Impacts	Significant irreversible adverse impacts, such as destroying a wetland or impact to the aquifer, OR would require a full environmental impact statement.
4	Major Impacts	Major impacts to the natural environment OR significant remediation efforts required.
6	Significant Reversible Impacts	Significant reversible impacts to the natural environment, OR any remediation efforts required, OR significant impacts to the City's sustainability goals.
8	Minor Reversible Impacts	Minor short-term reversible impacts to the natural environment, with no remediation required, OR minor impacts to the City's sustainability goals.
10	Ideal Environmental and Sustainability Impacts	It is anticipated that there will be no negative impacts to the natural environment AND no impact on the City's sustainability goals.

Neighborhood Impacts

A relative measure of the impacts to the built environment in the immediate neighborhood, including cultural, aesthetic, historical preservation, and livability impacts, such as those related to increased traffic, noise, air quality, and odors (see Table PA-2). This includes temporary impacts during construction.

Weighting: 12%

Table PA-2. Neighborhood Impacts Scales

Rating	Label	Description
0	Unacceptable Noticeable/ Lasting Disruption	The degree of noticeable and lasting disruption to the neighborhood is so significant; OR results in considerable persistent increased traffic, noise, air quality, or odors during operations; OR introduces additional environmental inequity in an area with historical inequities beyond any degree of acceptability.
2	High Likelihood of Noticeable/ Lasting Disruption	There is a high likelihood of noticeable and lasting disruption to the neighborhood, such as damage to or destruction of a historic or culturally significant building; OR persistent increased traffic, noise, air quality, or odors during operations; OR would introduce significant additional environmental inequity in an area with historical inequities.

Rating	Label	Description
4	Minor Likelihood of Uncorrectable Disruption	There is a minor likelihood of uncorrectable disruption to the neighborhood, such as damage to a historic or culturally significant building; OR significant short-term traffic, noise, air quality, or odors OR minor but persistent increased traffic, noise, air quality, or odors during operations; OR would introduce minor additional environmental inequity in an area with historical inequities.
6	Moderately Likely Fully Correctable Disruption	There is a moderate likelihood of correctable disruption to the neighborhood, such as damage to a historic or culturally significant building; OR moderate short-term traffic, noise, air quality, or odors; OR periodic (such as monthly) increased traffic, noise, air quality, or odors during facility operations.
8	Highly Likely Fully Correctable Disruption	There is high likelihood of fully correctable disruption to the neighborhood, such as minor damage to a historic or culturally significant building; OR minor short-term livability impacts, such as traffic, noise, air quality, and odors, limited to the construction phase.
10	Ideal Neighborhood Impacts	It is anticipated that there will be no negative impacts to the built environment during construction or long-term operations.

Safety – Public

A relative measure of potential public safety hazards in the immediate neighborhood as well as the broader region, including those related to increased truck traffic. These evaluation criteria do not include health impacts associated with consumption of fluoridated water; however, they do include hazards during construction (see Table PA-3).

Weighting: 25%

Table PA-3. Safety – Public Scales

Rating	Label	Description
0	Unacceptable Safety Impacts to Public	The impacts to public safety, such as a significant fire, major chemical spill, or traffic incident, are beyond acceptable in degree of likelihood; OR semi-sized truck trips in a residential area far exceed one per week on average during facility operations.
2	Incident(s) Impacts Several Members of Public and Truck Trips in Residential Area Exceed One per Week	High likelihood of impacts to public safety, such as a significant fire, major chemical spill, or traffic incident, impacting many members of the community; OR semi-sized truck trips in a residential area exceeding one per week on average during facility operations.
4	Incident Impacts Several Members of Public and Truck Trips in Residential Area Exceed One per Month	Likelihood of a public safety incident, such as a fire, chemical spill, or traffic incident, impacting several members of the community; OR semi-sized truck trips in a residential area exceeding one per month on average during facility operations.

Rating	Label	Description
6	Incident Impacts 1-2 Members of Public	Likelihood of a public safety incident during construction and/or operations, such as a fire, chemical spill, or traffic incident, that would cause impact to one or two members of the public with non-permanent and non-life-threatening injuries.
8	Safety Precautions Required	Safety precautions will need to be put in place during construction and/or operations and there is a likelihood of a near miss or minor public safety incident such as a minor fire, chemical spill, or traffic incident.
10	Ideal Public Safety	It is anticipated that there will be no public safety hazards introduced during construction or long-term operations.

Safety – Worker

A relative measure of potential worker safety hazards, including chemical loading/unloading, exposure to chemicals, and other safety hazards, such as slips, trips, falls, and confined space entry, during facility operations and maintenance (see Table PA-4). Includes hazards during construction.

Weighting: 25%

Table PA-4. Safety – Worker Scales

Rating	Label	Description
0	Unacceptable Safety Impacts to Workers	The degree of workplace safety risk is unacceptably high, with significant possibility of multiple deaths, OR major life-changing injuries.
2	Possible Impacts Resulting in Death or Major Impacts to Workers	There is the possibility of worker safety impacts, including one or more death(s) OR major life-changing injuries.
4	Possible Workplace Injury Incurring Permanent Disability	There is the possibility of a workplace safety incident causing a permanent disability.
6	Possible Significant Workplace Injury	There is the possibility of a significant workplace injury but that can be healed or cured OR any injury requiring up to 30 days off work.
8	Possible Workplace Injury with No Lost Time	There is the possibility of a workplace injury but with no lost time.
10	Ideal Worker Safety	It is anticipated that there will be no worker safety hazards introduced during construction or long-term operations.

Service Reliability

A relative measure of the ability to achieve desired reliability of the fluoridation system, including resiliency in extreme conditions. This includes considerations of overfeeding (which may require public notice due to termination of fluoridation) and the ability of the system to consistently achieve regulatory requirements, both near and long term (see Table PA-5). This measure also considers outcomes at the customer tap.

Weighting: 15%

Table PA-5. Service Reliability Scales

Rating	Label	Description
0	Unacceptable Service Reliability	The degree of extended outages for the customers is frequent and unacceptable in terms of service reliability.
2	Extended Outages (> 1 time per year)	There are extended outages for large groups of customers likely once a year (or more).
4	Likely Service Outages (> 1 time per year) OR Extended Outages to a Small Number of Customers (< 1 time per year)	Service outages likely for a small number of customers more than once a year OR extended outages for small or large groups of customers less than once a year.
6	Likely Service Outages to a Small Number of Customers (< 1 time per year)	Service outages are likely but limited to a small number of customers for short periods of time and less than once per year.
8	Good Service Reliability at Start-Up but Uncertain in Future	Service reliability is easily achieved upon initiation of operations, but future reliability is not certain.
10	Ideal Service Reliability	It is anticipated that reliability of the fluoridation system will be easily achieved with certainty upon initiation of operations as well as into the future.

Ease of Maintenance and Operations

A measure of the relative ease of maintenance and operational activities, including training, certifications, equipment needed, frequency of visits to the sites, and renewal and rehabilitation needs (see Table PA-6).

Note: This measure does not include cost, which will be included in the life cycle cost estimate. In addition, this measure does and not include worker safety, which is considered in the Safety – Worker criterion.

Weighting: 15%

Table PA-6. Ease of Maintenance and Operations Scales

Rating	Label	Description
0	Unacceptable Change in Maintenance and Operations	The relative degree of maintenance and operations will require changes so substantial that they are unacceptable relative to the current maintenance and operations profile.
2	Significant Change in Maintenance and Operations	The relative degree of maintenance and operations will require additional staff with qualifications not currently available among staff, OR will require regular site visits more than once a day, OR major equipment will need renewal within 2 years or less.
4	Considerable Change in Maintenance and Operations	The relative degree of maintenance and operations will require additional staff, OR certifications or annual training for current staff, OR will require regular site visits more than twice a week, OR major equipment will need renewal within about 2 to 5 years.
6	Moderate Change in Maintenance and Operations	The relative degree of maintenance and operations will require new processes or technology tools for which training will be required OR will require regular site visits about once every 2 weeks.

Rating	Label	Description
8	Minor Change in Maintenance and Operations	The relative degree of maintenance and operations will require new processes or technology tools but no new staff or any significant new training OR will require regular site visits about once a month.
10	No Change in Maintenance and Operations	The relative degree of maintenance and operations will not be significantly different from prior to the fluoridation system installation.

Performance Criteria Prioritization

The performance criteria of a project are rarely of equal importance. Therefore, the relative importance of each criterion in meeting the project's need and purpose must be determined. During the May 2022 Criteria Workshop, participants were asked to systematically compare the criteria's importance against each other while considering which would provide the greatest benefit relative to the project's need and purpose. Participants of that workshop were asked to indicate their priorities and the relative intensities of their preferences. Figure 2 below provides the final weightings of the six criteria described in this section.

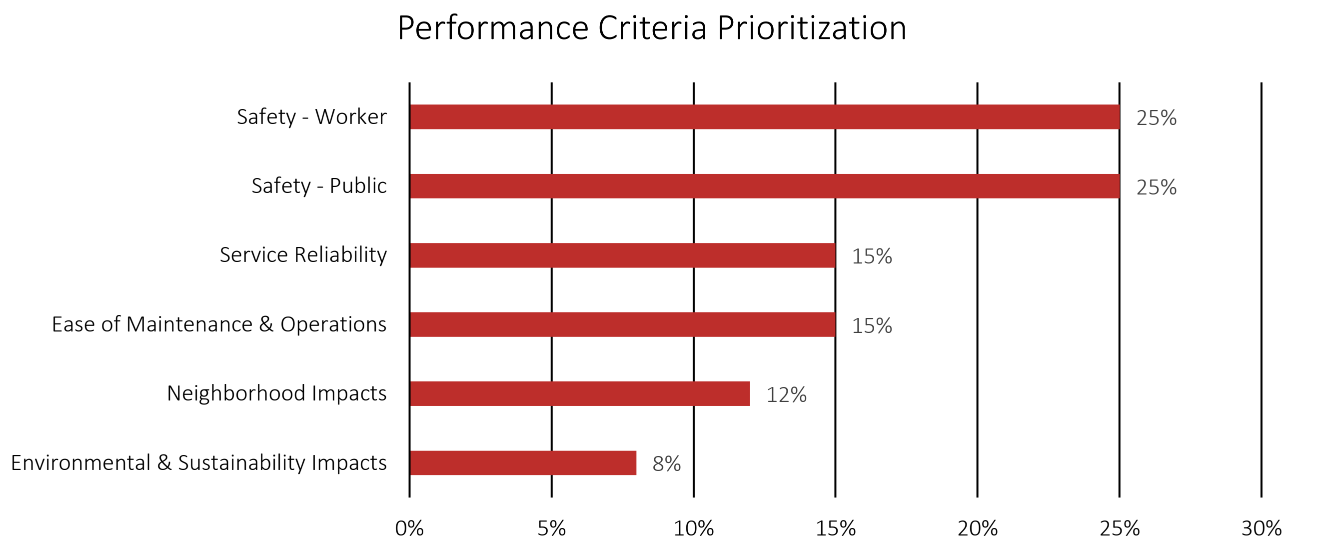


Figure 2. Performance Criteria Prioritization

The weightings heavily favor safety, making up a total of 50% of the total weightings, followed by operating-related criteria and then neighborhood, environmental, and sustainability impacts.

Measuring Performance

The project team worked with the technical team to apply the criteria to both fluoridation alternatives during the November 2022 MODA Workshop. Participants of the workshop were asked to consider each criterion and their measurements and then apply a 0 to 10 score to both the Liquid and Dry fluoridation alternatives based on the criteria definitions and evaluation scales presented in the previous section. Detailed information about each alternative was provided beforehand, and there were opportunities for clarification by the project team during the process. At the end, each participant's rankings were consolidated into an average performance rating for each criterion. Below are final performance ratings for each criterion and alternative as well as a summary of the rationale for the ratings.

Environmental and Sustainability Impacts

Liquid Rating	Dry Rating
5.6	5.7

Rationale – In the event of a spill, there is more impact with the Liquid versus the Dry. In addition, the Liquid could potentially contaminate an aquifer. In the event of a spill of Dry material, there could be a plume of the Dry compound. In terms of sustainability, the material deliveries (either Liquid or Dry) will result in increased greenhouse gases and emissions due to transport from outside the region. There is a relatively higher carbon footprint for the Dry material. The amount of material that is produced, treated, and used by the end user is relatively low for either material in terms of consumptive use.

Neighborhood Impacts

Liquid Rating	Dry Rating
5.3	4.7

Rationale – There is less overall traffic in the neighborhoods for the Liquid material relative to the Dry material. Note that increased traffic also increases the risk of spills of material. Additionally, some locations where the fluoride dosing occurs are recreational areas where the City should be aware of safety considerations and possible odors. Additionally, the Dry alternative requires a taller building to accommodate storage.

Safety – Public

Liquid Rating	Dry Rating
5.6	5.8

Rationale – The two materials are relatively similar. The primary considerations weighing into the safety of the public could consider vehicle traffic (more traffic with Dry versus Liquid). There is a higher potential for spills with the Liquid material versus the Dry material; however, the Dry material could spread in the wind. It is anticipated that any impacts would be non-permanent and non-life-threatening injuries.

Safety – Worker

Liquid Rating	Dry Rating
5.0	5.0

Rationale – The discussion centered around the two alternatives having distinct yet equivalent worker safety components. Both options require some level of personal protective equipment, with Dry requiring a lower level of protection than Liquid. The Dry chemical requires that staff wear a respirator, while Liquid requires splash protection, which is considered more burdensome. The Dry option requires more chemical handling and higher risk of exposure. Dry calls for smaller containment but comes with forklift safety considerations. Both alternatives were scored equally, with a 5.0, when weighing each alternative’s unique safety considerations.

Service Reliability

Liquid Rating	Dry Rating
6.4	5.2

Rationale – There are fewer components with Liquid material. With Dry material, there could be caking and plugging of components. In addition, the Dry material requires more product, so there could be logistical/supply chain challenges. The Liquid is also easier to maintain a steadier concentration, primarily because it comes premixed.

Ease of Maintenance and Operations

Liquid Rating	Dry Rating
3.6	2.8

Rationale – There is less overall maintenance required with the Liquid; it requires a daily site visit, but maintenance efforts are easier. The Dry powder has more overall maintenance; it requires fewer visits but more challenging staff efforts during each visit. There is the potential for corrosion to the equipment in the event of a leak of the Liquid material. It is noted that either option results in a significant change for maintenance and operations across the board. However, the additional handling of material for the Dry compound drives a higher maintenance and operational demand than for the Liquid compound.

Weighted Performance Rating

Following the Liquid and Dry alternatives being rated across each criterion, a weighted performance rating can be calculated for each alternative. Each criterion's rating is multiplied by its weight, and all those products are added together to calculate the final weighted performance rating. A higher performance rating indicates better performance based on the criteria. Below are the results.

Liquid Rating	Dry Rating
5.2	4.9

The Liquid alternative performed better than the Dry alternative according to the group ratings. Through further group discussions, this consensus held true, as noted in the above rating rationales. The Service Reliability and Ease of Maintenance and Operations criteria, which had medium weightings, were the largest drivers on the final scoring. Liquid rated higher on both by 1.2 and 0.8, respectively, with a combined weighting of 30% between them both. The two Safety criteria, which accounted for 50% of the weighting, were not large sources of difference between the two alternatives. They rated very closely to each other, with a score difference of 0.2 for Safety – Public in favor of Dry. Safety – Worker received scores of 5.0 for both alternatives.

VALUE OF ALTERNATIVES

Value metrics techniques are utilized to calculate a value index score for each alternative, which is used as a final measurement of relative value of alternatives and determine a *Technically Preferred Alternative.* The relative value of each alternative is derived from the cost and performance scores calculated in the previous sections. The basic value equation used in this analysis is:

$$Value = \frac{Performance}{Cost'}$$

Performance is measured by the weighted performance rating that was calculated out of the MODA Workshop. Cost is measured using the NPV costs from the previously performed TCO analysis. A cost score is calculated adding the two alternatives' costs together, dividing each alternative's cost by that total, multiplying by 10, and then subtracting that total from 10. The value index score is then calculated using the above value equation, with the alternative's performance score divided by the complement of the cost score (for example, the value score for Liquid is equal to its performance score divided by the difference of 10 minus its cost score). A summary of the performance, cost, and value scores is in Table VA-1 below:

Table VA-1. Option Rankings

Option	TCO (USD) *50-Year Life Cycle*	Performance Score	Cost Score	Value Index	% Change
Fluorosilicic Acid – Liquid	$204,289,000	5.2	5.7	1.2	38.5%
Sodium Fluoride – Dry	$264,126,000	4.9	4.3	0.9	

The Liquid option achieved a better score for both performance and cost, with 5.2 and 5.7, respectively. Conversely, the Dry option had a worse score for both performance and cost, with 4.9 and 4.3, respectively. As such, the Liquid option also came out on top with a higher value index of 1.2, compared with 0.9 for Dry. That gives the Liquid option a 38.5% higher value score than the Dry option. Figure 3 below further illustrates the comparison in value between both fluoridation options.

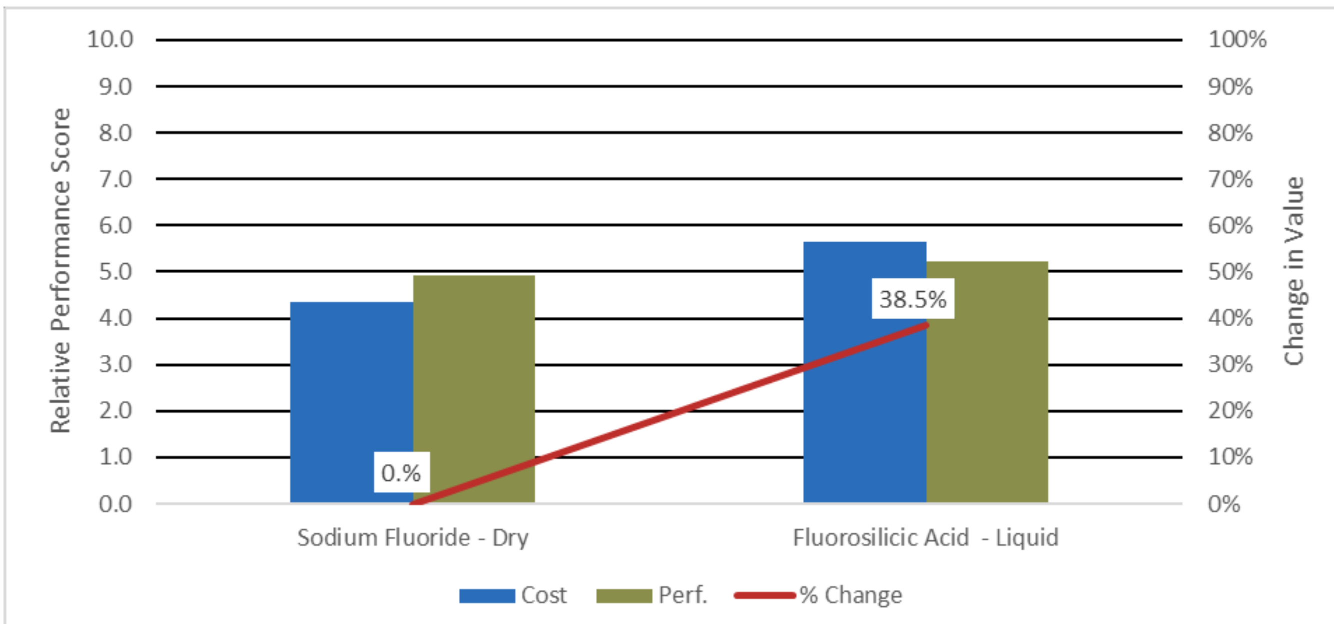


Figure 3. Option Rankings

Technically Preferred Alternative

With the value index score being calculated and compared between alternatives, the technically preferred alternative can be determined.

The Liquid alternative using fluorosilicic acid is projected to be the lower cost option for the City over a 50-year time period, which earns it a better cost score. The differential in the upfront initial capital costs to further develop, engineer, and build the project is close to $2 million higher for the Dry alternative in 2022 dollars, which is not significant relative to the entire 50-year life cycle of the project and the associated TCO, as the initial costs account for only about 6% of the TCO for each alternative. Several subsequent life cycle costs, including engineering, maintenance, and equipment replacement, are all indexed to the initial project cost. Engineering and maintenance costs are both derived as a percentage of initial capital costs, being 10% and 2%, respectively. Equipment replacement costs are the same as the initial capital costs, escalated to the year in which the replacement occurs. As such, the higher initial capital costs for the Dry alternative will lead to higher subsequent costs for these items, though these items account for only a small share of the overall difference in life cycle costs. The largest driver of the life cycle cost differences is the price of the chemicals used, with Dry NaF costing close to $37 million more than Liquid FSA over the 50-year period of analysis in 2022 dollars, which accounts for 62% of the differential in TCO between the two alternatives.

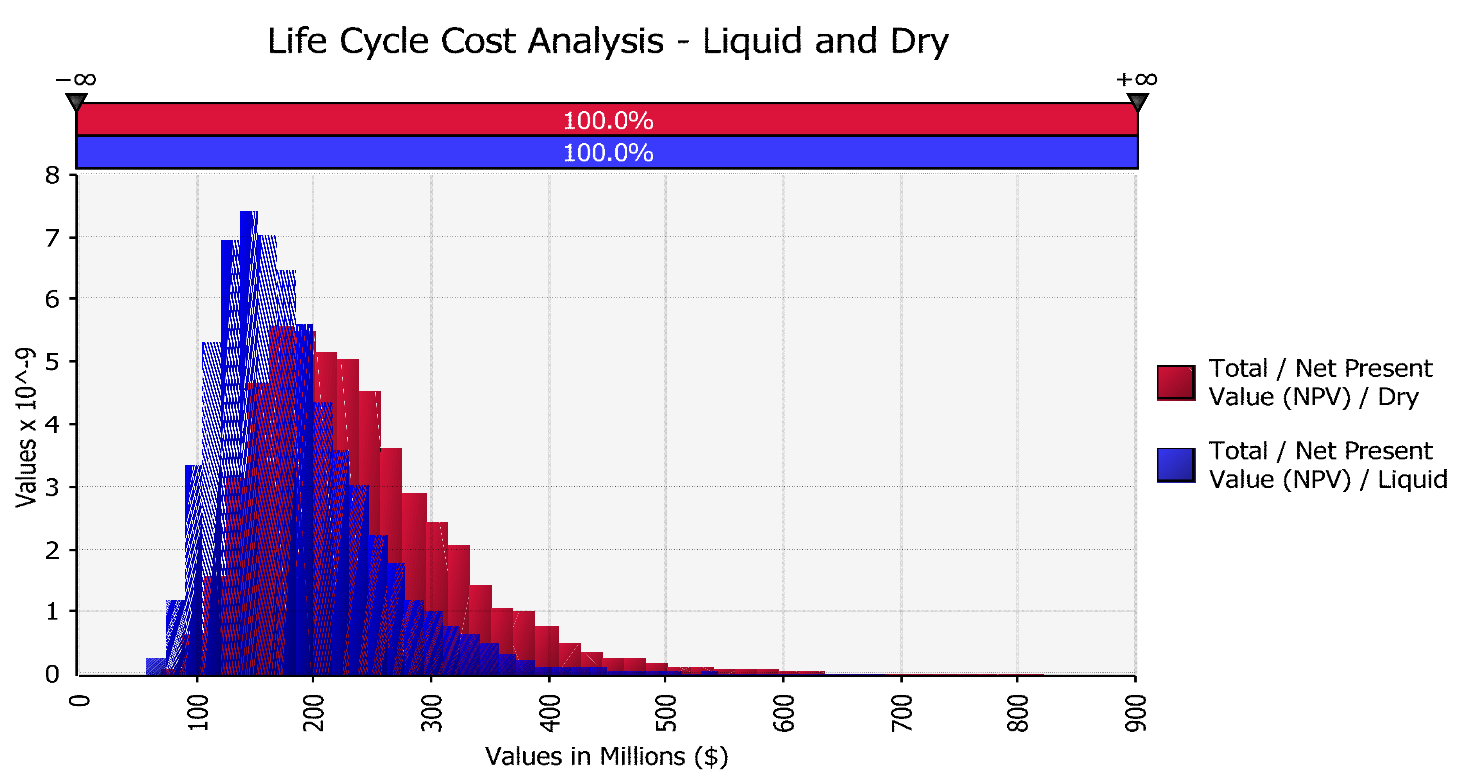
The Liquid alternative also has a better performance score than the Dry alternative using a set of mutually derived criteria meeting the project's needs and purpose. The two alternatives rate similarly in terms of safety to both workers and the public, which makes up 50% of the weighted performance score. However, Liquid performs significantly better than Dry on Service Reliability (6.4 with to 5.2) and Ease of Maintenance and Operations criteria (3.6 compared with 2.8). Given that the Liquid alternative earned a better cost and performance score, the Liquid alternative also achieved a higher value index score, resulting in the recommendation that the fluorosilicic acid (Liquid) is the technically preferred alternative for fluoridation implementation if the City chooses to move forward.

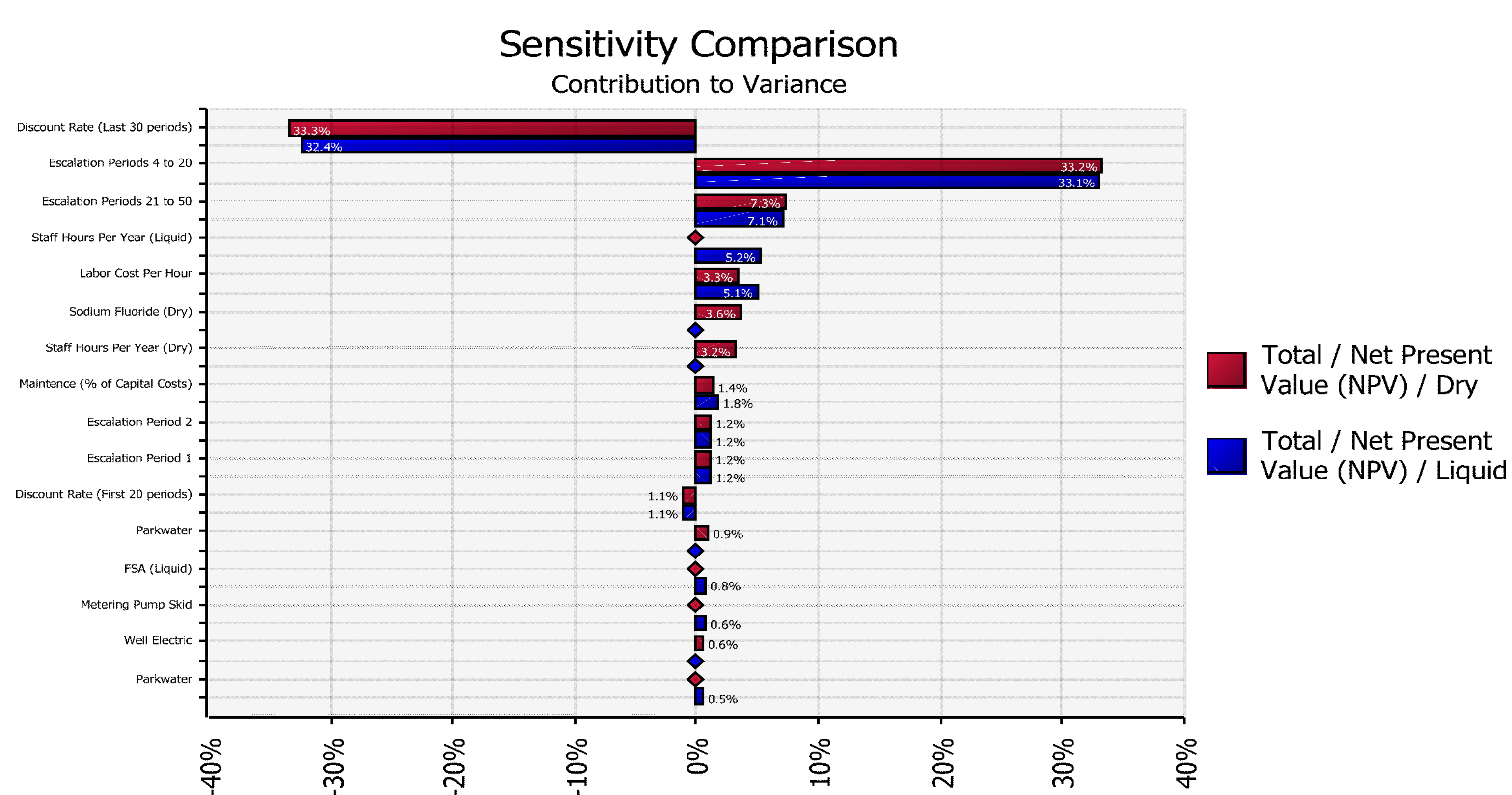
Total Cost of Ownership

City of Spokane
Fluoridation Total Cost of Ownership Model
Summary

Life Cycle Cost Estimate			
Project Name:	Preliminary Engineering Study for Fluoridation	Date:	11/15/2022
Description:	Options for Fluoridating drinking water supply	Estimators:	Ben Crawley
Location:	Spokane, Washington		Royce Stewart
	Total Cost of Ownership (P70)	**Option 1**	**Option 2**
Life Cycle Period (Years)	50	Liquid (FSA)	Dry (NaF)
Note: Costs are in nominal dollars	Initial Capital	$ 14,872,000	$ 16,943,000
	Engineering	$ 1,487,000	$ 1,694,000
	Operating and Maintenance	$ 354,981,000	$ 472,364,000
	Capital and Equipment Replacement	$ 71,609,000	$ 81,643,000
	Operating Contingency	$ 106,494,000	$ 141,709,000
	Salvage	$ (2,298,000)	$ (2,641,000)
	Net Costs	$ 543,729,000	$ 707,845,000
Net Present Value in $2022 (NPV)		**$ 202,812,000**	**$ 264,024,000**
	Equivalent Annual Cost (EAC) in $2022 (P70)	**Option 1**	**Option 2**
Life Cycle Period (Years)	50	Liquid (FSA)	Dry (NaF)
	Operating and Maintenance	$ 6,098,000	$ 8,117,000
	Capital and Equipment Replacement	$ 1,169,000	$ 1,334,000
	Operating Contingency	$ 1,829,000	$ 2,435,000
	Salvage	$ (35,000)	$ (41,000)
Net Equivalent Annual Cost in $2022		$ 9,061,000	$ 11,846,000

Note: Above costs are based on P70 values from Uncertainty Analysis





City of Spokane
Fluoridation Total Cost of Ownership Model
Assumptions

Notes
Cost Data was taken from "Alternatives Estimate_11082022_PostCityReview.xlsx".
General information was taken from "Fluoridation System Alternatives TM-09-08-22.docx".
The Grace/Nevada sites are in one building.
Each site's maintenance costs are 2% of its subtotal capital costs, escalated to the current year's dollars.
For Dry Well Electric and Parkwater, the cheaper building cost of the two was applied. This capital cost is $190,500.00 (building 635 SF @ 300)
Escalation rate is applied to capital, operating, and replacement costs.
For both dry and liquid, Central Ave is the only site that requires demolition of the existing building.
Murray Smith's construction cost estimate is in dollars valued at the time of the estimate (09/19/2022).
This estimate is an opinion of probable cost based on information available at the time of its development.
Chemical costs are based on the average operating day from 2019-2021.
Operating costs start the year after construction is complete.
Residual values are under the assumption that assets will continue to be used after the 50 year LLCA periods.
BBU costs for dry include refill feeder, weigh feeder, model 810 BBU, saturator, volumetric feeder, control panel.
Engineering occurs in the year 2023 (Period 1) and is 10% of the initial capital costs (sum of the capital costs in 2023 and 2024).
Construction will begin in 2024/2025 (Periods 2 and 3). Therefore, initial capital costs are split, with 50% being allocated to 2024, and 50% to 2025. These costs are then escalated to the respective years.
Annual operating costs begin in 2026 (Period 4).

Distributions	
Estimate Low	70%
Estimate Medium	100%
Estimate High	150%

Time	
Starting Period	0
Start Year	2022
Number of Periods (Years)	50

Life Cycle Cost Estimate Assumptions and Uncertainty Ranges				
Variable	Minimum	Most Likely	Maximum	Probabilistic
Engineering Costs		10%		
Discount Rate (First 20 periods)	3.5%	5.0%	7.5%	5.43%
Discount Rate (Last 30 periods)	2.1%	3.0%	4.5%	3.26%
Escalation				
Escalation Period 1	8.8%	12.5%	18.8%	13.57%
Escalation Period 2	8.4%	12.0%	18.0%	13.03%
Escalation Period 3	5.6%	8.0%	12.0%	8.69%
Escalation Periods 4 to 20	3.5%	5.0%	7.5%	5.43%
Escalation Periods 21 to 50	2.1%	3.0%	4.5%	3.26%
Operating Costs				
Maintence (% of Capital Costs)	1%	2%	3%	2.17%
Replacement Schedule (Liquid)		**Years**		
Electrical Equipment	7	10	15	10.86
PLC MicroLogic 1400	7	10	15	10.86
Metering Pump Skid	14	20	30	21.72
Bulk Storage Tank	14	20	30	21.72
Day Storage Tank	14	20	30	21.72
Roll up Door	14	20	30	21.72
Man Door	14	20	30	21.72
Fluoride Analyzer	7	10	15	10.86
Backflow Preventer	14	20	30	21.72
Transfer Pump Skid	14	20	30	21.72
Secondary Containment	0	0	0	0.00
Building 915 sf @ $300	0	0	0	0.00
Site Improvements	14	20	30	21.72
Replacement Schedule (Dry)				
Electrical Panel	7	10	15	10.86
PLC MicroLogic 1400	7	10	15	10.86
Metering Pump Skid	14	20	30	21.72
Backflow Preventer	14	20	30	21.72
Man Door	14	20	30	21.72
Roll up Door	14	20	30	21.72
Fluoride Analyzer	7	10	15	10.86
BBU	14	20	30	21.72
Saturator Basement	0	0	0	0.00
Building 635 sf @ $300	0	0	0	0.00
Site Improvements	14	20	30	21.72
Operations and Maintenance				
Labor Cost Per Hour	$ 49.00	$ 70.00	$ 105.00	$ 76.02
Staff Hours Per Year (Liquid)	4421.2	6316	9474	6858.97
Staff Hours Per Year (Dry)	4634	6620	9930	7189.10
Power Costs				
Cost per kWh	$ 0.07	$ 0.10	$ 0.15	$ 0.11
Total Energy per Year (Liquid)				
Well Electric	7886	11265	16898	12233.42
Parkwater	10141	14487	21731	15732.41
Ray	7414	10591	15887	11501.48
Central Ave	7414	10591	15887	11501.48
Grace	7414	10591	15887	11501.48
Nevada	8071	11530	17295	12521.21
Hoffman	7252	10360	15540	11250.62
Havana	9388	13411	20117	14563.91
Total Energy per Year (Dry)				
Well Electric	8181	11687	17531	12691.70
Parkwater	10514	15020	22530	16311.23
Ray	7493	10704	16056	11624.20
Central Ave	7474	10677	16016	11594.87
Grace	7486	10694	16041	11613.34
Nevada	8152	11645	17468	12646.09
Hoffman	7214	10306	15459	11191.98
Havana	9561	13659	20489	14833.23
Chemical Costs (per lb)				
FSA (Liquid)	$ 0.39	$ 0.45	$ 0.50	$ 0.45
Sodium Fluoride (Dry)	$ 1.54	$ 1.92	$ 2.30	$ 1.92
Usage per Month (Liquid)				
Well Electric	200149	285926	428890	310506.88
Parkwater	251752	359645	539468	390563.19
Ray	71864	102663	153995	111488.79
Central Ave	63249	90356	135534	98124.03
Grace	63243	90347	135520	98113.40
Nevada	78759	112512	168768	122184.61
Hoffman	33322	47603	71405	51695.60
Havana	86924	124177	186266	134852.64
Usage per Month (Dry)				
Well Electric	78162	111660	167490	121259.05
Parkwater	98314	140449	210673	152522.62
Ray	28064	40092	60138	43538.57
Central Ave	24700	35286	52929	38319.37
Grace	24697	35282	52923	38315.21
Nevada	30757	43938	65907	47715.50
Hoffman	13013	18590	27885	20188.15
Havana	33946	48494	72741	52662.61

City of Spokane

Fluoridation Total Cost of Ownership Model

Liquid Data Input

Liquid Capital Costs (Concept Level Costs, 2022 Dollars)													
Description	**Well Electric**	**Parkwater**	**Ray**	**Central Ave**	**Grace/Nevada**	**Hoffman**	**Havana**	**Subtotal**	**Contingency 30%**	**Total Capital Costs (Most Likely)**	**Total Capital Costs (Minimum)**	**Total Capital Costs (Maximum)**	**Total Capital Costs (Probabilistic)**
Electrical Equipment	$ 71,000.00	$ 71,000.00	$ 71,000.00	$ 71,000.00	$ 71,000.00	$ 71,000.00	$ 71,000.00	**$ 497,000.00**	**$ 149,100.00**	**$ 646,100.00**	**$ 452,270.00**	**$ 969,150.00**	**$ 701,644.00**
PLC MicroLogic 1400	$ 45,000.00	$ 45,000.00	$ 45,000.00	$ 45,000.00	$ 45,000.00	$ 45,000.00	$ 45,000.00	**$ 315,000.00**	**$ 94,500.00**	**$ 409,500.00**	**$ 286,650.00**	**$ 614,250.00**	**$ 444,704.00**
Metering Pump Skid	$ 360,000.00	$ 480,000.00	$ 120,000.00	$ 120,000.00	$ 360,000.00	$ 120,000.00	$ 360,000.00	**$ 1,920,000.00**	**$ 576,000.00**	**$ 2,496,000.00**	**$ 1,747,200.00**	**$ 3,744,000.00**	**$ 2,710,575.00**
Bulk Storage Tank	$ 30,000.00	$ 30,000.00	$ 30,000.00	$ 30,000.00	$ 30,000.00	$ 30,000.00	$ 30,000.00	**$ 210,000.00**	**$ 63,000.00**	**$ 273,000.00**	**$ 191,100.00**	**$ 409,500.00**	**$ 296,470.00**
Day Storage Tank	$ 20,000.00	$ 20,000.00	$ 20,000.00	$ 20,000.00	$ 20,000.00	$ 20,000.00	$ 20,000.00	**$ 140,000.00**	**$ 42,000.00**	**$ 182,000.00**	**$ 127,400.00**	**$ 273,000.00**	**$ 197,647.00**
Roll up Door	$ 10,000.00	$ 10,000.00	$ 10,000.00	$ 10,000.00	$ 10,000.00	$ 10,000.00	$ 10,000.00	**$ 70,000.00**	**$ 21,000.00**	**$ 91,000.00**	**$ 63,700.00**	**$ 136,500.00**	**$ 98,824.00**
Man Door	$ 8,000.00	$ 8,000.00	$ 8,000.00	$ 8,000.00	$ 8,000.00	$ 8,000.00	$ 8,000.00	**$ 56,000.00**	**$ 16,800.00**	**$ 72,800.00**	**$ 50,960.00**	**$ 109,200.00**	**$ 79,059.00**
Fluoride Analyzer	$ 20,000.00	$ 20,000.00	$ 20,000.00	$ 20,000.00	$ 20,000.00	$ 20,000.00	$ 20,000.00	**$ 140,000.00**	**$ 42,000.00**	**$ 182,000.00**	**$ 127,400.00**	**$ 273,000.00**	**$ 197,647.00**
Backflow Preventer	$ 6,000.00	$ 6,000.00	$ 6,000.00	$ 6,000.00	$ 6,000.00	$ 6,000.00	$ 6,000.00	**$ 42,000.00**	**$ 12,600.00**	**$ 54,600.00**	**$ 38,220.00**	**$ 81,900.00**	**$ 59,294.00**
Transfer Pump Skid	$ 30,000.00	$ 30,000.00	$ 30,000.00	$ 30,000.00	$ 30,000.00	$ 30,000.00	$ 30,000.00	**$ 210,000.00**	**$ 63,000.00**	**$ 273,000.00**	**$ 191,100.00**	**$ 409,500.00**	**$ 296,470.00**
Secondary Containment	$ 50,000.00	$ 50,000.00	$ 50,000.00	$ 50,000.00	$ 50,000.00	$ 50,000.00	$ 50,000.00	**$ 350,000.00**	**$ 105,000.00**	**$ 455,000.00**	**$ 318,500.00**	**$ 682,500.00**	**$ 494,116.00**
Building SF	$ 194,100.00	$ 274,500.00	$ 291,600.00	$ 440,800.00	$ 194,100.00	$ 291,600.00	$ 366,000.00	**$ 2,052,700.00**	**$ 615,810.00**	**$ 2,668,510.00**	**$ 1,867,957.00**	**$ 4,002,765.00**	**$ 2,897,916.00**
Demo Existing Building	$ -	$ -	$ -	$ 20,000.00	$ -	$ -	$ -	**$ 20,000.00**	**$ 6,000.00**	**$ 26,000.00**	**$ 18,200.00**	**$ 39,000.00**	**$ 28,236.00**
Site Improvements	$ 250,000.00	$ 250,000.00	$ 150,000.00	$ 150,000.00	$ 250,000.00	$ 150,000.00	$ 150,000.00	**$ 1,350,000.00**	**$ 405,000.00**	**$ 1,755,000.00**	**$ 1,228,500.00**	**$ 2,632,500.00**	**$ 1,905,873.00**
Subtotal Capital Cost	$ 1,094,100.00	$ 1,294,500.00	$ 851,600.00	$ 1,020,800.00	$ 1,094,100.00	$ 851,600.00	$ 1,166,000.00	**$ 7,372,700.00**					
Contingency (30%)	$ 328,230.00	$ 388,350.00	$ 255,480.00	$ 306,240.00	$ 328,230.00	$ 255,480.00	$ 349,800.00	**$ 2,211,810.00**					
Total Capital Costs	$ 1,422,330.00	$ 1,682,850.00	$ 1,107,080.00	$ 1,327,040.00	$ 1,422,330.00	$ 1,107,080.00	$ 1,515,800.00	**$ 9,584,510.00**		**$ 9,584,510.00**	**$ 6,709,157.00**	**$ 14,376,765.00**	**$ 10,408,475.00**

Liquid Operating Costs (Concept Level Costs, 2022 Dollars)								
Description	**Well Electric**	**Parkwater**	**Ray**	**Central Ave**	**Grace/Nevada**	**Hoffman**	**Havana**	**Total**
Operating of Equipment	$74,486.19	$74,486.19	$74,486.19	$74,486.19	$74,486.19	$74,486.19	$74,486.19	**$ 521,403.33**
Energy	$1,328.51	$1,708.49	$1,249.02	$1,249.02	$1,261.17	$1,221.78	$1,581.59	**$ 9,599.59**
Chemical	$138,175.56	$173,800.62	$49,612.51	$43,665.20	$98,032.61	$23,004.54	$60,009.43	**$ 586,300.47**

Replacement Schedule					Salvage Rate			
	Years				**Percent**			
Component	**Minimum**	**Most Likely**	**Maximum**	**Probabilistic**	**Minimum**	**Most Likely**	**Maximum**	**Probabilistic**
Electrical Equipment	7	10	15	11	4%	5%	8%	5.43%
PLC MicroLogic 1400	7	10	15	11				
Metering Pump Skid	14	20	30	22				
Bulk Storage Tank	14	20	30	22				
Day Storage Tank	14	20	30	22				
Roll up Door	14	20	30	22				
Man Door	14	20	30	22				
Fluoride Analyzer	7	10	15	11				
Backflow Preventer	14	20	30	22				
Transfer Pump Skid	14	20	30	22				
Secondary Containment	0	0	0	0				
Building 915 sf @ $300	0	0	0	0				
Site Improvements	14	20	30	22				

City of Spokane **(Liquid) Fluoridation Total Cost of Ownership Model**

Life Cycle Period	50		Engineering	Initial Capital Costs	Annual Operating Costs				Capital and Equipment Replacement	Contingency	Salvage Values	LCCA Cost (2022 Dollars)		Net Present Value (NPV)			
Period	Year	Escalation (Construction)	Total Engineering	Total Capital	Maintenance	Operation of Equipment	Power	Chemical	Total Replacement	Operating Contingency	Total Salvage	Net Costs	Net Present Value (NPV)	Operating and Maintenance	Capital Replacement	Operating Contingency	Salvage
0	2022	0.00%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	$ -	$ -	$ -
1	2023	13.57%	$ 1,394,232.32	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,394,232.32	$ 1,322,426.70	$ -	$ -	$ -	$ -
2	2024	28.38%	$ -	$ 6,680,949.85	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,680,949.85	$ 6,010,507.43	$ -	$ -	$ -	$ -
3	2025	39.53%	$ -	$ 7,261,373.40	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,261,373.40	$ 6,196,238.98	$ -	$ -	$ -	$ -
4	2026	47.10%	$ -	$ -	$ 445,458.41	$ 767,006.43	$ 14,121.41	$ 862,472.86	$ -	$ 626,717.73	$ -	$ 2,715,776.83	$ 2,198,061.97	$ 1,690,816.90	$ -	$ 507,245.07	$ -
5	2027	55.09%	$ -	$ -	$ 469,646.08	$ 808,653.63	$ 14,888.17	$ 909,303.73	$ -	$ 660,747.48	$ -	$ 2,863,239.10	$ 2,198,061.97	$ 1,690,816.90	$ -	$ 507,245.07	$ -
6	2028	63.51%	$ -	$ -	$ 495,147.10	$ 852,562.21	$ 15,696.58	$ 958,677.45	$ -	$ 696,625.00	$ -	$ 3,018,708.33	$ 2,198,061.97	$ 1,690,816.90	$ -	$ 507,245.07	$ -
7	2029	72.39%	$ -	$ -	$ 522,032.78	$ 898,854.95	$ 16,548.88	$ 1,010,732.07	$ -	$ 734,450.60	$ -	$ 3,182,619.28	$ 2,198,061.97	$ 1,690,816.90	$ -	$ 507,245.07	$ -
8	2030	81.75%	$ -	$ -	$ 550,378.31	$ 947,661.31	$ 17,447.45	$ 1,065,613.18	$ -	$ 774,330.08	$ -	$ 3,355,430.33	$ 2,198,061.97	$ 1,690,816.90	$ -	$ 507,245.07	$ -
9	2031	91.62%	$ -	$ -	$ 580,262.96	$ 999,117.78	$ 18,394.82	$ 1,123,474.25	$ -	$ 816,374.94	$ -	$ 3,537,624.75	$ 2,198,061.97	$ 1,690,816.90	$ -	$ 507,245.07	$ -
10	2032	102.03%	$ -	$ -	$ 611,770.29	$ 1,053,368.25	$ 19,393.63	$ 1,184,477.07	$ -	$ 860,702.77	$ -	$ 3,729,712.02	$ 2,198,061.97	$ 1,690,816.90	$ -	$ 507,245.07	$ -
11	2033	113.00%	$ -	$ -	$ 644,988.42	$ 1,110,564.43	$ 20,446.67	$ 1,248,792.25	$ -	$ 907,437.53	$ -	$ 3,932,229.32	$ 2,198,061.97	$ 1,690,816.90	$ -	$ 507,245.07	$ -
12	2034	124.56%	$ -	$ -	$ 680,010.25	$ 1,170,866.28	$ 21,556.89	$ 1,316,599.64	$ -	$ 956,709.92	$ -	$ 4,145,742.98	$ 2,198,061.97	$ 1,690,816.90	$ -	$ 507,245.07	$ -
13	2035	136.75%	$ -	$ -	$ 716,933.70	$ 1,234,442.41	$ 22,727.40	$ 1,388,088.86	$ -	$ 1,008,657.71	$ -	$ 4,370,850.08	$ 2,198,061.97	$ 1,690,816.90	$ -	$ 507,245.07	$ -
14	2036	149.61%	$ -	$ -	$ 755,862.03	$ 1,301,470.63	$ 23,961.46	$ 1,463,459.83	$ 2,010,740.00	$ 1,063,426.18	$ (109,179.91)	$ 6,509,740.22	$ 3,105,089.64	$ 1,690,816.90	$ 959,105.55	$ 507,245.07	$ (52,077.87)
15	2037	163.16%	$ -	$ -	$ 796,904.11	$ 1,372,138.37	$ 25,262.53	$ 1,542,923.32	$ -	$ 1,121,168.50	$ -	$ 4,858,396.82	$ 2,198,061.97	$ 1,690,816.90	$ -	$ 507,245.07	$ -
16	2038	177.45%	$ -	$ -	$ 840,174.71	$ 1,446,643.25	$ 26,634.24	$ 1,626,701.54	$ -	$ 1,182,046.12	$ -	$ 5,122,199.87	$ 2,198,061.97	$ 1,690,816.90	$ -	$ 507,245.07	$ -
17	2039	192.52%	$ -	$ -	$ 885,794.83	$ 1,525,193.62	$ 28,080.44	$ 1,715,028.79	$ -	$ 1,246,229.31	$ -	$ 5,400,326.99	$ 2,198,061.97	$ 1,690,816.90	$ -	$ 507,245.07	$ -
18	2040	208.40%	$ -	$ -	$ 933,892.05	$ 1,608,009.16	$ 29,605.16	$ 1,808,152.07	$ -	$ 1,313,897.53	$ -	$ 5,693,555.97	$ 2,198,061.97	$ 1,690,816.90	$ -	$ 507,245.07	$ -
19	2041	225.15%	$ -	$ -	$ 984,600.87	$ 1,695,321.44	$ 31,212.67	$ 1,906,331.79	$ -	$ 1,385,240.03	$ -	$ 6,002,706.80	$ 2,198,061.97	$ 1,690,816.90	$ -	$ 507,245.07	$ -
20	2042	242.80%	$ -	$ -	$ 1,038,063.10	$ 1,787,374.64	$ 32,907.47	$ 2,009,842.50	$ -	$ 1,460,456.31	$ -	$ 6,328,644.02	$ 2,198,061.97	$ 1,690,816.90	$ -	$ 507,245.07	$ -
21	2043	253.97%	$ -	$ -	$ 1,071,882.18	$ 1,845,605.56	$ 33,979.56	$ 2,075,321.21	$ -	$ 1,508,036.55	$ -	$ 6,534,825.07	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
22	2044	265.50%	$ -	$ -	$ 1,106,803.06	$ 1,905,733.59	$ 35,086.58	$ 2,142,933.15	$ -	$ 1,557,166.91	$ -	$ 6,747,723.30	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
23	2045	277.41%	$ -	$ -	$ 1,142,861.62	$ 1,967,820.53	$ 36,229.67	$ 2,212,747.82	$ -	$ 1,607,897.89	$ -	$ 6,967,557.54	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
24	2046	289.70%	$ -	$ -	$ 1,180,094.94	$ 2,031,930.21	$ 37,410.00	$ 2,284,836.99	$ -	$ 1,660,281.64	$ -	$ 7,194,553.77	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
25	2047	302.40%	$ -	$ -	$ 1,218,541.28	$ 2,098,128.51	$ 38,628.78	$ 2,359,274.75	$ 20,833,516.92	$ 1,714,371.99	$ (1,131,226.10)	$ 27,131,236.13	$ 12,172,705.48	$ 2,563,901.53	$ 9,347,169.60	$ 769,170.46	$ (507,536.11)
26	2048	315.51%	$ -	$ -	$ 1,258,240.16	$ 2,166,483.49	$ 39,887.27	$ 2,436,137.62	$ -	$ 1,770,224.56	$ -	$ 7,670,973.10	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
27	2049	329.05%	$ -	$ -	$ 1,299,232.40	$ 2,237,065.41	$ 41,186.76	$ 2,515,504.61	$ -	$ 1,827,896.75	$ -	$ 7,920,885.92	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
28	2050	343.02%	$ -	$ -	$ 1,341,560.12	$ 2,309,946.82	$ 42,528.58	$ 2,597,457.29	$ -	$ 1,887,447.84	$ -	$ 8,178,940.66	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
29	2051	357.46%	$ -	$ -	$ 1,385,266.84	$ 2,385,202.63	$ 43,914.12	$ 2,682,079.92	$ -	$ 1,948,939.05	$ -	$ 8,445,402.57	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
30	2052	372.36%	$ -	$ -	$ 1,430,397.49	$ 2,462,910.21	$ 45,344.80	$ 2,769,459.46	$ -	$ 2,012,433.59	$ -	$ 8,720,545.54	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
31	2053	387.75%	$ -	$ -	$ 1,476,998.44	$ 2,543,149.42	$ 46,822.09	$ 2,859,685.75	$ -	$ 2,077,996.71	$ -	$ 9,004,652.41	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
32	2054	403.64%	$ -	$ -	$ 1,525,117.61	$ 2,626,002.74	$ 48,347.51	$ 2,952,851.52	$ -	$ 2,145,695.82	$ -	$ 9,298,015.20	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
33	2055	420.05%	$ -	$ -	$ 1,574,804.45	$ 2,711,555.35	$ 49,922.62	$ 3,049,052.55	$ -	$ 2,215,600.49	$ -	$ 9,600,935.47	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
34	2056	436.99%	$ -	$ -	$ 1,626,110.05	$ 2,799,895.18	$ 51,549.05	$ 3,148,387.70	$ -	$ 2,287,782.59	$ -	$ 9,913,724.58	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
35	2057	454.49%	$ -	$ -	$ 1,679,087.13	$ 2,891,113.03	$ 53,228.47	$ 3,250,959.10	$ -	$ 2,362,316.32	$ -	$ 10,236,704.05	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
36	2058	472.55%	$ -	$ -	$ 1,733,790.15	$ 2,985,302.68	$ 54,962.60	$ 3,356,872.18	$ 6,351,068.70	$ 2,439,278.28	$ (344,852.70)	$ 16,576,421.88	$ 5,226,994.45	$ 2,563,901.53	$ 2,002,663.85	$ 769,170.46	$ (108,741.39)
37	2059	491.20%	$ -	$ -	$ 1,790,275.34	$ 3,082,560.93	$ 56,753.23	$ 3,466,235.80	$ -	$ 2,518,747.59	$ -	$ 10,914,572.88	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
38	2060	510.47%	$ -	$ -	$ 1,848,600.76	$ 3,182,987.75	$ 58,602.19	$ 3,579,162.38	$ -	$ 2,600,805.93	$ -	$ 11,270,159.02	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
39	2061	530.35%	$ -	$ -	$ 1,908,826.37	$ 3,286,686.39	$ 60,511.40	$ 3,695,768.00	$ -	$ 2,685,537.65	$ -	$ 11,637,329.81	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
40	2062	550.89%	$ -	$ -	$ 1,971,014.07	$ 3,393,763.43	$ 62,482.80	$ 3,816,172.52	$ -	$ 2,773,029.84	$ -	$ 12,016,462.66	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
41	2063	572.10%	$ -	$ -	$ 2,035,227.79	$ 3,504,328.93	$ 64,518.43	$ 3,940,499.69	$ -	$ 2,863,372.45	$ -	$ 12,407,947.29	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
42	2064	593.99%	$ -	$ -	$ 2,101,533.53	$ 3,618,496.55	$ 66,620.37	$ 4,068,877.33	$ -	$ 2,956,658.33	$ -	$ 12,812,186.11	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
43	2065	616.60%	$ -	$ -	$ 2,169,999.44	$ 3,736,383.63	$ 68,790.80	$ 4,201,437.39	$ -	$ 3,052,983.38	$ -	$ 13,229,594.63	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
44	2066	639.95%	$ -	$ -	$ 2,240,695.90	$ 3,858,111.37	$ 71,031.94	$ 4,338,316.12	$ -	$ 3,152,446.60	$ -	$ 13,660,601.92	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
45	2067	664.05%	$ -	$ -	$ 2,313,695.59	$ 3,983,804.87	$ 73,346.09	$ 4,479,654.22	$ -	$ 3,255,150.23	$ -	$ 14,105,651.01	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
46	2068	688.95%	$ -	$ -	$ 2,389,073.53	$ 4,113,593.35	$ 75,735.63	$ 4,625,596.99	$ -	$ 3,361,199.85	$ -	$ 14,565,199.36	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
47	2069	714.65%	$ -	$ -	$ 2,466,907.22	$ 4,247,610.21	$ 78,203.03	$ 4,776,294.43	$ 49,234,955.56	$ 3,470,704.46	$ (2,673,378.04)	$ 61,601,296.87	$ 13,651,954.05	$ 2,563,901.53	$ 10,911,350.65	$ 769,170.46	$ (592,468.60)
48	2070	741.19%	$ -	$ -	$ 2,547,276.65	$ 4,385,993.20	$ 80,750.81	$ 4,931,901.44	$ -	$ 3,583,776.63	$ -	$ 15,529,698.73	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
49	2071	768.60%	$ -	$ -	$ 2,630,264.44	$ 4,528,884.58	$ 83,381.59	$ 5,092,577.98	$ -	$ 3,700,532.58	$ -	$ 16,035,641.16	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
50	2072	796.89%	$ -	$ -	$ 2,715,955.89	$ 4,676,431.23	$ 86,098.08	$ 5,258,489.20	$ -	$ 3,821,092.32	$ -	$ 16,558,066.71	$ 3,333,071.99	$ 2,563,901.53	$ -	$ 769,170.46	$ -
Total			**$ 1,394,232.32**	**$ 13,942,323.25**	**$ 65,132,054.44**	**$ 112,146,730.53**	**$ 2,064,740.73**	**$ 126,105,216.31**	**$ 78,430,281.17**	**$ 91,634,622.60**	**$ (4,258,636.75)**	**$ 486,591,564.61**	**$ 172,847,852.06**	**$ 105,660,933.29**	**$ 23,220,289.65**	**$ 31,698,279.99**	**$ (1,260,823.98)**

Annual Operating Costs $ 305,448,742.01

City of Spokane
Fluoridation Total Cost of Ownership Model
Dry Data Input

Dry Capital Costs (Concept Level Costs, 2022 Dollars)

Description	Well Electric	Parkwater	Ray	Central Ave	Grace/Nevada	Hoffman	Havana	Subtotal	Contingency 30%	Total Capital Costs (Most Likely)	Total Capital Costs (Minimum)	Total Capital Costs (Maximum)	Total Capital Costs (Probabilistic)
Electrical Panel	$ 71,000.00	$ 55,000.00	$ 55,000.00	$ 71,000.00	$ 71,000.00	$ 55,000.00	$ 55,000.00	**$ 433,000.00**	**$ 129,900.00**	**$ 562,900.00**	**$ 394,030.00**	**$ 844,350.00**	**$ 611,292.00**
PLC MicroLogic 1400	$ 45,000.00	$ 45,000.00	$ 45,000.00	$ 45,000.00	$ 45,000.00	$ 45,000.00	$ 45,000.00	**$ 315,000.00**	**$ 94,500.00**	**$ 409,500.00**	**$ 286,650.00**	**$ 614,250.00**	**$ 444,704.00**
Metering Pump Skid (2-8 pumps per facility)	$ 360,000.00	$ 480,000.00	$ 120,000.00	$ 120,000.00	$ 360,000.00	$ 120,000.00	$ 360,000.00	**$ 1,920,000.00**	**$ 576,000.00**	**$ 2,496,000.00**	**$ 1,747,200.00**	**$ 3,744,000.00**	**$ 2,710,575.00**
Backflow Preventer	$ 6,000.00	$ 6,000.00	$ 6,000.00	$ 6,000.00	$ 6,000.00	$ 6,000.00	$ 6,000.00	**$ 42,000.00**	**$ 12,600.00**	**$ 54,600.00**	**$ 38,220.00**	**$ 81,900.00**	**$ 59,294.00**
Man Door	$ 8,000.00	$ 8,000.00	$ 8,000.00	$ 8,000.00	$ 8,000.00	$ 8,000.00	$ 8,000.00	**$ 56,000.00**	**$ 16,800.00**	**$ 72,800.00**	**$ 50,960.00**	**$ 109,200.00**	**$ 79,059.00**
Roll up Door	$ 10,000.00	$ 10,000.00	$ 10,000.00	$ 10,000.00	$ 10,000.00	$ 10,000.00	$ 10,000.00	**$ 70,000.00**	**$ 21,000.00**	**$ 91,000.00**	**$ 63,700.00**	**$ 136,500.00**	**$ 98,824.00**
Fluoride Analyzer	$ 20,000.00	$ 20,000.00	$ 20,000.00	$ 20,000.00	$ 20,000.00	$ 20,000.00	$ 20,000.00	**$ 140,000.00**	**$ 42,000.00**	**$ 182,000.00**	**$ 127,400.00**	**$ 273,000.00**	**$ 197,647.00**
Water Softener	$ 2,500.00	$ 2,500.00	$ 2,500.00	$ 2,500.00	$ 2,500.00	$ 2,500.00	$ 2,500.00	**$ 17,500.00**	**$ 5,250.00**	**$ 22,750.00**	**$ 15,925.00**	**$ 34,125.00**	**$ 24,706.00**
BBU	$ 200,000.00	$ 200,000.00	$ 200,000.00	$ 200,000.00	$ 200,000.00	$ 200,000.00	$ 200,000.00	**$ 1,400,000.00**	**$ 420,000.00**	**$ 1,820,000.00**	**$ 1,274,000.00**	**$ 2,730,000.00**	**$ 1,976,461.00**
Saturator Basement	$ 50,000.00	$ 50,000.00	$ 50,000.00	$ 50,000.00	$ 50,000.00	$ 50,000.00	$ 50,000.00	**$ 350,000.00**	**$ 105,000.00**	**$ 455,000.00**	**$ 318,500.00**	**$ 682,500.00**	**$ 494,116.00**
Building SF	$ 142,500.00	$ 190,500.00	$ 254,000.00	$ 440,800.00	$ 142,500.00	$ 254,000.00	$ 254,000.00	**$ 1,678,300.00**	**$ 503,490.00**	**$ 2,181,790.00**	**$ 1,527,253.00**	**$ 3,272,685.00**	**$ 2,369,353.00**
Storage Warehouse Space	$ 78,000.00	$ 117,000.00	$ 104,000.00	$ 104,000.00	$ 78,000.00	$ 104,000.00	$ 84,000.00	**$ 669,000.00**	**$ 200,700.00**	**$ 869,700.00**	**$ 608,790.00**	**$ 1,304,550.00**	**$ 944,466.00**
Demo Existing Building	$ -	$ -	$ -	$ 20,000.00	$ -	$ -	$ -	**$ 20,000.00**	**$ 6,000.00**	**$ 26,000.00**	**$ 18,200.00**	**$ 39,000.00**	**$ 28,236.00**
Site Improvements	$ 250,000.00	$ 250,000.00	$ 150,000.00	$ 150,000.00	$ 250,000.00	$ 150,000.00	$ 150,000.00	**$ 1,350,000.00**	**$ 405,000.00**	**$ 1,755,000.00**	**$ 1,228,500.00**	**$ 2,632,500.00**	**$ 1,905,873.00**
Subtotal Capital Cost	$ 1,243,000.00	$ 1,434,000.00	$ 1,024,500.00	$ 1,247,300.00	$ 1,243,000.00	$ 1,024,500.00	$ 1,244,500.00	**$ 8,460,800.00**					
Contingency (30%)	$ 372,900.00	$ 430,200.00	$ 307,350.00	$ 374,190.00	$ 372,900.00	$ 307,350.00	$ 373,350.00	**$ 2,538,240.00**					
Total Capital Costs	$ 1,615,900.00	$ 1,864,200.00	$ 1,331,850.00	$ 1,621,490.00	$ 1,615,900.00	$ 1,331,850.00	$ 1,617,850.00	**$ 10,999,040.00**		**$ 10,999,040.00**	**$ 7,699,328.00**	**$ 16,498,560.00**	**$ 11,944,606.00**

Liquid Operating Costs (Concept Level Costs, 2022 Dollars)

Description	Well Electric	Parkwater	Ray	Central Ave	Grace/Nevada	Hoffman	Havana	Total
Operating of Equipment	$78,071.34	$78,071.34	$78,071.34	$78,071.34	$78,071.34	$78,071.34	$78,071.34	**$546,499.38**
Energy	$1,378.28	$1,771.35	$1,262.35	$ 1,259.17	$ 1,261.17	$ 1,215.41	$ 1,610.84	**$9,758.56**
Chemical	$ 232,817.38	$ 292,843.43	$ 83,594.05	$ 73,573.19	$ 165,178.96	$ 38,761.25	$ 101,112.22	**$987,880.47**

Replacement Schedule

	Years			
Component	**Minimum**	**Most Likely**	**Maximum**	**Probabilistic**
Electrical Panel	7	10	15	11
PLC MicroLogic 1400	7	10	15	11
Metering Pump Skid	14	20	30	22
Backflow Preventer	14	20	30	22
Man Door	14	20	30	22
Roll up Door	14	20	30	22
Fluoride Analyzer	7	10	15	11
BBU	14	20	30	22
Saturator Basement	0	0	0	0
Building 635 sf @ $300	0	0	0	0
Site Improvements	14	20	30	22

Salvage Rate

Percent			
Minimum	**Most Likely**	**Maximum**	**Probabilistic**
4%	5%	8%	5.43%

City of Spokane **(Dry) Fluoridation Total Cost of Ownership Model**

Life Cycle Period	50		Engineering	Initial Capital Costs	Annual Operating Costs				Capital and Equipment Replacement	Contingency	Salvage Values	LCCA Cost (2022 Dollars)		Net Present Value (NPV)			
Period	Year	Escalation (Construction)	Total Engineering	Total Capital	Maintenance	Operation of Equipment	Power	Chemical	Total Replacement	Operating Contingency	Total Salvage	Net Costs	Net Present Value (NPV)	Operating and Maintenance	Capital Replacement	Operating Contingency	Salvage
0	2022	0.00%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1	2023	13.57%	$ 1,599,999.60	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,599,999.60	$ 1,517,596.57	$ -	$ -	$ -	$ -
2	2024	28.38%	$ -	$ 7,666,955.41	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,666,955.41	$ 6,897,565.98	$ -	$ -	$ -	$ -
3	2025	39.53%	$ -	$ 8,333,040.55	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 8,333,040.55	$ 7,110,708.65	$ -	$ -	$ -	$ -
4	2026	47.10%	$ -	$ -	$ 511,201.23	$ 803,923.77	$ 14,355.26	$ 1,453,214.09	$ -	$ 834,808.30	$ -	$ 3,617,502.65	$ 2,927,889.70	$ 2,252,222.84	$ -	$ 675,666.85	$ -
5	2027	55.09%	$ -	$ -	$ 538,958.62	$ 847,575.53	$ 15,134.73	$ 1,532,121.25	$ -	$ 880,137.04	$ -	$ 3,813,927.17	$ 2,927,889.70	$ 2,252,222.84	$ -	$ 675,666.85	$ -
6	2028	63.51%	$ -	$ -	$ 568,223.20	$ 893,597.50	$ 15,956.52	$ 1,615,312.94	$ -	$ 927,927.05	$ -	$ 4,021,017.21	$ 2,927,889.70	$ 2,252,222.84	$ -	$ 675,666.85	$ -
7	2029	72.39%	$ -	$ -	$ 599,076.80	$ 942,118.39	$ 16,822.93	$ 1,703,021.81	$ -	$ 978,311.98	$ -	$ 4,239,351.91	$ 2,927,889.70	$ 2,252,222.84	$ -	$ 675,666.85	$ -
8	2030	81.75%	$ -	$ -	$ 631,605.69	$ 993,273.89	$ 17,736.39	$ 1,795,493.13	$ -	$ 1,031,432.73	$ -	$ 4,469,541.82	$ 2,927,889.70	$ 2,252,222.84	$ -	$ 675,666.85	$ -
9	2031	91.62%	$ -	$ -	$ 665,900.86	$ 1,047,207.04	$ 18,699.45	$ 1,892,985.48	$ -	$ 1,087,437.85	$ -	$ 4,712,230.68	$ 2,927,889.70	$ 2,252,222.84	$ -	$ 675,666.85	$ -
10	2032	102.03%	$ -	$ -	$ 702,058.19	$ 1,104,068.68	$ 19,714.80	$ 1,995,771.52	$ -	$ 1,146,483.96	$ -	$ 4,968,097.14	$ 2,927,889.70	$ 2,252,222.84	$ -	$ 675,666.85	$ -
11	2033	113.00%	$ -	$ -	$ 740,178.81	$ 1,164,017.82	$ 20,785.28	$ 2,104,138.67	$ -	$ 1,208,736.17	$ -	$ 5,237,856.74	$ 2,927,889.70	$ 2,252,222.84	$ -	$ 675,666.85	$ -
12	2034	124.56%	$ -	$ -	$ 780,369.31	$ 1,227,222.09	$ 21,913.89	$ 2,218,389.97	$ -	$ 1,274,368.58	$ -	$ 5,522,263.85	$ 2,927,889.70	$ 2,252,222.84	$ -	$ 675,666.85	$ -
13	2035	136.75%	$ -	$ -	$ 822,742.10	$ 1,293,858.26	$ 23,103.77	$ 2,338,844.94	$ -	$ 1,343,564.72	$ -	$ 5,822,113.79	$ 2,927,889.70	$ 2,252,222.84	$ -	$ 675,666.85	$ -
14	2036	149.61%	$ -	$ -	$ 867,415.66	$ 1,364,112.66	$ 24,358.27	$ 2,465,840.42	$ 1,875,565.11	$ 1,416,518.10	$ (101,840.14)	$ 7,911,970.08	$ 3,773,941.13	$ 2,252,222.84	$ 894,628.29	$ 675,666.85	$ (48,576.86)
15	2037	163.16%	$ -	$ -	$ 914,514.92	$ 1,438,181.76	$ 25,680.89	$ 2,599,731.55	$ -	$ 1,493,432.73	$ -	$ 6,471,541.84	$ 2,927,889.70	$ 2,252,222.84	$ -	$ 675,666.85	$ -
16	2038	177.45%	$ -	$ -	$ 964,171.59	$ 1,516,272.69	$ 27,075.32	$ 2,740,892.74	$ -	$ 1,574,523.70	$ -	$ 6,822,936.04	$ 2,927,889.70	$ 2,252,222.84	$ -	$ 675,666.85	$ -
17	2039	192.52%	$ -	$ -	$ 1,016,524.54	$ 1,598,603.83	$ 28,545.46	$ 2,889,718.76	$ -	$ 1,660,017.78	$ -	$ 7,193,410.37	$ 2,927,889.70	$ 2,252,222.84	$ -	$ 675,666.85	$ -
18	2040	208.40%	$ -	$ -	$ 1,071,720.17	$ 1,685,405.42	$ 30,095.43	$ 3,046,625.79	$ -	$ 1,750,154.04	$ -	$ 7,584,000.86	$ 2,927,889.70	$ 2,252,222.84	$ -	$ 675,666.85	$ -
19	2041	225.15%	$ -	$ -	$ 1,129,912.83	$ 1,776,920.19	$ 31,729.57	$ 3,212,052.62	$ -	$ 1,845,184.56	$ -	$ 7,995,799.78	$ 2,927,889.70	$ 2,252,222.84	$ -	$ 675,666.85	$ -
20	2042	242.80%	$ -	$ -	$ 1,191,265.26	$ 1,873,404.07	$ 33,452.43	$ 3,386,461.85	$ -	$ 1,945,375.09	$ -	$ 8,429,958.70	$ 2,927,889.70	$ 2,252,222.84	$ -	$ 675,666.85	$ -
21	2043	253.97%	$ -	$ -	$ 1,230,075.52	$ 1,934,437.75	$ 34,542.28	$ 3,496,789.48	$ -	$ 2,008,753.51	$ -	$ 8,704,598.53	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
22	2044	265.50%	$ -	$ -	$ 1,270,150.18	$ 1,997,459.84	$ 35,667.63	$ 3,610,711.47	$ -	$ 2,074,196.74	$ -	$ 8,988,185.86	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
23	2045	277.41%	$ -	$ -	$ 1,311,530.44	$ 2,062,535.14	$ 36,829.65	$ 3,728,344.93	$ -	$ 2,141,772.04	$ -	$ 9,281,012.19	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
24	2046	289.70%	$ -	$ -	$ 1,354,258.82	$ 2,129,730.52	$ 38,029.52	$ 3,849,810.77	$ -	$ 2,211,548.89	$ -	$ 9,583,378.51	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
25	2047	302.40%	$ -	$ -	$ 1,398,379.25	$ 2,199,115.06	$ 39,268.49	$ 3,975,233.85	$ 24,445,219.61	$ 2,283,598.99	$ (1,327,335.68)	$ 33,013,479.57	$ 14,811,833.92	$ 3,415,199.84	$ 10,967,596.81	$ 1,024,559.95	$ (595,522.68)
26	2048	315.51%	$ -	$ -	$ 1,443,937.08	$ 2,270,760.09	$ 40,547.82	$ 4,104,743.09	$ -	$ 2,357,996.42	$ -	$ 10,217,984.49	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
27	2049	329.05%	$ -	$ -	$ 1,490,979.14	$ 2,344,739.23	$ 41,868.83	$ 4,238,471.61	$ -	$ 2,434,817.64	$ -	$ 10,550,876.46	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
28	2050	343.02%	$ -	$ -	$ 1,539,553.79	$ 2,421,128.55	$ 43,232.87	$ 4,376,556.88	$ -	$ 2,514,141.63	$ -	$ 10,894,613.72	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
29	2051	357.46%	$ -	$ -	$ 1,589,710.95	$ 2,500,006.56	$ 44,641.36	$ 4,519,140.84	$ -	$ 2,596,049.91	$ -	$ 11,249,549.61	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
30	2052	372.36%	$ -	$ -	$ 1,641,502.18	$ 2,581,454.33	$ 46,095.73	$ 4,666,370.04	$ -	$ 2,680,626.68	$ -	$ 11,616,048.96	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
31	2053	387.75%	$ -	$ -	$ 1,694,980.72	$ 2,665,555.60	$ 47,597.48	$ 4,818,395.82	$ -	$ 2,767,958.89	$ -	$ 11,994,488.50	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
32	2054	403.64%	$ -	$ -	$ 1,750,201.54	$ 2,752,396.80	$ 49,148.16	$ 4,975,374.46	$ -	$ 2,858,136.29	$ -	$ 12,385,257.24	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
33	2055	420.05%	$ -	$ -	$ 1,807,221.40	$ 2,842,067.20	$ 50,749.36	$ 5,137,467.30	$ -	$ 2,951,251.58	$ -	$ 12,788,756.84	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
34	2056	436.99%	$ -	$ -	$ 1,866,098.91	$ 2,934,658.98	$ 52,402.72	$ 5,304,840.97	$ -	$ 3,047,400.48	$ -	$ 13,205,402.06	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
35	2057	454.49%	$ -	$ -	$ 1,926,894.59	$ 3,030,267.30	$ 54,109.95	$ 5,477,667.52	$ -	$ 3,146,681.81	$ -	$ 13,635,621.18	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
36	2058	472.55%	$ -	$ -	$ 1,989,670.94	$ 3,128,990.46	$ 55,872.80	$ 5,656,124.58	$ 5,924,108.95	$ 3,249,197.63	$ (321,669.48)	$ 19,682,295.88	$ 6,206,360.58	$ 3,415,199.84	$ 1,868,031.89	$ 1,024,559.95	$ (101,431.09)
37	2059	491.20%	$ -	$ -	$ 2,054,492.47	$ 3,230,929.91	$ 57,693.09	$ 5,840,395.60	$ -	$ 3,355,053.32	$ -	$ 14,538,564.40	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
38	2060	510.47%	$ -	$ -	$ 2,121,425.83	$ 3,336,190.46	$ 59,572.67	$ 6,030,670.00	$ -	$ 3,464,357.69	$ -	$ 15,012,216.64	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
39	2061	530.35%	$ -	$ -	$ 2,190,539.82	$ 3,444,880.29	$ 61,513.49	$ 6,227,143.34	$ -	$ 3,577,223.08	$ -	$ 15,501,300.02	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
40	2062	550.89%	$ -	$ -	$ 2,261,905.47	$ 3,557,111.13	$ 63,517.54	$ 6,430,017.60	$ -	$ 3,693,765.52	$ -	$ 16,006,317.25	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
41	2063	572.10%	$ -	$ -	$ 2,335,596.14	$ 3,672,998.34	$ 65,586.88	$ 6,639,501.30	$ -	$ 3,814,104.80	$ -	$ 16,527,787.45	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
42	2064	593.99%	$ -	$ -	$ 2,411,687.59	$ 3,792,661.04	$ 67,723.63	$ 6,855,809.77	$ -	$ 3,938,364.61	$ -	$ 17,066,246.65	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
43	2065	616.60%	$ -	$ -	$ 2,490,258.02	$ 3,916,222.24	$ 69,930.00	$ 7,079,165.37	$ -	$ 4,066,672.69	$ -	$ 17,622,248.31	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
44	2066	639.95%	$ -	$ -	$ 2,571,388.19	$ 4,043,808.94	$ 72,208.26	$ 7,309,797.67	$ -	$ 4,199,160.92	$ -	$ 18,196,363.97	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
45	2067	664.05%	$ -	$ -	$ 2,655,161.51	$ 4,175,552.29	$ 74,560.73	$ 7,547,943.75	$ -	$ 4,335,965.48	$ -	$ 18,789,183.76	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
46	2068	688.95%	$ -	$ -	$ 2,741,664.08	$ 4,311,587.71	$ 76,989.85	$ 7,793,848.39	$ -	$ 4,477,227.01	$ -	$ 19,401,317.04	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
47	2069	714.65%	$ -	$ -	$ 2,830,984.83	$ 4,452,055.03	$ 79,498.10	$ 8,047,764.37	$ 57,770,337.39	$ 4,623,090.70	$ (3,136,835.39)	$ 74,666,895.02	$ 16,547,525.32	$ 3,415,199.84	$ 12,802,944.60	$ 1,024,559.95	$ (695,179.08)
48	2070	741.19%	$ -	$ -	$ 2,923,215.55	$ 4,597,098.64	$ 82,088.07	$ 8,309,952.68	$ -	$ 4,773,706.48	$ -	$ 20,686,061.42	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
49	2071	768.60%	$ -	$ -	$ 3,018,451.06	$ 4,746,867.63	$ 84,762.42	$ 8,580,682.83	$ -	$ 4,929,229.18	$ -	$ 21,359,993.12	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
50	2072	796.89%	$ -	$ -	$ 3,116,789.25	$ 4,901,515.95	$ 87,523.90	$ 8,860,233.11	$ -	$ 5,089,818.66	$ -	$ 22,055,880.86	$ 4,439,759.79	$ 3,415,199.84	$ -	$ 1,024,559.95	$ -
Total			**$ 1,599,999.60**	**$ 15,999,995.96**	**$ 74,744,545.02**	**$ 117,544,546.57**	**$ 2,098,933.66**	**$ 212,479,586.89**	**$ 90,015,231.06**	**$ 122,060,283.64**	**$ (4,887,680.70)**	**$ 631,655,441.70**	**$ 223,585,281.67**	**$ 140,743,783.52**	**$ 26,533,201.59**	**$ 42,223,135.06**	**$ (1,440,709.71)**
				Annual Operating Costs	$ 406,867,612.14												

Performance and Value Scoring

Liquid Criteria	(1) Environmental & Sustainability	(2) Neighborhood Impacts	(3) Safety - Public	(4) Safety - Worker	(5) Service Reliability	(6) Ease of Maintenance & Operations	Total Performance
Weighting	*8%*	*12%*	*25%*	*25%*	*15%*	*15%*	*100%*
Respondant 1	6	5	5	6	7	5	
2	4	8	4	6	8	4	
3	5	5	4	4	5	3	
4	6	8	8	7	9	5	
5	9	6	8	6	4	4	
6	6	2	6	4	4	2	
7	3	3	7	3	6	3	
8	8	7	6	6	7	4	
9	1	1	4	2	6	2	
10	8	8	4	6	8	4	
Average	5.6	5.3	5.6	5.0	6.4	3.6	
Weighted	**0.4**	**0.6**	**1.4**	**1.3**	**1.0**	**0.5**	**5.2**
Liquid TCO (millions)	**$ 202**	**Cost Score:**	**4.3**		**Liquid Value Score:**		**1.2**

Dry Criteria	(1) Environmental & Sustainability	(2) Neighborhood Impacts	(3) Safety - Public	(4) Safety - Worker	(5) Service Reliability	(6) Ease of Maintenance & Operations	Total Performance
Weighting	*8%*	*12%*	*25%*	*25%*	*15%*	*15%*	*100%*
Respondant 1	7	4	7	5	5	4	
2	4	8	6	3	4	3	
3	6	5	5	5	6	3	
4	5	5	5.5	7	6	4	
5	9	6	8	6	4	4	
6	6	0	4	6	4	0	
7	4	3	6	4	7	3	
8	7	8	7	4	6	3	
9	1	2	3	2	4	2	
10	8	6	6	8	6	2	
Average	5.7	4.7	5.8	5.0	5.2	2.8	
Weighted	**0.5**	**0.6**	**1.4**	**1.3**	**0.8**	**0.4**	**4.9**
Dry TCO (millions)	**$ 264**	**Cost Score:**	**5.7**		**Dry Value Score:**		**0.9**

Score Difference	(1) Environmental & Sustainability	(2) Neighborhood Impacts	(3) Safety - Public	(4) Safety - Worker	(5) Service Reliability	(6) Ease of Maintenance & Operations	Total Performance
	-0.1	**0.6**	**-0.2**	**0.0**	**1.2**	**0.8**	**0.3**

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APPENDIX F
PRELIMINARY DESIGN
DRAWINGS SUBMITTAL

CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

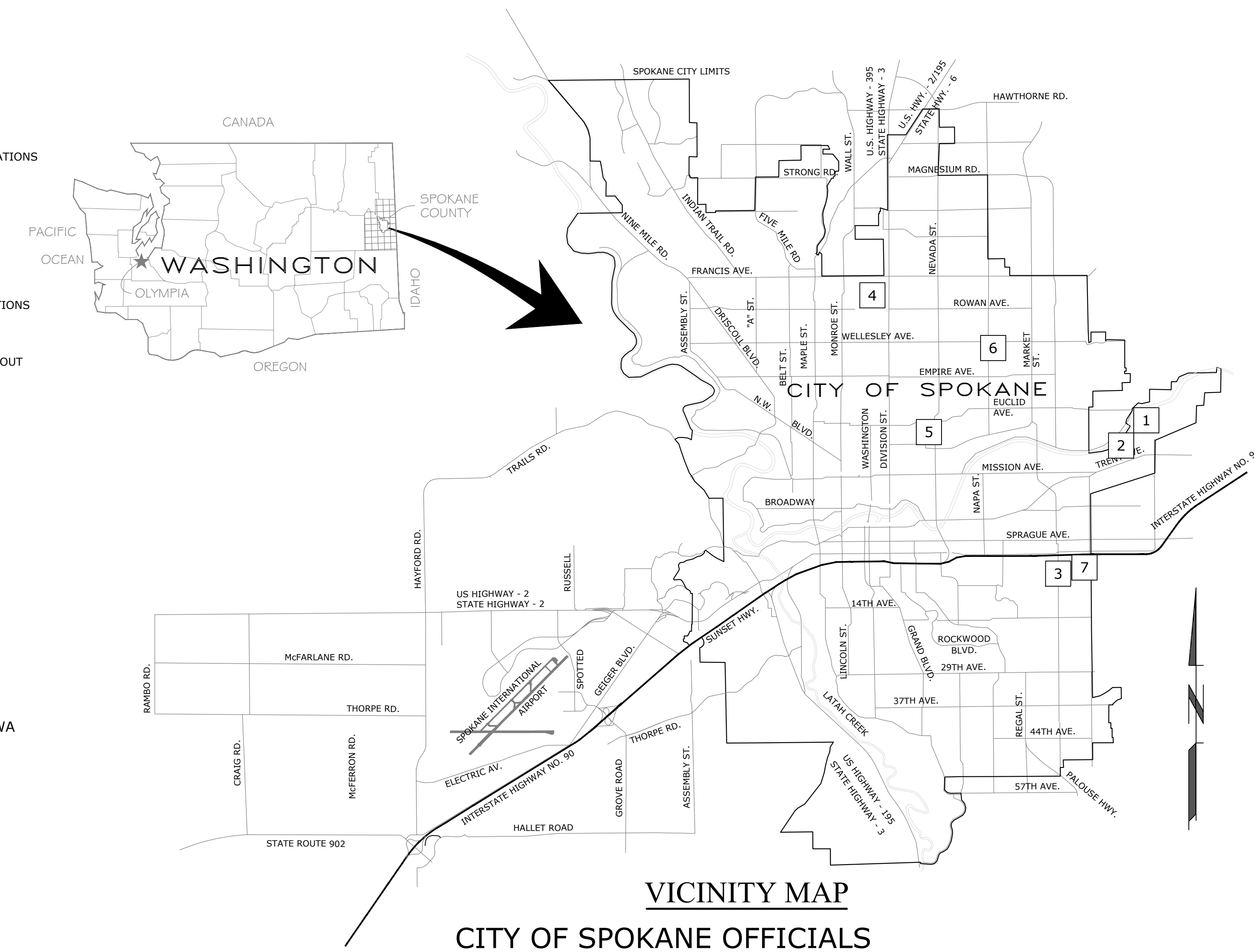
MAY 2023

PRELIMINARY DESIGN DRAWINGS

INDEX OF DRAWINGS

SITE:

1	100 - WELL ELECTRIC WELL	2710 N WATERWORKS ST. SPOKANE, WA
2	200 - PARKWATER WELL	5317 E RUTTER AVE. SPOKANE, WA
3	300 - RAY STREET WELL	607 S RAY ST. SPOKANE, WA
4	400 - CENTRAL AVE WELL	5903 N NORMANDIE ST. SPOKANE, WA
5	500 - GRACE & NEVADA WELLS	1024 E NORTH FOOTHILLS DR. SPOKANE, WA
6	600 - HOFFMAN WELL	2109 E HOFFMAN AVE. SPOKANE, WA
7	700 - HAVANA WELL	4302 E 6TH AVE. SPOKANE, WA



VICINITY MAP

CITY OF SPOKANE OFFICIALS

NADINE WOODWARD	MAYOR
BREEAN BEGGS	COUNCIL MEMBER
MICHAEL CATHART	COUNCIL MEMBER
JONATHAN BINGLE	COUNCIL MEMBER
LORI KINNEAR	COUNCIL MEMBER
BETSY WILKERSON	COUNCIL MEMBER
ZACK ZAPPONE	COUNCIL MEMBER
KAREN STRATTON	COUNCIL MEMBER
MARLENE FEIST	PUBLIC WORKS DIRECTOR
JOHNNIE PERKINS	CITY ADMINISTRATION
TERRI PFISTER	CITY CLERK
DAN BULLER, P.E.	CITY ENGINEER
LOREN SEARL	DIRECTOR OF WATER & HYDRO-ELECTRIC

consor
421 W. RIVERSIDE AVENUE
SPOKANE, WA 99201
P 509.321.0340

22-3386

PIPE & FITTING SYMBOLS

PLANT | SCHEMATIC

- WELDED JOINT
- FLANGED JOINT
- GROOVED END JOINT
- MECHANICAL JOINT
- PUSH-ON JOINT (RUBBER GASKET)
- FLANGED COUPLING ADAPTER
- DOUBLE BALL FLEXIBLE EXTENSION COUPLING
- FLEXIBLE COUPLING W/ THRUST RING
- 90° BEND UP
- 90° BEND DOWN
- TEE UP
- TEE DOWN
- LATERAL UP
- LATERAL DOWN
- CONCENTRIC REDUCER
- ECCENTRIC REDUCER
- UNION
- BLIND FLANGE
- CAP
- LONG SLEEVE
- FLEXIBLE COUPLING
- FITTING (45°)

VALVE SYMBOLS

PLANT | SCHEMATIC

- BUTTERFLY VALVE
- GATE VALVE
- GLOBE VALVE
- BALL VALVE
- BALANCING VALVE
- PLUG VALVE (TOP)
- PLUG VALVE (SIDE)
- 3-WAY PLUG VALVE
- CHECK VALVE
- SWING CHECK VALVE
- DOUBLE CHECK ASSEMBLY
- BALL SWING CHECK
- SILENT CHECK VALVE
- PRESSURE REDUCING VALVE
- ALTITUDE CONTROL VALVE
- SOLENOID VALVE (S)
- RELIEF VALVE
- NEEDLE VALVE (M)
- HOSE VALVE
- REDUCED PRESSURE BACKFLOW PREVENTER W/ GATE VALVES
- HOSE BIBB

TOPOGRAPHIC LEGEND

	EXISTING	PROPOSED
WATERLINE	10"W	12"DI W
ELECTRICITY	E	E
GAS	4"G	4"G
TELEPHONE/TELEMETRY	T	T
CABLE TELEVISION	CATV	CATV
SANITARY SEWER LINE	8"SS	8"SS
SANITARY SEWER FORCE MAIN	6"FM	6"FM
STORM DRAIN	8"SD	8"SD
CULVERT		18"D
ABANDON PIPE		
DRAINAGE DITCH		
BARBWIRE FENCE		
CHAIN LINK FENCE		
TEMPORARY SILT FENCE		
GUARDRAIL		
ROCK WALL		
TREE/BUSH LINE		
CENTERLINE		
EASEMENT/PROPERTY LINE		
RIGHT-OF-WAY		
EDGE OF PAVEMENT/AC		
EDGE OF GRAVEL		
CURB		
SIDEWALK	S/W	
STRUCTURE OR FACILITY		
CONTOUR MINOR		
CONTOUR MAJOR	200	200
MANHOLE		
CLEAN-OUT		
CATCH BASIN/FIELD INLET		
THRUST BLOCK		
VALVE		
AIR INJECTION ASSEMBLY		
BLOW-OFF ASSEMBLY		
AIR RELEASE ASSEMBLY		
FIRE HYDRANT ASSEMBLY		
WATER METER		
PULL BOX/JUNCTION BOX		
UTILITY POLE		
GUY WIRE		
LIGHT POST		
MAILBOX		
SIGN		
BENCHMARK		
TREE DECIDUOUS		
TREE CONIFEROUS		
TREE TO BE REMOVED		
SURFACE ELEVATION		

SECTION AND DETAIL DESIGNATIONS

SECTION DESIGNATIONS

A / 2 — SECTION LETTER DESIGNATION; SHEET WHERE SECTION IS SHOWN *

SECTION A / 2
SCALE:

SECTION LETTER DESIGNATION
SHEET FROM WHICH SECTION IS TAKEN *

DETAIL DESIGNATIONS

DETAIL 2 / 2
SCALE:

DETAIL NUMBER
SHEET FROM WHICH DETAIL IS TAKEN *

* NOTE: IF PLAN AND SECTION FOR DETAIL CALL-OUT AND DETAIL ARE SHOWN ON THE SAME DRAWING, DRAWING NUMBER IS REPLACED WITH A DASH.

MISCELLANEOUS PIPING SYMBOLS

- STRAINER
- SIGHT GLASS
- PRESSURE GAUGE W/ COCK
- PRESSURE SWITCH W/ COCK
- SP — SLIP-ON JOINT PIPE
- R — RESTRAINED JOINT PIPE
- M — FLOW METER
- CL — CHLORINE ANALYZER
- CHLORINE INJECTION POINT
- SAMPLE POINT FOR CHLORINE MONITOR ANALYSIS
- APPROX LOCATION OF WELL PUMP
- F — CHEMICAL SOLUTION LINE

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

NDH — DESIGNED
EJJ — DRAWN
JHBF — CHECKED

PRELIMINARY ONLY — NOT FOR CONSTRUCTION — 38779 — MAY 2023

consor

CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

SYMBOLS AND LEGEND

SHEET G-002

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023

@	AT
AASHTO	AMERICAN ASSOCIATION OF STATE HIGHWAY & TRANSPORTATION OFFICIALS
AB	ANCHOR BOLT
ABAN(D)	ABANDON(ED)
ABS	ACRYLONITRILE BUTADIENE STYRENE
ABV	ABOVE / ALCOHOL BY VOLUME
AC	ASPHALTIC CONCRETE
ACP	ASPHALTIC CONCRETE PAVING
ADJ	ADJUSTABLE
ADJC	ADJACENT
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AHR	ANCHOR
AL	ALUMINUM
ALT	ALTERNATE
AMP	AMPERE
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
APPROX	APPROXIMATE
APPVD	APPROVED
APWA	AMERICAN PUBLIC WORKS ASSOCIATION
ARCH	ARCHITECTURAL
ARV	AIR RELEASE VALVE
ASCE	AMERICAN SOCIETY OF CIVIL ENGINEERS
ASR	AQUIFER STORAGE & RECOVERY
ASSN	ASSOCIATION
ASSY	ASSEMBLY
ASTM	AMERICAN SOCIETY FOR TESTING & MATERIALS
ATM	ATMOSPHERE
AUTO	AUTOMATIC
AUX	AUXILIARY
AVE	AVENUE
AVG	AVERAGE
AWWA	AMERICAN WATER WORKS ASSOCIATION
B&S	BELL & SPIGOT
BC	BOLT CIRCLE
BD	BOARD
BETW	BETWEEN
BF	BOTH FACE
BFD	BACKFLOW PREVENTION DEVICE
BFILL	BACKFILL
BFV	BUTTERFLY VALVE
BHP	BRAKE HORSEPOWER
BKGD	BACKGROUND
BLDG	BUILDING
BLK	BLOCK
BLVD	BOULEVARD
BM	BENCHMARK / BEAM
BMP	BEST MANAGEMENT PRACTICES
BO	BLOW-OFF
BOC	BACK OF CURB
BS	BOTH SIDES
BSMT	BASEMENT
BTF	BOTTOM FACE
BTU	BRITISH THERMAL UNIT
BV	BALL VALVE
BW	BOTH WAYS
C	CELSIUS
C TO C	CENTER TO CENTER
CALTRANS	CALIFORNIA DEPARTMENT OF TRANSPORTATION
CARV	COMBINATION AIR RELEASE VALVE
CATV	CABLE TELEVISION
CB	CATCH BASIN
CCP	CONCRETE CYLINDER PIPE
CCW	COUNTER CLOCKWISE
CDOT	COLORADO DEPARTMENT OF TRANSPORTATION
CFM	CUBIC FEET PER MINUTE
CFS	CUBIC FEET PER SECOND
CHAN	CHANNEL
CHEM	CHEMICAL
CHFR	CHAMFER
CHKV	CHECK VALVE
CI	CAST IRON
CIP	CAST IRON PIPE
CIPC	CAST IN PLACE CONCRETE
CISP	CAST IRON SOIL PIPE
CJ	CONSTRUCTION JOINT
CL OR C/L	CENTER LINE
CL2	CHLORINE
CLG	CEILING
CLJ	CONTROL JOINT
CLR	CLEAR
CLSM	CONTROLLED LOW STRENGTH MATERIAL
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CND	CONDUIT
CO	CLEANOUT
COL	COLUMN
COMB	COMBINATION
CONC	CONCRETE
CONN	CONNECTION
CONST	CONSTRUCTION
CONT	CONTINUOUS / CONTINUATION
CONTR	CONTRACT(OR)
COORD	COORDINATE
COP	COPPER
CORP	CORPORATION
CORR	CORRUGATED
CP	CONTROL POINT
CPLG	COUPLING
CPVC	CHLORINATED POLYVINYL CHLORIDE
CR	CRUSHED ROCK
CS	COMBINED SEWER
CSP	CONCRETE SEWER PIPE
CT	COURT
CTR	CENTER
CU	CUBIC
CULV	CULVERT
CV	CONTROL VALVE
CW	CLOCKWISE / COLD WATER
CY	CUBIC YARDS
CYL	CYLINDER LOCK
D	DRAIN
DC	DIRECT CURRENT
DEFL	DEFLECTION
DEQ	DEPARTMENT OF ENVIRONMENTAL QUALITY
DET	DETAIL
DI	DUCTILE IRON
DIA	DIAMETER
DIM	DIMENSION
DIR	DIRECTION
DIST	DISTANCE
DN	DOWN
DR	DRIVE
DS	DOWNSPOUT
DWG	DRAWING
DWL	DOWEL
DWV	DRAIN WASTE AND VENT
DWY	DRIVEWAY
E / ELEC	ELECTRICAL
EA	EACH
ECC	ECCENTRIC
EF	EACH FACE
EL	ELEVATION
ELB	ELBOW
ENCL	ENCLOSURE
EOP	EDGE OF PAVEMENT
EQ	EQUAL
EQL SP	EQUALLY SPACED
EQUIP	EQUIPMENT
ESMT	EASEMENT
EW	EACH WAY
EXC	EXCAVATE
EXIST	EXISTING
EXP	EXPANSION
EXP BT	EXPANSION BOLT
EXP JT	EXPANSION JOINT
EXT	EXTERIOR
F	FAHRENHEIT
F TO F	FACE TO FACE
FAB	FABRICATE
FB	FLAT BAR
FCA	FLANGED COUPLING ADAPTER
FCO	FLOOR CLEANOUT
FD	FLOOR DRAIN
FDN	FOUNDATION
FEXT	FIRE EXTINGUISHER
FF	FINISHED FLOOR / FAR FACE
FGL	FIBERGLASS
FH	FIRE HYDRANT
FIN	FINISH(ED)
FIPT	FEMALE IRON PIPE THREAD
FITG	FITTING
FL	FLOOR LINE
FLEX	FLEXIBLE
FLG	FLANGE
FLL	FLOW LINE
FLR	FLOOR
FM	FORCE MAIN
FO	FIBER OPTIC
FOC	FACE OF CONCRETE
FOF	FACE OF FINISH
FOM	FACE OF MASONRY
FOS	FACE OF STUDS
FPM	FEET PER MINUTE
FPS	FEET PER SECOND
FRP	FIBERGLASS REINFORCED PLASTIC
FT	FEET / FOOT
FTG	FOOTING
FUT	FUTURE
FXTR	FIXTURE
G	GAS
GA	GAUGE
GAL	GALLON
GALV	GALVANIZED
GC	GROOVED COUPLING
GFA	GROOVED FLANGE ADAPTER
GI	GALVANIZED IRON
GIP	GALVANIZED IRON PIPE
GJ	GRIP JOINT
GL	GLASS
GLV	GLOBE VALVE
GND	GROUND
GPD	GALLONS PER DAY
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
GPS	GALLONS PER SECOND
GR	GRADE
GR LN	GRADE LINE
GRTG	GRATING
GV	GATE VALVE
GRVL	GRAVEL
GYP	GYPSUM
HB	HOSE BIBB
HC	HOLLOW CORE
HDPE	HIGH DENSITY POLYETHYLENE
HDR	HEADER
HDWE	HARDWARE
HGR	HANGER
HGT	HEIGHT
HH	HANDHOLD
HM	HOLLOW METAL
HMAC	HOT MIX ASPHALT CONCRETE
HNDRL	HANDRAIL
HOA	HAND-OFF-AUTO
HOR	HAND-OFF-REMOTE
HORIZ	HORIZONTAL
HP	HIGH PRESSURE / HORSEPOWER
HPG	HIGH PRESSURE GAS
HPT	HIGH POINT
HR	HOUR
HSB	HIGH STRENGTH BOLT
HV	HOSE VALVE
HVAC	HEATING, VENTILATION, AIR CONDITIONING
HWL	HIGH WATER LINE
HWY	HIGHWAY
HYD	HYDRANT
HYDR	HYDRAULIC
I&C	INSTRUMENTATION & CONTROL
IAW	IN ACCORDANCE WITH
ID	INSIDE DIAMETER
IE	INVERT ELEVATION
IF	INSIDE FACE
IMPVT	IMPROVEMENT
IN	INCH
INCC	INCLUDE(D)(ING)
INFL	INFLUENT
INJ	INJECTION
INSTL	INSTALLATION / INSTALL
INSUL	INSULATION
INTER	INTERCEPTOR
INTR	INTERIOR
INV	INVERT
IP	IRON PIPE
IPT	IRON PIPE THREAD
IR	IRON ROD
IRRIG	IRRIGATION
ITD	IDAHO TRANSPORTATION DEPARTMENT
JT	JOINT
JUNC	JUNCTION
KPL	KICK PLATE
KVA	KILOVOLT AMPERE
KW	KILOWATT
KWY	KEYWAY
L	LENGTH
LAB	LABORATORY
LAV	LAVATORY
LB	POUND
LF	LINEAR FOOT
LIN	LINEAL
LN	LANE
LOC	LOCATION
LONG	LONGITUDINAL
LP	LOW PRESSURE
LPT	LOW POINT
LRG	LARGE
LS	LONG SLEEVE / LUMP SUM
LT	LEFT
LVL	LEVEL
LWL	LOW WATER LINE
MAN	MANUAL
MAT	MATERIAL
MAX	MAXIMUM
MCC	MOTOR CONTROL CENTER
MCP	MASTER CONTROL PANEL
MECH	MECHANICAL
MET	METAL
MFR	MANUFACTURER
MGD	MILLION GALLONS PER DAY
MH	MANHOLE
MIN	MINIMUM
MIPT	MALE IRON PIPE THREAD
MISC	MISCELLANEOUS
MJ	MECHANICAL JOINT
MON	MONUMENT / MONOLITHIC
MOT	MOTOR
MP	MILEPOST
MSL	MEAN SEAL LEVEL
MTD	MOUNTED
NA	NOT APPLICABLE
NAVD	NORTH AMERICAN VERTICAL DATUM
NC	NORMALLY CLOSED
NF	NEAR FACE
NIC	NOT IN CONTRACT
NO / NO.	NORMALLY OPEN / NUMBER
NOM	NOMINAL
NORM	NORMAL
NRS	NON-RISING STEM
NTS	NOT TO SCALE
O TO O	OUT TO OUT
OAR	OREGON ADMINISTRATIVE RULES
OC	ON CENTER
OD	OUTSIDE DIAMETER
ODOT	OREGON DEPARTMENT OF TRANSPORTATION
OF	OVERFLOW / OUTSIDE FACE
OPNG	OPENING
OPP	OPPOSITE
ORIG	ORIGINAL
OSHA	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
OVHD	OVERHEAD
P&ID	PROCESS & INSTRUMENTATION DIAGRAM
PC	POINT OF CURVE
PCC	POINT OF COMPOUND CURVE
PCVC	POINT OF CURVATURE ON VERTICAL CURVE
PE	PLAIN END
PERF	PERFORATED
PERM	PERMANENT
PERP	PERPENDICULAR
PG	PRESSURE GAUGE
PH	PIPE HANGER
PI	POINT OF INTERSECTION
PIVC	POINT OF INTERSECTION ON VERTICAL CURVE
PL OR P/L	PROPERTY LINE / PLATE / PLASTIC
PLBG	PLUMBING
PNL	PANEL
POC	POINT OF CURVATURE
POLY	POLYETHYLENE
PP	POWER POLE / PURPLE PIPE
PRC	POINT OF REVERSE CURVATURE
PRCST	PRECAST
PREP	PREPARATION
PRESS	PRESSURE
PRKG	PARKING
PROP	PROPERTY
PRV	PRESSURE REDUCING VALVE
PS	PUMP STATION
PSIG	POUNDS PER SQUARE INCH GAUGE
PSL	PIPE SLEEVE
PSPT	PIPE SUPPORT
PT	POINT OF TANGENCY
PTVC	POINT OF TANGENCY ON VERTICAL CURVE
PTW	PUMP TO WASTE
PV	PLUG VALVE
PVC	POLYVINYL CHLORIDE
PVMT	PAVEMENT
PW	POTABLE WATER
PWR	POWER
QTY	QUANTITY
RAD	RADIUS
RC	REINFORCED CONCRETE
RCP	REINFORCED CONCRETE PIPE
RD	ROAD / ROOF DRAIN
RDCR	REDUCER
REF	REFERENCE
REINF	REINFORCE(D)(ING)(MENT)
REQ'D	REQUIRED
RESTR	RESTRAINED
RFCA	RESTRAINED FLANGE COUPLING ADAPTER
RM	ROOM
RND	ROUND
RO	ROUGH OPENING
R/W	RIGHT-OF-WAY
RPBPD	REDUCED PRESSURE BACKFLOW PREVENTION DEVICE
RPM	REVOLUTIONS PER MINUTE
RR	RAILROAD
RST	REINFORCED STEEL
RT	RIGHT
SALV	SALVAGE
SAN	SANITARY
SC	SOLID CORE
SCHED	SCHEDULE
SD	STORM DRAIN
SDL	SADDLE
SDR	STANDARD DIMENSION RATIO
SECT	SECTION
SHLDR	SHOULDER
SHT	SHEET
SIM	SIMILAR
SLP	SLOPE
SLV	SLEEVE
SOLN	SOLUTION
SP	SOIL PIPE / SEWER PIPE
SPCL	SPECIAL
SPEC(S)	SPECIFICATION(S)
SPG	SPACING
SPL	SPOOL
SPRT	SUPPORT
SQ	SQUARE
SQ FT	SQUARE FOOT
SQ IN	SQUARE INCH
SQ YD	SQUARE YARD
SS	SANITARY SEWER
SST	STAINLESS STEEL
ST	STREET
STA	STATION
STD	STANDARD
STL	STEEL
STOR	STORAGE
STR	STRAIGHT
STRUCT	STRUCTURE / STRUCTURAL
SUBMG	SUBMERGED
SUCT	SUCTION
SV	SOLENOID VALVE
S/W	SIDEWALK
SWD	SIDEWATER DEPTH
SWGR	SWITCH GEAR
SYMM	SYMMETRICAL
SYS	SYSTEM
T OR TEL	TELEPHONE
T&B	TOP & BOTTOM
TAN	TANGENCY
TB	THRUST BLOCK
TBM	TEMPORARY BENCHMARK
TC	TOP OF CONCRETE / TOP OF CURB
TCE	TEMPORARY CONSTRUCTION EASEMENT
TDH	TOTAL DYNAMIC HEAD
TEMP	TEMPERATURE / TEMPORARY
T&G	TONGUE & GROOVE
THK	THICK / THICKNESS
THRD	THREAD (ED)
THRU	THROUGH
TP	TEST PIT / TOP OF PAVEMENT / TURNING POINT
TRANS	TRANSITION
TSP	TRI-SODIUM PHOSPHATE
TST	TOP OF STEEL
TW	TOP OF WALL
TYP	TYPICAL
UG	UNDERGROUND
UH	UNIT HEATER
UN	UNION
UON	UNLESS OTHERWISE NOTED
USGS	UNITED STATES GEOLOGIC SURVEY
V	VENT / VOLT
VAC	VACUUM
VB	VACUUM BREAKER
VBOX	VALVE BOX
VC	VERTICAL CURVE
VERT	VERTICAL
VFD	VARIABLE FREQUENCY DRIVE
VOL	VOLUME
VCP	VITRIFIED CLAY PIPE
VTR	VENT THROUGH ROOF
W	WATER
W/	WITH
W/IN	WITHIN
W/O	WITHOUT
W/W	WALL TO WALL
WD	WOOD
WF	WIDE FLANGE
WH	WATER HEATER
WI	WROUGHT IRON
WM	WATER METER
WP	WORKING POINT / WATERPROOFING
WS	WATER SERVICE
WSDOT	WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
WT	WEIGHT
WTP	WATER TREATMENT PLANT
WTRT	WATERTIGHT
WWF	WELDED WIRE FABRIC
WWTF	WASTEWATER TREATMENT FACILITY
WWTP	WASTEWATER TREATMENT PLANT
X SECT	CROSS SECTION
XFMR	TRANSFORMER
YD	YARD DRAIN / YARD
YH	YARD HYDRANT
YR	YEAR
ZN	ZINC

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE

0 ½ 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

NDH DESIGNED

EJJ DRAWN

JHBF CHECKED

PRELIMINARY ONLY

consor

CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

ABBREVIATIONS

SHEET G-003

PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: MAY 2023

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DESIGN CRITERIA

FLUORIDE:

PRODUCT	FLUOROSILICIC ACID (FSA)
CONCENTRATION	23.75%
SPECIFIC GRAVITY	1.22
FLUORIDE DOSE	0.70 MG/L

WELL ELECTRIC DESIGN CRITERIA:

WELL ELECTRIC WATER DEMAND:	
CURRENT OPERATING ADD	23.3 MGD
CURRENT OPERATING MDD	41.3 MGD
PROJECTED 2043 ADD	28.0 MGD
PROJECTED 2043 MDD	49.6 MGD
WELL ELECTRIC PUMP CAPACITY:	
WELL PUMP NO. 1 FLOWRATE	7,550 GPM
WELL PUMP NO. 2 FLOWRATE	8,330 GPM
WELL PUMP NO. 3 FLOWRATE	13,500 GPM
WELL PUMP NO. 4 FLOWRATE	8,000 GPM
TOTAL CAPACITY	37,380 GPM
WELL ELECTRIC DOSING FLOW AND PRESSURE:	
DOSING PUMP NO. 1 FLOWRATE	32.9 GPD
DOSING PUMP NO. 1 INJECTION PRESSURE	165.4 PSI
DOSING PUMP NO. 2 FLOWRATE	36.3 GPD
DOSING PUMP NO. 2 INJECTION PRESSURE	126.4 PSI
DOSING PUMP NO. 3 FLOWRATE	58.8 GPD
DOSING PUMP NO. 3 INJECTION PRESSURE	87.9 PSI
DOSING PUMP NO. 4 FLOWRATE	34.8 GPD
DOSING PUMP NO. 4 INJECTION PRESSURE	126.4 PSI
WELL ELECTRIC FSA STORAGE:	
BULK TANK MINIMUM VOLUME	8,989 GAL
BULK DESIGN TANK VOLUME	10,000 GAL
BULK TANK STORAGE AT CURRENT ADD	142 DAYS
BULK TANK STORAGE AT 2043 MDD	67 DAYS
DAY TANK MINIMUM VOLUME	188 GAL
DAY TANK DESIGN TANK VOLUME	200 GAL
DAY TANK STORAGE AT CURRENT ADD	2.8 DAYS
DAY TANK STORAGE AT 2043 MDD	32 HOURS

RAY STREET WELL STATION DESIGN CRITERIA:

WATER DEMAND:	
CURRENT OPERATING ADD	12.6 MGD
CURRENT OPERATING MDD	22.3 MGD
PROJECTED 2043 ADD	15.1 MGD
PROJECTED 2043 MDD	26.8 MGD
RAY PUMP CAPACITY:	
WELL PUMP NO. 1 FLOWRATE	7,000 GPM
WELL PUMP NO. 2 FLOWRATE	7,200 GPM
WELL PUMP NO. 3 FLOWRATE	4,350 GPM
TOTAL CAPACITY	18,550 GPM
RAY DOSING FLOW AND PRESSURE:	
DOSING PUMP NO. 1 FLOWRATE	30.5 GPD
DOSING PUMP NO. 1 INJECTION PRESSURE	154.7 PSI
DOSING PUMP NO. 2 FLOWRATE	31.3 GPD
DOSING PUMP NO. 2 INJECTION PRESSURE	154.7 PSI
DOSING PUMP NO. 3 FLOWRATE	18.9 GPD
DOSING PUMP NO. 3 INJECTION PRESSURE	154.7 PSI
RAY FSA STORAGE:	
BULK TANK MINIMUM VOLUME	4,834 GAL
BULK DESIGN TANK VOLUME	5,000 GAL
BULK TANK STORAGE AT CURRENT ADD	132 DAYS
BULK TANK STORAGE AT 2043 MDD	62 DAYS
DAY TANK MINIMUM VOLUME	101 GAL
DAY DESIGN TANK VOLUME	225 GAL
DAY TANK STORAGE AT CURRENT ADD	2.6 DAYS
DAY TANK STORAGE AT 2043 MDD	30 HOURS

PARKWATER WELL STATION DESIGN CRITERIA:

PARKWATER WATER DEMAND:	
CURRENT OPERATING ADD	29.3 MGD
CURRENT OPERATING MDD	44.8 MGD
PROJECTED 2043 ADD	35.2 MGD
PROJECTED 2043 MDD	53.8 MGD
PARKWATER PUMP CAPACITY:	
WELL PUMP NO. 1 FLOWRATE	7,000 GPM
WELL PUMP NO. 2 FLOWRATE	7,500 GPM
WELL PUMP NO. 3 FLOWRATE	8,000 GPM
WELL PUMP NO. 4 FLOWRATE	8,000 GPM
WELL PUMP NO. 5 FLOWRATE	8,000 GPM
WELL PUMP NO. 6 FLOWRATE	8,000 GPM
WELL PUMP NO. 7 FLOWRATE	8,000 GPM
WELL PUMP NO. 8 FLOWRATE	8,000 GPM
TOTAL CAPACITY	62,500 GPM
PARKWATER DOSING FLOW AND PRESSURE:	
DOSING PUMP NO. 1 FLOWRATE	30.5 GPD
DOSING PUMP NO. 1 INJECTION PRESSURE	137.0 PSI
DOSING PUMP NO. 2 FLOWRATE	32.6 GPD
DOSING PUMP NO. 2 INJECTION PRESSURE	137.0 PSI
DOSING PUMP NO. 3 FLOWRATE	34.8 GPD
DOSING PUMP NO. 3 INJECTION PRESSURE	59.5 PSI
DOSING PUMP NO. 4 FLOWRATE	34.8 GPD
DOSING PUMP NO. 4 INJECTION PRESSURE	59.5 PSI
DOSING PUMP NO. 5 FLOWRATE	34.8 GPD
DOSING PUMP NO. 5 INJECTION PRESSURE	59.5 PSI
DOSING PUMP NO. 6 FLOWRATE	34.8 GPD
DOSING PUMP NO. 6 INJECTION PRESSURE	59.5 PSI
DOSING PUMP NO. 7 FLOWRATE	34.8 GPD
DOSING PUMP NO. 7 INJECTION PRESSURE	59.5 PSI
DOSING PUMP NO. 8 FLOWRATE	34.8 GPD
DOSING PUMP NO. 8 INJECTION PRESSURE	59.5 PSI
PARKWATER FSA STORAGE:	
BULK TANK MINIMUM VOLUME	9,751 GAL
BULK DESIGN TANK VOLUME	10,000 GAL
BULK TANK STORAGE AT CURRENT ADD	113 DAYS
BULK TANK STORAGE AT 2043 MDD	62 DAYS
DAY TANK MINIMUM VOLUME	204 GAL
DAY DESIGN TANK VOLUME	225 GAL
DAY TANK STORAGE AT CURRENT ADD	2.5 DAYS
DAY TANK STORAGE AT 2043 MDD	33 HOURS

CENTRAL AVENUE WELL STATION DESIGN CRITERIA:

WATER DEMAND:	
CURRENT OPERATING ADD	11.1 MGD
CURRENT OPERATING MDD	18.8 MGD
PROJECTED 2043 ADD	13.3 MGD
PROJECTED 2043 MDD	22.6 MGD
CENTRAL PUMP CAPACITY:	
WELL PUMP NO. 1 FLOWRATE	8,000 GPM
WELL PUMP NO. 2 FLOWRATE	8,000 GPM
TOTAL CAPACITY	16,000 GPM
CENTRAL DOSING FLOW AND PRESSURE:	
DOSING PUMP NO. 1 FLOWRATE	34.8 GPD
DOSING PUMP NO. 1 INJECTION PRESSURE	50.9 PSI
DOSING PUMP NO. 2 FLOWRATE	34.8 GPD
DOSING PUMP NO. 2 INJECTION PRESSURE	50.9 PSI
CENTRAL FSA STORAGE:	
BULK TANK MINIMUM VOLUME	4,094 GAL
BULK DESIGN TANK VOLUME	4,250 GAL
BULK TANK STORAGE AT CURRENT ADD	127 DAYS
BULK TANK STORAGE AT 2043 MDD	62 DAYS
DAY TANK MINIMUM VOLUME	86 GAL
DAY DESIGN TANK VOLUME	100 GAL
DAY TANK STORAGE AT CURRENT ADD	3.0 DAYS
DAY TANK STORAGE AT 2043 MDD	35 HOURS

NEVADA WELL STATION DESIGN CRITERIA:

WATER DEMAND:	
CURRENT OPERATING ADD	13.8 MGD
CURRENT OPERATING MDD	23.8 MGD
PROJECTED 2043 ADD	16.5 MGD
PROJECTED 2043 MDD	28.6 MGD
NEVADA PUMP CAPACITY:	
WELL PUMP NO. 1 FLOWRATE	5,700 GPM
WELL PUMP NO. 2 FLOWRATE	9,800 GPM
WELL PUMP NO. 3 FLOWRATE	9,800 GPM
WELL PUMP NO. 4 FLOWRATE	5,700 GPM
TOTAL CAPACITY	31,000 GPM
NEVADA DOSING FLOW AND PRESSURE:	
DOSING PUMP NO. 1 FLOWRATE	24.8 GPD
DOSING PUMP NO. 1 INJECTION PRESSURE	63.6 PSI
DOSING PUMP NO. 2 FLOWRATE	42.7 GPD
DOSING PUMP NO. 2 INJECTION PRESSURE	63.6 PSI
DOSING PUMP NO. 3 FLOWRATE	42.7 GPD
DOSING PUMP NO. 3 INJECTION PRESSURE	63.6 PSI
DOSING PUMP NO. 4 FLOWRATE	24.8 GPD
DOSING PUMP NO. 4 INJECTION PRESSURE	63.6 PSI
NEVADA FSA STORAGE:	
COMBINED WITH GRACE. SEE GRACE/NEVADA FSA STORAGE ABOVE	

GRACE WELL STATION DESIGN CRITERIA:

WATER DEMAND:	
CURRENT OPERATING ADD	11.0 MGD
CURRENT OPERATING MDD	22.7 MGD
PROJECTED 2043 ADD	13.3 MGD
PROJECTED 2043 MDD	27.2 MGD
GRACE PUMP CAPACITY:	
WELL PUMP NO. 1 FLOWRATE	8,000 GPM
WELL PUMP NO. 2 FLOWRATE	8,000 GPM
TOTAL CAPACITY	16,000 GPM
GRACE DOSING FLOW AND PRESSURE:	
DOSING PUMP NO. 1 FLOWRATE	34.8 GPD
DOSING PUMP NO. 1 INJECTION PRESSURE	98.3 PSI
DOSING PUMP NO. 2 FLOWRATE	34.8 GPD
DOSING PUMP NO. 2 INJECTION PRESSURE	98.3 PSI

COMBINED GRACE & NEVADA DESIGN CRITERIA:

GRACE/ NEVADA FSA STORAGE:	
BULK TANK MINIMUM VOLUME	9,364 GAL
BULK DESIGN TANK VOLUME	10,000 GAL
BULK TANK STORAGE AT CURRENT ADD	133 DAYS
BULK TANK STORAGE AT 2043 MDD	64 DAYS
DAY TANK MINIMUM VOLUME	195 GAL
DAY DESIGN TANK VOLUME	200 GAL
DAY TANK STORAGE AT CURRENT ADD	2.7 DAYS
DAY TANK STORAGE AT 2043 MDD	31 HOURS

HAVANA WELL STATION DESIGN CRITERIA:

WATER DEMAND:	
CURRENT OPERATING ADD	13.6 MGD
CURRENT OPERATING MDD	23.3 MGD
PROJECTED 2043 ADD	16.3 MGD
PROJECTED 2043 MDD	27.9 MGD
HAVANA PUMP CAPACITY:	
WELL PUMP NO. 1 FLOWRATE	4,200 GPM
WELL PUMP NO. 2 FLOWRATE	4,200 GPM
WELL PUMP NO. 3 FLOWRATE	4,200 GPM
WELL PUMP NO. 4 FLOWRATE	3,750 GPM
WELL PUMP NO. 5 FLOWRATE	3,750 GPM
WELL PUMP NO. 6 FLOWRATE	3,750 GPM
TOTAL CAPACITY	23,850 GPM
HAVANA DOSING FLOW AND PRESSURE:	
DOSING PUMP NO. 1 FLOWRATE	18.3 GPD
DOSING PUMP NO. 1 INJECTION PRESSURE	71 PSI
DOSING PUMP NO. 2 FLOWRATE	18.3 GPD
DOSING PUMP NO. 2 INJECTION PRESSURE	71 PSI
DOSING PUMP NO. 3 FLOWRATE	18.3 GPD
DOSING PUMP NO. 3 INJECTION PRESSURE	71 PSI
DOSING PUMP NO. 4 FLOWRATE	16.3 GPD
DOSING PUMP NO. 4 INJECTION PRESSURE	148.3 PSI
DOSING PUMP NO. 5 FLOWRATE	16.3 GPD
DOSING PUMP NO. 5 INJECTION PRESSURE	148.3 PSI
DOSING PUMP NO. 6 FLOWRATE	16.3 GPD
DOSING PUMP NO. 6 INJECTION PRESSURE	148.3 PSI
HAVANA FSA STORAGE:	
BULK TANK MINIMUM VOLUME	5,067 GAL
BULK DESIGN TANK VOLUME	5,250 GAL
BULK TANK STORAGE AT CURRENT ADD	128 DAYS
BULK TANK STORAGE AT 2043 MDD	62 DAYS
DAY TANK MINIMUM VOLUME	106 GAL
DAY DESIGN TANK VOLUME	125 GAL
DAY TANK STORAGE AT CURRENT ADD	3.0 DAYS
DAY TANK STORAGE AT 2043 MDD	36 HOURS

HOFFMAN WELL STATION DESIGN CRITERIA:

WATER DEMAND:	
CURRENT OPERATING ADD	5.8 MGD
CURRENT OPERATING MDD	7.4 MGD
PROJECTED 2043 ADD	7.0 MGD
PROJECTED 2043 MDD	8.9 MGD
HOFFMAN PUMP CAPACITY:	
WELL PUMP NO. 1 FLOWRATE	5,500 GPM
WELL PUMP NO. 2 FLOWRATE	5,500 GPM
TOTAL CAPACITY	11,000 GPM
HOFFMAN DOSING FLOW AND PRESSURE:	
DOSING PUMP NO. 1 FLOWRATE	23.9 GPD
DOSING PUMP NO. 1 INJECTION PRESSURE	58.1 PSI
DOSING PUMP NO. 2 FLOWRATE	23.9 GPD
DOSING PUMP NO. 2 INJECTION PRESSURE	58.1 PSI
HOFFMAN FSA STORAGE:	
BULK TANK MINIMUM VOLUME	1,618 GAL
BULK DESIGN TANK VOLUME	1,800 GAL
BULK TANK STORAGE AT CURRENT ADD	102 DAYS
BULK TANK STORAGE AT 2043 MDD	67 DAYS
DAY TANK MINIMUM VOLUME	34 GAL
DAY DESIGN TANK VOLUME	50 GAL
DAY TANK STORAGE AT CURRENT ADD	2.8 DAYS
DAY TANK STORAGE AT 2043 MDD	45 HOURS

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

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CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

DESIGN CRITERIA

PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: MAY 2023

SHEET G-004

PLAN SYMBOLS

CONDUIT SYMBOLS

- X-### — CONDUIT NUMBER: P = POWER C = CONTROL, J = SIGNAL X = SPARE
- 3/4"C-(3)#12 — CALLOUT INDICATING CONDUIT SIZE, NUMBER OF WIRES AND WIRE SIZE.
- X-### — CALLOUT INDICATING CONDUIT NUMBER AND WIRE PER SCHEDULE.
- EXPOSED CONDUIT
- CONCEALED CONDUIT
- FLEXIBLE CONDUIT
- CAP ON CONDUIT STUB
- CONDUIT TURNING UP
- CONDUIT TURNING DOWN
- CONDUIT WITH SEAL FITTING
- UNDERGROUND DIRECT BURIAL CONDUITS
- INDICATES REMOVAL
- GROUND CONDUCTOR
- CONDUIT RUN, BROKEN AND CONTINUED SAME SHEET OR AS NOTED
- HOME RUN TO PANELBOARD OR AS INDICATED
- CABLE TRAY
- UNDERGROUND DUCT LINE (CONCRETE ENCASEMENT)
- J — JUNCTION BOXES, FLOOR, WALL AND CEILING
- HEAT TRACE

EQUIPMENT AND INSTRUMENT SYMBOLS

- XXX-### — EQUIPMENT ID #
- G xxKW — GENERATOR: xxKW = SIZE
- xx — MOTOR: xx = HORSEPOWER
- EQUIPMENT CONNECTION
- INSTRUMENT LOCATION
- T — THERMOSTAT
- xxA — DISCONNECT SWITCH, UNFUSED: xxA = AMPERAGE
- xxAF/xxAT F — DISCONNECT SWITCH, FUSED: xxAF = FRAME SIZE, xxAT = TRIP SIZE
- xxAF/xxAT CB — ENCLOSED CIRCUIT BREAKER: xxAF = FRAME SIZE, xxAT = TRIP SIZE
- MH — MANHOLE
- HH — HANDHOLE
- GROUND ROD
- GROUND ROD AND BOX
- PNL-100 — WALL-MOUNTED CONTROL PANEL, PANELBOARD, OR TERMINAL CABINET. SHOWN WITH EQUIPMENT ID TAG.
- MCC-100 — FLOOR-STANDING DISTRIBUTION ASSEMBLY, SUCH AS MCC, SWITCHBOARD, OR XFMR. SHOWN WITH EQUIPMENT ID TAG.

ALARM SYMBOLS

- FACP — FIRE ALARM CONTROL PANEL
- SH — COMBINATION SMOKE/HEAT DETECTOR
- ALARM HORN
- F — MANUAL PULL STATION
- X — X INDICATES COLOR: A = AMBER STROBE LIGHT, B = BLUE STROBE LIGHT, G = STEADY GREEN LIGHT, R = RED STROBE LIGHT

RECEPTACLE AND SWITCH SYMBOLS

- CKT TYPE — DUPLEX WALL RECEPTACLE, 120V: CKT = CIRCUIT NUMBER; TYPE: WP = WEATHERPROOF, G = GROUNDED, IG = ISOLATED GROUND, GF = GROUND FAULT INTERRUPTER
- DUPLEX RECEPTACLE, EMERGENCY/ STAND-BY
- SINGLE RECEPTACLE, 120V
- SINGLE RECEPTACLE, EMERGENCY/ STAND-BY
- DOUBLE DUPLEX RECEPTACLE, 120V
- DOUBLE DUPLEX RECEPTACLE, EMERGENCY/STAND-BY
- DUPLEX FLOOR RECEPTACLE, 120V: TYPE: F = FLUSH, S = SURFACE
- X IN. — MULTI-OUTLET ASSEMBLY WITH SINGLE RECEPTACLE, 120V SPACING (X IN.) AS NOTED. MOUNTING HEIGHT AS NOTED.
- SPECIAL PURPOSE WALL RECEPTACLE, RATING AS NOTED.
- $\$^{(a,b)}_{*}$ — SINGLE POLE SWITCH (SEE NOTE S1): * = SINGLE POLE, 2 = 2 POLE, 3 = 3 WAY, 4 = 4 WAY, M = HP RATED, LOCKABLE, OS = OCCUPANCY SENSOR, P = SWITCH WITH PILOT LIGHT, WP = WEATHERPROOF

NOTES:

S1 LOWERCASE LETTERS IN PARENTHESIS ADJACENT TO A SWITCH OR LIGHT FIXTURE INDICATE A SWITCHED CIRCUIT AND IDENTIFY THE FIXTURE/SWITCH COMBINATIONS. FOR FOUR LAMP FLUORESCENT FIXTURES WIRED IN PAIRS WITHIN EACH FIXTURE, THE "a" SWITCH CONTROLS THE OUTER LAMPS AND THE "b" SWITCH CONTROLS THE INNER LAMPS. WIRE 3 LAMP FIXTURES SIMILARLY.

S2 NUMBERS IN PARENTHESIS ADJACENT TO A LIGHT FIXTURE OR RECEPTACLE INDICATE THE LIGHTING PANEL BRANCH CIRCUIT FEEDING THE DEVICE.

LIGHTING SYMBOLS

- ID NL (a) (LPXX/X) — LUMINAIRE WITH IDENTIFICATION TAG: ID = TYPE, PER LIGHTING SCHEDULE; NL = UNSWITCHED NIGHT LIGHT; a = SWITCH CONTROL; LPXX/X = POWER SOURCE PANEL AND CIRCUIT NUMBER
- SURFACE MOUNTED FIXTURE
- WALL MOUNTED FIXTURE
- POLE MOUNTED FIXTURE
- WALL/CEILING MOUNTED EXIT LIGHT - DIRECTIONAL ARROW WHERE INDICATED, SHADED AREA INDICATES ILLUMINATED FACE.
- PE — PHOTO ELECTRIC CELL
- EMERGENCY LIGHT WITH SELF-CONTAINED BATTERY

UTILITIES SYMBOLS

- M — ELECTRICITY UTILITY METER AND SOCKET
- PLYWOOD BACKBOARD

ONE-LINE SYMBOLS

- XXX-### — EQUIPMENT ID #
- X-### — CONDUIT NUMBER: P = POWER C = CONTROL, J = SIGNAL X = SPARE
- G xxKW — GENERATOR: xxKW = SIZE
- xx — MOTOR: xx = HORSEPOWER
- xxAF xxAT (WITH DRAWOUT / NO DRAWOUT) — POWER CIRCUIT BREAKER, 3 POLE, ABOVE 1500V. xxAF = FRAME SIZE, xxAT = TRIP RATING
- xxAF xxAT (WITH DRAWOUT / NO DRAWOUT) — CIRCUIT BREAKER, 3-POLE UNLESS OTHERWISE NOTED. xxAF = FRAME SIZE, xxAT = TRIP RATING
- xxKVA xxV - yyV — POWER OR DISTRIBUTION TRANSFORMER, 3 PHASE UNLESS OTHERWISE NOTED. xxKVA = SIZE, xxV = PRIMARY VOLTAGE, yyV = SECONDARY VOLTAGE
- ATS xxAF — TRANSFER SWITCH, ATS OR MTS AS INDICATED. 3 POLE UNLESS OTHERWISE NOTED. xxAF = RATING
- MOTOR STARTER WITH THERMAL OVERLOAD. 3 PHASE UNLESS OTHERWISE NOTED. * = NEMA SIZE
- VFD ### — VARIABLE FREQUENCY DRIVE. 3 PHASE UNLESS OTHERWISE NOTED. ### = TAG ID NUMBER
- SS ### — ELECTRONIC SOFT STARTER WITH BYPASS. 3 PHASE UNLESS OTHERWISE NOTED. ### = TAG ID NUMBER
- LINE OR LOAD REACTOR
- K — KIRK KEY INTERLOCK
- ST — SHUNT TRIP
- FUSE
- CURRENT TRANSFORMER
- VOLTAGE TRANSFORMER
- SURGE ARRESTOR
- X — SENSOR. X INDICATES DEVICE TYPE: A = AMMETER, AS = CURRENT SWITCH, V = VOLTMETER, VS = VOLT SWITCH, WH = WATTHOUR METER
- POWER RECEPTACLE
- CAPACITOR
- VACUUM BREAK SWITCH
- TERMINATOR / POTHEAD
- X — ELEMENTARY DIAGRAM REFERENCE: X = DIAGRAM NUMBER
- GROUND CONNECTION

SCHEMATIC SYMBOLS

- TAG xxAF — DISCONNECT SWITCH, 3-POLE. TAG = DEVICE TAG ID, xxAF = SWITCH RATING, IN AMPERES
- TAG xxA — CIRCUIT BREAKER, 3-POLE. TAG = DEVICE TAG ID, xxA = TRIP RATING, IN AMPERES
- M OL — MOTOR STARTER WITH THERMAL OVERLOAD, 3-POLE.
- M — MOTOR, 3-PHASE. VOLTAGE AND HORSEPOWER AS INDICATED.
- M — MOTOR, SINGLE PHASE. VOLTAGE AND HORSEPOWER AS INDICATED.
- BUS STAB ON MCC OR SWITCHGEAR OR MOTOR CORD AND PLUG CONNECTION
- CPT xxxVA xxV-yyV — CONTROL POWER TRANSFORMER: xxxVA = SIZE, xxV = PRIMARY VOLTAGE, yyV = SECONDARY VOLTAGE
- TAG xxA — CIRCUIT BREAKER, SINGLE-POLE: TAG = DEVICE TAG ID, xxA = TRIP RATING, IN AMPERES
- TAG xxA — FUSE: TAG = DEVICE TAG ID, xxA = FUSE RATING, IN AMPERES
- PUMP 1 H O A XOO OXO OOX — SELECTOR SWITCH ASSEMBLY, 3-POSITION. TYPICAL CONFIGURATIONS: H O A = HAND/OFF/AUTO, L O R = LOCAL/OFF/REMOTE
- START STOP — PUSHBUTTON, NORMALLY OPEN AND NORMALLY CLOSED
- XXX ### — CONTROL DEVICE COIL: XXX INDICATES TYPE: ALT = ALTERNATING RELAY, CR = CONTROL RELAY, LR = LATCHING RELAY, TR/TDR = TIMING RELAY/TIME DELAY RELAY, M = MOTOR STARTER CONTACTOR; ### = DEVICE ID NUMBER
- X — INDICATING LIGHT: X INDICATES COLOR: A = AMBER, B = BLUE, C = CLEAR, G = GREEN, R = RED, W = WHITE, Y = YELLOW
- X — INDICATING LIGHT, PUSH-TO-TEST

STANDARD RELAY CONTACTS

- ### ### — CONTACT, NORMALLY OPEN AND NORMALLY CLOSED. ### = DEVICE ID NUMBER

TIME-DELAY RELAY CONTACTS

- ### — NORMALLY OPEN, CLOSES AFTER TIME DELAY. ### = DEVICE ID NUMBER
- NORMALLY CLOSED, OPENS AFTER TIME DELAY.
- NORMALLY OPEN, INSTANTANEOUS CLOSE, OPENS AFTER TIME DELAY.
- NORMALLY CLOSED, INSTANTANEOUS OPEN, CLOSES AFTER TIME DELAY.

SENSING DEVICE CONTACTS

CLOSES RISING	CLOSES FALLING	DEVICE TYPE
		FLOW SWITCH
		LEVEL/FLOAT SWITCH
		PRESSURE SWITCH
		TEMPERATURE SWITCH

LIMIT SWITCH CONTACTS

- NORMALLY OPEN, CLOSES ON REACHING LIMIT
- NORMALLY CLOSED, OPENS ON REACHING LIMIT

WIRE AND CABLE SYMBOLS

- WIRING INSIDE ENCLOSURE
- FIELD WIRING
- CONDUCTORS CONNECTED
- CONDUCTORS NOT CONNECTED
- SPLICE OR TERMINATION

TERMINAL SYMBOLS

- MAIN CONTROL PANEL
- LOCAL CONTROL PANEL
- FIELD TERMINAL
- FIELD PANEL
- POWER JUNCTION BOX
- VFD
- MCC OR SWITCHGEAR
- PLC I/O TERMINAL
- CONTROL CABLE JUNCTION BOX
- MOTOR LOAD CABLE JUNCTION BOX OR DISCONNECT

MISCELLANEOUS DEVICES

- ETM — ELAPSED TIME METER / HOURMETER
- SOLENOID
- H — HORN
- B — BELL
- BUZZER
- ETHERNET, RJ25, RJ45

ABBREVIATIONS

A	AMPERES
AC	ALTERNATING CURRENT
A/D	ANALOG TO DIGITAL
ADJ	ADJUSTABLE
AF	AMPERE FRAME
AFD	ADJUSTABLE FREQUENCY DRIVE
A.F.F.	ABOVE FINISHED FLOOR
A.F.G.	ABOVE FINISHED GRADE
AIC	AMPERES INTERRUPTING CAPACITY
AMP	AMPERES
ANN	ANNUNCIATOR
AS	AMMETER SWITCH
AT	AMMETER TRIP
ATS	AUTOMATIC TRANSFER SWITCH
AUTO	AUTOMATIC
AWG	AMERICAN WIRE GAUGE
BCG	BARE COPPER GROUND
C	CONDUIT
CAB	CABINET
CAP	CAPACITOR
CB	CIRCUIT BREAKER
CC	CONTROL CABLE, CLOSING COIL, CLARIFIER CONSOLE
CHH	COMMUNICATION HANDHOLE
CJB	CALIBRATION JUNCTION BOX
CKT	CIRCUIT
CMH	COMMUNICATION MANHOLE
CO	CONDUIT ONLY
COMM	COMMUNICATION
COND	CONDUCTOR
CPT	CONTROL POWER TRANSFORMER
CP	CONTROL PANEL
CR	CONTROL RELAY
CS	CONTROL STATION
CT	CURRENT TRANSFORMER
DB	DIRECT BURIAL
DC	DIRECT CURRENT
DIAG	DIAGRAM
DISC	DISCONNECT
DISTR	DISTRIBUTION
DIV	DIVISION
DP	DISTRIBUTION PANEL
DPDT	DOUBLE POLE, DOUBLE THROW
DPST	DOUBLE POLE, SINGLE THROW
(E)	EXISTING
EE	ELECTRICAL ENCLOSURE
EHH	ELECTRICAL HANDHOLE
ELEM	ELEMENTARY
EMERG	EMERGENCY
ENCL	ENCLOSURE
EFFL	EFFLUENT
EGC	EQUIPMENT GROUND CONDUCTOR
EQPT	EQUIPMENT
ETM	ELAPSED TIME METER
FDR	FEEDER
FE	FLOW ELEMENT
FIT	FLOW INDICATION TRANSMITTER
FLEX	FLEXIBLE
FLUOR	FLUORESCENT
F.O.	FIBER OPTIC
FREQ	FREQUENCY
FSH	FLOAT SWITCH HIGH
FSO	FLOAT SWITCH OVERFLOW
FU	FUSE
FUT,(F)	FUTURE
FVNR	FULL VOLTAGE, NON- REVERSING
FVR	FULL VOLTAGE, REVERSING
FWD	FORWARD
GEN	GENERATOR
GFI	GROUND FAULT INTERRUPTER
GND	GROUND
GRS	GALVANIZED RIGID STEEL
H	HYDROGEN PEROXIDE
HH	HANDHOLE
HOA	HAND-OFF- AUTOMATIC
HOR	HAND-OFF-REMOTE
HPS	HIGH PRESSURE SODIUM
HT	HEAT TAPE
HTR	HEATER
HV	HIGH VOLTAGE
HZ	HERTZ (CYCLES PER SECOND)
IND LT	INDICATING LIGHT
INCAND	INCANDESCENT
INSTR	INSTRUMENT, INSTRUMENTATION
I/O	INPUT/OUTPUT
ISB	INTRINSICALLY SAFE BARRIER
ISR	INTRINSICALLY SAFE RELAY
JB	JUNCTION BOX
KA	KILOAMPERES
KCMIL	THOUSANDS OF CIRCULAR MILS
KV	KILOVOLTS
KVA	KILOVOLT AMPERES
KVAR	KILOVOLT AMPERES REACTIVE
KWH	KILOWATT HOURS
LCP	LOCAL CONTROL PANEL
LCS	LOCAL CONTROL STATION
LTG	LIGHTING
LTS	LIGHTS
LP	LIGHTING PANEL
(M)	MODIFIED
mA	MILLIAMPERES
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTION OR MAIN CONTROL PANEL
MCM	THOUSAND CIRCULAR MILS (KCMIL)
MON	MONITOR
MOV	MOTOR OPERATED VALVE
MS	MOTOR STARTER
MTD	MOUNTED
MTG	MOUNTING
MTS	MANUAL TRANSFER SWITCH
(N)	NEW
NC	NORMALLY CLOSED
NEMA	NATIONAL ELECTRICAL MANUFACTURER'S ASSOC.
NEUT	NEUTRAL
NO	NORMALLY OPEN, NUMBER
OCP	OZONE CONTROL PANEL
OL	OVERLOAD
OT	OVER TEMPERATURE
OVLD	THERMAL OVERLOAD RELAY
OIT	OPERATOR INTERFACE TERMINAL
P	POLE, PUMP
PB	PULLBOX
PBSW	PUSHBUTTON SWITCH
PEC	PHOTOELECTRIC CELL
PF	POWER FACTOR
PGRS	PVC COATED GALVANIZED RIGID STEEL
pH	MEASURE OF ACIDITY OR ALKALINITY
PH	PHASE
PIOP	PLC I/O PANEL
PLC	PROGRAMMABLE LOGIC CONTROLLER
PNL	PANEL
PNLBD	PANELBOARD
POSN	POSITION
POT	POTENTIOMETER
PPS	PACKAGED POWER SUPPLY
PRI	PRIMARY
PWR	POWER
(R)	RELOCATED
RCPT	RECEPTACLE
RCT	REPEAT CYCLE TIMER
RT	RESET TIMER
SCCR	SHORT CIRCUIT CURRENT RATING
SCHD80	SCHEDULE 80 PVC
SCR	SILICON CONTROLLED RECTIFIER
SD	SMOKE DETECTOR
SIG	SIGNAL
SN	SOLID NEUTRAL
SPD	SURGE PROTECTIVE DEVICE
SPDT	SINGLE POLE, DOUBLE THROW
SST	STAINLESS STEEL
SV	SOLENOID VALVE
SW	SWITCH
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
SYNC	SYNCHRONIZING
TB	TERMINAL BOX
TC	TELEPHONE CABINET
TEL	TELEPHONE
TERM	TERMINAL
TO	TIMED OPENING
TOA	TEST-OFF- AUTOMATIC
TSP	TWISTED SHIELDED PAIR
TST	TWISTED SHIELDED TRIAD
UGND	UNDERGROUND
UV	ULTRAVIOLET
VA	VOLT-AMPERES
VAR	VOLT AMPERES REACTIVE
VFD	VARIABLE FREQUENCY DRIVE
VH	VAR-HOUR
VS	VOLTMETER SWITCH
W	WIRE, WATTS
WH	WATTHOUR METER
WHDM	WATTHOUR DEMAND METER
WP	WEATHERPROOF
WR	WEATHER RESISTANT
WT	WATERTIGHT
WWR	WASHWATER RECOVERY
XFMR	TRANSFORMER

GENERAL NOTES

G1 THE INSTALLATION OF ALL EQUIPMENT SHOWN ON THESE DRAWINGS OR DESCRIBED IN THE SPECIFICATIONS SHALL CONFORM TO THE REQUIREMENTS SET FORTH IN THE LATEST EDITIONS OF ALL APPLICABLE CODES AND UTILITY COMPANY STANDARDS. CONTACT THE UTILITY COMPANY REPRESENTATIVES AND VERIFY THEIR REQUIREMENTS.

G2 THIS IS A GENERALIZED LEGEND SHEET. THIS CONTRACT MAY NOT USE ALL INFORMATION SHOWN.

G3 NOTIFY THE ENGINEER IMMEDIATELY IF CONFLICTS IN EQUIPMENT LOCATIONS ARE DISCOVERED OR IF PROBLEMS ARISE DUE TO FIELD CONDITIONS, LACK OF INFORMATION OR ANY OTHER REASON.

G4 INFORMATION SHOWN MAY NOT BE ALL INCLUSIVE. SEE ALSO ANSI C37.2, Y1.1, Y32.2, AND Y32.9.

G5 REFER TO THE MECHANICAL DRAWINGS FOR EXACT LOCATIONS OF MECHANICAL EQUIPMENT AND FOR CERTAIN CONNECTIONS TO BE MADE TO ELECTRICAL CIRCUITS.

G6 EQUIPMENT SHOWN IN HALF TONE OR GREY TONE ARE EXISTING OR BY OTHERS.

G7 VERIFY ALL COLOR REQUIREMENTS BEFORE ORDERING MATERIALS.

G8 CONDUIT SIZE AND FILL SHALL BE AS INDICATED. WHERE NO SIZE IS SHOWN, THE CONDUIT SHALL BE SIZED IN ACCORDANCE WITH THE EDITION OF THE NATIONAL ELECTRIC CODE ADOPTED BY THE AUTHORITY HAVING CODE ENFORCEMENT JURISDICTION. WHERE NO FILL IS INDICATED, PROVIDE (3) #12 WIRES. PROVIDE 3/16 INCH NYLON PULL ROPE IN EACH EMPTY CONDUIT.

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PRELIMINARY DESIGN DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
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MCC — DESIGNED
JEV — DRAWN
CHK — CHECKED

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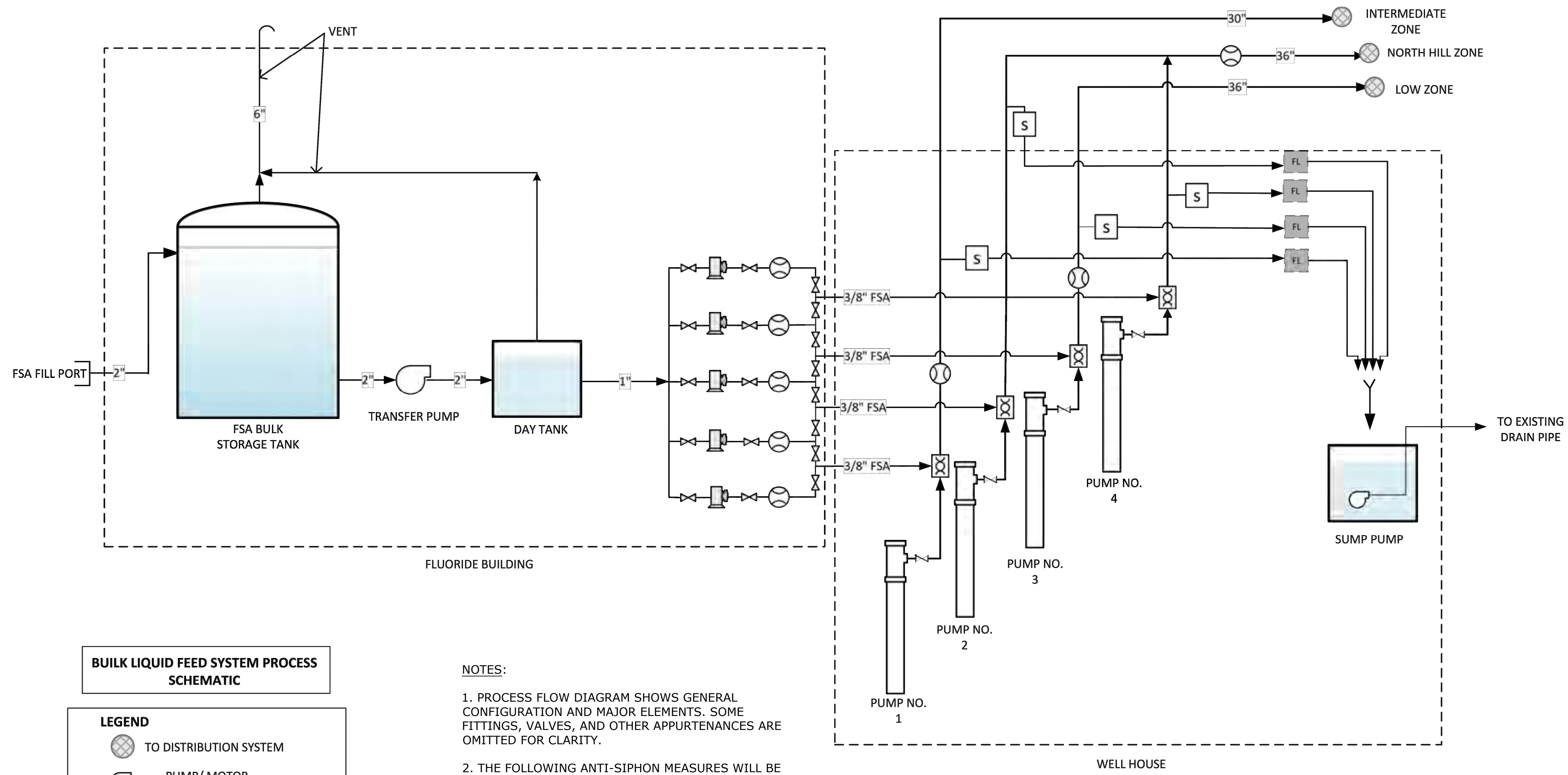
CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

ELECTRICAL - LEGENDS AND ABBREVIATIONS

SHEET G-005

PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: MAY 2023



BUILK LIQUID FEED SYSTEM PROCESS SCHEMATIC

LEGEND

- TO DISTRIBUTION SYSTEM
- PUMP/ MOTOR
- FLOW METER
- DOSING PUMP
- S SOLENOID VALVE
- STATIC MIXER
- FL FLUORIDE ANALYZER

NOTES:

1. PROCESS FLOW DIAGRAM SHOWS GENERAL CONFIGURATION AND MAJOR ELEMENTS. SOME FITTINGS, VALVES, AND OTHER APPURTENANCES ARE OMITTED FOR CLARITY.

2. THE FOLLOWING ANTI-SIPHON MEASURES WILL BE INCLUDED IN THE FINAL DESIGN:
   - -THE TRANSFER PUMP WILL BE MANUALLY OPERATED
   - -THE DAY TANK WILL INCLUDE SCADA ALARM IF LEVEL CHANGE IS HIGHER THAN EXPECTED
   - -BACKPRESSURE VALVE, ANTI-SIPHON VALVE, PRESSURE RELIEF, AND CHECK VALVE WILL BE INCLUDED
   - -CHEMICAL FEED PUMPS WILL ONLY OPERATE IF FLOW IS DETECTED IN THE MAIN PIPE

3. CONTROLS FOR FLUORIDE DOSING WILL INCLUDED FLOW PACING AND TRIM BASED ON FLUORIDE ANALYZER

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
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NDH DESIGNED
EJJ DRAWN
JHBF CHECKED

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MAY 2023

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CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

WELL ELECTRIC
WELL STATION PROCESS FLOW DIAGRAM

PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: MAY 2023

SHEET G-100

6 of 52

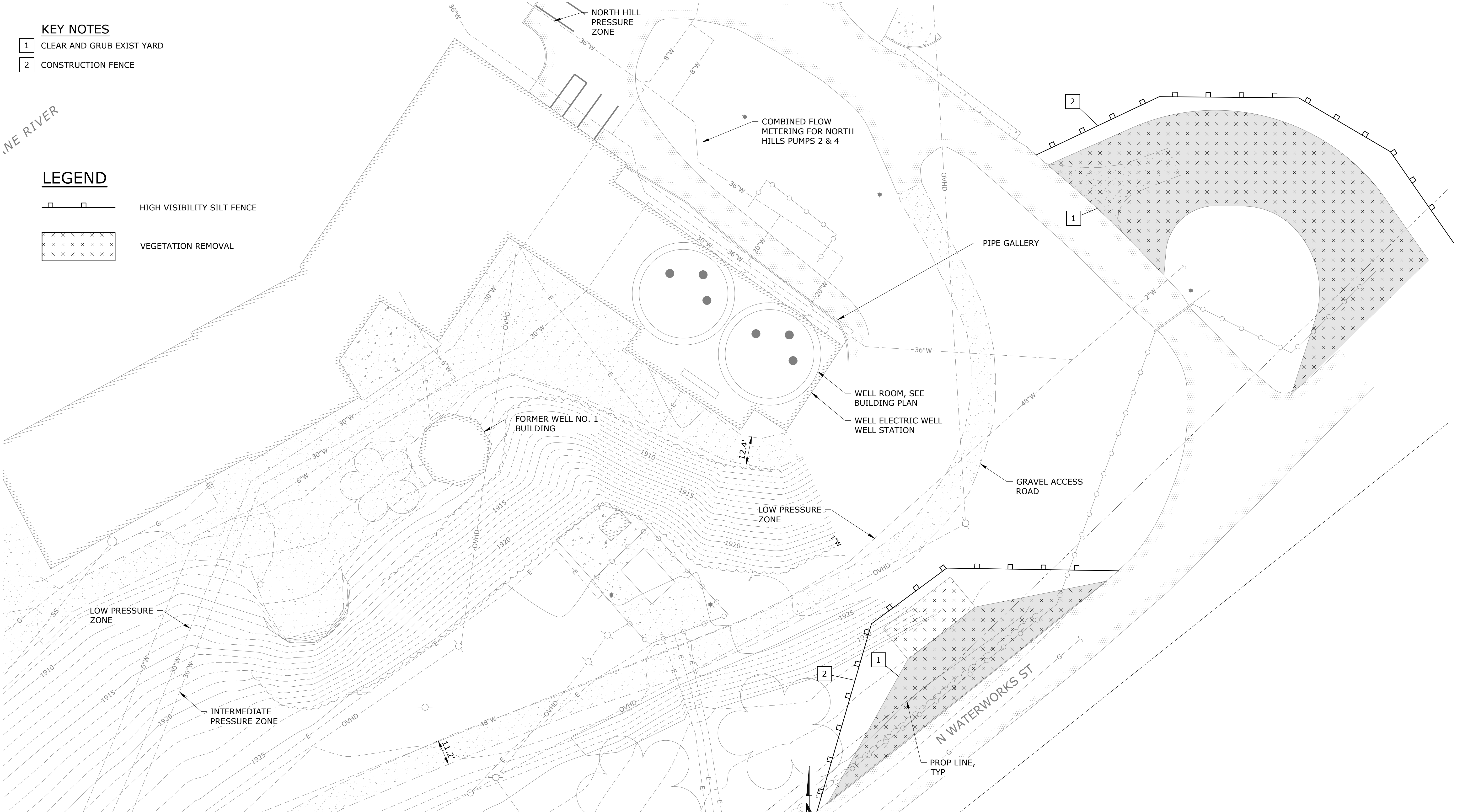
KEY NOTES

1. CLEAR AND GRUB EXIST YARD
2. CONSTRUCTION FENCE

LEGEND

HIGH VISIBILITY SILT FENCE

VEGETATION REMOVAL



SCALE IN FEET (20 10 0 20 40)

PLAN
SCALE: 1"=20'

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
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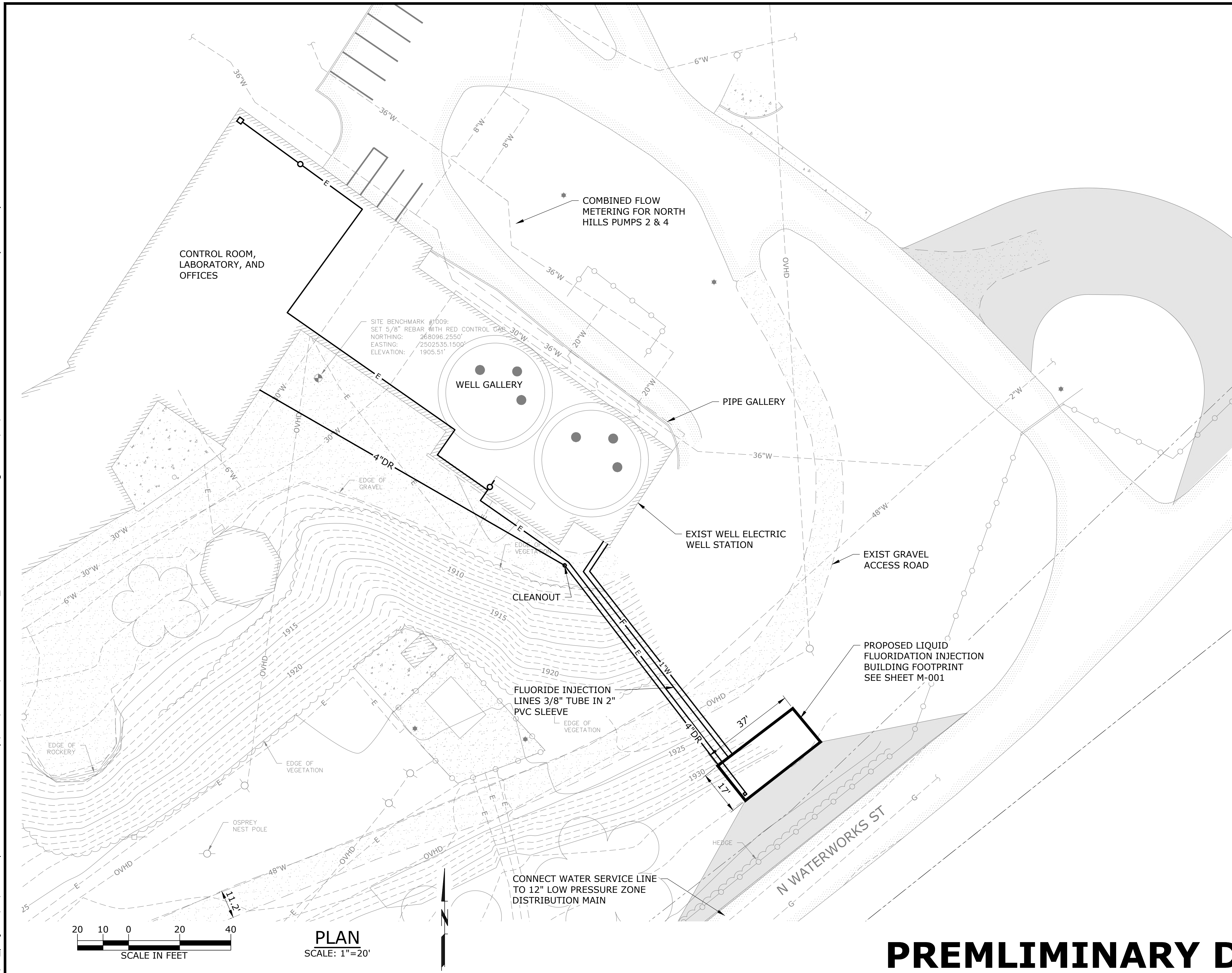
CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

WELL ELECTRIC WELL STATION DEMOLITION

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023

SHEET C-100



PLAN
SCALE: 1"=20'

NOTES:

1. PVC PIPES MAY REQUIRE PROTECTIVE PIPE CASING IN TRAFFIC AREAS

ARCHITECTURAL DATA:

ZONING: LIGHT INDUSTRIAL USE
ARCHITECTURAL FEATURES: UNREINFORCED MASONRY
AREA: 647 SF
HEIGHT: APPROX 25 FT
ROOF TYPE: STANDING-SEAM METAL GABLE
LANDSCAPING: IN ACCORDANCE WITH CITY CODE, MATCH EXISTING

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
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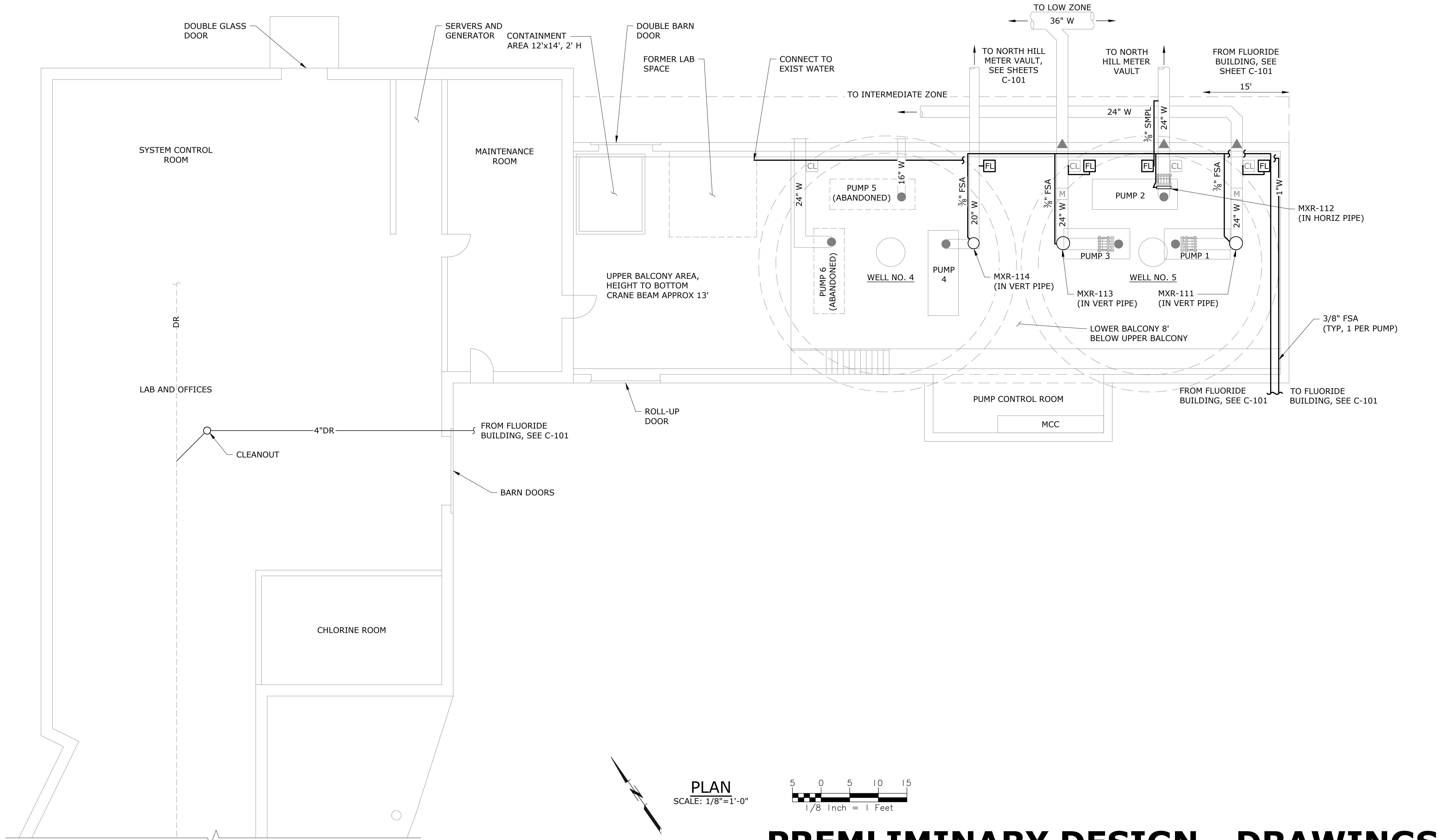
PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

WELL ELECTRIC WELL STATION SITE PLAN

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023

SHEET
C-101
8 of 52



PREMLIMINARY DESIGN - DRAWINGS

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CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

WELL ELECTRIC
WELL STATION PROCESS MECHANICAL

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023

SHEET
M-100
9 of 52

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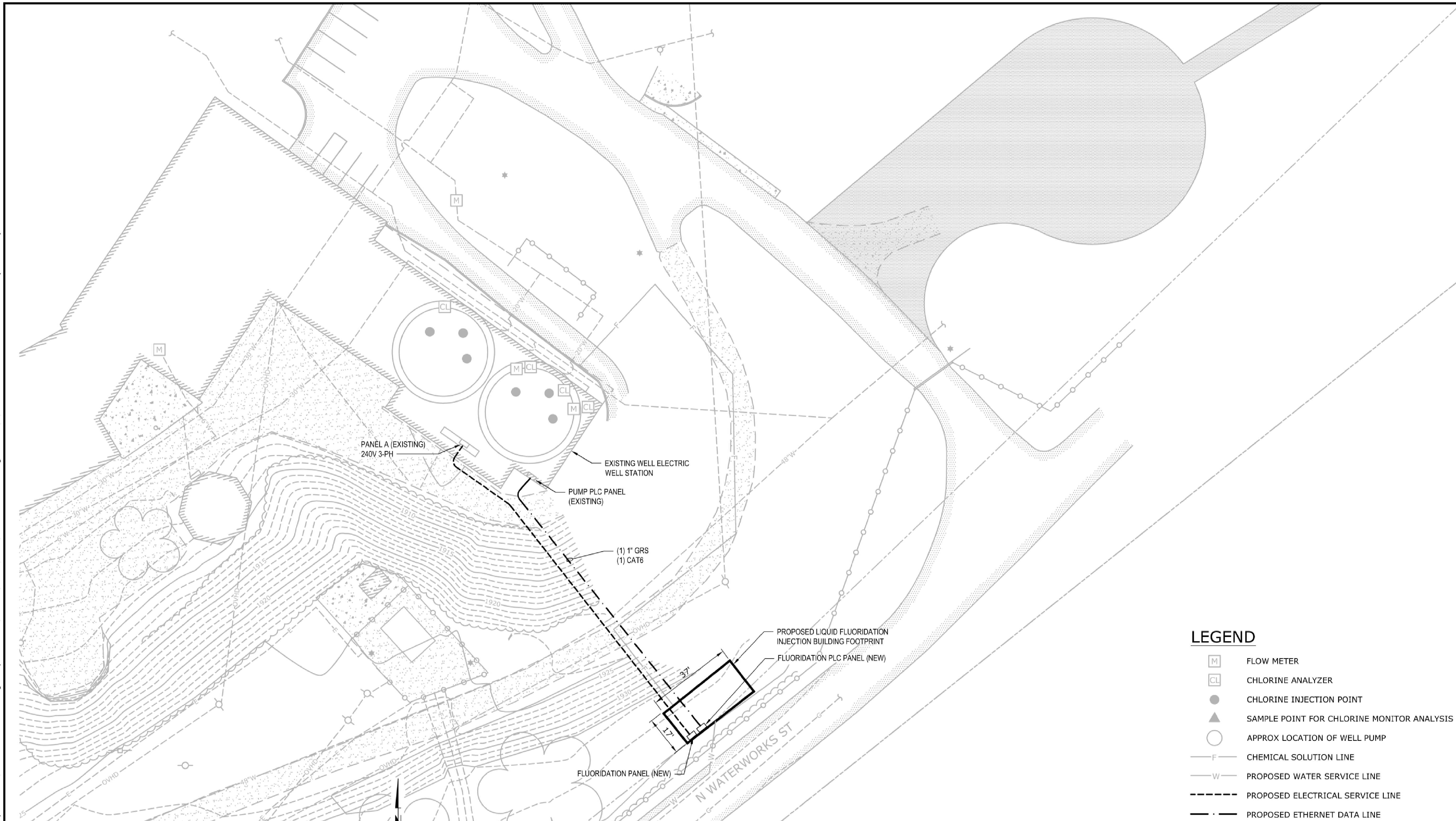

PLAN

SCALE: 1"=20'

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PRELIMINARY DESIGN DRAWINGS

NO.	DATE	BY	REVISION

NOTICE

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PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

WELL ELECTRIC WELL STATION ELECTRICAL SITE PLAN

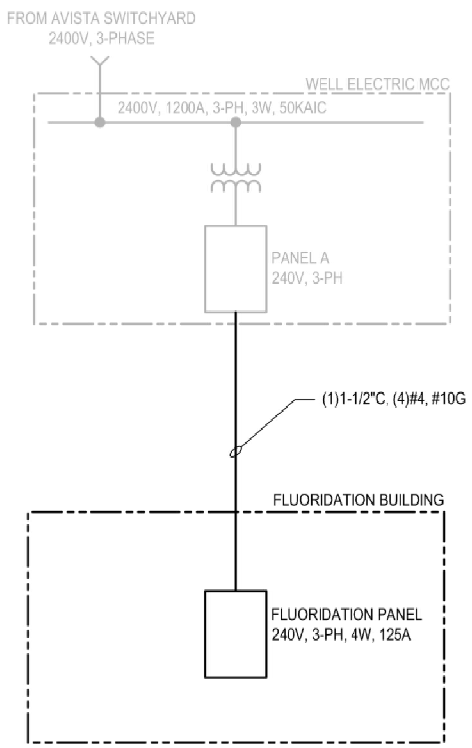
PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: MAY 2023

SHEET

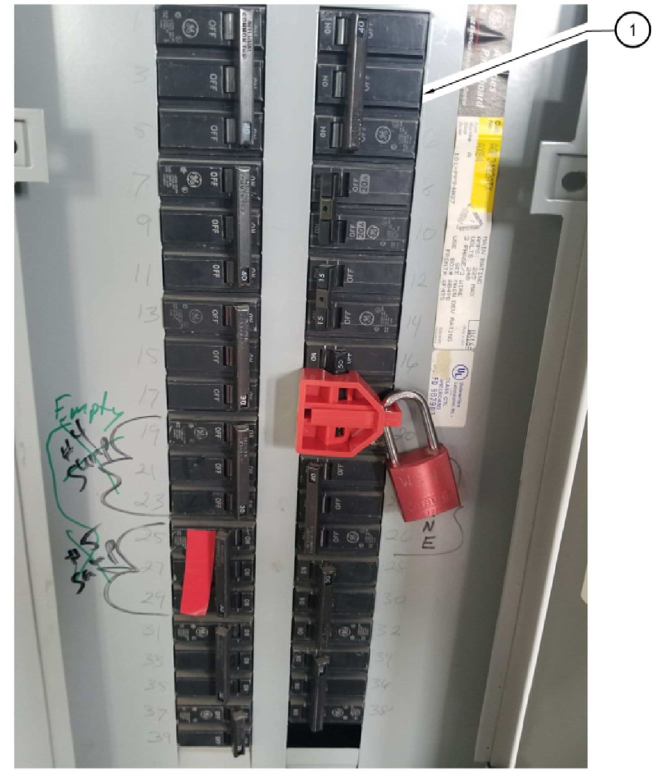
E-101

NOTES

1. CONTRACTOR SHALL USE EXISTING 40A BREAKER TO FEED NEW FLUORIDATION PANEL.



PARTIAL ONE-LINE



PANEL A PHOTO

PANELBOARD SCHEDULE

v 5.0

NAME: WELL ELECTRIC FLUORIDATION PANEL

VOLTAGE RATING: **240/120 VOLTS, 3 PHASE, 4 WIRE**
BUS RATING: **125** AMPS
MAIN BREAKER: **40** AMPS
FEED: **BOTTOM**
MOUNTING: **SURFACE**
SPECIAL FEATURES: **22 kAIC SCCR**

LOCATION: **FLUORIDATION BUILDING**
FED FROM: **PANEL A**
NOTES: **LIQUID FEED SYSTEM**

LOAD TYPE	CIRCUIT DESCRIPTION	VA	CKT	BRKR	L1 L2 L3	BRKR	CKT	VA	CIRCUIT DESCRIPTION	LOAD TYPE
M	FLUORIDE METERING PUMP 1	190	1	15 / 1	-A-		2	500		LM
M	FLUORIDE METERING PUMP 2	190	3	15 / 1	-B-	15 / 3	4	500	FLUORIDE TRANSFER PUMP	LM
X	PLC CABINET	960	5	15 / 1	-C-		6	500		LM
H		1,240	7		-A-	15 / 1	8	370	ROLL-UP DOOR	M
H	HVAC	1,240	9	15 / 3	-B-	15 / 1	10	180	CHEMICAL ROOM RECEPTACLE	R
H		1,240	11		-C-	15 / 1	12		SPARE	
L	LIGHTING	240	13	15 / 1	-A-	15 / 1	14		SPARE	
R	ELECTRICAL ROOM RECEPTACLE	180	15	15 / 1	-B-	15 / 1	16	120	FLUORIDE ANALYZER	X
	SPARE		17	15 / 1	-C-	15 / 1	18		SPARE	
	SPACE		19	/ 1	-A-	/ 1	20		SPACE	
M	FLUORIDE METERING PUMP 3	190	21	15 / 1	-B-	/ 1	22			
M	FLUORIDE METERING PUMP 4	190	23	15 / 1	-C-	/ 1	24			
	LINE LOADS:	**2,540 VA(L1)**			**2,600 VA(L2)**			**2,890 VA(L3)**		
	TOTAL LOAD:	**8.03 KVA**			**19.3 AMPS**					

WELL ELECTRIC FLUORIDATION PANEL LOAD CALCULATION:

		CONNECTED VA	METHOD	NEC DEMAND	CALC. VA
TOTAL LIGHTING (L) LOAD:	L	240	ALL @	125%	300
TOTAL RECEPTACLE (R) LOAD:	R	360	FIRST 10KVA @	125%	450
			REMAINDER OVER 10KVA	50%	0
TOTAL MOTOR (M) LOAD:	M	1130	ALL @	100%	1130
	LM	1500	125% OF LARGEST	125%	1875
TOTAL HVAC (H) LOAD:	H	3720	ALL @	125%	4650
TOTAL MISCELLANEOUS (X) LOAD:	X	1080	ALL @	125%	1350
TOTAL VA:		8030 VA			9755 VA
AVERAGE AMPS @		19 AMPS			23 AMPS
VOLTAGE PHASE TO PHASE=	240				

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PRELIMINARY DESIGN DRAWINGS

NO.	DATE	BY	REVISION

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CHK
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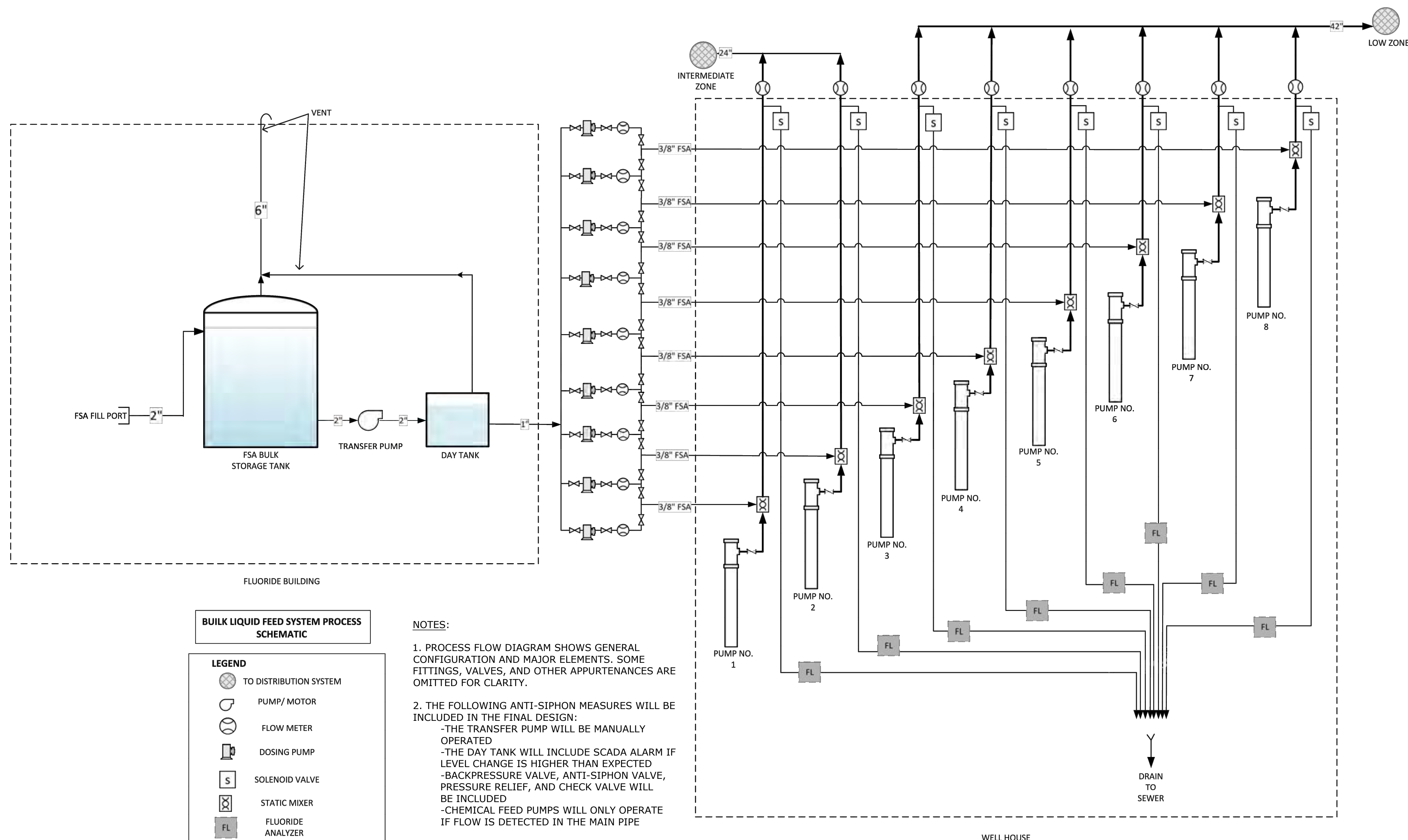
CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

WELL ELECTRIC WELL STATION ONE-LINE, PANEL SCHEDULE AND LOAD CALCULATIONS

SHEET E-102

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023



BUILK LIQUID FEED SYSTEM PROCESS SCHEMATIC

LEGEND

- TO DISTRIBUTION SYSTEM
- PUMP/ MOTOR
- FLOW METER
- DOSING PUMP
- S SOLENOID VALVE
- STATIC MIXER
- FL FLUORIDE ANALYZER

NOTES:

1. PROCESS FLOW DIAGRAM SHOWS GENERAL CONFIGURATION AND MAJOR ELEMENTS. SOME FITTINGS, VALVES, AND OTHER APPURTENANCES ARE OMITTED FOR CLARITY.

2. THE FOLLOWING ANTI-SIPHON MEASURES WILL BE INCLUDED IN THE FINAL DESIGN:
   - -THE TRANSFER PUMP WILL BE MANUALLY OPERATED
   - -THE DAY TANK WILL INCLUDE SCADA ALARM IF LEVEL CHANGE IS HIGHER THAN EXPECTED
   - -BACKPRESSURE VALVE, ANTI-SIPHON VALVE, PRESSURE RELIEF, AND CHECK VALVE WILL BE INCLUDED
   - -CHEMICAL FEED PUMPS WILL ONLY OPERATE IF FLOW IS DETECTED IN THE MAIN PIPE

3. CONTROLS FOR FLUORIDE DOSING WILL INCLUDED FLOW PACING AND TRIM BASED ON FLUORIDE ANALYZER

PREMLIMINARY DESIGN - DRAWINGS

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PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

PARKWATER
WELL STATION PROCESS FLOW DIAGRAM

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023

SHEET G-200

KEY NOTES

1 CLEAR AND GRUB EXIST YARD

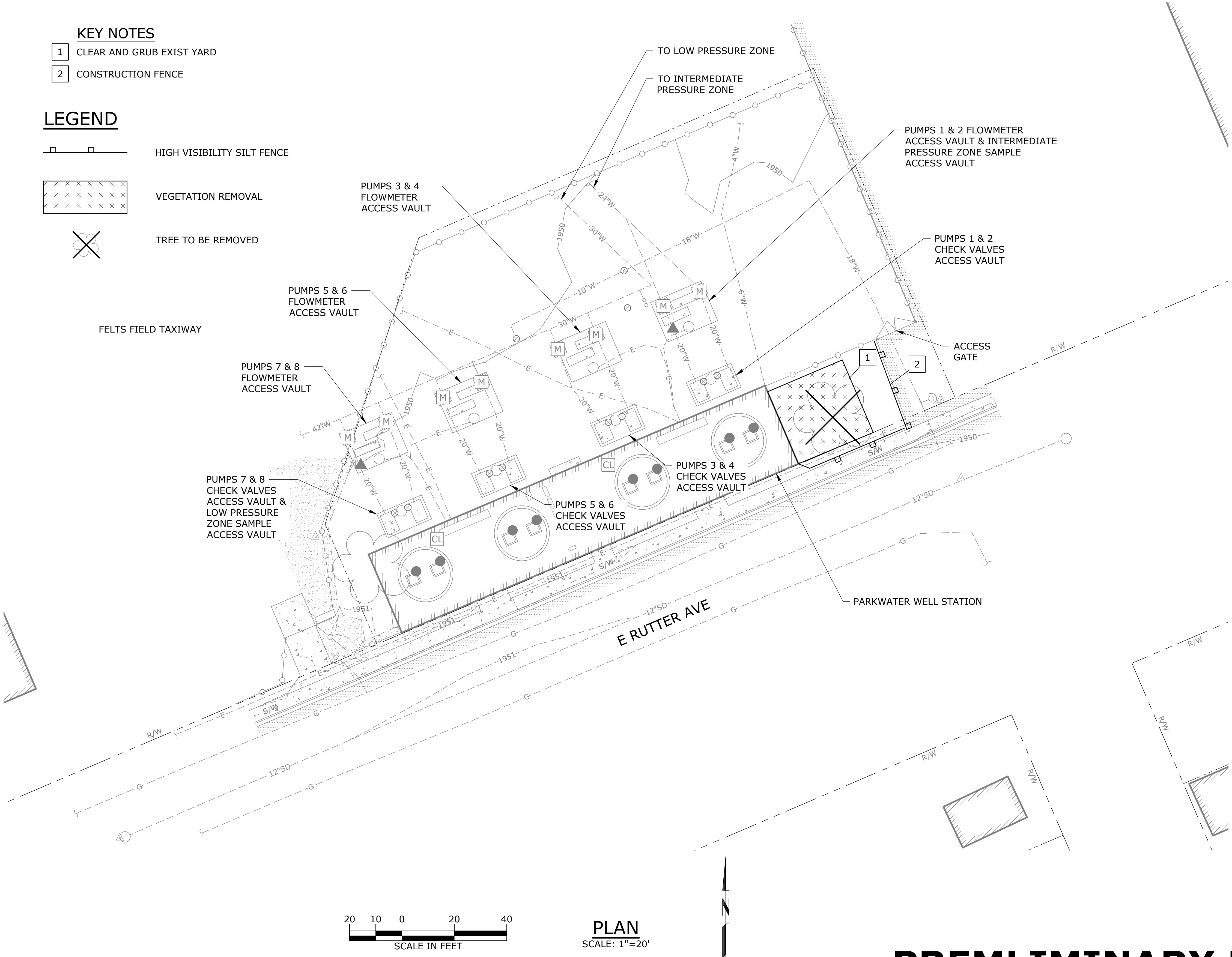
2 CONSTRUCTION FENCE

LEGEND

HIGH VISIBILITY SILT FENCE

VEGETATION REMOVAL

TREE TO BE REMOVED



20 10 0 20 40

SCALE IN FEET

PLAN

SCALE: 1"=20'

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE

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CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

PARKWATER WELL STATION DEMOLITION

PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: MAY 2023

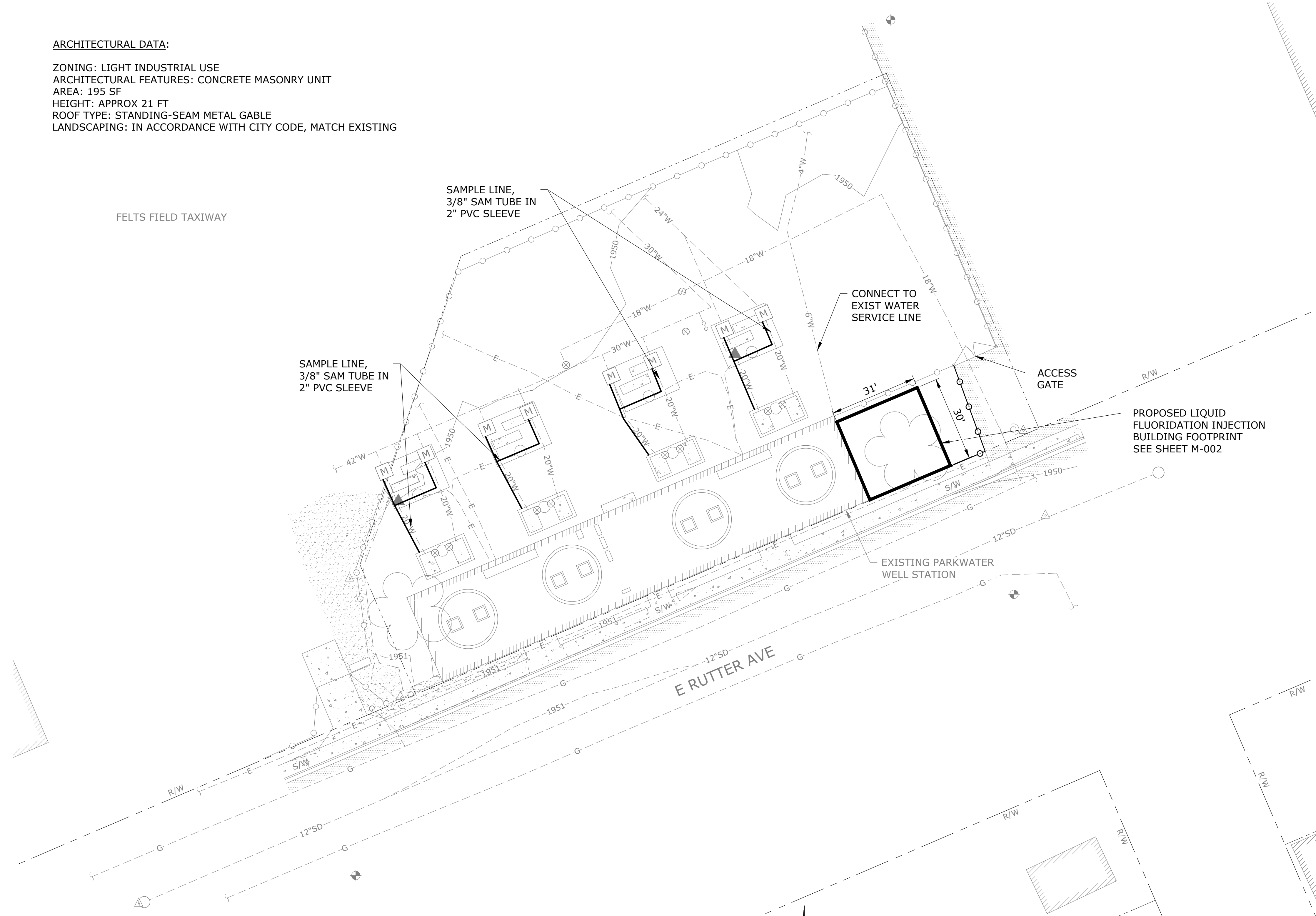
SHEET C-200

NOTES:

1. PVC MAY REQUIRE PROTECTIVE PIPE CASING IN TRAFFIC AREAS

ARCHITECTURAL DATA:

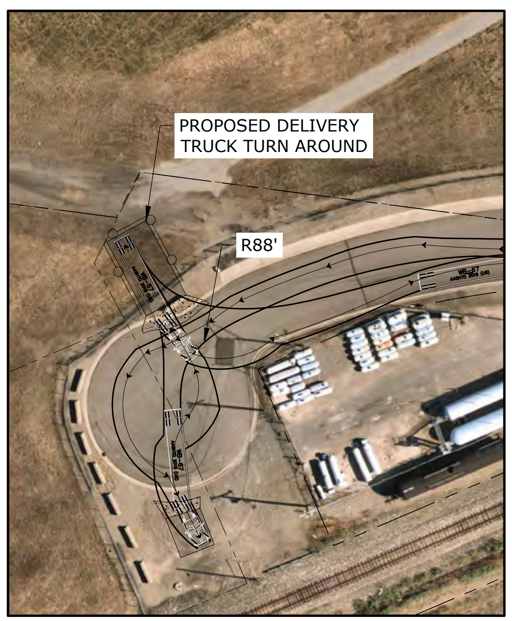
ZONING: LIGHT INDUSTRIAL USE
ARCHITECTURAL FEATURES: CONCRETE MASONRY UNIT
AREA: 195 SF
HEIGHT: APPROX 21 FT
ROOF TYPE: STANDING-SEAM METAL GABLE
LANDSCAPING: IN ACCORDANCE WITH CITY CODE, MATCH EXISTING



PLAN

SCALE: 1"=20'

20 10 0 20 40
SCALE IN FEET



VICINITY MAP

SCALE: 1"=50'

100 50 0 100 200
SCALE IN FEET

PREMLIMINARY DESIGN - DRAWINGS

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CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

PARKWATER WELL STATION SITE PLAN

PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: MAY 2023

SHEET
C-201
14 of 52

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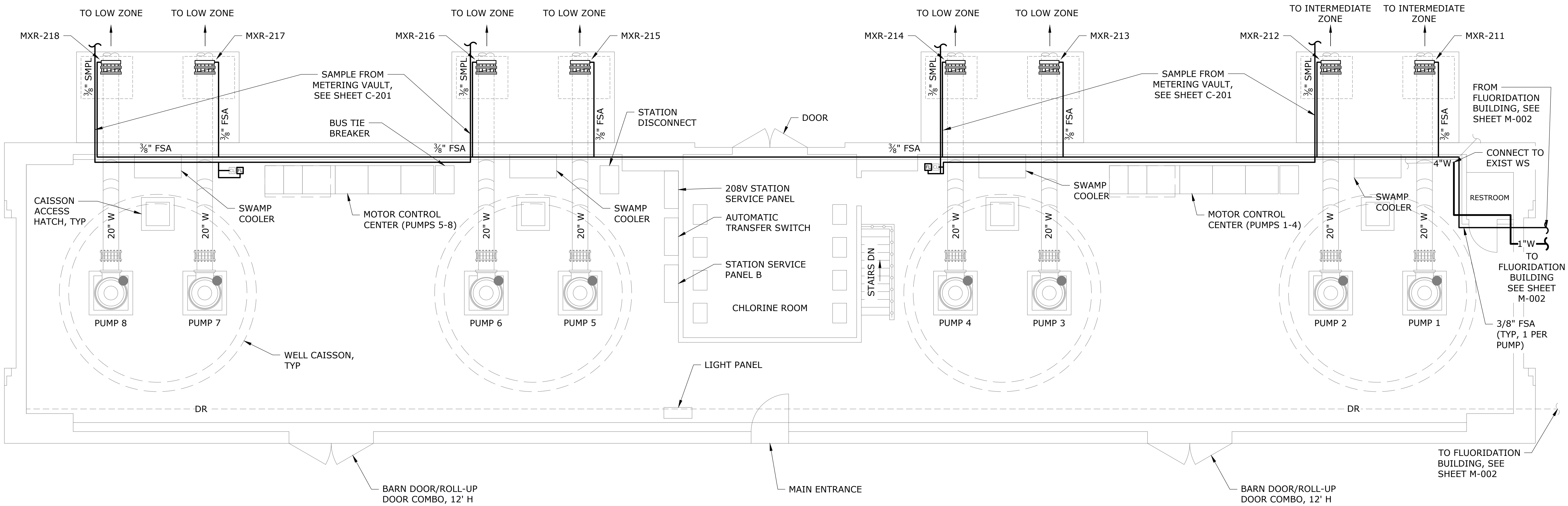
NOTE:

1. DISTANCE BETWEEN FINISHED FLOOR OF PUMP LEVEL AND BOTTOM OF CRANE BEAM APPROXIMATELY 24'

2. VERIFY LOCATION AND DISCHARGE POINT OF EXISTING DRAINS



PLAN
SCALE: 3/16"=1'-0"

0 5 10 15
3/16 Inch = 1 Feet

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
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DKH DRAWN
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MAY 2023

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CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

PARKWATER
WELL STATION PROCESS MECHANICAL

PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: MAY 2023

SHEET
M-200
15 of 52

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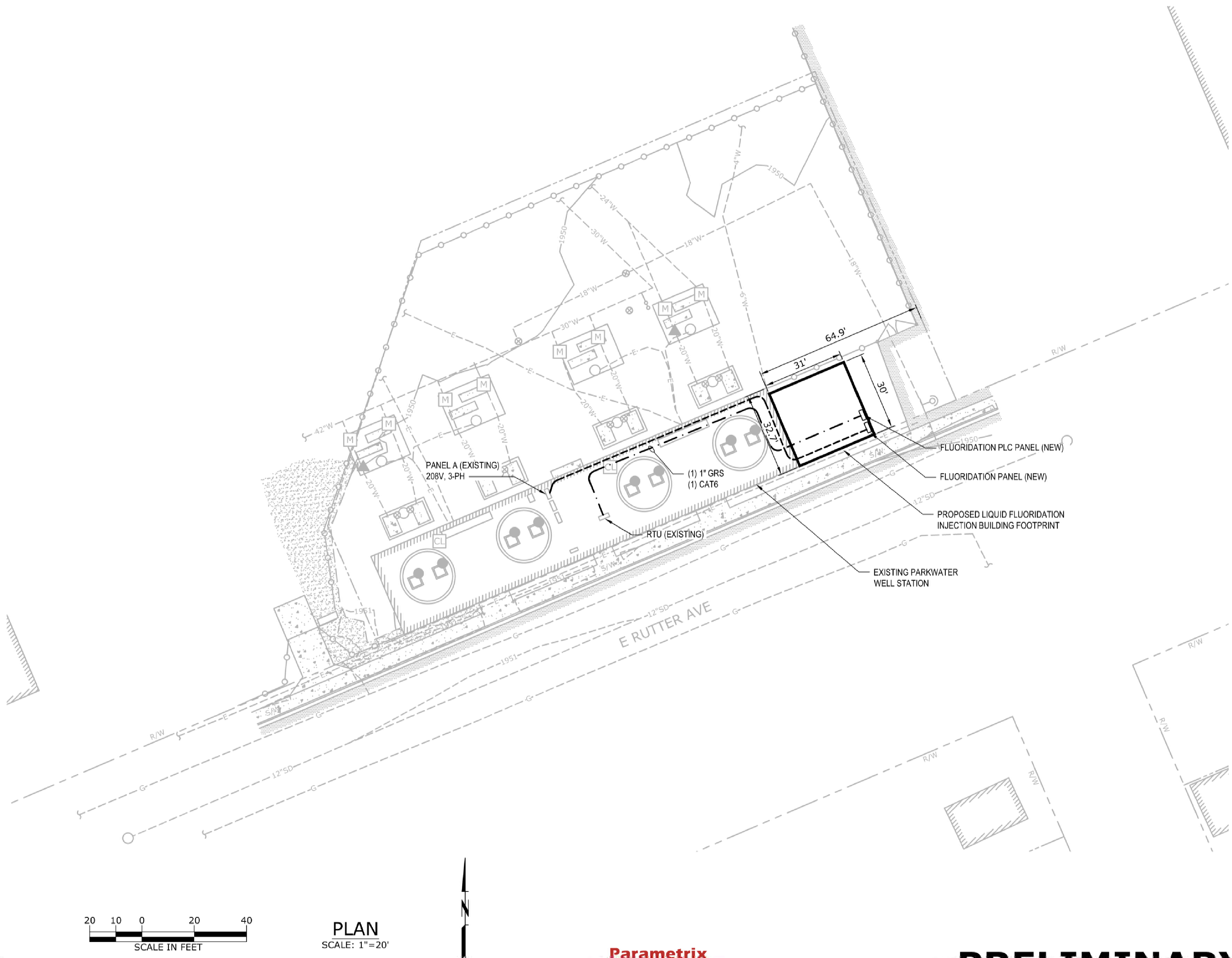

PLAN

SCALE: 1"=20'

LEGEND

- M — FLOW METER
- CL — CHLORINE ANALYZER
- ● — CHLORINE INJECTION POINT
- ▲ — SAMPLE POINT FOR CHLORINE MONITOR ANALYSIS
- ○ — APPROX LOCATION OF WELL PUMP
- - - - — PROPOSED ELECTRICAL SERVICE LINE
- — · — — PROPOSED ETHERNET DATA LINE

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PRELIMINARY DESIGN DRAWINGS

NO.	DATE	BY	REVISION

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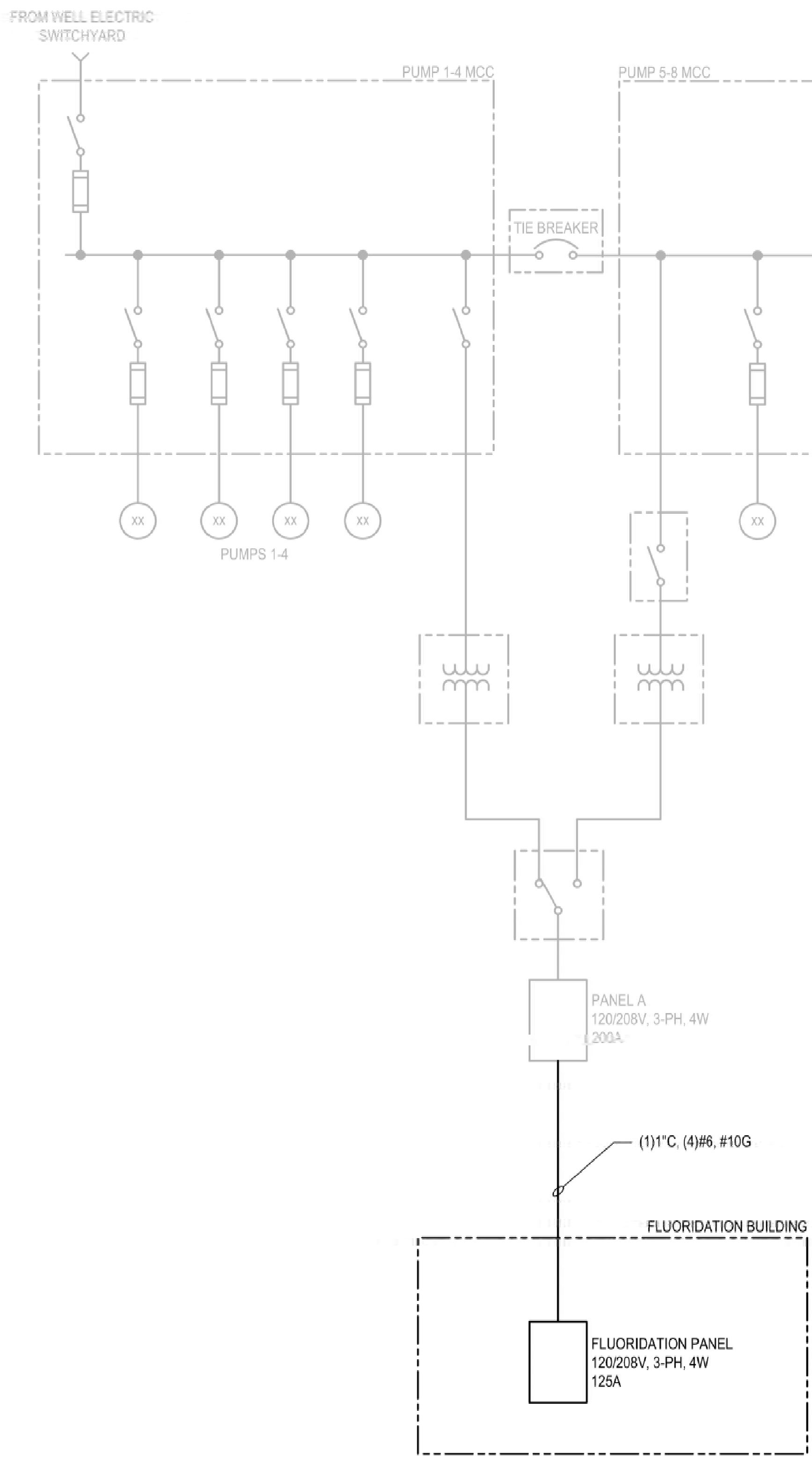
CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

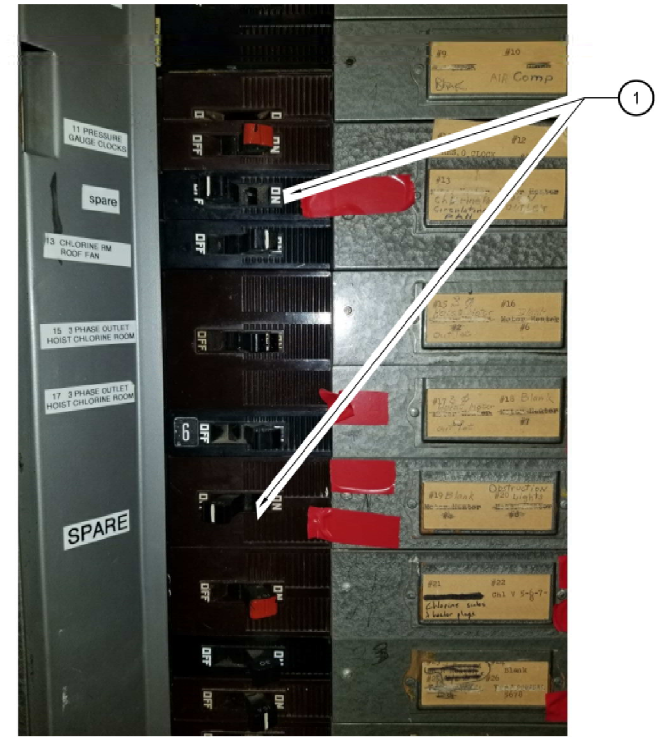
PARKWATER WELL STATION ELECTRICAL SITE PLAN

SHEET E-201

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023



PARTIAL ONE-LINE



PANEL A PHOTO

NOTES

1. CONTRACTOR SHALL REMOVE SINGLE-POLE SPARE BREAKER AND 2-POLE SPARE BREAKER IN EXISTING PANEL A, THEN REARRANGE EXISTING BREAKERS TO MAKE SPACE FOR AND INSTALL A 3-POLE, 40-AMP BREAKER.

PANELBOARD SCHEDULE

v 5.0

NAME: PARKWATER FLUORIDATION PANEL

VOLTAGE RATING: **208/120 VOLTS, 3 PHASE, 4 WIRE**
BUS RATING: **125** AMPS
MAIN BREAKER: **40** AMPS
FEED: **BOTTOM**
MOUNTING: **SURFACE**
SPECIAL FEATURES: **22 kAIC SCCR**

LOCATION: **FLUORIDATION BUILDING**
FED FROM: **PANEL A**
NOTES: **LIQUID FEED SYSTEM**

LOAD TYPE	CIRCUIT DESCRIPTION	VA	CKT	BRKR	L1 L2 L3	BRKR	CKT	VA	CIRCUIT DESCRIPTION	LOAD TYPE
M	FLUORIDE METERING PUMP 1	190	1	15 / 1	-A-		2	500		LM
M	FLUORIDE METERING PUMP 2	190	3	15 / 1	-B-	15 / 3	4	500	FLUORIDE TRANSFER PUMP	LM
X	PLC CABINET	960	5	15 / 1	-C-		6	500		LM
H		1,240	7		-A-	15 / 1	8	370	ROLL-UP DOOR	M
H	HVAC	1,240	9	15 / 3	-B-	15 / 1	10	180	CHEMICAL ROOM RECEPTACLE	R
H		1,240	11		-C-	15 / 1	12	190	FLUORIDE METERING PUMP 5	M
L	LIGHTING	240	13	15 / 1	-A-	15 / 1	14	190	FLUORIDE METERING PUMP 6	M
R	ELECTRICAL ROOM RECEPTACLE	180	15	15 / 1	-B-	15 / 1	16	120	FLUORIDE ANALYZER	X
M	FLUORIDE METERING PUMP 3	190	17	15 / 1	-C-	15 / 1	18	190	FLUORIDE METERING PUMP 7	M
M	FLUORIDE METERING PUMP 4	190	19	15 / 1	-A-	15 / 1	20	190	FLUORIDE METERING PUMP 8	M
	SPARE		21	15 / 1	-B-	15 / 1	22		SPARE	
	SPACE		23	/ 1	-C-	/ 1	24		SPACE	
	LINE LOADS:	**3,110 VA(L1)**			**2,410 VA(L2)**			**3,270 VA(L3)**		
	TOTAL LOAD:	**8.79 KVA**			**24.4 AMPS**					

PARKWATER FLUORIDATION PANEL LOAD CALCULATION:

		CONNECTED VA	METHOD	NEC DEMAND	CALC. VA
TOTAL LIGHTING (L) LOAD:	L	240	ALL @	125%	300
TOTAL RECEPTACLE (R) LOAD:	R	360	FIRST 10KVA @	125%	450
			REMAINDER OVER 10KVA	50%	0
TOTAL MOTOR (M) LOAD:	M	1890	ALL @	100%	1890
	LM	1500	125% OF LARGEST	125%	1875
TOTAL HVAC (H) LOAD:	H	3720	ALL @	125%	4650
TOTAL MISCELLANEOUS (X) LOAD:	X	1080	ALL @	125%	1350
TOTAL VA:		8790 VA			10515 VA
AVERAGE AMPS @		24 AMPS			29 AMPS
VOLTAGE PHASE TO PHASE=	208				

PRELIMINARY DESIGN DRAWINGS

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NO.	DATE	BY	REVISION

NOTICE
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IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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JEV DRAWN
CHK CHECKED

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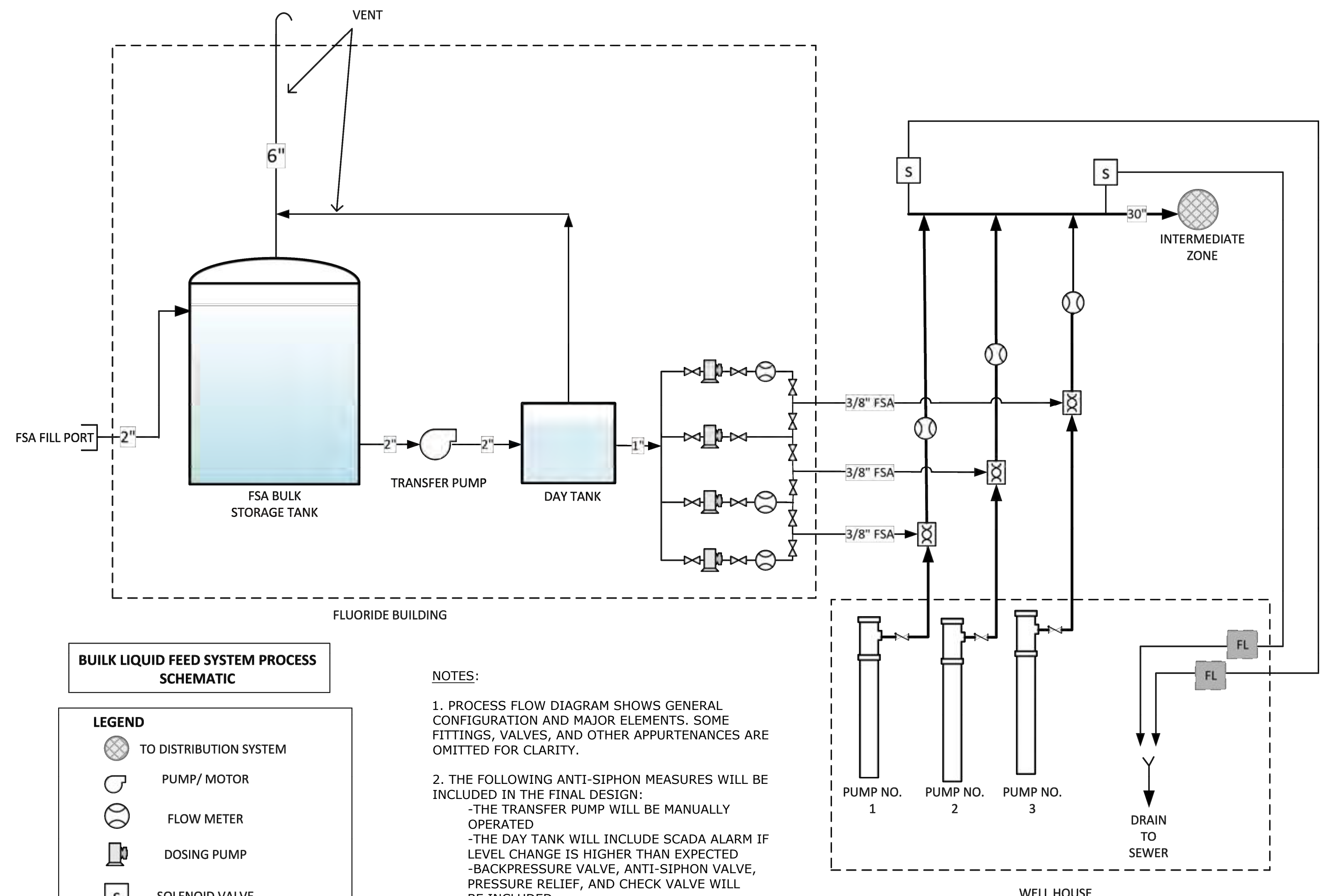
CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

PARKWATER WELL STATION
ONE-LINE, PANEL SCHEDULE AND LOAD CALCULATIONS

PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: MAY 2023

SHEET E-202



BUILK LIQUID FEED SYSTEM PROCESS SCHEMATIC

LEGEND

- TO DISTRIBUTION SYSTEM
- PUMP/ MOTOR
- FLOW METER
- DOSING PUMP
- S SOLENOID VALVE
- STATIC MIXER
- FL FLUORIDE ANALYZER

NOTES:

1. PROCESS FLOW DIAGRAM SHOWS GENERAL CONFIGURATION AND MAJOR ELEMENTS. SOME FITTINGS, VALVES, AND OTHER APPURTENANCES ARE OMITTED FOR CLARITY.

2. THE FOLLOWING ANTI-SIPHON MEASURES WILL BE INCLUDED IN THE FINAL DESIGN:
   - -THE TRANSFER PUMP WILL BE MANUALLY OPERATED
   - -THE DAY TANK WILL INCLUDE SCADA ALARM IF LEVEL CHANGE IS HIGHER THAN EXPECTED
   - -BACKPRESSURE VALVE, ANTI-SIPHON VALVE, PRESSURE RELIEF, AND CHECK VALVE WILL BE INCLUDED
   - -CHEMICAL FEED PUMPS WILL ONLY OPERATE IF FLOW IS DETECTED IN THE MAIN PIPE

3. CONTROLS FOR FLUORIDE DOSING WILL INCLUDED FLOW PACING AND TRIM BASED ON FLUORIDE ANALYZER

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE

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EJJ DRAWN
JHBF CHECKED

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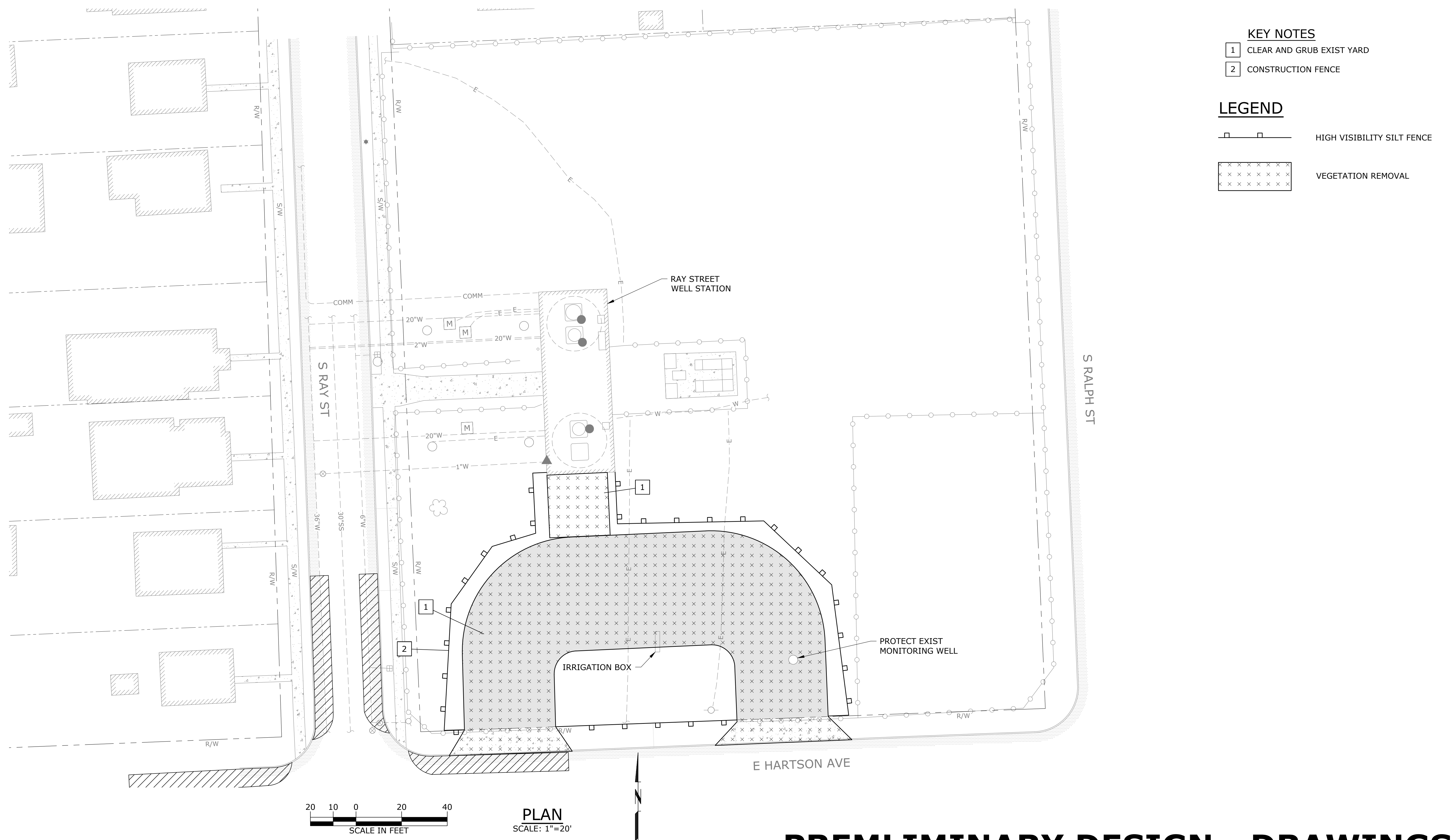
CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

RAY STREET
WELL STATION PROCESS FLOW DIAGRAM

PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: MAY 2023

SHEET G-300



PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

NDH DESIGNED
EJJ/DKH DRAWN
JHBF CHECKED

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CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

RAY STREET
WELL STATION DEMOLITION

PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: MAY 2023

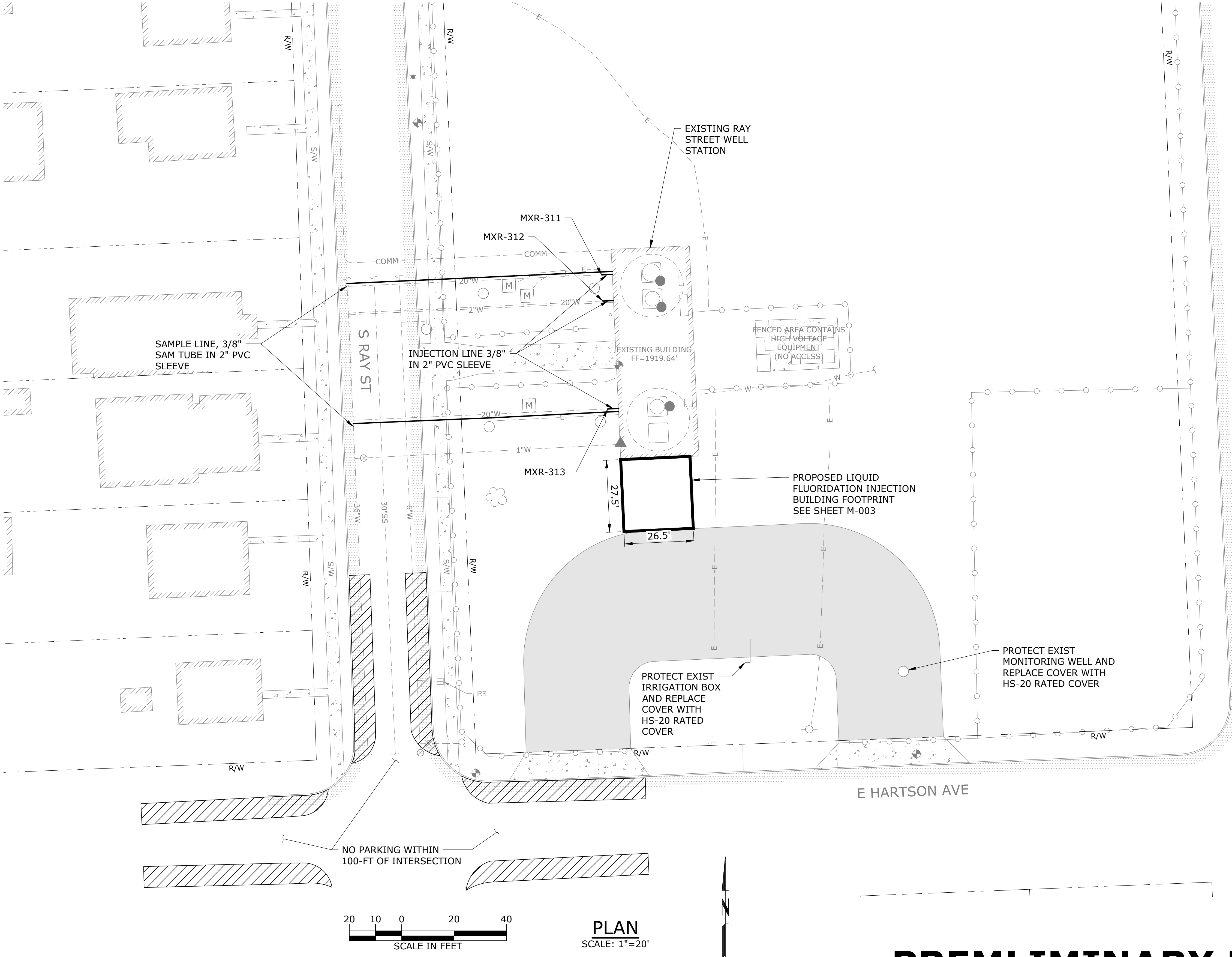
SHEET C-300
19 of 52

\\ad.msa-ep.com\boise\boi_projects\22\3386 - Spokane Fluoridation Study\CAD\Sheets\22-3386-WA-RAY-C-300-301.dwg C-300 5/17/2023 9:27 AM JUSTIN.DEUEL 23.0s (LMS Tech)

ARCHITECTURAL DATA
ZONING:RESIDENTIAL TWO-FAMILY USE
ARCHITECTURAL FEATURES: UNREINFORCED MASONRY
AREA: 729 SF
HEIGHT: APPROX 20 FT
LANDSCAPING: IN ACCORDANCE WITH CITY CODE, MATCH EXISTING

NOTES:

1. PVC PIPES MAY REQUIRE PROTECTIVE PIPE CASING IN TRAFFIC AREAS



20 10 0 20 40
SCALE IN FEET

PLAN
SCALE: 1"=20'

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

NDH DESIGNED
EJJ DRAWN
JHBF CHECKED

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MAY 2023

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CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

RAY STREET
WELL STATION SITE PLAN

PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: MAY 2023

SHEET
C-301
20 of 52

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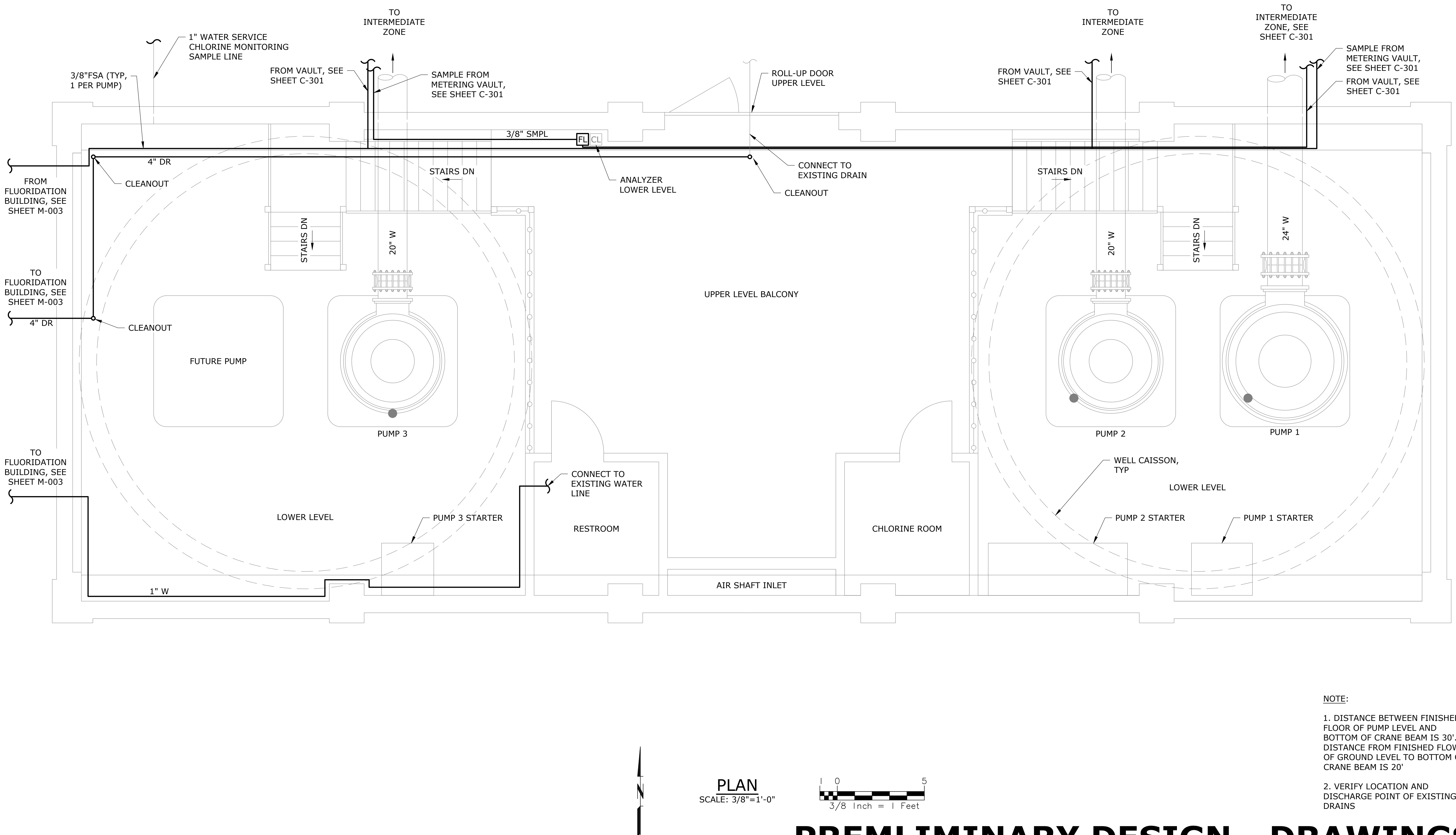

NOTE:

1. DISTANCE BETWEEN FINISHED FLOOR OF PUMP LEVEL AND BOTTOM OF CRANE BEAM IS 30'. DISTANCE FROM FINISHED FLOW OF GROUND LEVEL TO BOTTOM OF CRANE BEAM IS 20'

2. VERIFY LOCATION AND DISCHARGE POINT OF EXISTING DRAINS

PLAN
SCALE: 3/8"=1'-0"

1 0 5
3/8 Inch = 1 Feet

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

NDH DESIGNED
DKH DRAWN
JHBF CHECKED

PRELIMINARY ONLY
MAY 2023
38779

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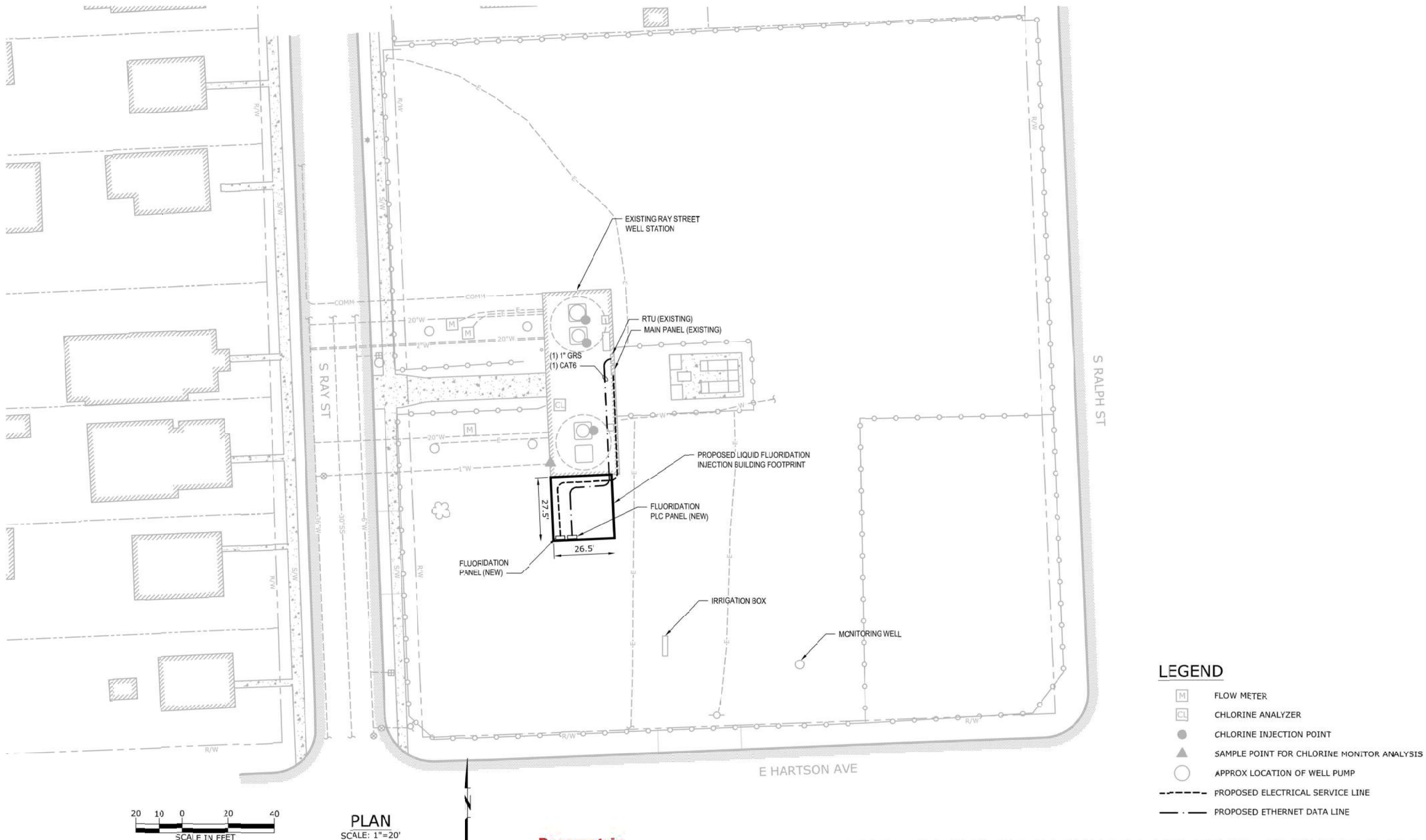
CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

RAY STREET
WELL STATION PROCESS MECHANICAL

SHEET M-300

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023



PLAN

SCALE: 1"=20'

PRELIMINARY DESIGN DRAWINGS

NO.	DATE	BY	REVISION

NOTICE: IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

MCC DESIGNED; JEV DRAWN; CHK CHECKED

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

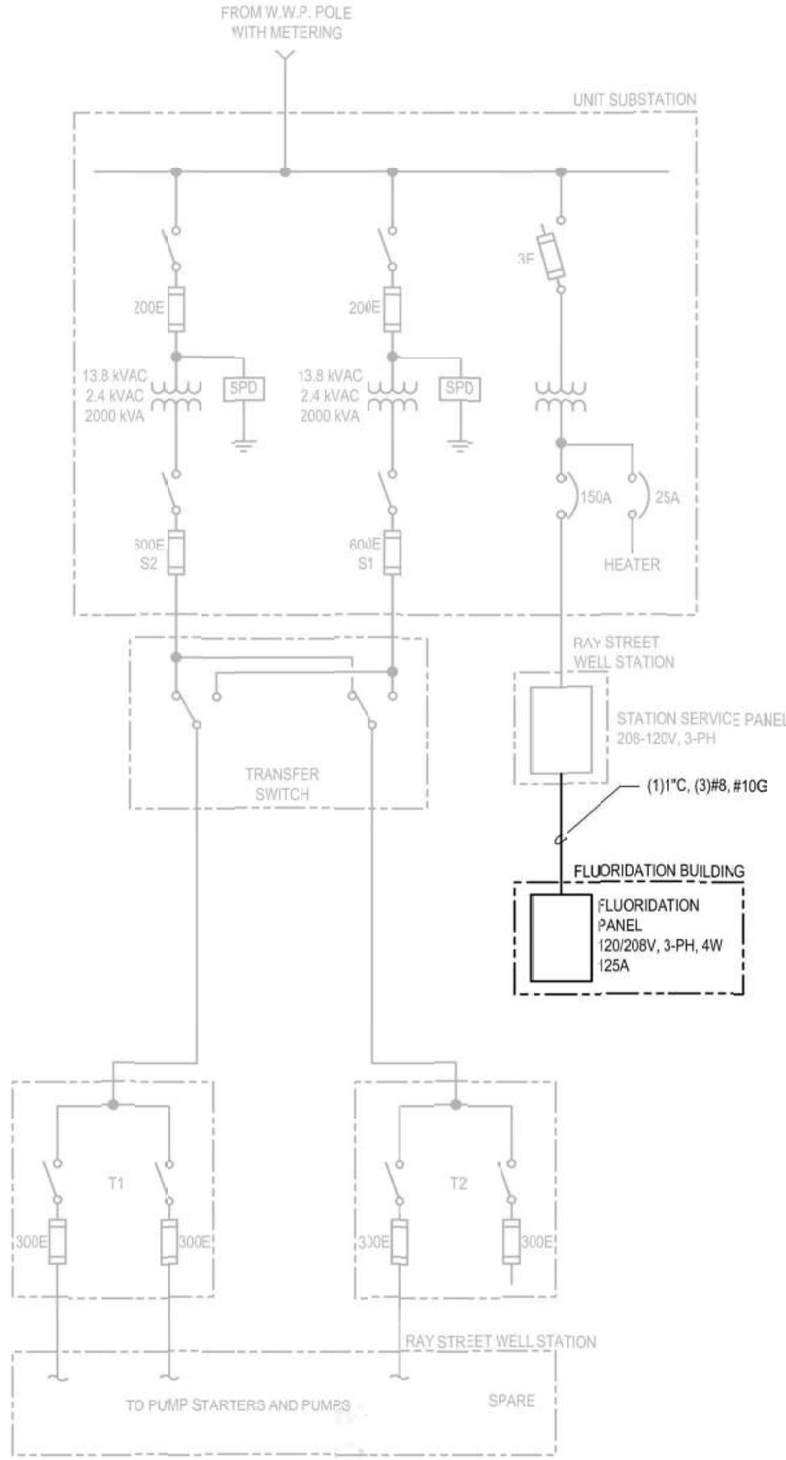
RAY STREET WELL STATION ELECTRICAL SITE PLAN

SHEET E-301

PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: MAY 2023

22 OF 52

U:\Spok\Projects\Clients\4109-MurraysmithInc\376-4109-001 PrelEngStudyforFluorid\99Svcs\CADD\DWG\22-3386-E-301.dwg E-301 5/17/2023 8:55 AM VONDEJAM 22.0s (LMS Tech)



SIMPLIFIED ONE-LINE DIAGRAM

MAIN PANEL PHOTO

NOTES

(1) CONTRACTOR SHALL INSTALL 30-AMP, 3-POLE BREAKER FOR THE FLUORIDATION PANEL FEEDER.

v 5.0

PANELBOARD SCHEDULE

NAME: RAY FLUORIDATION PANEL

VOLTAGE RATING: **208/120 VOLTS, 3 PHASE, 4 WIRE**
BUS RATING: **125** AMPS
MAIN BREAKER: **30** AMPS
FEED: **BOTTOM**
MOUNTING: **SURFACE**
SPECIAL FEATURES: **22 kAIC SCCR**

LOCATION: **FLUORIDATION BUILDING**
FED FROM: **MAIN PANEL**
NOTES: **LIQUID FEED SYSTEM**

LOAD TYPE	CIRCUIT DESCRIPTION	VA	CKT	BRKR	L1 L2 L3	BRKR	CKT	VA	CIRCUIT DESCRIPTION	LOAD TYPE
M	FLUORIDE METERING PUMP 1	190	1	15 / 1	-A-		2	500		LM
M	FLUORIDE METERING PUMP 2	190	3	15 / 1	-B-	15 / 3	4	500	FLUORIDE TRANSFER PUMP	LM
X	PLC CABINET	960	5	15 / 1	-C-		6	500		LM
H		1,240	7		-A-	15 / 1	8	370	ROLL-UP DOOR	M
H	HVAC	1,240	9	15 / 3	-B-	15 / 1	10	160	CHEMICAL ROOM RECEPTACLE	R
H		1,240	11		-C-	15 / 1	12		SPARE	
L	LIGHTING	240	13	15 / 1	-A-	15 / 1	14		SPARE	
R	ELECTRICAL ROOM RECEPTACLE	180	15	15 / 1	-B-	15 / 1	16	120	FLUORIDE ANALYZER	X
M	FLUORIDE METERING PUMP 3	190	17	15 / 1	-C-	15 / 1	18		SPARE	
			19	/ 1	-A-	/ 1	20			
			21	/ 1	-B-	/ 1	22			
			23	/ 1	-C-	/ 1	24			

LINE LOADS: 2,540 VA(L1) 2,410 VA(L2) 2,390 VA(L3)
TOTAL LOAD: 7.84 KVA 21.8 AMPS

RAY FLUORIDATION PANEL LOAD CALCULATION:

		CONNECTED VA	METHOD	NEC DEMAND	CALC. VA
TOTAL LIGHTING (L) LOAD:	L	240	ALL @	125%	300
TOTAL RECEPTACLE (R) LOAD:	R	360	FIRST 10KVA @	125%	450
			REMAINDER OVER 10KVA	50%	0
TOTAL MOTOR (M) LOAD:	M	940	ALL @	100%	940
	LM	1500	125% OF LARGEST	125%	1875
TOTAL HVAC (H) LOAD:	H	3720	ALL @	125%	4650
TOTAL MISCELLANEOUS (X) LOAD:	X	1080	ALL @	125%	1350
TOTAL VA:		7840 VA			9565 VA
AVERAGE AMPS @		22 AMPS			27 AMPS
VOLTAGE PHASE TO PHASE=	208				

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PRELIMINARY DESIGN DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
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MCC
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JEV
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CHK
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PROFESSIONAL ENGINEER — 48689 — May 23

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CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

RAY STREET WELL STATION ONE-LINE, PANEL SCHEDULE AND LOAD CALCULATIONS

PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: MAY 2023

SHEET
E-302

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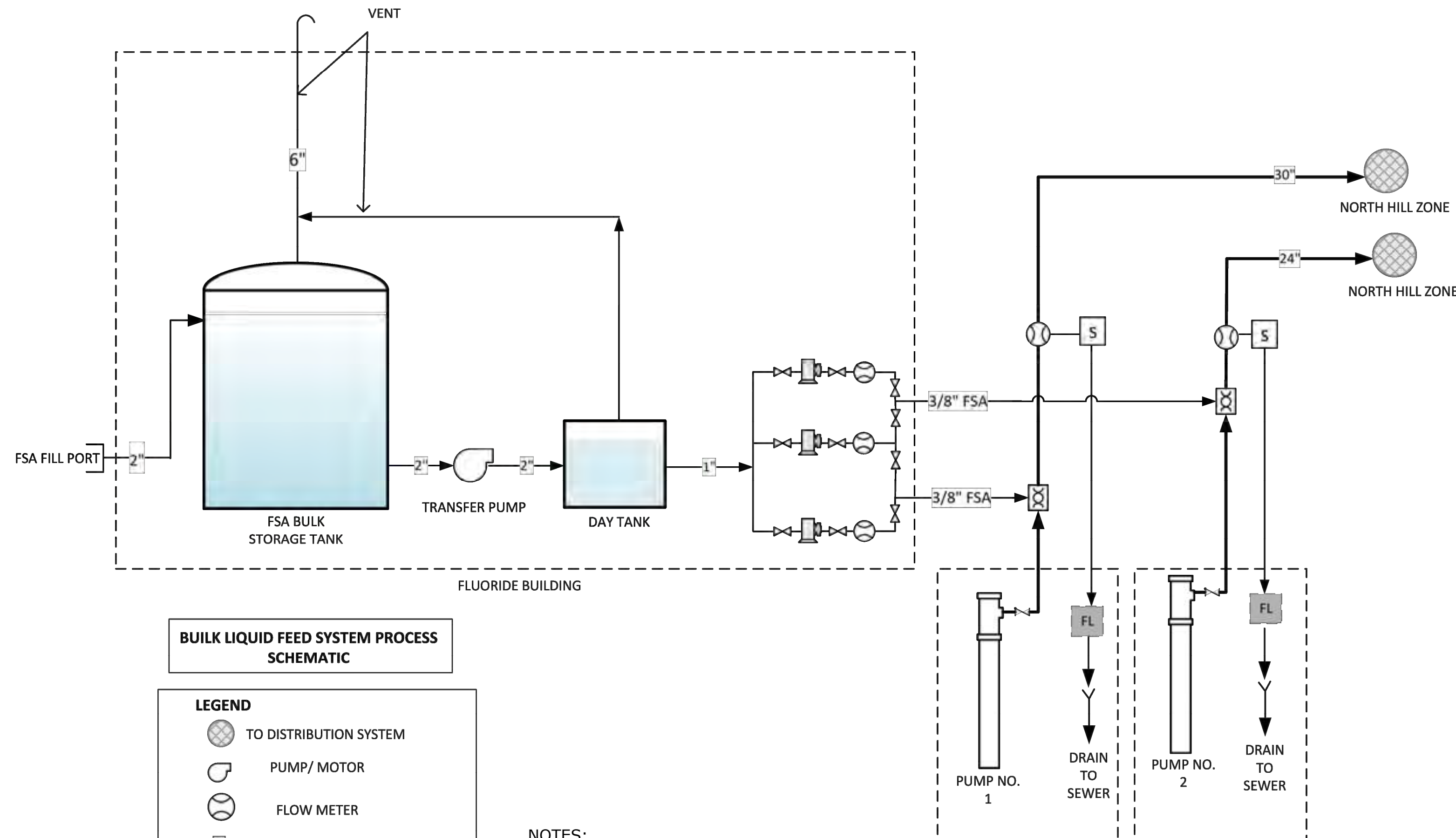

BUILK LIQUID FEED SYSTEM PROCESS SCHEMATIC

LEGEND

- TO DISTRIBUTION SYSTEM
- PUMP/ MOTOR
- FLOW METER
- DOSING PUMP
- S SOLENOID VALVE
- STATIC MIXER
- FL FLUORIDE ANALYZER

NOTES:

1. PROCESS FLOW DIAGRAM SHOWS GENERAL CONFIGURATION AND MAJOR ELEMENTS. SOME FITTINGS, VALVES, AND OTHER APPURTENANCES ARE OMITTED FOR CLARITY.

2. THE FOLLOWING ANTI-SIPHON MEASURES WILL BE INCLUDED IN THE FINAL DESIGN:
   - -THE TRANSFER PUMP WILL BE MANUALLY OPERATED
   - -THE DAY TANK WILL INCLUDE SCADA ALARM IF LEVEL CHANGE IS HIGHER THAN EXPECTED
   - -BACKPRESSURE VALVE, ANTI-SIPHON VALVE, PRESSURE RELIEF, AND CHECK VALVE WILL BE INCLUDED
   - -CHEMICAL FEED PUMPS WILL ONLY OPERATE IF FLOW IS DETECTED IN THE MAIN PIPE

3. CONTROLS FOR FLUORIDE DOSING WILL INCLUDED FLOW PACING AND TRIM BASED ON FLUORIDE ANALYZER

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
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EJJ DRAWN
JHBF CHECKED

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CITY OF SPOKANE

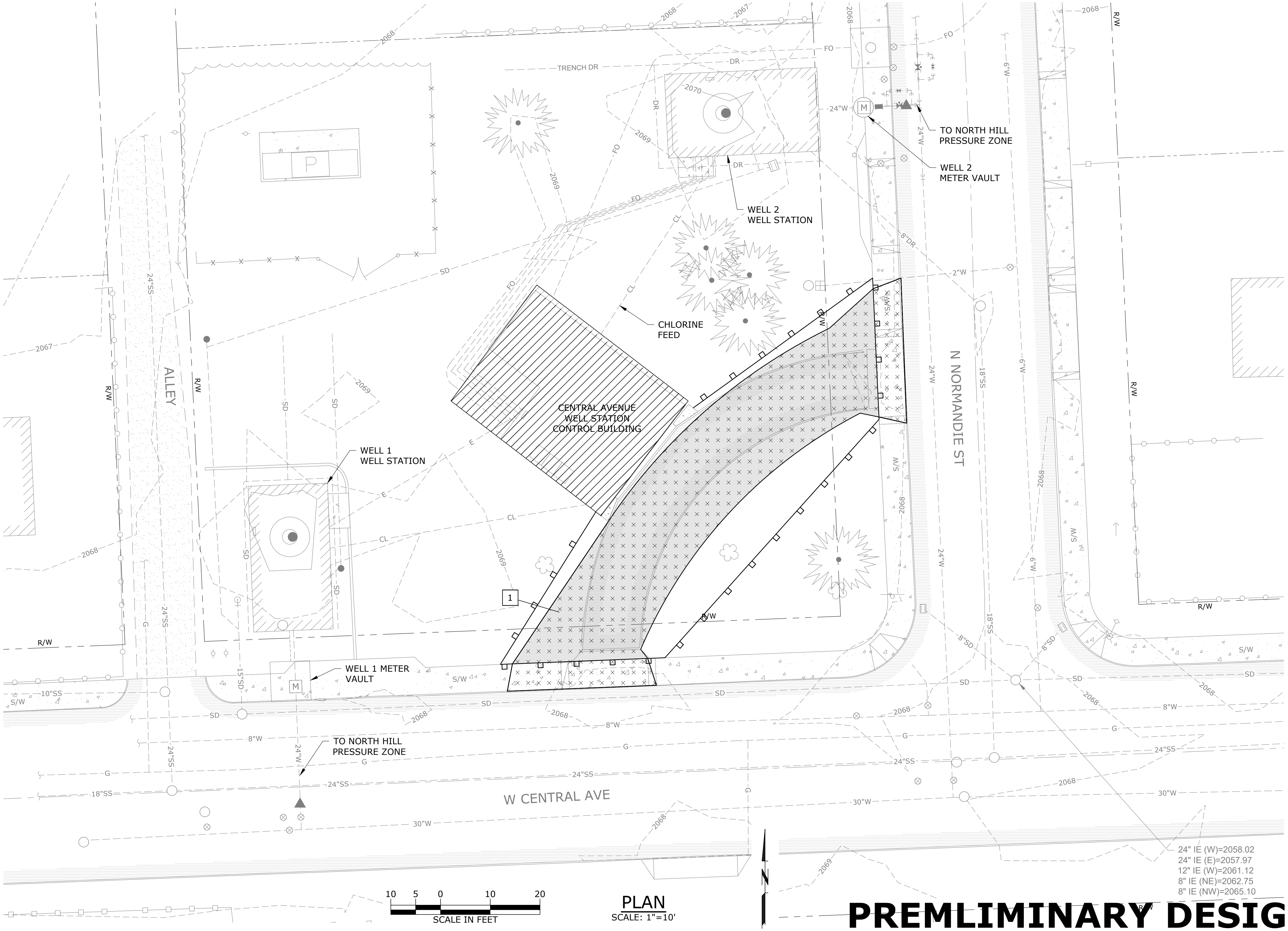
PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

CENTRAL AVE WELL STATION PROCESS FLOW DIAGRAM

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023

SHEET G-400

\\ad.msa-ep.com\boise\boi_projects\22\3386 - Spokane Fluoridation Study\CAD\Sheets\22-3386-WA-CENTRAL-C-400-401.dwg C-400 5/17/2023 9:34 AM JUSTIN.DEUEL 23.0s (LMS Tech)



KEY NOTES

1 CLEAR AND GRUB EXIST YARD

LEGEND

- HIGH VISIBILITY SILT FENCE
- VEGETATION REMOVAL
- TREE TO BE REMOVED
- DEMOLISH

10 5 0 10 20
SCALE IN FEET

PLAN

SCALE: 1"=10'

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
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EJJ/DKH DRAWN
JHBF CHECKED

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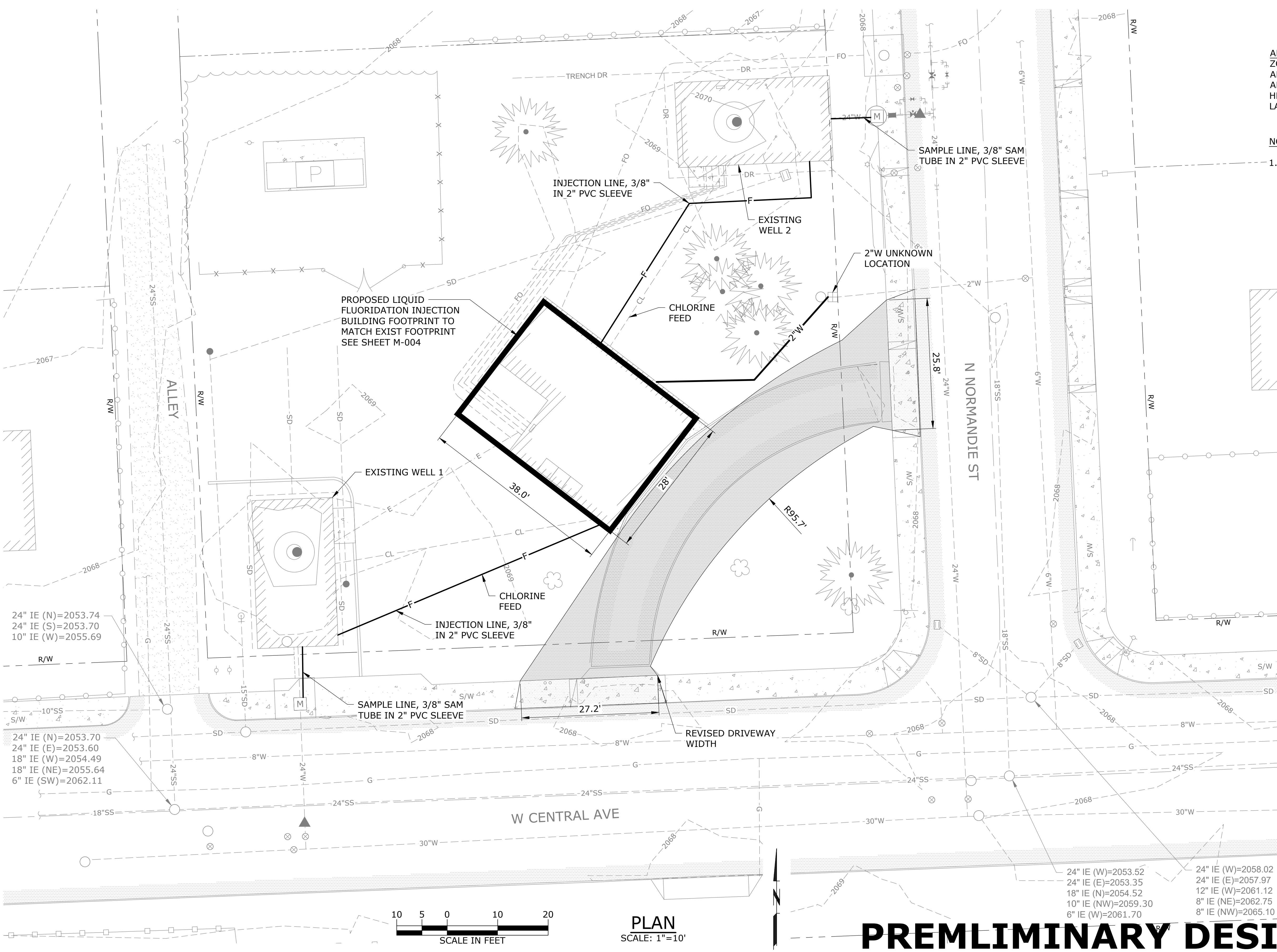
PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

CENTRAL AVENUE WELL STATION DEMOLITION

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023

SHEET C-400

25 of 52



ARCHITECTURAL DATA
ZONING: RESIDENTIAL SINGLE-FAMILY USE
ARCHITECTURAL FEATURES: CONCRETE MASONRY UNIT
AREA: 1132 SF
HEIGHT: APPROX 22.5 FT
LANDSCAPING: IN ACCORDANCE WITH CITY CODE, MATCH EXISTING

NOTES:
1. VERIFY LOCATION AND DISCHARGE POINT OF EXISTING DRAINS

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
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NDH DESIGNED
EJJ/DKH DRAWN
JHBF CHECKED

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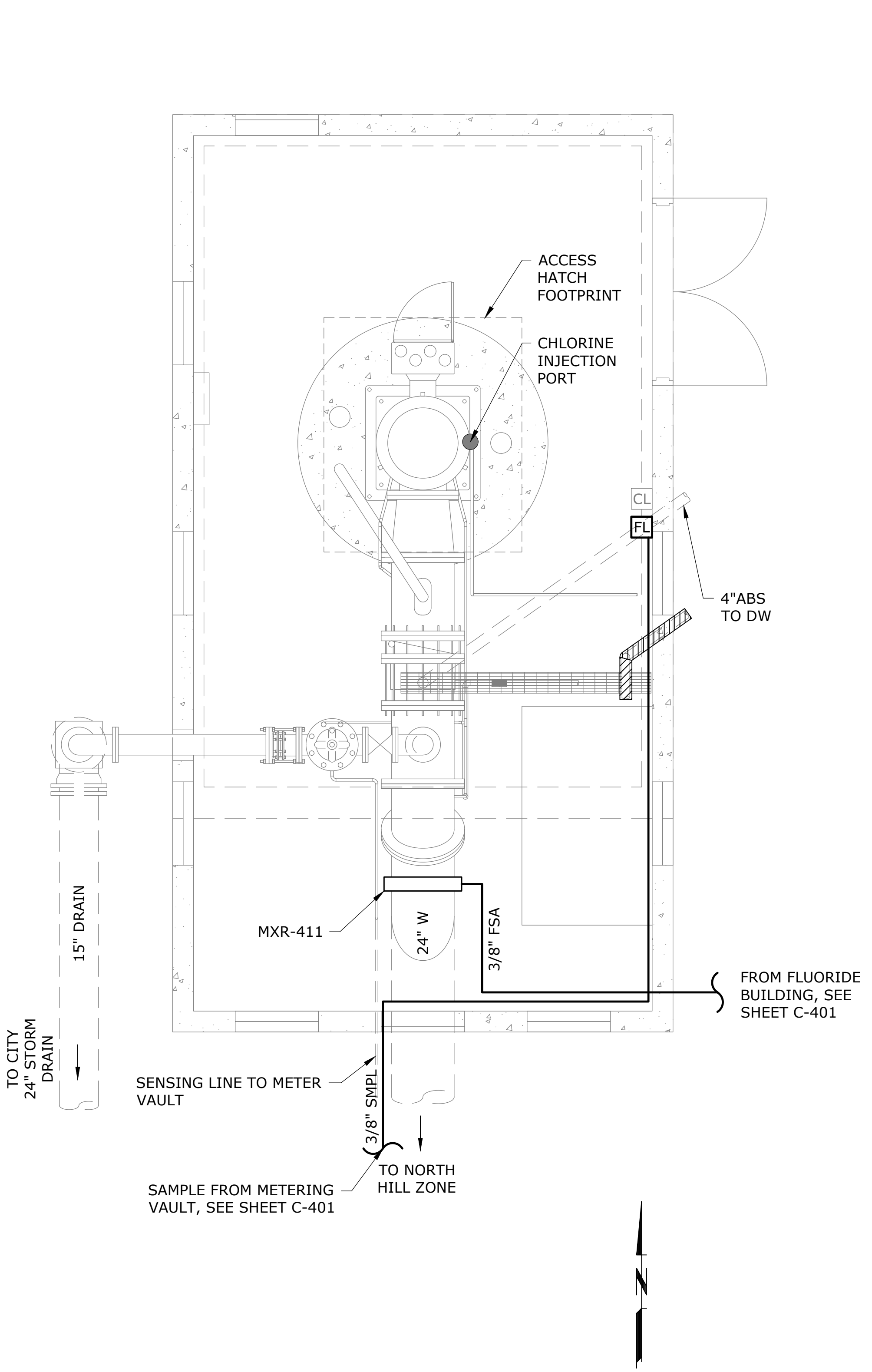
PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

CENTRAL AVENUE WELL STATION SITE PLAN

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023

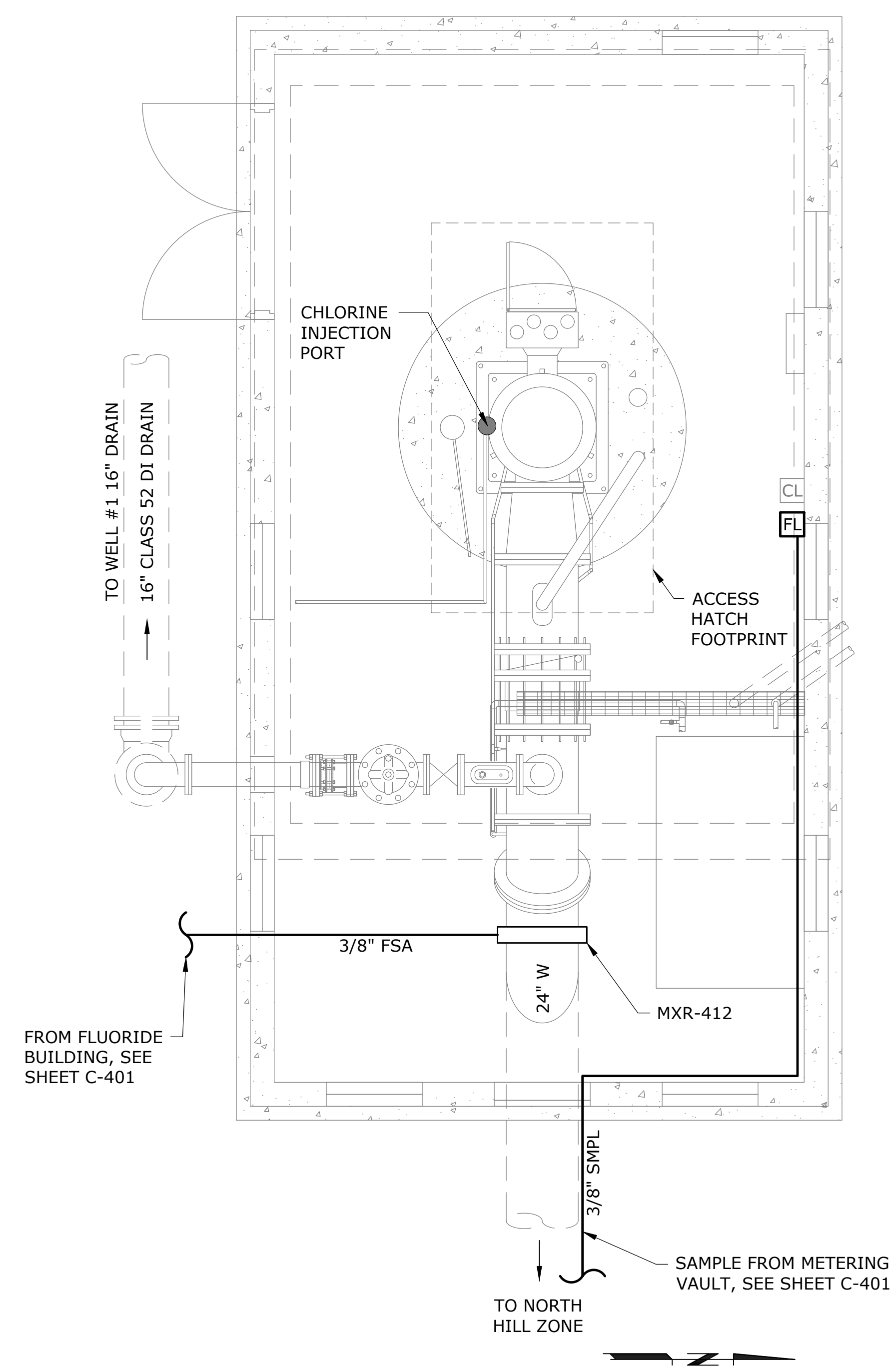
SHEET C-401

26 of 52



CENTRAL AVENUE WELL 1 - WELL HOUSE PLAN

SCALE: 3/8"=1'



CENTRAL AVENUE WELL 2 - WELL HOUSE PLAN

SCALE: 3/8"=1'

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE

0 ½ 1

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NDH
DESIGNED
EJJ
DRAWN
JHBF
CHECKED

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CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

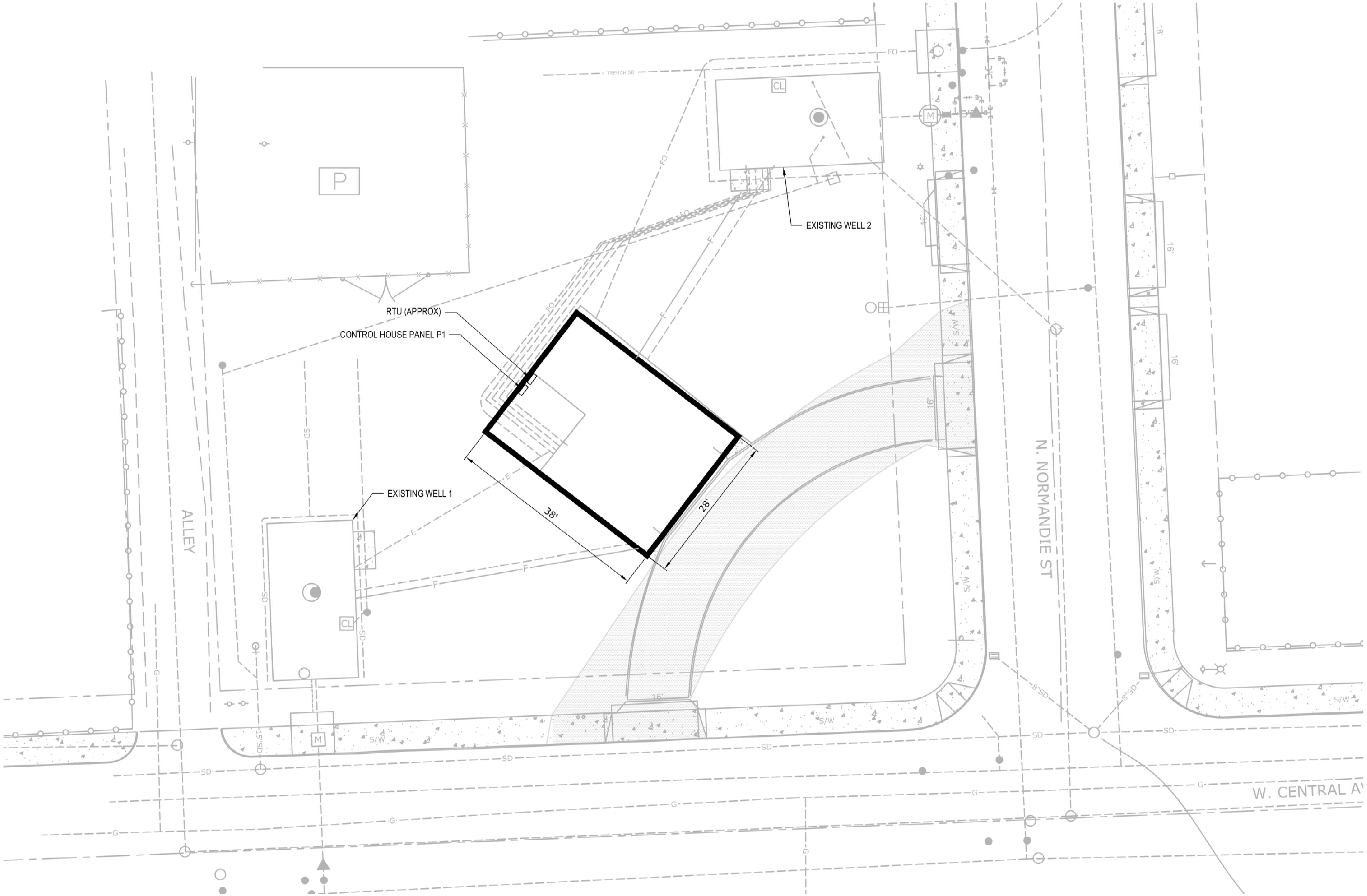
CENTRAL AVE
WELL STATION PROCESS MECHANICAL

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023

SHEET
M-400

NOTES

1. CONTROL HOUSE TO BE DEMOLISHED AND REDESIGNED BY OTHERS. NEW CONTROL HOUSE ELECTRICAL PANELBOARD WILL BE SIZED TO ACCOMMODATE FLUORIDATION SYSTEM LOADS IN ADDITION TO OTHER REQUIRED LOADS FOR THE CONTROL HOUSE.



LEGEND

M	FLOW METER
CL	CHLORINE ANALYZER
●	CHLORINE INJECTION POINT
▲	SAMPLE POINT FOR CHLORINE MONITOR ANALYSIS
○	APPROX LOCATION OF WELL PUMP
—F—	CHEMICAL SOLUTION LINE

10 5 0 10 20
SCALE IN FEET

PLAN
SCALE: 1"=10'

N

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PRELIMINARY DESIGN DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
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MCC DESIGNED
JEV DRAWN
CHK CHECKED

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CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

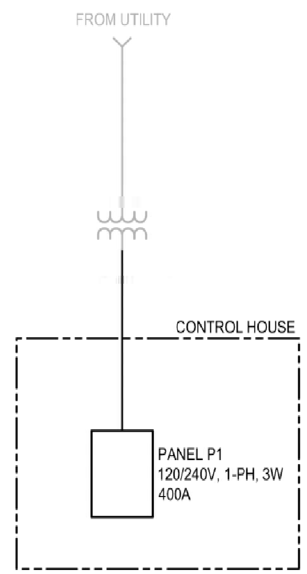
CENTRAL AVENUE WELL STATION ELECTRICAL SITE PLAN

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023

SHEET E-401

NOTES

1. LOADS IN THE PANELBOARD SCHEDULE BELOW ARE FOR THE FLUORIDATION SYSTEM ONLY, AND IS SHOWN FOR THE PURPOSE OF PROVIDING INFORMATION TOWARDS A COMPREHENSIVE LOAD CALCULATION AND PANEL SCHEDULE FOR THE PANELBOARD TO BE DESIGNED FOR THE RECONSTRUCTION OF THE CONTROL HOUSE.



PARTIAL ONE-LINE

v 5.0

PANELBOARD SCHEDULE

NAME: P1 CONTROL HOUSE PANEL

VOLTAGE RATING: **120/240 VOLTS, 1 PHASE, 3 WIRE**
BUS RATING: **400** AMPS
MAIN BREAKER: **300** AMPS
FEED: **BOTTOM**
MOUNTING: **SURFACE**
SPECIAL FEATURES: **22 kAIC SCCR**

LOCATION: **CONTROL HOUSE**
FED FROM: **UTILITY**
NOTES: **LIQUID FEED SYSTEM**

LOAD TYPE	CIRCUIT DESCRIPTION	VA	CKT	BRKR	L1	L2	BRKR	CKT	VA	CIRCUIT DESCRIPTION	LOAD TYPE
M	FLUORIDE METERING PUMP 1	190	1	15 / 1	-A-		15 / 2	2	750	FLUORIDE TRANSFER PUMP	LM
X	PLC CABINET	960	3	15 1		-B-		4	750		LM
X	FLUORIDE ANALYZER	120	5	15 / 1	-A-		15 / 1	6	190	FLUORIDE METERING PUMP 2	M
			7	15 / 1		-B-	15 / 1	8	370	ROLL-UP DOOR	M
			9	15 / 1	-A-		15 / 1	10			
			11	15 / 1		-B-	15 / 1	12			
			12	15 / 1	-A-		15 / 1	14			
			13	15 / 1		-B-	15 / 1	16			
			15	15 / 1	-A-		15 / 1	18			
			17	15 / 1		-B-	15 / 1	20			
			21	15 / 1	-A-		15 / 1	22			
			23	15 / 1		-B-	15 / 1	24			
			25	15 / 1	-A-		15 / 1	26			
			27	15 / 1		-B-	15 / 1	28			
LINE LOADS:		**1,250 VA(L1)**							**2,080 VA(L2)**		
TOTAL LOAD:		**3.33 KVA**				**13.9 AMPS**					

P1 CONTROL HOUSE PANEL LOAD CALCULATION:

		CONNECTED VA	METHOD	NEC DEMAND	CALC. VA
TOTAL EXISTING (E) LOAD FROM 30 DAY METER RECORDING, PER NEC (2017) 220.87:	E	0	ALL @	125%	0
TOTAL LIGHTING (L) LOAD:	L	0	ALL @	125%	0
TOTAL RECEPTACLE (R) LOAD:	R	0	FIRST 10KVA @	125%	0
			REMAINDER OVER 10KVA	50%	0
TOTAL MOTOR (M) LOAD:	M	750	ALL @	100%	750
	LM	1500	125% OF LARGEST	125%	1875
TOTAL HVAC (H) LOAD:	H	0	ALL @	125%	0
TOTAL MISCELLANEOUS (X) LOAD:	X	1080	ALL @	125%	1350
TOTAL VA:		3330 VA			3975 VA
AVERAGE AMPS @		14 AMPS			17 AMPS
VOLTAGE PHASE TO PHASE=	240				

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PRELIMINARY DESIGN DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

MCC
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JEV
DRAWN
CHK
CHECKED

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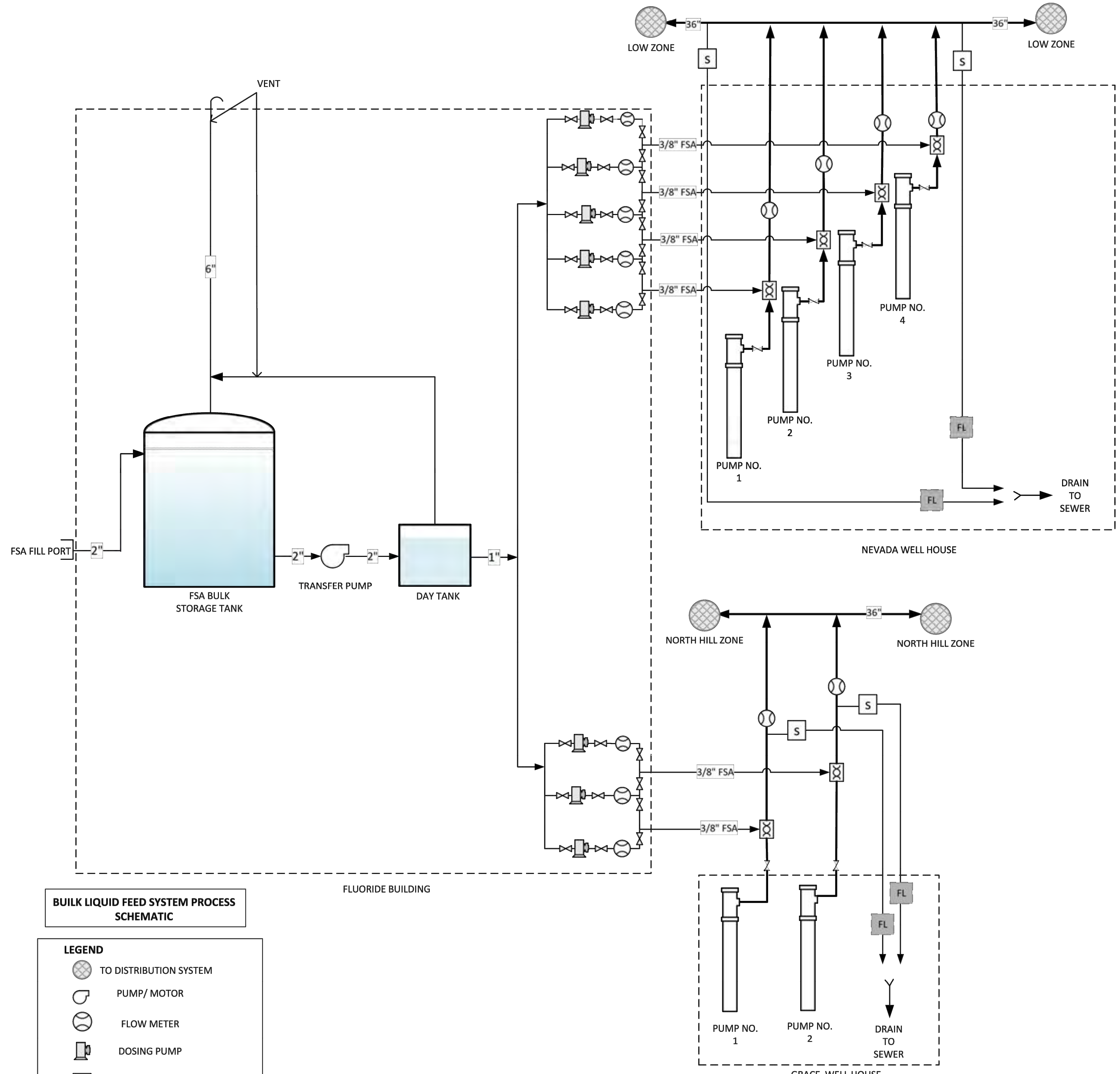
CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

CENTRAL AVENUE WELL STATION ONE-LINE, PANEL SCHEDULE AND LOAD CALCULATIONS

SHEET
E-402
29 OF 52

PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: MAY 2023



NOTES:

1. PROCESS FLOW DIAGRAM SHOWS GENERAL CONFIGURATION AND MAJOR ELEMENTS. SOME FITTINGS, VALVES, AND OTHER APPURTENANCES ARE OMITTED FOR CLARITY.

2. THE FOLLOWING ANTI-SIPHON MEASURES WILL BE INCLUDED IN THE FINAL DESIGN:
   - -THE TRANSFER PUMP WILL BE MANUALLY OPERATED
   - -THE DAY TANK WILL INCLUDE SCADA ALARM IF LEVEL CHANGE IS HIGHER THAN EXPECTED
   - -BACKPRESSURE VALVE, ANTI-SIPHON VALVE, PRESSURE RELIEF, AND CHECK VALVE WILL BE INCLUDED
   - -CHEMICAL FEED PUMPS WILL ONLY OPERATE IF FLOW IS DETECTED IN THE MAIN PIPE

3. CONTROLS FOR FLUORIDE DOSING WILL INCLUDED FLOW PACING AND TRIM BASED ON FLUORIDE ANALYZER

BUILK LIQUID FEED SYSTEM PROCESS SCHEMATIC

LEGEND

- TO DISTRIBUTION SYSTEM
- PUMP/ MOTOR
- FLOW METER
- DOSING PUMP
- S SOLENOID VALVE
- STATIC MIXER
- FL FLUORIDE ANALYZER

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
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EJJ DRAWN
JHBF CHECKED

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CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

GRACE AND NEVADA WELL STATION PROCESS FLOW DIAGRAM

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023

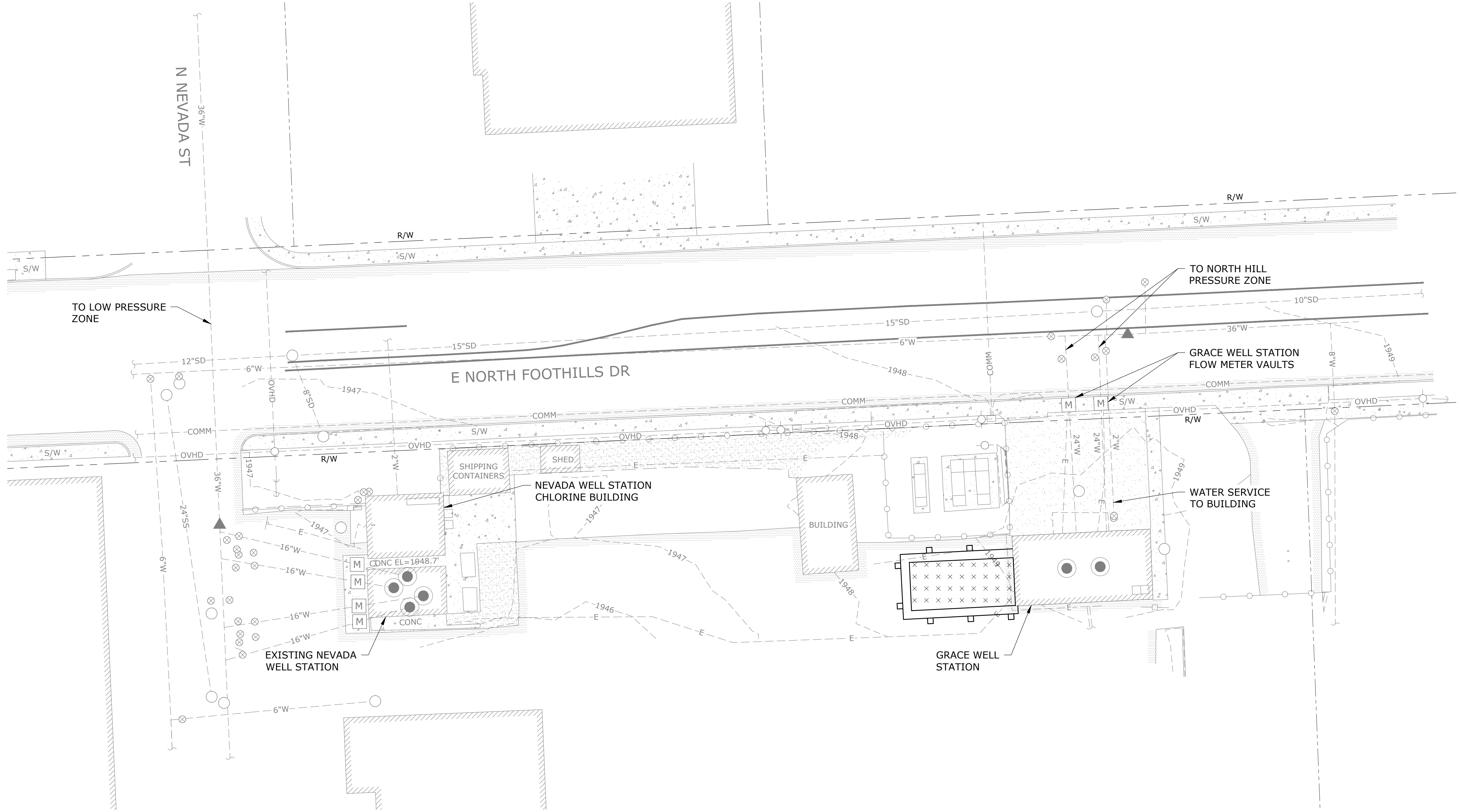
SHEET
G-500
30 of 52

KEY NOTES

1. CLEAR AND GRUB EXIST YARD
2. CONSTRUCTION FENCE

LEGEND

- HIGH VISIBILITY SILT FENCE
- ASPHALT REMOVAL



20 10 0 20 40
SCALE IN FEET

PLAN
SCALE: 1"=20'

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
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NDH DESIGNED
EJJ/DKH DRAWN
JHBF CHECKED

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CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

GRACE AND NEVADA WELL STATION DEMOLITION

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023

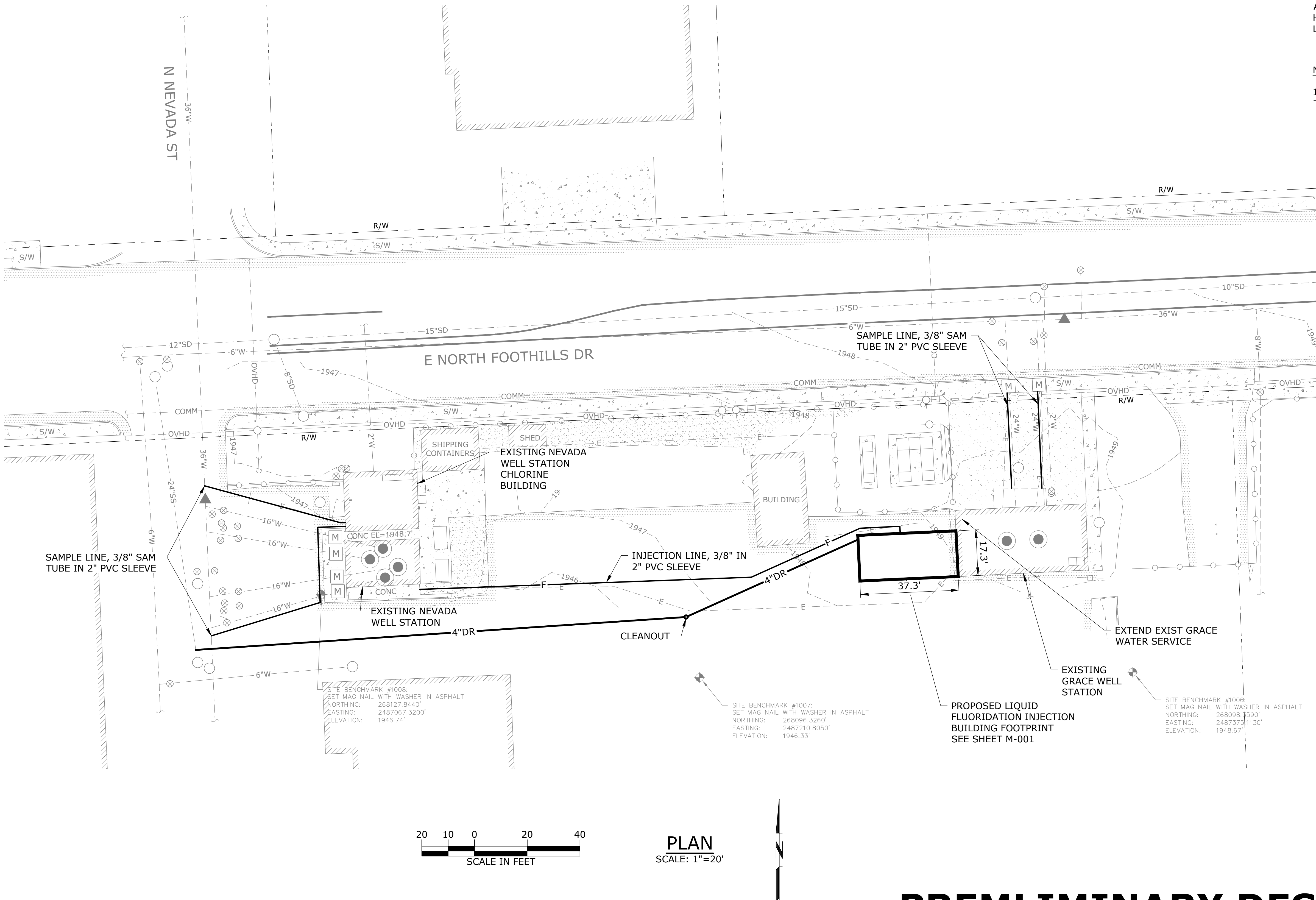
SHEET C-500

\\ad.msa-ep.com\boise\boi_projects\22\3386 - Spokane Fluoridation Study\CAD\Sheets\22-3386-WA-GRACE-NEVADA-C-500-501.dwg C-501 5/17/2023 9:34 AM JUSTIN.DEUEL 23.0s (LMS Tech)

ARCHITECTURAL DATA
ZONING: CENTER AND CORRIDOR TYPE 1 ZONE-EMPLOYMENT CENTER
ARCHITECTURAL FEATURES: CONCRETE MASONRY UNIT
AREA: 629 SF
HEIGHT: APPROX 25 FT
LANDSCAPING: IN ACCORDANCE WITH CITY CODE, MATCH EXISTING

NOTES:

1. PVC PIPES MAY REQUIRE PROTECTIVE PIPE CASING IN TRAFFIC AREAS



PLAN
SCALE: 1"=20'

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

NDH DESIGNED
EJJ DRAWN
JHBF CHECKED

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CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

GRACE AND NEVADA WELL STATION SITE PLAN

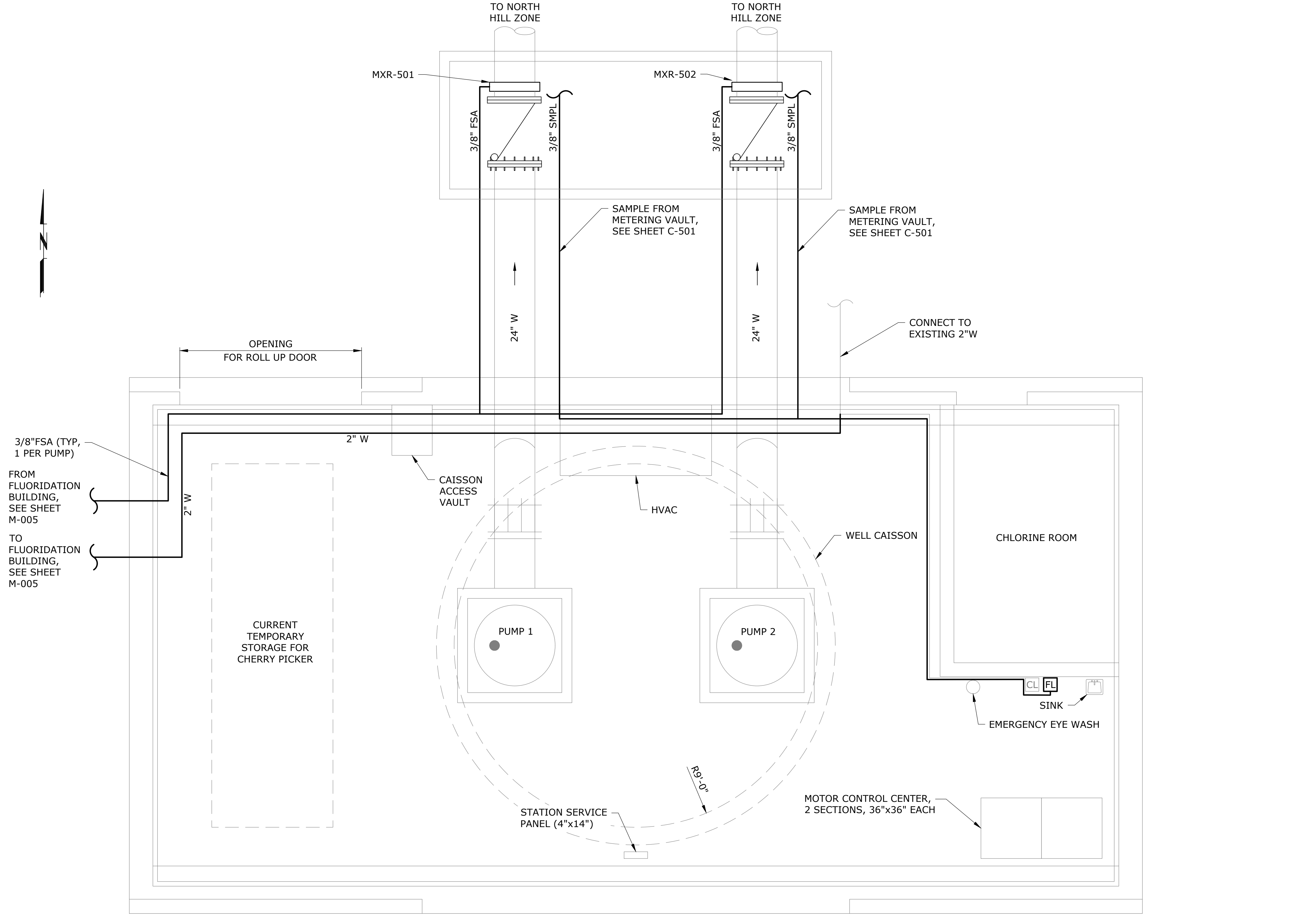
PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: MAY 2023

SHEET C-501

32 of 52

NOTE:

1. DISTANCE BETWEEN FINISHED FLOOR AND BOTTOM OF CRANE BEAM IS 25'-6".



PLAN

SCALE: 3/8"=1'-0"

1 0 5

3/8 Inch = 1 Feet

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE

0 ½ 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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DESIGNED
EJJ/DKH
DRAWN
JHBF
CHECKED

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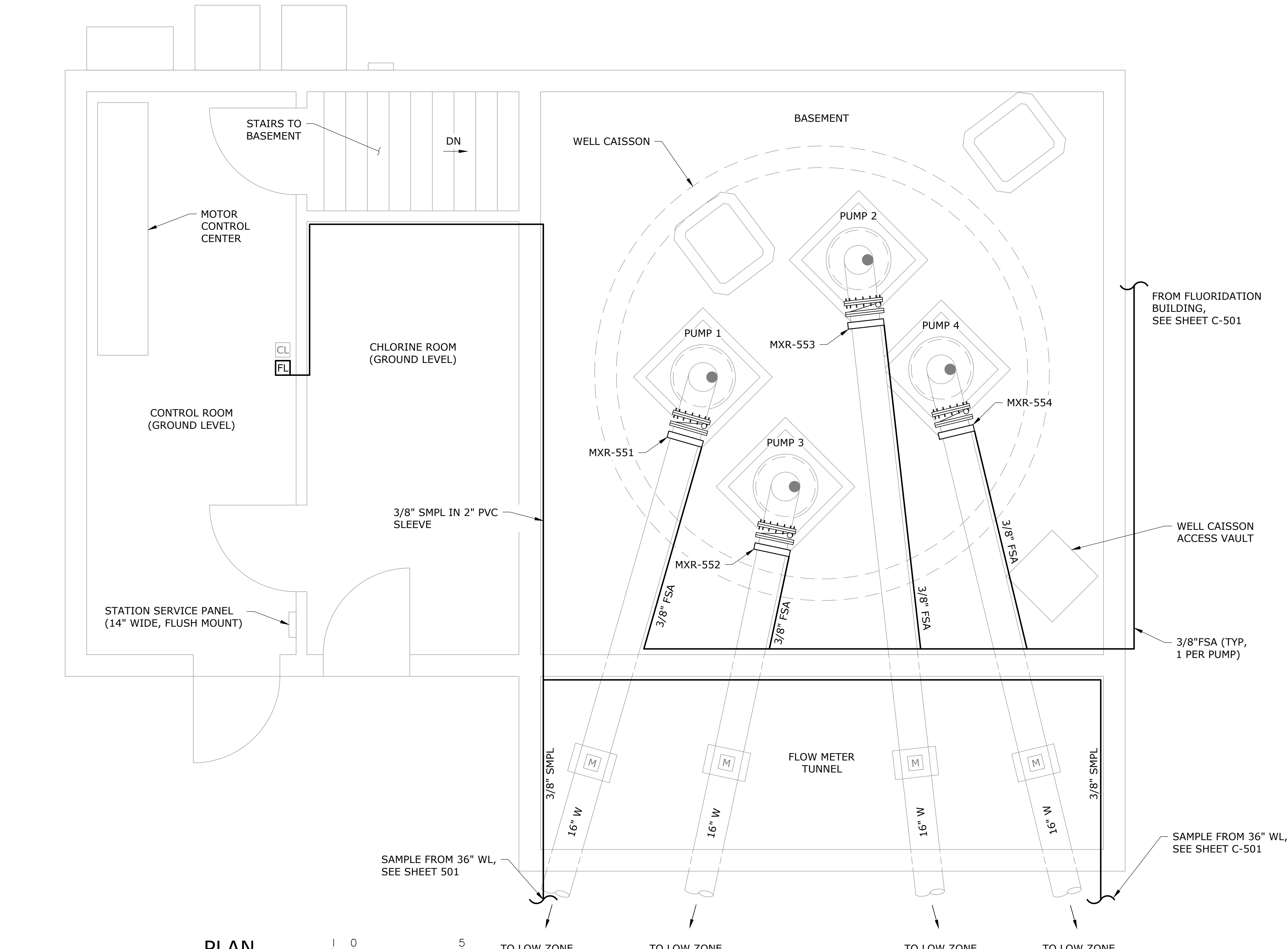
CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

GRACE
WELL STATION PROCESS MECHANICAL

SHEET
M-500
33 of 52

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023



PLAN
SCALE: 3/8"=1'-0"

3/8 Inch = 1 Feet

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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DESIGNED
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JHBF
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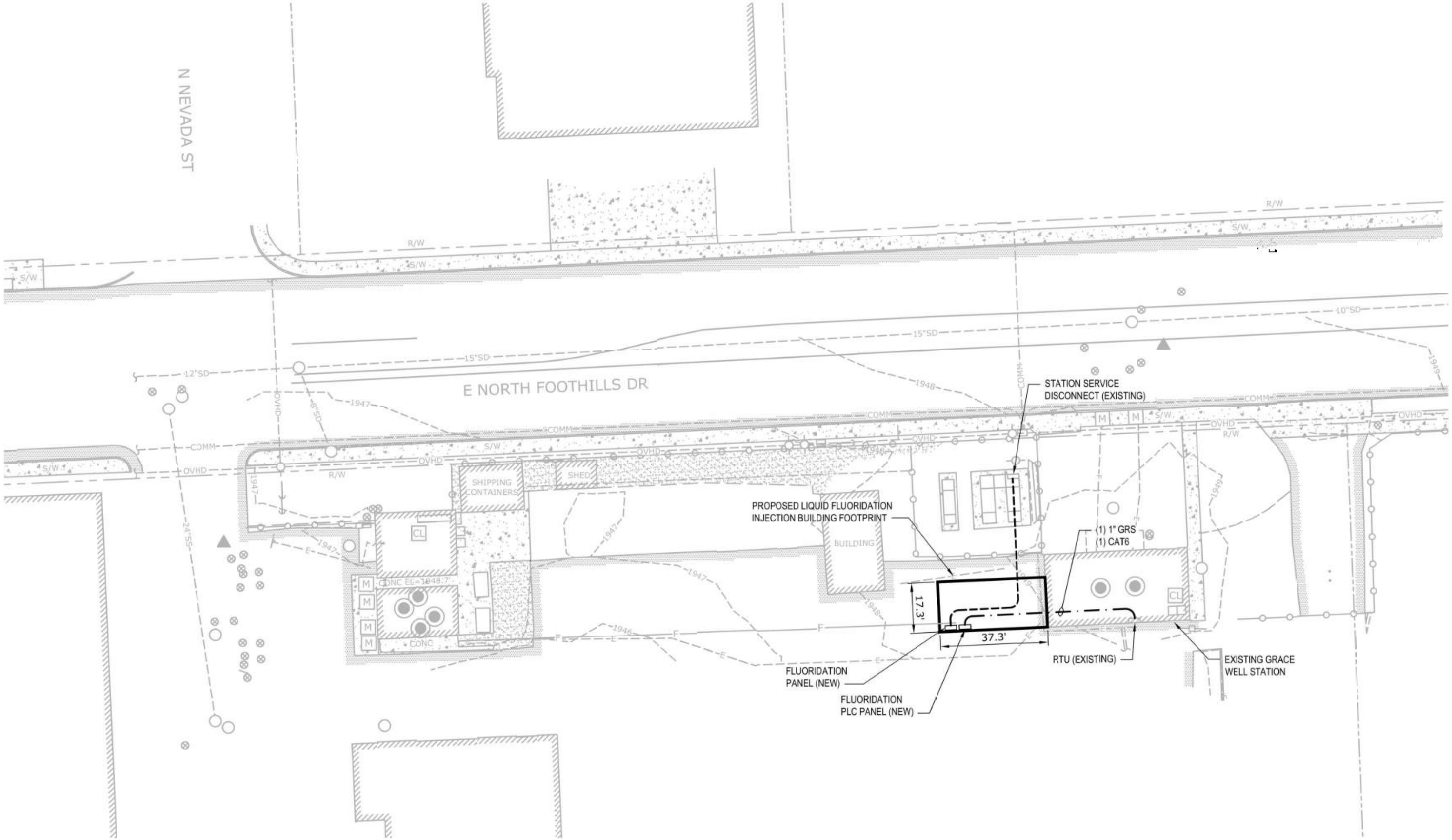
CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

NEVADA
WELL STATION PROCESS MECHANICAL

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023

SHEET
M-550
34 of 52



LEGEND

- M FLOW METER
- CL CHLORINE ANALYZER
- ● CHLORINE INJECTION POINT
- ▲ SAMPLE POINT FOR CHLORINE MONITOR ANALYSIS
- ○ APPROX LOCATION OF WELL PUMP
- —F— CHEMICAL SOLUTION LINE
- – – – PROPOSED ELECTRICAL SERVICE LINE
- —·— PROPOSED ETHERNET DATA LINE

20 10 0 20 40
SCALE IN FEET

PLAN
SCALE: 1"=20'

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PRELIMINARY DESIGN DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
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MCC DESIGNED
JEV DRAWN
CHK CHECKED

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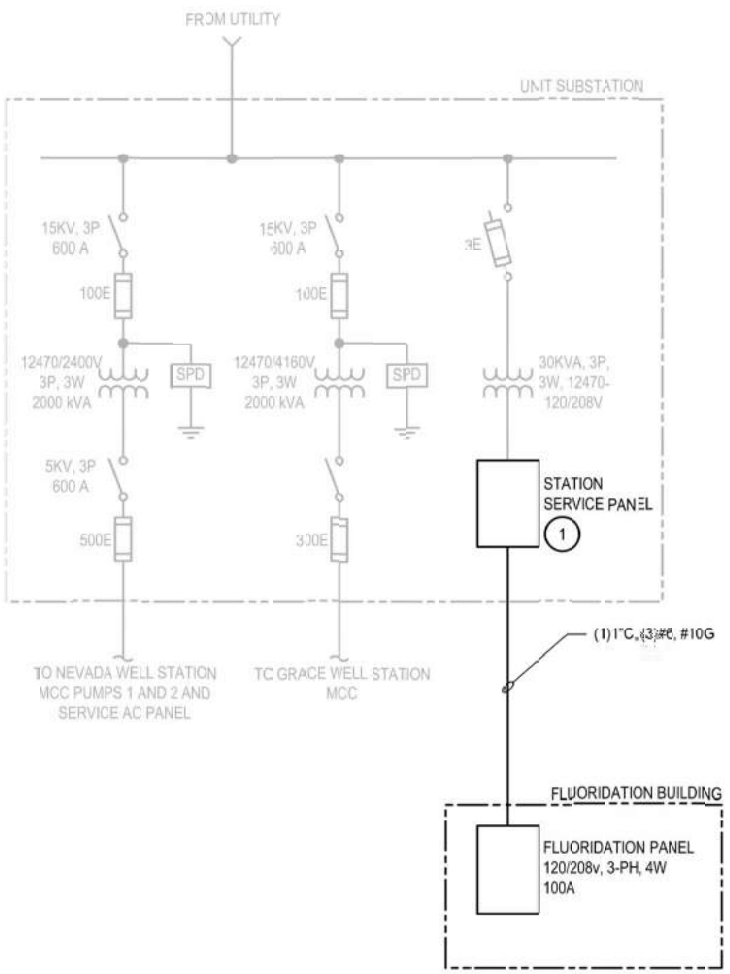
CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

GRACE AND NEVADA WELL STATION ELECTRICAL SITE PLAN

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023

SHEET E-501



STATION SERVICE DISCONNECT PHOTO

NOTES

1. CONTRACTOR SHALL REPLACE EXISTING STATION SERVICE DISCONNECT WITH A PANELBOARD ENCLOSURE WITH TWO CIRCUITS. ONE CIRCUIT SHALL FEED THE GRACE STATION SERVICE, AND THE OTHER SHALL FEED THE FLUORIDATION PANEL.

PANELBOARD SCHEDULE

v 5.0

NAME: GRACE/NEVADA FLUORIDATION PANEL

VOLTAGE RATING: **208/120 VOLTS, 3 PHASE, 4 WIRE**
BUS RATING: **100** AMPS
MAIN BREAKER: **40** AMPS
FEED: **BOTTOM**
MOUNTING: **SURFACE**
SPECIAL FEATURES: **22 kAIC SCCR**

LOCATION: **FLUORIDATION BUILDING**
FED FROM: **STATION SERVICE PANEL (OUTDOOR)**
NOTES: **LIQUID FEED SYSTEM**

LOAD TYPE	CIRCUIT DESCRIPTION	VA	CKT	BRKR	L1 L2 L3	BRKR	CKT	VA	CIRCUIT DESCRIPTION	LOAD TYPE
M	FLUORIDE METERING PUMP 1 - GRACE	190	1	15 / 1	-A-		2	500		LM
L	LIGHTING	240	3	15 / 1	-B-	15 / 3	4	500	FLUORIDE TRANSFER PUMP	LM
X	PLC CABINET	960	5	15 / 1	-C-		6	500		LM
H		1,240	7		-A-	15 / 1	8	370	ROLL-UP DOOR	M
H	HVAC	1,240	9	25 / 3	-B-	15 / 1	10	180	CHEMICAL ROOM RECEPTACLE	R
H		1,240	11		-C-	15 / 1	12		SPARE	
M	FLUORIDE METERING PUMP 2 - GRACE	190	13	15 / 1	-A-	15 / 1	14		SPARE	
R	ELECTRICAL ROOM RECEPTACLE	180	15	15 / 1	-B-	15 / 1	16	120	FLUORIDE ANALYZER	X
M	FLUORIDE METERING PUMP 1 - NEVADA	190	17	15 / 1	-C-	15 / 1	18		SPARE	
M	FLUORIDE METERING PUMP 2 - NEVADA	190	19	/ 1	-A-	/ 1	20			
M	FLUORIDE METERING PUMP 3 - NEVADA	190	21	/ 1	-B-	/ 1	22			
M	FLUORIDE METERING PUMP 4 - NEVADA	190	23	/ 1	-C-	/ 1	24			

LINE LOADS: 2,680 VA(L1) 2,650 VA(L2) 3,060 VA(L3)
TOTAL LOAD: 8.41 KVA 23.3 AMPS

GRACE/NEVADA FLUORIDATION PANEL LOAD CALCULATION:

		CONNECTED VA	METHOD	NEC DEMAND	CALC. VA
TOTAL LIGHTING (L) LOAD:	L	240	ALL @	125%	300
TOTAL RECEPTACLE (R) LOAD:	R	360	FIRST 10KVA @	125%	450
			REMAINDER OVER 10KVA	50%	0
TOTAL MOTOR (M) LOAD	M	1510	ALL @	100%	1510
	LM	1500	125% OF LARGEST	125%	1875
TOTAL HVAC (H) LOAD	H	3720	ALL @	125%	4650
TOTAL MISCELLANEOUS (X) LOAD:	X	1080	ALL @	125%	1350
TOTAL VA		8410 VA			10135 VA
AVERAGE AMPS @		23 AMPS			28 AMPS
VOLTAGE PHASE TO PHASE=	208				

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PRELIMINARY DESIGN DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
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1" THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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JEV DRAWN
CHK CHECKED

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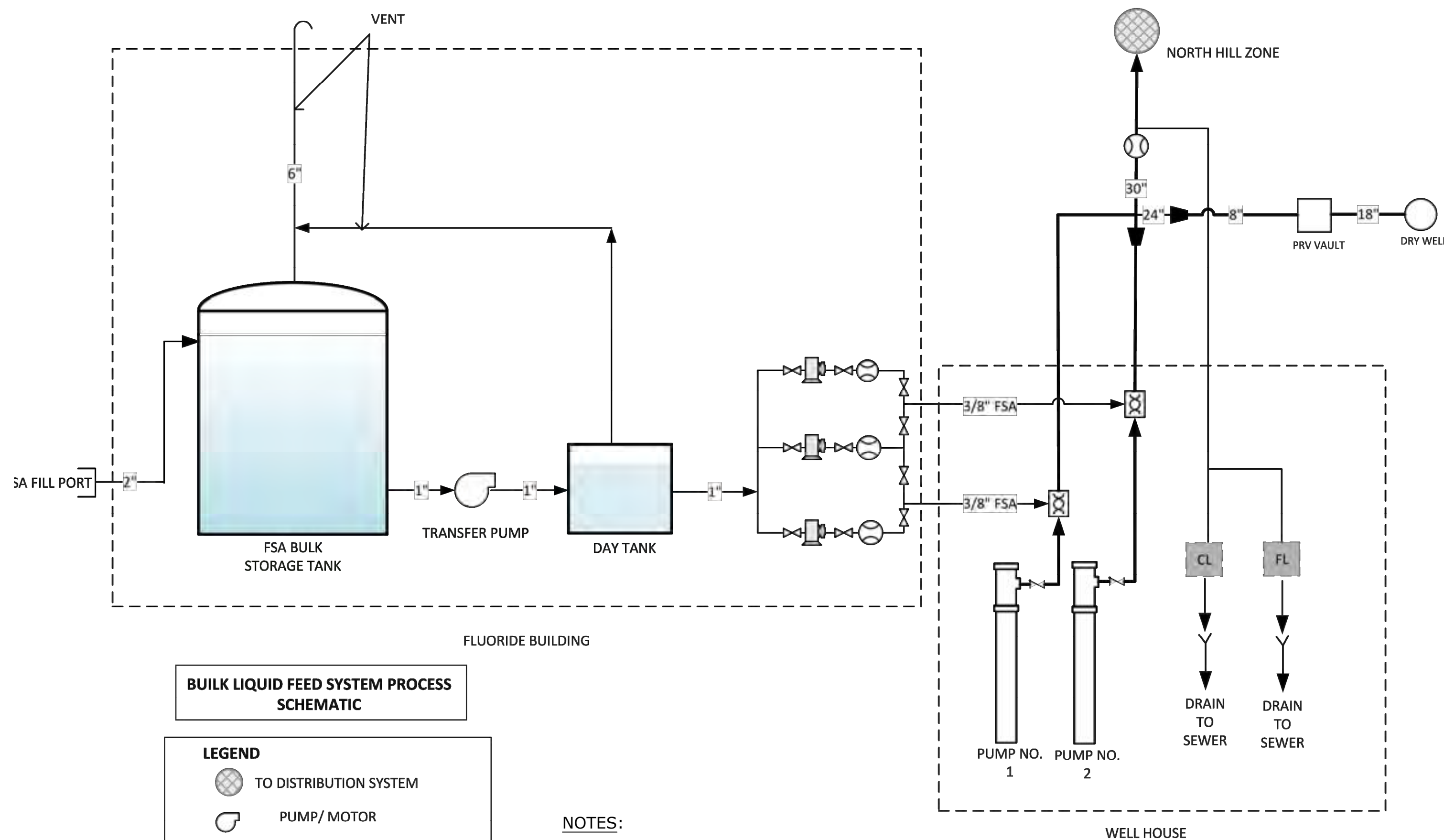
CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

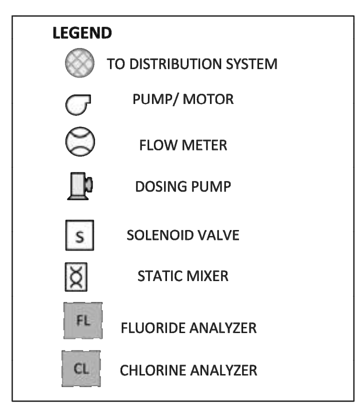
GRACE AND NEVADA WELL STATION ONE-LINE, PANEL SCHEDULE AND LOAD CALCULATIONS

PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: MAY 2023

SHEET E-502



BUILK LIQUID FEED SYSTEM PROCESS SCHEMATIC



NOTES:

1. PROCESS FLOW DIAGRAM SHOWS GENERAL CONFIGURATION AND MAJOR ELEMENTS. SOME FITTINGS, VALVES, AND OTHER APPURTENANCES ARE OMITTED FOR CLARITY.

2. THE FOLLOWING ANTI-SIPHON MEASURES WILL BE INCLUDED IN THE FINAL DESIGN:
   - -THE TRANSFER PUMP WILL BE MANUALLY OPERATED
   - -THE DAY TANK WILL INCLUDE SCADA ALARM IF LEVEL CHANGE IS HIGHER THAN EXPECTED
   - -BACKPRESSURE VALVE, ANTI-SIPHON VALVE, PRESSURE RELIEF, AND CHECK VALVE WILL BE INCLUDED
   - -CHEMICAL FEED PUMPS WILL ONLY OPERATE IF FLOW IS DETECTED IN THE MAIN PIPE

3. CONTROLS FOR FLUORIDE DOSING WILL INCLUDED FLOW PACING AND TRIM BASED ON FLUORIDE ANALYZER

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE

0 ½ 1

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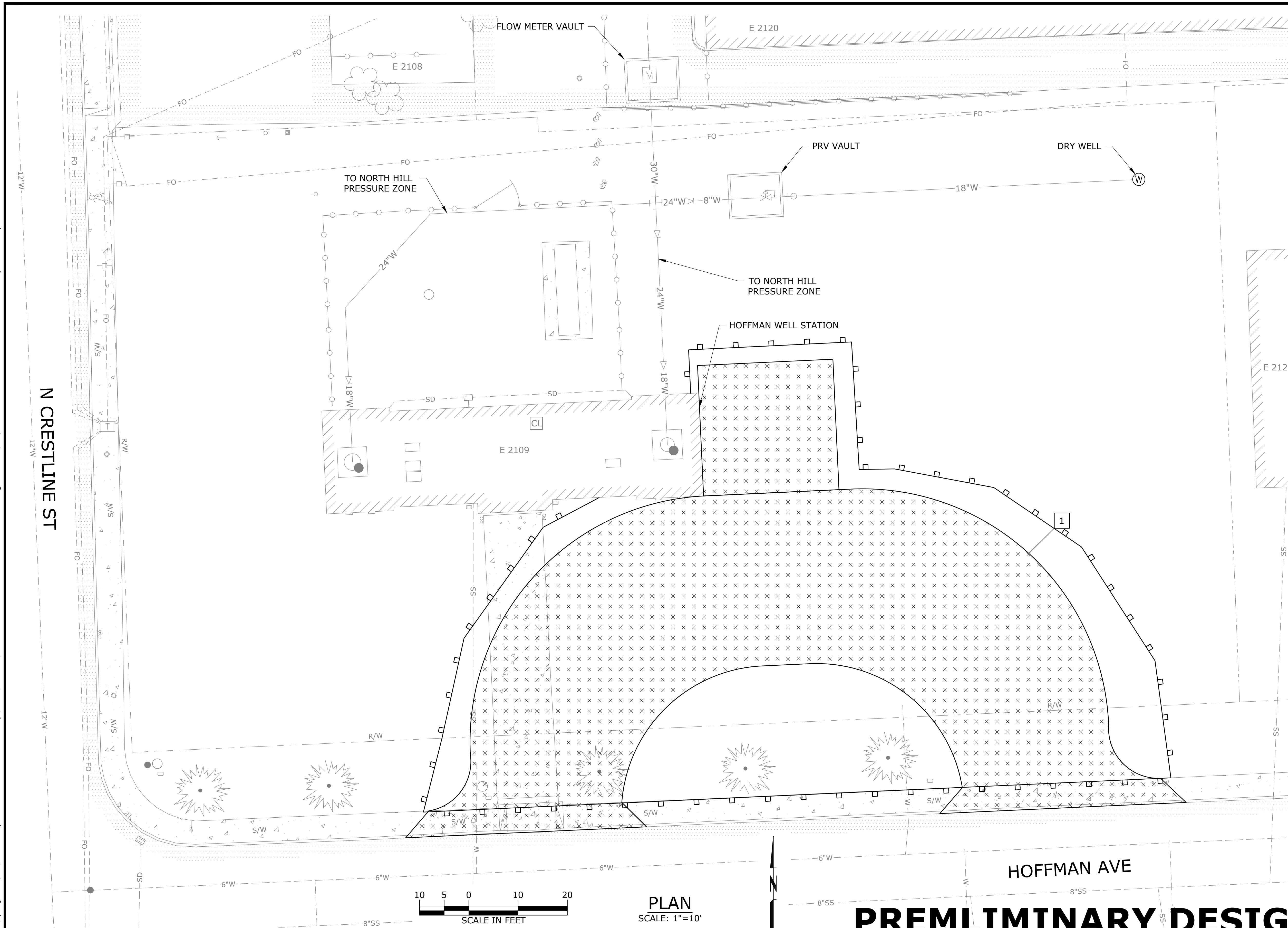
CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

HOFFMAN
WELL STATION PROCESS FLOW DIAGRAM

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023

SHEET
G-600



PLAN
SCALE: 1"=10'

KEY NOTES

1 CLEAR AND GRUB EXIST YARD

2 CONSTRUCTION FENCE

LEGEND

HIGH VISIBILITY SILT FENCE

VEGETATION REMOVAL

PREMLIMINARY DESIGN - DRAWINGS

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NOTICE
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DESIGNED
EJJ
DRAWN
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CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

HOFFMAN WELL STATION DEMOLITION

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023

SHEET
C-600
38 of 52

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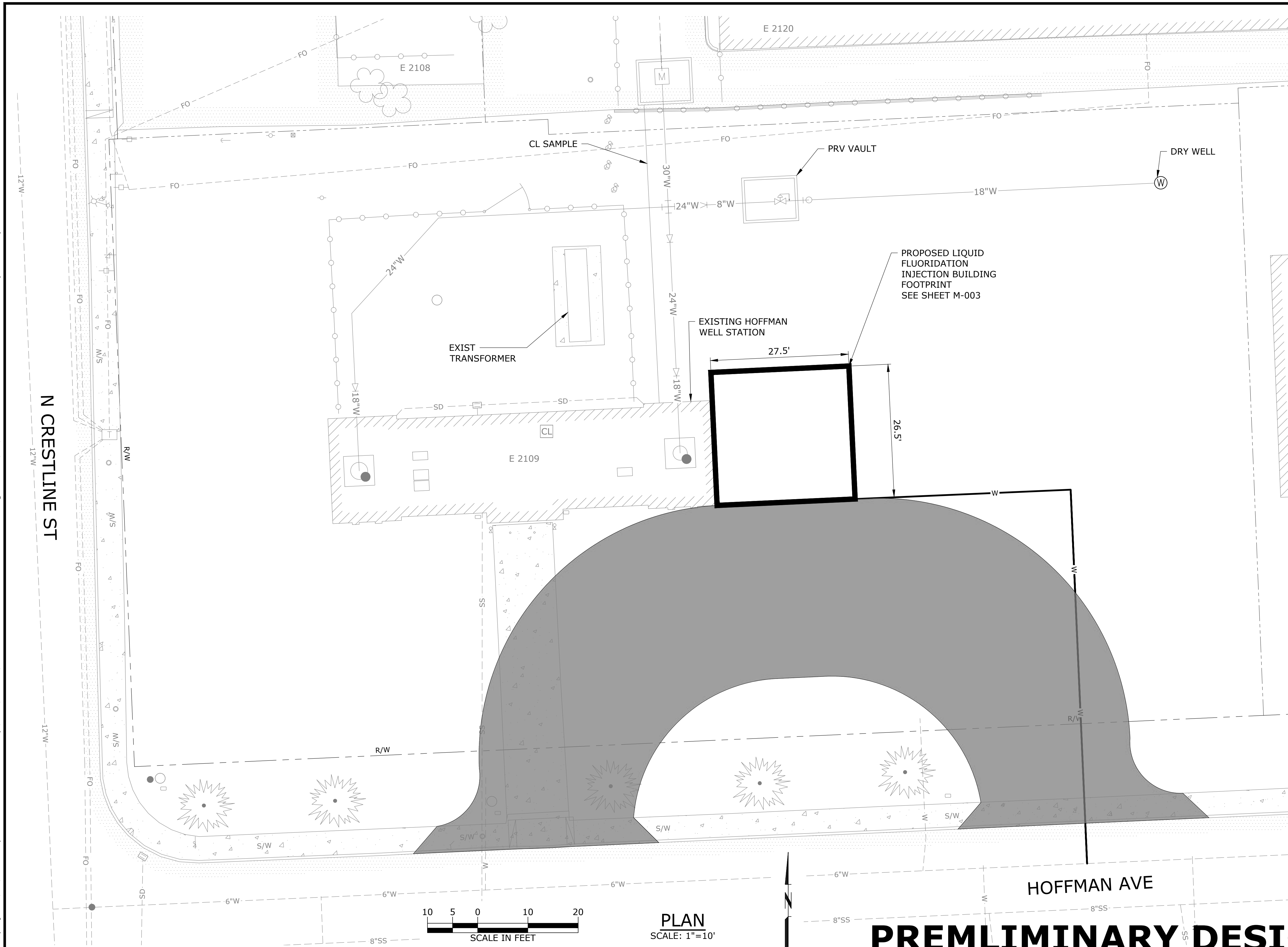
ARCHITECTURAL DATA
ZONING: RESIDENTIAL SINGLE-FAMILY USE
ARCHITECTURAL FEATURES: UNREINFORCED BRICK MASONRY
AREA: 729 SF
HEIGHT: APPROX 18.5 FT
LANDSCAPING: IN ACCORDANCE WITH CITY CODE, MATCH EXISTING



10 5 0 10 20
SCALE IN FEET

PLAN
SCALE: 1"=10'

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
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DESIGNED
EJJ
DRAWN
JHBF
CHECKED

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MAY 2023

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CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

HOFFMAN
WELL STATION SITE PLAN

PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: MAY 2023

SHEET
C-601
39 of 52

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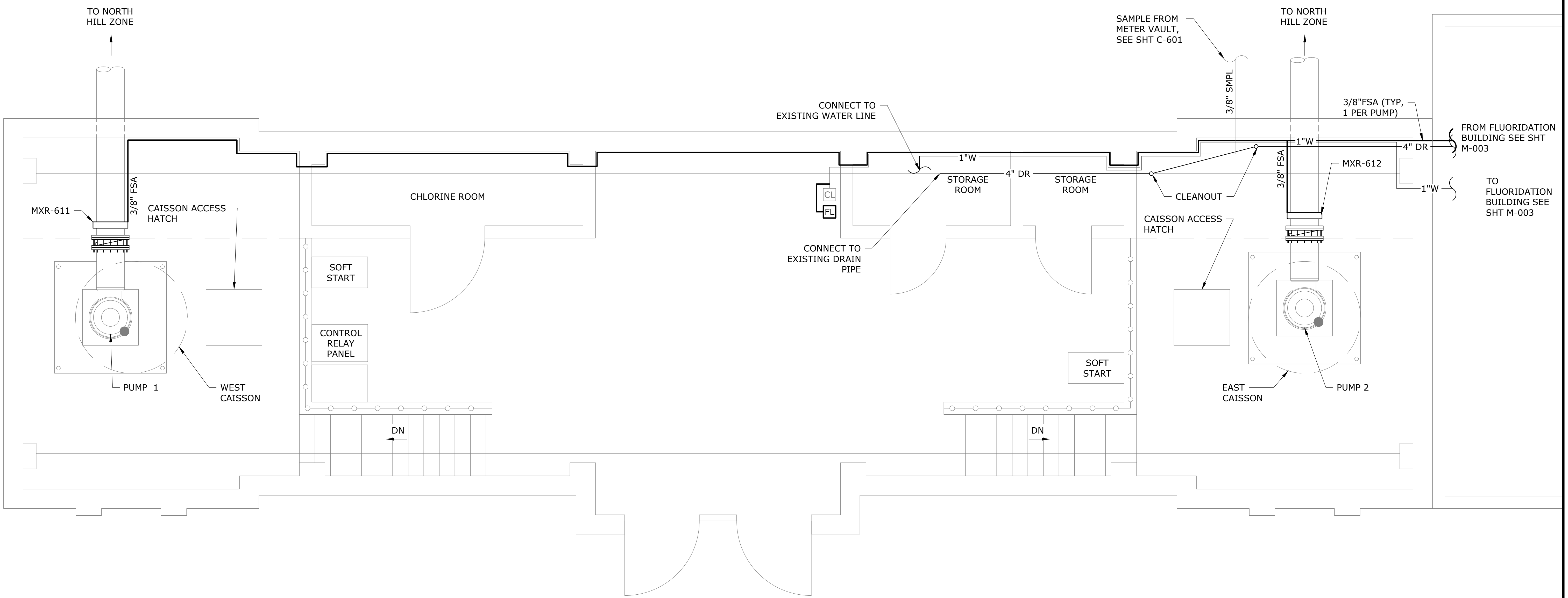
NOTES:

1. VERIFY LOCATION AND DISCHARGE POINT OF EXISTING DRAINS



PLAN

SCALE: 3/8"=1'-0"

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE

0 ½ 1

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NDH — DESIGNED
DKH — DRAWN
JHBF — CHECKED

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CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

HOFFMAN
WELL STATION PROCESS MECHANICAL

SHEET M-600

40 of 52

PROJECT NO.:	22-3386	SCALE:	AS SHOWN	DATE:	MAY 2023

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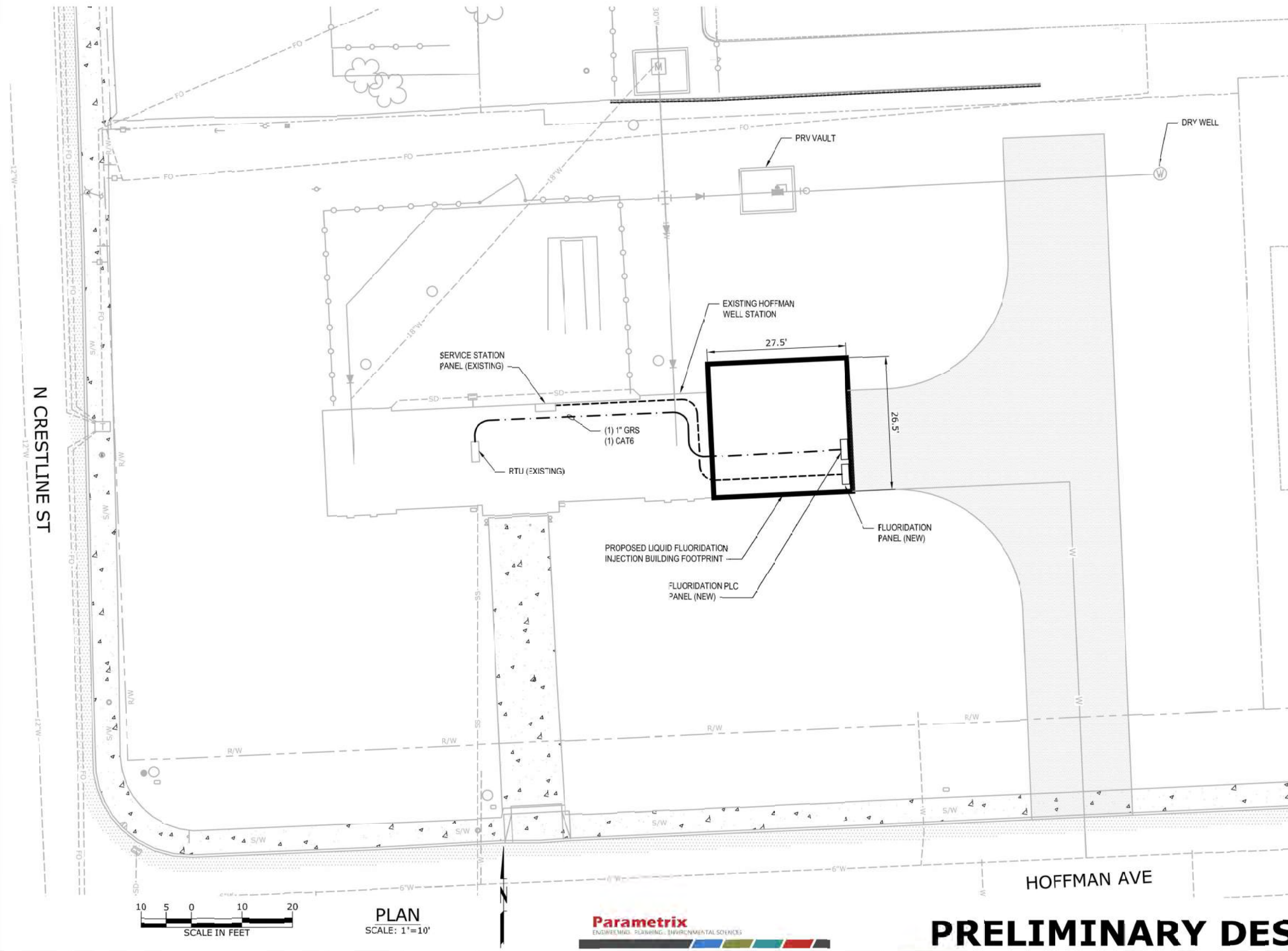

PLAN
SCALE: 1"=10'

LEGEND

- FLOW METER
- CHLORINE ANALYZER
- CHLORINE INJECTION POINT
- SAMPLE POINT FOR CHLORINE MONITOR ANALYSIS
- APPROX LOCATION OF WELL PUMP
- PROPOSED WATER SERVICE LINE
- PROPOSED ELECTRICAL SERVICE LINE
- PROPOSED ETHERNET DATA LINE

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PRELIMINARY DESIGN DRAWINGS

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NO.	DATE	BY	REVISION

NOTICE
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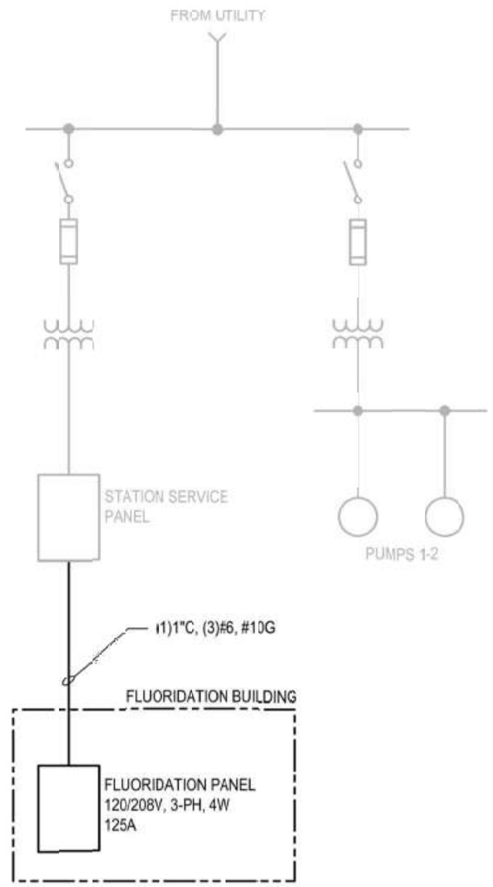
CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

HOFFMAN WELL STATION
ELECTRICAL SITE PLAN

PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: MAY 2023

SHEET
E-601
41 OF 52



PARTIAL ONE-LINE

STATION SERVICE PANEL PHOTO

NOTES

1. CONTRACTOR SHALL REPLACE THREE EXISTING 1-POLE SPARE BREAKERS WITH ONE 3-POLE, 40-AMP BREAKER FOR THE PANELBOARD FEEDER.

PANELBOARD SCHEDULE v5.0

NAME: HOFFMAN FLUORIDATION PANEL

VOLTAGE RATING: **208/120 VOLTS, 3 PHASE, 4 WIRE**
BUS RATING: **125** AMPS
MAIN BREAKER: **40** AMPS
FEED: **BOTTOM**
MOUNTING: **SURFACE**
SPECIAL FEATURES: **22 kAIC SCCR**

LOCATION **FLUORIDATION BUILDING**
FED FROM **STATION SERVICE PANEL**
NOTES **LIQUID FEED SYSTEM**

LOAD TYPE	CIRCUIT DESCRIPTON	VA	CKT	BRKR	L1 L2 L3	BRKR	CKT	VA	CIRCUIT DESCRIPTION	LOAD TYPE
M	FLUORIDE METERING PUMP 1	190	1	15 / 1	-A-		2	500		LM
M	FLUORIDE METERING PUMP 2	190	3	15 / 1	-B-	15 / 3	4	500	FLUORIDE TRANSFER PUMP	LM
X	PLC CABINET	960	5	15 / 1	-C-		6	500		LM
H		1,240	7		-A-	15 / 1	8	370	ROLL-UP DOOR	M
H	HVAC	1,240	9	15 / 3	-B-	15 / 1	10	180	CHEMICAL ROOM RECEPTACLE	R
H		1,240	11		-C-	15 / 1	12		SPARE	
L	LIGHTING	240	13	15 / 1	-A-	15 / 1	14		SPARE	
R	ELECTRICAL ROOM RECEPTACLE	180	15	15 / 1	-B-	15 / 1	16	120	FLUORIDE ANALYZER	X
			17	15 / 1	-C-	15 / 1	18		SPARE	
			19	/ 1	-A-	/ 1	20			
			21	/ 1	-B-	/ 1	22			
			23	/ 1	-C-	/ 1	24			
	LINE LOADS:	**2,540 VA(L1)**			**2,410 VA(L2)**			**2,700 VA(L3)**		
	TOTAL LOAD:	**7.65 KVA**			**21.2 AMPS**					

HOFFMAN FLUORIDATION PANEL LOAD CALCULATION:

		CONNECTED VA	METHOD	NEC DEMAND	CALC. VA
TOTAL LIGHTING (L) LOAD:	L	240	ALL @	125%	300
TOTAL RECEPTACLE (R) LOAD:	R	360	FIRST 10KVA @	125%	450
			REMAINDER OVER 10KVA	50%	0
TOTAL MOTOR (M) LOAD:	M	750	ALL @	100%	750
	LM	1500	125% OF LARGEST	125%	1875
TOTAL HVAC (H) LOAD:	H	3720	ALL @	125%	4650
TOTAL MISCELLANEOUS (X) LOAD	X	1080	ALL @	125%	1350
TOTAL VA:		7650 VA			9375 VA
AVERAGE AMPS @		21 AMPS			26 AMPS
VOLTAGE PHASE TO PHASE=	208				

PRELIMINARY DESIGN DRAWINGS

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NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
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MCC DESIGNED
JEV DRAWN
CHK CHECKED

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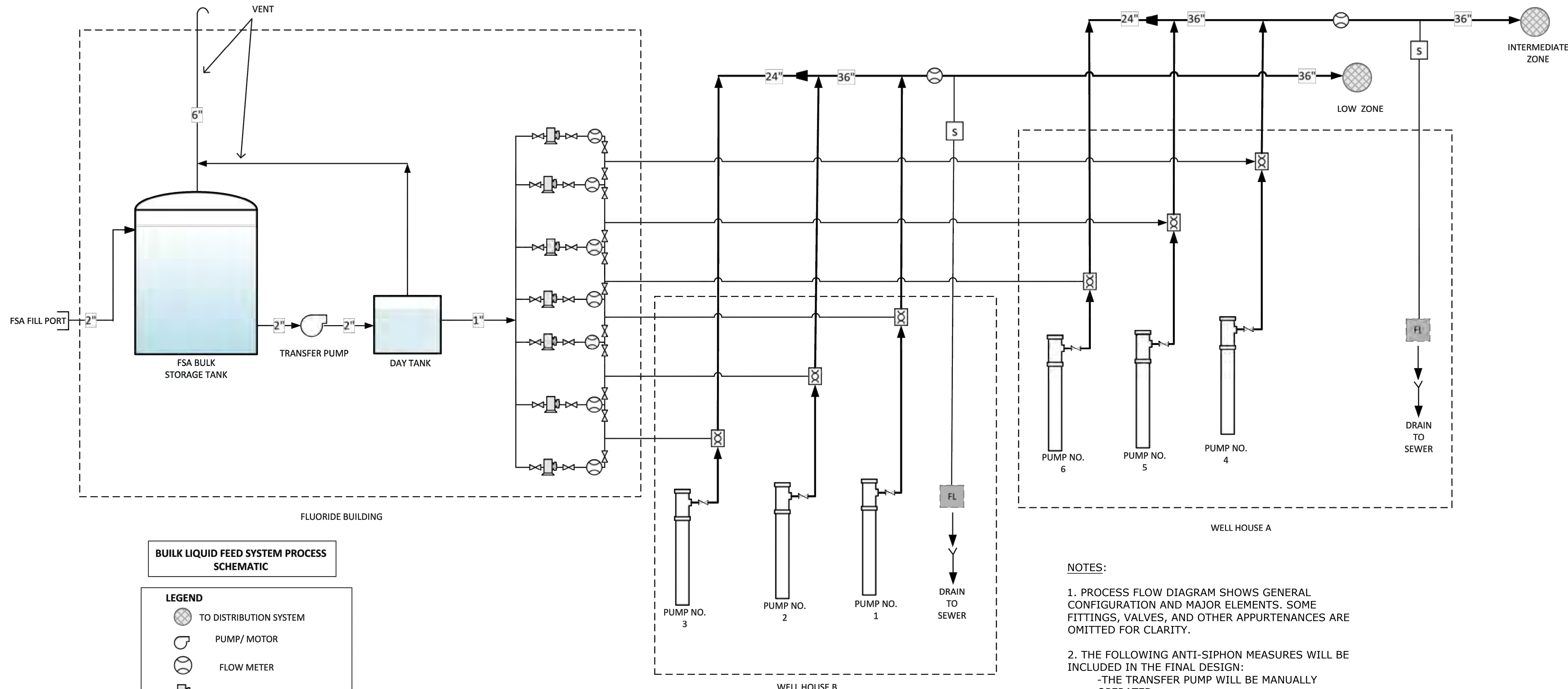
CITY OF SPOKANE

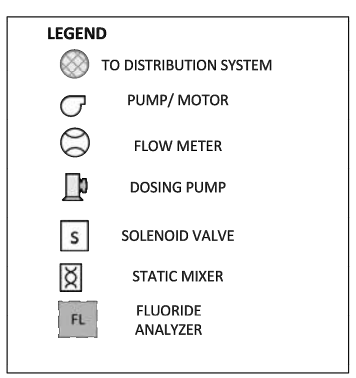
PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

HOFFMAN WELL STATION ONE-LINE, PANEL SCHEDULE AND LOAD CALCULATIONS

PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: MAY 2023

SHEET E-602





NOTES:

1. PROCESS FLOW DIAGRAM SHOWS GENERAL CONFIGURATION AND MAJOR ELEMENTS. SOME FITTINGS, VALVES, AND OTHER APPURTENANCES ARE OMITTED FOR CLARITY.

2. THE FOLLOWING ANTI-SIPHON MEASURES WILL BE INCLUDED IN THE FINAL DESIGN:
   - -THE TRANSFER PUMP WILL BE MANUALLY OPERATED
   - -THE DAY TANK WILL INCLUDE SCADA ALARM IF LEVEL CHANGE IS HIGHER THAN EXPECTED
   - -BACKPRESSURE VALVE, ANTI-SIPHON VALVE, PRESSURE RELIEF, AND CHECK VALVE WILL BE INCLUDED
   - -CHEMICAL FEED PUMPS WILL ONLY OPERATE IF FLOW IS DETECTED IN THE MAIN PIPE

3. CONTROLS FOR FLUORIDE DOSING WILL INCLUDED FLOW PACING AND TRIM BASED ON FLUORIDE ANALYZER

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

NDH DESIGNED
EJJ DRAWN
JHBF CHECKED

PRELIMINARY ONLY
MAY 2023

consor

CITY OF SPOKANE

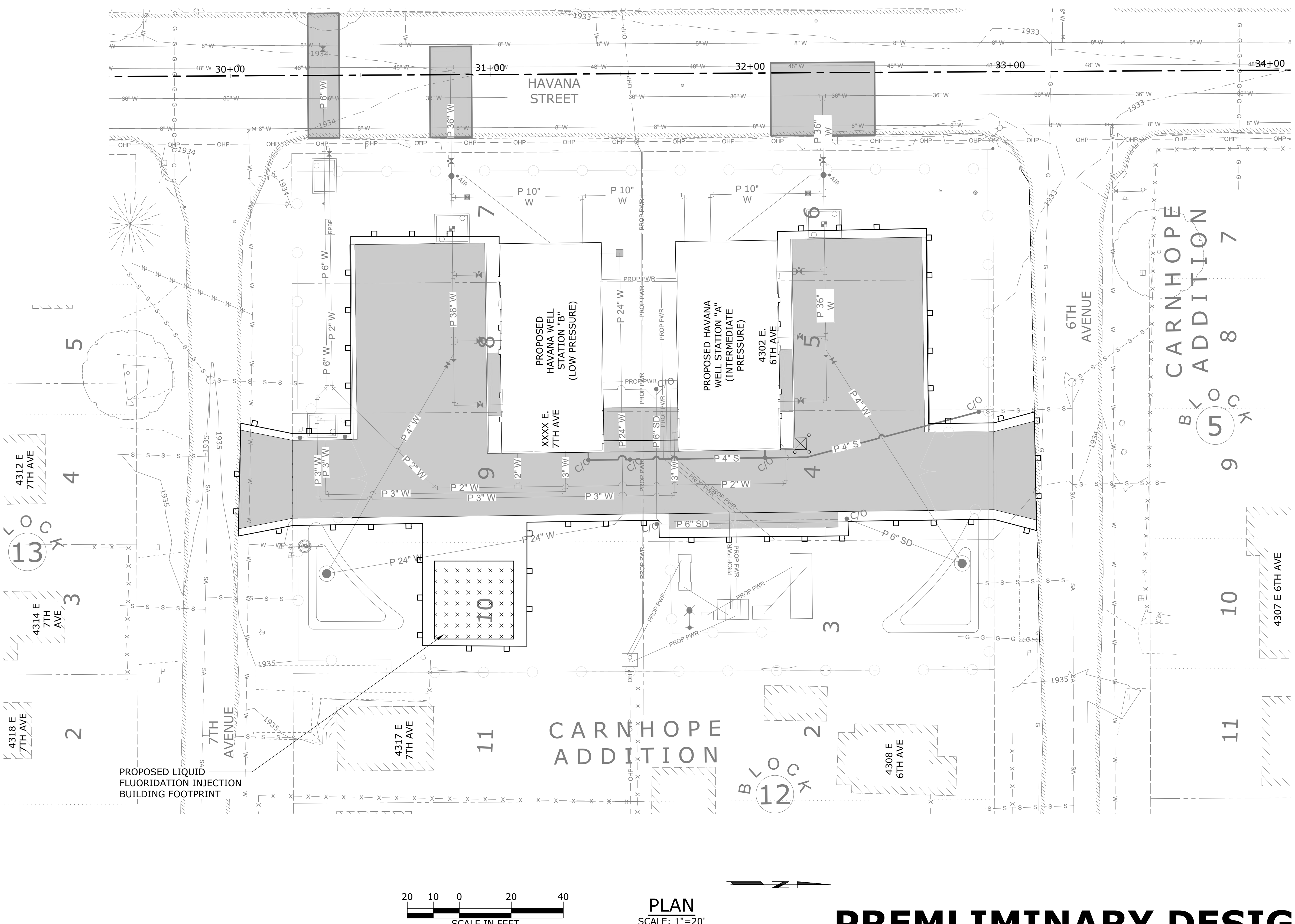
PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

HAVANA
WELL STATION PROCESS FLOW DIAGRAM

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023

SHEET G-700
43 of 52

\\ad.msa-ep.com\boise\boi_projects\22\3386 - Spokane Fluoridation Study\CAD\Sheets\22-3386-WA-G.dwg G-700 5/17/2023 9:37 AM JUSTIN.DEUEL 23.0s (LMS Tech)



KEY NOTES

1. CLEAR AND GRUB EXIST YARD
2. CONSTRUCTION FENCE

LEGEND

HIGH VISIBILITY SILT FENCE

VEGETATION REMOVAL

PLAN

SCALE: 1"=20'

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
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NDH — DESIGNED
EJJ — DRAWN
JHBF — CHECKED

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consor

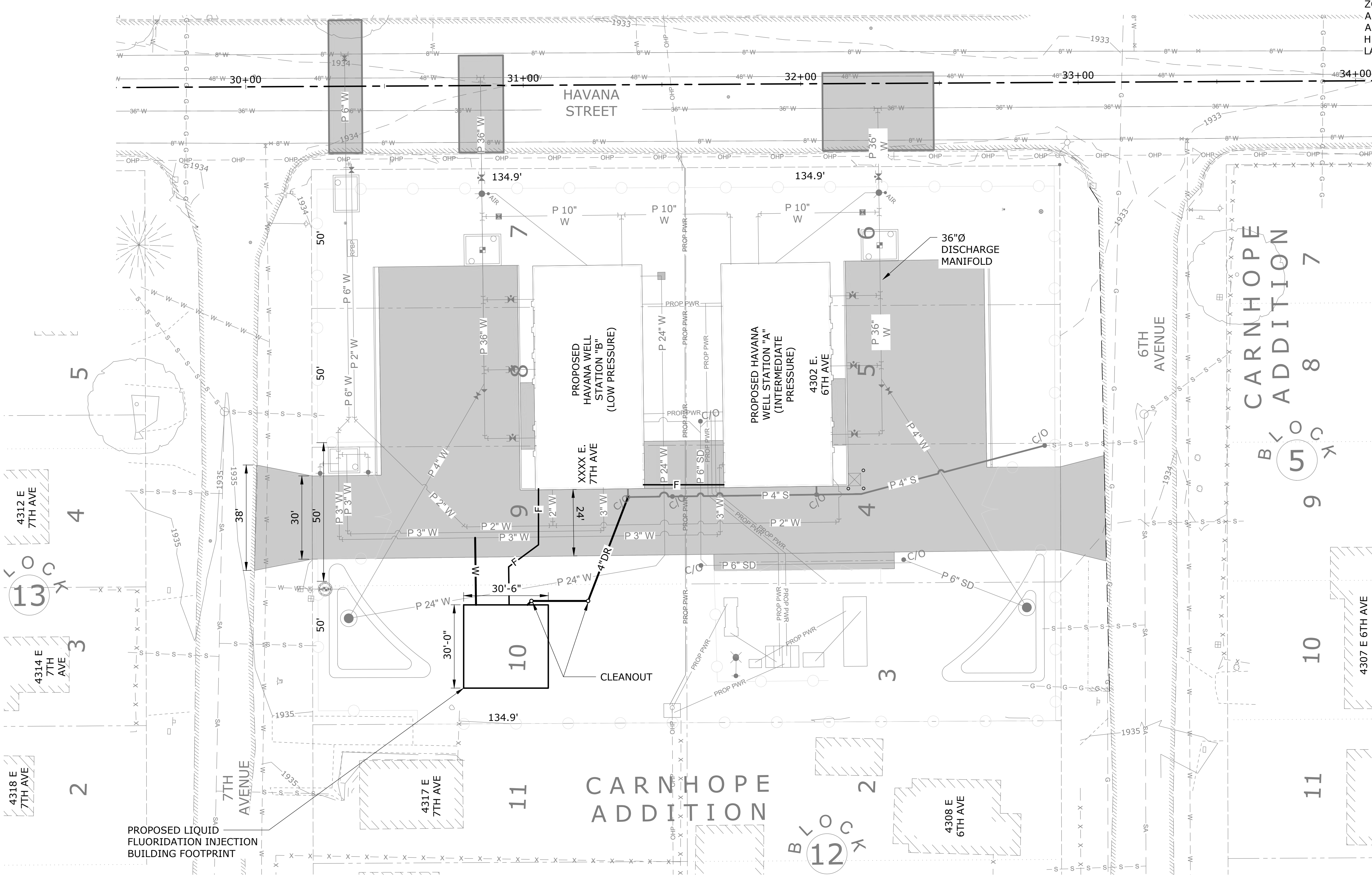
CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

HAVANA WELL STATION DEMOLITION

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023

SHEET C-700



ARCHITECTURAL DATA
ZONING: NO DESIGNATION
ARCHITECTURAL FEATURES: CONCRETE MASONRY UNIT
AREA: 915 SF
HEIGHT: APPROX 22.5 FT
LANDSCAPING: IN ACCORDANCE WITH CITY CODE, MATCH EXISTING

NOTES:

1. PVC PIPES MAY REQUIRE PROTECTIVE PIPE CASING IN TRAFFIC AREAS

20 10 0 20 40
SCALE IN FEET

PLAN
SCALE: 1"=20'

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
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NDH DESIGNED
EJJ DRAWN
JHBF CHECKED

PRELIMINARY ONLY
MAY 2023

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CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

HAVANA
WELL STATION SITE PLAN

PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: MAY 2023

SHEET C-701

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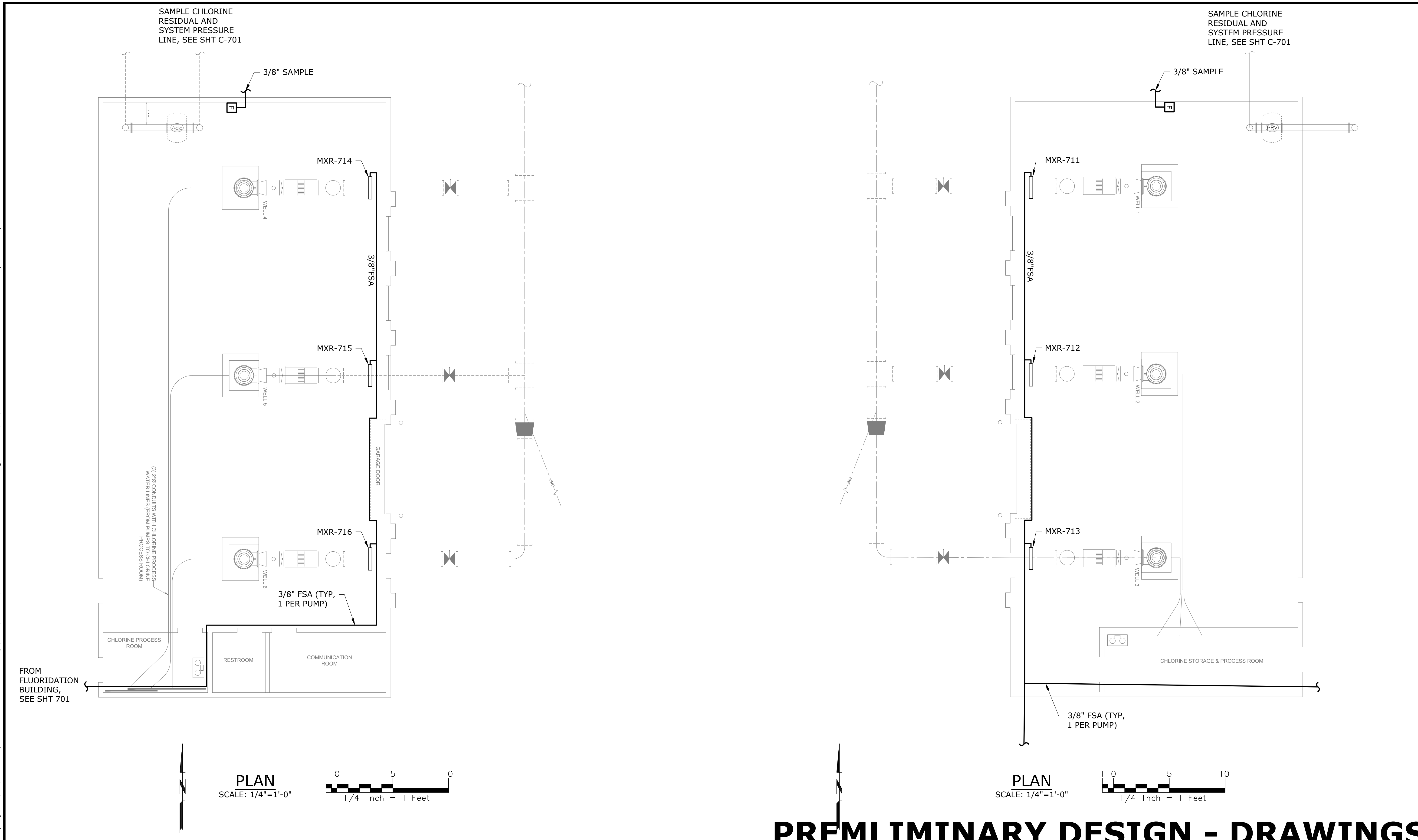

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PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
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PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

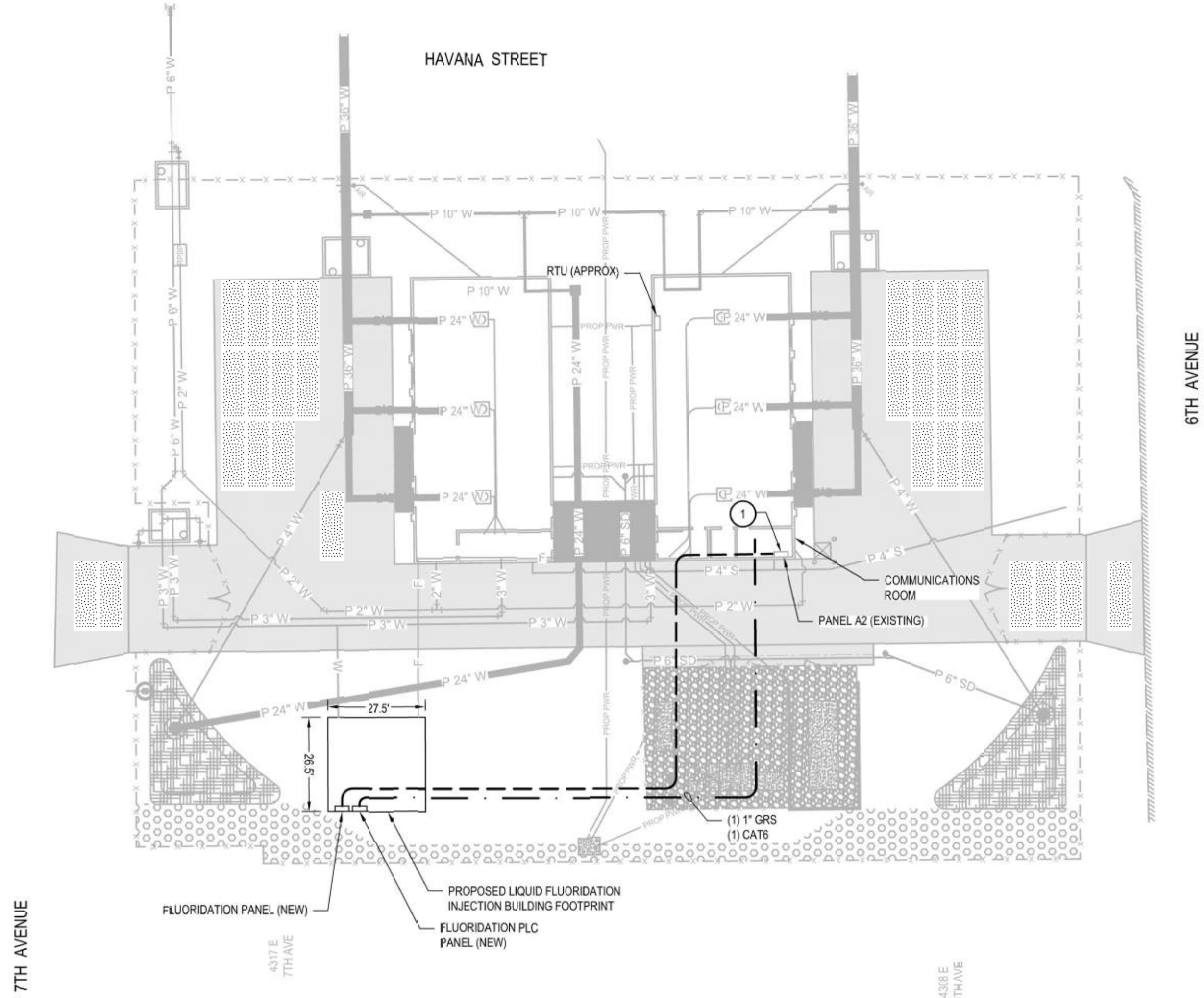
HAVANA
WELL STATION PROCESS MECHANICAL

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023

SHEET M-700
46 of 52

NOTES

(1) CONTRACTOR SHALL VERIFY COMMUNICATION ROOM HAS NETWORKING EQUIPMENT THAT ALLOWS FOR THE CONNECTION OF A CAT6 CABLE TO THE WATER SYSTEM SCADA NETWORK. IF EQUIPMENT IS PRESENT, CONNECT FLUORIDATION PLC CONTROL PANEL HERE. OTHERWISE, CONNECT TO RTU.



LEGEND

- EDGE OF EXISTING ASPHALT
- ASSUMED RIGHT-OF-WAY LINE
- EXISTING STORM LINE
- EXISTING WATER LINE
- EXISTING SEWER LINE
- EXISTING SIDE SEWER SERVICE
- EXISTING GAS LINE
- UNIMPROVED ROADWAY
- EXISTING POWER LINE
- EXISTING BUILDING
- PROPOSED CONCRETE
- PROPOSED ASPHALT
- DRAINAGE FLOW DIRECTION
- SAWCUT LINE
- FENCE (EX / PROP)
- PROPOSED LANDSCAPE AREA
- PROPOSED SWALE AREA
- PROPOSED 4" DEEP CSTC
- PROPOSED BUILDING
- CHEMICAL SOLUTION LINE
- PROPOSED WATER SERVICE LINE
- PROPOSED ELECTRICAL SERVICE LINE
- PROPOSED ETHERNET DATA LINE

NOTE: RIGHT-OF-WAY SHOWN ON SHEETS IS ASSUMED.

20 10 0 20 40
SCALE IN FEET

PLAN
SCALE: 1"=20'

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PRELIMINARY DESIGN DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
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JEV DRAWN
CHK CHECKED

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CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

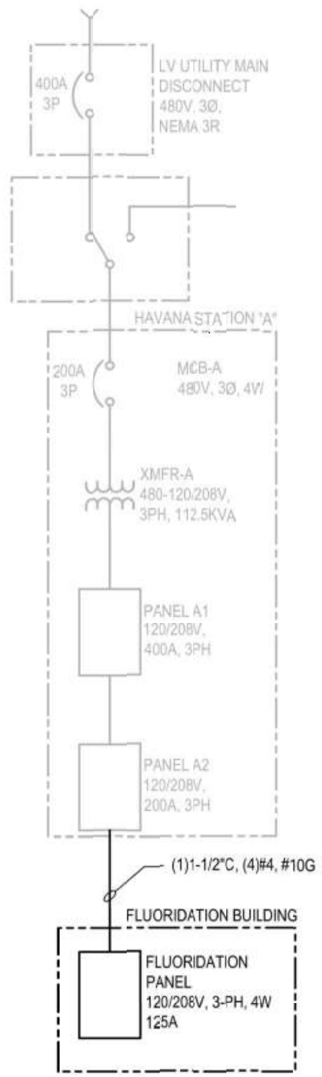
HAVANA WELL STATION
ELECTRICAL SITE PLAN

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023

SHEET E-701

NOTES

1. CONTRACTOR SHALL REPLACE 30-AMP, 3-POLE SPARE BREAKER WITH A 40-AMP, 3-POLE BREAKER FOR THE FLUORIDATION PANELBOARD FEEDER.



PARTIAL ONE-LINE

PANELBOARD SCHEDULE

v 6.0

NAME: HAVANA PANEL A2

VOLTAGE RATING: 208/120 VOLTS, 3 PHASE, 4 WIRE
BUS RATING: 200 AMPS
MAIN BREAKER: 200 AMPS
FEED: BOTTON
MOUNTING: SURFACE
SPECIAL FEATURES: 10 kAIC SCCR

LOCATION: COMMUNICATIONS ROOM
FED FROM: PANEL A1
NOTES: NEMA 1 ENCLOSURE

LOAD TYPE	CIRCUIT DESCRIPTION	VA	CKT	BRKR	L1 L2 L3	BRKR	CKT	VA	CIRCUIT DESCRIPTION	LOAD TYPE
L	EQUIPMENT PLATFORM LIGHTING	90	1	20 / 1	-A-	20 / 1	2	360	EQUIPMENT PLATFORM RECEPTACLES	R
L	COMMUNICATION ROOM LIGHTING	90	3	20 / 1	-B-	20 / 1	4	360	COMMUNICATON ROOM RECEPTACLES	R
M	COMMUNICATION ROOM FAN F-1	500	5	20 / 1	-C-	20 / 1	6	360	COMMUNICATION ROOM RECEPTACLES	R
H	ELECTRIC WALL HEATER EWH-1	1,500	7	20 / 1	-A-		8	10,000		X
H	ELECTRIC WALL HEATER EWH-2	1,500	9	20 / 1	-B-	100 / 3	10	10,000	WATER HEATER WH-1	X
X	FIRE ALARM CONTROL PANEL	1,440	11	15 / 1	-C-		12	10,000		X
X	CHLORINE SYSTEM CONTROL POWER	1440	13	20 / 1	-A-	20 / 1	14	500	P-TRAP PRIMERS	X
	SPARE		15	20 / 1	-B-	20 / 1	16	500	IRRIGATION CONTROLLER	X
	SPARE		17	20 / 1	-C-	20 / 1	18	540	RESTROOM/CHLORINE ROOM RECEPTACLES	R
H		3,333	19		-A-	20 / 1	20		SPARE	
H	ELECTRIC UNIT HEATER EUH-2	3,333	21	40 / 3	-B-	20 / 1	22		SPARE	
H		3,333	23		-C-	20 / 1	24		SPARE	
H		3,333	25		-A-		26			
H	ELECTRIC UNIT HEATER EUH-3	3,333	27	40 / 3	-B-	30 / 1	28		SPARE	
H		3,333	29		-C-		30			
M		865	31		-A-		32			
M	CHLORINE ROOM HVAC CP (EF-2A, 2B)	865	33	30 / 3	-B-	60 / 1	34		SPARE	
M		865	35		-C-		36			
			37		-A-		38	50		X
	SPARE		39	20 / 3	-B-	30 / 1	40	50	SPD	X
			41		-C-		42	50		X
	LINE LOADS:	21,471 VA(L1)			20,031 VA(L2)			20,421 VA(L3)		
	TOTAL LOAD:	61.92 KVA			171.9 AMPS					

HAVANA PANEL A2 LOAD CALCULATION:

		CONNECTED VA	METHOD	NEC DEMAND	CALC. VA
TOTAL LIGHTING (L) LOAD:	L	180	ALL @	125%	225
TOTAL RECEPTACLE (R) LOAD:	R	1620	FIRST 10KVA @	125%	2025
			REMAINDER OVER 10KVA	50%	0
TOTAL MOTOR (M) LOAD:	M	3095	ALL @	100%	3095
	LM	0	125% OF LARGEST	125%	0
TOTAL HVAC (H) LOAD	H	22998	ALL @	125%	28748
TOTAL MISCELLANEOUS (X) LOAD:	X	34030	ALL @	125%	42538
TOTAL VA:		61923 VA			76630 VA
AVERAGE AMPS @		172 AMPS			213 AMPS
VOLTAGE PHASE TO PHASE=	208				

PANELBOARD SCHEDULE

v 6.0

NAME: HAVANA FLUORIDATION PANEL

VOLTAGE RATING: 208/120 VOLTS, 3 PHASE, 4 WIRE
BUS RATING: 125 AMPS
MAIN BREAKER: 40 AMPS
FEED: BOTTOM
MOUNTING: SURFACE
SPECIAL FEATURES: 22 kAIC SCCR

LOCATION: FLUORIDATION BUILDING
FED FROM: PANEL A2
NOTES: LIQUID FEED SYSTEM

LOAD TYPE	CIRCUIT DESCRIPTION	VA	CKT	BRKR	L1 L2 L3	BRKR	CKT	VA	CIRCUIT DESCRIPTION	LOAD TYPE
M	FLUORIDE METERING PUMP 1	190	1	15 / 1	-A-		2	500		LM
M	FLUORIDE METERING PUMP 2	190	3	15 / 1	-B-	15 / 3	4	500	FLUORIDE TRANSFER PUMP	LM
X	PLC CABINET	960	5	15 / 1	-C-		6	500		LM
H		1,240	7		-A-	15 / 1	8	370	ROLL-UP DOOR	M
H	HVAC	1,240	9	15 / 3	-B-	15 / 1	10	180	CHEMICAL ROOM RECEPTACLE	R
H		1,240	11		-C-	15 / 1	12		SPARE	
L	LIGHTING	240	13	15 / 1	-A-	15 / 1	14		SPARE	
R	ELECTRICAL ROOM RECEPTACLE	180	15	15 / 1	-B-	15 / 1	16	120	FLUORIDE ANALYZER	X
M	FLUORIDE METERING PUMP 3	190	17	15 / 1	-C-	15 / 1	18		SPARE	
			19	/ 1	-A-	/ 1	20			
			21	/ 1	-B-	/ 1	22			
			23	/ 1	-C-	/ 1	24			
	LINE LOADS:	2,540 VA(L1)			2,410 VA(L2)			2,890 VA(L3)		
	TOTAL LOAD:	7.84 KVA			21.8 AMPS					

HAVANA FLUORIDATION PANEL LOAD CALCULATION:

		CONNECTED VA	METHOD	NEC DEMAND	CALC. VA
TOTAL LIGHTING (L) LOAD:	L	240	ALL @	125%	300
TOTAL RECEPTACLE (R) LOAD:	R	360	FIRST 10KVA @	125%	[illegible]
			REMAINDER OVER 10KVA	50%	0
TOTAL MOTOR (M) LOAD:	M	940	ALL @	100%	940
	LM	1500	125% OF LARGEST	125%	1875
TOTAL HVAC (H) LOAD:	H	3720	ALL @	125%	4650
TOTAL MISCELLANEOUS (X) LOAD:	X	1080	ALL @	125%	1350
TOTAL VA:		7840 VA			9565 VA
AVERAGE AMPS @		22 AMPS			27 AMPS
VOLTAGE PHASE TO PHASE=	208				

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PRELIMINARY DESIGN DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
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JEV DRAWN
CHK CHECKED

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CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

HAVANA WELL STATION ONE-LINE, PANEL SCHEDULE AND LOAD CALCULATIONS

SHEET E-702

48 OF 52

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023

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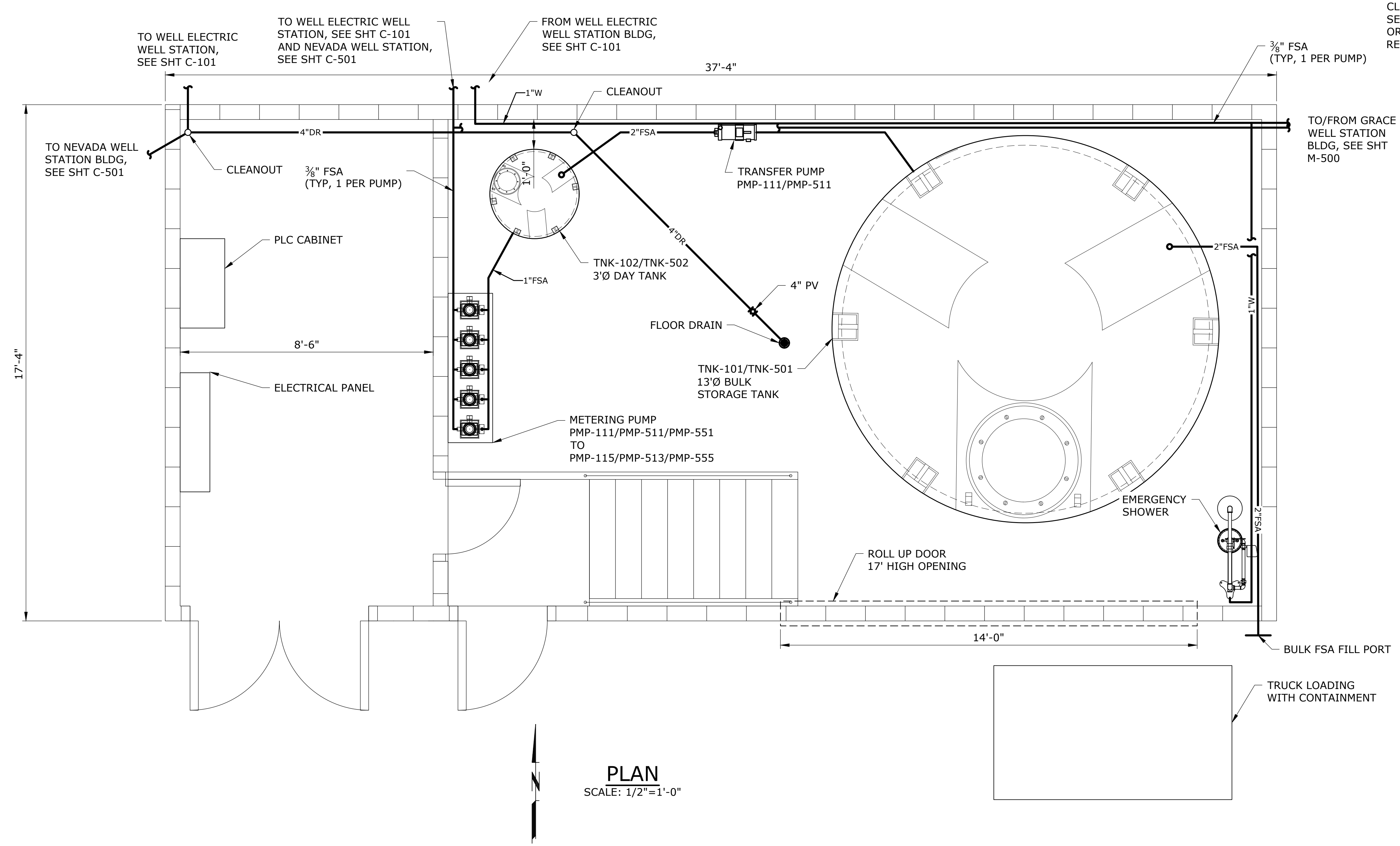
NOTES:

1. HVAC AND TANK VENTS NOT SHOWN FOR CLARITY

2. CHEMICAL STORAGE FLOOR IS 5-FT BELOW GRADE TO PROVIDE 11,000 GALLONS OF SECONDARY CONTAINMENT STORAGE

3. PLUG VALVE ON DRAIN LINE TO BE NORMALLY CLOSED TO PREVENT UNPLANNED DISCHARGE TO SEWER. IN THE EVENT OF AN FSA SPILL, TREATMENT OR NEUTRALIZATION OF SPILLED FSA MAY BE REQUIRED BEFORE DISCHARGE TO SEWER



PLAN

SCALE: 1/2"=1'-0"

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE

0 ½ 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

EKW DESIGNED

EJJ DRAWN

KLW CHECKED

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MAY 2023

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CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

WELL ELECTRIC/GRACE AND NEVADA LIQUID FEED SYSTEM MECHANICAL LAYOUT

PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: MAY 2023

SHEET M-001

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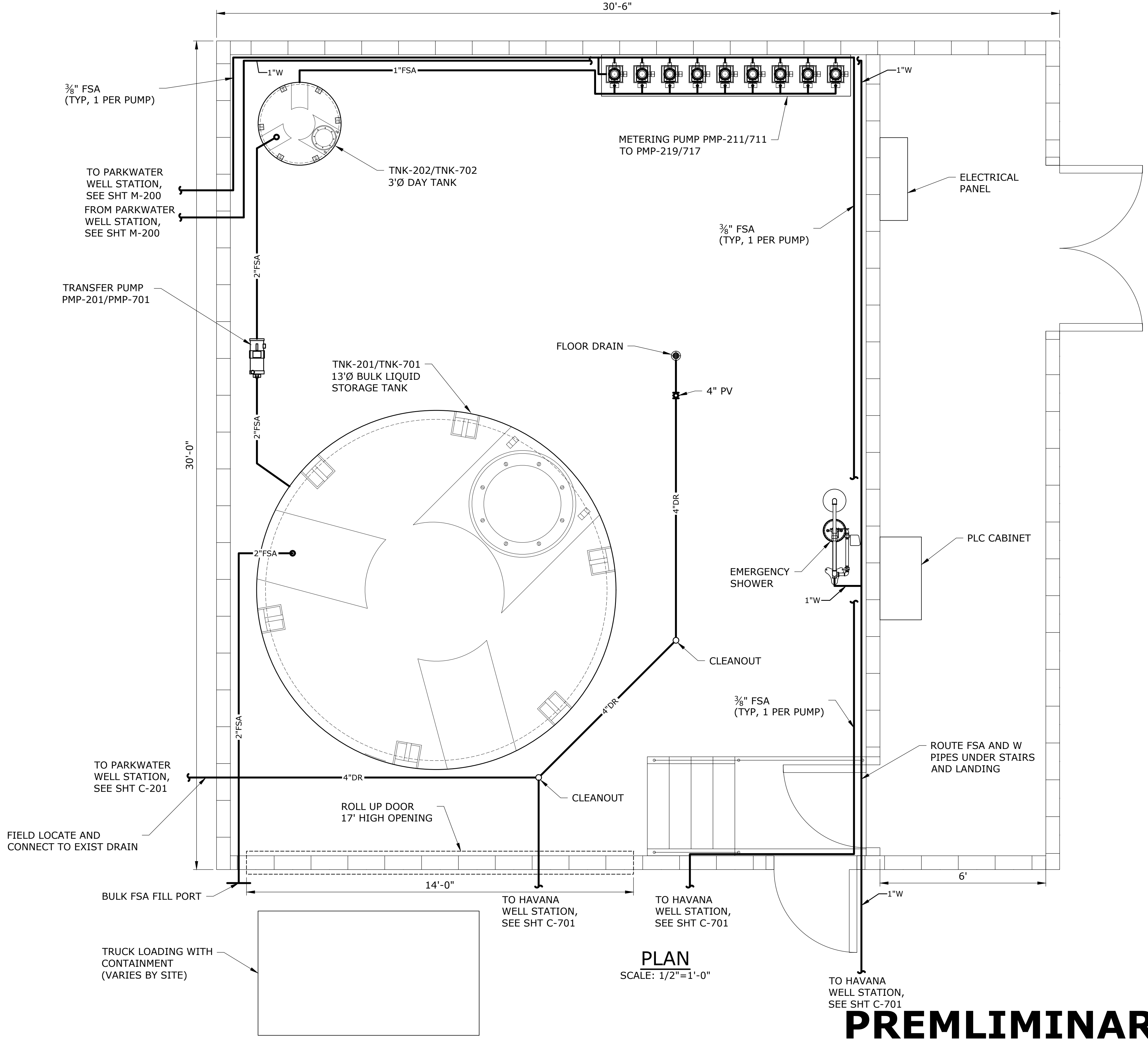

PLAN
SCALE: 1/2"=1'-0"

NOTES:

1. HVAC AND TANK VENTS NOT SHOWN FOR CLARITY.

2. CHEMICAL STORAGE FLOOR IS 2.8-FT BELOW GRADE TO PROVIDE 11,000 GALLONS OF SECONDARY CONTAINMENT STORAGE

3. PLUG VALVE ON DRAIN LINE TO BE NORMALLY CLOSED TO PREVENT UNPLANNED DISCHARGE TO SEWER. IN THE EVENT OF AN FSA SPILL, TREATMENT OR NEUTRALIZATION OF SPILLED FSA MAY BE REQUIRED TO DISCHARGE TO SEWER

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
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EKW DESIGNED
EJJ DRAWN
KLW CHECKED

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CITY OF SPOKANE

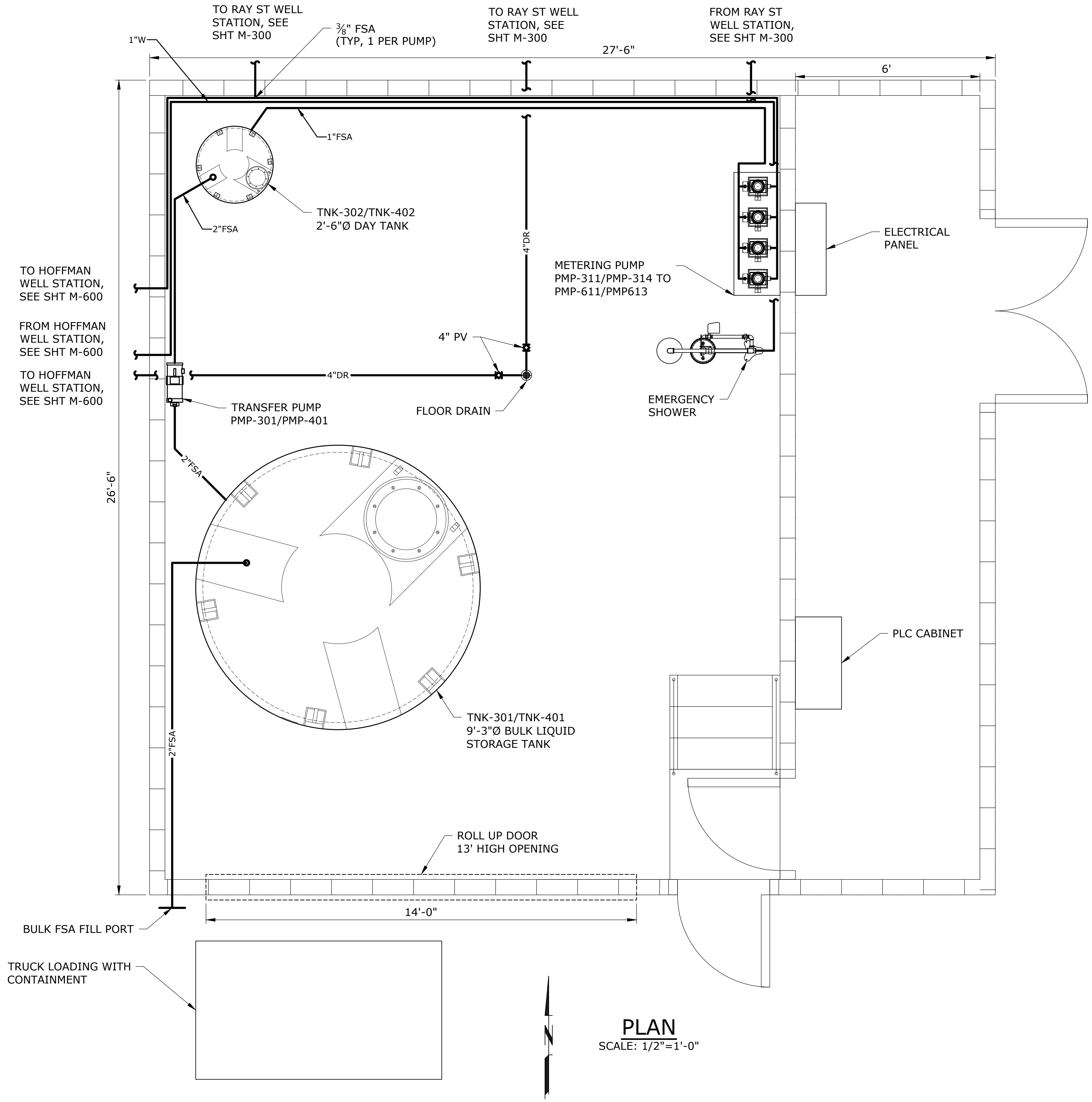
PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

PARKWATER/HAVANA LIQUID FEED SYSTEM MECHANICAL LAYOUT

PROJECT NO.: 22-3386 SCALE: AS SHOWN DATE: MAY 2023

SHEET M-002

50 of 52



PLAN

SCALE: 1/2"=1'-0"

NOTES:

1. HVAC AND TANK VENTS NOT SHOWN FOR CLARITY.
2. CHEMICAL STORAGE FLOOR IS 1.7-FT BELOW GRADE TO PROVIDE 5,500 GALLONS OF SECONDARY CONTAINMENT STORAGE.
3. PLUG VALVE ON DRAIN LINE TO BE NORMALLY CLOSED TO PREVENT UNPLANNED DISCHARGE TO SEWER. IN THE EVENT OF AN FSA SPILL, TEREATMENT OR NEUTRALIZATION OF SPILLED FSA MAY BE REQUIRED BEFORE DISCHARGE TO SEWER.

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE
0 ½ 1
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EKW DESIGNED
EJJ DRAWN
KLW CHECKED

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MAY 2023
38779
PROFESSIONAL ENGINEER

consor

CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

RAY STREET/HOFFMAN
LIQUID FEED SYSTEM
MECHANICAL LAYOUT

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023

SHEET
M-003

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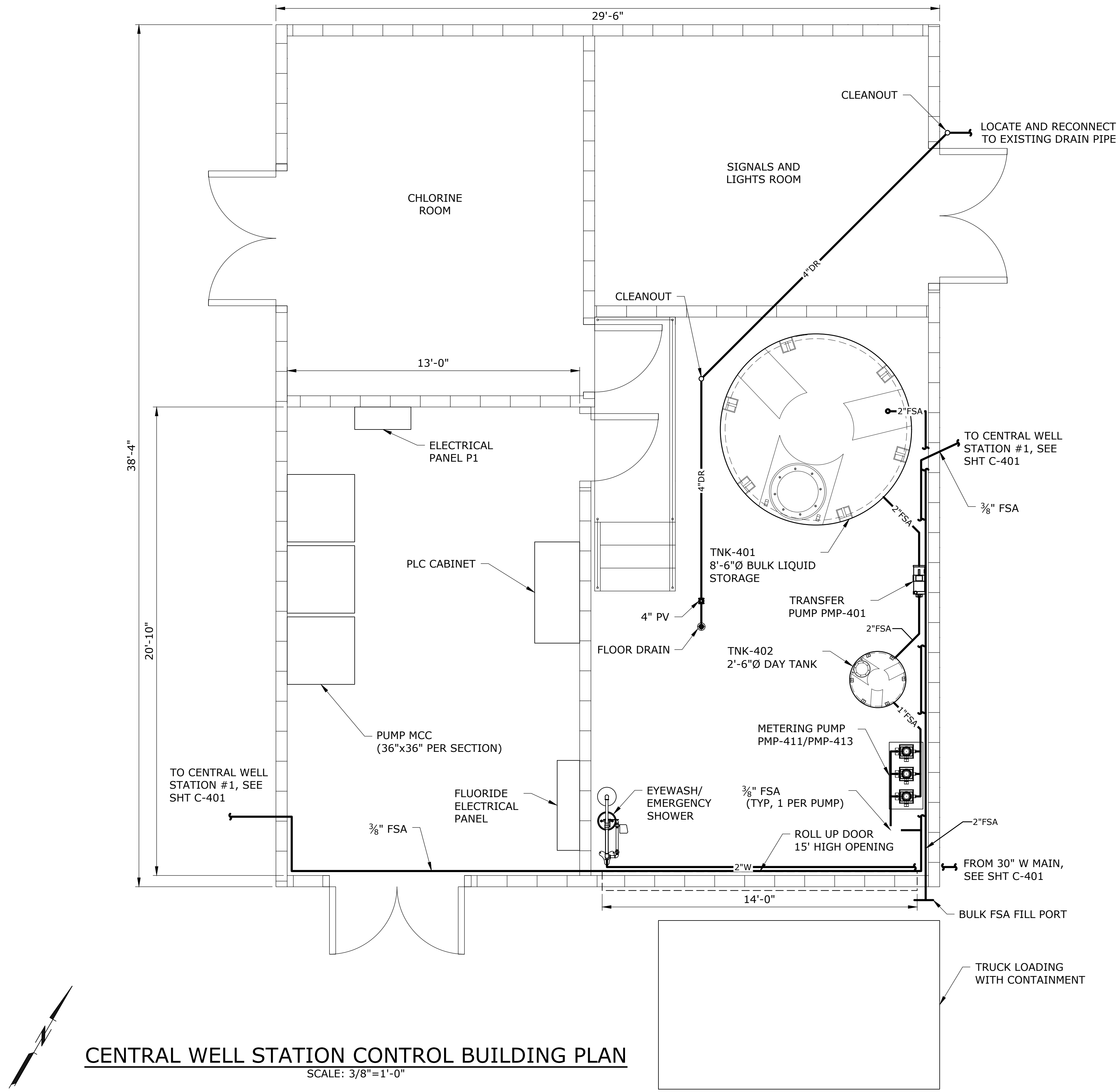

CENTRAL WELL STATION CONTROL BUILDING PLAN

SCALE: 3/8"=1'-0"

NOTES:

1. HVAC AND TANK VENTS NOT SHOWN FOR CLARITY.

2. CHEMICAL STORAGE FLOOR IS 2.0-FT BELOW GRADE TO PROVIDE 4,675 GALLONS OF SECONDARY CONTAINMENT STORAGE.

3. PLUG VALVE ON DRAIN LINE TO BE NORMALLY CLOSED TO PREVENT UNPLANNED DISCHARGE TO SEWER. IN THE EVENT OF AN FSA SPILL, TEREATMENT OR NEUTRALIZATION OF SPILLED FSA MAY BE REQUIRED BEFORE DISCHARGE TO SEWER.

PREMLIMINARY DESIGN - DRAWINGS

NO.	DATE	BY	REVISION

NOTICE

0 ½ 1

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EKW DESIGNED

EJJ DRAWN

KLW CHECKED

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CITY OF SPOKANE

PRELIMINARY ENGINEERING STUDY FOR FLUORIDATION

CENTRAL LIQUID FEED SYSTEM MECHANICAL LAYOUT

SHEET M-004

PROJECT NO.: 22-3386 | SCALE: AS SHOWN | DATE: MAY 2023

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APPENDIX G
DOH FLUORIDATION FORMS

Fluoridation Monthly Operations Report Form

for Fluoride Acids

DOH Form 331-497
Jan. 2016

System Name : ____________________ System ID: ____________________

FIP No: ____________________ Month/Year: __________/__________

Contact Name: ____________________ Phone #: ____________________

Date	Water Production: Meter Reading	Water Production: Volume Treated	Fluoride Additive: Total Remaining (Circle one)	Fluoride Additive: Quantity Used (Circle one)	Monitoring: Calculated Dosage	Monitoring: Field Tested Result*
	(MG)	(MG)	(gals) or (lbs)	(gals) or (lbs)	(mg/L)	(mg/L)
Prev.						
1		0				
2		0				
3		0				
4		0				
5		0				
6		0				
7		0				
8		0				
9		0				
10		0				
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25		0				
26		0				
27		0				
28		0				
29		0				
30		0				
31		0				
Total		0		0		
Min					#NUM!	#NUM!
Max					0.00	0.00
Avg					#DIV/0!	#DIV/0!
Count Total					0	0
Count within Range					0	0
Percent within Range					#DIV/0!	#DIV/0!

The Department of Health supports water fluoridation as a sound population-based public health measure, and supports communities in their efforts to maintain and fluoridate community water supplies.

Raw Water Data:

Date of Last Sample: ____________________

Lab Result: ____________________ mg/L

Fluoride Additive Data:

☐ Fluorosilicic Acid ☐ Sodium Fluorosilicate

Manufacturer: ____________________

ANSI-NSF Standard 60 Approved | | Yes

Percent strength of acid used: __________ %

Specific Gravity (SG) of acid: __________ g/cm²

Testing and Monitoring:

*Instrument used in field testing (Make/Model)

Method used: ☐ SPADNS ☐ Electrode

Weekly Instrument Calibration:

Date	Standard mg/L	Result mg/L

Date Split Sample Taken:

Split Sample Result mg/L:

Process Interuption(s) (date/time):

1st Start:		
End:		
2nd Start:		
End:		
3rd Start:		
End:		

Explain cause and corrective actions taken for interruption(s) on back of page.

Please send your report to us by the 10th day of the following month.

Certified Operator Signature: ____________________ Date: ____________________

Washington Certification No.: ____________________

If you need this publication in an alternative format, call 800.525.0127 (TDD/TTY call 711).
This and other publications are available at: http://www.doh.wa.gov/drinkingwater

Fluoridation Monthly Operations Report - Supplemental Form

Explain cause and corrective actions taken for each interruption/overfeed.
(Use this page to the report if these occurred during the month. Add additional pages, if needed.)

System Name : 0 | System ID: 0
FIP No: 0 | Month/Year: 01/00/00
Contact Name: 0 | Phone #: -

Date(s)	Cause and Response

Certified Officer Signature: ______________________ **Date:** ______________

Please send report to: Fluoride@doh.wa.gov *(preferred)* **OR** PO BOX 47822, Olympia, WA 98504-7822 **OR** Fax: 360-236-2252

Fluoridation

Monthly Operations Report Guidance

331-573 • Updated 10/1/2018

We designed this guide to help public water systems prepare monthly operating reports (MORs) for fluoride to the state Department of Health Office of Drinking Water (Department). We included sample MOR templates for sodium fluoride saturators (form 331-496) and fluorosilicic acid or sodium fluorosilicate (form 331-497).

Copies of the templates are on our Fluoride for Water Systems webpage.

We designed these templates in Microsoft Excel to automate some features.

The following cells in Form **331-496** are automated.

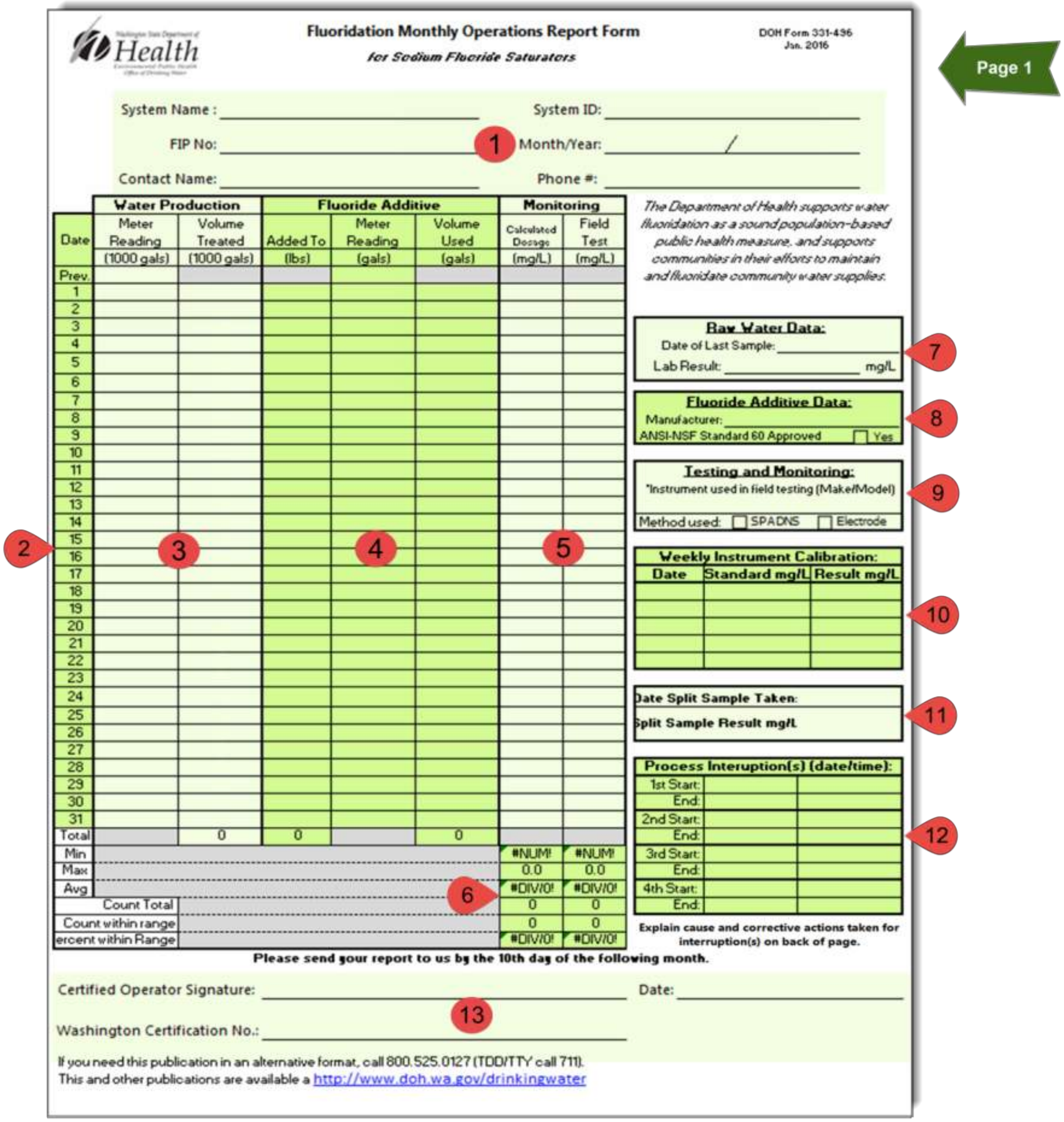
- Header information Page 2 (system name, system ID, FIP No, Month/Year, Contact Name, and Phone #) auto populates from information you enter on page one.
- Volume Treated Column.
- Fluoride Additive Added To Total.
- Fluoride Additive Volume Used Total.
- Monitored Calculated Dosage Min, Max, Avg, Count Total, Count within Range, and Percent within Range.
- Monitored Field Tested Result Min, Max, Avg, Count Total, Count within Range, and Percent within Range.

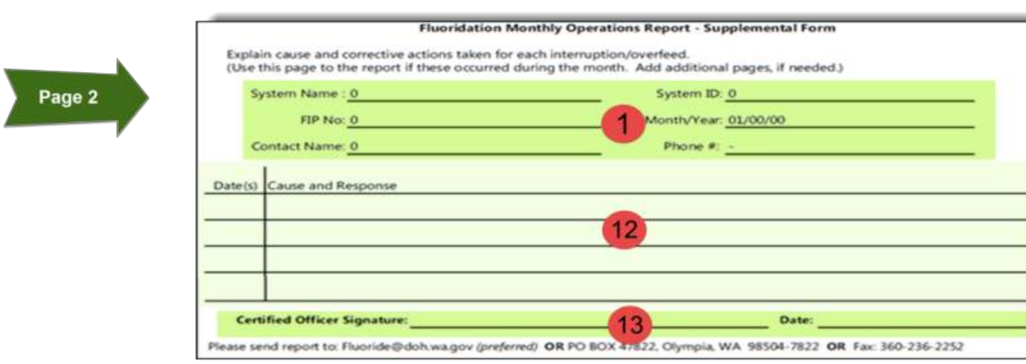
The following cells in Form **331-497** are automated.

- Header information Page 2 (system name, system ID, FIP No, Month/Year, Contact Name, and Phone #) auto populates from information you enter on page one.
- Volume Treated Column.
- Fluoride Additive Quantity Used Total.
- Monitored Calculated Dosage Min, Max, Avg, Count Total, Count within Range, and Percent within Range.
- Monitored Field Tested Result Min, Max, Avg, Count Total, Count within Range, and Percent within Range.

Sodium Fluoride Saturators: Form 331-496

This section explains how to complete the sodium fluoride saturator form.





Section 1 Form Header Information

Enter water system name registered with the Department.

Enter the 5–6 character water system ID number.

Enter Fluoride Injection Point (FIP) number.

Enter month/year of report.

Enter primary contact name for all fluoride related questions.

Enter phone number of primary contact.

Section 2 Date

This section lists the day of the month, starting with a **Prev** cell. Enter the last reading from previous month's report in the **Meter Reading** cell column, to right of the cell marked **Prev**.

Section 3 Water Production

Enter your daily water production meter reading (in thousands of gallons) under **Meter Reading** in the corresponding day's cell.

The **Volume Treated (1000 gallons)** is the difference between that day's reading and the previous day's reading.

Section 4 Fluoride Additive

Enter the number of pounds of sodium fluoride added to the saturator on any given day during the month in the **Added To** column.

Enter the meter reading (in gallons) from the fluoride saturator water supply line in the **Meter Reading** column.

Enter the amount of saturated fluoride solution used on any given day in the **Volume Used** column. (This is the difference between today's Meter Reading and yesterday's Meter Reading.)

Section 5 Monitoring

Enter the calculated fluoride concentration based on the raw water fluoride levels added to the calculated added fluoride in the **Calculated Dosage** column.

Calculated Dosage Example

((18,000 × Fluoride Volume Used) ÷ Water Volume Tested) + Raw Water Data

Enter the daily fluoride field result in the **Field Test** column. Either a single daily value or an average of all daily sample values if you take more than one sample during the day.

Section 6 Monthly Totals

The Calculated Dosage and Field Test Min, Max, Avg, Count Total, Count within Range, and Percent within Range automatically calculate with an embedded formula. However, if the formulas fail, please calculate the **Calculated Dosage** totals and **Field Test Results** totals by:

Min—Enter minimum value for month.

Max—Enter maximum value for month.

Avg—Enter calculated average of all monthly results.

> Calculation: Summation of all of the results ÷ the total number of results

Count Total—Enter number of results entered for month.

Count within Range—Number of results within 0.5–0.9 mg/L.

Percent within Range—Percentage of total results within 0.5–0.9mg/L.

> Calculation: ((number of samples within range ÷ total number of samples) × 100)

Section 7 Raw Water Data

Enter most recent certified laboratory result for fluoride concentration of your **raw** water.

Section 8 Fluoride Additive Data

Enter manufacturer information for your fluoride additive.

Section 9 Testing and Monitoring

Enter make and model of instrument used for field monitoring

Section 10 Weekly Instrument Calibration

After instrument calibration; enter date, concentration of calibration standard, and result from analysis of calibration standard.

Section 11 Monthly Split Sample

Enter date when split sample was taken and result from certified lab. Results entered in the field result cell on the day the split sample was taken must correspond with the field result reported to the certified lab when split sample was submitted.

Section 12 Process Interruption

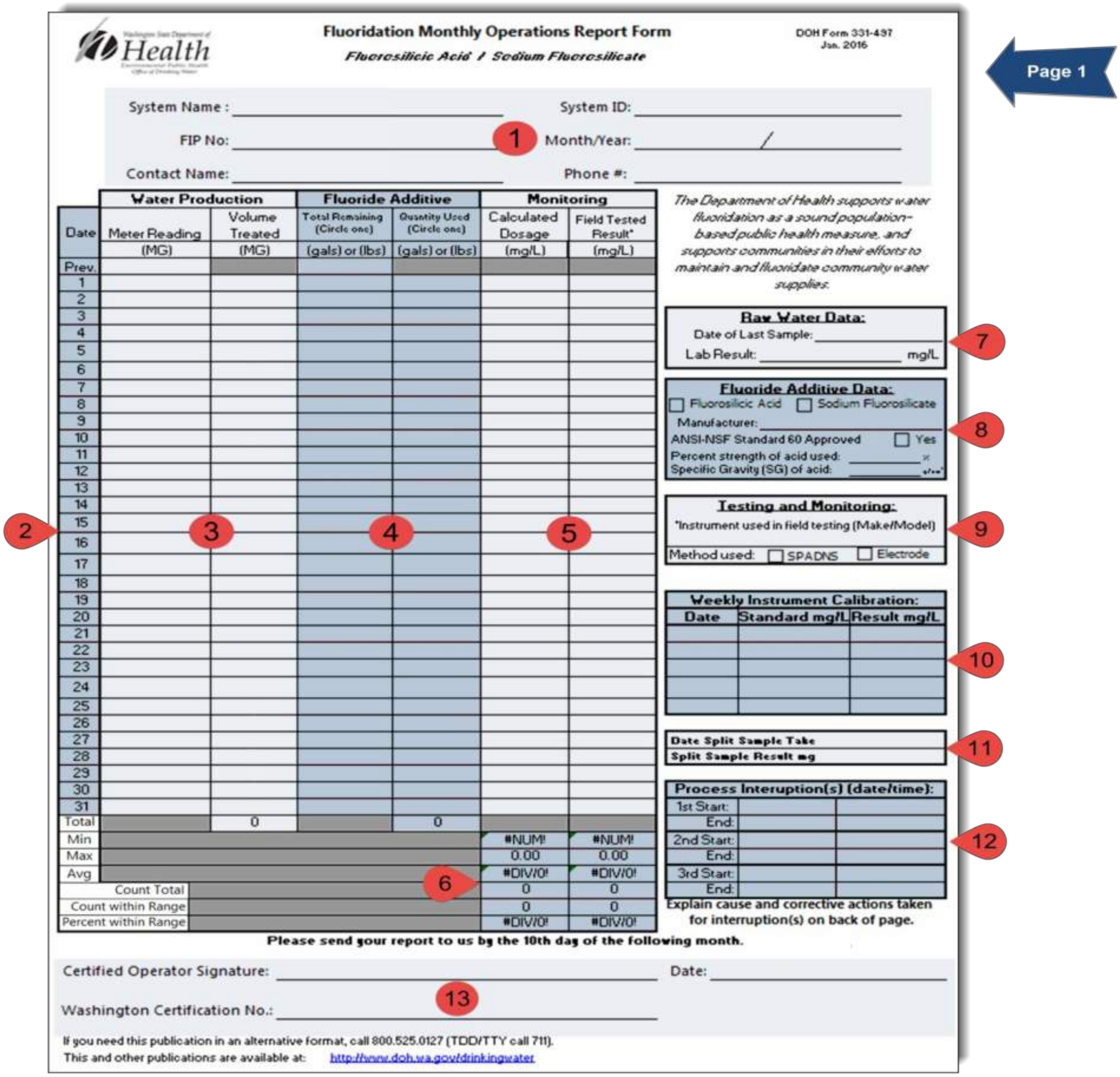
Enter start date/time and end date/time of any process interruption. On the second page, there must be a detailed account of the cause and response for every process interruption.

Section 13 Certified Operator Sign-off

A state certified operator must either manually or electroincially sign and date page one and page two. On page one, the certified operator must provide their Washington Certification Number.

Fluorosilicic Acid/Sodium Fluorosilicate: Form 331-497

This section explains how to complete the Fluorosilicic Acid/Sodium Fluorosilicate form.



Page 1

Washington State Department of Health

Fluoridation Monthly Operations Report Form

Fluorosilicic Acid / Sodium Fluorosilicate

DOH Form 331-497
Jan. 2016

System Name: ______ System ID: ______
FIP No: ______ (1) Month/Year: ____/____
Contact Name: ______ Phone #: ______

Date	Water Production: Meter Reading (MG)	Water Production: Volume Treated (MG)	Fluoride Additive: Total Remaining (Circle one) (gals) or (lbs)	Fluoride Additive: Quantity Used (Circle one) (gals) or (lbs)	Monitoring: Calculated Dosage (mg/L)	Monitoring: Field Tested Result* (mg/L)
Prev.						
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15 (2)	(3)		(4)		(5)	
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
Total		0		0		
Min					#NUM!	#NUM!
Max					0.00	0.00
Avg				(6)	#DIV/0!	#DIV/0!
Count Total					0	0
Count within Range					0	0
Percent within Range					#DIV/0!	#DIV/0!

The Department of Health supports water fluoridation as a sound population-based public health measure, and supports communities in their efforts to maintain and fluoridate community water supplies.

Raw Water Data: (7)
Date of Last Sample: ______
Lab Result: ______ mg/L

Fluoride Additive Data: (8)
☐ Fluorosilicic Acid ☐ Sodium Fluorosilicate
Manufacturer:
ANSI-NSF Standard 60 Approved ☐ Yes
Percent strength of acid used: ______ %
Specific Gravity (SG) of acid: ______

Testing and Monitoring: (9)
*Instrument used in field testing (Make/Model)
Method used: ☐ SPADNS ☐ Electrode

Weekly Instrument Calibration: (10)

Date	Standard mg/L	Result mg/L

Date Split Sample Take (11)
Split Sample Result mg

Process Interuption(s) (date/time): (12)

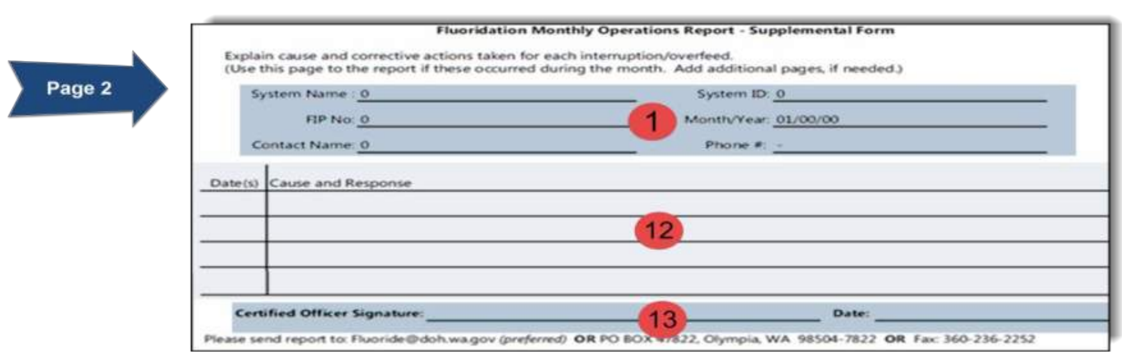
1st Start:		
End:		
2nd Start:		
End:		
3rd Start:		
End:		

Explain cause and corrective actions taken for interruption(s) on back of page.

Please send your report to us by the 10th day of the following month.

Certified Operator Signature: ______ Date: ______
(13)
Washington Certification No.: ______

If you need this publication in an alternative format, call 800.525.0127 (TDD/TTY call 711).
This and other publications are available at: http://www.doh.wa.gov/drinkingwater



Page 2

Fluoridation Monthly Operations Report - Supplemental Form

Explain cause and corrective actions taken for each interruption/overfeed.
(Use this page to the report if these occurred during the month. Add additional pages, if needed.)

System Name: 0 System ID: 0
FIP No: 0 (1) Month/Year: 01/00/00
Contact Name: 0 Phone #: -

Date(s)	Cause and Response
	(12)

Certified Officer Signature: ______ (13) Date: ______

Please send report to: Fluoride@doh.wa.gov (preferred) OR PO BOX 47822, Olympia, WA 98504-7822 OR Fax: 360-236-2252

Section 1 Form Header Information

Enter water system name registered with the Department.

Enter the 5–6 character water system ID number.

Enter Fluoride Injection Point (FIP) number.

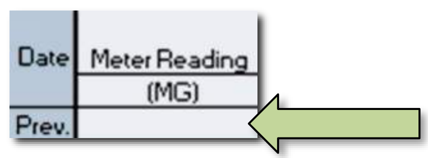
Enter month/year of report.

Enter primary contact name for all fluoride related questions.

Enter phone number of primary contact.

Section 2 Date

This section lists the day of the month, starting with a **Prev** cell. Enter the last reading from the previous month's report in the **Meter Reading** cell to right of the cell marked **Prev**.



Section 3 Water Production

Enter your daily water production meter reading (in millions of gallons) under **Meter Reading** in the corresponding day's cell.

The **Volume Treated (MG)** is the difference between that day's reading and the previous day's reading.

Section 4 Fluoride Additive

Enter number of gallons or pounds (circle one) remaining in the additive storage tank in **Total Remaining** column.

Enter amount of gallons or pounds (circle one) of additive used in **Quantity Used** column. This is the difference between the today's Total Remaining and yesterday's Total Remaining.

Section 5 Monitoring

Enter the calculated fluoride concentration based on the raw water fluoride levels added to the calculated added fluoride in the **Calculated Dosage** column.

Calculated Dosage Example (based on 23% acid concentration).

((Fluoride Quanity Used (lbs) × 0.79 × 0.23) ÷ (Water Volume Treated (MG) × 8.34)) + Raw Water Data

Enter the daily fluoride field result in the **Field Tested Result** column. This is either a single daily value or an average of all daily sample values if more than one sample is taken during the day.

Section ❻ Monthly Totals

The **Calculated Dosage** and the **Field Test** Min, Max, Avg, Count Total, Count within Range, and Percent within Range are automatically calculated with an embedded formula. However, if those formulas fail, please calculate **Calculated Dosage** totals and **Field Test Results** totals by:

Min—Enter minimum value for month.

Max—Enter maximum value for month.

Avg—Enter calculated average of all monthly results.

> Calculation: Summation of all of the results ÷ the total number of results

Count Total—Enter number of results entered for month.

Count within Range—Number of results within 0.5–0.9 mg/L.

Percent within Range—Percentage of total results within 0.5–0.9mg/L.

> Calculation: ((number of samples within range ÷ total number of samples) × 100)

Section ❼ Raw Water Data

Enter most recent certified laboratory result for fluoride concentration of your **raw** water.

Section ❽ Fluoride Additive Data

Mark which type of acid you are using.
Enter manufacturer information for your fluoride additive.
Mark if additive is ANSI-NSF Standard 60 approved.
Enter percent strength of acid used.
Enter Specific Gravity of acid used.

Section ❾ Testing and Monitoring

Enter make and model of instrument used for field monitoring

Section ❿ Weekly Instrument Calibration

After instrument calibration; enter date, concentration of the calibration standard, and result from analysis of the calibration standard.

Section ⓫ Monthly Split Sample

Enter the date when the split sample was taken and result from the certified lab. The result entered in the field result cell on the day the split sample was taken must correspond with the field result reported to the certified lab when the split sample was submitted.

Section ⓬ Process Interruption

Enter start date/time and end date/time of any process interruption. On the second page, there must be a detailed account of the cause and response for every process interruption.

Section ⓭ Certified Operator Sign-off

A state certified operator must either manually or electroincially sign and date page one and page two. On page one the certified operator must provide their Washington Certifaction Number.

The Department must receive all completed forms by the tenth of the following month for which you are reporting.

E-mail (preferred method) forms to: Fluoride@doh.wa.gov.

Or mail to

Department of Health
Attn: Fluoride Program
PO BOX 47822
Olympia, WA 98504-7822

Fluoride Program Contact Information

Technical Support	Compliance Support
Stephen Baker	Andy Schut
(360) 236-3138	(360) 236-3197
stephen.baker@doh.wa.gov	andy.schut@doh.wa.gov

Washington State Department of Health

To request this document in another format, call 1-800-525-0127. Deaf or hard of hearing customers, please call 711 (Washington Relay) or email civil.rights@doh.wa.gov.

Engineering, Design, and Water Treatment

Recommended Actions Following Fluoride Overfeed

331-609 • 7/31/2018

In the event of an overfeed, immediately determine the fluoride level, and then take action based on the table below.

FLUORIDE LEVEL (mg/L)	ACTIONS RECOMMENDED
<2.0	1. Leave the fluoridation system on. 2. Determine what has malfunctioned and correct or repair it.
2.1 to 4.0	1. Leave the fluoridation system on. 2. Notify your supervisor, and report the incident to your DOH regional drinking water office (or after-hours hotline number[1]). 3. Determine what has malfunctioned and immediately correct or repair. 4. Measure and record fluoride content of water samples at several points in the distribution system to identify extent of excessive level. 5. Tier 3 public notification of the overfeed occurrence is required as soon as practical but no later than 12 months after the exceedance (such as in an annual consumer confidence report).
4.1 to 30	1. Immediately turn off the fluoridation feed system, but leave on-line monitors ON. 2. Promptly notify your supervisor, and report the incident to your DOH regional drinking water office (or after-hours hotline number[1]). 3. Measure and record fluoride content of water samples at several points in the distribution system to identify extent of excessive level. Save 125 mL portion of each sample for future reference. 4. Determine duration of exceedance, and whether excessive fluoride content could have reached customers. 5. Determine what has malfunctioned and repair it. Once levels are reduced to less than 4.0 mg/L, and with supervisor's and state's permission, restart the fluoridation system. 6. If initial and distribution system confirmation samples are 4.1 mg/L or greater, Tier 2 public notice of the exceedance is required (as soon as practical, but no later than 30 days after the exceedance).
>30	1. Immediately turn off the fluoridation feed system, but leave on-line monitors ON. 2. Promptly notify your supervisor, and report the incident to your DOH regional drinking water office (or after-hours hotline number[1]). 3. Measure and record fluoride content of water samples at several points in the distribution system to identify extent of excessive level. Save 125 mL portion of each sample for future reference. 4. Determine duration of exceedance, and whether excessive fluoride content could have reached customers. 5. If initial and distribution system confirmation samples are 30.1 mg/L or greater Tier 1 public notification is required. Issue "Do Not Drink" warning. 6. Open hydrants to flush mains. "Do Not Drink" public notice can be rescinded once levels are reduced to less than 4.0 mg/L. Record these measurements. 7. Determine what has malfunctioned and repair it. With supervisor's and state's permission, restart the fluoridation system.

[1]DOH After-Hours Emergency Line (for Purveyors/Water Systems only) **1-877-481-4901.**

Washington State Department of Health

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Fluoridation Treatment Quality Award Program

331-610 • 7/31/2018

To support the benefits of water fluoridation and recognize water treatment facilities that do an outstanding job of providing a consistent level of fluoride in the water supply, the Washington State Department of Health (DOH) and the National Centers for Disease Control and Prevention (CDC) commend public water systems that achieve optimal fluoridation levels with an annual Water Fluoridation Quality Award. Earning these awards represents a high level of operator care and accomplishment.

CDC issues the certificates annually to state oral health programs, which are then responsible for distributing the award certificates to the recipient communities.

These awards are important to community water systems because they recognize achieving high water quality standards that water systems can promote in their consumer communications.

The DOH Office of Drinking Water reviews and evaluates the monthly operating reports to identify those water systems that meet the highest standards for control and accuracy in water fluoride treatment, monitoring and reporting. For a water system to be eligible, its performance must be documented by the state in the Water Fluoridation Reporting System (WFRS). The information from these reports identifies systems that qualify for the Water Fluoridation Quality Award.

Optimization Criteria

Adequate Points of Addition	All active sources* (including interties) continuously and optimally fluoridated for at least 11 months per calendar year *Not required of emergency or seasonal sources that operate less than 90 days/year.
Adequate Monitoring	Daily monitoring samples analyzed for each point of fluoride addition operating for two hours or more on any given day
	Calculated dose computed daily from records of water production and additive used
	Background fluoride levels in untreated raw source water analyzed by certified laboratory at least once per calendar year
Adequate Split Samples	Monthly split sample(s) analyzed for each point of addition operating for five or more days in any given month
	At least 12 monthly split samples submitted to certified lab per calendar year
	Operator and lab split sample results must be within +/- 0.20 mg/L tolerance
Optimal Fluoride Concentration and Control Range	Target fluoride concentration is 0.7 mg/L
	Optimal monthly average is a minimum of 0.7 mg/L • Lowest optimal concentration is 0.6 mg/L • Highest optimal concentration is 0.9 mg/L
	75% of daily samples must be between 0.6 and 0.8 mg/L
Reporting	Monthly operations reports complete and received by the tenth of the following month.

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APPENDIX H
DOH PURIFICATION PLANT CRITERIA WORKSHEET

WASHINGTON STATE DEPARTMENT OF HEALTH

PURIFICATION PLANT CRITERIA WORKSHEET ABC Classification: WTPO

Water Treatment Plant - address and contact person			
Plant Name	City of Spokane Water Department	WA WFI #	26050 Q
Contact Name and Title	Seth McIntosh – Water System & Hydroelectric Plant Manager		
Address	914 E North Foothills Dr		
City/State/Zip	Spokane, WA, 99207		
Phone and Fax	509-742-8154 | Cell: 509-847-9415		

A groundwater supply with only chlorination is considered a distribution system, not a water treatment facility. The addition of any chemical to a public water supply, other than a disinfectant, will be considered a treatment facility and should use this rating worksheet to determine the classification of the facility.* Unless otherwise noted, give full amount of points in the "Your Plant" box. For example:

	Raw water quality is subject to or has elevated:	Points	Your Plant
Correct:	Taste and/or odor levels	3	3
Incorrect:	Taste and/or odor levels	3	1

Do not double count. If the plant has two horizontal-flow (rectangular basins), **DO NOT** give 10 points, give 5 points. If the plant has more than one type of unit for each process, give points once for each unit.

*With the exception of unit processes installed to allow in-line fluoridation, in-line chlorination, or chemical addition to inhibit corrosion are not included within the scope of the term "purification plant" per WAC 246-292-010.

Item	Points Possible	Your Facility
Size		
Design flow average day, or peak month s average day, whichever is larger (1 point per 0.5 MGD. Round up.) Design flow: Consider this to be the design capacity of the plant. Examples: 9.2 MGD = 19 points 4.7 MGD = 10 points (20 points maximum allowed)	1-20	20
Water Supply Sources (Rating based on public health significance)		
Seawater/saltwater	0	
Groundwater	0	
Groundwater under direct influence of surface water (GWI)	8	
Surface water	10	
Average Raw Water Quality Variation - Applies to all sources (surface and groundwater). Key is the effect on treatment process changes that would be necessary to achieve optimized performance. • Little or no variation - no treatment provided except disinfection (0 points) • Minor variation - e.g. "high quality" surface source appropriate for slow sand filtration (1 point) • Moderate variation in chemical feed, dosage changes made: monthly (2 points), weekly (3 points), or daily (4 points) • Variation significant enough to require pronounced and/or very frequent changes (5 points) • Severe variation - source subject to non-point discharges, agricultural/urban storm runoff, flooding (7 points) • Raw water quality subject to agricultural or municipal waste point source discharges (8 points) • Raw water quality subject to industrial waste pollution (10 points)	0-10	0
Raw water quality is subject to:		
• Taste and/or odor for which treatment process adjustments are routinely made	2	
• Color > 15 CU (not due to precipitated metals) - see exceptions in Note **I** at end of table.	3	
• Iron or/and manganese > MCL: Fe (2 points), Mn (3 points) (3 points maximum allowed) see exceptions in Note 1 at end of Table 1	2-3	
• Algal growths for which treatment process adjustments are routinely made	3	

Item	Points Possible	Your Facility
Chemical Treatment/Addition Processes		
Fluoridation	4	4

Disinfection/Oxidation (Note: Points are additive to a maximum of 15 points allowed for this category.)
CHECK □ ALL THAT APPLY:
• Chlorination:
  • Hypochlorites (5 points)
    • If generated on site (add 1 point) □
  • Chlorine gas (8 points) x
  • Chloramination (10 points) □
  • Chlorine dioxide (10 points) □
• Ozonation (10 points) □
• UV Irradiation (2 points) □
• Iodine, Peroxide, or similar (5 points) □
• Potassium permanganate (4 points) □ (If used with greensand filtration do not give 4 points)
	0-15	8

pH adjustment for process control (e.g. pH adjustment aids coagulation)	4	
Stability or Corrosion Control (If the same chemical is used for both Corrosion Control and pH adjustment, count points only once)	4	
Coagulation/Flocculation & Filter Aid		
Primary coagulant addition	6	
Coagulant aid / Flocculant chemical addition (in addition to primary coagulant use)	2	
Flocculation	2	
Filter aid addition (Non-ionic/anionic polymers)	2	
Clarification/Sedimentation		
Sedimentation (plain, tube, plate)	4	
Contact adsorption	6	
Other clarification processes (air flotation, ballasted clarification, etc.)	6	
Upflow clarification ("sludge blanket clarifier") [2]	8	
Filtration		
Granular media filtration (Surface water/GWI) ≤ 3 gpm/sq ft	10	
Granular media filtration (Surface water/GWI) □ 3 gpm/sq ft	20	
Groundwater filtration	6	
Membrane filtration • For compliance with a primary regulation (10 points) • For compliance with a secondary regulation (6 points)	6-10	
Diatomaceous earth (pre-coat filtration)	10	
Cartridge/bag	5	
Pre-filtration (staged cartridges, pressure sand w/o coagulation, etc.): add one point per stage to maximum of 3 points	1-3	
Slow sand	5	
Other Treatment Processes		
Aeration	3	
Air stripping (including diffused air, packed tower aeration)	5	
Ion-exchange/softening	5	
Greensand filtration	10	
Lime-soda ash softening (includes: chemical addition, mixing/flocculation/ clarification/filtration - do not add points for these processes separately)	20	

Item	Points Possible	Your Facility
Granular activated carbon filter (do not assign points when included as a bed layer in another filter)	5	
Powdered activated carbon	2	
Blending sources with significantly different water quality • To achieve MCL compliance (4 points) • For aesthetic reasons (2 points)	2-4	
Reservoir management employing chemical addition	2	
Electrodialysis	15	
Other: Certification authority may assign 2 to 15 additional points for processes not listed elsewhere in this document. (Specify: ______________________________)	2-15	
Residuals Disposal		
• Discharge to surface, sewer, or equivalent (0 points) • On-site disposal, land application (1 point) • Discharge to lagoon/drying bed, with no recovery/recycling – e.g. downstream outfall (1 point) • Backwash recovery/recycling: discharge to basin or lagoon and then to source (2 points) • Backwash recovery/recycling: discharge to basin or lagoon and then to plant intake (3 points)	0-3	
Facility Characteristics		
Instrumentation - Use of SCADA or similar instrumentation systems to provide data, with: • Monitoring/alarm only, no process operation - plant has no automated shutdown capability (0 points) • Limited process operation - e.g. remote shutdown capability (1 point) • Moderate process operation - alarms and shutdown, plus partial remote operation of plant (2 points) • Extensive or total process operation - alarms and shutdown, full remote operation of plant possible (4 points)	0-4	4

Total Score:____36______

See WAC 246-292-050 for minimum certification requirements:

Class I .... 30 points or less
Class II .... 31-55 points
Class III.................. 56-75 points
Class IV .... 76 points and greater

Worksheet Completed by: ____

Phone: ________________________ Effective Date of Treatment: ____________________

1 Raw water quality is subject to:

- Taste and/or odor for which treatment process adjustments are routinely made (2 points):
  1) T&O issue has been identified in a pre-design report, etc.,
  2) a process has been installed to address, and
  3) operational control adjustments are made at least seasonally.

Do not give points for T&O when there is no specific additional impact on operation. E.g. if a system is already pre-chlorinating for disinfection, give no points for T&O.

- Color > 15 CU (not due to precipitated metals) (3 points) with following exceptions: Color will be considered elevated and points assigned when levels exceed 75 Color Units (CU) for conventional filtration, 40 CU for direct filtration, or 15 CU for all other technologies, except reverse osmosis (no points given for color for reverse osmosis).

 Iron and/or manganese > MCL: Fe (2 points), Mn (3 points) (3 points maximum allowed) with following exceptions. Iron and manganese levels will be considered elevated and points assigned if they are greater than the MCL, except for applications of manganese greensand filters. For applications of manganese greensand filters, iron and manganese levels will be considered elevated when their combined level exceeds 1.0 mg/L (3 points allowed).

 Algal growths for which treatment process adjustments are routinely made (3 points): Raw water will be considered subject to algae growths when treatment processes are specifically adjusted due to the presence of high levels of algae on at least a weekly basis for at least two months each year.

2 Upflow clarification ("sludge blanket clarifier") – 8 points – Also known as sludge blanket clarification. Includes such proprietary units as Super-Pulsator. These units include processes for flocculation and sedimentation. Important note: these are not the same as adsorption clarifiers.

Water Treatment Definitions

Definitions reprinted from "Master Glossary of Water and Wastewater Terms," [http://www.owp.csus.edu/glossary/glossary.php], with permission from Office of Water Programs, California State University, Sacramento.

Adsorption
The gathering of a gas, liquid, or dissolved substance on the surface or interface zone of another material.

Aeration
The process of adding air to water. Air can be added to water by passing air through water or passing water through air.

Air stripping
A treatment process used to remove dissolved gases and volatile substances from water. Large volumes of air are bubbled through the water being treated to remove (strip out) the dissolved gases and volatile substances.

Chloramination
The application of chlorine and ammonia to water to form chloramines for the purpose of disinfection.

Diatomaceous earth
A fine, siliceous (made of silica) "earth" composed mainly of the skeletal remains of diatoms.

Direct filtration
A method of treating water which consists of the addition of coagulant chemicals, flash mixing, coagulation, minimal flocculation, and filtration. The flocculation facilities may be omitted, but the physical-chemical reactions will occur to some extent. The sedimentation process is omitted.

Electrodialysis
The selective separation of dissolved solids on the basis of electrical charge, by diffusion through a semipermeable membrane across which an electrical potential is imposed.

Reverse osmosis
The application of pressure to a concentrated solution which causes the passage of a liquid from the concentrated solution to a weaker solution across a semipermeable membrane. The membrane allows the passage of the water (solvent) but not the dissolved solids (solutes).

SCADA system
The Supervisory Control And Data Acquisition system is a computer-monitored alarm, response, control and data acquisition system used by drinking water facilities to monitor their operations.

Stabilization
Processes that convert organic materials to a form that resists change. Organic material is stabilized by bacteria

which convert the material to gases and other relatively inert substances. Stabilized organic material generally will not give off obnoxious odors.

APPENDIX I
FLUORIDE REGULATORY AND PLANNING REVIEW TECHNICAL MEMORANDUM

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Parametrix
ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES

835 NORTH POST, SUITE 201 | SPOKANE, WA 99201 | P 509.328.3371

TECHNICAL MEMORANDUM

DATE: May 4, 2023

TO: City of Spokane

FROM: Parametrix and Murraysmith

SUBJECT: Updated Task 4 – Fluoride Regulatory and Planning Review

CC:

PROJECT NUMBER: 376-4109-001

INTRODUCTION

The Preliminary Engineering Study for Fluoridation (Study) is to provide a comprehensive understanding of the ramifications of implementing fluoridation of the City of Spokane's water system. Task 4 – Fluoride Regulatory and Planning Review of the Study is to identify and review code and industry recommendations for fluoride feed and monitoring systems and identify any conflicts with existing City planning documents and water agreements. A review of local, state, and national regulatory requirements, City planning documents, and applicable City water service agreements as they pertain to fluoridation system implementation and design. The City must thoroughly analyze the implications of fluoridation implementation, including the effects of fluoride chemical feed systems on existing facilities, continuous operations and maintenance, and safety.

BACKGROUND

The City of Spokane operates the third largest water system in the state of Washington. The Water Department's priority is continuing to deliver safe, high-quality drinking water to its residents with efficient operations, while keeping rates affordable for our community. To inform future decisions, the City is completing a feasibility study to better understand the costs and implementation steps associated with providing fluoridated water to the community. The study will take about a year and a half to complete and is fully paid for with grant funds. City of Spokane's elected leaders are committed to a full and transparent public process throughout, including a public engagement period once the study is complete.

The City is committed to thoughtful preparation, asset management, ongoing education regarding the purpose of this study, and implementation planning, as well as a complete understanding of the alternatives and implications for installing the fluoride chemical feed system that utilizes the best alternative. Murraysmith and Parametrix are performing this Study to meet the City's goals and offer a comprehensive understanding of the ramifications of implementing one of the proposed fluoride system alternatives.

TASK 4 – FLUORIDE REGULATORY AND PLANNING REVIEW

Subtask 4.1 – Regulatory Review

As a part of Subtask 4.1, Parametrix reviewed national, state, and local regulatory requirements as it relates to fluoridated water systems. The following is a list of documents reviewed:

Washington State Legislature Engrossed Substitute House Bill (ESHB) 1251

The Washington State Legislature passed the ESHB 1251 on February 9, 2023, which is an act relating to water systems' notice to customers of public health considerations. The bill relates to the fluoridation of municipal water supplies in the state of Washington and will add a new section to chapter 70A.125 of the Revised Code of Washington (RCW). Specifically, the bill requires that a public water system that is considering commencing or discontinuing fluoridation of its water supply shall notify its customers and the department of its intentions at least 90 days prior to a vote or decision on the issue. This notification can be made by any method that effectively notifies its customers i.e., radio, television, newspaper, mail, or electronically. Any public water system that violates the notification requirements shall return the fluoridation of its water supply to its previous level until the required notification has been provided. The bill takes effect 90 days after adjournment of the session in which the bill is passed, therefore the new section to RCW 70A.125 will take effect June 15, 2023 (House Bill Report ESHB 1251, 2023). The following is a link to this information: https://apps.leg.wa.gov/documents/billdocs/2023-24/htm/bill%20reports/House/1251-S.E%20HBR%20APH%2023.htm

Washington State Department of Health Guidance

Regulations

The State Board of Health (Board) updated and adopted *WAC 246-290-460*, fluoridation of drinking water, on May 9, 2016. The major changes to the rule include the following:

- Purveyors will notify the Department of Health (DOH) before permanently discontinuing fluoridation.
- Optimization level is 0.7mg/L.
- New terminology:
  - Operating Tolerance – Daily sampling results must fall between 0.5 – 0.9 mg/L.
  - Off Measure – The drinking water certified laboratory results differ by more than 0.2 mg/L from the purveyor's analytical results.
- Starting July 2016, purveyors must use the required department's Monthly Operating Reports listed below.
- Starting in January 2017, water systems will be automatically enrolled in the fluoride optimization program (F-TOP).
- Starting January 2017, water system's monthly fluoride performance will be tracked in the Center for Disease Control (CDC) Water Fluoridation Reporting System (WFRS) (Floride for Water Systems, 2022).

If the City decides to fluoridate the municipal water supply, these procedures will need to be taken into consideration.

Required Reports and Forms

The DOH requires monthly operating reports (MOR) from water districts who fluoridate. If the City decides to fluoridate the water system, MORs will be required. These forms are generated in an unprotected Excel format and can be customized for use. Links to the forms are provided below.

- *Monthly Operations Report for Sodium Fluoride Saturators (Excel)*
- *Monthly Operations Report for Fluoride Acids (Excel)*

- *Fluoridation Monthly Operations Report Guidance (PDF)*

Overfeed Guidelines

The DOH provides information on appropriate actions to take in the event of an overfeed of fluoride to the water system. If the City decides to fluoridate, the City will be required to ensure that proper remediation actions are taken if there is an overfeed of fluoride to the municipal water system. The recommended actions information is provided in the following link: *https://doh.wa.gov/sites/default/files/legacy/Documents/Pubs//331-609.pdf?uid=625ef4322a954.*

Washington State Administrative Code (WAC)

Section 246-290-460 of the WAC outlines information regarding the fluoridation of drinking water and references other applicable WAC sections.

WAC 246-290-460

Final Significant Rule Analysis Full Report March 2016

This document provides requirements for Washington Administrative Code (WAC) 246-290-460, Fluoridation of Drinking Water, and sets the allowed fluoridation concentration range for water systems that add fluoride to its water for dental health benefits. To meet these obligations, both the Board and DOH rely on federal agencies that evaluate best available science to guide rulemaking and program administration. For standards regarding the safety of drinking water, the Board and DOH rely predominantly on the U.S. Environmental Protection Agency (EPA). For setting the optimal fluoride concentration, the DOH relies predominantly on guidance from U.S. Department of Health and Human Services (HHS) (Final Significant Rule Analysis, 2016). The following is a link to the referenced document. *https://doh.wa.gov/sites/default/files/legacy/Documents/4200//FINALFluorideSA.pdf.*

This section of the WAC sets the fluoridation concentration range for Group A public water systems that fluoridate. It also provides guidance for the requirements of fluoridation treatment facilities, including fluoridation start and discontinuation notice guidelines, optimal fluoride concentrations, monitoring, and recording. *https://apps.leg.wa.gov/wac/default.aspx?cite=246-290-460.*

If the City decides to fluoridate, it will be required to ensure that fluoride levels are set to DOH standards.

WAC 246-290-71002: Public Notice Content

This section of the WAC provides requirements for the public notice of water sample results, violations, health risks, and steps taken to remedy the situation. The following is a link to this section: *https://app.leg.wa.gov/WAC/default.aspx?cite=246-290-71002.*

If the City decides to fluoridate, it will be required to provide this public notice.

WAC 246-290-71004: Public Notification Mandatory Language

This section of the WAC provides requirements for public notice and specific health effects language and other standard language in the notification of the exceedance of the secondary maximum contaminant level (MCL) for fluoride and when issued a category red operating permit. The following is a link to this section: *https://apps.leg.wa.gov/WAC/default.aspx?cite=246-290-71004.*

If the City decides to fluoridate, it will be required to provide this language.

WAC 246-290-71005: Special Public Notification Requirements

This section of the WAC provides requirements for notifying the water system users of the availability of the results of monitoring for unregulated contaminants no later than 12 months after the monitoring results are known. The following is a link to this section: *https://apps.leg.wa.gov/WAC/default.aspx?cite=246-290-71005*.

If the City decides to fluoridate, it will be required to provide this information to the public water users.

WAC 246-290-135

This section of the WAC explains how to set up a source water protection program in conjunction with the requirement that all Group A water systems keep a sanitary control area (SCA) around all drinking water sources to protect them from contamination. The following is a link to this section: *https://apps.leg.wa.gov/WAC/default.aspx?cite=246-290-135*.

If the City decides to fluoridate, they will be required to meeting secondary containment requirements for storing fluoride chemicals within the defined SCA around all of their drinking water sources.

RCW Requirements

RCW 70A.125 Public Water Systems—Penalties and Compliance

This section of the RCW states explains the penalties and compliance for Group A and B water systems. On February 9, 2023, the Washington State Legislature passed ESHB 1251. The bill relates to the fluoridation of municipal water supplies in the state of Washington and will add a new section to chapter 70A.125 of the RCW. The new section will include language regarding a public water systems notification process, compliance, and penalties when considering commencing or discontinuing fluoridation of its water supply (. The bill takes effect 90 days after adjournment of the session in which the bill is passed, therefore the new section to RCW 70A.125 will take effect June 15, 2023 (House Bill Report ESHB 1251, 2023). The following is a link to this section: *https://app.leg.wa.gov/RCW/default.aspx?cite=70A.125*

RCW 57.08.012 Fluoridation of Water Authorized

This section of the RCW states that a water district by a majority vote of its board of commissioners may fluoridate the water supply system of the water district. The commissioners may cause the proposition of fluoridation of the water supply to be submitted to the water district at any general election or special election to be called for the purpose of voting on the proposition. The proposition must be approved by a majority of the electors voting on the proposition to become effective. If the City decides to fluoridate, they will be required to submit this proposition along with resulting voting process. The following is a link to this section: *https://app.leg.wa.gov/rcw/default.aspx?cite=57.08.012*

International Fire Code (IFC) and Fire Department Requirements

The IFC does not specifically call out any of the fluoride additives commonly used in community water systems; although it does provide guidelines for the indoor storage of highly toxic and toxic materials, which will in the case of storing fluorosilicic acid, sodium fluorosilicate, or sodium fluoride.

The code outlines storage requirements depending on the chemical and gives guidelines on equipment testing requirements, displaying of safety data sheets, and hazard identification signage to name a few. If the City were to fluoridate and store fluorosilicic acid, sodium fluorosilicate, or sodium fluoride, the recommendation would be to work with the local fire department on recommended codes and procedures. This item may need further review.

The following is a link to this section of the code: *https://codes.iccsafe.org/content/IFC2021P1/chapter-50-hazardous-materials-general-provisions#IFC2021P1_Pt05_Ch50_Sec5003.1.1*

Consumer Confidence Report (CCR) Requirements

CCR documents provide a summary on the quality of the water provided to the community for the year. The federal EPA Safe Drinking Water Act (SDWA) requires that utilities issue an annual CCR to customers in addition to other notices that may also be required by law. This report details where the water comes from, what it contains (natural or additive), and the risks that water testing and water treatment are designed to prevent. If the City decides to fluoridate, it would be required to provide similar types of reports. As a examples from communities that currently fluoridate their water, links to the Cities of Cheney and Pullman CCR documents are provided below:

City of Cheney, WA CCR (2021)

http://cheneyks.org/images/Consumer_Water_2021.pdf

City of Pullman, WA CCR (2021)

https://p1cdn4static.civiclive.com/UserFiles/Servers/Server_15252867/File/Departments/M-O/2021%20Consumer%20Confidence%20Water%20Report%20-%20Final.pdf

Subtask 4.2 – City Planning Documents Review

The team reviewed the following planning documents and municipal codes associated with past fluoridation resolutions to determine impacts to City planning associated with the fluoridation of the water system.

City of Spokane Comprehensive Plan

The 2017 City of Spokane Comprehensive Plan includes land use, capital facilities planning, transportation, housing, rural, and other chapters that address the needs of Spokane County for the next 20 years and ensures compliance with the Growth Management Act (GMA). There was no mention of or information pertaining to fluoride included in the City of Spokane Comprehensive Plan.

Spokane Municipal Code (SMC)

There was no mention of or information pertaining to fluoride included in the SMC. If the City decides to fluoridate, an ordinance adding a new section to SMC Chapter 13.04 directing the adjustment of the fluoride level in the Spokane water supply would need to be adopted.

City Clerk

A search of the City Clerk's website revealed a City Council action memorandum dated August 31, 2004, for Council Action on August 23, 2004, which contains details on an ordinance that would be enacted if the proposition for fluoridation adjustment to the City's municipal water were to pass. The following is the text of the proposed ordinance:

Council Action Memorandum, August 31, 2004

INITIATIVE 2004-1, FILED BY FLUORIDATION WORKS, PERTAINING TO THE CITY OF SPOKANE PERIODICALLY ADJUSTING THE FLUORIDE CONTENT OF ITS WATER SUPPLY WITHIN THE RANGE PRESCRIBED BY THE WASHINGTON STATE ADMINISTRATIVE CODE, AS PROVIDED BY ORDINANCE C33477

During the Spokane City Council 3:30 p.m. Briefing Session held Monday, August 23, 2004, Deputy Mayor Jack Lynch advised that the City Clerk's Office received notification from the County that the fluoride initiative did not meet the 5 percent threshold for the number of valid signatures required for submission of this ballot item on the November 2005 ballot. Subsequently, the Council took the following actions: The City ordained that there be added to SMC Chapter 13.04 a new section, designated SMC 13.04.045 to read as follows:

13.04.045 Fluoride Adjustment

An ordinance directing the adjustment of the fluoride level in the Spokane water supply; adding a new section to SMC Chapter 13.04; and providing for the submittal of a proposition to the electors of Spokane.

The City of Spokane does ordain:

Section 1. That there be added to SMC Chapter 13.04 a new section, designated 13.04.045, to read as follows:

13.04.45 Fluoride Adjustment

A. The chief executive officer from time to time determines a specific level, in accordance with state standards, to assure the healthful dental effects of fluoride for persons consuming such water.

B. The city engineer takes whatever measures are necessary to adjust the fluoride level as determined under subsection A.

Section 2. The initial determination of a specific fluoride level shall be made by February 28, 2001. The program for adjusting fluoride content shall begin as soon as practical, no later than December 31, 2001.

Section 3. That this ordinance be submitted to the electors of the City of Spokane for their approval or rejection at a special municipal election to be held in conjunction with the state general election of November 7, 2000. If approved by the electors, this ordinance shall take effect and be in force upon issuance of the certificate of election by the Spokane County Auditor.

Impacts to the Urban Growth Area (UGA)

The Spokane County Long Range Planning Program is responsible for preparing, maintaining, and updating the Spokane County Comprehensive Plan and the Urban Growth Area (UGA) boundary which guide the County's and UGA's future growth. The City would have to enlarge its service area to accommodate the additional acreage if the UGA were to increase its current boundary for future development. Infrastructure such as municipal water delivery would be provided by the City. If the City chose to fluoridate its water, the fluoridated water supply would have to be extended to the new boundary area. This would most certainly have an impact on capital improvement fund spending for extra infrastructure to ensure that fluoridated water is available throughout the expansion. Please refer to Figure 1 for a map, which outlines the UGA, current and future service areas.

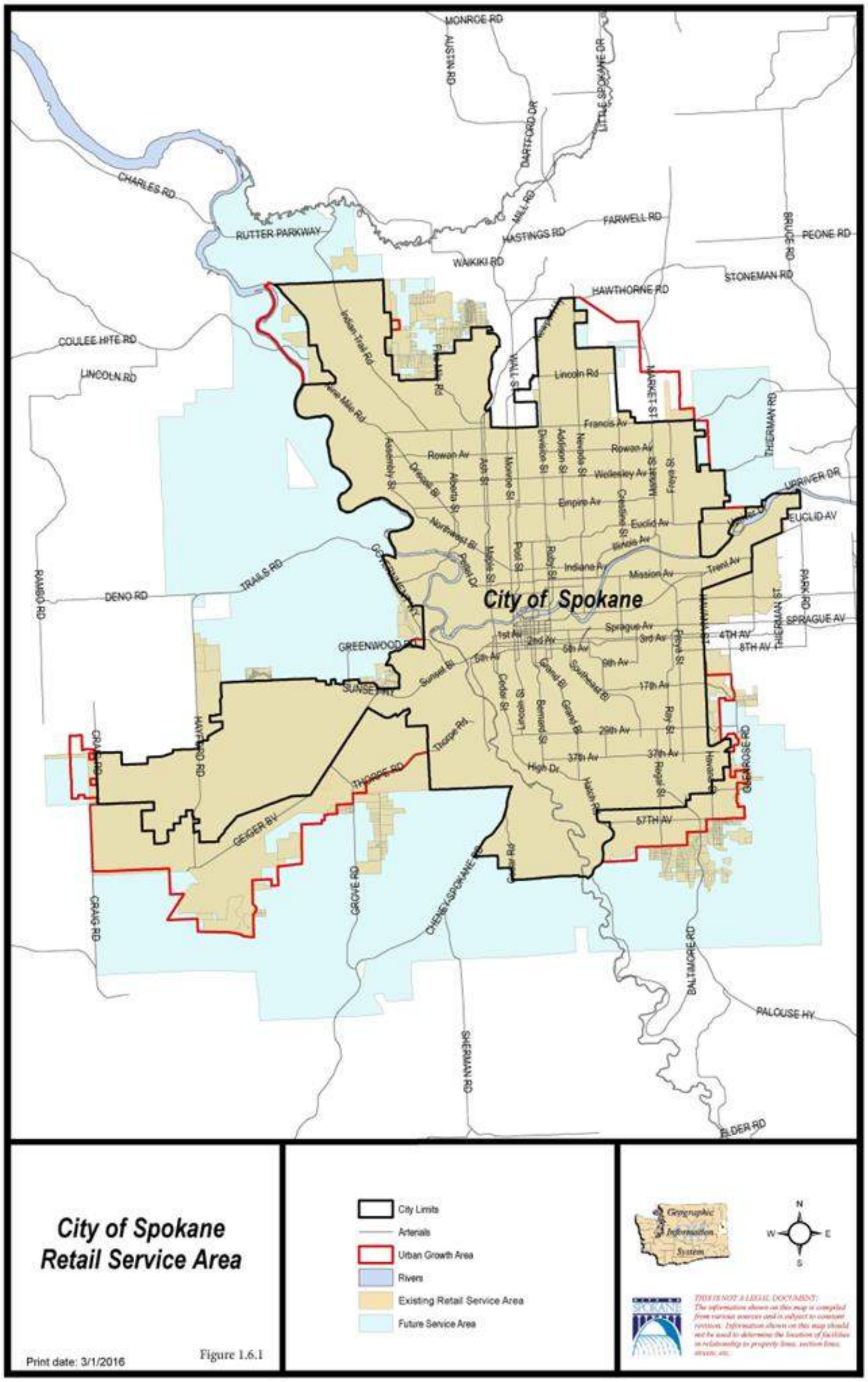

Figure 1. City of Spokane retail service area map

Source: (City of Spokane Water System Plan, 2016)

Public Infrastructure, Environment, and Sustainability Committee

Parametrix reviewed past committee minutes for 2022 through April 26 of 2021, for the Public Infrastructure, Environment, and Sustainability Committee. There was mention of the UGA in the June 28, 2021, committee minutes. Below is the paragraph in which it is mentioned.

> **“4. Retail water service area amendment**
>
> Eldon Brown, Principal Engineer, head of Developer Services and Elizabeth Schoedel, Assistant City Attorney presented the retail water service area amendment, which would allow city water service to parcels located outside the Urban Growth Area (UGA), outside the City’s Retail Water Service (RWS) Area, but inside the City’s Future Water Service Area. There are four criteria under consideration in evaluating these parcels for water service. These include: 1) is water available in a timely and reasonable manner; 2) are there sufficient water rights available; 3) is there sufficient capacity to serve; and 4) is it consistent with requirements of local plans and regulations. Eldon reviewed the applications and explained which of the appropriate criteria applied to each request. Locations where water service applications have been received include: 1) a facility in the Glenrose Prairie area that will provide public parks and recreation services; 2) various parcels zones for single-home dwellings on Five Mile Prairie; 3) a property which operates an existing farm; and 4) various parcels located in Spokane County. The resolution must come to a public hearing before it is presented to City Council for approval.”

(Public Infrastructure, Environment, and Sustainability, 2021).

The City evaluates all water service requests according to the Duty to Provide Water Service Policy and Chapter 246-290 WAC. The City of Spokane Water Department, as a municipal water supplier, has a duty to provide service to all new connections requested in its retail service area. Service within the retail service area will be provided when the service connection request meets all four elements stated in RCW 43.20.260.

Upon review of this document and the WAC 246-290 and RCW 43.20.260, the City will need to provide water services to any extension to the UGA and within the City’s service area.

Subtask 4.3 – Wholesale-Direct Services Agreements Review

The City of Spokane has intertie agreements with City of Airway Heights, Fairchild Air Force Base, City of Medical Lake, North Spokane Irrigation #8, Spokane County Water District #3, Vel View Water District #13, and Whitworth Water District #2. Parametrix reviewed the City’s intertie water service agreements. If the City decides to fluoridate the municipal water system, the current intertie agreements and water wholesale agreements will need to be amended to include fluoridation language. This item will need further review.

List of Current Intertie Agreements

- City of Airway Heights
- Fairchild Air Force Base
- City of Medical Lake
- North Spokane Irrigation #8
- Spokane County Water District #3

- Vel View Water District #13
- Whitworth Water District #2

List of Current Wholesale Agreements

- City of Airway Heights
- Whitworth Water District #2
- Spokane County Water District #3
- Fairchild Air Force Base
- Vel View Water District #13

Source: https://static.spokanecity.org/documents/publicworks/water/spokane-water-system-plan-march-2016-exhibits-appendices.pdf.

Potential Impacts to Direct Service and Wholesale Water Agreements

If the City decides to fluoridate the municipal water system, the current direct service and wholesale agreements would need to be amended to include information pertaining to fluoride being added to the water supply. Further, confirmation with DOH has indicated that there is not a requirement for a wholesale customer that receives fluoridated water through an intertie to fluoridate their other sources, even if blending fluoridated with non-fluoridated. Thus, blending two sources, one that is fluoridated and one that is not fluoridated does not trigger a need for the wholesale customer to implement fluoridation in their own supply.

Spokane Municipal Code and Ordinance Notification Requirements

If the City decides to fluoridate the municipal water supply, it will need the City Council to draft an ordinance to be added to the Spokane Municipal Code as a subsection under Chapter 13.04 outlining guidelines pertaining to fluoridation. The Spokane Municipal Code outlined under Section 01.01.070, Publication of Code, provides notification requirements for the adoption of codes:

> **Title 01 General Provisions**
>
> **Chapter 01.01 Adoption of Code**
>
> **Section 01.01.070 Publication of Code**
>
> The Spokane Municipal Code shall be published pursuant to the following schedule and standards:
>
> A. The Spokane Municipal Code shall be republished on a calendar quarterly basis at the end of each calendar quarter.
> B. Each republication of the code shall include publication on the City's website at the time of each republication.
> C. Publication on the City's website shall include a search engine at the site of each republished code that is for the context of the code.
> D. Copies of each republication of the code shall be made available for download on the City's website. The City will also provide a text-based format on CD to any database provider upon request, free of charge.

A link to the SMC is provided here: https://my.spokanecity.org/smc/?Section=01.01.070.

The RCW outlines the below notification requirements for the adoption of codes:

> **RCW 35.21.180**
>
> **Ordinances—Adoption of codes by reference.**
>
> Ordinances passed by cities or towns must be posted or published in a newspaper as required by their respective charters or the general laws: PROVIDED, That ordinances may by reference adopt Washington state statutes and codes, including fire codes and ordinances relating to the construction of buildings, the installation of plumbing, the installation of electric wiring, health and sanitation, the slaughtering, processing and selling of meats and meat products for human consumption, the production, pasteurizing and sale of milk and milk products, or other subjects, may adopt by reference, any printed code or compilation, or portions thereof, together with amendments thereof or additions thereto, on the subject of the ordinance; and where publications of ordinances in a newspaper is required, such Washington state statutes or codes or other codes or compilations so adopted need not be published therein: PROVIDED, HOWEVER, That not less than one copy of such statute, code or compilation and amendments and additions thereto adopted by reference shall be filed for use and examination by the public, in the office of the city or town clerk of said city, or town prior to adoption thereof. Any city or town ordinance heretofore adopting any state law or any such codes or compilations by reference are hereby ratified and validated.

A link to the RCW is provided here: https://app.leg.wa.gov/RCW/default.aspx?cite=35.21.180.

REFERENCES

House Bill Report ESHB 1251. (2023, February 9) Retrieved from https://apps.leg.wa.gov/documents/billdocs/2023-24/htm/bill%20reports/House/1251-S.E%20HBR%20APH%2023.htm

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Final Significant Rule Analysis. (2016, March). Retrieved from Washington State Department of Health: https://doh.wa.gov/sites/default/files/legacy/Documents/4200/FINALFluorideSA.pdf

Floride for Water Systems. (2022). Retrieved May 2022, from Washington State Department of Health: https://doh.wa.gov/community-and-environment/drinking-water/fluoride-drinking-water/fluoride-water-systems

Public Infrastructure, Environment, and Sustainability. (2021, May 24). *Standing Committee Minutes*. Spokane, WA. Retrieved from https://static.spokanecity.org/documents/bcc/committees/public-infrastructure-environment-sustainability/minutes/2021/05/pies-minutes-2021-05-24.pdf

APPENDIX J

consor FLUORIDATION COST CALCULATIONS

	Well Electric Well Electric Buildling	Concept Level Cost Capital Cost (2023 Dollars)	LCCA Cost (2023 Dollars) 50-Year Replacement Cost (2023 Dollars)	2024 12%	2025 8%	2026 5%	2027 5%	2028 5%
1	Mobilization	$ 101,200		$ 12,144.00	$ 9,067.52	$ 6,120.58	$ 6,426.60	$ 6,747.94
2	Electrical Equipment	$ 48,400	$ 242,000	$ 5,808.00	$ 4,336.64	$ 2,927.23	$ 3,073.59	$ 3,227.27
3	PLC MicroLogic 1400	$ 44,900	$ 224,500	$ 5,388.00	$ 4,023.04	$ 2,715.55	$ 2,851.33	$ 2,993.90
4	Metering Pump Skid	$ 76,000	$ 152,000	$ 9,120.00	$ 6,809.60	$ 4,596.48	$ 4,826.30	$ 5,067.62
5	Bulk Storage Tank	$ 89,200	$ 178,400	$ 10,704.00	$ 7,992.32	$ 5,394.82	$ 5,664.56	$ 5,947.78
6	Day Storage Tank	$ 20,600	$ 41,200	$ 2,472.00	$ 1,845.76	$ 1,245.89	$ 1,308.18	$ 1,373.59
7	Roll up Door	$ 10,000	$ -	$ 1,200.00	$ 896.00	$ 604.80	$ 635.04	$ 666.79
8	Man Door	$ 2,000	$ -	$ 240.00	$ 179.20	$ 120.96	$ 127.01	$ 133.36
9	Fluoride Analyzer	$ 40,000	$ 200,000	$ 4,800.00	$ 3,584.00	$ 2,419.20	$ 2,540.16	$ 2,667.17
10	Backflow Preventer	$ 6,000	$ -	$ 720.00	$ 537.60	$ 362.88	$ 381.02	$ 400.08
11	Static Mixer	$ 163,200	$ -	$ 19,584.00	$ 14,622.72	$ 9,870.34	$ 10,363.85	$ 10,882.05
12	Transfer Pump	$ 60,000	$ 120,000	$ 7,200.00	$ 5,376.00	$ 3,628.80	$ 3,810.24	$ 4,000.75
13	Secondary Containment	$ 50,000	$ -	$ 6,000.00	$ 4,480.00	$ 3,024.00	$ 3,175.20	$ 3,333.96
14	Building 647 sf (@ $290)	$ 187,600	$ -	$ 22,512.00	$ 16,808.96	$ 11,346.05	$ 11,913.35	$ 12,509.02
15	HVAC	$ 6,500	$ 13,000	$ 780.00	$ 582.40	$ 393.12	$ 412.78	$ 433.41
16	Site Improvements	$ 187,300	$ 37,460	$ 22,476.00	$ 16,782.08	$ 11,327.90	$ 11,894.30	$ 12,489.01
17	Injection Line	$ 3,900	$ -	$ 468.00	$ 349.44	$ 235.87	$ 247.67	$ 260.05
18	Sample Line	$ 400	$ -	$ 48.00	$ 35.84	$ 24.19	$ 25.40	$ 26.67
19	Plumbing and Eyewash/Shower	$ 2,000	$ -	$ 240.00	$ 179.20	$ 120.96	$ 127.01	$ 133.36
20	Drain Piping and Sewer	$ 12,000	$ -	$ 1,440.00	$ 1,075.20	$ 725.76	$ 762.05	$ 800.15
21	Drain	$ 2,000	$ -	$ 240.00	$ 179.20	$ 120.96	$ 127.01	$ 133.36
	Subtotal Capital Cost	$ 1,113,200						
	Sales Tax (City of Spokane 9%)	$ 100,200						
	Contingency 30%	$ 334,000						
	Total Capital Cost	**$ 1,547,400**						

	Well Electric Operating Cost	Cost Per Year	Annual Inflation Rate 50-Year Total Costs (2023 Dollars)	2024 12%	2025 8%	2026 5%	2027 5%	2028 5%	2029 5%	2030 5%
1	Equipment Maintenance	$ 11,200	$ 560,000	$ 12,544	$ 13,548	$ 14,225	$ 14,936	$ 15,683	$ 16,467	$ 17,290
2	Maintenance Staff	$ 11,800	$ 590,000	$ 13,216	$ 14,273	$ 14,987	$ 15,736	$ 16,523	$ 17,349	$ 18,217
3	Administration	$ 1,200	$ 60,000	$ 1,344	$ 1,452	$ 1,524	$ 1,600	$ 1,680	$ 1,764	$ 1,853
4	Operation of Equipment	$ 66,600	$ 3,330,000	$ 74,592	$ 80,559	$ 84,587	$ 88,817	$ 93,258	$ 97,920	$ 102,816
5	Power Cost	$ 1,200	$ 60,000	$ 1,344	$ 1,452	$ 1,524	$ 1,600	$ 1,680	$ 1,764	$ 1,853
6	Chemical Cost	$ 143,000	$ 7,150,000	$ 160,160	$ 172,973	$ 181,621	$ 190,703	$ 200,238	$ 210,250	$ 220,762
	Subtotal Operating Cost, 2023 Dollars	$ 235,000	$ 11,750,000				**Subtotal Operating Cost**	$ 329,062	$ 345,515	$ 362,791
	Sales Tax (Chemical, City of Spokane 9%)	$ 12,870	$ 752,270				**Sales Tax (Chemical, City of Spokane 9%)**	$ 18,021	$ 18,922	$ 19,869
	Operating Contingency 30%	$ 70,500	$ 3,525,000				**Operating Contingency 30%**	$ 98,719	$ 103,654	$ 108,837
	Average Yearly Operating (2023 Dollars)	$ 318,370					**Average Yearly Operating**	$ 445,802	$ 468,092	$ 491,496
	Replace Equipment (50 years, 2023 dollars)		$ 1,208,560							
	Sales Tax (Equipment & Chemical, City of Spokane 9%)		$ 108,770							
	Total 50-year Operating & Maintenance Cost, 2023 Dollars		**$ 17,344,700**							
	Total Capital and Life Cycle		**$ 18,892,100**							
	Total Yearly O&M Cost Average w/ Equip Replacement		**$ 346,894**							
	50-Year LCA Averaged Over 50 Years (2023 Dollars)	$ 377,800								
	Replace Equipment, Yearly (2023 Dollars)	$ 26,400								

Three-Year Operations and Maintenance Costs

	Year 1 (2028)	Year 2 (2029)	Year 3 (2030)
Equip. Op.	$ 135,800	$ 136,100	$ 136,100
Equip. Maint.	$ 46,100	$ 46,200	$ 46,200
Power	$ 2,200	$ 2,300	$ 2,500
Chemical costs	$ 278,400	$ 292,300	$ 306,900
Average Annual Cost to Operate (2028)	$ 416,400		
Average Annual cost to Maintain (2028)	$ 46,100		

Low-Range: No Contingency

Equip. Op.	$ 104,500
Equip. Maint.	$ 35,500
Power	$ 1,700
Chemical costs	$ 214,200
Average Annual Cost to Operate (2028)	$ 320,400
Average Annual cost to Maintain (2028)	$ 35,500

	Parkwater Parkwater Building	Concept Level Cost Capital Cost (2023 Dollars)	LCCA Cost (2023 Dollars) 50-Year Replacement Cost (2023 Dollars)	2024 12%	2025 8%	2026 5%	2027 5%	2028 5%
1	Mobilization	$ 115,036		$ 13,804.32	$ 10,307.23	$ 6,957.38	$ 7,305.25	$ 7,670.51
2	Electrical Equipment	$ 44,300	$ 221,500	$ 5,316.00	$ 3,969.28	$ 2,679.26	$ 2,813.23	$ 2,953.89
3	PLC MicroLogic 1400	$ 44,900	$ 224,500	$ 5,388.00	$ 4,023.04	$ 2,715.55	$ 2,851.33	$ 2,993.90
4	Metering Pump Skid	$ 136,000	$ 272,000	$ 16,320.00	$ 12,185.60	$ 8,225.28	$ 8,636.54	$ 9,068.37
5	Bulk Storage Tank	$ 89,200	$ 178,400	$ 10,704.00	$ 7,992.32	$ 5,394.82	$ 5,664.56	$ 5,947.78
6	Day Storage Tank	$ 20,800	$ 41,600	$ 2,496.00	$ 1,863.68	$ 1,257.98	$ 1,320.88	$ 1,386.93
7	Roll up Door	$ 10,000	$ -	$ 1,200.00	$ 896.00	$ 604.80	$ 635.04	$ 666.79
8	Man Door	$ 2,000	$ -	$ 240.00	$ 179.20	$ 120.96	$ 127.01	$ 133.36
9	Fluoride Analyzer	$ 80,000	$ 400,000	$ 9,600.00	$ 7,168.00	$ 4,838.40	$ 5,080.32	$ 5,334.34
10	Backflow Preventer	$ 6,000	$ -	$ 720.00	$ 537.60	$ 362.88	$ 381.02	$ 400.08
11	Static Mixer	$ 271,000	$ -	$ 32,520.00	$ 24,281.60	$ 16,390.08	$ 17,209.58	$ 18,070.06
12	Transfer Pump	$ 60,000	$ 120,000	$ 7,200.00	$ 5,376.00	$ 3,628.80	$ 3,810.24	$ 4,000.75
13	Secondary Containment	$ 50,000	$ -	$ 6,000.00	$ 4,480.00	$ 3,024.00	$ 3,175.20	$ 3,333.96
14	Building 915 sf @ $290	$ 265,300	$ -	$ 31,836.00	$ 23,770.88	$ 16,045.34	$ 16,847.61	$ 17,689.99
15	HVAC	$ 9,200	$ 18,400	$ 1,104.00	$ 824.32	$ 556.42	$ 584.24	$ 613.45
16	Site Improvements	$ 39,200	$ 7,840	$ 4,704.00	$ 3,512.32	$ 2,370.82	$ 2,489.36	$ 2,613.82
17	Injection Line	$ 2,660	$ -	$ 319.20	$ 238.34	$ 160.88	$ 168.92	$ 177.37
18	Sample Line	$ 3,800	$ -	$ 456.00	$ 340.48	$ 229.82	$ 241.32	$ 253.38
19	Plumbing and Eyewash/Shower	$ 2,000	$ -	$ 240.00	$ 179.20	$ 120.96	$ 127.01	$ 133.36
20	Drain Piping and Sewer	$ 12,000	$ -	$ 1,440.00	$ 1,075.20	$ 725.76	$ 762.05	$ 800.15
21	Drain	$ 2,000	$ -	$ 240.00	$ 179.20	$ 120.96	$ 127.01	$ 133.36
	Subtotal Capital Cost	$ 1,265,400						
	Sales Tax (City of Spokane 9%)	$ 113,900						
	Contingency 30%	$ 379,700						
	Total Capital Cost	**$ 1,759,000**						

	Parkwater Operating Cost	Cost Per Year	Annual Inflation Rate 50-Year Total Costs (2023 Dollars)	2024 12%	2025 8%	2026 5%	2027 5%	2028 5%	2029 5%	2030 5%
1	Equipment Maintenance	$ 12,700	$ 635,000	$ 14,224	$ 15,362	$ 16,130	$ 16,937	$ 17,783	$ 18,673	$ 19,606
2	Maintenance Staff	$ 11,800	$ 590,000	$ 13,216	$ 14,273	$ 14,987	$ 15,736	$ 16,523	$ 17,349	$ 18,217
3	Administration	$ 1,200	$ 60,000	$ 1,344	$ 1,452	$ 1,524	$ 1,600	$ 1,680	$ 1,764	$ 1,853
4	Operation of Equipment	$ 66,600	$ 3,330,000	$ 74,592	$ 80,559	$ 84,587	$ 88,817	$ 93,258	$ 97,920	$ 102,816
5	Power Cost	$ 1,500	$ 75,000	$ 1,680	$ 1,814	$ 1,905	$ 2,000	$ 2,100	$ 2,205	$ 2,316
6	Chemical Cost	$ 179,900	$ 8,995,000	$ 201,488	$ 217,607	$ 228,487	$ 239,912	$ 251,907	$ 264,503	$ 277,728
	Subtotal Operating Cost, 2023 Dollars	$ 273,700	$ 13,685,000							
	Sales Tax (Chemical, City of Spokane 9%)	$ 16,191	$ 943,132							
	Operating Contingency 30%	$ 82,110	$ 4,105,500							
	Average Yearly Operating (2023 Dollars)	$ 372,001								
	Replace Equipment (50 years, 2023 dollars)		$ 1,484,240							
	Sales Tax (Equipment & Chemical, City of Spokane 9%)		$ 133,582							
	Total 50-year Operating & Maintenance Cost, 2023 Dollars		**$ 20,351,500**							
	Total Capital and Life Cycle		**$ 22,110,500**							
	Total Yearly O&M Cost Average w/ Equip Replacement		**$ 407,000**							
	50-Year LCA Averaged Over 50 Years (2023 Dollars)	$ 442,200								
	Replace Equipment, Yearly (2023 Dollars)	$ 32,400								

	2028	2029	2030
Subtotal Operating Cost	$ 383,252	$ 402,415	$ 422,535
Sales Tax (Chemical, City of Spokane 9%)	$ 22,672	$ 23,805	$ 24,996
Operating Contingency 30%	$ 114,976	$ 120,724	$ 126,761
Average Yearly Operating	$ 520,899	$ 546,944	$ 574,291

Three-Year Operations and Maintenance Costs

	Year 1 (2028)	Year 2 (2029)	Year 3 (2030)
Equip. Op.	$ 135,800	$ 136,100	$ 136,100
Equip. Maint.	$ 49,100	$ 49,200	$ 49,200
Power	$ 2,800	$ 2,900	$ 3,100
Chemical costs	$ 350,200	$ 367,700	$ 386,100
Average Annual Cost to Operate (2028)	$ 488,800		
Average Annual cost to Maintain (2028)	$ 49,100		

Low-Range: No Contingency

Equip. Op.	$ 104,500
Equip. Maint.	$ 37,800
Power	$ 2,200
Chemical costs	$ 269,400
Average Annual Cost to Operate (2028)	$ 376,100
Average Annual cost to Maintain (2028)	$ 37,800

	Ray Ray St Building	Concept Level Cost Capital Cost (2023 Dollars)	LCCA Cost (2023 Dollars) 50-Year Replacement Cost (2023 Dollars)	2024 12%	2025 8%	2026 5%	2027 5%	2028 5%
1	Mobilization	$ 98,110		$ 11,773.20	$ 8,790.66	$ 5,933.69	$ 6,230.38	$ 6,541.90
2	Electrical Equipment	$ 42,000	$ 210,000	$ 5,040.00	$ 3,763.20	$ 2,540.16	$ 2,667.17	$ 2,800.53
3	PLC MicroLogic 1400	$ 44,900	$ 224,500	$ 5,388.00	$ 4,023.04	$ 2,715.55	$ 2,851.33	$ 2,993.90
4	Metering Pump Skid	$ 61,000	$ 122,000	$ 7,320.00	$ 5,465.60	$ 3,689.28	$ 3,873.74	$ 4,067.43
5	Bulk Storage Tank	$ 62,400	$ 124,800	$ 7,488.00	$ 5,591.04	$ 3,773.95	$ 3,962.65	$ 4,160.78
6	Day Storage Tank	$ 19,600	$ 39,200	$ 2,352.00	$ 1,756.16	$ 1,185.41	$ 1,244.68	$ 1,306.91
7	Roll up Door	$ 10,000	$ -	$ 1,200.00	$ 896.00	$ 604.80	$ 635.04	$ 666.79
8	Man Door	$ 2,000	$ -	$ 240.00	$ 179.20	$ 120.96	$ 127.01	$ 133.36
9	Fluoride Analyzer	$ 20,000	$ 100,000	$ 2,400.00	$ 1,792.00	$ 1,209.60	$ 1,270.08	$ 1,333.58
10	Backflow Preventer	$ 6,000	$ -	$ 720.00	$ 537.60	$ 362.88	$ 381.02	$ 400.08
11	Static Mixer	$ 110,800	$ -	$ 13,296.00	$ 9,927.68	$ 6,701.18	$ 7,036.24	$ 7,388.06
12	Transfer Pump	$ 60,000	$ 120,000	$ 7,200.00	$ 5,376.00	$ 3,628.80	$ 3,810.24	$ 4,000.75
13	Secondary Containment	$ 50,000	$ -	$ 6,000.00	$ 4,480.00	$ 3,024.00	$ 3,175.20	$ 3,333.96
14	Building 729 sf @ $390	$ 284,300	$ -	$ 34,116.00	$ 25,473.28	$ 17,194.46	$ 18,054.19	$ 18,956.90
15	HVAC	$ 7,300	$ 14,600	$ 876.00	$ 654.08	$ 441.50	$ 463.58	$ 486.76
16	Site Improvements	$ 168,800	$ 33,760	$ 20,256.00	$ 15,124.48	$ 10,209.02	$ 10,719.48	$ 11,255.45
17	Injection Line	$ 1,000	$ -	$ 120.00	$ 89.60	$ 60.48	$ 63.50	$ 66.68
18	Sample Line	$ 3,000	$ -	$ 360.00	$ 268.80	$ 181.44	$ 190.51	$ 200.04
19	Plumbing and Eyewash/Shower	$ 2,000	$ -	$ 240.00	$ 179.20	$ 120.96	$ 127.01	$ 133.36
20	Drain Piping and Sewer	$ 24,000	$ -	$ 2,880.00	$ 2,150.40	$ 1,451.52	$ 1,524.10	$ 1,600.30
21	Drain	$ 2,000	$ -	$ 240.00	$ 179.20	$ 120.96	$ 127.01	$ 133.36
	Subtotal Capital Cost	$ 1,079,300						
	Sales Tax (City of Spokane 9%)	$ 97,100						
	Contingency 30%	$ 323,800						
	Total Capital Cost	**$ 1,500,200**						

	Ray Operating Cost	Cost Per Year	Annual Inflation 50-Year Total Costs (2023 Dollars)	2024 12%	2025 8%	2026 5%	2027 5%	2028 5%	2029 5%	2030 5%
1	Equipment Maintenance	$ 10,800	$ 540,000	$ 12,096	$ 13,064	$ 13,717	$ 14,403	$ 15,123	$ 15,879	$ 16,673
2	Maintenance Staff	$ 11,800	$ 590,000	$ 13,216	$ 14,273	$ 14,987	$ 15,736	$ 16,523	$ 17,349	$ 18,217
3	Administration	$ 1,200	$ 60,000	$ 1,344	$ 1,452	$ 1,524	$ 1,600	$ 1,680	$ 1,764	$ 1,853
4	Operation of Equipment	$ 50,500	$ 2,525,000	$ 56,560	$ 61,085	$ 64,139	$ 67,346	$ 70,713	$ 74,249	$ 77,961
5	Power Cost	$ 800	$ 40,000	$ 896	$ 968	$ 1,016	$ 1,067	$ 1,120	$ 1,176	$ 1,235
6	Chemical Cost	$ 51,400	$ 2,570,000	$ 57,568	$ 62,173	$ 65,282	$ 68,546	$ 71,974	$ 75,572	$ 79,351
	Subtotal Operating Cost, 2023 Dollars	$ 126,500	$ 6,325,000				**Subtotal Operating Cost**	$ 177,133	$ 185,990	$ 195,289
	Sales Tax (Chemical, City of Spokane 9%)	$ 4,626	$ 320,297				**Sales Tax (Chemical, City of Spokane 9%)**	$ 6,478	$ 6,801	$ 7,142
	Operating Contingency 30%	$ 37,950	$ 1,897,500				**Operating Contingency 30%**	$ 53,140	$ 55,797	$ 58,587
	Average Yearly Operating (2023 Dollars)	$ 169,076					**Average Yearly Operating**	$ 236,751	$ 248,588	$ 261,018
	Replace Equipment (50 years, 2023 dollars)		$ 988,860							
	Sales Tax (Equipment & Chemical, City of Spokane 9%)		$ 88,997							
	Total 50-year Operating & Maintenance Cost, 2023 Dollars		**$ 9,620,700**							
	Total Capital and Life Cycle		**$ 11,120,900**							
	Total Yearly O&M Cost Average w/ Equip Replacement		**$ 192,400**							
	50-Year LCA Averaged Over 50 Years (2023 Dollars)	$ 222,400								
	Replace Equipment, Yearly (2023 Dollars)	$ 21,600								

Three-Year Operations and Maintenance Costs

	Year 1 (2028)	Year 2 (2029)	Year 3 (2030)
Equip. Op.	$ 103,600	$ 103,800	$ 103,800
Equip. Maint.	$ 45,300	$ 45,400	$ 45,400
Power	$ 1,500	$ 1,600	$ 1,700
Chemical costs	$ 100,100	$ 105,100	$ 110,300
Average Annual Cost to Operate (2028)	$ 205,200		
Average Annual cost to Maintain (2028)	$ 45,300		

Low-Range: No Contingency

Equip. Op.	$ 79,700
Equip. Maint.	$ 34,800
Power	$ 1,200
Chemical costs	$ 77,000
Average Annual Cost to Operate (2028)	$ 157,900
Average Annual cost to Maintain (2028)	$ 34,800

	Central Central Ave Building	Concept Level Cost Capital Cost (2023 Dollars)	LCCA Cost (2023 Dollars) 50-Year Replacement Cost (2023 Dollars)	2024 12%	2025 8%	2026 5%	2027 5%	2028 5%
1	Mobilization	$ 100,989		$ 12,118.68	$ 9,048.61	$ 6,107.81	$ 6,413.21	$ 6,733.87
2	Electrical Equipment	$ 38,100	$ 190,500	$ 4,572.00	$ 3,413.76	$ 2,304.29	$ 2,419.50	$ 2,540.48
3	PLC MicroLogic 1400	$ 44,900	$ 224,500	$ 5,388.00	$ 4,023.04	$ 2,715.55	$ 2,851.33	$ 2,993.90
4	Metering Pump Skid	$ 46,000	$ 92,000	$ 5,520.00	$ 4,121.60	$ 2,782.08	$ 2,921.18	$ 3,067.24
5	Bulk Storage Tank	$ 57,200	$ 114,400	$ 6,864.00	$ 5,125.12	$ 3,459.46	$ 3,632.43	$ 3,814.05
6	Day Storage Tank	$ 19,600	$ 39,200	$ 2,352.00	$ 1,756.16	$ 1,185.41	$ 1,244.68	$ 1,306.91
7	Roll up Door	$ 10,000	$ -	$ 1,200.00	$ 896.00	$ 604.80	$ 635.04	$ 666.79
8	Man Door	$ 2,000	$ -	$ 240.00	$ 179.20	$ 120.96	$ 127.01	$ 133.36
9	Fluoride Analyzer	$ 20,000	$ 100,000	$ 2,400.00	$ 1,792.00	$ 1,209.60	$ 1,270.08	$ 1,333.58
10	Backflow Preventer	$ 6,000	$ 12,000	$ 720.00	$ 537.60	$ 362.88	$ 381.02	$ 400.08
11	Static Mixer	$ 86,200	$ -	$ 10,344.00	$ 7,723.52	$ 5,213.38	$ 5,474.04	$ 5,747.75
12	Transfer Pump	$ 60,000	$ 120,000	$ 7,200.00	$ 5,376.00	$ 3,628.80	$ 3,810.24	$ 4,000.75
13	Secondary Containment	$ 50,000	$ -	$ 6,000.00	$ 4,480.00	$ 3,024.00	$ 3,175.20	$ 3,333.96
14	Building 1132 sf @ $390	$ 441,400	$ -	$ 52,968.00	$ 39,549.44	$ 26,695.87	$ 28,030.67	$ 29,432.20
	Demo Existing Building	$ 20,000		$ 2,400.00	$ 1,792.00	$ 1,209.60	$ 1,270.08	$ 1,333.58
15	HVAC	$ 11,400	$ 22,800	$ 1,368.00	$ 1,021.44	$ 689.47	$ 723.95	$ 760.14
16	Site Improvements	$ 67,000	$ 13,400	$ 8,040.00	$ 6,003.20	$ 4,052.16	$ 4,254.77	$ 4,467.51
17	Injection Line	$ 1,440	$ -	$ 172.80	$ 129.02	$ 87.09	$ 91.45	$ 96.02
18	Sample Line	$ 650	$ -	$ 78.00	$ 58.24	$ 39.31	$ 41.28	$ 43.34
19	Plumbing and Eyewash/Shower	$ 2,000	$ -	$ 240.00	$ 179.20	$ 120.96	$ 127.01	$ 133.36
20	Drain Piping and Sewer	$ 24,000	$ -	$ 2,880.00	$ 2,150.40	$ 1,451.52	$ 1,524.10	$ 1,600.30
21	Drain	$ 2,000	$ -	$ 240.00	$ 179.20	$ 120.96	$ 127.01	$ 133.36
	Subtotal Capital Cost	$ 1,110,900						
	Sales Tax (City of Spokane 9%)	$ 100,000						
	Contingency 30%	$ 333,300						
	Total Capital Cost	**$ 1,544,200**						

	Central Operating Cost	Cost Per Year	Annual Inflation 50-Year Total Costs (2023 Dollars)	2024 12%	2025 8%	2026 5%	2027 5%	2028 5%	2029 5%	2030 5%
1	Equipment Maintenance	$ 11,200	$ 560,000	$ 12,544	$ 13,548	$ 14,225	$ 14,936	$ 15,683	$ 16,467	$ 17,290
2	Maintenance Staff	$ 11,800	$ 590,000	$ 13,216	$ 14,273	$ 14,987	$ 15,736	$ 16,523	$ 17,349	$ 18,217
3	Administration	$ 1,200	$ 60,000	$ 1,344	$ 1,452	$ 1,524	$ 1,600	$ 1,680	$ 1,764	$ 1,853
4	Operation of Equipment	$ 50,500	$ 2,525,000	$ 56,560	$ 61,085	$ 64,139	$ 67,346	$ 70,713	$ 74,249	$ 77,961
5	Power Cost	$ 800	$ 40,000	$ 896	$ 968	$ 1,016	$ 1,067	$ 1,120	$ 1,176	$ 1,235
6	Chemical Cost	$ 45,200	$ 2,260,000	$ 50,624	$ 54,674	$ 57,408	$ 60,278	$ 63,292	$ 66,456	$ 69,779
	Subtotal Operating Cost, 2023 Dollars	$ 120,700	$ 6,035,000				**Subtotal Operating Cost**	$ 169,012	$ 177,462	$ 186,335
	Sales Tax (Chemical, City of Spokane 9%)	$ 4,068	$ 269,847				**Sales Tax (Chemical, City of Spokane 9%)**	$ 5,696	$ 5,981	$ 6,280
	Operating Contingency 30%	$ 36,210	$ 1,810,500				**Operating Contingency 30%**	$ 50,704	$ 53,239	$ 55,901
	Average Yearly Operating (2023 Dollars)	$ 160,978					**Average Yearly Operating**	$ 225,412	$ 236,682	$ 248,516
	Replace Equipment (50 years, 2023 dollars)		$ 738,300							
	Sales Tax (Equipment & Chemical, City of Spokane 9%)		$ 66,447							
	Total 50-year Operating & Maintenance Cost, 2023 Dollars		**$ 8,920,100**							
	Total Capital and Life Cycle		$ 10,464,300							
	Total Yearly O&M Cost Average w/ Equip Replacement		**$ 178,400**							
	50-Year LCA Averaged Over 50 Years (2023 Dollars)	$ 209,300								
	Replace Equipment, Yearly (2023 Dollars)	$ 16,100								

	Three-Year Operations and Maintenance Costs		
	Year 1 (2028)	Year 2 (2029)	Year 3 (2030)
Equip. Op.	$ 103,600	$ 103,800	$ 103,800
Equip. Maint.	$ 46,100	$ 46,200	$ 46,200
Power	$ 1,500	$ 1,600	$ 1,700
Chemical costs	$ 88,000	$ 92,400	$ 97,000
Average Annual Cost to Operate (2028)	$ 193,100		
Average Annual cost to Maintain (2028)	$ 46,100		

	Low-Range: No Contingency
Equip. Op.	$ 79,700
Equip. Maint.	$ 35,500
Power	$ 1,200
Chemical costs	$ 67,700
Average Annual Cost to Operate (2028)	$ 148,600

	Hoffman	Concept Level Cost	LCCA Cost (2023 Dollars)	2024	2025	2026	2027	2028
	Hoffman Building	Capital Cost (2023 Dollars)	50-Year Replacement Cost (2023 Dollars)	12%	8%	5%	5%	5%
1	Mobilization	$ 93,750		$ 11,250.00	$ 8,400.00	$ 5,670.00	$ 5,953.50	$ 6,251.18
2	Electrical Equipment	$ 42,100	$ 210,500	$ 5,052.00	$ 3,772.16	$ 2,546.21	$ 2,673.52	$ 2,807.19
3	PLC MicroLogic 1400	$ 44,900	$ 224,500	$ 5,388.00	$ 4,023.04	$ 2,715.55	$ 2,851.33	$ 2,993.90
4	Metering Pump Skid	$ 46,000	$ 92,000	$ 5,520.00	$ 4,121.60	$ 2,782.08	$ 2,921.18	$ 3,067.24
5	Bulk Storage Tank	$ 38,400	$ 76,800	$ 4,608.00	$ 3,440.64	$ 2,322.43	$ 2,438.55	$ 2,560.48
6	Day Storage Tank	$ 19,000	$ 38,000	$ 2,280.00	$ 1,702.40	$ 1,149.12	$ 1,206.58	$ 1,266.90
7	Roll up Door	$ 10,000	$ -	$ 1,200.00	$ 896.00	$ 604.80	$ 635.04	$ 666.79
8	Man Door	$ 2,000	$ -	$ 240.00	$ 179.20	$ 120.96	$ 127.01	$ 133.36
9	Fluoride Analyzer	$ 10,000	$ 50,000	$ 1,200.00	$ 896.00	$ 604.80	$ 635.04	$ 666.79
10	Backflow Preventer	$ 6,000	$ 12,000	$ 720.00	$ 537.60	$ 362.88	$ 381.02	$ 400.08
11	Static Mixer	$ 59,800	$ -	$ 7,176.00	$ 5,358.08	$ 3,616.70	$ 3,797.54	$ 3,987.42
12	Transfer Pump	$ 60,000	$ 120,000	$ 7,200.00	$ 5,376.00	$ 3,628.80	$ 3,810.24	$ 4,000.75
13	Secondary Containment	$ 50,000	$ -	$ 6,000.00	$ 4,480.00	$ 3,024.00	$ 3,175.20	$ 3,333.96
14	Building 729 sf @ $390	$ 284,300	$ -	$ 34,116.00	$ 25,473.28	$ 17,194.46	$ 18,054.19	$ 18,956.90
15	HVAC	$ 7,300	$ 14,600	$ 876.00	$ 654.08	$ 441.50	$ 463.58	$ 486.76
16	Site Improvements	$ 227,900	$ 45,580	$ 27,348.00	$ 20,419.84	$ 13,783.39	$ 14,472.56	$ 15,196.19
17	Injection Line	$ 400	$ -	$ 48.00	$ 35.84	$ 24.19	$ 25.40	$ 26.67
18	Sample Line	$ 1,400	$ -	$ 168.00	$ 125.44	$ 84.67	$ 88.91	$ 93.35
19	Plumbing and Eyewash/Shower	$ 2,000	$ -	$ 240.00	$ 179.20	$ 120.96	$ 127.01	$ 133.36
20	Drain Piping and Sewer	$ 24,000	$ -	$ 2,880.00	$ 2,150.40	$ 1,451.52	$ 1,524.10	$ 1,600.30
21	Drain	$ 2,000	$ -	$ 240.00	$ 179.20	$ 120.96	$ 127.01	$ 133.36
	Subtotal Capital Cost	$ 1,031,300						
	Sales Tax (City of Spokane 9%)	$ 92,800						
	Contingency 30%	$ 309,400						
	Total Capital Cost	**$ 1,433,500**						

	Hoffman Operating Cost	Cost Per Year	Annual Inflation 50-Year Total Costs (2023 Dollars)	2024	2025	2026	2027	2028	2029	2030
				12%	8%	5%	5%	5%	5%	5%
1	Equipment Maintenance	$ 10,400	$ 520,000	$ 11,648	$ 12,580	$ 13,209	$ 13,869	$ 14,563	$ 15,291	$ 16,055
2	Maintenance Staff	$ 11,800	$ 590,000	$ 13,216	$ 14,273	$ 14,987	$ 15,736	$ 16,523	$ 17,349	$ 18,217
3	Administration	$ 1,200	$ 60,000	$ 1,344	$ 1,452	$ 1,524	$ 1,600	$ 1,680	$ 1,764	$ 1,853
4	Operation of Equipment	$ 50,500	$ 2,525,000	$ 56,560	$ 61,085	$ 64,139	$ 67,346	$ 70,713	$ 74,249	$ 77,961
5	Power Cost	$ 700	$ 35,000	$ 784	$ 847	$ 889	$ 934	$ 980	$ 1,029	$ 1,081
6	Chemical Cost	$ 23,900	$ 1,195,000	$ 26,768	$ 28,909	$ 30,355	$ 31,873	$ 33,466	$ 35,140	$ 36,897
	Subtotal Operating Cost, 2023 Dollars	$ 98,500	$ 4,925,000				**Subtotal Operating Cost**	$ 137,926	$ 144,822	$ 152,063
	Sales Tax (Chemical, City of Spokane 9%)	$ 2,151	$ 187,108				**Sales Tax (Chemical, City of Spokane 9%)**	$ 3,012	$ 3,163	$ 3,321
	Operating Contingency 30%	$ 29,550	$ 1,477,500				**Operating Contingency 30%**	$ 41,378	$ 43,447	$ 45,619
	Average Yearly Operating (2023 Dollars)	$ 130,201					**Average Yearly Operating**	$ 182,316	$ 191,431	$ 201,003
	Replace Equipment (50 years, 2023 dollars)		$ 883,980							
	Sales Tax (Equipment & Chemical, City of Spokane 9%)		$ 79,558							
	Total 50-year Operating & Maintenance Cost, 2023 Dollars		**$ 7,553,200**							
	Total Capital and Life Cycle		**$ 8,986,700**							
	Total Yearly O&M Cost Average w/ Equip Replacement		**$ 151,100**							
	50-Year LCA Averaged Over 50 Years (2023 Dollars)	$ 179,700								
	Replace Equipment, Yearly (2023 Dollars)	$ 19,300								

Three-Year Operations and Maintenance Costs

	Year 1 (2028)	Year 2 (2029)	Year 3 (2030)
Equip. Op.	$ 103,600	$ 103,800	$ 103,800
Equip. Maint.	$ 44,500	$ 44,600	$ 44,600
Power	$ 1,300	$ 1,400	$ 1,500
Chemical costs	$ 46,600	$ 48,900	$ 51,300
Average Annual Cost to Operate (2028)	$ 151,500		
Average Annual cost to Maintain (2028)	$ 44,500		

Low-Range: No Contingency

Equip. Op.	$ 79,700
Equip. Maint.	$ 34,200
Power	$ 1,000
Chemical costs	$ 35,800
Average Annual Cost to Operate (2028)	$ 116,500
Average Annual cost to Maintain (2028)	$ 34,200

	Nevada AND Grace (One Building)							
	Nevada/Grace Buildling	Concept Level Cost	LCCA Cost (2023 Dollars)	2024	2025	2026	2027	2028
				12%	8%	5%	5%	5%
		Capital Cost (2023 Dollars)	50-Year Replacement Cost (2023 Dollars)					
1	Mobilization	$ 99,274		$ 11,912.88	$ 8,894.95	$ 6,004.09	$ 6,304.30	$ 6,619.51
2	Electrical Equipment	$ 42,000	$ 210,000	$ 5,040.00	$ 3,763.20	$ 2,540.16	$ 2,667.17	$ 2,800.53
3	PLC MicroLogic 1400	$ 44,900	$ 224,500	$ 5,388.00	$ 4,023.04	$ 2,715.55	$ 2,851.33	$ 2,993.90
4	Metering Pump Skid	$ 106,000	$ 212,000	$ 12,720.00	$ 9,497.60	$ 6,410.88	$ 6,731.42	$ 7,068.00
5	Bulk Storage Tank	$ 89,200	$ 178,400	$ 10,704.00	$ 7,992.32	$ 5,394.82	$ 5,664.56	$ 5,947.78
6	Day Storage Tank	$ 20,600	$ 41,200	$ 2,472.00	$ 1,845.76	$ 1,245.89	$ 1,308.18	$ 1,373.59
7	Roll up Door	$ 10,000	$ -	$ 1,200.00	$ 896.00	$ 604.80	$ 635.04	$ 666.79
8	Man Door	$ 2,000	$ -	$ 240.00	$ 179.20	$ 120.96	$ 127.01	$ 133.36
9	Fluoride Analyzer	$ 40,000	$ 200,000	$ 4,800.00	$ 3,584.00	$ 2,419.20	$ 2,540.16	$ 2,667.17
10	Backflow Preventer	$ 6,000	$ 12,000	$ 720.00	$ 537.60	$ 362.88	$ 381.02	$ 400.08
11	Static Mixer	$ 257,000	$ -	$ 30,840.00	$ 23,027.20	$ 15,543.36	$ 16,320.53	$ 17,136.55
12	Transfer Pump	$ 60,000	$ 120,000	$ 7,200.00	$ 5,376.00	$ 3,628.80	$ 3,810.24	$ 4,000.75
13	Secondary Containment	$ 50,000	$ -	$ 6,000.00	$ 4,480.00	$ 3,024.00	$ 3,175.20	$ 3,333.96
14	Building 647 sf @ $290	$ 187,600	$ -	$ 22,512.00	$ 16,808.96	$ 11,346.05	$ 11,913.35	$ 12,509.02
15	HVAC	$ 6,500	$ 13,000	$ 780.00	$ 582.40	$ 393.12	$ 412.78	$ 433.41
16	Site Improvements		$ -	$ -	$ -	$ -	$ -	$ -
17	Injection Line	$ 3,540	$ -	$ 424.80	$ 317.18	$ 214.10	$ 224.80	$ 236.04
18	Sample Line	$ 3,400	$ -	$ 408.00	$ 304.64	$ 205.63	$ 215.91	$ 226.71
19	Plumbing and Eyewash/Shower	$ 2,000	$ -	$ 240.00	$ 179.20	$ 120.96	$ 127.01	$ 133.36
20	Drain Piping and Sewer	$ 60,000	$ -	$ 7,200.00	$ 5,376.00	$ 3,628.80	$ 3,810.24	$ 4,000.75
21	Drain	$ 2,000	$ -	$ 240.00	$ 179.20	$ 120.96	$ 127.01	$ 133.36
	Subtotal Capital Cost	$ 1,092,100						
	Sales Tax (City of Spokane 9%)	$ 98,300						
	Contingency 30%	$ 327,700						
	Total Capital Cost	**$ 1,518,100**						

	Nevage / Grace Operating Cost	Cost Per Year	Annual Inflation 50-Year Total Costs (2023 Dollars)	2024	2025	2026	2027	2028	2029	2030
				12%	8%	5%	5%	5%	5%	5%
1	Equipment Maintenance	$ 11,000	$ 550,000	$ 12,320	$ 13,306	$ 13,971	$ 14,669	$ 15,403	$ 16,173	$ 16,982
2	Maintenance Staff	$ 11,800	$ 590,000	$ 13,216	$ 14,273	$ 14,987	$ 15,736	$ 16,523	$ 17,349	$ 18,217
3	Administration	$ 1,200	$ 60,000	$ 1,344	$ 1,452	$ 1,524	$ 1,600	$ 1,680	$ 1,764	$ 1,853
4	Operation of Equipment	$ 50,500	$ 2,525,000	$ 56,560	$ 61,085	$ 64,139	$ 67,346	$ 70,713	$ 74,249	$ 77,961
5	Power Cost	$ 800	$ 40,000	$ 896	$ 968	$ 1,016	$ 1,067	$ 1,120	$ 1,176	$ 1,235
6	Chemical Cost	$ 101,500	$ 5,075,000	$ 113,680	$ 122,774	$ 128,913	$ 135,359	$ 142,127	$ 149,233	$ 156,695
	Subtotal Operating Cost, 2023 Dollars	$ 176,800	$ 8,840,000				**Subtotal Operating Cost**	$ 247,567	$ 259,945	$ 272,942
	Sales Tax (Chemical, City of Spokane 9%)	$ 9,135	$ 565,749				**Sales Tax (Chemical, City of Spokane 9%)**	$ 12,791	$ 13,431	$ 14,103
	Operating Contingency 30%	$ 53,040	$ 2,652,000				**Operating Contingency 30%**	$ 74,270	$ 77,983	$ 81,883
	Average Yearly Operating (2023 Dollars)	$ 238,975					**Average Yearly Operating**	$ 334,628	$ 351,359	$ 368,927
	Replace Equipment (50 years, 2023 dollars)		$ 1,211,100							
	Sales Tax (Equipment & Chemical, City of Spokane 9%)		$ 108,999							
	Total 50-year Operating & Maintenance Cost, 2023 Dollars		**$ 13,377,900**							
	Total Capital and Life Cycle		**$ 14,896,000**							
	Total Yearly O&M Cost Average w/ Equip Replacement		**$ 267,600**							
	50-Year LCA Averaged Over 50 Years (2023 Dollars)	$ 297,900								
	Replace Equipment, Yearly (2023 Dollars)	$ 26,500								

Three-Year Operations and Maintenance Costs

	Year 1 (2028)	Year 2 (2029)	Year 3 (2030)
Equip. Op.	$ 103,600	$ 103,800	$ 103,800
Equip. Maint.	$ 45,700	$ 45,800	$ 45,800
Power	$ 1,500	$ 1,600	$ 1,700
Chemical costs	$ 197,600	$ 207,500	$ 217,900
Average Annual Cost to Operate (2028)	$ 302,700		
Average Annual cost to Maintain (2028)	$ 45,700		

Low-Range: No Contingency

Equip. Op.	$ 79,700
Equip. Maint.	$ 35,200
Power	$ 1,200
Chemical costs	$ 152,000
Average Annual Cost to Operate (2028)	$ 232,900
Average Annual cost to Maintain (2028)	$ 35,200

	Havana Havana Building (Residential)	Concept Level Cost Capital Cost (2023 Dollars)	LCCA Cost (2023 Dollars) 50-Year Replacement Cost (2023 Dollars)	2024 12%	2025 8%	2026 5%	2027 5%	2028 5%
1	Mobilization	$ 110,790		$ 13,294.80	$ 9,926.78	$ 6,700.58	$ 7,035.61	$ 7,387.39
2	Electrical Equipment	$ 50,300	$ 251,500	$ 6,036.00	$ 4,506.88	$ 3,042.14	$ 3,194.25	$ 3,353.96
3	PLC MicroLogic 1400	$ 45,000	$ 225,000	$ 5,400.00	$ 4,032.00	$ 2,721.60	$ 2,857.68	$ 3,000.56
4	Metering Pump Skid	$ 106,000	$ 212,000	$ 12,720.00	$ 9,497.60	$ 6,410.88	$ 6,731.42	$ 7,068.00
5	Bulk Storage Tank	$ 64,000	$ 128,000	$ 7,680.00	$ 5,734.40	$ 3,870.72	$ 4,064.26	$ 4,267.47
6	Day Storage Tank	$ 19,400	$ 38,800	$ 2,328.00	$ 1,738.24	$ 1,173.31	$ 1,231.98	$ 1,293.58
7	Roll up Door	$ 10,000	$ -	$ 1,200.00	$ 896.00	$ 604.80	$ 635.04	$ 666.79
8	Man Door	$ 8,000	$ -	$ 960.00	$ 716.80	$ 483.84	$ 508.03	$ 533.43
9	Fluoride Analyzer	$ 10,000	$ 50,000	$ 1,200.00	$ 896.00	$ 604.80	$ 635.04	$ 666.79
10	Backflow Preventer	$ 6,000	$ 12,000	$ 720.00	$ 537.60	$ 362.88	$ 381.02	$ 400.08
11	Static Mixer	$ 258,400	$ -	$ 31,008.00	$ 23,152.64	$ 15,628.03	$ 16,409.43	$ 17,229.91
12	Transfer Pump	$ 60,000	$ 120,000	$ 7,200.00	$ 5,376.00	$ 3,628.80	$ 3,810.24	$ 4,000.75
13	Secondary Containment	$ 50,000	$ -	$ 6,000.00	$ 4,480.00	$ 3,024.00	$ 3,175.20	$ 3,333.96
14	Building 915 sf @ $390	$ 356,800	$ -	$ 42,816.00	$ 31,969.28	$ 21,579.26	$ 22,658.23	$ 23,791.14
15	HVAC	$ 9,200	$ 18,400	$ 1,104.00	$ 824.32	$ 556.42	$ 584.24	$ 613.45
16	Site Improvements		$ -	$ -	$ -	$ -	$ -	$ -
17	Injection Line	$ 2,200	$ -	$ 264.00	$ 197.12	$ 133.06	$ 139.71	$ 146.69
18	Sample Line	$ 600	$ -	$ 72.00	$ 53.76	$ 36.29	$ 38.10	$ 40.01
19	Plumbing and Eyewash/Shower	$ 2,000	$ -	$ 240.00	$ 179.20	$ 120.96	$ 127.01	$ 133.36
20	Drain Piping and Sewer	$ 48,000	$ -	$ 5,760.00	$ 4,300.80	$ 2,903.04	$ 3,048.19	$ 3,200.60
21	Drain	$ 2,000	$ -	$ 240.00	$ 179.20	$ 120.96	$ 127.01	$ 133.36
	Subtotal Capital Cost	$ 1,218,700						
	Sales Tax (City of Spokane 9%)	$ 109,700						
	Contingency 30%	$ 365,700						
	Total Capital Cost	**$ 1,694,100**						

	Havana Operating Cost	Cost Per Year	Annual Inflation 50-Year Total Costs (2023 Dollars)	2024 12%	2025 8%	2026 5%	2027 5%	2028 5%	2029 5%	2030 5%
1	Equipment Maintenance	$ 12,200	$ 610,000	$ 13,664	$ 14,757	$ 15,495	$ 16,270	$ 17,083	$ 17,937	$ 18,834
2	Maintenance Staff	$ 11,800	$ 590,000	$ 13,216	$ 14,273	$ 14,987	$ 15,736	$ 16,523	$ 17,349	$ 18,217
3	Administration	$ 1,200	$ 60,000	$ 1,344	$ 1,452	$ 1,524	$ 1,600	$ 1,680	$ 1,764	$ 1,853
4	Operation of Equipment	$ 66,600	$ 3,330,000	$ 74,592	$ 80,559	$ 84,587	$ 88,817	$ 93,258	$ 97,920	$ 102,816
5	Power Cost	$ 1,400	$ 70,000	$ 1,568	$ 1,693	$ 1,778	$ 1,867	$ 1,960	$ 2,058	$ 2,161
6	Chemical Cost	$ 62,100	$ 3,105,000	$ 69,552	$ 75,116	$ 78,872	$ 82,816	$ 86,956	$ 91,304	$ 95,869
	Subtotal Operating Cost, 2023 Dollars	$ 155,300	$ 7,765,000				**Subtotal Operating Cost**	$ 217,461	$ 228,334	$ 239,751
	Sales Tax (Chemical, City of Spokane 9%)	$ 5,589	$ 374,463				**Sales Tax (Chemical, City of Spokane 9%)**	$ 7,826	$ 8,217	$ 8,628
	Operating Contingency 30%	$ 46,590	$ 2,329,500				**Operating Contingency 30%**	$ 65,238	$ 68,500	$ 71,925
	Average Yearly Operating (2023 Dollars)	$ 207,479					**Average Yearly Operating**	$ 290,525	$ 305,051	$ 320,304
	Replace Equipment (50 years, 2023 dollars)		$ 1,055,700							
	Sales Tax (Equipment & Chemical, City of Spokane 9%)		$ 95,013							
	Total 50-year Operating & Maintenance Cost, 2023 Dollars		**$ 11,619,700**							
	Total Capital and Life Cycle		**$ 13,313,800**							
	Total Yearly O&M Cost Average w/ Equip Replacement		**$ 232,394**							
	50-Year LCA Averaged Over 50 Years (2023 Dollars)	$ 266,300								
	Replace Equipment, Yearly (2023 Dollars)	$ 23,100								

Three-Year Operations and Maintenance Costs

	Year 1 (2028)	Year 2 (2029)	Year 3 (2030)
Equip. Op.	$ 135,800	$ 136,100	$ 136,100
Equip. Maint.	$ 48,100	$ 48,200	$ 48,200
Power	$ 2,600	$ 2,700	$ 2,900
Chemical costs	$ 120,900	$ 127,000	$ 133,300
Average Annual Cost to Operate (2028)	$ 259,300		
Average Annual cost to Maintain (2028)	$ 48,100		

Low-Range: No Contingency

Equip. Op.	$ 104,500
Equip. Maint.	$ 37,000
Power	$ 2,000
Chemical costs	$ 93,000
Average Annual Cost to Operate (2028)	$ 199,500
Average Annual cost to Maintain (2028)	$ 37,000

APPENDIX K
FLUORIDATION ANCILLARY TECHNICAL REVIEW TECHNICAL MEMORANDUM

Technical Memorandum

Date: February 6, 2023

Project: Preliminary Engineering Study for Fluoridation

To: City of Spokane

From: Consor

Re: Fluoridation Ancillary Elements Technical Review

Introduction

This technical memorandum (TM) provides ancillary details associated with the potential implementation of providing fluoridated water to the City of Spokane (City) community. Impacts on water quality, specifically corrosion indices, considerations of downstream impacts to the City's Riverside Park Water Reclamation Facility wastewater treatment plant (WWTP) and considerations for non-fluoridated fill stations are summarized in this TM.

Water Quality

Finished water quality impacts of fluoridation, specifically corrosivity were assessed using Water!Pro™ software package to generate theoretical values for water equilibrium concentrations of dissolved lead and copper in the City's water distribution system. Alkalinity and hydrogen potential (pH) values both contribute significantly to the calculation of corrosion indices. Chemicals that change the pH or alkalinity of a water will therefore change the corrosion indices calculated for that water. Not all chemicals added to water impart significant acidity or alkalinity. Two of the three chemicals being considered for fluoridation would add acidity, which alters the relevant indices by consuming alkalinity, while the third is neutral.

Using fluorosilicic acid (H_2SiF_6) to achieve the desired fluoride level will consume about 2.1 milligrams per liter (mg/L) of alkalinity. Using sodium fluorosilicate (Na_2SiF_6) will consume about 1.4 mg/L of alkalinity. Using sodium fluoride will not impact pH or corrosion indices. Although sodium fluoride is a basic salt and the pH of saturated sodium fluoride solution is around 8.5, adding the small quantities of saturated sodium fluoride solution required for the desired fluoride concentration will not add sufficient alkalinity to measurably alter any of the parameters used to calculate corrosion indices.

The amount of change in pH that results from chemical addition depends not only on the acidity or alkalinity of the chemical added to the water but also on the buffering capacity of the water being treated. Of the seven wells used by the City, the Ray well has the highest buffering capacity while the Grace and Nevada wells have the lowest buffering capacities.

Prior to addition of any chemicals (including the chlorine gas for disinfection) most of the wells have neutral or slightly positive values for the Langelier Saturation Index (LSI). The LSI is a calculated number used to predict the calcium carbonate stability of water. It indicates whether the water will precipitate, dissolve, or be in equilibrium with calcium carbonate. The LSI is expressed as the difference between the actual system pH and the saturation pH.

LSI = pH (measured) − pH_s

- For LSI > 0, water is super saturated and tends to precipitate a scale layer of $CaCO_3$.
- For LSI = 0, water is saturated (in equilibrium) with $CaCO_3$. A scale layer of $CaCO_3$ is neither precipitated nor dissolved.
- For LSI < 0, water is under saturated and tends to dissolve solid $CaCO_3$.

If the actual pH of the water is below the calculated saturation pH, the LSI is negative, and the water has a very limited scaling potential. If the actual pH exceeds pHs, the LSI is positive, and being supersaturated with $CaCO_3$, the water has a tendency to form scale. At increasing positive index values, the scaling potential increases.

In practice, water with an LSI between −0.5 and +0.5 will not display enhanced mineral dissolving or scale forming properties. Water with an LSI below −0.5 tends to exhibit noticeably increased dissolving abilities while water with an LSI above +0.5 tends to exhibit noticeably increased scale forming properties.

The Grace, Nevada and Ray wells have slightly negative LSI. The LSI values after fluoridation with both fluorosilicic acid and sodium fluorosilicate will be lower than current operations. Using the Water!Pro™ water quality model, it is estimated the changes in water quality parameters that may be anticipated from adding either fluorosilicic acid or sodium fluorosilicate to the water from each of the City's seven wells, in addition to the chlorine gas already added.

Adding fluorosilicic acid will reduce the pH of the Ray well water by about 0.08 pH units while the pH of the Grace well water my decrease by as much as 0.28 units. This will reduce the LSI of the water from those wells by about 0.1 units for the Ray well and as much as 0.3 units for the Grace well. Using the City's typical chlorine dose of 0.3 mg/L, all seven of the wells will have a negative LSI after addition of sufficient fluorosilicic acid to achieve 0.7 mg/L Fluoride. Grace well water would have the lowest LSI at -0.47. The water from the Central well will have the highest LSI value at -0.07. If chlorine doses higher than 0.3 mg/L are used, this will decrease the LSI values even more.

Using sodium fluorosilicate will reduce the pH of the wells by lesser amounts than using fluorosilicic acid. The Ray well water pH may be reduced by about 0.05 pH units while the pH of the Grace well water my decrease by as much as 0.120 units. This will reduce the LSI of the water from those wells by about 0.06 units for the Ray well by about 0.21 units for the Grace well. Assuming a chlorine dose of 0.3 mg/L, all seven of the wells will have a negative LSI after addition of sufficient sodium fluorosilicate to achieve 0.7 mg/L Fluoride. Grace well water would have the lowest LSI at -0.39. The water from Central well will have the highest LSI values at -0.01.

The water quality model indicates that use of either fluorosilicic acid or sodium fluorosilicate in conjunction with the existing chlorine gas disinfectant will result in negative LSI values at all the wells. The LSI will be only slightly negative for Well Electric and Parkwater if those wells are treated with sodium fluorosilicate. LSI will be significantly negative for Grace and Nevada wells regardless of which of the two chemicals is used.

The water from Grace well currently has the lowest LSI of all the wells: -0.18 after dosing with chlorine gas at 0.3 mg/L. Well Electric, Parkwater, Central, Hoffman, and Ray wells will have higher LSI values than the current conditions at Grace well, regardless of which fluoride chemical is used. Nevada well will have higher LSI values regardless of which fluoride chemical is used.

Similar to the analysis completed as part of the 2016 City of Spokane Fluoridation Feasibility Study Update, the impact of fluoride addition was also modelled on a weighted blend of the water from the seven wells to estimate potential changes in the theoretical equilibrium values for lead and copper.

Neither fluorosilicic acid nor sodium fluorosilicate will have an impact on the dissolution of lead. As with the analysis done in 2016, the current study found that theoretical equilibrium values for lead concentrations are about 0.15 mg/L after disinfection and would be about 0.15 mg/L after addition of either fluorosilicic acid or sodium fluorosilicate. Using either chemical will have a slight but insignificant impact on the dissolution of copper. The current study found that theoretical equilibrium values for copper concentrations are about 0.17 mg/L after disinfection and would increase to about 0.18 mg/L after addition of either fluorosilicic acid or sodium fluorosilicate.

If either fluorosilicic acid or sodium fluorosilicate is chosen as the preferred chemical, the City may want to closely monitor the system in the months and years after the change for any signs that corrosion has increased or that scale deposits previously formed in the system have destabilized. Given that five of the seven wells will have LSI values approximately equal to the existing conditions at Grace well, and given the fact that the theoretical equilibrium concentration for lead will be unchanged and while the theoretical equilibrium concentration for copper will only increase by about 6 percent, there are unlikely to be significant changes in the distribution system with the use of either chemical, in spite of the negative LSI values calculated for all the wells.

Table 1 provides a summary of LSI of the for each of the City's wells before and after fluoridation.

Table 1 | Langelier Saturation Index Summary

Well	No Chemicals Added	0.3 mg/L Cl Added	0.3 mg/L Cl and Na_2SiF_6	0.3 mg/L Cl and H_2SiF_6
Central	0.12	0.06	-0.10	-0.17
Well Electric	0.17	0.13	-0.01	-0.07
Grace	-0.11	-0.18	-0.39	-0.47
Hoffman	0.09	0.04	-0.10	-0.16
Nevada	-0.08	-0.15	-0.34	-0.42
Parkwater	0.1	0.07	-0.04	-0.09
Ray	-0.04	-0.06	-0.06	-0.15

Wastewater Treatment Considerations

The City's Riverside Park Water Reclamation Facility was recently expanded to include the Next Level of Treatment (NLT), membrane filtration. This new filtration system will improve the quality of effluent that is released to the Spokane River.

Treatment impact considerations with fluoride within the influent wastewater is that conventional wastewater treatment such as electrochemical, precipitation, and adsorption methods are effective in removing fluoride owing to its ionic size and reactivity. Membrane technology as installed with the NLT is one of the newer technologies found to be effective in reducing fluoride to desired standards levels. Though removal is not required, at the concentrations targeted for the water system fluoridation are within